



OEM Digital NDIR CO₂ sensor with flow through gas cell

User defines **RANGE** from 25 to 100% CO₂

Model 2015SPI-100

The **VALTRONICS** Model **2015SPI-100** is an OEM **NDIR** CO₂ sensor with digital signal processing and temperature compensation. The firmware **VERSION** depends upon the specific customer interface requirements. The **SPI** (Serial Peripheral Interface) is described on pages 2 and 3. Each serial numbered sensor is individually gas calibrated and temperature compensated at the factory. **RS-232 Test Board** for field gas calibration (See Application Note A66). On board & remote switches for calibration. **RANGE** setting of **25%** up to **100%** defines **0-1 volt** full scale (see page 4).

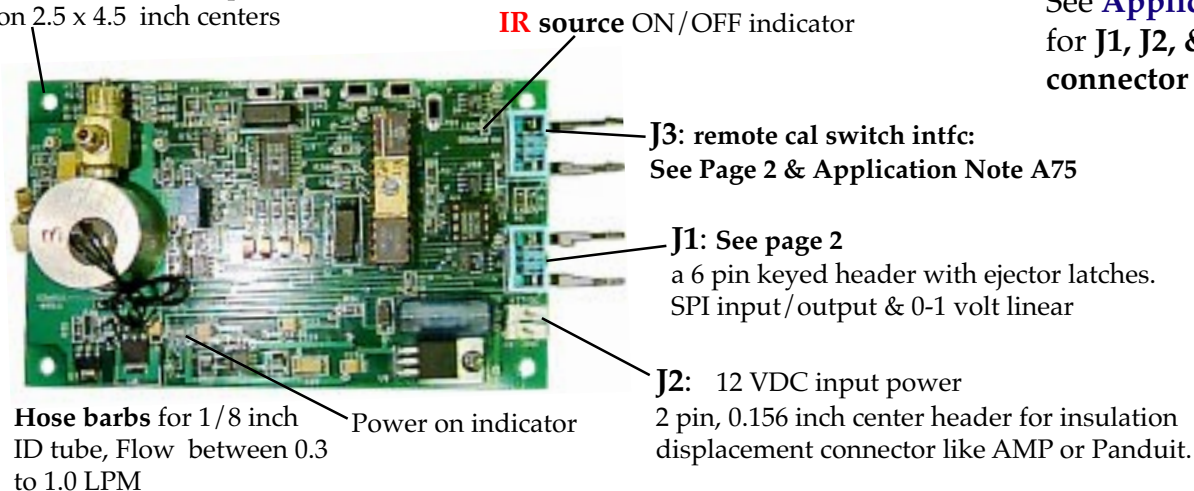
Model 2015SPI-100 Specifications:

- Method: **NDIR** with Digital Signal processing and temperature compensation
- Gas: **Carbon Dioxide (CO₂)**
- Full Scale and RANGE:** **0-100% CO₂** **RANGE** is **user defined** from **25%** to **100%** CO₂, see **page 4**
- Input Power **+12 VDC** (@ 0.250 amp max., 0.135 amp typ, 16.0 volts max, 8.0 volts min)
- Accuracy: if calibrated at 50% CO₂ using 50±1% CO₂ gas, the accuracy is best at
..... 0 to 50±2% CO₂ and 5% of reading from 55 to 100% CO₂. 16 Bit digital
- Warm-up Time: Less than 2 minutes for use and 5 minutes for accuracy.
- Resolution / Repeatability : ±0.2% CO₂ (challenge with same gas sample multiple times & assure zero)
- Stability: Less than 0.4% CO₂ during any 20 second period at constant temperature
- Output Signal: Digital **SPI** and linear **0 to 1 volt output** signal See **Application Note A59**
..... **RS-232 Test Board**. See **Application Note A66**
- LED** Indicators: **IR** Source ON/OFF Indicator, Power ON indicator, Cal Switch Indicators.
- Input Signal: Digital **SPI** input for calibration and diagnostic modes. See page 3
- Calibration Switches: SW1 (Zero), SW2 (Span Target), SW3 (Span), SW4 (Range adj), remote via J3
- Operating Temperature Range: 0 to 50°C (32° to 122°F) see **Application Note A12**
- Ambient Relative Humidity: 0 to 95% RH non-condensing: see **Application Note A30**
- Storage Temperature range:- -40 to +70°C (-40 to +158°F)
- Weight: Less than 0.25 pound (<0.11 kilogram)
- External Dimensions: PCB Card: ... **4.9" x 2.9" x 1.5"** see page 2 for mounting

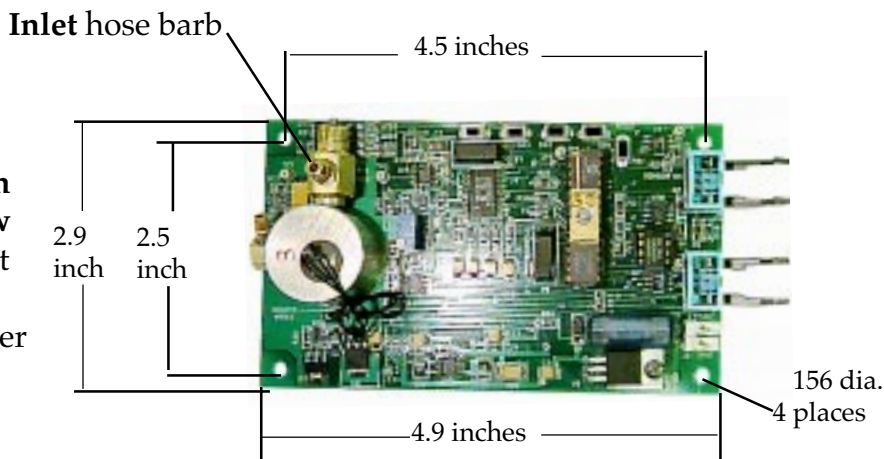
All dimensions are in **inches**, max. vertical clearance is **1.5** inch

0.156 dia. hole four places
on 2.5 x 4.5 inch centers

See **Application Note A75**
for **J1, J2, & J3** mating
connector part numbers.



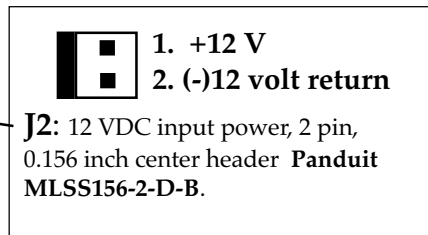
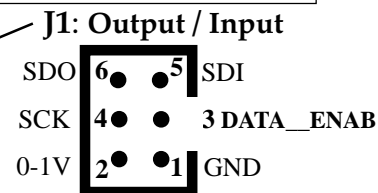
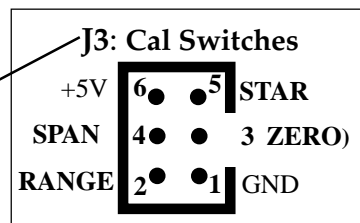
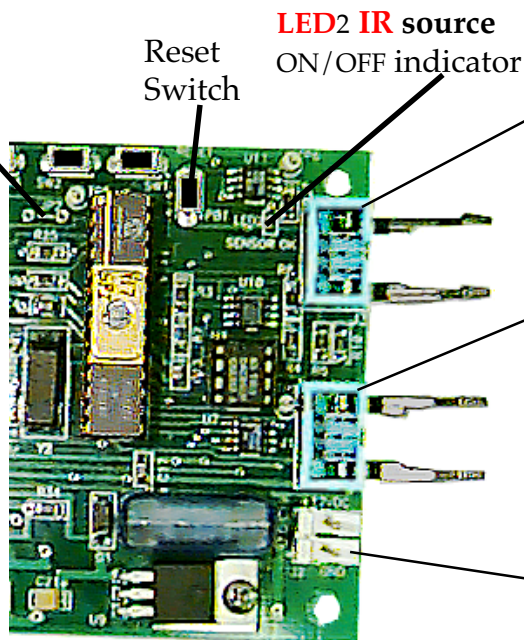
Hose barbs for 1/8 inch ID tube, Flow between 0.3 to 1.0 LPM. **Push** gas through the cell, **DO NOT draw gas** through the cell because it is not hermetically sealed and the sample may be diluted if the cell is at a lower pressure than atmospheric.



See **Application Note A67** for gas conditioning requirements and information about gas sample pumps and filters. A **hydrophobic filter** (**App Note A79**) in front of the **inlet** hose barb is required to prevent particles & droplets from entering the gas cell. Try to minimize the outflow resistance to minimize the back pressure inside the gas cell.

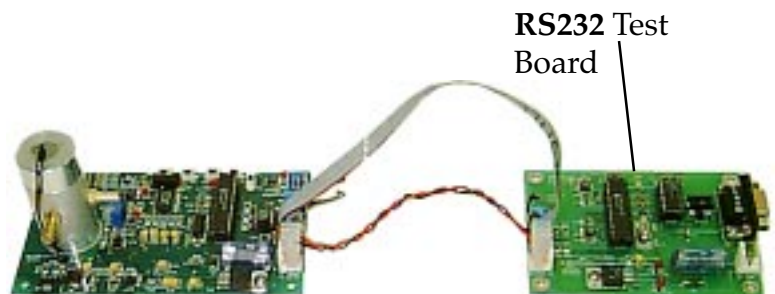
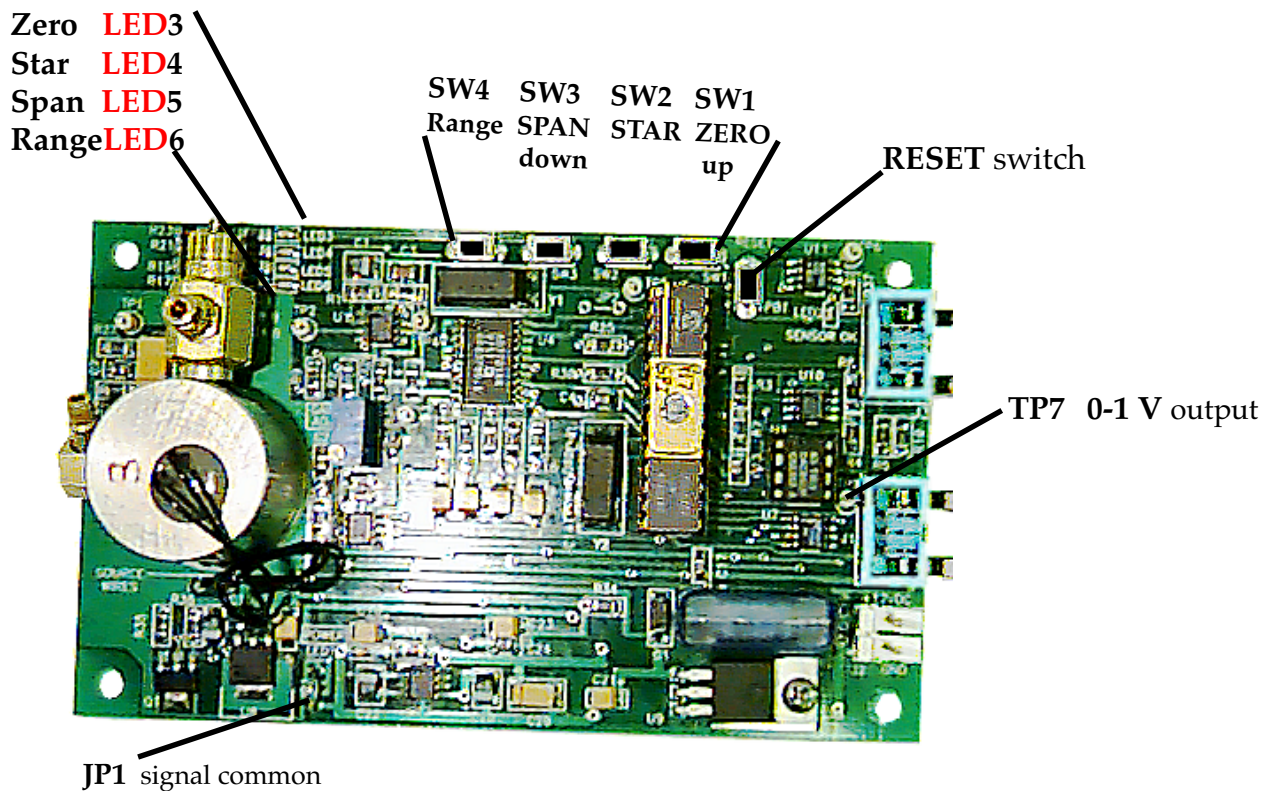
See **Application Note A75** for J1, J2, & J3 mating connector part numbers. **Keep J1 interface cable shorter than 18 inches.** See **Application Note A61** for 16 bit serial digital output timing diagram.

Master/Slave jumper **JP2**
Slave mode if installed.
Leave **JP2** out and operate in Master Mode when using the RS-232 Test Board to diagnose problems.
See Application Note A66.



Gas calibration may be initiated via a command from the SPI input on **J3** (see page 4, definition of SDI or serial data in) or from the on board or remote **switches** (Logic "0" to initiate)below (**Application Note A53**): **ZERO** (SW1 or remote J4-3): With nitrogen flowing in gas calibration tube press and hold SW1 for 2 seconds. **LED3** through 6 will flash on & off together. If they flash on/off sequentially the sensor has detected an error & the **RESET** button must be pressed. Wait 1 minute and continue where you left off. The 0 to 1 volt output should snap to 0.0 ± 0.01 volt measured with a **DVM** "+" lead connected to **TP7** and "-" lead connected to **GND** test point. **LED3** will be **ON** to indicate a ZERO calibration.

RANGE (SW4 or remote J4-2): To set the full scale or range press and hold SW4. From the chart on page 6 find the voltage value that corresponds to the full scale that you want from 30 to 100%. **LED6** will be **ON** . Use SW1 as an **UP** and SW3 as a **DOWN** switch to adjust this value (examples:100% = 1.00 v, 50% = 0.50 v, 30% = 0.3 v). **STAR** (SW2 or remote J4-5): To set the Span Target (calibration gas value) press and hold SW2. **LED4** will be **ON** Use SW1 as an **UP** and SW3 as a **DOWN** switch to adjust this value read on the DVM. See chart on page 6. **SPAN** (SW3 or remote J4-4): To **SPAN** calibrate while flowing certified span gas like $50 \pm 1\%$ CO₂ into gas calibration tube for at least 30 seconds at about 300 ml/min. Press & hold SW2 for 2 seconds.**LED5** will be **ON** . The DVM voltage should snap to the STAR value entered above & **LED3** through 6 will flash on & off together.





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Below is a table that shows the 0 to 1 volt output equivalent to any value for Full Scale **RANGE** or Span Target (**STAR**) anywhere from **25** to **100%** CO₂. See the procedure on page 3 for more detail. A typical application would be a full scale **RANGE** of **100.0** and a **STAR** of **50.0**

The Full Scale **Range** will set what % CO₂ will give an output of 1.00 volt in **normal operation**.

A Range of **100** will give a 0-1 V output of **0.500** volt for a reading of **50%** CO₂.

A Range of **80** will give a 0-1 V output of **0.500** volt for a reading of **40%** CO₂.

A Range of **25** will give a 0-1 V output of **0.800** volt for a reading of **20%** CO₂.

Please remember that calibration using the **RS-232 test board** (see **Application Note A66**) will give the user much better visibility on all the calibration parameters.

Table used for **Calibration** for setting the Full Scale & the Target Span Gas value, **STAR**(certified tank %)

Range / STAR	0 to 1 V	Range / STAR	0 to 1 V
% gas	Output	% gas	Output
100	1.000	50	0.500
99	0.990	49	0.490
98	0.980	48	0.480
97	0.970	47	0.470
96	0.960	46	0.460
95	0.950	45	0.450
94	0.940	44	0.440
93	0.930	43	0.430
92	0.920	42	0.420
91	0.910	41	0.410
90	0.900	40	0.400
89	0.890	39	0.390
88	0.880	38	0.380
87	0.870	37	0.370
86	0.860	36	0.360
85	0.850	35	0.350
84	0.840	34	0.340
83	0.830	33	0.330
82	0.820	32	0.320
81	0.810	31	0.310
80	0.800	30	0.300
79	0.790	29	0.290
78	0.780	28	0.280
77	0.770	27	0.270
76	0.760	26	0.260
75	0.750	25	0.250
74	0.740		
73	0.730		
72	0.720		
71	0.710		
70	0.700		
69	0.690		
68	0.680		
67	0.670		
66	0.660		
65	0.650		
64	0.640		
63	0.630		
62	0.620		
61	0.610		
60	0.600		
59	0.590		
58	0.580		
57	0.570		
56	0.560		
55	0.550		
54	0.540		
53	0.530		
52	0.520		
51	0.510		

To Check what **RANGE** (Full Scale) is selected, press & hold SW4 (see page 3) and measure the voltage out at TP7. As an example TP7 will read 0.25 volt for a full scale **RANGE** of 25% CO₂. The **STAR** will be relative to the new full scale **RANGE**. As an example, a **STAR** of 25% CO₂ with a full scale **RANGE** of 50% will give a 0 to 1 volt output with the **STAR** switch pressed of 0.50 volt. A **STAR** of 20% CO₂ with a full scale **RANGE** of 100% will give a 0 to 1 volt output with the **STAR** switch pressed of 0.20 volt.