VALTRONICS

OEM Digital NDIR CO_2 Sensor

with **Industry Standard Flange Mount**

Diffusion Gas Cell

Description: Model 2005SPI-2

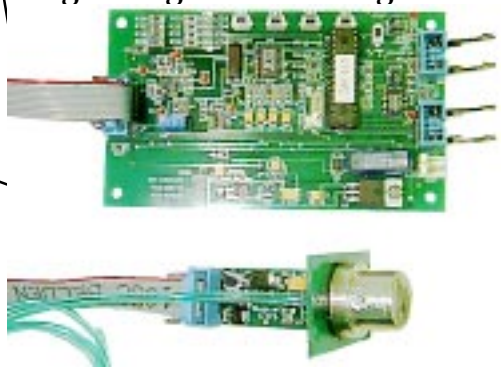
The ***VALTRONICS*** Model **2005SPI** is an OEM **NDIR** CO_2 sensor with digital signal processing and temperature compensation. The firmware **VERSION** depends upon the specific customer interface requirements. The **SPI** (Serial Peripheral Interface) is described in App. Note **A59** & **A61**. Each serial #sensor is individually gas calibrated and temperature compensated at the factory. **Single Point field calibration** typically done using fresh air is supported. On board & remote switches for calibration.

Model 2005SPI-2 Specifications:

Method:	**NDIR** with Digital Signal processing and temperature compensation
Gas:	**Carbon Dioxide** (CO_2)
Range:	**0-20% CO_2** (**Full scale** is **user selectable** from **3** to **20%**)
Input Power	**+12 VDC** (@ 0.250 amp max., 0.135 amp typ, 16.0 volts max, 8.0 volts min)
	2 pin, 0.156 inch center header , Panduit # MLSS156-2-D-B
Accuracy:	if calibrated at 5.0% CO_2 using 5.0±0.1% CO_2 gas, the accuracy is best at
	0 to **5.0±0.2%** CO_2 and 5% of reading from 10% to 20% CO_2.
	16 bit analog to digital converter: Delta-Sigma Conversion Method
Resolution / Repeatability :	**±0.05% CO_2** (challenge with same gas sample multiple times & assure zero)
Stability:	Short term < 0.05% CO_2 in 20 sec., Long term: 5.0±0.5% or 10±1% CO_2 per year
Output Signal:	Digital **SPI** (Serial Peripheral Interface) Application Notes **A59** and **A61**
	Linear 0 to **1 volt output** signal, 12 bit resolution. See pages 2, 3, &4
	Optional **RS-232** Serial interface PC board for terminal com. with any PC
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 J4
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 1.0" see page 2 for mounting (6.2 inch long clearance for latches)
Remote diffusion gas cell	Ribbon cable to remote cell is 30±2 inches long and 0.4 inch wide max.

Gas calibration & tempCo constants are stored in **EEPROM** on each serial numbered remote gas cell so gas cells are interchangeable with any digital signal processing PCB

Digital Signal Processing PCB



J4 to remote switches

J3 SPI digital output & **0-1 V** linear output

J2 +12 VDC input power
Panduit # MLSS156-2-D-B

Remote diffusion gas cell with industry standard **flange mount**

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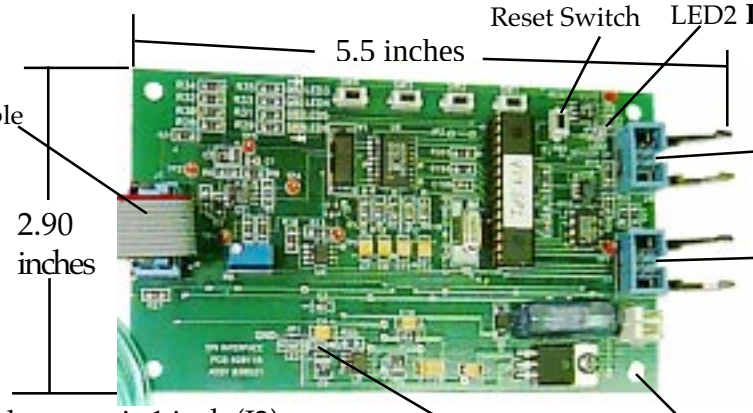
Model 2005SPI-2 Digital Carbon Dioxide Sensor

J1: IR Sensor input: a keyed header with ejector latches to 30" cable

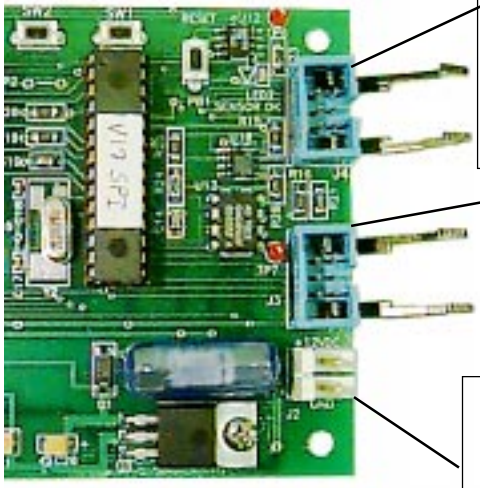


J4: is for remote cal switches **Thomas & Betts 501-6-27ESR**

J3: Thomas & Betts 501-6-27ESR a 6 pin keyed header with ejector latches. **SPI input/output. 0-1 volt** linear output.

0.156 dia. hole four (4) places on **4.5 x 2.5 inch centers**

maximum vertical clearance is 1 inch (J2)



J4: Cal Switches

+5V	6 ● ● 5	**STAR**
SPAN	4 ● ●	**3 ZERO)**
RANGE	2 ● ● 1	GND

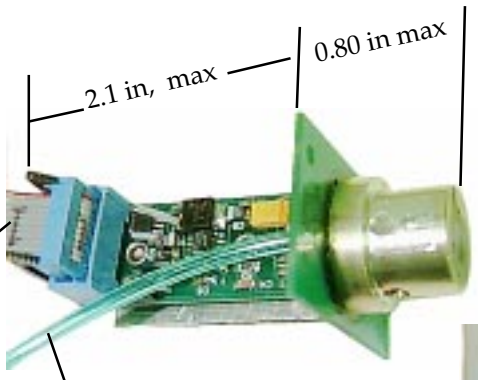
J3: Output / Input

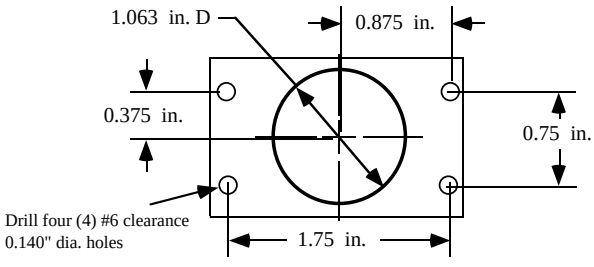
SDO	6 ● ● 5	SDI
SCK	4 ● ●	**3 DATA__ENAB**
0-1V	2 ● ● 1	GND

1. +12 V
2. (-)12 volt return

J2: 12 VDC input power, 2 pin, 0.156 inch center header **Panduit MLSS156-2-D-B**.

The aluminum plate under pc board is 1 inch wide and 1.25 inch vertical claerance including the connector latches





Diffusion Head Mounting Dimensions

outer dimensions of flange are **2.0** x **1.25** in.

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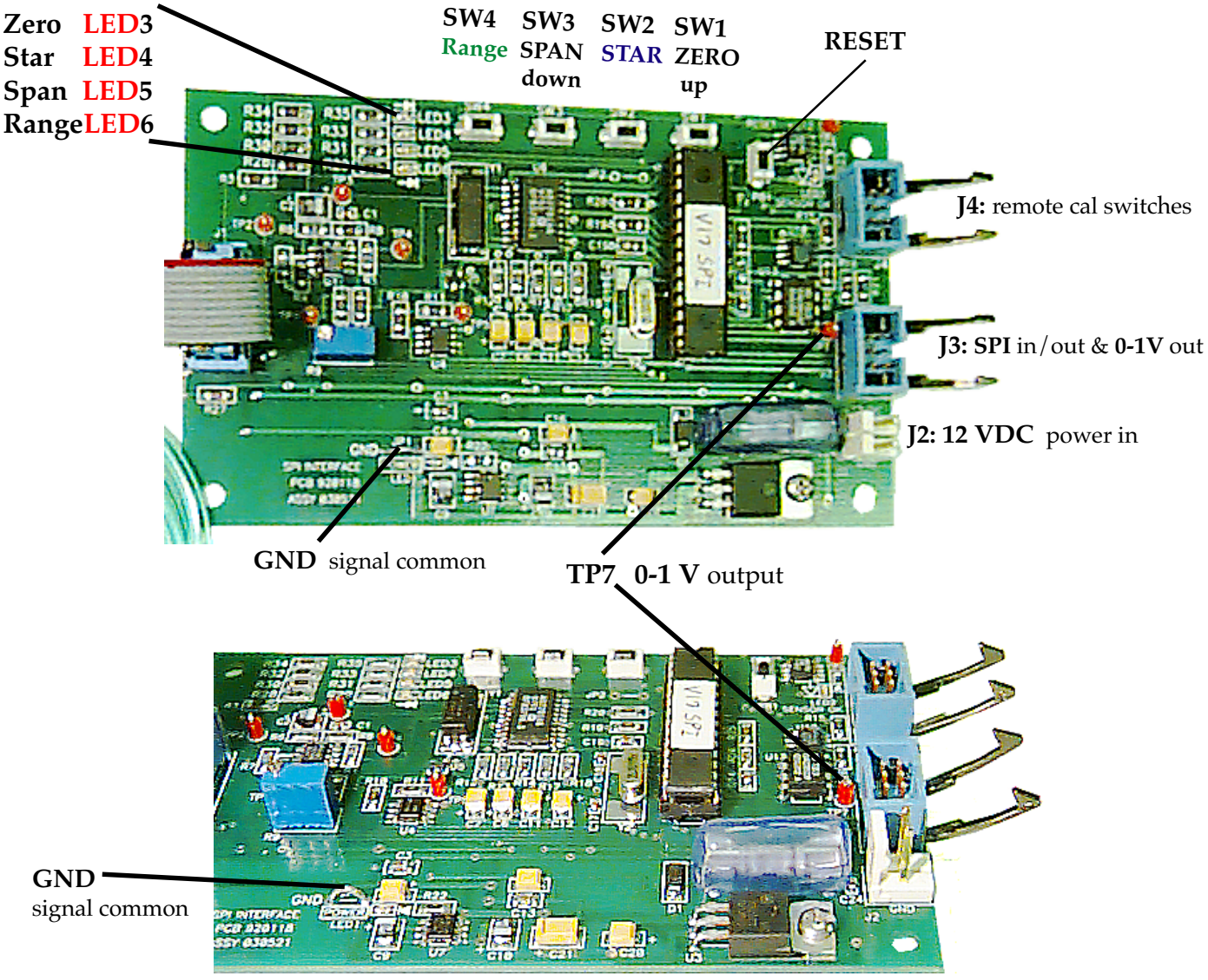
Model 2005SPI-2

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 A59**):
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 4 find the voltage value that corresponds to the full scale that you want from 0.2 to 2.0%. **LED6** will be **ON** . Use SW1 as an **UP** and SW3 as a **DOWN** switch to adjust this value (examples: 20% = 1.00 v, 10% = 0.50 v, 3% = 0.15v).
STAR (**SW2** or remote J4-5): To set the Span Target (calibration gas value) press and hold SW2. **LED4** will be **ON** Use SWI 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 5.0±0.1% CO_2 in gas calibration tube for at least 30 seconds at about 300 ml/min. Press & hold **SW3** 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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Model 2005SPI-2

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 **3** to **20**% CO_2. See the procedure on page 5 and **Application Note A52** for more detail. A typical application would be a full scale range of 20.0 and a STAR of 5.0

The **Full Scale Range** will set what % CO_2 will give an output of 1.00 volt in **normal operation**.

A Range of **3.0** will give a 0-1 V output of **0.500** volt for a reading of **1.5**% CO_2.
A Range of **5.0** will give a 0-1 V output of **0.500** volt for a reading of **2.5**% CO_2.
A Range of **20.0** will give a 0-1 V output of **0.250** volt for a reading of **5.0**% CO_2.

Please remember that **calibration** using the **RS-232 interface board** or via the SPI digital interface will give the user much better visibility than just the 0-1V output.

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

Range / STAR % gas	0 to1 V Output	Range / STAR % gas	0 to1 V Output	Range / STAR % gas	0 to1 V Output	Range / STAR % gas	0 to1 V Output
20.0	1.000	**15.0**	0.750	**10.0**	0.500	**5.0**	0.250
19.9	0.995	**14.9**	0.745	**9.9**	0.495	**4.9**	0.245
19.8	0.990	**14.8**	0.740	**9.8**	0.490	**4.8**	0.240
19.7	0.985	**14.7**	0.735	**9.7**	0.485	**4.7**	0.235
19.6	0.980	**14.6**	0.730	**9.6**	0.480	**4.6**	0.230
19.5	0.975	**14.5**	0.725	**9.5**	0.475	**4.5**	0.225
19.4	0.970	**14.4**	0.720	**9.4**	0.470	**4.4**	0.220
19.3	0.965	**14.3**	0.715	**9.3**	0.465	**4.3**	0.215
19.2	0.960	**14.2**	0.710	**9.2**	0.460	**4.2**	0.210
19.1	0.955	**14.1**	0.705	**9.1**	0.455	**4.1**	0.205
19.0	0.950	**14.0**	0.700	**9.0**	0.450	**4.0**	0.200
18.9	0.945	**13.9**	0.695	**8.9**	0.445	**3.9**	0.195
18.8	0.940	**13.8**	0.690	**8.8**	0.440	**3.8**	0.190
18.7	0.935	**13.7**	0.685	**8.7**	0.435	**3.7**	0.185
18.6	0.930	**13.6**	0.680	**8.6**	0.430	**3.6**	0.180
18.5	0.925	**13.5**	0.675	**8.5**	0.425	**3.5**	0.175
18.4	0.920	**13.4**	0.670	**8.4**	0.420	**3.4**	0.170
18.3	0.915	**13.3**	0.665	**8.3**	0.415	**3.3**	0.165
18.2	0.910	**13.2**	0.660	**8.2**	0.410	**3.2**	0.160
18.1	0.905	**13.1**	0.655	**8.1**	0.405	**3.1**	0.155
18.0	0.900	**13.0**	0.650	**8.0**	0.400	**3.0**	0.150
17.9	0.895	**12.9**	0.645	**7.9**	0.395		
17.8	0.890	**12.8**	0.640	**7.8**	0.390		
17.7	0.885	**12.7**	0.635	**7.7**	0.385		
17.6	0.880	**12.6**	0.630	**7.6**	0.380		
17.5	0.875	**12.5**	0.625	**7.5**	0.375		
17.4	0.870	**12.4**	0.620	**7.4**	0.370		
17.3	0.865	**12.3**	0.615	**7.3**	0.365		
17.2	0.860	**12.2**	0.610	**7.2**	0.360		
17.1	0.855	**12.1**	0.605	**7.1**	0.355		
17.0	0.850	**12.0**	0.600	**7.0**	0.350		
16.9	0.845	**11.9**	0.595	**6.9**	0.345		
16.8	0.840	**11.8**	0.590	**6.8**	0.340		
16.7	0.835	**11.7**	0.585	**6.7**	0.335		
16.6	0.830	**11.6**	0.580	**6.6**	0.330		
16.5	0.825	**11.5**	0.575	**6.5**	0.325		
16.4	0.820	**11.4**	0.570	**6.4**	0.320		
16.3	0.815	**11.3**	0.565	**6.3**	0.315		
16.2	0.810	**11.2**	0.560	**6.2**	0.310		
16.1	0.805	**11.1**	0.555	**6.1**	0.305		
16.0	0.800	**11.0**	0.550	**6.0**	0.300		
15.9	0.795	**10.9**	0.545	**5.9**	0.295		
15.8	0.790	**10.8**	0.540	**5.8**	0.290		
15.7	0.785	**10.7**	0.535	**5.7**	0.285		
15.6	0.780	**10.6**	0.530	**5.6**	0.280		
15.5	0.775	**10.5**	0.525	**5.5**	0.275		
15.4	0.770	**10.4**	0.520	**5.4**	0.270		
15.3	0.765	**10.3**	0.515	**5.3**	0.265		
15.2	0.760	**10.2**	0.510	**5.2**	0.260		
15.1	0.755	**10.1**	0.505	**5.1**	0.255		

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 0.50 volt for a full scale **RANGE** of 10.0% CO_2. The **STAR** will be relative to the new full scale **RANGE**. As an example, a **STAR** of 5.0% CO_2 with a full scale **RANGE** of 10% will give a 0 to 1 volt output with the **STAR** switch pressed of 0.50 volt. A **STAR** of 5.0% CO_2 with a full scale **RANGE** of 20% will give a 0 to 1 volt output with the **STAR** switch pressed of 0.25 volt.