

OPERATION & MAINTENANCE MANUAL

GUARDIAN PLUS
SPACE PRESSURE MONITOR
AND CONTROLLER

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/SPMPLUS
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1.0 BASIC OPERATION

The Guardian Plus is a complete system package consisting of space and reference pressure sensors and the central control processing module. The central module measures and displays the pressure differential with a resolution of up to one ten thousandth of an inch water column. The LED display can be calibrated to read in either inches of water column or pascals. The 3-mode (P, I, I/D) controller circuitry compares the space pressure to a space pressure setpoint signal and outputs a 0-10vdc or 4-20ma signal to maintain the desired differential pressure. Controller status LED•s indicate controller output level and status of control interrupt input signal. An auxiliary 0-10vdc or 4-20ma analog output signal linear to the pressure differential is provided for remote monitoring, control and data logging. An alarm condition will occur when the space pressure falls outside the preset operating range. During an alarm condition, a local LED will illuminate, the audible alarm will enable if turned on and an auxiliary dry contact for remote alarming will close. An alarm acknowledge button located on the front panel will turn only the audible alarm off. A key locked front panel allows for controlled access to the field configurable functions of the Guardian Plus. These functions include:

- 1.1 Transducer calibration zero and span adjustments.
- 1.2 Alarm setpoint adjustment.
- 1.3 Controller setpoint adjustment.
- 1.4 Alarm time delay to prevent nuisance alarms which would occur due to normal foot traffic.
- 1.5 Audible alarm On/Off selection.
- 1.6 Alarm and Controller setpoint display selection switches.
- 1.7 Controller (P, I, I/D) tuning adjustments.
- 1.8 Controller output selection (Auto/Manual) and adjustment.

2.0 GUARDIAN PLUS FEATURES

(Note: Refer to figures 1, 3 & 4 for component and test point locations)

2.1 POWER SUPPLY

The Guardian Plus utilizes an isolated linear type power supply generating +15 vdc and ∇ 5vdc to power the transducer sensor, scaling and digital circuitry. Input power to the Guardian is 24VAC. The power supply is fused with an 3/8 Amp Slo Blow fuse.

2.2 ALARM STATUS

- 1) **NORMAL** (Green LED) - Indicates space pressure is within the operating range.
- 2) **ALARM** (Red LED) - Indicates space pressure has fallen outside the operating range.

2.3 CONTROLLER STATUS

- 1) **MIN OUTPUT** (Red LED) - Indicates that controller output is at a minimum value (0vdc or 4ma).
- 2) **NORMAL** (Green LED) - Indicates that controller output is controlling between minimum and maximum output.
- 3) **MAX OUTPUT** (Red LED) - Indicates that controller output is at a maximum value (10vdc or 20ma).
- 4) **CONTROL INTERRUPT** (Red LED) - Indicates that the controller is in a control interrupt mode of operation. Depending upon controller setup, the output will drive to a pre-determined output value or lock the output at the same value it was when the control interrupt was activated.

2.4 AUDIBLE ALARM ON/OFF

- 1) **ON** - Indicates audible alarm is activated when in alarm condition.
- 2) **OFF** - Indicates audible alarm is de-activated when in the alarm condition.

2.5 **ALARM ACKNOWLEDGE**

If the space pressure has fallen outside the operating range and is in alarm mode, the audible alarm can be silenced by pressing the ALARM ACKNOWLEDGE switch.

2.6 **REMOTE ALARM RELAY**

A SPDT relay is de-energized when space pressure is within the operating range and energized when the space pressure has fallen outside the operating range.

2.7 **DISPLAY SELECT**

Pressing the **ALARM SP.** or **CONT. SP.** switch once will change from process monitoring to displaying the alarm or controller setpoint value.

1) **PROCESS** - Displays the measured pressure differential.

2) **ALARM SP** - Displays field adjustable positive or negative setpoint value.

To return to displaying process, press the ALARM SP. switch once. If the ALARM SP. switch is not pressed, the display will automatically return to process in approx. 60 seconds.

3) **CONT. SP.** - Displays field adjustable positive or negative setpoint value. To return to displaying process, press the CONT. SP. switch once. If the CONT. SP. switch is not pressed, the display will automatically return to process in approx. 60 seconds.

2.8 **DISPLAY**

The 3-1/2 digit LED is factory calibrated for either Inches of Water or Pascals.

2.9 **ACCESS DOOR OPTIONS & ADJUSTMENTS**

1) **SPAN** - Used for span calibration of the transducer.

2) **ZERO** - Used for zero calibration of the transducer.

3) **ALARM SETPOINT** - By pressing the ALARM SP. Switch once and displaying the alarm setpoint, the user can adjust the positive or negative alarm setpoint value.

4) **ALARM DELAY** - Alarm time delay adjustable from 0 to 30 seconds.

5) **AUDIBLE ALARM SELECT** - The audible alarm is ON/OFF jumper selectable.

6) **CONTROLLER SELECTIONS & ADJUSTMENTS:**

a) **CONTROLLER SETPOINT** - By pressing the CONT.SP. switch once and displaying the controller setpoint, the user can adjust the positive or negative controller setpoint value.

b) **INTERLOCK(H12)** - Provides an unloaded system start-up output value. Shorting of SYSTEM START terminals is required and will illuminate a green LED indicating system start is activated. Either minimum or maximum controller output condition can be achieved by jumper selection.

c) **ACTION(H13)** - Selects either inverse or direct control action.

d) **RESET(H15)** - Selects controller reset rate (1=fast / 3=slow).

e) **1/D(H16)** - Selects controller inverse derivative rate (1=fast / 4=slow).

f) **AUTO/MANUAL MODE(H17)** - Selects if controller output is controlled manually or in the auto mode.

g) **MANUAL/SAMPLE HOLD(H14)** - In manual mode or door interrupt mode of operation, the output can be manually controlled by R9 potentiometer adjustment (MAN) or the output will lock at the same value it was when the manual mode of operation was selected (SH).

h) **INTERNAL SETPOINT** - R49 (INT SP) adjusts the internal controller setpoint.

i) **EXTERNAL SETPOINT** - R68 (EXT. SP ZERO) and R64 (EXT SP SPAN) adjust external setpoint signal.

j) CONTROLLER OUTPUT - R51 (10V), R79 (I ZERO) and R77 (I SPAN) adjust voltage and current output levels.

2.10 DOOR INTERLOCK

The Door Interlock option allows a user to disable the PI1/D control algorithm in the case of room pressure loss due to a door opening and either forces the controller output to a pre-determined value or lock the output at the same value it was when the door interlock option was activated. The following jumper positions determine how door interlock is activated and how the controller output will react to option activation.

- 1) **Door Interlock Activation (H10):** **CL Position** = Contact closure activates door interlock.
 OP Position = Open contact activates door interlock.
- 2) **Controller Output (H14):** **Man Position** = Controller output will ramp to a pre-determined value determined by potentiometer R9.
 S/H Position = Controller output will lock at the value it was when the option was activated.

2.11 SYSTEM START

Closure of the System Start contact enables the control algorithm and guarantees the output starts from a known value (0vdc, 4-ma, etc). If System Start is not activated, the control algorithm is disabled and the controller output will remain at the minimum value.

(NOTE: If not interlocked with fan start command, jumper terminals to enable controller)

3.0 PRE-STARTUP CHECK

3.1 Equipment Needed

- 1) 4-1/2 Digit Digital Volt Meter (DMM)

3.2 Pre-Startup Check

(Refer to Figure 1.0 for test point and adjustment locations)

- 1) With 24VAC power applied to the Guardian Plus, Verify Display is illuminated.
- 2) Open access door and connect + probe of DMM to TP7 (PROCESS) and the - probe to TP1 (GND). Disconnect one side of ROOM and REFERENCE tubing from fittings. Verify a reading of 0∇.005vdc. If out of specification, adjust ZERO potentiometer (R4) for 0.000vdc.
- 3) Verify system start LED (LED2) is off and MIN OUTPUT controller status LED is illuminated.

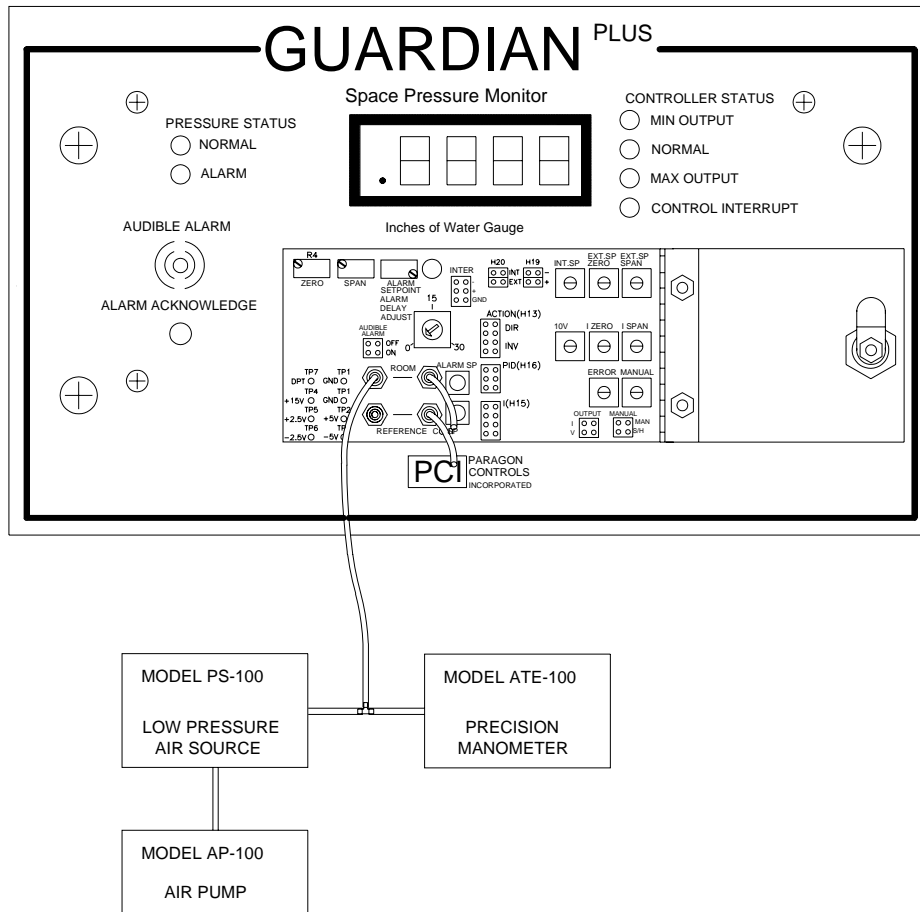


FIGURE 1.0 GUARDIAN PLUS PRE-STARTUP CHECK

4.0 CALIBRATION PROCEDURES

(NOTE):

- 1) Removal of Guardian Plus from the wall will be required to perform the following calibration procedure.
- 2) All voltage measurements will be performed with DMM (-) Probe attached to TP1.
- 3) Refer to Figure 1.0 for test set-up and Figure 2.0, 3.0 & 4.0 for test point and potentiometer locations.
- 4) Equipment needed:
 - 1) 4-1/2 Digit Multi Meter
 - 2) Precision Manometer
 - 3) Low Pressure Air Source

4.1 Power Supply

- 1) Turn system power (24 VAC) ON
- 2) Monitor TP2 and verify a reading of $+5.0 \pm .6$ vdc.
- 3) Monitor TP3 and verify a reading of $-4.5 \pm .6$ vdc
- 4) Monitor TP4 and verify a reading of $+15 \nabla .6$ vdc.
- 5) Monitor TP5 and verify a reading of $+2.5 \nabla .1$ vdc.
- 6) Monitor TP6 and verify a reading of $-2.5 \nabla .1$ vdc.

4.2 Input / Process Output & Display Scaling

(Note: To determine the output configuration (CURRENT or VOLTAGE), refer to the label on the back side of the access door)

- 1) With zero input pressure to the transducer -
 - a. Adjust R4 (ZERO) for a reading of $0.0 \pm .001$ VDC at TP7.
 - b. PROCESS OUTPUT ZERO:
 - CURRENT (**Uni-Polar Range**)- Adjust R89 (ZERO) for a reading of $4.0 \pm .01$ MA between J2 PROCESS (OUT+) and (GND) terminals.
 - CURRENT (**Bi-Polar Range**)- Adjust R89 (ZERO) for a reading of $12.0 \pm .01$ MA between J2 PROCESS (OUT+) and (GND) terminals.
 - VOLTAGE (**Uni-polar Range**)- Adjust R75 (ZERO) for a reading of $0.00 \pm .01$ vdc between J2 PROCESS (OUT+) and (GND) terminals.
 - VOLTAGE (**Bi-polar Range**)- Adjust R75 (ZERO) for a reading of $5.00 \pm .01$ vdc between J2 PROCESS (OUT+) and (GND) terminals.

- 2) With full scale pressure applied to the ROOM port (See label on back of access door) -
 - a. Adjust R10 (SPAN) for a reading of $1.00 \pm .001$ VDC at TP7.
 - b. OUTPUT SPAN:
 - CURRENT - Adjust R87 (SPAN) for a reading of 20.0ma between J2 PROCESS (OUT+) and (GND) terminals.
 - VOLTAGE - Adjust R84 (SPAN) for a reading of 10.00vdc between J2 PROCESS(OUT+)and (GND) terminals.
 - c. Adjust R38 (DISPLAY) for full scale value on the LED display.

- 3) Repeat steps 1 and 2 to verify that they meet specification tolerances. Large adjustments to either zero or span may result in a slight shift in the other adjustment.

4.3 Controller Output Scaling

(Note: All adjustments are made on the control board located under the access door.)

- 1) CURRENT OUTPUT ZERO:
 - a. Set H12 jumper to -5vdc if H13 is in the INV position or +5vdc if H13 is in the DIR position and verify controller status MIN OUTPUT LED is illuminated.
 - b. Adjust R79 (I ZERO) for a reading of 4.0ma between J2 CONT (OUT+) and (GND) terminals.

- 2) OUTPUT SPAN:
 - a. Set H12 jumper to +5vdc if H13 is in the INV position or -5vdc if H13 is in the DIR position and verify controller status MAX OUTPUT LED is illuminated.
 - b. CURRENT - Adjust R77 (I SPAN) for a reading of 20.0ma between J2 CONT (OUT+) and (GND) terminals.
 - VOLTAGE - Adjust R51 (10V) for a reading of 10.0vdc between J2 CONT (OUT+) and (GND) terminals.
 - c. Return H12 jumper to the original position.

5.0 CONTROLLER JUMPER SELECTIONS

5.1 Controller Action

(Note: All adjustments are made on the control board located under the access door.)

1) The controller action is determined by the jumper position of H13.

SELECTED ROOM PRESSURE	ACTION	H13 JUMPER SELECTION
Positive	Direct	DIR
Positive	Reverse	INV
Negative	Direct	INV
Negative	Reverse	DIR

TABLE 5.1 CONTROLLER ACTION MODIFICATIONS

5.2 Reset

1) Based on a field survey performed, the three (3) most commonly used reset rates have been selected by the factory. These rates are user selectable by positioning H15 jumper to the respective resistance on the controller board. The following table gives the jumper position, resistance value and time rate.

H15 JUMPER SELECTION	TIME RATE
1	40 Secs.
2	1.66 Min.
3	2.5 Min.

TABLE 5.2 RESET JUMPER SETTINGS

5.3 Inverse Derivative (1/D)

1) Inverse Derivative (1/D): All inverse derivative time rates have been computed for a 10% proportional band (factory set standard). These rates are user selectable by positioning H16 jumper to the respective resistance on the controller board. The following table gives the jumper position, resistance value and time rate.

H16 JUMPER SELECTION	TIME RATE
1	32 Sec.
2	1.1 Min.
3	1.9 Min.

TABLE 5.3 INVERSE DERIVATIVE JUMPER SETTINGS

5.4 Process Output

1) Process Output signal can be changed between voltage or current by positioning H5 jumper to I or V. The following table gives the jumper position and corresponding output selection.

H5 JUMPER SELECTION	OUTPUT SELECTION
I V	4-20 MA 0-10VDC

TABLE 5.4 OUTPUT SELECTION

5.5 External Controller Setpoint

1) The Guardian Plus can be set up for an External Controller Setpoint signal by positioning H20 jumper located under the access door to EXT. The factory default setup is for 4-20ma input but can be configured for 0-10vdc.

H20 JUMPER SELECTION	SETPOINT SELECTION
EXT INT	EXT. Setpoint INT. Setpoint

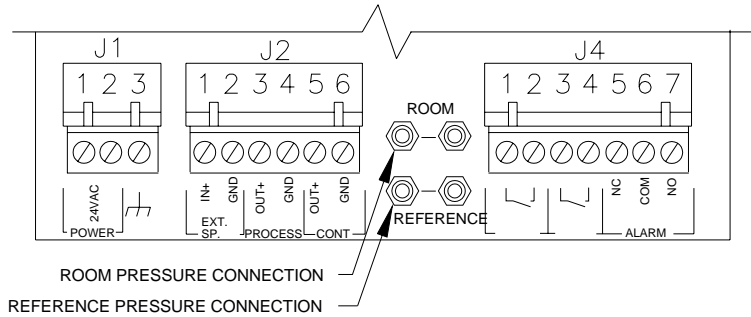
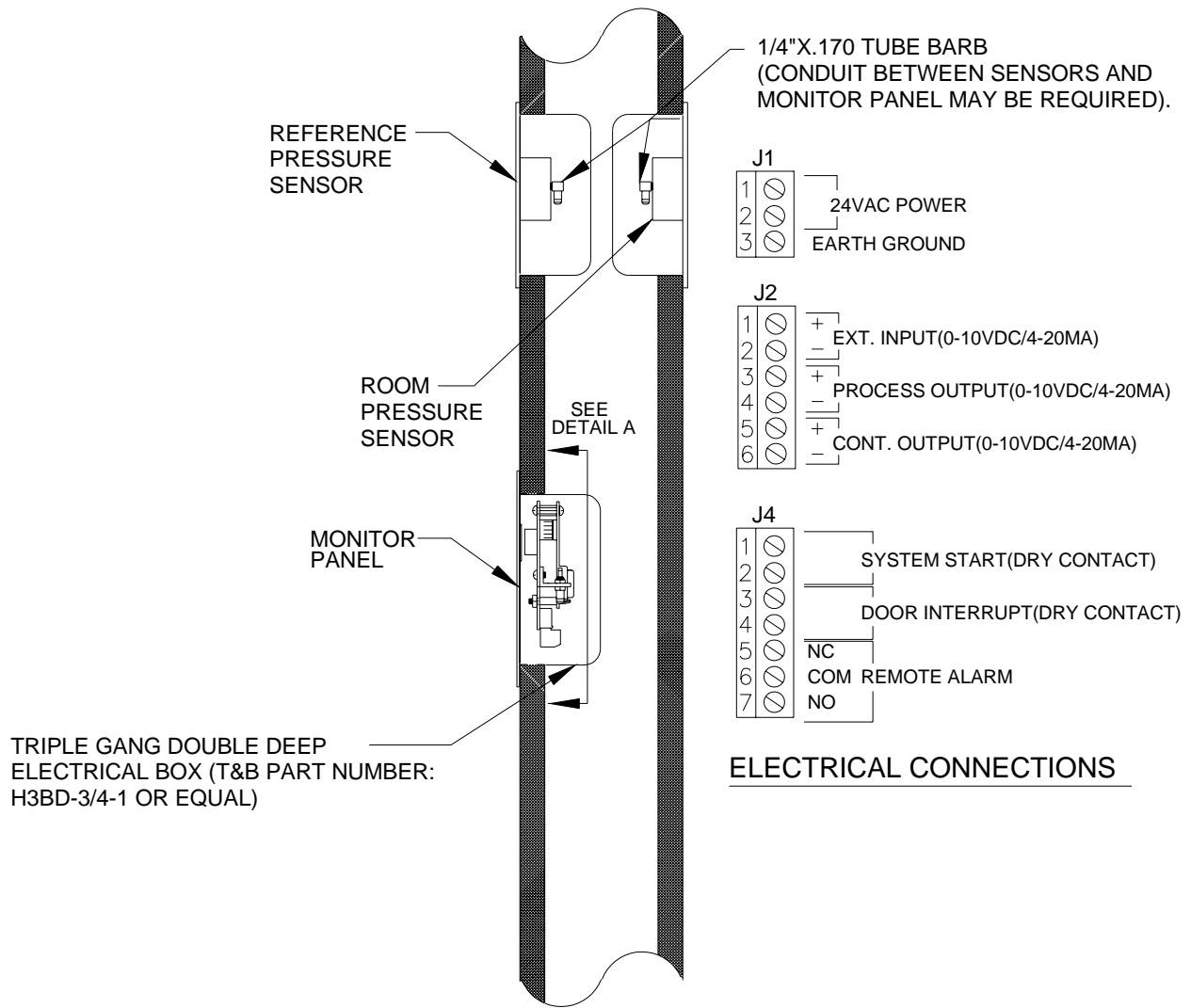
TABLE 5.3 SETPOINT CONFIGURATION

5.6 Controller Output

1) Controller Output signal can be changed between voltage or current by positioning H21 jumper to I or V. The following table gives the jumper position and corresponding output selection.

H21 JUMPER SELECTION	CONTROLLER OUTPUT SELECTION
I V	4-20 MA 0-10VDC

TABLE 5.6 CONTROLLER OUTPUT SELECTION



DETAIL A

FIGURE 2.0 FIELD CONNECTION LAYOUT

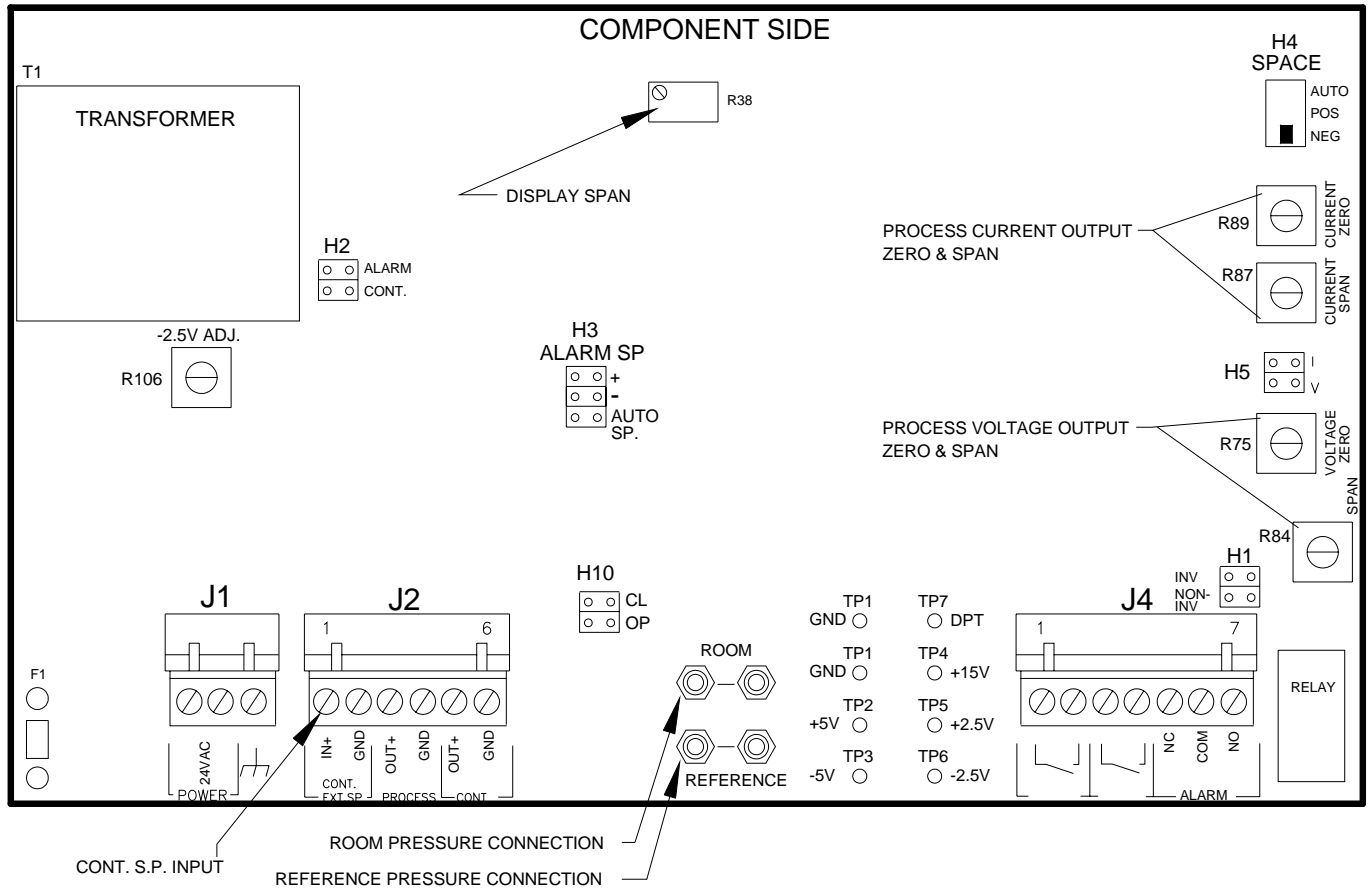


FIGURE 3 COMPONENT AND ADJUSTMENT LOCATIONS

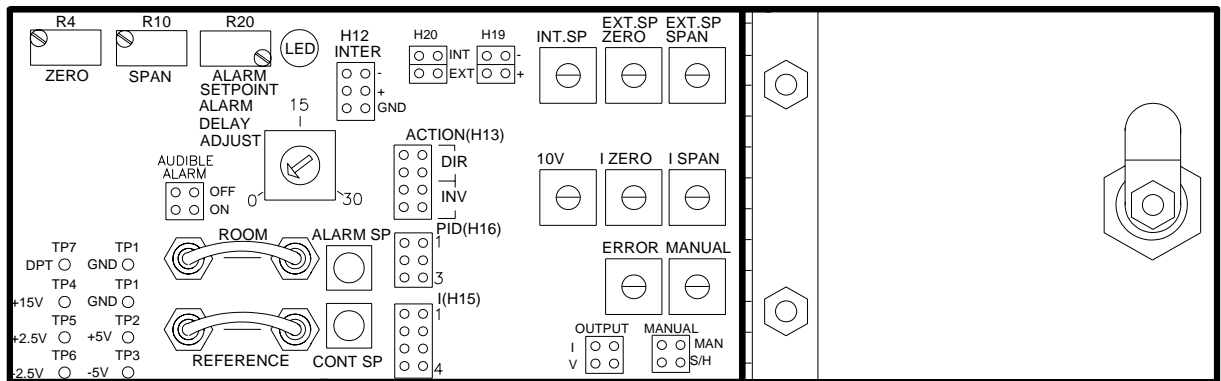


FIGURE 4 CONTROLLER COMPONENT AND ADJUSTMENT LOCATIONS