Franklin Fueling Systems

EVO™ SERIES

AUTOMATIC TANK GAUGES POSITIVE SHUTDOWN

REFERENCE GUIDE

The information in this publication is provided for reference only. While every effort has been made to ensure the reliability and accuracy of the information contained in this manual at the time of printing, we recommend that you refer to "franklinfueling.com" for the most current version of this manual. All product specifications, as well as the information contained in this publication, are subject to change without notice. Franklin Fueling Systems does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of, or in any way connected with, installation, operation, use, or maintenance by using this manual. Franklin Fueling Systems assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of this manual or the products. We make no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

For technical assistance, please contact:

franklinfueling.com
3760 Marsh Rd. • Madison, WI 53718 • USA
Tel: USA & Canada +1 800 225 9787 • Fax: +1 608 838 6433
Tel: UK +44 (0) 1473 243300 • Tel: Mex 001 800 738 7610
Tel: DE +49 6571 105 380 • Tel: CH +86 10 8565 4566

10000007526 r1

Conventions used in this manual

This manual includes safety precautions and other important information presented in the following format:

NOTE: This provides helpful supplementary information.

IMPORTANT: This provides instructions to avoid damaging hardware or a potential hazard to the environment, for example: fuel leakage from equipment that could harm the environment.

⚠ CAUTION: This indicates a potentially hazardous situation that could result in minor or moderate injury if not avoided. This may also be used to alert against unsafe practices.

⚠ WARNING: This indicates a potentially hazardous situation that could result in severe injury or death if not avoided.

⚠ DANGER: This indicates an imminently hazardous situation that will result in death if not avoided.

Operating precautions

Franklin Fueling Systems (FFS) equipment is designed to be installed in areas where volatile liquids such as gasoline and diesel fuel are present. Working in such a hazardous environment presents a risk of severe injury or death if you do not follow standard industry practices and the instructions in this manual. Before you work with or install the equipment covered in this manual, or any related equipment, read this entire manual, particularly the following precautions:

IMPORTANT: To help prevent spillage from an underground storage tank, make sure the delivery equipment is well-maintained, that there is a proper connection, and that the fill adaptor is tight. Delivery personnel should inspect delivery elbows and hoses for damage and missing parts.

⚠ CAUTION: Use only original FFS parts. Substituting non-FFS parts could cause the device to fail, which could create a hazardous condition and/or harm the environment.

⚠ WARNING: Follow all codes that govern how you install and service this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on while you are installing or servicing this product. Refer to this manual (and documentation for related equipment) for complete installation and safety information.

⚠ WARNING: Before you enter a containment sump, check for the presence of hydrocarbon vapors. Inhaling these vapors can make you dizzy or unconscious, and if ignited, they can explode and cause serious injury or death. Containment sumps are designed to trap hazardous liquid spills and prevent environmental contamination, so they can accumulate dangerous amounts of hydrocarbon vapors. Check the atmosphere in the sump regularly while you are working in it. If vapors reach unsafe levels, exit the sump and ventilate it with fresh air before you resume working. Always have another person standing by for assistance.

⚠ WARNING: Follow all federal, state, and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A, and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage, and/or environmental contamination.

⚠ WARNING: Always secure the work area from moving vehicles. The equipment in this manual is usually mounted underground, so reduced visibility puts service personnel working on it in danger from moving vehicles that enter the work area. To help prevent this safety hazard, secure the area by using a service truck (or some other vehicle) to block access to the work area.

⚠ DANGER: Make sure you check the installation location for potential ignition sources such as flames, sparks, radio waves, ionizing radiation, and ultrasound sonic waves. If you identify any potential ignition sources, you must make sure safety measure are implemented.

Introduction

The purpose of this guide is to provide instruction on the various methods of achieving positive shutdown of a submersible turbine based on predetermined scenarios. The methods discussed will include the use of relays, Turbine Pump Interface (TPI) and various other means of programming the EVO(TM) Series Automatic Tank Gauge (ATG) console including Rules, Logic Conditions and settings within specific applications.

The following methods are covered:

- Use of programmed Inputs- TPI and relays (EVO™ 550/5000).
- Use of Shutdown On Alarm in Pumps configuration (EVO™ 200/400/600/6000)
- Use of logic conditions.
- Use of Rules engine.
- Application specific selections.
- Dispenser shut down examples.

Intentionally Blank

Use of Programmed Inputs - TPI and Relays

The following illustrations will help understand how the programming of each method can create a positive shutdown given a programmed input under the submersible turbine programming of either turbine pump interface or relay.

Turbine Pump Interface (TPI)

Turbine Pump Interface (TPI) is a communication protocol and parameter programming subset that allows the EVO™ series console to control several FE Petro™ intelligent pump control relays. The primary function of TPI is to monitor and manage FE Petro pump controllers. The FE Petro pump controllers are connected to the EVO™ series console via a three conductor shielded cable. This cable is daisy-chained between each controller. The wires connect to three terminals; a positive (+), a negative (–) and a ground (gnd). The wiring is then daisy-chained like color to like color to all pump controllers to the corresponding terminals (+ – gnd).

On the EVO™ Series Console, the TPI port has 5 total spaces. The first two terminals (A and B) are not used for TPI applications.

For EcoVFCs and MagVFCs that are functioning in a group scenario (Leveling, Priority, None) the #4 (Frequency) terminal should be connected between the two VFCs. This allows for frequency data to be transferred.

Each controller is then given a specific address that the console uses to recognize that individual controller. The EVO™ console can be configured for a maximum of 31 controllers with any variation of controllers being accepted. The controllers themselves may have restrictions with how many can be configured due to dip switch limitations. Within the TPI relationship the EVO™ console always acts as a Primary controller and all subsequent controllers are considered secondary devices. Being the Primary Controller means that the EVO™ console is internally addressed as 0 and cannot be changed, therefore the controllers should be addressed starting at 1 as a secondary device.

The TPI example below shows the controller programmed with six inputs:

- AC Input module- hook signals (hook isolation) for dispenser 1-2, 3-4 unleaded.
- 4-20mA- LS500 line leak transducer (requirement for Electronic Line Leak Detection (ELLD))
  - Provides ability to energize turbine for testing and disable turbine in event of ELLD alarm (positive shutdown)
- 2-Wire Sensor module- 2 wire sensors located in unleaded STP (sump) and dispenser sump 1-2,3-4
  - Sensor inputs programmed as inputs to a STP utilizing TPI will disable the submersible in the event of an alarm and reenable once alarm clears (positive shutdown)
  - 3-wires sensors- can be used in same manner as 2-wire sensors but will disable the submersible for any of the various alarms associated with a 3-wires sensor. An Individual alarm such as product, cannot be isolated for positive shutdown. Alarm specific shutdown with 3-wire sensors will be discussed in the section on Logic conditions.

NOTE: ELLD is not mandatory for this feature to work.

```
        TS-TPI
------------------------
Enable Interface:    Yes
------------------------
      Controllers
------------------------
Number of controllers: 2
------------------------
      Controller 1
------------------------
Name:       Unleaded SCI
Enabled:             Yes
Type:            Smart I
Address:               0
Group:                 1
Tank:                  1
Height:          5.00 in
Number of inputs:      6
------------------------
        Input 1
------------------------
Type:    AC Input Module
Channel:
Disp 1-2 Unleaded Reques
                       t
------------------------
        Input 2
------------------------
Type:    AC Input Module
Channel:
Disp 3-4 Unleaded Reques
                       t
------------------------
        Input 3
------------------------
Type:4-20mA Input Module
Channel:   Unleaded ELLD
------------------------
        Input 4
------------------------
Type:
    2-Wire Sensor Module
Channel:      Unlead STP
Bypass:               No
------------------------
        Input 5
------------------------
Type:
    2-Wire Sensor Module
Channel:   Dispenser 1&2
Bypass:               No
------------------------
        Input 6
------------------------
Type:
    2-Wire Sensor Module
Channel:   Dispenser 3&4
Bypass:               No
```

Power Supply		
Low Voltage Inputs »	...	...
TS-TPI	Enable Interface	Yes
Controllers	Number of controllers	2
Controller 1	Name	Unleaded SCI
	Enabled	Yes
	Type	Smart I
	Address	0
	Group	1
	Tank	1
	Height	5.00 in
	Number of inputs	6
Input 1	Type	AC Input Module
	Channel	Disp 1-2 Unleaded Request
Input 2	Type	AC Input Module
	Channel	Disp 3-4 Unleaded Request
Input 3	Type	4-20mA Input Module
	Channel	Unleaded ELLD
Input 4	Type	2-Wire Sensor Module
	Channel	Unlead STP
	Bypass	No
Input 5	Type	2-Wire Sensor Module
	Channel	Dispenser 1&2
	Bypass	No
Input 6	Type	2-Wire Sensor Module
	Channel	Dispenser 3&4
	Bypass	No

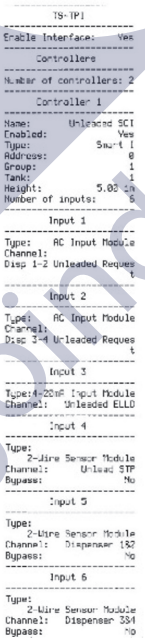
Relay Module

The relay modules have two styles: a 10-amp module and a 2-amp module. The 2-amp module is a non-intrinsically safe module that has 8 identical 2-amp SPDT (Single Pole Double Throw) output relays. The 10-amp module has 6 identical 10-amp SPDT output relays. Each channel has a fuse and three terminals. Each channel can be configured as normally open or normally closed, with the power off, by wiring to the appropriate terminals. The relay module provides another method of controlling a submersible turbine and can be used instead of TPI. The relay programmed to control a submersible will send a high voltage motor activation signal to the submersible controller to activate the turbine. This input programming is identical to TPI input programming in which positive shutdown occurs when a programmed input is in an alarm state.

- AC input module- hook signals (hook isolation) for dispenser 1-2, 3-4 Unleaded
  - 4-20mA- LS500 line leak transducer (required for Electronic Line Leak Detection (ELLD))
    - Provide ability to energize turbine for testing and disable turbine in event of ELLD alarm (positive shutdown)
  - 2-Wire sensor module- 2 wires sensors located in unleaded STP (sump) and dispenser 1-2,3-4
    - Sensor inputs programmed as inputs to a STP utilizing relay module channels will disable the submersible in the event of an alarm and reenable once alarm clears (positive shutdown).
    - 3-wires sensors can be used the same way as 2-wire sensors but will disable the submersible for any of the alarms associated with a 3-wires sensor. An individual alarm such as product, cannot be isolated for positive shutdown. (Alarm-specific shutdown with 3-wire sensors is explained in the section on logic conditions.)

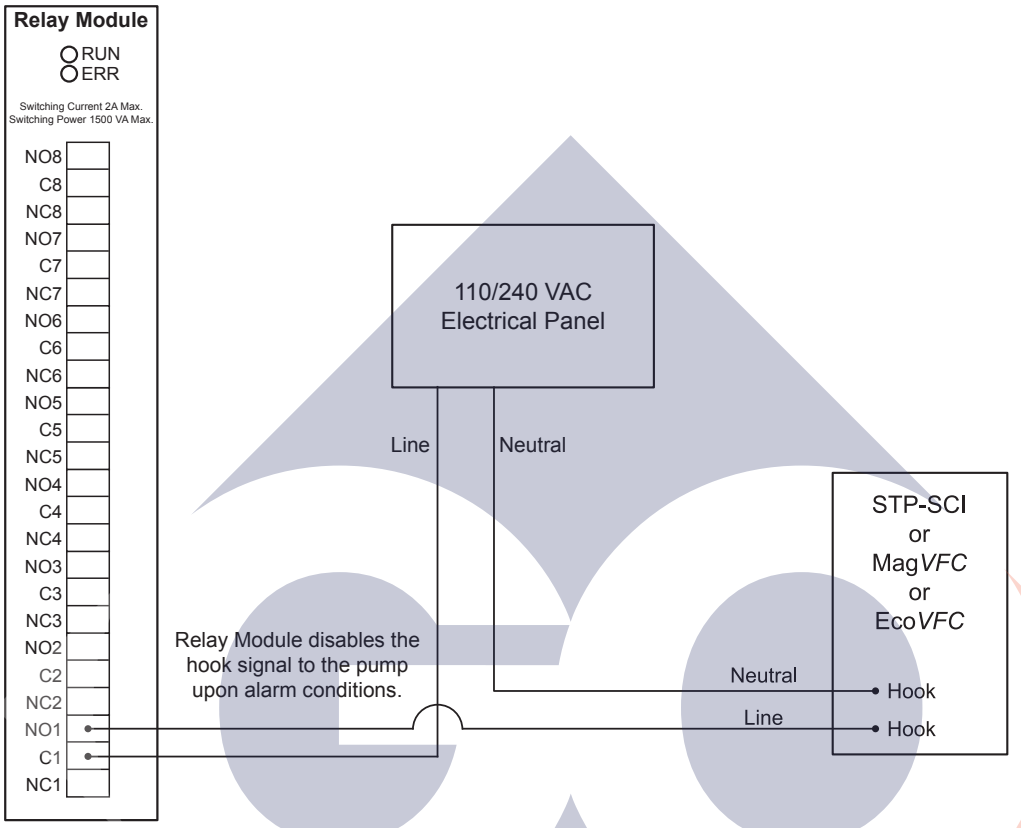
NOTE: ELLD is not mandatory for this feature to work.

Module 1		10 Amp	Yes
		Channels	2
	Channel 1	Name	Unleaded Submersible Activate
		Enabled	Yes
		Type	Submersible Pump
		Polarity	Normal
		Logic	OR Logic
		Physically Wired As	Normally Open
		Number of inputs	6
	Input 1	Type	4-20mA Input Module
		Channel	Unleaded ELLD
	Input 2	Type	2-Wire Sensor Module
		Channel	Unlead STP
		Bypass	No
	Input 3	Type	2-Wire Sensor Module
		Channel	Dispenser 1&2
		Bypass	No
	Input 4	Type	2-Wire Sensor Module
		Channel	Dispenser 3&4
		Bypass	No
	Input 5	Type	AC Input Module
		Channel	Disp 1-2 Unleaded Request
	Input 6	Type	AC Input Module
		Channel	Disp 3-4 Unleaded Request



- A relay module can be wired two ways. Normal relay states can be wired as Normally Open or Normally Closed (NC). When wiring relays for Positive shutdown, use Normally Open for safety and simplicity. If NC relays are required, contact FFS Technical Service.

Relay Wiring Comparisons



Programming TPI

Module 1		10 Amp	Yes
		Channels	2
	Channel 1	Name	Unleaded Submersible Activate
		Enabled	Yes
		Type	Submersible Pump
		Polarity	Normal
		Logic	OR Logic
		Physically Wired As	Normally Open
		Number of inputs	6
	Input 1	Type	4-20mA Input Module
		Channel	Unleaded ELLD
	Input 2	Type	2-Wire Sensor Module
		Channel	Unlead STP
		Bypass	No
	Input 3	Type	2-Wire Sensor Module
		Channel	Dispenser 1&2
		Bypass	No
	Input 4	Type	2-Wire Sensor Module
		Channel	Dispenser 3&4
		Bypass	No
	Input 5	Type	AC Input Module
		Channel	Disp 1-2 Unleaded Request
	Input 6	Type	AC Input Module
		Channel	Disp 3-4 Unleaded Request

Shutdown On Alarm

On EVO 200/400/600/6000, the Pumps section of Configuration is used to configure pumps operated using either TPI or Relays. Each Pump has a section called "Shutdown On Alarm", by adding alarms in this section specific sensors or even specific alarms from a given sensor can be assigned to perform positive shutdown on each pump. In this example, setting Event Code "Any" will cause the pump to be shutdown whenever the assigned sensor is not in its normal or OK state.

☐ **Pumps** +		
☐ **Pump 1** –	Name	Pump 1
	Connection Type	Smart Controller
	Controller Type	STP-SCI
	Controller Address	2
	Is Grouped	No
	Tank	Premium Unleaded
	Inlet Height	5.00 in
☐ **External Hooks** +		
☐ **Shutdown On Alarm** +		
☐ **Alarm 1** –	ID Type	Sensor
	ID	Dispenser Sump 1
	Event Priority	Alarm
	Event Code	Any

Intentionally Blank

Logic Conditions

For the purpose of positive shutdowns, logic conditions use a status based approach typically combined with OR logic. This approach allows the console to be configured with multiple devices and multiple alarms under one condition and ties these status conditions to one or more programmed outputs. In the case of positive shutdown, the output will be programmed for a submersible turbine or multiple submersible turbines using either TPI or Relay Output(s)/Relay Module(s).

- Condition Inputs are programmed to include any combination of sensor alarms or other alarms that are to be include in the disabling of a submersible turbine. For example, the owner operator may want the submersible turbines to be disabled for 3-wire sensor (unleaded sump) "product alarm" or at a tank level alarm (unleaded tank) of Low or low low. All required alarms in this scenario can be included under one condition to disable a specific turbine (unleaded STP).
- An additional condition can be created to disable all submersible turbines for example, in the event of a dispenser sump sensor alarm.
- NOTE: Creating multiple conditions with the same output can lead to conflicts and all required conditions should be mapped out prior to programming.
    - 4-20mA- LS500 line leak transducer (requirement for Electronic Line Leak Detection (ELLD))
        - Provide ability to energize turbine for testing and disable turbine in the event of ELLD alarm (positive shutdown)

Conditions

Logic Conditions		
Group - STP Disable UDC Product Alarm	Name	STP Disable UDC Product Alarm
	Enabled	Yes
Conditions		
Condition - STP Shutdown Condition	Name	STP Shutdown Condition
	Description	STP Shutdown on UDC Product Alarm
	Type	Logic
	Logic Operator	OR
Inputs	Number of Inputs	8
Input 1	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-1-DDS
	Code	SN3 Product
	Invert Input	No
Input 2	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-2-DDS
	Code	SN3 Product
	Invert Input	No
Input 3	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-3-DDS
	Code	SN3 Product
	Invert Input	No
Input 4	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-4-DDS
	Code	SN3 Product
	Invert Input	No
Input 5	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-1-DDS
	Code	SN3 No Signal
	Invert Input	No
Input 6	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-2-DDS
	Code	SN3 No Signal
	Invert Input	No
Input 7	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-3-DDS
	Code	SN3 No Signal
	Invert Input	No
Input 8	Input Type	Alarm
	Category	FMS
	Device	3-Wire Sensor
	Device ID	Disp-4-DDS
	Code	SN3 No Signal
	Invert Input	No

Condition Output

- The condition output examples show both options of a relay module or TPI being used. Typically, you would only use one or the other method (TPI or Relay) for submersible motor control.
- Condition outputs are programmed outcomes based on the status of any programmed condition inputs. These outputs will have an Invert Input to dictate the desired Action Type in programming.
- To invert an action is to program the opposite action as programmed.
    - Enable- inverted is Disable

Outputs	+		
Condition Output	–	Invert Input	Yes
		Input Condition	None
		Type	Relay
		Module	Relay Module
		Channel	Unleaded STP
		Action Type	Enable

Intentionally Blank

Rules Engine

Rules are another method of programming the EVO™ for positive shutdown. Rules are event based in comparison to conditions that are status based. Using rules for positive shutdown has limitations. Rules as programmed operate independently from one another and for this reason can lead to undesired results. Using the rules engine for sensor positive shutdown is not advised due to the fact that the rules are event based, acting on an individual event versus the status of the devices associated tied to the particular device shutdown. For example:

- Rule # 1- Event – Sensor #1 Alarm-Action Pump Disable (UNL)
- Rule # 2 Event – Sensor #2 Alarm -Action Pump Disable (UNL)
- Rule # 3 Event – Sensor #1 Alarm(clear)- Action Pump Enable (UNL)
- Rule # 4 Event – Sensor #2 Alarm (clear)- Action Pump Enable (UNL)

Scenario: Rule #1 has an Event (Sensor Alarm), and the UNL Pump disables as the Action. Rule #2 has an Event (Sensor Alarm), and then clears with Rule #4. The pump will then be enabled even though Rule #1 (Sensor Alarm) is still active. Once an event happens, the action is performed, any future event will supersede the initial event and act based on the rule as programmed. Rules are isolated events and actions will respond according to individual programming of each rule and will not recognize other rules when activating or deactivating. This logic set up is why rules should rarely if ever be used for the purpose of positive shutdown using sensors.

Rules however can be used for other scenarios involving positive shutdown, such as a low product level. A RULE can be programmed to disable a STP at a Low or Low Low level. The counter rule can then be created to re-enable at a low-level cleared event. This set of rules works as there are only two events being monitored, and they are on the same device (tank) with no other events of the same nature that will conflict.

Intentionally Blank

Application Specific Shutdown

Positive shutdown programming is simplified within the Electronic Line Leak Detection (ELLD) application. The ability to provide positive shutdown is simply selecting Yes or No under the programming parameter sections of the specific applications.

ELLD

The ELLD (Electronic Line Leak Detection) positive shutdown for a 3 GPH gross Line leak fail is hardcoded into the software as this is an EPA requirement. As you can see in the example below that positive shutdown form precision testing (.1,.2) is also available by setting shut down on test fail to Yes.

Lines		Number of Lines	4
	Line 1	Name	V-Power Unleaed Line
		Submersible Pump Module	Relay Module
		Submersible Pump Channel	V-Power Unleaded STP
		Transducer	V-Power Unleaded ELLD
		Enable SLLD	No
		Enable	Yes
		Monthly compliance	Yes
		Annual compliance	Yes
		Pressure Up Test Wait Time	4 sec
		Catch Pressure Wait Time	2 sec
		Dispenser Pressure Test	Yes
		Catch And Sudden Pressure Loss Test	Yes
	Gross Tests	Enable	Yes
	Monthly Tests	Enable	Yes
		Wait Period Between Passed Tests	1 day
		Shutdown on Test Fail	Yes
		Fails Before Shutdown	1
	Annual Tests	Enable	Yes
		Wait Period Between Passed Tests	30 days
		Shutdown on Test Fail	No

Testing Positive Shutdown

The best and quickest way to verify positive shutdown is the simulation of an event.

Intentionally Blank

Intentionally Blank

10000007526 r1