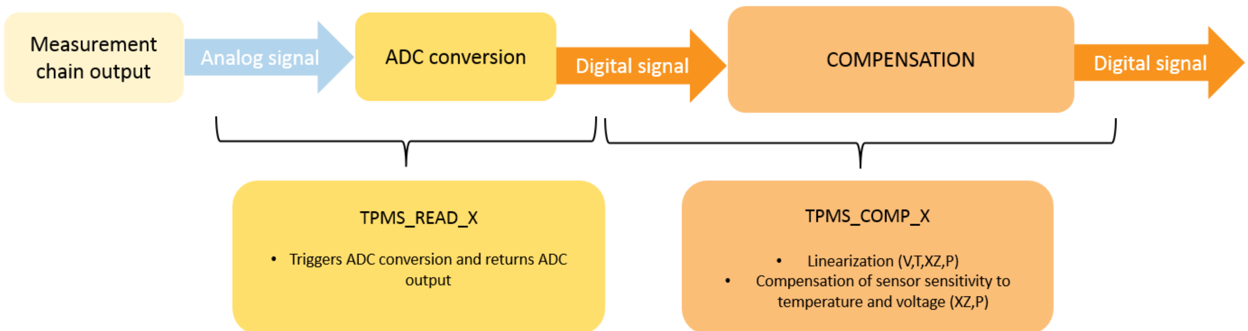
## Correspondence between compensated sensor data and data in common units




The output of the compensation routines is a value in counts. Below is explained how to convert the value in counts to a value in common units (kPa for pressure, g for acceleration, volt for voltage and °C for temperature):

- **Pressure:**

To know the correspondence between the compensated pressure value given by the module (in counts) and the pressure in kPa, refer to the product specification. An example of conversion is given below.

*Example:*

The example was done with a FXTH8715xx device in the range 100 – 1500kPa, using the FXTH871x6 datasheet, but it is similar for other ranges of pressure and other families of devices, only sensor characteristics indicated in the datasheet have to be changed accordingly.
Compensated pressure value received: Pressure = 0x0001 = 1 (decimal)
The pressure in kPa can be calculated with the Eqn. 1 on page 80: $P = \Delta P_{1500} * P_{CODE} + (100 - \Delta P_{1500})$
We have PCODE = 1, it is the compensated value given by the module. Then in the table on page 155 of the datasheet we find that $\Delta P_{1500}$ = 2.750 kPa/count.
So we have P = 2.750*1 + (100 – 2.750) = **100kPa**

**AccelZ** and **AccelX:**
To know the correspondence between the compensated acceleration value given by the module and the acceleration in g, refer to the product specification.
Two examples of conversion are given below. They were done with a FXTH870911 device, using the FXTH870xD datasheet, but it is similar for the other families of devices: only sensor characteristics indicated in the datasheet have to be changed accordingly.

*Example 1:*

AccelZ = 0x0108 = $(264)_{10}$

- In order to find the value in g of the Z-axis acceleration, we need to know the offset step of the acceleration measure. As the Z-axis acceleration goes from -210g to 300g (FXTH870x11 family) the range has been divided into 16 'windows' or steps, and each step has been divided into 510 counts. So we always get an acceleration value between 1 and 510 counts, but depending on the offset step, that does not correspond to the same actual acceleration. Firmware routines can give the offset step.
  In our case the offset step is step 6 (parameter of the reading function) so acceleration is between -30g and 30g (refer to the datasheet).
- Then we also need to know some acceleration measurement characteristics of the device that are given in the datasheet (in this example in section 17.10.2 on page 157):
  - Z-axis Average Accel Sensitivity (1 to 510 counts) = 0.118g/count (here we use the average sensitivity but it can be calculated more precisely for each step, refer to the datasheet).
  - $A_{Z-6}$ @ $A_{ZCODE1}$ = -30g
- Now we can apply the Eqn. 17 on page 156 : $A_Z = \Delta A_{Z6} * A_{ZCODE} + (A_{Z6} @A_{ZCODE}1 - \Delta A_{Z6})$
  We have $\Delta A_{Z6}$ = 0.118g/count, $A_{ZCODE}$ = 264 (the compensated acceleration value given by the module) and
  $A_{Z6}$ @$A_{ZCODE}$1 = -30g
  So we get $A_Z$ = 0.118*264 + (-30 – 0.118) = 1.034g

*Example 2:*

AccelX = 0x010C = $(268)_{10}$

- In order to find the value in g of the X-axis acceleration, we need to know the offset step of the acceleration measure. As the X-axis acceleration goes from -80g to 90g (FXTH870x11 family) the range has been divided into 16 'windows' or steps, and each step has been divided into 510 counts. So we always get an acceleration value between 1 and 510 counts, but depending on the offset step, that does not correspond to the same actual acceleration. Firmware routines can give the offset step.
  In our case the offset step is step 7 (parameter of the reading function) so acceleration is between -10g and 10g (refer to the datasheet).
- Then we also need to know some acceleration measurement characteristics of the device that are given in the datasheet (in this example in section 17.10.2 on page 157):
  - X-axis Average Accel Sensitivity (1 to 510 counts) = 0.039g/count (here we use the average sensitivity but it can be calculated more precisely for each step, refer to the datasheet).
  - $A_{X-7}$ @ $A_{XCODE1}$ = -10g
- Now we can apply the Eqn. 17 on page 156 for the X-axis:
  $A_X = \Delta A_{X7} * A_{XCODE} + (A_{X7} @A_{XCODE}1 - \Delta A_{X7})$
  We have $\Delta A_{X7}$ = 0.039g/count, $A_{ZCODE}$ = 268 (the compensated acceleration value given by the module) and
  $A_{X7}$ @$A_{XCODE}$1 = -10g
  So we get $A_X$ = 0.039*268 + (-10 – 0.039) = 0.413g

- **Volt:**

To get the value in volt first convert the compensated hexa value in decimal then add 122 and then divide by 100. Example: Volt = 0xAD = 173 (decimal) => V = (173 + 122)/100 = 2.95V

- **Temp:**

Compensated temperature is given with an offset of 55 (refer to the product specification).

Example: Temp = 0x53 = 83 (decimal) => T = 83 - 55 = 28°C