1. 由于每个仪表制造商电路上的差异，有时需要重新计算线性系数和温度补偿系数。对于每个型号的传感器需要下列系数：

| 系数 | 目的 |
|---|---|
| a | 线性 |
| n | 线性 |
| α | 零点温度补偿 |
| β | 满量程温度补偿 |

2. 计算线性系数

2.1 利用下面公式计算线性系数

**$1 - (Act / [Zero \times Ref]) = Span \times [1 - \exp(-aC^n)]$**

Where:

| | | |
|---|---|---|
| Act | = | the peak-to-peak output of the Active Detector in volts in the calibration test gas. |
| Ref | = | the peak-to-peak output of the Reference Detector in volts in the calibration test gas. |
| Zero | = | the "Zero" value (Act/Ref in 0% vol. Test gas). |
| Span | = | the value calculated as part of the calibration process. **Note: This value is not required when determining "a" and "n" as it will be automatically determined by the curve fitting program.** |
| a | = | fixed linearisation coefficient (to be derived using the curve fitting program). |
| C | = | the concentration of the applied calibration test gas in % volume (i.e. 5 for 5% vol.) |
| n | = | fixed linearisation coefficient (to be derived using the curve fitting program). |

注: 在计算 a 和 n 时，Span 是不需要的，因为该值由曲线拟合程序自动决定。

2.2 选取至少 5 支传感器，在满量程内平均划分十个或更多的浓度间隔，通入相应浓度的气体得到工作通道和参考通道的输出并计算出标准化的吸光率。下表是一个典型的 IR12BD 的实验数值。

| Applied Concentration (% vol.) | Average Normalised Absorbance |
|---|---|
| 0.0 | 0.000 |
| 0.5 | 0.031 |
| 1.0 | 0.050 |
| 1.5 | 0.064 |
| 2.0 | 0.076 |
| 2.5 | 0.086 |
| 3.0 | 0.095 |
| 3.5 | 0.103 |
| 4.0 | 0.110 |
| 4.5 | 0.117 |
| 5.0 | 0.123 |

**Table 2 – Typical Normalised Absorbance Measurements for the IR12BD**

2.3 使用曲线拟合程序利用下面公式，得出 a 和 n.

**$y = s*(1 - \exp[-a*(x\hat{}n)])$**

Where:

y = Average Normalised Absorbance at each concentration.

x = Methane Concentrations.

注: S 可以忽略不计

2. 计算温度补偿系数 a 和 β

2.1 计算温度补偿系数的原理是将下面计算温度补偿后的公式转化成 y=mx+c,使 m 等于 a 或 β 。

**Alpha Compensation (Equation 1)**

**Normalised Transmittance $_{(comp)}$ = Normalised Transmittance x (1 + α (T - $T_{cal}$)**

Where,
Normalised Transmittance = Act / (Zero x Ref), or
Normalised Transmittance = 1 – Normalised Absorbance
Act = the peak-to-peak output of the Active Detector in volts (in zero gas).
Zero = the "Zero" value calculated during the calibration routine.
Ref = the peak-to-peak output of the Reference Detector in volts (in zero gas).
α = the Alpha coefficient.
T = the actual temperature measured at the sensor in kelvin.
$T_{cal}$ = the temperature (stored in non-volatile memory) measured during the calibration routine (see below) in kelvin.

**Beta Compensation (Equation 2)**

**$Span_{(comp)}$ = Span + [ β x ((T – $T_{cal}$) / $T_{cal}$)]**

Where:
Span = the "Span" value calculated during the calibration routine.
β = the Beta coefficient.
T = the actual temperature measured at the sensor in kelvin.
$T_{cal}$ = the temperature measured during the calibration routine in kelvin.

2.2 计算 a

**(Normalised Transmittance $_{(comp)}$ / Normalised Transmittance) = α (T - $T_{cal}$) + 1**

As the Alpha coefficient effectively temperature compensates the zero reading, the target value for the Normalised Transmittance $_{(comp)}$ calculation should be equal to 1 as this is equivalent to 0% vol. concentration.

Therefore:

**(1 / Normalised Transmittance) = α (T - $T_{cal}$) + 1**

Where:
y = (1 / Normalised Transmittance)
m = α
x = (T - $T_{cal}$)
c = 1

转换成 y=mx+c 格式，在该式中 Normalised Trnamittance$_{(comp)}$的目标值应该是 1。

将至少 5 个传感器的不同温度下的零点输出记录并形成下面表格。

| Temperature (°C) | Average Normalised Transmittance (to 0% vol. Target Gas) |
|---|---|
| 60 | 0.978 |
| 40 | 0.989 |
| 20 | 1.000 |
| 0 | 1.011 |
| -20 | 1.022 |

**Table 3 – Typical Normalised Transmittance Measurements for the IR12BD at Various Temperatures**

根据上面数据画出点，如下图

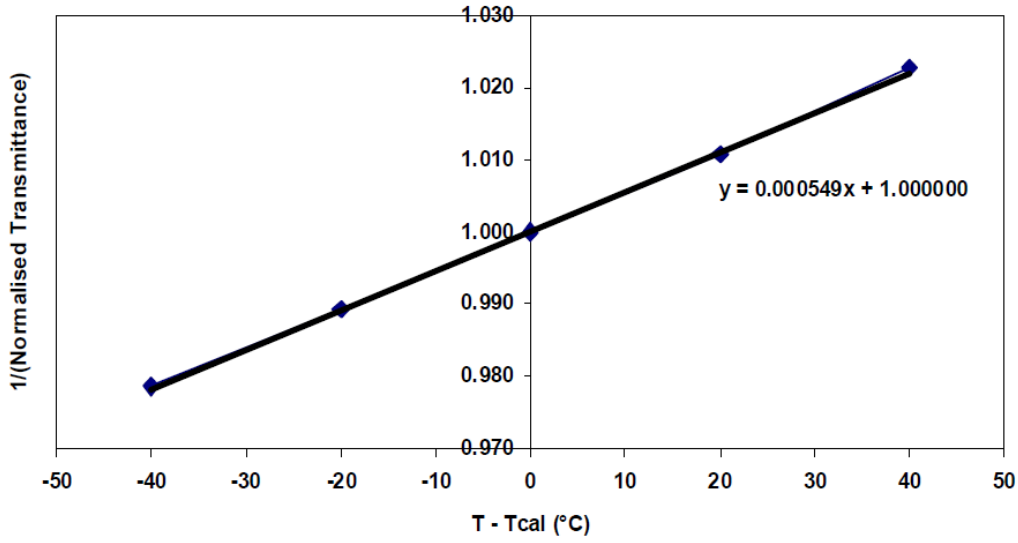


**Figure 1 – Graph to Determine Alpha**

可以得到斜率即 a

3. 计算 β

3.1 按 y=mx+c 转化成下式

$$Span_{(comp)} = \beta \times [(T - T_{cal}) / T_{cal}] + Span$$

Where:

$y = Span_{(comp)}$

$m = \beta$

$x = [(T - T_{cal}) / T_{cal}]$

$c = Span$

3.2 将至少 5 个传感器不同温度下的输出记录在下面表格

| Temperature (°C) | Average Normalised Transmittance (to 5% vol. Methane) | $Span_{(comp)}$ |
|---|---|---|
| 60 | 0.873 | 0.186 |
| 40 | 0.877 | 0.199 |
| 20 | 0.880 | 0.212 |
| 0 | 0.883 | 0.227 |
| -20 | 0.885 | 0.243 |

**Table 4 – Typical Normalised Transmittance Measurements for the IR12BD at Various Temperatures**

注 :

**Note: Span = (1 – Normalised Transmittance) / (1 – exp(-$aC^n$))**

将计算后的 Span(comp)和(T-Tcal)/Tcal 画在坐标图上，如下图

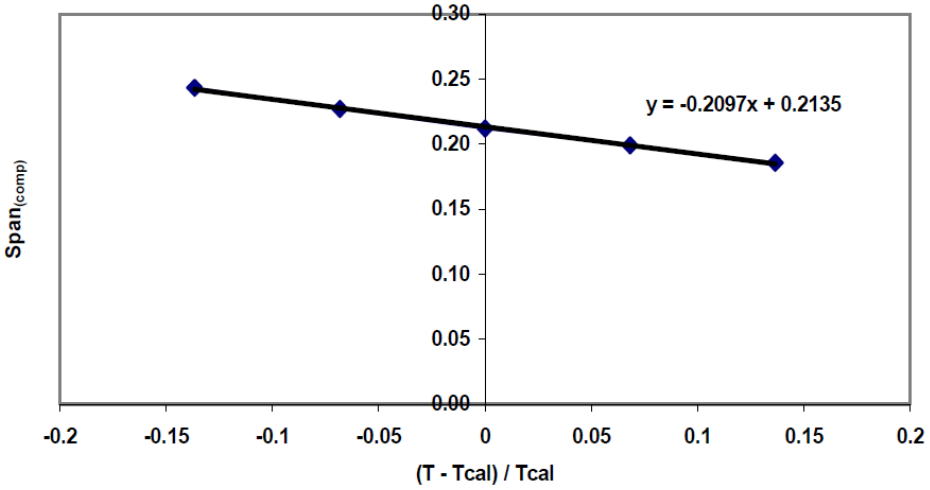


**Figure 2 – Graph to Determine Beta**

从而得到斜率即 β

下面是英文原文，请双击获得全文

http://www.sgxsensortech.com/site/wp-content/uploads/2012/10/AN5-Determining-Coefficients-for-Linearisation-and-Temperature-Compensation.pdf