Electronic Preset Delivery System

Smith Meter®
microLoad.net™

Operations Manual

Bulletin MN06149 ‖ Issue/Rev 0.4 (9/13)

GUIDANT

Caution

The default or operating values used in this manual and in the program of the microLoad.net are for factory testing only and should not be construed as default or operating values for your metering system. Each metering system is unique and each program parameter must be reviewed and programmed for that specific metering system application.

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Product Description

The Smith Meter® microLoad.net™ is a micro-processor based single arm, single product electronic preset instrument that supports up to 12 recipes. It is configurable to support a variety of user applications.

Optimum measurement accuracy is attained through continuous linearization of the meter factor with changes in flow rates. The microLoad.net is also capable of maintaining back pressure on the measurement system using automatic flow optimization. Volumetric correction is calculated directly from published API equations providing precise volumetric measurement results. Precise temperature, pressure compensation (using programmed maintenance pressure), and density correction are options that are available in the instrument.

The dynamic real-time display of the current actual operating conditions of the system provides the operator with valuable system information while the system is operating.

The microLoad.net provides several loading system control functions: Additive injection, pump control, alarm control, set stop, valve control, back-pressure control, and automatic adjustment of final trip point. Other significant features are as follows:

- 200 Driver Database
- Ethernet Connectivity
- Three Multi-drop Serial Communications Ports
- Event Logging / Audit Trail
- User Configurable I/O
- Three Security Levels
- Optional Battery Backed Display per OIML
- Programmable language/messages
- Automated Proving
- API Tables from LPG to Crude Oil

How To Use This Manual

This manual is to be used as an operators guide for the microLoad.net.

This manual is divided into five sections: Introduction, RUN Mode, Dynamic Displays, Automated Proving Mode, Program Mode, and Index.

The "Display and Controls" section describes the microLoad.net's physical display screen and keypad as well as some of the basic messages that would initially occur.

The "Run Mode" section describes the typical operation of a microLoad.net.

The "Dynamic Displays" section describes the information that can be displayed by the microLoad.net while in the "READY" state or in the Run Mode.

The "Automated Proving Mode" section describes the procedures and events involved in meter proving with a microLoad.net.

The "Program Mode" section describes the mechanics of making configuration changes to a microLoad.net using the integral display and keypad. See the Reference Manual for details of the parameters that are affected in the Program Mode.

The "Index" is a comprehensive listing, with page numbers, of all subjects covered in this manual.

The examples presented in this manual are for clarity and operator convenience. The values might vary for specific installations and/or operations.

microLoad.net Display and Controls

Figure 1. microLoad.net Display and Controls

The user interfaces with the microLoad.net through either one of its several communications ports or via the display and keypad found on the face of the instrument. The display and keypad alter their format and function based upon the mode (Run Mode, Programming Mode….) that the instrument is currently running. The following provides previews to the various screens as well as the keypad functions associated with the various modes.

Power Up

The following describes the events which occur when the power is applied to a microLoad.net. Upon power up the microLoad.net goes through a start up sequence. The start up screen will be displayed while a RAM test is being performed.

```
        FMC
    microLoad.net

     RAM test

  _____
```
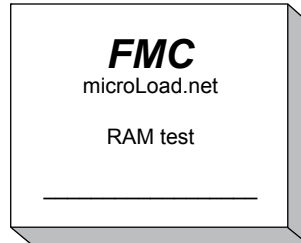
Figure 2. Power Up Screen

Once the start up sequence is complete the microLoad.net will go into its normal operating mode. Depending upon how the instrument is configured, one of two screens will be seen next. If the microLoad.net does not have the Powerfail alarm configured the instrument will go directly to the Ready Screen. The Ready Screen is the launching point for all the microLoad.net functions.

```
  microLoad.net Ready
      AAAAAAA

    Press SET key

  MM/DD/YY  HH:MM:SS
```
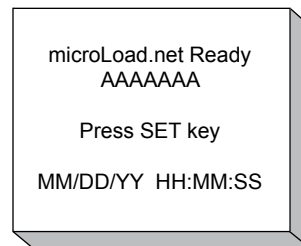
Figure 3. Ready Screen

If the Powerfail alarm is configured, the microLoad.net will go to the Powerfail Alarm screen after the start up sequence is completed. It will be necessary for the operator to enter the instrument's passcode in order to acknowledge the alarm and proceed to the Ready Screen.

Note: The default passcode for the microLoad.net is "0000".

Ready Screen

The Ready Screen informs the user that the microLoad.net is operating normally and awaiting the user's input. In normal day-to-day operation, the driver/operator will be accessing the microLoad's Run Mode to enter the information required to dispense their loads. The driver initiates the process by depressing the SET key. The microLoad.net will respond with a series of up to five prompts designed to collect information for the transaction to take place. The number of prompts and their content is defined by Prompt parameters entered into the Communication Directory (761 through 777). The following is an example of a sequence of prompts.

Figure 4. Typical Prompt Sequence

Note: To adjust the display contrast, go to the Main Menu, click on Diagnostics, scroll through the Diagnostics Menu until the arrow is next to Display Contrast, press Enter, and adjust the screen contrast. (Factory reset settings change only when a Factory Initialize is implemented.)

Run Mode

The Run Mode is the normal driver-controlled mode of operation where a preset volume of product is entered into the microLoad.net. The flow is then initiated, controlled, and stopped by the microLoad.net at the end of the batch.
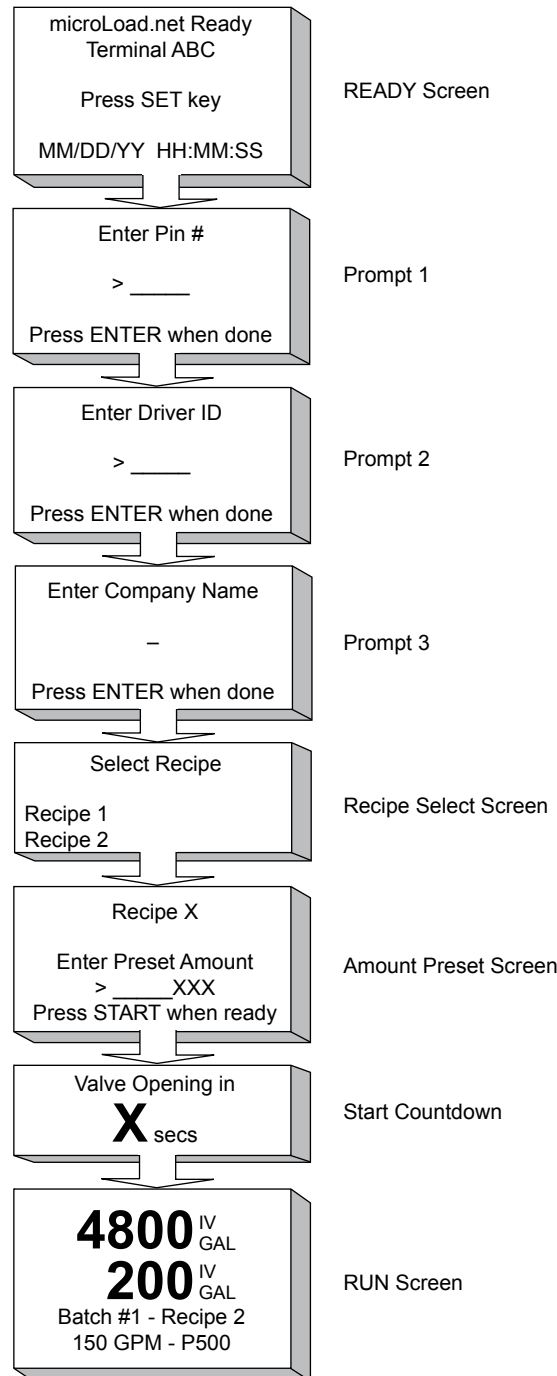
All preset and control operations can be performed either locally through the keypad or through communications. The operation described in this section assumes that the microLoad.net is being operated locally through the keypad. For information on operating through communications, refer to the microLoad.net Communications Manual MN06147 and the Operator Reference Manual MN06148.

Keypad Functions

The pushbuttons on the keypad perform the following preset functions in the Run Mode:

0 - 9	Used for entering numeric data
CLEAR	Used to clear incorrect entries and to exit from the dynamic displays
ENTER	Used for dynamic displays and selecting the recipe to be loaded
PRINT	Signals completion of transaction
SET	Used to initiate the preset sequence
START	Used to start the delivery (providing all external permissive senses are satisfied)
STOP	Used to stop delivery at any time (not intended as emergency stop)
↑	Used to move the selection arrow up in selection of recipes and navigating the dynamic displays and for entry of alphanumeric prompt responses
↓	Used to move the selection arrow down in selection of recipes and navigating the dynamic displays and for entry of alphanumeric prompt responses
←→	Used for entry of alphanumeric prompt responses
F1	Not Used
F2	Not Used

Overview

The "RUN" Mode permits the operator to select the recipe and preset volume, start the preset volume, and observe the dynamic variables such as flow rate, temperature, volume correction factors, transaction totals and non-resettable totals. The microLoad.net processes normal start-up, flow control and shutdown sequences, and operator-requested stops.

Product delivery is controlled by several program code entries. Functions such as first high flow rate, second high flow rate, low flow start, and first and second trip points are automatically controlled and monitored per their program entries. Safety and volume accuracy functions including excess high flow, low flow, overrun, and temperature probe failure are also monitored per their program parameters. If at any time, an alarm occurs while in the Ready State or the Run Mode, the microLoad.net will attempt to shut down the flow and a message indicating an alarm condition will pop up over the current display.

At the end of the delivery, the "batch complete" message will flash at the bottom of the RUN screen.

4800 IV GAL
4800 IV GAL

Batch #1 - Recipe 2
Batch Complete
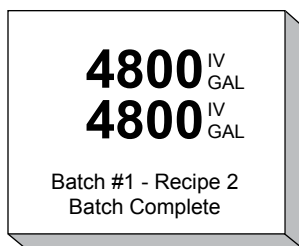
Depending on how the microLoad.net is programmed, a transaction can be ended by pressing the "PRINT" button, by a communication command, or by an external input.

If the "STOP" button is pressed during flow, and if the Start after Stop delay is programmed, the preset position will display:

Restart in
X
secs
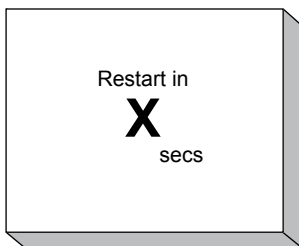
Once the time-out has been reached, the display will flash "Batch Stopped".

4800 IV GAL
200 IV GAL

Batch #1 - Recipe 2
Batch Stopped
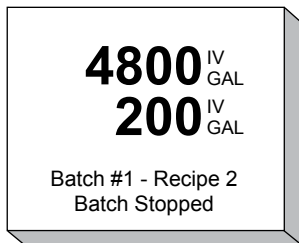
The operator can then press "START" and continue the batch or "PRINT" to terminate the batch. If the operator elects to continue the batch the microLoad.net will countdown to valve reopening and then return to the RUN screen.

Remote Start/Stop

Digital inputs can be programmed to be used for Remote Start/Remote Stop operations. When the power is applied to these contacts, the microLoad.net will respond as though the "START" or "STOP" keys have been pressed on the keypad.

Additive Monitoring

Additive injector feedback provides the capability of the microLoad.net monitoring the additive products that are being injected. The microLoad.net monitors the injector feedback switches for a change of state and counts the errors if no change is detected before the next injection. An alarm will be set if the number of errors exceeds the programmable maximum.

With Smart or metered injectors, the additive volume injected is actually measured, providing the ultimate in feedback. The microLoad.net communicates with the Additive Injector System where the microLoad.net is the master. The microLoad.net constantly monitors the Additive System for its status, polls for additive totals, and signals the system when to inject the additive – all through the communications line.

The microLoad.net communications package has also been designed with a pass-through communications mode. In this mode of operation, the supervisory computer can talk to the Additive Injector System through the communication lines that have been run to the microLoad.net and from the microLoad.net to the Additive Injector System(s). (This is further described in the microLoad.net Communications Manual MN06147.)

microLoad.net interfaces with smart additive injector systems. A system may incorporate one metered injector along with digital outputs to energize additive pumps and injector solenoids.

Dynamic Displays

While in the RUN mode the user may review both live and stored data held in the microLoad.net. The ENTER key is used to switch to the Dynamic Displays page. (The CLEAR key will return to the RUN screen.)

```
Dynamic Displays

System/Live
Batch Totals/Avgs
Transaction
Diagnostics
```
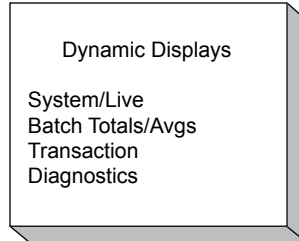
There are four groups of dynamic display data available to the user. The "System/Live" data is related to the active data gathered at the time of inquiry. The Batch Totals/Avgs is total and average data for the current or past batches. The Transaction data is related to the ongoing transaction.

Keypad Functions

The keys on the keypad perform the following functions when accessing the dynamic displays:

0 - 9   Used for entering numeric data

↑   Used to move the selection arrow up in selection of recipes and navigating the dynamic displays and for entry of alphanumeric prompt responses

←   Once in the dynamic displays, this works like the up arrow to move backwards through the displays

→   Once in the dynamic displays, this works like the down arrow to move forward through the displays

↓   Used to move the selection arrow down in selection of recipes and navigating the dynamic displays and for entry of alphanumeric prompt responses

CLEAR   Used to clear incorrect entries and to exit from the dynamic displays

ENTER   Used for dynamic displays and selecting the recipe to be loaded System / Live

System / Live

The System / Live data appears on several screens which are accessible using the UP and DOWN ARROW keys. The information includes: Flowrate (/minute), Flowrate (/hour), Recipe #, Preset Amount, Amount Remaining, Meter Factor, Temperature, Density, Pressure, Additive Presets, Valve Position, Date and Time of last power failure.

```
XXXXX.X  Gal/Mn ──────── Flowrate in amount/minute
 XXXXX.X  Gal/Hr ──────── Flowrate in amount/hour

Recipe # ──────────────── Current Recipe Designation
Reset    XXXXX ────────── Preset Amount
```

```
Remain  XXXXX ─────────── Amount yet to be Delivered
Mfac    X.XXXXX ───────── Meter Factor
Temp    XX.X ──────────── Temperature
Den     XXXXX ─────────── Density
```

```
Pres        XX.X ──────── Pressure
A1 P XXX C XXX ────────── Additive 1 Preset & Current Amount
Valve Req.  AAAAA ─────── Valve Request (Open, Close, Lock)
PF Date MM/DD/YY ──────── Date of last Power Failure
```

```
PF Time HH:MM:SS ──────── Time of Last Power Failure
```

Figure 5. System/Live Screens

Press Clear to return to the Dynamic Displays screen.

Batch Totals / Averages

The microLoad.net will require the operator to select which batch data is to be viewed. Simply pressing the ENTER key will provide the current data.

```
Batch Totals / Avgs
Select Batch
>____
Press ENTER for
current or last batch
```
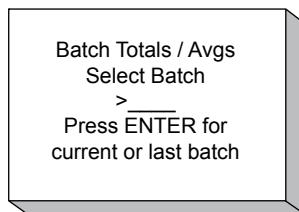
The data provided includes the various volume types (i.e. IV, GV, GST, GSV), Mass, Meter Factor, Temperature, Density, Pressure, Vapor Pressure, CTL, CPL, and Additive Amount.

Batch Totals / Averages

Batch Totals / Avgs
Select Batch
>____
Press ENTER for
current or last batch

Recipe #	Recipe Designation
IV XXXX.XX	Indicated (Raw) Volume
GV XXXX.XX	Gross Volume
GST XXXX.XX	Gross Volume at Standard Temperature
Batch #X more	

GSV XXXX.XX	Gross Volume at Standard Temperature and Pressure
Mass XXXX.XX	Mass Total
MFac X.XXXXXX	Mass Factor
Temp XX.X	Temperature
Batch #X more	

Dens XX.X	Density
Pres XX.X	Pressure
VPre X.X	Vapor Pressure
D@60 XX.X	Density @ Reference Temperature (API)
Batch #X more	

D@60 XX.X	Density @ Reference Temperature (Mass/Vol)
Rel D@60 X.XXXX	Relative Density @ Reference Temperature
CTPL X.XXXXX	Temperature and Pressure Correction Factor
CTL X.XXXXX	Temperature Correction Factor
Batch #X more	

	Pressure Correction Factor
CPL X.XXXXX	Additive Amount
Add X X.XXX	
Batch #X more	

Figure 6. Batch Totals / Averages

Transaction

The transaction data provided includes the various volume types (i.e. IV, GV, GST, GSV), Mass, Temperature, Density, Pressure, Meter Factor, CTL, CPL, and Additive Amount.

IV	XXXX.XX	— Indicated (Raw) Volume
GV	XXXX.XX	— Gross Volume
GST	XXXX.XX	— Gross Volume at Standard Temperature
GSV	XXXX.XX	— Gross Volume at Standard Temperature and Pressure
	Transaction more	

Mass	XXXX.XX	— Mass Total
Temp	XX.X	— Mass Factor
Den	XX.X	— Temperature
Pres	XX.X	— Pressure
	Transaction more	

MFac	X.XXXXX	— Meter Factor
CTL	X.XXXX	— Temperature Correction Factor
CPL	X.XXXX	— Pressure Correction Factor
Add X	X.XXX	— Additive X Amount
	Transaction more	

Figure 7. Transaction Display

Press Clear to return to the Dynamic Displays screen.

Automated Proving Mode

The microLoad.net firmware provides an automated proving mode of operation. This feature allows the operator to prove the meter and update meter factors and associated flow rates without having to enter the program mode. When the automated proving mode is activated, the microLoad.net will calculate the meter factor for 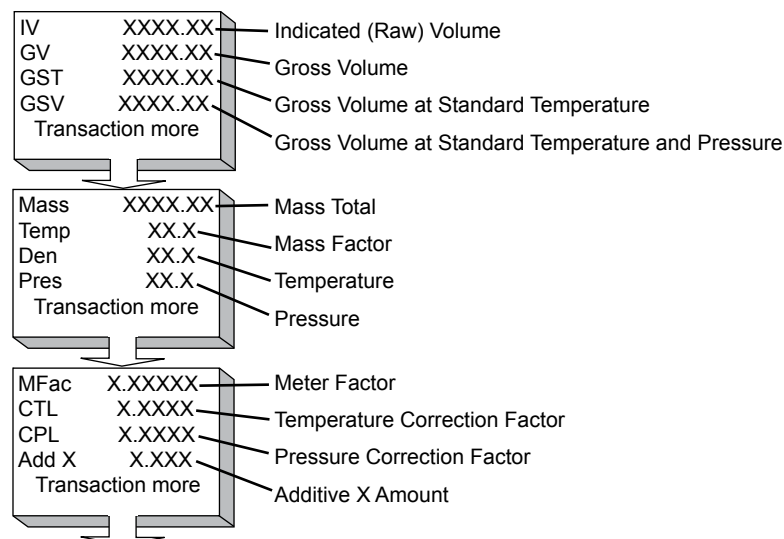a proving run based on information that is obtained during the prove. The operator can select the flow rate and associated meter factor that is being proved through the keypad of the microLoad.net. After the prove is complete, the operator enters the prover volume and prover temperature and the microLoad.net calculates the new meter factor. The operator has the choice of accepting the new meter factor or ignoring it. The microLoad.net also has the capability of providing an average meter factor over a maximum of ten proves.

Entry to the Automated Proving Mode will require several conditions to be met.

1. The Automated Proving Mode must be enabled via "Volume Accuracy, Auto Prove Select", parameter 331. This parameter is used to enable or disable the Automated Proving Mode. The default for this program code will be disabled. Select one of the two (2) security options to enable the automated prove and associated security. Once selected and the security activated, the beginning of the next transaction will launch the auto prove.

2. The counters must be set to the proving mode through "Volume Accuracy, Proving Counters", parameter 332. In this mode the microLoad.net operates as in the Run Mode, except the preset and delivery counters both count up and go to tenths resolution. Volume preset and delivery units are in the volume units selected in the display units select code. The factory default is "Not Proving."

3. The programmed security must be met. When normal conditions are met for starting a transaction (pressing the "SET" key or receiving authorization via communications), the Automated Proving Mode will be activated. After the microLoad.net has gone through the user programmed prompts (see Figure 4) the will display the question "Are You Proving?". If the user indicates NO, the balance of the preset sequence will continue as if a normal load. If the user answers YES, the automated proving sequence continues.

4. To initiate the proving sequence, the microLoad.net will prompt for the prover volumetric coefficient of expansion. Note that the most recent value for this entry will be displayed. If this value is acceptable, the operator need only press "ENTER."

5. The microLoad.net will prompt for the low flow start volume. If low flow start is not desired, enter zero. Press "ENTER."

6. Next, the microLoad.net will display the "Select Recipe" prompt. If in remote control communications mode, only those recipes allocated will be available for selection. Recipes must be selected before the meter factors, since the recipe determines the product being proved. Using the up and down arrow keys, select the required recipe.

7. The operator must next select the meter factor and associated flow rate for proving.

Move the up or down arrow keys to the meter factor associated flow rate that is required. Note that only those factors currently programmed will be offered as selections. Press ENTER after entering the selection.

8. Enter the batch amount desired.

9. Press "START" to begin flow. The flow rate associated with the selected meter factor will be used as the high flow rate. The batch will be delivered. The flow rate ramp-down from first trip to the end of the batch will be the same as if not proving.

```
        ┌──────────────────┐
        │ Are You Proving? │
        │                  │
        │       No         │
        │       Yes        │
        └──────────────────┘
                 │
                 ▼
        ┌──────────────────┐
        │  Enter Prover    │
        │   Coefficient    │
        │                  │
        │   1.000000000    │
        │                  │
        │ Date       Time  │
        └──────────────────┘
                 │
                 ▼
        ┌──────────────────┐
        │ Enter Low Flow   │
        │  Start Amount    │
        │                  │
        │    ----- Gal     │
        │                  │
        │ Date       Time  │
        └──────────────────┘
                 │
                 ▼
        ┌──────────────────┐
        │  Select Recipe   │
        │                  │
        │  Recipe 1        │
        │  Recipe 2        │
        │                  │
        └──────────────────┘
                 │
                 ▼
        ┌──────────────────┐
        │ Select Meter     │
        │ Factor to Prove  │
        │                  │
        │ #1 1.XXXX XXGPM  │
        │ #2 1.XXXX XXGPM  │
        │ #3 1.XXXX XXGPM  │
        └──────────────────┘
                 │
                 ▼
        ┌──────────────────┐
        │   Recipe X       │
        │  Enter Preset    │
        │    Amount        │
        │   _____ Gal    │
        │                  │
        │ Press START when │
        │     Ready        │
        └──────────────────┘
```
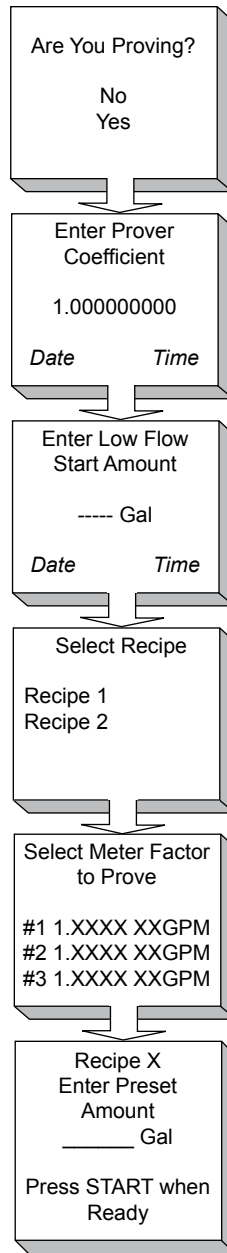
Figure 8. Prove Setup

10. When the batch has completed, the microLoad.net will prompt for the actual prover volume. Enter the prover volume and press "ENTER."

11. The microLoad.net will prompt for the prover temperature. Press ENTER to have the meter factor calculated.

12. The microLoad.net will then calculate the meter factor. The new meter factor will be displayed.

13. When the ENTER key is pressed, the microLoad.net will display the following screen.

14. If "REJECT" or "SAVE" is selected, the microLoad.net will return to the Run Mode display where the transaction

can be ended. If "AVERAGE" is selected, the microLoad.net will then average all meter factors in the buffer (up to ten of them). The average meter factor will be displayed. Select "SAVE" to download the average meter factor into the Program Mode.

15. If "Save" is selected, the microLoad.net will download the average meter factor and will return to the "RUN" mode display where the transaction can be ended or a new batch can be started. If "Continue" is selected, a new batch can be started allowing the microLoad.net to continue proving at this rate. Note that if the microLoad. net is in remote control mode, authorization is required for each batch.
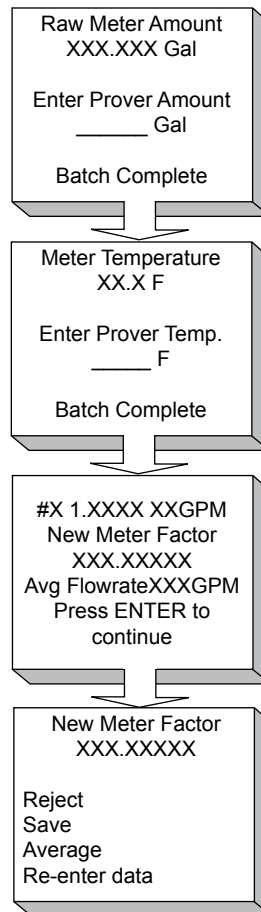
```
┌──────────────────────────┐
│  Raw Meter Amount        │
│     XXX.XXX Gal          │
│                          │
│  Enter Prover Amount     │
│  _____ Gal            │
│                          │
│  Batch Complete          │
└──────────────────────────┘
            │
            ▼
┌──────────────────────────┐
│  Meter Temperature       │
│     XX.X F               │
│                          │
│  Enter Prover Temp.      │
│  _____ F                │
│                          │
│  Batch Complete          │
└──────────────────────────┘
            │
            ▼
┌──────────────────────────┐
│  #X 1.XXXX XXGPM         │
│  New Meter Factor        │
│     XXX.XXXXX            │
│  Avg FlowrateXXXGPM      │
│  Press ENTER to          │
│  continue                │
└──────────────────────────┘
            │
            ▼
┌──────────────────────────┐
│  New Meter Factor        │
│     XXX.XXXXX            │
│                          │
│  Reject                  │
│  Save                    │
│  Average                 │
│  Re-enter data           │
└──────────────────────────┘
```

Figure 9. Prove Data

16. In the event that the meter factor is not successfully downloaded, the microLoad.net will display a message indicating that the meter factor was rejected.

Printing Pending Reports from Print Menu

Pending reports may be re-printed from the Print Menu.

First select "Print Menu" from the microLoad's Main Menu. If there are pending reports to be printed, the microLoad will display the following prompt message:
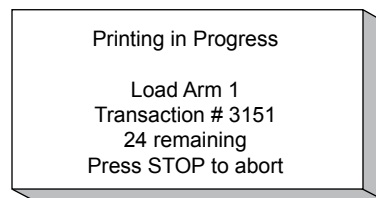
```
                    Print Menu

        ->   Print Individual Report
             Print Pending Reports
```
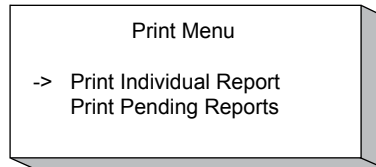
If "Print Pending Reports" is selected, the microLoad will prompt whether it is desired to print pending reports from all arms or a particular arm. Note that only arms with pending reports will be displayed.

```
                Print Pending Reports

        ->   Print all pending reports
             Load Arm 1
             Load Arm 3
                          more...
```
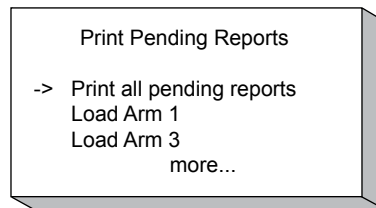
Once the selection is made, the microLoad will display the number of pending reports to be printed.

```
            Print All Pending Reports

                 25 Transactions

             Press ENTER when ready
```
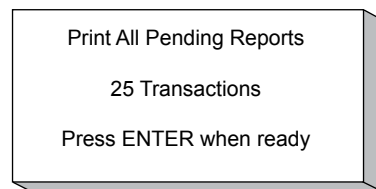
While printing is in progress, the microLoad will display the current transaction being printed.

```
              Printing in Progress

                 Load Arm 1
              Transaction # 3151
                 24 remaining
              Press STOP to abort
```

Pressing STOP will abort the printing after the current transaction report is finished. Also, if any report fails to be printed within programmed communications timeout, the microLoad will abort printing any more pending reports.

Note: If it is desired to abort the printing of pending reports initiated automatically (auto reprint) or via communications command, the Print Menu may be entered and will allow the printing to be aborted.

Program Mode

The microLoad.net has a significant number of customizable features which are selectable by the user. The process of selecting these features and customizing the microLoad.net to each application is performed in the Program Mode. All programming information is entered via the keypad or through communications. This section will describe the procedure for entering via the keypad. The program codes for microLoad.net are divided into several main directories plus Diagnostics. The main directories and their contents are discussed in detail in the microLoad.net Operator Reference Manual MN06148.

Keypad Data Entry

The pushbuttons on the keypad perform the following functions while the instrument is in the Program Mode:

0 - 9	Used to enter the access code and for data entries
CLEAR	Used for clearing incorrect entries or for getting to an exit point
ENTER	Used to enter the Program Mode security access code, to enter the subdirectory, and to enter program data
START	Not used in Program Mode
SET	Page scrolling
PRINT	Used to access Help Messages
STOP	Used to set the security level
F1	Not Used
F2	Not Used
↑	Used to move up through the menus and rows for alphanumeric entries
↓	Used to move down through the menus and rows for alphanumeric entries
+/-	Used for adding signs to values being programmed
.	Decimal point, for values requiring one
←→	Used for alphanumeric entries

Entry to Main Directories

1. Assert the security input if configured. This will provide the first step for access to program codes.

```
microLoad.net Ready
    AAAAAAA

   Press SET key

MM/DD/YY  HH:MM:SS
```
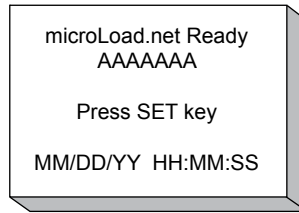
2. Press "ENTER." This displays the main menu.

```
microLoad.net Ready        Main Menu
XXXXXXXX
                           Dynamic Displays
Press SET key              Print Menu
                           Program Mode Menu
MM/DD/YY  H:MM:SS PM       Diagnostics Menu
```
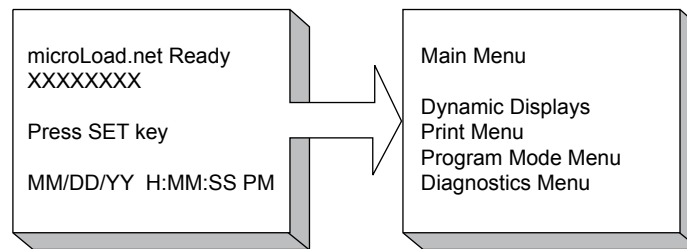
Figure 10. Accessing Main Menu

3. Move the arrow to the Program Mode menu and press "ENTER." This will display the "Enter Passcode" screen.

4. Enter the access code. (The access code preset at the factory is "0".) For security, any digit entered will be displayed as an "X". (Access codes can be up to four digits long.)

5. Press "ENTER." This procedure checks for the proper access code. If it is correct, the following will be displayed.

6. If an incorrect access code was entered, an "Access Denied, CLEAR = re-enter" message will appear. Press CLEAR to return the display to the "Enter Passcode Screen" in Step 3. Repeat Steps 3, 4, and 5 to re-enter Program Mode.
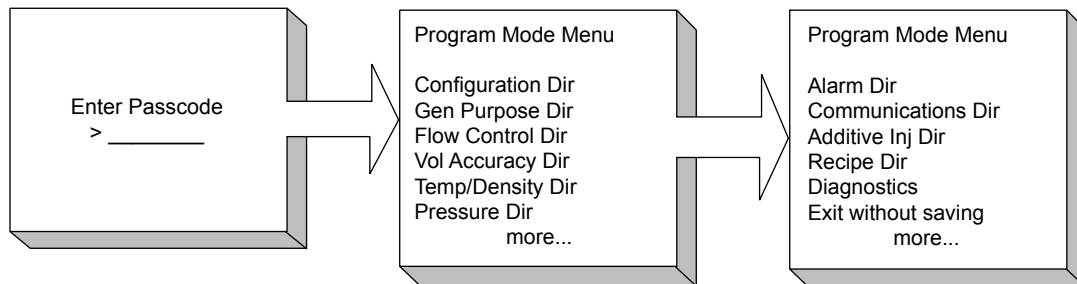
```
Enter Passcode        Program Mode Menu       Program Mode Menu
   > _____
                      Configuration Dir       Alarm Dir
                      Gen Purpose Dir         Communications Dir
                      Flow Control Dir        Additive Inj Dir
                      Vol Accuracy Dir        Recipe Dir
                      Temp/Density Dir        Diagnostics
                      Pressure Dir            Exit without saving
                             more...                 more...
```

Figure 11. Opening Program Mode

Changing Program Mode Parameters

The program codes represent parameters that can be changed either to enhance the performance of the microLoad.net or to accommodate application changes. There are three types of parameters in microLoad.net: codes that require numerical data, codes where an option can be selected from a list, and codes where alphanumeric data is entered. Once a code has been selected, change the programmed contents by entering a new value through the keypad.

Numeric Data

The numeric data is entered into the program codes via the keypad just as numbers are entered into a calculator. The number of digits for each entry is listed in the Reference section of this manual.

Alphanumeric Data

The parameters that require alphanumeric data are the codes that display Product Messages, Prompt Messages, or Permissive Messages on the displays of microLoad.net, or provide information to be printed out on the Bill of Lading Emulation. When adding or changing information in these alphanumeric program codes, the keys listed below perform the following functions.

Key	*Description*
ENTER	Moves the character from the character set to the ID line. Also enters the data into the instrument's memory after END has been selected from the character set
SET	Moves the cursor six positions to the right
→	Moves the cursor one position to the right each time it is pressed
←	Moves the cursor one position to the left each time it is pressed
↑ and ↓	Selects the next block of characters. An example of this is changing from uppercase letters to lowercase letters. The blocks of characters available in microLoad.net are as follows:

- A B C D E F G H I J K L M N O P Q R S T U V W X Y Z # *
- a b c d e f g h i j k l m n o p q r s t u v w x y z & @
- 0 1 2 3 4 5 6 7 8 9 < > ( ) ? ! . , ' - " / + = _ END

Main Menu Diagnostics

Main Menu Diagnostics allow the operator to review current configurations, identify causes of system errors, and analyze data collected by the microLoad. Selecting "Diagnostics" from the main menu, and then choosing a specific diagnostic, usually results in the screen shown directly below. Position the cursor beside the appropriate selection, and then press ENTER to reach the desired diagnostic screen.

```
        Diagnostics Menu
->   Active Alarms
     Alarm History
     Non-Reset Volumes
     Event Log
     Transaction Log
     Audit Trail
                More...
```
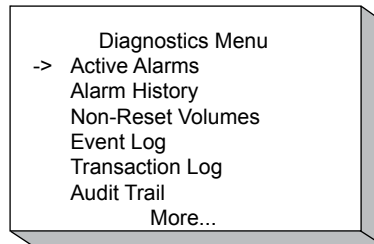
Note: The diagnostics available through the Main Menu are run-time diagnostics only. Program mode diagnostics are accessed from the Program Mode Main Menu.

The Diagnostics menu available through the Main Menu consists of the following:

- Active Alarms
- Alarm History
- Non-Resettable Volumes
- Event Log
- Transaction Log
- Audit Trail
- Digital Inputs
- Digital Outputs
- Analog Inputs
- Pulse Inputs
- Communications Monitor
- Download Directory
- Boolean Algebraic
- Transaction Archive Data
- Print Standby Data
- Summary Data
- Software Version
- Contrast Adjust

Active Alarms

The Diagnostics menu provides the selection "Active Alarms" where all active alarms for the load arm can be viewed with the arrow in front of "Active Alarms." Press ENTER, and one of the following will be displayed. If no alarms are active, the following screen will be displayed.

```
        No Active Alarms

        Press Any Key
```
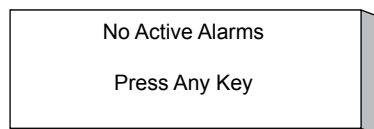
If there are active alarms, they will be displayed as follows:

```
          Active Alarms

   ->      PA: Powerfail Alarm
```
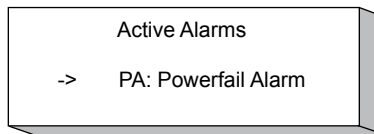
The active alarms can be cleared from this display by moving the arrow to the alarm and pressing "ENTER." The microLoad will then ask for the passcode. When the passcode is entered, the alarm will clear.

Pressing the CLEAR key will return the system to the Diagnostic menu.

Alarm History

The Diagnostics menu provides the selection "Alarm History" where the most recent alarms can be viewed. With the arrow in front of "Alarm History," press ENTER, and the historical alarms will be displayed. The alarms will be listed in order of occurrence.

```
          Alarm History

   PA: Powerfail Alarm
   DA: Mtr Program Error
   PA: Powerfail Alarm
```
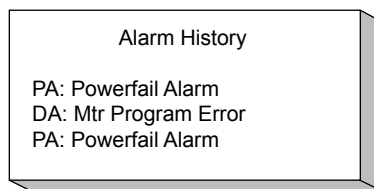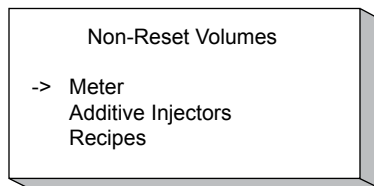
This is an alarm history for the transaction. For a more complete history of alarms, please access the Event Log.

Pressing the up and down arrow keys will allow the operator to page through the Alarm History displays. If "More..." is not displayed, then there is only one screen of alarms in the alarm history.
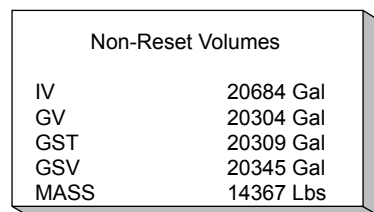
Pressing the CLEAR key will revert to the Diagnostic menu.

Non-Resettable Volumes

The Diagnostics menu provides the selection "Non-Reset Volumes" where the meter and additive injector volumes can be viewed. With the arrow in from of "Non-Reset Volumes," pressing ENTER will display a menu to allow the operator to view either the meter, the additive volumes or recipes. Choosing either the meter, additive injectors or recipe by moving the arrow and pressing ENTER will either display the non-resettable volumes or in the case of meter which load arm.
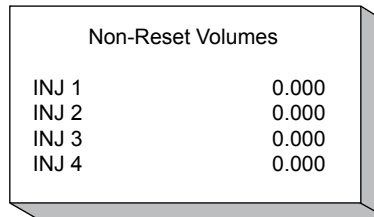
```
          Non-Reset Volumes

   ->   Meter
        Additive Injectors
        Recipes
```

Meter volumes are displayed as follows:

```
          Non-Reset Volumes

   IV                20684 Gal
   GV                20304 Gal
   GST               20309 Gal
   GSV               20345 Gal
   MASS              14367 Lbs
```

Press Clear to return to the Non-Resettable Volumes screen.

Additive injector values are displayed as follows: additives 1 through 4 are displayed. Using the arrow keys on the keypad will allow the operator to move through all 4 of the additives.
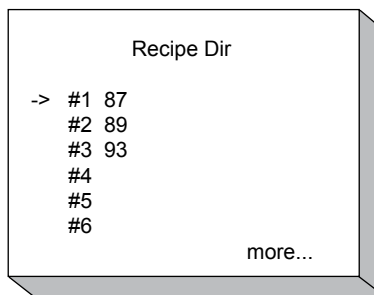
```
  Non-Reset Volumes

INJ 1              0.000
INJ 2              0.000
INJ 3              0.000
INJ 4              0.000
```

Pressing the CLEAR key will return the display to the Non-Reset Volumes screen.

Choosing "Recipes" from the "Non-Reset Volumes" menu results in the following screen:

```
        Recipe Dir

->  #1  87
    #2  89
    #3  93
    #4
    #5
    #6
                    more...
```
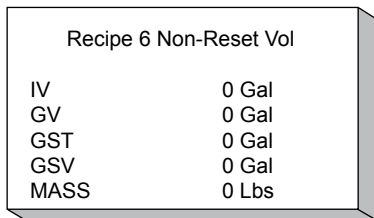
To view the other six available recipes, simply scroll with the arrow keys up or down.

```
        Recipe Dir

->  #7
    #8
    #9
    #10
    #11
    #12
                    more...
```

The following is displayed after the desired Recipe is selected by moving the arrow in front of the name and pressing ENTER.

```
   Recipe 6 Non-Reset Vol

IV               0 Gal
GV               0 Gal
GST              0 Gal
GSV              0 Gal
MASS             0 Lbs
```

Press CLEAR to return to the recipe directory. Press CLEAR to return to the Non-Resettable Volumes screen. Press CLEAR to return to the Diagnostics Menu.

Event Log

The View Only Diagnostics menu displays "Event Log" where past event can be viewed. #With the arrow in front of "Event Log," pressing ENTER will display the last event that occurred in the microLoad. The "Event Log" includes alarms, transaction start and end, and program mode parameter changes.

```
            Event #621

03/12/99              0:59:02
Alarm Cleared -
DA: Mtr Program Error
```
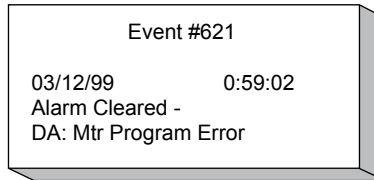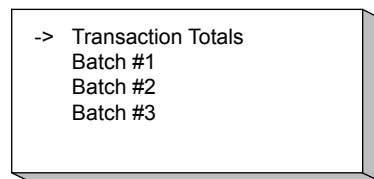
From the display, the operator can go back through the events using the up and down arrow keys. Pressing the CLEAR key will display the Diagnostics menu.
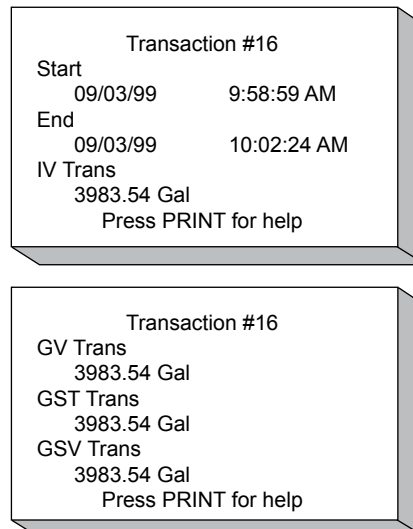
Transaction Log

The Diagnostics menu provides the selection "Transaction Log," where the transaction date can be viewed. With the arrow in front of "Transaction Log," pressing ENTER will display the following:

```
          Transaction Log

              Enter # of
           transactions back
               ->  1

       Enter 1 for the most recent.
```
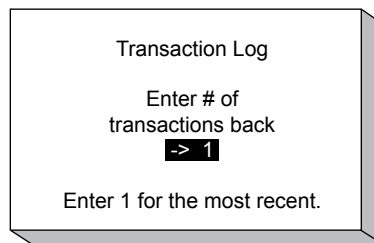
Entering the number of batches back, the microLoad will display the following screen:

```
    ->  Transaction Totals
        Batch #1
        Batch #2
        Batch #3
```

From the display, the operator can choose either "Transaction Totals" or "Batch Data." If more than one batch is included in a transaction, each will be listed separately. The following information is displayed for Transaction Totals:

```
           Transaction #16
Start
     09/03/99         9:58:59 AM
End
     09/03/99         10:02:24 AM
IV Trans
     3983.54 Gal
          Press PRINT for help
```

```
           Transaction #16
GV Trans
     3983.54 Gal
GST Trans
     3983.54 Gal
GSV Trans
     3983.54 Gal
          Press PRINT for help
```

```
                Transaction #16

Mass Trans
        16465.39 Lbs
Number of Batches
        1
Trans Avg Mtr Factor
        1.06547
            Press PRINT for help
```

```
                Transaction #16

Trans Avg Temp
        60.0 F
Trans Avg Dens
        42.7 Lb/Ft3
Trans Avg Press
        70.0 PSI
            Press PRINT for help
```

```
                Transaction #16

Trans Avg CTL
        1.0000
Trans Avg CPL
        1.0006
IV Non-Reset
        677789 Gal
            Press PRINT for help
```

Note: Additive totals will be displayed only for those injectors used in the transaction.

```
                Transaction #16

GV Non-Reset
        677789
GST Non-Reset
        677789
GSV Non-Reset
        677789
            Press PRINT for help
```

```
                Transaction #16

Mass Non-Reset
        9509 Lbs


            Press PRINT for help
```

When "Batch" is selected from the above menu, the following data will be displayed:

```
Transaction #16 – Batch #1

Recipe #
     02
IV Batch
     1902.33 Gal
GV Batch
     1902.33 Gal
          Press PRINT for help
```

```
Transaction #16 - Batch #1

GST Batch
     1902.33 Gal
GSV Batch
     1902.33 Gal
Mass Batch
   6557 Lbs
          Press PRINT for help
```

```
Transaction #16 - Batch #1

Batch Avg Mtr Factor
     1.0000
Batch Avg Temp
     60.0 F
Batch Avg Dens
     42.7 Lb/Ft3
          Press PRINT for help
```

```
Transaction #16 - Batch #1

Batch Avg Press
     70 PSI
Batch Avg CTL
     1.0000
Batch Avg CPL
     1.0006
          Press PRINT for help
```

```
Transaction #16 - Batch #1

Add 1 Batch
     150.000 cc
Add 2 Batch
     110.000 cc
Alarm Occurred
     1:VF
          Press PRINT for help
```

Press CLEAR to return to the Transaction selection. Press CLEAR again to return to the Transaction Log screen. Press CLEAR again to return to the Diagnostics Menu.

Audit Trail

The View Only Diagnostics menu provides the selection "Audit Trail" where audit trail data is available for viewing. With the arrow in front of "Audit Trail," pressing ENTER will display the last audit trail entry that occurred in the microLoad.

```
        Audit Trail Entry #13


02/12/99   11:43:32
Flow Simulator
Enabled
```

The audit trail provides the date, time, and description of Program Mode changes. Note that only changes to parameters secured at the two highest security levels programmed are logged in the audit trail. Pressing the up and down arrows on the keypad will allow the operator to step through the audit trail.

```
             Audit #478


02/12/99   11:36:13AM
Program Mode exit
     thru keypad
Calculated CRC 0xC515
Flash address 29f580
```

Pressing the CLEAR key will display the Diagnostic menu.

Digital Inputs

The Diagnostics menu provides for the selection of "Digital Inputs" where the current status of the digital inputs can be viewed. With the arrow in front of "Digital Input," pressing ENTER will display the digital inputs, the programmed function, and their status.

```
           Digital Inputs

#1 Permissive 1          ON
#2 NA                    OFF
#3 Permissive 2          OFF
```

Viewing the above displays provides information on digital input #1. It is used as a permissive and the current status is ON. Likewise, the functions and status of digital inputs #2 and #3 are also available. Pressing the CLEAR key will display the Diagnostics menu.

Digital Outputs

The Diagnostics menu provides the selection "Digital Outputs" where the function and status of the digital outputs can be viewed. With the arrow key in front of "Digital Outputs," pressing ENTER will display all six digital outputs and their status.

```
          Digital Outputs

#1 NA                    OFF
#2 Pump                  OFF
#3 Upstream Sole         OFF
#4 Downstream Sol        OFF
#5 N/A                   OFF
#6 N/A                   OFF
```

Pressing the CLEAR key will display the Diagnostics menu.

Analog Inputs

The Diagnostics menu provides the selection "Analog Inputs," where the function and status of the analog inputs can be viewed. With the arrow in front of "Analog Inputs," pressing ENTER will display the two analog inputs, their current reading in engineering units, current, or voltage, and raw analog input value.

```
              Analog Inputs

  #1: M1 Temp In      15.0 C
       14.062 mA       36863
  #2: M1 Pressure     6.2 Kg/cm2
       16.170 mA       42388

  #1 Cal: 0131072     0917504
  #2 Cal: 0131072     0917504
```

Pressing the CLEAR key will display the Diagnostics menu.

Pulse Inputs

The Diagnostics menu provides the selection "Pulse Inputs" where the leakage pulses and the batch pulses are displayed. The leakage pulses are the pulses received when the valve is not told to open and no flow is authorized. Batch pulses are zero since no batch is in progress. With the arrow in front of "Pulse Inputs," pressing ENTER will display the pulse inputs. Select meter pulse inputs or configurable pulse inputs.

If no transaction is in progress, the following display will appear:

```
              Pulse Inputs

  Mtr Leak                 0
  Metered Inj              0
```

If there is a transaction in progress, the following display will appear:

```
              Pulse Inputs

  Mtr Count              233
  Metered Inj              0
```

Pressing the CLEAR key will display the Diagnostics menu.

Communications Monitor

The Diagnostics menu provides the selection "Comm Monitor" to review messages being sent and received across the communications lines. With the arrow in front of "Comm Monitor," pressing ENTER will display the following:

```
           Comm Monitor Live

     ->   comm 1
          comm 2
          comm 3
```
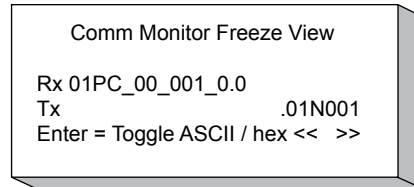
This display allows the operator to choose the communication port to be viewed. Pressing the ENTER key when the arrow is in front of the desired communications port will display the data that is being received by the microLoad and the response of the microLoad.

```
Comm Monitor Live View

Rx 01PC_00_001_0.0
Tx                        .01N001
Enter = Freeze
Print = errors
```
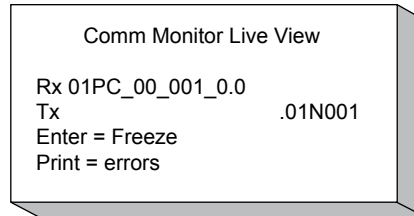
This display indicates that microLoad address 01 received a PC command from the host and responded with a "no response," indicating that it is in Program mode. To freeze a command or response for further viewing, press "ENTER."

```
Comm Monitor Freeze View

Rx 01PC_00_001_0.0
Tx                        .01N001
Enter = Toggle ASCII / hex <<   >>
```

On this display, the operator can toggle the message between the ASCII and hex characters. The decimal point key allows toggling between page scrolling ("<< >>") and character scrolling ("< >"). To return to the previous display, press CLEAR.

Pressing the PRINT key in the live view will display the following screen:

```
Comm Error Counts

Overruns: 00000
  Parity: 00000
 Framing: 00000
```
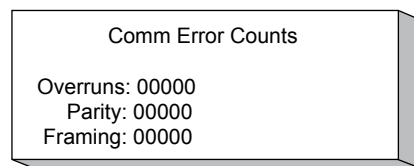
From this display, the overrun errors, parity errors, and framing errors can be viewed. Pressing CLEAR will return to the Live View display.

When completed, press CLEAR until the Diagnostics menu is displayed.

Download Directory

This directory will give a listing of all files that have been downloaded from the micromate. Some examples would be Translations, Configurable Bill of Lading Reports (factory default also), html webpages, Driver Database, Boolean Equations, etc. Simply press ENTER on the menu to view the listing and use the up and down arrows to navigate all downloads if they exist. Press CLEAR to get back to the Diagnostics Menu.

Boolean Algebraic

The Diagnostics menu provides the selection "Boolean Algebraic" to view Boolean/Algebraic registers and their results. General-purpose timers can also be viewed from this screen. With the arrow in front of "Boolean Algebraic," pressing ENTER will display the Boolean/Algebraic Processing menu.

```
Boolean/Algebraic

 ->      User Boolean Registers
         User Algebraic Registers
         Equation Line State
         General Purpose Timers
```
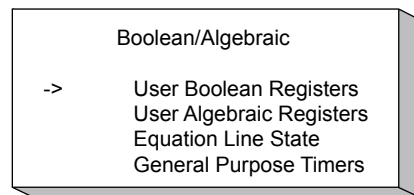
User Boolean Registers

The User Boolean Registers display indicates the registers and their current True or False value, where 0 is False and 1 is True.

```
                    User Boolean Regs

      #1      0        #7     0
      #2      0        #8     0
      #3      0        #9     0
      #4      0        #10    0
      #5      0        #11    0
      #6      0        #12    0
                      More...
```

Using the up and down arrows, the 50 User Boolean Registers can be viewed. Pressing CLEAR will return to the Boolean/Algebraic Processing menu.

User Algebraic Registers

The User Algebraic Registers display the current values of the variables in the register. This display is read-only, but the registers can be modified via Boolean/Algebraic equation or via communications. These registers are used to check the values of the variables that have been set up and/or downloaded from the micromate.

```
                    User Algebraic Regs

      #1                          0
      #2                          0
      #3                          0
      #4                          0
      #5                          0
      #6                          0
                      More...
```

Using the up and down arrows, all 50 Use Algebraic Registers can be viewed. Pressing CLEAR will return to the Boolean/Algebraic Processing menu.

Equation Line State

The Equation Line Status displays the current status of the equations, where "D" indicates that the equation is disabled, "T" is True, and "F" is false. All equations without an "IF" statement will have a "True" status. Those with an "IF" will indicate the result of the "IF" expression: either "True" or "False."

```
                    Equation Line State

      1                           7
      2                           8
      3                           9
      4                           10
      5                           11
      6                           12
                      More...
```

Using the up and down arrow keys, view all 50 equations. Pressing CLEAR will return to the Boolean/Algebraic Processing menu.

General Purpose Timers

The General Purpose Timers display the current time on the timers. The timers are broken down as follows:

Clear the timer by writing a zero to the database location of the desired timers.

Timer Numbers	Resolution	Range
1-2	0.1 second	109 minutes
3-4	1.0 second	18.2 hours
5-6	1.0 minute	45.5 days
7-8	1 hour	7.5 years

```
              General Purpose Timers

   #1          0    #7         0
   #2          0    #8         0
   #3          0
   #4          0
   #5          0
   #6          0
```

Using the up and down arrow keys will display the remaining timers. Pressing CLEAR will return to the Boolean/Algebraic Processing menu. Pressing CLEAR again will return the display to the Diagnostics menu.

Transaction Archive Data

The Diagnostics menu provides the selection "Transaction Archive Data," which allows the operator to view transaction data on the load arm. With the arrow in front of "Transaction Archive Data," pressing ENTER will display the following screen:

```
              Transaction Archive

   Actual # stored - 51
   Max # allowed - 1023
```

Pressing CLEAR will return to the Diagnostics menu.

Printer Standby Data

The following screen will be available for printer standby data:

```
              Printer Standby Data

   # Transactions            500
   # Locked                   15
   Transaction # Range
         3251-3265

        In Printer Standby Mode
```

The bottom line in the above screen will indicate one of the following options:

- In Printer Standby Mode (last attempt at printing failed)
- Printer Available (last transaction report was successfully printed)
- Storage Full (transactions are not permitted)

The transaction range shown will indicate the oldest transaction pending and the latest transaction pending. If the printer is down intermittently and pending reports have not been printed, it is possible that not all of the transactions in the range shown are pending.

Printer Summary Data

```
        Printer Summary Data

   # Transactions        41 ─────────── # of Total Transactions
   # Locked               3 ─────────── # of Transactions that unsuccessfully printed
   Transaction # Range
              001-003 ─────────────────── Transaction range of unsuccessfully printed reports
   Printer Available ──────────────────── Status of Printer
                                          (Printer Available, In Printer Standby, or Storage Full
```

Summary Data

This menu gives the totals for the batch running in the transaction. It displays how much was delivered and the associated pulses from the meter for the batch in progress. If a new batch is started in the same transaction, only the current batch information will be shown.

```
              Summary Data

    GV                    0.0 GAL
    GSV                   0.0 GAL
    Temp In               0.0 F

    Mtr Count             0
    Err Count             0
```
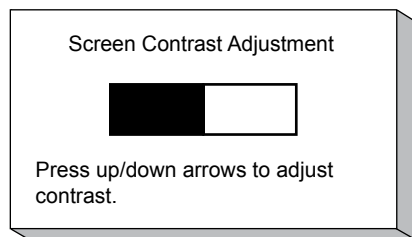
Software Version

The Diagnostics menu provides the selection "Software Version," which allows the operator to view the version of software that is running in the microLoad. With the arrow in front of "Software Version," pressing ENTER will display the software version, CRC, and MAC address.

```
              Summary Version

    microLoad Rev            00.06
    CRC                   9CFCE469
    Boot Load Rev           00.04

    MAC           00:50:C2:XX:XX:XX

               Copyright 2004-2009
               FMC Smith Meter Inc
```

Pressing CLEAR will return to the Diagnostics menu.

Contrast Adjust

This Diagnostics menu provides for adjusting the display contrast.

```
          Screen Contrast Adjustment

          ████████░░░░░░░░

          Press up/down arrows to adjust
          contrast.
```

Press CLEAR to return to the Diagnostics menu.

Revisions included in MN06149 Issue/Rev. 0.4 (9/13):

"Print Pending Reports" added to Section VIII. Diagnostics Menu and Printer Standby Data added after Transaction Archive Data and before Summary Data.

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