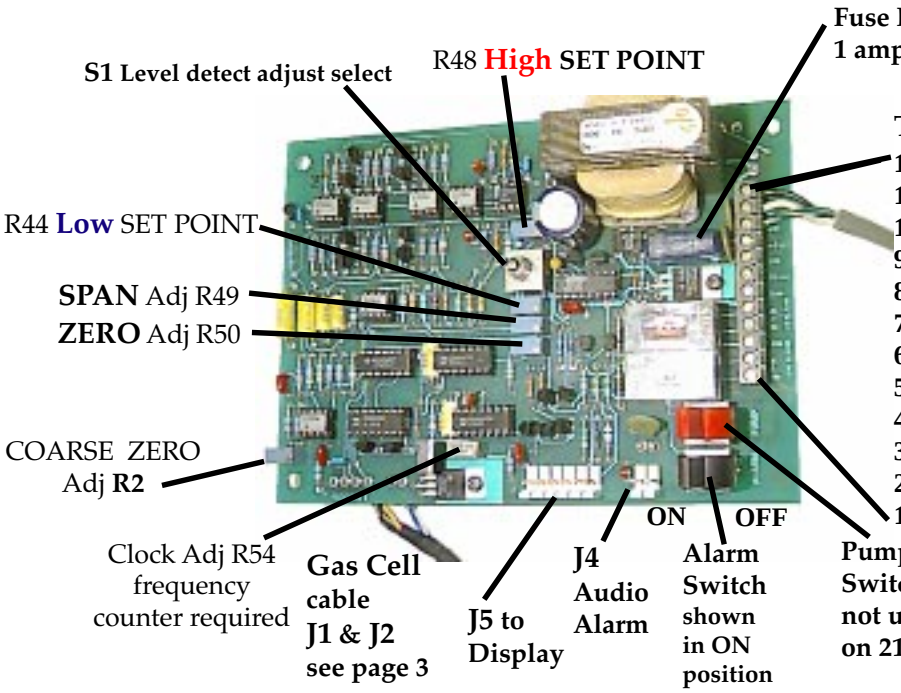
Application Note: A46

Model **2156** and **2166** printed circuit board adjustments and terminal connections

Model **2156** and **2166**
Processor Printed Circuit Board



Caution: Note jumper configuration for either 115 (**JP1 & JP2**) or 230 VAC (**JP3 only**) operation page 2.

Terminal Block TB1

12. AC power High
11. AC power neutral
10. Earth Ground
9. 0 to 5 volt signal out
8. Signal common
7. 4-20 mA current loop out
6. High Alarm Common(relay contact)
5. High Alarm N.C. (relay contact)
4. High Alarm N.O. (relay contact)
3. Low Alarm Common(relay contact)
2. Low Alarm N.C. (relay contact)
1. Low Alarm N.O. (relay contact)

R73 adjusts the **IR** source voltage (**J1**) for **3.0** volts on Rev-C boards. Make **ZERO adjustments** very slowly. There is about a 5 to 10 second delay in the response. See Application Note **A67** for spare part info and Application Notes **A24** & **A73** (Model 2166) & **A35** (Model 2156) for gas calibration info. **DO NOT** adjust the **COARSE ZERO** R2 unless you run out of adjustment on the **ZERO** Adj **R50**. If necessary, center the **ZERO** adj R50 (20 turn pot) and very SLOWLY adjust the COARSE ZERO R2 to bring the 0 to 5 volt output close to 0.00 volts. This should be done with nitrogen in the gas cell. If you do not have any nitrogen, **fresh air** contains about 400 ppm (0.04% by volume) **CO_2** , You could adjust the ZERO for the reading shown on your units' scale data chart for 400 ppm or 0.04%. For example, a **0.2%** full scale unit should have a 0 to 5 volt output of **1.00 volt** for 0.04% CO_2. A **0.5%** full scale unit should have a 0 to 5 volt output of **0.40 volt** for **0.04%** CO_2. A **1%** full scale unit should read only about **0.20 volt** for 0.04% CO_2 fresh air. A **3%** full scale unit should read only about **0.07 volt** for 0.04% CO_2 fresh air. Please remember that outside air may not be fresh and your breath may contain about 3% CO_2. **DO NOT** adjust the **SPAN** without a gas calibration kit. The SPAN is usually very stable. Gas calibration should be done every 6 months and the filters on the Model 2166 inspected at least every month. See **Application Note A77** for details about **Rev-C** versus Rev-B PC boards and pictures of the **TP2** waveform.

The **Level Detect SET POINTS** may be adjusted or viewed by switching **S1** in the direction of the **SET POINT** potentiometer you want (**right** for the **High** SET POINT). The display will read the SET POINT level in % CO_2. Adjust **R48** for the **High Level** you want and **R44** for the **Low Level** anywhere from 10% of full scale to full scale. Note: a 2000 ppm full scale unit would be alarming on fresh air if you set one at 200 ppm. The **Alarm Switch** is shipped in the OFF (toward the word ALARM on board) position and the **Pump Switch** (not used on 2156) is shipped in the ON position (away from the word PUMP on board). The adjustment of the SET POINTS WILL **NOT** EFFECT the sensors 0 to 5 volt nor 4-20 mA outputs.

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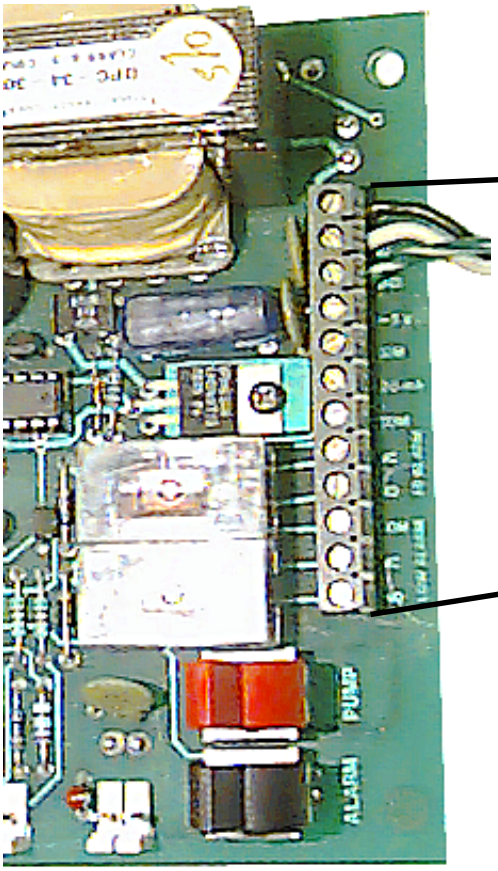
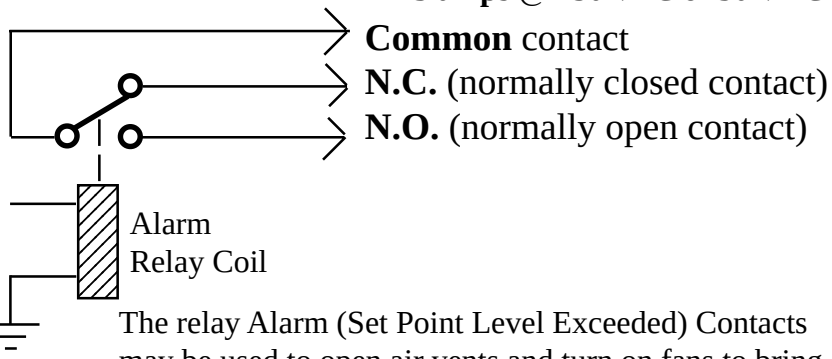


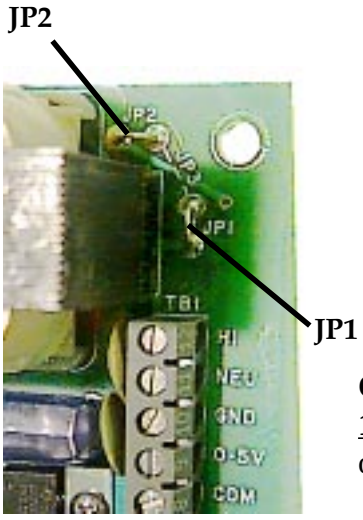
Terminal Block TB1

12. AC power High
11. AC power neutral
10. Earth Ground
9. **0 to 5 V** signal out
8. **Signal common**
7. **4-20 mA** current loop out
6. High Alarm **Common** (relay contact)
5. High Alarm **N.C.** (relay contact)
4. High Alarm **N.O.** (relay contact)
3. Low Alarm **Common** (relay contact)
2. Low Alarm **N.C.** (relay contact)
1. Low Alarm **N.O.** (relay contact)

Caution: Relay contacts **max rating**:
3 amps @ 250 VAC or 30 VDC



The relay Alarm (Set Point Level Exceeded) Contacts may be used to open air vents and turn on fans to bring in more fresh air. A typical example would be to use the Low Level Set Point adjusted to 0.5% CO_2 to bring in fresh air by connection 115 VAC to the Common of Low Alarm and the Fan Motor than brings in fresh air to the Low Alarm N.O. contact. The High Level Set Point could be adjusted to 1.0 % CO_2 and its N.O. contact used to actually set off an alarm.



Caution: Note jumper configuration for either **115 VAC** (**JP1 & JP2**) or **230 VAC** (**JP3 only**) operation.

The Model **2156** & **2166** have linear **0-5V** & **4-20 mA** outputs

Note: The **4** to **20 mA** output is driven by the **0** to **5 volt** output.

See the specification sheet for the output data table for the specific full scale you have.
Since the outputs are linear, it is easy to calculate what the ouput should be.

Examples: A full scale of **3**% **CO_2** equal to **5.00** ±0.25 **volts** and **20.0** ±0.8 **mA**
1.5% **CO_2** would give **2.50** ±0.125 **volts** and **12.0** ±0.4 **mA.**

A full scale of **0.5**% **CO_2** equal to **5.00** ±0.25 **volts** and **20.0** ±0.8 **mA**
0.25% **CO_2** would give **2.50** ±0.125 **volts** and **12.0** ±0.4 **mA**

See schematic **910081**.
J1 carries the detector and temperature sensor signals.
Pin 1 is the **Detector** signal with respect to pin 4 signal common.
Pin 2 is the AD592 **temperature** signal which is a current source of 0.298 mA at 25°C & 0.001 mA/°C
Pin 3 is **+12 V**DC
J2 connects the switched **3.0 V**DC to the **IR** source.

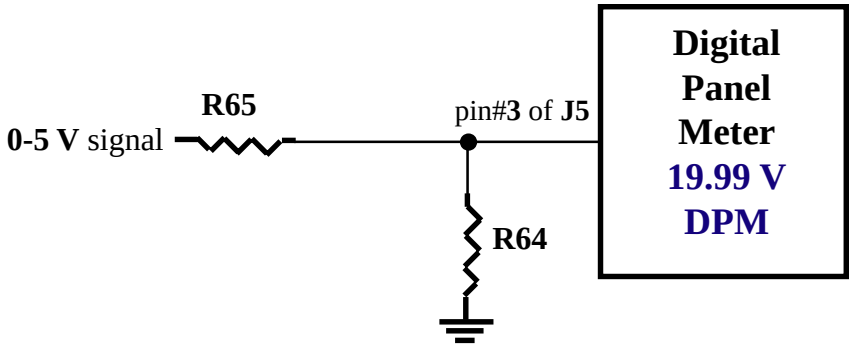
J4 has the audio alarm output signal on pin 2 and 12 VDC on pin 1.

J5 has the following outputs that goes to the Digital Panel Meter (see **page 4**) :
pin #
1. signal common (gnd)
2. 1.5K R65 to common for power LED (**Green**)
3. Analog signal from R64/R65 voltage divider (see page 4).
4. Low Level Detect Indicator (**Yellow**)(switch gnd via 1.5K R61)
5. **+5 VDC** from U16 (7805 regulator) for LED Digital Panel Meter.
6. High Level Detect Indicator (**RED**) (switch gnd via 1.5K R62)
7. **+12 VDC** for LED Indicator anodes.

Application Note: A46

Below is a table that shows how the digital panel meter (a **19.99 V** full scale **voltmeter**) reads the 0 to 5 volt output signal through a resistive voltage divider consisting of **R64** and **R65**. The voltage going into the meter is taken across **R64** so the ratio of **R64** divided by the sum of **R64** plus **R65** times 5 volts equals the full scale voltage that the digital panel meter (DPM) will see. The DPM gets this voltage via J5 pin # 3 with respect to pin# 1 signal common. This analog signal voltage changes to the SET Point level when the S1 toggle switch is thrown. See special notes below for the 2166-J with 4 & 1/2 digits.

Model 2156 / 2166 Meter voltage divider Resistors R64 and R65							
Meter is a **DMS-30PC-2** 3&1/2 digit DPM with 19.99V FS				**Full Scale**			
%CO2	**R64 KΩ**	**R65 KΩ**	**R64/(R64+R65)**	**Meter volts**	**Display**		Decimal Pt jump
0.2	2.00	3.01	0.3992	**1.996**	**0.200**	leading O not displayed	pin#**6** DP1
0.3	3.01	2.00	0.6008	**3.004**	**0.300**	leading O not displayed	pin#**6** DP1
0.5		0.10		**5.000**	**0.500**	leading O not displayed	pin#**6** DP1
1.0	1.00	4.02	0.1992	**0.996**	**1.00**		pin#**5** DP2
1.5	1.50	3.48	0.3012	**1.506**	**1.50**		pin#**5** DP2
2.0	2.00	3.01	0.3992	**1.996**	**2.00**		pin#**5** DP2
3.0	3.01	2.00	0.6008	**3.004**	**3.00**		pin#**5** DP2
5.0		0.10		**5.000**	**5.00**		pin#**5** DP2
10.0	1.00	4.02	0.1992	**0.996**	**10.0**		pin#**4** DP3
15.0	1.50	3.48	0.3012	**1.506**	**15.0**		pin#**4** DP3
20.0	2.00	3.01	0.3992	**1.996**	**20.0**		pin#**4** DP3
3000 ppm -J	3.01	2.00	0.6008	**3.004**	**3004**		
Model **2166-J** with 4& 1/2 digit DPM			**No decimal pt jumper & no jump pin 7 to 8**				
Revised 7/30/99	Meter is **DMS-40PC-2-RL** is a **19.999** volt meter						



Note: The Model 2166-J has a **4 & 1/2 digit display** DMS40PC-2-RL showing connections comming from J5. Note there is NO JUMPER from pin 7 to 8 (two lowest pins on the right hand connector shown) See drawing #030416 and schematic 910081.

DMS-30PC Panel Meter