



Secondary Containment Monitoring

Installation & User's Guide

TS-550/TS-5000 consoles

Notice

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This manual is for use expressly with the TS-550, TS-5000, and TS-SCM at their approved specifications.

For further information and installation and programming instructions, please refer to the *T5 Series Installation Guide* (p/n 000-2150) and/or *T5 Series Programming Guide* (p/n 000-2142).

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Inspection of Materials

Visually inspect all components for defects or damage prior to installation. If any defect or damage is found, do not use the product and contact Franklin Fueling Systems for further assistance.

Warranty Information

Please refer to the *FFS Fuel Management Systems & Product Warranty Policy* for all warranty information.

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Important Safety Messages


INCON equipment is designed to be installed in association with volatile hydrocarbon liquids such as gasoline and diesel fuel. Installing or working on this equipment means working in an environment in which these highly flammable liquids may be present. Working in such a hazardous environment presents a risk of severe injury or death if these instructions and standard industry practices are not followed. Read and follow all instructions thoroughly before installing or working on this, or any other related, equipment.


As you read this guide, please be aware of the following symbols and their meanings:


Warning  This symbol identifies a warning. A warning sign will appear in the text of this document when a potentially hazardous situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous situation may involve the possibility of severe bodily harm or even death.


Caution  This is a caution symbol. A caution sign will appear in the text of this document when a potentially hazardous environmental situation may arise if the instructions that follow are not adhered to closely. A potentially hazardous environmental situation may involve the leakage of fuel from equipment that could severely harm the environment.


Danger  This symbol identifies an electrical danger. An electrical danger sign will appear in the text of this document when a potentially hazardous situation involving large amounts of electricity may arise if the instructions that follow are not adhered to closely. A potentially hazardous situation may involve the possibility of electrocution, severe bodily harm, or even death.


Warning  Follow all applicable codes governing the installation and servicing of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and any 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 during installation or servicing. Please refer to the *Installation and Owner's Manual* for this equipment, and the appropriate documentation for any other related equipment, for complete installation and safety information.


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 this equipment in danger from moving vehicles entering the work area. To help eliminate these unsafe conditions, secure the area by using a service truck to block access to the work environment, or by using any other reasonable means available to ensure the safety of service personnel.

Warning  When the Tank Sentinel system is used to monitor tanks containing gasoline or other flammable substances, you may create an explosion hazard if you do not follow the requirements in this manual carefully.

Warning  All wiring must enter the console's enclosure through the designated knockouts. An explosion hazard may result if other openings are used.


Warning  All wiring from probes or sensors to the Tank Sentinel console must be run in conduit separate from all other wiring. Failure to do so will create an explosion hazard.

Warning  Substituting components could impair intrinsic safety. T5 series consoles are intrinsically safe for sensors installed in – Class I, Division 1, Group D – hazardous locations. Substitution of components could make the energy limiting circuitry in the system ineffective and could cause an explosion hazard. Repairs to a T5 series console or attached components should only be performed by a qualified, factory-trained technician.

Overview

The TS-SCM (Secondary Containment Monitoring) system is a continuous secondary containment monitoring system that monitors the interstitial spaces of double walled tanks and sumps, secondarily contained product and vapor return piping. This product can be ordered as an available option with Franklin Fueling Systems's TS-550 and TS-5000 FMS consoles.

The TS-SCM system is comprised of an application running on a T5 series FMS console and all necessary input and output modules with installation kits. The Secondary Containment Control Module (SCCM) consists of a vacuum sensor, solenoid valve, mechanical bypass valve, and vacuum manifold. SCM uses the STP siphon port vacuum to evacuate the containment space and AutoLearn® technology to determine the characteristics of each secondary containment area that is monitored.

Warning  **SCM equipment operates at a standard 2" to 6" Hg and should only be used to monitor containments that are designed to withstand these vacuum levels. Refer to the containment manufacturer for further information.**

Applications

The following diagram illustrates a typical installation of SCM equipment inside of a STP sump.

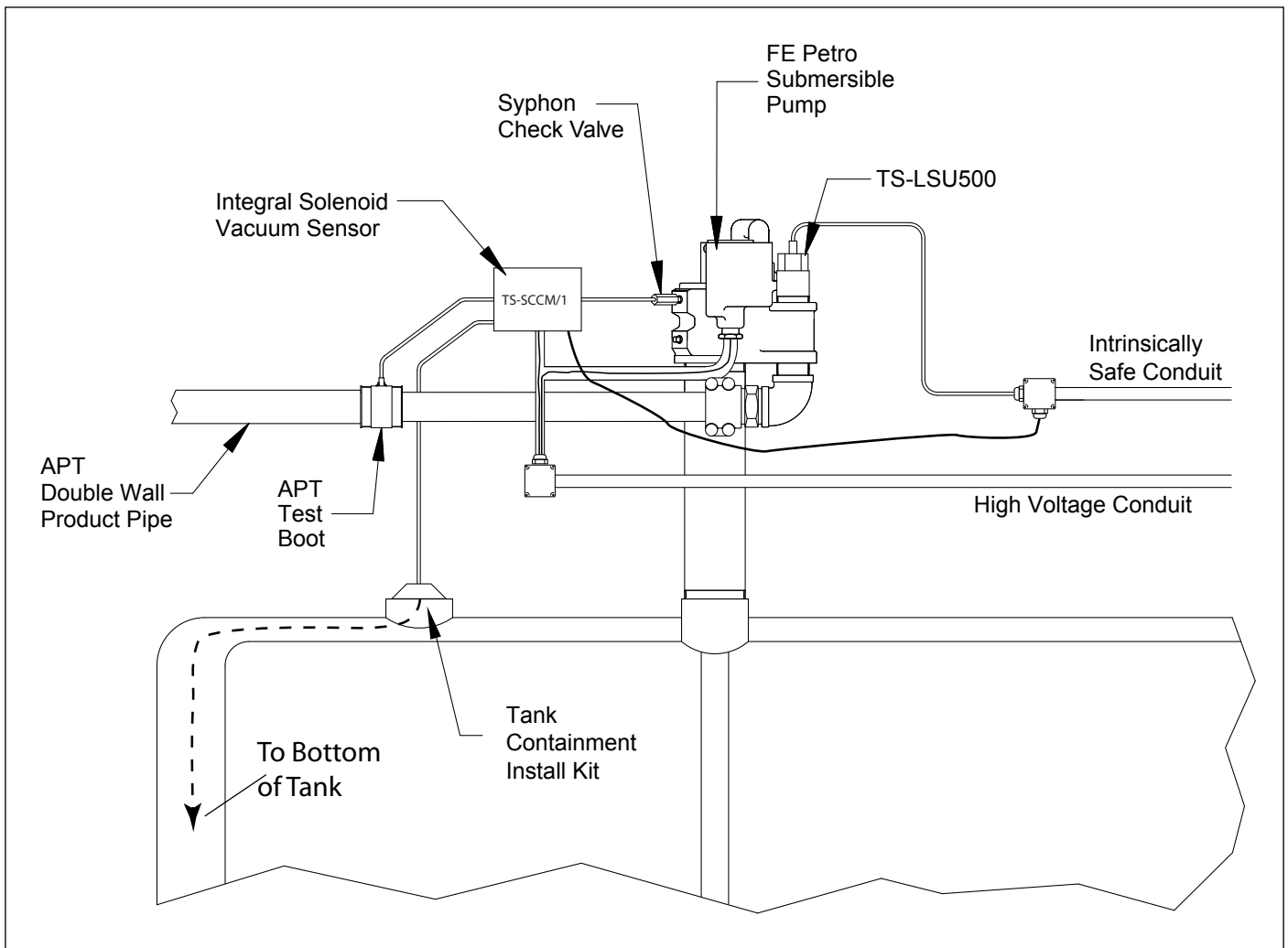


Figure 1 – TS-SCM System Overview

Site Requirements

Total Containment Volume*	Minimum - 0.25 gallons (1 L) Maximum - 500 gallons (1879 L)
Normal Operating Vacuum	2" – 6" Hg (1 – 3 PSIG)
Pre-Programmed Maximum Shutdown (Alarm Condition)	9" Hg (4.5 PSIG)
Mechanical Relief Valve Vacuum**	10" Hg (5 PSIG)
Jumper Tubing	Use only supplied vacuum tubing
Vacuum Sensor Wiring	Belden No. 87761(0.12" OD) to 400 ft. Belden No. 89182(0.31" OD) to 500 ft. (maximum distance)
Solenoid Wiring	600 V, 18 AWG minimum, UL approved refer to ANSI/NFPA70 or CEC electrical codes

*Refer to manufacturers' installation guides or data sheets to calculate containment area volumes.

**All containment areas MUST be compatible with the vacuum levels listed.

Note: SCM should be tested annually after installation.

The term *containment* (in *secondary containment*) refers to the interstitial spaces of double walled piping, sumps and tanks that serve as a secondary containment if the primary containment is damaged.

Individual containment sections of a given product pipeline may be jumpered together via a vacuum line to form one larger single containment. An example of 'jumpered' containment spaces is the secondary containment layer of product piping from the turbine containment to the first dispenser, and then jumpered to the secondary containment layer of the same product piping on the other side leading to the next dispenser containment area.

Several containment areas may be grouped together and used with a single Secondary Containment Control Module (TS-SCCM). No more than four (4) SCM groups should be used per pump siphon. The combination of any containment group may not exceed the volume limits listed for SCM.

Note: DO NOT jumper tank interstitials with other tank interstitials or other containments.

Note: DO NOT jumper containment areas of unlike product pipelines together.

Note: If grouping multiple containment areas together, the installer will need to purchase and use the vacuum hose, fittings, and clamps to secure the connection as specified by FFS.

Note: Both *intrinsically safe* and *explosion proof* conduits need to be available inside of the turbine containment for the TS-SCCM.

Available Configurations

Refer to Franklin Fueling Systems's current *Fuel Management Systems Product Catalog* for a complete listing of the current SCM configurations offered.

Note: The SCCM 1 (as pictured in Figure 2) can monitor one containment group and the SCCM 2 can monitor two containment groups.

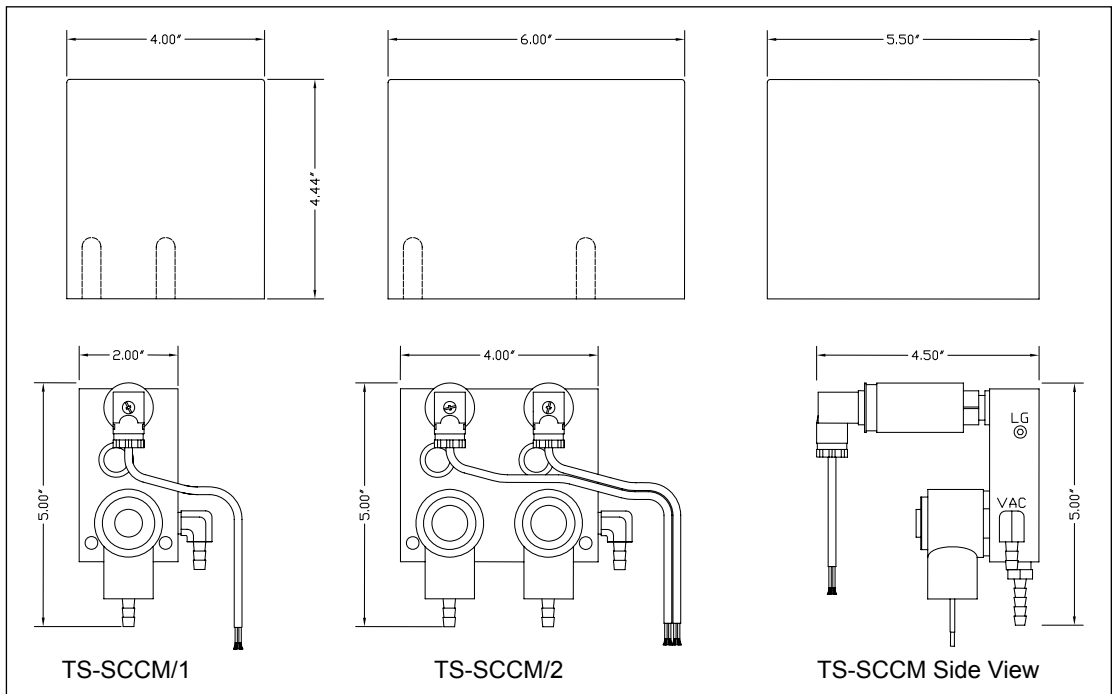


Figure 2 – SCCM 1 and SCCM 2 Dimensions

Installation

Before starting installation, conduct a site survey to identify potential containment groups. Based on that survey, plan out which STP sump the equipment will be installed in and how containment areas will be grouped together.

Warning ⚠️ **Lockout and tag circuit breakers, and disconnect console power wiring before installing or servicing any system wiring.**

Warning ⚠️ **DO NOT make solenoid and/or sensor wiring connections with live power connected to the console or any module.**

Caution ⚠️ **Do not run intrinsically safe (IS) wiring and non-intrinsically safe (non-IS) wiring in the same conduit.**

Note: TS-SCCM must be installed in accordance with the national electrical code, ANSI/NFPA 70, CEC or other applicable national or local codes.

Note: Maximum torque on supplied hose clamps is 20 inch-lbs.

1. Pull all wiring through the conduits that will be used for the TS-SCCM vacuum sensor and solenoid valve. The intrinsically safe (IS) sensor wiring must be run in an IS conduit. The non-IS solenoid wiring must be run in an approved explosion proof rigid metal conduit.

2. Mount the TS-SCCM inside of the turbine containment area, supported by rigid, explosion proof conduit. Then orientate the units to allow enough clearance to make the vacuum line connections without stretching, kinking, or creating sharp bends in vacuum hoses. The SCCM cover is installed with the label upwards. See Figure 3.

3. Connect the solenoid wiring to the field wiring using wire nuts to secure the connections. Replace the explosion proof junction box cover.

4. Connect the vacuum sensor wiring to the IS field wiring using epoxy wire seals to secure the connections. Replace the IS junction box cover.

5. Install the supplied Siphon Check Valve with the inscribed Flow Arrow pointing to the STP. Apply a non-hardening, thread sealing compound to the threads, then thread the valve body into the submersible turbine's siphon port. If necessary, use a FFS Secondary Syphon Assembly to connect the SCCM to the syphon port of the STP.

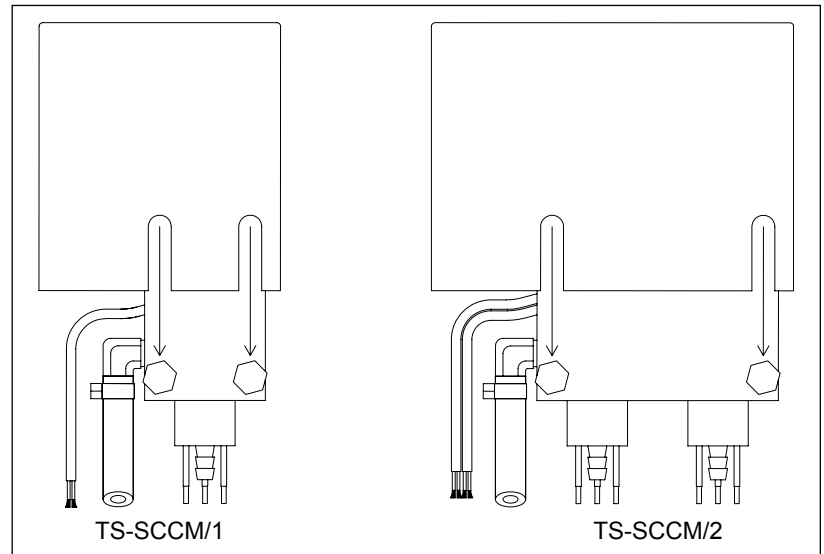


Figure 3 – Cover Installation (rear view)

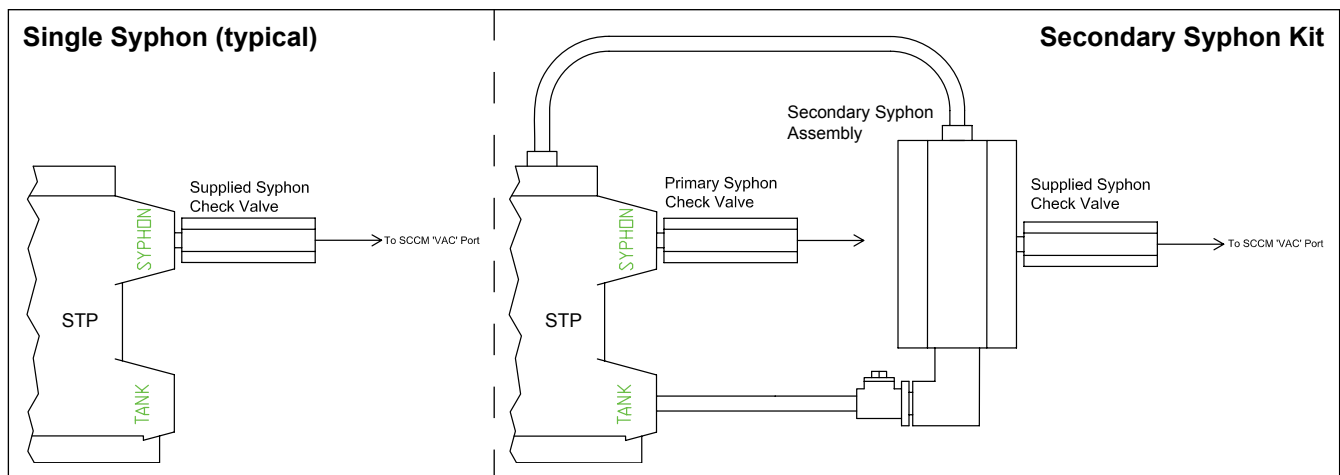


Figure 4 – Secondary Syphon Assembly Installation

6. Plumb the siphon hose from the VAC port of the TS-SCCM to the siphon check valve. Secure the hose to the fittings using one of the supplied hose clamps at each end.
 7. Plumb the containment vacuum hose from the INT port of the TS-SCCM to the containment area to be monitored. Secure the hose to the fitting using one of the supplied hose clamps per fitting. Install T-fittings and clamps where necessary to connect the hoses if more than one containment area will be monitored as a group.
- Note:** The containment vacuum hose must be placed in the lowest point of the containment space. For double walled tanks, this means ensuring that the vacuum line rests at the bottom most part of the tanks interstitial space. Use the same industry procedures used to install any sensor at the bottom of a double walled tank.
8. Secure all containment boots, lids and caps. Clean pipe surfaces to clear debris or foreign objects prior to tightening secondary test boots on secondary containment product or vapor return piping. Make all jumper connections inside of dispenser sumps by using supplied hardware.
 9. Inside the console, the TS-SCCM solenoid wiring must enter the console from the explosion proof rigid conduit through a designated knockout on the non-IS side of the barrier inside. Connect the line, neutral, and ground wire of the solenoid to a single unused channel on the Relay Module (RLY). The solenoid should be wired to the Common (C) and Normally Open (NO) contacts of the channel selected. Source voltage (110 VAC) will need to be provided to the dry contact relay.

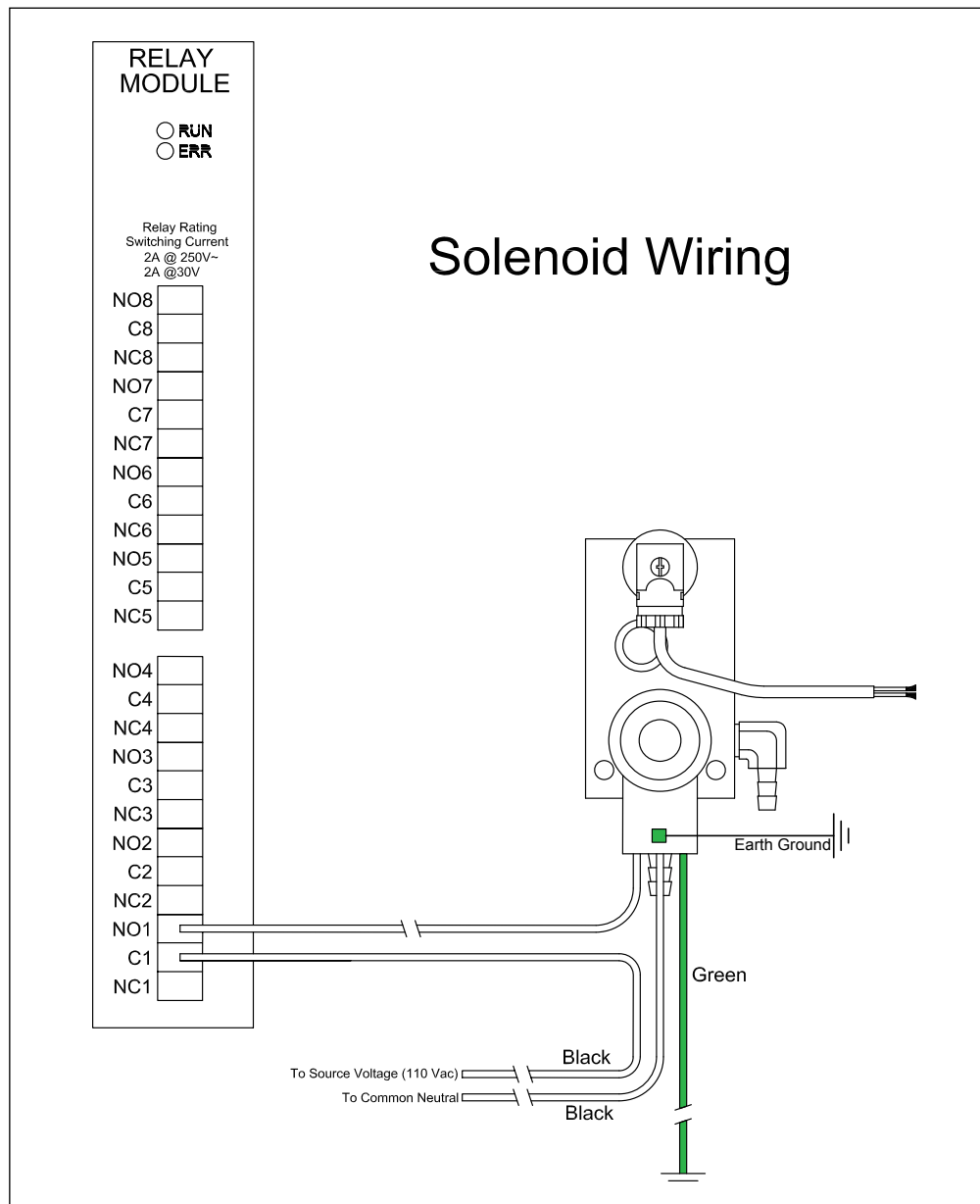



Figure 5 – Solenoid Wiring

Warning  If using console power wires to provide power to a dry contact relay channel, ensure that the console is positively shut down during installation and service. Failure to remove power may result in damage to equipment, personal injury or even death.

10. The TS-SCCM sensor wiring must enter the console in IS conduit through a knockout on the IS side of the barrier. Secure each pair of sensor wires to a single channel on the 4-20mA Analog Input Module. Always use the next available channel when wiring; for example, if Channels 1 – 3 are being used, Channel 4 must be used next. Pay close attention to the polarity (+/-) of the wires.

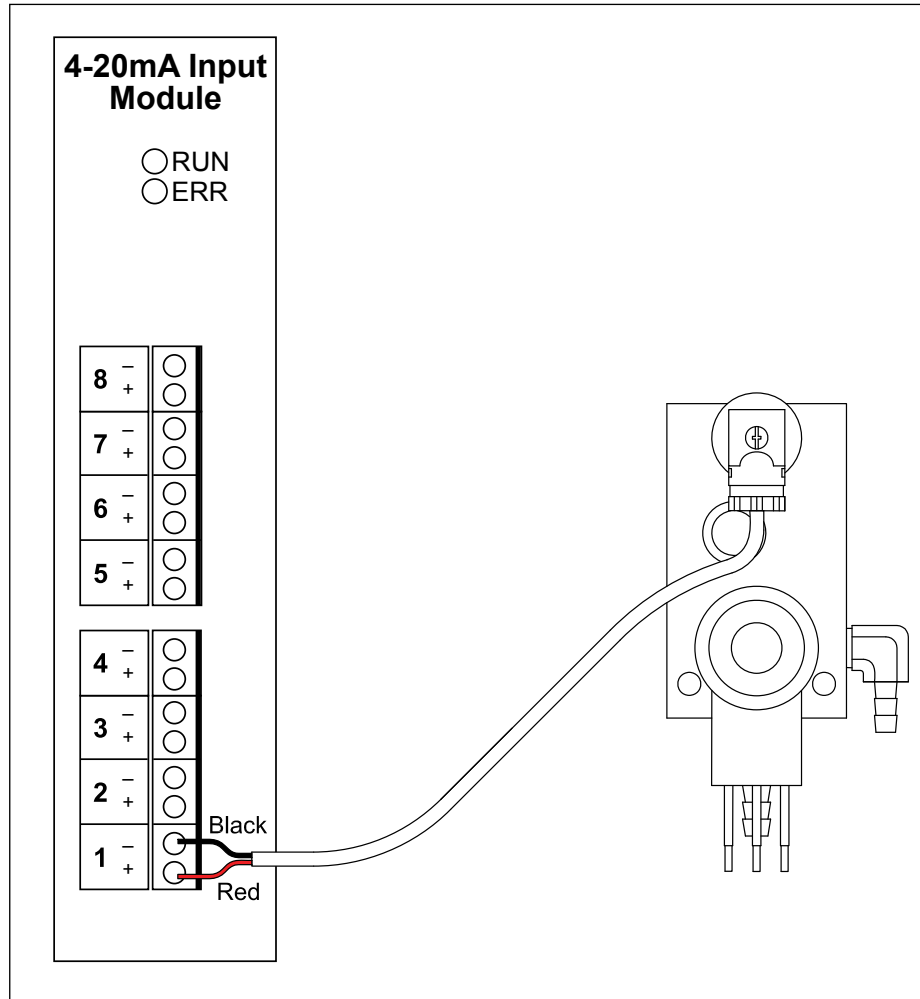


Figure 6 – Vacuum Sensor Wiring

SCM Setup (Console Programming)

The following instructions will guide you through SCM programming only. Administrator privileges will be necessary to program the SCM application for the T5 FMS console. For instructions on FMS programming or on how to obtain an Administrator access level, please refer to the *T5 FMS Programming Guide* (p/n 000-2142).

Access the T5 FMS console (via the LCD or Tank Sentinel Anyware - TSA) and navigate to the Setup Menu. Once at the Setup Menu, go to each of the following sections and adjust SCM parameters accordingly. You will be prompted to enter the Administrator access level when it is required.

Note: Sites setups vary depending on products used and other equipment installed. Setup information in the sections of this chapter depict a typical site and are meant as examples only.

AC Input Module

The AC Input Module can accept incoming dispenser hook control signals. Hook signals are used to activate the STP via the relay channel connected to the pump controllers. Control signals from the dispenser tell the console which product is requested by the dispenser, then control signals activate the appropriate STP. To perform tests accordingly, SCM needs to know when pumps/dispensers are being used by other applications.

Parameter	Parameter Value
Active High	If set to Yes, a high signal level will activate the channel and a low signal will deactivate the channel. If set to No, then the channel is inverted and will only become active when a signal is absent and inactive when a signal is present.
Channels	Only select the total number of inputs intended for use.
Enabled	If yes, will allow the channel to be mapped to another module. Other modules may use this signal to trigger an event.
Name	Should be a specific device from which the signal is originated.
Number Gasoline Hooks per Dispenser	The number of product hook signal inputs to the console from the dispensers.

Example: AC Input Module SCM Setup

Group Name	Parameter Name	Parameter Value
AC Input Modules	Number Gasoline Hooks per Dispenser	2
Module '#'	Channels	'#'
Channel '#'	Name	Disp 1 Unleaded Hook Signal
	Enabled	Yes
	Active High	Yes
Channel '#'	Name	Disp 2 Unleaded Hook Signal
	Enabled	Yes
	Active High	Yes
Channel '#'	Name	Disp 3 Unleaded Hook Signal
	Enabled	Yes
	Active High	Yes

4-20mA Input Module

SCCM Vacuum Sensors use a single 4-20mA channel per sensor to accept an incoming signal that allows the console to monitor secondary containment vacuum levels.

Parameter	Parameter Value
Channels	The total number of channels used for SCM, LLD, or other analog devices connected to the module.
Enabled	Set to Yes.
Name	Should be a specific device or location where the SCCM Vacuum Sensor is located.
Service Type	Indicates the type of device sending the input to the console. Choose <i>Secondary Containment Monitor</i> to indicate that the device is a SCCM 4-20mA Vacuum Sensor.

Example: 4-20mA Input Module SCM Setup

Group Name	Parameter Name	Parameter Value
4-20mA Input Modules		
Module '#'	Channels	'#'
Channel '#'	Name	Regular SCCM Vacuum Sensor
	Enabled	Yes
	Service Type	Secondary Containment Monitor
Channel '#'	Name	Premium SCCM Vacuum Sensor
	Enabled	Yes
	Service Type	Secondary Containment Monitor
Channel '#'	Name	Diesel SCCM Vacuum Sensor
	Enabled	Yes
	Service Type	Secondary Containment Monitor

Relay Module

The Relay Module contains eight separate relays (called Relay Channels). A channel is used to open and close an individual SCCM solenoid. For SCM, the solenoid relay channel is controlled by an input from the 4-20mA Input Module (the SCCM Vacuum Sensor channel).

Parameter	Parameter Value
Channels	The total number of channels used for any equipment connected to the module.
Enabled	Set to Yes.
Input Channel	Select the 4-20mA Input Module channel connected to the SCCM vacuum sensor on the same SCCM as the solenoid being programmed.
Input Type	Select the 4-20mA Input Module that contains the SCCM vacuum sensor on the same SCCM as the solenoid being programmed.
Logic	Set to <i>OR</i> logic.
Name	Should be a specific device or location of the SCCM Solenoid connected to the relay.
Number of Inputs	Set to 1.
Physically Wired As	Select <i>Normally Open</i> to indicate which contacts the solenoid is wired to.
Polarity	Set to <i>Normal</i> .
Type	Select <i>Solenoid</i> for type identify the type of device connected to the relay is a SCCM solenoid.

Example: Relay Module SCM Setup

Group Name	Parameter Name	Parameter Value
Relay Modules		
Module '#'	Channels	'#'
Channel '#'	Name	Unleaded Solenoid Valve
	Enabled	Yes
	Type	Solenoid
	Polarity	Normal
	Logic	OR Logic
	Physically Wired As	Normally Open
	Number of inputs	1
Input '#'	Type	4-20mA Input Module
	Channel	Unleaded SCCM Vacuum Sensor
Channel '#'	Name	Premium Solenoid Valve
	Enabled	Yes
	Type	Solenoid
	Polarity	Normal
	Logic	OR Logic
	Physically Wired As	Normally Open
	Number of inputs	1
Input '#'	Type	4-20mA Input Module
	Channel	Premium SCCM Vacuum Sensor
Channel '#'	Name	Diesel Solenoid Valve
	Enabled	Yes
	Type	Solenoid
	Polarity	Normal
	Logic	OR Logic
	Physically Wired As	Normally Open
	Number of inputs	1
Input '#'	Type	4-20mA Input Module
	Channel	Diesel SCCM Vacuum Sensor

Turbine Pump Interface (TPI) Applications (Alternate STP Control)

TPI is an alternative to using the Relay Module to actuate an STP on demand (from a dispenser request or SCM). Just as with using a relay channel, this method will provide positive pump shutdown on alarm (if that option is chosen in the setup). When using the standard TPI feature of the console to control a STP, be sure to map the SCCM vacuum sensor as an “Input” for the STP that it is connected to (as shown in the TPI table). This will allow the SCM application to actuate the STP when it is necessary to regulate the vacuum levels in the containment. For further information and instructions on programming TPI and/or Relay Modules to control a STP, please refer to the *T5 FMS Programming Guide* (p/n 000-2142).

Example: TPI Setup

Group Name	Parameter Name	Parameter Value
Power Supply		
RS-485	Enable Interface	Yes
TS-TPI	Enable Interface	Yes
Controllers A	Number of Controllers	'#'
Controller '#'	Name	Unleaded Controller
	Enabled	Yes
	Type	Mag/Eco
	Address	1
	Group	0
	Tank	1
	Height	5.00 in
	Number of inputs	2
Input 1	Type	AC Input Module
	Channel	Unleaded Hook Signal
Input 2	Type	4-20mA Input Module
	Channel	Unleaded SCM Vacuum Sensor
Controller '#'	Name	Premium Controller
	Enabled	Yes
	Type	Smart I
	Address	2
	Group	0
	Tank	2
	Height	5.00 in
	Number of inputs	2
Input 1	Type	AC Input Module
	Channel	Premium Hook Signal
Input 2	Type	4-20mA Input Module
	Channel	Premium SCM Vacuum Sensor
Controller '#'	Name	Diesel Controller
	Enabled	Yes
	Type	Smart III
	Address	3
	Group	0
	Tank	3
	Height	5.00 in
	Number of inputs	2
Input 1	Type	AC Input Module
	Channel	Diesel Hook Signal
Input 2	Type	4-20mA Input Module
	Channel	Diesel SCM Vacuum Sensor

Secondary Containment Monitoring Application

Programming the SCM application sets the parameters for SCM and enables it to monitor a set number of channels. Each containment area or group must be programmed separately on the T5 FMS console.

Parameter	Parameter Value
Auto-Enable on Reset	A feature that allows the Containment area to enable itself after an alarm condition is cleared, or when the system is powered on or reset.
Enabled	Set to Yes.
Name	Should be a specific location or product type of the containment area.
Number of Containments	The number of SCCMs connected to the console.
Pump Shutdown on Alarm	If set to Yes, provides positive pump shutdown when the containment area is in alarm.
Submersible Pump Channel	Maps the containment area to the specific pump control output channel.
Submersible Pump Module	Maps the containment area to a specific pump to provide pump on/off.
Transducer	Maps the containment area to the SCM Vacuum Sensor as specified by the 4-20mA Input Module channel assignments.

Example: SCM Application Setup

Group Name	Parameter Name	Parameter Value
Secondary Containment Monitor	Number of Containments	3
Containment 1	Name	Unleaded Line Containment
	Enabled	Yes
	Pump Shutdown on Alarm	Yes
	Auto-enable on Reset	Yes
	Submersible Pump Module	Relay Module (or Power Supply for TPI)
	Submersible Pump Channel	Unleaded Pump Control
	Transducer	Unleaded SCCM Vacuum Sensor
Containment 2	Name	Premium Line Containment
	Enabled	Yes
	Pump Shutdown on Alarm	Yes
	Auto-enable on Reset	Yes
	Submersible Pump Module	Relay Module (or Power Supply for TPI)
	Submersible Pump Channel	Premium Pump Control
	Transducer	Premium SCCM Vacuum Sensor
Containment 3	Name	Diesel Line Containment
	Enabled	Yes
	Pump Shutdown on Alarm	Yes
	Auto-enable on Reset	Yes
	Submersible Pump Module	Relay Module (or Power Supply for TPI)
	Submersible Pump Channel	Diesel Pump Control
	Transducer	Diesel SCCM Vacuum Sensor

SCM Status and Control Screens

The status of each containment channel can be viewed at any time by navigating to the SCM Status or Control screens. To get to the SCM Status or Control screens, go to **SCM > Status (Summary)** or **SCM > Control (Containment)**.

SCM Status Summary Screen

INCON - Administrator access level		
Franklin Fueling Systems		SCM Status
Home System FMS VRM SCM Setup Preferences		
Status Alarms Control Reports		
Parameter	Unleaded Piping Containment	Premium Piping Containment
	DISABLED	DISABLED
Status	Ok	Ok
Vacuum Level	19.0	19.0
Fail to Reach Vacuum		
Fail to Hold Vacuum		
Vacuum Unstable		
Not Learned		
Pump Request		
Solenoid Status		
Sensor Malfunction		
High Vacuum		
Low Vacuum		
Program Error		
Pump Request Ignored		

When viewing the SCM Status Summary screen, remember to enable *Auto Refresh*. The Auto Refresh button will allow the on-screen results to be automatically updated. When the results will update is dependent on the user-defined parameter *Refresh Rate* found on the Configuration page.

Status and Alarm Indicators

Indicator	Description
Fail to Hold Vacuum	The containment will not maintain the learned level of vacuum.
Fail to Reach Vacuum	The containment has not reached the learned level of vacuum.
High Vacuum	The vacuum level of the containment has exceeded 9" Hg.
Low Vacuum	The vacuum level of the containment has dropped below 1.25" Hg.
Not Learned	The containment has not been learned.
Program Error	SCM has encountered an error.
Pump Request	SCM is attempting to cycle the pump on.
Pump Request Ignored	The pump is being used by another application.
Sensor Malfunction	SCM has detected a failure of the SCCM vacuum sensor.
Solenoid Status	Indicates whether the normally closed SCCM solenoid is open or closed.
Status	Indicates the condition of the containment.
Vacuum Level	A direct reading from the SCCM vacuum sensor.
Vacuum Unstable	The level of vacuum in the containment is not statistically sound.

For more information on alarms and troubleshooting, refer to the Alarms chapter in this manual.

SCM Control Screen

INCON - Administrator access level			
Franklin Fueling Systems		SCM Control	
Home System FMS VRM SCM Setup Preferences			
Status Alarms Control Reports			
Status	Unleaded Piping Containment		Premium Piping Containment
Vacuum Level	18.9		18.9
Enabled			
Not Learned			
Solenoid On			
Alarm			
Control			
Enable/Disable	<input type="checkbox"/>		<input type="checkbox"/>
Reset Alarm	<input type="checkbox"/>		<input type="checkbox"/>
Reset Containment	<input type="checkbox"/>		<input type="checkbox"/>
Solenoid On/Off	<input type="checkbox"/>		<input type="checkbox"/>
Learn			
Start/Stop	<input type="checkbox"/>		<input type="checkbox"/>
Learn Message	Sensor Malfunction		Sensor Malfunction
Learn Mode Active			
Learn Mode Error			

The SCM Control screen will automatically update containment information. Administrator privileges will be necessary to access the SCM Control screen. For instructions on FMS programming or on how to obtain an Administrator access level, please refer to the *T5 FMS Programming Guide* (p/n 000-2142).

Status Indicator Table

Indicator	Description
Alarm	The containment is in an alarm condition.
Enabled	The containment has been enabled by the user or by the application automatically (if the Auto-Enable on Reset parameter is turned on in the SCM Setup).
Not Learned	The containment has not been learned.
Solenoid On	Indicates whether the normally closed SCCM solenoid is open or closed.
Vacuum Level	A direct reading from the SCCM Vacuum Sensor.

Control Indicator Table

Indicator	Description
Enable/Disable	Manually enable or disable the containment.
Reset Alarm	Manually reset an alarm on the containment.
Reset Containment	Manually reset the testing cycle of the containment.
Solenoid On/Off	Manually cycle the solenoid on or off.

Learn Indicator Table

Indicator	Description
Learn Message	The status of the learning process.
Learn Mode Active	The containment is being learned.
Learn Mode Error	An error has been detected during the learning process.
Start/Stop	Start or stop the learning procedure.


Pre-Operational Containment Testing

Pre-operational containment tests determine the tightness of the entire SCM system, including TS-SCCM and inter-connect tubing. These tests consist of two separate procedures: Containment Tightness Tests and STP Siphon Tests. The first procedure, Containment Tightness Testing, will determine whether the containment areas chosen to be monitored are tight. The second, STP Siphon Testing, will determine if the STP is capable of creating enough vacuum for proper SCCM operation.

The Containment Tightness Testing procedure assumes that all STP's and pump controllers have been installed, wired, calibrated, and are operational and in accordance with their respective installation and operation procedures. It also assumes that all T5 FMS console programming has been completed.

Warning  **DO NOT apply vacuum or pressure until consulting the containment manufacturer on the maximum allowed vacuum or pressure levels.**

Warning  **DO NOT use equipment that is not explosion proof in classified areas. Keep vacuum pumps outside class 1, division 1, and class 2 areas. Refer to NFPA 30A, chapter 8.**

Caution  **DO NOT proceed to the Learn Process until each containment successfully completes pre-operational testing. Failure to perform these tests or ignoring any failed tests may prevent the SCM application from detecting a containment fault.**

Note: State and/or local laws may require a separate, more stringent containment tightness test. ALWAYS verify and comply with local regulations.

Note: The STP connected to the SCCM being tested will need to be activated by lifting the appropriate product dispenser handle. Verify that all STP's and pump controllers are installed, calibrated and operational.

Required Equipment

- Vacuum Pump (or other vacuum source)
- In-line Regulator
- Shut-off / Isolation Ball Valve
- Two 0" to -30" Hg Vacuum Gauge (2" Hg max. graduation marks)
- T-Fittings (where applicable)

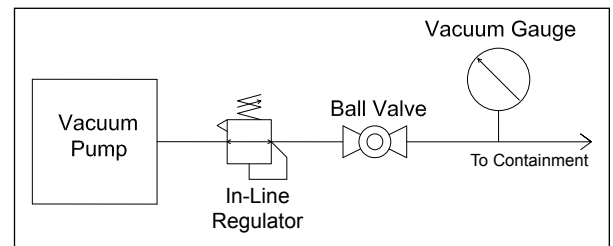


Figure 7 – Vacuum Pump Setup Diagram

Containment Tightness and Continuity Test

Perform the following steps for each SCCM channel.

1. Calculate the approximate containment volume for each area. Consult the secondary containment equipment manufacturer's manuals, data sheets, or other official references.

APT SC Pipe Size	Interstitial Volume (gal/ft)	Interstitial Volume (gal/100 ft)
1.00" (XP-100-SC)	0.006	0.600
1.50" (XP-150-SC)	0.008	0.800
1.75" (XP-175-SC)	0.009	0.900
2.00" (XP-200-SC)	0.010	1.000

2. Vacuum Gauge Installation

- For Individual DW Turbine and Tank Sump Containments, connect the vacuum gauge as shown in Figure 7.
- For SC Pipe and Multiple Jumpered Containments, in addition to the setup shown in Figure 7, connect a vacuum gauge to the end of the last interstitial space or pipe test boot.

3. Install a vacuum gauge, regulator and isolation / shut-off ball valve in-line, onto the vacuum pump. With the ball valve closed, power on the vacuum pump. Adjust the regulator to 6.5" – 7" Hg maximum. Power the vacuum pump off.
4. Remove the plug in the leak generator port on the SCCM. Connect the vacuum pump to this port.
5. Power the vacuum pump on. Open the isolation ball valve slowly to evacuate the containment area to 6" Hg. Close the isolation ball valve:
 - If the vacuum level does not increase after 30 seconds while the vacuum pump is running; large containments may take up to 10 minutes. Inspect each component for leaks.
 - If the gauge drops below 6" Hg immediately after closing the valve then steadies before zero. Slowly open the isolation ball valve again to evacuate the containment to 6" Hg. Repeat as necessary until containment remains at 6" Hg and close the isolation ball valve.
 - If the gauge immediately drops to zero. This indicates that a leak exists. All leaks must be identified and repaired before continuing this test.

Note: Vacuum leaks can be identified by pressurizing the containment area per the manufacturer's specified levels, then spraying a solution of water and liquid soap on connections and fittings. Consistent bubbling on soaped connections/fittings will give a visual indication of the source of a leak. **Consult the manufacturer's documentation for appropriate pressure levels.**

6. Once a stable vacuum level is reached (4.5" – 7" Hg on the vacuum gauge in-line with the vacuum pump), record the level. Use the table to the right to determine the required wait time. The containment vacuum level should remain stable throughout the entire wait time; the vacuum pump may be shut off at this point.


If the vacuum level drops more than 1" Hg during the required wait time, then the containment failed the test. All leaks must be identified and repaired first, then the Containment Tightness Test should be repeated until it successfully completes.

Containment Wait Time Table

Containment Volume	Wait Time
0.25 – 5 gal	15 min
5 – 50 gal	30 min
50 – 100 gal	60 min
100 – 250 gal	2 hr
250 – 500 gal	4 hr

7. If a vacuum gauge has been installed at the end of the system, compare the gauge reading with the console. If the measurements are not within ± 2 " Hg, a blockage may exist within the containment and/or between the SCCM and vacuum gauge. All blockages must be identified and corrected. Once the blockage is corrected, restart the Containment Tightness Test.
8. Uninstall the vacuum pump, regulator, isolation / shut-off valve and vacuum gauges at this time. Continue on to the STP Vacuum Test in the next section. Do not replace the Leak Generator Port Plug.

STP Siphon Flow Rate Test

Warning  Failure to open the leak generator (TS-SCMCAL) during this test can apply an excessive vacuum level to the containment, causing irreversible damage. Ensure that the leak generator is installed properly and that the toggle switch is in the **OPEN** position prior to energizing the STP.

Note: During this procedure the containment reaches 9" Hg, which will cause the console to display a High Vacuum alarm and disable the containment. If *Pump Shutdown on Alarm* is chosen in the options, a disabled containment will not allow the STP to be activated. Navigate to the SCM Control screen, press **Reset Alarm** to continue.

1. Install a vacuum gauge and the vacuum leak generating device (TS-SCMCAL) into the leak generator (LG) port on the SCCM using necessary fittings. Switch the toggle valve to the *UP* (open) position.
2. At the T5 series FMS console (using either the LCD or Tank Sentinel Anywhere), navigate to the SCM Control Menu. Press the **Solenoid** button — this activates (opens) the solenoid.
3. Activate the STP by lifting the appropriate dispenser handle.
4. With the STP on and the toggle valve open, the vacuum level must be able to reach at least 6.5" Hg. Verify vacuum levels at the gauge connected to the containment area.

Large Containments (>50 gal.) may take several minutes. For large containments, close the leak generator until the vacuum level reaches approximately 6" Hg. Open the leak generator. Allow the vacuum to build. The vacuum level must be able to reach at least 6.5" Hg, but, if the vacuum is not able to reach at least 6.5" Hg, then the STP siphon assembly must be repaired or replaced.

5. Once the vacuum level is verified above 6.5" Hg, return the hook signal to turn off the STP.
6. At the T5 series FMS console (LCD or TSA), navigate to the SCM Control Menu. Press the **Solenoid** button — this deactivates (closes) the solenoid.
7. Allow the vacuum to decay to 0" Hg.

If you are proceeding to the Learn Process chapter next, the TS-SCMCAL may remain installed at the SCCM leak generator port.

Learn Process

Each containment area must be Learned before the SCM system can continuously monitor it. *Learning* involves evacuating the containment area, then introducing a calibrated leak using the Leak Generating Kit (TS-SCMCAL). The system learns what the evacuation and decay curves look like by employing this process. The system then uses the curves it's learned to determine if there is a leak while it monitors the containment area.

Note: All console programming must be completed prior to the learn process. Refer to the SCM Setup (Console Programming) chapter in this manual for details. Administrator privileges are necessary to Learn containments. Refer to *T5 FMS Programming Guide* (p/n 000-2142) for information on gaining Administrator privileges.

Note: Complete the *Pre-Operation Containment Testing* chapter prior to starting the Learn Process.

Note: No dispensing can take place during the Learn Process. If product is dispensed while Learning, stop the process by pressing the **Reset** button. Always restart the Learn Process from the beginning.

Note: DO NOT submerge or block the TS-SCMCAL orifice while learning the containment. The orifice MUST be kept free of dirt and debris.

When to Learn/Re-Learn

- SCM installation and start-up
- After repairs or modifications to containment areas
- After repairs or modifications that may affect the siphon flow rate
- After 4-20mA Input Module replacement
- After certain 4-20mA Input Module firmware upgrades (consult FFS Technical Services Department)
- If moving the SCCM to another 4-20mA channel
- When adding or removing volume from a containment

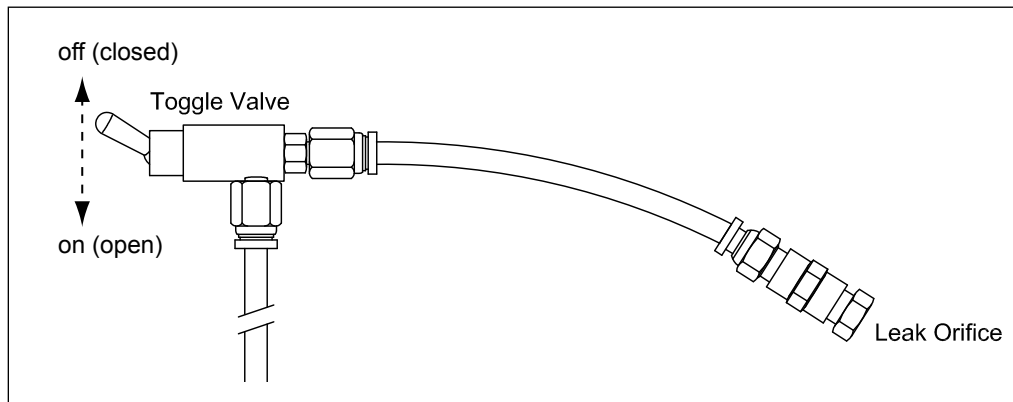


Figure 8 – Leak Generator Kit (TS-SCMCAL)

Procedure

1. The SCCM leak generator port is plugged for normal operation but may have been removed for pre-operational testing. If the leak generator port is plugged, remove the plug.
2. Install a TS-SCMCAL at the leak generator port on the SCCM; the TS-SCMCAL may remain installed from the *Pre-Operational Containment Testing* chapter.
3. Switch the toggle valve to the *Up* (closed) position.
4. At the T5 series FMS console (LCD or TSA), navigate to the SCM Control screen. Verify that the console is indicating less than 0.2" Hg before the containment is Learned. If the vacuum level is above 0.2" Hg, open the toggle valve to equalize containment vacuum to 0" Hg. Close the toggle valve when the containment is below 0.2" Hg.
5. Press/Click the **Learn** button. SCM will activate the pump and open the solenoid valve. The vacuum level of the containment should rise and the Learn Message should display *Learning Evacuation Curve*. When the vacuum reaches 6" Hg, the solenoid will close and the STP will turn off. The solenoid may cycle on and off during evacuation, which is part of its normal operation during this procedure.

6. When the message *Open Leak Toggle Valve* appears, switch the toggle valve to the *UP* (open) position. SCM will learn the vacuum decay curve and display *Learning Decay Curve* on-screen. The vacuum level will begin to fall.
 7. When finished, the message *Learn Completed – No Errors* is displayed on-screen and the Not Learned indicator will become inactive.
- Note:** If any errors are encountered at any time during the Learn Process, the screen will display the appropriate error message and the Not Learned indicator will be active. Refer to the Alarms chapter of this guide for information on troubleshooting any errors that are displayed.
8. Once the containment has been successfully learned, enable the containment on the Containment Control screen with the leak generator open. The console will automatically begin a test on the containment. This test should fail, forcing the containment into alarm status.
 9. Close the leak generator. To clear the alarm, navigate to the Containment Control screen and choose **Reset Alarm**. If the *Auto-enable on Reset* option is turned on in the SCM section of programming, the containment will be automatically enabled after resetting the alarm condition and will automatically begin a test on the containment. This test should pass, allowing SCM to continue to monitor the containment. If this test fails, isolate why the test failed, make necessary repairs, and then retry the test.
 10. Remove the leak generator and replace the leak generator plug. Apply TFP tape sealant to the threads of the plug, then tighten the plug. If alarms or errors occur, refer to the Alarms chapter of this guide. When the condition is corrected, restart the Learn Process.

Learn Messages

Learn Message	Description
Existing Vacuum Detected	The Learn Process was started with .5" Hg or more existing in the containment. The Learn Process needs to be restarted at 0" Hg.
Learned	The containment has been Learned with no errors.
Learning Decay Curve	Displayed during the Learn Process to indicate that the calibrated leak decay curve is being recorded.
Learning Evacuation	During the Learn Process, SCM is recording the time and vacuum levels while evacuating the containment.
Failed to Reach Target Vacuum / Time Limit Exceeded / Pre-Existing Leak	A vacuum leak is present when the leak generator should not be open.
No Leak Detected	Vacuum level is constant or has risen while Learning the decay curve.
No Leak Detected/Time Limit Exceed	The leak valve was opened when prompted, but the leak valve was closed before the Learn Process was completed. Restart the Learn Process and open the leak valve when prompted. Close the leak valve after the Learn Process has completed.
Not Learned	The containment has been programmed, but the containment has never been Learned. Refer to the SCM Learn Process section to Learn the containment. Follow all Warnings, Cautions, and Notes prior to Learning the containment.
Open Leak Valve	This is a required step during the Learn Process. When shown, open the leak generator.
Pump Request Ignored	SCM sent a request to start the STP, but the TPI or the relay module didn't send confirmation that the STP was running. The STP may be used or disabled by other applications.
Sensor Malfunction	This message is displayed if the containment is enabled in the setup, not Learned, and the sensor was disconnected. Verify sensor wiring.
Exceed Time Limit to Reach Target Vacuum	Evacuation Learning exceeds the limit.
Time Out for Leak Valve Not Opened	The leak valve is not open during the Learn Process. Restart the Learn Process and open the leak valve when prompted to by the console.

SCM Reports

SCM reports are available on demand from the console locally or remotely (with TSA). Several report options may be used to print or save generated reports. For more information on reports in general, please refer to either the *T5 Series Programming Manual* (p/n 000-2142) or the *T5 Series Operator's Guide* (p/n 000-2151).

SCM Alarm Reports

SCM Alarm Reports include any SCM alarms or application events that occurred within the date range chosen by the user. An example of an SCM Alarm History Report can be found below.


INCON				
Franklin Fueling Systems		Last 30 Days		27-Feb-07 16:00:05
3760 Marsh Road				
Madison, WI 53718				
608-838-8786				
USA				
SCM Alarm History Report				
Device	Description	Type	Date Occurred	Date Cleared
Containment 1	Vacuum Pressure Sensor Failed/Not Connected	Warning	23-Feb-07 17:47:02	
Containment 1	Not Learned	Warning	23-Feb-07 17:47:02	

Application Event Reports

Application Event Reports include any system warning pertaining to SCM equipment that occurred within the date range chosen by the user.

Alarms

When a T5 FMS console is in alarm, the Alarm LED on the front of the console will flash. If SCM has been programmed to shut down the pump on alarm (in the SCM Setup), the pump will be unavailable for all system tests and dispensing until the containment with the active alarm is manually Reset. If the condition still exists after reset, the alarm will return. A service visit may be required to identify and correct the condition.

Warning  **Always REMOVE POWER from the console prior to installing/removing a module or performing any maintenance while the console door is open.**

Note: Refer to the Important Safety Messages outlined in the beginning of this manual before performing any console maintenance.

Note: If at any time while troubleshooting a Warning or Alarm this guide is not able to help you correct the issue, please contact FFS Technical Services.

SCM Alarms and Warnings

To troubleshoot your alarm or warning, identify the Alarm/Warning display on the console in the table below and review the solution presented in the Error Code Table that follows.

Alarm/Warning	Possible Error Codes
Channel Not Learned	G
Failed to Hold Vacuum	A, B, H
Failed to Reach Target Vacuum	A, B, C, D, F
Low Vacuum	A, B, C, D, F
Low Vacuum and Pump Request Ignored	A, B, F, G
Not Configured	G
Not Learned	G
Program Error Detected	Check SCM Programming
Pump Request Ignored	F
Unstable Vacuum	B, D, C
Vacuum Sensor Failure	E
Vacuum Sensor Failure / Not Connected	E
Vacuum Too High	B, G

Error Code	Error	Solution
A	Containment Tightness	Refer to the Containment Tightness Testing section of this guide and perform the tests in that section to ensure that there are no leaks and that the tank is tight.
B	Thermal Contraction	Caused by temperature variations of the air (or liquid if present) in the containment.
C	Liquid in Containment	This will decrease the containment size. If liquid is drawn through the containment, through the STP siphon, various parameters and containment vacuum readings will be incorrect. Containments should remain free of liquid at all times.
D	Siphon Function Check	The siphon must be able to pull a vacuum of 8" Hg or more if connected to other equipment. The vacuum also must have a minimum flow rate of 146 L/Hr. Perform a STP Siphon Flow Rate Test as illustrated in the Pre-Operational Containment Testing chapter.
E	SCCM Vacuum Sensor Function Check	The transducer is sending incorrect data or no data to the console. Verify wiring from the transducer to the console. If wiring is correct, setup and program the transducer on a different, unused channel for testing.
F	STP Function Check	Use the dispenser to signal the STP when the dispenser is authorized then the STP should run. Also, SCM must be able to signal the STP pump on. Force a test on the containment using the SCM Control screen. The STP will start only if necessary to evacuate the containment. If the STP does not run to evacuate the containment, verify programming.
G	Verify Programming	Refer to the SCM Setup chapter of this guide for all SCM related programming information.
H	SCCM Vacuum Relief Valve Function Check	The mechanical vacuum relief valve is designed to open when containment vacuum levels reach or exceed 10" Hg. If at any time the containment vacuum level exceeds 10" Hg while the pump is on, this error will occur as an indication of a relief valve failure.

Clearing Alarms

Clearing a console of alarms is important because, depending on how the T5 FMS console has been set up, alarms can: disable channels, start an annunciator, or stop an SCM test under way.

Administrator privileges will be necessary to clear SCM alarms on the T5 FMS console. For instructions on how to obtain an Administrator access level, please refer to the *T5 FMS Programming Guide* (p/n 000-2142).

1. Identify the alarm on the SCM Alarms screen.
2. Diagnose the condition using information found in the Alarms chapter of this guide.
3. Follow the troubleshooting steps in the previous section of this chapter to correct the issues indicated by the alarms.
4. Navigate to the SCM Control screen.
5. Select **Reset Alarms** on the Control screen.
6. If Auto-Enable on Reset is chosen in the SCM Setup, then the containment will enable automatically. Otherwise, select **Enable/Disable** on the Control screen.

If the condition still exists, the alarm can take up to several hours to reappear after the containment is enabled.

Enabling/Disabling SCM

After learning the channel(s), each channel will need to be enabled to allow containments to be monitored. The Containment Status reflects the current status of the channel.

Enabling SCM Channels

At the T5 FMS console (LCD or TSA), navigate to the SCM Control screen. Press the **Enable/Disable** button to enable the channel.

Only while the channel is enabled will that channel continuously monitor and test vacuum levels by activating the STP as necessary. Normal SCM operating vacuum level is between 2" Hg and 5" Hg. During vacuum recharge periods, it is normal for the vacuum levels to reach 6" Hg.

Note: A channel will not enable properly if it is not learned, in an alarm status, or if an error condition exists (such as a sensor malfunction). An alarm must be reset to enable a SCM channel.

Disabling SCM Channels

At the T5 FMS console (LCD or TSA), navigate to the SCM Control screen. Press the **Enable/Disable** button to disable the channel.

Important: While the channel is *Disabled*, SCM will neither maintain nor test containment vacuum levels.

Disabling the channel will force the console to display a Containment Not Enabled warning. This warning will also appear on the SCM History Report. The channel may be re-Enabled at any time.

If alarms or errors occur, please refer to the Alarms chapter of this guide.

SCM Annual Functional Testing

Perform a SCM Functional Test annually. This test will verify that the SCM application will detect and alarm on a leak condition. This test should be performed during times when there is no dispensing.

1. If the channel is Enabled, disable the channel. At the T5 FMS console (via LCD or TSA), navigate to the SCM Control screen. Press the **Enable/Disable** button to disable the channel.
2. Remove the plug in the Leak Generator (LG) port on the SCCM. Connect the TS-SCMCAL (Leak Generator Kit) to this port.
3. Switch the toggle valve to the DN (closed) position.
4. Enable the channel. Wait for the containment vacuum levels to reach normal operating levels.
5. Switch the toggle valve to the *UP* (open) position.
6. The vacuum levels will then fall, which could take several minutes for large containments. Verify that the console displays an alarm.
7. The channel will be disabled by the SCM application. Remove the TS-SCMCAL. Apply TFP tape sealant to the threads of the Leak Generator Port Plug. Replace and tighten the plug.
8. At the T5 FMS console (via LCD or TSA), navigate to the SCM Control screen. Press the **Reset Alarm** button to enable the channel, then press the **Enable/Disable** button to enable the channel. Resume normal operation.
9. If the SCM Annual Functional Test passed, please skip this step. If the system did not catch the leak and the test failed, disable the channel and run the pre-operational tests. Perform the annual test again. If the channel still fails to detect the leak, please contact FFS Technical Support.

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