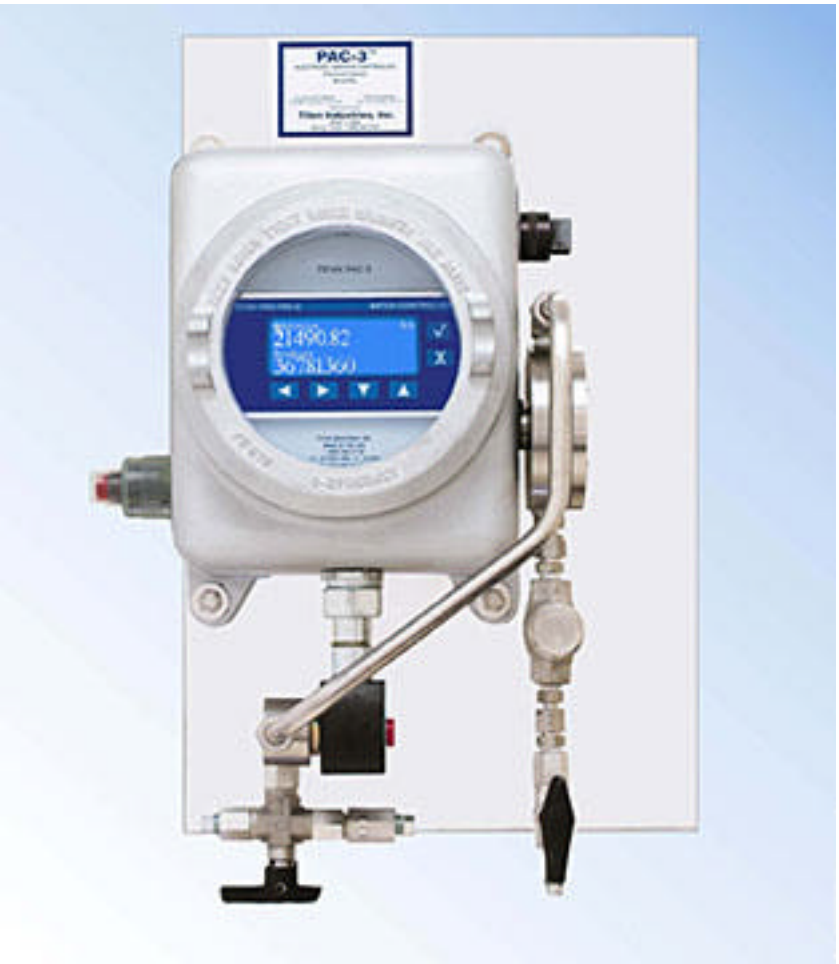
ProPAC-3
Chemical Additive Injector
General Information

ProPAC-3 3.0 & Auto-PAC 1.0



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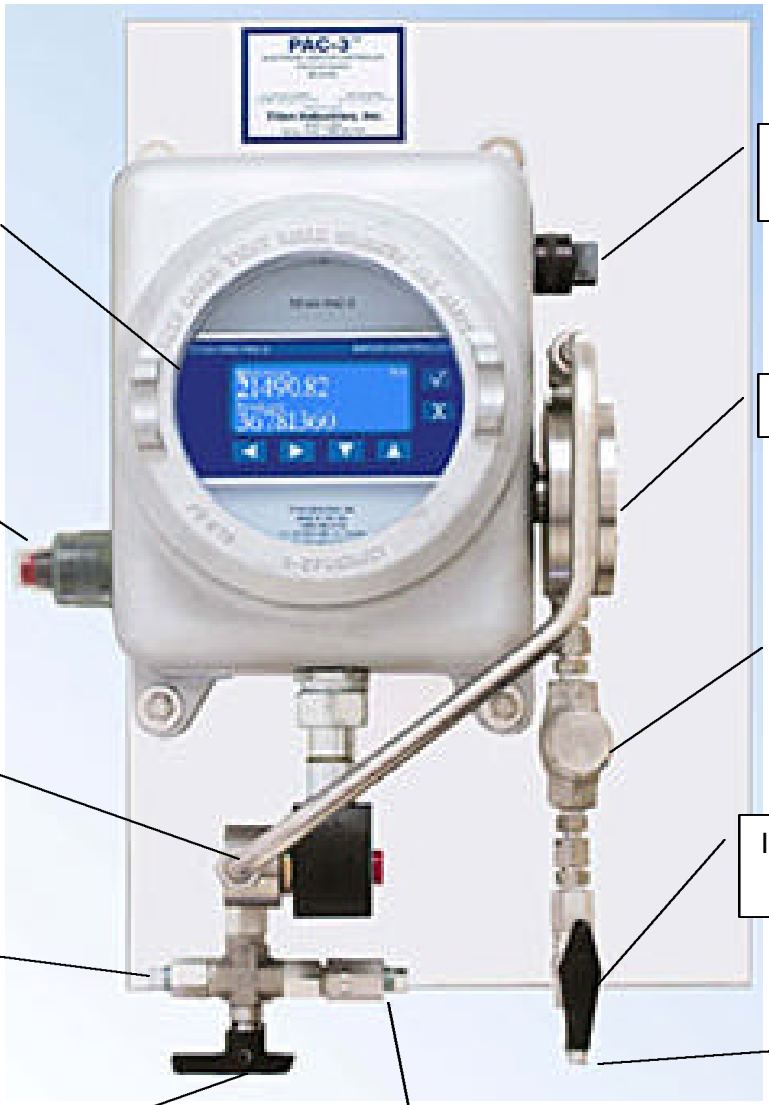

Introduction

Titan Industries, Inc. introduced the first PAC-3 injector in 1989. Since that time, the PAC-3 has enjoyed a reputation as the most accurate and reliable additive injector in the world. The ProPAC-3 injector is the latest addition to the PAC-3 family. Titan engineers totally redesigned the PAC-3 electronics, incorporating additional features that make the ProPAC-3 injector easier to install, program, and use.

General Description

The Titan ProPAC-3 additive injector is specifically designed to batch inject liquid chemical additives at petroleum product terminals. The ProPAC-3 incorporates patented hardware and software designed to accurately inject additive, thereby, insuring 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, thereby, attaining an excellent additive/product ratio. The injector includes features that will provide the highest level of EPA regulatory compliance.

Typical Operation

ProPAC-3 Proportional Injection Controller

In its simplest form, the ProPAC-3 requires only AC power, a flow pulse, and pressurized additive to operate. Additive supply pressure (125-150 psig) is provided to the inlet ball valve of the injector, via a positive displacement additive pump located on or near an additive storage tank. The injection batch begins when the ProPAC-3 microprocessor energizes the normally closed 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 flow pulses has been accumulated by the microprocessor. The flow of additive then passes through a positive displacement flow meter that generates a DC pulse train to the ProPAC-3 microprocessor, via a Hall Effect sensor. This low voltage pulse train represents the volume of additive being injected into the product stream. The additive then exits the flow meter and flows through the solenoid control valve, prior to exiting the injector. 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 ProPAC-3 microprocessor totals the additive injected, totals the product treated, verifies the additive/product ratio, and is in standby mode, awaiting the next injection batch.

Auto-PAC Automatic Timed Injection Batch Controller

Titan offers a variation of the ProPAC-3 called the Auto-PAC. The Auto-PAC 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.

The Auto-PAC has three programmable injection rates which can be selected by either an optional 4 position switch or other remote automation equipment. The Auto-PAC's maximum load volume and periodic injection features can be combined together to inject for example 10 cc' every minute for a maximum of 3 gallons of additive. The injector would inject 10 cc's every minute for approximately 19 hours then shut down the pump at the completion of the load. All ProPAC-3 shutdowns and alarms that are applicable are implemented in the Auto-PAC, and all Auto-PAC injectors can be upgraded to a ProPAC-3 injector simply by inserting a new microprocessor display unit.

Primary System Components

Microprocessor - The ProPAC-3 utilizes a state-of-the-art high speed microprocessor. The microprocessor provides all the operational, alarm, and communication functions for the injector. The microprocessor incorporates a large graphical display that displays all load, alarm, and programming information. Injectors can be upgraded from Auto-PAC to ProPAC-3 simply by replacing this unit.

Mother Board - The vertically mounted mother board serves as a terminating point for all the injector inputs and outputs. The microprocessor, all wiring, and optically isolated I/O modules plug into the mother board making access easy and I/O configuration changes possible in the field.

Positive Displacement Flow Meter - The ProPAC-3 incorporates a patented positive displacement gear type flow meter. The meter is highly reliable, easy to service and accurate to within 0.05% of rate. The ProPAC-3 flowmeter uses two rotating impellers driven by the additive flow through the meter. Each pocket formed between the lobes and the case of the meter forms a known volume. Magnets embedded in the impeller lobes are sensed by a non-intrusive Hall Effect sensor. As the magnets pass the sensor, a 12 VDC pulse train is generated and sent to the microprocessor. The meter body and gears are constructed of 316 stainless steel that will provide many years of accurate and trouble free service.

Solenoid Control Valve - The solenoid control valve is a 2-way, 120 VAC, normally closed, direct acting, stainless steel with teflon seat, explosion proof solenoid. The solenoid is used to control all additive flow through the injector.

Other ProPAC-3 Components

Filter -A 316 stainless steel filter to protect the injector from particulate contamination. The filter contains a 100 mesh stainless steel screen filter element that is easily removed for servicing.

Check Valve -A check valve is also provided at the injector outlet to prevent product from flowing back through the injector. This is an in-line check valve made of 316 stainless steel with teflon seat.

On-Off Switch - The two position ON-OFF switch provides electrical control for the injector. In the OFF position, all electrical power to the injector is removed, except for the input signals to the injector. In the ON position, the ProPAC-3 will be electrically powered and the unit will operate automatically on the receipt of the proper input signals. For added security, an optional key lock switch is available. The key lock is lockable in both the ON and OFF positions.

Push Button - The externally mounted push button has several functions which can be enabled/disable via menu options:

> **Test injections** - By pressing and releasing the push button one time simulates one injection request, thereby causing the ProPAC-3 to inject. The test injection serves to verify that the ProPAC-3 is working properly.
> **Clear Alarms** - When in alarm pressing and releasing the push button will clear the alarm condition, pressing and holding the push button for

approximately three seconds will clear the alarm and restart the currently authorized load while making up for any additive shortages.

Auto Calibration - By pressing and holding the push button is held in for approximately three seconds, the injector will enter auto-calibration mode.

Features

3 Separate Channels for Accumulating Additive and Product Totals - Particularly handy for shared additive systems or multiple grade products where the same additive is injected at different rates. Each additive has a programmable injection rate, Injection frequency and Additive meter k-factor, and Text ID for easy identification. Each channels additive along with its corresponding product total is stored for individual analysis. Channel selection is accomplished either via a hardwired permissive input, or via a software permissive. Each channel maintains accountability for its own additive/product ratio.

Graphical Display - The ProPAC-3 incorporates a graphical display that provides the user with vital information on the injection process. Injector programming is also simplified with easy to read programming steps and instructions. Trouble shooting is quick and easy because all the information you need is clearly displayed one screen specifically related to the current state of the injector.

Loading State Display -While in the load state, the ProPAC-3 displays a Load Additive Total, Load Product Total, and a batch total for each injection. These load totals start at zero and totalize until the permissive is removed, resulting in a run-time display of the total additive and product treated per truck.

Idle State Display - In the idle state, the Titan ProPAC-3 displays the Additive Total for each channel as well as a Grand Additive and Product Total.

Alarm State Display - In alarm state, the ProPAC-3 displays an alarm screen that will alternate at five second intervals with any of the other viewed screens. The alarm screen will show inverted colors from normal, thereby making an alarm more noticeable to terminal personnel.

Programming Display - In program state, the ProPAC-3 displays a small section of the program menu. Push buttons on the microprocessor allow the user to scroll through the menu and change programmed values.

Simplified Injector Calibration - The ProPAC-3 is equipped with an automatic calibration mode. All calibration calculations are performed by the ProPAC-3, thus eliminating the possibility of calculation errors. To calibrate the ProPAC-3, simply push and hold the test injection button on the injector for approximately three seconds, and follow the on-screen instructions. Each additive should be calibrated to provide the most accurate additive injection.

Frequency Line Flush - For dye injection or Clean Start of diesel or gasoline additives it is often necessary to flush the product line clear of additive so that the next truck does not receive any of the previously loaded additive. The ProPAC-3 has a unique feature which allows the injector to detect the decrease in the product flow rate at the on set of low flow shutdown. The line flush is accomplished by allowing unadditized product to flow through the line at the end of each compartment load. The Preload feature allows

extra additive to be injected at the start of the load to compensate for the unadditized line flush at the end of the load.

Enhanced Input/Output Capability - The ProPAC-3 incorporates a host of I/O features. This I/O may be either AC or DC:

Pulse Input - The ProPAC-3 requires a pulse proportional to the product flow rate. Various pulse rates may be used from a turbine meter to a 40:1 pulser.

Permissive Inputs - Up 3 permissive inputs can be used to select the additive channel and rate. Enhanced alarming such ad flow pulse signal failure detection can be accomplished when permissive and flow switch inputs are use together.

Line Flush Input - Clean Start, requires either a 1:1 product pulse or a hardwired line flush input be brought to the ProPAC-3 to signal the beginning of the line flush.

Line Flush Output - For dye injection or Clean Start of diesel or gasoline additives, a line flush output may be sent from the ProPAC-3 to close a block valve at the injection point. This prevents the leaching due to thermal expansion of the dye into the clear product line.

Load Permissive Output - The ProPAC-3 supplies a normally closed load permissive contact. If the ProPAC-3 goes into alarm or power is removed from the injector, the load permissive contact will open.

Permissed Permissive Output - This output works similar to the load permissive contact. The permissed permissive contact is normally closed, except when the ProPAC-3 goes into alarm **and** a permissive input is received by the injector. If no permissive is received by the injector, the permissed permissive contact will always be closed allowing other injectors not associated with the alarmed additive system to load. This prevents one problematic additive system from shutting down the entire terminal.

Alarm Output - The alarm output is normally open. If the ProPAC-3 goes into alarm, this contact will close. The inverse of the permissed permissive contact.

Confirmation Outputs/Scaled Pulse Outputs - Used in conjunction with electronic preset or Terminal Automation System (TAS), this output is sent to the preset or TAS to confirm that an injection has been completed or a pulse output can be programmed to represent a specific volume of additive. Both the volume and the pulse width are programmable.

Flow Switch Input - An optional flow switch signal can be sent to the ProPAC-3 to verify product loading has begun.

Pump Start Output - The pump start output is used to send a hardware pump start to the additive pump. This feature is commonly used when using serial communications to control the injector from the preset or terminal automation system. This output eliminates running a hardwired pump start from the automation system to the additive pump. Each injector will start the pump automatically whenever additive is required. Also the Auto-PAC uses this output to turn off the pump at the end of a load based on the maximum load volume.

Enhanced Alarming Features - The ProPAC-3 incorporates a total of 12 alarm features:

Additive Flow Problem - This alarm protects against under injection of additive. The alarm activates if the injector is either three injection attempts behind or if a single injection takes more than 30 seconds to complete.

Additive Quantity Alarm - The ProPAC-3 continually computes the additive/product ratio. The injector will alarm any time the additive/product ratio exceeds either the upper or lower programmed limits.

No Additive Pulse - This alarm activates whenever an injection request has been made and no additive pulses are received by the microprocessor from the additive flow meter.

No Product Pulse - This alarm is used in conjunction with permissive and flow switch inputs. If the microprocessor detects a permissive input and flow switch input, and does not receive product pulses within 120 seconds, the injector will alarm.

Product Line Flush Failed - This alarm is used to verify a complete line flush has occurred. In the event the volume of product is less than the programmed flush volume, the injector will alarm.

Solenoid Leak Detection - This alarm is designed to prevent unauthorized flow of additive.

Additive Permissive Failed - This alarm will activate if two permissives are sent to the injector, or no permissive is received while product pulses are received.

Fail Safe - Serves as a backup alarm in case of catastrophic failure of the microprocessor. 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 alarm circuitry terminates power to the solenoid, thereby terminating the flow of additive.

Excessive Temperature - The ProPAC-3 circuitry includes temperature monitoring of the microprocessor. If the ProPAC-3 internal temperature exceeds 180 degrees Fahrenheit, the alarm will activate.

Permissive Time-out Alarm - If a permissive is received by the injector and no product pulses are detected for a period of 120 seconds, the alarm will activate.

Flow switch failed - This alarm verifies the flow switch is working properly. The alarm will activate any time there are more than three consecutive injection attempts with no flow switch indicating product flow.

Calibration Alarm - This alarm will assist terminal personnel with scheduling quarterly calibrations. Current EPA regulations require quarterly calibration of additive injectors.

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