



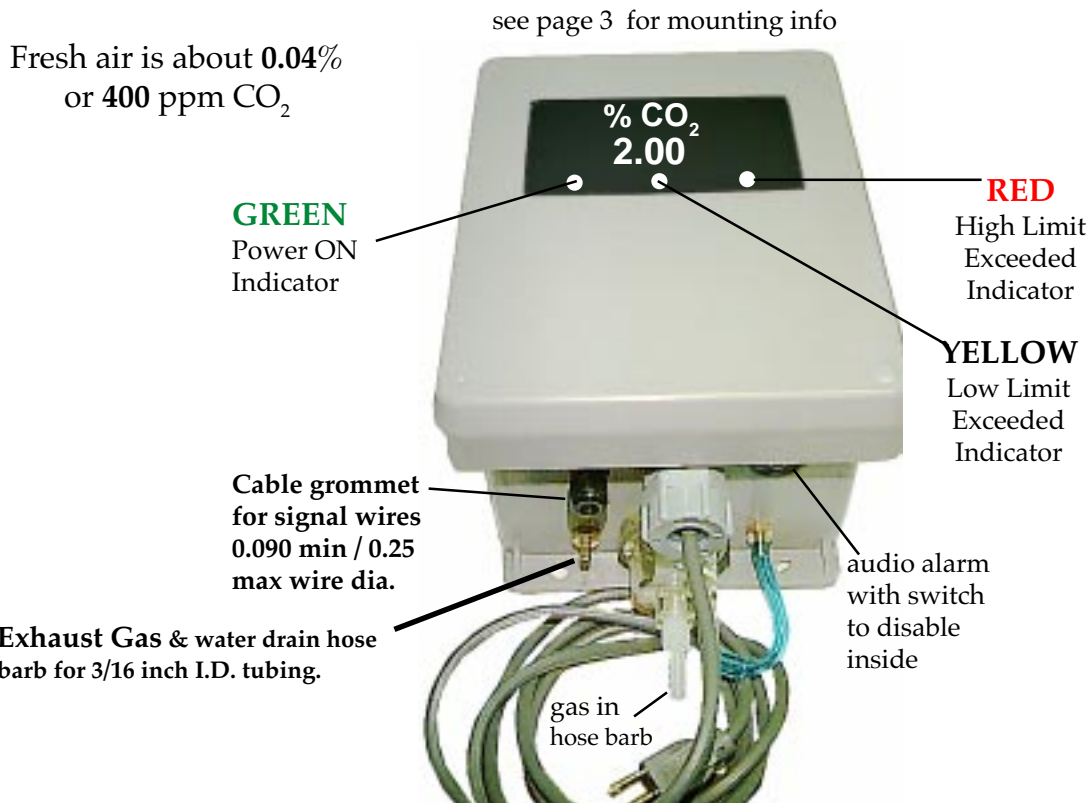
# Carbon Dioxide Monitor

## Model 2166 2% (20,000 ppm) CO<sub>2</sub>

### Features:

- Self contained unit with pump/water trap
- Non dispersive infrared (**NDIR**) technology
- **ECONO-CAL™** calibration kit available
- Fast warm-up
- Industrially robust: **0-5 V** and **4-20 mA** outputs
- **Dual** level detect set points and relays
- **Audio Alarm** beeps when **Low** level exceeded, **ON** continuous when **High** level exceeded
- 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** readout with 0.56 inch red LED display

### Model 2166 2% CO<sub>2</sub>



**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 CO<sub>2</sub> 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 2% CO<sub>2</sub>

---

### 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 2% CO<sub>2</sub>

---

Method: ..... N.D. I. R. (Non-dispersive Infra-red) Gas sample pump (see application note A7)  
Gas: ..... Carbon dioxide (CO<sub>2</sub>)  
Range: ..... 0-2.00% (20,000 ppm) CO<sub>2</sub>  
Accuracy: ..... ±0.05% CO<sub>2</sub> from 0 -1% CO<sub>2</sub> and ± 5% of reading from 1% to 2% CO<sub>2</sub>  
Repeatability: ..... ± 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 0.2% CO<sub>2</sub> to full scale (audio alarms below)  
..... Low SET Point adjusted to 0.5% and High SET Point to 1% 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 2% CO<sub>2</sub> ( linear scale data attached)  
Current Loop: ..... 4 to 20 mA = 0 to 2% CO<sub>2</sub> ( 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  
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



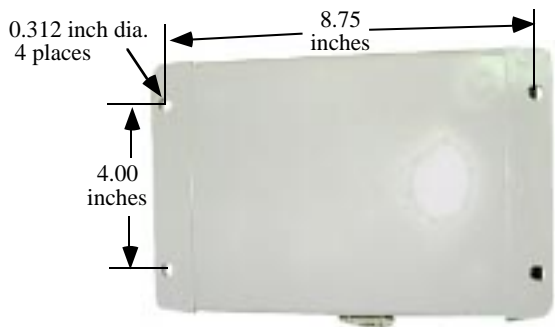
Terminal block TB1 has a linear 0 to 5 volt output signal on pin number 9 with respect to pin number 8 which is signal common. Pin number 7 has a linear 4 to 20 mA current loop signal referenced again to pin number 8. See the wiring diagram on page 4.

The table below shows both the linear 0 to 5 volt and the 4 to 20 mA current loop responses to 0 to 2% 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.

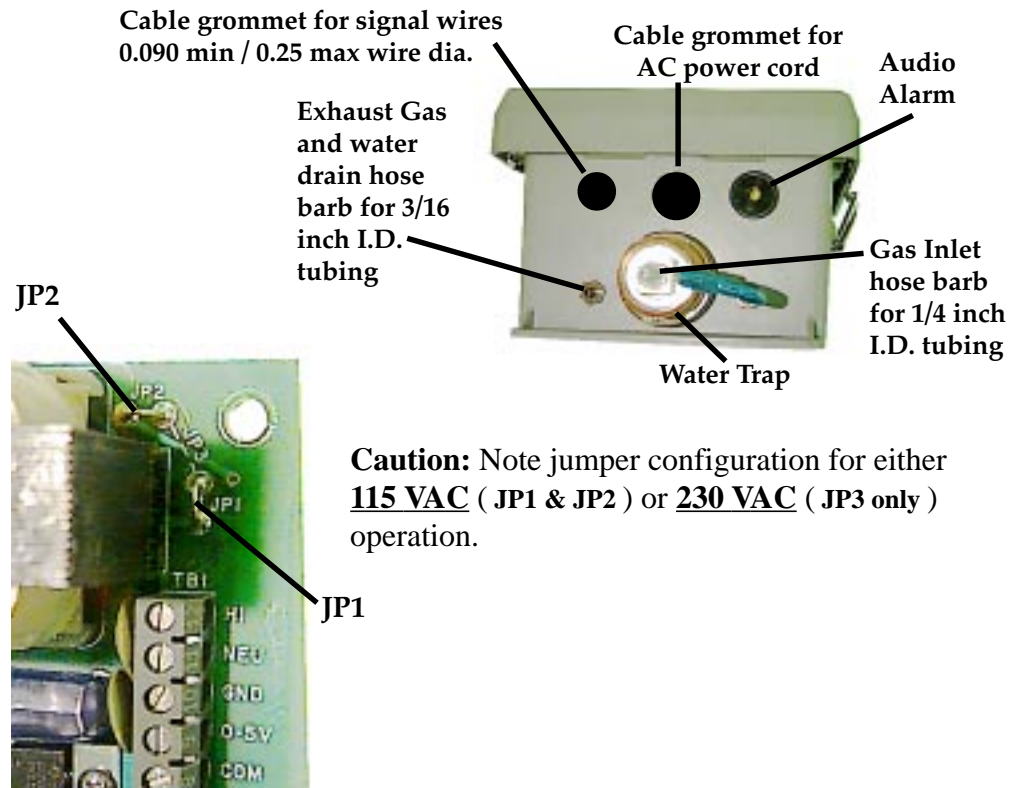
**VALTRONICS** 2% & 5 volt linear full scale

Gas in %	Output in volts	±0.05% CO2		4-20 mA			Gas in %	Output in volts	±5% of reading		4-20 mA			±5% of reading	
		Max.	Min.	Output	Max.	Min.			Max.	Min.	Output	Max.	Min.		
0.00	0.000	0.125	-0.125	4.00	4.40	3.60	1.02	2.550	2.678	2.423	12.16	12.57	11.75		
0.02	0.050	0.175	-0.075	4.16	4.56	3.76	1.04	2.600	2.730	2.470	12.32	12.74	11.90		
0.04	0.100	0.225	-0.025	4.32	4.72	3.92	1.06	2.650	2.783	2.518	12.48	12.90	12.06		
0.06	0.150	0.275	0.025	4.48	4.88	4.08	1.08	2.700	2.835	2.565	12.64	13.07	12.21		
0.08	0.200	0.325	0.075	4.64	5.04	4.24	1.10	2.750	2.888	2.613	12.80	13.24	12.36		
0.10	0.250	0.375	0.125	4.80	5.20	4.40	1.12	2.800	2.940	2.660	12.96	13.41	12.51		
0.12	0.300	0.425	0.175	4.96	5.36	4.56	1.14	2.850	2.993	2.708	13.12	13.58	12.66		
0.14	0.350	0.475	0.225	5.12	5.52	4.72	1.16	2.900	3.045	2.755	13.28	13.74	12.82		
0.16	0.400	0.525	0.275	5.28	5.68	4.88	1.18	2.950	3.098	2.803	13.44	13.91	12.97		
0.18	0.450	0.575	0.325	5.44	5.84	5.04	1.20	3.000	3.150	2.850	13.60	14.08	13.12		
0.20	0.500	0.625	0.375	5.60	6.00	5.20	1.22	3.050	3.203	2.898	13.76	14.25	13.27		
0.22	0.550	0.675	0.425	5.76	6.16	5.36	1.24	3.100	3.255	2.945	13.92	14.42	13.42		
0.24	0.600	0.725	0.475	5.92	6.32	5.52	1.26	3.150	3.308	2.993	14.08	14.58	13.58		
0.26	0.650	0.775	0.525	6.08	6.48	5.68	1.28	3.200	3.360	3.040	14.24	14.75	13.73		
0.28	0.700	0.825	0.575	6.24	6.64	5.84	1.30	3.250	3.413	3.088	14.40	14.92	13.88		
0.30	0.750	0.875	0.625	6.40	6.80	6.00	1.32	3.300	3.465	3.135	14.56	15.09	14.03		
0.32	0.800	0.925	0.675	6.56	6.96	6.16	1.34	3.350	3.518	3.183	14.72	15.26	14.18		
0.34	0.850	0.975	0.725	6.72	7.12	6.32	1.36	3.400	3.570	3.230	14.88	15.42	14.34		
0.36	0.900	1.025	0.775	6.88	7.28	6.48	1.38	3.450	3.623	3.278	15.04	15.59	14.49		
0.38	0.950	1.075	0.825	7.04	7.44	6.64	1.40	3.500	3.675	3.325	15.20	15.76	14.64		
0.40	1.000	1.125	0.875	7.20	7.60	6.80	1.42	3.550	3.728	3.373	15.36	15.93	14.79		
0.42	1.050	1.175	0.925	7.36	7.76	6.96	1.44	3.600	3.780	3.420	15.52	16.10	14.94		
0.44	1.100	1.225	0.975	7.52	7.92	7.12	1.46	3.650	3.833	3.468	15.68	16.26	15.10		
0.46	1.150	1.275	1.025	7.68	8.08	7.28	1.48	3.700	3.885	3.515	15.84	16.43	15.25		
0.48	1.200	1.325	1.075	7.84	8.24	7.44	1.50	3.750	3.938	3.563	16.00	16.60	15.40		
0.50	1.250	1.375	1.125	8.00	8.40	7.60	1.52	3.800	3.990	3.610	16.16	16.77	15.55		
0.52	1.300	1.425	1.175	8.16	8.56	7.76	1.54	3.850	4.043	3.658	16.32	16.94	15.70		
0.54	1.350	1.475	1.225	8.32	8.72	7.92	1.56	3.900	4.095	3.705	16.48	17.10	15.86		
0.56	1.400	1.525	1.275	8.48	8.88	8.08	1.58	3.950	4.148	3.753	16.64	17.27	16.01		
0.58	1.450	1.575	1.325	8.64	9.04	8.24	1.60	4.000	4.200	3.800	16.80	17.44	16.16		
0.60	1.500	1.625	1.375	8.80	9.20	8.40	1.62	4.050	4.253	3.848	16.96	17.61	16.31		
0.62	1.550	1.675	1.425	8.96	9.36	8.56	1.64	4.100	4.305	3.895	17.12	17.78	16.46		
0.64	1.600	1.725	1.475	9.12	9.52	8.72	1.66	4.150	4.358	3.943	17.28	17.94	16.62		
0.66	1.650	1.775	1.525	9.28	9.68	8.88	1.68	4.200	4.410	3.990	17.44	18.11	16.77		
0.68	1.700	1.825	1.575	9.44	9.84	9.04	1.70	4.250	4.463	4.038	17.60	18.28	16.92		
0.70	1.750	1.875	1.625	9.60	10.00	9.20	1.72	4.300	4.515	4.085	17.76	18.45	17.07		
0.72	1.800	1.925	1.675	9.76	10.16	9.36	1.74	4.350	4.568	4.133	17.92	18.62	17.22		
0.74	1.850	1.975	1.725	9.92	10.32	9.52	1.76	4.400	4.620	4.180	18.08	18.78	17.38		
0.76	1.900	2.025	1.775	10.08	10.48	9.68	1.78	4.450	4.673	4.228	18.24	18.95	17.53		
0.78	1.950	2.075	1.825	10.24	10.64	9.84	1.80	4.500	4.725	4.275	18.40	19.12	17.68		
0.80	2.000	2.125	1.875	10.40	10.80	10.00	1.82	4.550	4.778	4.323	18.56	19.29	17.83		
0.82	2.050	2.175	1.925	10.56	10.96	10.16	1.84	4.600	4.830	4.370	18.72	19.46	17.98		
0.84	2.100	2.225	1.975	10.72	11.12	10.32	1.86	4.650	4.883	4.418	18.88	19.62	18.14		
0.86	2.150	2.275	2.025	10.88	11.28	10.48	1.88	4.700	4.935	4.465	19.04	19.79	18.29		
0.88	2.200	2.325	2.075	11.04	11.44	10.64	1.90	4.750	4.988	4.513	19.20	19.96	18.44		
0.90	2.250	2.375	2.125	11.20	11.60	10.80	1.92	4.800	5.040	4.560	19.36	20.13	18.59		
0.92	2.300	2.425	2.175	11.36	11.76	10.96	1.94	4.850	5.093	4.608	19.52	20.30	18.74		
0.94	2.350	2.475	2.225	11.52	11.92	11.12	1.96	4.900	5.145	4.655	19.68	20.46	18.90		
0.96	2.400	2.525	2.275	11.68	12.08	11.28	1.98	4.950	5.198	4.703	19.84	20.63	19.05		
0.98	2.450	2.575	2.325	11.84	12.24	11.44	2.00	5.000	5.250	4.750	20.00	20.80	19.20		
1.00	2.500	2.625	2.375	12.00	12.40	11.60									

Accuracy = ±5% of reading from 1% CO2 to 2% CO2 and ±0.05% CO2 from 0 to 1% CO2 Chart modified on 11-19-97



Rear view:



**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 1.0% CO<sub>2</sub>) at least once a year. A **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). See **Application Note A67** for maintenance information.

