



# Digital NDIR Methane (CH<sub>4</sub>) Sensor

## with flow through gas cell Model 2015SPI-4

### Description:

The **VALTRONICS** Model 2015SPI-4 is an OEM NDIR CH<sub>4</sub> sensor with digital signal processing and temperature compensation. The **SPI** (Serial Peripheral Interface) see Application Notes **A59** & **A64**. Each serial numbered sensor is individually gas calibrated and temperature compensated at the factory. Single Point field calibration is supported. On board & remote switches for calibration.

### Model 2015SPI-4 Specifications:

- Method: ..... **NDIR** with Digital Signal processing and temperature compensation
- Gas: ..... **Methane (CH<sub>4</sub>)**
- Range: ..... **0-100% CH<sub>4</sub>** (Full scale is **user selectable RANGE** from **4** to **100% CH<sub>4</sub>**)
- CAUTION:** ..... **Lower Explosive Limit (LEL)** is **5.0 % CH<sub>4</sub>** by volume in air
- ..... **Upper Explosive Limit (UEL)** is **15% CH<sub>4</sub>** by volume in air
- Note:** CH<sub>4</sub> levels near or above the LEL, unit should be enclosed in an **explosion proof housing** with flame arrestors in the gas path.
- Input Power ..... **+12 VDC** (@ 0.250 amp max., 0.135 amp typ, 16.0 volts max, 8.0 volts min)
- Accuracy: ..... if calibrated at 5% CH<sub>4</sub> using 5±0.1% CH<sub>4</sub> gas, the accuracy is best at
- ..... 0 to 5±0.25% CH<sub>4</sub> and 5% of reading from 5.5 to 100% CH<sub>4</sub>.
- Resolution / Repeatability : ..... **±0.1% CH<sub>4</sub>** on 5% Range(challenge w/same gas sample multiple times& assure zero)
- Stability: ..... Less than 0.05% CH<sub>4</sub> digital out in any 20 second period at constant temperature
- Output Signal: ..... **Digital SPI** and linear **0 to 1 volt linear output** signal. See App Note **A64**
- ..... Optional RS-232 Serial interface 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 App Note **A59**
- 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 3.25"** see page 2 for mounting



0.156 dia. hole four places on 2.5 x 4.5 inch centers  
**Hose barbs** for 1/8 inch ID tube, Flow between 0.2 to 0.9 LPM

All dimensions are in **inches**, max. vertical clearance is **3.25** inches

**IR source ON/OFF indicator**

**J3: remote cal switch intfc:**  
 Thomas & Betts 501-6-27ES

**J1: I/O connector: Thomas & Betts 501-6-27ES**  
 a 6 pin keyed header with ejector latches.  
 SPI input/output & 0-1 volt linear

**J2: 12 VDC input power**  
 2 pin, 0.156 inch center header for insulation displacement connector like AMP or Panduit.



Power on indicator

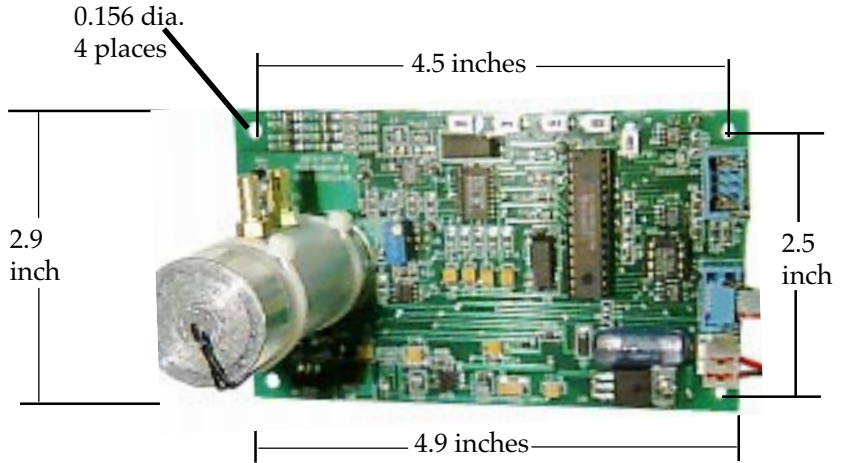




# Model 2015SPI-4 (methane)



Hose barbs for 1/8 inch ID tube, Flow adjust between 0.2 to 0.8 LPM. Max. vertical clearance is 3.25 inches.



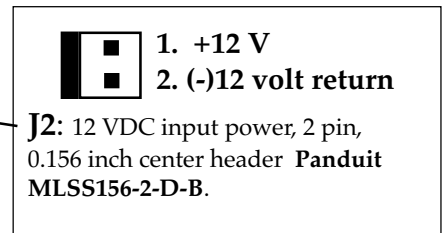
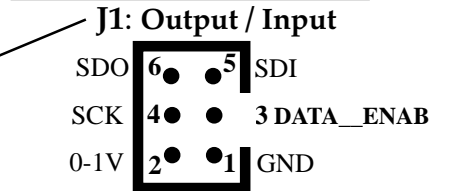
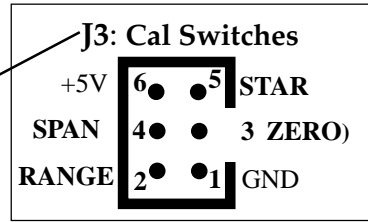
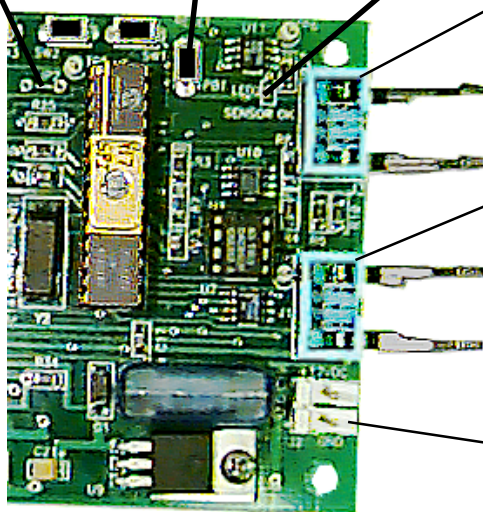
See **Application Note A67** for gas conditioning requirements and information about gas sample pumps and filters.

See **Application Note A75** for interface connector part numbers.

Master/Slave jumper JP2  
Slave mode if installed

Reset Switch

LED2 IR source  
ON/OFF indicator



**Gas calibration** may be initiated via a command from the SPI input on **J3** (see Application Note A59) or from the on board or remote **switches** (Logic "0" to initiate) below :

**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.

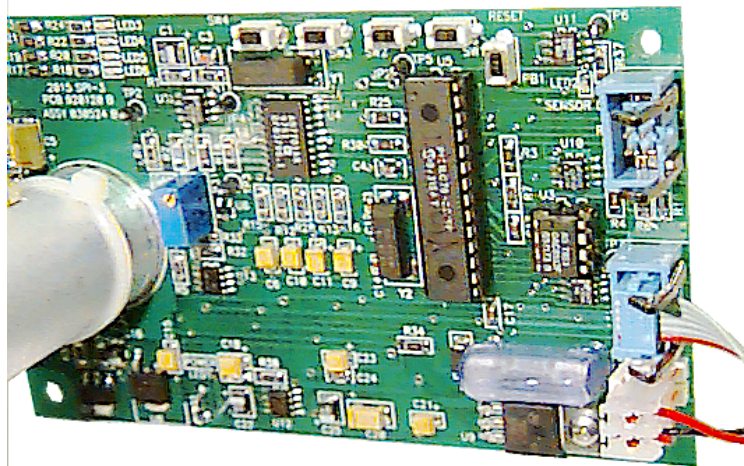
**RANGE** (SW4 or remote J4-2 ): To set the full scale or range press and hold SW4. From the chart on page 4 find the voltage value that corresponds to the full scale that you want from 4 to **100%CH<sub>4</sub>**. **LED6** will be **ON** . Use SW1 as an **UP** and SW3 as a **DOWN** switch to adjust this value(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 4.

**SPAN** (SW3 or remote J4-4 ): To **SPAN** calibrate while flowing certified span gas like **5.0±0.1% CH<sub>4</sub>** 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.

Zero **LED3**  
Star **LED4**  
Span **LED5**  
Range**LED6**

SW4 SW3 SW2 SW1  
Range SPAN STAR ZERO  
down up  
RESET switch



JP1 signal common

2015SPI-4 0-100% CH<sub>4</sub>

RS232 test board  
connects to COM port



Use any PC with a terminal emulation program like **HyperTerminal** to test & calibrate the 2015SPI-4. See **Application Note A66** for commands and responses.

# Model 2015SPI-4 0-100% CH<sub>4</sub> (methane)

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 4 to 100% CH<sub>4</sub>. See page 3 & **Application Notes A59 & A66** 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 % CH<sub>4</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%** CH<sub>4</sub>.

A Range of **80** will give a 0-1 V output of **0.500** volt for a reading of **40%** CH<sub>4</sub>.

A Range of **5** will give a 0-1 V output of **1.000** volt for a reading of **5%** CH<sub>4</sub>.

Please remember that calibration using the RS-232 Test board will give the user much better visibility. If you use the digital output you will not have to worry about the **RANGE** (16 bit digital resolution).

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

Range / STAR % gas	0 to 1 V Output	Range / STAR % gas	0 to 1 V 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	24	0.240
73	0.730	23	0.230
72	0.720	22	0.220
71	0.710	21	0.210
70	0.700	20	0.200
69	0.690	19	0.190
68	0.680	18	0.180
67	0.670	17	0.170
66	0.660	16	0.160
65	0.650	15	0.150
64	0.640	14	0.140
63	0.630	13	0.130
62	0.620	12	0.120
61	0.610	11	0.110
60	0.600	10	0.100
59	0.590	9	0.090
58	0.580	8	0.080
57	0.570	7	0.070
56	0.560	6	0.060
55	0.550	5	0.050
54	0.540	4	0.040
53	0.530		
52	0.520		
51	0.510		

See **Application Note A67** for information about gas conditioning and parts for filtering the gas and preventing water droplets from entering the gas cell. A **hydrophobic filter** in front of the gas inlet hose barb is required as a minimum to prevent particles & droplets from getting into the gas cell.

Equivalent Full scale % of some hydrocarbon compounds that the 2015SPI-4 will respond to:

<u>Gas</u>	<u>Chemical formula</u>	<u>LEL</u>	<u>% that produces a full scale response</u>	<u>Relative response</u>
<b>Methane</b>	<b>CH<sub>4</sub></b>	5.0 % in air	5.00 % CH <sub>4</sub>	<b>1.00</b>
Propane	C <sub>3</sub> H <sub>8</sub>	2.1 % in air	1.50 % C <sub>3</sub> H <sub>8</sub>	3.33
Butane	C <sub>4</sub> H <sub>10</sub>	1.8 % in air	0.75 % C <sub>4</sub> H <sub>10</sub>	6.67
Ethane	C <sub>2</sub> H <sub>6</sub>	3.0 % in air	1.79 % C <sub>2</sub> H <sub>6</sub>	4.21
Ethylene	C <sub>2</sub> H <sub>4</sub>	2.7 % in air	2.37 % C <sub>2</sub> H <sub>4</sub>	2.11
Hexane	C <sub>6</sub> H <sub>14</sub>	1.2 % in air	0.75 % C <sub>6</sub> H <sub>14</sub>	6.67

response accuracy is not specified for compounds other than methane.

