

# **MODEL 2008SDH**

## **CARBON DIOXIDE MONITOR**

### **Instruction Manual**



**# 990016**

VALTRONICS MODEL 2008SDH  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

5/11/11

**TABLE OF CONTENTS**

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
I.	INTRODUCTION	2
II.	DESCRIPTION	
	A. System	2
	Figure 1	2
	B. Power Supply	3
	C. Circuit Board	3
	Figure 2	4
	D. Gas Cell/Detector	5
	Figure 3	5
III.	INSTALLATION	
	A. Circuit Board	6
	B. Wiring	6
	C. Start-up Precaution	6
	Figure 4	6
IV.	OPERATION	7
	Figure 5	7
V.	SERVICING	
	A. Zero Adjustment	8
	B. Span Adjustment	8
	C. Scale Data Chart	9
	D. Span Calibration Kits	10
	Figure 6	10
VI.	SPECIFICATIONS	11
VII.	TECHNICAL NOTES	12
	Figure 7	12
	Figure 8	13
VIII.	ASSISTANCE/TECH SUPPORT	14
IX.	WARRANTY	14

VALTRONICS MODEL 2008SDH  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

**I. INTRODUCTION**

The Model 2008SDH is a gas detection system designed to determine the carbon dioxide content of the air for various monitoring applications. It senses and measures carbon dioxide (full-scale ranges are available from 3% to 100%) and provides a linear output of 0-1VDC and 4-20mA as a function of carbon dioxide concentration.

The electro-optics gas sensor contains a 1/8" hose barb to provide gas flow into the optical path, where it is analyzed by NDIR (Non-Dispersive Infrared) method.

**II. DESCRIPTION**

**A. System (See Figure 1)**

The Model 2008SDH consists of a printed circuit board with the electro-optics gas sensor. The board contains all the power supply and signal-processing components. Model 2008SDH-P is the same as Model 2008SDH with a low-profile terminal block and 90° hose-barbs.

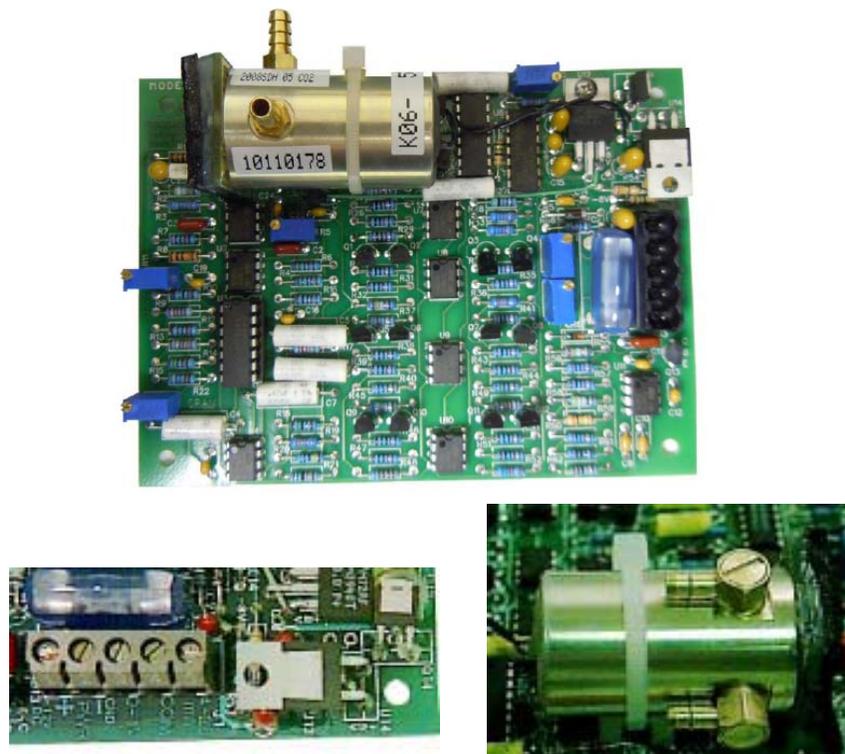


FIGURE 1 (Model 2008SDH and 2008SDH-P)

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

**B. Power Supply**

The power supply converts the applied 12VDC into various DC voltages to operate the instrument's electronics. It consists of diode protection against reverse polarity of the 12VDC input power and solid-state regulators to provide constant voltages for operation of various electronic circuits.

**C. Circuit Board (See Figure 2)**

All circuit components are mounted on a glass-epoxy printed circuit board. This board includes the gas detection amplifier, electronic components, integrated circuits, potentiometers, terminal block connector, and fuse.

1. Two multi-turn slotted shaft potentiometers for user-adjustment are:
  - a) ZERO: to adjust the instrument's output to read zero voltage in the absence of carbon dioxide.
  - b) SPAN: to adjust the sensitivity of the instrument to the required voltage value to produce a correct reading of a known gas sample.
2. Two additional potentiometers on the board marked "4mA" and "20mA" are factory set and should not require adjustment.
3. External connections for input power and output for voltage and current are provided at connector J1. The connector has a row of screw clamp terminals which will accept bare stripped wire, #18 awg or smaller.
4. A 1-amp fuse adjacent to J1 for DC input protection.

VALTRONICS MODEL 2008SDH  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

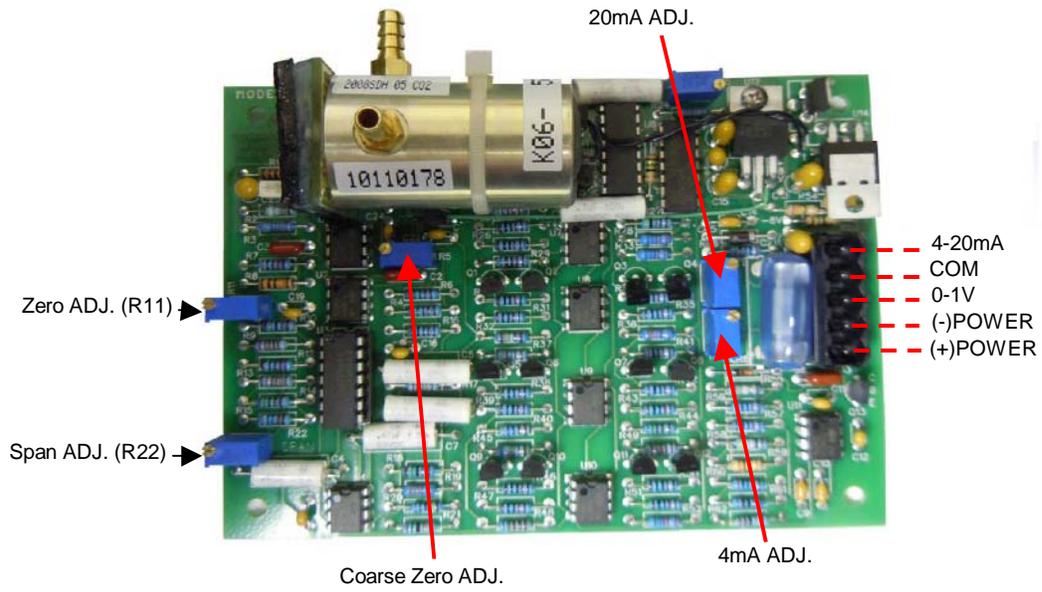


FIGURE 2

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

**D. Gas Cell/Detector** (see Figure 3)

The board-mounted sensor contains a pulsed infrared source, a gas sample cell, optical filter and detector. The detector provides an electronic signal that is converted into a gas concentration value (voltage/current output).

Gas detection by the infrared method is based on the principle that most gases absorb infrared energy at a characteristic frequency. In this instrument, a broadband infrared source emits energy that is then filtered to produce a narrow range of frequencies characteristic of the carbon dioxide absorption spectra. The band pass filter is chosen to match a strong absorption band of carbon dioxide, while avoiding absorption bands from other gases that may be present. Any carbon dioxide in the gas sample cell selectively absorbs energy reaching the detector. This change in energy is detected, amplified and sent to the signal-processing portion of the system.

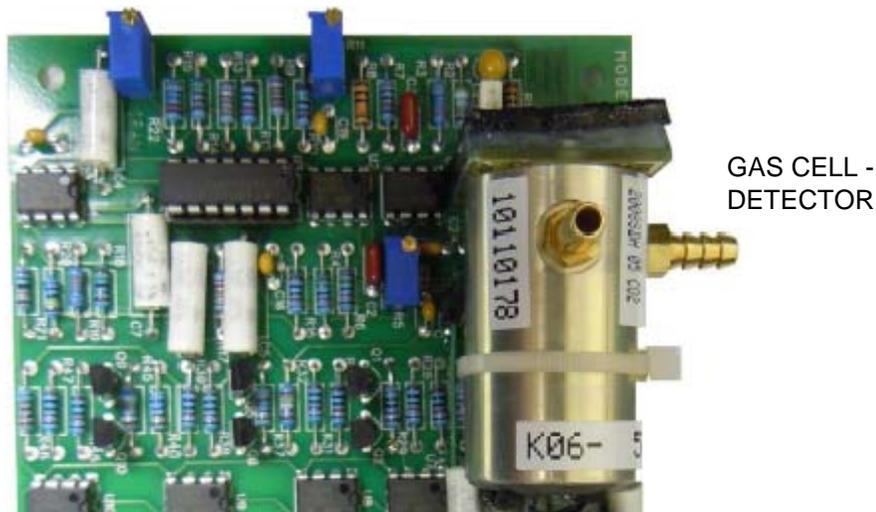


FIGURE 3

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

### III. INSTALLATION

#### A. Circuit Board

Place the unit on a flat mounting surface in the area where the presence of carbon dioxide is to be monitored or controlled. Mount the board on stand-offs using screws through holes in the corners of the board.

#### B. Wiring (See Figure 4)

The J1 connections by number are as follows:

1	Positive	12VDC Power Input
2	Ground	Common / Return for 12VDC
3	+	0-1VDC Output
4	Ground	Common / Return for 4-20mA and 0-1VDC
5	4-20mA	4-20mA Output

#### C. Start-up Precaution

1. Before applying power and placing the unit into operation, insure that the wiring is correct.
2. Do not install sensor or interface cable near transformers, fans or power line-cords.
3. Make sure that the 12VDC power supply (11 to 16VDC) has at least a 0.5 amp capacity. The unit does not require a regulated supply.
4. A dedicated power supply will also help avoid any ground-loop problems with recorders or control circuits connected to the signal output of the unit.
5. Separate wires are required for both the Common 4-20mA output and the Common 0-1V output (if using both).

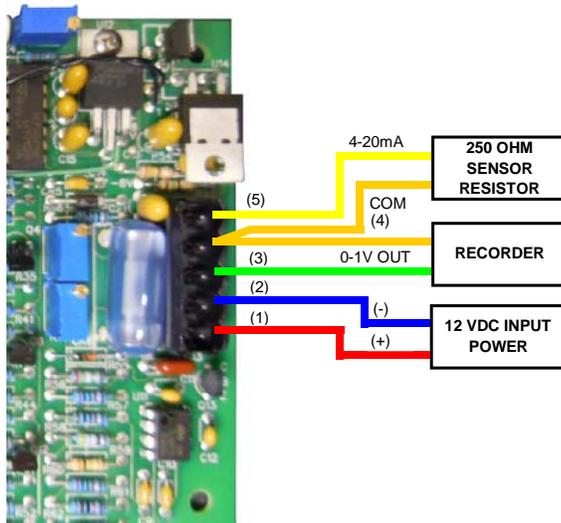


FIGURE 4

### IV. OPERATION (See Figure 5)

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

1. Apply 12VDC power to the unit and allow 5 minutes for warm-up.
2. Connect a multimeter to the 0-1V output signal, pins 3 and 4 of J1. With “outside” fresh air, assumed to contain between 300 to 400 ppm CO<sub>2</sub>, the reading should be between 0.000 to 0.020 volts.
3. Apply CO<sub>2</sub> gas through the gas cell – an amount equal to or lower than the “full-scale” of the unit. Example: if you are checking a 2008SDH 20% unit, flowing 20.00% gas through the gas cell at a flow rate of about 300ml/min. should produce a reading of 1.00V ± .050. 10.00% gas should produce a reading of 0.5V ± .025.
4. If the readings are off, refer to Section V (SERVICING) for instructions on how to re-calibrate the unit.

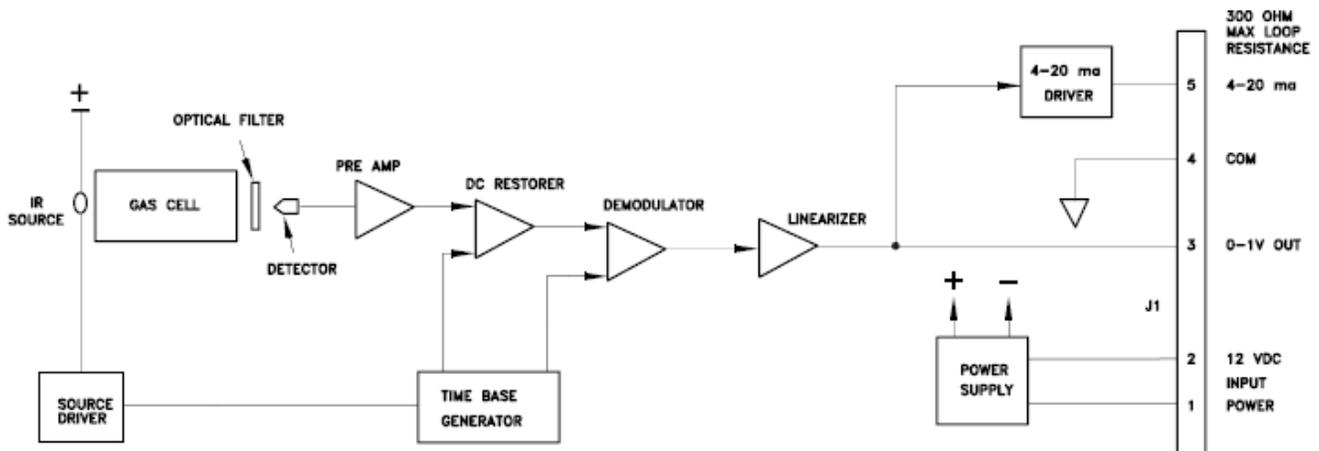


FIGURE 5

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INSTRUCTION MANUAL

## V. SERVICING

### A. Zero Adjustment

If the accuracy of the unit is in doubt, a zero check can be made by using a cylinder of Nitrogen or CO<sub>2</sub>-free air.

The following procedure is used with a Span Gas Calibration Kit (see Section D) or equivalent.

1. Remove protective cap from the top of the nitrogen cylinder. Push and thread pressure regulator valve onto cylinder outlet. Nitrogen is **ZERO** gas. Fresh air is about **0.04% (400ppm)** CO<sub>2</sub>.
2. Connect plastic tubing from the pressure regulator outlet to the flow meter inlet (bottom connection of flow meter).
3. Connect plastic tubing from the flow meter outlet to the inlet of the gas cell.
4. Before applying power, connect a voltmeter to the 0-1V signal output.
5. Verify that the unit has had at least a 5-minute warm-up before attempting any adjustments.
6. Make sure the flow meter is in a vertical/upright position. Open the regulator flow valve slowly while observing the flow meter.
7. Adjust the flow to between 250 and 350 ml/min. (ml = cc), or about .5 to .7 SCFH (Standard Cubic Feet per Hour).
8. After 3 minutes of continuous nitrogen flow, the signal output should read 0 VDC  $\pm$  10 mV. Perform a zero adjustment, if required.
9. Depending on the signal output reading, turn the Fine Zero Adjustment (R11) clockwise for an upscale adjustment or counter-clockwise for a downscale adjustment. The process will reset the zero reading.
10. Turn off the regulator flow valve and remove the pressure regulator valve from the nitrogen cylinder.

### B. Span Adjustment

**Note:** It is not normally necessary to adjust the span on the Model 2008SDH. Once the span has been properly adjusted at the factory, it does not require adjusting. All that is normally required is a zero check or adjustment.<sup>1</sup>

If the span adjustment is in doubt, please observe the following guidelines:

1. Verify the zero set point (reference the previous section).
2. Replace the nitrogen cylinder with a cylinder of the desired concentration, usually mid or near full-scale, of carbon dioxide.

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<sup>1</sup>NOTE: Gas calibration should be done a minimum of once every (6) six months (at least for **ZERO** calibration). If you keep a calibration logbook and record how much zero & span drift occur, you can verify if the calibration interval is correct. You may find that **ZERO** calibration every 6 months and **SPAN** once a year is sufficient to maintain accuracy.

NOTE: Refer to product spec sheet for **ZERO & SPAN** adjustment locations.

VALTRONICS MODEL 2008SDH  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

3. Open the regulator flow valve slowly while observing the flow meter. The flow meter should read between 100 and 300 ml/min.
4. Allow the gas sample to flow through the unit for approximately 60 seconds before any adjustments are made. Perform a span adjustment if required.
5. Refer to the scale data chart (Section C) for the corresponding output voltage that matches the sample gas concentration. Depending on the signal output reading, turn the Span Adjustment (R22) clockwise for an up-scale adjustment or counter-clockwise for a downscale adjustment. This process will reset the span.
6. Turn off the regulator flow valve and remove the pressure regulator from the cylinder.

This completes the checkout and adjustments procedures.

### C. Scale Data Chart

<b>20</b>	<b>15</b>	<b>10</b>	<b>5</b>	<b>0-1V OUT</b>	<b>mA OUT</b>
<b>% GAS</b>	<b>% GAS</b>	<b>% GAS</b>	<b>% GAS</b>		
1.0	0.75	0.5	0.3	<b>0.050</b>	<b>4.8</b>
2.0	1.50	1.0	0.5	<b>0.100</b>	<b>5.6</b>
3.0	2.25	1.5	0.8	<b>0.150</b>	<b>6.4</b>
4.0	3.00	2.0	1.0	<b>0.200</b>	<b>7.2</b>
5.0	3.75	2.5	1.3	<b>0.250</b>	<b>8.0</b>
6.0	4.50	3.0	1.5	<b>0.300</b>	<b>8.8</b>
7.0	5.25	3.5	1.8	<b>0.350</b>	<b>9.6</b>
8.0	6.00	4.0	2.0	<b>0.400</b>	<b>10.4</b>
9.0	6.75	4.5	2.3	<b>0.450</b>	<b>11.2</b>
10.0	7.50	5.0	2.5	<b>0.500</b>	<b>12.0</b>
11.0	8.25	5.5	2.8	<b>0.550</b>	<b>12.8</b>
12.0	9.00	6.0	3.0	<b>0.600</b>	<b>13.6</b>
13.0	9.75	6.5	3.3	<b>0.650</b>	<b>14.4</b>
14.0	10.50	7.0	3.5	<b>0.700</b>	<b>15.2</b>
15.0	11.25	7.5	3.8	<b>0.750</b>	<b>16.0</b>
16.0	12.00	8.0	4.0	<b>0.800</b>	<b>16.8</b>
17.0	12.75	8.5	4.3	<b>0.850</b>	<b>17.6</b>
18.0	13.50	9.0	4.5	<b>0.900</b>	<b>18.4</b>
19.0	14.25	9.5	4.8	<b>0.950</b>	<b>19.2</b>
20.0	15.00	10.0	5.0	<b>1.000</b>	<b>20.0</b>

**How to use this chart:**

- 1) Find the full-scale gas concentration of the unit you are calibrating (top row)**
- 2) Find the calibration gas concentration you are using under the "% Gas" column**
- 3) Go across to find the correct voltage (and/or current) for that span gas**

VALTRONICS MODEL 2008SDH  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

**D. Span Calibration Kits (See Figure 6)**

Carbon dioxide calibration kits are available from VTI-Valtronics (see information below), or you may return your unit for re-calibration.

**CO2 "Flow Thru" Field Calibration Kits**

<u>Gas %</u>	<u>Part #</u>
0.1%	030252
0.5%	030340
1.0%	030341
2.0%	030716
5.0%	030342
10.0%	030785

**Replacement Gas Cylinders**

<u>Gas %</u>	<u>Part #</u>	<u>Gas %</u>	<u>Part #</u>
100% N2	0616	1.0% CO2	0836
.1% CO2	0615	2.0% CO2	0856
.2% CO2	0610	3.0% CO2	1069
.3% CO2	1070	5.0% CO2	0612
.5% CO2	0611	10.0% CO2	0837
		15.0% CO2	1068

Each kit contains: 2 Disposable 6D size cylinders of calibration gas, reusable regulator with on/off valve, tubing and twin-pack carrying case.

For ordering information contact Valtronics Sales Department - Phone: (209) 754-0707 • FAX (209) 754-0104 • e-mail: [vti@val-tronics.com](mailto:vti@val-tronics.com) • <http://val-tronics.com>



FIGURE 6

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

## VI. SPECIFICATIONS

- **Method:** N.D.I.R. (Non-Dispersive Infra-red) Sample-Draw type gas sampling
- **Gas Sample Hose Barbs:** Designed for 1/8 inch I.D. tubing and flow rates between 0.3 and 0.5 liters/minute
- **Gas:** Carbon Dioxide (CO<sub>2</sub>)
- **Available Ranges:** 0-5%, 0-10%, 0-15%, and 0-20%
- **Accuracy:** ± 5% of reading from 1/2 scale to full scale and ± .025V from 0.0 % to 1/2 scale
- **Repeatability:** ± 1% of full scale (using the same gas sample and assure zero)
- **External Power Source:** 12 VDC @ .6A max. (11.0 to 16.0 VDC absolute min/max)
- **Power Consumption:** Less than 3 watts @ 12.0 VDC (2.4 watts typical/7.2 watts peak)
- **Output Signals:** Standard output connector is a Phoenix 5-pin male connector with a mating terminal block (optional low-profile terminal block is available: model 2008SDH-P).
  - Voltage Output: 0 to 1 volt = 0 to full-scale CO<sub>2</sub>
  - Current Output: 4 to 20 mA = 0 to full scale CO<sub>2</sub>
- **Zero Drift at Constant Temperature:** Less than 2% of full scale per 24 hours (random, not cumulative)
- **Zero Noise at Constant Temperature:** Less than 10 mV peak to peak, measured at V out during any 20-second period.
- **Zero Drift due to Ambient Temperature:** Less than 0.5% of full scale per degree Centigrade
- **Operating Temperature Range:** 0 to 50°C (32° to 122°F)
- **Storage Temperature Range:** -40° to +70°C (-40° to +158°F)
- **Operating Humidity Range:** 5 to 95% Relative Humidity (non-condensing)
- **Weight:** Less than 0.5 pounds (0.23 kilograms)
- **External Dimensions:** 3.9" x 5" x 1.5"

VALTRONICS MODEL 2008SDH  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

**VII. TECHNICAL NOTES**

1. How to avoid Ground Loops: As seen in figure 7, you should keep the power supply circuit and the signal circuits separated. Even though the Power common and the Signal common are tied together on our printed circuit board, you must run separate wires for each one and make sure that the Power common wire is a large wire gauge and as short as possible. The object is to prevent the pulsed power supply current from getting into the signal path. The power supply current pulses, created by the infrared source turning on and off every 1.008 seconds, will follow the path of least resistance (represented by  $R_{W1}$  and  $R_{W2}$ , the resistance of the wires). The current flowing through the wire resistance creates a voltage drop (current times resistance) that would appear to be noise if the two loops were connected together. This is classically called a **ground loop** problem.
2. EMI (Electro-Magnetic Interference): The infrared detector and its amplifiers are sensitive to strong magnetic fields that are building and collapsing at 50 Hz and 60 Hz rates. Examples of this would be devices like fan motors, florescent light fixtures, or AC solenoids that are within a few centimeters of the 2008. The magnetic field induces a signal that beats up and down at a period of about 8 to 15 seconds. This can be easily avoided by keeping the unit away from the sources of the strong fields. If you cannot avoid being close to an EMI source, then place an earth grounded steel shield between the EMI source and the 2008.

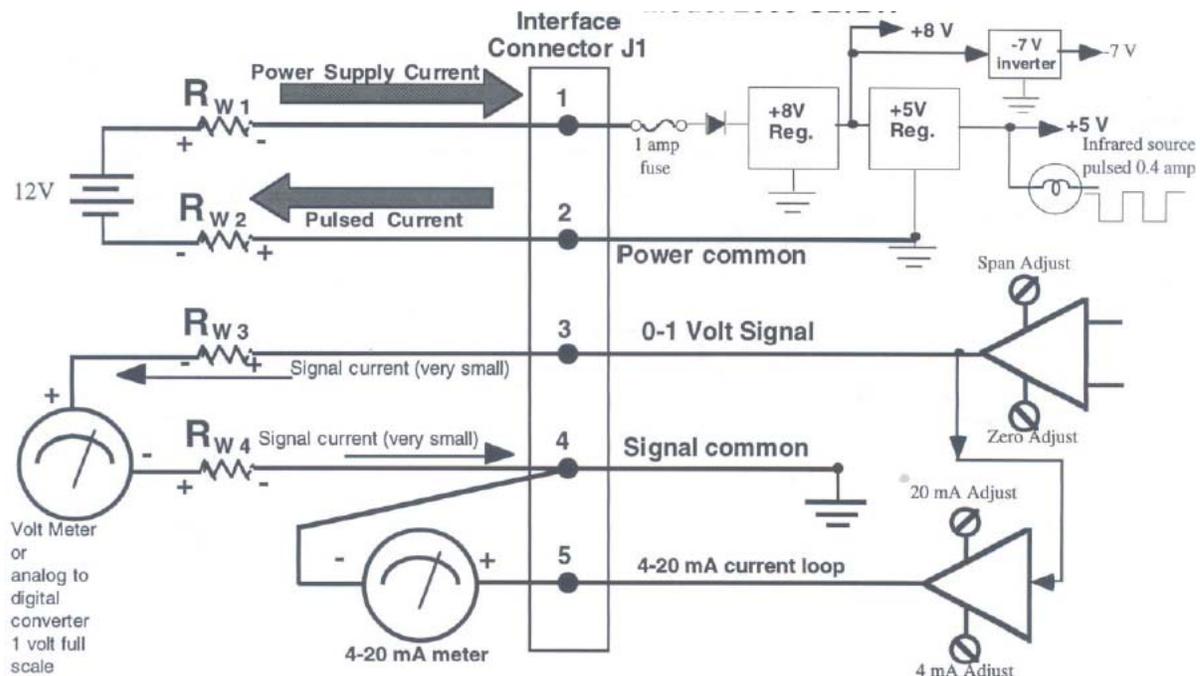


FIGURE 7

3. See Figure 8. This setup improves Zero Stability and sensor life.

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

Recommend the use of a [Hydrophobic Filter #0508](#) in front of gas cell flow.

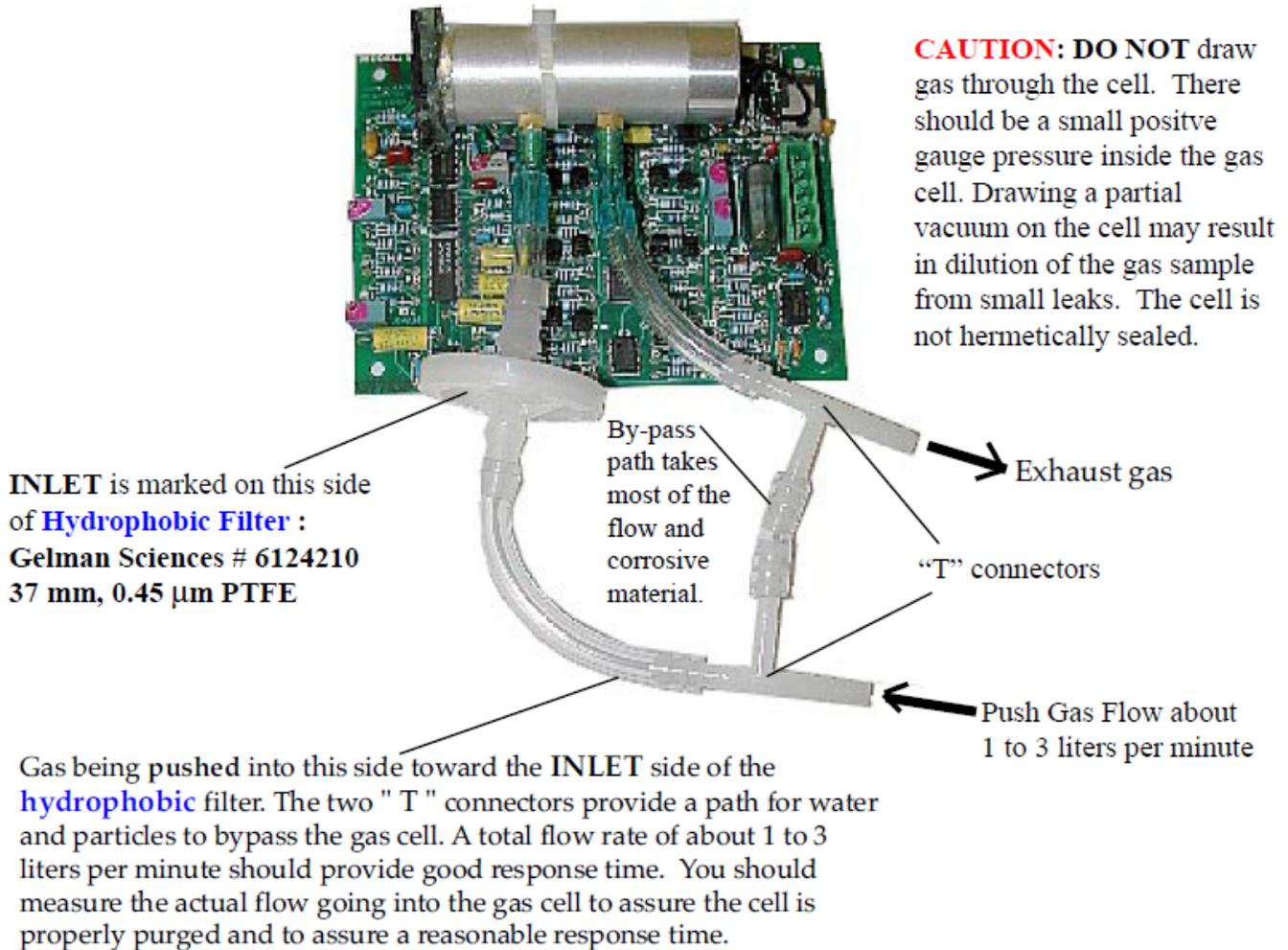


FIGURE 8

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CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

## VIII. ASSISTANCE OR TECHNICAL SUPPORT

Before calling for assistance or technical support, please refer to the technical note above. If you still need help, follow the instructions below.

When calling, please know the purchase date, the complete model and serial number of the unit. This information will help us to better respond to your request.

If you need to send the unit to us for repair, please contact the sales department. You will be issued an RMA (Returned Materials Authorization) number and instructions on how to return the unit. Please allow 2 – 4 weeks turnaround time, depending on the problem.

Phone: (209) 754-0707 • FAX (209) 754-0104 • e-mail: vti@val-tronics.com

## IX. WARRANTY

Valtronics warrants that the original items furnished under this warranty will be free from defects in material and workmanship. This warranty is exclusive and in lieu of all other warranties whether written, oral, or implied (including any warranty of merchantability of fitness for purpose). If it appears within 12 months from the date of invoice that this material does not meet the warranty specified above, and you notify us of this promptly, we shall correct any defect or any nonconformancy to the specifications, either (at our option) by repairing any defective part of parts which are returned to us freight prepaid or by making available at your plant (via lowest freight rate) a repaired or replacement material or at Valtronics option to credit the customer the original purchase of the item. Our liability to you arising out of the supplying of this material, or its use, whether on warranty, contract, or negligence, shall not in any case exceed the cost of correcting defects in the material, as herein provided, and upon the expiration of the warranty period all such liability shall terminate. The foregoing shall constitute your sole remedy and our sole liability. **In no event shall we be liable for special or consequential damages.** This warranty does not include abuse of malicious damage.

If equipment returned during the warranty period is found to have nothing wrong with it, there will be a \$198.00 handling charge. There is a minimum of a \$198.00 charge for equipment returned for out of warranty repair.

Please call for an RMA (Return Material Authorization) number before sending any equipment back. Items returned for repair must be accompanied by a purchase order. Equipment repair not covered by warranty will be billed on material and labor basis. There will be an additional 60% “end-user” charge for customers who did not purchase the equipment directly from Valtronics. Equipment must be sent to Valtronics prepaid and return transportation will be billed as part of the repair. Valtronics will not be responsible for damage due to improper packaging of the item returned for repair.