Appendix P
Satlantic SUNA Sensor

This appendix provides assembly instructions and firmware information for using the SUNA with the McLane Moored Profiler (MMP). Profiler firmware release versions 4.15 and above support the Satlantic SUNA nitrate sensor. SUNA data is recorded in the 'S' file (one *SNNNNNNN*.DAT file for each profile). The MMP v4.15 Release Notes also contain information about SUNA integration.

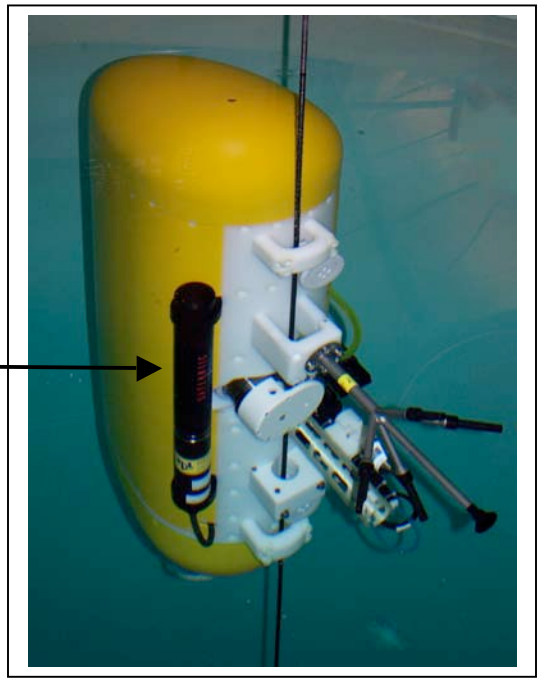

Figure P-1: MMP with SUNA Sensor

Installing the SUNA in the Sensor Mounting Brackets

The SUNA sensor is removed from the MMP for shipment and must be re-installed prior to deployment. To install the SUNA, complete the following steps:

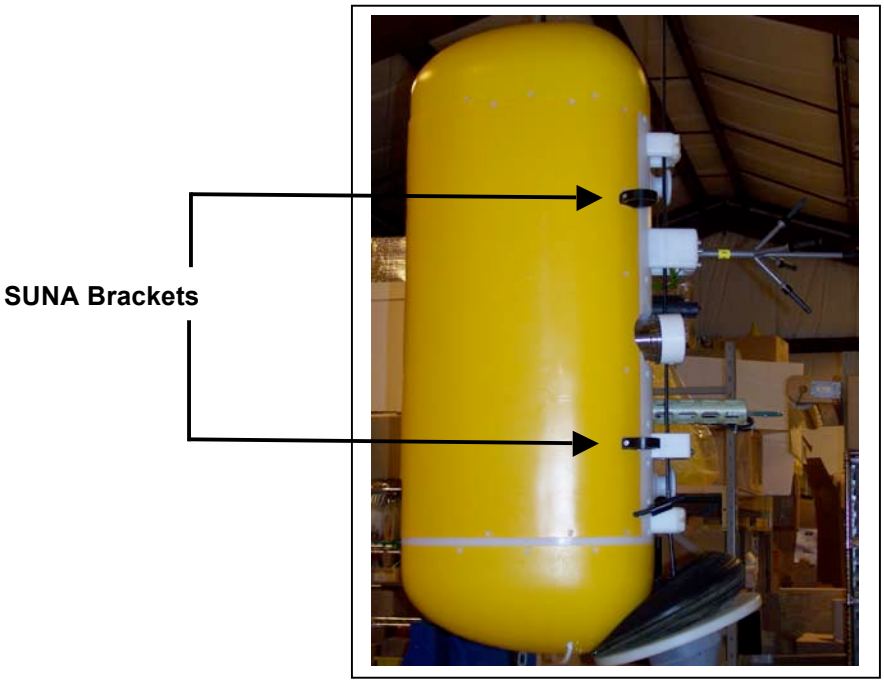

Figure P-2: MMP with SUNA Sensor

1. Slide the SUNA into the top and bottom mounting brackets on the MMP.

Figure P-3: Sliding the SUNA into the Sensor Brackets

2. Using the provided hex driver, tighten the bottom and top mounting bracket screws as shown in Figure P-4 and P5.

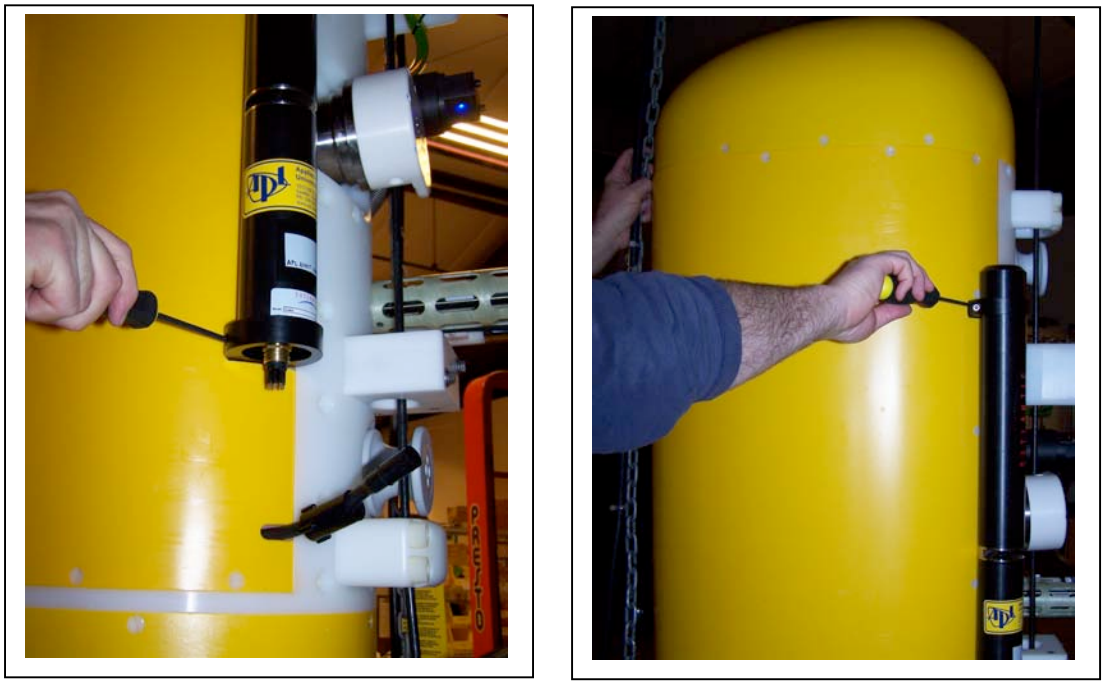

Figure P-4 and P-5: Tightening Bottom and Top Mounting Screws

3. Connect the 5-pin connector to the SUNA and secure the connector locking sleeve.

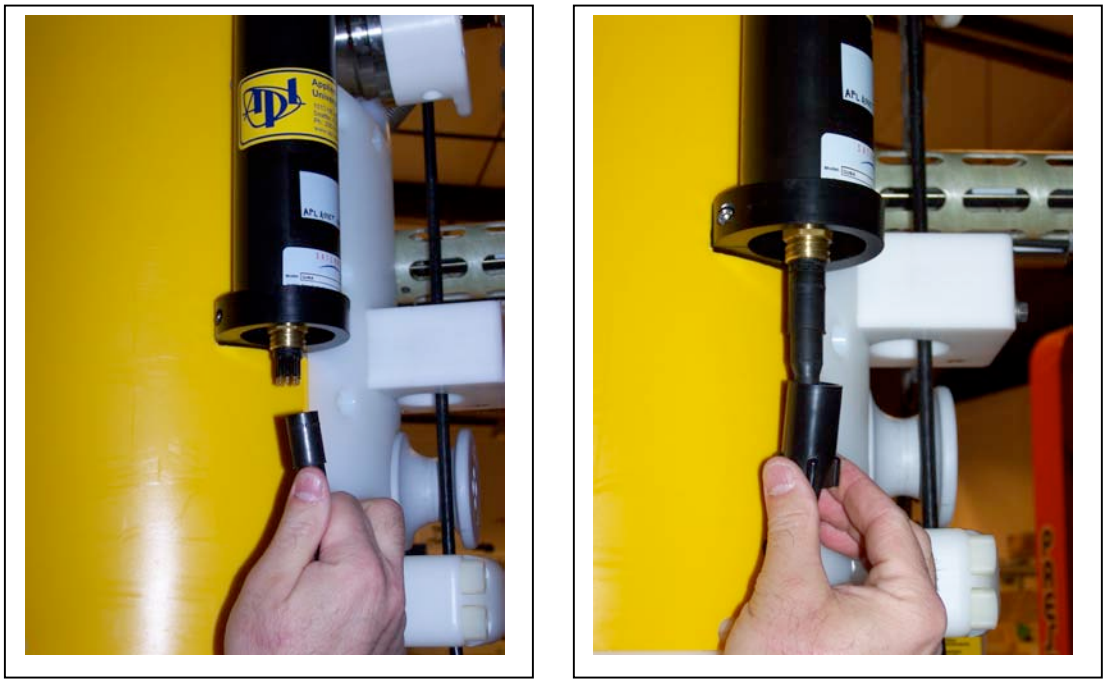

Figure P-6 and P-7: Connecting the SUNA Cable

4. Connect the opposite end of the cable (not shown) to the 8-pin connector on the controller housing marked SUNA.

Figure P-8: Completed SUNA Installation

Figure P-8 shows the completed SUNA installation.

NOTE
The SUNA also has a test cable for direct connection to the sensor. This cable is incuded in the Profiler shipment.

Configuring the Firmware for the SUNA Sensor

Profilers equipped with a SUNA nitrate sensor are configured with the SUNA enabled on the System Configuration menu. The Configuration information at the top of the screen indicates 'NI' for 'Nitrate' sensor as shown in Figure P-9. The number of light sample frames captured can be changed, however the sampling time varies based on how many framed are recorded.

IMPORTANT
Recording more data frames requires a longer SUNA response time and increases the length of each check stop interval. The SUNA response time also varies accoding to nitrate concentration. Conducting pre-deployment *in-situ* SUNA timing tests is recommended to check response time.

1. Type 'c' and the password 'configure' to access the System Configuration menu.
2. Selecting <V> Satlantic SUNA and then 'Y' enables the SUNA. The option to change the frames per stop check displays on the next line.

'NI' in config indicates Nitrate sensor enabled

```
_____________________________________________________________________
Configuration: MMP_CT_CM_FL_TU_NI           V4_15 of Feb 22 2011

                  ___________________________________
                         System Configuration
                  ___________________________________
                       Tue Feb 22 11:38:15 2011
        System Parameters:
          <E> Nominal Endurance          240 Ah
          <I> Inductive Telemetry        Enabled
          <T> Acoustic Transponder       Disabled
          <C> Inductive Charger Modem    Disabled
          <F> File Deletion              Disabled

        Sensor Suite:
          <1> FSI EM        CTD          Disabled
          <2> SeaBird 41CP  CTD          Disabled
          <3> SeaBird 52MP  CTD          Enabled
          <4> FSI 2D        ACM          Enabled
          <5> Nobska MAVS   ACM          Disabled
          <6> SeaPoint      Fluorometer  Enabled    (Chlorophyll ‡)
          <7> Wetlabs       Fluorometer  Disabled
          <8> SeaPoint      Turbidity    Enabled    (IR)
          <9> Aanderaa      Optode       Disabled
          <P> BioSpherical  PAR          Disabled
          <O> Wetlabs BBFL2              Disabled
          <V> Satlantic SUNA             Enabled
          <R> Teledyne RDI  DVS          Disabled
          <L> RBR Logger    CTD          Disabled

        Exit:
          <X> Save Changes and Exit
      Selection  [X] ? v
Enable the Satlantic SUNA Nitrate (Yes/No) [N] ? y
Number of frames per stop-check (1 to 4) ? 3
```

Frames per stop check

Figure P-9: System Configuration Menu with Sensor Selections

3. Specify the number of data frames to capture at each stop check interval and select [X] to exit and save the entry. The setting for Frames per stop check displays next to the SUNA option.

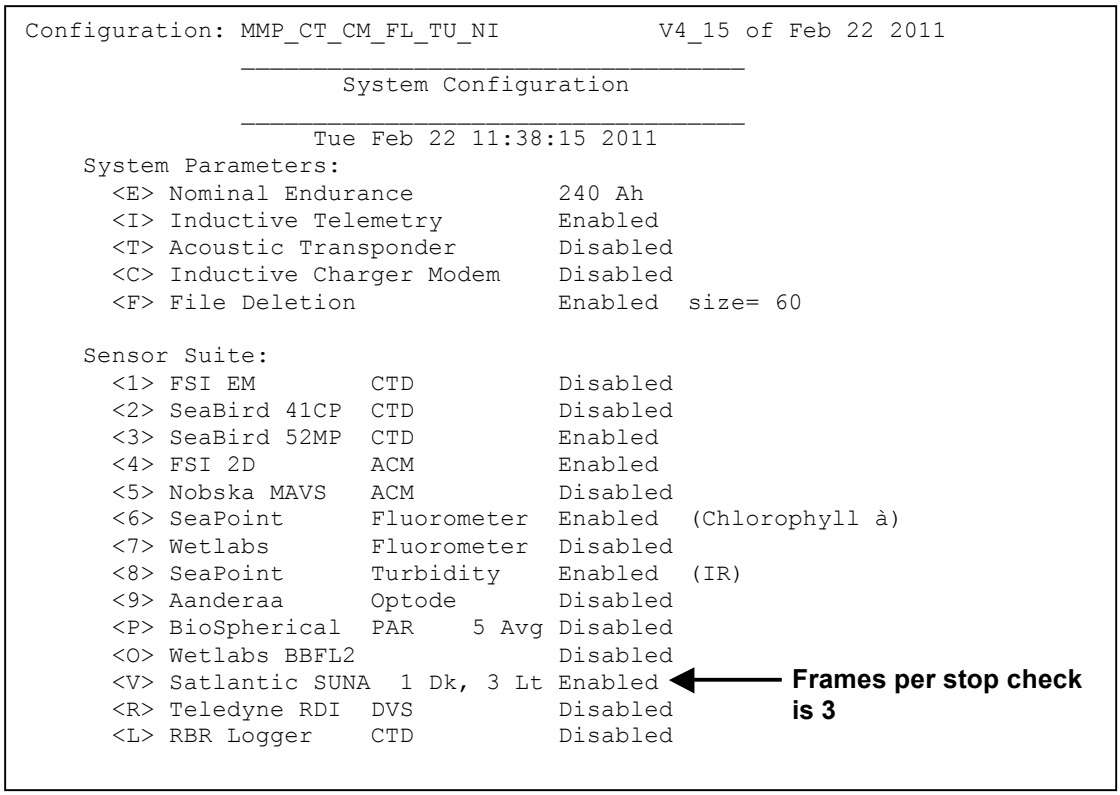

Figure P-10: System Configuration Menu Shows SUNA Frames per Stop Check

NOTE
The Dark frame is a SUNA reference frame. This number is 1 and cannot be changed.

Communicating with the SUNA

Use the Bench Tests menu in the firmware to communicate with the SUNA sensor. To display and verify settings, complete the following steps:

1. From the Bench Tests menu, select <V> 'Satlantic SUNA'.

```
_____________________________________________________________________

Configuration: MMP_CT_CM_FL_TU_NI           V4_15 of Jan 19 2011

                ______________________________________
                            Bench Tests
                ______________________________________
                     Thu Feb 10 12:04:57 2011
Sensor Utilities:
    <1> CTD Communication        <4> CTD Temperature Record
    <2> CTD Pressure             <5> ACM Communication
    <3> CTD Average Pressure     <6> ACM Tilt and Compass

 System Evaluation:
    <7> Motor Operation          <9> Independent Watchdog
    <8> Brake off. Change?

 System Options Tests:
    <A> Inductive Charger Modem  <O> Wetlabs BBFL2
    <B> Optode Communication     <P> Acoustic Transponder
    <C> CDOM Fluorometer         <S> SIM/UIM Transactions
    <E> Battery Endurance        <T> IR Turbidity
    <F> Chl ‡ Fluorometer        <U> Power UIM
    <I> Inductive Telemetry      <V> Satlantic SUNA
    <N> Aanderaa Optode          <Y> Biospherical PAR
```

Figure P-11: Bench Tests Menu

The SUNA Bench Test Menu displays. The number of data frames per stop check can also be changed on the Bench Test menu as shown in Figure P-12.

```
Configuration: MMP_CT_CM_FL_TU_NI           V4_15 of Feb 22 2011
                ______________________________________
                     SAT/SUNA Bench Test Menu
                ______________________________________
                     Tue Feb 22 11:34:44 2011

    <1> Direct communications (9600 Baud)
    <2> Restore McLane parameters
    <3> Restore factory parameters
    <4> Report parameter settings
    <5> Perform a profile test loop
    <6> Perform a sensor self-test
    <7> Set number of frames/stopcheck (2)

    <M> Return to previous Menu

       Selection  [M] ? 7
Number of frames per stop-check (1 to 4) ? 3
```

Figure P-12 SUNA Bench Test Menu

Selecting <1> from the SUNA Bench Test Menu connects directly with the SUNA sensor as shown in Figure P-13.

```
Selection  ? 1

Press ^C to terminate Sat/SUNA session

14:40:43 Sat/SUNA communication channels opened..
14:40:43 Sat/SUNA powered ON.
************************************************************

SUNA V1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1    (Aug 28 2009, 14:46:06)

Reset source: BROWNOUT
Temperature sensors:
       Lamp housing: FOUND
       Spectrometer: FOUND
RS-232 POLLED MODE
CMD?
```

Figure P-14: Direct Communications with SUNA

Option <2> and Option <3> from the SUNA Bench Test menu provide a way to restore the McLane or Satlantic factory settings on the SUNA.

Figure P-15 shows an example of resetting the McLane-defined parameters. Using option <2> requires typing the password 'McLane'.

IMPORTANT
The profiler firmware requires the SUNA parameters configured by McLane. Changing these settings, including resetting to the factory settings will prevent the SUNA from working correctly with the profiler.

Restoring McLane parameters provides a way to configure a new SUNA to work with the profiler firmware.

```
Selection  ? 2   Password:  mclane

14:41:03 Sat/SUNA communication channels opened..
14:41:03 Sat/SUNA powered ON. . ......................

14:41:10 Sat/SUNA sending [$] command. . ................. .....
14:41:11 Sat/SUNA sending [$Conf SetOpMode POLLED] command. ... .. .
14:41:12 Sat/SUNA sending [$Conf SetTFMode FULL_BINARY] command. ... .. .
14:41:13 Sat/SUNA sending [$Conf SetWaterType salt] command. ... .. .

14:41:14 Sat/SUNA was able to restore McLane parameters.

14:41:14 Sat/SUNA powered OFF.
14:41:14 Sat/SUNA power-down delay .....................
14:41:19 Sat/SUNA communication channels closed..

  Exit:
    <M> Main Menu
```

Figure P-15: Option <2> Restore McLane Parameters

Option <3> (not shown) restores the factory configuration parameters delivered with the SUNA. Option <3> requires using the password ‘factory’.

Option <4> displays the current SUNA parameter settings as shown in Figure P-16.

```
Selection  ? 4

14:41:21 Sat/SUNA communication channels opened..
14:41:21 Sat/SUNA powered ON. . ......................

14:41:28 Sat/SUNA current parameter settings.

FirmwareVersion:  1.7.1

Identify Pkg:     61835
Identify Cal:     21054
LampTime:         134828
GetSNum:          0052
GetBaud:          38400
GetOpMode:        POLLED
GetTFMode:        FULL_BINARY
GetFMTime:        60
GetIntPeriod:     400
GetBLOrder:       Linear
GetFitMin:        217.0
GetFitMax:        240.0
GetNtrDACMin:     -5.000000
GetNtrDACMax:     100.000000
GetLFrames:       1790
GetDFrames:       10
GetWaterType:     salt


14:41:39 Sat/SUNA powered OFF.
14:41:39 Sat/SUNA power-down delay .....................
14:41:44 Sat/SUNA communication channels closed..

  Exit:
    <M> Main Menu
```

Figure P-16: Option <4> Report Parameter Settings

Option <5> performs a profile test loop. This test simulates an automated sensor verification and a 5 minute profile, as shown in Figure P-17.

The predefined 5 minute test time allows 2 minutes for sensor warm up, 1 minute for simulated profiling and 2 minutes for sensor warm down.

```
Selection  ? 5


14:45:29 Sat/SUNA Automated verification of sensor settings.
14:45:29 Sat/SUNA communication channels opened..
14:45:29 Sat/SUNA powered ON. . ......................
14:45:36 Sat/SUNA powered OFF.
14:45:36 Sat/SUNA power-down delay .....................
14:45:41 Sat/SUNA communication channels closed..


Press ^C to exit the loop

14:45:42 Sat/SUNA prepping for profile.
14:45:42 Sat/SUNA communication channels opened..
14:45:42 Sat/SUNA powered ON. . ......................
14:45:49 Sat/SUNA opening file S0000000.DAT for profile 0.
14:45:49 Sat/SUNA writing 4 byte header for profile 0.
14:45:50 Sat/SUNA communication channels closed..

14:45:50 Sat/SUNA performing 20 "stop-checks" at 15 second intervals (5
minutes).

Sat/SUNA profile 0, "stop-check" 1:
14:45:50 Sat/SUNA communication channels opened..
14:45:50 Sat/SUNA acquiring 1 reference sample.
14:45:50 Sat/SUNA sending [DATA] command. . .
14:45:51 Sat/SUNA writing 511 byte block for profile 0. .
14:45:51 Sat/SUNA sending [LON] command. . .
14:45:53 Sat/SUNA acquiring 4 nitrate samples.
14:45:54 Sat/SUNA sending [DATA] command. . .
14:45:54 Sat/SUNA writing 511 byte block for profile 0. .
14:45:55 Sat/SUNA sending [DATA] command. . .
14:45:56 Sat/SUNA writing 511 byte block for profile 0. .
14:45:56 Sat/SUNA sending [DATA] command. . .
14:45:57 Sat/SUNA writing 511 byte block for profile 0. .
14:45:57 Sat/SUNA sending [DATA] command. . .
14:45:58 Sat/SUNA writing 511 byte block for profile 0. .
14:45:58 Sat/SUNA sending [LOFF] command. . .
14:45:58 Sat/SUNA communication channels closed..0.009866 mg/L nitrate
. . .
14:50:51 Sat/SUNA halting profile.
14:50:51 Sat/SUNA writing 519 byte trailer for profile 0.
14:50:52 Sat/SUNA closing file S0000000.DAT for profile 0.
14:50:52 Sat/SUNA communication channels opened..
14:50:52 Sat/SUNA powered OFF.
14:50:52 Sat/SUNA power-down delay .....................
14:50:58 Sat/SUNA communication channels closed..


Sat/SUNA test profile 0 succeeded
Press ^C to exit the loop
```

Figure P-17: Option <5> Perform a profile test loop

Option <6> Performs a SUNA self test to verify SUNA operation.

```
Selection  ? 6

Press ^C to terminate Sat/SUNA session

14:44:43 Sat/SUNA communication channels opened..
14:44:44 Sat/SUNA powered ON.
************************************************************
SUNA V1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1    (Aug 28 2009, 14:46:06)

Reset source: BROWNOUT
Temperature sensors:
       Lamp housing: FOUND
       Spectrometer: FOUND

RS-232 POLLED MODE
CMD? $
SUNA V1
Submersible Ultraviolet Nitrate Analyzer
Satlantic Inc.
Firmware Version: 1.7.1    (Aug 28 2009, 14:46:06)

Type '$Help' for a list of available commands.

Note:commands are case insensitive.

SUNA> $SelfTest ← Profiler firmware executes scripted command for SUNA self test to run
*** SUNA DIAGNOSTICS ***
Erasing LOG file, if present...OK

TEST 1 (7.695 s): Memory ... wrote: 19345 read: 19345 OK
TEST 2 (8.008 s): External SRAM ........ Bytes: 32768 Errors: 0 OK
TEST 3 (9.117 s): Temperature Sensor (Lamp Housing)... 25.813 C OK
TEST 4 (9.965 s): Temperature Sensor (Spectrometer)... 25.563 C OK
TEST 5 (10.816 s): Input voltage (VMAIN) ... 11.71 V OK
. . .
$Ok
SUNA> $reboot
$Ok
SUNA V1
Submersible Ultraviolet Nitrate Analyzer

Satlantic Inc.
Firmware Version: 1.7.1    (Aug 28 2009, 14:46:06)
Reset source: WATCHDOG
Temperature sensors:
       Lamp housing: FOUND
       Spectrometer: FOUND
RS-232 POLLED MODE

CMD? [^C]  ← User types [CTRL]-[C] to terminate session
************************************************************
14:45:21 Sat/SUNA powered OFF.
14:45:21 Sat/SUNA power-down delay .....................
14:45:27 Sat/SUNA communication channels closed..
```

Figure P-18: Option <6> SUNA Self Test