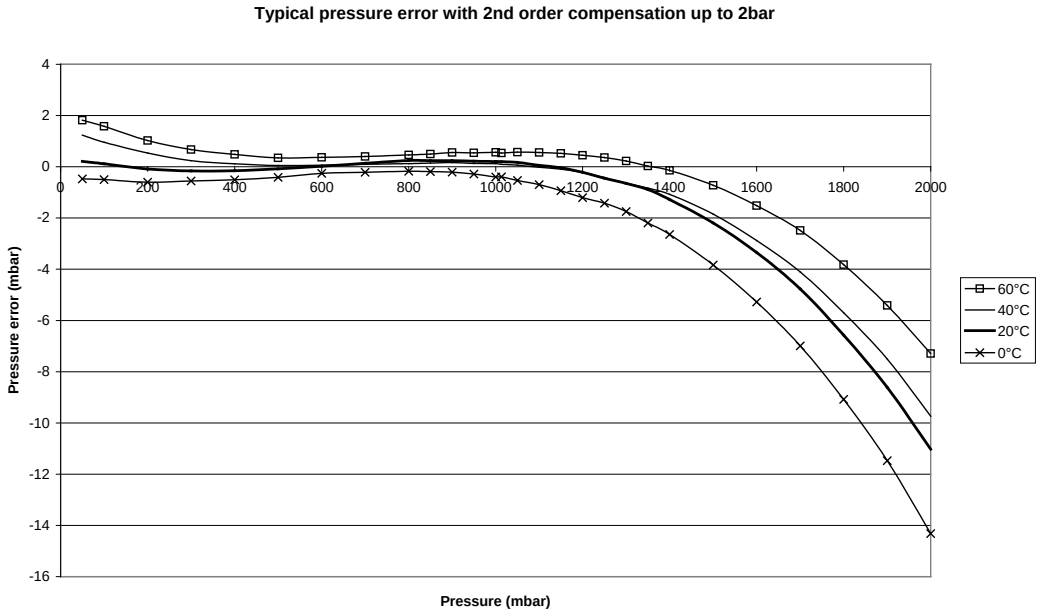
AN515 Using MS5540-CM in snorkelling application

USING MS5540-CM IN SNORKELLING

MS5540-CM is a fully compatible replacement of MS5540-BM pressure sensor, designed for a pressure range from 10 mbar to 1100 mbar. This pressure range is adapted to barometer and altimeter applications. With MS5540-CM, the possibility exists to increase this pressure range up to a minimum of 1600 mbar or more. In an aquatic use, 1600 mbar pressure corresponds to approximately 5 meters below water level.
Using a special algorithm for high pressure (described in page 2) with the calibration data stored in the interface IC of the MS5540C water depth measurements for snorkeling down to 5 meter with an accuracy of 5 cm or better can be achieved. Resolution remains at 0.1 mbar.

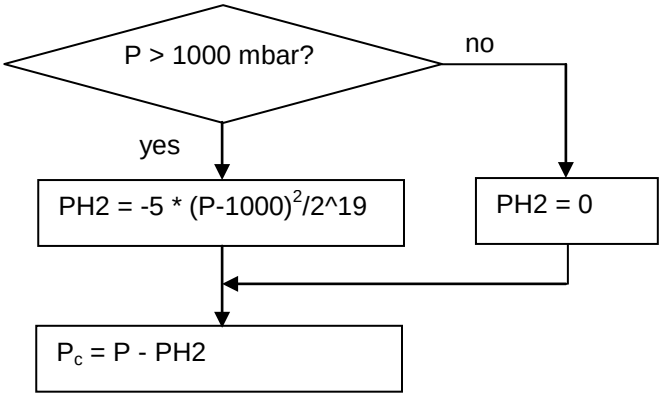
1 mbar ≅ 10 mmH2O

The following curves show the typical pressure errors up to 2 bar for the MS5540-CM using standard compensation algorithm:



One can see that the pressure error increases beyond 1100 mbar. The maximum error given by the above curves is 14 mbar, corresponding to an error of about 14cm of water. Up to 2 bars, the resolution is 0.1mbar or 1mm of water.

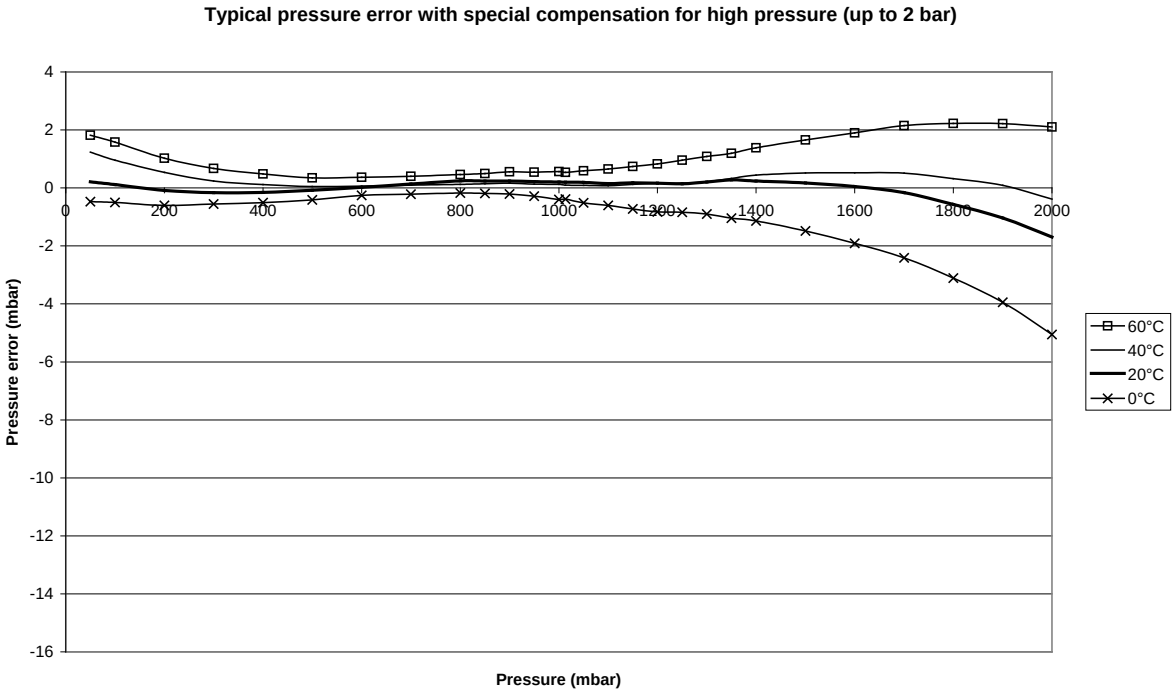
MS5540-CM is specially calibrated to offer a good accuracy in the altimeter range, i.e. from 600 mbar to 1100mbar. Beyond this pressure, the non-linearity of the sensor increases strongly. This non-linearity is relatively constant for the different batches of sensors and can be partially compensated with the following quadratic function:



Pc, P and PH2 are in mbar.

The coefficient PH2 is a parabolic function calculated from the measured pressure P. The corrected pressure Pc is obtained by subtracting PH2 from the measured pressure value. This calculation is to be used only for measured pressure values higher than 1000 mbar. It is specially designed for a temperature range of 0°C to 60°C.

Using the above formula to correct pressure measurements higher than 1000 mbar gives the following pressure error curves:



Compared to curves of page 1 a significant reduction of pressure errors beyond 1000 mbar can be observed.
An altitude reset to zero should be made before the snorkeling application to eliminate barometric or other effects (snorkeling at sea level or at higher levels in a lake).

PRESSURE OUTPUT CHARACTERISTICS UNTIL 1.600 BAR

Using the special algorithm for high pressure values (described in page 2) and with the calibration data stored in the interface IC of the MS5540C, the following characteristics can be achieved:

(VDD = 3.0 V unless noted otherwise)

Parameter	Conditions	Min	Typ	Max	Unit	Notes
Resolution			0.1		mbar	1
Absolute Pressure Accuracy	p = 1000 mbar T_a = 25°C	-1.5		+1.5	mbar	2
Relative Pressure Accuracy	p = 1000 ... 1600 mbar T_a = 25°C	-8	-2	+4	mbar	3, 4
Relative Pressure Error over Temperature	T = 0 ... +60°C p = 1000 ... 1600 mbar	-12		+8	mbar	4
Long-term Stability	12 months		-1		mbar	5

1mbar ≅ 10mmH_2O

NOTES

1. A stable pressure reading of the given resolution requires taking the average of 2 to 4 subsequent pressure values due to noise of the ADC.
2. Maximum error of pressure reading over the pressure range.
3. Maximum error of pressure reading over the pressure range after offset adjustment at one pressure point.
4. With the quadratic compensation algorithm for high pressure as described in this application note.
5. The long-term stability is measured with non-soldered devices.

REVISION HISTORY

Date	Revision	Type of changes
18.02.2008	01	Initial document
06.01.2010	02	Change to MEAS logo and layout
17.08.2011	03	Insertion of the logo MEAS TM. Modification of the Shenzhen ZIP code to 518057. Modification of the north America contact to Fremont, modification of the Europe company legal entity to Sàrl and correction of the Europe email and website addresses. Modification of the document number 0005540C1722 to applicno1722.

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