

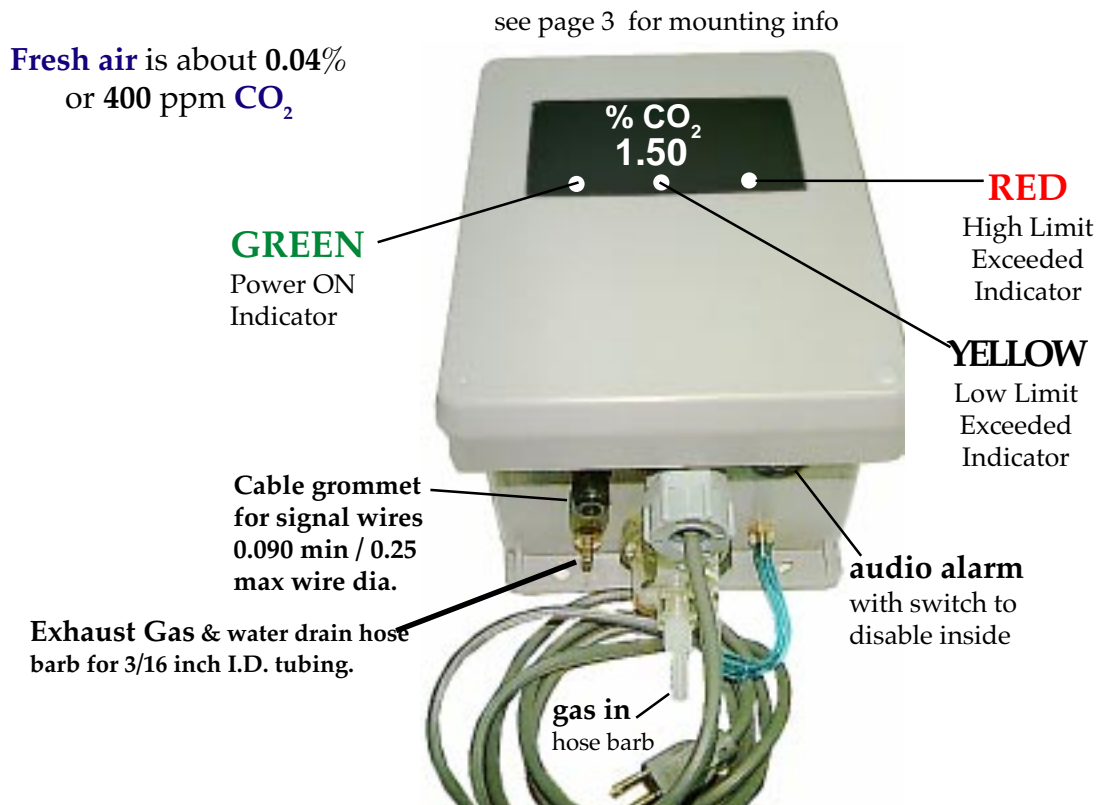
Carbon Dioxide Monitor

Model 2166 1.5% CO₂

Features:

- Complete self contained units
- Non dispersive infrared (NDIR) technology
- **Low Cost** gas calibration kit available
- Fast warm-up
- **Linear** 0-5 V and 4-20 mA outputs
- Dual level detect set points and relays
- **YELLOW** & **RED** level exceeded indicators
- Cost effective - High quality
- Sample draw system with pump switch for calib.
- Solid state throughout - linear outputs
- Humidity and moisture resistant
- Dust-tight water resistant fiberglass enclosure
- **Digital** display with 0.56 inch red LED display
- Built-in **Audio Alarm** beeps at low, on at high

Model 2166 1.5% (15,000 ppm) CO₂



Overall Clearance: 5 x 7.5 x 13 inches including the water trap and 1/8" hose barb

Application:

- Greenhouses
 - Mushroom Farms
 - Wineries
 - Breweries
 - Food Processing
 - with CO₂ Blasters
- The VALTRONICS Model 2166 is a non-dispersive infrared (NDIR) carbon dioxide monitor for use as an outdoor air sensor. It produces a control signal proportional to carbon dioxide concentration. This control signal is then used to provide remote control of the outdoor air dampers; thereby controlling the fresh air intake or varying the ventilation rates while maintaining safe indoor air quality. Dual adjustable level detect circuits may be used for alarms.



Carbon Dioxide Monitor

Model 2166 0-1.50% CO₂

Description:

The Model 2166 is a non dispersive infrared gas monitor designed as a fully functioning stand-alone unit for the continuous monitoring of carbon dioxide. The optical system is not effected by humidity. The pumped gas sampling circuit has a self-draining water trap. This eliminates difficulties with water condensation in the sample lines. It has a 0.56 inch high digital readout and two adjustable level detect circuits with associated front panel indicators (yellow and red) and SPDT relay contacts.

This low power, water resistant system makes this an ideal remote sensor to interface with any central control unit. It has linear 0 to 5 volt and 4 to 20 mA current loop outputs. In either configuration, interfaced or stand-alone, this device is an excellent choice for any environment in which the level of carbon dioxide must be monitored or controlled.

Specifications: 2166 1.5% CO₂

Method: N.D. I. R. (Non-dispersive Infra-red) Gas sample pump (**App Note A67**)
Gas: Carbon dioxide (CO₂)
Range: **0-1.50%** (15,000 ppm) CO₂
Accuracy: $\pm 0.038\%$ CO₂ from 0 -0.75% CO₂ & $\pm 5\%$ of reading from 0.75% to 1.5% CO₂
Repeatability: $\pm 1\%$ of full scale (challenge with same gas sample and assure zero)
External Power Source: 115/220 VAC , 50/60 Hz
Power Consumption: less than 8 watts @ 115 VAC
Adjustable Set Points: Dual set points adjustable from 0.15% CO₂ to full scale (audio alarms below)
..... Low SET Point adjusted to 0.5% and High SET Point to 1.0% unless specified on PO
SET POINT Relay Contact Rating: ... SPDT contacts: non-latching N.C., N.O. 3 amp max. at 250 VAC or 30 VDC
Display: 0.56 inch high digital Light Emitting Diode (LED) readout
Output Signals:
 Voltage: 0 to 5 volt = 0 to 1.5% CO₂ (linear scale data attached)
 Current Loop: 4 to 20 mA = 0 to 1.5% CO₂ (linear scale data attached) 0 to 550Ω load
 Audio Alarms: Beeps once a second when Low SET Point is exceeded, continuous when High exceeded
 Set Point Indicators: Yellow flashes when Low SET Point is exceeded, RED on continuous when High exceeded
Zero Drift at Constant Temperature: Less than 2% of full scale per month (random not cumulative)
Zero Noise at Constant Temperature: Less than 50 mV peak to peak measured during any 20 second period
..... measured on voltage output (equals less than 1% of full scale)
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) see **Application Note A12**
Storage Temperature Range: -40 to +70°C (-40 to +158°F)
Operating Humidity Range: 5 to 95% RH (non-condensing) in gas cell, see **Application Note A30**
Weight: Less than 6 pounds (< 2.72 kilograms)
External Clearance Dimensions: . 5 inches high, 7.5 inches wide, 13 inches long (including 3.5" water trap)
Mounting, four 0.312 inch dia holes ... Mounting centers 4.0 inch x 8.75 inch: see diagram

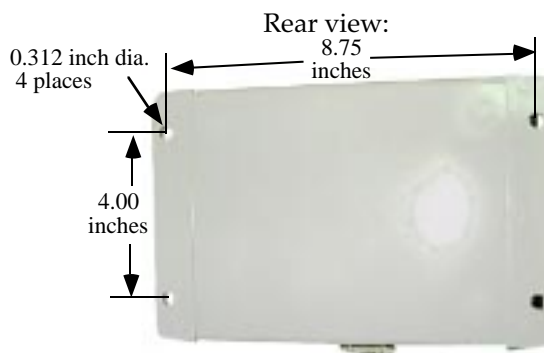


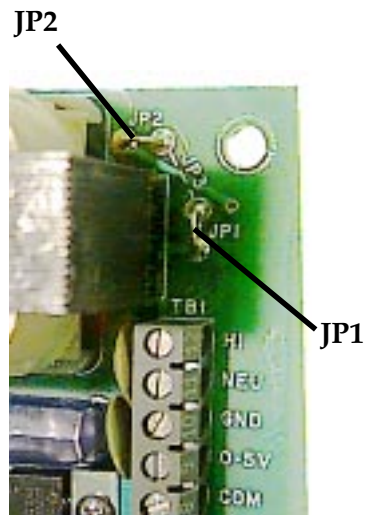
Terminal block TB1 has a linear 0 to 5 volt output signal on pin number 9 with respect to pin number 8 which is signal common. Pin number 7 has a linear 4 to 20 mA current loop signal referenced again to pin number 8. See the wiring diagram on page 4.

The table below shows both the linear 0 to 5 volt and the 4 to 20 mA current loop responses to 0 to 1.5% carbon dioxide being drawn through the gas cell by the sample pump. The wires from TB1 go through the strain relief cable grommet shown on page 4. The resulting wire bundle must be between 0.090 and 0.25 inch diameter to be properly strain relieved.

| VALTRONIC | | | | | | | | 1.5% & 5 volt full scale linear | | | | | | | |
|-----------|-----------------|----------------|--------|---------|----------------|-------|------|---------------------------------|-----------------|----------------|-------|---------|----------------|------|--|
| Gas in % | Output in volts | ±5% of reading | | 4-20 mA | ±5% of reading | | | Gas in % | Output in volts | ±5% of reading | | 4-20 mA | ±5% of reading | | |
| | | Max. | Min. | out | Max. | Min. | | | | Max. | Min. | out | Max. | Min. | |
| 0.00 | 0.000 | 0.125 | -0.125 | 4.00 | 4.40 | 3.60 | 0.76 | 2.533 | 2.660 | 2.407 | 12.11 | 12.51 | 11.70 | | |
| 0.02 | 0.067 | 0.192 | -0.058 | 4.21 | 4.61 | 3.81 | 0.78 | 2.600 | 2.730 | 2.470 | 12.32 | 12.74 | 11.90 | | |
| 0.04 | 0.133 | 0.258 | 0.008 | 4.43 | 4.83 | 4.03 | 0.80 | 2.667 | 2.800 | 2.533 | 12.53 | 12.96 | 12.11 | | |
| 0.06 | 0.200 | 0.325 | 0.075 | 4.64 | 5.04 | 4.24 | 0.82 | 2.733 | 2.870 | 2.597 | 12.75 | 13.18 | 12.31 | | |
| 0.08 | 0.267 | 0.392 | 0.142 | 4.85 | 5.25 | 4.45 | 0.84 | 2.800 | 2.940 | 2.660 | 12.96 | 13.41 | 12.51 | | |
| 0.10 | 0.333 | 0.458 | 0.208 | 5.07 | 5.47 | 4.67 | 0.86 | 2.867 | 3.010 | 2.723 | 13.17 | 13.63 | 12.71 | | |
| 0.12 | 0.400 | 0.525 | 0.275 | 5.28 | 5.68 | 4.88 | 0.88 | 2.933 | 3.080 | 2.787 | 13.39 | 13.86 | 12.92 | | |
| 0.14 | 0.467 | 0.592 | 0.342 | 5.49 | 5.89 | 5.09 | 0.90 | 3.000 | 3.150 | 2.850 | 13.60 | 14.08 | 13.12 | | |
| 0.16 | 0.533 | 0.658 | 0.408 | 5.71 | 6.11 | 5.31 | 0.92 | 3.067 | 3.220 | 2.913 | 13.81 | 14.30 | 13.32 | | |
| 0.18 | 0.600 | 0.725 | 0.475 | 5.92 | 6.32 | 5.52 | 0.94 | 3.133 | 3.290 | 2.977 | 14.03 | 14.53 | 13.53 | | |
| 0.20 | 0.667 | 0.792 | 0.542 | 6.13 | 6.53 | 5.73 | 0.96 | 3.200 | 3.360 | 3.040 | 14.24 | 14.75 | 13.73 | | |
| 0.22 | 0.733 | 0.858 | 0.608 | 6.35 | 6.75 | 5.95 | 0.98 | 3.267 | 3.430 | 3.103 | 14.45 | 14.98 | 13.93 | | |
| 0.24 | 0.800 | 0.925 | 0.675 | 6.56 | 6.96 | 6.16 | 1.00 | 3.333 | 3.500 | 3.167 | 14.67 | 15.20 | 14.13 | | |
| 0.26 | 0.867 | 0.992 | 0.742 | 6.77 | 7.17 | 6.37 | 1.02 | 3.400 | 3.570 | 3.230 | 14.88 | 15.42 | 14.34 | | |
| 0.28 | 0.933 | 1.058 | 0.808 | 6.99 | 7.39 | 6.59 | 1.04 | 3.467 | 3.640 | 3.293 | 15.09 | 15.65 | 14.54 | | |
| 0.30 | 1.000 | 1.125 | 0.875 | 7.20 | 7.60 | 6.80 | 1.06 | 3.533 | 3.710 | 3.357 | 15.31 | 15.87 | 14.74 | | |
| 0.32 | 1.067 | 1.192 | 0.942 | 7.41 | 7.81 | 7.01 | 1.08 | 3.600 | 3.780 | 3.420 | 15.52 | 16.10 | 14.94 | | |
| 0.34 | 1.133 | 1.258 | 1.008 | 7.63 | 8.03 | 7.23 | 1.10 | 3.667 | 3.850 | 3.483 | 15.73 | 16.32 | 15.15 | | |
| 0.36 | 1.200 | 1.325 | 1.075 | 7.84 | 8.24 | 7.44 | 1.12 | 3.733 | 3.920 | 3.547 | 15.95 | 16.54 | 15.35 | | |
| 0.38 | 1.267 | 1.392 | 1.142 | 8.05 | 8.45 | 7.65 | 1.14 | 3.800 | 3.990 | 3.610 | 16.16 | 16.77 | 15.55 | | |
| 0.40 | 1.333 | 1.458 | 1.208 | 8.27 | 8.67 | 7.87 | 1.16 | 3.867 | 4.060 | 3.673 | 16.37 | 16.99 | 15.75 | | |
| 0.42 | 1.400 | 1.525 | 1.275 | 8.48 | 8.88 | 8.08 | 1.18 | 3.933 | 4.130 | 3.737 | 16.59 | 17.22 | 15.96 | | |
| 0.44 | 1.467 | 1.592 | 1.342 | 8.69 | 9.09 | 8.29 | 1.20 | 4.000 | 4.200 | 3.800 | 16.80 | 17.44 | 16.16 | | |
| 0.46 | 1.533 | 1.658 | 1.408 | 8.91 | 9.31 | 8.51 | 1.22 | 4.067 | 4.270 | 3.863 | 17.01 | 17.66 | 16.36 | | |
| 0.48 | 1.600 | 1.725 | 1.475 | 9.12 | 9.52 | 8.72 | 1.24 | 4.133 | 4.340 | 3.927 | 17.23 | 17.89 | 16.57 | | |
| 0.50 | 1.667 | 1.792 | 1.542 | 9.33 | 9.73 | 8.93 | 1.26 | 4.200 | 4.410 | 3.990 | 17.44 | 18.11 | 16.77 | | |
| 0.52 | 1.733 | 1.858 | 1.608 | 9.55 | 9.82 | 9.27 | 1.28 | 4.267 | 4.480 | 4.053 | 17.65 | 18.34 | 16.97 | | |
| 0.54 | 1.800 | 1.925 | 1.675 | 9.76 | 10.05 | 9.47 | 1.30 | 4.333 | 4.550 | 4.117 | 17.87 | 18.56 | 17.17 | | |
| 0.56 | 1.867 | 1.992 | 1.742 | 9.97 | 10.27 | 9.67 | 1.32 | 4.400 | 4.620 | 4.180 | 18.08 | 18.78 | 17.38 | | |
| 0.58 | 1.933 | 2.058 | 1.808 | 10.19 | 10.50 | 9.88 | 1.34 | 4.467 | 4.690 | 4.243 | 18.29 | 19.01 | 17.58 | | |
| 0.60 | 2.000 | 2.125 | 1.875 | 10.40 | 10.72 | 10.08 | 1.36 | 4.533 | 4.760 | 4.307 | 18.51 | 19.23 | 17.78 | | |
| 0.62 | 2.067 | 2.192 | 1.942 | 10.61 | 10.94 | 10.28 | 1.38 | 4.600 | 4.830 | 4.370 | 18.72 | 19.46 | 17.98 | | |
| 0.64 | 2.133 | 2.258 | 2.008 | 10.83 | 11.17 | 10.49 | 1.40 | 4.667 | 4.900 | 4.433 | 18.93 | 19.68 | 18.19 | | |
| 0.66 | 2.200 | 2.325 | 2.075 | 11.04 | 11.39 | 10.69 | 1.42 | 4.733 | 4.970 | 4.497 | 19.15 | 19.90 | 18.39 | | |
| 0.68 | 2.267 | 2.392 | 2.142 | 11.25 | 11.62 | 10.89 | 1.44 | 4.800 | 5.040 | 4.560 | 19.36 | 20.13 | 18.59 | | |
| 0.70 | 2.333 | 2.458 | 2.208 | 11.47 | 11.84 | 11.09 | 1.46 | 4.867 | 5.110 | 4.623 | 19.57 | 20.35 | 18.79 | | |
| 0.72 | 2.400 | 2.525 | 2.275 | 11.68 | 12.06 | 11.30 | 1.48 | 4.933 | 5.180 | 4.687 | 19.79 | 20.58 | 19.00 | | |
| 0.74 | 2.467 | 2.592 | 2.342 | 11.89 | 12.29 | 11.50 | 1.50 | 5.000 | 5.250 | 4.750 | 20.00 | 20.80 | 19.20 | | |

Accuracy = ±5% of reading from 0.75% to 1.5% CO₂ and ±0.0375% CO₂ from 0 to 0.75% CO₂



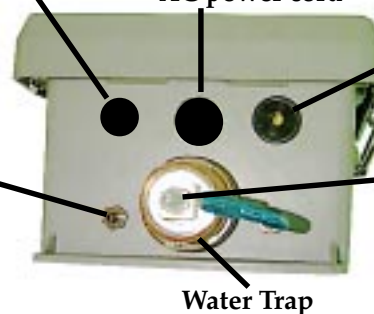


Cable grommet for signal wires
0.090 min / 0.25 max wire dia.

Cable grommet for
AC power cord

Audio
Alarm

Exhaust Gas
and water
drain hose
barb for 3/16
inch I.D.
tubing



Gas Inlet
hose barb
for 1/4 inch
I.D. tubing

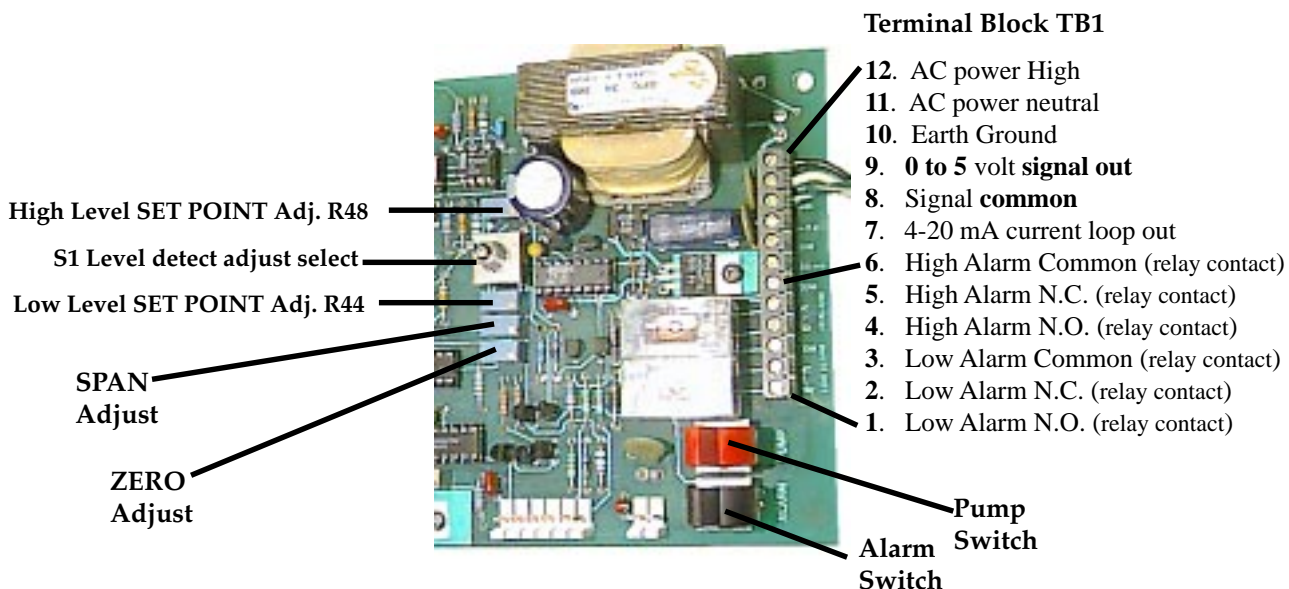
Water Trap

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

Preventive Maintenance:

Gas calibration should be done every six months. At least calibration with zero gas (nitrogen) every six months and both zero and span (certified 0.5% or 1% CO₂) at least once a year. A calibration log book where you record how much ZERO and SPAN had drifted before it was recalibrated will help you decide what the optimum duration between calibrations should be. See **Application Note A73** for detailed calibration instructions. The **pump switch should be turned OFF** during calibration and the flow rate set to about 2 to 4 Liters per minute. You can flow directly into the hydrophobic filter at about 0.3 liter per min.

The filter in the water trap and the hydrophobic / particle filter inside should inspected and changed when necessary. The flow rate of the pump should be checked to see if it is still operating properly. It should be about 4 to 6 liters per minute if measured at the water trap input, Gas Inlet (both sides of the pump drawing). If you attempt to gas calibrate with the pump on (you will use a very large amount of gas), follow instructions in Application Note A24. See **Application Note A67** for maintenance information.



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)

- High Level SET POINT Adj. R48
- S1 Level detect adjust select
- Low Level SET POINT Adj. R44
- SPAN Adjust
- ZERO Adjust

Pump
Switch
Alarm
Switch