



# OEM Digital NDIR CO<sub>2</sub> sensor with flow through gas cell

User defines **RANGE** from 25 to 100% CO<sub>2</sub>

## Model 2015SPI-100

The **VALTRONICS** Model **2015SPI-100** is an OEM **NDIR** CO<sub>2</sub> 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).

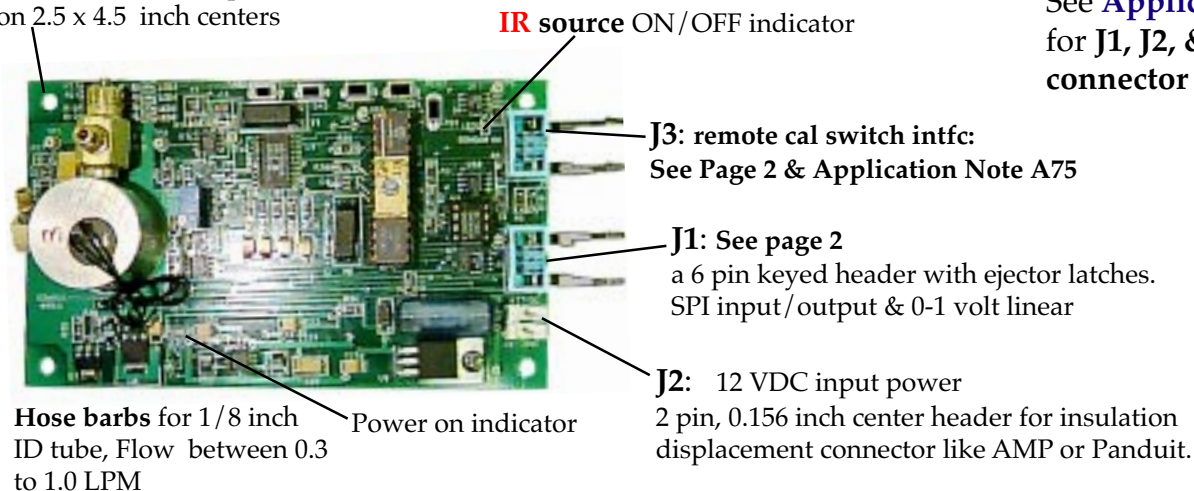
### Model 2015SPI-100 Specifications:

- Method: ..... **NDIR** with Digital Signal processing and temperature compensation
- Gas: ..... **Carbon Dioxide (CO<sub>2</sub>)**
- Full Scale and RANGE:** ..... **0-100% CO<sub>2</sub>** **RANGE** is **user defined** from **25%** to **100%** CO<sub>2</sub>, 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% CO<sub>2</sub> using 50±1% CO<sub>2</sub> gas, the accuracy is best at  
..... 0 to 50±2% CO<sub>2</sub> and 5% of reading from 55 to 100% CO<sub>2</sub>. 16 Bit digital
- Warm-up Time: ..... Less than 2 minutes for use and 5 minutes for accuracy.
- Resolution / Repeatability : ..... ±0.2% CO<sub>2</sub> (challenge with same gas sample multiple times & assure zero)
- Stability: ..... Less than 0.4% CO<sub>2</sub> 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

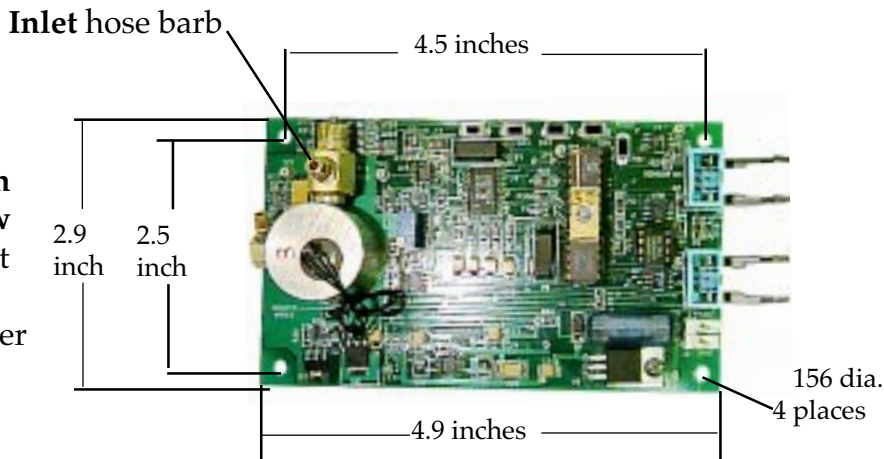
All dimensions are in **inches**, max. vertical clearance is **1.5** inch

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.



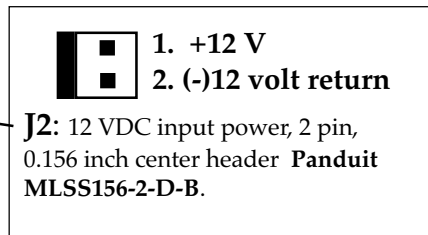
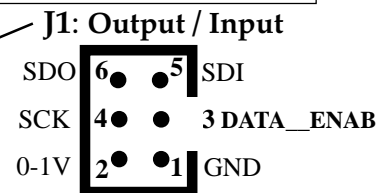
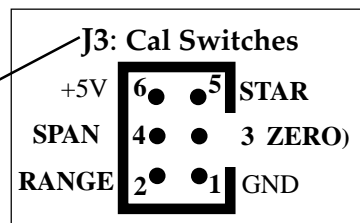
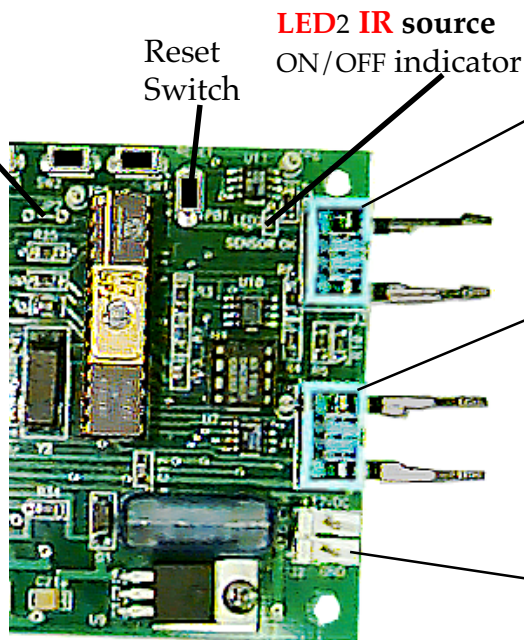
**Hose barbs** for 1/8 inch ID tube, Flow between 0.3 to 1.0 LPM. **Push** gas through the cell, **DO NOT draw gas** through the cell because it is not hermetically sealed and the sample may be diluted if the cell is at a lower pressure than atmospheric.



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.

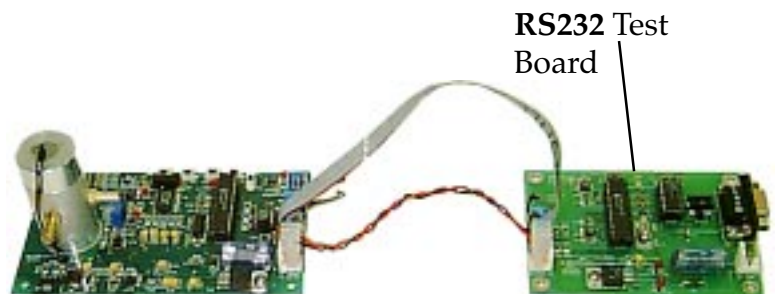
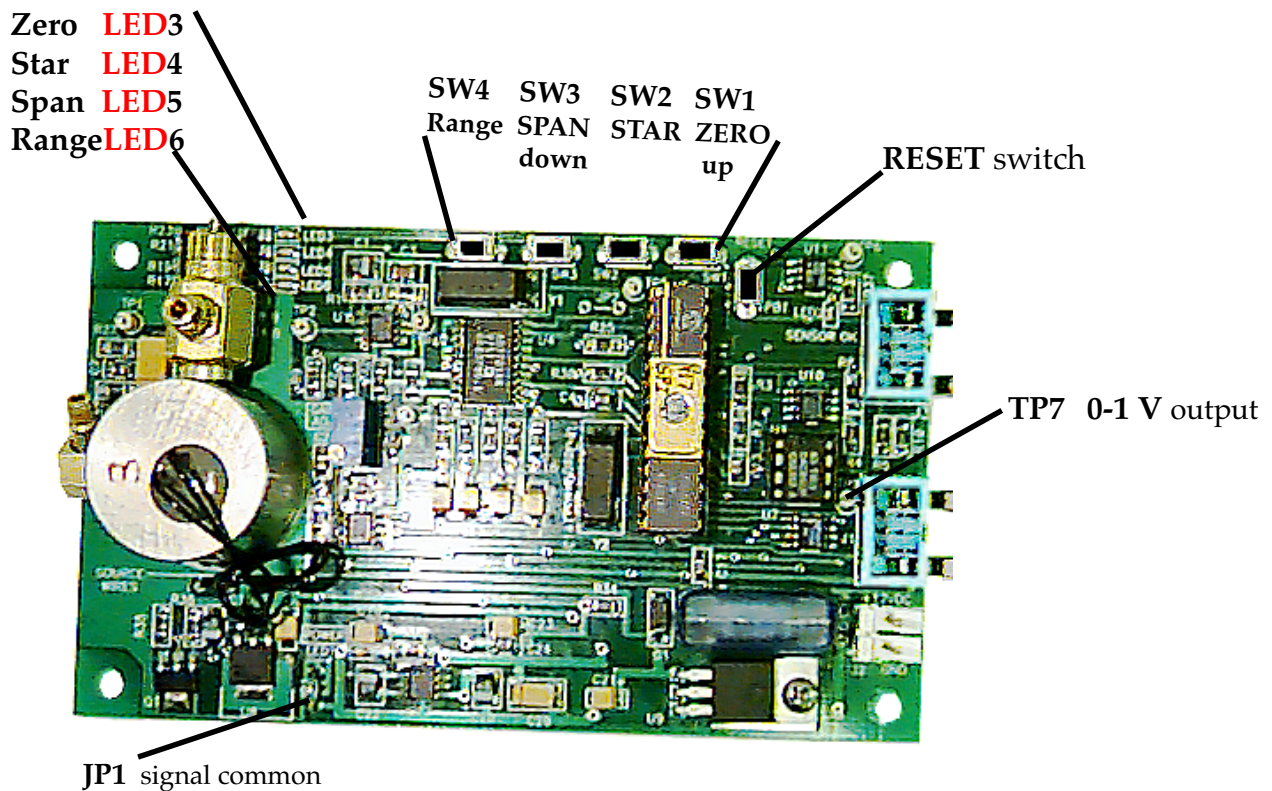
See **Application Note A75** for J1, J2, & J3 mating connector part numbers. **Keep J1 interface cable shorter than 18 inches.** See **Application Note A61** for 16 bit serial digital output timing diagram.

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  $0.0 \pm 0.01$  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  $50 \pm 1\%$  CO<sub>2</sub> 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.





## Model 2015SPI-100

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

A Range of **80** will give a 0-1 V output of **0.500** volt for a reading of **40%** CO<sub>2</sub>.

A Range of **25** will give a 0-1 V output of **0.800** volt for a reading of **20%** CO<sub>2</sub>.

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% CO<sub>2</sub>. The **STAR** will be relative to the new full scale **RANGE**. As an example, a **STAR** of 25% CO<sub>2</sub> 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% CO<sub>2</sub> with a full scale **RANGE** of 100% will give a 0 to 1 volt output with the **STAR** switch pressed of 0.20 volt.