1. 传感器输出

1.1 工作通道探测器：正弦波输出，频率与钨丝灯驱动电源频率相同。当传感器位于目标气体时，正弦波振幅降低。注意双气体传感器有两个工作通道输出。

1.2 参考通道探测器：正弦波输出，频率与钨丝灯驱动电源频率相同。用于补偿温度，光源等误差，当传感器位于目标气体时，正弦波输出振幅不变。

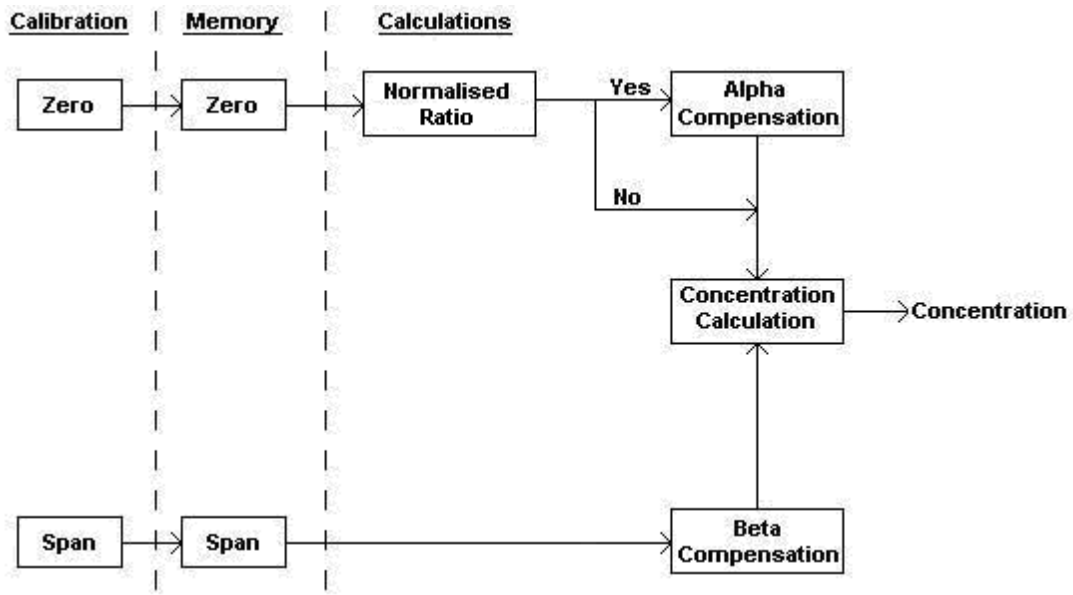
1.3 热敏电阻：传感器内的温度输出需要进行线性处理。(IR11BD, IR12BD 没有内置温度传感器)

1.4 温度传感器：传感器内的温度线性输出可以直接进 AD

2．浓度计算简介

利用工作通道的峰峰值电压和参考通道的峰峰值电压的比值进行浓度计算。在计算时先要进行零点和量程标定并把标定的数值存储在内存便于浓度计算时调用。在计算过程中会用到线性系数 a 和 n，以及温度补偿系数 Alpha 和 Beta，这些系数的计算过程在技术指南 5 中有详细介绍，在附件 G 中有 SGX 公司根据我们电路和测试环境得出的系数，客户可以选用。

下图为信号处理流程图：



Note: Normalised Ratio = Act / (Zero x Ref)

Normalised Absorbance = 1 - (Act / (Zero x Ref))

2.1 零点标定

用干净的环境气体或纯氮气进行零点标定，将下面公式的计算结果和标定时的温度存放在内存中供浓度计算时调用。

Zero = Act / Ref

Where:

Act = the peak- to-peak output of the Active Detector in volts in zero test gas.（零点标定时工作通道峰峰值电压）

Ref = the peak-to-peak output of the Reference Detector in volts in zero test gas.（零点标定时参考通道峰峰值电压）

2.2 满量程标定

用满量程目标气体进行量程标定 Span。将下面公式的计算结果和标定时的温度储存在内存中供浓度计算时调用。

Span = [1 – Act / (Zero x Ref)] / [1 – exp(–aCn)]

Where:

Act = the peak-to-peak output of the Active Detector in volts in the calibration test gas.（在满量程目标气体中工作通道峰峰值电压输出）

Ref = the peak-to-peak output of the Reference Detector in volts in the calibration test gas.（在满量程目标气体中参考通道峰峰值电压输出）

Zero = the "Zero" value (stored in non-volatile memory) calculated during this calibration routine.（储存在内存中的零点标定值）

a = fixed linearisation coefficient (see Appendix G).（固定的线性系数，查附件 G 中的表格得到）

C = the concentration of the applied calibration test gas in % Volume (i.e. 5 for 5% Vol.)（标定的气体浓度，推荐用满量程气体）

n = fixed linearisation coefficient (see Appendix G).（固定的线性系数，查附件 G 中的表格得到）

3 温度补偿

尽管通过参考通道已经剔除了温度对传感器的影响但由于温度对传感器的影响是复杂而且因传感器的不同也会有差异，所以在某些应用中会需要附加的温度补偿。

对于甲烷传感器温度主要影响零点，所以可以用 Alpha 系数进行补偿，如不进行补偿会使浓度计算基准线以近乎线性地向上移动。对二氧化碳传感器主要是对量程的影响，可以通过 Beta 系数进行补偿。

我们建议以标定温度为界分正负两段进行补偿即 AlphaPos, AlphaNeg 和 BetaPos, BetaNeg.

3.1 Alpha 补偿

Normalised Ratio (comp) = Normalised Ratio x (1 + α (T - Tcal))

Where:

Normalised Ratio = Act / (Zero x Ref)

Act = the peak-to-peak output of the Active Detector in volts.

Zero = the "Zero" value (stored in non-volatile memory) calculated during the calibration routine (see Calibration above).

Ref = the peak-to-peak output of the Reference Detector in volts.

α = the "alpha" coefficient, either "alphapos" or "alphaneg" (see Appendix G),系数通过查附件 G 中的表格得到

T = the actual temperature measured at the sensor in kelvin.注意开氏温度

Tcal = the temperature (stored in non-volatile memory) measured during the calibration routine (see Calibration above) in kelvin. 注意开氏温度

3.2 Beta 补偿

Span(comp) = Span + (β x ((T – Tcal) / Tcal))

Where:

Span = the "Span" value (stored in non-volatile memory) calculated during the calibration routine (see Calibration above).

β = the "beta" coefficient, either "betapos" or "betaneg" (see Appendix G).系数通过查附件 G 中的表格得到

T = the actual temperature measured at the sensor in kelvin. 注意开氏温度

Tcal = the temperature (stored in non-volatile memory) measured during the calibration routine (see Calibration above) in kelvin. 注意开氏温度

4. 浓度计算

C = (–ln [1 – ((1 – Normalised Ratio (comp)) / Span(comp))] / a)(1 / n)

Where:

a = fixed linearisation coefficient (see Appendix G).系数通过查附件 G 中的表格得到

n = fixed linearisation coefficient (see Appendix G).系数通过查附件 G 中的表格得到

Note: For this equation to work the value of "(1 – Normalised Ratio (comp))" needs to be positive. If a negative value is obtained then perform the following actions if required:

注意：在此计算公式中(1 – Normalised Ratio (comp))要求为正，如果出现负值要采取乘上-1 的变换得到正值，然后再计算浓度。

(i)Convert (1 – Normalised Ratio (comp)) to a positive value (i.e. multiply by "–1", known as the modulus).

(ii)Perform the calculation to determine concentration, as normal.

(iii)Display the concentration as a negative value (i.e. multiply by "–1").

This is the same as the following equation:

C = – ((ln [1 – ((1 – Normalised Ratio (comp)) / Span(comp))] / a)(1 / n))

5. 温度测量

5.1 热敏电阻

Temperature (K) = 375.120 – (54.122*V) + (13.349*V2) – (1.617*V3)

(Twin Gas Devices only, e.g. IRxxTT)

Temperature (K) = 395.47 – (74.94*V) + (19.68*V2) – (2.327*V3)

(IRxxEx Devices only)

Where V = voltage between the 10 kΩ resistor and the thermistor output (see Infrared Sensor Application Note 4).该电压是在温度输出串一个 10 kΩ 电阻的值详见技术指南 4。

5.2 温度传感器

Temperature (K) = ((V – 0.5) / 0.01) + 273

(IR600 Series Devices only)

Temperature (K) = ((V – 0.424) / 0.00625) + 273

(IRxxGx Devices only)

Where V = voltage output of the temperature channel.该电压为温度芯片的输出

6. 相关线性和温度补偿系数

APPENDIX G – TABLE OF COEFFICIENTS

Note: These coefficients are based upon results measured at e2v technologies using standard test equipment. These coefficients may vary slightly when using different circuits. It may be required to recalculate some of these coefficients if small inaccuracies are observed during testing (refer to Infrared Sensor Application Note 5 for determination of coefficients).

Note: For sensor variants with a "_1" suffix (supported lamp versions), use the equivalent non-supported lamp version. For example for an IR11GM_1, use coefficients for the IR11GM.

Sensor Type	Gas Type	Range (v/v)	a	n	alphapos	alphaneg	betapos	betaneg
IR11BD / IR21BD	CO_2	0.5%	2.49	0.811	0.000464	0.000501	0.084	0.143
		2.0%	1.12	0.667			0.236	0.329
		5.0%	0.892	0.570			0.351	0.447
IR11EJ / IR11GJ	CO_2	0.5%	1.88	0.761	0.000275	0.000242	0.159	0.157
		2.0%	1.13	0.658			0.263	0.256
		5.0%	0.929	0.560			0.296	0.281
IR11EM / IR11GM	CO_2	0.5%	1.75	0.789	0.000275	0.000242	0.100	0.113
		2.0%	1.02	0.678			0.211	0.208
		5.0%	0.832	0.588			0.352	0.358
IR11BR	CO_2	100%	0.0975	0.469	0.000568	0.000390	0.121	0.537
IR12BD / IR22BD	CH_4	5.0%	0.256	0.731	0.000366	0.000379	-0.148	-0.164
		100%	0.0530	0.484			Contact e2v	
IR12EJ / IR12GJ	CH_4	5.0%	0.267	0.725	0.000363	0.000235	-0.106	-0.137
		100%	0.0563	0.497			Contact e2v	
IR13BD / IR23BD	CH_4	5.0%	0.236	0.675	0.000223	0.000072	-0.064	-0.097
		100%	0.046	0.504			Contact e2v	
IR14BD / IR24BD	C_2H_2	2.5%	0.397	0.924	Contact e2v		Contact e2v	
		100%	0.122	0.691	Contact e2v		Contact e2v	
IR15TT / IR25TT IR15TT-M / IR25TT-M	CO_2	0.3%	1.02	0.673	0.000500	0.000500	0.100	0.100
		2.0%	1.01	0.675			0.300	0.300
		5.0%	0.861	0.620			0.400	0.400
	CH_4	5.0%	0.223	0.665	0.000400	0.000400	-0.059	-0.059
		100%	0.071	0.559			Contact e2v	
IR15TT-R	CO_2	100%	0.106	0.542	0.000586	0.000445	-0.088	0.344
	CH_4	5%	0.190	0.779	0.000438	0.000365	-0.156	-0.165
		100%	0.015	0.464			-1.636	-1.967
IR31SE / IR31SC	CO_2	0.3%	2.11	0.791	0.000718	0.001517	-0.120	-0.120
		2.0%	1.02	0.66			-0.272	-0.272
		5.0%	0.816	0.537			Contact e2v	
IR31BC	CO_2	0.3%	2.49	0.811	0.000464	0.000501	0.084	0.143
		2.0%	1.12	0.667			0.236	0.329
		5.0%	0.892	0.570			0.351	0.447
IR32BC	CH_4	5.0%	0.251	0.786	0.000366	0.000379	-0.148	-0.164
		100%	0.0530	0.484			Contact e2v	
IR33BC	CH_4	5.0%	0.236	0.675	0.000223	0.000072	-0.064	-0.097
		100%	0.046	0.504			Contact e2v	
IR34BC	C_2H_2	2.5%	0.397	0.924	Contact e2v		Contact e2v	

Sensor Type	Gas Type	Range (v/v)	a	n	alphapos	alphaneg	betapos	betaneg
IR601	CO_2	0.3%	3.36	0.905	0.000600	0.000600	Contact e2v	
		2.0%	1.05	0.730			0.703	0.703
		5.0%	0.820	0.665			Contact e2v	
IR602	CH_4	5.0%	0.283	0.883	0.000600		Contact e2v	
IR603	CH_4	5.0%	0.283	0.883	0.000600		Contact e2v	
IR604	C_2H_2	2.5%	Contact e2v		Contact e2v		Contact e2v	

英文原文如下：请双击获得全文。

http://www.sgxsensortech.com/site/wp-content/uploads/2012/10/AN2-Signal-Processing-for-Infrared-Gas-Sensors.pdf