

AN515 Using MS5540-CM in snorkelling application

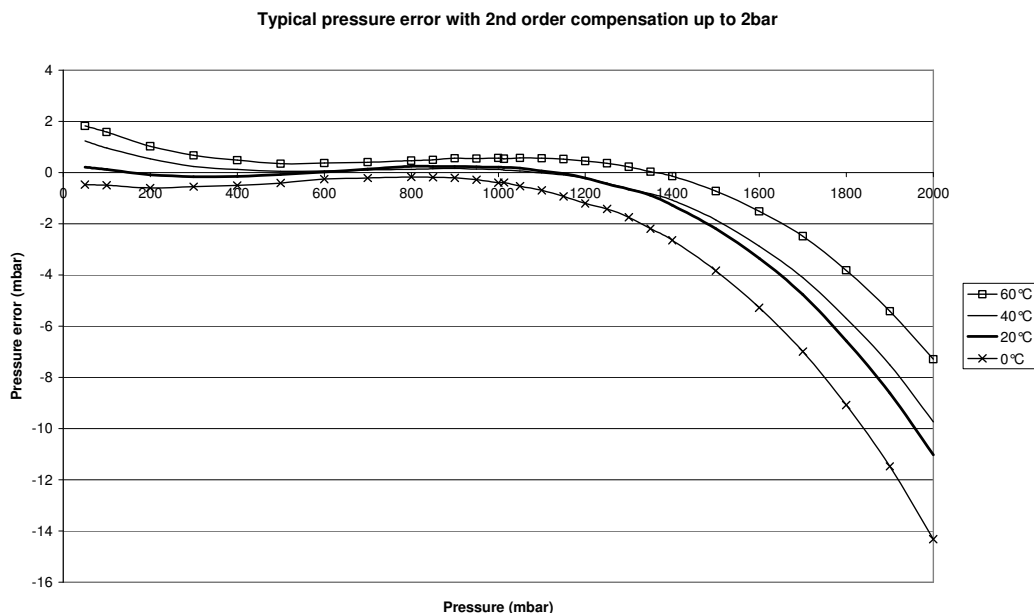
USING MS5540-CM IN SNORKELLING

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 \cong 10 mmH₂O

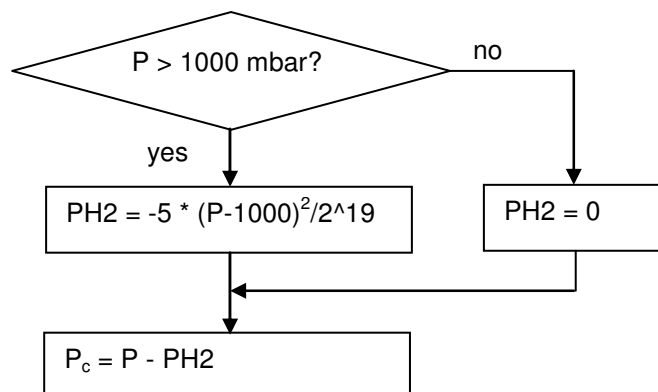
The following curves show the typical pressure errors up to 2 bar for the MS5540-CM using standard compensation algorithm:



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 bar, 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:

AN515 Using MS5540-CM in snorkelling application

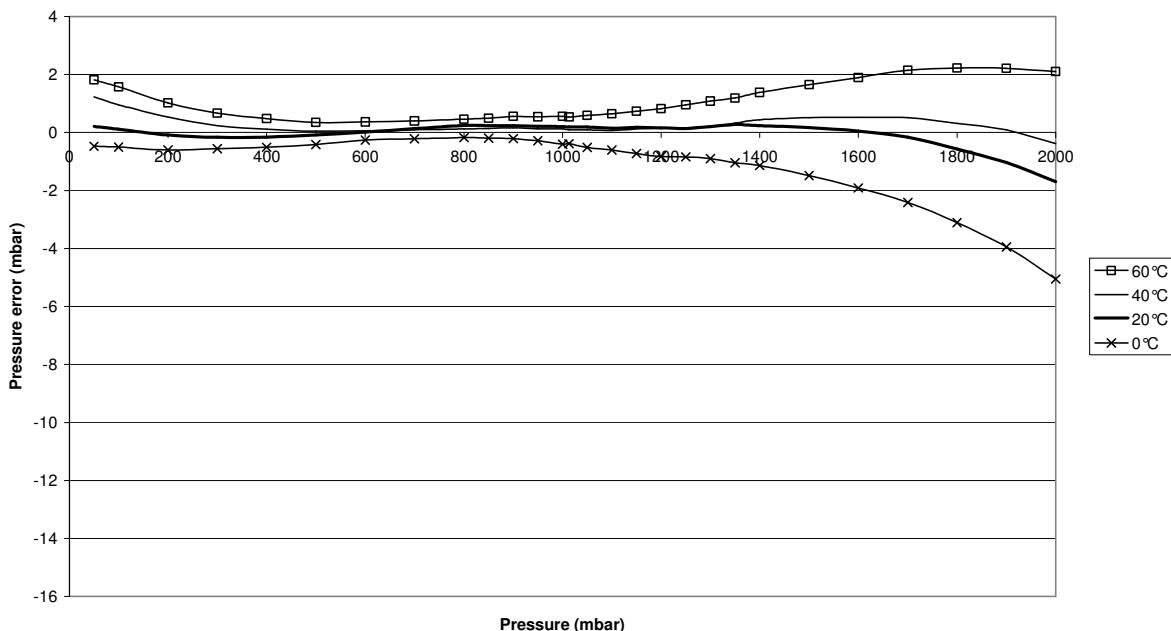


Pc, P and PH2 are in mbar.

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:

Typical pressure error with special compensation for high pressure (up to 2 bar)



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 snorkelling application to eliminate barometric or other effects (snorkeling at sea level or at higher levels in a lake).

AN515 Using MS5540-CM in snorkelling application

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	$p = 1000 \text{ mbar}$ $T_a = 25^\circ\text{C}$	-1.5		+1.5	mbar	2
Relative Pressure Accuracy	$p = 1000 \dots 1600 \text{ mbar}$ $T_a = 25^\circ\text{C}$	-8	-2	+4	mbar	3, 4
Relative Pressure Error over Temperature	$T = 0 \dots +60^\circ\text{C}$ $p = 1000 \dots 1600 \text{ mbar}$	-12		+8	mbar	4
Long-term Stability	12 months		-1		mbar	5

1mbar \cong 10mmH₂O

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.

AN515 Using MS5540-CM in snorkelling application

REVISION HISTORY

Date	Revision	Type of changes
18.02.2008	01	Initial document
06.01.2010	02	Change to MEAS logo and layout

FACTORY CONTACTS

NORTH AMERICA

Measurement Specialties, Inc.
1000 Lucas Way
Hampton, VA 23666
Tel: +1 800 555 1551
Fax: +1 757 766 4297
e-mail: sales@meas-spec.com
Website: www.meas-spec.com

EUROPE

MEAS Switzerland SA
Ch. Chapons-des-Prés 11
CH-2022 Bevaix
Tel: +41 32 847 9550
Fax: + 41 32 847 9569
e-mail: sales@intersema.ch
Website: www.intersema.ch

ASIA

Measurement Specialties (China), Ltd.
No. 26 Langshan Road
Shenzhen High-Tech Park (North)
Nanshan District, Shenzhen, 518107
China
Tel: +86 755 3330 5088
Fax: +86 755 3330 5099
e-mail: pfc.cs.asia@meas-spec.com
Website: www.meas-spec.com

The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. Measurement Specialties, Inc. reserves the right to make changes without further notice to any product herein. Measurement Specialties, Inc. makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does Measurement Specialties, Inc. assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications. All operating parameters must be validated for each customer application by customer's technical experts. Measurement Specialties, Inc. does not convey any license under its patent rights nor the rights of others.