FGI 351

Installation
&
Operation Manual

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WARRANTY

Titan Logix Corp. warrants all equipment of its own manufacture to be free of defects in material and workmanship for a gauge period of twelve (12) months from date of shipment. Titan Logix Corp.'s sole obligation hereunder shall be expressly limited to repair or exchange free of charge, F.O.B. Edmonton, Alberta, Canada, of such defective equipment (alternatively, Titan Logix Corp. will, at its option, refund the purchase price). Titan Logix Corp.'s obligation under this warranty is limited to the above and does not apply to exchange or repairs, which are required as a result of improper installation, misuse, maladjustment, abnormal operating conditions, or lack of routine maintenance. Nor does the warranty include the furnishing of service for maintenance or problems arising from the foregoing causes. No claims for labour, installation, removal, transportation, or other expenses will be recognized. Notwithstanding any stipulation of the purchaser to the contrary, all other obligations, representations, warranties and conditions, express or implied, statutory or otherwise, including any implied warranties or conditions of merchantability, quality or fitness are hereby excluded and, Titan Logix Corp. shall not be liable for any loss, cost or damages, of any kind whatsoever, whether consequential, indirect, special or otherwise, arising out of or in connection with the equipment or any defect therein, even if caused by the negligence of Titan Logix Corp., its employees or agents. The provisions hereof relating to the warranty and limitations hereon and limitation of liability shall continue to be enforceable between the parties notwithstanding termination of the within agreement for any reason including fundamental breach. Equipment not of Titan Logix Corp. manufacture will carry the vendor's or manufacturer's standard warranty.

PROPRIETARY INFORMATION

Warnings:	THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2 GROUPS C & D OR NON-HAZARDOUS LOCATIONS ONLY.
	WARNING: -EXPLOSION HAZARD- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2
	WARNING: -EXPLOSION HAZARD- DO NOT REMOVE OR REPLACE THE POWER TERMINAL OR FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA HAS IS KNOWN TO BE NON-HAZARDOUS.
	WARNING: -EXPLOSION HAZARD- DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWNTO BE NON-HAZARDOUS
	WARNING: -EXPLOSION HAZARD- DO NOT SERVICE EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS

Table of Contents

1 Product Description

1.1 About This Manual

This instruction manual provides information specific to the Titan Logix Corp. FGI 351 Burner Management System. Other peripheral equipment should be supplied with its own instruction manual and that manual should be referred to for proper operation of the peripheral equipment.

It is essential that this manual be read and understood for proper installation and operation of your new FGI 351.

This manual includes:

INTRODUCTION	Briefly describes the key features and components of the FG1 351 and the IGN 50.
INSTALLATION	Detailed description of mounting and wiring of external equipment.
OPERATION	Describes the operation and use of the features of the FGI 351.
WIRING	Describes how to connect the FGI 351 to the power supply, safety switches, communication systems, and output devices.
TROUBLESHOOTING	Describes several quick problem solving techniques.
SPECIFICATIONS	Describes the physical and operational characteristics.

Only qualified personnel should install this product. Please read this manual before installing this product and follow all applicable safety and electrical regulations as required. If this product is to be installed in a Class I, Div.2 area, follow all extra regulations required for installing products in Hazardous locations.

Disclamer

The information in this document is subject to change without notice. Titan Logix Corp makes no representations or warranties with respect to the contents hereof.

1.2 About the FGI 351 & IGN 50

Burner Management

Titan Logix Corp. has designed the FGI 351 / IGN 50 Burner Management System (BMS) to meet the requirements of regulatory authorities and industry to control and monitor atmospheric burner appliances up to 10 000 000 Btu/H. The FGI 351 / IGN 50 system can be used in applications that require a CSA C22.2 # 199 certified Combustion Safety Control.

Applications

The following are examples of such appliances:

- Line Heaters
- Dehydrators
- Amine and Glycol Reboilers
- Salt Bath Heaters
- Treaters

System Kit

The following components are included in a standard FGI 351 system kit:

- FGI 351 Flame-Gard™/Ignition Burner Management System
- IGN 50 Sparker / Flame Sense Module
- Ignitor & Flame Rod assembly with ignition cable
- Bracket for mounting flame rod & thermocouple to pilot assembly
- Type K thermocouple encased in 446 SS c/w shielded thermocouple cable
- Sample P&ID's
- Installation and Operation Manual

Function Overview

The FGI 351/ IGN 50 system will control and monitor the complete ignition and firing sequence. Including monitoring for the presence of a pilot flame and shut off the gas flow if the flame goes out. An auto re-light will try to re-ignite the burner up to three times if there is a flame failure. There are dedicated alarm inputs for low fluid level, high bath temperature and low and high gas pressure that can be configured for hard or soft lockouts.

Display

A Vacuum Fluorescent Display (VFD) in the front door provides an easy to use yet powerful user interface. It provides the operator with important information about burner status and certain operational variables.

An RS232/RS485 MODBUS communication interface is provided so that a host computer, PLC or RTU can control or monitor the FGI 351 / IGN 50 systems.

The FGI 351 / IGN 50 can control two main, one pilot, and one high fire start valve. A Proof of Closure input is provided for the Main valve.

Self Diagnostics

System hardware, Ionization input, Flame Monitor input, Proof of Closure, and Low Fire inputs are all monitored for correct performance throughout all operations of the FGI 351. **The**

outputs are fed back to the CPU so it can ensure the outputs are in the desired state at all times. For example, before trying to ignite the pilot the CPU ensures all the valve outputs are off and the Ionization input indicates that a flame isn't present at the pilot. If either of these situations is true, the display will indicate the nature of the problem or indicate the appropriate error code.

1.3 System Hardware Description

Three circuit boards are mounted in the FGI 351 controller: the terminal board, the I/O board, and the main board. The function of each is described in the sections that follow.

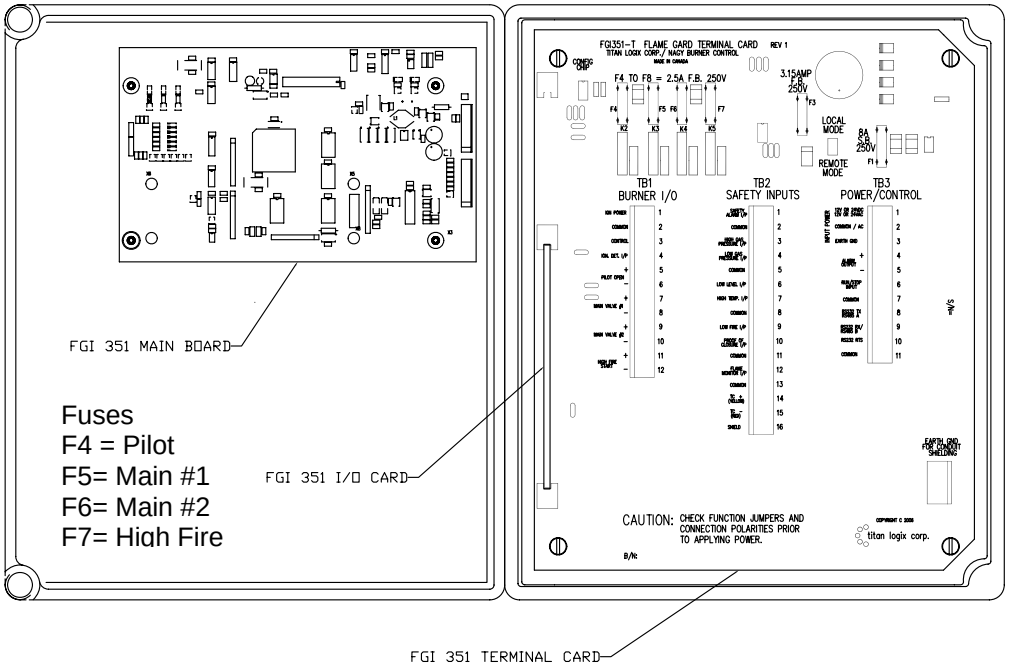


Figure 1
FGI 351 Circuit Boards

1.4 FGI 351 Main Board

Main Board Sections

The main board is located on the back side of the front door and contains the CPU that controls all the inputs and outputs. The display indicates the status of the burner and certain operational variables. More detailed information is provided in the FRONT PANEL section in this manual. There are five status indicating light emitting diodes on this board to indicate the following:

LED Indicators

LED Indicator	Status
Run	Flashes to indicate the CPU is running.
Ionization Detect	Flashes to indicate the IGN 50 has sensed the presence of a flame via the IGN 50.
Power Fail Detect	Lit when the power supply voltage drops below 90% of the rated voltage, the 351 will shut down the burner.

Tx — Flashes when the CPU has recognized a message sent to it from the host computer and is responding to it.

Rx — Flashes when a message is being received from the host computer.

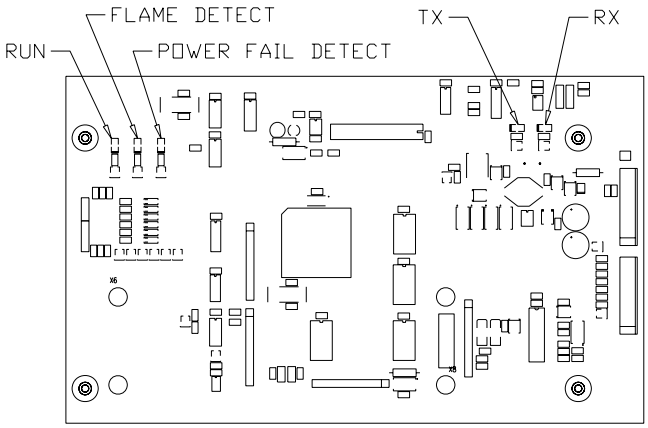


Figure 2
FGI 351 Main Board

1.5 FGI 351 Terminal Board

All field wiring for the FGI 351 unit is connected to the terminal board through conduit openings the field installer must cut in the bottom of the FGI 351 enclosure. All fuses are located on the terminal board.

EEPROM

If the main board or the I/O board are damaged or replaced, the configuration data stored on the terminal board will be maintained in the EEPROM.

1.6 Configuration

The FGI 351 has a factory configured Pre-Purge time that must be requested when ordering the product. However all other configuration settings can be either factory set or field set by approved personnel (see APPLICATION DATA sheet at back of manual). Other settings include:

Start on Power up
Remote Start Enable
Soft Start
Low Fire Start
Sleep Enable
Safety Alarm Lockouts
- General Safety
- High Temperature
- Low Level
- High Gas Pressure
- Low Gas Pressure

Start on Power Up

When set the controller will automatically start its ignition sequence when power is supplied.

Remote Start Enable	When the Run/Stop contacts are opened the controller will stop the firing sequence. Shorting the contacts will automatically start a firing sequence if remote start is enabled. If Remote start is not enabled an operator will need to press the 'START' button after shorting the contacts to start a firing sequence.
Soft Start	Soft start provides a method to induce a draft for appliances that only have on/off control on the main valve. The main valve will pulse on and off to heat up the fire tube and induce a draft before the main valve is left on for the duration of the firing sequence. See Figure 21 for firing sequence. This may not be recommended for small diameter fire tubes.
Low Fire Start	Provides a method for starting a firing sequence in a low fire condition for appliances that only have on/off control on the main valve. When enabled, opening the main valve will allow gas to flow through a pressure regulated by-pass to start a firing sequence in a low fire state. After user selected period a high fire valve will open allowing full gas flow to the main burner. See Figure 17 for more information.
Sleep Enable	After 15 minutes of no activity the display will turn off to conserve power. Pressing the 'MENU' button will turn it back on.
Safety Alarm Lockouts	Effects the action of the controller after a safety alarm condition has cleared either on its own or through operator intervention. Safety alarms will always cause the firing sequence to stop. However, if the lockout is set the controller will not automatically restart a firing sequence once the alarm condition has cleared (an operator must press the START button). If the lockout is not set the controller will automatically start a firing sequence once an alarm condition has cleared. General Safety Alarm: Input to be used if all safety alarms are tied in series or if additional user alarm has been added. Prevents operator confusion instead of having a set of series alarms fed into a dedicated input and indicating improper alarms on the display Dedicated Safety Alarms: Inputs to these alarms inputs will indicate the cause of the alarm on the display. (High Pressure, Low Pressure, Low Level, High Temperature)

2 Installation

Trained Personnel

This product is to be installed by trained service personnel. Proper wiring practices need to be followed when installing this product, including using seals where required when locating the product in hazardous locations.

2.1 Site Selection

Area Approvals

The FGI 351 controller is approved for a Class I, Division 2 Groups C & D area classification. The IGN 50 Sparker / Flame Sense is approved for a safe area or general purpose area classification. The system can be mounted on the unit skid or on a building wall as long as the FGI 351 controller does not infringe on a Class I, Division 1 area. The FGI 351 must be used in conjunction with the IGN 50.

The controller should be mounted in a location facing away from the burner housing so the operator can view the display and the burner housing while operating the unit. If possible mount the unit facing away from the sun to improve display visibility. The FGI 351 should be mounted a safe distance away from any source of RF signal that may interfere with its operation. Other mounting considerations are panel access, traffic, and wire runs.

2.2 Mounting the FGI 351 Controller

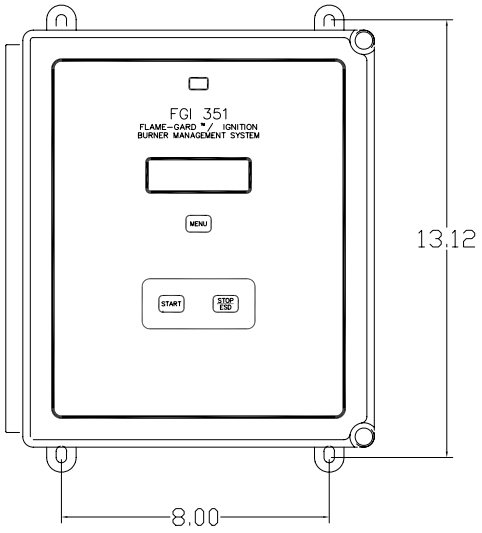


Figure 3
FGI 351 Mounting

Enclosure Specifications

The FGI 351 controller enclosure is a fibreglass box measuring 12” H x 10” W x 6” D complete with mounting tabs. The enclosure weighs less than 5 pounds so heavy duty supports are not required, but the unit should be firmly mounted so the push buttons on the front panel can be easily operated.

2.3 Mounting the IGN 50

High Voltage Hazard

The IGN 50 generates high voltages. It must be mounted in a non-hazardous location inside a suitable tamperproof enclosure to protect it from the weather and prevent shock hazards. The inside of the burner housing is a suggested mounting location. There are four mounting holes for ¼" bolts that can be used to attach the unit either on a plate or a flat surface. Input and output signals are all accessible from the terminal block on top of the unit.

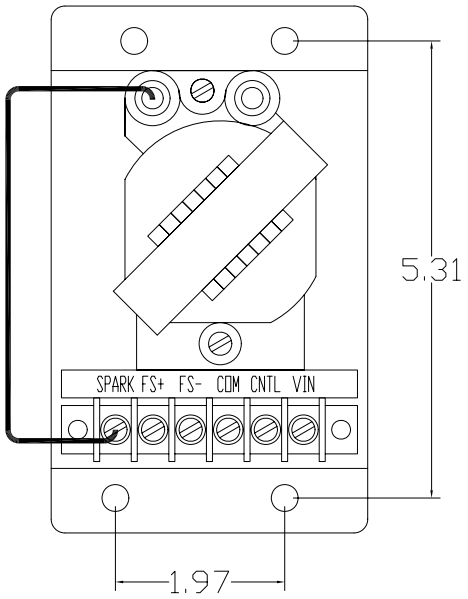


Figure 4
IGN 50 Mounting

2.4 Mounting the Sparker/Flame Rod

Nozzle Type, Spark Gap

The gap between the Flame Rod/ Sparker and the Pilot nozzle should be less than 3/16". The illustration below shows the recommended Flameco or perforated tip pilot nozzle. If a straight tip pilot nozzle is used the spark electrode provided may need modification: the electrode may need to be bent to ensure it arcs to the pilot tip's inside edge to light off properly.

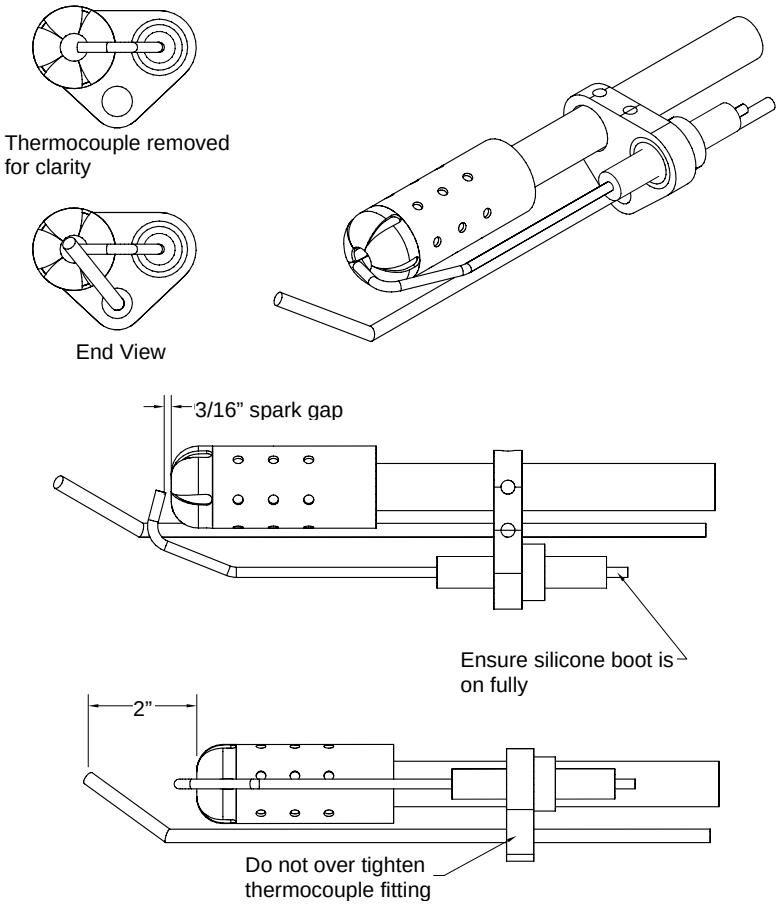


Figure 5
FGI 351 Pilot Assembly

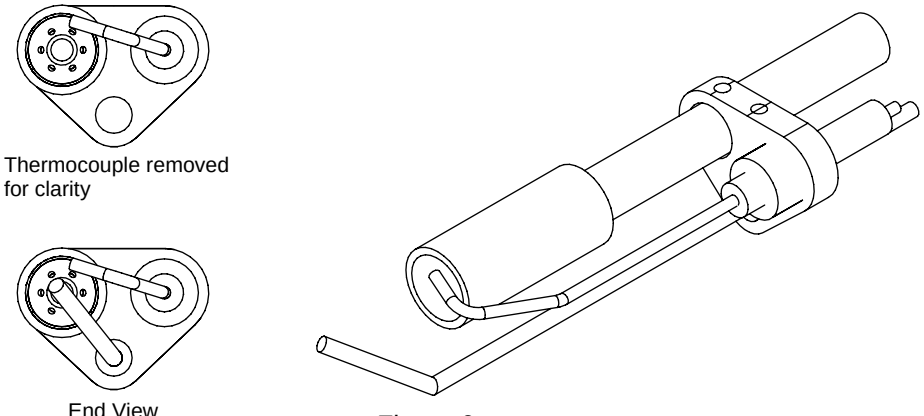


Figure 6
Straight tipped Pilot

3 Wiring and Jumper Settings

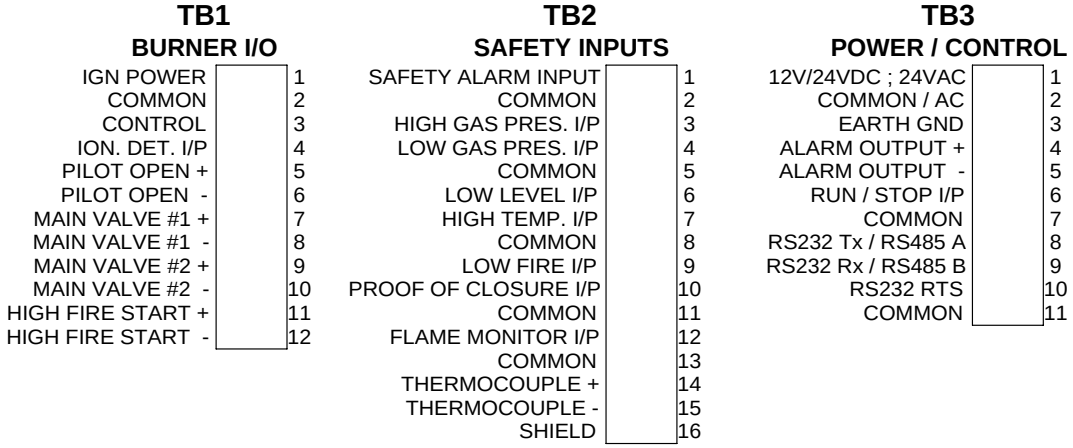


Figure 7

FGI 351 Terminal Block

Conduit — All wiring must be run through grounded metal conduit

Terminal Block 1 (TB1)

Terminal 1 — Power to the IGN 50

Terminal 2 — Common to the IGN 50

Terminal 3 — Control for IGN 50 spark

Terminal 4 — Flame status input from the IGN 50

Terminal 5 –12 — Outputs for valve control. Each output is fused at 1.5 A

DC solenoids are not polarity dependent so either wire from the terminals of a given solenoid can be connected to either terminal on the FGI 351 for the particular solenoid.

The valve section of the solenoid must be tubed into the pneumatic lines in a normally closed configuration.

NOTE: The maximum current output to each solenoid is 1.5 amps regardless of what the supply voltage is.

Terminal Block 2 (TB2)

Block 2 provides terminals for various types of safety switches to be connected to the FGI 351 unit.

Terminal 1-2 — Safety alarm input for series connected alarm devices

Terminal 3 — High Gas pressure safety input

Terminal 4 — Low Gas pressure safety input

Terminal 5 — Common

Terminal 6 — Low-liquid level safety input

Terminal 7 — High bath Temperature safety input

Terminal 8 — Common

Terminal 9	Low Fire Proof input to confirm low fire condition. May be required on appliances larger than 1 000 000 Btu/H to ensure the main burner is in a low fire condition lit.
Terminal 10	Proof of Closure (POC) input from main valve may be required to ensure the main gas valve is off and in the closed position before trying an ignition sequence. **NOTE:** The POC input is an important feature that eliminates the requirement to use 2 safety valves. In compliance with the B149.3 Code, the FGI 351 / IGN 50 system allows for the use of 2 safety valves on the main burner line, or, 1 safety valve with a proof of closure (POC) switch.
Terminal 11	Common
Terminal 12-13	Extra Flame monitor input (future use)
Terminal 14-15	Thermocouple input for proving pilot flame quality
Terminal 16	Thermocouple shield

The FGI 351 has a thermocouple input that can be used for a temperature dependent pre-purge and to monitor the 'quality' of the pilot flame. Jumper J3 on the main board controls if the thermocouple is enable or not. To enable J3 must be 'IN' i.e. shorting the two terminals at J3

J3 Jumper Status
In = Thermocouple Enable
Out = Disabled

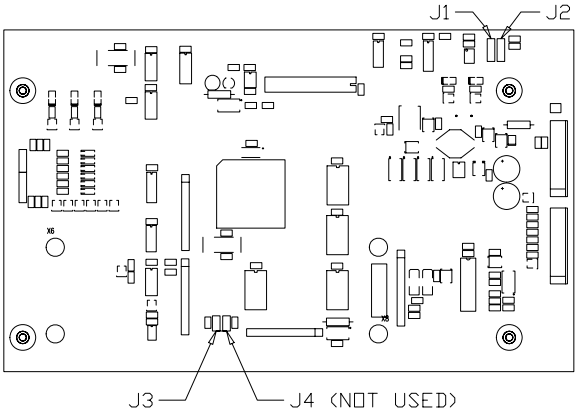


Figure 8
Thermocouple Jumper location on Main Board

The T/C extension wire does not need to be thermocouple wire as the signal is only a relative temperature signal and the cold junction created by the non-thermocouple extension wire has little effect. If a thermocouple cable is run, then the cable should be light gauge, twisted pair and shielded. If a shield is run with the thermocouple wire, only attach the shield to the main terminal block on the terminal provided (TB2 #16), and leave the other end of the shield open. Never ground both ends of a shield wire as this ground loop may attract miscellaneous noise and cause the T/C signal to be very erratic.

NOTE: Any unused TB2 inputs must be connected to Common.

Terminal Block 3 (TB3)

This terminal block is used for power, control, and monitoring functions.

Terminal 1-2	Power input 12/24VDC or 24 VAC: The FGI 351 power supply voltage must match the voltage rating of the solenoids to be used. The power supply and solenoids should be rated for 12 VDC or 24 VDC or 24VAC. The FGI 351 must have a good earth ground to the terminal marked “EARTH GND” for the unit to function properly.
Terminal 3	Ground (GND)
Terminal 4-5	Alarm output – a 0.1A 300V photovoltaic relay to indicate the operational status of the burner system. This is ideal for sending an alarm to a SCADA or to a remote dial-in system. The alarm contact will be open when the FGI 351 is in "Flame Failure" mode and closed when in "Flame Proved" mode. The "Flame Failure" mode will be activated after the third unsuccessful attempt to light and prove the pilot. The alarm out contact is an optically isolated solid-state switch that is like a set of "dry contacts". The terminal blocks are marked '+' and '-', but the switch is not polarity dependent.
Terminal 6-7	The RUN/STOP input, terminal 6, provides for remote operation from an RTU, PLC, or on/off switch and can operate in one of two modes. A closed set of dry contacts rated for a minimum of 24 volts at 20mA will start the burner Mode 1: The FGI 351 will stop operation of the burner when the contacts are opened across the RUN/STOP Input and ground. All local attempts, i.e. pressing the ‘START’ button, to start the burner will be ignored. When the contacts are closed an attempt will be made to automatically start the burner. Local attempts to start and stop the burner are allowed when the RUN/STOP contacts are closed. Mode 2: operates the same way as mode 1 except when the contacts close no attempt will be made to automatically start the burner. The ‘START’ must be pressed to attempt to start the burner. The Run/Stop contact must be closed (shorted to common) for an ignition attempt to be made. The Run/Stop input acts as a master control for any type of local or remote start to be used. A stop command by any source whether it is from communications or the keypad will have equal priority and will stop all burner operations. Stop commands from any source will override start commands.
Terminal 8-11	An RS232 or RS485 port for Modbus communications enables a host computer to control and/or receive information on the status of the FGI 351 operation and its operating variables. An RS232 RTS signal is also provided. This signal may be used if a radio or modem needs to be keyed for transmissions. A more detailed description of the Mod Bus communications may be found in the COMMUNICATIONS section of this manual.

Jumper Settings J1 & J2 (See Figure 8)

A = RS485
B = RS232

The communications port uses the following settings:

9600 baud
8 data bits
1 stop bit
No parity

RS 232 TB3 #8 => Transmit (TX)
TB3 #9 => Receive (RX)
TB3 #10 => Request to Send (RTS)
TB3 #11 => Common (COM)

RS 485 TB3 #8 => A
TB3 #9 => B
TB3 #10 => Request to Send (RS232 signal)
TB3 #11 => Common

The Local / Remote switch located on the terminal board allows the user to disable or enable PLC modbus control regarding starting or stopping the burner.

In 'Local Mode'
- Start or Stop commands via the RS232/485 port will be ignored.

In 'Remote Mode'
- Start or Stop commands via the RS232/485 port will be processed.

NOTE: This switch does not affect the function of the RUN/STOP input.

The Request to Send signal is provided to allow a transmitter or modem to be keyed when transmissions take place. This line will always use the RS232 signal levels.

3.1 From FGI 351 to IGN 50

Wire Size

Four conductors (16 or 14 AWG wire) must be routed from the FGI 351 Controller to the IGN 50. For flame detection and proper sparking a good return circuit path is required between the pilot nozzle and COM on the IGN 50. Ensure there is a clean thread and no sealant material between the pilot nozzle and the fuel line. Ensure the pilot bracket is in good electrical contact with the fuel line. These conductors should be labelled or colour coded to ensure correct installation and re-attachment if necessary. See Figure, below, for IGN 50 wiring.

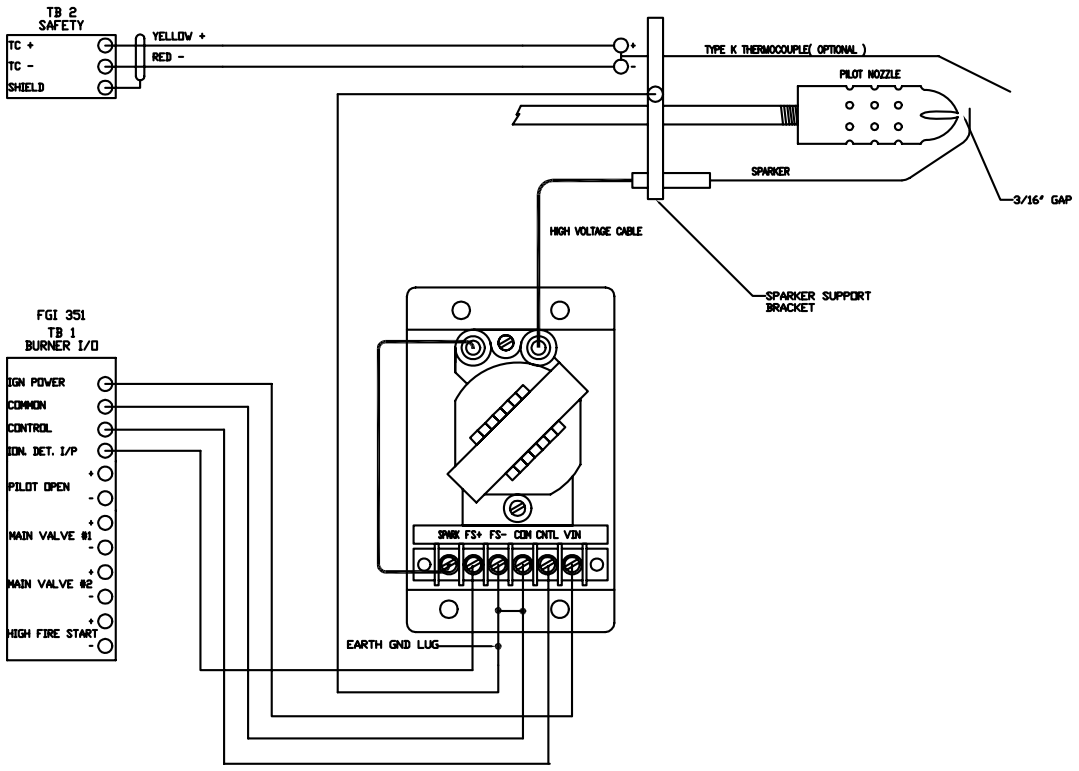


Figure 9
IGN 50 Wiring

High Voltage Cable

A Resistive High Voltage Cable provided must be used when connecting the spark/flame rod to the IGN 50. A 10-foot length of high voltage cable is provided unless a shorter length is requested. Care should be taken to avoid / minimize contact between the high voltage cable and any metallic surface.

NOTE: Substitution of high voltage cable with cable other than supplied by Titan may result in damage to the FGI 351 system or IGN 50. Such damage is not covered under the warranty.

Ground Wire

A dedicated ground wire must run from the pilot nozzle to the 'COM' terminal on the IGN 50 to ensure proper operation.

Jumper Settings

NOTE: Prior to mounting the IGN 50, set the positions of jumpers J1 and J2, located on the IGN 50 circuit board, for the supplied power. These jumpers can be accessed by removing the bottom plate from the IGN50. Please note the orientation of the jumpers (ie they should be vertical as shown below).

Voltage	Jumper	Jumper State
12VDC	J1 & J2	IN
24VDC or 24VAC	J1 & J2	OUT

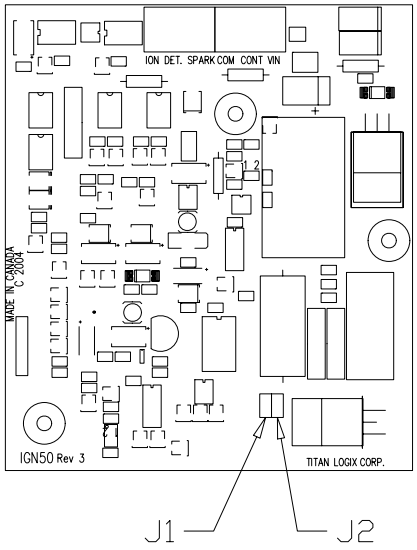


Figure 10
Setting IGN 50 Jumpers

3.2 P&ID's

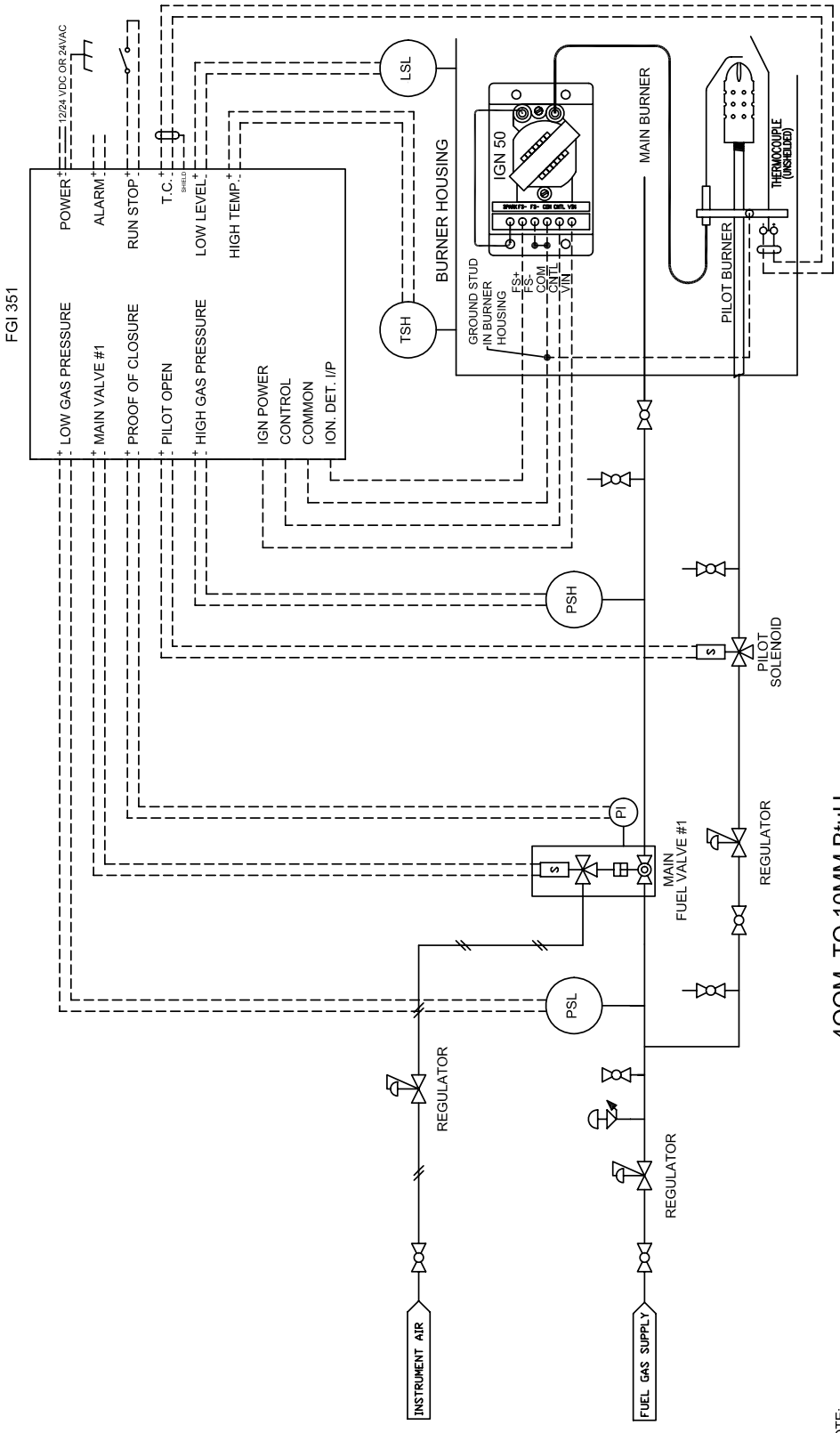


Figure 11
One Main Valve with Proof of Closure Switch

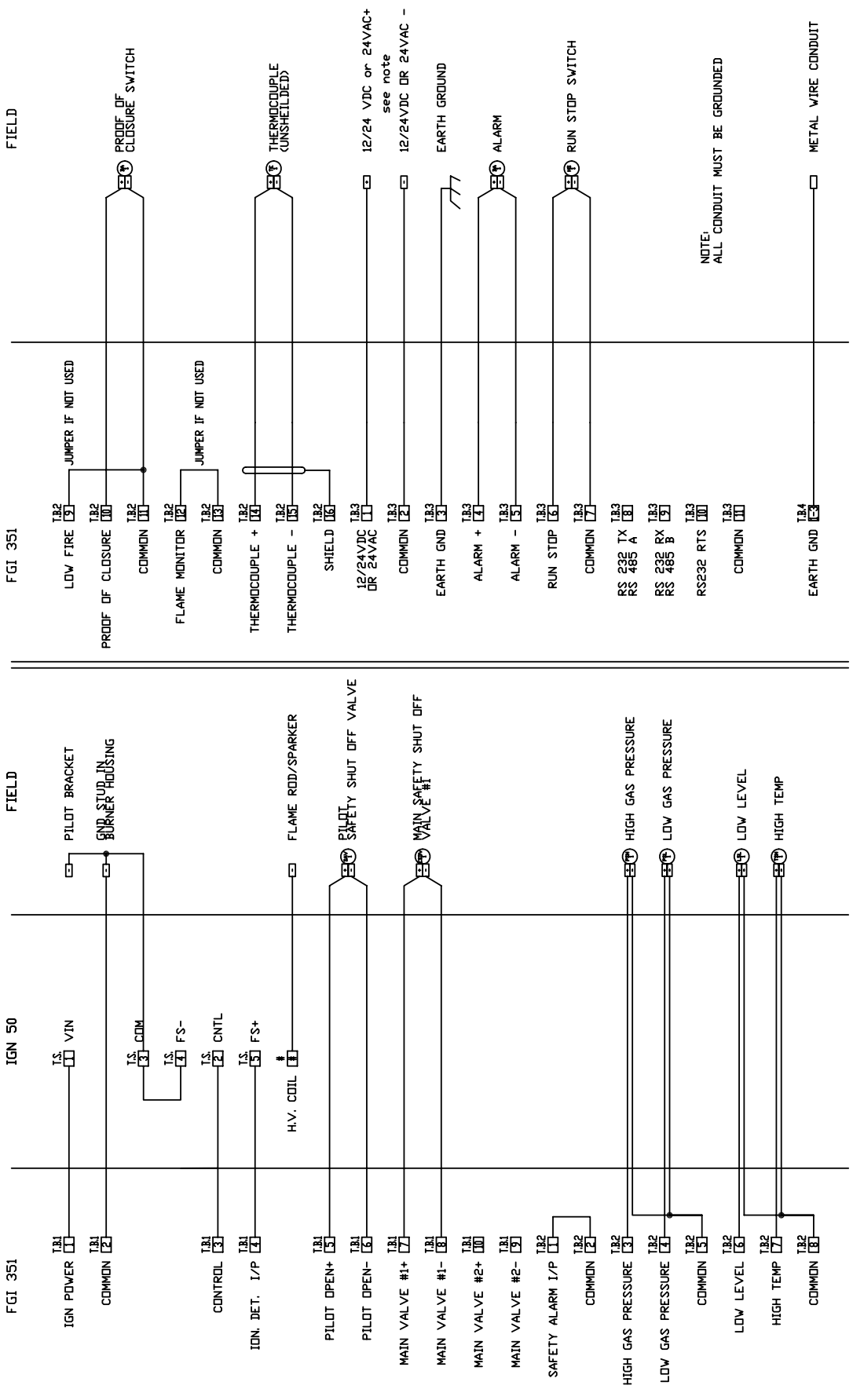


Figure 12
One Main Valve with Proof of Closure Switch Wiring

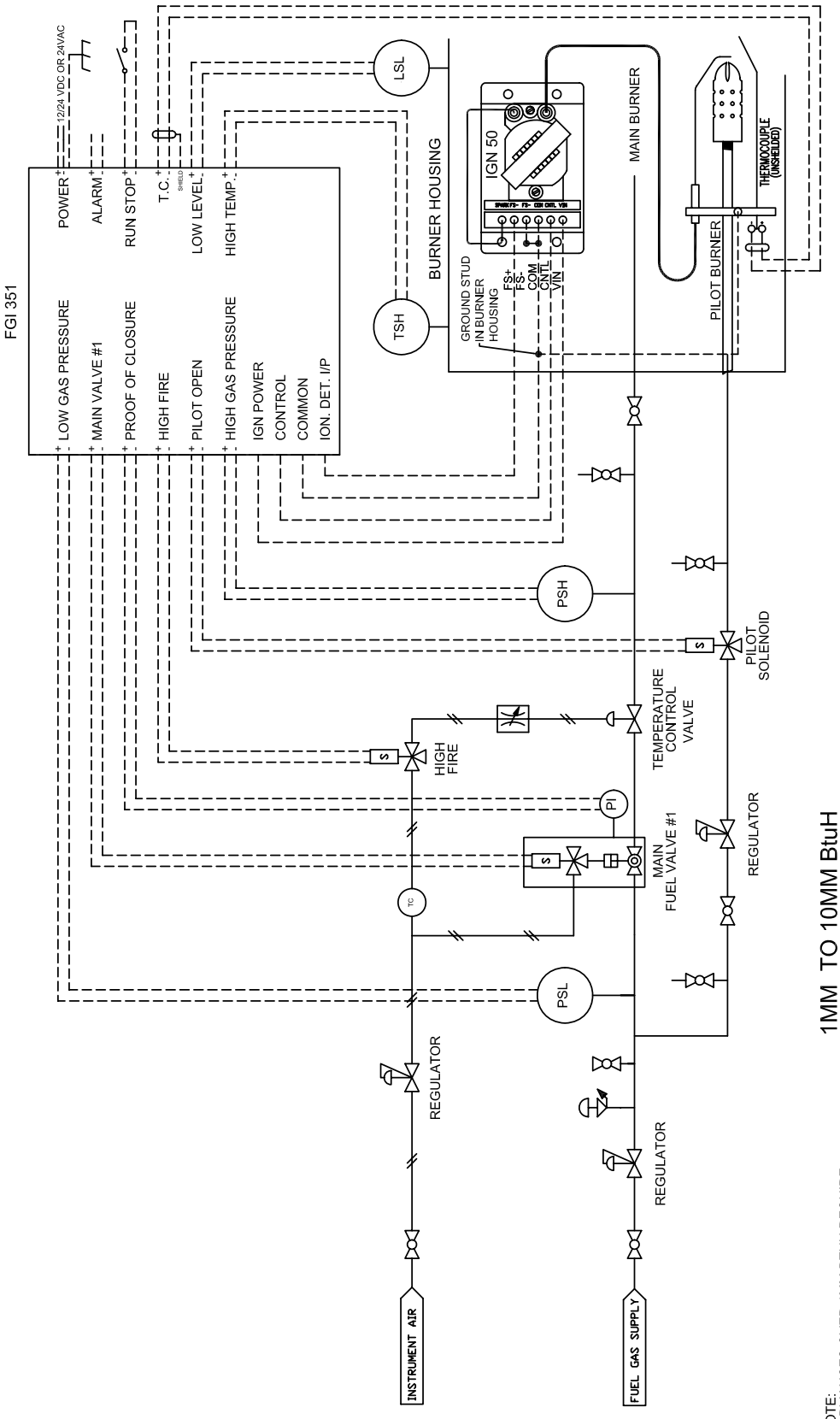


Figure 13
One Main Valve with Temperature Control

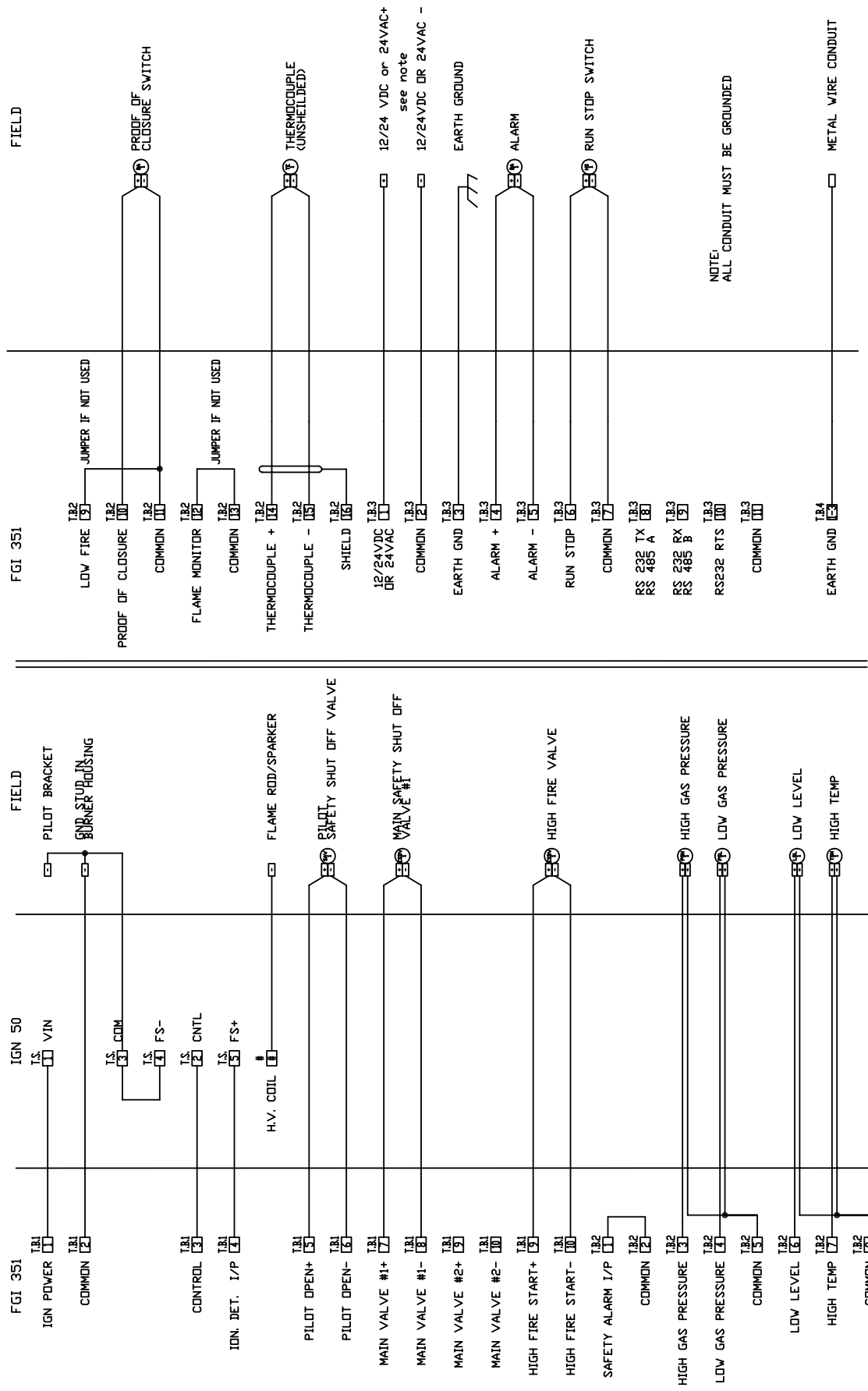


Figure 14
One Main Valve with Temperature Control Wiring

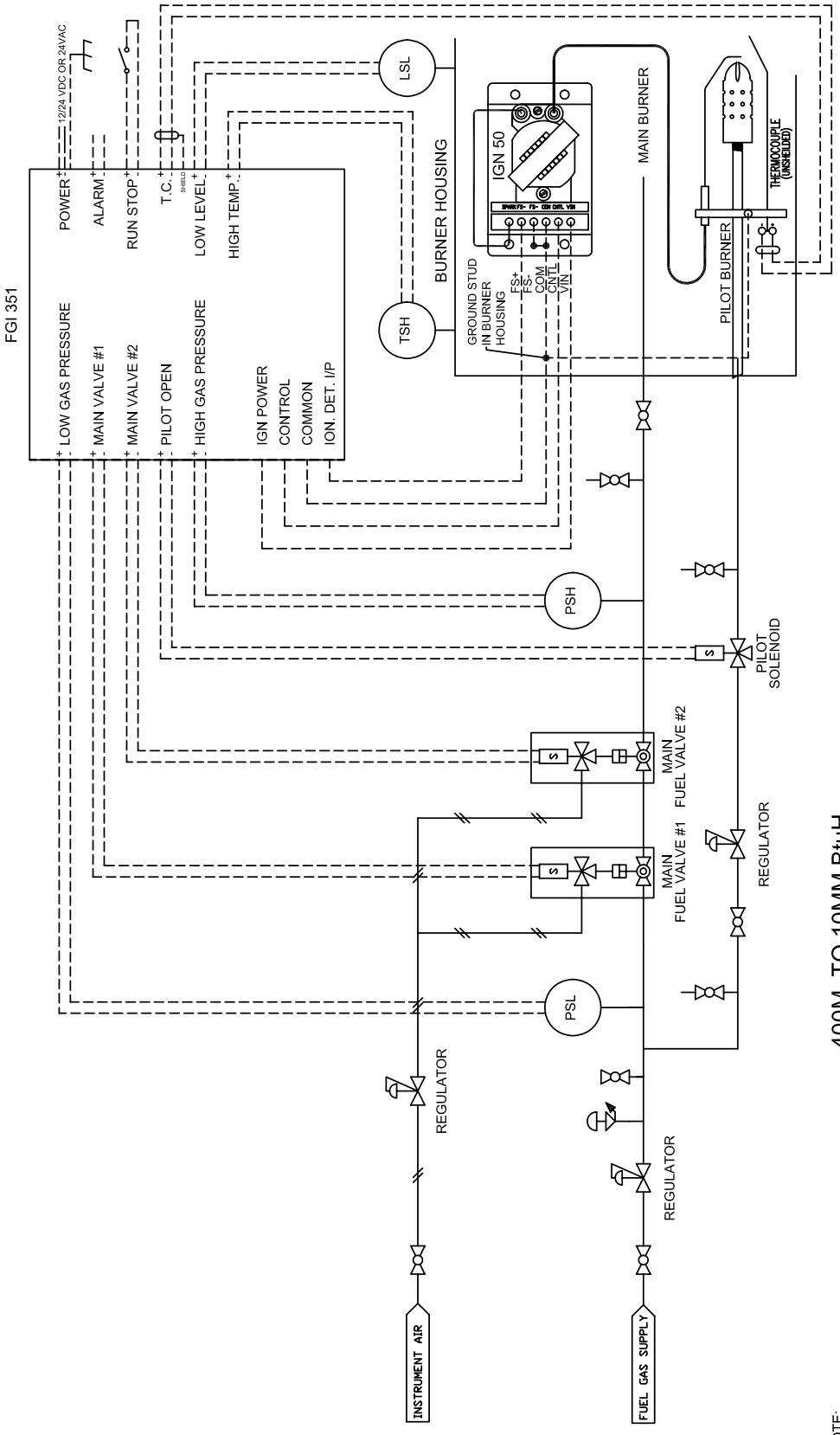


Figure 15
Two Main Valves

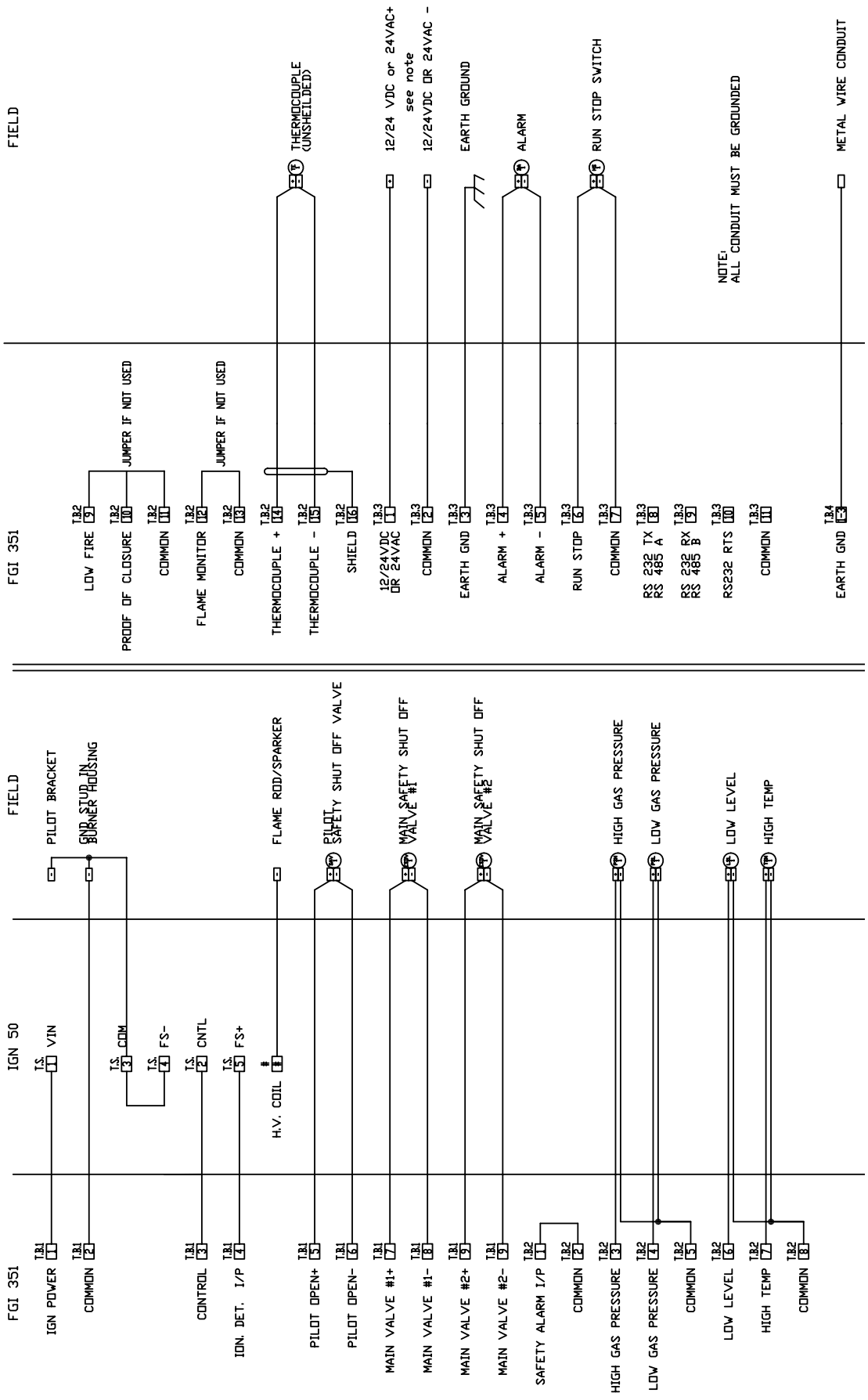


Figure 16
Two Main Valves Wiring

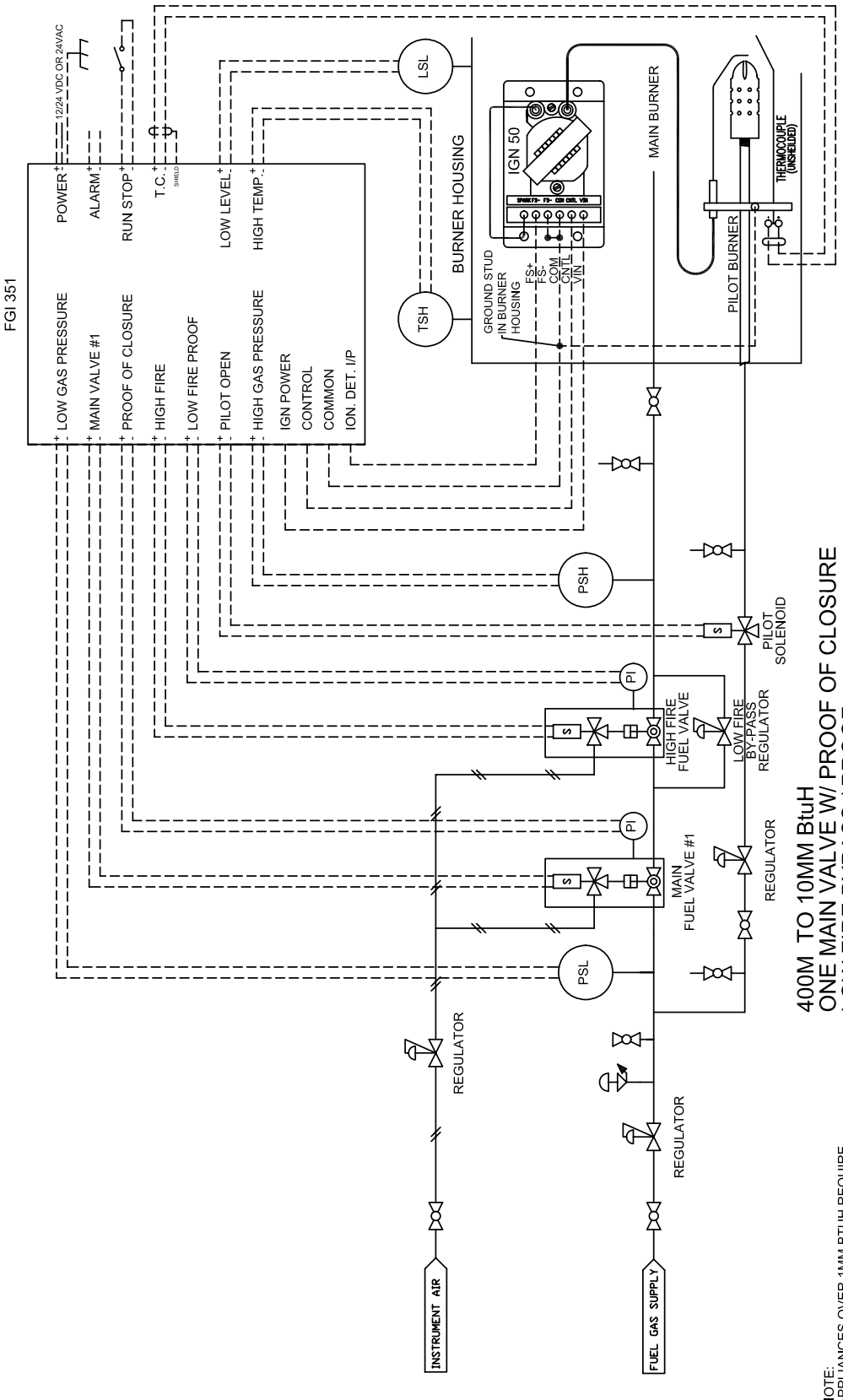


Figure 17
One Main with High Fire By-Pass

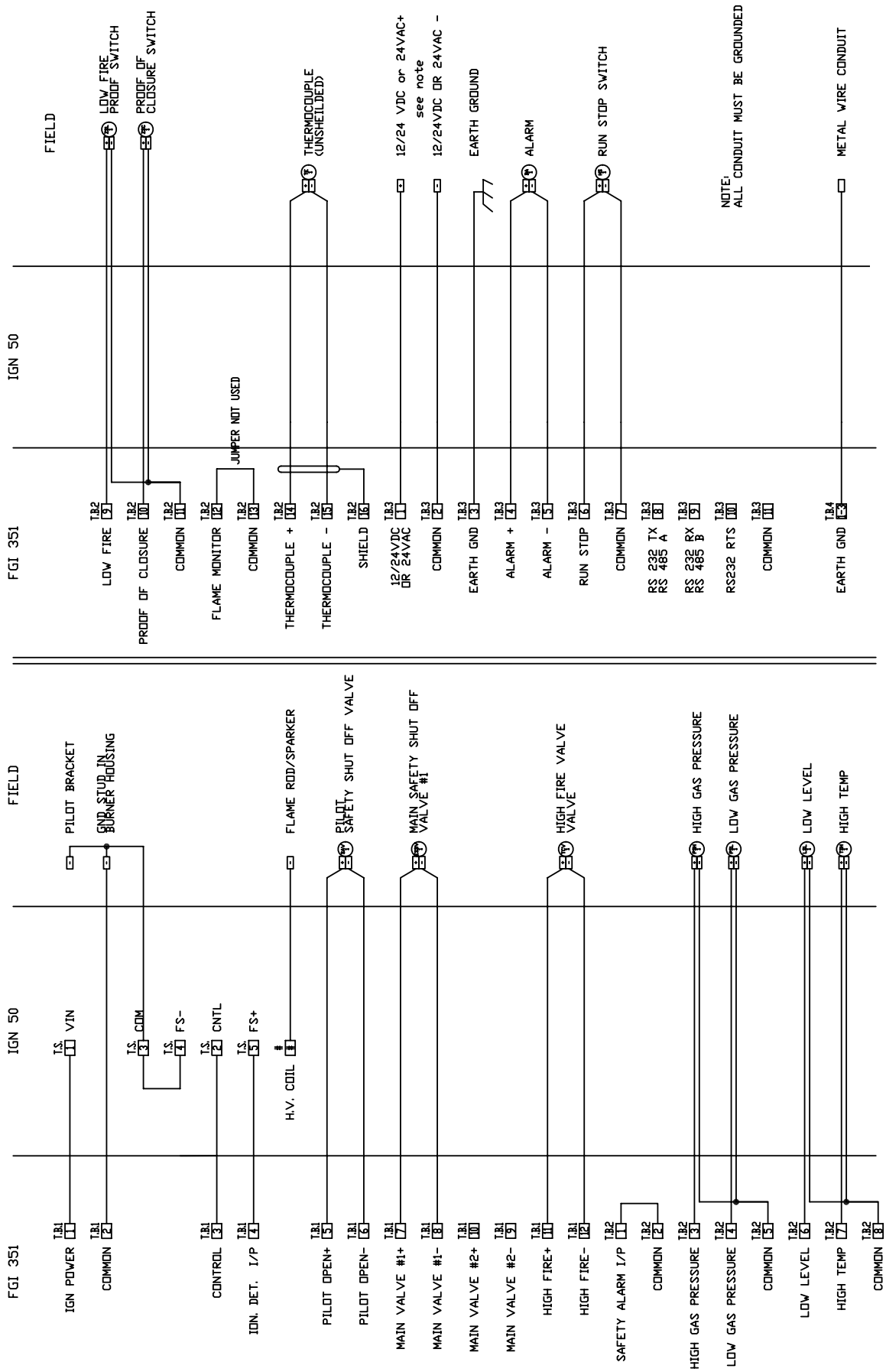


Figure 18
One Main with High Fire By-Pass Wiring

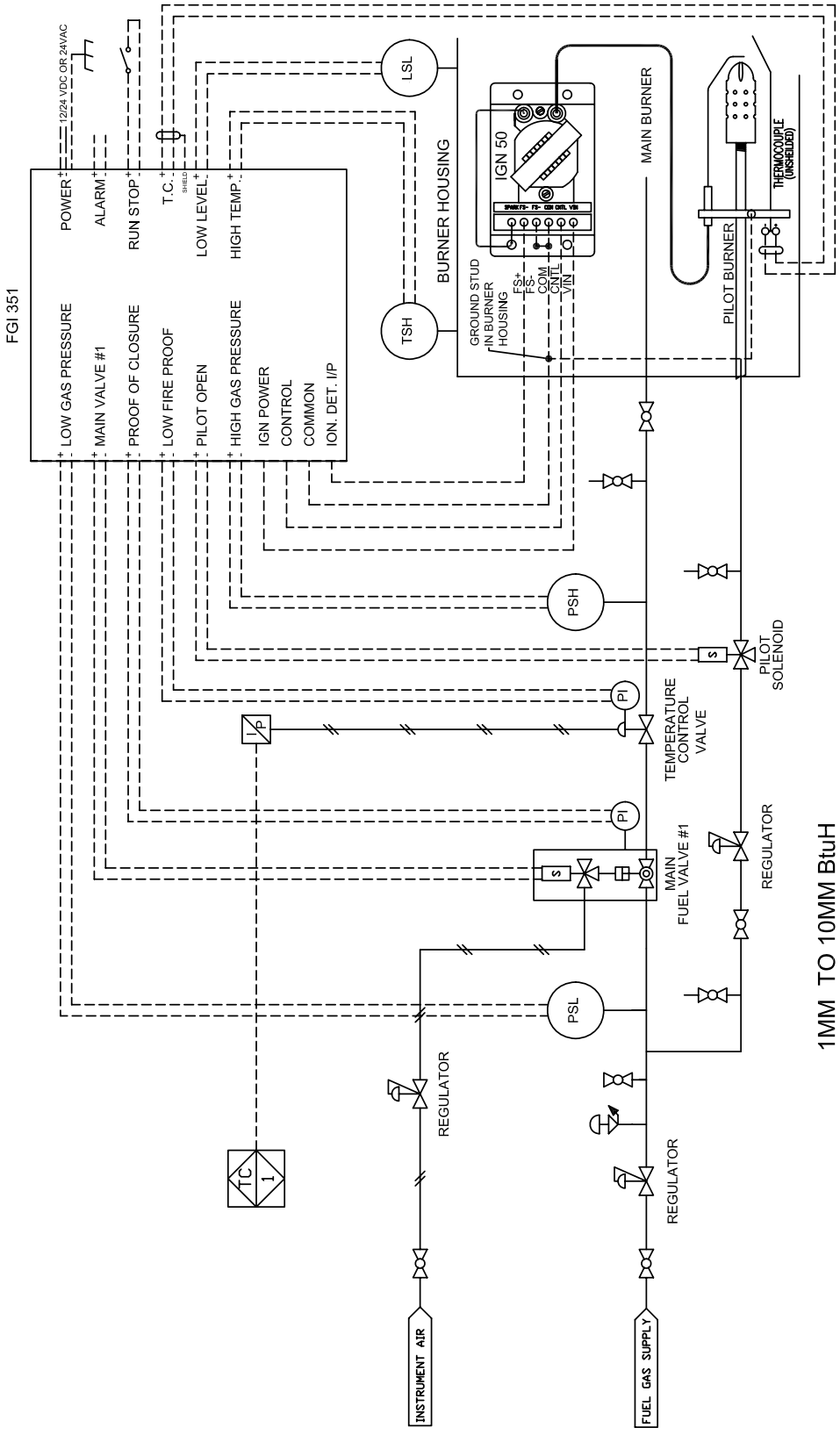


Figure 19

One Main with Temp. Control & Low Fire Proof

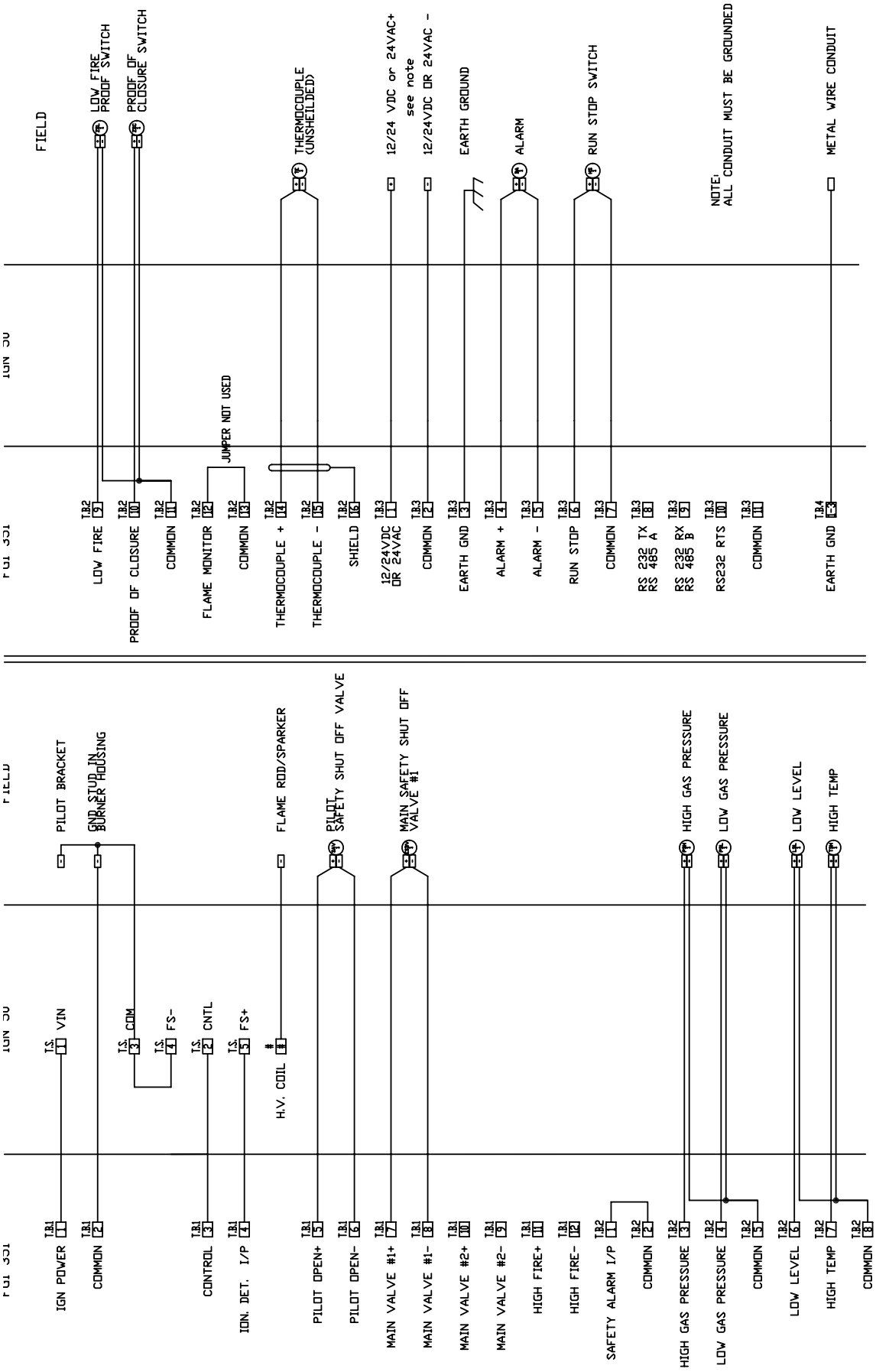
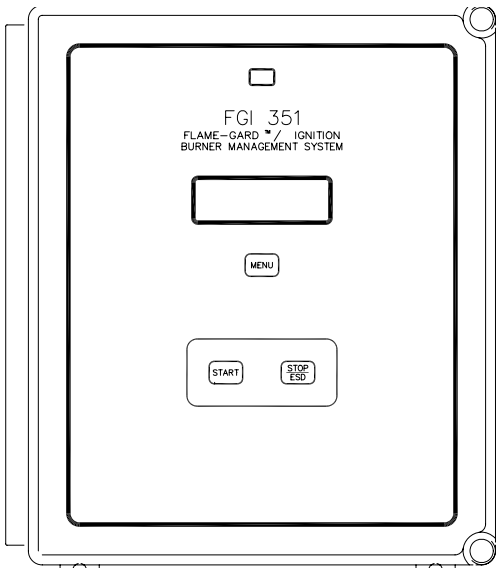


Figure 20
One Main with Temp. Control & Low Fire Proof Wiring

4 Set-Up and Operation

4.1 Front Panel

The three control buttons on the front of the FGI 351 are: 'MENU', 'START' and 'STOP'.



The 'MENU' button can be used to cycle through 4 screens of information.

Screen 1 — Current status of the FGI 351 control sequence.
If there is a change in the functions being performed by the system this page will automatically appear to inform the operator (unless the FGI 351 display has entered 'Sleep' mode).

Screen 2 — Displays the current valve status, open or closed.

Screen 3 — Thermocouple variables.

Screen 4 — Number of times the unit has restarted after a flame failure.

Start Button — The 'START' button is used to start an ignition sequence. The RUN/STOP inputs on terminal board TB3 6-7 must be shorted or connected through a switch for the unit to operate.

Stop Button — The 'STOP/ESD' button shuts down the burner no matter what stage of the firing sequence it is in. This button overrides all commands from the RUN/STOP, remote control, or software, to act as an emergency shut down to ensure the burner can be turned off safely by site personnel.

4.2 Power-Up

Hardware Test — Upon power-up the FGI 351 checks its configuration data and performs a hardware test before starting an ignition sequence. If the configuration data is corrupted the FGI 351 will not start the ignition sequence. The hardware test ensures the solenoids are

closed, flame detection inputs are off, and no alarms are active. The display will indicate if a hardware problem exists. If the hardware test does not encounter any problems the FGI 351 will start the burner ignition sequence.

If a hardware problem exists it will be indicated on the display. Turn off the power and gas before fixing the problem. After fixing the problem the display should then be monitored to ensure the problem has been repaired.

4.3 Firing Sequence

Overview

At the beginning of a firing sequence the FGI 351 will wait for a factory set pre-purge time before attempting to ignite the pilot. After this pre-purge time, the FGI 351 will open up the pilot valve and simultaneously direct the IGN 50 to initiate a spark. If a flame is present at the nozzle the IGN 50 Ionization detection circuit will pulse the Ionization Detect signal going back to the FGI 351 system. This acts as a “heartbeat” to indicate the presence of a pilot flame and proper operation of the IGN 50. The FGI 351 expects a pulsed signal from the IGN 50. If the Ionization Detect signal is continuously held low the FGI 351 will indicate a problem and shut the burner down. If a valid pulse train is received the FGI 351 will indicate ‘Proving Pilot’ on the display. The pilot is then allowed two minutes to stabilize before the main burner valve will open. The main burner valve(s) will then be opened for the duration of the burn period.

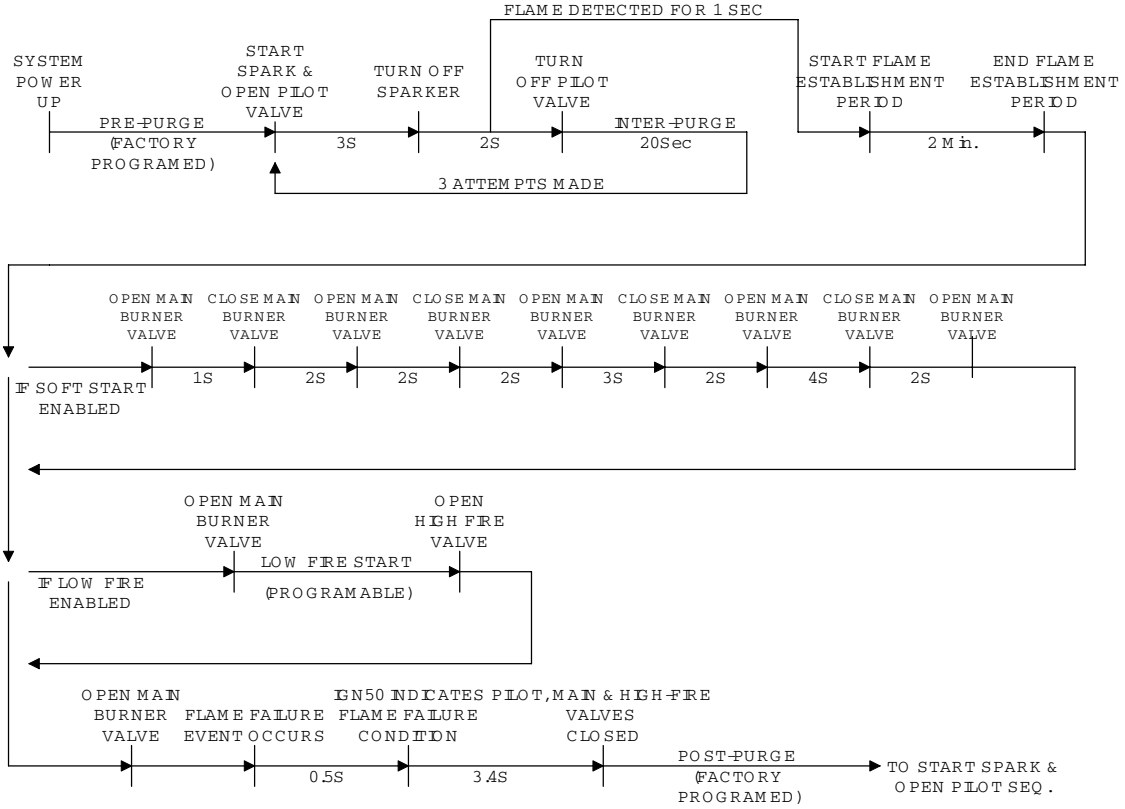


Figure 21
FGI 351 System Timing

Pre-Purge	The pre-purge cycle can not be completed until the thermocouple temperature drops below 200°C.
Flame Establishment Period	Once the pilot is lit there is a two-minute Pilot Flame Establishment Period (PFEP). If the pilot temperature has exceeded the high temperature set-point by the end of the PFEP the main burner valve will be opened and the burner ignited. If the High temperature set-point has not been reached, an additional 3 minutes (for a total of 5 minutes) is allowed for the thermocouple to reach the high temperature set-point. If the high temperature set point is not reached the pilot flame is considered unfit to light the main burner. The pilot will then be shut off and the alarm will be activated (TB3 #4, #5).
Soft start	The optional Soft Start setting enables the gas to the Main Burner valve to be pulsed on and off for a total of 18 seconds before remaining on continuously. The Soft Start option helps a draft to be formed in a natural draft burner from a cold start.
Low Fire Start	A Low Fire Start method may be required on appliances larger than 1 MM Btu/H. The Low Fire start option ensures gas going to the main burner is limited during ignition. The Low Fire Start timer delays the opening of a High Fire Valve. When the main burner valve opens it sends fuel through a pressure-regulated bypass allowing the main burner to start and stabilize in a low fire condition. When the High Fire valve is activated it will allow full gas flow to the main burner. If at any time a pilot flame is not detected for 3.8 seconds the pilot and main valves will be shut. The FGI 351 will then attempt a normal purged start. If the burner cannot be started after three attempts the FGI 351 will display an alarm and go into a lockout mode. Only after failing the 3 re-ignition attempts will the FGI 351 open the alarm output contact.
Burner OK/Down	The display indicates the current FGI 351 status. After 15 minutes of no keypad activity, text indicating the system status will scroll across the display, either “BURNER OK” or “BURNER DOWN”. If the FGI351 is configured with SLEEP Enable the display will go blank after 15 minutes to reduce the power requirements to the FGI 351. Pressing the ‘MENU’ button will reactivate the display.
Poor Flame Quality	A poor flame Quality shut down will occur if the thermocouple temperature drops below the high temperature set point.
Thermocouple Purge	When the thermocouple (T/C) is enabled the FGI 351 will not attempt to light the pilot until the thermocouple temperature is less than approximately 200°C and the pre-purge or post-purge timer has elapsed. This provides a temperature dependent pre-purge for a pilot ignition attempt after a flame out.
Post Purge	The Post-Purge cycle can not be completed until the thermocouple temperature drops below 200°C.

4.4 Setting Thermocouple High Temp. Set-point

Establishing Pilot

Ignite the pilot and allow the flame to become well established (i.e. wait at least 2 minutes and observe the pilot flame to ensure it is of a good quality). Select the thermocouple page (page 3) on the display by pressing the 'MENU' button until the following text appears on the display:

TC Value = XX

TC fail S.P. = XX

Temperature Set-Point

Then press and hold the MENU button for 5 seconds. The FGI 351 will automatically establish a set-point temperature approximately 200 C° (approximately 8.1 mV) less than the pilot's current temperature. This will become the high temperature set-point. The main and pilot valves will be turned off if the pilot temperature drops below this set point. It is also the temperature the thermocouple must reach before any attempt is made to ignite the main burner. Factory default setting is approximately 500 C° (approximately 20.6 mV).

4.5 System Errors and Safety Alarms

System Alarm Inputs

There are several types of system alarm inputs that cause the FGI 351 to halt burner operation. All inputs TB2 1-8 are dry contact inputs. If a particular alarm is not being used the alarm must be shorted to Common on the terminal board.

Terminal Input	Explanation
System Alarms	For configurations where the alarm contacts from the safety switches are all tied in series.
High Gas Pressure	High gas pressure safety switch input.
Low Gas Pressure	Low gas pressure safety switch input.
High Temp	The bath temperature of the vessel is beyond a maximum limit.
Low Level	Liquid in the vessel is lower than a minimum operating level.

System Errors

If a system error occurs the FGI 351 will shut down the burner and leave it in a locked-out state so the problem can be diagnosed and repaired. The trouble-shooting guide in this manual gives a description of error messages.

Clearing System Errors

To clear a system error, select page 1 on the display and then press and hold down the 'MENU' key for 5 seconds. The error cannot be reset from any other display page. After any error the unit should to be checked by qualified personnel to ensure the FGI 351 is not acting in a hazardous manner.

Safety Alarms

All safety alarm inputs (e.g. low pressure) have an associated software lockout. These lockouts can be configured for automatic or manual restart. If an alarm occurs the burner will shut down. The purpose of the lockouts is to control what the FGI 351 unit does after the alarm condition has cleared.

Clearing Safety Alarms

If a safety alarm occurs and has its lockout enabled it must be reset manually. Before attempting to reset the FGI 351 the alarm condition must first be cleared (e.g. the low pressure safety switch no longer indicates a low pressure condition). When this is done, select page 1 on the display and then press and hold down the 'MENU' key for 5 seconds. The alarm cannot be reset from any other display page.

If the appropriate alarm does not have the lockout enabled an automatic re-ignition will be attempted when the alarm condition is cleared (e.g. the low pressure safety switch no longer indicates a low pressure condition).

The FGI 351 will never operate during an alarm condition.

4.6 Communications

The communications port allows a host computer to communicate with and control the FGI 351 through an RS232 / RS485 port located on TB3 of the terminal board. Jumpers J1 and J2, see figure 8, on the main board set which communications interface is used (RS232 or RS485). J1 and J2 must both be in the same position.

Jumpers J1 and J2

A = RS485
B = RS232

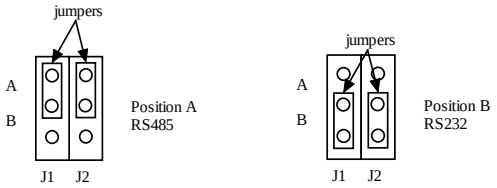


Figure 22
Communications Jumper settings

The communications port uses the following settings:

Comm. Port Settings

9600 baud
8 data bits
1 stop bit
No parity

Modbus

The MODBUS protocol uses functions 3, 6, and 16. The Modbus card address is programmable by the Palm Pilot™ or through the hardwired communication link. Modbus address 250 can be recognized by all devices and can be used to set up the configuration setting as well as designating a unique Modbus address. Because RS485 is a multi-drop interface, only one FGI 351 unit should be connected when configuring multiple burner controls unless each unit address has already been configured.

Listed below are the FGI 351's registers and their addresses. These can be read using MODBUS protocol.

4.7 Function 3 (Read Registers)

Register Definition

0000h = Status Register
0001h = Option Register
0002h = Pre-Purge Time (sec.)
0003h = Post Purge Time (sec.)
0004h = Low Fire Start Time (sec.)
0005h = Modbus Unit Address
0006h = Error Reg. –Newest LSB (8 error registers)
0007h = Error Reg.
0008h = Error Reg.
0009h = Error Reg. – Oldest MSB
0010h = Thermocouple reading in mV
0011h = Option2 Register

Status Register (0000h)

b000000000000000x = When set, indicates burner is in run mode, otherwise burner operation is halted.

b000000000000xxx0 = current operational state.

Variable

b000 = BNR_DOWN
b001 = PURGE
b010 = IGNITION
b011 = PROVED
b100 = MAIN ON SOFT START
b101 = MAIN ON LOW
b110 = MAIN_ON

b00000000000x0000 = When set, the Ionization input is activated.

b0000 00xx xxx0 0000 = System alarm inputs (direct input reflection)

b00001 = High Temp Alarm
b00010 = Low Level Alarm
b00100 = Low Gas Pressure
b01000 = High Gas Pressure
b10000 = General Safety

Option Register (0001h)

bx0xxxxxxxxxxxxx

Bit

1 = When set, soft start enabled.

2 = When set, proof of closure switch enabled.

3 = When set, IGN Ionization input used.

4 = When set, the Flame Monitor input used.

5 = When set, the unit will lockout restarts from a Safety alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

6 = When set, the unit will lockout restarts from a High Temperature alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

7 = When set, the unit will lockout restarts from a Low Level alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

8 = When set, the unit will lockout restarts from a High Gas Pressure alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

9 = When set, the unit will lockout restarts from a Low Gas Pressure alarm unit reset. Otherwise a restart will immediately occur upon removal of the alarm.

10 = When set, the Low fire I/P is enabled.

11 & 12 (not used)

13 = When set, the display will turn off when the FGI goes to sleep. Otherwise a scrolling message will occur.

14 = When set, a 0.8 second fast restart is attempted on loss of flame. Otherwise a purge and restart is attempted.

15= Not used

16 = When set, this bit will turn the burner ON when power is applied to the unit. Otherwise the unit will wait for a manual or remote start.

Pre-Purge Time (0002h)	This is the time required for the burner to wait before an ignition attempt is made after power is applied to the system or after the START button is pressed. This is called a cold start. The time entered here is in seconds.
Post-Purge Time (0003h)	If there is a loss of flame the post purge timer will be executed before a re-ignition attempt is made. This time will typically be set the same as the Pre-Purge time.
Low Fire Start Time (0004h)	The Low-Fire Start time is the time between the opening of the Main valve(s) and the opening of the High Fire valve. This value is only used if the Low Fire Enable bit is set in the Option register.
Unit Address (0005h)	This word indicates what Modbus Address the Unit will respond to in a multi-drop environment such as RS485. Addresses can range between 1 and 249. If the FGI 351 is directly connected to a host with no other systems attached then addresses 0 and 250 may be used.

Errors (0006h – 0009h)

There are eight error registers that hold what type of hardware errors had occurred since the last loss of power. The errors are automatically sorted from most recent to oldest. Address 0006h MSB contains the most recent Errors and address 0009h LSB contains the oldest error values. Bit 3 in the Command register allows these error messages to be cleared when requested. Error codes 0 to 49 contain possible external hardware problems and errors 50 to 59 contain hardware problems most likely contained within the FGI 351 electronics.

1 = Proof of closure switch on main valve is open when it should be closed.
2 = Proof of closure switch on main valve is closed when it should be open.
3 = Ionization input should be open cct but indicates closed.
4 = Unit not able to start properly after 3 attempts.
5 = Low fire input contact open when should be closed.
6 = Low fire input contact closed when it should be open.
7 = TC probe connection alarm
8 = TC didn't reach high trip point.
9 = poor flame quality

50 = 3 bit do->di feedback test incorrect.
51 = EEPROM data incorrect.
52 = Pilot relay in wrong state, check relay
53 = Main1 driver in wrong state, check relay
54 = Main2 driver in wrong state, check relay
55 = High Fire Start in wrong state, check relay
56 = Master op driver in wrong state, check relay
57 = Input test error

Thermocouple (mV) (000Ah)

This register contains the temperature reading in mV for the thermocouple. J3 on the Main board enabling the thermocouple option must be in to get an accurate reading from this register.

4.8 Function 6 and 16 (Write Registers)

Register Definition

0000h = Command Register
0001h = Option Register
0002h = Pre-Purge Time
0003h = Post - Purge
0004h = Low Fire Timer
0005h = Modbus Unit Address
0006h = Option2 Register

Command Register (0000h)

b000000000000xxxx

Bit (LSB)1 = When set a Run Burner instruction is executed.

2 = When set a Stop Burner instruction is executed.

3 = Clear Error Register and locked out alarms.

4 = Clear Error Log.

Option Register (0001h) bxxxxxxxxxxxxxxxx

Bit (LSB)1 = When set, soft start enabled.

2 = When set, proof of closure switch enabled.

3 = When set, IGN Ionization input used.

4 = When set, the Flame Monitor input used.

5 = When set, the unit will lockout restarts from a Safety Alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

6 = When set, the unit will lockout restarts from a High Temperature alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

7 = When set, the unit will lockout restarts from a Low Level alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

8 = When set, the unit will lockout restarts from a High Gas Pressure alarm until reset. Otherwise a restart will immediately occur upon removal of the alarm.

9 = When set, the unit will lockout restarts from a Low Gas Pressure alarm unit reset. Otherwise a restart will immediately occur upon removal of the alarm.

10 = When set, the Low fire I/P is enabled.

11 & 12 (Not Used)

13 = When set, the display will turn off when the FGI goes to sleep. Otherwise a scrolling message will occur.

14 = Reserved. A zero should be written to this bit.

15= Reserved. A zero should be written to this bit.

16 = When set, this bit will turn the burner ON when power is applied to the unit. Otherwise the unit will wait for a manual or remote start.

Pre-Purge Time (0002h) This is the time required for the burner to wait before an ignition attempt is made after power is applied to the system or after the START button is pressed. This is called a cold start. The time entered here is in seconds. This cannot be programmed by the user through the MODBUS interface.

Post-Purge Time (0003h)	If there is a loss of flame post purge timer will be executed before a re-ignition attempt is made. This time will typically be set the same as the Pre-Purge time.
Low Fire Start Time (0004h)	The Low-Fire Start time is the time between the opening of the Main valve(s) and the opening of the High Fire valve. This value is only used if the Low Fire Enable bit is set in the Option register.
Unit Address (0005h)	This word indicates what Modbus Address the Unit will respond to in a multi-drop environment such as RS485. Addresses can range between 1 and 247.
Option 2 Register (0006h)	b000000000000000x Bit 1= This bit when set disables the automatic restart of the burner when the Run/Stop external contact closes.

5 Trouble Shooting

5.1 Information Screens

Display	Explanation
PILOT= ON	Valve status display page Indicates pilot valve status
PILOT= OFF	Valve status display page Indicates pilot valve status
MAIN= ON	Valve status display page Indicates main valve status
MAIN= OFF	Valve status display page Indicates main valve status
HIGH FIRE= ON	Valve status display page High fire valve status
HIGH FIRE= OFF	Valve status display page High fire valve status
TC VALUE = XX	Thermocouple status page Current mV output of thermocouple
TC FAIL S.P. = XX	Thermocouple status page Unit will shut down if thermocouple mV output falls below this Value
FAIL CNT= XX HOLD MENU TO RESET CNT	Restart count Page Indicates the number of times there has been a flame failure after the main burner has been lit.
HOLD MENU BUTTON DOWN TO RESET	Instruction command to reset unit after an error

5.2 Normal Operation

Display	Explanation	Next Steps
BURNER OPERATION HALTED	1. If configured to <u>not</u> start on power up (normal) 2. There has been a power failure that has caused the 351 to stop. 3. A stop has been initiated locally or remotely.	Press START to begin ignition sequence
PURGING SYSTEM XX SEC REMAINING	1. If 351 set to auto start on power up. 2. Loss of flame occurred. Vessel trying a re-light.	
PURGING SYSTEM TC HIGH, TC=XX	T.C. temperature is greater than 200C (if T.C. is enabled)	1. Wait for T.C. to cool below 200C. 2. If T.C. reading is still greater than 200 C (10 mV) and T.C. is known to be cooled down: 2a. Ensure using a K Type T.C. 2b. Ensure correct mV output of T.C. 2c. Ensure correct polarity on T.C. wiring 3. If T.C. is working properly there is a problem with the FGI 351 main board.

Display	Explanation	Next Steps
PURGING SYSTEM TC HIGH, TC=XX		3a. Connect mV generator to T.C. input to simulate T.C. If not functioning properly then FGI 351 main board to be replaced.
PILOT OPEN	The pilot valve is open, sparking will soon begin. (Screen on 2 seconds)	
PILOT AND SPARK	The pilot solenoid is opened and IGN 50 is sparking. (Screen on 5 seconds)	
FAIL #1 PURGING SYS XX SEC REMAINING	20 second interpurge time to prepare for spark attempt #2. (Screen on 20 seconds)	
FAIL #2 PURGING SYS XX SEC REMAINING	20 second interpurge time to prepare for spark attempt #3. (Screen on 20 seconds)	
FAIL #3 PURGING SYS XX SEC REMAINING	Pilot not lit after third attempt. (Screen on 1 second)	
PROVING PILOT MAIN ON IN XX SEC	Pilot flame establishment period. 2 minutes to establish good pilot.	
PROVING PILOT TC STILL BELOW S.P.	T.C. is less than High Temperature set point.	Wait for total of 3 minutes after completion of flame establishment period.
SOFT START IN PROG.	Soft start sequence in progress (if configured).	
LOW FIRE START	Low fire start sequence in progress (if configured to do so)	
MAIN BURNER ON	Main valve has just opened. Displayed for about 2 seconds.	
ONLINE OK	Pilot and Main are on and operating properly.	
FLAME FAILURE	Pilot flame has gone out. Message displayed for 4 seconds.	
BURNER OK	Scrolls across screen after 15 minutes of no activity when Burner is operating properly.	Press Menu button to return to regular display.
BURNER DOWN	Scrolls across screen after 15 minutes of no activity when Burner is down.	Press Menu button to return to regular display.
SYSTEM ALARMS RESET	Menu button has been pressed for 5 seconds. Alarm conditions are reset.	

5.3 Errors

Display	Cause	Resolution
FLAME FAILURE	Pilot flame out	Check Pilot
EEPROM DATA ERROR	Data in the EEPROM is corrupted. (configuration chip)	Check Ribbon strips from Main to Terminal Board are secure and placed correctly Contact Titan for a new EEPROM. Ensure Configuration chip is properly seated in its socket
BAD T.C. PROBE CONNECTION	T.C. probe wiring or connections not correct	1. Ensure properly wired into terminals 2. Check for wire breaks. 3. Check thermocouple
SAFETY ALARM IN PROGRESS	ON POWER UP ONLY Safety alarm serial input (on FGI 351). Open circuit between alarm input and Common.	1. Ensure continuous circuit between alarm serial input and Common 2. Resolve cause of safety alarm
HIGH GAS PRESSURE ALARM IN PROGRESS	ON POWER UP ONLY High Gas Pressure alarm (on FGI 351). Open circuit between High Gas Pressure input and Common.	1. Ensure continuous circuit between High Gas Pressure input and Common 2. Resolve High Gas safety alarm
LOW GAS PRESSURE ALARM IN PROGRESS	ON POWER UP ONLY Low Gas Pressure alarm (on FGI 351). Open circuit between Low Gas Pressure input and Common.	1. Ensure continuous circuit between Low Gas Pressure input and Common 2. Resolve Low Gas Pressure safety alarm
LOW FLUID LEVEL ALARM IN PROGRESS	ON POWER UP ONLY Low Fluid Level alarm (on FGI 351). Open circuit between Low Fluid Level input and Common.	1. Ensure continuous circuit between Low Fluid Level input and Common 2. Resolve Low Fluid Level safety alarm
HIGH FLUID TEMP. ALARM IN PROGRESS	ON POWER UP ONLY High Fluid Temperature alarm (on FGI 351). Open circuit between High Fluid Temperature input and Common.	1. Ensure continuous circuit between High Fluid Temperature input and Common 2. Resolve High Fluid Temperature safety alarm
SYS SHUT DOWN, MAIN VALVE STUCK OPEN	Proof of closure switch on main valve is <u>open</u> when it should be closed	1.Check adjustment on proof of closure switch on main valve 2.Short input contacts if no proof of closure switch is being used

Display	Cause	Resolution
IONIZATION I/P OR FLAME MON. I/P ERROR	1. Ionization input (i.e. to the FGI 351 from the IGN 50) is closed when it should be open. 2. Pilot flame is present when pilot solenoid should be closed.	
LOW FIRE I/P CONTACT OPEN ERROR	Low Fire input contact is open when it should be closed.	1. Ensure proof of closure on low fire solenoid is on when solenoid is closed. 2.Short input contacts if input is not being used
LOW FIRE I/P CONTACT CLOSED ERROR	Low fire input contact is closed when it should be open.	Ensure proof closure on low fire solenoid is off when solenoid is open.
BAD T.C. PROBE CONNECTION	1. T.C. wiring not connected properly. 2. Damaged T.C.	1. Ensure correct T.C. wiring 2. Replace T.C.
T.C. DID NOT REACH GOOD FLAME SETPOINT	T.C. did not reach operating temperature within 5 minutes from pilot ignition	1. Reposition T.C. to ensure proper contact with pilot flame 2. Ensure pilot flame is proper size and quality (proper orifice size, no obstructions in pilot line, proper pressure)
POOR FLAME QUALITY ERROR	T.C. temperature has dropped below operating set point at some point during normal burner operation. Ionization still reads flame present.	1. Ensure pilot flame is proper size and quality (proper orifice size, no obstructions in pilot line, proper pressure, etc).
I/O BOARD COMMUNICATION ERROR	Digital input feedback test failed.	1. Service I/O board (ensure properly seated, may need replacement) 2. Service interconnection cables (properly seated, check for wire breakage) 3. Reduce the amount of radio frequency noise in the area or protect the FGI 351 from radio frequency noise. 4.Reduce the amount of noise on the power to the FGI 351
PILOT SOLENOID CONTROL ERROR	Pilot relay in wrong state Un-expected voltage at pilot terminals	1. Remove external voltage source to pilot terminals 2. Pilot relay K2 or fuse F4 may need to be replaced 3. Terminal board may need replacement
MAIN1 SOLENOID CONTROL ERROR	Main 1 relay in wrong state Un-expected voltage at main1 terminals	1. Remove external voltage source to pilot terminals 2. Main 1 relay K3 or fuse F5 may need to be replaced 3. Terminal board may need replacement

Display	Cause	Resolution
MAIN2 SOLENOID CONTROL ERROR	Main 2 relay in wrong state Un-expected voltage at main2 terminals	1. Check TB# 2 terminals 12& 13 need to be jumpered. 2. Remove external voltage source to pilot terminals 3. Main 2 K4 relay or fuse F6 may need to be replaced 4. Terminal board may need replacement
HIGH FIRE START SOL. CONTROL ERROR	High Fire Start relay in wrong state Un-expected voltage at high fire terminals	1. Remove external voltage source to pilot terminals 2. High Fire Start relay K5 or fuse F7 may need to be replaced 3. Terminal board may need replacement
MASTER SOLENOID CONTROL ERROR	Master relay in wrong state.	1. Master Solenoid relay may need to be replaced 2. Terminal board may need replacement
SYSTEM ALARM = SAFETY ALARM I/P	Generic alarm(s) in progress	1. Check external alarms connected to this input. 2.Short input contacts if input is not being used
SYSTEM ALARM = HIGH TEMP. ALARM	High Temperature alarm in progress. Open circuit between High Temperature input and Common.	1. Ensure continuous circuit between High Temperature input and Common 2. Resolve High Temperature safety switch alarm 3.Short input contacts if input is not being used
SYSTEM ALARM = LOW LEVEL ALARM	Low Fluid Level alarm in progress. Open circuit between Low Fluid Level input and Common.	1. Ensure continuous circuit between Low Fluid Level input and Common 2. Resolve Low Fluid Level safety switch alarm 3.Short input contacts if input is not being used
SYSTEM ALARM = LOW GAS PRESSURE	Low Gas Pressure alarm in progress. Open circuit between Low Gas Pressure input and Common.	1. Ensure continuous circuit between Low Gas Pressure input and Common 2. Resolve Low Gas safety switch alarm 3.Short input contacts if input is not being used
SYSTEM ALARM = HIGH GAS PRESSURE	High Gas Pressure alarm in progress. Open circuit between High Gas Pressure input and Common.	1. Ensure continuous circuit between High Gas Pressure input and Common 2. Resolve High Gas safety switch alarm 3.Short input contacts if input is not being used

Display	Cause	Resolution
BAD TC	Replaces the numeric value in the T.C. window when the T.C. is bad.	1. Ensure correct T.C. wiring 2. Replace T.C.
INPUT ELECTRONICS TEST ERROR	All input hardware is checked for proper function. This test has detected an error	1. Ensure a voltage source has not been connected to any input. 2. Have unit serviced
MASTER SOLENOID DRIVER ERROR	AT POWER UP ONLY The master relay for power to all output relays is in an improper state.	 Have unit serviced, relay is not field serviceable
PILOT DRIVER ERROR	AT POWER UP ONLY The relay controlling power to the pilot valve is in an improper state	 1. Replace relay K2 or fuse F4. 2. Have unit serviced
MAIN1 DRIVER ERROR	AT POWER UP ONLY The relay controlling power to the main 1 valve is in an improper state	 1. Replace relay K3 or fuse F5 2. Have unit serviced
MAIN2 DRIVER ERROR	AT POWER UP ONLY The relay controlling power to the main 2 is in an improper state	 1. Replace relay K4 fuse F6 2. Have unit serviced
HIGH FIRE DRIVER ERROR	AT POWER UP ONLY The relay controlling power to the high fire valve is in an improper state	 1. Replace relay K5 or fuse F7 2. Have unit serviced
IONIZATION INPUT ERROR	AT POWER UP ONLY Signal to the FGI 351 from the IGN 50 indicating a flame is present when it should not be. 1. Pilot flame is present when pilot solenoid should be closed. 2. Flame Rod shorted to nozzle 3. Wiring short from FGI 351 to IGN 50	 1. Check pilot flame present when it should not be. 2. Check for leaky pilot valve. 3. Check wiring.
LOW FIRE INPUT ERROR	AT POWER UP ONLY Low Fire input contact is open when it should be closed or closed when it should be open	 1. Check wiring.

Display	Cause	Resolution
PROOF OF CLOSURE INPUT ERROR	AT POWER UP ONLY Low Fire input contact is open when it should be closed or closed when it should be open	1. Check wiring.
FLAME MONITOR INPUT ERROR	AT POWER UP ONLY Signal to the FGI 351 from the IGN 50 indicating a flame is present when it should not be. 1. Pilot flame is present when pilot solenoid should be closed. 2. Flame Rod shorted to nozzle 3. Wiring short from FGI 351 to IGN 50	1. Check pilot flame present when it should not be. 2. Check for leaky pilot valve. 3. Check wiring. 4. Check should also be made to ensure that the Flame Monitor inputs are shorted on the FGI 351 terminal board when it is not being used.
I/O CARD COMMUNICATION ERROR	AT POWER UP ONLY A test is performed the data transmitted between the Main board and the I/O board. This test has detected a data error.	1. Service I/O board (ensure properly seated, may need replacement) 2. Service interconnection cables (properly seated, check for wire breakage) 3. Reduce the amount of radio frequency noise in the area or protect the FGI 351 from radio frequency noise. 4. Reduce the amount of noise on the input power to the FGI 351
SYSTEM ALARMS RESET	Information statement The ‘Menu’ button has been pressed for 5 seconds and all the error alarms have been cleared. If there is still an active alarm it will not be cleared.	

5.4 Other Messages

Display	Cause	Resolution
DID NOT START. CHECK FUEL GAS AND SPARK	Three attempts have been made to light the pilot and they have all failed. The display only indicates the last failure type.	1. Ensure pilot gas is available to nozzle. 2. Check the spark gap to ensure it is less than 3/16". 3. Check for proper connections to spark electrode
DID NOT START. CHECK PILOT + FLAME PROBE	Three attempts have been made to light the pilot and they have all failed. The display only indicates the last failure type.	Ensure proper gas pressure, air/fuel mixture, and correct pilot tip are used.
DID NOT START. MAIN EXTIGUISHED PILOT	Three attempts have been made to light the pilot and they have all failed. The pilot went out after the main valve was opened. The main burner may be affecting the pilot.	The pilot may need to be repositioned with respect to the Main burner nozzle. Ensure proper pilot and main gas pressure. Main valve may be opening to quickly

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Specifications: FGI 351/ IGN 50 Burner Management System

The FGI 351 / IGN 50 Burner Management System has been developed specifically for atmospheric burners, particularly in the oil and gas industry. It is compliant to the requirements of the B149.3 Code. Designed and manufactured by Titan Logix (Nagy Burner Control), the original developers of the industry preferred FGI 100, 201, 202 and 301 for the Western Canadian oil and gas industry. The FGI 351 / IGN 50 controls the fuel gas and monitors the pilot flame. A DC voltage spark generator and electrode supply an ignition spark. If there is a flame fail or safety interlock condition the fuel gas is promptly shut off. Residual fuel is given time to purge before the FGI 351 / IGN 50 attempts to restart the pilot.

FGI 351
(Controller)

IGN 50
(Ignition / Flame Rod Circuitry)

Ignitor / Flame Rod
(with thermocouple)

#	Feature	Description
1	Included in kit	1 x FGI 351: Controller 1 x IGN 50: Sparker and Flame Rod circuitry 1 x Ignitor (doubles as the flame rod) 1 x Pilot mounting bracket (for ignitor, thermocouple, user-supplied pilot nozzle) 1x 10 ft ignition cable 1x Thermocouple, K Type 1 x 20 ft shielded thermocouple cable
2	Design	Based on the **industrial design** of the market leading FGI 100, 201, 202 and 301 product family, since the 1990's. Designed at our Edmonton, Alberta facility utilizing modern testing and manufacturing equipment. Industrial electronics development since 1980.
3	Approvals	**CSA**: Class I Division 2 Groups C & D. T3 (FGI 351 Controller Only) **CSA**: C22.2 No. 199 (Combustion Safety Controls and Solid-State Igniters for Gas and Oil Burning Equipment) The IGN 50 is approved for installations in non-hazardous areas. Meets the requirements for a certified Combustion Safety Control as required by B149.3.
4	Display	**2 line x 20 character** vacuum fluorescent display. Full text messages. –40°C to + 60°C. NOT an LED or LCD display. Provides operator with specific operational, diagnostic and troubleshooting information such as timer countdown, safety alarm state, # of restart attempts, etc.
5	Operator Controls	**3 buttons**: Start, Stop, Menu (press and hold Menu for 5 seconds to reset). Industrial **positive action** buttons (tactile feedback).
6	Enclosures	**FGI 351**: Fiberglass, 12 (H) x 10 (W) x 6 (D) inches. - Mounting plate dimensions should be minimum of 14 (H) x 12 (W) inches. **IGN 50:** Metal, 6.1 (L) x 4.1 (W) x 5 (D) inches.
7	Appliance Size	Up to **10MM** Btuh per appliance.
8	Configuration / Programming	**Original Installation:** Factory configured. Customer can complete the 351 Application Data identifying the settings of each configured variable. **Field Modifications (2 options)** - User replaceable **EEPROM.** - Field programming of most variables by factory trained technician.
9	Flame-out Response	**3.8 seconds after pilot flame out (as determined by flame rod/ionization detection)**: solenoids/valves will be commanded to close, alarm contact opened, alarm shown on screen
10	Pilot Nozzle	Can use **various user-supplied pilots**. Commonly used is the Natco / FlameCo with Perforated tip.
11	Terminal Blocks	**4 (Four)**. Ample **spacing** between each terminal input.
12	Ignition Source	**IGN 50:** DC Transformer spark ignition coil. The IGN 50 must be installed in a non-hazardous

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		location. Inside the burner housing or other non- hazardous location. The FGI 351 Controller can be **100's of feet away** from the ignition coil. This provides greater **safety** and convenience to the operator.
13	Solenoid ratings supported	12 DC or 24 VDC or 24 VAC
14	Output: Solenoids	1 x pilot **2** x main 1 x **high fire** start
15	Input: Proof of Closure (POC) for Main Valve	1 x **Main** burner valve: Enables the use of **1 safety valve** with POC vs. 2 valves.
16	Low Fire Start method	Inputs and outputs for High Fire Bypass Alternative methods available
17	Input: Low Fire Proof	1 x **Low fire I/P**: Enables the use of alternative low fire start methods.
18	Input: Safety Switch(es)	1 x **Low Pressure** alarm 1 x **High Pressure** alarm 1 x **Low Liquid Level** alarm 1 x **High Temperature** alarm 1 x Series alarm The safety alarms/lockouts can be connected in series or as individual inputs. If connected as individual inputs then an alarm condition can be more **easily tracked down** and corrective action taken. This **reduces down-time** of the heater and the associated processes.
19	Flame monitor: Flame Rod	**IGN 50:** Once ignition is completed then the ignitor becomes a flame rod. Proves the **presence** of a pilot flame. **Material**: Kanthal
20	Input: Thermocouple	Thermocouple input. Proves the **quality** of the pilot flame only. **Material**: Type K thermocouple encased in 446 sst c/w 20 ft. thermocouple cable **NOTE**: does not replace the Flame rod.
21	Power Requirements	12 VDC or 24 VDC +/- 10%; or 24 VAC, +/- 10%.
22	Power Consumption	**FGI 351**: 150 mA. Max. @ 12 VDC (in sleep mode reduced to 100 mA) Add power required by the solenoids: Pilot: 1.5 A max (fused) Main 1: 1.5 A max (fused) Main 2: 1.5 A max (fused) High Fire: 1.5 A max (fused) **IGN 50**: 100 mA @ 12 VDC (2.5A. surge during sparking)
23	Output: Alarm	1 x alarm output (relay)
24	Input: Remote run/stop	1 x **remote run/stop** Can be connected to a remote PLC, PC, controller, etc
25	Communications	**RS 232/485 (Modbus)** remote communications for monitoring and on/off control only. Multidrop communications via RS485.
26	Timers	**Pre-purge**: 1 second to 160 minutes (time between pressing the START button and spark sequence) **Low Fire Start**: 1 second to 160 minutes (duration of low fire condition) 3 **relight** attempts
27	Operating Temperature	-40°C to +60°C
28	Sold by	Titan Logix Corp Dealer network. Call Titan for Dealer listings in your area.

Head Office: 4130 - 93 Street, Edmonton, Alberta T6E 5P5 P (780) 462-4085 Toll Free 877-462-4085
Saskatchewan Branch: Box 460, 103 Cenaiko Street, Lampman, Saskatchewan S0C 1N0 P (306) 487-2883
Calgary Sales Office: 1214-19 Ave NW, Calgary, Alberta T2M 1A2 P (403) 251-5797

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Application Data Sheet: FGI 351 / IGN 50 (v.2)

Instructions: *Complete as many fields as necessary to properly describe the application. Those marked by * are required fields.*
Default Settings *are configuration parameters that are programmed unless otherwise specified.*

	Customer Information			
*1	Contact			
*2	Company			
3	Address			
*4	Phone, Fax, Email			
5	Date			
6	Project Reference			
*7	Quotation or Order			
*8	Quotation Required by [date]?			
	Process Conditions			
9	Heater Type and Qty (Dehydrator, Line Heater, etc)			
10	# of Burners			
11	Fuel Type: Pilot? Main Burner?			
12	Pilot Type: Perforated? Straight Tip? Other?			
13	BTU Rating: Pilot? Main Burner?			
	FGI System			
*14	FGI Quantity (submit 1 worksheet for each Heater type/design)			
15	Ignition cable length	*10 ft (length supplied by Titan-can be reduced in the field)*		
	Configuration			
16	Power Source	12 VDC	24 VDC	24VAC
*17	Timer: Pre-Purge (1 sec to 160 min, no default)	_____ Seconds		
*18	Start on power-up (default = ON)	ON	OFF	
*19	Remote Start Enable (default = OFF)	ON	OFF	
*20	Soft Start (not recommended below 3 MM Btuh, default = OFF)	ON	OFF	
*21	Sleep Enable (default = ON)	ON	OFF	
*22	Low Fire Start (provide timing in line 23 below, default = OFF)	ON	OFF	
*23	Timer: Low-Fire Start (1 sec to 160 min, default = 1 second)	_____ Seconds		
	Safety Alarm Auto Restart (Default = off)			
*24	Safety Alarm (default = OFF)	ON	OFF	
*25	Low Pressure (default = OFF)	ON	OFF	
*26	High Pressure (default = OFF)	ON	OFF	
*27	Low Level (default = OFF)	ON	OFF	
*28	High Temperature (default = OFF)	ON	OFF	
	Thermocouple			
29	Required	*Supplied*		
30	Cable length	*20 ft (length supplied by Titan-can be reduced in the field)*		
	Installation			
31	Installation company			
32	Site: Name, location			
33	Contact name			
34	Contact phone, fax, email			
*35	Installation date / date equipment required			
36	Installation condition (new, used, in-service)			
37	Internal Use: DCM, OS, IS			

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