titan logix corp.

FGI 301/FMI 100

Burner Management System

Installation and Operation Manual

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Rev. 12

Aug 31, 2004

Warranty Statement

Equipment
Titan Logix Corp. Edmonton, AB and Lampman, SK offices, (hereafter known as TLC) warrants all its manufactured assemblies to be free from defects in material and workmanship under normal use for a period of one year, commencing upon the date of shipment.

This warranty does not cover those damages incurred during installation by any company other than TLC. Nor does it include damage to any peripheral devices or modifications made to TLC's devices after sale.

TLC shall assume fiscal responsibility only to the extent of TLC's invoiced price of the particular product. Warranty does not cover the removal, reinstallation or modification of equipment.

All repairs are FOB Edmonton, AB and /or Lampman, SK; the customer is responsible for any and all freight charges.

Labour
All service and installation work completed by TLC is warranted for a period of 60 days.

For those repairs completed at TLC's facilities, warranty will cover all parts and labour. For those repairs performed in any other location, only parts and labour on site is covered. See below for travel to site details.

Travel
Any repairs conducted away from the TLC's facilities shall be subject to TLC's current travel and mileage rates. The travel charges are based on a round trip to site, starting from one of TLC's main offices.

TLC states that it makes no other guarantee or warranties express or implied by customer, trade usage or law.

Proprietary Information

Warnings:

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2 GROUPS A, B, 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

Specifications

The FGI 301/FMI 100 Burner Management System has been developed specifically for atmospheric burners. It is compliant to the requirements of the B149.3 Code.

Approvals	Class I, Division 2 Groups A, B, C & D T5 CSA C22.2 # 199 Combustion Safety Controls Meets the requirements for a certified Combustion Safety Control as required by B149.3
Appliance size:	Up to 10 000 000 Btu/H
Enclosure:	FGI 301 Fibreglass 12" x 10" x 6" Enclosure type 4 FMI 100 Fibreglass 8" x 6" x 4" Enclosure type 4
Power requirements:	12VDC or 24VDC ±10% ; 24VAC ±10%
Power Consumption:	FGI 301 only: 150 mA @ 12VDC Add power required by solenoids Pilot: 2.5A max Main 1: 2.5A max Main 2: 2.5A max High Fire: 2.5A max FMI 100 only 300mA @ 12VDC
Operating Conditions:	-40 ºC to +60 ºC

Introduction

Titan Logix Corp. has designed the FGI 301/FMI 100 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 BtuH. The FGI 301/FMI 100 system can be used in applications that require a CSA C22.2 # 199 certified Combustion Safety Control and a Solid State Ignitor for gas burning appliances.

The following are examples of such appliances

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

The following components are included in a standard FGI 301 system kit.

- FGI 301 Flame-Gard™/Ignition Burner Management System
- FMI 100 Sparker / Flame Sense Module
- Ignitor & Flame Rod assembly with ignition cable
- Bracket for mounting flame rod &/or optional thermocouple to pilot assembly
- Sample P&ID's
- Installation and Operation Manual
- (Optional) Type K thermocouple encased in 446 SS c/w thermocouple cable

The FGI 301/ FMI 100 system will monitor 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. There are dedicated alarm inputs for low fluid level, high fluid temperature and low and high gas pressure. A generic alarm input is also provided so that multiple alarm signals can be tied in series and into FGI 301 unit. The alarms can be programmed to provide a continuous or intermittent lockout. An intermittent lockout will try relighting the burner after the alarm condition is removed. A continuous lockout requires a manual reset.

The front panel provides an easy to use yet powerful user interface. A Vacuum Fluorescent Display (VFD) provides the operator with important information about burner status and certain operational variables. A 'MENU' key enables cycling through the display pages.

An RS232/RS485 MODBUS communication interface is provided so that a host computer, PLC or RTU can control or monitor the FGI 301/FMI 100 systems.

The FGI 301/FMI 100 can control two main, one pilot, and a high fire start valve. Proof of Closure inputs are provided for a Main and High Fire Start valve.

System Hardware Description

Three circuit boards are mounted in the FGI 301 controller, the terminal board, the I/O board, and the main board. The function of each is described in the sections that follow.

FGI 301 Main Board

The main board contains the CPU that controls all the input and output data for the FGI 301 unit. A VFD indicates the status of the burner and certain operational variables. More detailed information is provided in the FRONT PANEL section in this manual, page 10. Trained personnel may view five light emitting diodes by opening the door. These diodes indicate the following.

LED Indicator	Status
Run	Flashes to indicate the CPU is running.
Ionization Detect	Lit to indicate the flame sensing device(s) have sensed a flame.
Power Fail Detect	Lit when the power supply voltage drops below 90% of the rated voltage, the burner will shut down.
Tx	Flashes when the CPU has recognized a message sent to it and is responding to the host computer.
Rx	Flashes when a message is being received from the host computer.

Jumpers

J1 & J2	A = RS485 B = RS232
J3	Thermocouple Enable
J4	Not used

FGI 301 Terminal Board

All field wiring for the FGI 301 unit is connected to the terminal board through conduit openings the field installer must cut in the bottom of the FGI 301 enclosure. All fuses are located on the terminal board.

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.

The Local / Remote switch located on the terminal board allows the user to disable or enable PLC modbus control of 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 enabled.

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

FGI 301 Terminal Block

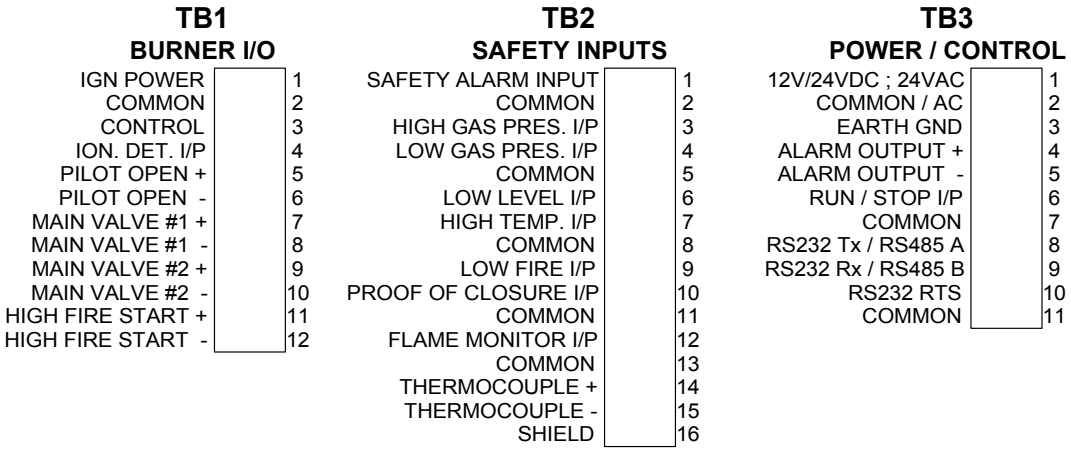


Figure 1

Terminal Block 1 (TB1)

Terminal 1&3 Not used, must remain open

Terminal 2 Common

Terminal 4 Flame status input from the FMI 100.

Terminal 5 –12 Outputs for valve control and must be wired through the appropriate terminal of the FMI 100, see Figure 3. Each output fused at 2.5A

Terminal Block 2 (TB2)

Provides terminals for various types of alarm to be connected to the FGI 301 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-level safety input

Terminal 7	High 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 to ensure main burner is lit off in a low fire condition.
Terminal 10	Proof of Closure (POC) input from main valve may be required on the main gas valve to ensure the main gas is off and in the closed position before trying an ignition sequence.
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

Any unused TB2 inputs must be connected to Common.

There are two methods of wiring the safety's to the FGI 301/FMI 100. Both require the alarm devices to be connected in series to the safety contacts of the FMI 100.

The first method requires all alarm devices to be wired in series directly to the FMI 100. The system will shut down the burner when an alarm condition occurs

The second method is similar to the first. It requires all alarm devices to be wired in series directly to the FMI 100. In addition the FGI 301 can be connected to the each alarm device, so the FGI 301 can report the nature of an alarm condition. This method is possible if the alarm devices have a set of DPDT contacts allowing one set to connect to the FMI 100 and the other set to connect to the FGI 301. In using either method all alarm devices must be wired to the FMI 100 and not to the FGI 301 alone.

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 301/FMI 100 system allows for the use of 2 safety valves on the main burner line, or, 1 safety valve with a proof of closure (POC) output.

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
Terminal 3	GND
Terminal 4-5	Alarm output - 100mA 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. If the burner is operating with no problems this contact will be closed. This contact

will open if the burner operation is halted due to operator or software intervention or a system error.

Terminal 6-7 RUN/STOP used for external control of the burner. If terminal 6 is connected to terminal 7 by an external contact (e.g. a short wire, a switch, or a relay), the FGI 301 will initiate the Start sequence. Once operational it will remain operational until the contact is opened.

RUN/STOP inputs must be shorted or connected through a switch for the unit to operate, even when pressing the START button to initiate a lighting sequence.

Terminal 8-11 A RS232 or RS485 port for Modbus communications, enables a host computer to control and/or receive information on the status of the FGI 301 operation and 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 communications may be found in the Communications section of this manual.

System Operation

Front Panel

The three control buttons on the front of the FGI 301 are: 'MENU', 'START' and 'STOP'.

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

Page 1	Current status of the FGI 301 control sequence. If there is a change in functions being performed by the system this page will automatically appear to inform the operator (unless the FGI 301 is set to 'Sleep' mode).
Page 2	Current valve status, open or closed.
Page 3	Thermocouple variables. (Optional)
Page 4	Number of times the unit has restarted after a flame failure.

If the FGI 301 locks out on a safety alarm it can be reset. Select page 1 on the display and hold the 'MENU' button down for 5 seconds. This will reset the FGI 301.

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

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.

Startup

Upon power-up the FGI 301 checks its configuration data and performs a hardware test before starting an ignition sequence. If the configuration data is corrupted the FGI 301 will not start the burner 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 301 will start the burner lighting sequence.

If a hardware problem exists 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.

Control

At the beginning of a firing sequence the FGI 301 will wait for a factory set pre-purge time before attempting to start the pilot. After this pre-purge time, the FGI 301 will direct the FMI 100 to simultaneously initiate a spark and open up the pilot valve. If the pilot is lit the FGI 301 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 valve(s) will then open for the duration of the burn period.

The optional Soft Start setting enables the gas to the Main Burner 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.

A Low Fire Start method may be required on appliances larger than 1 MM BTUH. The Low Fire start option ensures gas going to the main burner is limited during light off. The Low Fire Start timer delays the opening of a High Fire Solenoid. When the main 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.

At any time if the pilot flame is undetected for 0.8 seconds the pilot and main burners will be shut down. The FGI 301 will then attempt a normal purged start. If the burner cannot be started after three attempts the FGI 301 will display an alarm and go into a lockout mode. Only after failing the 3 re-ignition attempts will the FGI 301 open the alarm output contact.

The display indicates the current FGI 301 status. After 15 minutes of no activity on the keypad text indicating system status will scroll across the display either "BURNER OK" or "BURNER DOWN". If the Sleep enable option is selected the display will go blank after 15 minutes, to reduce the power requirements to the FGI 301. Pressing the 'MENU' button will reactivate the display.

The Run/Stop contact must be closed, either shorted at the terminal or through a switch, for an ignition attempt to be made. The Run/Stop input acts as a master control for any type of remote start. 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.

Control Timing Sequence
Thermocouple enabled

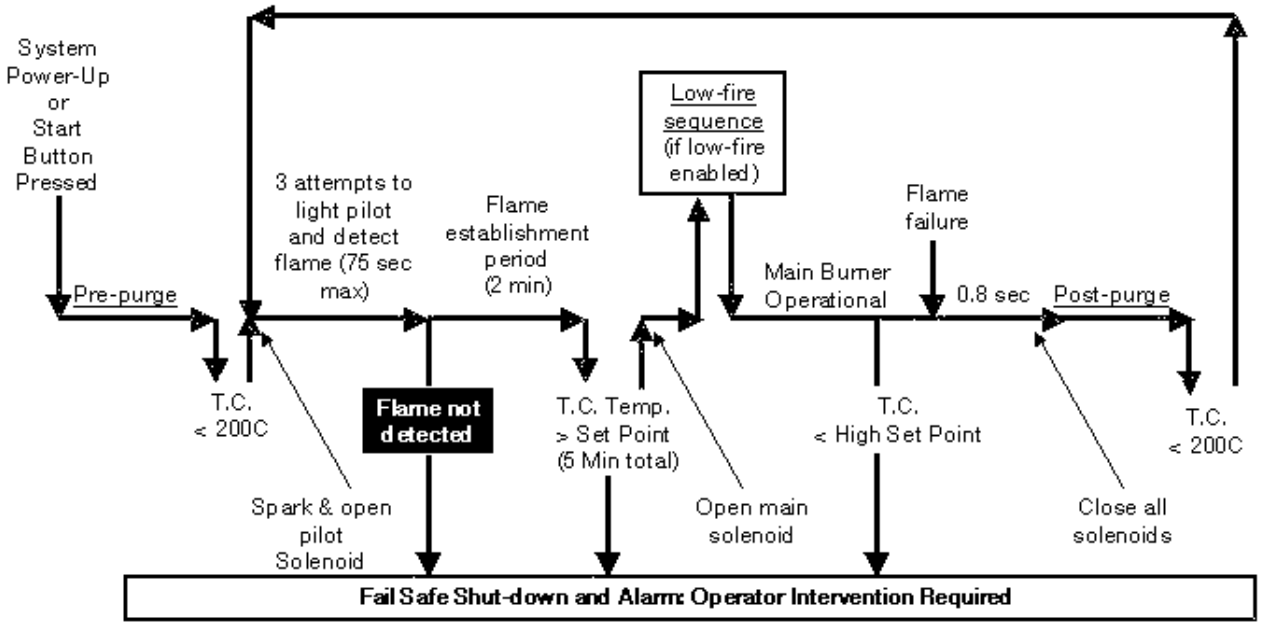


Figure 2

Setting Thermocouple High Set-point

Light the pilot and allow the flame to become well established. Select the thermocouple page on the display by pressing the 'MENU' button until the following text appears on the display: "TC Value = XX ; TC fail S.P. = XX". Then press and hold the MENU button for 5 seconds. The FGI 301 will automatically establish a set-point temperature approximately 200 C° less than the pilot's current temperature. This will become the high temperature set point. The burner will shutdown if the pilot temperature drops below this set point. It is also the temperature the thermocouple must reach before any attempt to light the main burner.

Units that require the thermocouple option must be ordered with this option enabled.

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 301. 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 start the pilot the CPU ensures all the valves outputs are off and the Ionization input indicates that a flame isn't present at the pilot. If an error is present, the display will indicate the nature of the problem or indicate the appropriate error code.

Error Codes and Messages

If any system errors occur the FGI 301 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. The system can be reset by selecting page 1 on the display and holding the 'MENU' button down for 5 seconds. If the problem has been fixed the display will indicate the system is in proper operating mode. After any error the unit should to be checked by a qualified personnel to ensure the FGI 301 is not acting in a hazardous manner.

System Alarms

There are several types of system alarm inputs that cause the FGI 301 to halt burner operation. All inputs TB2 1-8 are dry contact inputs. The first set of contacts on an alarm device must be tied in series to the Safety Alarm input on the FMI 100 module. If the safety device has a second set of contacts they can be connected to the FGI 301 alarm inputs.

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

All alarm inputs have an associated software lockout. These lockouts are programmed into the system configuration at the factory. If an alarm occurs the burner will shut down. The purpose of the lockouts is to prevent the unit from starting up the burner automatically after the alarm is removed.

If a safety alarm has it's lockout enabled it must be reset manually. Before attempting to reset the FGI 301 the alarm condition must first be cleared. Then select page 1 on the display, press and hold down the 'MENU' key for 5 seconds. The alarm cannot be cleared from any other display page.

If the appropriate alarm does not have the lockout enabled an automatic re-light will be attempted when the alarm condition is cleared.

The FGI 301 will never operate during an alarm condition.

Any unused alarm inputs must be connected to Common.

Installation and Wiring

Only trained service personnel may install this product. Proper wiring practices need to be followed when installing this product, including using seals where required when locating the product in hazardous locations.

Site Selection

The FGI 301 Flame Gard™/ Ignition Burner Management System and the FMI 100 Sparker/Flame Sense are CSA approved for Class I, Division 2 Groups A, B, C & D area classification. The system can be mounted on the unit skid or on a building wall as long as it does not infringe on a Class I, Division 1 area. The FGI 301 must be used in conjunction with the FMI 100.

The FGI 301 controller should be mounted in a location facing away from the burner housing so the operator can view the FGI 301 and the burner housing while operating the unit. If possible mount the unit facing away from the sun to improve display visibility. Other mounting considerations are panel access, traffic, and wire runs.

Mounting the FGI 301 Controller

The FGI 301 controller enclosure is a fibreglass box 12” x 10”x 6” 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.

Installing the FMI 100

The FMI 100 generates high voltages so care must be taken in mounting it. There are four mounting holes for attaching the unit either on a plate or on a flat surface. Input and output terminals are accessible from inside the unit.

The High Voltage Cable provided must be used when connecting the spark/flame rod to the FMI 100. Titan Logix Corp. provides a 10-foot length of high voltage cable with flexible PVC conduit unless a shorter length is requested. Care should be taken to avoid contact between the high voltage cable and any metallic part. The gap between the Flame Rod/ Sparker and the Pilot nozzle should be 1/8”, see drawing 1000489APV01 at end of manual. A dedicated ground wire must run from the pilot nozzle to the ‘Burner Ground’ terminal on the FMI 100 to ensure proper operation of sparker. A typical pilot is a Flameco or perforated tip pilot can be installed as per drawing 1000489APV01. If a straight tip pilot 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.

NOTE: Substitution of high voltage cable with cable other than supplied by Titan may result in damage to the FGI 301 system or FMI 100. Such damage is not covered under the warranty.

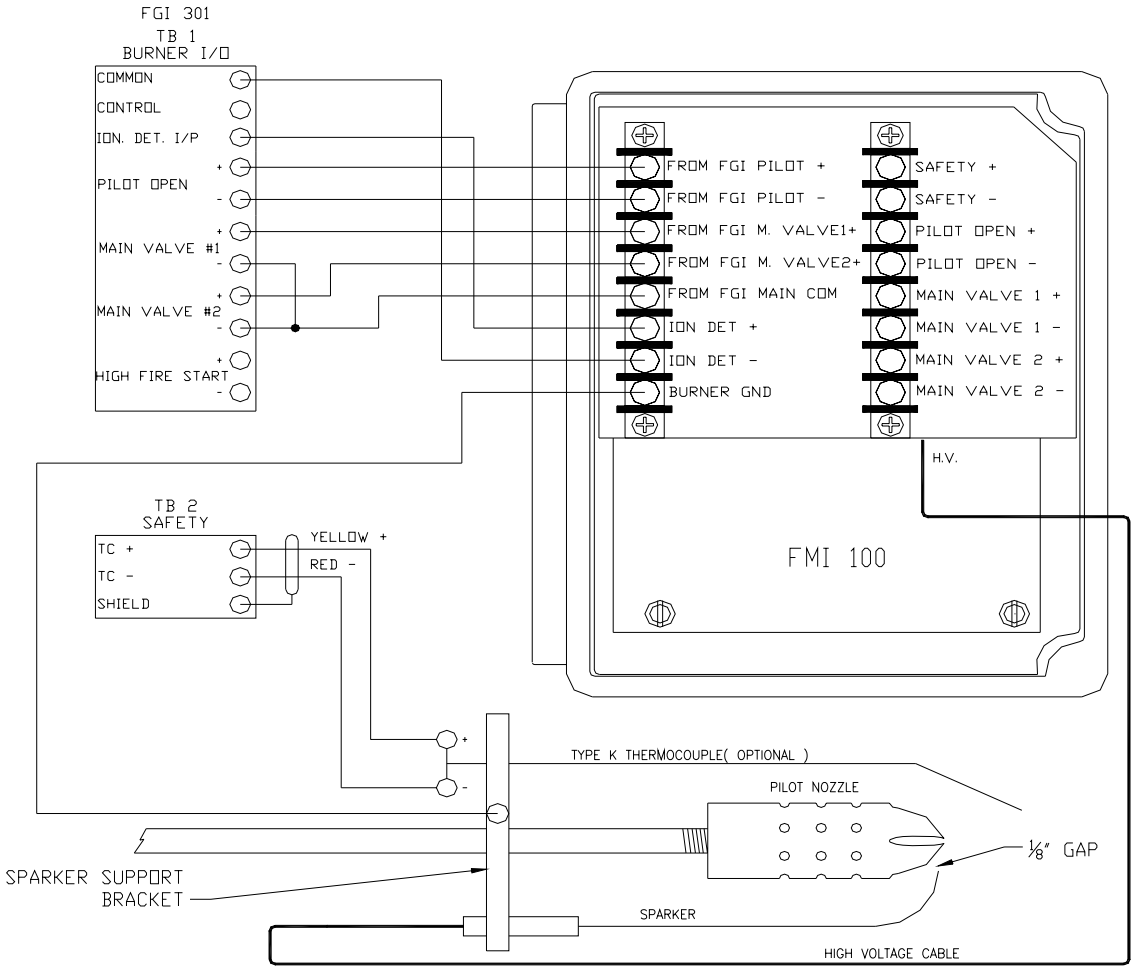


Figure 3

Wiring

FROM FGI 301 (TB1 4-10) TO FMI 100

Seven conductors (#18 AWG wire or larger) must be routed from the FGI 301 Controller to the FMI 100. These conductors should be labelled or colour coded to ensure correct installation and re-attachment if necessary. See Figure 3, above, for FMI 100 wiring diagram and Figure 1 for FGI 301 Terminal Block (TB) layout.

FGI 301		FMI 100
Common	to	Ion Det -
Ion Det I/P+	to	Ion Det+
Pilot Open+	to	From FGI Pilot Open+
Pilot Open-	to	From FGI Pilot Open-
Main Valve #1+	to	From FGI Main Valve #1+
Main Valve #2+	to	From FGI Main Valve #2+
Main Valve1&2-	to	From FGI Main Valve Com

MAIN AND PILOT SOLENOIDS (TB1 5-12)

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

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

NOTE: The maximum current output to each solenoid is 2.5 amps regardless of what the supply voltage is.

THERMOCOUPLE INPUT (TB2 14-16)

The FGI 301 has an optional thermocouple input that can be used for a temperature compensated pre-purge and to monitor the 'quality' of the pilot flame.

If the thermocouple is enabled the FGI 301 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 compensated pre-purge for a pilot relight attempt after a flame out.

Once the pilot is lit there is a two-minute flame establishment period. If the pilot temperature has exceeded the high temperature set-point the main burner will be activated. If not, an additional 3 minutes (for a total of 5 minutes) is allowed for the thermocouple to reach the high set-point temperature. If the high set point is not reached the pilot flame is unfit to light the main burner. The pilot will then be shut off and the alarm will be activated.

The T/C extension wire need not 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, and leave the other end of the shield open. Never ground both ends of a shield wire as this ground loop will attract miscellaneous noise and cause the T/C signal to be very erratic.

POWER SUPPLY INPUT (TB3 1-3)

The FGI 301 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. Bring a good earth ground to the terminal marked "EARTH GND". Test to ensure it grounds the system.

ALARM OUT CONTACT (TB3 4-5):

The alarm out contact is an optically isolated solid-state switch that is like a set of "dry contacts". The "contacts" are rated for 0.1 A at 300 volts AC or DC. The terminal blocks are marked '+' and '-', but the switch is not polarity dependent. The alarm contact will be open when the FGI 301 is in "Flame Failure" mode and closed when in "Flame Proved" mode. The "Flame Failure" alarm is not activated until after the third unsuccessful attempt to light and prove the pilot.

REMOTE RUN/STOP CONTROL (TB3 6-7)

The FGI 301 provides for remote operation from an RTU, PLC, or on/off switch. A closed set of dry contacts rated for a minimum of 24 volts at 20 mA will start the burner. Opening the contacts will stop the burner. The FGI 301 could also be started or stopped by applying or removing power.

COMMUNICATIONS PORT (TB3 8-11)

A Modbus communications protocol is provided on this port using either an RS232 or RS485 interface. The communications require a baud rate of 9600, no parity, and 1 stop bit regardless of the type of interface.

RS232- TB3 #8 => Transmit (TX)
TB3 #9 => Receive (RX)
TB3 #10 => Request to Send (RTS)
TB3 #11 => Common (COM)

RS485- TB3 #8 => A
TB3 #9 => B
TB3 #10 => Request to Send (RS232 signal)
TB3 #11 => Common

The jumpers J1 and J2 on the FGI 301 Main board control the interface required.

A = RS485
B = RS232

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.

Communications

The communications port allows a host computer to communicate with and control the FGI 301 through an RS232 / RS485 port located on TB3. Jumpers J1 and J2 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 & J2

A = RS485
B = RS232

The communications port uses the following settings:

9600 baud
8 data bits
1 stop bit
No parity

The MODBUS protocol uses functions 3, 6, and 16. The card address must be factory set. This is to ensure each FGI 301 has a unique address in an RS485 multidrop configuration.

Listed below are the FGI 301's registers and their addresses. These can be read using MODBUS protocol.

Function 3 (read)

Location 0000h = Status Register
0001h = Option Register
0002h = Purge Time (sec.)
0003h = Low Fire Start Time (sec.)
0004h = Card Address
0005h-0008h = Error register log (8 bytes)

Function 6 and 16 (write)

Location 0000h = Command Register

Command Register bit defines (0000h)

Bit 1 = Run Burner.
2 = Clear Error Register and locked out alarms.
3 = Clear Error Log.

Status Register bit defines

Bit 0001h = When set, indicates burner is in run mode, otherwise burner operation is halted.

b000000000000xxx0 = current operational state.

Variable

0 = BNR_DOWN
1 = PURGE
2 = START
3 = PROVED
4 = MAIN ON SOFT START
5 = MAIN ON LOW
6 = MAIN_ON

Bit 0010h = 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 bit defines (0001h)

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 (b0000xx0000000000) = This defines the system power supply.

00=12VDC
10=24VDC
11=24VAC

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 = 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.

FGI 301/FMI 100 Trouble Shooting Guide

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
PRE-PURGE TIME= XX SEC	Main status display page Indicates Pre-purge status (only applicable on ver2.5 or less)
PRE-PURGE TIME= XX MIN	Main status display page Indicates Pre-purge status (only applicable on ver2.5 or less)
POST-PURGE TIME= XX SEC	Main status display page Indicates Pre-purge status (only applicable on ver2.5 or less)
POST-PURGE TIME= XX MIN	Main status display page Indicates Pre-purge status (only applicable on ver2.5 or less)
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

Normal Operation

Display	Explanation	Next Steps
BURNER OPERATION HALTED	1. If configured to not start on power up (normal) 2. There has been a power failure that has caused the 301 to stop. 3. A stop has been initiated locally or remotely.	Press START to begin ignition sequence
PURGING SYSTEM XX SEC REMAINING	1. If 301 set to auto start on power up. 2. Loss of flame occurred. Vessel trying a re-light.	
PURGING SYSTEM MIN REMAINING (only applicable on ver2.5 or less otherwise SEC only displayed)	See above explanation	
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 301 main board. 3a. Connect mV generator to T.C. input to simulate T.C. If not functioning properly then FGI 301 main board to be replaced.
PILOT OPEN	The pilot is open, sparking will soon begin. (Screen on 2 seconds)	
PILOT AND SPARK	The pilot solenoid is opened and FMI 100 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)	

Display	Explanation	Next Steps
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 to do so).	
LOW FIRE START	Low fire start sequence in progress (if configured to do so)	
MAIN BURNER ON	Main valve has just opened. 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.	

Errors

Display	Cause	Resolution
EEPROM DATA ERROR	Data in the EEPROM is corrupted. (configuration chip)	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.

Display	Cause	Resolution
SAFETY ALARM IN PROGRESS	ON POWER UP ONLY Safety alarm serial input (on FGI 301). Open circuit between alarm input and Common.	1. Ensure continuous circuit between alarm serial input and Common 2. Resolve safety switch serial alarm
HIGH GAS PRESSURE ALARM IN PROGRESS	ON POWER UP ONLY High Gas Pressure alarm (on FGI 301). 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
LOW GAS PRESSURE ALARM IN PROGRESS	ON POWER UP ONLY Low Gas Pressure alarm (on FGI 301). 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
LOW FLUID LEVEL ALARM IN PROGRESS	ON POWER UP ONLY Low Fluid Level alarm (on FGI 301). 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
HIGH FLUID TEMP. ALARM IN PROGRESS	ON POWER UP ONLY High Fluid Temperature alarm (on FGI 301). 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 switch alarm
SYS SHUT DOWN, MAIN VALVE STUCK OPEN	Proof of closure switch on main valve is open when it should be closed	Check adjustment on proof of closure switch on main valve
SYS SHUT DOWN, MAIN VALVE STUCK CLOSED	Proof of closure switch on main valve is closed when it should be open	Check adjustment on proof of closure switch on main valve
IONIZATION I/P OR FLAME MON. I/P ERROR	1. Ionization input (i.e. to the FGI 301 from the FMI 100) 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.	Ensure proof of closure on low fire solenoid is on when solenoid is closed.

Display	Cause	Resolution
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, etc)
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 301 from radio frequency noise. 4.Reduce the amount of noise on the power to the FGI 301
PILOT SOLENOID CONTROL ERROR	Pilot relay in wrong state	1. Pilot relay or relay fuse may need to be replaced 2. Terminal board may need replacement
MAIN1 SOLENOID CONTROL ERROR	Main 1 relay in wrong state	1. Main 1 relay or relay fuse may need to be replaced 2. Terminal board may need replacement
MAIN2 SOLENOID CONTROL ERROR	Main 2 relay in wrong state	1. Main 2 relay or relay fuse may need to be replaced 2. Terminal board may need replacement
HIGH FIRE START SOL. CONTROL ERROR	High Fire Start relay in wrong state	1. High Fire Start relay or relay fuse may need to be replaced 2. Terminal board may need replacement

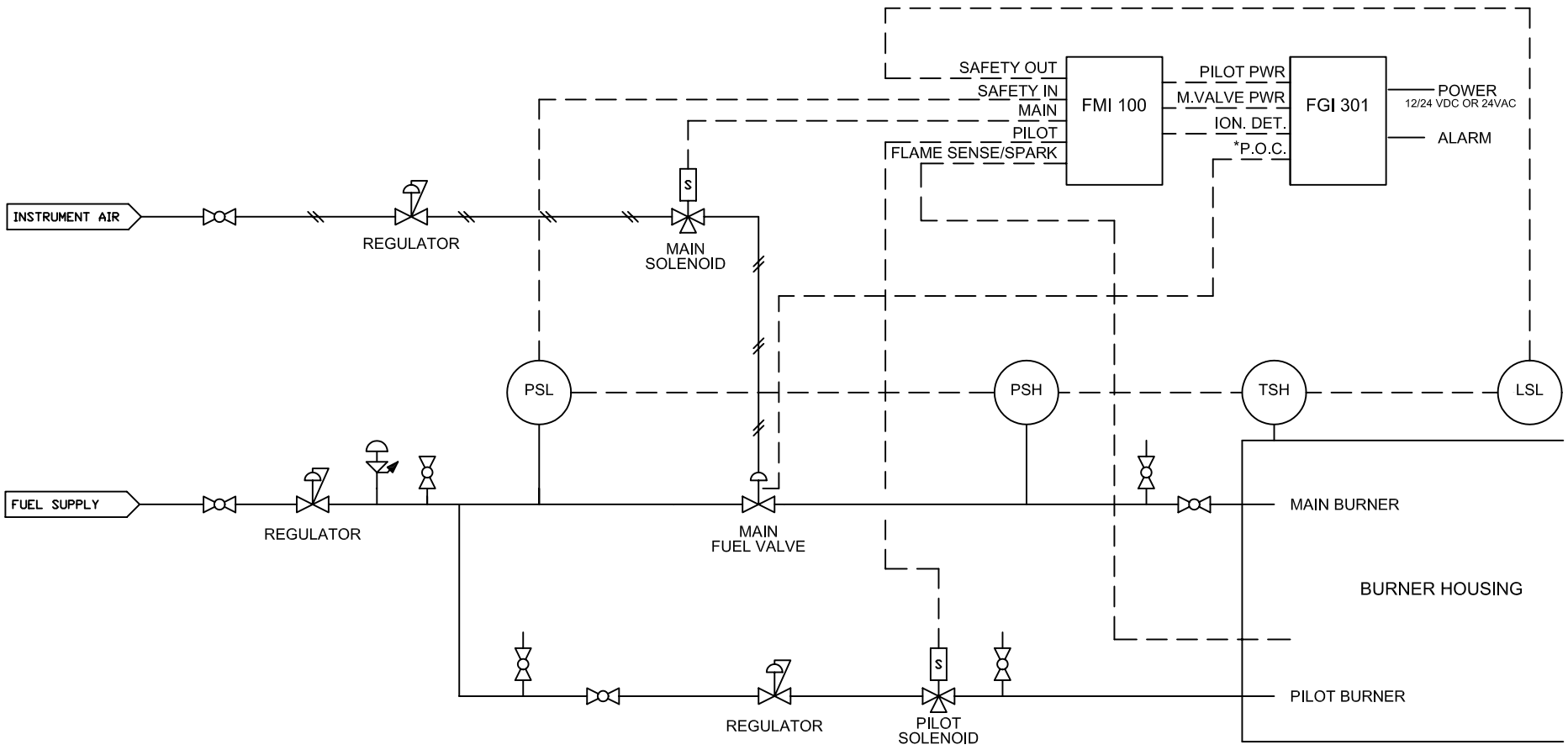
Display	Cause	Resolution
MASTER SOLENOID CONTROL ERROR	Master relay in wrong state.	1. Master Solenoid relay may need to be replaced 2. Terminal board may need replacement
SYSTEM ALARM = SAFETY ALARM I/P	1. No feedback from FMI 100. 1a. No power to FMI 100 Pilot In (from TB 1, 5-6) 1b. No continuity between Safety +/- on FMI 100. 1c. Power is connected backwards on FGI 301. This will blow the fuse on the power supply card in the FMI 100. 1d. There is a pilot flame present. FMI 100 will not make ignition attempt. 1e. The sparker electrode is shorted to the pilot nozzle. 1f. FMI 100 sparker card is malfunctioning. 1g. No spark attempt feedback from FMI 100 to FGI 301. 2. A safety alarm exists on TB2 1-2. 3. Pilot Flame Present	1a. Check wiring. 1b. Check wiring, check for safety alarm in progress (incorrect safety switch calibration) 1c. Connect FGI 301 power in proper polarity. Replace fuse on FMI 100 power board. 1d. Check for leaky pilot valve. 1e. Reposition sparker electrode with 1/8” gap. 1f. Call for assistance to check the sparker card. Replace if necessary. 1g. Check for closed circuit between Ion Det + and Ion Det – on FMI 100 during sparking. Check for wiring continuity between Ion Det +/- on FMI 100 and Ion Det I/P on FGI 301. 2a. Check for safety alarm in progress. 2b. Check wiring. Ensure short circuit between TB2 1-2. 3. If pilot is being lit by hand ensure there is no flame near the flame rod until after the ignition start sequence begins
SYSTEM ALARM = HIGH TEMP. ALARM	High Gas Pressure alarm (on FGI 301). 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
SYSTEM ALARM = LOW LEVEL ALARM	Low Fluid Level alarm (on FGI 301). 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
SYSTEM ALARM = LOW GAS PRESSURE	Low Gas Pressure alarm (on FGI 301). 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

Display	Cause	Resolution
SYSTEM ALARM = HIGH GAS PRESSURE	High Gas Pressure alarm (on FGI 301). 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
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 or fuse. 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 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 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 2. Have unit serviced
IONIZATION INPUT ERROR	AT POWER UP ONLY 1. Ionization input (i.e. to the FGI 301 from the FMI 100) is closed when it should be open. 2. Pilot flame is present when pilot solenoid should be closed. 3. Ion. Det. I/P shorted to ground	

Display	Cause	Resolution
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	
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	
FLAME MONITOR INPUT ERROR	AT POWER UP ONLY 1. Ionization input (i.e. to the FGI 301 from the FMI 100) is closed when it should be open. 2. Pilot flame is present when pilot solenoid should be closed.	A check should also be made to ensure that the Flame Monitor input is shorted on the FGI301 terminal board when it is not being used.
I/O CARD COMMUNICATION ERROR	AT POWER UP ONLY A test is performed every 200ms on 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 301 from radio frequency noise. 4. Reduce the amount of noise on the input power to the FGI 301
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.	

Other

Display	Cause	Resolution
DID NOT START. CHECK FUEL GAS AND SPARK	Three attempts have been made to start 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 1/8”. 3. Check for proper connections to spark electrode
DID NOT START. CHECK PILOT + FLAME PROBE	Three attempts have been made to start 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 start the pilot and they have all failed. The display only indicates the last failure type.	The pilot may need to be repositioned with respect to the Main burner nozzle. Ensure proper pilot and main gas pressure.



4OOM TO 10MM BtuH W/ PROOF OF CLOSURE
BASED ON CSA B149.3-00 VALVE TRAIN #3

NOTE:
APPLIANCES OVER 1MM BTUH REQUIRE
A METHOD OF LOW FIRE START

* PROOF OF CLOSURE

REV	DESCRIPTION	BY	DATE

DIMENSION UNITS: INCHES [mm]
TOLERANCES EXCEPT AS NOTED
.X ±0.05 125 RMS
.XX ±0.01 63 RMS
.XXX ±0.005 32 RMS
ANGLES ±1°
PROJECTION

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

NEXT ASSEMBLY / MATING PARTS

WEIGHT

MATERIAL NA

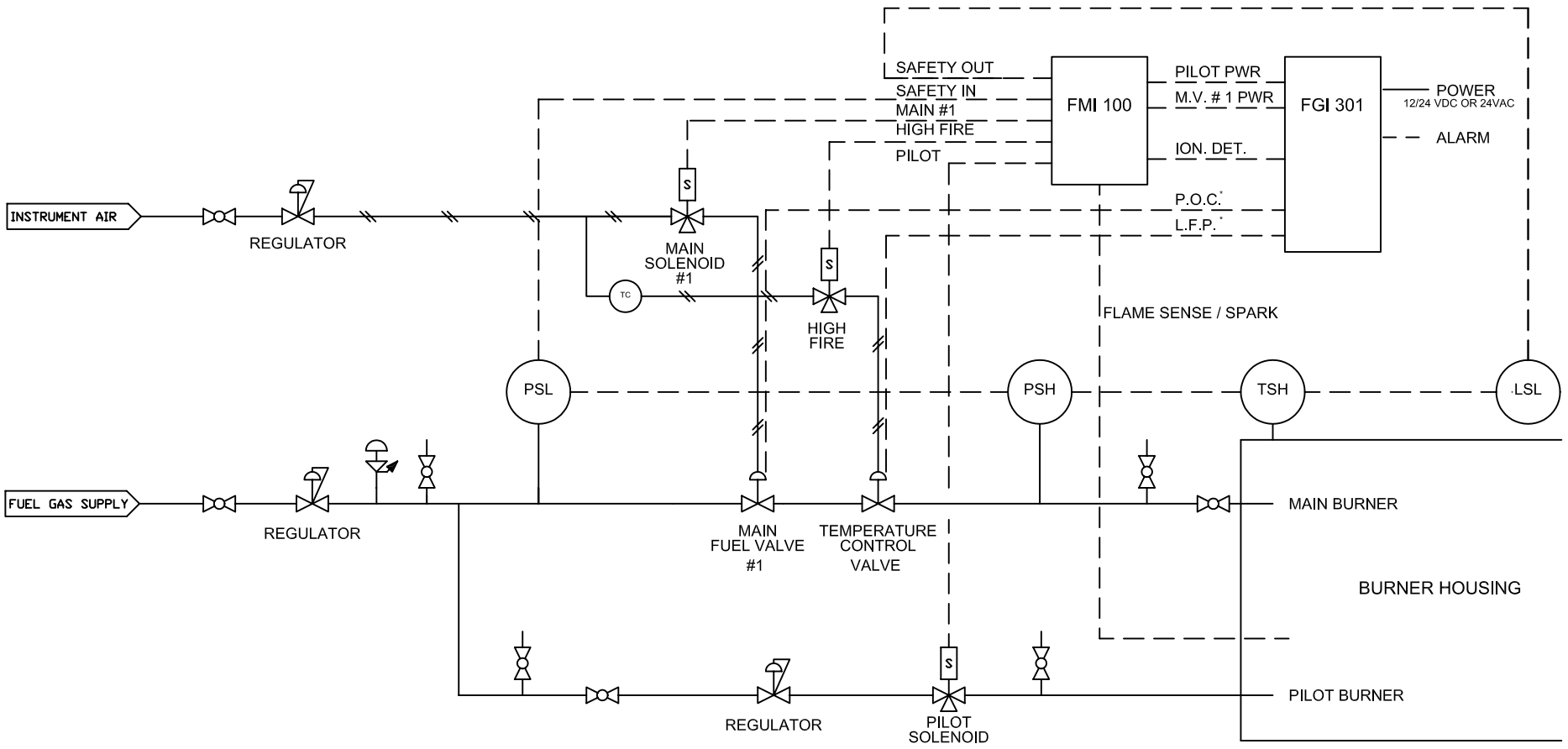
FINISH

SCALE NA
DESIGN DT CHK
DRAWN DT CHK
DATE 2003AUG18
FILE 1000453SCS00

TITAN LOGIX CORP
TEL: 780-462-4085

DWG. TITLE
FGI301/FMI 100 P&ID

PART NO. 1000453SCS00
REVISION SHT 1/1



1MM TO 10MM BtuH W/ P.O.C. & L.F.P & TEMPERATURE CONTROL
BASED ON CSA B149.3-00 VALVE TRAIN #3

* PROOF OF CLOSURE
* LOW FIRE PROOF

REV	DESCRIPTION	BY	DATE

DIMENSION UNITS: INCHES [mm]
TOLERANCES EXCEPT AS NOTED
.X ±0.05 125 RMS
.XX ±0.01 63 RMS
.XXX ±0.005 32 RMS
ANGLES ±1°
PROJECTION

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

NEXT ASSEMBLY / MATING PARTS

WEIGHT

MATERIAL NA

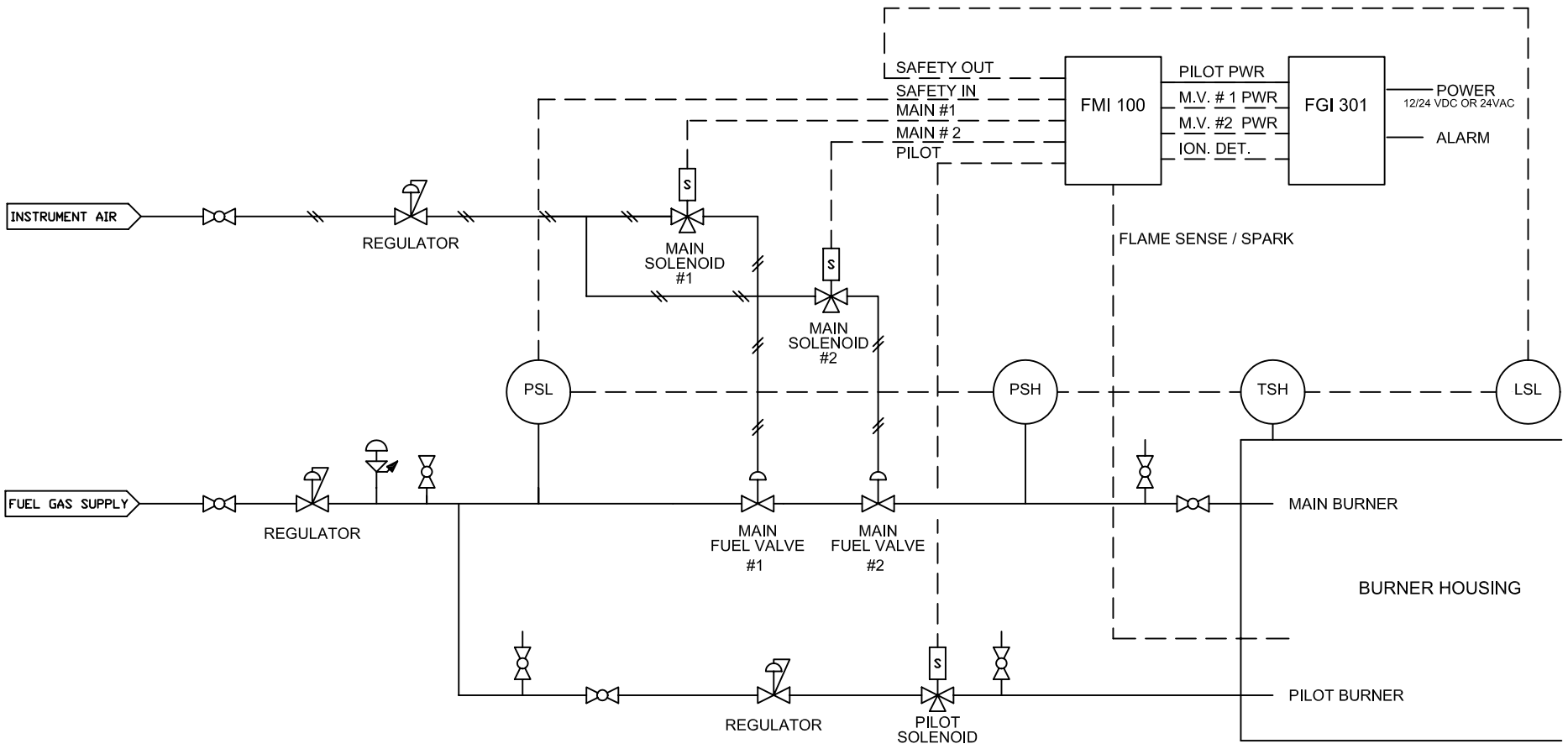
FINISH

SCALE NA
DESIGN CHK
DRAWN DT CHK
DATE 2004SEP02
FILE 1000458SCS00

TITAN LOGIX CORP
TEL: 780-462-4085

DWG. TITLE
FGI301/FMI 100 P&ID

PART NO. 1000458SCS00
REVISION SHT 1/1



4OOM TO 1MM BtuH W/ 2 MAIN VALVES
BASED ON CSA B149.3-00 VALVE TRAIN #3

REV	DESCRIPTION	BY	DATE

DIMENSION UNITS: INCHES [mm]
TOLERANCES EXCEPT AS NOTED
.X ±0.05 125 RMS
.XX ±0.01 63 RMS
.XXX ±0.005 32 RMS
ANGLES ±1°
PROJECTION

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

NEXT ASSEMBLY / MATING PARTS

WEIGHT

MATERIAL NA

FINISH

SCALE NA

DESIGN DT CHK

DRAWN DT CHK

DATE 2003AUG18

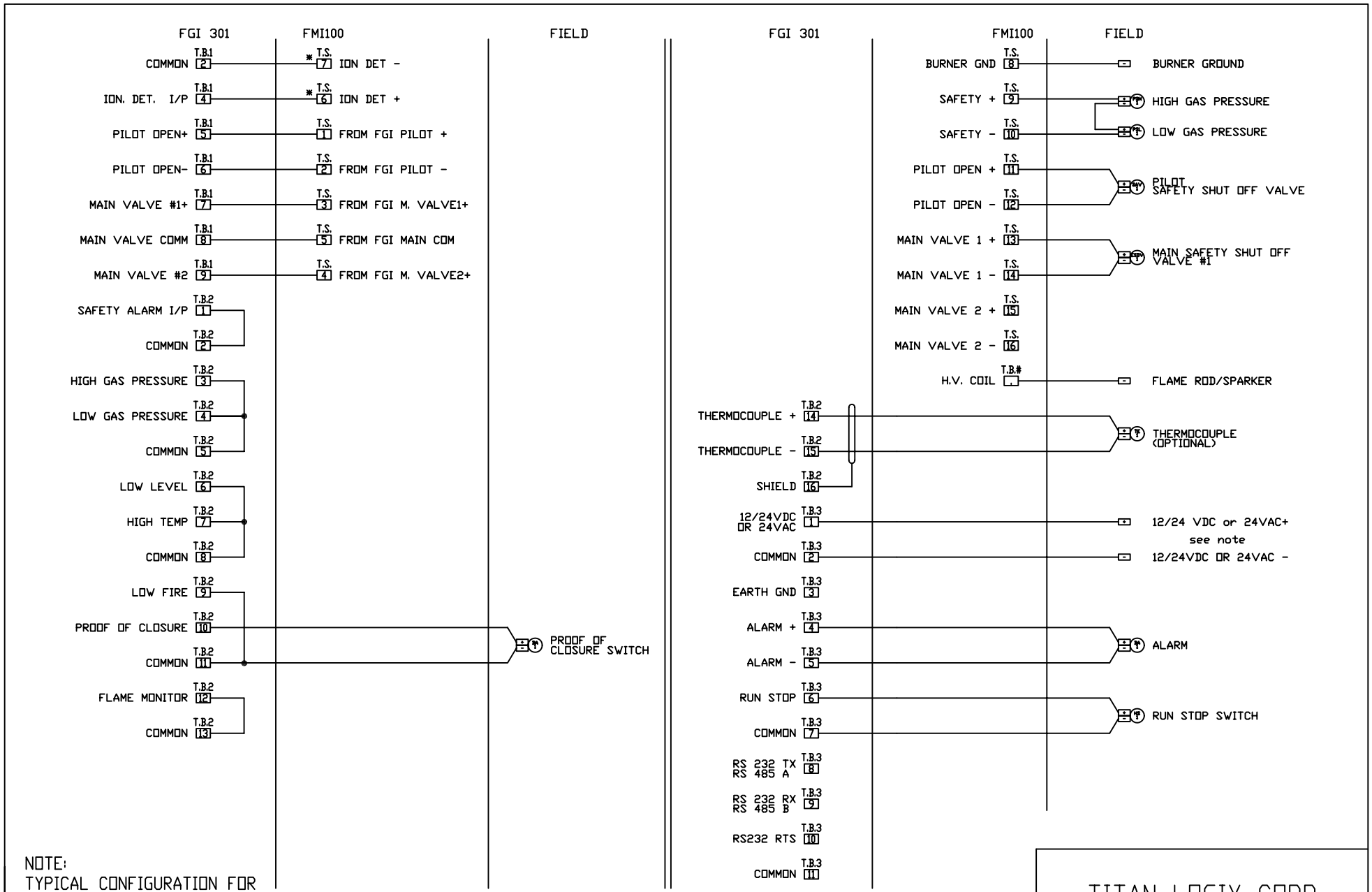
FILE 1000454SCS00

TITAN LOGIX CORP
TEL: 780-462-4085

DWG. TITLE
FGI301/FMI 100 P&ID

PART NO. 1000454SCS00

REVISION SHT 1/1



NOTE:
TYPICAL CONFIGURATION FOR APPLIANCES FROM 400 000 TO 1MM BTU/H WITH 1 MAIN VALVE & A PROOF OF PROOF OF CLOSURE SWITCH

USE PROPER VOLTAGE FOR FGI 301 AND FMI 100 MODEL SUPPLIED

REV	DESCRIPTION	BY	DATE
01	TEXT CHANGE AT *	DT	16MAR2004

DIMENSION UNITS: INCHES [mm]
TOLERANCES EXCEPT AS NOTED
.X ±0.05 125 RMS
.XX ±0.01 63 RMS
.XXX ±0.005 32 RMS
ANGLES ±1°
PROJECTION

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

WEIGHT

MATERIAL NA

FINISH

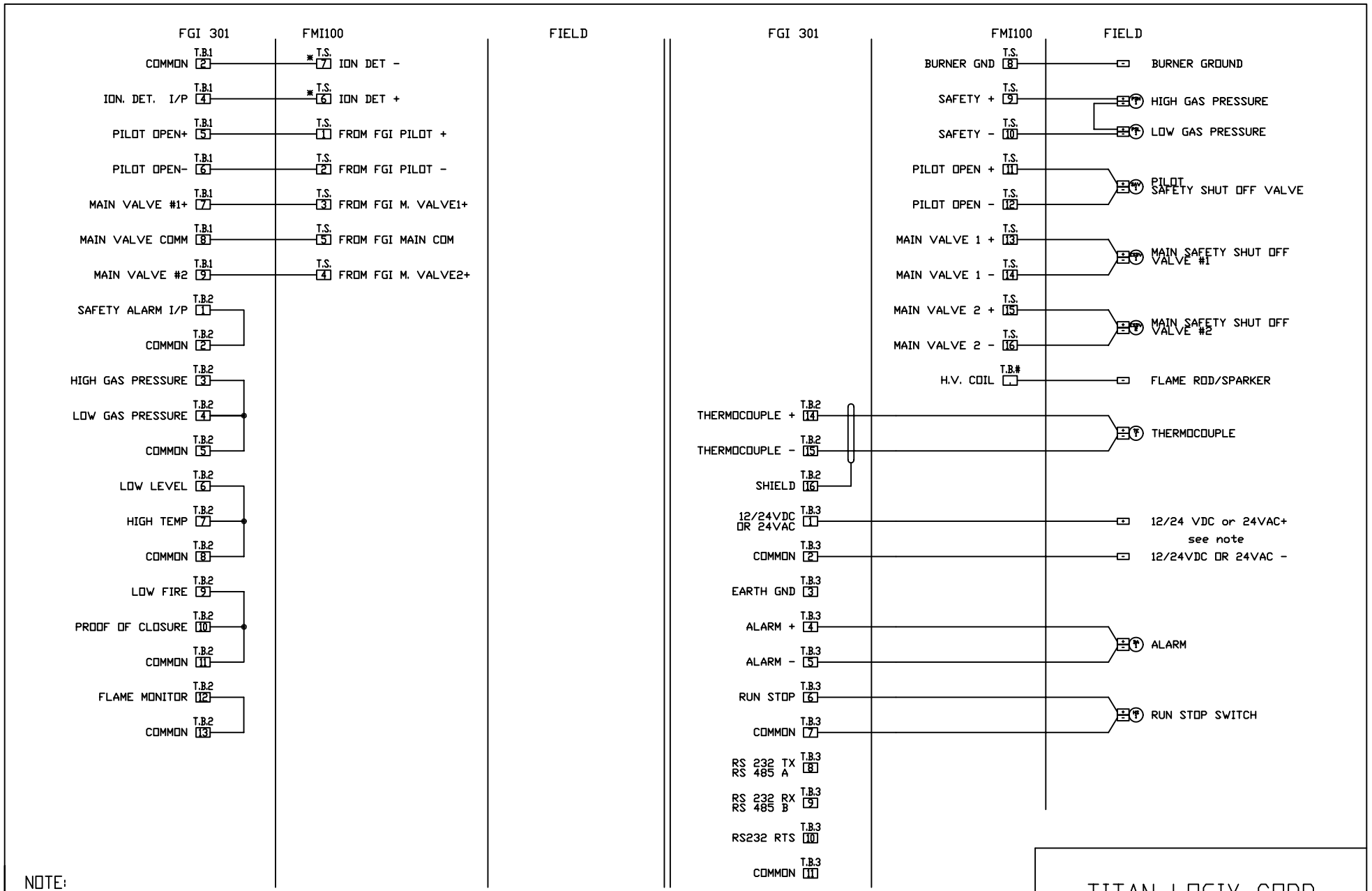
NEXT ASSEMBLY / MATING PARTS

SCALE NA
DESIGN DT CHK
DRAWN DT CHK
DATE 2003JUL25
FILE 1000456SEL01

TITAN LOGIX CORP
TEL: 780-462-4085

DWG. TITLE
FGI 301/FMI 100 WIRING
400 000 TO 1MM BTUH

PART NO. 1000455SEL01
REVISION SHT 1/1



NOTE:
TYPICAL CONFIGURATION FOR
APPLIANCES FROM 400 000 TO 1MM BTU/H
WITH 2 MAIN VALVES

USE PROPER VOLTAGE FOR
FGI 301 AND FMI 100 MODEL SUPPLIED

REV	DESCRIPTION	BY	DATE
01	TEXT CHANGE AT *	DT	16MAR2004

DIMENSION UNITS: INCHES [mm]
TOLERANCES EXCEPT AS NOTED
.X ±0.05 125 RMS
.XX ±0.01 63 RMS
.XXX ±0.005 32 RMS
ANGLES ±1°
PROJECTION

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

NEXT ASSEMBLY / MATING PARTS

WEIGHT

MATERIAL NA

FINISH

SCALE NA

DESIGN DT CHK

DRAWN DT CHK

DATE 2003JUL25

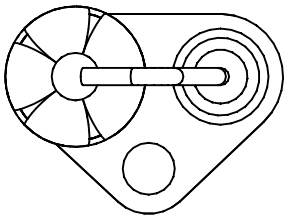
FILE 1000456SEL01

TITAN LOGIX CORP
TEL: 780-462-4085

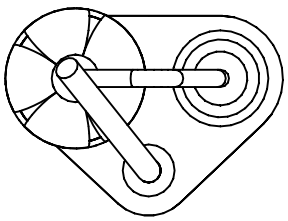
DWG. TITLE
FGI 301/FMI 100 WIRING
400 000 TO 1MM BTUH

PART NO. 1000456SEL01

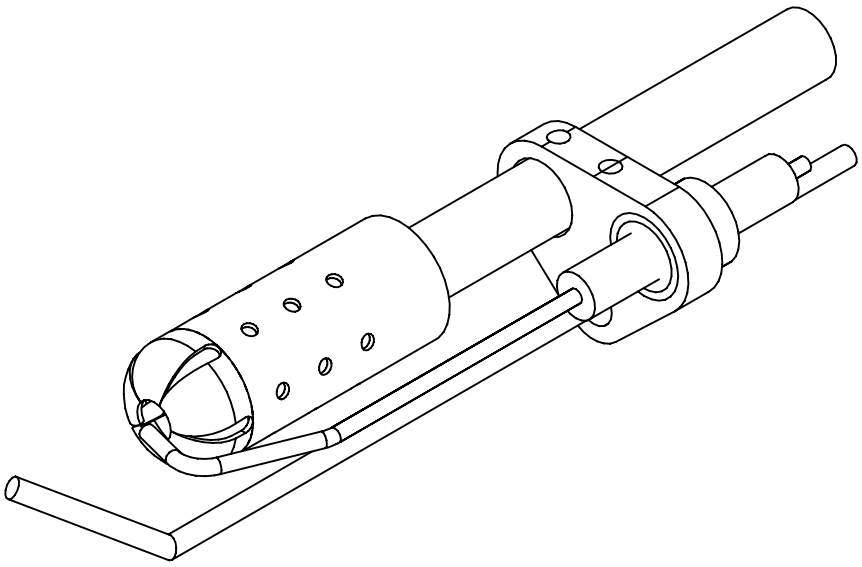
REVISION SHT 1/1

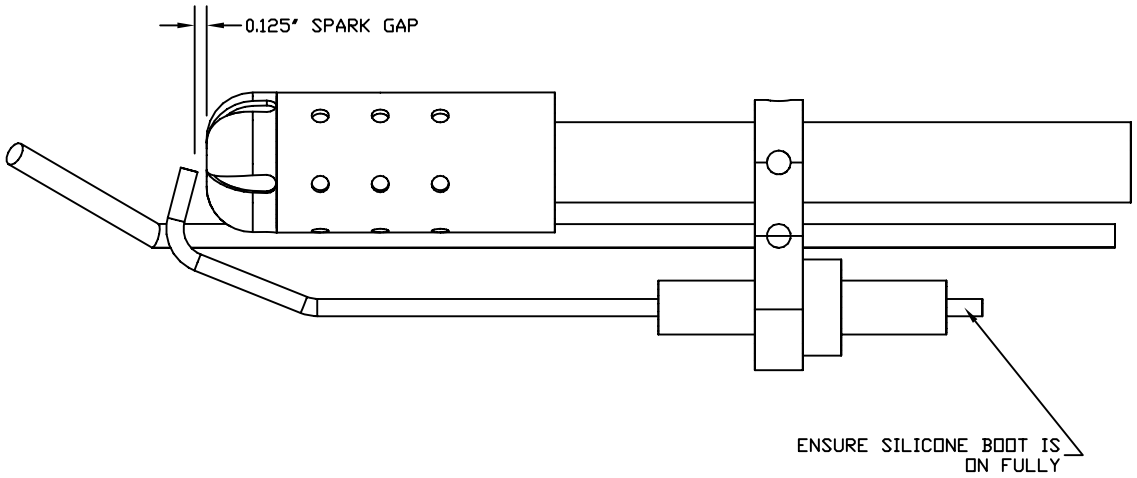


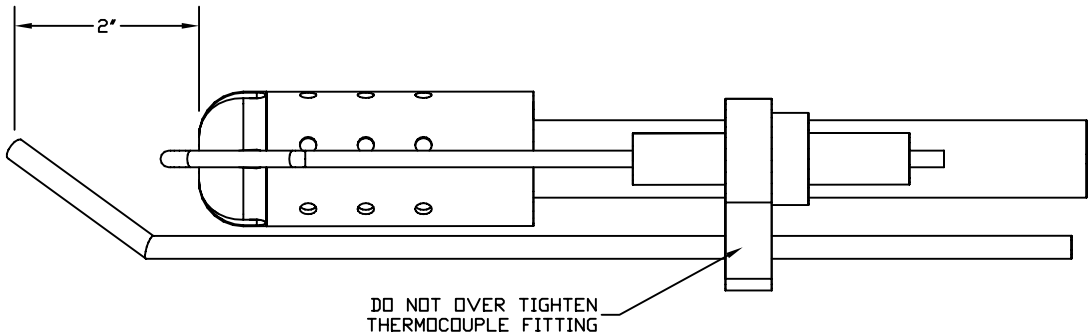
THERMOCOUPLE REMOVED
FOR CLARITY



END VIEW







REV	DESCRIPTION	BY	DATE
01	ELECTRODE SHAPE	DT	2004JUN23

TITAN LOGIX CORP.
TEL: 780-462-4085

DIMENSION UNITS: INCHES [mm]
TOLERANCES EXCEPT AS NOTED
.X ±0.05 125 RMS
.XX ±0.01 63 RMS
.XXX ±0.005 32 RMS
ANGLES ±1°
PROJECTION

BREAK SHARP EDGES
CHAMFER FIRST THRD
REMOVE ALL BURRS

MATERIAL NA
FINISH NA

SCALE 1/2
DESIGN DT CHK
DRAWN DT CHK
DATE 2004JUN10
FILE 1000489APV01

DWG. TITLE
FGI 301
ELECTRODE CONFIGURATION

PART NO. 1000489APV01
REVISION 01
SHT 1/1