# ProPAC-3
# Chemical Additive Injector
# Field Manual

Version 3.01a


Titan Industries, Inc.
INNOVATIVE TECHNOLOGY GLOBAL SOLUTIONS

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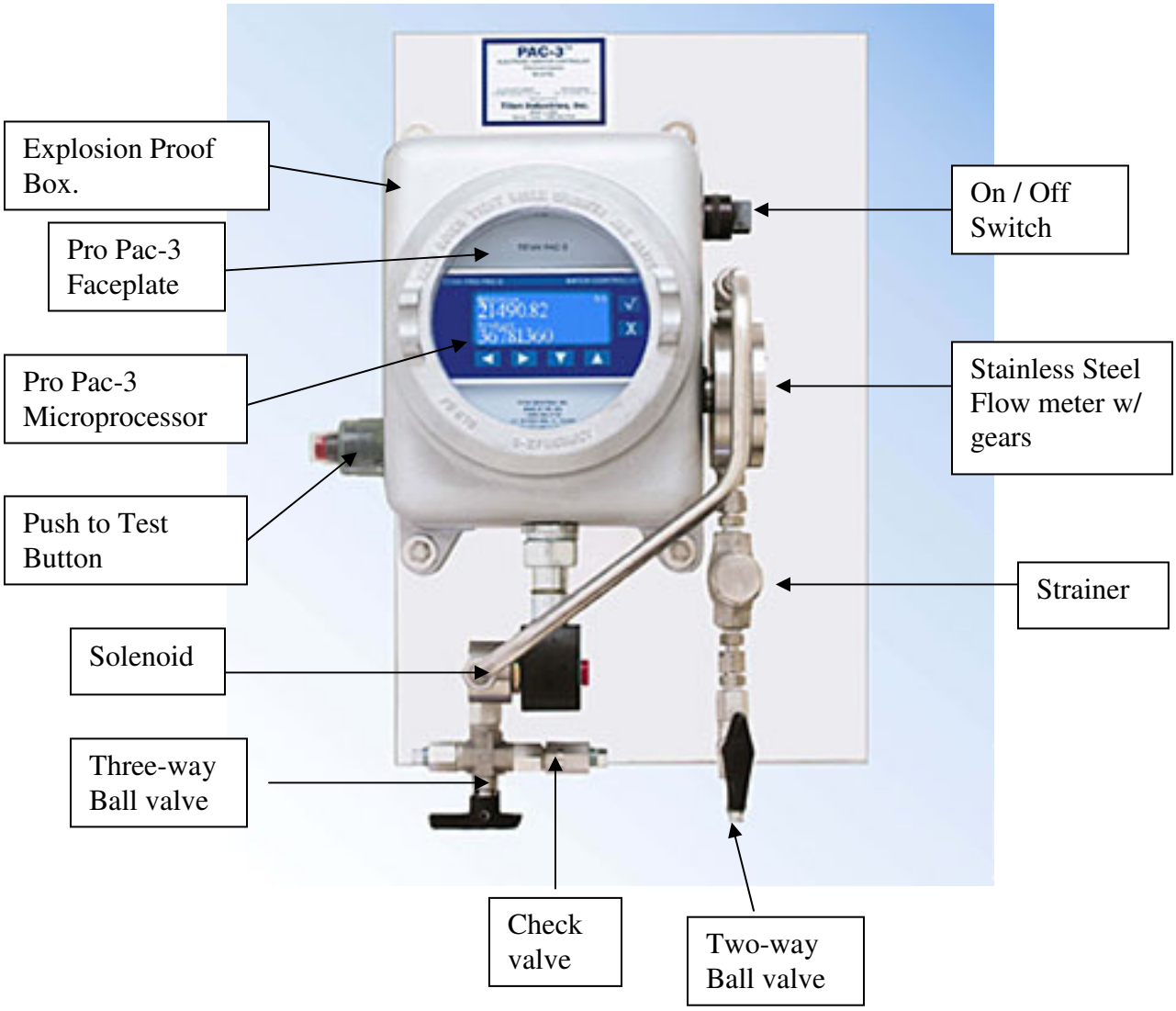
## Standard Accessories for Pro Pac-3

**External Accessories:**




**Internal Accessories:**

1. Pro Pac-3 Mother Board.
2. Pro Pac-3 Microprocessor.
3. One Single Input module. (AC or DC)
4. One Single Output module. (AC or DC)
5. One Hall-Effect Sensor.
6. Two Eight-Pin Wago Connectors.
7. Three Five-Pin Wago Connectors.
8. Two Four-Pin Wago Connectors.
9. One Three-Pin Wago Connector.
10. One Wago Tool.

**ProPAC-3**
**Introduction**
Version 3.01

The Titan ProPAC-3 Additive Injector is specifically designed to inject liquid chemical additives at petroleum product terminals. The ProPAC-3 includes patented hardware and software that assures the additive/product ratio is always maintained within customer specifications. The ProPAC-3, when properly integrated into a users control system, can inject within 0.5% accuracy. Injector features, when used properly, provide the highest level of EPA regulatory compliance.

The ProPAC-3 microprocessor is a state-of-the-art high-speed microprocessor capable of operating and accounting for additive and product on three separate channels. The three channels may be used to inject three different additive injection rates, as with a generic additive system shared by multiple users. Injection rates may be selected via a hardware permissive input or via software permissive. Each channel maintains accountability for its own additive/product ratio.

The microprocessor provides all the operational, alarm, and communication functions for the injector. The microprocessor is field replaceable. The ProPAC-3 incorporates a large graphical display enabling the injector to present a large degree of information on one display screen. The Titan ProPAC-3 communicates injector data via RS-485 serial communications. The communications protocol is mature and well established.

Because the ProPAC-3 has numerous input/output control options and performance features, it is recommended the user contact Titan to discuss the specifics of how the ProPAC-3 may be integrated in an integrated control system in order to achieve user expectations.

This manual pertains to software Version 3.01.

## Proprietary Notice

The information contained in this publication is derived, in part, from proprietary data and patent data, from Titan Industries, Inc. The information herein has been prepared for the expressed purpose of assisting management, operations and maintenance personnel in the effective use of the ProPAC-3 additive injector. Publication of this information does not convey any rights to use or reproduce it, or to use for any other purpose other than in connection with the installation, operation, repair, and maintenance of the equipment, as described herein.

**Frequently Asked Questions.**

**1. How does the Pro Pac-3 operate?**
In a typical operation, additive supply pressure (125-150 psig typical) is provided to the inlet ball valve of the ProPAC3 injector, via a positive displacement additive pump located on or near the additive storage tank. The injection cycle begins when the ProPAC3 microprocessor energizes the normally closed two-way solenoid control valve, thereby, allowing additive flow to enter the injector through the inlet ball valve. The solenoid is energized when the programmed number of product pulses has been accumulated. The flow of additive passes through the stainless steel filter, prior to entering the ProPAC3 flow meter. The flow of additive through the flow meter results in generation of a DC pulse train from the flow meter to the ProPac3 microprocessor, via a Hall Effect sensor. This low voltage pulse train represents the volume of additive being injected into the product stream. The additive exits the flow meter through ½ inch stainless steel tubing, where it flows through the two-way solenoid control valve, prior to exiting the injector through the check valve. When the volume of additive through the flow meter equals the programmed volume for each injection batch, the microprocessor terminates power to the solenoid control valve, thereby, terminating the flow of additive through the injector. The ProPac3 microprocessor totals the additive injected, totals the product treated and is in the stand-by mode, awaiting the next injection batch request.

**2. What is the power requirement for Pro Pac-3 injector?**
120 VAC 60 Hz or 230 VAC 50 Hz.

**3. What type of product pulse signals can a Pro Pac-3 accept?**
Both AC and DC signals.

**4. Would I be able to use Titan injector if I do not have product pulses?**
Yes. You can use Auto PAC.

**5. What is the difference between Pro Pac-3, Auto Pac, and MAI?**
ProPAC3 is a proportional injection controller. It will inject proportional to the product pulses received. For instance the injector will inject 60 cc of additive for every 40 gallon of product. In its simplest form, the ProPAC3 requires only AC power, a product flow pulse, and pressurized additive to operate.
Auto Pac is an automatic timed injection batch controller. It is designed for situations where a product pulse signal is not available to pace the injection process. The Auto Pac injects based on a user-programmed time between injections and an optional maximum load volume.
MAI (Multi-Additive Injector) is a proportional injection controller. It is specifically designed to sequentially batch inject up to eight additives at petroleum product terminals.

**6. Are there any alarm features to ensure the additive/product ratio?**
There are 12 alarms. Three of them are non-programmable alarms and the rest are programmable alarms. See Alarm Section for detail.

**7. Can I do on-site calibration?**
Yes. As a matter of fact, the Pro Pac-3 has a feature called Auto Calibration. Once the feature is enabled, you just need to follow the instructions displayed and the injector calibration will be done in seconds.

**8. How can I configure the Pro Pac-3 injector?**
There are 3 ways you can configure the Pro Pac-3 injector: internal pad buttons, Infrared Remote.

**9. What is operating temperature?**
Low temperature (with heater pad on) is –40° F
High temperature (with heater pad off) is +132° F

**10. What is the operating pressure?**
The maximum operating pressure is 250 psig.
The maximum differential pressure is 145 psig.

**11. What is the injection volume per cycle?**
The minimum is 5 cc.
The maximum is 685 cc.

**12. What is the flow meter accuracy?**
Up to 0.05% of rate.

## CONTRAST ADJUSTMENT

**Note: Use the Up/Down arrows ▼ ▲ to change the graphical display contrast, if on ProPac-3 power-up the display is difficult to read. Hold down until display is clear.**

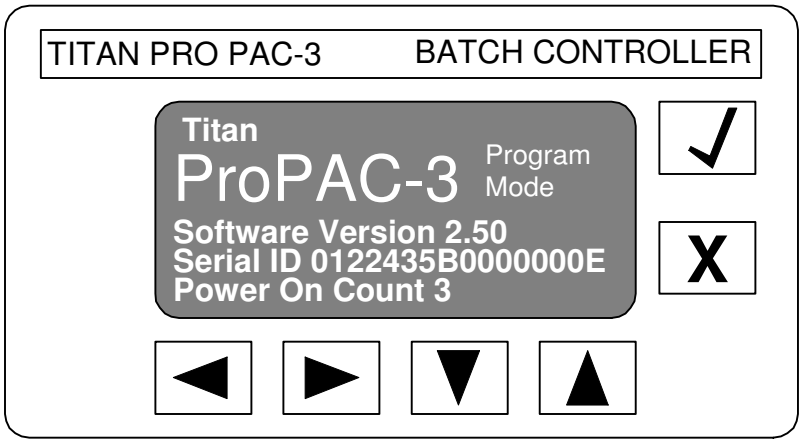
**STEP 1**
Press the ✓ key to ENTER the program. If lock code has been programmed, enter the lock code as instructed. See following page for menu selections.

**STEP 2**
Use Up/Down arrows ▼ ▲ to scroll through menu selections, changing options, and incrementing/decrementing counters. Each menu will be highlighted during scrolling.

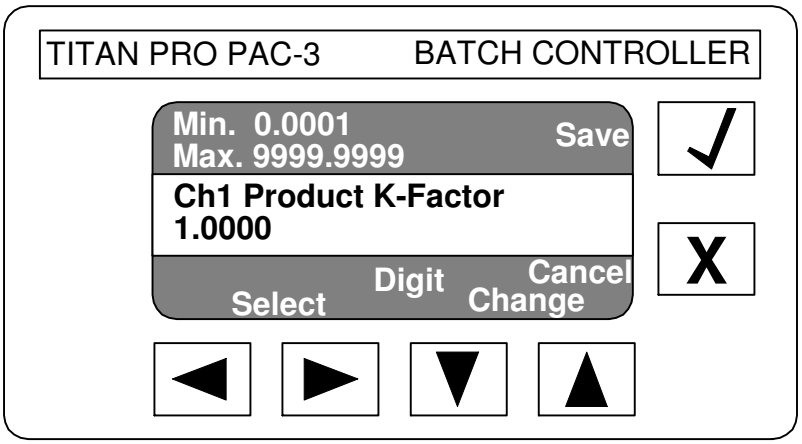
Use Left/Right arrows ◀ ▶ to select digit for changing when in Edit mode.

**STEP 3**
Use the ✓ key to EDIT/SAVE. Use the X key for EXIT/Cancel.

The graphical display screen displays a sky-blue background with white alphanumeric characters.

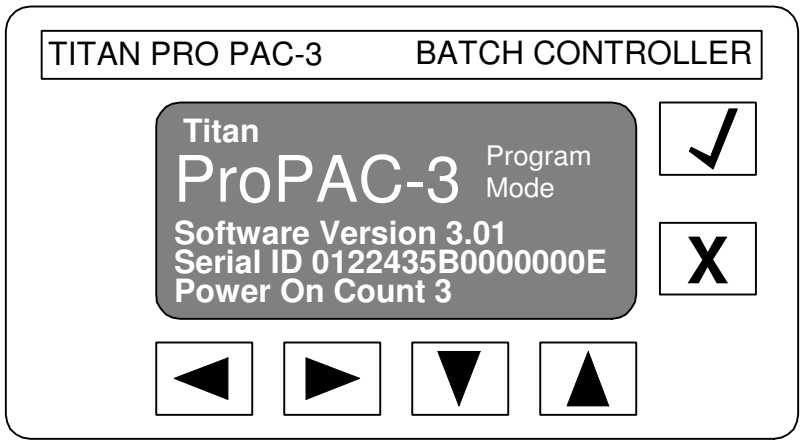



Programming instructions and Min./Max. Values are provided on the graphical display screen while in the program EDIT



**PRESS ✓ TO ENTER THE PROGRAMMING MODE**

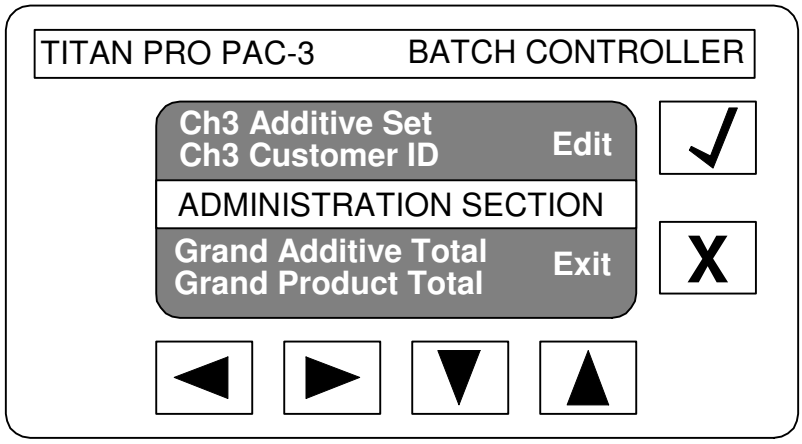
On entering the program, the Program Mode screen will appear for four (4) seconds.




- Microprocessor Software Version
- Unique Microprocessor Serial Number
- Number of times the Microprocessor has been turned on

If ✓ Is pressed again this screen will be displayed for another 4 seconds

Following the four (4) second viewing of the Program Mode screen, the following Menu Selection screen will appear - ADMINISTRATION SECTION.

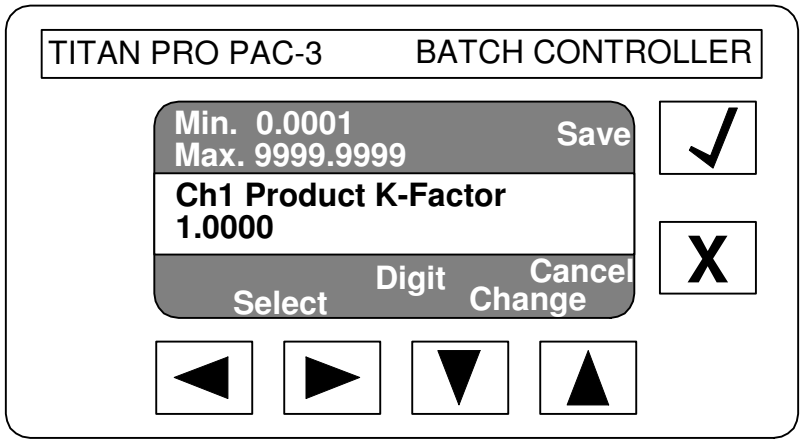



**USE ▼ ▲ TO SCROLL THROUGH MENU SELECTIONS**

**USE ✓ TO EDIT SELECTION**

**USE X TO EXIT PROGRAM**

Scroll to desired menu selection for Editing. Modify value if necessary, and then save. Minimum and maximum values for each menu selection will be displayed in the upper left corner of the graphical display.




**IN EDIT MODE, USE ◄ ► TO SELECT DIGIT FOR EDITING**

**USE ▼ ▲ TO INCREMENT OR DECREMENT SELECTED DIGIT**

**USE ✓ TO SAVE EDIT**

**USE X TO CANCEL EDIT**

## PROGRAM MENU DEFINITIONS

(Use with Programming Guide Section 1 pg. 17-19)

The following definitions are provided in order to assist the user in properly programming the Titan ProPAC-3 additive injector. The definitions are also provided in order to explain the many product features of the ProPAC-3 additive injector.

Programming features and parameters are organized into five (5) distinct sections in the ProPAC-3 program menu. This section of the manual provides detailed definitions for the Administration, Communications, Line Flush, and the Channel Sections of the program menu. Limited definitions are provided for the Alarm menu, since the alarms are fully described in the dedicated Alarm Section of the manual. See Alarm Operations Section 3.

### ADMINISTRATION SECTION

**Grand Additive Total** - The total represents the cumulative volume of additive dispensed through the injector. If more than Channel 1 is used, the Additive Total for all channels is accumulated in the Grand Additive Total. If only Channel 1 is used, the volume represents the additive total for the channel. The value is programmable and can be reset. *Note: The Grand Additive Total does not change when a specific channel total is changed or reset to zero.*

**Grand Product Total** - The total is identical to the Grand Additive Total above except the total represents the product treated.

**Permissive Input** - Represents the number of channels used. This number should correspond to the number of rates selections, either hardware or software, from an electronic preset or terminal automation system. Up to three (3) channels (rate selections) may be used in order to select different rates of additive. Each of the three channels may be used and programmed with the same or different injection rates. Consequently, a single Pro Pac-3 injector may be used to document the additive/product ratio for up to three different injection rates. Menu selection 1,2 or 3.

**Authorize** - Represents a more sophisticated way of controlling the additive injector. Authorization must be accomplished either by serial communications command or by hardware permissive. Rate selection is accomplished by sending either a software or hardware additive permissive signal to the injector, requiring that Authorize mode be used whenever more than one channel is used. Up to three different rates may be selected and accounted for in the injector. This does not limit the fact that an infinite number of injection rates are available by changing the injection rates via the serial communications. However, the injector can only accurately account for the additive/product ratio for three rates. When Authorize is enabled, product pulses to the injector are ignored and the injector will scroll between the Grand Total screen and the Channel Screen(s) until an additive permissive is received.
Even when only one rate or channel is used**, Authorize mode** is the recommended mode of injector operation for the following reasons.

**1.** Allows for simpler pulse wiring, because pulse wires can be paralleled from one pulse source to multiple injectors.
**2.** Flow pulse switching via a PLC or relays is not necessary.
**3.** Allows for simpler load permissive circuit wiring, because load permissive circuit can be looped per load arm (See Premised Permissive).
**4.** Better accountability when blended products or multiple additive rate products are loaded on the same load arm.
**5.** Product pulse failures can be detected (see product pulse and Permissive timeout alarm).

**Flow Switch Input** - A flow switch input, when available, is an effective means to determine a product pulse failure. Programmable Enabled/Disabled. If no flow switch is installed, program Disabled.

**Definitions continued**

**Confirmation Pulse Output** - The output is typically used in conjunction with electronic presets or a PLC. The output may be used to confirm that an injection has been properly completed (End of Batch), or it may be programmed to represent a programmed volume of additive (Scaled Pulse Amount). When programmed and wired using the Confirmation Pulse, the confirmation pulse width (mS) must be programmed. When programmed and wired using the Scaled Pulse, both the scaled pulse amount (cc's) and the scaled pulse width (mS) must be programmed accordingly. The pulse width effectively allows the user to program the on/off time of the pulse output, thereby, simplifying systems integration. The scaled pulse signal is similar to a flow meter output. Even if the injector is in an alarm state, Scaled Pulses are generated whenever additive is flowing. *Note: If the feature is not used, (the output is not wired into the system), program values for Confirmation Pulse Output, Scaled Pulse Amount, and the Scaled Pulse Width are irrelevant.*

**Confirmation Pulse Width** - Related to Confirmation Pulse Output above. This parameter defines the amount of time that the output relay will be closed creating a pulse. The open part of the cycle will depend on the amount of time between injections. The parameter is only relevant when confirmation pulse is selected.

**Scaled Pulse Width** - Related to Scaled Pulse Output above. This parameter defines the minimum on and off pulse width. The open contact time will be dependent upon the flow rate.

**Scaled Pulse Amount** - Related to Scaled Pulse Output above. This parameter defines the amount in cc's that each closure of the scaled pulse output represents. *Note: This output can continue pulsing after each injection if this parameter and its related parameter (Scaled Pulse Width) are set such that there is not sufficient time during the injection for the pulses to be generated.*

**Permissed Permissive** - Feature is used in conjunction with permissive signal allowing simpler permissive circuit wiring. A permissive for each riser can be looped rather than parallel wiring per individual injector. Some terminals install injectors where an alarm on one injector will prohibit the injection of additive by other injectors that are operating on the same riser. This feature allows the injectors that are not in alarm to operate as normal even though one injector servicing the riser is in alarm. Programmable Enabled or Disabled. Contact Titan Industries for specific use.

**Pump Start** - An additive pump start output is available on the ProPAC-3. This output is turned on when: the injector is either hardware or software Authorized, the Test Injection Button is pushed or Calibration Mode is entered. When Authorized Mode is used, this can eliminate the direct control of the additive pump from the automation system. The feature can also eliminate manually having to turn on the additive pump for calibration. A dual output module is required to use this function. Programmable Enabled or Disabled. If the feature is not used, program Disabled.

**Test Injections** - Enables the use of the external push-button for Test Injections. Test injections are used for troubleshooting. Programmable either Enabled or Disabled. If the feature is programmed Disabled, the external push-button will not generate an injection pulse, but can be used for other features.

**Test Injection Add-In** - Allows the user to determine whether the additive dispensed during testing and calibration is added to the channel additive total. ***NOTE:*** *During test injections, the corresponding amount of product will also be added to the product total* if the feature is programmed Enabled. If disabled, scaled additive or confirmation pulses will not be generated.

**Front Panel Lockout** - Provides limited access security for entering the Pro Pac-3 programming. Programmable Enabled or Disabled. If programmed Enabled, a numeric security code must be entered as the Password.

**Password** - Used with Front Panel Lockout feature. Numeric range for Password (0-99,999). Use only if limited access is required. Note: If used, do not fail to record the programmed Password.

**End Of Load Compensation** - Allows the use of the external push-button to inject the amount of additive that will get the current compartment into spec resulting in taking the injector out of the alarm state. Although unlikely, it is possible that at the end of a product load, the additive/product ratio calculation may indicate a slight shortage of additive. This shortage would more than likely occur only when utilizing the Frequency Line Flush method or if the actual Flush Volume is greater than the programmed value for Flush Volume. *Note: The following features must be programmed Enabled, in order to utilize the End of Load Compensation feature: End of Load Compensation, Test Injections, Additive Quantity Alarm and appropriate values must be entered for Additive Quantity Injections, the Additive Quantity Low%.* If the feature is used, the additive may be injected into the product line, or it may be injected into an appropriate container for manual addition to the product loaded. Additive in the container may be added to the product by hand or as company policy dictates. With this feature Enabled, the user can utilize the external Push-button to makeup any additive shortage. Programmable Enabled or Disabled.

**Additive Pre-Load** - Additive may be pre-loaded, at the beginning of the product load. The feature is normally required when utilizing any product line flush feature such as dye injection where additive that is not injected during the line flush period at load end is pre-loaded at load start. The feature is also useful for maintaining the minimum required additive/product ratio. For example, depending on where the load meter stops at load end, from one to 39 gallons of product will typically be loaded without any additive. Utilizing the preload feature, one extra injection of additive can always be provided at load start to make up for the potential loss of additive at load end. ***Note:*** *When Enabled, at a minimum, the following items in the Line Flush Section must be programmed: Pre-Load Injections and Flush Volume.* See the Line Flush Section of this manual.

**Additive Units** - Additive and Product totals may be accumulated in either Gallons or Liters.

**Calibration Mode** - Provides an auto-calibration of the ProPac-3. Programmable Enabled or Disabled. When enabled, the user can enter the auto-calibration mode of the injector by pushing and *holding* the Test Injection Button for three (3) seconds.

**Load Timeout** - Provides a user programmable timeout of the load status screen. See Section 2.

**Current Time / Date** - Sets the current time and date. These features are used only in conjunction with the Calibration Alarm.

## ALARM SECTION

**Pushbutton Clears Alarms** - This feature provides for the resetting of alarms, via the external calibration pushbutton, when the feature is enabled. When an alarm occurs during the loading process, pushing the pushbutton momentarily will reset the alarm and reset all the load totals as if a new load has started. However, by holding the pushbutton in for three seconds until the injector beeps, the injector will attempt to restart the previous load maintaining all load totals while making larger injections to get the load back into spec. This is a more sophisticated way of recovering from a low additive alarm situation. This method will assure that even when the injector goes into alarm the correct additive has been injected into the load. Programmable Enabled or Disabled. For the following alarms, please reference the explanation provided in the Alarm Section of this manual. Each alarm is described in detail therein.

**Alarms Reset by "Pushbutton Clears Alarm"**
Additive Flow Problem
No Additive Pulse
No Product Pulse
Line Flush Failed
Permissive Timeout Error
Flow Switch Failed
Additive Permissive Failed
Additive Quantity Alarm
Solenoid Leak Alarm
Failsafe Alarm

## COMMUNICATIONS SECTION

**Address** - When utilizing serial communications, each ProPAC-3 will be addressed with a unique address identifying the unit. Address range (1-999). Each injector on a serial communication network should have a unique address. (Program as required) If communications is not used then the address is irrelevant.

**Baud Rate** - The baud rate must be programmed when utilizing serial communications. Baud rate selections are: 1200, 2400, 4800, 9600, 19200, 38400 and 57600. If communications is not used then the baud rate is irrelevant.

**Accuload Serial Communications** - This should be enabled whenever a Smith Acculaod is communicating over a RS-485 communication line to the Injector. There are two modes of operation with the Smith Accuload: 1) Product Pulses with communication verification and alarm shutdown, 2) No Product Pulses, batch injection commands are sent to the injector via the communication link. Call Titan technical support for detail about which mode of operation to use.

## LINE FLUSH SECTION

**Pre-Load Injections** - When utilizing the Additive Pre-Load feature (normally only used for line flushing) the user specifies the number of injections the pre-loading of additive will take place, beginning at load start. The preload feature may be used even when not utilizing any line flush method. For example, when the injector is configured to inject every 40 gallons of product, and if the product total is not an even multiple of 40, there could be up to 39 gallons of untreated product. However, by preloading enough additive to treat 39 gallons of product, the problem (of 39 gallons of untreated product at the end) is eliminated. Programmable 1-99 injections. Note: In order to use the feature, the following must be programmed: Number of Injections, Flush Volume and the Additive Pre-Load feature Enabled.

Example:

If (5) is entered for *Pre-Load Injections*, *Additive Set* (40), *Flush Volume* (100 gal), and *Product Set* (40). Since the *Flush Volume* is 100 gallons *Flush Volume / Product Set* = number of skipped injections as a result of the flush (100/40 = 2.5). The preload additive volume (the volume of additive not injected at load end during the flush period) will be *Additive Set* x 2.5 (40 x 2.5) = 100 cc's. Then 100 cc's is pre-loaded over the first five (5) injections. Therefore, if the preload additive volume is 100 cc's, the first five (5) injections of the load will include an additional 20 cc's or (40 + 20) for a total of 60 cc's.

**Flush Volume** - User enters the volume of product used to calculate the additive to be pre-loaded. When using product line flush, the volume should represent the actual volume of product to be flushed at load end. The software uses the Flush Volume to calculate the amount of additive that corresponds to the amount of product used to flush. The software calculates the preload additive volume by dividing this

number by the Product Set to determine the number of injections including fractional injections and then multiplies this result by the additive set. See above Example. Programmable 1-999 gallons.

**Flush Alarm Volume** - The minimum amount of product that will not cause a Line Flush Alarm. Represents the calculated volume of product from the additive injection point in the product line to the end of the load nozzle. If the flush volume, as programmed, is not counted at the load end, the unit will alarm "Line Flush Failed", provided the alarm has been programmed Enabled. The alarm indicates an incomplete flush, leaving contaminated product in the product line. The alarm is used for dye applications where both clear and dyed products are loaded from the same riser. This alarm will alert terminal personnel that the product line may not be clear of dye. Program range 0-999 gallons. If a line flush method is not used, the programmed value is irrelevant.

**Line Flush Hardware Input** - Provides the means to accomplish a product line flush by utilizing a hardware input. Typically implemented by users demanding no co-mingling or contamination of additives in the product line. The input may be provided from a mechanical preset, electrical preset, terminal automation system, or any other field device with the capability of signaling the ProPAC-3. Programmable Enabled or Disabled. **Note:** An actual hardware signal is not necessarily needed. When authorized mode is enabled and Line Flush Hardware Input is enabled, Line Flush can be initiated by removing the authorize signal while product flow continues.

**Flush Frequency Method** - Provides the means to accomplish a product line flush by utilizing the product pulse input frequency (Input 1), in order to determine the flush. Programmable either Enabled or Disabled. If Frequency Flushing is not desired, program Disabled.
***Note:*** *The product pulse input frequency must be 1:1 resolution or higher, as a turbine meter input. A 40:1 product pulse cannot be used! Additionally, it has been found some electronic presets do not provide a 1:1 product frequency that accurately represents the actual load frequency. These presets, due to limitations in their processing abilities, send product pulses in bursts, thereby, not representing the actual load frequency. The ProPAC-3 minimizes this problem by allowing the user to average product pulse frequency over programmable number of product pulses.*

**Pulse Width Long Average** - This average is used to determine the maximum or full flow rate. The ProPAC-3 compares this number with the Short Average to determine if the product flow rate has decreased by the *Flush Start % Decrease*. Programming the Long Average number too large will have no adverse effect on the performance of the frequency method. There is a flush diagnostic screen in the ProPAC-3 code. This screen will show the user the Instantaneous value, Short Average, (Max) Long Average, and the Freq %. The first three values Inst, Aver, Max are all in units of pulses/sec. Instantaneous, Aver and Long (Max) product pulse frequency are the average over a number of product pulses. Average numbers should be fairly constant during normal flow. However, if the average numbers are not constant then increasing the Short and Long Pulse Width Average numbers may be required in order to determine both an Average (Short) and Maximum (Long) Average product flow frequency. Only used with Frequency Line Flush.

**Pulse Width Short Average** - This average is used to determine the instantaneous flow rate. The ProPAC-3 compares this number with the Pulse Width Long Average to determine if the product flow rate has decreased by the *Flush Start % Decrease*. See above. Programming the Short Average number too large can adversely affect the performance of the frequency method by delaying the detection of product slow flow. Delaying the detection of slow flow will result in injections during slow flow, hence not allowing sufficient product to flow after the last injection to clear the product line. It may need to necessary to decrease *Flush Start % Decrease* number to balance out a larger number in the Pulse Width Short Average. Only used with Frequency Line Flush.

**Definitions continued**

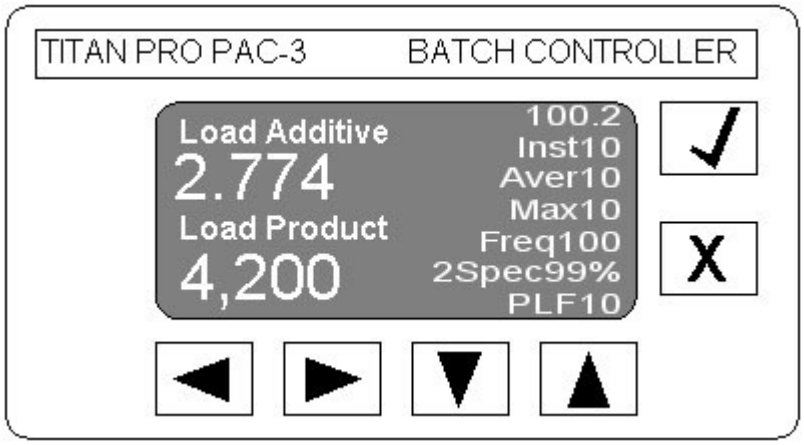
**Suggested Settings for Brooks Presets using Frequency Line Flush**

All Brooks electronic presets send 1:1 product flow signals out in bursts that do not reflect the actual flow rate of the product. Hence averaging of product pulse frequency is a necessity when using the frequency method of line flush with a Brook preset.

Short Average 40
Long Average 45%
Decrease 50%

To enable the diagnostic screen press the up arrow and check simultaneously.
The diagnostic screen is only displayed while a truck is loading.

Flush Diagnostic Screen




To disable the diagnostic screen press the up arrow and check simultaneously or cycle injector power.

**Instantaneous Product Pulse Frequency (Inst)** - This is the instantaneous frequency of the product pulses (Pluses per second).

**Average Product Pulse Frequency (Aver)** - This is the Short Average frequency. **Example:** If *Flush Start % Decrease* is set to 20%, when average (Aver) is 80% of (Max) average, the injector will begin to flush.

**Maximum Product Pulse Frequency (Max)** - This is the Long Average frequency.

**Frequency (Freq)** - This is the percentage of the full flow rate.

**Spec** - This is the instantaneous actual additive percentage as a percentage of the product volume. As the load progresses is number should approach 100 %. With the Preload feature enabled the load spec will be 150 % high and approach 100 as the load progresses through line flush. With Preload disabled the % spec will start at 0 and approach 100%. Variations in the % spec are related to the fact that the injector treats in fixed gallon increments. The *Quantity Alarm % spec* high and low parameters will assure that the automation system is alerted if a load terminates with an additive to product ratio outside the spec range.

**Product Line Flush (PLF)** - This is the amount of product that is included in the line flush. This number should start at zero and counts up toward the *Product Line Flush Volume*.

## Definitions Continued

**Flush Start % Decrease** - Feature provides the user with the ability to define the initiation of the flush. The programmed value entered for % Decrease defines the decrease of normal steady-state product flow (Long average) when the flush begins. Example: Normal product loading 600 gpm, Flush Start % Decrease programmed 20%. During slow flow, as the product flow rate decreases by 20% to 480 gpm, the flush will be initiated at 480 gpm flow rate. Only used with Frequency Line Flush.

**Blocking Control Valve** - The blocking control valve is typically used in conjunction with product line flushing. However, it may be used in conjunction with typical additive installations as well. The blocking control valve is typically a solenoid control valve installed at the additive injection point. This solenoid valve is in addition to the solenoid control valve located on the ProPAC-3 injector. The blocking control valve is controlled by the ProPAC-3 microprocessor and it is opened (energized) when additive/dye injections are prescribed for a product load. The valve is used primarily to prevent additive or dye from entering the product line during all periods where additive/dye is not called for. Without the feature implemented, thermal expansion and pressure relief in the product line can cause small amounts of dye to leach into the product line causing a section of dyed product to flow into a clear truck. By using the Blocking Control Valve, this problem is minimized. The blocking control valve is opened when the first injection is made and is closed at the initiation of line flush. See Dye System Considerations Section 6 - pg.3 for installation recommendations. Programmable Enabled or Disabled.

When authorize mode is enabled, the Blocking Control Valve is not opened until the first injection is made. This prevents situations where a lane permissive is provided to a number of injectors even though flow is not definite on the dyed product riser, hence allowing the dye line to relieve into the product line. See Dye System Considerations Section 6 - pg.3.

**CHANNEL SECTION**

**Ch1 Product Total** - Provides product total in gallons, for Channel 1.
***Note:*** *If using a 40:1 product pulse, the total provides a count of the injection requests, not gallons, when the Product K-Factor is programmed to 1.00. However, if the Product K-Factor is set to 0.025 and the Product Set is programmed 40, the unit will increment by 40 gallons for each 40:1 product pulse input (injection request). When using a 40:1 product pulse, this is the preferred method of accounting for the product treated. This is very useful when using the Comm-link monitoring or ticketing systems for documenting additive and product throughput.*

**Ch1 Product K-Factor** - Defined as product pulses per gallon. Provides the user the ability inject additive via a wide range of product pulse inputs. Range 0.0001-9999.9999.

***Note 1****: When a 40:1 pulse is provided, 0.025 is programmed for the Product K-Factor, and the Product Set is programmed 40, the Channel Product Total will increment by 40 gallons on each injection request. When the a 20:1 pulse is provided, 0.05 is programmed for the Product K-Factor, and the Product Set is programmed 20, the Channel Product Total will increment by 20 gallons, on each injection request. When using a 1:1 pulse or a turbine meter pulse input, provided the program values are correct, the Channel Product Total will increment 1 gallon for each gallon of product loaded.*

***Note 2****: It is recommended to use a 1:1 product pulse or turbine meter pulse as the ProPAC-3 product input pulse so accurate product loads may be documented and accounted for.*

**Ch. 1 Product Set** - Defined as product units (gallons or Liters) per injection request. Used to designate the volume of product units (gallons or Liters) to be counted, prior to initiating an injection request. Typical injections are made every 20 or 40 gallons of product. Program range 1-9999 gallons.

The following displays the relationship between the various product program menu selections:

| Product Pulse Type | Recommended Product K-Factor | Product Set |
|---|---|---|
| 40:1 | 0.025 | 40 |
| 20:1 | 0.05 | 40 |
| 1:1 | 1 | 40 |
| Turbine Meter | As Specified On Meter | |

**Ch1 Additive Total** - Reflects the total additive volume, in gallons, dispensed through the ProPAC-3 flow meter for Channel 1. If Channel 1 is the only channel used, then the Channel 1 Total should match the Grand Additive Total. Programmable 0.0000-999999999.9999.

**Ch1 Additive K-Factor** - The additive K-Factor is determined via a calibration test. K-Factor is defined as pulses per unit volume, consequently, an Additive K-Factor of 2700 would designate there are 2700 additive pulses per gallon of additive. Calibration testing insures the actual volume dispensed through the injector is accurately reflected by the unit display. This number is automatically calculated when that Auto-Calibration feature is used. See Calibration Section 4.

**Ch1 Additive Set** - Used to designate the volume of additive, in cc's, per injection request. The user must calculate the injection rate, in cc's, for the Product Set value programmed. The calculated injection rate must be entered into the program. Program range 2.0000-9999.9999.

**Ch1 Customer ID** - User may enter a unique customer identification number, if desired. Program range 1-999,999. Alphanumeric entry.

## PROGRAMMING GUIDE

The following menu selections are programmable in the ProPAC-3 Program Mode, Version 3.01

| MENU SECTION | RANGE / PROGRAM SELECTION | RECOMMENDED PROGRAM SETTING |
|---|---|---|
| **ADMINISTRATION SECTION** | | |
| GRAND ADDITIVE TOTAL | 0.0000 - 9999999999.9999 | none |
| GRAND PRODUCT TOTAL | 0.00 - 99999999999.99 | none |
| PERMISSIVE INPUT (Hardware or software) | 1,2, or 3 | enter the number of channels used |
| AUTHORIZE (hardware or software) | Enabled / Disabled | 3 channels available for rate selection normally not used |
| FLOW SWITCH INPUT | Enabled / Disabled | Output typically wired to load preset |
| CONFIRMATION PULSE OUTPUT | Scaled Pulse/End-of-Batch | Used with Confirmation Pulse only |
| CONFIRMATION PULSE WIDTH | 1-32,000 mS | Used with Scaled Pulse only |
| SCALED PULSE WIDTH | 1-32,000 mS | Used with Scaled Pulse only |
| SCALED PULSE AMOUNT | 10-32,000 cc's | As desired, if authorize is enabled |
| PERMISSED PERMISSIVE | Enabled/Disabled | When using pump start feature |
| PUMP START | Enabled/Disabled | Enabled |
| TEST INJECTIONS | Enabled / Disabled | Enabled |
| TEST INJECTION ADD IN | Enabled / Disabled | Enabled- when using Password |
| FRONT PANEL LOCKOUT | Enabled / Disabled | Enter number when Lockout Enabled |
| PASSWORD | 0-99,999 | |
| END OF LOAD COMPENSATION | Enabled/Disabled | Used with Additive Quantity Alarm |
| ADDITIVE PRE-LOAD | Enabled/Disabled | Typically used with product line flush |
| ADDITIVE UNITS | Gallon/Liter | Gallon for USA |
| CALIBRATION MODE | Enabled / Disabled | Enabled |
| LOAD TIMEOUT | 1-900 | 180 sec. for 3 min load timeout |
| **ALARM SECTION** | | |
| PUSHBUTTON CLEARS ALARMS | Enabled / Disabled | Enabled |
| ADDITIVE FLOW PROBLEM | Enabled / Disabled | Enabled |
| NO ADDITIVE PULSE | Enabled / Disabled | Enabled |
| NO PRODUCT PULSE | Enabled / Disabled | Requires use of flow switch input |
| LINE FLUSH FAILED | Enabled / Disabled | Used only when using line flush feature |

## PROGRAMMING GUIDE

| MENU SECTION | RANGE / PROGRAM SELECTION | RECOMMENDED PROGRAM SETTING |
|---|---|---|
| **ALARM SECTION CONTINUED** | | |
| PERMISSIVE TIMEOUT ERROR | Enabled / Disabled | Only when using a permissive input |
| FLOW SWITCH FAILED | Enabled / Disabled | Used only when using flow switch input |
| ADDITIVE PERMISSIVE FAIL | Enabled/Disabled | Used only with software Authorize |
| CALIBRATION ALARM | Enabled/Disabled | As desired |
| ADDITIVE QUANTITY ALARM | Enabled / Disabled | Enabled |
| ADD. QUANTITY INJECTIONS | 1-999 | 5 injections |
| ADD. QUANTITY LOW PERCENT | 0-99% | As desired, but not zero (0) |
| ADD. QUANTITY HIGH PERCENT | 0-99% | As desired, but not zero (0) |
| SOLENOID LEAK DETECTION | Enabled / Disabled | Enabled |
| **COMMUNICATIONS SECTION** | | |
| ADDRESS | 1-999 | As required |
| BAUD RATE | 1200, 2400,4800, 9600, 19200, 38400, 57,600 | As required |
| ACCULOAD SERIAL COMMUNICATIONS | Enabled / Disabled | Use only when communicating with Smith Accuload preset |
| **LINE FLUSH SECTION** | | |
| PRE-LOAD INJECTIONS | 1-99 | 5 injections<br>Typically used with product line flush feature |
| FLUSH VOLUME | 1-999 | Used with product line flush<br>Used to determine preload amount<br>Enter actual volume of product to flush at initiation of product slow flow |
| FLUSH ALARM VOLUME | 0-999 | Used with flush alarm<br>Enter calculated flush volume (injection point to end of load arm) should be < Flush Volume above |
| LINE FLUSH HARDWARE INPUT | Enabled/Disabled | As required by user |
| FLUSH FREQUENCY METHOD | Enabled / Disabled | As required by user |
| PULSE WIDTH LONG AVERAGE | 1-50 | 25 pulses<br>Increase if variations in product pulse frequency cause line flush detection in the middle of load |
| PULSE WIDTH SHORT AVERAGE | 1-50 | 15 pulses (see above comment) |
| FLUSH START (% DECREASE) | 1-99% | 25% |

## PROGRAMMING GUIDE

| MENU SECTION | RANGE / PROGRAM SELECTION | RECOMMENDED PROGRAM SETTING |
|---|---|---|
| BLOCKING CONTROL VALVE | Enabled/Disabled | Program Enabled, when blocking control valve is installed and used |
| **CHANNEL SECTION** | 0 - 9999999999.99 | None |
| Ch1 PRODUCT TOTAL | 0.0001 - 9999.9999 | As desired<br>See Section 1 pg. 14 |
| Ch1 PRODUCT K FACTOR | 1 - 9999 | As desired<br>See Section 1 pg. 14 |
| Ch1 PRODUCT SET | 0.0000 - 999999999.9999 | None |
| Ch1 ADDITIVE TOTAL | 0.0001 - 9999.9999 | Determined by injector calibration |
| Ch1 ADDITIVE K FACTOR | 2.0000 - 9999.9999 | Additive volume (cc's) per injection |
| Ch1 ADDITIVE SET | 1 - 999,999 | As required by user |
| Ch1 CUSTOMER ID | 2.0 versions alphanumeric | Used as ID for channels on channel screens defaults ch1, ch2, ch3 |
| Note:<br>Ch2 AND Ch3 menu sequence the same as for Ch1. | | |
| Ch.2 and Ch3 may be used only when: Permissive Input programmed 1,2,3<br>or<br>Authorize programmed-Enabled. | | |

**Section 2**
**Normal Operations**
Version 3.0

## 1.0 Introduction

The injector may be used in its simplest form as a single station injector requiring only power and product pulses in order to operate, or it may be programmed, wired and used to operate as a multiple station (rate) injector, thereby, taking advantage of the many system features designed into the product.

## 2.0 Use as: Single Station Injector - One Rate

The ProPAC-3 may be used in its simplest form as previous injectors that are used to inject a single additive at a single injection rate. In this example, the "Authorize" feature is programmed Disabled, and Permissive Inputs are not used. Note: Although the injector is used as a single station injector, it may be used to inject multiple injection rates, via the RS-485 serial communications.

When the ProPAC-3 is used as a single station injector with no serial communications installed, the following is required as a minimum, in order for the injector to operate:

**1.** Power (120 VAC/60 Hz. / 230 VAC/50 Hz.)
**2.** Product Pulse (AC or DC)
**Note**: The product pulse input module located at position “Input 1” on the ProPAC-3 Motherboard must conform to the input voltage provided. See Field Installation section.

**Minimum recommended product features for implementation:**

**Permissive Output** (AC or DC) - used to terminate product loading in the event of an injector alarm, ProPAC-3 power failure or the ProPAC-3 power switch being positioned OFF.

**Serial Communications** - used to document regulatory compliance for additive/product loaded as well ell as record injector alarms

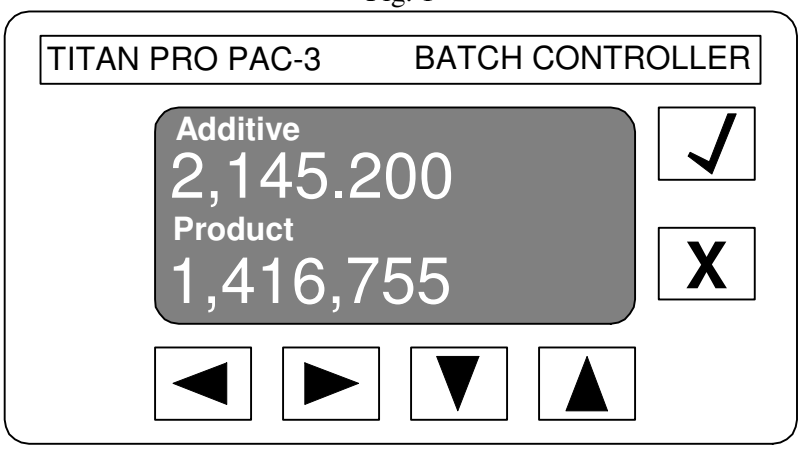
**Confirmation Pulse Output** (AC, DC, or mechanical) - used to terminate product loading in the event of the failure of the product pulse. Typically used when a flow switch input is not used.

***Note**: The confirmation pulse output module is located at position Output 2, on the Pro PAC-3 main circuit board. See Field Installation Section*

## 2.1 Single Station Injector - Idle State Operation

The ProPac-3 is in the idle state when waiting for product pulses. The ProPac-3 displays the screen below when in the idle state, on which both the Additive and the Product totals are indicated. When used as a single station injector (one rate), Channel 1 (Ch1) is the designated channel used to accumulate totals. The additive total and the product total are both cumulative totals, since system start-up, or since the totals have been reset.

Idle State Screen - Single Station Injector
Fig. 1



**2.2 Single Station Injector - Load State Operation**

The ProPAC-3 will enter the Load State, on receipt of either of the following:

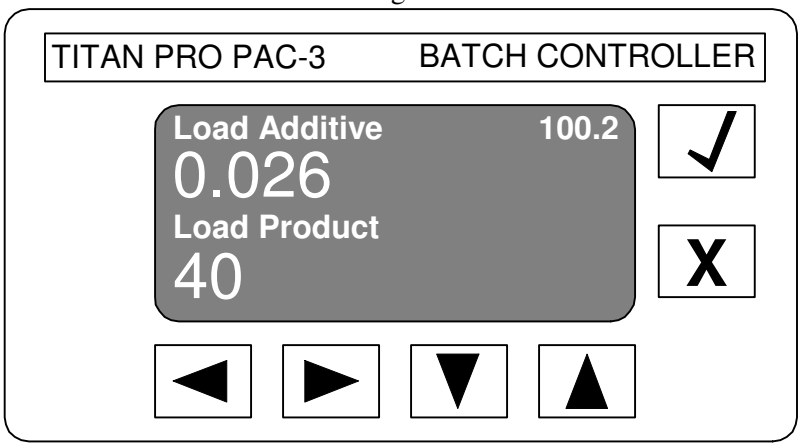
**1.** Permissive input signal. (Typically 1:1 DC input pulse)

**2.** Injection request. (Typically 40:1 AC input pulse)

On entering the Load State, the viewed screen will automatically switch from the Idle State screen (Fig. 1) to the Load State screen (Fig. 2.)

Load State Screen - During Load Event

Fig. 2




**Example**: ProPAC-3 programmed as follows:
Product Pulses (1:1 DC)
Product Set (40) - unit will inject every 40 gallons of product loaded
Additive Set (100) - unit will inject 100 cc's of additive, every 40 gallons of product loaded

The **Load Product counter** will increment in accordance with the receipt of the 1:1 product pulses. At 40 gallons product loaded, the Batch counter (upper/right corner of display) will increment from 0.0 to the value injected (100.2). As the Batch counter increments, the Load Additive counter will increment accordingly, reflecting the total additive loaded during each product load event. At the end of the product load event, the Load State screen will display the total additive and total product loaded during the product load.

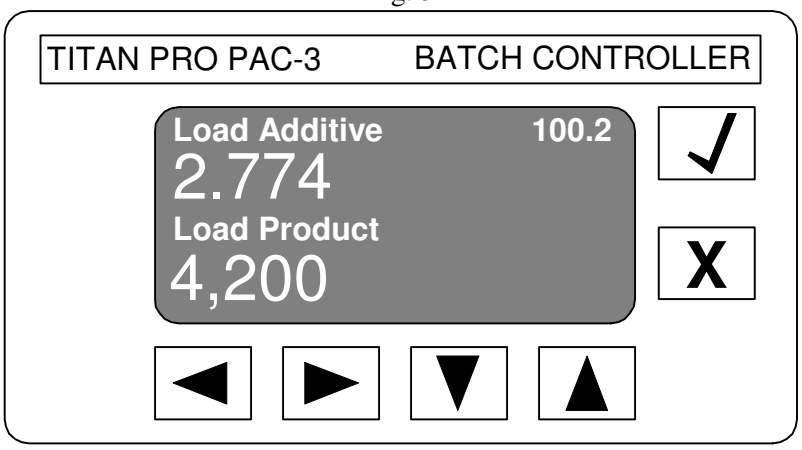
The ProPAC-3 will remain in the Load State until:

**Authorize Enabled** - The permissive input signal is removed.

**Authorize Disabled** - After the last product pulse, the time programmed in the Load Timeout.

Load State Screen - End of Load Event

Fig. 3



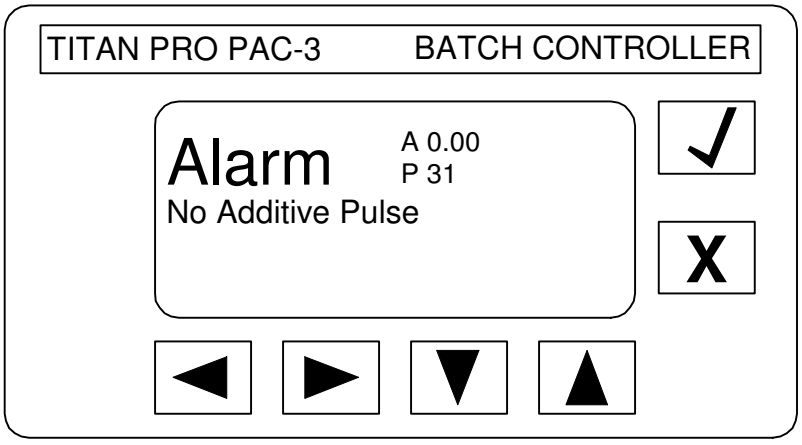
**2.3 Single Station Injector - Alarm State Operation**

There are numerous alarms provided by the Pro PAC-3. Alarms are discussed in great detail in the Alarm Section of this manual.

Alarms are typically used in an integrated control system where product loading will be terminated immediately in the event of an injector alarm. The termination of product loading insures the additive to product ratio is within prescribed limits, as specified by the user, for the entire product load. Provided the specific alarm has been programmed Enabled, anytime the injector enters an Alarm State, the Alarm State Screen shall be automatically displayed and will alternate, at five (5) second intervals, with any of the other viewed screens. For example, if the injector is loading when the alarm occurs, the Alarm State Screen will alternate (5 second intervals) with the Load State Screen (Fig. 5), as depicted in the example below.

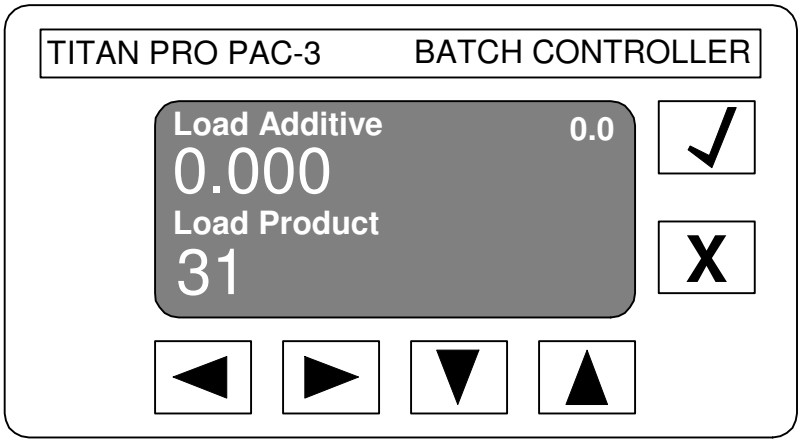
**Note:**
**1.** The termination of product loading during periods of active injector alarms is *absolutely necessary* if the user intends to insure no product leaves the terminal without the minimum concentration of additive.
**2.** The alarm display will show *inverted colors* from normal (white background with blue letters), making an active alarm more highly noticeable to local terminal personnel.
**3.** Alarms may be cleared by the following three methods:

- **a.** External "Push to Test" button provided when depressed Clears Alarms.
- **b.** Cycling the ProPAC-3 power OFF to ON.
- **c.** RS-485 serial communications protocol command.




Alarm State Screen
Fig. 4

SCREEN CYCLE
5 SECOND INTERVAL




Load State Screen
Fig. 5

**3.0 Use as: Multiple Station Injector - Up to Three (3) Injection Rates**

The ProPAC-3 injector maintains three distinct channels, and each channel maintains a set of counters providing the capability of totaling additive and product for each dedicated channel. For example, a single injector can total and account for additive at three different injection rates. Injection rate selection must be made via a dedicated hardware Permissive Input or via the serial communications protocol. Hardware inputs are typically provided by the users TAS (Terminal Automation System). When a specific input is received, the injector will inject the programmed injection rate for the selected input during the product load period. Provided three users share the same additive, the ProPAC-3 can inject and totalize additive and product loaded for all three users from a single injector. If serial communications is established, an infinite number of injection rates are available.

When the ProPAC-3 is used as a multiple station injector and wired utilizing the Permissive Input feature, the following is required, as a **minimum**, in order for the injector to function:

**1.** Power (120 VAC/60 Hz. / 230 VAC/50 Hz.)
**2.** Product Pulse (AC or DC)
**3.** Authorize feature (programmed Enabled)
**4.** Permissive Input feature (programmed 1,2, or 3)

**Recommended product features for implementation:**

**1. Permissive Output** (AC or DC) - used to terminate product loading in the event of an injector alarm, ProPAC-3 power failure, or the Pro PAC-3 power switch being positioned OFF

**2. Serial Communications** - used to document regulatory compliance for additive/product loaded, as well as, record injector alarms

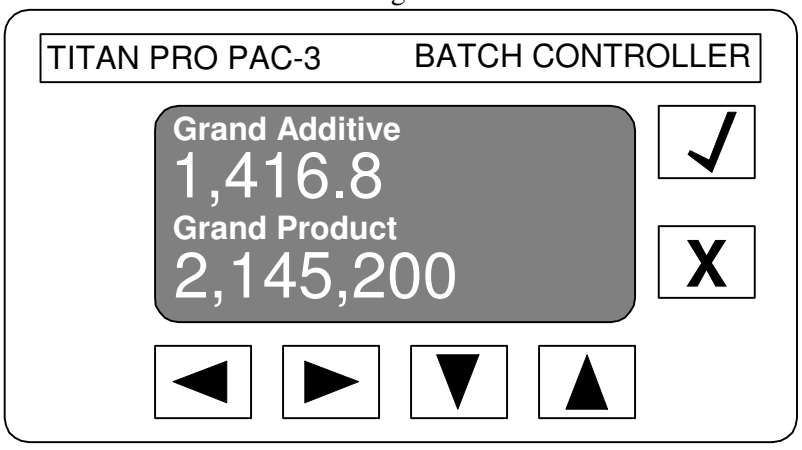
**3. Confirmation Pulse Output** (AC, DC, or mechanical) - used to terminate product loading in the event of the failure of the product pulse. Typically used when a flow switch input is not used.

**Note:** The confirmation pulse output module is located at position Output 2, on the Pro PAC-3 main circuit board.

**3.1 Multiple Station Injector - Idle State Operations**

In the Idle State (no Permissive Input received), the graphical display will cycle between the Grand Total Screen, and the Channel Total Screens. Therefore, a terminal operator may daily view and record the channel specific totals as well as the Grand Total screen (cumulative additive and product totals for all channels) without having to physically access the ProPAC-3 injector electronics.

Grand Total Screen - Idle State
Fig. 2



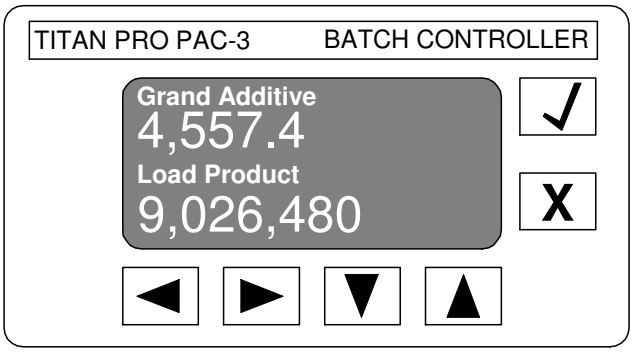

See screen cycle Fig.3 next page.

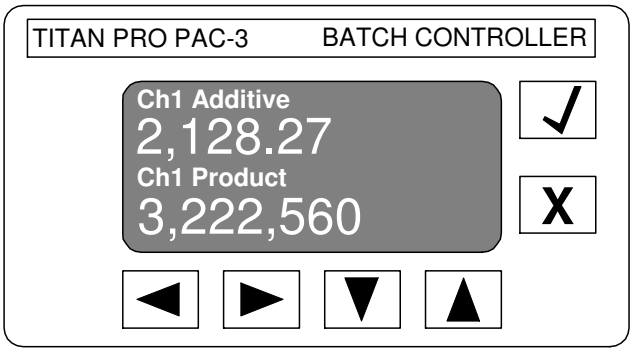
### 3.2 Multiple Station Injector - Screen Cycling Idle State Operation

In order to use multiple channels, the Permissive Input must be programmed with the number of channels desired for use (1,2, or 3) and the Authorize feature must be programmed Enable.

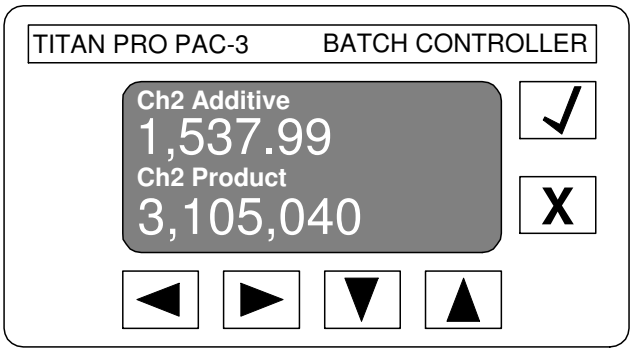
In the Idle State (no Permissive Input received), the graphical display will cycle between the Grand Total Screen, and the channel total screens. Cycling between each screen is set at 5 seconds.

Totals displayed on the Grand Total Screen represent the cumulative totals for additive and product, for all three channels.

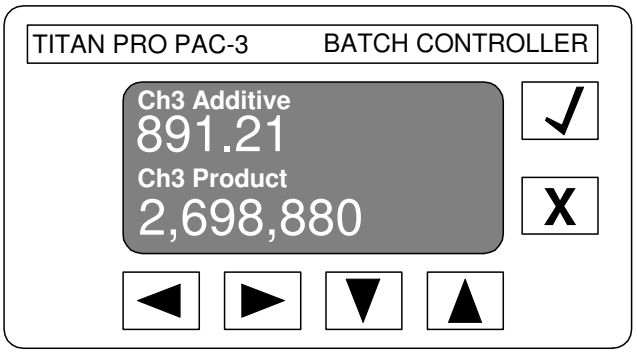



**Note**: If any one of the three channels is programmed for a different injection rate, the user will not be able to determine whether the additive to product ratio is correct from the Grand Total Screen. However, the additive to product ratio for each of the channel screens should always be within prescribed specifications.



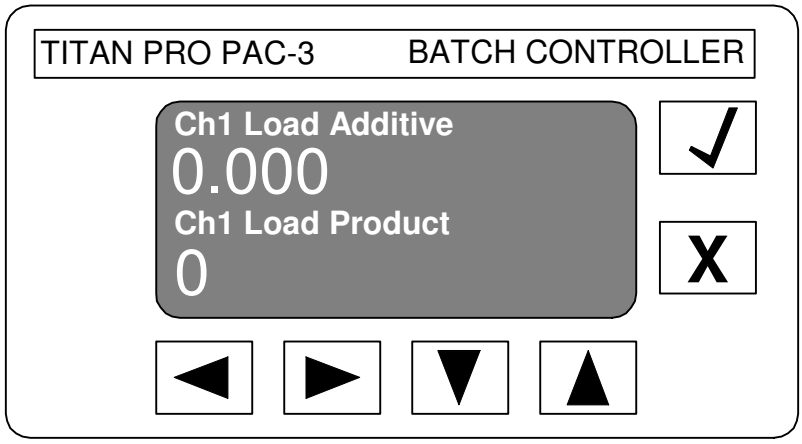

**Note**: Anytime Authorize is enabled, the graphical display will scroll through the channels in the Idle State. The number of channels scrolled will equal the number programmed in Permissive Input.



### 3.3 Multiple Station Injector - Load State Operation

Provided the ProPAC-3 is programmed Authorize-Enable, and Permissive Input programmed (1,2, or 3), on receipt of a Permissive Input (rate selection), the ProPAC-3 will enter the Load State for the channel permitted, and the injector will automatically display the appropriate Load Screen.

Load Screen - Load Start



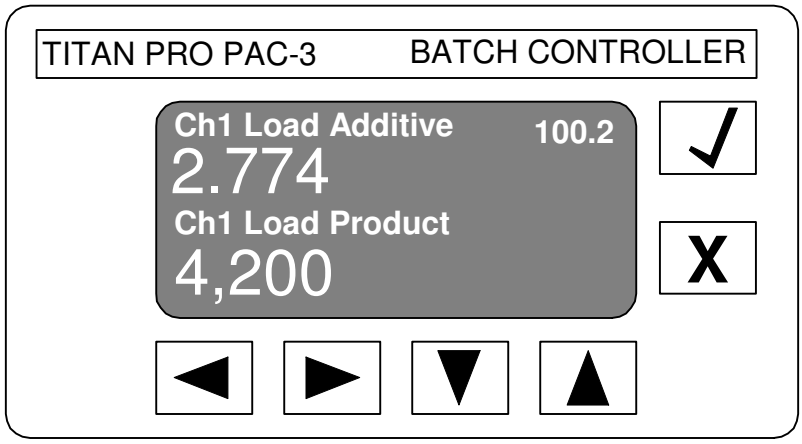

Load Additive (0.000), Load Product (0), and the Batch Injection (0.0) shall be displayed, on the receipt of product pulses.

Provided 1:1 product pulses are provided to the injector, on receipt of each pulse the Load Product total shall increment 1 gallon for each product pulse received.

If the Product Set is programmed 40, the ProPAC-3 will inject, as programmed, each 40 gallons of product loaded.

During the product load, the Batch Injection counter will increment each injection of additive, as programmed. If the Additive Set is programmed 100.00 cc's, and the Product Set is programmed 40, the ProPAC-3 will inject 100 cc's of additive every 40 gallons of product loaded.

Load Screen - Load End




**Load Additive, Load Product, and the Batch Injection** (0.0), will increment accordingly during product loading activity.

At the end of the product load, the Load Screen shall display the total additive loaded and the total product loaded during the load period. Additionally, the Batch Injection will display the last injected additive volume (cc's).

Following the removal of the Permissive Input, the ProPAC-3 will revert to cycling the various Idle State Screens.

**Note**: The Channel ID defaults: Ch1, Ch2, Ch3 can be changed to a six character alphanumeric ID. The Channel ID has been changed to Red Dye in Fig 6 next page.

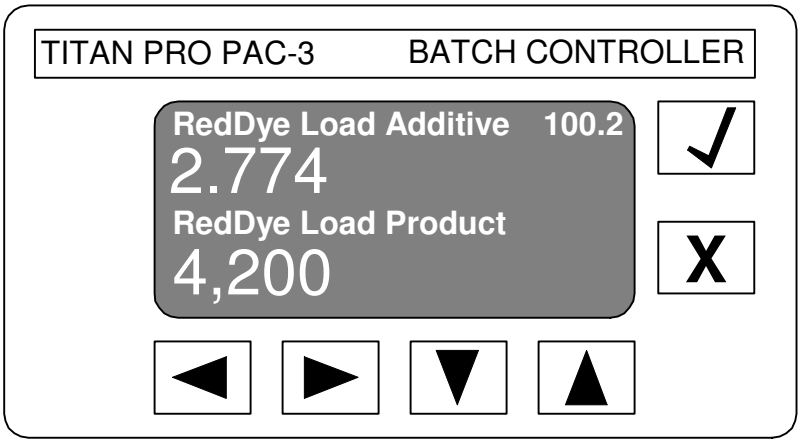



Fig. 6

**3.4 Multiple Station Injector - Alarm State Operation**

As with the single station use of the ProPAC-3, the Alarm State Screen will indicate injector alarms occurring during the Load State. The Alarm State Screen will alternate (5 second intervals) with the channel specific Load State Screen until the alarm has been reset.

When the Multiple Station Injector is in the Idle State (no Permissive Input selected) and an alarm is active, the Alarm Screen will cycle, at 5-second increments, with the various Idle State screens.

**Section 3**
**Alarm Operations**
Version 3.01

## 1.0 Introduction

The ProPAC-3 incorporates twelve (12) distinct alarms. All alarms are incorporated into the microprocessor software except one alarm, which is an integral part of the main circuit board design. The alarms are provided in order to insure the additive to product ratio during product loading is within prescribed user specifications for each and every product load. Alarms are useful in determining conditions that may adversely affect the desired additive/product ratio.

*It is important to note, the desired additive/product ratio can only be achieved if the ProPAC-3 is integrated into a control system where product loading is terminated anytime an alarm is activated.*

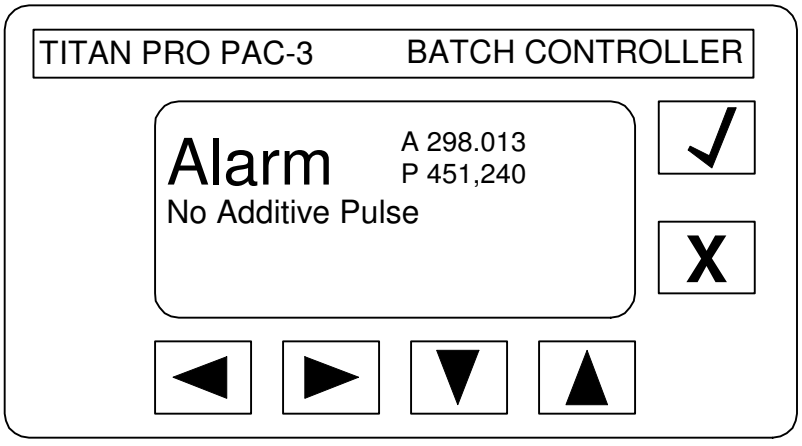
**Alarms may generally be covered by the following five category types:**

1. Failure to inject additive when required (no additive flow)
2. Unauthorized flow of additive, when additive is not required (additive leak)
3. Under injection of additive (ratio of additive to product is less than specification)
4. Over injection of additive (ratio of additive to product is more than specification)
5. Other alarm conditions not specifically related to the additive/product ratio, permissive timeout, calibration, excessive temperature.

## 1.1 Recommended System Integration

It is recommended at a minimum, that the ProPAC-3 Permissive Output be integrated into the control system, so product loading can be terminated on the activation of an injector alarm. **Termination of product loading is instrumental in insuring the integrity of the additive/product ratio**. In the event of an injector alarm, the ProPAC-3 Permissive Output relay, which is normally energized, will be de-energized. The Permissive Output relay is provided in order to simplify integration of the injector permissive output with an electronic preset, PLC or TAS. Use of the Permissive Output provides the additional advantage of prohibiting product loading in the event power is not on the ProPAC-3 or the external OFF/ON switch has been positioned to the OFF position. The Permissive Output relay may be AC, DC or mechanical dry contact (standard product).

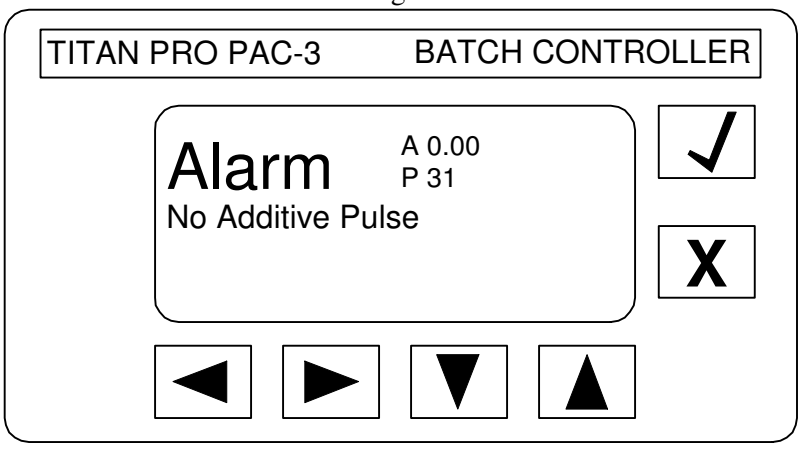
Alarm State Screen
Fig. 1



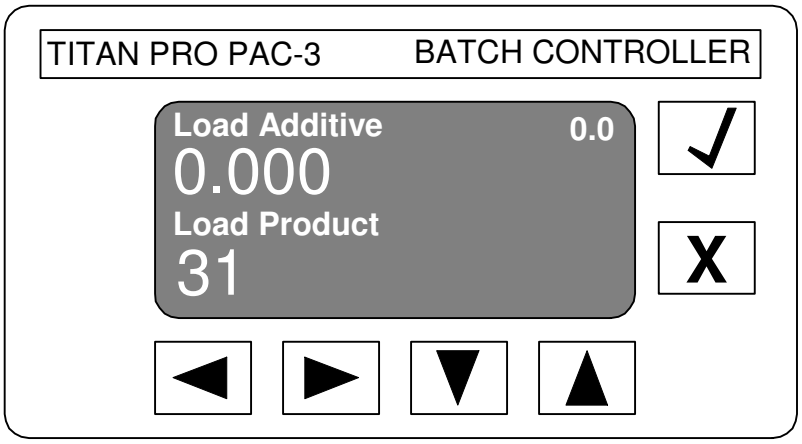
### 1.2 Alarm State

When one or more of the alarms are activated, the specific alarm(s) will be displayed on the graphical display Alarm State Screen (Fig.1). The injector will display inverted colors from normal (white background with blue letters), thereby, making the alarm highly noticeable to local terminal personnel. See screens below.
The Load Additive total (A 0.00) and the Load Product total (P31) will be displayed on the alarm screen, in addition to the alarm description (No Additive Pulse).

Alarm Cycle Screens
Fig. 2




SCREEN CYCLE
5 SECOND INTERVAL



## 2.0 Alarm - General Information

It must be emphasized that an alarm notification by itself will not insure additive/product ratio compliance. It is imperative the ProPAC-3 Permissive Output, as well as other I/O's, be integrated into the terminal control system where product loading may be terminated in the event of an injector alarm. The various I/O and programming features available in the ProPAC-3, when properly integrated, are the best means to insure regulatory compliance regarding additive/product ratios.

**ProPAC-3 Alarms may be classified as:**

**1.** Non-Programmable Alarms (cannot program Disabled))
**2**. Programmable Alarms (can program either Enabled or Disabled)

### 2.1 Resetting Alarms

**Alarms may be reset, via the following means**:

**1.** ProPAC-3 External Pushbutton. (Note: Item 1 of the Alarm Section of the program menu, the menu titled Pushbutton Clears Alarms, must be programmed Enabled)
**2.** Cycling power to the ProPAC-3 (OFF to ON)
**3.** Protocol Reset command, via the RS-485 serial communications

### 2.2 Resetting Alarms and Continue Current Load

Holding the pushbutton in for three seconds until the injector beeps can reset alarms that are caused by low or no additive flow. The injector will attempt to restart the previous load maintaining all load totals while making larger injections to get the load back into spec. This is a more sophisticated way of recovering from a low additive alarm situation. This method will assure that even when the injector goes into alarm the correct additive has been injected into the load.

## 3.0 Alarm Description

A general description for each alarm condition is provided herein.

### 3.1 Non-Programmable Alarms

There are two (2) Non-Programmable alarms. These alarms, by their nature, are always considered to be critical alarms. Therefore, there is no ability to disable any of the non-programmable alarms.

### 3.11 Fail Safe Alarm

**Problem:** Although it is highly unlikely, it is possible there could be a failure of the microprocessor programming or other event that could cause the injector to flow additive any time the additive pump was pressurized.

**Solution:** The Fail Safe alarm serves as a back-up alarm in the event of a catastrophic failure of the microprocessor or processor programming. This alarm circuitry is totally independent of the ProPAC-3 microprocessor and is incorporated into the design of the main circuit board. The alarm activates under the following condition:

The alarm circuitry monitors the energized state of the ProPAC-3 solenoid control valve. If the circuitry detects the solenoid has been energized continuously, for approximately 45 seconds, the circuitry terminates power to the solenoid, thereby, terminating the flow of additive.

**Note:** When the ProPAC-3 is in this alarmed state, further injection attempts are prohibited.

### 3.12 Excessive Temperature Alarm

**Problem:** Although it is unlikely for the microprocessor's internal temperature to exceed 180 Deg.F, even in the hottest of climates, temperatures in excess of 180 Deg.F may cause severe damage to the unit. Temperatures in excess of 180 Deg.F will invalidate the product Warranty.

**Solution:** The ProPAC-3 circuitry includes temperature monitoring of the microprocessor. If the ProPAC-3 internal temperature exceeds 180 Deg. F, the Excessive Temperature alarm will activate, thus, indicating the maximum rated temperature has been exceeded.

### 3.2 Programmable Alarms

There are ten (10) programmable alarms. These alarms may be programmed either Enabled or Disabled, as the user requires. When programmed Enabled, it is recommended the Permissive Output be used to terminate product loading.

### 3.21 Additive Flow Problem (Low Flow)

**Problem:** During certain conditions, the flow of additive may be insufficient to complete normal injections. Conditions may include a closed ball valve in the additive line, insufficient additive pump pressure, high additive viscosity, or foreign contaminates in the additive line restricting additive flow.

**Cause:** The alarm activates under the following conditions:

**1.** Conditions whereby additive flow is occurring, but at a reduced flow rate. It is likely a second injection request may be received by the ProPAC-3 microprocessor, while the injector is attempting to complete a previous injection request. If the injector is unable to complete three (3) consecutive injection requests, the alarm will activate. However, the injector will continue to attempt to inject additive, provided the ProPAC-3 can complete at least one injection within 30 seconds.

**2.** When the solenoid is energized continuously for >30 seconds, thereby, attempting to complete just one injection request, the injector will activate the Additive Flow Problem alarm. However, under this condition, further injection attempts shall be prohibited.

**Troubleshooting:** Check to make sure all valves in the additive system are fully open. Check the additive pump pressure when several injectors are in use simultaneously.

### 3.22 No Additive Pulse (Additive Pulse Failure)

**Problem:** Additive flow is determined by the ProPAC-3 microprocessor by counting additive pulse counts as the flow meter gears rotate. The two gears in the flow meter are rotated by the additive flow through the meter. Counting is accomplished via a Hall-Effect sensor. It is possible the additive flow meter pulse counts from the Titan flow meter are not received by the microprocessor following an injection request. This problem could cause the solenoid to remain energized (open) for an extended period of time in an attempt to complete the injection request. The No Additive Pulse Alarm will provide an indication to terminal personnel of the problem.

**Cause:** The alarm activates whenever an injection request has been made (attempt to inject) and no additive counts are counted by the microprocessor. In the event the microprocessor does not count additive pulses from the Titan additive flow meter within 25 seconds of an injection request, the unit will alarm. When the ProPAC-3 is in this alarmed state, further injection attempts are prohibited. The alarm will activate under the following conditions:

**1.** Failure of the additive pump/motor to be permitted ON when product pulses are sent to the injector.

**2.** Failure of the Hall-Effect sensor.

**3.** Failure of the additive flow meter gears to turn freely.

**4.** Loss of additive pump pressure.

**5.** Closed ball valve.

**6.** Check valve installed in the wrong direction.

**7**. Solenoid failure.

**Troubleshooting:** Check to make sure all valves in the additive system are fully open. Check the additive pump pressure when several injectors are in use simultaneously. Open the test port and make a test injection (have a bucket ready under the test port!!!) If additive pours through the injector without being registered on the injector, either the Hall-effect sensor is bad or the meter gears are stuck. If no additive flows through the injector, the solenoid has probably failed.

### 3.23 No Product Pulse

**Problem:** The alarm is used to detect the loss or failure of the product pulse (typically 40:1 or 1:1), which is provided to the additive injector. When injectors are installed and used in their simplest form, the injector simply injects additive on receipt of product pulses. In order for the injector to function properly,

only power and product pulses are required. If the product pulse failed, an additive injector cannot determine when it should be injecting additive.

**Cause:** When the microprocessor detects a permissive input and flow switch input, and does not receive a product pulse input within 120 seconds, the unit will alarm. When the ProPAC-3 is in this alarmed state, further injection attempts are prohibited.

**Troubleshooting:** Check the pulse input module.

### 3.24 Line Flush Failed (Line Flush)

**Problem:** The ProPAC-3 Line Flush feature provides the capability of flushing all additive or dye from the product line by the end of product loading. The alarm is used in conjunction with all means capable of product line flushing. Incomplete flushing will cause contaminated product to remain in the product line at the end of product loading.

**Cause:** The user enters the volume of product to be flushed into the program. Microprocessor software is designed to count product volume following the initiation of the flush. The unit is programmed to count a specific volume of product between the initiation of the flush (typically at or near initiation of product slow flow) and the end of product loading. At the end of the product load, in the event the volume of product is less than the programmed flush volume, the unit will alarm indicating the product line has not been flushed properly. When the ProPAC-3 is in this alarmed state, further injection attempts are prohibited. The alarm activates under the following conditions:

**1.** Flush volume is too small.
**2.** Flush alarm volume is too high.
**3.** Flush Start % Decrease is set too high (Frequency Flush).

**Troubleshooting:** Enable the flush diagnostic screen (See Section 1 - pg. 9). Call Titan Technical Support for additional help.

### 3.25 Permissive Timeout Error (Permissive Timeout)

**Problem:** It is possible a Permissive Input (hardware or software) is received by the injector, yet no product pulses are received. If the injector software recognizes a new product load is to commence (reason for the permissive), however, no product pulses are received within 120 seconds, the software can not determine whether there has been a product pulse failure or whether the injector was falsely permitted with no real intent to load product.

**Cause:** The alarm may be used for applications where either hardware or software permissive inputs are used but no flow switch is used. If the injector receives the permissive and no product pulses are detected, for a period of 120 seconds, the alarm will activate. Note: When the permissive is removed, the alarm will automatically reset.

**Troubleshooting:** Check the pulse input module.

### 3.26 Flow Switch Failed

**Problem:** The alarm is used to detect the failure of an installed product flow switch. A flow switch may be installed in order to assist in the detection of a product pulse failure (see Alarm - Product Pulse Failed). If the flow switch fails, then the failure of a product pulse cannot be easily determined, and product could be loaded without additive and without any alarm indication.

**Cause:** Provided a flow switch has been installed, when the flow switch input is wired, the alarm will activate any time there are more than three (3) consecutive injection attempts with no flow switch indicating product flow (flow switch-made). When the ProPAC-3 is in this alarmed state, further injection attempts are not prohibited. Note: In order to use the feature, a product flow switch must be installed and wired correctly to the flow switch input located on the ProPAC-3 main circuit board. Additionally, both the Flow Switch Input and the Flow Switch Alarm must be programmed Enabled.

**Troubleshooting:** First check the flow switch input module. If the problem continues, the flow switch has probably failed.

### 3.27 Additive Permissive Fail

**Problem:** Used with Authorize permissive feature (software permissive). It is possible once software permissive (rate selection) is provided, the active Authorize permissive changes to a different Authorize permissive. Thereby, providing an inconsistency, as to the desired injection rate.

**Cause:** The ProPAC-3 software is designed to alarm in the event of an inconsistency between two or more Authorize rate selections for over 30 seconds. The Authorize permissive must go to zero (0) permissive state within 30 seconds or the unit will alarm. Note: Alarm will automatically reset after all Authorize commands are removed for a period of time.

**Troubleshooting:** Call Terminal Automation System (TAS) vendor.

### 3.28 Calibration Alarm

**Problem:** Current EPA regulations require the periodic calibration of each additive injector and the documentation of the date of the last calibration.

**Cause:** The ProPAC-3 can provide a quarterly Calibration Alarm by utilizing the on board Real Time Clock (RTC). The alarm assists the user in assuring regulatory compliance. When the ProPAC-3 is in this alarmed state, it does not prevent further injection attempts. The alarm is activated when the injector has not been calibrated for a period of three months.

**Troubleshooting:** Calibrate the injector.

### 3.29 Additive Quantity Alarm

**Problem:** Although it is unlikely during most normal operations, it is possible the injector may under inject or over inject additive during a load without the injector entering any of the previous alarm states. The following may contribute to this condition:

**1.** Additive pre-load feature is used and the product load is terminated soon after the start of the product load. Under this condition, additive is pre-loaded on the front end of the load to make up for the additive not injected during product line flushing. If product loading is terminated early in the load, the additive quantity may be high (depending on program setting for the Quantity Alarm-High).

**2.** Excessive product is flushed at the end of a load. This condition may adversely affect the additive/product ratio by making the additive quantity out of programmed specifications.

**3.** Frequency flush is activated early because of changes in product flow rate caused by varying product line pressure.

**Cause:** Depending on user programming, the ProPAC-3 will alarm anytime the additive/product ratio exceeds either the upper or lower programmed limits, thus providing an on-line continuous product quality check during product loading. When the ProPAC-3 is in this alarmed state, it does not prevent further injection attempts.

**Troubleshooting:** Many times this alarm will occur in conjunction with one of the other injector alarms. If so, follow the troubleshooting instructions for that alarm. If not, call Titan for additional assistance.

### 3.3 Solenoid Leak Detection

**Problem:** The Solenoid Leak Detection alarm is designed to prevent a gross over injection of additive, loss of additive, and the unauthorized flow of additive. The alarm is activated when a single injection volume exceeds twice the programmed volume.

**Cause:** There are several conditions that can cause this alarm:

**1.** Leakage of the solenoid control valve may occur due to worn or damaged seals in the solenoid or the presence of a foreign object inhibiting valve closure.
Product under pressure may leak in a reverse direction through the ProPAC-3 additive flow meter, falsely indicating additive flow. Additive installations should always include a ball valve and a check installed on the additive line at the additive injection point.

**2.** Air in the additive supply lines may cause "gear rocking" in the additive flow meter. This rocking is registered in the injector as a leak.

**3.** The injection rate may be set too low for the injector to control. In this case, the injector will enter the alarm state almost immediately after the first injection.

**4**. It is possible the microprocessor's solid-state relay that is used to energize the solenoid control valve could fail in the energized position causing the injector to flow additive anytime the additive pump was pressurized.

**Troubleshooting:** Turn on the additive pump and open the test port on the injector (Have a bucket ready under the test port!!!) If additive leaks from the test port, the solenoid seat is leaking. If additive is not leaking from the test port, push the test injection button. If the injection occurs so fast that you can't distinguish between the solenoid opening and closing, then the injection rate is too low for the injector to control. To fix this problem, partially close the outlet ball valve on the injector until each injection lasts for 1-2 seconds. If all else fails, the meter gears are probably rocking back and forth due to air in the additive supply lines. A riser tube installed in the additive supply tubing will probably solve this problem.

**Section 4**
**Field Calibration Instructions**
Version 3.01

## 1.0 Background

The EPA is currently mandating that all additive injectors be calibrated at least two times per year. Injector calibration insures the **indicated volume** dispensed (additive indicated on ProPAC-3 display) represents the **actual volume** dispensed. Calibration is affected by several factors including additive viscosity, pressure, meter-to-meter variation and the volume of additive injected. Often, additive viscosity changes greatly with temperature, thereby, necessitating the need for quarterly (seasonal) calibration.

The ProPAC-3 utilizes a positive displacement flow meter that provides additive pulses to the injector microprocessor. Each additive pulse represents a measured quantity of additive dispensed through the injector. The measured quantity varies slightly from meter to meter. The meter-to-meter variation, combined with other variations such as viscosity, necessitates the need to field calibrate the injector on site.

The value, which equates the additive flow meter pulses into a measured quantity of additive, is termed the additive K-Factor. K-Factor is defined as pulses per unit of measure. Typical additive K-Factors for the standard Titan flow meter are 2700 pulses per gallon, however, typical K-Factors for fuel additives may range from 2000-2800.

Calibration is typically performed by injecting additive into a 1000 ml graduated cylinder. The ProPAC-3 is calibrated by adjusting the Additive K-Factor (program menu), until the indicated volume dispensed equals the actual volume of additive dispensed into the graduated cylinder.

## 2.0 Calculating the Additive K-Factor

There are two recommended methods, which may be used to calculate the Additive K-Factor, the Automated Calibration method and Manual Calibration method.

**Automated Calibration -** The ProPAC-3 incorporates unique software that automatically calculates the additive K-Factor for the user. The user is required to use a graduated cylinder, follow directions displayed on the graphical display, and enter the actual volume of additive dispensed into the cylinder following the calibration. The user will enter the actual volume dispensed (cc's) into the ProPAC-3 program software. The software calculates and automatically changes the K-Factor to the newly computed value. The new Additive K-Factor is displayed for a period of time, so it may be recorded by the user in a calibration log.

**Step 1** - Enter the ProPAC-3 program. Insure Calibration is programmed Enabled.

**Step 2** - Redirect the additive flow out the Test Port of the 3-way outlet ball valve. Crack the ball valve approximately 3/4 open in order to provide some back pressure and reduce the flow of additive. With a slop oil bucket under the Test Port and with the additive pump/motor positioned ON, push the Test Injection pushbutton on the side of the ProPAC-3 several times, in order to purge any air from the system. Air in the additive fluid will make injector calibration impossible to perform accurately.

**Step 3** - Following the purge of air from the system, press and hold the calibration pushbutton for three (3) seconds, then releases the pushbutton. When the pushbutton is released, the display prompts the user to prepare for the Automatic Calibration.

**Step 4** - Follow instructions provided on the graphical display. Several calibrations may be required in order for the displayed additive volume to match the actual volume of additive injected.

**Step 5** - When the calibration is complete, document the new additive K-Factor.

**Step 6** - Remember to return the 3-way outlet ball valve to the product side of the outlet, and plug the Test outlet, if required. Also, turn the additive pump/motor selector to the normal Automatic position. The ProPAC-3 is now ready for normal operation.

**Manual Calibration -** Calibration may be performed manually, as previous injectors were calibrated.

**Step 1** - Enter the program and annotate the current Additive K-Factor.
**Step 2** - Exit the program
**Step 3** - Redirect the additive flow out the Test Port of the 3-way outlet ball valve. Crack the ball valve approximately 3/4 open, in order to provide some back pressure and reduce the flow of additive. With a slop oil bucket under the Test Port and with the additive pump/motor positioned ON, push the Test Injection pushbutton on the side of the ProPAC-3 several times, in order to purge any air from the system. Air in the additive fluid will make injector calibration impossible to perform accurately.
**Step 4** - With a graduated cylinder under the Test Port, push the Test Injection pushbutton approximately ten (10) times. Insure there is minimal residual additive in the cylinder.

***Caution**: Insure the graduated cylinder can adequately contain ten (10) injections at the current injection rate (cc's per injection). **Do not exceed the cylinder capacity**.*

Using the ProPAC-3 Calibration Sheet (next two pages), note each batch injection value, as each injection is made. See attached example. The batch injection value is located in the upper right corner of the graphical display. Total all batch injection volumes obtained during the calibration testing, as the total shall be used in the calculation formula. Also, record the actual volume of additive in the graduated cylinder, after the air bubbles escape.

**Step 5** - Calculate the new additive K-Factor utilizing the following calculation:

$$\text{New Additive K-Factor} = \frac{\text{(Current K-Factor X Total Batch Injection Volume)}}{\text{Graduated Cylinder Total}}$$

**Step 6** - Enter the new Additive K-Factor in software programming.
**Step 7** - Exit the program.
**Step 8** - Repeat Steps 3 through 7 until the actual volume injected into the cylinder equals the Total batch injection volume noted, or until the volumes are within 0.5% of each other. The user may elect to have the cylinder volume be slightly more than the displayed volume, thereby, insuring a slight over injection of additive.
**Step 9** - Remember to return the 3-way outlet ball valve to the product side of the outlet, and plug the Test outlet, if required. Also, turn the additive pump/motor selector to the normal Automatic position. The ProPAC-3 is now ready for normal operation.

**Useful Calculations:**
(1) US gallon = 3785.4118 cc's

$$\frac{\text{Injection Rate per 1,000 gal. of product X 3785.4118}}{25} = \text{cc's per 40 gallons (Additive Set)}$$

$$\text{Example : } \frac{0.750 \text{ X } 3785.4118}{25} = 113.5624 \text{ cc's per 40 gallons (Additive Set)}$$

**ProPAC3 Calibration Sheet**

| Location | Injector # | By | Date |
|---|---|---|---|
| | | | |

| Beginning K-Factor | |
|---|---|

| | Trial # 1 | Trial # 2 | Trail # 3 | Trial # 4 |
|---|---|---|---|---|
| Test Injection #1 | | | | |
| Test Injection #2 | | | | |
| Test Injection #3 | | | | |
| Test Injection #4 | | | | |
| Test Injection #5 | | | | |
| Test Injection #6 | | | | |
| Test Injection #7 | | | | |
| Test Injection #8 | | | | |
| Test Injection #9 | | | | |
| Test Injection #10 | | | | |
| Test Injection #11 | | | | |
| Test Injection #12 | | | | |
| Test Injection #13 | | | | |
| Test Injection #14 | | | | |
| Test Injection #15 | | | | |
| Test Injection #16 | | | | |
| Test Injection #17 | | | | |
| Test Injection #18 | | | | |
| Test Injection #19 | | | | |
| Test Injection #20 | | | | |
| Injector Total (cc) | | | | |
| Cylinder Total (cc) | | | | |
| New K-Factor | | | | |

**ProPAC3 Calibration Sheet (Sample)**

| Location | Injector # | By | Date |
|---|---|---|---|
| Houston, TX | 1 | Rob | 1/1/2001 |

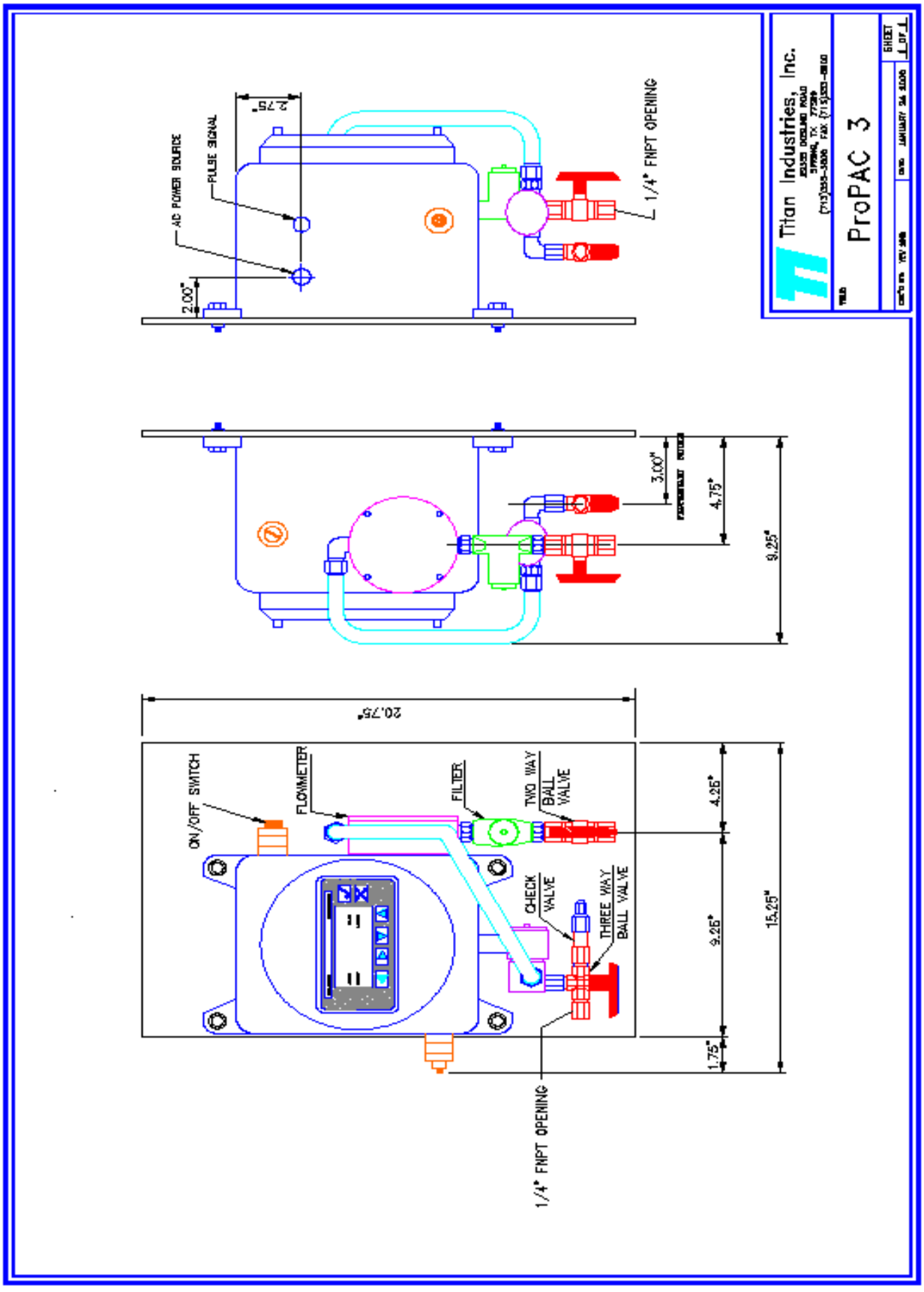
| Beginning K-Factor | 2710 |
|---|---|

| | Trial # 1 | Trial # 2 | Trail # 3 | Trial # 4 |
|---|---|---|---|---|
| Test Injection #1 | 46 | 45.5 | 45 | 45 |
| Test Injection #2 | 44.6 | 45.5 | 46 | 46 |
| Test Injection #3 | 45 | 45.5 | 44 | 44 |
| Test Injection #4 | 44 | 44 | 47 | 47 |
| Test Injection #5 | 45.5 | 44 | 43 | 43 |
| Test Injection #6 | 45.5 | 44 | 45 | 45 |
| Test Injection #7 | 45.5 | 45 | 44 | 44 |
| Test Injection #8 | 45.5 | 45 | 46 | 46 |
| Test Injection #9 | 46 | 45 | 44 | 44 |
| Test Injection #10 | 46 | 44.5 | 46 | 46 |
| Test Injection #11 | | | | |
| Test Injection #12 | | | | |
| Test Injection #13 | | | | |
| Test Injection #14 | | | | |
| Test Injection #15 | | | | |
| Test Injection #16 | | | | |
| Test Injection #17 | | | | |
| Test Injection #18 | | | | |
| Test Injection #19 | | | | |
| Test Injection #20 | | | | |
| Injector Total (cc) | 453.6 | 448 | 450.0 | 450.0 |
| Cylinder Total (cc) | 475.0 | 439.0 | 452.0 | 450.0 |
| New K-Factor | 2587.91 | 2640.96 | 2629.28 | 2629.28 |

**Section 5**
**Product Specifications**
Version 3.01

| | |
|---|---|
| PROCESS CONNECTIONS | 1/4" INLET / OUTLET / TEST (standard ProPAC-3) |
| ELECTRICAL | 120 VAC/60 HZ or 230 VAC/50 HZ. (Auto-range capable) |
| ProPAC-3 POWER | (Except solenoid valve)<br>30 WATTS WITH HEATER - OFF<br>130 WATTS WITH HEATER - ON |
| ADDITIVE INJECTION PULSE | 120 VAC Input Module (standard product)<br>DC Input Module (available as an option) |
| AC PULSE INPUT MODULE (standard) | 90-140 VAC, 115 VAC (typical) |
| TURN-ON TIME | 20 msec |
| TURN-OFF TIME | 20 msec |
| INPUT RESISTANCE | 14 KW |
| MINIMUM DROP OUT VOLTAGE | 20 VAC |
| DC PULSE INPUT MODULE (optional) | 8-30 VDC, 15 VDC (typical) |
| TURN-ON TIME | 0.025 msec |
| TURN-OFF TIME | 0.025 msec |
| INPUT RESISTANCE | 900 W |
| OTHER INPUTS | No modules in standard product (AC or DC modules optional) |
| ProPAC-3 FLOWMETER SENSOR | 12 VDC, HALL EFFECT type |
| MEMORY | Lithium Battery Backed RAM, 256 K |
| SOLENOID CONTROL VALVE | 120 VAC/60 Hz, 24 Watt (standard product) |
| PERMISSIVE OUTPUT | Mechanical Relay (standard) see manual for optional AC/DC |
| OTHER OUTPUTS | No modules in standard product (AC, DC or mechanical option) |
| ENCLOSURE HEATER | 120 VAC, 100 WATTS (with heater ON) |
| THERMOSTAT HEATER CONTROL | ON below: 40 Deg. F<br>OFF above: 55 Deg. F |
| OUTPUT INTRUMENT POWER | +/- 12 VDC 250 ma<br>+5 VDC 500 ma |
| PAC-3 OPERATING TEMPERATURE (Ambient O.A.T.) | (Ambient O.A.T.) |
| LOW TEMPERATURE (with heater ON) | -40 Deg. F |
| HIGH TEMPERATURE (with heater OFF) | +132 Deg. F<br>Note: Excessive Temperature Alarm activates at 180 Deg.F |
| MATERIALS OF CONSTRUCTION | 300 series stainless steel, Teflon |
| OPERATING PRESSURE | 250 PSIG Maximum (Std.) / 1000 PSIG (optional)<br>145 PSIG Maximum Differential Pressures |
| PAC-3 FLOW METER ACCURACY | .05 % of rate (system accuracy 0.5%) |
| WEIGHT | 40 pounds |
| RECOMMENDED PANEL SPACING | 6 Inches |
| INJECTION VOLUME PER CYCLE | Minimum 5 CC standard product (Note 1)<br>Maximum + 685 CC standard product (Note 2) |

Note 1: Lower injection rates optional.
Note 2: Higher injection rates optional.


Titan Industries, Inc.
ProPAC 3
AC POWER SOURCE
PULSE SIGNAL
2.00"
2.75"
1/4" FNPT OPENING
3.00"
4.75"
9.25"
20.75"
ON/OFF SWITCH
FLOWMETER
FILTER
TWO WAY BALL VALVE
CHECK VALVE
THREE WAY BALL VALVE
4.25"
9.25"
15.25"
1.75"
1/4" FNPT OPENING

**Section 6**
**Field Installation / Illustrations**
Version 3.01

**Electrical Considerations**

**1.** Insure all conduit openings are sealed properly following the installation of all required field wiring, thereby, prohibiting water from entering the enclosure. Alterations to the enclosure void both the UL Listing and the product Warranty.

**2.** Insure the desired I/O modules are installed prior to operation. All I/O modules may be solid state AC or DC modules. Some output modules may be mechanical.

**3.** If PAC-3 injectors are being upgraded to the ProPAC-3 model, the existing wiring may have to be replaced if it is too short. The existing PAC-3 Hall effect sensor should be replaced with the short version of the sensor designed for the ProPAC-3.

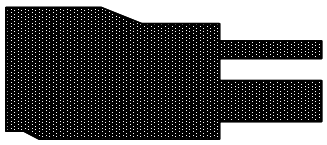
**4.** Insure all DC I/O and communications wiring is installed in a separate conduit from any AC wiring. AC wiring should be run in dedicated conduit for AC.

**5.** All DC I/O and serial communications wiring should be shielded Belden cable, in order to protect the signal integrity.

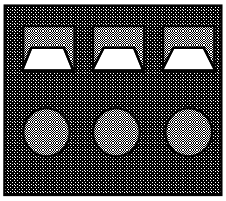
**6.** The ProPAC-3 utilizes solid-state relays for all inputs. Because of the potential for current leakage when using a solid-state device, never provide inputs to the ProPAC-3, which originate from a solid-state device unless a resistor is installed to "bleed down" the current leakage.

**7.** The ProPAC-3 main circuit board utilizes Wago connectors for all AC, DC and serial communications connections. Wago connectors are a very high quality connector providing a positive lock on the wiring. A special Wago tool is provided in connector P4 (Power) and is useful for terminating all electrical connections. The Wago tool is used as a lever to open the connection for wiring. Insure the wire is engaged properly and not the wiring insulation.

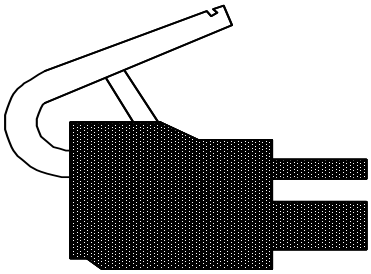
**Note:** If the Wago tool is not installed, a miniature flat head screwdriver (-0.125"/ 3mm) may be used to open the connector for wiring. See below.



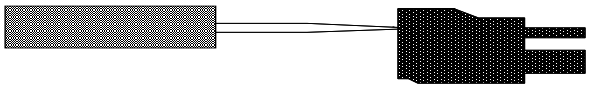
Wago
Side View



Wago
Front View



Side View
Wago Tool Installed



Side View
Miniature Screw Driver
Installed

**Mechanical Considerations**

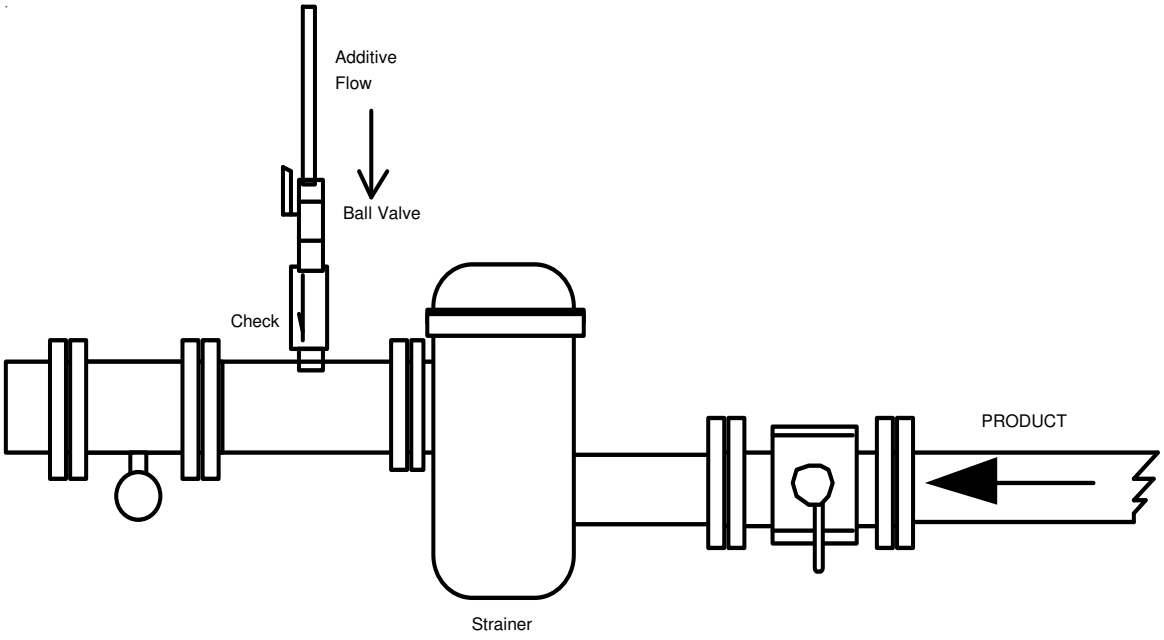
**1.** Where possible, allow 6" spacing between injector mounting plates.

**2.** The ProPAC-3 will arrive with the AC power wiring pre-wired by Titan. The 18" leads for AC power is the only wiring provided. No electrical conduit, seal-off, or junction box is provided.

**3.** The additive line-feeding additive to the injectors must be large enough to provide the minimum volume of additive for all injectors operating simultaneously. It is recommended the additive pump and motor, and the additive feed lines be sized for 200% of maximum flow required.

**4.** Any restriction in the additive feed line reducing maximum required flow will cause the injectors to alarm indicating an additive flow problem. Example: Required minimum additive feed to injectors is 5.0 gpm and an Oval Gear Meter is in the additive feed line downstream of the discharge of the pump. The Oval Gear Meter will only allow 2.8 gpm of additive flow, consequently, the injectors will alarm.

**5.** At the additive injection point, for each injector, it is absolutely necessary that a check valve and a ball valve be installed. Do not rely on the injector check valve alone to prevent product flow. It is highly possible a leaking check valve will allow product under pressure to flow through the ProPAC-3 in a reverse direction. The solenoid control valve is not designed to prevent flow in a reverse direction. Product flow through the injector flow meter will cause the injector to alarm indicating a Leak Alarm.




**6.** In order for additive to inject into a product line, the additive pressure at the point of injection must be a minimum of 25 psig above the product pressure (differential pressure). The additive pump and the additive motor must be size correctly in order to provide the minimum pressure differential and additive flow rate required. Typical additive pump pressures average approximately 150 psig, however, each site requires individual considerations.

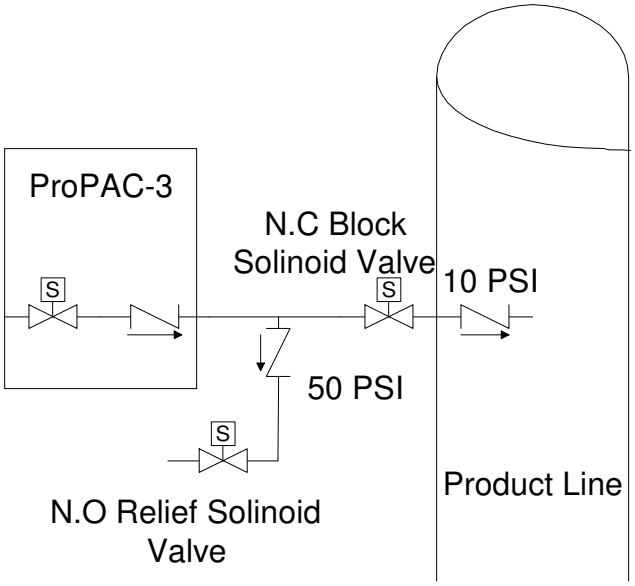
**7.** The installation should provide adequate additive pump pressure to the injector for the entire load. It has been noted, at some locations, it is possible the additive pump/motor are turned OFF as the last gallon of product is loaded. If the injection rate is high and residual additive pressure is insufficient, the last injection may not be completed, thereby, initiating an alarm. It may be practical to install a time delay relay, thereby, extending the time before the additive pump/motor is turned OFF at the end of a product load.

**8.** Install the ProPAC-3 where the graphical display is at normal eye level. This level will enhance the viewing angle of the graphical display and make servicing easier to perform.

**Dye System Considerations**

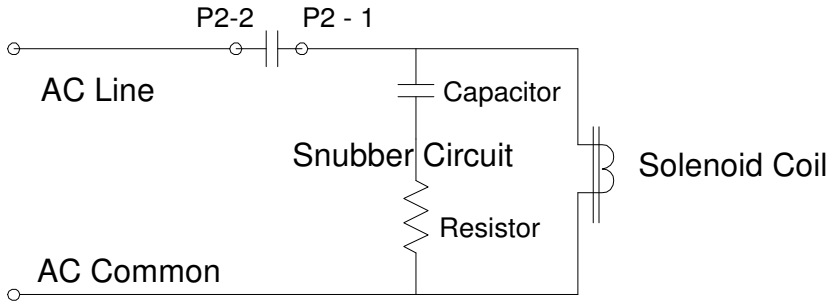
The ProPAC-3 incorporates a specially designed output for product line flush situations. Dyed and clear products are to be loaded from the same load arm. The Blocking Control Valve is used to minimize the capillary effect of the dye leaching into the product line after the product line is flushed. The Blocking Control Valve Output contact is closed when the injector is authorized and opened when line flush is initiated. The Blocking Control Valve Output contact is also activated when the test injection button is used to put extra dye into a particular load.

The following is a recommended installation configuration. The Blocking Control Valve output is on terminals 1 and 2 on P2. This output is only available by installing a dual output module into output module location 1.




**Note:** A **Snubber network** should be installed across the Blocking Control Valve. The Snubber will eliminate electrical back feed that is generated by de-energizing the Control Valve solenoid. This back feed can cause the injector to go into Solenoid Leak Detection Alarm when the line flush is initiated. This Snubber can be made with a .1 µf capacitor with at least a 120 Voltage rating (not electrolytic) and 100 OHM resistors. For maximum noise reduction the Snubber should be mounted as close to the solenoid as possible.

**Snubber Network:**




All the above dye system components can be ordered from Titan Industries.

## ProPAC-3 Main Circuit Board I/O Configuration

Up to three (3) permissive inputs are programmable in the ProPAC-3 additive injector. Depending on the features enabled, the same modules and wiring terminations can be used for different features. The following charts define which modules and module locations that should be used for the combination of features enabled.

**Step 1:** Choose the row with the number of permissives to determine the correct I/O configuration:

| Input Options | 1 Permissive Programmed with Optional Flow Switch with Optional Line Flush | 2 Permissives Programmed with Optional Flow Switch with Optional Line Flush | 3 Permissives Programmed with Optional Flow Switch with Optional Line Flush |
|---|---|---|---|
| Product Pulse | P10 pins 8,7, Input Module 1A | P10 pins 8,7, Input Module 1A | P10 pins 8,7, Input Module 1A |
| Permissive 1 | P10 pins 4,3, Input Module 2A | P10 pins 4,3, Input Module 2A | P10 pins 4,3, Input Module 2A |
| Permissive 2 | N/A | P09 pins 4,3, Input Module 3A | P09 pins 4,3, Input Module 3A |
| Permissive 3 | N/A | N/A | P10 pins 1,2, Input Module 2B |
| Flow Switch | P10 pins 1,2, Input Module 2B | P10 pins 1,2, Input Module 2B | P10 pins 5,6, Input Module 1B |
| Line Flush | P09 pins 4,3, Input Module 3A | P09 pins 4,3, Input Module 3B | P09 pins 1,2, Input Module 3B |

The standard ProPAC-3 injector utilizes input and output modules that are single channel modules (one input or output per module). Some advanced features of the ProPAC-3 require the use of optional dual input and/or dual output modules. Dual modules have either two inputs or two outputs per module location. The B portion of each module can only be accessed when a dual I/O module is installed. The following chart defines the mapping of each I/O module to its corresponding wiring termination.

**Step 2:** Based on your application, determine what type of modules needs to be installed in each location:

| Wire Terminations | | I/O Function | DC Polarity | Channel | Module Location |
|---|---|---|---|---|---|
| P10 | 8 | Product Pulse | + | A | Input Module 1 |
| P10 | 7 | Product Pulse (common) | - | A | |
| P10 | 6 | Flow Switch (common) | - | B | |
| P10 | 5 | Flow Switch | + | B | |
| P10 | 4 | Permissive 1 or Flow Switch | + | A | Input Module 2 |
| P10 | 3 | Permissive 1 or Flow Switch (common) | - | A | |
| P10 | 2 | Permissive 3 or FLow Switch (common) | - | B | |
| P10 | 1 | Permissive 3 or Flow Switch | + | B | |
| P9 | 4 | Permissive 2 or Line Flush | + | A | Input Module 3 |
| P9 | 3 | Permissive 2 or Line Flush (common) | - | A | |
| P9 | 2 | Line Flush (common) | - | B | |
| P9 | 1 | Line FLush | + | B | |

**NOTE:** For UL installations, "common" in the above chart does not necessarily refer to AC neutral. Common refers to the fact that the same (common) voltage should be maintained on these two adjacent wire terminations. For example, P10-7 and P10-6 should both have the same voltage on them.

**Dual channel** modules can be special ordered from Titan industries.

| Wire Terminations | | I/O Function | DC Polarity | Channel | Module Location |
|---|---|---|---|---|---|
| P2 | 8 | Confirmation or Scaled Output | + | A | Output Module 2 |
| P2 | 7 | Confirmation or Scaled Output (common) | - | A | |
| P2 | 6 | Alarm Output or Pump Start if enabled (common) | - | B | |
| P2 | 5 | Alarm Output or Pump Start if enabled | + | B | |
| P2 | 4 | Load Permissive or Permissed Permissive | + | A | Output Module 1 |
| P2 | 3 | Load Permissive or Permissed Permissive (common) | - | A | |
| P2 | 2 | Line Flush Block Valve (common) | - | B | |
| P2 | 1 | Line Flush BLock Valve | + | B | |

Types of modules that are available as Inputs:

| Module | Description | Input Voltage Rating | | Input Resistance | Frequency Response |
|---|---|---|---|---|---|
| | | Off | On | | |
| IDC5D | Standard DC Input Module | 0-1.0 | 2.5-28 VDC | 900 Ohms | 400 Hz |
| IDC5 | Low Frequency DC Input Module | 0-3.0 | 10-32 VDC | 1500 Ohms | 100 Hz |
| IDC5K | High Frequency DC Input Module | 0-1 | 2.5-16 VDC | 500 Ohms | 5000 Hz |
| IAC5 | 120 VAC Input Module | 45 | 90-140 VAC | 14K Ohms | 25 Hz |
| IAC5A | 240 VAC Input Module | 80 | 180-280 VAC | 43K Ohms | 25 Hz |

Types of modules that are available as Outputs:

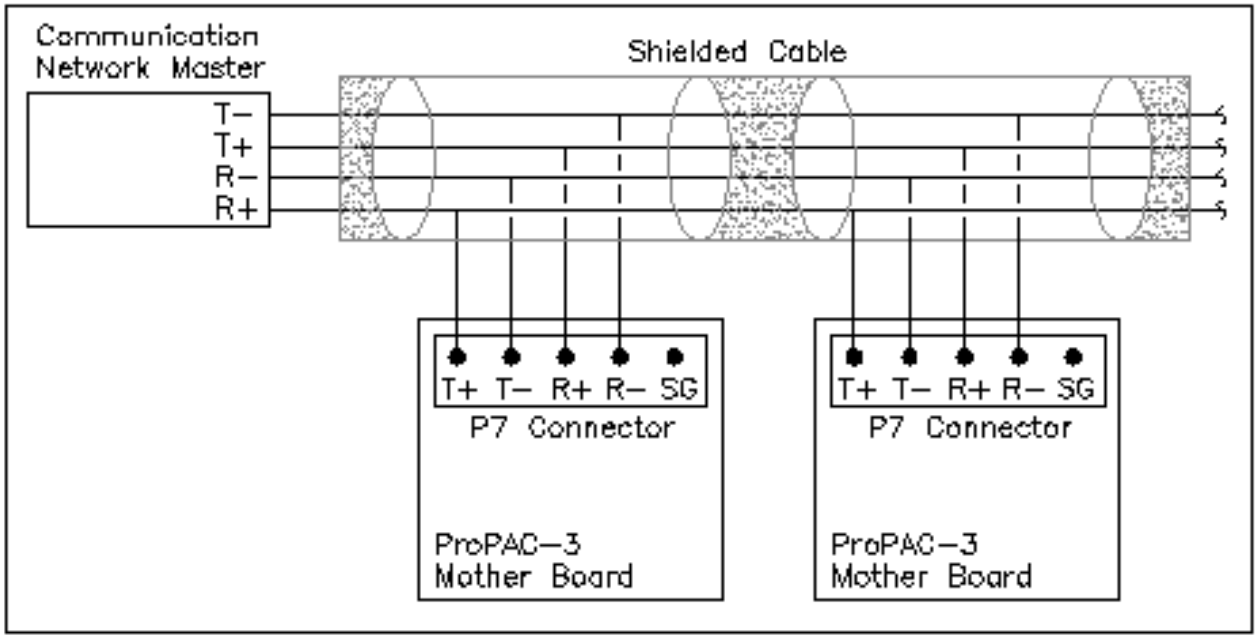
| Module | Description | Voltage Rating | Current Rating |
|---|---|---|---|
| ODC5 | Solid State DC Output Module | 60 VDC | 3.0 Amp (fused) |
| ODC5R | Relay AC/DC Output Module | 10 VA, 100 VDC, 130 VAC | 1.5 Amp (fused) |
| ODC5Rx2 | Dual Relay AC/DC Output Module | 1250 VA, 30 VDC, 250 VAC | 5.0 Amp (not fused) |
| OAC5A | Solid State AC Output Module | 24-280 VAC | 3.0 Amp (fused) |

## Communications Configuration

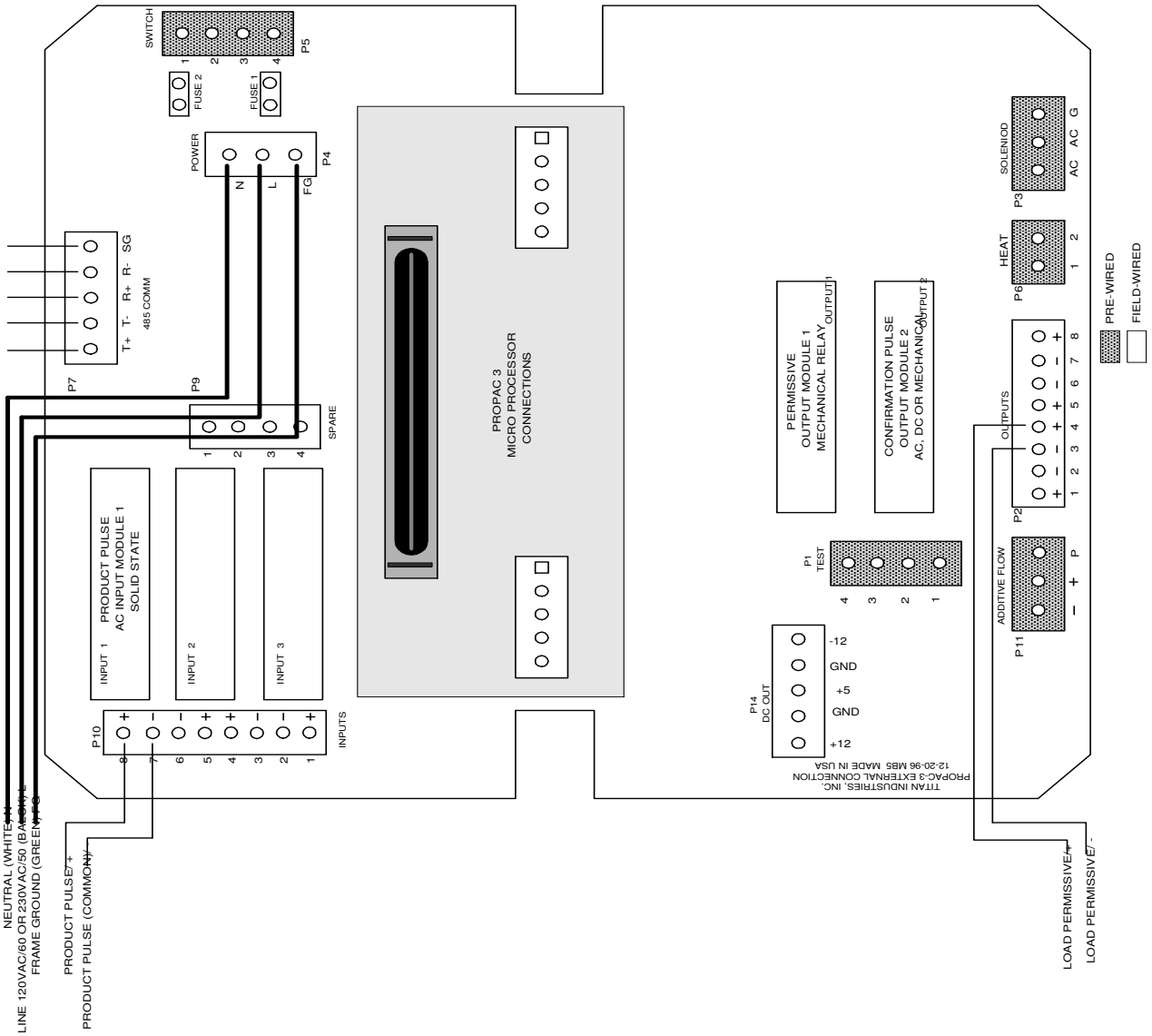
The ProPAC-3 motherboard has several communication jumpers on the upper center section of the board. The following chart defines the jumpers and their functions:

| Standard Serial Port | Extra Serial Port | Function |
|---|---|---|
| JP5 | JP12 | Connects a 120 ohm termination resistor across R+ and R- for 4-wire communications and across D+ and D- for 2-wire communications. Recommended for communication rates higher than 9600 baud or network cable lengths that exceed 1000 feet. Install only on the last injector on a network. |
| JP8 | JP13 | Connects signal ground to DC ground. This is generally not recommended. |
| JP3 | JP10 | Connects R- to T-. Converts ProPAC-3 to 2-wire RS-485 communications. D- connector becomes either the T- or R- terminal. |
| JP4 | JP11 | Connects R+ to T+. Converts ProPAC-3 to 2-wire RS-485 communications. D+ connector becomes either the T+ or R+ terminal. |

The ProPAC-3 adheres to standard EIA RS-485 hardware specifications. The RS-485 specification provides for a minimum of 32 driver/receiver pairs to be connected on a communication network with a maximum length of 4,000 feet. The cable of choice for RS-485 applications is shielded two-twisted pair with ground. The shield should maintain continuity throughout the entire network and should be grounded at a single end, usually the communication master end.



## Pro Pac-3 Main Circuit Board Wiring Schematic
## Minimum Product (AC Pulse)



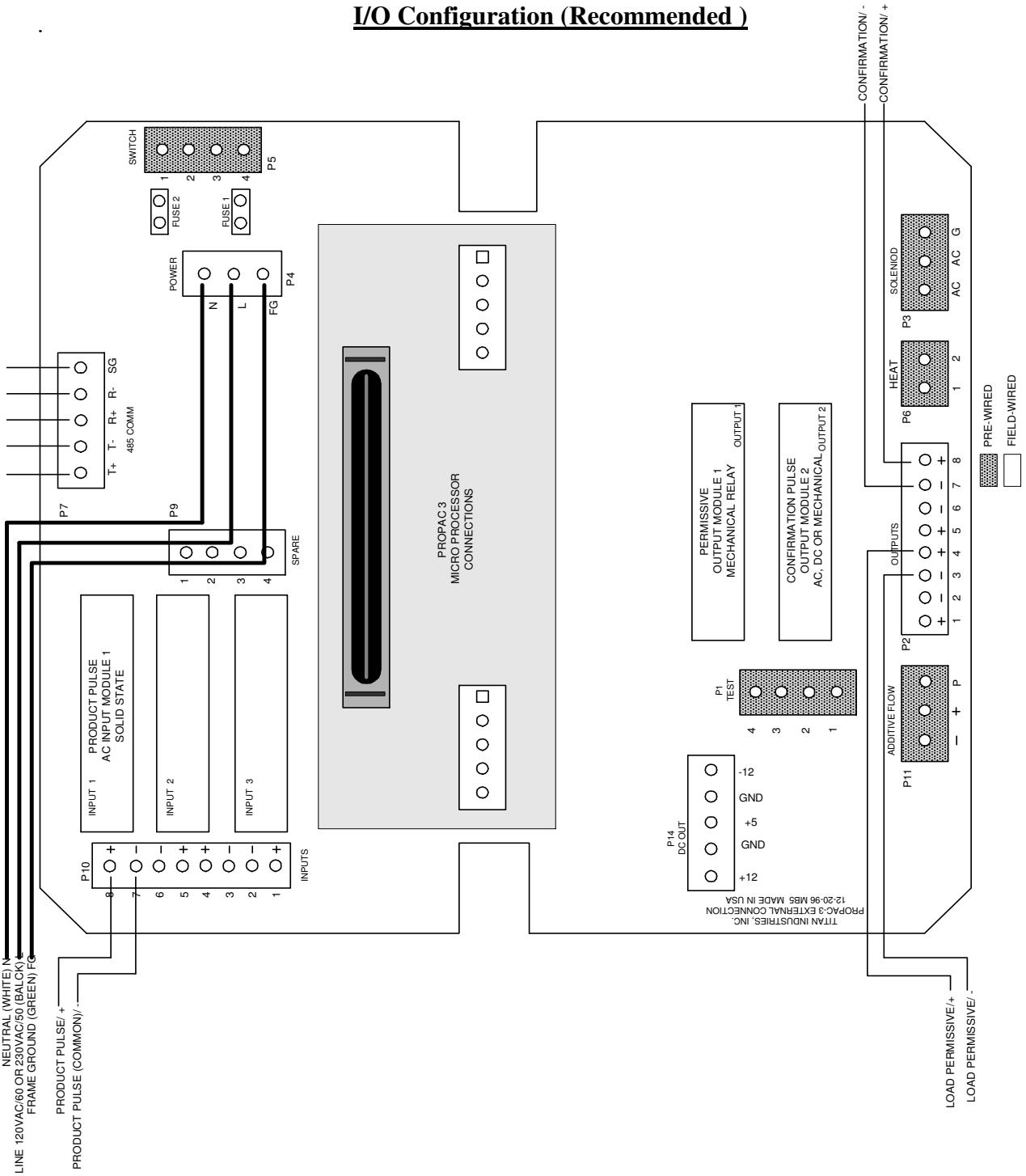

**ProPAC-3 Minimum Installation**

1. Connector P4 (AC Power) is Pre-wired with 18" leads. This is the only connector with external leads provided. Shown with bold lines.
2. Input 1 * (Opto-22, AC solid isolated state Input Module) - used for Product Pulse Input
3. Output 1 ** (Opto-22, mechanical relay Output Module) - used for injector Load Permissive Output
4. The following connectors are pre-wired and connected to ProPAC-3 system components: P5 OFF/ON Switch, P3 Solenoid, P6 Heater, P11 Additive Flow Meter, and P1*** Test Injection Button.

* ProPAC-3 may be special ordered with a DC Input Module, DC 1:1 product pulses are highly recommended by Titan Industries. Note: Shielded cable must be used if a DC input module is used. Input 1 module must match the input voltage provided to the injector.

** ProPAC-3 may be special ordered with an AC or DC Output Module. Connector P2 pin 3 (-) and Pin 4 (+) are used for Load Permissive output wiring. Please note polarity considerations.

## Pro Pac-3 Main Circuit Board Wiring Schematic
## I/O Configuration (Recommended )




**I/O Configuration (Recommended)**

**This Configuration utilizes many of the commonly used ProPAC-3 product features.**

1. Connector P4 (AC Power) is pre-wired with 18" leads. This is the only connector with external leads. Shown with bold lines.
2. Input 1 (DC Isolated solid state Input Module)
- Used for counting 1:1 Product Pulses inputs
- Shielded cable must be used when using DC product pulse inputs

Continue to next page>

3. Output 1** (mechanical relay Output Module)
-Used when Load permissive is integrated to prohibit product loading when the injector is in alarm, or when the ProPAC-3 power is OFF.
4. Output 2*** (AC Solid State, DC Solid State or Mechanical Relay Output Module)
-Used when a confirmation pulse is desired (used primarily to detect a product pulser failure)
-Confirmation pulse typically provided to electronic preset or PLC
5. RS-485 Serial Communications ****

*I/O modules for the DC Product Pulse (Input 1), and the Confirmation Pulse (Output 2) must be special ordered
(nonstandard).

**Connector P2 pin 3 (-) and pin 4 (+) are used for the Permissive Output wiring. Please note polarity considerations.

***Connector P2 pin 7 (-) and pin 8 (+) are used for Confirmation Output wiring. Please note polarity considerations.

*****Connector P7 RS-485. Shielded Belden cable must be used.

**Note 1:** When converting from a PAC-3 to a ProPAC-3. Only the two (2)red wires should be connected to pins 1 and 2 on the Test connector P1. Pins 3 and 4 are used for future purposes. If a lighted pushbutton is installed on the ProPAC-3, disconnect the black and white wires. Place wire nuts on the end of each wire to prevent electrical shorting. Installing of the black and white wires for the pushbutton, on connector P1 pin 3 and 4, may cause damage to the injector electronics. P1 - 1,2 are not ac output on the ProPAC-3. Lighted Pushbutton can be powered off the Output connector P2-5, 6 a dual output module will need to be installed in Output 2 module location.

Note 2: I/O module selections different for the modules provided on the standard product need to be special ordered with the original purchase order for ProPAC-3 injectors. However all I/O modules are field replaceable.

## ProPac-3 Spare Part List

| Injector Accessories | Part Number |
|---|---|
| Calibration Kit (one stem & one Body) | 6410 |
| Calibration Stem (Quick Release on Inj.) | 6405 |
| Calibration Body (Quick Release on Hand) | 6400 |
| Thermal Adjustable Relief Line | 5800 |
| On/Off Keylock for Switches | 9380 |
| Dye Point Kit | 9502 |
| | |
| **Injector Spare Parts** | **Part Number** |
| Microprocessor, Complete | 7000 |
| ProPAC-3 Fuse, 250 VAC | 7005 |
| ProPAC-3 Face plate Ring | 7020 |
| ProPAC-3 Motherboard | 7100 |
| ProPAC-3 Back plate. | 7200 |
| Flow meter, 1/8", with gears | 3285 |
| Flow meter, 1/4", with gears | 3210 |
| Flow meter gears, 1/8" | 3305 |
| Flow meter gears, 1/4" | 3235 |
| Flow meter gasket, 1/8" | 3320 |
| Flow meter gasket, 1/4" | 3250 |
| Pad Heater, 220 VAC | 3352 |
| Strainer | 3400 |
| Strainer Screen | 3415 |
| Strainer cap O-ring | 3418 |
| 1/4" Nupro Check Valve, 10PSI | 3455 |
| Needle Valve | 3460 |
| Ball Valve 2-way | 3465 |
| Ball Valve 3-way | 3470 |
| Asco Solenoid, 220 VAC | 3501 |
| Hall-effect Sensor | 3530 |
| Solenoid Rebuild Kit | 3535 |
| Dc Input Module (2.5-28 VDC) | 3635 |
| AC Input Module (240 VAC) | 3625 |
| DC Output Module (60 VDC) | 3655 |
| AC Output Module (240 VAC) | 3645 |
| Dual Input Module (240 VAC, 30 VDC) | 7500 |
| Dual Output Module (240 VAC, 30 VDC) | 7501 |
| ProPAC-3 On/Off Switch | 3045 |
| ProPAC-3 Push to Test Button | 3050 |
| ActionPak7500 4-20mA to Pulse | |

Call Titan Industries at (281)-353-3600 or send an email to **sales@titan-solutions.com** for price and ordering information.

## Trouble Shooting Guide for Titan PAC3 and ProPAC3

1. **Power is applied to the injector, but the display does not light up.**
   - ◆AC wiring incorrect – check power and ground wiring. Check power on other injectors.
   - ◆Auto Switch is in "Off" position – make sure the switch is in "On" position.
   - ◆Fuse (Fuse1) on the motherboard has blown – check and replace the fuse.
   - ◆Loose AC Connector (P1 on PAC3, P4 on ProPAC3) on the motherboard – check connector.
   - ◆Loose Switch Connector (P2 on PAC3, P5 on ProPAC3) – check connector.
   - ◆The microprocessor is not inserted properly – check connection.
   - ◆The microprocessor Display unit has failed – replace other microprocessor for test.

2. **The PAC3/ProPAC3 Display is on, but the injector does not inject.**
   Press the injector Test Button, if the unit injects properly, then look for the following:
   - ◆During loading – check if the LED on the Input Module is blinking. Make sure the product pulse is within the specifications for the high/low voltage (AC or DC voltage) and frequency for the Input Module.
   - ◆Loss or reduced additive pump pressure – check pump pressure (125-150 PSIG typical)
   - ◆Closed Ball Valve on injector or at the rack – open it.
   - ◆Solenoid not energized properly – check connector (P4 on PAC3, P3 on ProPAC3) on the motherboard.
   - ◆The flow meter gears are not turning freely – check for free turning.
   - ◆Solenoid Control Valve coils failed – check the AC voltage to the coil.

3. **Alarm Low Flow1 (PAC3) or Additive Flow Problem (ProPAC3) is displayed.**
   Conditions whereby additive flow is occurring, but at a reduced flow rate. It is likely a second injection request may be received by the PAC3/ProPAC3 microprocessor, while the injector is attempting to complete a previous injection request. If the injector is unable to complete 3 consecutive injection requests, the alarm will activate. Anytime the solenoid is energized continuously for > 30 seconds, thereby, attempting to complete just one injection request, the injector will activate the alarm.
   - ◆Reduced additive pump pressure – check pressure (125-150 PSIG typical) when several injectors are in used simultaneously.
   - ◆Closed or restricted Ball Valve – make sure Ball Valve is fully open.
   - ◆Additive viscosity too high – check viscosity curves.
   - ◆Strainer clogged – check strainer with power off and pressure removed.

4. **Alarm Low Flow2 (PAC3) or Additive Quantity Alarm (ProPAC3) is displayed.**
   Although it is unlikely, it is possible an under injection of additive can be made, without the injector entering Alarm Low Flow1 or Additive Flow Problem. This feature detects the actual quantity of additive injected over a programmed number of injection requests (cycles) and compares the actual quantity with the calculated quantity. Note: ProPAC3 allows the user to program Additive Quantity Low % and High % meanwhile PAC3 only allows Low %.
   - ◆Additive Pre-Load (ProPAC3) feature is enabled and the product load is terminated soon after the start of the product load. Under this condition, the additive quantity may be high (depending on the program setting for the Quantity High %) – unpredictable.
   - ◆Excessive product is flushed (ProPAc3) at the end of a load. This condition may adversely affect the additive/product ratio by making the additive quantity out of programmed specifications – make sure the amount of Flush Volume entered matches the actual volume from the injection point to the end of load arm.
   - ◆Frequency flush (ProPAC3) is activated early because of the changes in product flow rate caused by varying product line pressure – adjust the Flush Start (% Decrease).

5. **Additive Pulse Detection (PAC3) or No Additive Pulse (ProPAC3) is displayed.**

It is possible the additive flow meter pulse counts from the Titan flow meter are not received by the microprocessor following an injection request. This problem could cause the solenoid to remain energized (open) for an extended period of time in an attempt to complete the injection request. If the microprocessor does not count or detect pulses from the Titan flow meter within 30 seconds of the receipt of a valid injection request, the alarm will activate. This condition could also cause damage to the solenoid coil.

◆Failure of the additive pump and motor to be permitted ON when product pulses are sent to the injector – check pump and motor.

◆Failure of the Hall-Effect Sensor – check 12VDC output.

◆Failure of the additive flow meter to turn freely – check for free turning.

◆Check flow meter connector (P16 on PAC3, P11 on ProPAC3).

◆Loss of additive pump pressure – check pressure (125-150 PSIG).

◆Closed Ball Valve – make sure Ball Valve is open.

◆Check Valve installed in the wrong direction – open and check.

◆Solenoid failure - check connector (P4 on PAC3, P3 on ProPAC3) on the motherboard.

**Tips:** Open the Test Port and make a test injection. If additive pours through the injector without being registered on the injector (batch injection shows 0.0), either the Hall-Effect sensor is bad or the meter gears are stuck. If no additive flows through the injector, the solenoid has probably failed.

**6. Alarm High (PAC3) or Solenoid Leak Detection (ProPAC3) is displayed.**

This alarm will activate when the batch count (count up from zero to the programmed Additive Set value) exceeds 2 times the scaled Additive Set.

◆Damaged seals in the solenoid or the presence of a foreign object inhibiting valve closure – check and replace solenoid.

◆Product under pressure may leak in a reverse direction through the injector additive flow meter, falsely indicating additive flow – make sure the Ball Valve and Check

◆Valve is installed properly.

◆Air in the additive supply lines may cause "gear rocking" in the additive flow meter, this rocking is registered in the injector as a leak – install a riser tube in the additive supply tubing.

◆The microprocessor's solid-state relay that is used to energize the solenoid control valve has failed – use another microprocessor to test.

**7. Secondary Alarm (PAC3) or Fail Safe Alarm (ProPAC3) is displayed.**

Although it is unlikely, it is possible there could be a failure of the microprocessor programming or other event that could cause the injector to flow additive anytime the additive pump was pressurized. This alarm circuitry is totally independent of the microprocessor and is incorporated into the design of the motherboard. The alarm circuitry monitors the energized state of the solenoid control valve. If the circuitry detects the solenoid has been energized continuously, for approximately 45 seconds, the circuitry will terminate power to the solenoid, thereby, terminate the flow of additive.

◆Failure of the microprocessor – check and replace microprocessor.

**8. No Product Pulse (ProPAC3) is displayed.**

When the microprocessor detects a permissive input and flow switch input, and does not receive a product pulse input within 120 seconds, the alarm will activate.

◆Failure of Input Modules – check Input Module 1, 2 and, 3. Make sure the product pulse is within the specifications for the high/low voltage (AC or DC voltage) and frequency for the Input Module.

**9. The injector is injecting, but it always stops at 50 gallon of product.**

◆Failure of Output Module 1 - check the voltage between Pin3 and Pin4 of Outputs P2, it should read > 20 VDC. If it is 0 VDC or below 1 VDC, replace the module.

◆Failure of Output Module 2 - make sure the LED on Output Module 2 lights up (send confirmation pulse back to the PLC) every 40-gallon of product pulses. If it does not light up, replace the module.

**10. Inconsistent calibration.**

◆Flow meter gears damaged – inspect and replace gears.

◆Improper calibration check procedure – read Section 4 Field Calibration Instructions.

◆Inconsistent pressure differential during calibration test – make sure the differential does not fluctuate greatly during calibration test

**11. Power is applied to the injector, but the display does not light up.**

◆AC wiring incorrect – check power and ground wiring. Check power on other injectors.

◆Auto Switch is in "Off" position – make sure the switch is in "On" position.

◆Fuse (Fuse1) on the motherboard has blown – check and replace the fuse.

◆Loose AC Connector (P1 on PAC3, P4 on ProPAC3) on the motherboard – check connector.

◆Loose Switch Connector (P2 on PAC3, P5 on ProPAC3) – check connector.

◆The microprocessor is not inserted properly – check connection.

◆The microprocessor Display unit has failed – replace other microprocessor for test.

**12. The PAC3/ProPAC3 Display is on, but the injector does not inject.**

Press the injector Test Button, if the unit injects properly, then look for the following:

◆During loading – check if the LED on the Input Module is blinking. Make sure the product pulse is within the specifications for the high/low voltage (AC or DC voltage) and frequency for the Input Module.

◆Loss or reduced additive pump pressure – check pump pressure (125-150 PSIG typical)

◆Closed Ball Valve on injector or at the rack – open it.

◆Solenoid not energized properly – check connector (P4 on PAC3, P3 on ProPAC3) on the motherboard.

◆The flow meter gears are not turning freely – check for free turning.

◆Solenoid Control Valve coils failed – check the AC voltage to the coil.

**13. Alarm Low Flow1 (PAC3) or Additive Flow Problem (ProPAC3) is displayed.**

Conditions whereby additive flow is occurring, but at a reduced flow rate. It is likely a second injection request may be received by the PAC3/ProPAC3 microprocessor, while the injector is attempting to complete a previous injection request. If the injector is unable to complete 3 consecutive injection requests, the alarm will activate. Anytime the solenoid is energized continuously for > 30 seconds, thereby, attempting to complete just one injection request, the injector will activate the alarm.

◆Reduced additive pump pressure – check pressure (125-150 PSIG typical) when several injectors are in used simultaneously.

◆Closed or restricted Ball Valve – make sure Ball Valve is fully open.

◆Additive viscosity too high – check viscosity curves.

◆Strainer clogged – check strainer with power off and pressure removed.

**14. Alarm Low Flow2 (PAC3) or Additive Quantity Alarm (ProPAC3) is displayed.**

Although it is unlikely, it is possible an under injection of additive can be made, without the injector entering Alarm Low Flow1 or Additive Flow Problem. This feature detects the actual quantity of additive injected over a programmed number of injection requests (cycles) and compares the actual quantity with the calculated quantity. Note: ProPAC3 allows the user to program Additive Quantity Low % and High % meanwhile PAC3 only allows Low %.

◆Additive Pre-Load (ProPAC3) feature is enabled and the product load is terminated soon after the start of the product load. Under this condition, the additive quantity may be high (depending on the program setting for the Quantity High %) – unpredictable.

◆Excessive product is flushed (ProPAc3) at the end of a load. This condition may adversely affect the additive/product ratio by making the additive quantity out of programmed specifications – make sure the amount of Flush Volume entered matches the actual volume from the injection point to the end of load arm.

◆Frequency flush (ProPAC3) is activated early because of the changes in product flow rate caused by varying product line pressure – adjust the Flush Start (% Decrease).

**15. Additive Pulse Detection (PAC3) or No Additive Pulse (ProPAC3) is displayed.**

It is possible the additive flow meter pulse counts from the Titan flow meter are not received by the microprocessor following an injection request. This problem could cause the solenoid to remain energized (open) for an extended period of time in an attempt to complete the injection request. If the microprocessor does not count or detect pulses from the Titan flow meter within 30 seconds of the receipt of a valid injection request, the alarm will activate. This condition could also cause damage to the solenoid coil.

◆Failure of the additive pump and motor to be permitted ON when product pulses are sent to the injector – check pump and motor.
◆Failure of the Hall-Effect Sensor – check 12VDC output.
◆Failure of the additive flow meter to turn freely – check for free turning.
◆Check flow meter connector (P16 on PAC3, P11 on ProPAC3).
◆Loss of additive pump pressure – check pressure (125-150 PSIG).
◆Closed Ball Valve – make sure Ball Valve is open.
◆Check Valve installed in the wrong direction – open and check.
◆Solenoid failure - check connector (P4 on PAC3, P3 on ProPAC3) on the motherboard.

**Tips:** Open the Test Port and make a test injection. If additive pours through the injector without being registered on the injector (batch injection shows 0.0), either the Hall-Effect sensor is bad or the meter gears are stuck. If no additive flows through the injector, the solenoid has probably failed.

**16. Alarm High (PAC3) or Solenoid Leak Detection (ProPAC3) is displayed.**

This alarm will activate when the batch count (count up from zero to the programmed Additive Set value) exceeds 2 times the scaled Additive Set.

◆Damaged seals in the solenoid or the presence of a foreign object inhibiting valve closure – check and replace solenoid.
◆Product under pressure may leak in a reverse direction through the injector additive flow meter, falsely indicating additive flow – make sure the Ball Valve and Check
◆Valves are installed properly.
◆Air in the additive supply lines may cause "gear rocking" in the additive flow meter, this rocking is registered in the injector as a leak – install a riser tube in the additive supply tubing.
◆The microprocessor's solid-state relay that is used to energize the solenoid control valve has failed – use another microprocessor to test.

**17. Secondary Alarm (PAC3) or Fail Safe Alarm (ProPAC3) is displayed.**

Although it is unlikely, it is possible there could be a failure of the microprocessor programming or other event that could cause the injector to flow additive anytime the additive pump was pressurized. This alarm circuitry is totally independent of the microprocessor and is incorporated into the design of the motherboard. The alarm circuitry monitors the energized state of the solenoid control valve. If the circuitry detects the solenoid has been energized continuously, for approximately 45 seconds, the circuitry will terminate power to the solenoid, thereby, terminate the flow of additive.

◆Failure of the microprocessor – check and replace microprocessor.

**18. No Product Pulse (ProPAC3) is displayed.**

When the microprocessor detects a permissive input and flow switch input, and does not receive a product pulse input within 120 seconds, the alarm will activate.

◆Failure of Input Modules – check Input Module 1, 2 and, 3. Make sure the product pulse is within the specifications for the high/low voltage (AC or DC voltage) and frequency for the Input Module.

**19. The injector is injecting, but it always stops at 50 gallon of product.**

◆Failure of Output Module 1 - check the voltage between Pin3 and Pin4 of Outputs P2, it should read > 20 VDC. If it is 0 VDC or below 1 VDC, replace the module.

◆Failure of Output Module 2 - make sure the LED on Output Module 2 lights up (send confirmation pulse back to the PLC) every 40-gallon of product pulses. If it does not light up, replace the module.

**20. Inconsistent calibration.**

◆Flow meter gears damaged – inspect and replace gears.

◆Improper calibration check procedure – read Section 4 Field Calibration Instructions.

◆Inconsistent pressure differential during calibration test – make sure the differential does not fluctuate greatly during calibration test.

## WARRANTY

**Titan Industries, Inc. warrants its products against defects in material and workmanship, for a period of one (1) year, from the date of shipment to the Buyer.**

**The Warranty is limited to repair or replacement of the defective unit/component, at the option of Titan Industries, Inc. The Warranty is void, if the product has been altered, misused, dismantled, or otherwise abused.**

**Titan Industries, Inc. shall not, in any case, be liable for special, incidental, consequential, indirect, or other similar damages arising from the use of the Titan ProPAC-3 Injector.**

**ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE EXCLUDED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

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