Installation & Operation Manual
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CHAPTER 1 INTRODUCTION

1.1 Product Information and History

The Mini-Pak™ 6 is a new electronic controller produced to meet the ever changing needs of our customers. The controller is an improved design based upon current technology. The Mini-Pak™ family of controllers has been changed frequently during its history. First released late in 1995, the product was very simple. It was then a basic electronic replacement for a Gate-Pak® Injector. Since then, it has been enhanced many times to add many of the features that the established Blend-Pak® had available, yet at a reduced cost to the consumer.

For customers that have space constraints, the Mini-Pak™ 6 combines the functions of six individual Mini-Pak™ controllers into a single electronic package. Up to six manifold blocks can be grouped beneath the single controller for a much more compact installation.

NOTE: There are two versions of the Mini-Pak 6 software in the field. Each offers unique operational characteristics. This manual will identify features that are unique to a specific version with a "◊" character. The versions are generally distinguished as “Standard” and “Clean Start”, referring to the ability to do clean arm start, described in detail later in this manual.

1.2 Size

The Mini-Pak™ 6 utilizes a larger microprocessor circuit board and display than the current Mini-Pak™ 3000 product, allowing the handling of increased numbers of input and output points. The Mini-Pak™ 6 is mounted in a Killark GRK enclosure, providing adequate room for the increased number of wiring terminations.

1.3 Functional Description

Software for the Mini-Pak™ 6 has a firm foundation in the existing Mini-Pak™ code. Users familiar with Enraf’s existing parameter sets will feel at home setting up the Mini-Pak™ 6 for their application.

The Mini-Pak™ 6 Injector Controller is a dedicated, customized micro-controller built exclusively to manage chemical injection. The electronics controller is mounted in a rugged aluminum explosion proof enclosure rated for Class 1, Division 1, Group D areas. A wide temperature span liquid crystal display is visible behind the glass cover on the enclosure. A number of different screens for operation and setup may be displayed. Access to set up parameters by the technician is facilitated through use of an infrared hand-held controller. In addition to two high speed pulse inputs, the controller has an AC and DC status input and output defined below. Finally, the controller has an EIA RS-485 communications interface which allows complete control and access to all setup parameters.
Software in the controller is the result of decades of chemical injection control experience. Dedicated solely to chemical injection, the program efficient device.

The Mini-Pak™ 6 is a cycle based injector, meaning that chemical does not dispense continuously. An internal recipe controls the ratio of chemical being injected to the process stream. In a typical application, the process flow rate is monitored by the controller. As chemical additive is called for, the controller opens a solenoid control valve and injects a small quantity of additive into the process. The controller closes the valve and waits until the next injection is required. The injection cycle repeats in this manner, keeping the additive "in pace" with the process flow. The reason for cyclical injection technology is accuracy.

Many of the recipes used in Enraf Fluid Technology injectors call for a few parts per million ratio of chemical to process. Continuous flow control and measurement of these minute additive flow rates would be either impossible or prohibitively expensive. Instead, by using cyclic flow, low cost positive displacement meters can be used. Coupled with software algorithms that compensate for the start-stop flow affecting meter accuracy, this proves to be the most accurate injection technology for the vast majority of applications.

Chemical injection accuracy may be visualized graphically in the image of a pyramid. The top of the pyramid represents the highest accuracy or tightest tolerance for errors. As one descends the pyramid, error tolerances increase. At the top of the pyramid, with the greatest accuracy are chemical injectors that are exactly paced by the process, and have very accurate meters measuring the chemical being injected. A step down in the pyramid finds injectors with lower accuracy meters where broader accuracy tolerances are acceptable. Lower still are injectors having positive displacement pumps instead of meters. The amount of chemical additive being injected is “inferred” by counting injection strokes. If still less accuracy is tolerable, the pacing of the injector itself may be eliminated and time used as a pacing signal. This typically is used only in processes that have very stable flow rates over long periods. Various combinations of meter accuracy can be used to customize the chemical injector exactly to the customers needs.

Fundamental to the operation of the Mini-Pak™ 6 controller is the recipe. Two parameters set by the customer determine the ratio of additive to the process or the recipe. For example, in the case of motor fuel additives dispensed at a truck loading rack, it is the amount of additive in a volume of fuel being loaded. Two criteria are used in the recipe. HOW MUCH chemical is injected with each cycle is the first part of the recipe. The Mini-Pak™ 6 injects in cubic centimeters (CC’s). Your recipe might call for 34 CC’s of gasoline additive to be injected each cycle (One CC = One Milliliter). HOW OFTEN the injector cycles is the second critical part of the recipe. A parameter within the Mini-Pak™ 6 holds an amount of product volume that is to receive the amount of additive injected each cycle. When this amount of product volume has flowed, the Mini-Pak™ 6 controller will inject the volume of additive required. Your recipe might contain a process volume of 40 gallons. Thus, for every 40 gallons of fuel that flows, 34 CC’s of additive is injected.
Actual values for the CC’s Per Injection and Volume Of Product Per Cycle parameters should be adjusted to accommodate the chemical flow rates possible and the process tolerance for mixing the two flows uniformly. Enraf Fluid Technology application engineers will be happy to help you calculate your recipe requirements and suggest settings that will best optimize your system.

During normal operation the controller may experience a failure to meet the recipe demands. This may be due to a loss of chemical additive pressure, blocked injection lines, or other equipment failures. The Mini-Pak™ 6 Injector Controller utilizes a number of alarms for the purpose of reporting these failures. Alarms include “No Additive Flow” for occasions when the control solenoid opens and no additive flow is detected, “Leaking Solenoid” for reporting flow detected when the valve is closed, “Additive Deviation” for reporting volume errors, and a “Low Flow” alarm for reporting a special circumstance explained later. Alarms are reported on the text display and through setting status outputs. They may also be detected through the RS-485 communications interface.
Intentionally left blank.
CHAPTER 2 OVERVIEW

2.1 Controller Inputs

NOTE: The Mini-Pak™ 6 hardware is limited to one DC and one AC input per manifold being controlled. The various status functions listed below, ENABLE, PACING, and RESET, are shared among these two inputs. Refer to the description of the set up of Parameter #'s 081 and 082 for proper assignment of these inputs.

2.1.1 Enable

The enable signal input to the Mini-Pak™ 6 can be utilized to “permit” the unit to inject. This input is a status input, meaning it is “ON” continuously when the injector is to operate. This optional signal can be used when a single pacing pulse signal is used to drive multiple additive injectors, a situation common on truck loading facilities. For example, if several different chemical additives were available on a single product loading stream, and only one pulse signal from the meter on that load arm were available, it could be wired to all of the injectors dedicated to that arm. When ever fuel flowed, the pacing signal from the product meter would drive all of the injectors connected. The signal would be ignored by the injectors that were not permitted by the presence of the enable signal input.

The enable signal may be an AC input or a DC input or be communicated via the RS-485 interface.

2.1.2 Pacing

Traditionally, The Enraf Fluid Technology family of injectors utilize product pacing signals that are pulse signal based. Pacing consists of either AC, one pulse per injection cycle, or DC, multiple pulses per unit volume product signaling. This pacing signal accumulates product volume in the injector electronic controller and causes it to periodically inject additive to “keep pace” with the customer’s recipe requirements.

The Mini-Pak™ 6 controller allows for time based injection pacing in which no external pacing signal is used. That option is discussed later under Self Pacing Mode.

2.1.3 Alarm Reset

An AC or DC momentary pulse on the reset input will clear an existing alarm condition. Alarms may also be cleared using the RS-485 communications interface.

2.1.4 Additive Meter Input

This high speed pulse input is capable of capturing pulses up to 5khz in frequency and is dedicated to the accumulation of pulses from the chemical additive meter.
2.2 Controller Outputs

2.2.1 Solenoid Valve Control
The primary output from the controller is dedicated to the injection control solenoid valve. The Mini-Pak™ 6 provides a separate AC power input for feeding power to this solenoid control output as well as the Multi-Functional AC Output. This input can be supplied by an emergency shutdown interrupted source, thus granting override control external to the injector controller.

2.2.2 Ac Multi-functional Output
The Mini-Pak™ 6 has one AC triac output available for external use. This optically isolated, high current triac is provided with a separate AC feed. The feed input can be simply jumpered to the power feeding the Mini-Pak™ 6 or provided with an isolated source of power from a different supply, thus maintaining complete isolation. The ‘AC Multi-Functional Output’ can be user configured in any of the following ways:

- Fail safe alarm (alarm = off)
- Non-fail safe alarm (alarm = on)
- Piston Switch feedback (Available with 1 pulse per injection pacing only.)
- Post injection feedback
- Pump Start (Communication permissive controlled only.)
- Pump Start (Product pulse detect initiation only.)
- Solenoid Follower

2.2.3 Dc Multi-functional Output
The Mini-Pak™ 6 also has one DC control output. This optically isolated, high current power transistor output has both the emitter and collector connections available, allowing either pull-up or pull-down wiring options. The ‘DC Multi-Functional Output’ can be utilized in the following ways:

- One pulse output for each whole unit volume of additive dispensed.
- Ten pulses out for each whole unit volume of additive dispensed.
- 100 pulses out for each whole unit volume of additive dispensed.
- 1000 pulses out for each whole unit volume of additive dispensed.
- One pulse output for each additive meter pulse received.
- Piston Switch feedback (Available with 1 pulse per injection pacing only.)
- Post injection feedback,
- Double Piston Switch feedback.
- Feedback pulse sent during last 25% of cycle.

2.3 Controller Communications
The Mini-Pak™ 6 hardware provides two, 2-wire, EIA RS-485 communications interfaces. Each port is fully functional. It is at the discretion of the user how these ports are utilized and care should be taken to provide control functionality through one port only. The other port is intended for data retrieval, setup, and other non-control functions only. Master-Slave repetitive polling should be exercised on only one port at a time.

The Mini-Pak™ 6 Injector controller includes several different communications protocols. These include FMC Smith Accuload, Brooks Petrocount, and Modbus RTU ASCII.
3.1 Display Screens

The Mini-Pak™ 6 electronics module displays several different text messages during operation. This section of the manual describes these screens in detail.

3.1.1 Display

The Mini-Pak™ 6 electronics module display consists of four lines containing sixteen characters in each line. The total characters that can be displayed in single screen are sixty-four.

3.1.2 Adjustment

The display uses liquid crystal technology. At certain viewing angles, the characters can appear to fade out or turn into a dark rectangle. After the panel and electronics enclosure are mounted in the operation location, the display angle can be adjusted to provide the clearest display of text to the user.

**CAUTION:** The following procedure requires opening the electronics enclosure. **DO NOT OPEN THE ENCLOSURE IN THE PRESENCE OF HAZARDOUS VAPORS.** Follow all applicable company policies and regulations regarding service of electrical equipment in hazardous areas before proceeding.

The adjustment of the display is a micro-potentiometer control located on the round circuit board immediately behind the display circuit board. The control is accessible from the front of the module while installed and powered on. Refer to the drawing below for the location of the control. Use a small straight blade screwdriver to rotate the control until the best viewing of characters is achieved.
3.1.3 Start up Screens

Upon applying power to the electronics there are sequences of three screens that are displayed to the user. The initial screen is a message that the module is testing its memory prior to loading the program.

Testing Memory
Please Wait...

After a few seconds, the screen above is replaced by the next screen in the sequence. The first line is the device identifier screen. Software for the “Standard” version will either display ‘PCM-III’ or ‘MP6 Standard’ depending upon version dates. Software for the “Clean Start” version will either display ‘MP6 Flush EN’ or ‘MP6 Clean Start’ depending upon version release dates.

This screen also displays the major mode of the injector, slave or smart. Refer to the description of Parameter # 080 to determine which mode is correct for your application.

Dev. = PCM-III
Mode = Smart

After a few seconds, the third startup screen is displayed in the sequence. It is the critical parameter screen. In the upper left portion of the display is the hardware version. To the right in the first line is the communications port number 1 baud rate. The left portion of the second line contains the firmware version number, and in the right half is the communications address. The third line contains both port baud rates, and in the last line is the pulse mode defined by Parameter # 084.

REV_D 9600 BD
V3_14 ID# 123
BAUD1 = 9600 BAUD2 = 9600
Multi. Pulse Input

The final screen in the start up sequence is the running screen or screens. Those screens are described next.

3.1.4 Idle Screen

The main screen displayed on the Mini-Pak™ 6 injector controller is shown below. It contains two import pieces of information about the instantaneous conditions involving the controller.

TOTAL Vol. CC/Inj
1) 00123.070 0050
2) 00456.020 0025
3) 07890.306 0037

On the left side of the screen the total additive volume delivered for each injector block is displayed. This volume is in units determined by the number of CC's in one unit volume of additive, Parameter # 022.
On the right side of the screen is the number of CC’s per injection delivered into the product stream during the last injection cycle for the specific injector. This number can be seen to increment when the solenoid valve is open.

Every few seconds, as determined by the setting in Parameter # 151, the lower three lines of the screen will scroll to allow viewing of the other active injectors programmed. Viewing of an injector total is turned off when not used by the setting in Parameter # 083.

### 3.1.5 Running Screen

The screen displayed when an injector is running depends upon the settings of the Parameter # 081. If Parameter # 081 is set to a value of zero for a specific injector block, the screen displays in the same format as the idle screen. As injections occur, you can watch the totals increment. If Parameter # 081 is set such that an inject enable is required, indicator is provided on the screen to show when the specific injector block has been permitted. The main screen displayed on the Mini-Pak™ 6 injector controller is shown below. It contains information regarding three injector blocks, numbers one, two, and three. Number one is not permitted. Numbers two and three are permitted, as indicated by the letter “P” in between the totals.

```
TOTAL Vol. CC/Inj
1) 00123.070 0050
2) 00456.020 P 0025
3) 07890.306 P 0037
```

If an injector is set up as Self-Paced, and permissive is supplied to that particular injector block, the letter “S” is displayed when the unit is enabled. The screen below shows injector number one enabled in the Self-Paced Mode. Refer to the section on Self Pace Mode for further information.

```
TOTAL Vol. CC/Inj
1) 00123.070 S 0050
2) 00456.020 0025
3) 07890.306 0037
```

The screens described above are normal running screens. If the unit experiences an alarm condition, the alarm screens will alternate with the running screens until the specific alarm is cleared. More on this in the section on alarms.

### 3.2 Changing Parameter Values using the Hand-Held Controller

The Hand-Held Controller (HHC) uses infrared signals to transmit ASCII characters to the Mini-Pak™ 6 controller. This unique use of infrared technology allows the operator to make adjustments in programming without removing the cover of the explosion-proof enclosure on-site.
All prompts which require an operator response are clearly indicated on the Mini-Pak™ 6 controller LCD (Liquid Crystal Display).

The infrared receiver on the Mini-Pak™ 6 controller is designed to be insensitive to interference from light sources other than the HHC.

The HHC-4 Hand-Held Controller stores all of the infrared commands permanently in the 87C51 micro-controller. With the infrared codes stored in the micro-controller the HHC-4 can go without battery power indefinitely, and be restored to full operation by inserting a fresh set of batteries.

A “sleep” mode was designed into the HHC-4 to reduce battery consumption. When the HHC-4 is first used, or after a period of inactivity of approximately 30 seconds, the ATTN key must be pressed to “wake-up” the HHC-4. The SEND light will blink, indicating that the HHC-4 is ready for operation.

The HHC-4 has been DEMKO approved for use in hazardous atmospheres, Class 1, Group C & D.

The following table describes the functions of the various buttons on the HHC.

### Hand-Held Controller keys and definitions:

<table>
<thead>
<tr>
<th>Function</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Parameters</td>
<td>AP</td>
</tr>
<tr>
<td>Execute Task (from Task Listing)</td>
<td>TASK</td>
</tr>
<tr>
<td>Move Forward to Next Parameter</td>
<td>NEXT</td>
</tr>
<tr>
<td>Move Backward to Previous Parameter</td>
<td>NEXT</td>
</tr>
<tr>
<td>Enter Test Mode</td>
<td>TEST</td>
</tr>
<tr>
<td>Increase Value</td>
<td>NUMBER</td>
</tr>
<tr>
<td>Decrease Value</td>
<td>NUMBER</td>
</tr>
<tr>
<td>Display ID# and Version</td>
<td>ID</td>
</tr>
<tr>
<td>Reset Alarms</td>
<td>RESET</td>
</tr>
<tr>
<td>Exit Command</td>
<td>ESC</td>
</tr>
<tr>
<td>Enter Value Confirmation</td>
<td>ENTER</td>
</tr>
<tr>
<td>Move Cursor Right</td>
<td>CURSOR</td>
</tr>
<tr>
<td>Move Cursor Left</td>
<td>CURSOR</td>
</tr>
<tr>
<td>Attention (also powers up the HHC)</td>
<td>ATTN</td>
</tr>
<tr>
<td>Numbers 0 - 9</td>
<td>0 - 9</td>
</tr>
</tbody>
</table>
3.3 The Hand-Held Controller

- AP - Access Parameters
- ENTER - Completes a command
- TIME - If Applicable
- TASK - Executes a Task command
- TEST - Press to enter Test mode
- F1 - F2 - F3 Function Buttons
  Refer to manual for use

Notes:
- a) Three AAA batteries required for operation.
- b) Remote control range limited to 10 ft/3m.
- c) The switch mounted on the right hand side (if present) is not functional.

3.4 Accessing Parameter Values using the Hand-Held Controller

Mini-Pak™ 6 during idle mode:

TOTAL Vol. CC/Inj
1) 00123.070 0050
2) 00456.020 0025
3) 07890.306 0037

Press the [ATTN] key on the HHC. The screen changes to:

ENTER COMMAND

Press the [AP] key on the HHC. The screen changes to:

Enter Injector #: 

At this point the user must enter the number of the injector block (1-6) that is to have programming parameters modified. The last injector block to be accessed is always displayed in the second line. If the changes are to be to the same block, simply press the [ENTER] key. If a different injector number is desired, press the desired number key, then the [ENTER] key.

The screen changes to:

Parameter Code
To Access - 000

Enter the Parameter Code or number desired. The numbers may be entered from the numeric keypad on the HHC, or the Parameter Codes may be incrementally stepped through by pressing the [NEXT] bar key on the HHC. When the desired Parameter Code is displayed, press the [ENTER] key. The screen changes to:

Parameter->010
002.0

The top right-hand area of the display shows the Parameter number. The bottom line displays the current value stored for that Parameter. At this time, a combination of cursor bar and numeric keys may be used to change the current value into the new value desired. Upon completion of the change, the user presses the [ENTER] key. The screen changes to:

Save? 003.5
(1) = Yes  (2) = No

In the top right-hand area of the display is the new value you are about to store. Press either the [1] or [2] keys on the HHC as needed. The controller then returns to the Access Parameter mode:

Parameter Code
To Access - 000

When the desired changes have been completed, use the [ESC] key to exit the program setup mode. If the program setup mode is not exited, the controller will eventually time out and return to the run mode display on its own.

NOTE: There are two types of parameters in the controller. LOCAL parameters affect only a single injector block. Changes to parameter values for local parameters must be made to each injector number. Settings may be different in each injector. A typical Local parameter is the Additive K-factor (002). Some parameters are GLOBAL, meaning that setting a parameter value in ANY injector number will change that parameter value in ALL injectors. A typical Global parameter is the Main Screen Rotation Delay (151). Refer to the Parameter Table which follows to determine which parameters are Local and Global.
### Main Parameter Table

<table>
<thead>
<tr>
<th>Parameter #</th>
<th>Description</th>
<th>Value Range</th>
<th>Default</th>
<th>Values</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Product K-Factor</td>
<td>00000.001-99999.999</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>002</td>
<td>Additive K-Factor</td>
<td>00000.001-99999.999</td>
<td>2600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>010</td>
<td>Volume Per Injection (CC's)</td>
<td>0000.1-99999.9</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>020</td>
<td>Volume Of Product Per Injection Cycle</td>
<td>0001.0-99999.9</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>022</td>
<td>CCs Per Unit Volume Of Additive</td>
<td>0001-9999</td>
<td>3785</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>050</td>
<td>Multi-Function DC Output # 2</td>
<td>00-99</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>◊ 060</td>
<td>Number Of Clean Start Cycles</td>
<td>01-99</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>◊ 061</td>
<td>Low Flow Volume At End Of Load</td>
<td>000-999</td>
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<td>Frequency Modes</td>
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<td>Low Flow Mode Activate</td>
<td>00000-30000</td>
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<td>◊ 064</td>
<td>Product Flow Initiate</td>
<td>00000-30000</td>
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<td>◊ 065</td>
<td>Product Flow Time Out</td>
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<td>Injector Position Enable</td>
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<td>* 084</td>
<td>Product Pulse Selection</td>
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<tr>
<td>* ◊ 085</td>
<td>Communications Delay Port # 1</td>
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<td>Broadcast Address</td>
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<td>* 102</td>
<td>Unit Description</td>
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<td>* 131</td>
<td>Number Of Solenoid Retries</td>
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<td>AC Input Hysteresia</td>
<td>0000-1000</td>
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<td>* 133</td>
<td>Confirmation Pulse Duration</td>
<td>0000-1000</td>
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<td>134</td>
<td>Pump No Activity Time Out (minutes)</td>
<td>01-99</td>
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<td>Infrared Port Enable</td>
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<td>* 141</td>
<td>Infrared Port No Activity Time Out (Seconds)</td>
<td>010-999</td>
<td>60</td>
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</tbody>
</table>

- (black diamond) denotes a parameter in the Non-Clean Start model only
- (white diamond) denotes a parameter in the Clean Start model only
- (asterisk) denotes global parameter affecting ALL injector channels
### Main Parameter Table (Continued...)

<table>
<thead>
<tr>
<th>Parameter #</th>
<th>Description</th>
<th>Value Range</th>
<th>Default</th>
<th>Values</th>
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<tr>
<td>* 150</td>
<td>Alarm Screen Rotation Delay</td>
<td>1-99</td>
<td>2</td>
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<tr>
<td>* 151</td>
<td>Main Screen Rotation Delay</td>
<td>1-99</td>
<td>5</td>
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<tr>
<td>* 180</td>
<td>Language</td>
<td>0</td>
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<tr>
<td>* 190</td>
<td>Protocol Port # 1</td>
<td>0-4</td>
<td>1</td>
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</tr>
<tr>
<td>* 191</td>
<td>Protocol Port # 2</td>
<td>0-4</td>
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<td>* 195</td>
<td>Baud Rate Selector Port # 1</td>
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<td>Baud Rate Selector Port # 2</td>
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### Alarm Parameter Table

<table>
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<th>Value Range</th>
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</thead>
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<tr>
<td>310</td>
<td>No Additive Alarm Action</td>
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<td>* 311</td>
<td>No Additive Flow Time Out (Seconds)</td>
<td>1-9</td>
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<tr>
<td>320</td>
<td>Additive Volume Alarm Action</td>
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</tr>
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<td>322</td>
<td>Additive Volume Deviation Allowed (%)</td>
<td>001-100</td>
<td>10</td>
<td></td>
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<tr>
<td>323</td>
<td>Additive Deviation Basis</td>
<td>5-20</td>
<td>10</td>
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<td>340</td>
<td>Leaking Solenoid Alarm Action</td>
<td>0-1</td>
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<tr>
<td>341</td>
<td>Leak Solenoid Volume Limit (CC's)</td>
<td>000-999</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>342</td>
<td>Leaking Solenoid Timing Period (Sec)</td>
<td>1-99</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>* 371</td>
<td>No Activity Time Out Action</td>
<td>0-1</td>
<td>1</td>
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<tr>
<td>380</td>
<td>Low Flow Volume Alarm Action</td>
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<tr>
<td>381</td>
<td>Low Flow Volume Deviation %</td>
<td>000-100 %</td>
<td>025</td>
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</tbody>
</table>

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### Security Parameter Table

<table>
<thead>
<tr>
<th>Parameter #</th>
<th>Description</th>
<th>Value Range</th>
<th>Default</th>
<th>Values</th>
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</thead>
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<tr>
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<td>User 1 Password</td>
<td>0001-9999</td>
<td>4321</td>
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<td>701</td>
<td>User 1 Security Level</td>
<td>0-4</td>
<td>4</td>
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</tr>
<tr>
<td>710</td>
<td>User 2 Password</td>
<td>0001-9999</td>
<td>9999</td>
<td></td>
</tr>
<tr>
<td>711</td>
<td>User 2 Security Level</td>
<td>0-4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>720</td>
<td>User 3 Password</td>
<td>0001-9999</td>
<td>9999</td>
<td></td>
</tr>
<tr>
<td>721</td>
<td>User 3 Security Level</td>
<td>0-4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>730</td>
<td>User 4 Password</td>
<td>0001-9999</td>
<td>9999</td>
<td></td>
</tr>
<tr>
<td>731</td>
<td>User 4 Security Level</td>
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<td>781</td>
<td>Password Enable - Disable</td>
<td>0-1</td>
<td>1</td>
<td></td>
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</tbody>
</table>

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4.2 Mini-Pak™ 6 Injector Controller Parameter Details

**Product K-factor**  
Parameter # 001

The product K-factor is used by the controller to determine the volume from the process or product meter. The units are in meter pulses per unit volume of product.

Examples:
- One input pulse from product meter = 40 Gallons  
Enter: 0000.025
- One input pulse from product meter = 1 Gallon  
Enter: 0001.000
- One input pulse from product meter = 2 Liters  
Enter: 0000.500
- One input pulse from product meter = 0.100 Gallons  
Enter: 0010.000

To determine the Product K-factor for any other value, divide 1 by the flow meter pulse output.

**Additive K-factor**  
Parameter # 002

The Additive K-factor is the factor for the meter measuring the additive. The units are in pulses per unit of volume of additive.

Examples:
- When calibrated meter K-factor equals 3250 enter: 3250
- When calibrated meter K-factor equals 1640 enter: 1640

*Note: This value is automatically calculated during the TEST function. Refer to the test procedure outline in this manual for further detail.

---

**Read Only Parameter Table**

<table>
<thead>
<tr>
<th>Parameter #</th>
<th>Description</th>
<th>Value Range</th>
<th>Default</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>802</td>
<td>Active Alarms</td>
<td>0000h - FFFFh</td>
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<tr>
<td>804</td>
<td>Alarm &amp; Permissive Status (injector)</td>
<td>0-3</td>
<td>0</td>
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</tr>
<tr>
<td>806</td>
<td>Alarm &amp; Permissive Status (global)</td>
<td>0000h - OFFFh</td>
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</tr>
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<td>810</td>
<td>Product Total</td>
<td>0000000000-999999999</td>
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<td>850</td>
<td>Accumulative Total</td>
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<td>Batch Total</td>
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<td>Additive Leak Total</td>
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<td>* 890</td>
<td>Software Release Version</td>
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<td>* 891</td>
<td>Software Release Date</td>
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<tr>
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<td>TEXT</td>
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<td>Unit Serial Number</td>
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<td>Unit Oscillator Speed</td>
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<td>* 895</td>
<td>Installed Options</td>
<td>0000-ffff</td>
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</tbody>
</table>

♦ (black diamond) denotes a parameter in the Non-Clean Start model only
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* (asterisk) denotes global parameter affecting ALL injector channels
Additive Injection Volume    Parameter # 010
Additive Injection Volume is the number of CC’s that are to be injected each cycle by the Mini-Pak™ 6 Injector. The units are in CC’s.

Examples:
To inject 100 CC’s per injection enter: 0100.0
To inject 4.8 CC’s per injection enter: 0004.8

Volume of Product per Injection Cycle    Parameter # 020
The Volume of Product per Injection Cycle sets the amount of product (process volume) in one cycle.

Examples:
To perform an injection every 40 gallons enter 0040.0
To perform an injection every 100 liters enter 0100.0

In the Self Pacing Mode of operation (Parameter 080 = 2) this parameter sets the interval between injections in seconds.

Example:
To have the injector inject every 10 seconds, set the value to 0010.0.

CC’s per Unit Volume of Additive    Parameter # 022
CC’s per unit volume of Additive is the number of CC’s that are in one unit volume of additive. This number is used to convert the CC’s of additive injected into additive unit volumes (gallons, liters, etc.). The units are in (CC’s)/(additive unit of volume).

Examples:
If unit volumes of additive are in gallons enter: 3785
If unit volumes of additive are in liters enter: 1000

Multi-Functional DC Output    Parameter # 050
The Multi-Functional DC Outputs provide a variety of output tasks. The following values may be selected for Parameter 049 or 050:

0 = One pulse output for each whole unit volume of additive dispensed.
1 = Ten pulses out for each whole unit volume of additive dispensed.
2 = 100 pulses out for each whole unit volume of additive dispensed.
3 = 1000 pulses out for each whole unit volume of additive dispensed.
4 = One pulse output for each additive meter pulse received.
5 = Piston Switch feedback (Available with 1 pulse per injection pacing only.)
6 = Post injection feedback.
7 = Double Piston Switch feedback.
8 = Feedback pulse sent during last 25% of cycle.

Number of Clean Start Cycles    Parameter # 060
This parameter stores the number of injections cycles at the beginning of a transaction, during which the additive needed to make up the clean start volume at the end of the load is injected. When set to one, all the additive withheld at the end of the transaction is injected in the first cycle, along with the normal first cycle volume. When set to two, the additive volume...
withheld at the end of the transaction is divided by 2 and added to each of the first two cycle volumes. This parameter is only used if parameter #061 is non-zero and parameter #081 is non-zero. See the section on “Clean Start” in this manual.

**Low Flow Product Volume**

Parameter # 061

The Low Flow Product Volume is the gallons or liters of product that is to remain additive free or “clean” when the flow stops. This value is typically set larger than the volume between the additive injection point on the product line and the end of the loading arm coupling. This value must be coordinated with the preset low-flow trigger point in the delivery of product. (See parameters #063 and #064 below.) The injector electronics uses this number and the recipe to determine how many cc’s of additive to inject at the start of the transaction. Setting this value to zero disables Clean Start.

**High Flow Mode Threshold**

Parameter # 063

This value is the raw, un-factored increasing pulse frequency which must be exceeded to advise the injector that it is in a high flow rate condition. This value must be set equal to or greater than parameter #064. See the section on “Clean Start” in this manual. This parameter is only used when parameter #061 is non-zero.

**Low Flow Mode Threshold**

Parameter # 064

This value is the raw, un-factored decreasing pulse frequency at which the injector will go into the Clean Start Mode and stop injecting additive. This value must be set equal to or lower than parameter #063. See the section on “Clean Start” in this manual. This parameter is only used when parameter #061 is non-zero.

**Product Flow Timeout**

Parameter # 065

The Product Flow Timeout parameter works in conjunction with parameter #081 being set to 3. When product pacing pulses stop, this parameter determines the time delay until the current transaction is terminated. This time is in seconds.

**Injection Panel Type**

Parameter # 080

The Injection Panel Type parameter determines the mode of operation for the Mini-Pak™ 6. The Mini-Pak™ 6 may be operated in slave, smart, or self-pacing mode.

In slave mode the Mini-Pak™ 6 electronics provide a local display of additive volume usage and meter calibration functions, but DOES NOT provide additive injection control. Injection volume control must be provided by an external source such as a PLC or data system. When the pacing signal input is on (voltage present), the solenoid control output is on. The external controlling system must accumulate additive flow and determine when to close the solenoid by turning off the pacing signal input to the Mini-Pak™ 6.

In the Smart Mode, the injector is paced by the process and controls the solenoid based upon the recipe internally.
In Self-Pacing mode the injector will inject without an external pacing signal and will inject based upon a time interval. In this mode the interval between injections is the value in Parameter 020, and is in seconds.

Examples:
For Mini-Pak™ 6 Injector Slave mode operation enter: 0
For Mini-Pak™ 6 Injector Smart mode operation enter: 1
For Mini-Pak™ 6 Injector Self-Pacing mode operation enter: 2

Inject Enable Required  Parameter # 081

The Inject Enable Required parameter determines if the injector requires a permissive enable, or if the injector always injects upon receipt of product pulses. See table below in Parameter # 082.

Examples:
To have the Mini-Pak™ 6 always inject upon receipt of pacing pulses set 081 = 0.

To have the Mini-Pak™ 6 inject only upon receipt of a Task 010 command via communications, set Parameter 081 = 1.

To have the Mini-Pak™ 6 inject upon receipt of a DC or AC enable signal &/or a Task 010 command, set Parameter 081 = 2.

To have the Mini-Pak™ 6 enable and reset any alarm conditions, set Parameter 081 = 3.

Product Pacing Source Select  Parameter # 082

This parameter determines which input will be used by the controller for the purpose of pacing the injector to the product flow. The choices are DC pulse input on TB1-3, or AC pulse input on TB2-4. Based upon the setting of Parameter # 081 above, the input NOT used for pacing becomes either an ENABLE input or a RESET input. The following table provides the combinations available.

<table>
<thead>
<tr>
<th>Hardware Control</th>
<th>Param 81</th>
<th>Param 82</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Enable, DC or Comm Reset, AC or Comm Pacing</td>
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<td>0</td>
</tr>
<tr>
<td>No Enable, AC or Comm Reset, DC or Comm Pacing</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Comm Enable, DC or Comm Reset, AC or Comm Pacing</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Comm Enable, AC or Comm Reset, DC or Comm Pacing</td>
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<td>1</td>
</tr>
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<td>DC Enable, No H/W Reset1, AC Pacing</td>
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<td>AC Enable, No H/W Reset1, DC Pacing</td>
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<td>DC Enable w/Reset2, AC Pacing</td>
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<td>AC Enable w/Reset2, DC Pacing</td>
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</tbody>
</table>

Notes:
1. “No H/W Reset” indicates that no hardware or wired alarm reset is available. Reset via communications would still be possible.
2. “Enable w/Reset” refers to the automatic clearing of alarms upon application of the enable signal.
Parameters

**Injector Position Enable** Parameter #083
The Injector Position Enable determines the operational status of the injector channel. If the injector position is disabled, no injector information will be displayed for that position.

Examples:
To disable injector position for operation enter: 0
To enable injector position for operation enter: 1

**Product Pulse Select** Parameter #084
When the Product Pulse Select Parameter # 084 is set to a value of one (1), each injector is permitted and paced independently as if they were stand-alone injectors. The LCD display will say MULTI- PULSE INPUT on boot-up.

When the Product Pulse Select Parameter # 084 is set to a value of zero (0), and an individual injector is permitted (1-6), product pulses on injector one pacing input will inject additive on all permitted injectors (1-6). The LCD display will say: SINGLE PULSE INPUT on boot-up.

Example:
Parameter(084=0), Injectors(1,2,3) are permitted:
Product pulses on Injector(1) will inject additive through the three injectors(1,2,3).

NOTE: If parameter 084 = 0, then parameter 001 becomes a Global parameter. The value in Injector #1, parameter 001, becomes the value for parameter 001 for all injectors (1-6).

NOTE: If parameter 084 is changed from 1 to 0, a value must be entered and saved in parameter 001 for injector #1, EVEN IF IT IS THE EXISTING VALUE. If parameter 084 is changed from a 0 to 1, a value must be entered and saved in parameter 001 for ALL injectors (1-6).

**Communication Response Delay 1** Parameter # 085
The Communication Response Delay 1 parameter delays the response to a request received on Communication Port 1. The response delay is in milliseconds.

**Communication Response Delay 2** Parameter # 086
The Communication Response Delay 2 parameter delays the response to a request received on Communication Port 2. The response delay is in milliseconds.

**Unit Address** Parameter # 100
The Unit Address parameter is the primary communications address of the Mini-Pak™ 6. The primary address is the value used to identify a particular unit to the master computer. This 3 digit number must be unique to each unit on a communication loop.

Examples:
To assign the Mini-Pak™ 6 Injector an Address of 10 enter: 010
To assign the Mini-Pak™ 6 Injector an Address of 252 enter: 252
Broadcast Address Parameter # 101

The Broadcast Address parameter is the secondary communications address recognized by the Mini-Pak™ 6. It is not necessarily unique to any particular unit. This address is used by the master if it wants to transmit a command to more than one unit, simultaneously. All Mini-Pak™ 6 units on the system will respond to Broadcast messages. The Mini-Pak™ 6 will act upon a message addressed to its own Broadcast Address but will not acknowledge it. This permits many units to be controlled by the master with only a single command sent. A typical use for this might be setting the date or time.

Examples:
To assign the Mini-Pak™ 6 Injector a Broadcast Address of 999 enter: 999
To assign the Mini-Pak™ 6 Injector a Broadcast Address of 000 enter: 000

Unit Description Parameter # 102

The Unit Description field is a free form alphanumeric string used to help identify the unit to the user. All ASCII characters between 32 hex and 7A hex, with the exception of the reserved character 3b hex (semi-colon) are valid.

This parameter must be set using the serial communications port.
Note: 20 hex (space character) is a legal value.

Multi-Functional AC Output Parameter # 129

These parameter values determine the function of the second triac output. The following options are available:

0 = Fail Safe alarm
1 = Piston Switch feedback (Available with 1 pulse per injection pacing only.)
2 = Post injection feedback
3 = Pump Start (communication controlled only)
4 = Pump Start (pulse detect only)
5 = Inverse Piston Switch feedback (Available with 1 pulse per injection pacing only.)

Notes:
- In Fail Safe Alarm Mode (Parameter 129 = 0) the output is normally on and turns off upon alarm. It is therefore “FAIL SAFE”, or off if a failure of power or electronics occurs.
- Piston Switch feedback mimics the response of piston based injectors with magnetic piston detector switches.
- Post Injection Feedback sends a pulse output of the duration in seconds contained in Parameter 133. This pulse is only sent upon successful completion of the injection cycle.
- Pump Start may be used to turn on a supply pump feeding the injector. This output will come on upon receipt of an enable permissive command, or if desired upon receipt of pacing pulses.
Number Solenoid Retries Parameter # 131
The Number of Retries on the Solenoid parameter defines the number of times the Mini-Pak™ 6 will retry the injection solenoid if no additive flow is detected.

Examples:
To have the Mini-Pak™ 6 Injector close and then reopen the solenoid when no additive flow is detected, enter 1
To have the Mini-Pak™ 6 Injector not try to reopen solenoid once when no additive flow is detected, enter 0

AC Input Hysteresis Parameter # 132
The AC Input Hysteresis parameter defines the time duration required for an AC input to change state and remain in that state before the unit will recognize the change. This parameter is used to eliminate contact bounce. Units are in milliseconds (ms).

Examples:
To have the Mini-Pak™ 6 Injector to delay 100 ms before recognizing an AC input enter: 0100
To have the Mini-Pak™ 6 Injector to delay 500 ms before recognizing an AC input enter: 0500

Confirmation Pulse Duration Parameter # 133
The Confirmation Pulse Duration parameter defines the time duration that the Mini-Pak™ 6 Injector will hold the confirmation pulse contact closed, to signal that an injection took place. Confirmation Pulse Output must be selected in Parameter # 129.

Examples:
To have the Mini-Pak™ 6 Injector provide a 100 ms confirmation pulse feedback signal enter: 0100
To have the Mini-Pak™ 6 Injector provide a 500 ms confirmation pulse feedback signal enter: 0500

Pump No Activity Time Out Parameter # 134
The Pump No Activity Time Out parameter defines the time duration that the pump start output circuit will remain energized with no product pulses to the Mini-Pak™ 6 Injector. A Pump Start Output must be selected in Parameter # 128 or #129. Note that if enable is required (Parameter 081 = non-zero), the pump start output is energized upon application of the permissive signal. If enable is not required (Parameter 081 = 0) the pump start output is energized upon detection of the first pacing pulse. This value is in minutes.

Examples:
To have the Mini-Pak™ 6 Injector hold the pump start output on for 2 minutes following the last product pacing pulse, set Parameter # 134 = 2.
Enable Infrared Port Parameter # 140

The Enable Infrared Port parameter enables or disables the infrared communications port on the bezel of the Mini-Pak™ 6. Disabling the port prohibits the user from accessing the Mini-Pak™ 6 Injector with the Hand-Held controller. This parameter may only be set using the serial communications port.

To use the Mini-Pak™ 6 Injector with the hand-held IR programmer, set Parameter # 140 = 1.
To disable the hand-held IR programmer, set Parameter # 140 = 0.

Infrared Port No Activity Parameter # 141

The Infrared Port No Activity Time out sets the time the Mini-Pak™ 6 Injector will remain in the local programming mode without communication to the infrared port. When the port times out, the Mini-Pak™ 6 will return to the idle mode.

Examples:
To have the infrared port time out after 60 seconds enter: 060
To have the infrared port time out after 45 seconds enter: 045

LCD Alarm Screen Rotation Parameter # 150

The LCD Alarm Screen Rotation Delay parameter sets the length of time the alarm screen will remain on the LCD display of the Mini-Pak™ 6 before the next one, if any, is displayed. If more than one alarm is active, the alarm screens are displayed in rotation.

Examples:
To have the Mini-Pak™ 6 delay 4 seconds before displaying the next alarm enter: 04
To have the Mini-Pak™ 6 delay 10 seconds before displaying the next alarm enter: 10

LCD Main Screen Rotation Parameter # 151

The LCD Main Screen Rotation Delay parameter sets the length of time the main screen will remain on the LCD display of the Mini-Pak™ 6 Injector before the next one, if any, is displayed.

Examples:
To have the Mini-Pak™ 6 delay 4 seconds before displaying the next screen enter: 04
To have the Mini-Pak™ 6 delay 10 seconds before displaying the next screen enter: 10

Unit Language Parameter # 180

The Unit Language parameter is used to set the primary language the Mini-Pak™ 6 uses when displaying information to the LCD display. Currently the Mini-Pak™ 6 supports English and Spanish.
Parameters

Serial Port # 1 Protocol  Parameter # 190
The Serial Port Protocol parameter determines which protocol is used for communications through the serial port.

Settings:
Disable serial communications = 0
FMC Smith Accuload - Type I = 1
Brooks Petrocount – Type 2 = 2
GC - Type III protocol is not supported
Modbus RTU ASCII - Type IV protocol enter: 4

Serial Port # 2 Protocol  Parameter # 191
The Serial Port Protocol parameter determines which protocol is used for communications through the serial port.

Settings:
Disable serial communications = 0
FMC Smith Accuload - Type I = 1
Brooks Petrocount – Type 2 = 2
GC - Type III protocol is not supported
Modbus RTU ASCII - Type IV protocol enter: 4

Serial Port # 1 Baud Rate Select  Parameter # 195
This parameter selects the serial port baud rate used for communications. Setting values are:

1200 Baud  = 0
2400 Baud  = 1
9600 Baud  = 2
19200 Baud = 3

Serial Port # 2 Baud Rate Select  Parameter # 196
This parameter selects the serial port baud rate used for communications. Setting values are:

1200 Baud  = 0
2400 Baud  = 1
9600 Baud  = 2

4.3 Alarm Parameter Details {tc.“Security Parameters”}

No Additive Alarm Action  Parameter # 310
The No Additive Flow alarm occurs when the Mini-Pak™ 6 signals the solenoid to open and does not receive any additive flow pulses within a programmable period of time. This time is determined by the Zero Additive Flow time out parameter below.

Examples:
To have the Mini-Pak™ 6 ignore the alarm enter: 0
To have the Mini-Pak™ 6 display the alarm and energize an output enter: 1
Note: For this alarm to provide an external control output, one of the Multi-Functional Outputs must be assigned to an alarm function.
Zero Additive Flow Time Out Parameter # 311

The Zero Additive Flow Time Out parameter determines length of time the
Mini-Pak™ 6 will wait with the injection solenoid open with no incoming
additive pulses, before it sets the No Additive Alarm. Units are in seconds.

Examples:
To have the Mini-Pak™ 6 wait two seconds for additive flow enter: 2

Additive Cycle Volume Alarm Action Parameter # 320

The Additive Cycle Volume Deviation alarm occurs when the volume of
additive injected during an injection cycle is outside of the set parameters
(Parameter # 322), and the number of failures is greater than the number
permitted (Parameter # 323).

Examples:
To have the Mini-Pak™ 6 ignore the alarm enter: 0
To have the Mini-Pak™ 6 display the alarm and energize an output
enter: 1
Note: For this alarm to provide an external control output, one of the
Multi-Functional Outputs must be assigned to an alarm function.

Additive Volume Deviation Allowed Parameter # 322

The Additive Volume Deviation Allowed parameter sets the amount the
Mini-Pak™ 6 Injector can deviate from the desired injection rate during an
injection. A value of 10 sets the allowable deviation at 10%, therefore an
injection volume between 90 & 110% of the required volume would be an
acceptable injection.

Note:
The Mini-Pak™ 6 will try to compensate for a high or low additive injection
the next injection.

Examples:
To have the Mini-Pak™ 6 alarm when excess additive exceeds 110%
enter: 10
To have the Mini-Pak™ 6 alarm when excess additive exceeds 125%
enter: 25

Additive Deviation Basis Parameter # 323

Determines the number of injection cycles averaged together in Parameter
# 322 above.

Examples:
To calculate the additive volume deviation over ten cycles enter: 10

Leaking Solenoid Alarm Action Parameter # 340

The Leaking Solenoid Valve alarm occurs when the volume of unauthorized
additive leaking through the inject solenoid is greater than the programmed
volume. This volume is determined by Parameter # 341. Unauthorized
additive is defined to be additive that passes through the injector while the
inject solenoid is signaled to be closed.
Examples:
To have the Mini-Pak™ 6 ignore the alarm enter: 0
To have the Mini-Pak™ 6 display the alarm and energize an output enter: 1
Note: For this alarm to provide an external control output, one of the Multi-Functional Outputs must be assigned to an alarm function.

Leaking Solenoid Volume Limit Parameter # 341

The Leaking Solenoid Volume Limit parameter sets the volume of additive that is allowed to leak through the injection solenoid before the Leaking Solenoid Alarm is set. Units are in CC's.

Examples:
To have the Mini-Pak™ 6 alarm when unauthorized additive volume exceeds 100 CC's enter:100
To have the Mini-Pak™ 6 alarm when unauthorized additive volume exceeds 50 CC's enter: 050

Leaking Solenoid Timing Period Parameter # 342

The Leaking Solenoid Timing Period sets the time in which the volume defined in Parameter 341 above must occur. If the defined volume is not reached within the time allotted, the volume is discarded. Thus, the alarm is for a flow rate, not a fixed volume.

To have the alarm ignore volumes less than 10 CC's in less than 5 seconds, set 341 to 10 and this Parameter 342 to 5 (seconds). An alarm will occur if a volume greater than 10 CC's is reached in 5 seconds.

No Activity Alarm Action Parameter #370

The No Activity Alarm indicates that the permissive enable was applied to the injector and no pacing signal was sent to the injector for the period of time defined in parameter 371. The action taken by the injector is determined by the value in this parameter.

Examples:
To have the Mini-Pak 6 ignore the alarm enter a “0”.
To have the Mini-Pak 6 display the alarm enter a “1”.
To have the Mini-Pak 6 display the alarm and activate an alarm output signal enter a “2”.
To have the Mini-Pak 6 display, activate an output, and shut down injection enter a “3”.
Note: For this alarm to provide an external control output, one of the Multi-Functional Outputs must be assigned to an alarm function.

No Activity Alarm Timeout Parameter #371

This parameter value is the time period in minutes that the injector will wait for pacing pulses after an enable signal is received. If no pacing is received prior to the timeout, an alarm will be set. Each pacing pulse received resets this timer.

Example:
To have the injector wait 5 minutes for pacing signals to be received, enter a value of “005”.

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Clean Start Volume Alarm Action Parameter #380

The Clean Start Volume Alarm parameter defines the actions the Mini-Pak 6 will execute if this alarm occurs.

Examples:
To have the Mini-Pak 6 ignore the alarm enter: 0
To have the Mini-Pak 6 display the alarm and energize an output enter: 1
Note: For this alarm to provide an external control output, one of the Multi-Functional Outputs must be assigned to an alarm function.

Clean Start Volume Deviation Allowed Parameter #381

The Clean Start Volume Deviation Allowed parameter is the percentage of deviation below the desired Clean Start Volume allowed without setting the alarm. The deviation is expressed as a percentage of the actual product volume monitored after the low flow signal went active, to the desired Clean Start Volume (parameter #061). There is no upper percentage.

Examples:
To have the Mini-Pak Plus trigger a Clean Start Volume Alarm if the low flow dispensed volume is less than 50% of the normal Clean Start Volume enter: 050

4.4 Security Parameter Details

User #1 Password Parameter #700
The User #1 Password parameter sets the password that is defined as User #1.

Examples:
To set User #1 Password to 1234 enter: 1234
To set User #1 Password to 7497 enter: 7497

User #1 Security Level Parameter #701
The User #1 Security Level parameter sets the Security Level for User #1.

Examples:
To set User #1 Security Level to the highest level (4) enter: 4
To set User #1 Security Level to the lowest level (0) enter: 0
Note: There must be one user with a Security Level set to 4!

User #2 Password Parameter #710
The User #2 Password parameter sets the password that is defined as User #2.

Refer to Parameter #700 for examples.

User #2 Security Level Parameter #711
The User #2 Security Level parameter sets the Security Level for User #2.

Refer to Parameter #701 for examples.
**User #3 Password**  
Parameter # 720  
The User #3 Password parameter sets the password that is defined as User #3.  
Refer to Parameter # 700 for examples.

**User #3 Security Level**  
Parameter # 721  
The User #3 Security Level parameter sets the Security Level for User #3.  
Refer to Parameter # 701 for examples.

**User #4 Password**  
Parameter # 730  
The User #4 Password parameter sets the password that is defined as User #4.  
Refer to Parameter # 700 for examples.

**User #4 Security Level**  
Parameter # 731  
The User #4 Security Level parameter sets the Security Level for User #4.  
Refer to Parameter # 701 for examples.

**Password Enable/Disable**  
Parameter # 781  
The Password Enable/Disable parameter determines whether Password use is required or not. The switch is provided to allow the user to bypass the security feature if it is undesirable.

Examples:
To enable Password use enter: 0  
This means that a Password will be required to access and change parameter values.
To disable Password use enter: 1  
This means that a Password will NOT be required to access and change parameter values.

NOTE: A valid password is ALWAYS required to enable passwords. This ensures that the person turning on password protection is aware of the password required to turn them back off if necessary.

### 4.5 Read - Only Parameter Details

**Alarm Status**  
Parameter # 802  
The Alarm Status parameter records active alarms in a binary code that represents the current alarm status of a specific injector in the Mini-Pak™ 6 controller. Please refer to the Alarm Code Table for an explanation of the values found in this parameter.

**Alarm & Permissive Status (injector)**  
Parameter # 804  
This status value returns the condition of a specific injector in the Mini-Pak™ 6 controller. The conditions reported are:

Value = 0 - Not permitted and no alarm present  
Value = 1 - Permitted and no alarms present
Value = 2 - Not permitted with active alarm(s)
Value = 3 - Permitted with active alarm(s)

**Alarm & Permissive Status (global) Parameter # 806**

Reading the Alarm & Permissive Status global Parameter # 806 via communications returns the current status of all injector channels in a controller in one reply. This four digit hexadecimal representation of the status is defined in the table below. In this example, the following injector status is shown:

- Injector # 1 is enabled and has active alarms
- Injector # 2 is not enabled and has active alarms
- Injector # 3 is enabled and has no alarms
- Injector # 4 is not enabled and has no alarms
- Injector # 5 is not enabled and has active alarms
- Injector # 6 is not enabled and has no alarms

The table above, each of the hex (base 16) digits is the value of the four bit binary number immediately above it. In hex representation, numbers increment from 0-9, then A = 10 decimal, B = 11, C, D, E, and finally F representing 15 decimal.

**Product Total Parameter # 810**

This parameter stores the total product units as defined by the pacing pulse signal and the product k-factor. The number is in whole unit volumes. The units accumulated are determined by the number of pacing pulses received divided by the product k-factor Parameter # 001. This number increments from zero and may be reset to zero via TASK 800. This number cannot be preset to a specific value.
Combined Additive Total  Parameter # 850
The Combined Additive Total is the combined volume of chemical (additive) passing through the additive meter. This includes both the test volume and the injected volume. The Combined Additive Total is in whole unit volumes, as determined by the number of additive pulses received divided by the additive k-factor, Parameter # 002. This number increments from zero and may be reset to zero via TASK 800. This number cannot be preset to a specific value.

Injected Additive Total  Parameter # 860
The Injected Additive Total is the volume of chemical (additive) passing through the additive meter during normal use (non-test mode use). The Injected Additive Total is in whole unit volumes, as determined by the number of additive pulses received divided by the additive k-factor, Parameter # 002. This number increments from zero and may be reset to zero via TASK 800. This number cannot be preset to a specific value.

Test Additive Total  Parameter # 880
The Test Additive Total is the volume of chemical (additive) passing through the additive meter during calibration. The Test Additive Total is in whole unit volumes, as determined by the number of additive pulses received divided by the additive k-factor, Parameter # 002. This number increments from zero and may be reset to zero via TASK 800. This number cannot be preset to a specific value.

Software Release Version  Parameter # 890
The Software Release Version parameter provides a means of checking the current version number of software running the injector. This version number is also displayed upon powering up the unit.

Software Release Date  Parameter # 891
The Software Release Date parameter provides a means of checking the creation date of the current version of software running the injector.

Product ID  Parameter # 892
The Product ID parameter records the type of hardware device that the software is designed to run on.

Unit Serial Number  Parameter # 893
This parameter stores the unique serial number assigned to this hardware module at the factory.

Unit Oscillator Speed  Parameter # 894
The Unit Oscillator Speed parameter records the controller running speed for this hardware platform.

Installed Options  Parameter # 895
This binary code determines device functionality. Using this option, certain features of the software may be blocked from access by the user. To date, all features are available.
4.6 Task Codes

Task codes are functions that are performed by the Mini-Pak™ 6 either by using the Hand-Held Controller, or by utilizing the ‘execute task’ command via serial communications. Below is a table of task codes and its corresponding effect. Task codes are used to clear totals, reset the unit, or to reinitialize the Mini-Pak™ 6 module to its default parameters.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Relevant Mode</th>
<th>Access Mode</th>
<th>Port</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Disable Injection</td>
<td>Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>010</td>
<td>Enable Injection</td>
<td>Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>050</td>
<td>Inject One Cycle</td>
<td>Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>301</td>
<td>Clear All Alarms</td>
<td>Slave / Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>800</td>
<td>Clear All Totals</td>
<td>Slave / Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>801</td>
<td>Clear Batch Totals</td>
<td>Slave / Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>802</td>
<td>Clear Grand Totals</td>
<td>Slave / Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>1</td>
</tr>
<tr>
<td>940</td>
<td>Reset Unit</td>
<td>Slave / Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>4</td>
</tr>
<tr>
<td>999</td>
<td>Reinitialize Unit To Defaults</td>
<td>Slave / Smart</td>
<td>T-Anytime</td>
<td>S / I</td>
<td>5</td>
</tr>
</tbody>
</table>
CHAPTER 5  COMMUNICATIONS

5.1 Communications and Communication Wiring {tc. “communications and communication Wiring”}

The Mini-Pak™ 6 Injector uses the EIA-485 standard for communications. A converter is required to enable communications with peripheral devices such as modems or personal computers which use the EIA-232 interface standard. Enraf Fluid Technology can provide an EIA-485 to EIA-232 converter if your application requires one.

Communications via modem requires a modem to be installed at each end of the communications link, and an appropriate converter (if required). The modem must be programmed to Auto Answer, and the cabling must be designed to provide auto-answer capabilities on the terminal end.

Although often overlooked, proper system wiring is critical to the reliable operation of serial communications interfaces. Improper wiring can cause high data error rates and reduce data throughput.

Although exact wiring requirements vary depending on the type of interface used, each of the following is important to the overall success of a communications system:

- Cable lengths and types
- Shielding
- Twisted Pair Wiring

EIA 485 interfaces are typically used in multi-drop configurations. The system wiring can become very complex. When installing a 2-wire cable for use with the Mini-Pak™ 6, receive and transmit share the same conductor pair. The wires must be a twisted pair.

Wiring for EIA 485 must be designed as a daisy chain. Cable stubs are permitted so long as they are 15 feet or less in length. Conductor pairs must be terminated with a 100 ohm resistor at the most distant end to ensure proper line impedance for maximum signal reception. Using the recommended cable (Belden Cable 9841 for 2-wire) an EIA 485 interface may support multiple devices (stations) over a maximum wire length of 3600 feet.

5.1.1 Communication Settings {“tc. Communication Settings”}

Communication with the Mini-Pak™ 6 Injector may be achieved by two methods. The Hand-Held Controller (HHC) and its keypad access the Mini-Pak™ 6 via an infrared port, through the explosion-proof enclosure window, in much the same manner as a television remote control. Use of the HHC offers the convenience and safety of on-site communications with the unit in a hazardous environment, without having to remove the cover and exposing potentially explosive electrical connections.
The other method of communications takes place through a hard-wired, serial communications port which supports EIA 485 standards, and is connected to the master via a data communications line.

Protocol selection is determined by setting Parameter # 190, with the options being:

- Disable serial port (0)
- Type I – FMC Smith (1)
- Type II – Brooks (2)
- Type III – Not currently used (3)
- Type IV - Modbus RTU ASCII protocol (4)

Refer to the Communications Specification for complete details regarding your specific protocol. The settings for all of the communication protocols are as follows:

- Baud rate 1200/2400/9600/19,200
- Data Bits 8
- Stop Bit 1
- Parity None

5.2 Accessing Mini-Pak™ 6 Parameters Via Communications

How to read the tables:

- **Code** = Parameter code or Task code
- **Register Description** = the meaning or purpose of the register/task code
- **Range** = the minimum and maximum values that the register can hold
- **Format** = the exact format of the value as it is transmitted or received

- **N** - ASCII character between 0 and 9 (30 hex - 39 hex)
- **A** - an ASCII alphanumeric character (32 hex - 7A hex)
- **;** - Semi-colon (3B hex) is reserved and not allowed
- **B** - ASCII character representation of a binary value (0 or 1)
- **H** - ASCII hex character representation of a binary value
- **HH:MM:SS** - Standard time format hours: minutes:seconds
- **MM/DD/YY** - Standard date format months/days/years
Parameter Accessibility = when a given parameter is accessible to be read or written to
R - when it can be read
W - when it can be written to
T - when the task can be performed
Idle - when solenoid is de-energized
Anytime - register can be accessed at anytime

Port Access = which communications port(s) have access to the parameter / task
I - can only be accessed using the hand-held infrared remote
S - can only be accessed using the primary serial port

Security Level = security level the user must have to perform a read/write
1 - must have a security level of 1 (lowest)
2 - must have a security level of 2
3 - must have a security level of 3
4 - must have a security level of 4 (highest)

Example:
The Parameter Code for this register is 100 and is identified as the Unit Address. The value anywhere is from 1 to 997. The format of the value, when transmitted or received, must be three digits. The register can be read anytime, but can only be changed in the un-permitted mode. The parameter can be accessed using either the infrared remote or the serial port and applies to any mode of operation. In order to read the register value, the user must have a level 1 security level, but must have a level 3 to change the parameter.
### 5.3 Parameter Table For Communications

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
<th>RANGE</th>
<th>UNITS</th>
<th>FORMAT</th>
<th>ACCESS MODES</th>
<th>ACCESS PORT</th>
<th>SECURITY LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Product K-Factor</td>
<td>00000.001 - 99999.999</td>
<td>pulses / unit volume</td>
<td>mnnnn.mnn</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>002</td>
<td>Additive K-Factor</td>
<td>00000.001 - 99999.999</td>
<td>pulses / unit volume</td>
<td>mnnnn.mnn</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>010</td>
<td>Additive Injection Volume</td>
<td>0.1 - 9999.9</td>
<td>cubic centimeters</td>
<td>mnn.n</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>020</td>
<td>Volume Of Product Per Inj Cycle</td>
<td>0.001.0 - 99999.999</td>
<td>unit volumes of product</td>
<td>mnn.n</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>022</td>
<td>CC’s per unit volume of Additive</td>
<td>0.001 - 99999</td>
<td>cubic centimeters</td>
<td>mnnn</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>050</td>
<td>Multi-function DC Out # 2</td>
<td>00 - 12</td>
<td>various</td>
<td>nn</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>060</td>
<td>Number Of Clean Start Cycles</td>
<td>01-99</td>
<td>count</td>
<td>n</td>
<td>R / W - Anytime</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>061</td>
<td>Low Flow Volume At End Of Load</td>
<td>000-999</td>
<td>unit volumes of product</td>
<td>mnn</td>
<td>R / W - Anytime</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>062</td>
<td>Frequency Modes</td>
<td>1-2</td>
<td>Various</td>
<td>n</td>
<td>R / W - Anytime</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>063</td>
<td>Low Flow Mode Activate</td>
<td>00000-30000</td>
<td>pulse frequency - pps</td>
<td>mnnnn</td>
<td>R / W - Anytime</td>
<td>S/I</td>
<td>1/3</td>
</tr>
<tr>
<td>064</td>
<td>Product Flow Initiate</td>
<td>00000-30000</td>
<td>pulse frequency - pps</td>
<td>mnnnn</td>
<td>R / W - Anytime</td>
<td>S/I</td>
<td>1/3</td>
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<td>065</td>
<td>Product Flow Time Out</td>
<td>00005-30000</td>
<td>time in seconds</td>
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<td>S/I</td>
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<td>operating mode</td>
<td>n</td>
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<td>Inject Enable Required</td>
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<tr>
<td>082</td>
<td>Product Pacing Source Select</td>
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<td>AC - DC</td>
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<td>1/3</td>
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<td>disabled - enabled</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>S/I</td>
<td>1/3</td>
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<td>single - multiple</td>
<td>n</td>
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<td>S/I</td>
<td>1/3</td>
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<td>* 085</td>
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<td>S / I</td>
<td>1/3</td>
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<td>001-997</td>
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<td>R-Anytime / W-Idle</td>
<td>I</td>
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<td>* 101</td>
<td>Broadcast Address</td>
<td>&quot;000, 998, 999&quot;</td>
<td>system common number</td>
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<td>* 102</td>
<td>Unit Description</td>
<td>20 char alpha/numeric</td>
<td>text</td>
<td>a0 .. a20</td>
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<td>Configurable AC Output</td>
<td>0 - 6</td>
<td>various</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>S / I</td>
<td>1/3</td>
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<td>* 131</td>
<td>Number of Solenoid Retries</td>
<td>0-2</td>
<td>count</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>S / I</td>
<td>1/3</td>
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<tr>
<td>* 132</td>
<td>Hysteresis</td>
<td>0000-1000</td>
<td>milliseconds</td>
<td>mnnn</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>1/3</td>
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<td>* 133</td>
<td>Confirmation Pulse Duration</td>
<td>0000-1000</td>
<td>milliseconds</td>
<td>mnnn</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>1/3</td>
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<tr>
<td>134</td>
<td>Pump No Activity Time Out</td>
<td>1 - 99</td>
<td>minutes</td>
<td>nn</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>1/3</td>
</tr>
<tr>
<td>CODE</td>
<td>DESCRIPTION</td>
<td>RANGE</td>
<td>UNITS</td>
<td>FORMAT</td>
<td>ACCESS MODES</td>
<td>ACCESS PORT</td>
<td>SECURITY LEVEL</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------</td>
<td>-----------</td>
<td>-------</td>
<td>--------</td>
<td>----------------------------------</td>
<td>-------------</td>
<td>----------------</td>
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<tr>
<td>140</td>
<td>Infrared Port Enable</td>
<td>0 - 1</td>
<td>off - on</td>
<td>n</td>
<td>R-Anytime/W-Anytime</td>
<td>S</td>
<td>1/3</td>
</tr>
<tr>
<td>141</td>
<td>Infrared No Activity Time Out</td>
<td>010-999</td>
<td>seconds</td>
<td>nnn</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>1/3</td>
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<tr>
<td>150</td>
<td>Alarm Screen Rotation Delay</td>
<td>1 - 99</td>
<td>seconds</td>
<td>nn</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>1/3</td>
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<tr>
<td>151</td>
<td>Main Screen Rotation Delay</td>
<td>1 - 99</td>
<td>seconds</td>
<td>nn</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>1/3</td>
</tr>
<tr>
<td>180</td>
<td>Unit Language</td>
<td>0- English</td>
<td>fixed</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>I</td>
<td>1/3</td>
</tr>
<tr>
<td>190</td>
<td>Communications Protocol</td>
<td>0 - 5</td>
<td>various</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>I</td>
<td>1/3</td>
</tr>
<tr>
<td>191</td>
<td>Communications Protocol</td>
<td>0 - 5</td>
<td>various</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>I</td>
<td>1/3</td>
</tr>
<tr>
<td>195</td>
<td>Baud Rate Selector</td>
<td>0 - 3</td>
<td>various</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>I</td>
<td>1/3</td>
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<tr>
<td>196</td>
<td>Baud Rate Selector</td>
<td>0 - 3</td>
<td>various</td>
<td>n</td>
<td>R-Anytime / W-Idle</td>
<td>I</td>
<td>1/3</td>
</tr>
</tbody>
</table>

- (black diamond) denotes a parameter in the Non-Clean Start model only
- (white diamond) denotes a parameter in the Clean Start model only
- (asterisk) denotes global parameter affecting ALL injector channels

Alarms

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
<th>RANGE</th>
<th>UNITS</th>
<th>FORMAT</th>
<th>ACCESS MODES</th>
<th>ACCESS PORT</th>
<th>SECURITY LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>310</td>
<td>No Additive Alarm</td>
<td>0 - 1</td>
<td>off - on</td>
<td>n</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>* 311</td>
<td>No Additive Flow Timeout</td>
<td>1 - 9</td>
<td>seconds</td>
<td>n</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>320</td>
<td>Additive Volume Alarm</td>
<td>0 - 1</td>
<td>off - on</td>
<td>n</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>322</td>
<td>Volume Deviation Allowed</td>
<td>001 - 100%</td>
<td>percent</td>
<td>nnn</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>323</td>
<td>Additive Deviation Basis</td>
<td>5 - 20</td>
<td># injections</td>
<td>nn</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>340</td>
<td>Leaking Solenoid Alarm</td>
<td>0 - 1</td>
<td>off - on</td>
<td>n</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>341</td>
<td>Leaking Solenoid Volume Limit</td>
<td>000 - 999</td>
<td>CC's of additive</td>
<td>nnn</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>342</td>
<td>Leaking Solenoid</td>
<td>1-99</td>
<td>Seconds</td>
<td>nn</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
</tr>
<tr>
<td>370</td>
<td>No Activity Time Out Action</td>
<td>0-1</td>
<td>off - on</td>
<td>n</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
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<tr>
<td>* 371</td>
<td>No Activity Time Out Period</td>
<td>00000-65535</td>
<td>seconds</td>
<td>n</td>
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<td>S / I</td>
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<tr>
<td>380</td>
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<td>0-1</td>
<td>off - on</td>
<td>n</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
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<td>381</td>
<td>Low Flow Volume Deviation %</td>
<td>000-100 %</td>
<td>percent</td>
<td>nnn</td>
<td>R- Anytime / W-Idle</td>
<td>S / I</td>
<td>1/4</td>
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</tbody>
</table>

- (black diamond) denotes a parameter in the Non-Clean Start model only
- (white diamond) denotes a parameter in the Clean Start model only
- (asterisk) denotes global parameter affecting ALL injector channels
<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
<th>RANGE</th>
<th>UNITS</th>
<th>ACCESS MODES</th>
<th>SECURITY LEVEL</th>
<th>PORT ACCESS</th>
<th>CODE DESCRIPTION</th>
<th>RANGE</th>
<th>UNITS</th>
<th>ACCESS MODES</th>
<th>SECURITY LEVEL</th>
<th>PORT ACCESS</th>
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<tr>
<td>700</td>
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<td>0001 - 9999</td>
<td>unique number</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>700 User #1 Password</td>
<td>0001 - 9999</td>
<td>unique number</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
</tr>
<tr>
<td>701</td>
<td>User #1 Security Level</td>
<td>0001 - 9999</td>
<td>unique number</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>701 User #1 Security Level</td>
<td>0001 - 9999</td>
<td>unique number</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
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<tr>
<td>781</td>
<td>Password Enable - Disable</td>
<td>0 - 1</td>
<td>access level</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>781 Password Enable - Disable</td>
<td>0 - 1</td>
<td>access level</td>
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<td>S / I</td>
<td>4 / 4</td>
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<td>802</td>
<td>Alarm Status</td>
<td>0.0000 - 1111</td>
<td>binary</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>802 Alarm Status</td>
<td>0.0000 - 1111</td>
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<td>S / I</td>
<td>4 / 4</td>
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<td>824</td>
<td>Alarm &amp; Permissive Status (in)</td>
<td>0.0000 - 1111</td>
<td>binary</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>824 Alarm &amp; Permissive Status (in)</td>
<td>0.0000 - 1111</td>
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<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
</tr>
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<td>886</td>
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<td>unit volumes of product</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>886 Product Total</td>
<td>0000000.000 - 999999999</td>
<td>unit volumes of product</td>
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<td>S / I</td>
<td>4 / 4</td>
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<td>S / I</td>
<td>4 / 4</td>
<td>890 Accumulative Additive</td>
<td>0000000.000 - 999999999</td>
<td>unit volumes of additive</td>
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<td>S / I</td>
<td>4 / 4</td>
</tr>
<tr>
<td>892</td>
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<td>unit volumes of additive</td>
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<td>S / I</td>
<td>4 / 4</td>
<td>892 Total Totals</td>
<td>0000000.000 - 999999999</td>
<td>unit volumes of additive</td>
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<td>S / I</td>
<td>4 / 4</td>
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<tr>
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<td>Software Release Version</td>
<td>01/01/00 - 12/31/99</td>
<td>date</td>
<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
<td>896 Software Release Version</td>
<td>01/01/00 - 12/31/99</td>
<td>date</td>
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<td>S / I</td>
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<td>S / I</td>
<td>4 / 4</td>
<td>899 Software Release Date</td>
<td>TEXT</td>
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<td>R-Anytime/W-Anytime</td>
<td>S / I</td>
<td>4 / 4</td>
</tr>
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<td>S / I</td>
<td>4 / 4</td>
<td>904 Unit Serial Number</td>
<td>0000000.000 - 999999999</td>
<td>factory set</td>
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<td>S / I</td>
<td>4 / 4</td>
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<td>905</td>
<td>Installed Options</td>
<td>0000 - ffff</td>
<td>hhhh</td>
<td>R-Anytime/W-Never</td>
<td>S / I</td>
<td>1 / 12</td>
<td>905 Installed Options</td>
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<td>hhhh</td>
<td>R-Anytime/W-Never</td>
<td>S / I</td>
<td>1 / 12</td>
</tr>
</tbody>
</table>

*(asterisk) denotes a parameter affecting ALL injector channels.

♦ (black diamond) denotes a parameter in the Non-Clean Start model only

◊ (white diamond) denotes a parameter in the Clean Start model only
5.4 Alarm Code Table

The following table provides the values for each alarm type in the Mini-Pak™ 6. These values are determined by reading Program Parameter 802 for the current active alarm status, or by reading the 4 digit alarm value in the transaction record detail for a previously completed transaction.

Codes 1, 2, 4, 8, and 10 each represent a single alarm condition. Should multiple, simultaneous alarms occur, these values add together, creating the other values in the table.

<table>
<thead>
<tr>
<th>Alarm Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>No Alarms</td>
</tr>
<tr>
<td>0001</td>
<td>Additive Cycle Volume</td>
</tr>
<tr>
<td>0002</td>
<td>No Additive</td>
</tr>
<tr>
<td>0003</td>
<td>Additive Cycle Volume + No Additive</td>
</tr>
<tr>
<td>0004</td>
<td>Leaking Solenoid</td>
</tr>
<tr>
<td>0005</td>
<td>Additive Cycle Volume + Leaking Solenoid</td>
</tr>
<tr>
<td>0006</td>
<td>No Additive + Leaking Solenoid</td>
</tr>
<tr>
<td>0007</td>
<td>Additive Cycle Volume + No Additive + Leaking Solenoid</td>
</tr>
<tr>
<td>0008</td>
<td>Firmware Failure</td>
</tr>
<tr>
<td>0009</td>
<td>Firmware Failure + Additive Cycle Volume</td>
</tr>
<tr>
<td>000A</td>
<td>Firmware Failure + No Additive</td>
</tr>
<tr>
<td>000B</td>
<td>Firmware Failure + Additive Cycle Volume + No Additive</td>
</tr>
<tr>
<td>000C</td>
<td>Firmware Failure + Leaking Solenoid</td>
</tr>
<tr>
<td>000D</td>
<td>Firmware Failure + Additive Cycle Volume + Leaking Solenoid</td>
</tr>
<tr>
<td>000E</td>
<td>Firmware Failure + No Additive + Leaking Solenoid</td>
</tr>
<tr>
<td>000F</td>
<td>Firmware Failure + Additive Cycle Volume + No Additive + Leaking Solenoid</td>
</tr>
<tr>
<td>0010</td>
<td>EEPROM Failure</td>
</tr>
<tr>
<td>0020</td>
<td>No Activity Time Out</td>
</tr>
<tr>
<td>0030</td>
<td>EEPROM Failure + No Activity Time Out</td>
</tr>
<tr>
<td>0040</td>
<td>Low Flow Volume</td>
</tr>
<tr>
<td>0050</td>
<td>EEPROM Failure + Low Flow Volume</td>
</tr>
<tr>
<td>0060</td>
<td>No Activity Time Out + Low Flow Volume</td>
</tr>
<tr>
<td>0070</td>
<td>EEPROM Failure + No Activity Time Out + Low Flow Volume</td>
</tr>
<tr>
<td>0080</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
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CHAPTER 6 ELECTRICAL DRAWINGS

6.1 Mini-Pak™ 6 Jumper Settings

![Diagram of controller backside with factored pulse output jumpers]

**FACTORED PULSE OUTPUT JUMPERS**

- Factored Pulse
- Raw Pulse
## 6.2 Mini-Pak™ 6

### TERMINAL BASEPLATE/POWER SUPPLY

<table>
<thead>
<tr>
<th>Output E</th>
<th>TB1-1</th>
<th>POWER INPUT (HOT)</th>
<th>TB1-2</th>
<th>POWER INPUT (NEUTRAL)</th>
<th>TB1-3</th>
<th>EARTH GROUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB2-1</td>
<td>SOLENOID 1 OUTPUT</td>
<td>TB2-2</td>
<td>SOLENOID 1 NEUTRAL</td>
<td>TB2-3</td>
<td>SOLENOID 2 OUTPUT</td>
<td>TB2-4</td>
</tr>
<tr>
<td>Input B:</td>
<td>TB3-1</td>
<td>AC INPUT 1</td>
<td>TB3-2</td>
<td>AC INPUT 2</td>
<td>TB3-3</td>
<td>AC INPUT 3</td>
</tr>
<tr>
<td>Input C:</td>
<td>TB4-1</td>
<td>TRIAC 1 FEED</td>
<td>TB4-2</td>
<td>TRIAC 1 OUTPUT</td>
<td>TB4-3</td>
<td>TRIAC 2 FEED</td>
</tr>
<tr>
<td>TB5-1</td>
<td>+12 VDC SUPPLY OUT</td>
<td>TB5-2</td>
<td>DC COMMON</td>
<td>TB5-3</td>
<td>ADDITIVE PULSE INPUT 1</td>
<td>TB5-4</td>
</tr>
</tbody>
</table>

### NOTE:
- All +12VDC supply output are electrically common internally.
- All DC Common connections are electrically common internally.
- All AC Neutral connections are electrically common internally.
- All Triac feeds connections on TB4 are electrically common internally.
6.3 Mini-Pak™ 6 Typical Wiring Connection Drawings

PACING WIRING CONNECTIONS

DC Pacing Connections - Typical Electronic Transmitter
HP 6 Powered

DC Pacing Connections - Typical MHT Transmitter

ALARM RESET WIRING CONNECTIONS

DC Reset Connections - Typical Momentary Input

ENABLE WIRING CONNECTIONS

DC Enable Connections - Typical Maintained Input
DC MULTI-FUNCTION OUTPUT WIRING CONNECTIONS

Typical Sourcing Output
Internally Powered

Typical Sinking Output
Internally Powered

AC MULTI-FUNCTION OUTPUT WIRING CONNECTIONS

Injector Sourced Output to
Typical External Device

Externally Sourced Output to
Typical External Device
**COMUNICATIONS WIRING CONNECTIONS**

**Acculaod 2-Wire RS-485**

**Communications Connections**

1. **Shield drain wire to be terminated one end only. Tape off or isolate other end from earth ground. Optional termination point is shown. Common practice dictates that shields be terminated at the communications master.**

2. **Termination resistor to be installed on only one injector per communications drop or circuit. Install termination resistor on injector most remote from the master. See Communications Wiring text.**
Intentionally left blank.
CHAPTER 7  MONO-BLOCK™ III FUNCTIONAL DESCRIPTION

The Mono-Block™ III manifold is a low cost solution to chemical additive injection in the petroleum terminal environment. This manifold design meets the entire standard requirements for metering and control of a cyclical injection chemical stream. The Mono-Block™ III provides an electrically operated solenoid valve and a precision fluid meter in a common manifold. In addition, the manifold includes an inlet strainer, a calibration security diverter valve with integral flow control and an outlet check valve. Combining this functionality into a single manifold block reduces the size of the instrumentation. This is critical in the limited spaces available on truck loading racks today. Additionally, combining the solenoid, meter, and test port into a single manifold eliminates most potential leak points common to component built injectors assembled in the field.

This manifold block provides the physical instrument needed to allow a Terminal Automation System, Preset, or PLC System to directly control chemical additive injection. This manifold does not include the electronics control necessary to pace the chemical to a flowing fuel stream, nor does it contain the logic necessary to accumulate additive volume passing through it.

AC line voltage is typically used to energize the solenoid valve and allow flow. The controlling device (e.g. Mini-Pak Controller) then accumulates flow volume in the form of pulses transmitted from the meter sensor. When sufficient volume of additive chemical has moved through the manifold, the controlling device then turns off the solenoid valve in order to stop flow. It is the responsibility of the controlling device, Terminal Automation System, Preset, or PLC System, to perform the algorithms necessary to ratio the chemical properly into the fuel stream. Functionality for recipe, injection interval, tolerance, alarm annunciation, shutdown, etc. are all the responsibility of the controlling system. If the controlling system is not capable of this level of function, manifold blocks alone are not the solution. The user should consult our factory for information on complete injection panels that include microprocessor based controllers having the capability of complete injection control.

7.1 MONO-BLOCK™ III Mounting

The Mono-Block™ III manifold may be mounted in any orientation provided the gear axes remain horizontal. The inlet and outlet ports can be up, down, left, or right. The arrowed line in the sketch below depicts the horizontal axis of the gear axes in the block. When choosing a mounting position, make certain that the arrowed line remains orientated horizontally.
7.1.1 MONO-BLOCK™ III Solenoid Input

The Mono-Block™ III manifold has a single control input. That input is the electrical connections to the actuator coil of the solenoid valve. The coil is typically operated from AC line voltage (110-240V) and frequency (50/60Hz) common to the area of the world into which the block is sold. Optionally, DC coils in 12 volt and 24 volt models are available. Coil voltage is model dependent and should be specified when placing the equipment order.

The solenoid valve is normally closed. This means that when the coil is de-energized (no voltage applied) the valve is closed. Applying the rated voltage to the coil opens the fluid flow path through the Mono-Block™ III.

7.1.2 MONO-BLOCK™ III Sensor Output

The Mono-Block™ III meters the fluid flowing through it. Two high precision oval gears are mounted in a measuring chamber machined into the block. As fluid passes through the measuring chamber, the fluid force rotates the gears. Imbedded into the gears are four high field strength rare earth magnets. As the gears rotate, these magnets pass beneath a Hall-Effect
pickup mounted in the sensor housing. The magnetic field from the gear magnets causes the Hall-Effect pickup to change state (off-on-off) as each magnet passes. Approximately 4,800 pulses are generated for each gallon of fluid passing through the meter (1270 pulses/litre). (Different nominal resolutions are available as options.) The customer’s equipment is responsible for providing a means of calibration of the meter. That is, a method of determining the exact number of pulses per gallon, liter, etc. of fluid. This calibration factor is normally referred to as the “K-Factor” for the meter. The k-factor is then used by the customer’s equipment for conversion of pulses received to volume dispensed.

7.1.3 MONO-BLOCK™ III 3-Way Diverter Valve
Mounted on the discharge side of the MonoBlock III is the 3-Way Diverter Valve. The valve consists of a ‘hand tight’ knurled barrel, scored with a position indication line. The valve can be positioned to ‘injection’ (INJ) or calibration (CAL) positions. ‘Injection’ directs flow to the discharge port of the MonoBlock and on to the point of injection, whilst positively isolating the calibration port. Conversely ‘Calibration’ directs flow to the calibration port whilst positively isolating the discharge port, his operation ensures that additive flow can only ever be in one direction. Located under the Allan headed bolt, is a flat blade screwdriver adjustable, flow control adjuster. This allows for the variable control of flow-rate through the valve. The default position being fully open, the adjustment is most commonly made to reduce the flow-rate of the additive at very low injection rates, thereby elongating the injection period and enhancing flow control. The valve is also pre-drilled to allow for the fixing of tamper-proof security wiring.

7.2 MONO-BLOCK™ III Wiring
7.2.1 Control Solenoid
The solenoid wiring should be a minimum of #16 AWG/1.5mm² and a maximum of #14 AWG/2.5mm², type THHN or THWN wire. Good practice dictates AC and DC wiring should be run in separate conduits or multi-core cables for extended distances. Follow local, state, and federal codes and practices applicable to your area.

WARNING! The solenoid coil presents an inductive load to the switching device controlling it. High counter EMF voltages may be produced when removing the voltage source from such loads. Steps should be taken to ensure these high surge voltages are properly dissipated, or damage to the controlling device may occur. Consult with the manufacturer of the controlling equipment for guidance regarding the control of inductive loads. Triac switching is recommended.
7.2.2 Meter Sensor (general)

The sensor wiring can be three conductor, #18-22 AWG/0.5-1mm² shielded instrument cable, with a foil or braided wire shield. Use Belden® number 9363 or similar. Drain or screen wires should be terminated on a DC COMMON or on a specifically assigned shield termination at the controller end only. Do not terminate shields to AC earth ground. Tape off and isolate the shield at the sensor end. Refer to wiring diagrams in this document for specific connection details.

7.2.3 Meter Sensor - Pulse Signal Output

The Mono-Block™ III meter sensor output is an un-sourced, open collector, NPN transistor output. The blue sensor wire is connected to the transistor collector. The emitter of the transistor is connected to the black wire, or DC COMMON connection. The term “un-sourced” means that no voltage is applied to the output from within the sensor. It must be pulled to a ‘high’ or ‘on’ or ‘true’ state by voltage supplied from an external source. The sensor electronics then drives the collector ‘low’ or ‘off’ or ‘false’ with each pulse transmitted. The output is NOT driven high internally within the sensor. This industry common scheme allows the sensor to drive external equipment supplied by its own internal transmitter power. There must be a common connection between the DC negative of the sensor supply and the DC COMMON of the signal accumulating device. Refer to the wiring diagrams at the end of this manual for specific connection details.

7.2.4 Customer Equipment For Meter Sensor Input

The controlling equipment used for capturing pulses from the Mono-Block™ III may be of two general categories; Un-sourced Inputs, having no voltage present normally on the input connection; Sourced Inputs, having a DC pull-up voltage supplied to the input connection. Two different wiring methods are used for the two types of pulse inputs. Wiring diagrams are provided at the end of this document for each type of input. Refer to the documentation for the controlling equipment for a description of the inputs to determine the type. If the documentation still does not resolve the issue, the following test can be performed.
A digital volt-ohm meter is used to test the equipment input for the presence of voltage. Use the setup in the sketch below. Place the meter in the DC Voltage mode. Disconnect any wires on the DC Pulse Input. Power the controller. Measure the voltage from the DC COMMON terminal (black voltmeter lead) to the DC Pulse Input (red voltmeter lead). If the voltage reading is greater than +5.0 volts, the input is considered a sourced input. If the voltage reading is less than +5.0 volts, the input is considered an un-sourced input. Refer to the corresponding wiring diagram for connections.

\[ \text{Test setup for determining customer equipment input type.} \]

\[ > +5.0 \text{ Volts} = \text{Sourced Input} \]
\[ < +5.0 \text{ Volts} = \text{Un-sourced Input} \]

7.3 MONO-BLOCK™ III Fluid Connections

The fluid inlet and outlet of the Mono-Block™ III manifold is marked with engraved text on the block. The inlet pressure should always be higher than the outlet pressure to ensure proper operation.

7.3.1 Fluid Inlet Piping

Attention should be given to flow dynamics when sizing the tubing, isolation valve, and strainer components feeding the injector inlet. The minimum tubing size for flows approaching the 3 gall/min (12 litre/min) maximum flow rate through the Mono-Block™ III is \( \frac{1}{2} \)”. Significantly lower flow rates may allow smaller tubing dimensions. The isolation valve, feed pipe and strainer size must be increased to handle the flow required for the number of blocks being fed.

7.3.2 Fluid Outlet Piping

Stainless steel tubing is also used for piping the outlet of the Mono-Block™ III manifold to the point of injection.

**WARNING!** A check valve and an isolation valve MUST be installed between the manifold and the point of injection! Failure to install an isolation valve will require complete fuel delivery system shutdown in the event of a need for service on the injector manifold. Failure to install a check valve in the line may result in fuel backing up into the additive chemical delivery system and may cause contamination or spill.
Good design practice dictates that an isolation valve, usually a quarter turn ball valve, be installed at the point of chemical injection into the fuel piping. This valve should meet the needs of local policies and practices regarding piping system valves.

An injection point check valve is required. This check valve should be a positive shut-off, spring closed check such as a plug or ball type. A small opening or ‘cracking’ pressure is acceptable, generally limited to a maximum of 15 PSI/1Bar. Cracking pressures of 1 PSI to 10 PSI/0.06 to 0.6 Bar are common in the industry. Ensure the flow characteristic (Cv) of the check valve is adequate to handle the maximum flow rate expected through the injector manifold. Although the location is not critical, it is common practice to place the check valve near the isolation valve at the point of injection.

Remember, pressure differentials across the isolation valve, check valve, tubing, manifold, strainer, etc. all accumulate and ultimately dictate the required supply pump pressure. Minimizing the individual pressure drops allow the lowering of the supply pump pressure and effectively reduces the load and wear on the system.

**WARNING!** Care should be exercised when connecting multiple injector manifold blocks to one common point of injection. Each manifold line MUST have its own check valve to prevent cross contamination. The length of common piping should be minimized to ensure all additive chemical being injected reaches the fuel line. Not all chemicals are compatible. If multiple additives are used simultaneously, be certain to size common piping for the combined flow.

### 7.3.3 Thermal Expansion Relief

Thermal relief bypass kits may be required with the Mono-Block™ III manifold when installed with a point-of-injection actuated valve. This includes a solenoid valve or electric or pneumatic actuated ball valve.

The Mono-Block™ III manifold will stop flow in the reverse direction when the solenoid is de-energized. The check valve in the block prevents reverse flow. When the additive chemical injection system is idle, any fluid expansion that occurs between the block and the point of injection MUST be relieved, usually back to additive storage. When designing the pumping system, provision should be made to allow this thermal expansion volume to return to the additive chemical storage tank.
7.3.4 Equipment Connections

**Solenoid**
- Two Red Wires: Actuator Coil
- Green Wire w/ Yellow Stripe: Earth Ground

**Meter Pickup Sensor**
(3-wire, Hall-Effect pickup)
- Red Wire: Sensor Power
- Black Wire: Power & Signal Common
- Blue Wire: Pulse Signal

**Fluid**
- Inlet: 3/8" Female NPT
- Outlet: 3/8" Female NPT
- Test Port: 3/8" Female NPT

7.4 Specifications

7.4.1 Control Solenoid

**General Data:**
- Fluid Port Sizes: 5/16" – 8mm
- Material (Body): 304 Stainless Steel
- Max Working Pressure: 235 PSI, 16Bar
- Max Differential Pressure: 150 PSI, 10Bar
- Certifications: UL Listed 106A, CSA®, ATEX.

**Coil Data:**
- Power Req.: 17.1 Watts @ 120 VAC, 8.6 Watts @ 240 VAC
- Certifications: NEMA Type 3, 35, 4, 4X, 6, 6P, 7, & 9 ATEX

7.4.2 Meter & Pickup Sensor

**Manifold Block Physical:**
- Fluid Port Sizes: 3/8" FNPT
- Material (Body): 303 Stainless Steel
- Material (Elastomers): Teflon
- Max Working Pressure: 400 PSI, 27Bar

**Fluid Metering Gears:**
- Nominal Pulse Resolution: 2400 pulses/gallon (635 pulses/litre) in water (Full Height Gear)
- Nominal Pulse Resolution: 4800 pulses/gallon (1270 pulses/litre) in water (Half Height Gear)
- Material (Gears): Ryton™ (Phillips Petroleum Co.)

**Sensor Physical:**
- Sensor Thread: 1/2" x 13 S.A.E. threads, female
- Material: Aluminum
Sensor Electrical:
Type: Solid-state, bi-polar magnetic gated, open collector output
Sensor Power: 5vdc to 25vdc, 20 mA maximum
Open Collector Output: 5vdc to 25dc, 100 mA maximum

3-wire Connection -
Red Wire Function: Sensor power
Black Wire Function: Sensor power common & emitter (signal common)
Blue Wire Function: Sensor signal, open collector output (un-sourced)

Environmental:
Ambient Operating Range: -40°F to 150°F, -40ºC to 66ºC

7.5 MONO-BLOCK™ III Parts Assembly

Refer to the next page for the parts identification table
### 7.5.1 Mono-block III (ATEX Version) Parts List

<table>
<thead>
<tr>
<th>NO.</th>
<th>QTY.</th>
<th>PART DESCRIPTION</th>
<th>PART NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>MONOBLOCK III MANIFOLD S/STEEL.</td>
<td>30–10–020</td>
</tr>
<tr>
<td></td>
<td>OPT1</td>
<td>MONOBLOCK III MANIFOLD S/STEEL(Low Flow)</td>
<td>30–10–020A</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>GEAR SET ’STD’HEIGHT+POST+’O’RING.</td>
<td>30–40–00</td>
</tr>
<tr>
<td></td>
<td>OPT1</td>
<td>GEAR SET ’1/2’HEIGHT+POST+’O’RING(Low Flow)</td>
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<tr>
<td>2A</td>
<td>1</td>
<td>FLOWMETER CAP ’O’RING</td>
<td>3–033</td>
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<td>1</td>
<td>FLOWMETER CAP (MONOBLOCK)</td>
<td>30–10–011</td>
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<td>4</td>
<td>6</td>
<td>M5 SOCKET CAP SCREW</td>
<td>M5–12–01</td>
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<td>1</td>
<td>SENSOR ASSEMBLY(MONO–BLOCK)</td>
<td>10–31558</td>
</tr>
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<td>6</td>
<td>4</td>
<td>M4 SPRING WASHER</td>
<td>30–80–09</td>
</tr>
<tr>
<td>6A</td>
<td>4</td>
<td>M4 SOCKET CAP SCREW</td>
<td>30–80–08</td>
</tr>
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<td>7</td>
<td>OPT1</td>
<td>ASCO SOLENOID 230V 50Hz T3 (STD)</td>
<td>30–00–65</td>
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<td>ALCOM SOLENOID 230V 50Hz T5 (STD)</td>
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<td>8</td>
<td>1</td>
<td>DIVERTER VALVE ASSEMBLY</td>
<td>30–10–021</td>
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<td>9</td>
<td>1</td>
<td>FILTER ELEMENT</td>
<td>30–30–010</td>
</tr>
<tr>
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<td>1</td>
<td>FILTER ELEMENT</td>
<td>30–30–010B</td>
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<tr>
<td>10</td>
<td>1</td>
<td>FILTER CAP</td>
<td>30–30–008</td>
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<td>1</td>
<td>FILTER CAP SEAL</td>
<td>2–017</td>
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<td>11</td>
<td>1</td>
<td>CHECK VALVE ASSEMBLY</td>
<td>30–00–010BA</td>
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<td>15</td>
<td>1</td>
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<td>16</td>
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<td>MOUNTING SCREW M8 X 70mm(15mm)</td>
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<td>16B</td>
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<td>MOUNTING SCREW M8 X 1200mm(60mm)</td>
<td>M8–120–01</td>
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</table>

ATEX VERSION ONLY - item numbers refer to the drawing on the previous page.
7.5.2 MONO-BLOCK™ III General Arrangement

Functional Description
7.6 Electrical Connection Drawings

7.6.1 MONO-BLOCK™ III Sensor Lead Identification

NOTES: The power supply pictured above may be a separate supply or part of the controller / additive pulse accumulator electronics.

7.6.2 Wiring Diagram for Sourced Inputs
7.6.3 Wiring Diagram for Un-Sourced Inputs

NOTES: The power supply pictured above may be a separate supply or part of the controller / additive pulse accumulator electronics. Resistor R1 value varies with the Power Supply voltage.
For 5 - 12 volts use 1500 ohms.
For 12.1 - 18 volts use 2200 ohms.
For 18.1 - 25 volts use 2700 ohms.
For all voltages, ½ watt, 10% or better precision resistors are satisfactory.
8.1 Mini-Pak™ 6 Setup

This section will describe the fundamental steps necessary to program the control parameters and wire the injector controller. There are many possible setup combinations. Described below are typical examples. Your particular application may require a combination of portions of several of these typical examples.

There are four basic functions necessary for proper injector setup. Each of these subjects will be covered in detail.

1. **Recipe**. The recipe defines how much chemical additive is going to be injected into the fuel.
2. **Calibration**. This step will ensure accurate measurement of the chemical being delivered.
3. **Pacing**. To be accurate, the injector controller must know the flow rate of the fuel. Using this information, the controller will control the dispensing of the additive to keep “pace” with the fuel.
4. **Failure Detection**. Alarm functions within the controller can detect when the additive is not within the recipe specifications and can alert external equipment controlling the fuel delivery process. This signal should suspend fuel delivery in critical applications.

8.1.1 Recipe

The recipe is the ratio of the chemical additive to the process flow (fuel). As mentioned in the Functional Description section previously, the recipe consists of two parts. HOW MUCH chemical is going to be put in each injection cycle is the first part. HOW OFTEN the cycle occurs determines the second part. These two criteria are interrelated. Changing either one will affect the ratio, and thus the recipe. By changing both values, it is possible to adjust the operating characteristics of the injector to an optimum setting, without changing the actual recipe.

8.1.2 Where do I get my Recipe?

Recipes are defined by the chemical suppliers and by decision makers within your company. They may also be determined by law. In the case of detergent additives, testing determines the optimum concentrations of the chemical in the fuel and company policies are set which regulate the amounts put in. Odorants, dyes, and tracers are generally regulated by government decree and the dosage rates required to meet those needs are established in advance. Chemical suppliers, company management, and other similar facilities are all sources for determining the “typical” setup for your injection recipe.

8.1.3 Conversion of Recipe Volumes

Determine the additive concentration required by your company. This may be specified in volume of additive per volume of product delivered, parts per
million, or a percentage. Injections occur at some regularly spaced product volume interval. In the USA, it is typical to use CC’s per 40 gallons. In areas outside of the USA, a more typical concentration is CC’s per 100 Liters.

The table below provides factors for the conversion of recipe volumes.

<table>
<thead>
<tr>
<th>This ↓ X Factor = This →</th>
<th>LBS / MBBLS</th>
<th>CC’s / 40 GAL</th>
<th>GAL / MGAL</th>
<th>PPM</th>
<th>CC’s / 100L</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBS / MBBLS</td>
<td>1</td>
<td>0.4312</td>
<td>0.002845</td>
<td>2.845</td>
<td>0.2845</td>
</tr>
<tr>
<td>CC’s / 40 GAL</td>
<td>2.32</td>
<td>1</td>
<td>0.0066</td>
<td>6.6</td>
<td>0.66</td>
</tr>
<tr>
<td>GAL / MGAL</td>
<td>351.5</td>
<td>151.5</td>
<td>1</td>
<td>1000</td>
<td>100</td>
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<tr>
<td>PPM</td>
<td>0.3515</td>
<td>0.1515</td>
<td>0.001</td>
<td>1</td>
<td>0.10</td>
</tr>
<tr>
<td>CC’s / 100L</td>
<td>3.515</td>
<td>1.515</td>
<td>0.01</td>
<td>0.1</td>
<td>1</td>
</tr>
</tbody>
</table>

**EXAMPLE:** Assume that the recipe from the additive manufacturer is provided in Parts Per Million (PPM). The recipe calls for 285 PPM. The injector will be set up to inject every 40 gallons. Find PPM in the left-hand column. Follow the row across to the CC’s / 40 GAL column and find the factor of 0.1515. Multiply 285 PPM by 0.1515 and get 43.2. To meet the 285 PPM requirement, set up the injector to inject 43.2 CC’s every 40 Gallons.

### 8.1.4 Frequency of Injection

The example above used a 40 gallon interval for injections. The frequency of injections depends upon several factors that may apply to your situation. Years ago, pacing injectors was done exclusively with pulse transmitters placed in the mechanical meter stack. Due to gearing limitations and injection volumes at that time, it was commonplace to send a pacing pulse that was on for 20 gallons and off for 20 gallons. That became a standard. With today’s modern pulse transmitters, the advent of electronic pulse splitters, and the capability of presets to send virtually any factored pulse output, the 40 gallon interval has become less used.

One criteria in determining how often to inject is the k-factor of the pacing pulse. If the product pacing pulse represents more than one unit of flow (i.e.; For example 100 liters per pulse), the k-factor is less than one. When the product k-factor is less than one, the interval between injections MUST be set to an exact multiple of the number of units that the pulse represents. In our example of 100 liters per pulse, we are limited to injecting every 100, 200, 300, etc. liters. Setting the injection interval to an amount that is not a multiple of the units per pulse (such as 150 liters) will cause irregular injection cycles to occur with a resultant loss of accuracy. Similarly, if the pacing pulse is one pulse every 40 gallons, the interval between injections must be set to 40, 80, 120, etc. 50 gallons will not work.

Pulse rates of 1 pulse per unit volume of fuel flow or higher allows the user to configure any interval within limitation of the other factors mentioned below.

One of the factors to consider is the homogeneity of the finished blend. The longer between injections, the less consistent the blend becomes. For this reason it is desirable to inject more frequently.
Counter to the homogeneity factor above is the limitation of the injector hydraulics to meter and control very small volumes. The typical Enraf injector can handle injection volumes down to 1 CC. It is much more accurate to put in several CC's. For this reason, the volume of fuel in one cycle must be large enough to receive at least 2 or 3 CC's of additive.

The factors above must be considered and a balance achieved that allows the injector to cycle in an optimum manner. The ideally tuned injection system should be set up to be injecting 50% of the time at maximum fuel flow rate. This means that the additive system pressure, injection interval, injection volume, and manual throttling of manifold needle valves should be adjusted until the injector solenoid is open 50% of the time when the fuel is flowing at its fastest flow rate. This ensures the most accurate injection and allows for the widest possible compensation for variations in flow.

8.1.5 Calibration

The ability of the controller to accurately measure the amount of additive being injected depends upon the calibration. Due to variations in manufacturing and fluid characteristics, the controller must be programmed with the true number of pulses per unit volume of additive. This cannot be determined in advance at the factory.

The controller is placed in a test mode in which it dispenses and measures an amount of additive into a measuring vessel, typically a graduated cylinder. The controller stores the amount it measured. The operator then enters the amount of additive that was actually dispensed, as read on the graduated cylinder. The controller can then calculate a corrected k-factor for the additive meter and applies that factor during normal use. The result is a very accurate measurement of additive flow.

Refer to the section on Calibration for a step by step procedure that guides the user through this simple process.

8.1.6 Pacing

As mentioned above, an important aspect of injector setup is the Pacing function. Pacing refers to the synchronization of the injector to the product (fuel) flow. This can be accomplished through several means.

8.1.7 Hard-Wired Pacing

A pulse can be sent from a pulse transmitter in the meter stack, from a flow meter, or from a preset to the injector controller. This pulse can be an AC signal or a DC signal. Refer to the wiring section at the rear of this manual for examples of how to wire a pacing signal to the controller.

Each pulse received by the controller represents some quantity of fuel that has flowed. In the case of AC pulses, each pulse typically represents a volume greater than one unit. Typical pulse resolutions for AC pulses are 40 gallons per pulse or 100 liters per pulse. DC pulse resolutions can be similar to the AC pulses, but more often are one or more pulses per unit volume. One pulse per gallon or liter is typical.
Product pacing pulses are divided by a k-factor value to determine the volume of product that has flowed. Program Parameter 001 is the product k-factor. The value in this parameter is divided into the pulses coming into the controller to determine how much product has flowed. If the value in Parameter 001 is set to 0001.000, then each pulse that is received is divided by 1 and the total number of pulses is the total units of product flow. If each pulse represents 0.1 (1/10th) gallon of product flow, set Parameter 001 = 0010.000 or ten pulses per gallon.

To determine the k-factor for use when a pulse represents more than one unit volume of product, divide 1 by the volume. Thus, for one pulse per 100 liters, divide 1 by 100 and get 0.010. The value entered would be 0000.010. For one pulse per 40 gallons, divide 1 by 40 and get 0.025. The value for Parameter 001 would be 0000.025.

So far, the settings determined for Parameter 001 have made the injector controller accurately account for product flow. We now need to program the controller HOW OFTEN to inject. This is done by setting Program Parameter 020 to the number of units of product contained in one injection cycle. If you want the injector to inject after each 40 gallons of product flow, set Parameter 020 = 40. As previously stated, proper tuning of the injector may dictate that this value be adjusted to optimize control.

Program Parameters 001 & 020 work together to allow pacing pulses to drive the injection frequency.

8.1.8 Communications Pacing

When using RS-485 communications wiring to a terminal automation system or smart preset, the injector controller can be directly commanded to “inject now”. It becomes the responsibility of the master (TAS or preset) to determine how much product or fuel has flowed and when to inject the additive. No hard-wired pacing signal is required when using communications.

It is still important to set Parameters 001 & 020 accurately when using communications pacing. Each time the injector is commanded to inject, the product total is incremented by the amount in Parameter 020. If this value does not match the master injection interval, the product total in the injector will not match the product total in the automation system or preset.

8.1.9 Failure Detection

The injector controller has software that monitors the injection process and can detect a variety of failures. Several methods are available for automatically annunciating a failure and suspending delivery of improperly additized fuel.

The action taken upon detection failure is dependent on how critical the blend accuracy is. In some cases the presence of the additive in the product is of little consequence and it is not necessary to shut down delivery. In other cases alarm annunciation and shutdown is very critical and requires very tight security.
The following types of failure annunciation and process shutdown are provided:

1. Local alarm indication (text display).
2. Remote indication.
4. Feedback suspension.

8.1.10 Local Alarm Indication

Each alarm can be individually configured for use. Refer to the section on alarms for a description of how to set up Alarm Action and the Program Parameter description for each alarm on how to set the values.

Upon detection of an alarm condition, the controller will display a text message on the screen that corresponds to the alarm present. Local only alarm indication is the least secure method of operation and does not ensure blend integrity.

8.1.11 Remote Alarm Indication

A configurable AC triac output on the Mini-Pak™ 6 is available as a status indicator for alarms. Refer to the wiring section in the back of this manual for typical connections and to the Program Parameter Description section for Parameter # 129. This output is normally on (fail safe). Upon detection of an alarm condition or upon loss of power to the injector controller, the output turns off. External equipment should be used to detect the error condition and indicate the alarm condition.

8.1.12 Remote Shutdown

Utilizing the same status output used for indication purposes, the injector electronics can provide a status signal for the purpose of shutting down the fuel flow when detecting failures in the additive injection system. Most product delivery systems have provisions for various “permissive” signals to be monitored. These might include a ground and overfill system, a security system, vapor recovery equipment status, etc. The status of the additive injector may also be monitored.

The alarm status is “fail safe” in that the signal is on when the injector is powered and no alarms are present. The signal turns OFF upon detection of an alarm condition. Using this method, if power is removed from the electronics, the alarm control status to the monitoring equipment is the same as if it were in alarm. This is the most secure method of alarm status monitoring.

Refer to the wiring section in the back of this manual for typical connections and to the Program Parameter Description section for Parameter number 129.

8.1.13 Feedback Suspension

“Feedback” is a technique used in additive injection in which a status output is utilized to send confirmation pulses to a remote monitoring system. This system might be an automation system or simply a preset. Typically, one pulse is sent each time an injection cycle is completed.
A configurable AC triac output and a DC transistor output on the Mini-Pak™ 6 is available as a feedback output. Refer to the wiring section in the back of this manual for typical connections and to the Program Parameter Description section for Parameter numbers 050 & 129.

Upon detection of an alarm condition, the injector will suspend transmittal of the confirmation pulses. Some terminal automation systems and presets are programmed to look for these confirmation pulses and shutdown loading operations when they are not received.

8.2 Calibrating the Mini-Pak™ 6 Injector

8.2.1 Why Calibrate?
Calibration of the Mini-Pak™ 6 Injector Controller is required to obtain the most accurate results. Calibration affects the accurate measurement of the chemical additive being dispensed and is a function of the additive meter K-factor. The accuracy depends upon the correct setting of Parameter 002, Additive K-factor. A routine is included in the controller software that permits the user to easily determine and install the correct additive K-factor into the parameter table.

8.2.2 Calibration Procedure Overview
The calibration of the Mini-Pak™ 6 consists of dispensing chemical through the injector in as close to operating conditions as possible. The volume measured by the injector is then divided by the volume observed by the user. A correction factor results from this math. The correction factor is multiplied by the current additive K-factor to obtain a new K-factor, and the new K-factor is stored into Parameter 002. The injector performs all the mathematics so the procedure is as easy as pressing a button!

Accurately calibrating an additive injector requires more than one cycle. A test run should consist of five to ten injections so a more accurate average may be obtained.

The Mini-Pak™ 6 Injector may only be tested while in the idle mode. (Not receiving pacing pulses.) To configure the Mini-Pak™ 6 Injector for the test mode perform the following steps:

1) Close the outlet needle valve.
2) Connect the dry-break fitting to the test port.
3) With the Mini-Pak™ 6 Injector in the idle state, press the ATTN button on the Hand-Held Controller (HHC).
4) Note: If the Hand-Held Controller is “asleep” (has been idle more than 30 seconds) the ATTN button must be pressed twice. Once to “wake-up” the HHC, and once to get the attention of the electronics.
5) If the Mini-Pak™ 6 Injector asks for a password, enter your password.
6) Place a graduated cylinder under the test port.
7) When the Mini-Pak™ 6 Injector displays ENTER COMMAND, press the TEST button on the HHC.
8) The Mini-Pak™ 6 Injector will then display:

   ENTER INJECTOR #

9) Select the injector channel that you wish to calibrate. The Mini-Pak™ 6 Injector will then display:

   Press TEST
   For each cycle

10) Pressing TEST a second time changes the LCD on the Mini-Pak™ 6 Injector to display the following:

   Total = 00000 CCs (5 Digits)
   Cycle = 00000 CCs (5 Digits)

11) Pressing TEST again, the solenoid will energize for the first test cycle. The Mini-Pak™ 6 Injector will then display:

   Total = 150 CCs (Example)
   Cycle = 150 CCs (Example)

12) The first line indicates the number of CCs delivered during the test. The second line indicates the number of CCs delivered during the last test injection.

13) A typical display after 10 test runs might show the following:

   Total = 01510 CCs (Example)
   Cycle = 00149 CCs (Example)

Such a display would indicate the total amount injected per cycle is 1510 CCs, and the last injection cycle delivered 149 CCs. If after 10-20 cycles or "a sufficient numbers of cycles" the volume in the graduated cylinder and the volume indicated on the Mini-Pak™ 6 Injector do not agree, then a change in the meter K-factor is required. To complete the calibration, enter the amount observed in the graduated cylinder.

14) To have the Mini-Pak™ 6 Injector automatically calculate the meter factor for you, press the ENTER key after 10 - 20 injections and the Mini-Pak™ 6 Injector display will change to:

   CCs Actually
   Injected = 01510 CCs

   (This is the number the Mini-Pak™ 6 Injector thinks it injected.)

   Enter the actual volume observed in the graduated cylinder by moving the cursor over the numbers displayed and pressing the appropriate number key.

15) Press ENTER, the Mini-Pak™ 6 Injector display will change to:

   Save? 0000.000 (New K-Factor)
   (1) = Yes  (2) = No
16) Then press (1, Yes) to save or (2, No) not to save, then the Mini-Pak™ 6 Injector display will change to:

Enter Command

The Mini-Pak™ 6 Injector will automatically store the new meter factor. The meter factor is now calibrated to 3 decimal places.

17) Then press ESC, the Mini-Pak™ 6 Injector display will change to:

Total CC/INJ
00000.000 0000

The Mini-Pak™ 6 Injector is now calibrated.

18) The test should be repeated to ensure accuracy. This time, the volume measured by the electronics, and the volume in the graduated cylinder should agree.

19) Disconnect the dry-break fitting from the test port.

20) Open the outlet needle valve.

8.3 Self-Pacing Operation

The Mini-Pak™ 6 is able to operate in a ‘self-pacing’ operation. The Mini-Pak™ 6 is the perfect product for applications where no pacing signals are available from outside sources like flow meters, or other instruments. In the Self-pace mode, the Mini-Pak™ 6 continuously injects on a timed and fluid volume basis.

Parameter 080 -
This parameter should be set to a “2”, indicating an injector type of Self-Pacing.

Parameter 010 -
This parameter should be set to the MAXIMUM volume (in CC’s) that the Mini-Pak™ 6 should pump per injection sequence. The value of Parameter 010 is derived by determining the maximum amount of fluid that can be injected by the pump being controlled by the Mini-Pak™ 6 in the period of time designated in Parameter 020 (which is a fixed value). Thus, if Parameter 020 is set at 005 (5 seconds), the value for 010 is the maximum volume (in CC’s) that the pump can inject over that period of time during maximum stroking.

Parameter 020 -
When the self-pacing mode has been selected, values placed in Parameter 020 become the number of SECONDS between injections. Thus a value of 10 in Parameter 020 will cause the panel to inject every 10 seconds. This value remains fixed during normal operation, but can be changed, along with Parameter 010, to fine-tune the pump for maximum performance.

In the Self-Pacing mode of operation (Parameter 080 set to 2) the character display on the panel changes. When the unit is idle (not injecting) the word “TOTAL” is displayed in the upper left portion of the display area.
as in normal operation. When the unit is permitted for injection, the display changes to the word “RUN” in the upper left portion of the display area. The upper right area of the display shows the rate in CC’s or gallons (volume), in minutes, hours, or days (time base). Directly below this is displayed the accumulated total amount injected since the last reset, and is displayed in either CC’s or gallons.

### 8.4 Clean Start Operation

Clean Start is a term used in the additive injection world to indicate the technique of ending the fuel transaction with the loading arm free of contaminating additives. Thus the loading arm is “Clean” during the “Start” of the next transaction.

Additive chemical is typically injected upstream of the product flow control valve and product flow meter. This is due to regulations by most states preventing injection of any fluids downstream of the custody transfer meter. The net result is that one or more injections of chemical may be trapped in the loading arm, piping, meter, and control valve. In some cases this can be a significant volume. The next truck compartment loaded from the arm will receive these chemicals. In the case of detergent additives, the effects are minimal. But in the case of dyes or markers, this trail-back of chemical into the next compartment or truck is detrimental.

Many years ago the Blend-Pak Injector electronics pioneered logic that utilized a hard-wired signal from the preset to tell the injector when it was in the low flow end flow delivery stage. The injector suspended injection during that time to prevent load arm and piping contamination. Algorithms allowed makeup chemical to be injected at the start of the compartment, bringing the accuracy of the injector back into tolerance.

Using the frequency of the product pacing signal as a threshold, the Mini-Pak 6 electronics can facilitate Clean Start. Setup for this method is detailed below.

#### 8.4.1 Clean Start using Pacing Frequency

**NOTE:** Clean Start in the Mini-Pak 6 requires at least one pulse per unit volume of product input to the injector. (1 pulse per gallon or liter, or more.) One pulse per 40 gallons of product WILL NOT WORK. Parameter #001 must therefore be set to a value of 1 or greater to use Clean Start. Values of 10 or higher work best.

**SETUP:**

The steps listed below should be followed to set up Clean Start in the Mini-Pak 6.

1. Set Parameter #062 to a value of 1 or 2 depending upon the modes needed.
2. Determine the number of pulses per gallon or liter of product flow being sent to the injector. This value must be 1 or greater (see note above).
If the injector is already operational, determine this number by observing parameter #001.

3. Determine the flow rate in units per minute that the product flows during the low flow end flow delivery stage. For example: The typical load preset may control this flow rate at 120 gallons per minute.

4. Multiply the number determined in step 2 times the number determined in step 3. This yields the number of pulses per minute arriving at the injector during low flow.

5. Divide this number by 60 to get the pulses per second. Add 10 percent for head room. For example: At 10 pulses per gallon, and 120 gallons per minute:
   \[10 \times 120 = 1200 / 60 = 20\] pulses per second. Add 10% or 2 pulses per second for a setting of 22 pulses per second.

6. Install the value determined in step 5 above into Parameters #063 and #064.

7. Determine the volume of product in the load arm piping between the point of additive injection and the end of the loading arm coupling. Determine the low flow trip point for the preset. (This is the number of gallons or liters that flow at the low rate near the end of the transaction.) If the two numbers differ, set the preset to trip into low flow at or greater than the volume contained in the pipe. The objective here is that the full volume of the pipe is delivered out into the truck prior to flow stopping AT THE LOW FLOW RATE.

8. Set the volume of gallons that flow during the low flow end flow delivery of the preset into Parameter #061. This is the "clean" volume of product that must be additized early in the delivery.

9. Based upon the volume determined in step 8 above, determine the volume of additive that would be required in that product volume. For example if the cc's per cycle (param 010) is 35 and the interval between injections is 40, (param 020) and the volume in the pipe is 100 gallons, the amount of additive is 100 gal / 40 gal = 2.5 cycles X 35 cc's = 87.5 cc's additive.

10. Decide how many injection cycles at the beginning of the delivery is needed to get the makeup additive injected. A good rule of thumb is to not inject more than double the normal cycle volume. Remember that the injector has to inject the normal volume and the makeup volume each cycle. 2.5 cycles of makeup additive at the end of the delivery was determined above. One half cycles are not permitted so round up and use 3 cycles. Set a value of 3 into Parameter #060. Thus, during the first 3 cycles of a transaction, the injector will inject 35 cc's + (87.5 / 3) cc's or 64.2 cc's per cycle. After 3 cycles, the injector will return to the 35 cc's per cycle rate. At 100 gallons from the end of the transaction, when the flow rate drops to the low flow rate, the injector will suspend injection. The volume of additive for the volume of product delivered into the truck will be exact.
EXAMPLE:
In Step 1, we are using hardware permissive and frequency Clean Start. We will set Parameter #062 equal to a value of 1.

Under Step 2 above, we determine that our truck rack meter has 50 pulses per gallon of product delivered.

In Step 3 above, it is determined that the low flow rate for the loading arm is set to 150 gallons per minute.

According to Step 4 above, multiplying the 50 pulses per gallon times the 150 gallons per minute yields a number of 7500 pulses per minute.

In Step 5 we divide by 60 to get the pulses per second. In our example that results in 125 pulses per second. Adding 10% overhead, or 13 pulses, we get 138 pulses per second.

Following Step 6 we install the number 138 into Parameters #063 & #064.

It is determined that between the point of additive injection and the coupling on the loading arm, a volume of 85 gallons is contained. In addition, the preset is programmed to deliver the last 50 gallons at the low flow rate of 150 gallons per minute. According to the directions in Step 7 above, the preset should be re-programmed to deliver at least 85 gallons during low flow. This is to ensure that the loading arm is completely flushed. To guarantee flushing, we will re-program the preset to deliver 100 gallons of fuel at low flow.

Per Step 8, set the same volume (100 gallons) into Parameter #061.

Under Step 9, we determine that a normal injection cycle (Parameter #010) is set to 53 cc's. The volume in the pipe is 100 gallons (Step 8), and the injection interval is 40 gallons.

\[
\frac{100 \text{ gal}}{40 \text{ gal per cycle}} = 2.5 \text{ cycles} \times \frac{53 \text{ cc's per cycle}}{100 \text{ gal}} = 132.5 \text{ cc's per 100 gallons}
\]

Following our rule of thumb in Step 10 of not exceeding double cycle volumes, the missing additive takes 2.5 cycles to inject, and we round up to 3 cycles. Set Parameter #060 = 3. During the first 3 cycles of a transaction, the injector will inject 53 cc’s + (132.5 / 3) cc’s or 97.2 cc’s per cycle. After 3 cycles, the injector will return to the 53 cc’s per cycle rate. At 100 gallons from the end of the transaction, when the flow rate drops to the low flow rate, the injector will suspend injection. The volume of additive for the volume of product delivered into the truck will be exact.
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CHAPTER 10  MINI-PAK™ 6 SPECIFICATIONS

10.1 Electrical Inputs

AC Power:
90 to 265 Volts, 48 to 63 Hz
Instrument Current Consumption: 35 watts

AC Power Input:
Fuse protected 2.5 amps
Surge current <10 amps, <0.1 sec

AC Status Input: (reset, enable, pacing)
(6) Optically isolated
30K ohms (capacitive) to L2 (Neutral) @ 50 Hz
25K ohms (capacitive) to L2 (Neutral) @ 60 Hz
Driving circuit must rise to greater than 85 Vac for “on” state and fall below
20 Vac for “off” state. Maximum on-off-on frequency 5 Hz

DC Status Input: (reset, enable, pacing) (6)
Driving circuit must sink 10 mA to within 0.8 volts of DC common, signal
must rise to at least 4.5 Vdc. 30 Vdc open circuit maximum. Maximum
pulse input frequency 1 kHz.

DC Pulse Input: (additive meter sensor input) (6)
Driving circuit must sink 10 mA to within 0.8 volts of DC common, signal
must rise to at least 4.5 Vdc. 30 Vdc open circuit maximum. Maximum
pulse input frequency 1 kHz.

10.2 Electrical Outputs

AC Multi-functional Outputs: (various uses)
(6) Optically isolated, AC solid state triac outputs, with one feed. Feed
voltage range: 24 VAC to 280 VAC. Steady state load current range:
5A (rms) maximum into an inductive load. Leakage current at maximum
voltage: 100 micro-amps maximum.

DC Multi-functional Outputs: (various uses)
(6) Optically Isolated Open Collector-Open Emitter Transistor, 100 mA
maximum current, 30 vdc maximum open circuit voltage. Duty cycle on
pulse use: Raw = Input, 1:1, 1:10, 1:100 = 50/50, 1:1000 = 5 msec

Communications: (2 ports)
COMM 1
EIA RS-485 Multi-drop, poll and reply, slave only. 2-wire, 32 Injectors total
on one drop. Data rates of 1200/2400 /9600/19,200 Baud supported. 8
Data bits, no parity, one stop bit, fixed.

COMM 2
EIA RS-485 Multi-drop, poll and reply, slave only. 2-wire, 32 Injectors total
on one drop. Data rates of 1200/2400 /9600 Baud supported. 8 Data bits,
no parity, one stop bit, fixed.
10.2.1 Other
Display:
Module format: 4 Line by 20 characters per line
Type: Liquid crystal, backlit
Character format: 5 by 7 dot matrix

Environmental:
Ambient Operating Range: -40°F to 150°F
Display may appear slow at temperatures below 0°F. Humidity 5 to 95% without condensation.

Enclosure Ratings:
Killark GRB type, Class I, Division 1, Groups C and D. Class II, Groups E, F, and G explosion proof when installed with approved seals. Otherwise, Class I, Division 2, Groups A, B, C, and D.

10.2.2 MonoBlock™ III Standard Features
- 303 Stainless steel machined manifold block.
- 3/8” FNPT inlet and outlet connections machined into block.
- 3 GPM, 12Litres/min maximum flow rate through complete assembly.
- Oval gear meter machined into manifold block.
- High resolution gears 4800 pulses/gallon (1270 Pulses/Litre) output.
- Meter accuracy of 0.5%.
- Meter repeatability 0.25%.
- Oval Gear material Ryton.
- Gear pinion shafts of 18-8 Stainless Steel.
- Explosion proof hall-effect meter sensor.
- Sensor is 3-wire type with power (12VDC), common, and pulse signal connections.
- Sensor carries UL listing for Group I, Div I and ATEX approvals.
- UL or ATEX solenoid, machined into manifold block.
- Solenoid 120 VAC, 240 VAC, 24 VDC or 12 VDC powered.
- Built in calibration security diverter valve with integral flow control.
- Built-in strainer
- Built-in check valve
- 235 PSI, 16Bar max working pressure.
- 150 PSI, 10Bar max differential pressure.
- Solenoid is 303 SS construction.
- Solenoid ‘Isolast’ seat standard.
- Calibration port with standard quick disconnect coupler.
10.2.3 Optional Accessories

- Calibration kit, including quick-coupler (female), cylinder, back pressure check valve, and spout.
- Inlet and outlet isolation/flow control locking ball valves.
- Inlet and outlet QRC flushing connections.