OXYSSH-SYS HUMAN OXIMETRY (SpO_2) SYSTEM

This Human Pulse Oximetry System includes everything required to record SpO_2, Heart Rate, and Pulse with an MP36R Research System or MP36, MP35, MP46, or MP45* Education System.

Human SpO_2 System components:

OXYSSH Oximeter module for MP3X/4X

BSLCBL15 Pulse cable for OXYSS

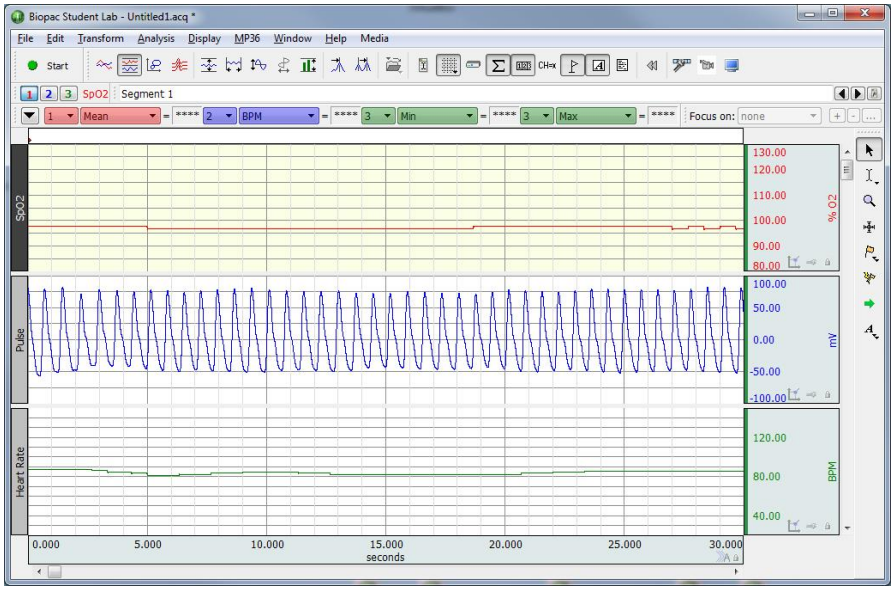
BSLCBL16 Rate cable for OXYSS

TSD124D SPO_2 Finger Transducer*

To access optional auxiliary Status output, add the BSLCBL14A adapter.

Power is via the MP input, so no external power supply is required.

* The Oximeter module also accepts optional Ear Clip Transducer (TSD124B) and Flex Wrap Transducer (TSD124C). The Human SpO_2 Transducers (TSD124B/C/D) output SpO_2 via a 1.8 m (6') cable terminated in a DB9 Male connector for an MP device analog CH input.



There are three auxiliary outputs (3.5 mm stereo jacks):

PULSE BSLCBL15 (uncalibrated) output cable is 3.5 mm male mono phone plug with 1.8 m (6') cable to DB9 Male; attenuates by 5 and employs 3.32 K Ohm resistor.

RATE BSLCBL16 output cable is 3.5 mm male mono phone plug with 1.8 m (6') cable to DB9 Male; attenuates by 5 and employs 7.62 K Ohm resistor.

STATUS BSLCBL14 add-on required for optional output , which is 3.5 mm male mono phone plug with 3 m (10') cable to DB9 Male; attenuates by 10, which translates 10 V to 1 V.

* When used with the MP46/45 two-channel system, only one of the three auxiliary outputs can be used in conjunction with the SpO_2 output.

OXYSSH-SYS Specifications

Outputs:	**SpO_2** OXYSSH	**Pulse** BSLCBL15	**Rate** BSLCBL16	**Status** BSLCBL14 add-on
Range	0 – 100 % O_2	+- 250 mV	18 – 321 BPM	0 – 200 mV
Averaging:	4-beat average*	No	4-beat average*	No
Accuracy:	+- 2 digits for 70 – 100 %O_2	N/A	+- 3 digits, no motion, +- 5 digits with motion	+- 5 mV
Update Rate (samples/sec)	3	75	3	75

Measurement Wavelengths and Output Power:

Red:	660 nanometers @ 0.8 mV maximum average
Infrared:	910 namometers @ 1.2 mW maximum average
Finger transducer placement:	index, middle or ring fingers
Subject weight requirement**:	> 30 Kg (66 Lbs)
Operating Temperature Range:	0- 40 deg. C (32 – 104 deg. F)
Operating Humidity Range:	10 – 90% non-condensing
Weight:	366 grams (excluding BSLCBL14 cable)
Size of OXYSSH module:	9.5 cm x 6.5 cm x 3 cm
Length of MP interface cables:	1.8 m
Length of finger transducer cable:	1 m

Notes:

***** SpO_2 and Rate outputs use 4-beat average values that are updated on every pulse beat.

**Subject weight requirement is based on the design of the Adult finger clip transducer that is included with the OXYSSY-SYS.

Status Indicators:

The OXYSSH outputs status information in two ways: (1) via LEDs on the OXYSSH module and (2) via output voltage levels on Status auxiliary output. A green blinking LED indicates the pulse oximeter is working properly and detecting SpO_2. An Orange blinking LED indicates an error condition (i.e., finger is not detected,) or the level of perfusion may be too low to measure SpO_2. If the status is indicating low perfusion, see Appendix 2: Troubleshooting. The blink pattern of the LEDs (number of blinks in quick succession) provides more detailed information as shown in the following table:

OXYSSH Status condition	Green LED	Orange LED	Status Output
High Perfusion: working with amplitude of high signal quality	1 blink	Off	210 mV
Medium Perfusion: working with amplitude of moderate signal quality	2 blinks	Off	185 mV
Low Perfusion: working with amplitude of low signal quality	3 blinks	Off	170 mV
Sensor Alarm Error: finger transducer is providing an unusable signal	Off	1 blink	< 5mV
Out of Track Error: an absence of consecutive good pulse signals	Off	2 blinks	< 5 mV
Artifact Error: a detected pulse beat didn't match the current pulse interval	Off	2 blinks	13 mV
Sensor Disconnect Error – finger transducer is not connected to OXYSSH module or sensor is inoperable	Off	3 blinks	< 5 mV

Note: The stated output voltages are approximate and can vary by as much as +- 5mV when the OXYSSH is working (Green LED blinking) and +- 2 mV when there is an error condition.

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OXYSSH Setup and Calibration

Setup:

1. Turn OFF MP unit. If using the MP46/45, it must be turned OFF by disconnecting the USB cable from the computer.
2. OXYSSH Connections:
   a. Plug the TSD124D Finger clip transducer into the "Transducer" input on the OXYSSH.
   b. Plug the 3.5 mm phone plug on the "Pulse"-BSLCBL15 cable into OXYSSH output labeled "Aux. - Pulse".
   c. Plug the 3.5 mm phone plug on the "Rate"-BSLCBL16 cable into the output labeled "Aux. - Rate".
   d. If monitoring "Status", plug the 3.5 mm phone plug on the optional BSLCBL14 into the output labeled Aux. – Status.

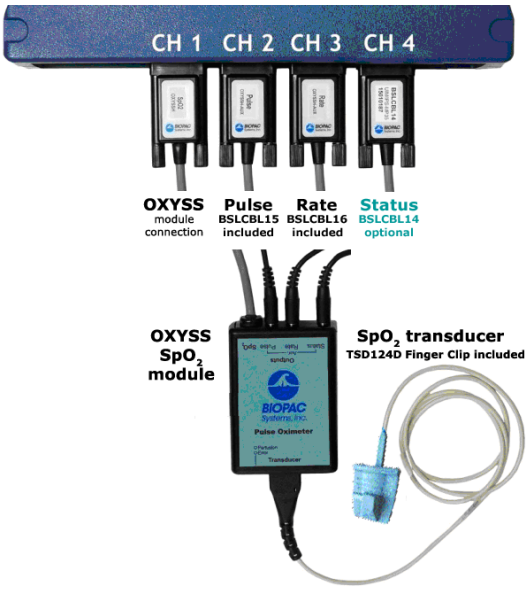

Figure 1

3. MP connections:*
   a. Plug in the "SpO2" cable into CH 1.
   b. Plug the "Pulse"-BSLCBL15 cable into CH 2.
   c. Plug the "Rate"-BSLCBL16 cable into CH 3.
   d. Plug the BSLCBL14 (Status) cable into CH 4 (Optional).

Note* The MP46/45 (not shown) is a two channel device, so only one of the auxiliary outputs can be used.

4. Turn ON the MP unit. If using the MP46/45, plug the USB cable into the computer.

Connecting TSD124D Finger Clip Transducer to Subject:

To obtain optimal pulse oximeter data, the finger clip transducer must be positioned at or near heart level and the **Subject** must be seated, relaxed and fingers should be warm. The finger transducer can be placed on the index, middle or ring finger. Make sure that the side of the clip displaying the finger graphic is properly oriented. The hand should be positioned so that there is no additional pressure placed on the transducer, and motion artifact should be minimized. Two recommended positions are:

- Hand resting in lap with palm facing up.
- Arm resting on arm rest with palm facing up.

Although it is possible to record pulse oximetry data during exercise, it is not recommended as it is difficult to control motion artifact. For resting vs. exercise comparisons, consider taking recordings only in the resting and post exercise state. After recording the "at rest" portion, click **Stop**. The **Subject** can then remove the finger clip transducer and begin exercising. Immediately after stopping exercise, the **Subject** must quickly return to a seated and relaxed position, reapply the finger transducer, and continue the recording.

Calibration:

If using BSL 4.1.3 or higher, or Acq*Knowledge* 5.0.x or higher with MP36R, OXYSSH SpO_2 calibration prompts will appear automatically after clicking the BSL or Acq*Knowledge* graph's "**Start**" button. Follow the prompts to complete OXYSSH SpO_2 calibration.

If using BSL 4.0.1-4.1.2, or Acq*Knowledge* 4.4.x with MP36R, follow the steps below. If using software prior to BSL 4.0, it will be necessary to manually setup all channel parameters referencing Appendix 1 and then proceed starting at Step 4. (Acq*Knowledge* versions prior to 4.1 do not offer MP36R support.)

1. After launching the software, choose "**Create/Record a new experiment**" from the Startup dialog and click "**OK**" to display the "**Data Acquisition Settings**" dialog. Alternately, if the software is already running, select "**Set Up Data Acquisition**" from the MP menu.
2. From the **Channels > Preset** pop-up menu list, choose the correct preset for each of the four channels as shown below.

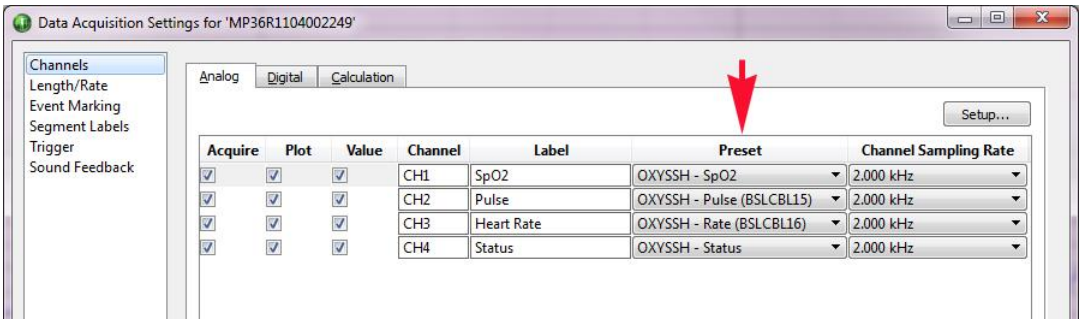

Figure 2

3. Exit the "**Data Acquisition Settings**" dialog using the "**Close**" button.
4. Click "**Start"** followed by "**Stop"** to record a small amount of data, which sets up the graph display.
5. Instruct the **Subject** to remove finger from the finger clip transducer.
6. Using the arrow selection tool, click the wrench button in the units (% O2) region of **CH 1** (SpO2) as shown in Figure 3 to display the Scaling dialog shown in Figure 4.
7. Click "**Cal 2**" to update the "**Input millivolts**" value and make sure the corresponding "**Map value**" is **127** % O2.
8. Click "**OK**" to close the dialog.

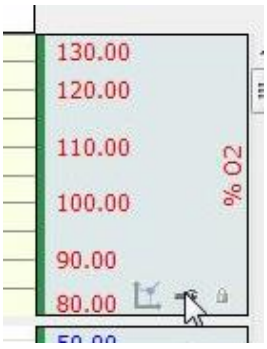

Figure 3

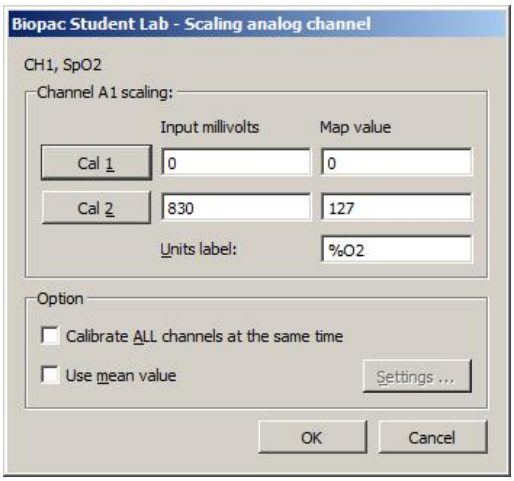

Figure 4

9. It may be useful to enable **textual value display** in order to show the numerical values for SpO_2 during the recording. This option is not available in software prior to BSL 4.0. To enable, position the arrow cursor over the numerical values in the vertical scale region and click the mouse button. The dialog shown in Figure 5 will appear. Check the "**Show textual value display**" box and click "**OK**" to close the dialog.

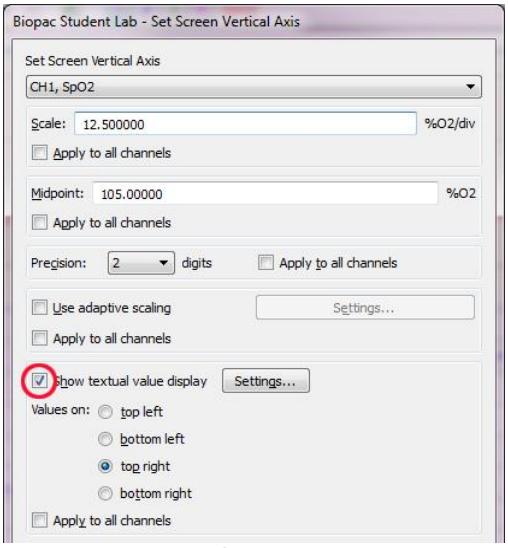

Figure 5

10. Click the wrench button in the units (BPM) region of **CH 3** (Heart Rate) to display the Scaling dialog shown in Figure 6.
11. Click "**Cal 2**" and make sure the corresponding "**Map value**" is **511** BPM.
12. Click "*OK*" to close the dialog.
13. Enable the "**Show textual value display**" option for CH 3.

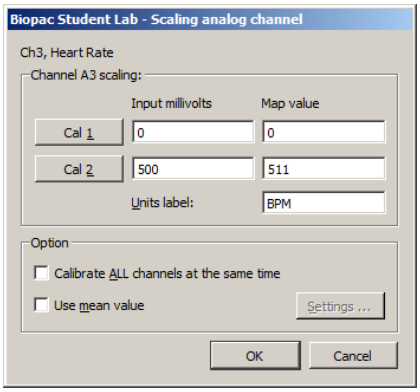

Figure 6

Recording

1. **Subject** attaches the finger clip transducer to index finger and gets into a seated and in a relaxed position.
2. Click "**Start"** to begin the recording. The recording should resemble data shown in Figure 7.

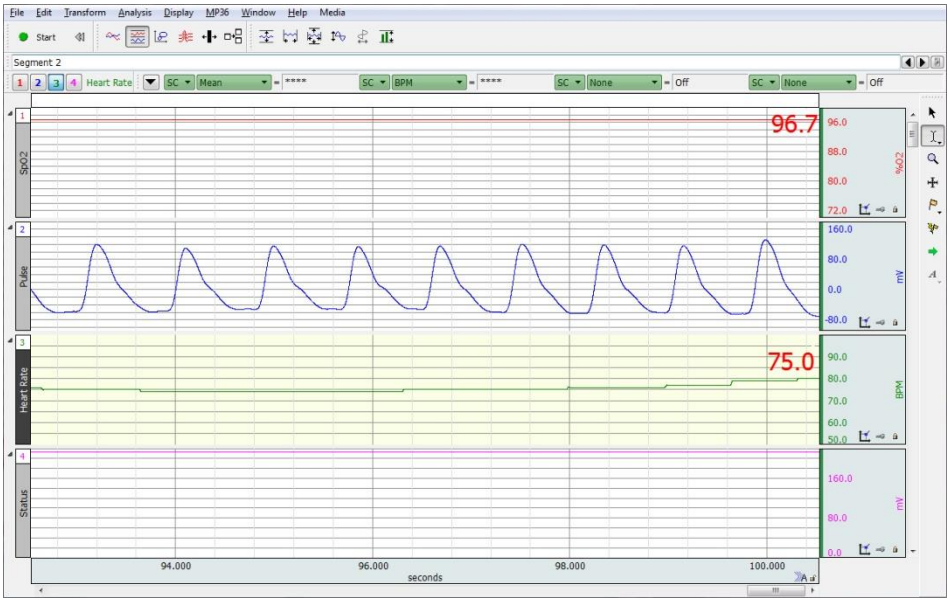

Figure 7

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Appendix 1: Channel Settings

CH 1, "SpO2":

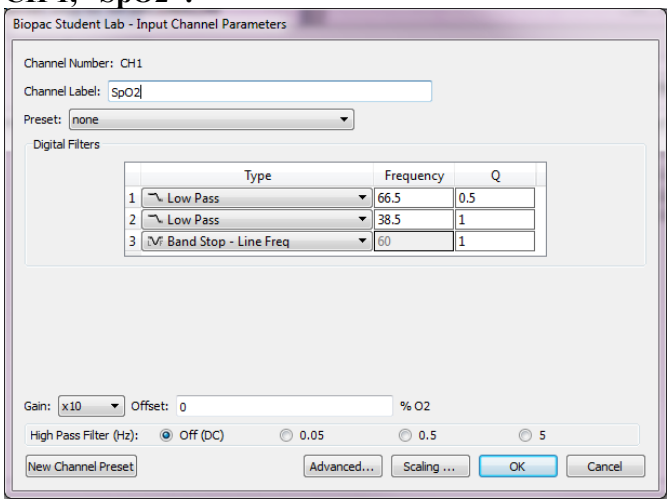

Figure 8

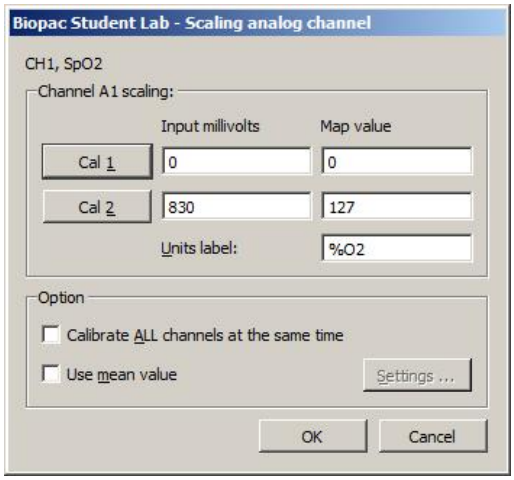

Figure 9

CH 2, "Pulse":

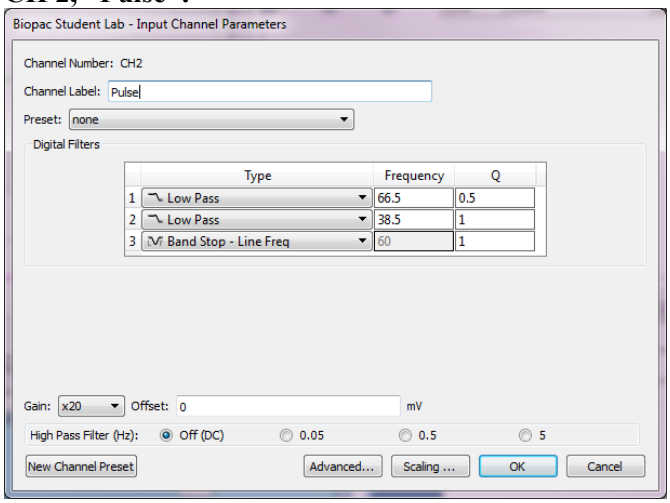

Figure 10

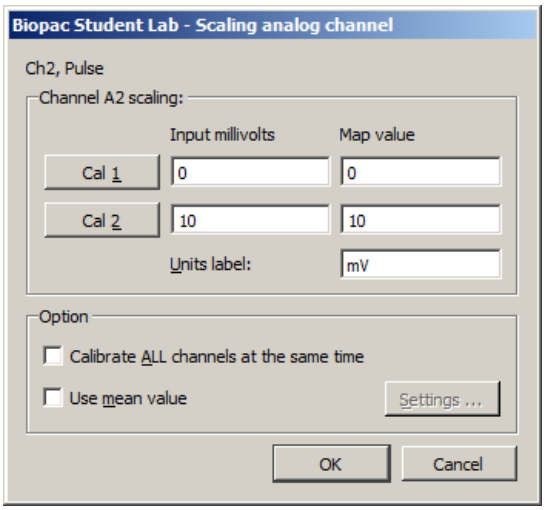

Figure 11

Ch 3, "Rate":

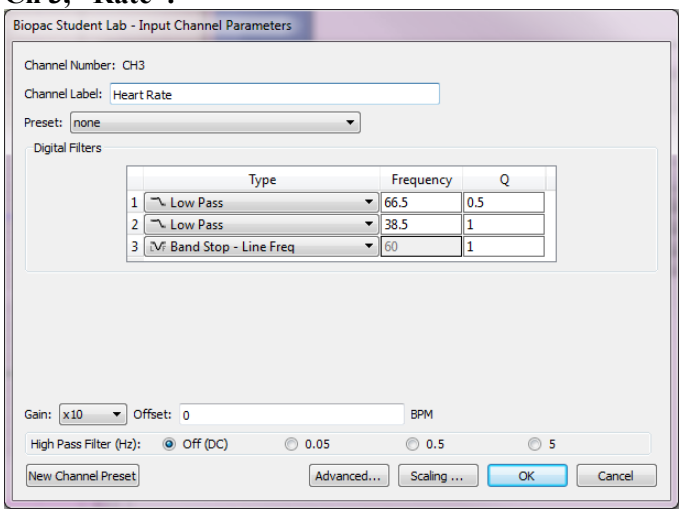

Figure 12

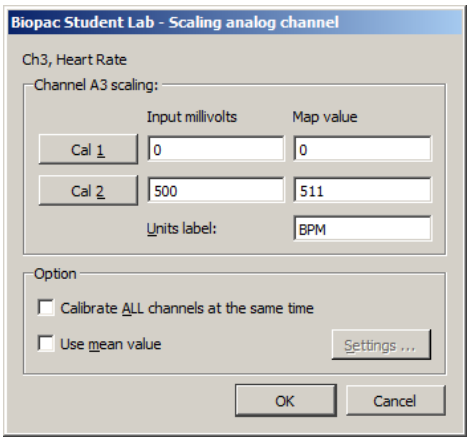

Figure 13

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Ch 4, "Status":

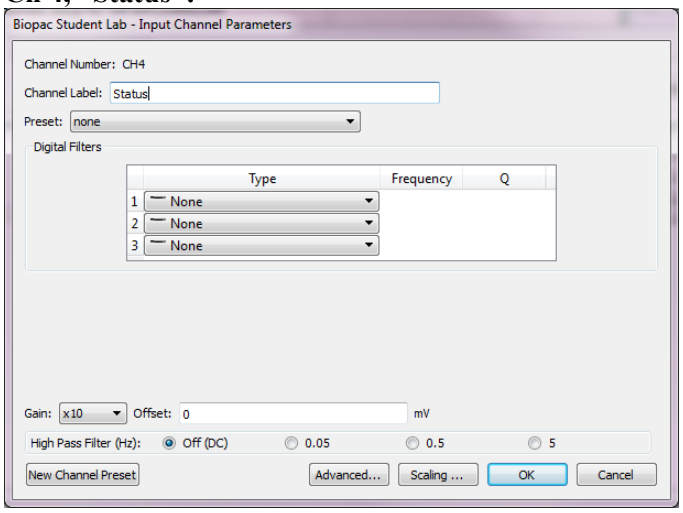

Figure 14

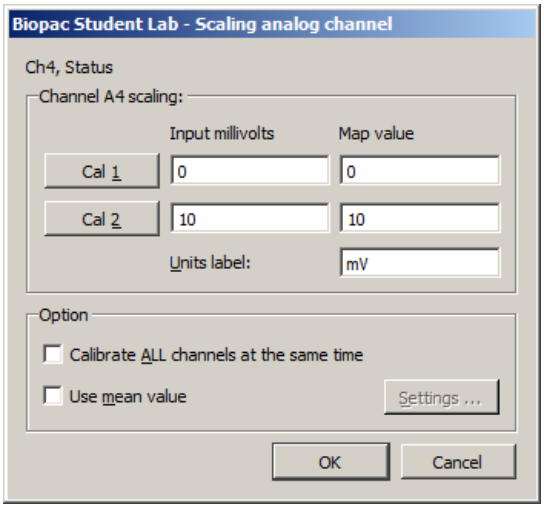

Figure 15

Appendix 2: Troubleshooting

If the status is indicating low perfusion:

- Reposition the finger transducer or place it on an alternate finger.
- Ensure that recording finger is warm. Lower body temperature will give poor readings.
- Make sure the finger transducer is not positioned above heart level.
- Reduce the amount of ambient light around the finger transducer.
- Remove any nail polish.

If the status is indicating an error condition:

- Make sure the finger transducer is plugged all the way into the OXYSSH module.
- Make sure the finger is placed all the way into the finger transducer.
- Turn the MP unit off and then back on.