GPI Model 801
INSTRUCTION MANUAL

Integrated Time Systems, Inc.

W A R R A N T Y

Integrated Time Systems, Inc. is dedicated to designing, engineering, and manufacturing Gas Panel Interfaces of the highest quality and utility. Your satisfaction with our products is of great importance to us.

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1. DESCRIPTION

The **GPI Model 801** is a **Gas Panel Interface** designed to connect a gas tray on a deposition, oxidation, diffusion or anneal furnace to its controlling process sequencer or DDC[1]. The **GPI Model 801** is particularly useful on systems where the process controller does not provide analog setpoints for gas flows or on systems where the process controller does not provide for manual control of the valves and MFC's[2] or else on systems where the process controller does not provide a sufficient quantity of outputs.

In addition to providing setpoint display and control functions, the **GPI Model 801** provides a powerful combination of hardware and software interlock functions, including torch temperature, H_2:O_2 ratio and EMO[3] circuits.

Also included in the **GPI Model 801** are the power supplies required for the various solenoids, MFC's and sensors.

Among the features of the **GPI Model 801** are:

- +/- 15 volt switching power supply for MFC's.
- 3 to 30 volt adjustable power supply for solenoid valves and sensors.
- 10-turn wirewound potentiometers for setpoint control of (6) MFC's.
- MFC 'override' control.
- control of (24) digital functions including solenoids and relays.
- throttle valve control and monitor for LPCVD[4] systems.
- internal door pressure sensor for LPCVD systems.
- provision for both external and internal EMO switches.
- hard-wired and software interlock functions.
- MFC coil voltage display.
- torch temperature monitor for burnt-Hydrogen systems.
- control inputs compatible with all known process sequencers and DDC's.
- 32 channel, 12 bit A/D converter to monitor gas flows and setpoints.
- 32K ROM and 32K RAM.
- host communications options available for data collection.

[1]DDC: Direct Digital Control system - Computer-controlled system which sequences gas valves, furnace temperature, boat loaders etc. in response to time-based recipes and external sensors.
[2]MFC: Mass Flow Controller - controls flow of a gas stream in response to an analog control voltage.
[3]EMO: Emergency Off - Manually operated mushroom switch which removes power from all solenoid valves.
[4]LPCVD: Low Pressure Chemical Vapor Deposition

2. INSTALLATION OVERVIEW

2.1. Physical Requirements

The **GPI Model 801** is designed to mount on the surface of a furnace shelf, next to the gas tray. Four captive fasteners are provided to secure the enclosure to the shelf. The fasteners are mounted on 4.0 inch by 6.0 inch centers and require 8/32 machine screws (see *Bottom Panel Drawing* on page 22). The machine screws can protrude into the cabinet up to 1/2 inch without risk of contacting internal components.

> Note: Since many of the front panel controls require significant actuation force, it is recommended that the GPI be secured in this manner.

Though the enclosure itself is only 10.5 inches deep, additional clearance may be required to the rear of the **GPI Model 801** enclosure for the electrical connectors on the rear panel

2.2. Door Sensor

An internal pressure sensor detects door closure on LPCVD systems. The sensor has a trip point of 5 psi and is accessible at a barb fitting on the rear panel of the enclosure. The fitting accepts 1/8 inch OD tubing.

Alternately, an external contact closure may be used to indicate door closure. This input is accessible on the *Sensor Connector, J9* (see page 7).

2.3. AC Power

An AC power entry module is provided at the bottom of the rear panel. This module combines three functions:

- power entry
- fuse
- line voltage selection (option)

Selection of line voltage is performed by changing the orientation of a small circuit board located just under the fuse in the power entry module.

> Note: Some units contain an internal +/- 15 volt power supply which does not support operation at voltages other than 120vac. If 240vac operation is required, check with the manufacturer to determine whether that feature is available. Damage to the electronics may result if an incorrect line voltage is selected!

To access the line voltage selector, remove the AC power connector and slide the clear fuse cover to the left. The small, rectangular circuit board may be pulled from its socket using a bent paper clip to hook onto the round hole in the board.

Rotate the board such that the proper power line voltage, 120 or 240, will be visible under the fuse and reinstall the board in its socket.

The power entry module is fitted with a 4 amp, 250 v, 3AG fuse. To replace the fuse, remove the AC power connector and slide the clear fuse cover to the left. A plastic pull lever labeled *FUSE PULL* releases the fuse from its compartment.

2.4. Valve Power Supply

A potentiometer located inside the enclosure at the top of the power supply board sets the voltage level of the Valve Power Supply. This supply is factory adjusted for 24.0 volts and is accessible on pins 10 (+) and 9 (-) of the Sensor connector, J9. This power supply is not internally connected to the analog common of the MFC's nor to the logic ground of the microprocessor.

An internal slide switch can be configured to connect the Valve Power Supply to pins 25 (+) and 38 (-) of the I/O connector, J7, where it can be used to power the interface signals. This feature is useful in applications where the process sequencer provides uncommitted contact closures.

2.5. MFC Connectors, J1 through J6

Six polarized, flat-cable, insulation displacement connectors are provided for the MFC's. Following is the pinout of these connectors, J1 through J6. The number in the "Card-edge" column identifies the pin on the MFC end of the cable, while the number in the "IDC" column identifies the pin on the flat cable connector end (**I**nsulation **D**isplacement **C**onnector). The pinout shown is compatible with standard Unit Instruments Mass Flow Controllers. Other pinouts can be provided upon request.

Card-edge Pin #	IDC Pin #	Function
1	1	Case Gnd
2	3	Power Common
3	5	Output (0-5v)
4	7	+15 volts
5	9	N/C
6	11	N/C
7	13	Keyway
8	15	N/C
9	17	N/C
10	19	Common

Card-edge Pin #	IDC Pin #	Function
A	2	Setpoint
B	4	Signal Common
C	6	Signal Common
D	8	Valve Test
E	10	N/C
F	12	-15 volts
G	14	Keyway
H	16	N/C
I	18	N/C
J	20	Valve Off

2.6. Output Reference Adjustment

A potentiometer is provided at the rear of the enclosure to adjust the full scale reference voltage used by the multiplying D/A converters. This adjustment is preset at the factory and should not require field service.

In some units, the *Output Reference Adjust* potentiometer can be set using the built-in panel meter. To activate the adjust mode, press and hold the red *Alarm Silence* switch located to the left of the *EMO* display. The panel meter can then be forced to display four different voltages by selecting different combinations of the *Setpoint* and *Actual* switches. Note that this method of adjustment is affected by variations in the panel meter as well as by an incorrect setting of the potentiometer.

To adjust the *Output Reference*, set the display to each of the four settings and adjust the potentiometer to its optimum setting to reduce the variance from the readings in the table below:

	Target Display
Neither depressed	12.5
Setpoint depressed	50.0
Actual depressed	87.5
Setpoint & Actual depressed	99.6

2.7. I/O Connector, J7

Pin	Wire Color	801 Function
1	Black	DDC Analog Out 7
2	White	DDC Analog Out 6
3	Red	DDC Analog Out 5
4	Green	DDC Analog Out 4
5	Orange	DDC Analog Out 3
6	Blue	DDC Analog Out 2
7	White/Black	DDC Analog Out 1
8	Red/Black	DDC Analog Out 0
9	Green/Black	Analog Common
10	Orange/Black	DDC Al Sil Common
11	Blue/Black	DDC Alarm Silence
12	Black/White	N/C
13	Red/White	DDC Digital Inp 7
14	Green/White	DDC Digital Inp 5
15	Blue/White	DDC Digital Inp 3
16	Black/Red	DDC Digital Inp 1
17	White/Red	DDC Digital Out F
18	Orange/Red	DDC Digital Out D
19	Blue/Red	DDC Digital Out B
20	Red/Green	DDC Digital Out 9
21	Orange/Green	DDC Digital Out 7
22	Black/White/Red	DDC Digital Out 5
23	White/Black/Red	DDC Digital Out 3
24	Red/Black/White	DDC Digital Out 1
25	Green/Black/White	Supply (+)
26	Orange/Black/White	MFC Actual 7
27	Blue/Black/White	MFC Actual 6
28	Black/Red/Green	MFC Actual 5
29	White/Red/Green	MFC Actual 4
30	Red/Black/Green	MFC Actual 3
31	Green/Black/Orange	MFC Actual 2
32	Orange/Black/Green	MFC Actual 1
33	Blue/White/Orange	MFC Actual 0
34	Black/White/Orange	OUTCOM_C
35	White/Red/Orange	OUTCOM_D
36	Orange/White/Blue	N/C
37	White/Red/Blue	N/C
38	Black/White/Green	Supply (-)
39	White/Black/Green	DDC Digital Inp 6
40	Red/White/Green	DDC Digital Inp 4
41	Green/White/Blue	DDC Digital Inp 2
42	Orange/Red/Green	DDC Digital Inp 0
43	Blue/Red/Green	DDC Digital Out E
44	Black/White/Blue	DDC Digital Out C
45	White/Black/Blue	DDC Digital Out A
46	Red/White/Blue	DDC Digital Out 8
47	Green/Orange/Red	DDC Digital Out 6
48	Orange/Red/Blue	DDC Digital Out 4
49	Blue/Orange/Red	DDC Digital Out 2
50	Black/Orange/Red	DDC Digital Out 0

J7 is a 50-pin male communications connector located above the power entry module on the rear panel. This connector contains the necessary signals to connect the **801** to a DDC or process sequencer. A recommended pinout using Belden 9546 cable is as follows:

2.8. Valve Connector, J8

J8 is a 25-pin female 'D' connector located in the upper right corner of the rear panel. This connector contains the signals necessary to drive up to twenty-four pilot valves, gas solenoids or relays. If the solenoids are polarized, the positive side of each coil must be connected to the *Valve Common* pin, and the negative side of each solenoid must be connected to one of the valve output signals. The pinout of this connector is arranged to match that of an SMC manifold.

In applications where an SMC manifold with an IDC connector is used, a flat cable assembly can be used to connect the SMC manifold to J8. In other applications, a round, nylon-jacketed cable with a 25-pin male 'D' connector may be used to connect to the valves to J8. A typical color code using Belden 9543 wire is shown below:

Pin		Output	Function	Wire Color
1		Valve 1	Aux 1	Black
	14	Valve 2	Aux 2	White
2		Valve 3	Aux 3	Red
	15	Valve 4	Aux 4	Green
3		Valve 5	Gas 1 Upstream	Orange
	16	Valve 6	Gas 1 Downstream	Blue
4		Valve 7	Gas 1 Bypass	White/Black
	17	Valve 8	Gas 1 Purge	Red/Black
5		Valve 9	Gas 2 Upstream	Green/Black
	18	Valve 10	Gas 2 Downstream	Orange/Black
6		Valve 11	Gas 2 Bypass	Blue/Black
	19	Valve 12	Gas 2 Purge	Black/White
7		Valve 13	Gas 3 Upstream	Red/White
	20	Valve 14	Gas 3 Downstream	Green/White
8		Valve 15	Gas 3 Bypass	Blue/White
	21	Valve 16	Gas 3 Purge	Black/Red
9		Valve 17	Gas 4 Upstream	White/Red
	22	Valve 18	Gas 4 Downstream	Orange/Red
10		Valve 19	Gas 4 Bypass	Blue/Red
	23	Valve 20	Gas 4 Purge	Red/Green
11		Valve 21	Aux 5	Orange/Green
	24	Valve 22	Aux 6	Black/White/Red
12		Valve 23	Aux 7	White/Black/Red
	25	Valve 24	Aux 8	Red/Black/White
13		Valve Common		Green/Black/White

2.9. Sensor Connector, J9

J9 is a 15-pin female 'D' connector located on the right side of the rear panel. This connector contains the necessary signals for up to five external sensor circuits.

The **GPI Model 801** is designed to be used with external sensors and switches which have contacts that close under 'safe' conditions and open under 'unsafe' conditions. Each of the interlocks require a contact closure between the appropriate sensor input pin on J9 and one of the *24 volt return* pins.

Pin	Function
1	Earth Ground
2	Pump Monitor
3	Door / Hi H2
4	Leak
5	Over Pressure / Lo O2
6	External EMO
7	Throttle Set
8	Throttle Read
9	24 Volt Return
10	+24 Volts
11	Throttle Close (Throttle Enable)
12	Throttle Common
13	Throttle Open
14	Analog Common
15	Analog Common

Note: The EXTERNAL EMO circuit must be satisfied to energize any of the valve outputs. To bypass the EMO interlock, jumper the EXTERNAL EMO pin to 24Volt Return.

2.10. Configuration Slide Switches

The main **GPI Model 801** circuit board contains five slide switches which affect the status of the interlock signals sent from the GPI to the process sequencer or DDC. The switches are configured by the manufacturer before shipping and should not require attention during installation. If necessary, remove the top cover to access the switches. The switches are located on the inside surface of the large circuit board facing the left side of the cabinet. The switches are arranged in order, SL1 through SL5, with SL5 being nearest the front of the cabinet.

An explanation of their functions is provided below:

SL1 - INPCOM - This switch determines whether the relay that send digital signals to the process sequencer are commoned to Supply (+) or to Supply (-). If the switch is set to its up position, the signals will be contact closures to Supply (+). If the switch is set to its down position, the signals will be contact closures to Supply (-).

SL2 - OUTCOM - This switch determines whether the first eight bi-directional opto-isolators that receive digital commands from the process sequencer are commoned to *Supply (+)* or to *Supply (-)*. If the command signals are positive voltages, the switch must be set to its down position. If the command signals are contacts to *Supply (-)*, the switch must be set to its up position.

SW3 - I/O Supply - This switch determines whether the internal power supply is made available at the *Supply (+)* and *Supply (-)* pins of the I/O connector to power the interface circuitry. If the process sequencer/DDC is providing voltage outputs (as opposed to uncommitted relay contacts), this switch must be set to its up position. If the internal power supply is being used to power the interface, set the switch to its down position.

SW4 & SW5 - These switches compliment the behavior of SL2. SL4 controls opto-isolators 9 through 12, while SL5 controls opto-isolators 13 through 16. If either switch is in its up position, the corresponding opto-isolators are commoned to the OUTCOM signal as selected by SL2. If the switches are in their down positions, the corresponding opto-isolators are connected to a pin on the I/O connector (Pin 35 for opto's 9-12 and Pin 34 for opto's 13-16).

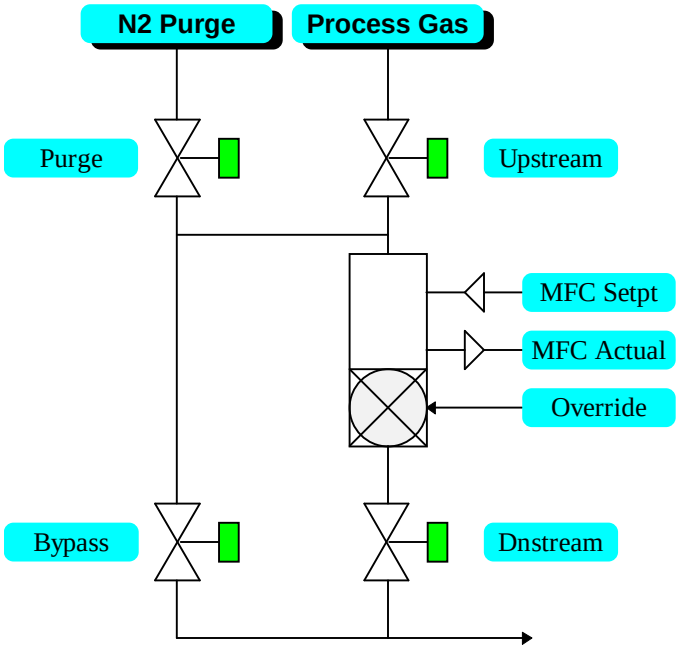
Switch	Function	UP	DOWN
SL1	INPCOM	Signals from GPI to Host are contacts to (+)	Signals from GPI to Host are contacts to (-)
SL2	OUTCOM (OptoIsolators 1-8)	Signals from Host to GPI are (-)	Signals from Host to GPI are (+)
SL3	I/O SUPPLY	Internal Power Supply is not connected to I/O Connecter	Internal Power Supply is used to power I/O
SL4	OptoIsolators 9-12	Commoned to OUTCOM	Commoned to J7, Pin 35
SL5	OptoIsolators 13-16	Commoned to OUTCOM	Commoned to J7, Pin 34

3. THEORY OF OPERATION

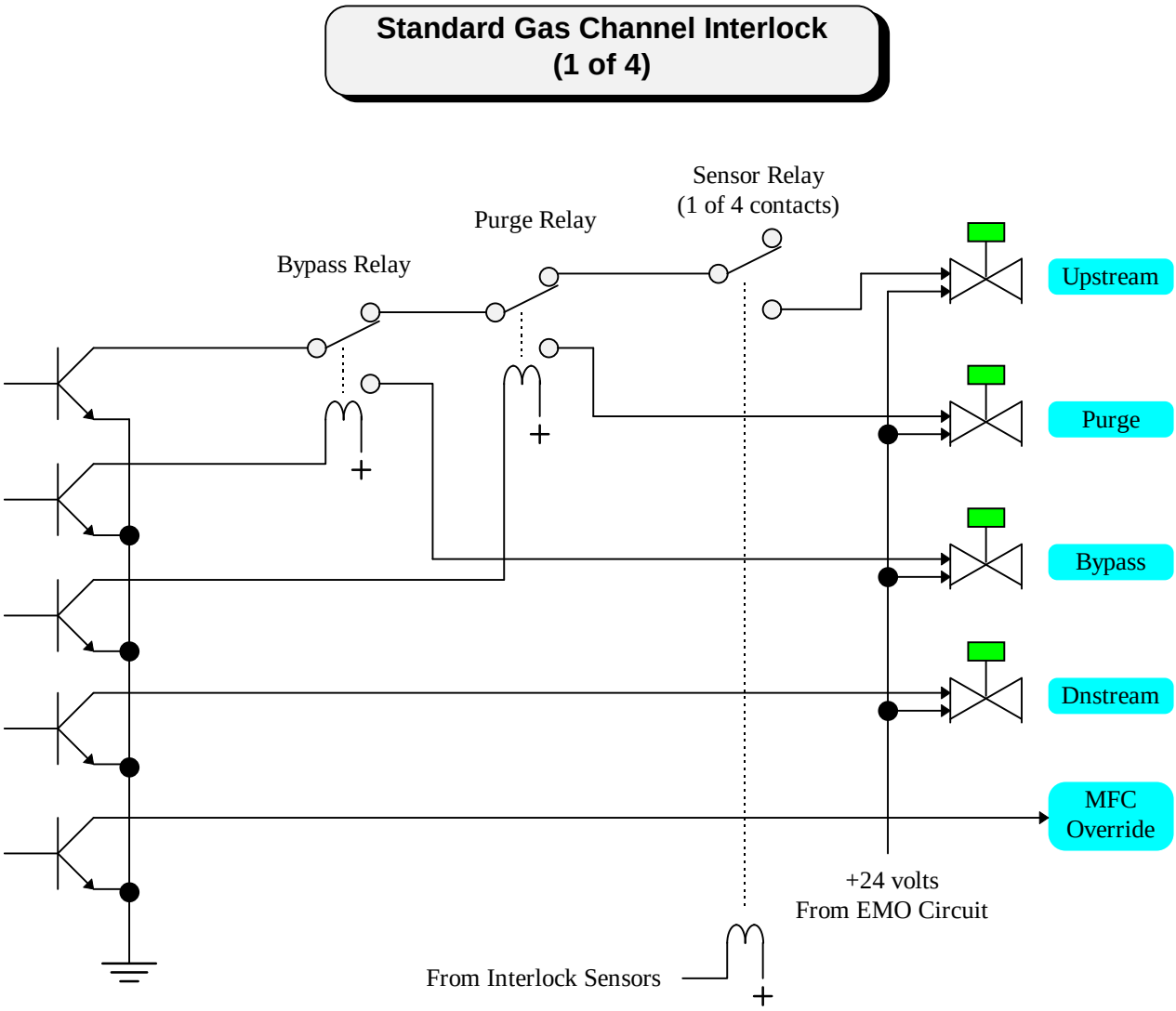
3.1. Reactive Gas Model

Four sets of hardware-interlocked functions are provided for control of toxic or flammable process gases. The control elements of each function are listed below:

Upstream Valve
Downstream Valve
Bypass Valve
Purge Valve
MFC Override
MFC Setpoint
MFC Actual



3.2. Hardware Interlocks



Each of the four process gas channels are individually interlocked to prevent the Purge Valve or Upstream Valve from being energized if the Bypass Valve is energized. In addition, the Upstream Valve is held off if the Purge Valve is energized.

A separate interlock function prevents all four Upstream Valves from being energized if either of two external sensors are unsafe.

An EMO circuit holds all valves deenergized if an internal mushroom switch is pressed or an external EMO interlock is not satisfied.

A watchdog circuit keeps all output valves, relays and buzzers deenergized unless the microprocessor services the output drivers on a predetermined schedule.

3.3. Function Timing

Software in the **GPI Model 801** is structured to take maximum advantage of a limited number of control signals from the host and to minimize the software requirements imposed on the host. When a particular configuration is specified, a number of *Virtual Functions* are defined in a software table.

The table has four major sections:

- Input Mapping - This section determines which hardware I/O port controls the *Virtual Function* and which A/D channel is assigned to the setpoint. A separate entry is provided for *Manual Mode* and for *DDC Mode*. This determines which front panel switch, if any, controls the function in *Manual Mode* and which I/O connector pin controls the function in *DDC Mode*.

- Function Timing - This section of the configuration table controls *Virtual Function* timing. One set of entries determine turn-on delays, and a separate section determine turn-off delays. Eight timers are assigned to each of the four process gas channels as described below:

  Primary: Time delay after the *Virtual Function* is triggerred before the primary valve signal is turned on. The primary signal drives the Upstream Valve, the Purge Valve or the Bypass Valve as determined by the interlock scheme described above.

  Downstream: Time delay after the *Virtual Function* is triggerred before the Downstream valve signal is turned on.

  Override: Time delay after the *Virtual Function* is triggerred before the MFC Override signal to the MFC is released.

  Setpoint: Time delay after the *Virtual Function* is triggerred before the analog signal to the MFC begins its ramp to setpoint.

- Output Mapping - This section determines which hardware I/O ports receive the *Virtual Function* commands and which D/A channel outputs the setpoint. This determines which valves and/or relays are controlled by each *Virtual Function*.

- Display Control - This section of the configuration table controls which front panel LED displays status of each *Virtual Function*.

3.4. Software Interlocks

Additional interlocks and functions can be provided in software to support application specific features such as soft pump sequencing, DDC alarm filtering, avoiding incompatible

gas mixtures and many others as required by the particular process. Any such features would be described in an attachment to this manual.

4. OPERATION

4.1. Power On Self Test

When first powered-up, the GPI Model 801 executes a software module which tests several internal functions. The sequence of tests is as follows:

- energize all front panel LED's to confirm operation.
- execute a pattern test on RAM.
- calculate and confirm the checksum of ROM.
- determine the AC line frequency for timing functions.
- check the crystal frequency.
- sound the buzzer.

In the normal software, the buzzer sounds continously after self-test is complete until the Alarm Silence switch is pressed. This function can be disabled with a different set of ROMs.

4.2. MANUAL / AUTO / DDC Switches

The **MANUAL/AUTO/DDC** switch array is mechanically interlocked and latched such that one and only one of the three switches is depressed at all times. It is possible to intentionally depress other combinations of switches, but this serves no useful purpose and is ignored by the software. The following descriptions apply:

- **MANUAL** - When only this switch is depressed, the valve output signals are controlled by the Output Select switches on the GPI front panel. In addition, the MFC setpoint voltages originate at the potentiometers on the GPI front panel.

- **AUTO** - When only this switch is depressed, the valve output signals originate at the process sequencer or DDC; however, the MFC setpoint voltages originate at the potentiometers on the GPI front panel.

- **DDC** - When only this switch is depressed, both the valve output signals and the MFC setpoint voltages originate at the process sequencer or DDC.

Three LEDs indicate the status of the *MANUAL/AUTO/DDC* switch array:

- If the *MANUAL* switch is depressed, the red *MANUAL* led lights.
- If the *AUTO* switch is depressed the yellow *AUTO* led lights.
- If the *DDC* switch is depressed the yellow *DDC* led lights.
- Any undefined combination of the three switches causes the red *MANUAL* led to flash.

Two status signals are generated in response to these switches for use by the host process sequencer or DDC:

- **GPI-AUTO** - This signal goes 'safe' when the *AUTO* switch is depressed.
- **GPI-DDC** - This signal goes 'safe' when the *DDC* switch is depressed.

4.3. SETPOINT / ACTUAL Switches

While the **SETPOINT/ACTUAL** switch array is mechanically interlocked and latched such that one and only one of the two switches is normally depressed at any time, it is possible to intentionally depress both switches or no switches as described below:

- **SETPOINT** - When this switch is depressed and the *ACTUAL* switch is not depressed, the panel meter displays the setpoint or target value of the parameter selected (gas flow or torch temperature). The gas flow setpoints might originate at the process sequencer or at the front panel potentiometers as determined by the *DDC* switch as described above.

- **ACTUAL** - When this switch is depressed and the *SETPOINT* switch is not depressed, the panel meter displays the actual value of the parameter selected (gas flow or torch temperature).

- **SETPOINT and ACTUAL** - When both switches are depressed, the panel meter displays the coil voltage of the MFC selected by the *DISPLAY SELECT* switch. This function is very useful as a diagnostic tool to determine the condition of the MFC orifice.

When neither *SETPOINT* nor *ACTUAL* switch is depressed, the panel meter serves no useful purpose.

4.4. DISPLAY SELECT Switch

Assuming that the TORCH switch is not depressed, the **DISPLAY SELECT** rotary switch determines which of the six gas flows is displayed on the panel meter.

Note: The *SETPOINT*, *ACTUAL* and *DISPLAY SELECT* switches control front panel displays only and do not affect gas flows.

4.5. OUTPUT SELECT Switches

Though not specifically labeled as such on the front panel, the *OUTPUT SELECT* switches are the (8) latching switches along the left edge of the mid-section of the front panel. These switches are not mechanically interlocked and may be individually controlled. When in *MANUAL* mode, six of the switches control the valve output signals while the two extra switches control auxiliary functions. The eight switches have no effect except in *MANUAL* mode.

A yellow led to the right of each switch indicates the status the particular valve output in *MANUAL*, *AUTO* and *DDC* modes.

4.6. GAS SETPOINT Potentiometers

Six, 10-turn potentiometers determine the gas setpoints when not in *DDC* mode. When the *DDC* switch is depressed, these potentiometers have no effect.

4.7. TORCH SELECT and SETPOINT

When depressed, a white-capped, momentary pushbutton switch causes torch parameters to be displayed on the panel meter instead of gas flows or coil voltages. If the *ACTUAL* switch is also depressed, the actual torch temperature is displayed in degrees Celsius. If, however,

the *SETPOINT* switch is depressed instead of the *ACTUAL* switch, the setting of the 10-turn *TORCH* potentiometer is displayed.

4.8. INTERLOCK Displays - Burnt Hydrogen

Five red LEDs located in the bottom section of the front panel indicate the status of various interlock circuits. In a typical burnt-hydrogen application, the five interlocks are:

- TORCH - Indicates torch T/C is below setpoint.
- Hi H_2 - Indicates status of external H_2 flow sensor.
- Lo O_2 - Indicates status of external O_2 flow sensor and O_2 valve.
- RATIO - Indicates ratio of H_2 to O_2 (Assumes H_2 orifice is 2x O_2 orifice).
- EMO - Lights when EMO switch on front panel is depressed or when external EMO circuit is not satisfied.

All of the interlocks except EMO are active only when the H2 valve is on.

The Hi H_2 and RATIO interlocks are internally latched and must be manually reset before H_2 flow is restored.

4.9. INTERLOCK Displays - LPCVD

Five red LEDs located in the bottom section of the front panel indicate the status of various interlock circuits. In a typical LPCVD application, the five interlocks are:

- Pump Monitor - Indicates status of signal supplied from pump.
- Door - Indicates status of Internal or External Door Sensor.
- Leak - Indicates status of signal supplied by Pressure Monitor.
- Overpressure - Indicates status of signal supplied by Pressure Monitor.
- EMO - Lights when EMO switch on front panel is depressed or when external EMO circuit is not satisfied.

4.10. EMO Switch

The **EMERGENCY OFF** switch is a large red latching mushroom switch located in the lower-right corner of the front panel. When depressed, this switch removes power from all valve outputs. Once depressed, the switch remains in the EMO position until it is intentionally restored to the normal position. An assortment of other types of actuators are available for the EMO switch, some of which require a key to reset.

An external EMO circuit is also available on the sensor connector. When not jumpered out, this circuit requires that both the internal and the external EMO be satisfied before valve outputs are permitted to be energized.

4.11. ALARM SILENCE Switch

The **ALARM SILENCE** switch is a red-capped, momentary pushbutton located in the lower-left corner of the front panel. This switch serves three functions:

- When a latched interlock failure has occurred, the switch silences the internal alarm.
- When all sensors are once again safe, the switch resets any latched interlocks.

- While depressed, this switch activates an LED test and analog calibration mode.

An isolated *ALARM SILENCE* contact closure is also available at the I/O connector for use by the process sequencer/DDC.

5. SPECIFICATIONS

The specifications listed below relate to the requirements and capabilities of the components contained in the **GPI Model 801** electronics enclosure.

5.1. Physical

Width:	5.75 inches.
Height:	10.50 inches.
Depth:	10.50 inches.
Weight:	10 pounds, maximum.
Paint:	Cardinal, 'high bake', water-based (Charcoal gray unless specified).

5.2. Pneumatic Connections

Door Sensor:	SS-200-61 (1/8” Swage to 1/8” Swage bulkhead).
Purge Inlet:	

5.3. AC Power Requirements

Voltage:	100 to 125 vac.
Current:	fused internally at 4 amps.
Frequency:	50 or 60 Hertz.
Power:	75 watts maximum.

5.4. Valve Power Supply

Voltage:	adjustable, 3 to 30 volts DC (factory set at 24.0 volts).
Current:	3.0 amps maximum.

5.5. MFC Power Supply

Voltage:	+/- 15 volts DC.
Current:	1.7 amps at each voltage.

5.6. Interlock Inputs

Quantity:	(5)
Trigger Current:	10 mA maximum @ 24 vdc.
Operation:	closed circuit when safe.

5.7. Torch Input

Quantity:	(1)
Thermocouple:	Type 'K' (not supplied).

Note: Provision can be made for Type 'J' on request.

5.8. Valve Outputs

Quantity:	(24)
Current Capability[5]:	200 milliamp each @ 24 volts DC.
Operation:	transistor closure to 24V Return when energized.

[5]The total current handling capability of the valve outputs is restricted by the printed circuit traces and by the capacity of the internal DC power supply.

6. MODIFICATIONS LOG

6.1. Hardware Changes

- 12/4/1993 Initial Release
- 1/12/1995 Completed 9990299 Rev. A
- 3/15/1995 Completed 9990299 Rev. B
- 3/15/1995 Completed 9990228 Rev. B

6.2. Software Modifications

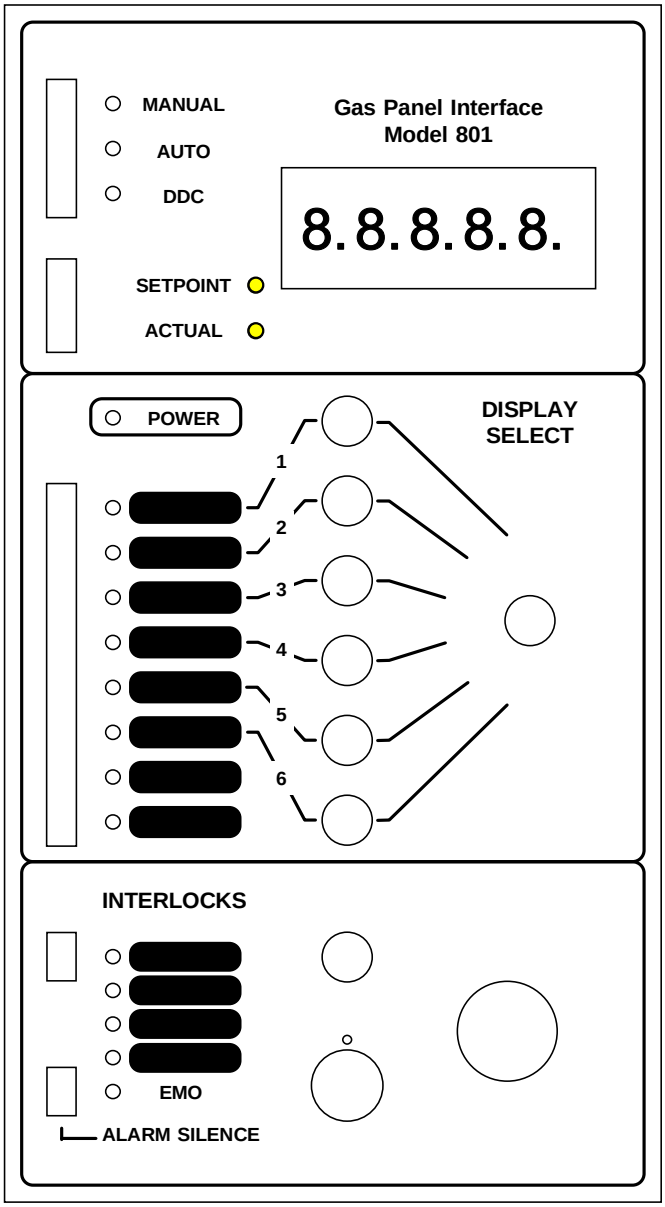
12/4/1993
- Initial Release

6.3. Manual History

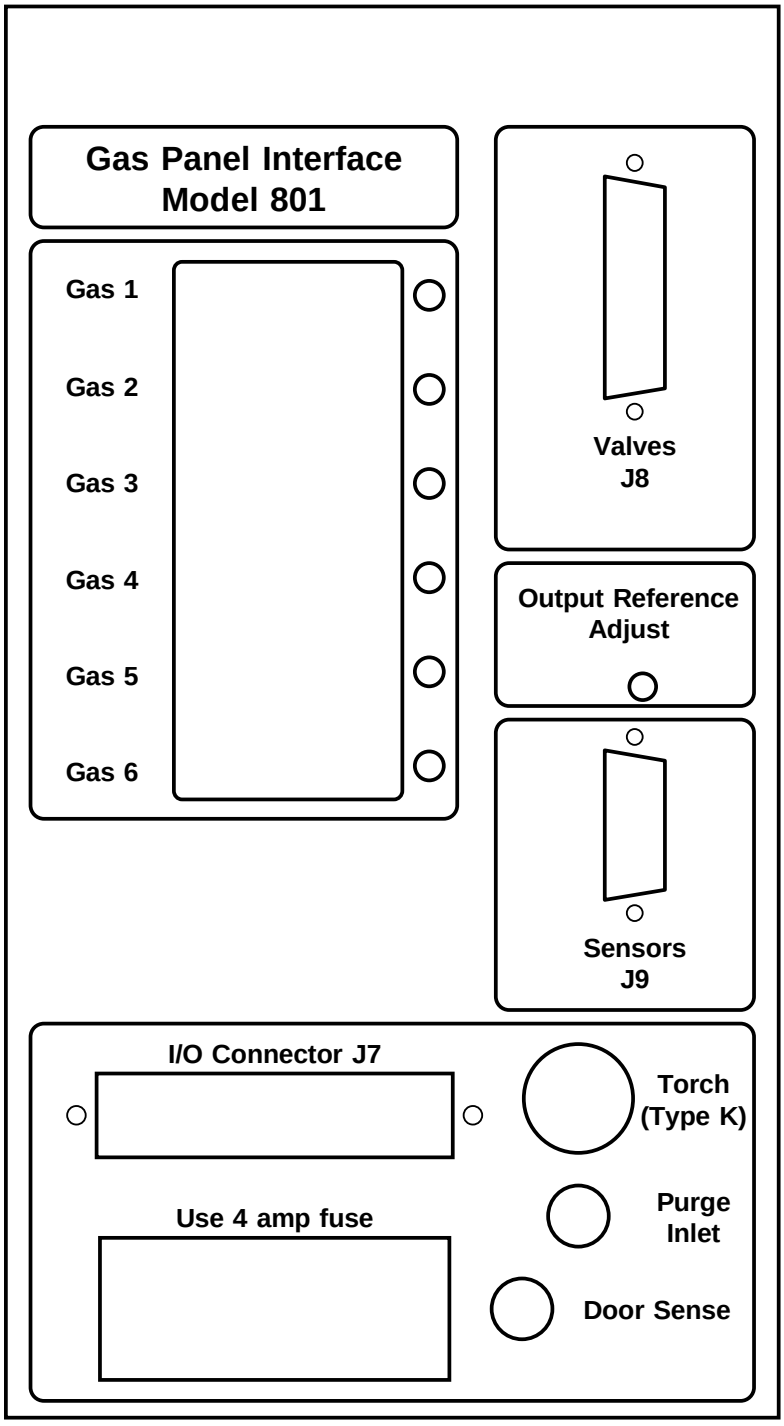
2/24/1994
- Initial Release.

5/22/2004
- Updfated for website

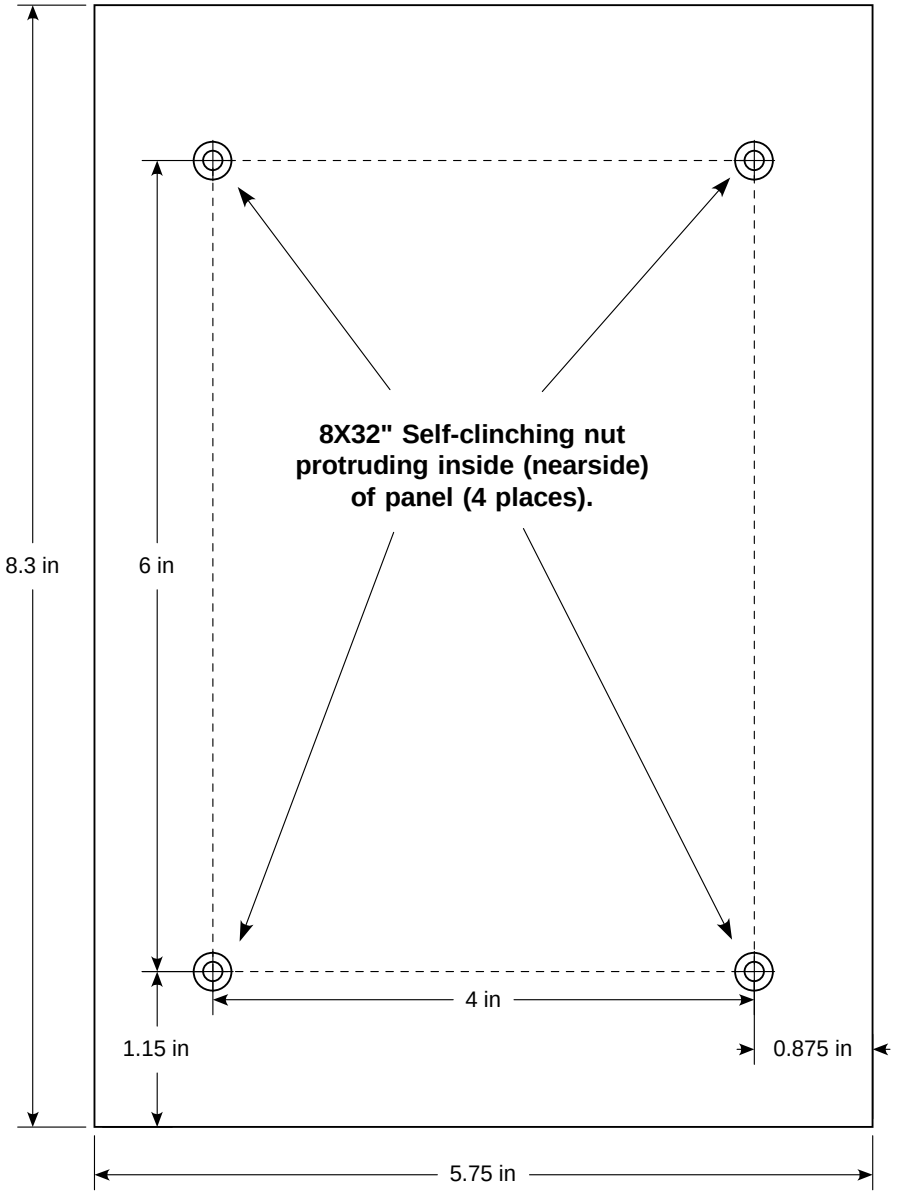
APPENDIX A, FRONT PANEL DRAWING



APPENDIX B, REAR PANEL DRAWING



APPENDIX C, BOTTOM PANEL DRAWING



APPENDIX D, SCHEMATIC LIST

Following is a list of schematics relating to the **GPI Model 801**:

- 9990282 Rev A or 9990299 Rev A, B or C, (Sheets 1, 2 & 3) GPI Main Logic Board.
- 9990263 Rev A, B or C CPU Board.
- 9990228 Rev A or B, GPI MFC Connector Board (Unit Instruments version).
- 9990226 Rev A, GPI Rotary Switch Board.
- 9990229 Rev A, Panel Meter Adapter.
- 9990227 Rev A, GPI Potentiometer Board.