OEM Digital NDIR CO sensor

Carbon Monoxide Model 2015SPI-CO Flow through gas cell

RANGE is user adjustable from 10% to 100% CO

The ***VALTRONICS*** Model **2015SPI-CO** is an OEM **NDIR** sensor with digital signal processing and temperature compensation. The firmware **VERSION** depends upon the specific customer interface requirements. The **SPI** (Serial Peripheral Interface) See App Notes **A59** & **A64**. 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 or via SPI.

Model 2015SPI-CO Specifications: RANGE defines the analog 0-1 volt output

Method:	**NDIR** with Digital Signal processing and temperature compensation
Gas:	**Carbon Monoxide** (**CO**)
Full scale & **RANGE**:	**0-100% CO** (**RANGE** is user selectable anywhere from **10 to 100% CO**)
CAUTION:	**Lower Explosive Limit** (**LEL**) is **12.5** % CO by volume in air
	Upper Explosive Limit (UEL) is **74**% CO by volume in air
Input Power:	**+12 VDC** (@ 0.250 amp max., 0.135 amp ave, 16.0 volts max, 8.0 volts min)
Accuracy:	0 to **20.0±1.0% CO** and 5% of reading from **20** to **100% CO** .
Resolution / Repeatability:	**±1% of RANGE** (challenge with same gas sample multiple times & assure zero)
Stability:	Less than 1% of **RANGE** during any 20 second period at constant temperature
Output Signal:	**Digital SPI** and **linear 0** to **1 volt output** signal See App Note **A59** & **A66**
RS232 Test Board:	Required for diagnotic & test use , 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**
CO_2 Interference:	Less than 2% **CO** response to 100% CO_2
	Less than 2% **CO** increased response with a mixture of 20% **CO** & 1.6% CO_2
Storage Temperature range:	-40 to +70°C (-40 to +158°F)
Weight:	Less than 0.25 pound (<0.11 kilogram)
External Dimensions (PCB)	**4.9**" x **2.9**" x **3.5**"vertical see page 2 for mounting

All dimensions are in **inches,** max. vertical clearance is **3.5** inch

J3: **remote cal switches (see page 2)**
Thomas & Betts 501-6-27ESR

J1: **I/O connector: Thomas & Betts 501-6-27ESR**
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.

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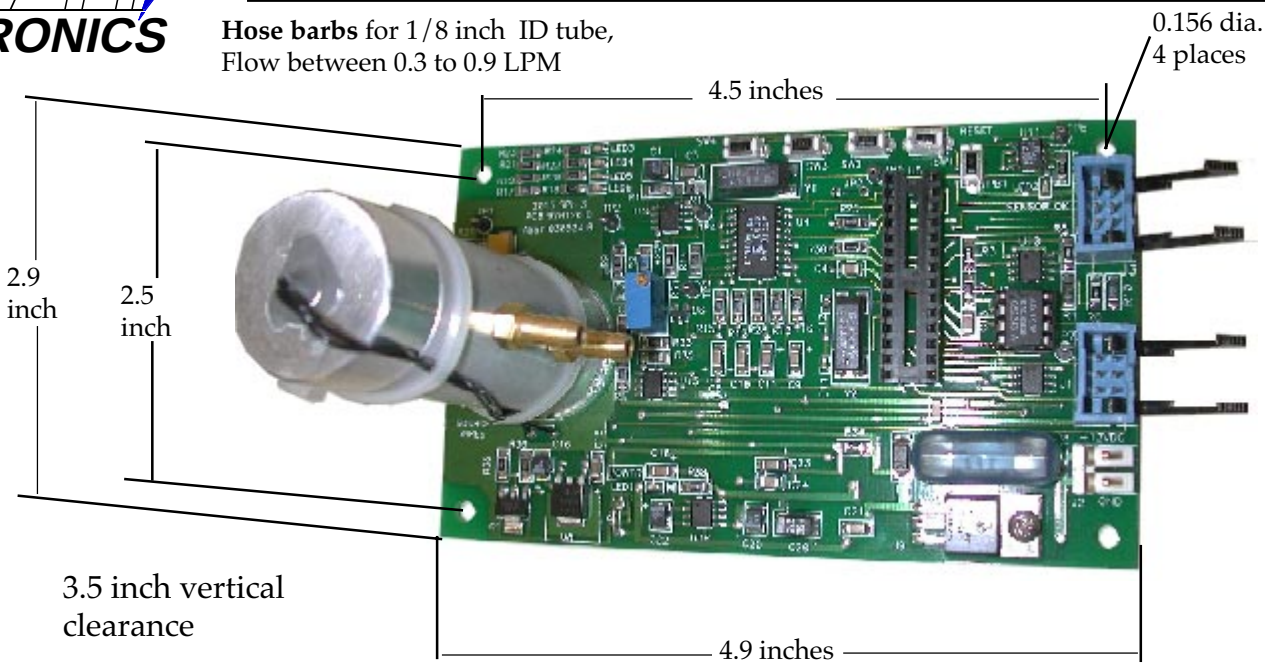
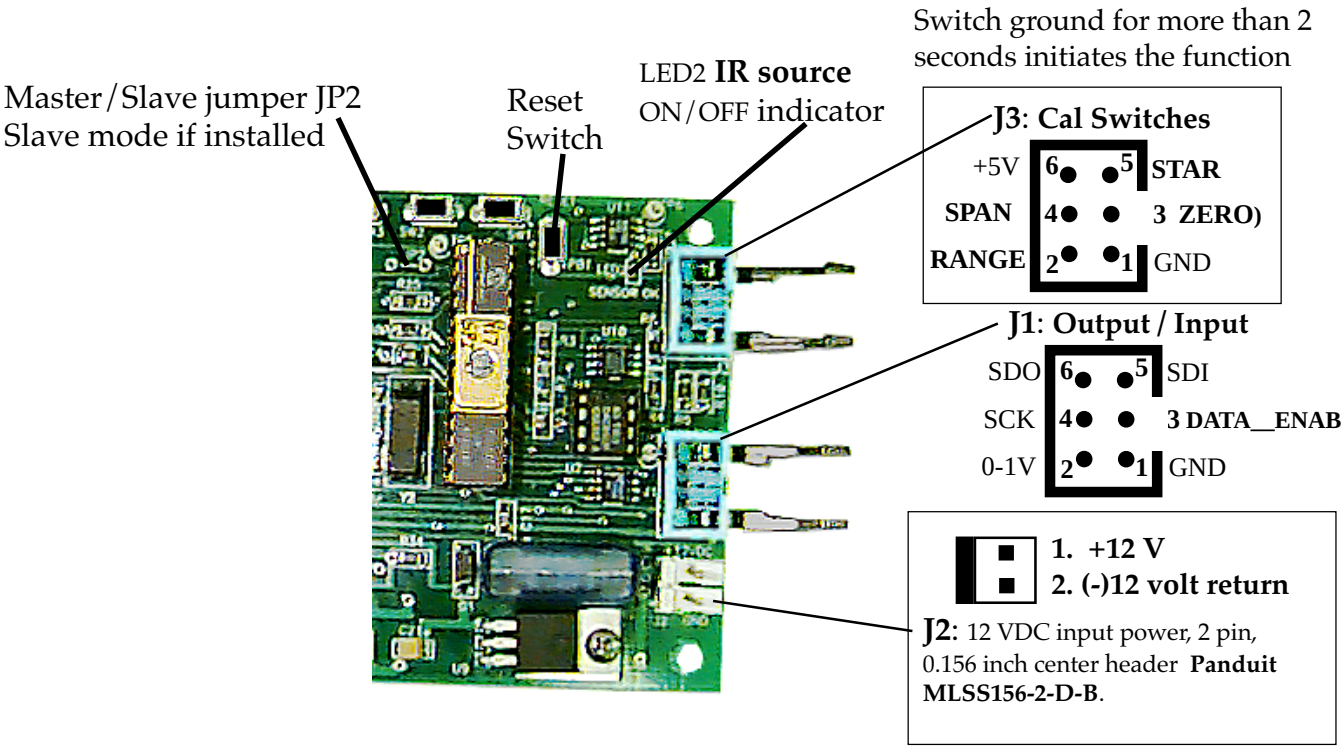
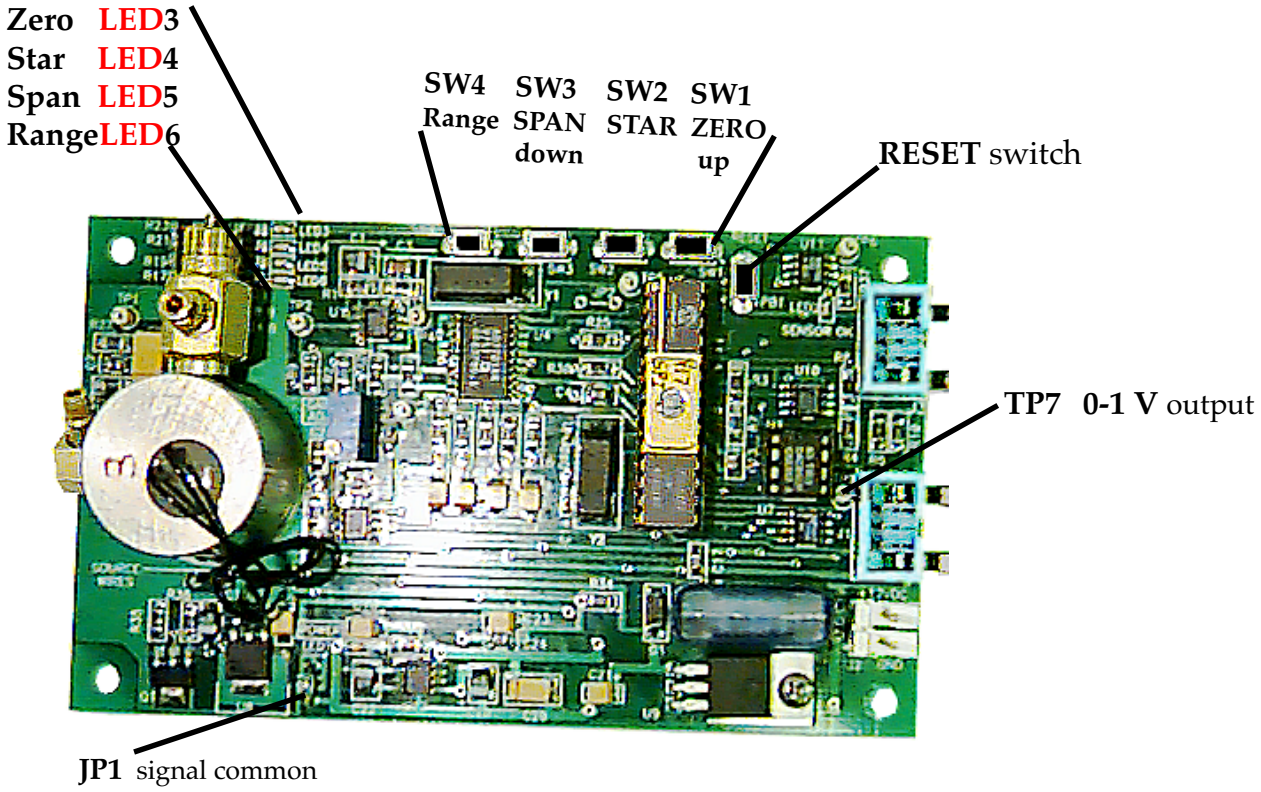
Model 2015SPI-CO



See **Application Note A67** for gas conditioning requirements and information about gas sample pumps and filters. **Use a Hydrophobic Filter immediately in front of gas inlet hose barb. Push gas through the gas cell at a rate between 0.3 to 1.0 liter per minute.** See **Application Note A79** for more info about the hydrophobic filter.



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 A66**):
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 10 to 100%. **LED6** will be **ON** . Use SW1 as an **UP** and SW3 as a **DOWN** switch to adjust this value (examples:30% = 0.30 v, 25% = 0.25 v, 10% = 0.1 v).
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 4.
SPAN (**SW3** or remote J4-4): To SPAN calibrate while flowing certified span gas like 10±0.2% **CO** 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-CO

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 **10** to **100**% CO. See the procedure on page 3 & **Application Note A66** for more detail. A typical application would be a full scale range of **25.0** and a **STAR** of **10.0**% CO.

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

A **Range** of **50** will give a 0-1 V output of **0.500** volt for a concentration of **25**% CO in gas cell.
A **Range** of **25** will give a 0-1 V output of **0.500** volt for a concentration of **12.5**% CO in gas cell.
The lowest Range of **10** will give a 0-1 V output of **0.250** volt for a concentration of **2.5**% CO in gas cell.

Please remember that calibration using the **RS-232 Test Board** will give the user much better visibility than just looking at the 0-1 volt output. See **Application Note A66.**

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

Rng / STAR % gas	0 to1 V Output	Rng / STAR % gas	0 to1 V Output	Rng / STAR % gas	0 to1 V Output	Rng / STAR % gas	0 to1 V Output	Rng / STAR % gas	0 to1 V Output
100	1.000	**50**	0.500	**25.9**	0.259	**19.6**	0.196	**13.3**	0.133
99	0.990	**49**	0.490	**25.8**	0.258	**19.5**	0.195	**13.2**	0.132
98	0.980	**48**	0.480	**25.7**	0.257	**19.4**	0.194	**13.1**	0.131
97	0.970	**47**	0.470	**25.6**	0.256	**19.3**	0.193	**13.0**	**0.130**
96	0.960	**46**	0.460	**25.5**	0.255	**19.2**	0.192	**12.9**	0.129
95	0.950	**45**	0.450	**25.4**	0.254	**19.1**	0.191	**12.8**	0.128
94	0.940	**44**	0.440	**25.3**	0.253	**19.0**	**0.190**	**12.7**	0.127
93	0.930	**43**	0.430	**25.2**	0.252	**18.9**	0.189	**12.6**	0.126
92	0.920	**42**	0.420	**25.1**	0.251	**18.8**	0.188	**12.5**	0.125
91	0.910	**41**	0.410	**25.0**	**0.250**	**18.7**	0.187	**12.4**	0.124
90	0.900	**40**	0.400	**24.9**	0.249	**18.6**	0.186	**12.3**	0.123
89	0.890	**39**	0.390	**24.8**	0.248	**18.5**	0.185	**12.2**	0.122
88	0.880	**38**	0.380	**24.7**	0.247	**18.4**	0.184	**12.1**	0.121
87	0.870	**37**	0.370	**24.6**	0.246	**18.3**	0.183	**12.0**	**0.120**
86	0.860	**36**	0.360	**24.5**	0.245	**18.2**	0.182	**11.9**	0.119
85	0.850	**35**	0.350	**24.4**	0.244	**18.1**	0.181	**11.8**	0.118
84	0.840	**34**	0.340	**24.3**	0.243	**18.0**	**0.180**	**11.7**	0.117
83	0.830	**33**	0.330	**24.2**	0.242	**17.9**	0.179	**11.6**	0.116
82	0.820	**32**	0.320	**24.1**	0.241	**17.8**	0.178	**11.5**	0.115
81	0.810	**31**	0.310	**24.0**	**0.240**	**17.7**	0.177	**11.4**	0.114
80	0.800	**30.0**	**0.300**	**23.9**	0.239	**17.6**	0.176	**11.3**	0.113
79	0.790	**29.9**	0.299	**23.8**	0.238	**17.5**	0.175	**11.2**	0.112
78	0.780	**29.8**	0.298	**23.7**	0.237	**17.4**	0.174	**11.1**	0.111
77	0.770	**29.7**	0.297	**23.6**	0.236	**17.3**	0.173	**11.0**	**0.110**
76	0.760	**29.6**	0.296	**23.5**	0.235	**17.2**	0.172	**10.9**	0.109
75	0.750	**29.5**	0.295	**23.4**	0.234	**17.1**	0.171	**10.8**	0.108
74	0.740	**29.4**	0.294	**23.3**	0.233	**17.0**	**0.170**	**10.7**	0.107
73	0.730	**29.3**	0.293	**23.2**	0.232	**16.9**	0.169	**10.6**	0.106
72	0.720	**29.2**	0.292	**23.1**	0.231	**16.8**	0.168	**10.5**	0.105
71	0.710	**29.1**	0.291	**23.0**	**0.230**	**16.7**	0.167	**10.4**	0.104
70	0.700	**29.0**	**0.290**	**22.9**	0.229	**16.6**	0.166	**10.3**	0.103
69	0.690	**28.9**	0.289	**22.8**	0.228	**16.5**	0.165	**10.2**	0.102
68	0.680	**28.8**	0.288	**22.7**	0.227	**16.4**	0.164	**10.1**	0.101
67	0.670	**28.7**	0.287	**22.6**	0.226	**16.3**	0.163	**10.0**	**0.100**
66	0.660	**28.6**	0.286	**22.5**	0.225	**16.2**	0.162	9.9	0.099
65	0.650	**28.5**	0.285	**22.4**	0.224	**16.1**	0.161	9.8	0.098
64	0.640	**28.4**	0.284	**22.3**	0.223	**16.0**	**0.160**	9.7	0.097
63	0.630	**28.3**	0.283	**22.2**	0.222	**15.9**	0.159	9.6	0.096
62	0.620	**28.2**	0.282	**22.1**	0.221	**15.8**	0.158	9.5	0.095
61	0.610	**28.1**	0.281	**22.0**	**0.220**	**15.7**	0.157	9.4	0.094
60	0.600	**28.0**	**0.280**	**21.9**	0.219	**15.6**	0.156	9.3	0.093
59	0.590	**27.9**	0.279	**21.8**	0.218	**15.5**	0.155	9.2	0.092
58	0.580	**27.8**	0.278	**21.7**	0.217	**15.4**	0.154	9.1	0.091
57	0.570	**27.7**	0.277	**21.6**	0.216	**15.3**	0.153	9.0	**0.090**
56	0.560	**27.6**	0.276	**21.5**	0.215	**15.2**	0.152	8.9	0.089
55	0.550	**27.5**	0.275	**21.4**	0.214	**15.1**	0.151	8.8	0.088
54	0.540	**27.4**	0.274	**21.3**	0.213	**15.0**	**0.150**	8.7	0.087
53	0.530	**27.3**	0.273	**21.2**	0.212	**14.9**	0.149	8.6	0.086
52	0.520	**27.2**	0.272	**21.1**	0.211	**14.8**	0.148	8.5	0.085
51	0.510	**27.1**	0.271	**21.0**	**0.210**	**14.7**	0.147	8.4	0.084
		27.0	**0.270**	**20.9**	0.209	**14.6**	0.146	8.3	0.083
		26.9	0.269	**20.8**	0.208	**14.5**	0.145	8.2	0.082
		26.8	0.268	**20.7**	0.207	**14.4**	0.144	8.1	0.081
		26.7	0.267	**20.6**	0.206	**14.3**	0.143	8.0	**0.080**
		26.6	0.266	**20.5**	0.205	**14.2**	0.142		
		26.5	0.265	**20.4**	0.204	**14.1**	0.141		
		26.4	0.264	**20.3**	**0.203**	**14.0**	**0.140**		

After setting the **Range** to **25**% CO, the new **STAR** & response chart for the 0-1 V output will start with 25% equals 1.00 volt and 12.5% equals 0.50 volt.

Please remember, the **minimum Range** for proper operation is 10.0% CO .

If you set the **Range** to **10.0**% CO the new **STAR** and response chart for the 0-1 V output will start with 10% equals 1.00 volt and 5.0% equals 0.50 volt. With the **Range** set to **10.0**% CO, the **STAR** could be set as low as 3.0 % CO by pressing the **STAR** switch and running the 0 to 1 volt output down to 0.30 volt.