TS-550/5000 evo®
Fuel Management System
Installation Guide
Important Safety Messages

Franklin Fueling Systems 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 Fuel Management System 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 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. TS-550/5000 evo 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 TS-550/5000 evo console or attached components should only be performed by a qualified, factory-trained technician.
Notice
Franklin Fueling Systems reserves the right to change this document and specifications at any time without notice. Franklin Fueling Systems makes no expressed or implied warranty with regard to the contents of this manual. Franklin Fueling Systems assumes no liability for errors or omissions, or for any damages, direct or consequential, that may result from the use of this document or the equipment that it describes.

Trademarks
INCON®, TS-5 Series®, TS-550 evo, TS-5000 evo®, System Sentinel®, SCALD®, Brite®, BriteBox®, BriteBus®, and BriteSensors® are registered trademarks of Intelligent Controls. All brand and product names are trademarks or registered trademarks of their respective companies.

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.

Return Shipping Charges
Franklin Fueling Systems will not accept shipments of returned products without a Return Material Authorization (RMA) number. RMAs are obtained by contacting Franklin Fueling Systems’s Technical Service Division — NO RMAs will be given without the unit’s serial number(s). Returned material remains the property of the buyer until replaced or repaired.

Under Warranty
Franklin Fueling Systems will pay all freight and insurance charges for all “Under-Warranty” RMAs.

Non-Warranty
It is the buyer’s responsibility to prepay all freight and insurance charges for “Non-Warranty” RMAs.

Refer to the Warranty section at the end of this manual for all warranty issues.

Contacting Franklin Fueling Systems (FFS)
Please feel free to contact us by mail at:
Franklin Fueling Systems
3760 Marsh Rd.
Madison, WI 53718 USA

Or contact us by phone, fax or e-mail:
Tel: 1 608 838 8786 E-mail: sales@franklinfueling.com
Fax: 1 608 838 6433 techserve@franklinfueling.com
Tel: US & Canada 1 800 225 9787
Tel: México 001 800 738 7610
Tel: Europa +49 6571 105 380

Office Hours: 8am to 5pm CST - Monday through Friday
Please visit our web site at www.franklinfueling.com
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Introduction
This manual contains installation and site preparation instructions for Franklin Fueling Systems’ TS-550 evo and TS-5000 evo consoles. Overall safety issues, troubleshooting information, warranty, service, and return policies, as defined in this manual, must be followed.
Please read this entire manual carefully. Failure to follow the instructions in this manual may result in faulty operation, equipment damage, injury or death. This equipment should only be serviced by an installer certified by Franklin Fueling Systems.

Certified Installer/Service Person
Only an Franklin Fueling Systems certified installer or service person is allowed to access both the user interface keypad and areas internal to the TS-550/5000evo console.

Station Owner/Operator
The station owner or operator of the TS-550/5000evo console is only allowed to access the user interface keypad. Access to areas internal to the console is strictly prohibited.

Abbreviations & Acronyms
10ARLY - 10 Amp Relay Module
2WSNS - 2-Wire Sensor Module (Intrinsically Safe)
3WSNS - 3-Wire Sensor Module (Intrinsically Safe)
420EXP - 4-20 mA Explosion-proof module
ACI - AC Input Module
420IB - 4-20mA Analog Input Module (Intrinsically Safe)
AST - Aboveground Storage Tank
ATG - Automatic Tank Gauge
CM - Controller Module
DIM - Dispenser Interface Module
FMS - Fuel Management Systems
IO - Input / Output module
IS - Intrinsically Safe
LON - LonWorks Interface Module
PC - Personal Computer
PRB - Probe Module (Intrinsically Safe)
PS - Power Supply Module
RLY - Relay Module
SCM - Secondary Containment Monitoring
TPI - Turbine Pump Interface
EVO-EXPC - TS-5000 - Expansion console with space for 11 modules
EVO-EXPC2 - TS-550 - Expansion console with space for 6 modules
UST - Underground Storage Tank

Related Documentation
The system operation and programming instructions, troubleshooting guide and console maintenance manual are provided for your use in separate documents. Detailed installation and testing instructions for each type of leak detection sensor are present in the relevant manual, and, likewise, the installation, testing, and programming of various upgrade kits and optional accessories are also contained in separate manuals, addenda or in one of this document’s appendixes.

Product Description
The TS-550/5000 evo is a modular, automatic, continuous monitoring system that uses plug-in modules to perform a wide variety of functions. From fuel management, monitoring, and/or control functions. The TS-550/5000 evo with its plug-in modules allows you to customize the system to meet your needs. Purchase only those functions that you require, and expand your system later for greater capabilities.

The TS-550/5000 evo’s enhanced processor and additional memory on the CM (Controller Module) along with the flexibility of the modular design allows for peak performance while monitoring multiple systems. The TS-550/5000 evo can easily monitor all of your tanks, lines, sumps, and secondary containments.

The TS-550/5000evo console comes standard with a Controller Module (CM), Power Supply Module (PS), and a color LCD display and these features:
• Generates reports automatically in response to preset/programmed conditions and alarms
• Provides audio-visual annunciation when an alarm or warning condition exists
• Performs inventory monitoring
• Is able to print reports on a compatible external Hewlett-Packard Printer
• Can communicate via Ethernet, RS-232, RS-485, or an optional internal fax/modem.

**The TS-550/5000 evo console optionally:**
• The TS-550evo has six (6) open slots for additional modules that can be used to expand its capabilities and the TS-5000evo has 11 slots.
• Can support a combination of up to:
  • 36 Probes (or three Probe Modules)
  • 36 2-wire sensors (or three 2-Wire Sensor Modules)
  • 24 3-wire or 2-wire sensors (or three 3-wire Sensor Modules)
  • 24 relay outputs (or three Relay Modules)
  • 24 4-20mA inputs  (or three 4-20ma Input Modules)
  • 36 AC inputs (or three AC Input Modules)
  • 12 4-20mA outputs & 24 AC/DC Inputs (or three Input & Output Modules)

**TS-550 evo Example Station:**
If your station has 8 Submersible Pumps, 12 Tanks, 8 Lines and 24 Sensors, you could control all of it with your FFS TS-550 evo and six plug-in modules: a Relay Module, a Probe Module, an Analog Input Module, an AC Input Module and two Sensor Modules.

**TS-5000 evo Example Station**
If your station has 16 Submersible Pumps, 24 Tanks, 16 lines, and 36 sensors you could control all of it with your FFS TS-5000 evo and nine plug-in modules: two Relay Modules, two Probe Modules, two Analog Input Modules and two AC Input Modules, and three Sensor Modules
Standard Installation Materials

Recommended standard materials should be selected and installed per all applicable local, state and federal codes governing the installation of this product and its associated systems. Please see the corresponding console/module wiring section or the associated devices section of this manual for complete installation details.

Cables Required for Liquid Level Probes, and 4-20 mA Sensors

Use cables and wires compliant with national and local codes. Franklin Fueling Systems recommends using the types of cable shown below up to a recommended length of:

- Belden No. 87760 (0.15” or 3.048 mm OD) to 260 feet (80 m)
- Belden No. 87761* (0.12” or 3.048 mm OD) to 400 feet (120 m)
- Belden No. 89182* (0.31” or 7.874 mm OD) to 1500 feet (450 m)

Note: An asterisk (*) denotes a cable that may be ordered from Franklin Fueling Systems.

Note: Conductors of different intrinsically safe (IS) circuits may be run together within the same conduit, and, when they do, they should have at least .01 inches (.25 mm) of insulation.

Cable or Wire for 2-Wire or 3-Wire Sensors

2-wire or 3-wire sensor wire (type THHN, TFFN, or THWN, gas and oil resistant, 18 AWG minimum, 1500 feet max. wire run length) can be used when enclosed within rigid metal conduit from the sensor to the console.

Leak detection sensor cable is required when NOT run through rigid metal conduit. Refer to the Direct Burial Cable – Installation Manual (P/N 000-1041) for further information. See below for cable types and descriptions:

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha 58411</td>
<td>Two conductor cable for standard, 2 conductor leak detection sensors (0.114 inch (2.9 mm) O.D.)</td>
</tr>
</tbody>
</table>

Wire required for the TS-550/5000 evo Console

- 3 conductors: Power – 14 GA to 12 GA Max. – Black, White, and Green
- 1 conductor: Safety Ground – 12 AWG Green (2 may be required in some locations)
- As required conductors: Accessories – Type THHN, TFFN, or THWN, 18 AWG minimum

Circuit Breaker

20 Amp — providing power only for the TS-550/5000evo console, one required per console

Note: Do not run other non-intrinsically safe wiring within the I.S. pull box.

Weatherproof Junction Boxes

Minimum 16 cubic inch (406.4 cubic mm) weatherproof junction box, cover, and cover gasket for the manholes of: liquid level probes and leak detection sensors. Also use ¾ to ½ inch (12.7 mm to 19.05 mm) bushings for probe/sensor compression fittings.

Use a weatherproof metal pull box for combining several circuits that will run into the TS-550/5000evo console through one or more conduits. Use a separate weatherproof metal pull box to combine intrinsically safe (IS) liquid level probe and leak detection sensor wiring. Do not run other non-intrinsically safe wiring within the IS pull box. Run ½ or ¾ inch (12.7 mm or 19.05 mm) IS probe or sensor conduit from the manholes to the IS pull box, and then run up to four ¾ or ½ inch (12.7 mm or 19.05 mm) conduits to the console’s IS conduit knockouts.

Conduit

Rigid metal conduit (RMC) - male NPT threaded: use ½ or ¾ inch (12.7 mm or 19.05 mm) for IS probe and sensor wiring to the console (from the manholes, use ½ or ¾ inch conduit), and use ½ or ¾ inch (12.7 mm or 19.05 mm) for non-intrinsically safe accessories and power wiring.

Use conduit hardware that is appropriate for the installation and meets local, state and federal requirements.

Splice Connector Kits Must Be Used — Warranty Requirement

Use the Franklin Fueling Systems-approved, moisture-resistant, no-strip splice connectors for liquid level probe and leak detection sensor wires. You may order the TSP-KW30, which contains 30 of the Franklin Fueling Systems-approved, moisture-resistant connectors.

Using moisture resistant splice connectors will:

- Reduce/eliminate corrosion of the wire connections from repeated exposure to water condensation, which causes eventual signal loss and system failure.
- Reduce/eliminate equipment damage from water flooding around the connectors, which causes short-circuit damage.
Thread Sealant (UL Classified)
Use a non-hardening, “stay-soft,” thread sealant, or equivalent, to seal and waterproof all tank riser pipe threads. In addition, the thread sealant (or “pipe dope” as it is commonly known) should also be chemically non-reactive to the product in the tank(s). Apply thread sealant to seal/waterproof all outdoor electrical conduit fitting threads including the hole plugs at the weatherproof junction boxes.

Riser Pipes
ANSI Schedule 40 (or chemically non-reactive) – 4 inch (101.6 mm) (8 NPT) riser pipes for liquid level probes. See the appropriate leak detection sensor manual for information on required riser pipes and riser cap adapters.

Probe Installation Kit(s)
See the TSP-LL2’s installation instructions that came with the probe for the items included with the TSP-K4A standard probe installation kit. For chemical applications, see the TSP-LL2’s installation instructions for the TSP-K4AS stainless steel riser cap adapter kit and the TSP-SSP stainless steel product float.

TSP-LL2 Probe Floats
- Floats for 4 inch (101.6 mm) riser pipes, order: TSP-IGF4 for gasoline applications or TSP-IDF4 for diesel and fuel oil
- Floats for 2 inch (50.8 mm) riser pipes, order: TSP-IGF2 for gasoline, TSP-IDF2 for diesel and fuel oils, or TSP-SSP stainless steel float for chemical products

Manufacturer’s Tank Chart for Each Tank
The manufacturer’s Tank Chart and other documentation will be used for installation and programming, and possibly for future reference. Keep this information — do not discard it.

Console Installation

Console Location
The location that you select to install the console must be indoors in an area classified as non-hazardous (see the console specifications table at the beginning of the Wiring the Console & Modules chapter for further information). To get the maximum benefit from this system, install the console where personnel can easily make use of it; mount it at eye level for operator convenience. Mount the console level on a vertical surface between 2 feet (0.6 m) and 6 feet (1.9 m) high using the appropriate fasteners. For European applications, the console must be located in a pollution degree 2 environment per IEC60664.

Mounting the Console

Warning
The TS-550/5000 evo consoles must be mounted in a location where explosive or flammable vapors are not present, otherwise an explosion hazard will be created which can result in severe injury, death, serious property damage and/or environmental contamination.

Warning
Leave a minimum of two inches (5.1 cm) of space around the console open to allow for ventilation, communication port connections, conduit and wiring. If the ventilation louvers located on the sides of the TS-550/5000 evo are obstructed, the unit may overheat and stop functioning as intended.

Four mounting tabs are available on the outside corners of the console. Select fasteners that have sufficient load carrying capacity and which are appropriate for wall construction – a fully equipped TS-550/5000 evo console can weigh as much as 40 pounds (18 kg), so make sure that your fasteners (and mounting surface) can adequately support that much weight. In addition, plan ahead to make sure that there is enough room around the console for: conduit coming into the unit, communication port connections, possible incoming probe or sensor wiring, and for the console door to fully open for easy access.

Note: For questions concerning standard installation materials to be used for the TS-550/5000 evo console, please refer to the Standard Installation Materials section of this manual.
TS-550/5000 evo Dimensions and Operating Parameters

The TS-550/5000 evo has conduit knockouts and communication ports located on the bottom of the unit. Use the diagram below to help you mount the console appropriately.

**Figure 1: TS-550 evo and TS-5000 evo Dimensions**

### Console Operating Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Voltage</td>
<td>115/230 V~ +15%, -10%</td>
</tr>
<tr>
<td>Frequency &amp; Power</td>
<td>50/60 Hz, 150 W maximum</td>
</tr>
<tr>
<td>Storage Temp.</td>
<td>-20° to 60° C (-4° to 140° F)</td>
</tr>
<tr>
<td>Operating Temp.</td>
<td>0° to 40° C (32° to 104° F)</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>0 to 95%, non-condensing</td>
</tr>
<tr>
<td>Cleaning</td>
<td>Cloth or sponge slightly dampened in mild detergent</td>
</tr>
<tr>
<td>Splash Resistance</td>
<td>Not to be exposed to direct spray, splash or drips</td>
</tr>
<tr>
<td>Location</td>
<td>Indoors in an office or in a non-hazardous pollution degree 2 environment per IEC60664</td>
</tr>
</tbody>
</table>
Communication Ports
The TS-550/5000 evo console has several communication ports that can be used to communicate with various devices. The communication ports can be used for a wide variety of applications: to connect the console to a computer network, to print reports on an external printer or to fax reports via the optional internal fax/modem. Please refer to the table below for a more complete listing of the ports and their associated devices.

<table>
<thead>
<tr>
<th>Port</th>
<th>Connector Type</th>
<th>Devices</th>
<th>Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232 Comm 1</td>
<td>DB9 Female</td>
<td>Local PC (preferred in Comm 1)</td>
<td>Controller</td>
</tr>
<tr>
<td>RS-232 Comm 2</td>
<td>DB9 Male</td>
<td>POS Terminal, External Modem, External ATG to TS-EMS or Local PC with a null-modem cable</td>
<td>Power Supply</td>
</tr>
<tr>
<td>Ethernet</td>
<td>RJ-45</td>
<td>Local Network</td>
<td>Controller</td>
</tr>
<tr>
<td>USB 1</td>
<td>Type A</td>
<td>External Hewlett-Packard Printer</td>
<td>Controller</td>
</tr>
<tr>
<td>USB 2</td>
<td>Type A</td>
<td>External Hewlett-Packard Printer</td>
<td>Controller</td>
</tr>
<tr>
<td>Fax/Modem</td>
<td>RJ-11</td>
<td>Phone Line (requires an optional fax/modem)</td>
<td>Controller</td>
</tr>
<tr>
<td>RS-485/TPI</td>
<td>4 Pin Pluggable Terminal Block, 0.2&quot; (5.08 mm) LS</td>
<td>TS-DIM (external) &amp; FE Petro Smart Controllers</td>
<td>Power Supply</td>
</tr>
<tr>
<td>Bus Extension (CAN)</td>
<td>3 Pin Pluggable Terminal Block, 0.15&quot; (3.81 mm) LS</td>
<td>EVO-EXPC and EVO-EXPC2</td>
<td>Power Supply</td>
</tr>
<tr>
<td>RS-422/232 &amp; Current Loop</td>
<td>DB9 Male</td>
<td>Dispenser Distribution Box (Dbox)</td>
<td>Dispenser Interface</td>
</tr>
<tr>
<td>LON</td>
<td>2 Pin Pluggable Terminal Block, 0.2&quot; (5.08 mm) LS</td>
<td>IFSF Network</td>
<td>LON Interface</td>
</tr>
</tbody>
</table>

Caution
Peripheral equipment connected to the TS-550/5000 evo console’s communication port must:

1. Be listed by UL or another third-party Nationally Recognized test laboratory when required by the authority having jurisdiction, and:
2. Not be installed over a hazardous location (unless so rated)

Figure 2: View of Communication Ports

Note: The onboard TS-DIMIB (Dispenser Interface Module) and the TS-LON (IFSF protocol Interface Module) are optional daughterboards that attach to the Power Supply Module. Only one daughterboard can be used in a system.

Note: Either the Current Loop or RS-422/232 connector will be used to connect to a dispenser distribution box (Dbox) depending on the manufacturer’s settings.

RS-232 Communication Connectors
Two connectors for RS-232 interfaces are provided on the bottom of the TS-550/5000 evo console. The pin designations for the RS-232 connectors are as follows:

**Console RS-232 Comm Port 1**

<table>
<thead>
<tr>
<th>DB9 Connector, Female, DCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin No.</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

**Console RS-232 Comm Port 2**

<table>
<thead>
<tr>
<th>DB9 Connector, Male, DTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin No.</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Note: Follow the communications setup instructions in the TS-550/5000evo Programming Guide.
**Wiring the Console & Modules**

Conduit must only enter the console enclosure through the designated knockouts as shown below in Figure 3.

![TS550 evo bottom view](image)

**Figure 3: TS-550/5000 evo Conduit Knockouts**

When installing additional modules, Franklin Fueling Systems recommends installing non-IS modules from left to right (from the open slot closest to the power supply) and IS modules from right to left. In this scenario, all unused slots will be concentrated in the middle of the enclosure. This lets the IS barrier be easily moved and allows for adding future modules to the system without needing to rewire existing devices.

It’s best to start wiring your module at the bottom-most set of channels (usually Channel 1) to further future-proof your installation and avoid any unnecessary confusion.

![TS5000 evo (Bottom View)](image)

**Figure 4: TS-550/5000 evo Module Connections**

It is important that intrinsically safe wiring only enter the console through IS knockouts, and non-intrinsically safe conduit only enter through non-IS knockouts. Maintain the integrity of the intrinsically safe modules by keeping probe and sensor wiring in conduit separate from all other wiring. Probe and sensor wiring may be run in the same conduit as long as they are both receiving power from the same console and the wire complies with NEC 504.30 or applicable local codes.

**Non-Intrinsically Safe Module Wiring**

**Danger** 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.

**Important:** Non-intrinsically safe wiring cannot be run in the same conduit as intrinsically safe wiring. Conduit knockouts for IS and non-IS module wiring are clearly identified in Figure 3 for your reference. Non-IS modules can be identified by their red faceplates and should always be installed to the left of the moveable isolation barrier.

Non-Intrinsically Safe modules include:

- Controller module
- Power Supply Module
- Relay Module
- AC Input Module
- Input/Output Module
- 10 Amp Relay Module
- 4-20mA EXP Analog Input Module
**Controller Module (CM)**

The Controller Module (CM) is a non-intrinsically safe module that acts like the brain of your console. The CM handles all of the communication between the modules and then sends that information to your output devices. You can use the LCD touch screen LCD or external printer (depending on model and configuration) as output devices to communicate with your system. The CM links to the status lights on the front of the console and the LCD via flexible cables.

**Flexible Cable Connectors**

The flexible cables are installed at the factory and are just long enough to allow the door to fully open. They are protected from high power wiring by the metal shroud attached to the CM. The cables should not be deformed, but should rather be freely folded back into the shroud so that they do not get pinched when the door is closed. If the flexible cables do become detached though, they can easily be reattached.

To reattach the flexible cables to the connectors, identify the two sides of each end on both cables: there are metal bands on one side and no metals bands on the other. The flexible cables connect to the CM by inserting one end of each cable into the LCD connector with the cables' metal bands facing to the left so that a metal to metal connection is made with the LCD's connector pins.

After the flexible cables have been correctly inserted all the way into each of the LCD connectors there will be no metal showing above the connection. Once the flexible cable connector is properly attached to the CM’s LCD connector, hook it up to the corresponding connector on the inside of your console’s door by making the same kind of metal-to-metal connection that you made while inserting it into the CM’s faceplate.

![Figure 5: Controller Module](image)
Power Supply Module (PS)
The PS is a non-intrinsically safe module that provides power to the TS-550/5000 evo console from line voltage rated 110 - 240 VAC. The PS is two inches wide, occupies two slots and is located immediately to the right of the CM. The PS consists of two AC /DC switching power supplies - one switching power supply is +5V and the other is +24V. The PS also has two relay outputs for use with remote annunciators and two low voltage inputs for emergency generator applications.

Line Power Wiring
At the electrical power panel, use or install a 20 amp circuit breaker — this breaker should be dedicated to only supplying power to the TS-550/5000 evo console. Mark this circuit “TS-550 evo or TS-5000 evo console [power] - ONLY” on the circuit label (at the back of the electrical power panel door). Refer to Figure B-1 and the 110 / 240 VAC Line Power Wire Connection List that precedes it for line power wiring information.

Note: Avoid connecting other equipment to this circuit. If other equipment is connected to this dedicated circuit, the resulting electrical noise could cause faulty system operation.

| Danger | Make sure that the TS-550/5000 evo console’s power circuit breaker is turned off during any installation. Lethal voltages are present inside the console which could kill or injure you. Also, secure the TS-550/5000 evo console’s circuit breaker in the off position and attach a “lockout” to it, which is dated and signed by you, to prevent accidental closure, injury or death. |
| Danger | The ground bus in the electrical panel must be connected to an earth ground as required by the National Electrical Code (or Canadian Electrical Code) when applicable. If the ground bus is not properly connected to an earth ground or if the IS safety ground is not properly connected at the console, a dangerous condition will be created which could result in an explosion. |

Check Electrical Resistance to Earth Ground
After wiring the IS safety grounds, check the resistance between the IS safety ground terminals at the console and the earth ground – this resistance must be less than 1 ohm.

110 / 240 VAC Line Power Wire Connection List

<table>
<thead>
<tr>
<th>Electrical Panel</th>
<th>No. Conductors, Color (Gauge)</th>
<th>Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Amp Circuit Breaker</td>
<td>1 Black wire, 14 AWG (1.6 mm) min.</td>
<td>110/240 VAC</td>
</tr>
<tr>
<td></td>
<td>1 White Wire, 14 AWG (1.6 mm) min.</td>
<td>Neutral</td>
</tr>
<tr>
<td>Ground Bus</td>
<td>1 Green wire, 14 AWG (1.6 mm) min.</td>
<td>Ground</td>
</tr>
<tr>
<td>Ground Bus</td>
<td>1 Green wire, 12 AWG (2.1 mm) min.</td>
<td>Safety Ground</td>
</tr>
</tbody>
</table>
Note: The installer must connect the earth ground conductor to the most convenient ground terminal as long as it meets local and national codes. The earth ground conductor must be 12 AWG (2.1 mm) or larger.

Figure 7 – Ground Stud

Figure 6 – 110/240 VAC Power and IS Ground Wiring
Relay Output Wiring (optional)
As illustrated in the diagram below, the Power Supply Module's two relay outputs can be used to activate an external alarm (TS-RA2) and the two inputs can be used to silence that alarm remotely (TS-RK).

![Enlarged View of Power Supply Module's Relay Outputs](image)

**Figure 8: Alarm Output Wiring Schematic**

**Note:** The TS-RA2, TS-RA1 and TS-RK are not part of the UL certification of this system.

Emergency Generator Applications (optional)
The wiring or use of discrete inputs is optional — skip this section if you don't plan to use this interface. Discrete inputs may be wired to a TS-550/5000 evo console with 18 AWG, type TFFN or THWN wire. You may also use THHN wire in sizes larger than 18 AWG.

Emergency backup power generator run-relay(s) are wired to the discrete input interface terminals at the TS-550/5000 evo console. A run-relay closure will stop a leak test on the associated generator fuel tank. When the generator run-relay opens (generator stops running), a run report is produced at the console, which shows the total and hourly fuel consumption rate during the run cycle.

**Note:** You must use dry run-relay contacts for this interface because the TS-550/5000 evo series supplies +5 VDC digital logic power at the IN (input) terminals.

**Note:** It is recommended that you use: IN 1 & GND for Generator 1 /fuel supply Tank #X, and IN 2 & GND for Generator 2 /fuel supply Tank #Y. The specific fuel tank(s) assigned are “programmable.” See Figure 9 for wiring details.
Non-Standard Power Requirements
The console’s power must be maintained on a power transfer supply for emergency backup generator applications. In addition, the TS-550/5000 evo series’ line power must be supplied through a UPS (Uninterruptible Power Supply). See Figure 9 for emergency generator applications.

Programming & Testing Discrete Inputs
Program the tank gauge and test the discrete inputs for proper operation after installation. See the TS-550/5000 evo Programming Guide for reports and programming issues.

---

Figure 9 – Emergency Generator Wiring
Relay Module (RLY)

The RLY is a non-intrinsically safe module that has 8 identical Form C output channels. Each channel has a fuse and three terminals. Each channel can be configured as NO or NC with the power off by wiring to the appropriate terminals. A TS-550/5000 evo console can accommodate up to 24 outputs (8 outputs on up to 3 modules) as space allows. The diagrams below illustrate two examples of positive shutdown upon alarm conditions.

### Relay Module Specifications

<table>
<thead>
<tr>
<th>Number of Channels:</th>
<th>8 Form C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Rating:</td>
<td>2A @ 250 VAC</td>
</tr>
</tbody>
</table>

**Figure 10: Positive Submersible Control Box Shutdown**

**Note:** A valid dispenser hook signal coming from the AC Input Module (shown in Figure 12) is required for these diagrams to function as shown.

**Figure 11: Positive Dispenser Shutdown**

**Note:** If a dispenser’s current rating is between 2 and 10 amps, use a 10 amp relay module. If the current rating is higher than 10 Amps, use an appropriate extension relay.
AC Input Module (ACI)

The ACI is a non-intrinsically safe module that has 12 identical optically isolated AC input channels that can be used for dispenser hook isolation, vapor processor input, or as generic AC inputs. The TS-550/5000 evo consoles can handle a total of 36 AC inputs or up to three AC Input Modules in one system.

Dispenser Hook Signals

Various TS-550/5000 evo applications may require that the dispenser hook signals be wired into the console’s AC Input Module. When making the connection for the hook signals to the AC Input Module, refer to the following diagram and use these guidelines:

- If there are two hooks per dispenser: wire the two hooks from Dispenser 1 to AC input channels 1 & 2, the hooks from Dispenser 2 to AC channels 3 & 4, etc..
- If there are three hooks per dispenser, then wire the three hooks of Dispenser 1 to the AC input channels 1, 2, 3 and so forth.

---

**AC Input Module Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Channels</td>
<td>12 optically isolated</td>
</tr>
<tr>
<td>Input Voltage Rating</td>
<td>110 – 240 VAC</td>
</tr>
<tr>
<td>Input Current</td>
<td>7 mA RMS</td>
</tr>
</tbody>
</table>

---

**Figure 12: Dispenser Hook Signal**
Input/Output Module (IO)

The Input/Output Module is a non-intrinsically safe module that provides eight separate AC or DC voltage inputs that can range from 0 to 240 volts. In addition to the AC/DC inputs, the IO module also includes four 4-20mA signal outputs.

The AC/DC inputs are NOT dry contact inputs (there are 2 dry contact inputs on the power supply). Even though the IO Module can accept AC line voltage levels, it is not intended to be used as a substitute for the AC Input Module for dispenser hook inputs. Dispenser hook signals often have leakage currents that could cause false ‘on’ signals when used with the IO Module.

**Important:** Use caution if both low voltage and high voltage signals are used simultaneously for the voltage inputs. Use agency approved wire rated at 600V for safety and always make sure terminal connections are tight and that no loose wire strands exist.

The IO Module’s four 4-20mA signal outputs can be used to interface to an external device such as a SCADA (Supervisory Control And Data Acquisition) system or a building monitoring system. Typically, data such as tank levels or line pressures can be sent via the 4-20 outputs.

**Important:** The IO Module supplies 4-20mA loop power. Do NOT connect it to an external device that supplies loop power or use an external power supply for the loop. Doing so may damage the IO and/or the external device. For similar reasons DO NOT connect the IO Module’s 4-20mA outputs to the 4-20mA inputs of the 4-20mA Input Module. The 4-20mA Input Module is intrinsically safe and cannot be used with the non-intrinsically safe IO Module; connecting the two together may damage either or both modules.

![Figure 13: IO Module Wiring Schematic](image-url)
10 Amp Relay Module (10ARLY)

The 10 Amp Relay Module is a non-intrinsically safe module that has 6 identical Form C output channels. Each channel has a fuse and three terminals. Each channel can be configured as NO or NC with the power off by wiring to the appropriate terminals. A TS-550/5000 evo console can accommodate up to 18 outputs (6 outputs on up to 3 modules) as space allows. The diagrams below illustrate two examples of positive shutdown upon alarm conditions.

Note: A valid dispenser hook signal coming from the AC Input Module (shown in Figure 12) is required for these diagrams to function as shown.

Note: If a dispenser’s current rating is higher than 10 Amps, use an appropriate extension relay.
4-20mA EXP Analog Input Module (420EXP)

The 420EXP has 8 identical channels for loop powered non-IS sensors with a 4-20 mA interface. The TS-550/5000 evo series can support up to 24 inputs (3 modules total including 420IB models with 8 inputs each) depending on available space in your console. The 420EXP will most likely be used with explosion proof version of the line leak pressure transducers at the sites where IS wiring is not available. It can also be used with other 4-20 mA sensors located in non-hazardous area.

**Note:** Components located in the hazardous area must be an explosion proof version and wiring must be enclosed in explosion proof conduits.

![Diagram of 4-20mA EXP Analog Input Module Connections](image)

**Figure 16: EXP Analog Input Module Connections**
Intrinsically Safe Module Wiring

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.

Important: Intrinsically safe wiring cannot be run in the same conduit as non-intrinsically safe wiring. Conduit knockouts for IS and non-IS module wiring are clearly identified in Figure 6 on page 10 for your reference. IS modules can be identified by their blue faceplates and should always be installed to the right of the moveable isolation barrier.

If local codes do not require the use of conduit, cable glands must be used at all enclosure knock-outs. Gaps larger than 0.06 inch (1.5 mm) will violate safety approvals. Be certain to provide adequate IS and non-IS wire separation.

Franklin Fueling Systems recommends that each run of IS wiring not exceed 1500 feet (450 m) using any 2-conductor shielded cable or the cables/wires recommended in the Standard Installation Materials chapter. If you are not using the recommended cables/wires as set out in the Standard Installation Materials chapter or need to run wiring beyond 1500 feet (450 m), then please contact Technical Support.

The IS modules in the TS-550/5000 evo console were certified as associated apparatuses using the “Entity Concept.” Under this concept, the IS apparatus (field device) has assigned parameters which, when properly matched to those of an associated apparatus, will constitute an intrinsically safe system. If there are none available however, values of 60 pF/foot (200 pF/m) for capacitance per wire pair and 0.2 uH/foot (0.7 uH/m) for inductance may be used. Refer to the associated apparatus’s control drawing for acceptable cable run length calculations.

The 3WSNS has also been evaluated using the “System Concept” for the specific sensors indicated on the control drawing 000-1722. When these sensors are used, cable must be limited to 1500 feet.

Associated apparatus parameter types and how they can be compared to IS apparatus parameter values are shown in the table below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Associated Apparatus</th>
<th>Comparison</th>
<th>IS Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Voltage</td>
<td>Uo</td>
<td>&lt;</td>
<td>Ui</td>
</tr>
<tr>
<td>Maximum Current</td>
<td>Io</td>
<td>&lt;</td>
<td>li</td>
</tr>
<tr>
<td>Maximum Power</td>
<td>Po</td>
<td>&lt;</td>
<td>Pi</td>
</tr>
<tr>
<td>Total unprotected capacitance</td>
<td>Co</td>
<td>&gt;</td>
<td>Ci + Cc</td>
</tr>
<tr>
<td>Total unprotected inductance</td>
<td>Lo</td>
<td>&gt;</td>
<td>Li + Lc</td>
</tr>
</tbody>
</table>

Standard Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>Maximum Output Voltage</td>
</tr>
<tr>
<td>Ui</td>
<td>Maximum Input Voltage</td>
</tr>
<tr>
<td>Io</td>
<td>Maximum Output Current</td>
</tr>
<tr>
<td>li</td>
<td>Maximum Input Current</td>
</tr>
<tr>
<td>Po</td>
<td>Maximum Output Power</td>
</tr>
<tr>
<td>Pi</td>
<td>Maximum Input Power</td>
</tr>
<tr>
<td>Co</td>
<td>Maximum External Capacitance</td>
</tr>
<tr>
<td>Ci</td>
<td>Maximum Internal Capacitance</td>
</tr>
<tr>
<td>Cc</td>
<td>Cable Capacitance</td>
</tr>
<tr>
<td>Lo</td>
<td>Maximum External Inductance</td>
</tr>
<tr>
<td>Li</td>
<td>Maximum Internal Inductance</td>
</tr>
<tr>
<td>Lc</td>
<td>Cable Inductance</td>
</tr>
</tbody>
</table>
Probe Module (PRB)

The Probe Module (PRB) gathers data from probes and presents that information to the Controller Module (CM) for use in inventory reconciliation and reports. Each PRB can accommodate 12 probes and the system as a whole can accept a total of 36 probes (3 modules with 12 inputs each) if space allows. Besides working with LL2 mag probes, the PRB also works with vapor flow meters to perform VRM functions.

Note: All components located in the hazardous area must be Third Party Certified and have appropriate Entity Parameters (see Control Drawing 000-1722 in the back of this manual for further information).

<table>
<thead>
<tr>
<th>Probe Module Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Channels:</strong> 12</td>
</tr>
<tr>
<td><strong>Safety Rating:</strong> Class I, Division 1, Group D, [Ex ia] IIA</td>
</tr>
<tr>
<td><strong>Entity Parameters</strong></td>
</tr>
<tr>
<td>$U_0 = 28.35 \text{ V}$</td>
</tr>
<tr>
<td>$I_0 = 157.5 \text{ mA}$</td>
</tr>
<tr>
<td>$C_0 = 1.04 \text{ uF}$</td>
</tr>
<tr>
<td>$L_0 = 1.4 \text{ mH}$</td>
</tr>
<tr>
<td>$P_0 = 1.1 \text{ W}$</td>
</tr>
</tbody>
</table>

Figure 17: PRB Connections
2-Wire Sensor Module (2WSNS)

The 2-Wire Sensor Module (2WSNS) is designed to accept 12 sensor inputs per module, and the system as a whole can accept a total of 36 sensors (3 modules with 12 inputs each). The 2WSNS only supports standard sensors, and does not accept inputs from BriteSensors. Refer to the diagram below to identify some of the standard sensors that can be used with this module.

**Note:** Standard sensors do not use digital data. They operate like ON–OFF switches, which are closed when no liquid is present and open when a liquid is detected.

- **Figure 18: 2-Wire Sensor Connections**

**Note:** Standard sensors do not use digital data. They operate like ON–OFF switches, which are closed when no liquid is present and open when a liquid is detected.

**Note:** Jumpers need to be present in positions that are not occupied by sensors as shown in Figure 18.

**Note:** All components located in the hazardous area must be Third Party Certified and have appropriate Entity Parameters (see Control Drawing 000-1722 in the back of this manual for further information).
### 3-Wire Sensor Module (3WSNS)

The 3-Wire Sensor Module (3WSNS) is designed to accept 8 sensor inputs per module, and the system as a whole can accept a total of 24 sensors (3 modules with 8 inputs each). The 3WSNS can support standard sensors and BriteSensors®. BriteSensors are powered sensors that digitally communicate the sensor–type and alarm status of the sensor to the console. Most BriteSensors can discriminate between water and hydrocarbon products and produce different alarm codes for each. Refer to the diagram below to identify the types of sensors that should be used with this module.

![3-Wire Sensor Module Diagram](image)

**Figure 19 3-Wire Sensor Wiring**

**Important:** Brite Sensors are not approved for use in European Union markets where ATEX approved devices are required.

Most of the Brite Sensors shown in this table are part of the UL & C-UL System Listing.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP-EIS</td>
<td>Electro-optical Interstitial liquid – Standard sensor</td>
</tr>
<tr>
<td>TSP-ULS</td>
<td>Universal Liquid – Standard sensor</td>
</tr>
<tr>
<td>TSP-HLS-15</td>
<td>High product Level, 15” – Standard sensor</td>
</tr>
<tr>
<td>TSP-HLS-30</td>
<td>High product Level, 30” – Standard sensor</td>
</tr>
<tr>
<td>TSP-HIS</td>
<td>Hydrostatic Interstitial reservoir – BriteSensor</td>
</tr>
<tr>
<td>TSP-DIS</td>
<td>Discriminating Interstitial liquid – BriteSensor</td>
</tr>
<tr>
<td>TSP-DDS</td>
<td>Discriminating Dispenser Sump – BriteSensor</td>
</tr>
<tr>
<td>TSP-DTS</td>
<td>Discriminating Turbine Sump – BriteSensor</td>
</tr>
<tr>
<td>TSP-MWS</td>
<td>Discriminating Monitoring Well – BriteSensor</td>
</tr>
<tr>
<td>TSP-UHS</td>
<td>Universal Hydrostatic Sensor – Standard sensor</td>
</tr>
<tr>
<td><strong>The following sensors are not covered by UL / cUL approval</strong></td>
<td></td>
</tr>
<tr>
<td>TSP-HIS-XL</td>
<td>Hydrostatic Interstitial reservoir, extra long – BriteSensor</td>
</tr>
<tr>
<td>TSP-DVS</td>
<td>Discriminating Vapor – BriteSensor</td>
</tr>
</tbody>
</table>

**Note:** Alternate sensors may be provided. All components located in the hazardous area must be Third Party Certified and have appropriate Entity Parameters (see Control Drawing 000-1722 in the back of this manual for further information).
4-20mA Analog Input Module (420IB)
The Analog Input Module has 8 identical channels for loop powered IS sensors with a 4-20 mA interface. The TS-550/5000 evo series can support up to 24 inputs (3 modules with 8 inputs each) depending on available space in your console. The Analog Input Module will most likely be used with: line leak pressure transducers, tank pressure sensors and vacuum sensors.

Analog Input Module Specifications

<table>
<thead>
<tr>
<th>Number of Channels:</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Rating:</td>
<td>Class I, Division 1, Group D, [Ex ia] IIA</td>
</tr>
</tbody>
</table>

Entity Parameters

- \( U_o = 26.25 \text{ V} \)
- \( I_o = 98.2 \text{ mA} \)
- \( C_o = 1.25 \text{ uF} \)
- \( L_o = 14.7 \text{ mH} \)
- \( P_o = 0.64 \text{ W} \)

Note: All components located in the hazardous area must be Third Party Certified and have appropriate Entity Parameters (see Control Drawing 000-1722 in the back of this manual for further information).
Warranty
For information concerning Franklin Fueling Systems’s warranties, please refer to the Franklin Fueling Systems Fuel Management Systems Warranty Policy (P/N 000-1124).

Warranty Registration
After installation, make sure to return the Warranty Registration form to Franklin Fueling Systems. This form validates the warranty as stated in Franklin Fueling Systems document 000-1124.
Specifications

The TS-550/5000 evo console must be mounted in a location where explosive or flammable vapors are not present, otherwise an explosion hazard will be created which can result in severe injury, death, serious property damage and/or environmental contamination.

### Console
- **Line Voltage:** 90-250 V~
- **Frequency & Power:** 50/60 Hz, 150 W maximum
- **Storage Temp.:** -20° to 60° C (-4° to 140° F)
- **Operating Temp.:** 0° to 40° C (32° to 104° F)
- **Operating Humidity:** 0 to 95%, non-condensing
- **Cleaning:** Cloth or sponge slightly dampened in mild detergent
- **Splash Resistance:** Not to be exposed to direct spray, splash or drips
- **Location:** Indoors in an office or in a non-hazardous pollution degree 2 environment per IEC60664

### Intrinsically Safe Modules

#### 2-Wire Sensor Module
- **Number of Channels:** 12
- **Safety Rating:** Class I, Division 1, Group D, [Ex ia] IIA
- **Entity Parameters**
  - \(U_o = 6.51\) V
  - \(I_o = 2.04\) mA
  - \(C_o = 500\) uF
  - \(L_o = 100\) mH
  - \(P_o = 3.3\) mW

#### 3-Wire Sensor Module
- **Number of Channels:** 8
- **Safety Rating:** Class I, Division 1, Group D, [Ex ia] IIA
- **Entity Parameters**
  - \(U_o = 7.71\) V
  - \(I_o = 573\) mA
  - \(C_o = 500\) uF
  - \(L_o = 433\) uH
  - \(P_o = 932\) mW

#### 4-20mA Analog Input Module
- **Number of Channels:** 8
- **Safety Rating:** Class I, Division 1, Group D, [Ex ia] IIA
- **Entity Parameters**
  - \(U_o = 26.25\) V
  - \(I_o = 98.2\) mA
  - \(C_o = 1.25\) uF
  - \(L_o = 14.7\) mH
  - \(P_o = 0.64\) W

#### Probe Module
- **Number of Channels:** 12
- **Safety Rating:** Class I, Division 1, Group D, [Ex ia] IIA
- **Entity Parameters**
  - \(U_o = 28.35\) V
  - \(I_o = 157.5\) mA
  - \(C_o = 1.04\) uF
  - \(L_o = 1.4\) mH
  - \(P_o = 1.1\) W

### Non-Intrinsically Safe Modules

#### AC Input Module
- **Number of Channels:** 12 optically isolated
- **Input Voltage Rating:** 110 – 240 VAC
- **Input Current Rating:** 7 mA

#### Relay Module
- **Number of Channels:** 8 Form C
- **Contact Rating:**
  - 2A @ 250V
  - 2A @ 30 VDC

#### 10 Amp Relay Module
- **Number of Channels:** 6 Form C
- **Contact Rating:**
  - 10A @ 250V
  - ½ hp @ 240 VAC
  - ¼ hp @ 120 VAC

#### Input/Output Module
- **Number of Channels:** 8 optically isolated inputs
- 4 analog outputs
- **Input Voltage Rating:** 3 - 240 Volts AC or DC (AC is rms value)
- **Input Current Rating:** 2 mA