



Important Notice for Petrel 2 Fischer Users

Some Petrel 2 models with analog PPO2 monitoring require a firmware update to correct offsets to voltage measurements of the O2 sensor channels. Only Petrel 2 models that shipped from the factory with v29 firmware and include analog PPO2 monitoring are affected.

This problem can be corrected in firmware by following these steps:

- Update the Petrel 2 to firmware v37 or higher.
- Install Shearwater Desktop v2.5.6 or higher.
- Go to the “Help->Correct O2 Offset” menu option in Shearwater Desktop.
- Follow the on-screen prompts.

The following sections provide detailed information on the problem and solution.

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1 Units Affected

Only Petrel 2 models with analog partial pressure of oxygen (PPO2) monitoring that were built with v29 firmware installed at the factory are affected. The majority of these units are the Petrel 2 Fischer model, but also included are some hardwired analog PPO2 monitors for rebreathers. A list of affected serial numbers is available at the end of this document.

No DiveCAN rebreather controller models are affected. No NERD models are affected.

By using the “Help->Correct O2 Offset” option in Shearwater Desktop (see Figure 1), you will be informed as to whether your unit was affected.

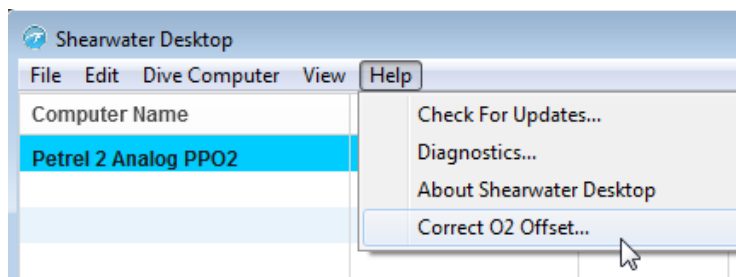


Figure 1: Correcting the O2 offsets from Shearwater Desktop



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2 Impact of problem

An offset of up to +/- 3 millivolts [mV] can exist on each of the O2 sensor channels. The average absolute magnitude of affected units is 0.84 mV.

The following describes how this offset error affects PPO2 accuracy:

The offset appears on the raw mV measurements. To calculate PPO2, the Petrel multiplies the raw mV reading by a gain factor. The gain factor is set when the user performs a PPO2 calibration. Typically, this is performed with 98% oxygen at sea-level, so the calibration point is at a PPO2 of 0.98 absolute atmospheres [ata].

At the point-of-calibration (0.98 ata in this example) the error from the offset is removed. However, as the PPO2 varies from the calibration point, the error grows since there is the expectation of zero offset. Typical and worst case errors are summarized in Table 1. In the typical case, error over the typical PPO2 operating range when rebreather diving (0.7 to 1.3 ata) is less than 0.01 ata, and full scale error is less than 0.02 ata. Worst case the error is around 0.02 ata over the 0.7 to 1.3 range, and less than 0.05 ata over the full range. This is shown graphically in Figure 2.

Actual PPO2	Typical Case (+0.84mV offset)		Worst Case (+3mV offset)	
	Measured PPO2 [ata]	PPO2 Error [ata]	Measured PPO2 [ata]	PPO2 Error [ata]
0.2	0.213	+0.013	0.245	+0.045
0.7	0.705	+0.005	0.716	+0.016
0.98	0.98	0	0.98	0
1.3	1.295	-0.005	1.282	-0.018
1.6	1.59	-0.010	1.564	-0.036

Table 1: Typical and worst case PPO2 errors due to the offset problem, assuming calibration at a PPO2 of 0.98 ata

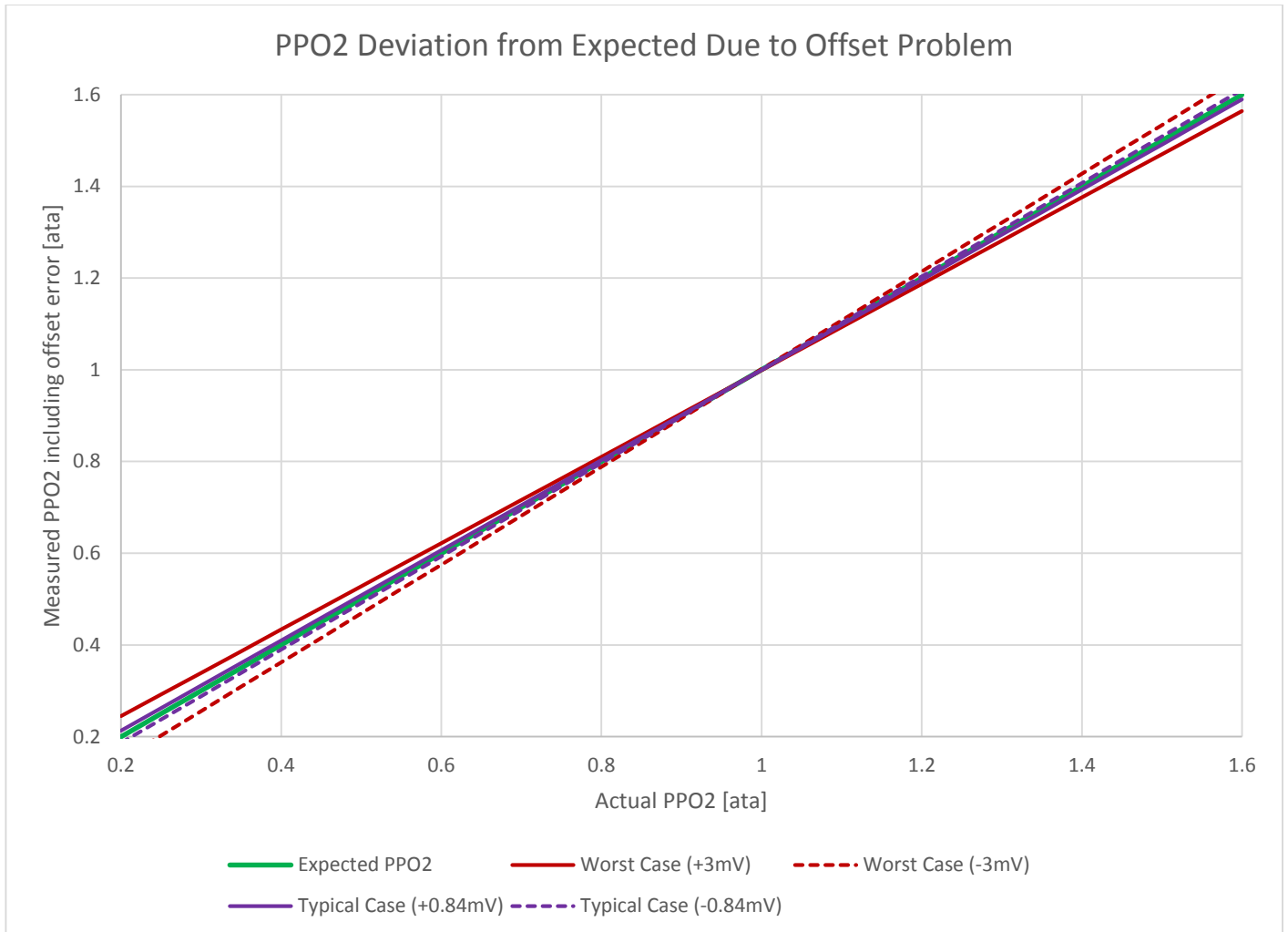


Figure 2: Impact of O2 Offset Problem on measured PPO2 (assuming calibration at a PPO2 of 0.98 ata)



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3 Cause

It is normal and expected to have millivolt level offsets on each O2 sensor channel. These offsets are caused by variations in component manufacturing of the analog signal processing circuit. During production, a calibration is performed and the resulting correction values are stored in non-volatile (permanent) memory in the Petrel. Unfortunately, a problem with this process resulted in the corrections not being permanently saved in the non-volatile memory. This problem was corrected (unnoticed at the time) when v33 firmware replaced v29 as the active release.

We have put in place corrective actions to not only to address the immediate problems, but also to improve our processes to prevent such problems from going undetected in the future.

4 Solution

Fortunately, the offset calibration was performed for each unit, and we have records in our database for each serial number and its proper calibration values. A table of this data has been loaded into Shearwater Desktop. When the “Help->Correct O2 Offset” option is used, Shearwater Desktop communicates to the Petrel via Bluetooth and requests the serial number. If this serial number is found in the table, the corresponding calibration values are sent to the Petrel and saved in its permanent memory. If the serial number is not found, a message indicating that no correction is needed will be shown.

To perform the correction:

- Update the Petrel to firmware v36 or higher.
- Install Shearwater Desktop v2.2.5 or higher.
- Go to the “Help->Correct O2 Offsets” menu option in Shearwater Desktop.
- On the Petrel 2 start Bluetooth by going to “Dive Log->Upload Log”.
- Press “Start” in Shearwater Desktop and follow the on-screen prompts.

5 Summary

Petrel 2 models with analog PPO2 monitoring that were built with firmware v29 factory installed have a problem where a calibration was not saved into permanent memory. Records exist of the proper calibration values, so the calibration can be loaded into affected units by matching the serial number to the recorded data. Shearwater Desktop software can apply these corrections using the “Help->Correct O2 Offset” menu option. Should you have any concerns or problems with performing the correction, please contact Shearwater Research Inc. at info@shearwater.com or 1-604-669-9958.



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Appendix A: Listing of affected serial numbers (347 units total)

39199B19	390D1C5E	330F9EAD	3012E42D	3012E3F5	3311858A	30117910
39199B19	320D1C8A	330FA0A8	3012E42F	3012E400	33118620	30117966
39199B86	320D1CCD	330F9E7D	3012E687	3012E3C9	3311860B	30117965
30199B67	320D1CF9	3312E403	3012E672	3012E47D	3311856A	30117932
30199B7D	320D1CFB	330F9EAE	3012E669	3012E46F	33118592	3011794E
30199B77	330D1C48	330F9E8C	3012E46B	3012E3CD	33118594	30117958
30199B6D	300D1C76	3312E401	3012E680	3012E412	33118590	3011795C
39199B88	390D2135	330F9E64	3012E680	3012E434	33118588	39117999
39199B45	390D1CC3	330FA08E	3012E3E7	3012E430	33118587	30117951
39199B3D	390D1C57	330FA092	3012E3FC	3012E3D7	33118574	3911798D
39199ACD	320D1CCB	330DB77F	3012E47C	3012E46D	39118156	3011793A
30199AB6	300D1BE4	330FA0A9	3012E3F2	3012E3E0	36117499	3011795E
39199AB8	300D1C7B	330FA09E	3012E66B	3012E420	36117499	37117875
39199AC6	300FB49D	330F9EB2	3012E480	3012E404	36117480	371176E6
39199AB9	320DB7CB	330F9E49	3012E671	3012E3D5	36117484	36117758
39199AC0	300FB47F	330F9E46	3012E3F3	3012E41F	33117552	38117742
300D1BE2	320D1D0C	330F9D7C	3012E485	3012E595	33117554	36117784
320DB7B5	390D1CBD	330F9E8D	3012E489	3012E5DE	361174A0	3911765C
330F9E5B	320D1C8B	330FA086	3012E3EF	33118554	361174A1	39117659
300FB489	300D1BE5	330F9E96	3012E413	33118586	33117556	37117864
300FB487	320D1CD2	330F9EAB	3012E470	3311852F	36117486	37117689
320FB4F5	320DB7DA	330FA2E0	3012E3F0	33118608	331175B7	3711768D
300FB4AD	320DB7C1	330F9D7A	3012E40B	33118579	36117485	37117682
30199A99	330F9F19	330F9EB4	3012E409	33118555	361174AA	37117680
330F9E29	330F9F19	330F9EB3	3012E3CE	33118591	361174DD	39117677
330FA2D7	330F9E23	330F9D89	3012E684	3311858F	361174C4	37117679
330FA2EA	330FA08B	330F9D8D	3012E668	33118584	361174A2	3911766B
330F9F2B	330F9F15	330F9D81	3012E68A	33118571	3611749E	38117794
330FA2F6	330F9E74	330F9EB0	3012E3E3	3311854D	36117505	3811779B
330F9E53	330F9E2B	330FA0A6	3012E3D6	33118621	33117550	3811778D
330F9F27	330F9E1B	330F9E9F	3012E479	33118604	3611749A	381177AC
330F9E3C	330FA2F1	330F9D8E	3012E3D9	3311759F	300FA33E	38117796
320FB504	330F9E19	330F9DC7	3012E407	36117496	3311752B	381177DD
320DB90D	330FA08C	330F9DBC	3012E686	361175D6	391179A5	38117797
300FB48E	330FA2E7	330F9DBF	3012E3C3	36117495	39117A97	3811779F
300D1BE4	330FA2F8	330F9E37	3012E678	361175E5	39117809	381177D0
300D1BE4	330F9E73	330F9DCF	3012E66F	36117497	39117A84	381177D1
390D1CC3	330FA1A7	330F9DE7	3012E3F9	361175D4	391179A9	36117604
390D1CC3	330F9E21	330F9DC6	3012E3C4	361175CF	391179AA	361175EC
390D1CC3	330FA085	330F9DD0	3012E472	391185E0	39117A83	36117708
320DB7BC	330FA116	330F9DDD	3012E48A	391182E1	39117A37	36117639
390D1C5C	330FA11F	330F9DDA	3012E416	39118526	39117A4C	37117874
320DB7D8	330FA1A9	330F9D99	3012E48B	3911851F	39117AA2	371176F7
320FB4E5	330FA091	3012E3E4	3012E3FD	3911816E	30117913	39117669
320D1CE4	330F9E3B	3012E4A3	3012E491	39118189	30117915	36117631
320D1C66	330FA115	3012E496	3012E429	39118153	3011791E	36117515
390D212D	330FA1A2	3012E426	3012E3DD	39118177	3011793C	391177B8
390D213F	330FA1A1	3012E3E6	3012E427	391185EB	3011791D	
330D1C4D	330F9E67	3012E41C	3012E427	391185E1	3011793B	
390D1C55	330F9E70	3012E425	3012E408	33118572	30117914	