Installation and Operating Instructions

Series DE2000™
Microcontroller Receiver
with
Standard Level Software
PREFACE

This instruction manual may contain information about features or options that are not included in each customer unit. Not all features are available on all models (e.g., RS485 communication). Consult the AMETEK Drexelbrook representative or factory for details (1-800-527-6297).

The user is encouraged to read this instruction manual in its entirety before operating the DE2000 Receiver. If this is not possible, review Sections 3.1 through 3.5 and use the Programming Guide (Section 5) to begin operation.

AMETEK Drexelbrook makes no warranty of any kind with regard to the material contained in this manual, including, but not limited to, implied warranties or fitness for a particular purpose. Drexelbrook shall not be liable for errors contained herein or for incidental or consequential damages in connection with the performance or use of material.

Copyright 2001 AMETEK Drexelbrook
Series DE2000™
Microcontroller Receiver
with
Standard Level Software
TABLE OF CONTENTS

SECTION 1
1.1 Introduction
1.2 System Description
   1.2.1 Optional Accessories
      1.2.1.1 Relays
      1.2.1.2 Analog Outputs
      1.2.1.3 Removable Memory Module
1.3 Model Numbering
1.4 Specifications

SECTION 2
2.1 Unpacking
2.2 Mounting the DE2000
2.3 Wiring the DE2000
   2.3.1 Power Wiring
   2.3.2 Analog Input Wiring
      2.3.2.1 Wiring as a Current Source - Analog Input
      2.3.2.2 Wiring as a Current Sink - Analog Input
   2.3.3 Analog Output Wiring
      2.3.3.1 Wiring as a Current Source - Analog Output
      2.3.3.2 Wiring as a Current Sink - Analog Output
   2.3.4 Relay Wiring
   2.3.5 Common Alarm and Fault Wiring
   2.3.6 TTL Output Wiring
   2.3.7 Remote Acknowledge Switch Wiring
   2.3.8 Wiring for Auto-Calibration
   2.3.9 Removable Memory Module

SECTION 3
3.1 System Start-Up
3.2 Operating Modes
3.3 Programming the DE2000 - Basic Rules
   3.3.1 Two-Line Display Operation Mode
   3.3.2 Prompts
   3.3.3 Selecting the Response
   3.3.4 Default Values
   3.3.5 Configuration Editor for Test and Numerical Values
   3.3.6 Programming Aids
3.4 Assigning the Password
3.5 Input Channels
   3.5.1 Type of Input
      3.5.1.1 Auto-Calibration
   3.5.2 Tag I.D.
   3.5.3 Time Delay
   3.5.4 Input Fail Safe
   3.5.5 Units Selection
   3.5.6 Calibration Units
      3.5.6.1 Defining “Other” Units
3.5.7 Output Units
   3.5.7.1 Defining “Other” Units
3.6 Calibration
  3.6.1 Point Calibration (or Pre-calibration refer to 3.6.2)
  3.6.2 Pre-Calibration
3.7 Analog Outputs
  3.7.1 Proportional Band
3.8 Setpoints
  3.8.1 Source Units for the Setpoint
  3.8.2 Setpoint Values
  3.8.3 Setpoint Logic
3.9 Relays (optional)
3.10 TTL Outputs
3.11 Alarms
  3.11.1 Common Alarm
  3.11.2 Fault Alarm
3.12 Curve Fitting
  3.12.1 Vessel is a Sphere
  3.12.2 Vessel is a Horizontal Cylinder
  3.12.3 User Defined Strapping Table
3.13 Pump Alternator (Pump Sequencer)
3.14 Removable Memory Module (RMM)

SECTION 4
  FACTORY AND FIELD SERVICE ASSISTANCE
  4.1 Telephone Assistance
  4.2 Equipment Return
  4.3 Field Service
  4.4 Customer Training

SECTION 5
  PROGRAMMING GUIDE (FLOW DIAGRAMS)
  5.1 Introduction
  5.2 Programming the DE2000 - Basic Rules
  5.3 Prompts
  5.4 Two Line Display
  5.5 Configuration Editor for Text and Numerical Entries
  5.6 Selecting the Response
  5.7 Specific Configuration Details (Application Related)
  5.8 SOFTWARE FLOW DIAGRAMS
    5.8.1 MAIN MENU SELECTIONS
    5.8.2 INPUT SELECTION
    5.8.3 UNITS SELECTION
    5.8.4 CURVE FITTING
    5.8.5 INPUT CALIBRATE
    5.8.6 INPUT TIME DELAY
    5.8.7 ANALOG OUTPUT
    5.8.8 SETPOINTS
    5.8.9 SETPOINT LOGIC
    5.8.10 RELAYS
    5.8.11 SPECIAL FUNCTIONS
    5.8.12 SYSTEM FUNCTIONS

APPENDIX I
  Setpoint Logic Worksheet
  DE2000 Factory Default Values Diagram

APPENDIX II
  Typical application example. A vertical tank with high and low setpoints, pump start/stop
  (adjustable differential) and reading a heel value.

  Step by Step Configuration example

INDEX
SECTION 1 INTRODUCTION

1.1 Introduction


The DE2000 is a microcontroller-based receiver that accepts up to (2) 4-20 mA inputs and performs process control functions according to specified configuration and calibration commands. The DE2000 displays the process channel information on a 2-line display on the front panel of the unit. A built-in keypad, also on the front panel, is used for both operation and configuration (programming) of the unit.

1.2 System Description

The DE2000 Receiver, shown in a typical system in Figure 1-1, operates from 120/240 Vac, 50/60 Hz power. It provides the power for up to (2), two-wire 4-20 mA transmitters (e.g. Drexelbrook 408-B200) and for up to (2) optional 4-20 mA output loops. System programming and calibration for the 2 current loops is accomplished at the receiver via a built-in keypad. A 2-line, vacuum-fluorescent display shows input information for both channels on a real-time basis.

Using the DE2000 software, the user can program up to 2 process channels and display the process variables in percent or engineering units. Eight (8) setpoints can be assigned as individual control points or programmed together using standard logic functions for more unusual control applications.

Auto-Calibration is available as a standard feature. It uses the second input channel to improve the accuracy of the level measurement.

Four (4) TTL outputs are also provided with the DE2000. The TTL outputs directly correspond to the relay outputs.

The unit is equipped with a common setpoint alarm relay and a common malfunction alarm relay rated at 5 amps @ 120 Vac.

The common alarm relay is assignable to any or all of setpoint or setpoint logic outputs using the keypad. If the setpoint or setpoint logic outputs are exceeded, the common alarm relay contacts close to operate the device to which they are connected (e.g. a light or horn). The relays remain closed until either the Acknowledge key (located on the keypad) or the remote Acknowledge key is pressed.

The common fault relay monitors the 2 input loops. It is activated when certain operating values (set by Drexelbrook) are exceeded.

a. If the input current from any transmitter goes below 3.5 mA (e.g. open loop).

or

b. If the input current from any transmitter goes above 22.5 mA (e.g. shorted loop).

Also included in a DE2000 system, is a system fault alarm. The DE2000 continuously runs a self-diagnostic program. If the diagnostic program finds a fault, the system fault lamp is lit and the common fault relay is activated. A message is displayed indicating which board should be changed.

To prevent the loss of user-configured data, the DE2000 has an on-board E² memory device. This memory device is automatically updated when changes are made to the configuration. If 120 Vac power is lost, and then returned, the DE2000 boots-up automatically. The information in the E² memory device is transferred to RAM with the same configuration as prior to the power failure.

The unit is housed in a NEMA 4X housing and is intrinsically safe without barriers.
Figure 1-1
Typical DE2000 System
1.2.1 Optional Accessories

Optional accessories for a DE2000 unit include Relays, Analog Outputs, and Removable Memory Module.

1.2.1.1 Relays (RLY)

Up to eight (8) individual SPDT relays rated 5 amps at 120 Vac, can be assigned to the setpoints or setpoint logic outputs through the software. There are four relays on a relay card. Two cards are required to provide 8 relays. Each individual relay, operating through one of the configured setpoints or logic outputs, can be used to operate control devices (e.g. pumps, valves).

The relay option also provides the user with a pump alternator function. The pump alternator is a specialized relay function that operates from one or more setpoints. A sequence of consecutively-numbered relays is specified for one setpoint. Each time that the setpoint is in an alarm condition, the next relay in the sequence is actuated for the alarm. As successive setpoints go into alarm, successive relays are actuated, making an activated relay for each alarmed setpoint.

1.2.1.2 Analog Outputs (A/O)

Two (2) 4-20 mA analog outputs are configurable individually as either a current source (as shipped) or current sink. Each analog output has an adjustable proportional band of 2% to 200% and can be configured as direct or reverse-acting.

1.2.1.3 Removable Memory Module (RMM)

The removable memory module provides long-term, non-volatile storage of the calibration, configuration, set point, and relay data that has been entered into the DE2000 by the user. It retains a user’s configuration in the event of a system failure. The module can also be used to set up repetitive calibration schemes and to confirm long-standing calibration and configuration data.

1.3 Model Numbering


601-2XX0-X0X-XXX

Reserved for Drexelbrook

7 Nema 4X Housing

Reserved for Future

0 Standard Software Package

1 Standard Software with Communications

2 Flow Software

3 Flow Software with Communications

Reserved for Future

0 120/240, 50/60 Hz Vac Power

1 24 Vdc power

Reserved

0 Indicating

1 Non-Indicating
1.4 Specifications

Following are the specifications for the DE2000:

Power Requirement: 80-260 Vac 50/60 Hz
24 Vdc available as an option.

Operating Temperature: -40°F to 185°F

Housing: 11 7/16" W X 13 5/8" H
X 7 5/8" D
NEMA 4X

Display: 2 line X 20 character vacuum fluorescent display.

Transient Protection: 10 amp (on input and output loops)

Receiver Inputs:
- Up to two 4-20 mA transmitters (sink or source).
- 12 bit, 0.025% input resolution.
- 0.1 second response time.

Receiver Outputs:
- Common alarm output SPDT 5A-120 Vac relay contacts.
- Common fault (loop malfunction) alarm output - SPDT 5A-120 Vac relay contacts.
- RS-485 serial communications port (9600 baud).
- TTL outputs (0-5 Vdc @ 125 mA maximum).

Intrinsic Safety: Signal wires are intrinsically safe with barriers or without barriers.
SECTION 2 - INSTALLATION

2.1 Unpacking

Carefully remove the contents of the shipping carton and check each item against the packing list before destroying any packing materials. If there is any shortage or damage, report it to the factory immediately.

2.2 Mounting the DE2000

Ambient temperatures should be between -40°F and 185°F (-40°C and 85°C). Whether indoors or outdoors, the unit should be mounted in a location that is as free as possible from vibration, corrosive atmospheres, and any possibility of mechanical damage. For convenience at start-up and calibration, mount the instrument in an easily accessible location.

Figure 2-1 shows the mounting dimensions of the DE2000 in the standard 10 X 12 (and Nema 4, 4X) housings.

2.3 Wiring the DE2000

Figure 2-2 depicts the standard card cage positions of the boards in the DE2000. The Analog Input board must be located in the last card slot (location J10). Other boards will function in any other card slot locations but should be positioned to the right or left of the intrinsic safety wiring barriers, depending on system requirements.

**Figure 2-1**
DE2000 Mounting Dimensions

**Figure 2-2**
DE2000 Standard Board Arrangement in Card Cage
2.3.1 Power Wiring

Figure 2-3 shows the wiring connections for 120/240 Vac power input to the DE2000.

For 120 Vac power input, connect the hot (black) wire to terminal 1, the neutral (white) wire to terminal 2 and the ground (green) wire to terminal 3.

For 240 Vac power input, connect one hot (L1) wire to terminal 1, the second hot (L2) wire to terminal 2 and the ground wire to terminal 3.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 Vac</td>
<td>B</td>
<td>W</td>
<td>G</td>
</tr>
<tr>
<td>240 Vac</td>
<td>L1</td>
<td>L2</td>
<td>Gnd</td>
</tr>
</tbody>
</table>

2.3.2 Analog Input Wiring

Analog input wiring is shown in Figure 2-3. The A11 (Analog Input) board is always located in slot J10 on the far right-hand side of the card cage.

Locate the 2 connectors labeled A and B. Connector A-terminals 1 through 4 are for input channel 1. Connector B-terminals 1 through 4 are for input channel 2.

**Note:** #18 AWG is recommended as the maximum wire size for input wiring. Twisted shielded pair is recommended in areas of high electrical noise.

These connectors pull off for ease of wiring. After connecting the wires, using a small screwdriver, they can be plugged back in again. The maximum wire size is 14 AWG.

2.3.2.1 Wiring as Current Source - Analog Input

Wiring the DE2000 as the source of current is the most common method. For this reason, the factory ships the DE2000 wired as the current source. When using two-wire transmitters (e.g., Drexelbrook 40B-B200), the DE2000 must be wired as the current source in order to supply power to and read the signal from a two-wire transmitter. Use the following procedure to connect the 4-20 mA analog inputs with the DE2000 as the current source.

a. Run the wires from the transmitter into the DE2000. For ease of wiring, remove connector A or B depending on the channel selection. Leave the factory-installed jumper between terminals 1 and 2 in place.

b. Place positive lead into terminal 3 and tighten.

**Note:** Allow extra wire so that connector can be plugged back into socket.

c. Connect the negative or ground lead under one of the screws on the ground bus.

**Note:** For intrinsically safe installations, there must be two independent conductors from the ground bus to earth ground. Always provide at least 1 earth ground. Refer to Figure 2-3.

d. Plug the connector back into socket. Analog input wiring is complete for selected channel.
2.3.2.2 Wiring as Current Sink - Analog Input

If the transmitter is connected through a separate or its own power supply and does not require operating power from the DE2000, the analog input connections are wired as sink. Use the following procedure to connect the 4-20 mA analog inputs as sink.

a. Remove connector A or B depending on channel selection.

b. Remove the factory-installed jumper between terminals 1 and 2.

c. Connect positive lead from the transmitter to terminal 2.
2.3.3 Analog Output Wiring

Analog output wiring is shown in Figure 2-4. The placement of the Analog Output board is dependent on the application. If the device being driven by the output is in an area that requires intrinsic safety, the Analog Output board must be placed on the right-hand side of the wiring barrier (usually next to the Analog Input card). If the device being driven is not capable of being intrinsically safe, the Analog Output card must be placed on the left-hand side of the wiring barrier.

There are two connectors on the Analog Output board labeled A and B. Connector A-terminals 1 through 4 are for output channel 1. Connector B-terminals 1 through 4 are for output channel 2.

*Note:* #18 Awg wire is the recommended maximum wire size for output wiring. Twisted shielded pair is recommended in areas of high electrical noise.

2.3.3.1 Wiring as Current Source - Analog Output

When it is wired as a current source, the DE2000 provides the power to operate the device to which it is connected. Use the following procedure to wire the analog outputs as source.

a. Remove connector A or B, depending on channel selection.

b. Leave factory-installed jumper between terminals 1 and 2 in place.

c. Place the positive lead into terminal 3 and tighten.

d1. If the application requires intrinsic safety, place the negative lead under one of the screws on the ground bus.

d2. If the system is not intrinsically safe, connect the negative lead to terminal 4 and tighten.

e. Replace the connector into the socket. Wiring is complete.

2.3.3.2 Wiring as Current Sink - Analog Output

The analog outputs are wired as sink when the operating power is coming from a source other than the DE2000. Use the following procedure to wire the analog outputs as sink.

a. Remove connector A or B depending on the selected output channel.

b. Remove the factory-installed jumper between terminals 1 and 2.

c. Place the positive lead from the device into terminal 2 and tighten.

d. Place the negative lead into terminal 3. For ground-referenced applications, add a jumper between terminals 3 and 4 and tighten.

e. Replace the connector in the socket. Wiring is complete.

2.3.4 Relay Wiring

Wiring for the optional Relay board is shown in Figure 2-4. In an intrinsically safe system, the Relay board must be placed on the left side of the wiring barrier.

Label A contains the two (2) connector terminals for Relays 1 through 4. Relays 2 and 4 use terminals labeled 1, 2, 3. Relays 1 and 3 use terminals labeled 4, 5, 6.

Label B contains 5 switches for manual relay control. Switches 1 through 4 control the position (normal or alarm) of relay 1 through 4. The 5th switch selects either the auto or manual control mode. If switch 5 is set in manual control, all of the relays are set manually.
Figure 2-4
Analog Output and Relay Wiring
Installation

Label C contains 4 sets of relay status lights indicating normal (green) or alarm (red) for each relay.

Label D is a yellow L.E.D. which when lit, indicates that the relay card is in the manual mode.

The wiring for each relay is identical. Use the following procedure to wire a relay. It assumes Relay 1 is being wired and that the relay-controlling device is 120 Vac-powered.

a. Remove connector for selected relay.

b. Insert 120 Vac power line into terminal 5 (for relays 1 and 3 -- terminal 2 for relays 2 and 4).

c. Insert a wire that is connected to the input terminal of the device to be controlled into terminal 4 (for relays 1 and 3 -- terminal 1 for relays 2 and 4).

d. Connect the Power Return terminal of the controlled device to the 120 Vac neutral line.

e. This wiring configuration turns the device ON when the relay is in the alarm state. Move the wire in terminal 4 (for relays 1 and 3 -- terminal 1 for relays 2 and 4) to terminal 6 to turn the device OFF in the alarm state.

f. Replace connector in socket. Wiring is complete.

2.3.5 Common Alarm and Fault Wiring

Figure 2-5 shows the common alarm and fault wiring. The common alarm and fault relays are located on the standard functions card in slot J2 of the card cage.

On the Standard Functions card, Label C connector contains the common alarm contacts. Label D connector contains the common fault contacts.

The wiring for common alarm and common fault are identical. Use the following procedure to wire the common alarm contacts. The procedure assumes that a 120 Vac-powered horn is actuated by the common alarm contacts.

a. Remove connector C (for common alarm -- connector D for common fault).

b. Place the 120 Vac hot line into terminal 2 and tighten.

c. Connect one of horn terminals to terminal 1 and tighten.

d. Connect other horn terminal to the 120 Vac neutral line.

e. Replace connector in the socket. The horn will sound when the common alarm is activated or when there is a line power loss to the DE2000.

601-2000-LM/P.9A
Figure 2-5
Common Fault, Common Alarm, TTL Outputs, Remote Acknowledge Switch, and RS-485 Communications Output Wiring.
2.3.6 TTL Output Wiring

TTL output wiring is shown in Figure 2-5. The TTL outputs are located on the connector labeled B on the Standard Functions card. The Standard Functions card is located in slot J2 of the card cage.

A TTL high output (5V) indicates a normal condition. A TTL low (0V) indicates an alarm condition. Use the following procedure to wire the TTL outputs.

a. Remove connector B.

b. Connect a ground wire from terminal 6 to the ground of the device receiving the TTL output from the DE2000.

c. Wire from the TTL outputs 1 through 4 (terminals 1 through 4) to the TTL inputs of the receiving device.

d. Replace the connector in the socket. TTL output wiring is complete.

c. Insert another wire into terminal 2 and tighten.

d. Connect the two (2) wires to the normally open and common terminals of the pushbutton switch.

e. Replace the connector in the sockets. Wiring is complete.

2.3.8 Wiring for Auto-Calibration

Auto-Calibration (Auto-Cal) requires a hardware connection as well as programming the software. Perform the following steps:

(a) Connect the continuous level transmitter to Channel 1 (terminal Strip A).

(b) Calibrate channel 1 as standard level Input Type using either the Pre-Cal or Point Cal methods described in section 3.6.

(c) Single point Auto-Cal: Connect (on/off) Auto-Cal point level control to Channel #2 (terminal strip B) as shown in Figure 2-6.

(d) Multiple point Auto-Cal: Consult factory.
2.3.9 Removable Memory Module

The Removable Memory Module board (RMM) is available as an option with the DE2000. In order to use the RMM function, the board should be placed in the J6 location of the DE2000 card cage, as shown in Figure 2-2.

A memory card is supplied with the RMM board. This card is inserted into the slot with the arrow from the card matching the arrow on the board. Extra memory cards are available to store multiple configurations.
SECTION 3 OPERATION AND CONFIGURATION

This section describes the different control functions of the DE2000 and outlines the respective programming procedures.

Refer to the DE2000 Programming Guide in Section 5 for a configuration overview.

3.1 System Start-up

For initial system start-up, check all wiring connections of the transmitters and sensing elements. Check the wiring of the DE2000 with section 2.3.

When the transmitters and sensing elements are properly installed and connected to the DE2000, apply power to the unit.

*Note*: Some rough calibration of the field transmitters may need to be done at installation. If the field transmitters are not calibrated and produce a current less than 3.5 mA or greater than 22.5 mA, the unit will display the common fault alarm until the transmitter produces a current within the allowable range.

3.2 Operating Modes

There are two basic operating modes of the DE2000:

a. **Configuration** - Use this mode to program the DE2000. The control variables for each channel are defined in configuration.

b. **Operation** - Use this mode to monitor the application. Real-time values are displayed in operation mode.

3.2.1 Two-Line Display (Operation Mode)

In the operation mode, channel information is displayed on the two-line display in various formats.

The single-channel mode uses both lines of the display to provide channel information. Pressing the DISPLAY key toggles between the two channels.

(1) Ch #1 Output Units Calibration Units (Press DISPLAY)
    Ch #2 Output Units Calibration Units

Pressing the left or right arrow key (← →) while in a single channel display causes the second display line to change.

(2) Output displayed as bar graph
    Ch #1 23.0 (Press →)
            [\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\n
(3) Setpoints in alarm
    Ch #1 23.0 (Press →)
            1 2 ALM

Depressing the DISPLAY key for a third time causes both channels to be displayed. In the dual-channel mode, the first line of the display is dedicated to Channel 1 and the second line is dedicated to Channel 2.

(4) Ch #1 Calibration Units
    Ch #2 Calibration Units

Pressing the up or down arrow key (↑ ↓) while in a dual-channel display causes the displayed information to change.

a) Calibration units for each channel
b) Output units for each channel
c) Setpoints and Logics in common-alarm
d) System Diagnostics Message
3.3 Programming the DE2000 - Basic Rules

By pressing EDIT, 3-key password, and EDIT again, the user enters the configuration (or programming) mode of the DE2000.

DE2000 configuration is accomplished using the series of menus containing the control variables. The user cycles through the menus and defines the specific variables according to the application. The DE2000 software is designed to be user-friendly. That is, it moves the user through the sequence of menus depending on the responses that are specified for each variable.

DISPLAY key enter operation mode and exits configuration mode.

EDIT key and password (paragraph 3.4) enters configuration mode, exits operation mode.

User interaction with the DE2000 is accomplished through the front panel keypad. The functions of each key are given in Figure 3-1.

There are a total of 11 main configuration menus:

- Input Selection
- Units Selection
- Curve Fitting
- Input Calibration
- Input Time Delay
- Analog Output
- Setpoints
- Setpoint Logic
- Relays
- Special Functions
- System Functions

Each menu contains specific variables relating to the menu function.

Using the arrow keys, the user can move within the menus to review or change a response. Each configuration menu begins from the main heading “DE2000 XXXXXXX VX.X” where: XXXXXXX is the software version date and VX.X is the version number.

**Note:** The software version date and version number should be permanently recorded. If service is required, it is necessary to refer to these numbers.

Movement within the configuration menus is as follows:

a) Up ↑ or Down ↓ - Vertical movement from the main heading is used to complete all the variables of one menu. With each movement of the vertical arrow keys, the user enters a different level in the menus.

b) Side-to-Side ↔ - Horizontal movement is used to “wrap around.” Use of the side arrow keys moves the user either to the next menu or to the next variable within the menu. Options for specific variables can be reviewed using horizontal arrow keys.

Figure 3-2 illustrates the use of the arrow keys.
LEGEND

1. **TWO LINE DISPLAY**
   Displays real-time values in operation mode and configuration menu prompts in configuration mode.

2. **SYSTEM FAULT INDICATOR**
   Alerts operator of system fault found during system diagnostics.

3. **RELAYS ON MANUAL**
   Indicates that relays are operating manually via switch on relay board.

4. **FAULT INDICATOR**
   Alerts operator of fault in channel 1 or channel 2 triggered by malfunction in transmitter.

5. **ALARM INDICATOR**
   Indicates common alarm triggered by high or low alarm condition.

6. **ARROW KEYS**
   Scrolls users through configuration menus in the configuration mode.

7. **CLEAR KEY**
   Erases a value in configuration mode that has been previously entered.

8. **DISPLAY KEY (OPERATION)**
   Used to enter operation mode.

9. **ENTER KEY**
   Assigns the configured value during configuration.

10. **EDIT KEY (CONFIGURATION)**
    Used to enter configuration mode.

11. **ACK KEY**
    Acknowledges an alarm condition in the operation mode.

*Figure 3-1*
DE2000 Display and Keyboard
3.3.1 Two-Line Display (Configuration Mode)

If the configuration mode, the two-line display on the front panel of the unit shows the main menu heading. Each time that the arrow keys are pressed the configuration menu item changes, according to the direction of the arrow. The user can recognize the menu item by using a programming convention built into the DE2000:

First Line of display = upper case letters
Second Line of display = lower case letters

Horizontal movement (left, right arrows) results in a two-line display with same first line as previous item and new second line option.

Vertical movement (up, down arrows) results in a two-line display with the previous second line now shown as the first line.

- First line upper case (where you are)
- Second line lower case (where you will go with ↓ arrow)
- Previous second line repeated with upper case
- Second line enters next level of menu

- First line, upper case same menu level.
- Second line, lower case different menu option.
3.3.2 Prompts

Along with the arrow keys, the use of prompts aid the user in programming the DE2000.

? (Prompt) Prompts user to make entry in response to question. Use ENTER key to select an option when ? appears and user is at lowest level of menu.

= (Prompt) Prompts user to enter or change a configuration value (usually alphanumeric) using EDIT key.

= XXX? If both = and ? appear, use ENTER key to accept or change value.

Blinking Character (Edit Mode) Cursor indicating that value can be edited.

3.3.3 Selecting the Response

After moving through the menus using the arrow keys, the sequence of options for each variable becomes apparent. Select the option (usually at the lowest level of menu) using the ENTER key. The DE2000 then displays the next logical menu item.

Arrow Keys provide movement through the menus without changing data. EDIT and ENTER Keys alter the data.

When a selection is entered, the default value is overwritten. A question mark will then be shown for the alternate responses, but not for the response that was selected. To escape a menu, back-track (using ↑ arrow to main menu heading). To exit configuration, press DISPLAY.

The message "SAVING TO MEM MODULE" is displayed when entering operation mode after changing values in configuration mode.

It is suggested that the user become familiar with the DE2000 programming rules by moving through the menus using the arrow keys, before entering actual application values (i.e., without using ENTER Key).

3.3.4 Default Values

Built in to the DE2000 software are default (or pre-defined) values that can be accepted or changed with the EDIT/ENTER Keys. Pre-configured default settings allow operation to begin as soon as the inputs are connected and power is applied.

The default values are listed in Table 3-1.

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Digit Password =</td>
<td>111(UP↑,UP↑,UP↑)</td>
</tr>
<tr>
<td>Input Type =</td>
<td>Standard Level</td>
</tr>
<tr>
<td>Tag ID =</td>
<td>Ch1 and Ch2</td>
</tr>
<tr>
<td>Auto-Cal Value</td>
<td>100%</td>
</tr>
<tr>
<td>Calibration =</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>Input Time Delay =</td>
<td>0.0 Seconds</td>
</tr>
<tr>
<td>Calibration Units =</td>
<td>0-100%</td>
</tr>
<tr>
<td>Output Units =</td>
<td>0-100%</td>
</tr>
<tr>
<td>Setpoint 1 =</td>
<td>95%, HLFS, Ch1</td>
</tr>
<tr>
<td>Setpoint 2 =</td>
<td>5%, LLFS, Ch1</td>
</tr>
<tr>
<td>Setpoint 3 =</td>
<td>95%, HLFS, Ch2</td>
</tr>
<tr>
<td>Setpoint 4 =</td>
<td>5%, LLFS, Ch2</td>
</tr>
<tr>
<td>Setpoint 5-8 =</td>
<td>Off</td>
</tr>
<tr>
<td>Setpoint Logic Points 1-8</td>
<td>Off</td>
</tr>
<tr>
<td>Analog Outputs =</td>
<td>Off</td>
</tr>
<tr>
<td>Relay 1 =</td>
<td>Off</td>
</tr>
<tr>
<td>Relay 2 =</td>
<td>Off</td>
</tr>
<tr>
<td>Relay 3 =</td>
<td>Off</td>
</tr>
<tr>
<td>Relay 4 =</td>
<td>Off</td>
</tr>
</tbody>
</table>

If relays are not installed, TTL outputs follow same action as relays.

Unless noted otherwise, the default values are the same for both input channels 1 and 2.

Table 3-1. DE2000 Default Values
A default value is indicated by the absence of a ? prompt. Once a default value is changed by the user, it can only be returned to the default value by:

a. re-entering the default value using the EDIT mode (refer to Table 3-1).
b. using System Functions menu to return to default configuration (all values listed in Table 3-1 will be defaulted).

3.3.5 Configuration Editor for Text and Numerical Entries

Certain menu items in the DE2000 program require a numerical or text entry in order to complete the sequence. In these cases use the configuration editor:

a. Press EDIT; cursor appears in text field to be edited.
b. Press up or down arrow key; character set is scrolled.
c. ← → move cursor to next character field.
d. Repeat step b for each character field.
e. Press ENTER when entry is complete; continue with menu sequence.

3.3.6 Programming Aids

Before starting configuration, prepare the application guidelines and specify the values that will be assigned.

Use the DE2000 Programming Guide (Section 5) to view the configuration menus and control variables (and options).

Refer to Sections 3.4 through 3.12 of this Instruction Manual for a functional description of each menu.
3.4 Assigning the Password

In order to enter the configuration mode of the DE2000, the user must press EDIT, enter a 3-digit password, and press EDIT again. The 3-digit code ensures that changes to the application cannot be made without the knowledge of the proper personnel.

Each key on the DE2000 Keypad corresponds to a numerical entry as shown in the following diagram.

<table>
<thead>
<tr>
<th>#0</th>
<th>#1</th>
<th>#2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAR</td>
<td>1</td>
<td>DISPLAY</td>
</tr>
<tr>
<td>#3</td>
<td>NO CODE</td>
<td>#4</td>
</tr>
<tr>
<td>LEFT</td>
<td>EDIT</td>
<td>RIGHT</td>
</tr>
<tr>
<td>#5</td>
<td>#6</td>
<td>#7</td>
</tr>
<tr>
<td>ACK</td>
<td>DOWN</td>
<td>ENTER</td>
</tr>
</tbody>
</table>

KEYPAD PASSWORD CODE VALUES

The default value for the password is 111. On the DE2000 keyboard, 111 is entered (or corresponds to) UP↑, UP↑, UP↑. To change the default value, use the SYSTEM FUNCTIONS menu.

3.5 Input Channels

Define the 2 input channels for the DE2000 using the INPUT SELECTION menu.

The DE2000 uses the defined inputs to perform calculations within the other menus. For example, Input Channel #2 can be programmed as the source input for one or more of the setpoints.

The input channel information is displayed on the 2-line display on the front panel of the unit.

DREXELBROOK ENGINEERING CO.(1) Main
DE2000 XXXXXXX VX.X
Menu Heading

(1) Main Menu
DE2000 XXXXXXX VX.X
System Functions

It is recommended to completely configure all the menu items of one input channel first, then move back to CHANNEL SELECT again (using arrow keys), select the second channel, and configure it completely.

System Select

CHANNEL SELECT

DE2000 XXXXXXX VX.X

Input Selection

(2) Wrap-around to Input Selection menu

DE2000 XXXXXXX VX.X

Input Selection

(3) Wrap-around to Channel Select

DE2000 XXXXXXX VX.X

System Functions

(2) Wrap-around to System Functions menu

SYSTEM FUNCTIONS

Change Password

(3) Wrap-around to Password

CHANGE PASSWORD

Val = 111

(4) Press EDIT to change Password or ENTER to accept Default.

601-2000-LMP. 18
3.5.1 Type of Input

The INPUT SELECTION menu selects the channel to be configured (#1 or #2), defines the type of information to be entered for that channel, and allows the user to assign a tag name (or ID) to the channel.

DREXELBROOK ENGINEERING CO (1) Main
DE2000 XXXXXXX VX.X
Menu
Heading

(2) Wrap-around Input Selection to Input Selection menu

(3) Asking Input Type
INPUT SELECTION
Input Type?

INPUT TYPE
inactive = standard level = true level = auto = input type
Calibration = presents true level

If a channel input needs to be turned off for some reason, select INACTIVE.

A STANDARD LEVEL input programs the unit to represent the current signal on the designated channel as 4-20 mA signal (default condition). Also use this selection for other types of inputs such as temperature or pressure transmitters.

A TRUE LEVEL input programs the unit to represent the current signal on input channel #1 as level compensated by the signal on channel #2 input of True level.

For example:
Channel #1 units = (% input of channel #1)
 divided by
(% input of channel #2)

The TRUE LEVEL menu selection is used with Drexelbrook 4-wire True Level transmitters with Level output to Input Channel #1 and Reference (composition) Output to Input Channel #2 (e.g., Model 408-7400 True Level transmitter).

Two-wire True level transmitters (e.g., 408-7200) require only one input channel and are calibrated as a STANDARD LEVEL input.

3.5.1.1 True Level Calibration

NOTE

Do not enable True Level in INPUT SELECTION until instructed to do so in this procedure.

Connect True Level transmitter(s) as detailed in Paragraph 2.3.2.1. Ensure level signal is connected to channel 1 and the reference (composition) signal to channel 2. Also refer to the True Level transmitter instruction manual for its proper calibration procedure.

Select CH #1 as the active channel and STANDARD LEVEL as the input type.

Select appropriate OUTPUT UNITS label (gallons, pounds, etc.) and edit the maximum output. This value in most instances will be the maximum vessel capacity and must equate to the capacity when the level is at the maximum height (the CALIBRATION UNITS value previously entered).

With the level sensor in air (uncovered), follow procedure in transmitter instruction manual and use POINT CAL to set the low current and edit the low unit value to the height at which the level probe tip is located (i.e., the heel value). The level probe tip on single probe True Level Systems is typically 5 1/2 inches above the actual probe tip. Consult the True Level transmitter manual.

With the reference and level sensors still uncovered, select CH #2. Use POINT CAL to set the low current and leave the low unit value at 0%. (This means the reference sensor is 0% covered.)
Raise the level in the vessel to more than cover the reference sensor and as much of the level sensor as possible.

While still editing channel 2 use POINT CAL and set the high current to 100%. (This means the reference sensor is 100% covered.)

Select CH #1. Use POINT CAL and set high unit value to the present calibration unit level in the tank. This means the level sensor is set to the calibration value that currently exists in the vessel.

The True Level system is now calibrated. Enable the TRUE LEVEL function as INPUT TYPE in the INPUT SELECTION configuration menu. After pressing the display key, this configuration will be saved. The TRUE LEVEL will be displayed on channel 1, the REFERENCE signal will be displayed on channel 2.

If the True Level calibration needs to be adjusted in the future, set the high unit of channel 1 in POINT CAL and reset to the actual level in the vessel in calibration units.

3.5.1.2 Auto-Calibration

The Auto-Calibration function (Auto-Cal) improves the accuracy of the level measurement by automatically resetting the calibration of the measurement channel during the course of routine measuring activity.

The reset capability is provided by point level, ON/OFF measuring devices: 1) The ON/OFF sensor is installed at a known material level. 2) When the material reaches the level of the ON/OFF sensor, the calibration of the corresponding continuous level measuring channel of the DE2000 is reset to provide a consistent level reading.

The DE2000 uses one of its input channels to receive the ON/OFF measurement (the recalibration channel). The second DE2000 channel is the level measuring channel. Refer to paragraph 2.3.8 for the hardware connections for Auto-Cal.

Auto-Calibration requires an input value to be entered. The value corresponds to the actual level of the Auto-Cal control. The default Auto-Cal value is 100%. Use the following instructions to program Auto-Cal:

DE2000 XXXXXX VX X (1) Wrap-around to input Selection menu

INPUT SELECTION
Input Type (2) Move down to Input Type selection.

INPUT TYPE
Auto-Calibration (3) Wrap-around to select Auto-Calibration. Press ENTER

MAX # OF CAL PTS.
Val = 1 (4) Edit the Auto-Calibration value to a value that corresponds to the actual level of the Auto-Cal control.

AUTO-CAL PT #n
Val = 10.00% AUTO-CAL DELAY
Val = 0.0 sec.

AUTOCAL DIRECTION
Up and Down ←→ Up Only ←→ Down Only
3.5.2 Tag ID

A tag name can be assigned to the channel using the Tag ID sequence in the INPUT SELECTION menu. Up to 6 alphanumeric characters can be used to specify a tag. The alphanumeric character set is accessible through the arrow keys after pressing EDIT key.

DREXELBROOK ENGINEERING CO. (1) Main DE2000 XXXXXX VX.X Menu Heading

DE2000 XXXXXX VX.X (2) Wrap-around Input Selection to Input Selection menu

INPUT SELECTION (3) Wrap-around Tag ID to Tag ID

TAG ID ID # = Not Entered

(4) Assign Tag using EDIT.

TAG ID ID # =

(5) Define ID using alphanumeric characters (accessible through arrow keys), press ENTER.

3.5.3 Input Time Delay

A designated time delay specified for the input channel provides for damping on the input signal. The time delay (in seconds) is specified through a separate menu: INPUT TIME DELAY. The time delay range is from 0.0 to 90 seconds.

It is best to add time delay (if desired) after the calibration configurations have been accomplished.

DREXELBROOK ENGINEERING CO. (1) Main DE2000 XXXXXX VX.X Menu Heading

DE2000 XXXXXX VX.X (2) Wrap-around input Time Delay to Input Time Delay menu.

INPUT TIME DELAY (3) Enter time delay by Delay = 0.0 Sec.

pressing EDIT and then using arrow keys to access alphanumeric character set. ENTER delay time.
3.5.4 Input Fail-Safe

The fail-safe of an input designates a relationship between the output and the input: direct-acting or reverse-acting.

The default condition is direct-acting or LLFS

(LLFS) 100% = Full tank = Direct-Acting
(HLFS) 100% = Empty tank = Reverse-Acting

The input fail-safe should be considered before calibrating the unit.

3.5.5 Units Selection

Units Selection refers to a label of measurement for display purposes (e.g., gallons, liters, etc.) that are assigned to the calibration and output ranges. The UNITS SELECTION menu is used to define maximum limits of calibration and output units and is also used to label calibration and output units for display purposes. Refer to paragraph 3.5.6 and 3.5.7 for a description of these functions respectively.

3.5.6 Calibration Units

As the incoming signal is calibrated, the user specifies the maximum input calibration units (i.e., maximum size of vessel) and the calibration units label. Calibration units are defined in terms of level (e.g., feet or meters). These designations are assigned through the UNITS SELECTION menu:

APPLICATION NOTE

Maximum Input Value cannot be less than the High Unit Value specified in the INPUT CALIBRATE menu (paragraph 3.6.1).

APPLICATION NOTE

The default input points of the user-defined strapping table (paragraph 3.12.3) are scaled in 5% increments according to the Maximum Input Value.
To label the calibration units, use the following programming sequence:

DREXELBROOK ENGINEERING CO.
DE2000 XXXXXX VX X
(1) Main
Menu
Heading

↓

DE2000 XXXXXX VX X
Units Selection
(2) Wrap-around to
UNITS SELECTION
menu.

↑

UNITS SELECTION
Calibration Units
(3) Move down to
Calibration Units
selection.

↓

CALIBRATION UNITS
Units Label
(4) Asking units label.

↑

UNITS = %
(5) Wrap-around to
Feet?
Units Label and
Inches?
press ENTER
Meters?
MM?
CM?
Other?

APPLICATION NOTE

If calibration units and outputs units (paragraph 3.5.7) are both assigned the same label (e.g. %) the operator will not be able to distinguish between the calibration units and output units on the two-line operating display (paragraph 3.2.1).

3.5.6.1 Defining “Other” Units

In the UNITS LABEL menu item, the user can select the “Other?” option:

a. To assign a label to the units measurement that is not available as a choice in the menu list. For example - ml. (milliliters)

When the “Other?” option is selected, use the configuration editor (described in paragraph 3.3.5) to make the text entry.

3.5.7 Output Units

The user specifies the maximum output value (i.e. maximum capacity) loop and the output units label. Output units are usually defined in terms of volume or weight.

Use the UNITS SELECTION menu to program the output units.

DREXELBROOK ENGINEERING CO.
DE2000 XXXXXX VX X
(1) Main
Menu
Heading

↑

DE2000 XXXXXX VX X
Units Selection
(2) Wrap-around to UNITS SELECTION menu.

↓

UNITS SELECTION
Maximum Output
(3) Asking maximum output.

↑

MAXIMUM OUTPUT
Max Out = 100.00
(4) Define maximum output (if different from default) by pressing EDIT and using arrow keys.

APPLICATION NOTE

The default output points of the user-defined strapping table (paragraph 3.12.3) are scaled in 5% increments according to the Maximum Output Value.
3.6 Calibration

NOTE

Before starting calibration, read Section 3.6 completely, along with the calibration section of the transmitter instruction manual.

The calibration software of the DE2000 is used to calibrate the input channels to the DE2000.

When calibrating the loop(s) using the DE2000, the user may want to turn off the time delay, so that it does not interfere with the calibration levels. Use the INPUT CALIBRATE menu to turn time delay on or off.

3.6.1 Point Calibration (for Pre-Calibration refer to 3.6.2)

Point calibration requires the entry of two distinct and known material levels, referred to as the high and low current points. The points do not have to be 0% and 100%, but they should be greater than 1.6mA apart for best accuracy.

Point calibration is accessed through the INPUT CALIBRATE menu.

Point calibration is intended for use with Drexelbrook Magi-Cal™ transmitter. Point calibration may also be used to make minor calibration corrections to an already-calibrated system regardless of transmitter type.
3.7 Analog Outputs (Optional)

A single circuit card provides up to (2) 4-20 mA (sink or source) analog outputs. Each of the output channels are assigned to inputs by the user, through configuration. Either output channel can be assigned to either input channel. The output channel represents a percentage of its designated CALIBRATION UNITS or OUTPUT UNITS.

The programming sequence for the analog outputs is used to activate the output signal for a specific channel. It is recommended that the analog output configuration be done after calibration is completed.

Analog output source units, listed below, are used to specify the display of the outputs in the operation (display) mode.

   a) calibration units -
      Low and High calibration units based on Low and High currents and unit values selected in the INPUT CALIBRATE (Magi-Cal) menu.
   
   b) output units -
      as specified by user in UNITS SELECTION menu.

   c) % output units -
      internal calculation by DE2000 based on user-specified output units.

   d) conditioned input -
      4-20 mA current input signal conditioned with designated time delay (if used) and input fail-safe.

To program the analog output source units, continue with the configuration as follows:

DE2000 XXXXXX VX X (1) Go to Analog Output
Analog Output

(2) Wrap-around to ANALOG OUTPUT menu.

(3) Select analog output.

(4) Asking for input source.

(5) Wrap-around to select input source and press ENTER.

Source Units

(2) Wrap-around to Source Units selection.

(3) Select a choice for the analog output source units and press ENTER.

SOURCE UNITS

Calibration Units

Output Units?

% Output Units?

Conditioned Input?

DREXELBROOK ENGINEERING CO. (1) Main
DE2000 XXXXXX VX X Menu
   Heading

DE2000 XXXXXX VX X (2) Wrap-around Analog Output to ANALOG OUTPUT menu.

(3) Select analog output.

Analog Output #1 or #2

(4) Asking for input source.

ANALOG OUTPUT #n

Input Source

(5) Wrap-around to select input source and press ENTER.

INPUT SOURCE

Off

Channel #1?

Channel #2?

601-2000-LM/P. 26
3.7.1 Proportional Band

The proportional band selection in the ANALOG OUTPUT menu allows the user to take the 4-20 mA signal (or defined analog output source units) and have it outputted with an adjustable 2% to 900% proportional band. For example, with a 50% proportioning band, the 4 mA can be produced at 30% of the original signal, and 20 mA correspond to 80% of the original signal.

To program the proportional band, continue with the ANALOG OUTPUT menu as follows:

DE2000 XXXXXX VX.X
Analog Output

ANALOG OUTPUT #n
Proportional Band

(1) Go to ANALOG OUTPUT menu.

(2) Wrap-around to Proportional Band selection.

3.8 Setpoints

Setpoints are mathematical points of measurement for each channel. They are used to define the control limits of the measurement. A HLFS setpoint is in the true condition when the level of the assigned input channel is at or above the specified setpoint level. A LLFS setpoint is in the true condition when the level of the assigned input channel is at or below the specified setpoint level. Setpoints are normally used as control points for the setpoint relays (Section 3.9). When a relay is associated with a setpoint, the relay will be in a non-energized state when the setpoint is in its fail-safe condition. “Fail-safe” means that in the event of the most probable failures, the instrument will fail safely. “Most-probable failures” means such things as loss of power and most transistor and component failures.

Up to eight setpoints can be configured per channel in the DE2000. Define the setpoints using the SETPOINTS menu, proceed as follows:

DREXELBROOK ENGINEERING CO. (1) Main
DE2000 XXXXXX VX.X
Menu Heading

DE2000 XXXXXX VX.X
Setpoints

(2) Wrap-around to SETPOINTS menu.

(3) Select setpoint. n = 1-8

SETPOINT #n
Input Source

(4) Asking input source.

INPUT SOURCE
Off or Channel #1? or #2?

(5) Define input source and press ENTER.
3.8.1 Source Units for the Setpoint

As part of the SETPOINTS configuration, the user can select the type of setpoint source units. The setpoint source units can differ from the specified engineering units used to display input and calibration.

Setpoint source units, listed below, are used to specify the activate and differential values, described in paragraph 3.8.2.

a) Calibration units -
   Low and High calibration units based on Low and High currents and unit values selected in the INPUT CALIBRATE (Magi-Cal) menu.

b) Output units -
   as specified by user in UNITS SELECTION menu.

c) % output units -
   internal calculation by DE2000 based on user-specified output units.

d) Conditioned input -
   4-20 mA current, input signal conditioned with designated time delay (if used) and input fail-safe.

To program the setpoint source units, continue with setpoint configuration as follows:
3.8.2 Setpoint Values

Three values are associated with each setpoint:

a) activate -
   value at which setpoint is reached.

b) differential value -
   offset value from setpoint before de-activating alarm condition.

c) fail-safe mode -
   high or low state

These values are also specified in setpoint configuration:

DREXELBROOK ENGINEERING CO.
DE2000 XXXXX VX.X

(1) Main Menu
    (2) Wrap-around to SETPOINTS menu.

Setpoints

(3) Asking for setpoint values.

SETPOINT VALUES
Activate Value
Differential Value
Fail Safe

(4) Wrap-around and complete each value.

ACTIVATE VALUE
sp#n = 0.0 source units (user-defined)

Differential Value
sp#n = 0.0 source units (user defined)

FAIL SAFE
High Level or Low Level

(5) Define value using EDIT and arrow key, Press ENTER.
3.8.3 Setpoint Logic

The SETPOINT LOGIC menu can be used to operate the relay(s) using a single setpoint or combination of setpoints. Use the Setpoint Logic Worksheet, located in the back of this manual, to work out the setpoint/relay connections on paper before doing software configuration. Up to 8 setpoints and 8 logic outputs can be configured as the input sources to the Logic function.

DREXELBROOK ENGINEERING CO. (1) Main Menu Heading

DE2000 XXXXXX VX.X (2) Wrap-around to Setpoint Logic menu.

SETPOINT LOGIC (3) Select Setpoint Logic #n Logic #. n = 1-8

LOGIC #n Input Sources (4) Asking input source

INPUT SOURCES Input A (5) Define inputs to logic functions.*

INPUT SOURCES Input B

INPUT A Off Setpoint 1-8? Logic 1-8?

INPUT B Off Setpoint 1-8? Logic 1-8?

Continue with the program to define Logic function:

LOGIC #n Function (7) Asking input function.

FUNCTION And
Or?
Not?*
X or?
N and?
Nor?

(8) Wrap-around to select function. Press ENTER.

*Not function requires only one input.
3.9 Relays (Optional)

Up to 8 relays are available in the DE2000 as a customer option. The relays, located on a separate relay (RLY) board cage, provide single-pole, double-throw (SPDT) contacts that open and close in response to setpoint conditions. There are 4 relays per board. Up to 2 boards may be installed.

Each relay is assigned to a setpoint (or combination of setpoints or logic points) during configuration. The user determines the setpoint logic used to activate each relay. The relay may be set up to respond (open or close) to the condition of a single setpoint or to a combination of setpoints.

To program the relays, proceed as follows:

1. **Main Menu**
   - **DE2000 XXXXXXX VX.X**
   - **Relays**

2. **Wrap-around to RELAYS menu.**

3. **Select Relay.**
   - **#n = 1,2,3,4, 5,6,7,8.**

4. **Asking Input source.**
   - **Input Source**
   - **Off or Setpoint #n or Logic #n**

5. **Define input source as setpoint #n or logic #n; n = 1-8. Press ENTER.**

A relay can be turned on or off in configuration without changing the original selections for the relay.

3.10 TTL Outputs

Included on the Standard Function card in the DE2000 (slot J2) are 4 TTL (transistor-to-transistor logic) outputs. Using these outputs the DE2000 is able to connect directly to the input or output of other TTL logic devices, such as PLCs, etc.

The 4 TTL outputs directly correspond to the relay outputs 1-4, thereby allowing the setpoint or logic outputs to drive TTL devices.

3.11 Alarms

Three types of alarms are provided in the DE2000. The types of alarm and how they function are described in the following paragraphs.

3.11.1 Common Alarm

The common alarm is configured to alert the operator of a serious condition when level is out of the range of the defined control points.

In DE2000 configuration, common alarm is accessed through the SETPOINTS menu if the setpoints are to activate the common alarm;

1. **Main Menu**
   - **DE2000 XXXXXXX VX.X**
   - **Setpoints?**

2. **Wrap-around to SETPOINTS menu.**

3. **Wrap-around to select setpoint.**

4. **Answer Yes to Common Alarm. Press ENTER.**
or through the SETPOINT LOGIC menu if the logic outputs are used to define the common alarm:

3.11.2 Fault Alarm

A fault alarm is activated when the signal from the transmitter is outside the 4-20 mA range. A fault alarm usually indicates a malfunction in the transmitter or loop wiring.

The fault alarm software is preset at the factory and is not accessible through DE2000 configuration. The low point is set to 3.5 mA and the high point to 22.5 mA.

During DE2000 operation, a fault alarm condition causes the ALARM indicator on the front panel to flash until acknowledged and then remain lit until the alarm condition is corrected. The ACK key on the keypad is used to acknowledge a fault alarm.

The display informs the operator of the channel in fault and displays a high or low fault message.

3.11.3 System Fault Indicator

A system fault condition exists when a malfunction is detected during the system diagnostics of the DE2000.

The display informs the operator of a system fault. Use the ACK key to acknowledge the system fault alarm.

During DE2000 operation, a common alarm condition (defined in configuration) causes the ALARM indicator on front panel to flash until acknowledged and then remain lit until alarm condition is controlled. The ACK Key on the keypad is used to acknowledge a common alarm.

The respective display channel will show a common alarm condition.
3.12 Curve Fitting

The curve fitting program allows the user to compensate the channel data to allow display of volume data when the vessel is a sphere, a horizontal cylinder, or other irregularly-shaped vessel or a non-linear output is required.

The default selection for the curve fitting menu is a linear tank. In this case, tank strapping is not required and the loop data is not compensated.

3.12.1 Vessel is a Sphere

If the vessel is a sphere, the DE2000 internally computes the non-linear relationship between volume and level and reports the proportioned data according to the specified maximum output units (UNITS SELECTION menu).

3.12.2 Vessel is a Horizontal Cylinder

If the vessel is a horizontal cylinder, the DE2000 internally computes the non-linear relationship between volume and level and reports the proportioned data according to the specified maximum output units (UNITS SELECTION menu).

DREXELBROOK ENGINEERING CO. DE2000 XXXXXX VX.X

(1) Main Menu Heading

DE2000 XXXXXX VX.X Curve Fitting

(2) Wrap-around to
Curve Fitting menu.

CURVE FITTING Select Active Table

(3) Asking for table of vessel type.

SELECT ACTIVE TABLE Sphere?

(4) Wrap-around to define vessel as a sphere. Press ENTER.

DE2000 XXXXXX VX.X

CURVE FITTING Select Active Table

SELECT ACTIVE TABLE Horizontal Cylinder?

Horizontal Cylinder with Flat Ends

Horizontal Cylinder with Dished Ends?

Horizontal Cylinder with Hemispheres?

(5) Define the type of cylinder ends. Select type and press ENTER.
3.12.3 User-Defined Strapping Table

The curve fitting program also allows the user to set up a strapping table that is different from the internal strap tables used by the DE2000. The user-specified table can be defined specifically to display the output units proportional to the shape of the vessel, e.g., accommodating a “heel” value, an intrusion in the vessel, or any other input-to-output relationship that can be stated in a table.

A user-defined strapping table consists of a maximum of 21 strapping points. Any number of points between 1 and 21 may be defined (5% increments if all 21 points are used). These points do not need to be uniformly spaced. The user may specify closely-spaced points in the areas of the vessel where the shape is changing rapidly and sparsely-spaced points where the vessel shape does not change.

The input values for the strapping table are defined to correspond with the transmitter inputs (labeled in UNITS SELECTION menu). The output is proportioned as specified in the table and displayed with the same units label as specified for the Output Units selection in the UNITS SELECTION menu.

To configure the user-defined strap tables, use the CURVE FITTING selection as follows:

DREXELBROOK ENGINEERING CO
DE2000 XXXXXX VX X

(1) Main Menu Heading

(2) Wrap-around to CURVE FITTING menu.

CURVE FITTING
User-Defined

MAX # OF POINTS
Val = 21

(3) Wrap-around to User-Defined selection.

CURVE FITTING
Point #n

(4) Define # of points in the table. Press EDIT, enter value. Press ENTER

POINT #n
In = 0.00%

(5) Define each point; n = 1-21. Press ENTER.

POINT #n
Out = 0.00%

(6) Specify input value. Press EDIT, select value, press ENTER.

(7) Specify corresponding output value. Press EDIT, select value, press ENTER.

The program moves back to the point # selection until each point in the table is specified.
3.13 Pump Alternator

The pump alternator program allows the user to alternately turn on and off a set of up to four relays successively from one or more setpoints or setpoint logics. Most of the configuration for the pump alternator function is accomplished through the SETPOINT (or SETPOINT LOGIC) and RELAYS menu.

A 2-pump alternator requires at least two setpoints tied to relays. The first setpoint is the pump-activate setpoint and the second setpoint is a high level fail-safe setpoint. If the level rises/falls too fast for one pump to handle, both relays will alarm.

In the SPECIAL FUNCTIONS (PUMP ALTERNATOR) menu, the user is asked to assign the number of relays (up to 4) that will be operated by the pump alternator.

1) Use the Setpoint Logic Worksheet (provided in Appendix I) to set up the setpoint values and relay sources before selecting the number of pumps to be alternated.

2) Use the Setpoint Activate and Differential Values to turn the pump on and off. The setpoint with the lowest Activate value should be attached to Relay #1. (Attach setpoints to relays using Input Source selection in RELAYS menu).

3) Attach any other setpoints (or setpoint logics) to other relays depending on the number of pumps to be alternated. Additional setpoints (or setpoint logics) should be attached to relays in increasing order. (e.g. SP #3 = 20% to relay #1; SP #6 = 40% to relay #2; SP #5 = 70% to relay #3). The setpoints do not have to be consecutively ordered.

4) Define the # of Pumps value in the SPECIAL FUNCTIONS (PUMP ALTERNATOR) menu according to the number of relays to be sequenced. A value less than two deactivates the pump alternator function. Up to 4 pumps can be selected.

5) Define the Relay start # in the SPECIAL FUNCTIONS (PUMP ALTERNATOR) menu according to the Relay # in which the sequence will begin.

DE2000 XXXXXX VX.X Special Functions
(1) Wrap-around to Special Functions menu.

SPECIAL FUNCTIONS
Pump Alternator #n
(2) Select Pump Alternator function n = 1 or 2.

PUMP ALTERNATOR
Relay Start # ↔ # of Pumps
(3) Assign # of relays and starting relay

RELAY START #
Val = 1-4
(4) Number of relays. Range = 0, 2-4
Val = 0 (0 = Off) Start relay = 1-4

The following example is a configuration for the pump alternator function using 3 pumps.

In the setpoint menu, configure as follows:

Setpoint #1 with 30% Activate value
10% Differential value
HLFS
No common alarm

Setpoint #2 with 60% Activate value
40% Differential value
HLFS
No common alarm

Setpoint #3 with 75% Activate value
55% Differential value
HLFS
No common alarm

In the RELAYS menu, configure as follows:

Relay #1 - Input Source = Setpoint #1
Relay #2 - Input Source = Setpoint #2
Relay #3 - Input Source = Setpoint #3
In the SPECIAL FUNCTIONS (PUMP ALTERNATOR) menu, configure as follows:

- # of Pumps: Val = 3
- Relay Start #: Val = 1

Using this configuration, the pump alternator will work as follows:

When the level rises above Sp #1 at 30% level, relay #1 will alarm and not return to normal until 20% level (30% - 10% diff. = 20%).

When the level again rises above Sp #1 at 30% level, relay #2 will alarm and not return to normal until 20% level. When the level again rises above Sp #1 at 30% level, relay #3 will alarm and not return to normal until 20% level. Each time Sp #1 is exceeded, the configured relays will alternate. If, however, the level is rising too fast for one pump to handle, the following will occur.

When the level rises above Sp #1 at 30% level, relay #1 will alarm. Yet the level continues rising. When the level exceeds 60% level, relay #2 will alarm. Yet the level continues to rise. When the level exceeds 75% level, relay #3 (or next relay) will alarm and not return to normal until 20% level (75% - 55% = 20%).

3.14 Removable Memory Module

The Removable Memory Module board provides long-term, non-volatile storage of the calibration, configuration, setpoint, and relay data that has been entered into the DE2000 by the user. It retains a user's configuration in the event of a system failure. The module can also be used to set up repetitive calibration schemes and to confirm long-standing calibration and configuration data.

The SYSTEMS FUNCTION menu is used to program the Removable Memory Module. The Write function Saves configuration data. The Read function Loads configuration data. Refer to paragraph 2.3.9 for the hardware connections for the removable memory module.

DE2000 XXXXXX VX.X System Functions

1. Wrap-around to System Functions menu.

SYSTEM FUNCTIONS Removable Memory

2. Wrap-around to Removable Memory function.

REMOVABLE MEMORY REMOVABLE MEMORY

Read Memory Write to Memory

3. Choose Memory Read (Load) or Write (Save).

READ MEMORY

Are you sure? Yes

WRITE TO MEMORY

or No

4. Choose Yes or No to confirm action. Press ENTER.

The software will display an error message if the RMM hardware is not installed.

a. If the memory module card is not present, "CARD NOT PRESENT" is displayed.

b. If the RMM board is not present or defective, a "BOARD NOT PRESENT" message is displayed.

c. A "SAVING RAM TO CARD" message indicates that the data is being saved by the removable memory module (Write function).

d. A "LOADING RAM FROM CARD" message indicates a successful loading, followed by a "SAVING TO MEM MOD" message which relates that the data was loaded and is being saved in the DE2000's internal memory.
SECTION 4  FACTORY AND FIELD SERVICE ASSISTANCE

4.1 Telephone Assistance

If you are having difficulty with your Drexelbrook equipment, and attempts to solve the problem have failed, notify your local Drexelbrook representative, or call the factory toll free at 1-800-527-6297. Drexelbrook Engineering Company is located at 205 Keith Valley Road, Horsham, PA 19044. To help us solve your problem quickly, please have as much of the following information as possible when you call:

Instrument Model 

Probe Model 

Software Version Date

Software Version 

P.O. 

& Date

Cable Length

Application

Material Being Measured

Temperature

Pressure

Agitation

Brief Description of the Problem

Checkout Procedures that Failed

4.2 Equipment Return

Do not return equipment without first contacting the factory for a return authorization number. Any equipment being returned must include the following information in addition to that above.

Reason for Return

Return Authorization 

Person to Contact at You Company

"Ship To" Address

If available, please include the original P.O. # and the original Drexelbrook order # also.

To keep the paperwork in order, include a purchase order with returned equipment, even though it may be coming back for warranty repair. You will not be charged if the equipment is covered under warranty. Please return your equipment with freight charges prepaid. We regret that we cannot accept collect shipments.

Standard electronic units are generally in factory stock. If the application is critical, a spare electronic chassis should be kept on hand.

4.3 Field Service

Trained field service engineers are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application problems, or in-plant training of personnel. Contact the service department for further details.

4.4 Customer Training

Periodically, the Drexelbrook instrument training seminars for customers are held at the factory. These sessions are guided by Drexelbrook engineers and specialists, and provide detailed information on all aspects of level measurement, including theory and practice of instrument operation. For more information about these valuable workshops, write to Drexelbrook Engineering, Attn: Communications/Training Group, or call direct (215) 674-1234.
SECTION 5 PROGRAMMING GUIDE

5.1 Introduction

This section introduces the DE2000 software package. It presents each available menu in a concise format for reference use.

A setpoint logic worksheet is also provided to document the applied setpoints and logic functions before connecting the relays through the software.

5.2 Programming the DE2000 - Basic Rules

By pressing EDIT, 3-key password, and EDIT again, the user enters the configuration (or programming) mode of the DE2000.

DE2000 configuration is accomplished using the series of menus containing the control variables. The user cycles through the menus and defines the specific variables according to the application. The DE2000 software is designed to be user-friendly. That is, it moves the user through the sequence of menus depending on the responses that are specified for each variable.

Each menu contains specific variables relating to the menu function.

Using the arrow keys, the user can move within the menus to review or change a response. Each configuration menu begins from the main heading "DE2000 XXXXXX VX.XX" where: XXXXXX is the software version date and VX.XX is the version number.

Movement within the configuration menus is as follows:

a) Up ↑ or Down ↓ -- Vertical movement from the main heading is used to complete all the variables of one menu. With each movement of the vertical arrow keys, the user enters a different level in the menus.

b) Side-to-Side ← -- Horizontal movement is used to "wrap around". Use of the side arrow keys moves the user either to the next menu or to the next variable within the menu. Options for specific variables can be reviewed using horizontal arrow keys.

5.3 Prompts

Along with the arrow keys, the use of prompts aid the user in programming the DE2000.

? (Prompt) Prompts user to make entry in response to question. Use ENTER key to select an option when ? appears and user is at lowest level of menu.

= (Prompt) Prompts user to enter or change a configuration value (usually alphanumeric) using EDIT key.

= XXX? If both = and ? appear, use ENTER key to accept or change value.

Blinking Cursor indicating that value can be edited.

Character

5.4 Two-Line Display

If the configuration mode, the two-line display on the front panel of the unit shows the main menu heading. Each time that the arrow keys are pressed the configuration menu item changes, according to the direction of the arrow. The user can recognize the menu item by using a programming convention built in to the DE2000:

First Line of display = upper case letters
Second Line of display = lower case letters

Vertical movement (up, down arrows) results in a two-line display with the previous second line now shown as the first line.
5.5 Configuration Editor for Text and Numerical Entries

Certain menu items in the DE2000 program require a numerical or text entry in order to complete the sequence. In these cases use the configuration editor:

a) Press EDIT; cursor appears in text field to be edited.

b) Press up or down arrow key; character set is scrolled (includes cursor moves to next field).

c) Repeat step b for each character field.

d) Press ENTER when entry is complete; continue with menu sequence.

5.6 Selecting the Response

After moving through the menus using the arrow keys, the sequence of options for each variable becomes apparent. Select the option (usually at the lowest level of menu) using the ENTER key. The DE2000 then displays the next sequential menu item.

When a selection is entered, the default value is overwritten. A question mark will then be shown for the alternate responses, but not for the response that was selected. To escape a menu, back-track (using arrow to main menu heading). To exit configuration, press DISPLAY.

It is suggested that the user become familiar with the DE2000 programming rules by moving through the menus using the arrow keys, before entering actual application values.

5.7 Specific Configuration Details (Application - Related)

The following rules define the relationship between the input calibration units and output units.

- **Calibration Units** relate to input and are defined in terms of level.

- **Output units** relate to output and are defined in terms of volume or weight.

- **Maximum Input** defines the size of the vessel and is configured in UNITS SELECTION menu using calibration units.

- **Low and High Current** equal the minimum and maximum current in the loop respectively as specified by the user in the INPUT CALIBRATE menu.

- **Low and High Units** are the value of calibration units that the low and high currents represent respectively. The Low and High Units are specified in the INPUT CALIBRATE menu.

- **Maximum Input** can never be less than High Unit Value. Conversely, High Unit value cannot exceed Maximum Input. If the Maximum Input value is changed the High and Low Unit values should also be changed.

- **Maximum Output** defines the maximum capacity of the vessel and is configured in UNITS SELECTION menu using output units.

- The maximum calibration input (Maximum Input) relates calibration units to output units.

5.8 Flow Diagrams

The flow diagrams that follow are a visual guide through the software program. The arrows correspond to the arrows on the keypad. The main menu selections (5.8.1) provide an overview of the configuration options. For each block on the main menu diagram there is a corresponding detailed diagram.
5.8.1 MAIN MENU SELECTIONS

DREXELBROOK ENGINEERING CO.
DE2000 XXXXXX VX.X

5.8.2 DE2000 XXXXXX VX.X
Input Selection
- Select process variable to be configured (channel #1 or channel #2)
- Select standard level, True Level, or Auto-Calibration
- Assign tag IDs

5.8.3 DE2000 XXXXXX VX.X
Units Selection
- Define calibration units
- Set maximum input value
- Define output units
- Set maximum output value

5.8.4 DE2000 XXXXXX VX.X
Curve Fitting
- Define values according to type of vessel and flow

5.8.5 DE2000 XXXXXX VX.X
Input Calibrate
- Select calibration method for each process variable; choose Magi-Cal and assign point calibration values or accept pre-calibrated values
- Turn on/off time delay during calibration
- Select fail safe of transmitter

5.8.6 DE2000 XXXXXX VX.X
Input Time Delay
- Configure input time delay value from 0-90 seconds

5.8.7 DE2000 XXXXXX VX.X
Analog Output
- Configure analog output, 1 or 2
- Define input source; choose channel 1 or 2
- Define units which control outputs
- Define proportional band values
- Assign fail-safe, activate, and differential values
- Assign common alarm

5.8.8 DE2000 XXXXXX VX.X
Setpoints
- Configure setpoints 1 through 8
- Define input source; choose channel 1 or 2
- Select source units

5.8.9 DE2000 XXXXXX VX.X
Setpoint Logic
- Combine setpoints to perform logic functions
- Define setpoints as inputs
- Select logic function

5.8.10 DE2000 XXXXXX VX.X
Relays
- Configure relays 1 through 8
- Define source of relay

5.8.11 DE2000 XXXXXX VX.X
Special Functions
- Configure Pump Alternator
- Edit configuration password
- Reset configuration to default values

5.8.12 DE2000 XXXXXX VX.X
System Functions
5.8.2 INPUT SELECTION

DE2000 XXXXXX VX.X
Input Selection

INPUT SELECTION
Input Type

INPUT TYPE
Standard Level

INPUT TYPE
True Level?
(ENTER to Select)

INPUT TYPE
Auto-Calibration?

INPUT TYPE
Inactive?

TAG ID
ID = Not Entered

CHANNEL SELECT
Channel #1

CHANNEL SELECT
Channel #2

See 5.8.2A
Auto-Calibration

(EDIT to change ID
ENTER to save)

(ENTER to Select)
default = italics

5.8.2 A
AUTO-CALIBRATION (Refer to 5.8.2 INPUT SELECTION)

INPUT TYPE
Auto-Calibration

Max # of CAL PTS
Val = 1

AUTO-CAL PT #n
Val = 10.00%

AUTO-CALDELAY
Val = 0.0 Sec.

AUTO-CAL DIRECTION
Up and Down

AUTO-CAL DIRECTION
Up Only?

AUTO-CAL DIRECTION
Down Only?
default = italics

DE2000 XXXXXX VK.X
Units Selection

5.8.3 UNITS SELECTION

UNITS SELECTION
Calibration Units

CALIBRATION UNITS
Maximum Input

(EDIT to change
ENTER to save)

CALIBRATION UNITS
Units Label

UNITS = %
%

UNITS = % Feet?

UNITS = % Inches?

UNITS = % Meters?

UNITS = % mm?

UNITS = % cm?

UNITS = % Other?

(ENTER to edit label with
"Other?" selection
ENTER again to save)

OUTPUT UNITS
Maximum Output

MAXIMUM OUTPUT
Max Out = 100.00
output units

(EDIT to change
ENTER to save)

OUTPUT UNITS
Units Label

UNITS LABEL
Volume?

UNITS = %
%

UNITS = % Gallons?

UNITS = % Barrels?

UNITS = % Liters?

UNITS = % Fl. OZ?

UNITS = % Other?

(ENTER to edit label with
"Other?" selection
ENTER again to save)

UNITS LABEL
Weight?

UNITS = %
%

UNITS = % Pounds?

UNITS = % Ounces?

UNITS = % Tons?

UNITS = % Kgrams?

UNITS = % Grams?

UNITS = % Other?

(ENTER to edit label with
"Other?" selection
ENTER again to save)

Due to space limitations, these menu items are listed vertically. In the actual software program they wrap around horizontally and are accessed using the left and right arrow keys.
default = italics

5.8.4 CURVE FITTING

DE2000 XXXXX VX.X
Curve Fitting

CURVE FITTING
Copy Active Table?

CURVE FITTING
User-Defined

COPY ACTIVE TABLE
Linear

COPY ACTIVE TABLE
Horizontal Cylinder?

COPY ACTIVE TABLE
Sphere?

MAX # OF POINTS
Val = 21

n = 1-21

Horizontal Cylinder
with Flat Ends

Horizontal Cylinder
with Dished Ends?

Horizontal Cylinder
with Hemispheres?

CURVE FITTING
Point #n

POINT #n
In = 0.00%

(Scaled in 5% increments according to Maximum Input in UNITS SELECTION menu.)

POINT #n IN
= 0.00%

OUT = 0.00%

(EDIT to change ENTER to save)

(Scaled in 5% increments according to Maximum Output in UNITS SELECTION menu.)
5.8.5 INPUT CALIBRATE

DE2000 XXXXXX VX.X
Input Calibrate

INPUT CALIBRATE Magi-Cal

MAGI-CAL Pre-Calibrate

MAGI-CAL Point Calibrate

TIME DELAY
On

TIME DELAY Off?

INPUT CALIBRATE Time Delay

INPUT CALIBRATE Fail Safe

FAIL-SAFE LLFS

FAIL-SAFE HLFS?

PRE-CALIBRATE No

PRE-CALIBRATE Yes?

(ENTER to Select)

POINT CALIBRATE Low Current

POINT CALIBRATE Low Unit

(ENTER to Select)

POINT CALIBRATE High Current

POINT CALIBRATE High Unit

(ENTER to Select)

LO CURRENT = 4.00MA
Loop Current (XX.XXmA)?

HI CURRENT = 4.00MA
Loop Current (XX.XXmA)?

HIGH UNIT
Val = 100.00

(EDIT to change Units Selection menu.)

LOW UNIT
Val = 0.00

(EDIT to change ENTER to save)
default = *italics*

5.8.6 INPUT TIME DELAY

DE2000 XXXXXX VX.X
Input Time Delay

INPUT TIME DELAY
Delay = 0.0 sec.

(EDIT to change
ENTRIR to save)
5.8.7 ANALOG OUTPUT

DE2000 XXXXXX VX.X
Analog Output

ANALOG OUTPUT
Analog Output #1

ANALOG OUTPUT
Analog Output #2

ANALOG OUTPUT #n
Input Source

INPUT SOURCE
Channel #1?
(ENTER to select)

INPUT SOURCE
Channel #2?
(ENTER to select)

ANALOG OUTPUT #n
Source Units

SOURCE UNITS
Calibration Units

SOURCE UNITS
Output Units?
(ENTER to select)

SOURCE UNITS
% Output Units?
(ENTER to select)

SOURCE UNITS
Conditioned Input?

ANALOG OUTPUT #n
Proportional Band

PROPORTIONAL BAND
4mA Output Value

PROPORTIONAL BAND
20 mA Output Value

(EDIT to change
ENTER to select)

4 MA VALUE
ao = 0.00 %

20 MA VALUE
ao = 100.00 %

(EDIT to change
ENTER to select)

FAULT DIRECTION
No Latch NLFS?

FAULT DIRECTION
No Latch LLFS

FAULT DIRECTION
Low Level?

FAULT DIRECTION
High Level
5.8.8 SETPOINTS - Use Setpoint Logic Worksheet

default = italics
5.8.9 SETPOINT LOGIC - Use Setpoint Logic Worksheet

default = italics

DE2000 XXXXXX V.X.X
Setpoint Logic

SETPOINT LOGIC
Logic #1

SETPOINT LOGIC
Logic #2

SETPOINT LOGIC
Logic #3

\ldots

SETPOINT LOGIC
Logic #8

LOGIC #n
Function

LOGIC #n
Input Sources

INPUT SOURCES
Input A

INPUT SOURCES
Input B

FUNCTION
And

Or?

Not?

X Or?

N and?

Nor?

COMMON ALARM
No

COMMON ALARM
Yes?

(ENTER to select)

(ENTER to select)

(ENTER to select)

Due to space limitations, these menu items are listed vertically. In the actual software program they wrap around horizontally and are accessed using the left and right arrow keys.
default = italics

5.8.10 RELAYS - Use Setpoint Logic Worksheet

Diagram showing the flow of RELAYS with INPUT SOURCE options:

- RELAYS Relay #1 #5
- RELAYS Relay #2 #6
- RELAYS Relay #3 #7
- RELAYS Relay #4 #8

INPUT SOURCE:
- Off
- Setpoint #1
- Setpoint #2
- Setpoint #3
- Setpoint #4
- Logic #1
- Logic #2
- Logic #3
- Logic #4
- Logic #5
- Logic #6

Due to space limitations, these menu items are listed vertically. In the actual software program, they wrap around horizontally and are accessed using the left and right arrow keys.
5.8.11 SPECIAL FUNCTIONS

DI2000 XXXXXX VX.X
Special Functions

SPECIAL FUNCTIONS
Pump Alternator #1

PUMP ALTERNATOR
Relay Start #

RELAY START #
Val = 1

SPECIAL FUNCTIONS
Pump Alternator #2

PUMP ALTERNATOR
# of Pumps

# OF PUMPS
Val = 0

default = italics
5.8.12 SYSTEM FUNCTIONS

DE2000 XXXXXX VX.X
System Functions

SYSTEM FUNCTIONS
Change Password

SYSTEM FUNCTIONS
External Memory

SYSTEM FUNCTIONS
Default Configure

SYSTEM FUNCTIONS
Analog Output Adjust

SYSTEM FUNCTIONS
Analog Input Adjust

CHANGE PASSWORD
Val = 111

EXTERNAL MEMORY
Read External Memory

EXTERNAL MEMORY
Write to External Memory

WRITE EX-MEMORY
No

ARE YOU SURE?
Yes

ANALOG OUTPUT #n
CAL
Decrement Zero?

ANALOG OUTPUT #n
CAL
Increment Zero?

ANALOG OUTPUT #n
CAL
Decrement Span?

ANALOG OUTPUT #n
CAL
Increment Span?
Appendix I includes a Setpoint Logic Worksheet and a default settings reference diagram.
FACTORY DEFAULT SETTINGS ON A DE2000

CH1 DISPLAY 0–100% (OUTPUT UNITS)
CH2 DISPLAY 0–100% (OUTPUT UNITS)

+--------------------------+--------------------------+
| ANALOG OUTPUTS           | ANALOG OUTPUTS (OPTIONAL)|
+--------------------------+--------------------------+
| (ACTIVE) (TIME DELAY OFF)|                         |
| (CALIBRATION UNITS       |                         |
| 0–100% = 4–20mA)         |                         |
|                          | (CALIBRATION UNITS       |
|                          | 0–100% = 4–20mA)         |
+--------------------------+--------------------------+

SP #1 95% (NO DIFF.)
SP #2 = 5% (NO DIFF.)
SP #3 = 95% (NO DIFF.)
SP #4 = 5% (NO DIFF.)

CH1
CH2

SETPOINTS
LOGIC POINTS
TTL'S
OPTIONAL RELAYS

SP1
LO1
TTL1
RL1

SP2
LO2
TTL2
RL2

SP3
LO3
TTL3
RL3

SP4
LO4
TTL4
RL4

SP5
LO5

SP6
LO6

SP7
LO7

SP8
LO8

COMMON ALARM
COMMON FAULT CONNECTED TO INDICATE FAULT IN CH1 AND/OR CH2
COMMON ALARM NOT CONNECTED
FACTORY DEFAULT SETTINGS ON A DE2000

CH1 DISPLAY 0-100% (OUTPUT UNITS)

CH2 DISPLAY 0-100% (OUTPUT UNITS)

ANALOG OUTPUTS

CH1 (ACTIVE) (TIME DELAY OFF) (CALIBRATION UNITS 0-100% = 4-20mA)

ANALOG OUTPUT CH1 (OFF)

ANALOG OUTPUTS (OPTIONAL)

ANALOG OUTPUT CH2 (OFF)

LED INDICATORS

COMMON ALARM

COMMON FAULT CONNECTED TO INDICATE FAULT IN CH1 AND/OR CH2

SETPOINTS

SP #1 95% (NO DIFF.)

HLFS

SP #2 = 5% (NO DIFF.)

LLFS

SP #3 = 95% (NO DIFF.)

HLFS

SP #4 = 5% (NO DIFF.)

LLFS

LOGIC POINTS

SP1

LO1

TTL1

RL1

SP2

LO2

TTL2

RL2

SP3

LO3

TTL3

RL3

SP4

LO4

TTL4

RL4

SP5

LO5

SP6

LO6

SP7

LO7

SP8

LO8

OPTIONAL RELAYS

RL5

RL6

RL7

RL8
APPENDIX II

Appendix II includes a typical application example and a sample configuration.

DE2000 TYPICAL APPLICATION

APPLICATION: The user has a 12,000 gallon vertical metal tank containing weak acid. The sensing element that is installed has an 11-foot insertion length. The user wants continuous indication with High and Low alarms plus a pump control relay to turn ON at 7 ft. (60%) and OFF at 6 ft. (50%). The display should indicate in gallons where the 100% point is 11 feet up from the bottom and 11,000 gallons.

CONFIGURATION: Configure the calibration parameters assuming the Magi-Cal transmitter produces 6 mA with the probe uncovered and 16 mA with the level at 100%. Configure the setpoints as follows:

- **Setpoint #3 = 10 feet**, HHLS  0% Differential and Common Alarm
- **Setpoint #2 = 7 feet**, HHLS  1 ft. (10%) Differential
- **Setpoint #1 = 2 feet**, LLFS  0% Differential and Common Alarm

6 Ft = 50%
DE2000 MENU PARAMETERS:

In the INPUT SELECTION menu the following items are given:

Input Type = Standard Level

In the INPUT CALIBRATE menu, the following items are given:

Select POINT CALIBRATE
Low Current = 6 mA
Low Unit = 1 foot
Hi Current = 16 mA
High Unit = 11 feet

In the UNITS SELECTION menu, the following items are given:

Maximum Input = 12
Calibration Units Label = Feet
Maximum Output = 12,000
Output Units Label = Gallons

In the SETPOINTS menu, the following items could be configured with these values:

Setpoint #1: Source Units = calibration units
Activate Value = 10 (Feet)
Differential Value = 0
Fail Safe = HLFS
Common Alarm = Yes

or

Setpoint #1: Source Units = output units
Activate Value = 10,000 (Gal)
Differential Value = 0
Fail Safe = HLFS
Common Alarm = Yes

or

Setpoint #1: Source Units = % output units
Activate Value = 90 (%)
Differential Value = 0
Fail Safe = HLFS
Common Alarm = Yes

Note: The units label for the display of the setpoints is determined by the Source Units selection.
Setpoint #2:  
Source Units = calibration units  
Activate Value = 7 (Feet)  
Differential Value = 1 (Foot)  
Fail Safe = HLFS  
Common Alarm = No

or

Setpoint #2:  
Source Units = output units  
Activate Value = 7000 (Gal)  
Differential Value = 1000 (Gal)  
Fail Safe = HLFS  
Common Alarm = No

or

Setpoint #2:  
Source Units = % output units  
Activate Value = 60 (%)  
Differential Value = 10 (%)  
Fail Safe = HLFS  
Common Alarm = No

Setpoint #3:  
Source Units = calibration units  
Activate Value = 2  
Differential Value = 0  
Fail Safe = LLFS  
Common Alarm = Yes

or

Setpoint #3:  
Source Units = output units  
Activate Value = 2000 (Gal)  
Differential Value = 0 (Gal)  
Fail Safe = LLFS  
Common Alarm = Yes

or

Setpoint #3:  
Source Units = % output units  
Activate Value = 10 (%)  
Differential Value = 0 (%)  
Fail Safe = LLFS  
Common Alarm = Yes

To test the configuration, return to Operation mode for the following reading:

At 15 mA input, the output display is 9280 gallons.
DE2000 STEP-BY-STEP CONFIGURATION EXAMPLE

FIGURE A-1

APPLICATION (shown in Figure A-1)

In this sample application there is a 10 foot diameter, 20 foot high vessel with a maximum capacity of 12,000 gallons. The level in this vessel is kept between 8-18 feet to ensure that there is enough material in the vessel for production to keep running. Also, the level is never to get so low that the pump would run dry and damage it.

In case any of these control points should fail to operate (i.e., stuck value) an audible warning for overfill and low level (Lo Lo) is required.

From the above description and Figure A-1, the control functions are:

1. An audible alarm for overfill @ 18.5 feet

601-2000-LM/IP. A-1
2. Close valve V1 @ 18.0 feet
3. Open valve V1 @ 8.0 feet
4. Start pump P1 when level is above 5.0 feet
5. Stop pump P1 when level is 4.0 feet or below
6. An audible alarm for Lo-Lo level @ 3.5 feet

The Drexelbrook equipment being used will be:
1. 19 foot Insertion Length Sensing Element
2. A 408-800 or 408-200 Magi-Cali Transmitter

The DE2000 optional relay card has 4 relays which can be operated from any of the setpoints or logic outputs. Two of the relays will be used to control the pump and valve. Relay 1 will control the valve and Relay 2 will control the pump.

For the overfill and Lo Lo level alarms a horn will be connected to the common alarm relay.

When power is applied to the DE2000 it "wakes" up with default settings; both input channels are on and are calibrated for 4-20 mA to equal 0-100%. To start configuration, enter the menu by pressing "EDIT," a 3-digit key code (UP↑, UP↑, UP↑, Drexelbrook default). At this point, display reads:

1ST LINE: DREXELBROOK ENG CO.
2nd Line: DE2000 XXXXXX VX.X

Press "↓" Down Arrow

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Input Selection

The second line is now showing the main menu heading starting with Input Selection.

Press "↓" Down Arrow

1ST LINE: INPUT SELECTION
2nd Line: Channel Select

The second line is now showing the functions that can be done in INPUT SELECTION the first is Channel Select "→" Input type "→" Tag ID "→" back to Channel Select press "↓":

1ST LINE: CHANNEL SELECT
2nd Line: Channel 1
The DE2000 needs to know which input channel the process variable being measured is wired to. By pressing the left and right arrows all of the choices are displayed. The choice that is presently selected will not have a ? after it. Assume that the level transmitter is connected to Channel 1.

Use left or right arrow until the display looks like:

1ST LINE: CHANNEL SELECT
2nd Line: Channel #1

To select Channel 1 press “ENTER”

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Input Selection

Notice that after ENTER was pressed the display jumped back to the top of the menu. After selecting the channel, the DE2000 is not sure what the user is going to do next. The channel selection variable is required for several other menus in order for the menus to know which input to apply their function to.

Press "↓" Arrow:

1ST LINE: INPUT SELECTION
2nd Line: Channel Select

Press “→” Arrow

1ST LINE: INPUT SELECTION
2nd Line: Input Type

Input Type tells the DE2000 what type of transmitter is being used on the selected input channel. Press "↓" arrow:

1ST LINE: INPUT TYPE
2nd Line: Standard Level

Using the left and right arrows the user can scroll through the available choices. The choices shown with a ? are not presently selected. In this application, standard level is the correct choice so no action is required.

Press “↑”

Press “→”

1ST LINE: INPUT SELECTION
2nd Line: Tag ID.

Press “↓”

1ST LINE: TAG ID.
2nd Line: ID # = Not Entered

When first turned on the DE2000 uses “Ch1” and “Ch2” to tag the input channels. Using Tag ID selection, those tags can be changed to ID the vessel or transmitter.
Press "EDIT"

1ST LINE: TAG ID
2nd Line: ID # =

After pressing "EDIT" the display clears everything after the = sign and places the cursor to the first position. Use the ↑ or ↓ arrow keys to scroll to the first character "T". Press the → arrow to move to the next position. Again use the ↓ or ↑ to select the next character or number. Continue until the display looks like this.

1ST LINE: TAG ID
2nd Line: ID # = T-101

Move the cursor left and right using the ← and → arrow keys to correct an individual character position or press clear which erases all characters entered, and places the cursor at the first position if a mistake was made. Press "ENTER".

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Input Calibrate

Our tag is entered and the DE2000 returns to the main menu headings, specifically, Input Calibrate which is the next main heading to the right of the Input Selection.

The DE2000 returned to this main heading because it is now ready to calibrate the transmitter. However, the DE2000 at start-up initiates itself to calibrate in percent; in this application it would be much easier to calibrate in terms of feet.

To do this press the → arrow key the main heading "UNITS SELECTION" appears. The display should read:

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Units Selection

Press “↓”

1ST LINE: UNITS SELECTION
2nd Line: Calibration Units

Press “↓”

1ST LINE: CALIBRATION UNITS
2nd Line: Maximum Input

Press “↓”

1ST LINE: MAXIMUM INPUT
2nd Line: Max Inp = 100.00

When changing the calibration units the DE2000 needs to know the maximum allowable value for error-checking during calibration. In this application the tank is 20 feet high, so 20.0 feet will be the maximum allowable calibration unit. To change the value press “EDIT” then “CLEAR”. Now enter the new value using the arrow keys (only numbers are scrolled here).
1ST LINE: MAXIMUM INPUT
2nd Line: Max Inp = 20.0

Press "ENTER"

1ST LINE: CALIBRATION UNITS
2nd Line: Units Label

At this point, name or label the calibration units, the DE2000 automatically moves to the correct place in the menu. Press ↓.

1ST LINE: UNITS = %
2nd Line: Feet

The first line is showing the units presently selected. The second line is showing the choices available, use the ← and → keys to scroll though the choices.

The "OTHER" selection is used when one of the preprogrammed units is not right for the user’s application. Press "ENTER" to select "OTHER" then "EDIT" to spell out the units using the ↑ and ↓ keys. press "ENTER" to complete the entry.

This application requires calibrating in feet so scroll to feet and press "ENTER":

1ST LINE: UNITS SELECTION
2nd Line: Output Units

The calibration units are now set. The DE2000 menu is now at Output Units. When in the display mode it is not always convenient to display the calibration units (always in terms of level). In this application the user needs to know how many gallons or pounds of material are in the vessel. Press "↓".

1ST LINE: OUTPUT UNITS
2nd Line: Maximum Output

Just like Calibration Units, the DE2000 needs to know maximum value for the output units. Press“↓”.

1ST LINE: MAXIMUM OUTPUT
2nd Line: Max Out = 100.00

Again this value is entered like Calibration Units. Press “EDIT” then “CLEAR” then the arrow keys. The display should read:

1ST LINE: MAXIMUM OUTPUT
2nd Line: Max Out = 12000.0

Press "ENTER"

1ST LINE: OUTPUT UNITS
2nd Line: Units Label

Press “↓”.

601-2000-LMP. A-5
Output units can be defined in terms of Volume or Weight. Using either ← or → keys scroll through the choices. Scroll to Volume and press "↓":

- 1ST LINE: UNITS LABEL
- 2nd Line: Volume

Using the ← and → scroll through the choices. Pressing "ENTER" selects the one being displayed. Select gallons and press "ENTER":

- 1ST LINE: DE2000 XXXXXX VXX
- 2nd Line: Curve Fitting

Output Units are now set. The DE2000 menu is back at the main menu heading at Curve Fitting. In this application there is a vertical cylinder and volume is linear with level. But if the application uses a horizontal cylinder or a sphere, curve fitting must be used to correct for volume.

Press ← or → until the display looks like this:

- 1ST LINE: DE2000 XXXXXX VXX.X
- 2nd Line: Input Calibrate

Press "↓".

- 1ST LINE: INPUT CALIBRATE
- 2nd Line: Magi-Cal

With a DE2000 there are two ways to calibrate the level transmitter.

Press "↓".

- 1ST LINE: MAGI-CAL
- 2nd Line: Point Calibrate

Point Calibrate is the most convenient way to calibrate the level transmitter because it does not require that the vessel be emptied to set zero or filled to set span. The level does have to be moved because point calibrate requires 2 points to calibrate. Point calibrate needs a low calibration point and a high calibration point. These points can be entered in any order and only requires a 10 percent difference between the points. Of course, the further apart the two calibration points are the better the calibration is. This means - that the system can be calibrated today, and the user could come back to the DE2000 later, tomorrow, next week or next month and reset either the high point or the low point for a better calibration.

Press "↓".

- 1ST LINE: POINT CALIBRATE
- 2nd Line: Low Current
At this point in the calibration menu there are four choices: low current, low units, high current, high units. Use ← and → to scroll. Now return to Low Current and press ↓.

Note: All of the loop currents used apply only to this example and will be different values in each actual application.

1ST LINE: LOW CURRENT = 4.00 mA
2nd Line: Loop Curr (6.10mA)

Refer to Figure A-1. For this example the two calibration points are at 3 feet and 15 feet. Enter the first calibration point of 3 feet.

The first line is showing the previous calibration current which is 4.00 mA.

The second line is showing the present loop current for 3 feet of material: 6.10 mA.

To replace the old current with the new one press “ENTER”.

1ST LINE: POINT CALIBRATE
2nd Line: Low Unit

Press ↓.

1ST LINE: LOW UNIT
2nd Line: Val = 0.00

After entering the new current tell the DE2000 what value of calibration units that current represents. Press EDIT and change value to 3.0 (3.0 feet).

Press Enter.

1ST LINE: POINT CALIBRATE
2nd Line: High Current

The low calibration point is now set, and the DE2000 is ready to set the high point. Assume that the tank can be quickly filled to the next point and continue.

Press ↓.

1ST LINE: HIGH CURRENT = 20.00 mA
2nd Line: Loop Curr (16.80 mA)

The information being displayed is the same as for the low point. Current for the high point is set at 20.00 mA. The current for the 15-foot calibration point is 16.80. Replace the old point by pressing ENTER.

1ST LINE: POINT CALIBRATE
2nd Line: High Unit

Press ↓.

1ST LINE: HIGH UNIT
2nd Line: 1
Again, the DE2000 must be told what calibration units is equal to: 16.80 mA press "EDIT", "CLEAR," and using ↑ and ↓ enter 15.0. Press "ENTER".

Calibration of the DE2000 and the transmitter are now completed. Refer to Figure A-1. Notice that the sensing element is 1 foot above the bottom of the tank. This automatically takes in account the “HEEL” (the amount of material under the sensing element). In this vessel every foot of material represents 600 gallons. If the user is concerned with the volume or weight of material always calibrate from the bottom of the vessel. For control applications, calibrate using the bottom of the sensing element (this would have made the entry for Low Unit 2 feet instead of 3 feet) or any point along its length.

1ST LINE: INPUT CALIBRATE
2nd Line: Time Delay

In this example any input time delay is not used. When using time delay it must be off to ensure accurate calibration.

Press ↓.

1st line: TIME DELAY
2nd Line: Off

Press either ← or →. The 2nd line toggles between off and on.

To turn time delay off during calibration, press ← or → until the word OFF appears on the display, then press ENTER. After calibrating turn the time delay back on using the same procedure. Press “ENTER”.

1st LINE: INPUT CALIBRATE
2nd Line: Magi-Cal

Press ↑.

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Input Calibrate.

Press →.

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Input Time Delay

Press ↓.

1ST LINE: INPUT TIME DELAY
2nd Line: Delay = 0.0 sec

Because the fill method that is used in this example causes waves in the material, time delay is needed to negate this effect (to the sensing element the waves look like small changes in level). Five (5) seconds of time delay should correct this condition so press “EDIT,” then use ↑ and ↓ to change the value. Press “ENTER”.

601-2000-LMIP. A-8
At this point, set up the control and alarm part of the application. Press \( \rightarrow \) until the display looks like this.

1ST LINE: DE2000 XXXXX VX.X
2nd Line: Setpoints

Press \( \downarrow \).

1ST LINE: SETPOINTS
2nd Line: Setpoint #1

At this point the DE2000 is asking which of the four setpoints to use. Press \( \leftarrow \) or \( \rightarrow \) to select the setpoint. Start at the top and work down. Press \( \leftarrow \) or \( \rightarrow \) to select setpoint 1 then press \( \downarrow \).

1ST LINE: SETPOINT 1
2nd Line: Input Source

Each setpoint must be told which input channel it is connected to. Press \( \downarrow \).

1ST LINE: INPUT SOURCE
2nd Line: Channel #1

Press \( \leftarrow \) or \( \rightarrow \) to see the choices: Channel 1, Channel 2, or Off.

Off turns a setpoint off. Selecting Channel 1 or Channel 2 turns the setpoint on without affecting any setpoint parameters. Select Channel 1, press "ENTER".

1st Line: SETPOINT 1
2nd Line: Source Units

Press \( \downarrow \).

1ST LINE: SOURCE UNITS
2nd Line: Calibration Units

For ease of configuration, four "SIGNALS" or types of data are provided that can be used to select to select the trip point of the setpoints.

1. **CALIBRATION UNITS** - Setpoint values are set in the units that the DE2000 is calibrated in. In this case feet. Press \( \rightarrow \).
2. **OUTPUT UNITS** - Setpoint values are set in the units selected. In this example gallons. Press \( \rightarrow \).
3. **% OUTPUT UNITS** - Setpoint values are set in % of output units: e.g. - a setpoint of 50% of output units would trip at 6,000 gallons. Press \( \rightarrow \).
4. **CONDITIONED INPUT** - Setpoint values are set in mA (4-20). This 4-20 mA "signal" is detected after the time delay function (conditioned). Press \( \rightarrow \).
In the example, calibration units is used to set the trip points so press → then "ENTER".

1ST LINE: SETPOINT #1
2nd Line: Setpoint Values

Press ↓.

1ST LINE: SETPOINT VALUES
2nd Line: Activate Value

The Activate value is the value at which the setpoint will trip.

Press ↓.

1ST LINE: ACTIVATE VALUE
2nd Line: sp1 = 0.00 feet

The Activate Value can now be changed. Refer to Figure A-1. The first setpoint is at 18.5 feet. This is the overfill alarm. Press "EDIT" then "CLEAR". Now use the arrow key to enter 18.5. Press "ENTER".

1ST LINE: SETPOINT VALUES
2nd Line: Differential Value

Differential Value is the point at which the setpoint will deactivate (adjustable differential). If not changed the differential value will be .1% of units selected. Alarm points don't usually require differential.

Press →.

1ST LINE: SETPOINT VALUES
2nd Line: Fail Safe

Press ↓.

1ST LINE: FAIL SAFE
2nd Line: High Level

Fail safe selection simply defines what kind of test is made to detect the trip point.

For high level the test is equal to or greater than setpoint. Press →.

For low level the test is equal to or less than setpoint. Refer to Figure A-1. Alarm Point 1 is an overfill alarm (Hi Hi point) so select high level and press "ENTER".

1ST LINE: SETPOINT 1
2nd Line: Common Alarm

Press ↓.

1ST LINE: COMMON ALARM
2nd Line: No
The common alarm relay on the Standard Function Board (refer to Figure 2-5) can be attached to any of the setpoints that require either an audible or visual alarm. To do this use ← or → to display the word YES then press "ENTER".

1ST LINE: SETPOINTS
2nd Line: Setpoint #2

The DE2000 returns to the top of Setpoints menu and automatically goes to setpoint #2. We will configure Setpoint #2 to be control point 1. Press ↓.

1ST LINE: SETPOINT #2
2nd Line: Input Source

Select the same Input Source as in the previous example. Press "ENTER".

1ST LINE: SETPOINT #2
2nd Line: Source Units

Again select the proper source units. Press "ENTER".

1ST LINE: SETPOINT #2
2nd Line: Setpoint Values

Press ↓.

1ST LINE: SETPOINT VALUES
2nd Line: Activate Value

Press ↓.

1ST LINE: ACTIVATE VALUE
2nd Line: sp2 = 0.00 feet

Refer to Figure A-1. Control Point 1 is at 18 feet. Use "EDIT" and ↑ and ↓ to set value then press "ENTER".

1ST LINE: SETPOINT VALUES
2nd Line: Differential Value

Control Point 1 uses differential to control the level between 18 and 8 feet. It will do this by closing the valve at 18 feet and not opening the valve until the level has gone down to 8 feet. To accomplish this, set the differential value to 10 feet (18 ft. - 8 ft. = 10 ft.).

Press ↓.

1ST LINE: DIFFERENTIAL VALUE
2nd Line: sp2 = 0.00 feet

Press "EDIT" and use ↑ and ↓ to change the value to 10 feet. Then press "ENTER".

1ST LINE: SET POINT VALUES
2nd Line: Fail Safe
Set the proper fail safe for Setpoint #2 (as in previous example).

1ST LINE: SETPOINT #2
2nd Line: Common Alarm

Setpoint #2 is being used as a control point. Therefore the audible alarm sounding is not required. Select No. Press "ENTER".

1ST LINE: SETPOINTS
2nd Line: Setpoint #3

At this point, configure Setpoint #3 for Control Point 2. Using the previous examples configure Setpoints #3 and #4. When finished, the display should read:

1ST LINE: SETPOINTS
2nd Line: Setpoint #1

The setpoints are all configured. Now assign the relays to the setpoints.

Press ↓.

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Setpoints

Press →.

Press →.

1ST LINE: DE2000 XXXXXX VX.X
2nd Line: Relays

Press ↓.

1ST LINE: RELAYS
2nd Line: Relay #1

Setpoint #2 has been configured as Control Point 1. To control the valve connect Setpoint #2 to Relay #1 using the software.

Press ↓.

1ST LINE: RELAY #1
2nd Line: Input Source

Press ↓.

1ST LINE: INPUT SOURCE
2nd Line: OFF

By pressing ← or → all available options are displayed. Press ← or → until Setpoint #2 is shown.

Press “ENTER”
1ST LINE: RELAYS
2nd Line: Relay #2

Relay #1 is now assigned to Setpoint #2 (Control Point 1). The DE2000 is ready to assign Relay #2.

Assign Relay #2 to Setpoint 3 (Control Point 2).

1ST LINE: RELAYS
2nd Line: Relay #3

The DE2000 is now configured for this application. Simply press the "DISPLAY" key to return to the display mode.
Acknowledgments, 3.11.1

Analog Inputs, 2.3.2
  as current source, 2.3.2.1
  as current sink, 2.3.2.2
  configuration of, 3.5

Analog Outputs, 1.2.1.2
  wiring, 2.3.3
  as current source, 2.3.3.1
  as current sink, 2.3.3.2
  configuration of, 3.7

Arrow Keys, 3.3

Auto-Calibration, 1.2
  wiring, 2.3.8
  configuration of, 3.5.1.2

Calibration, 3.6
  point calibration, 3.6.1
  pre-calibration, 3.6.2

Calibration Units, 3.5.6

Common Alarm, 1.2
  wiring, 2.3.5
  configuration of, 3.11.1

Common Fault, 1.2
  wiring, 2.3.5
  configuration of, 3.11.2

Configuration, 3
  configuration editor, 3.3.5
  configuration menus, 3.3

  INPUT SELECTION menu, 3.5, 3.5.1, 3.5.1.1, 3.5.2

  INPUT TIME DELAY menu, 3.5.3

  INPUT CALIBRATE menu, 3.5.5, 3.5.6, 3.5.7

  ANALOG OUTPUT menu, 3.7

  SETPOINT menu, 3.8

  SETPOINT LOGIC menu, 3.8.3

  RELAY menu, 3.9

  CURVE FITTING menu, 3.12, 3.12.1, 3.12.2, 3.12.3

  SYSTEM FUNCTION menu, 3.4, 3.4.4

  SPECIAL FUNCTIONS menu, 3.13, 3.14

Configuration Prompts, 3.3.2

Curve Fitting, 3.12

Customer Training, 4.4

Default Values, 3.3.4

Display, 3.2.1, 3.3.1

DISPLAY Key, 3.2.1, 3.3, 3.3.3

EDIT Key, 3.3, 3.3.3

Engineering Units, 3.5.5

Factory Service, 4.1.4.2

Fail-Safe, 3.5.4

Field Service, 4.3

Horizontal Cylinder, 3.12.2

Housing, 1.2, 2.2

Input Channels, 3.5

Input Type, 3.5.1

Magi-Cal, 3.6.1, 3.6.2

Maximum Input, 3.5.6

Maximum Output, 3.5.7

Memory Module, see removable memory module

Mounting, 2.2

Output Loops, 1.2, 1.2.1.2
  wiring, 2.3.3
  configuration, 3.7

Output Units, 3.5.7
Password, 3.4

Power Wiring, 2.3.1

Proportional Band, 1.2.1.2
  configuration of, 3.7.1

Pump Alternator, 3.13
  configuration of, 3.13

Relays, 1.2.1.1
  wiring, 2.3.4
  configuration, 3.9

Remote Acknowledge Switch, 2.3.7

Removable Memory Module, 1.2.1.3
  wiring, 2.3.9
  configuration, 3.1.4

Setpoints, 1.2
  configuration of, 3.8, 3.8.1, 3.8.2, 3.8.3

Specifications, 1.4

Sphere, 3.12.1

Standard Level Input, 3.5.1

Start-up, 3.1

Strapping Table, 3.12.3

Tag ID, 3.5.2

Time Delay,
  on input, 3.5.3
  for calibration, 3.6

Transmitter Loops, 1.2
  wiring, 2.3.2
  as current source, 2.3.2.1
  as current sink, 2.3.2.2
  configuration of, 3.5

True Level Input, 3.5.1, 3.5.1.1

TTL Outputs, 1.2
  wiring, 2.3.6
  configuration of, 3.9

Wiring, 2.3