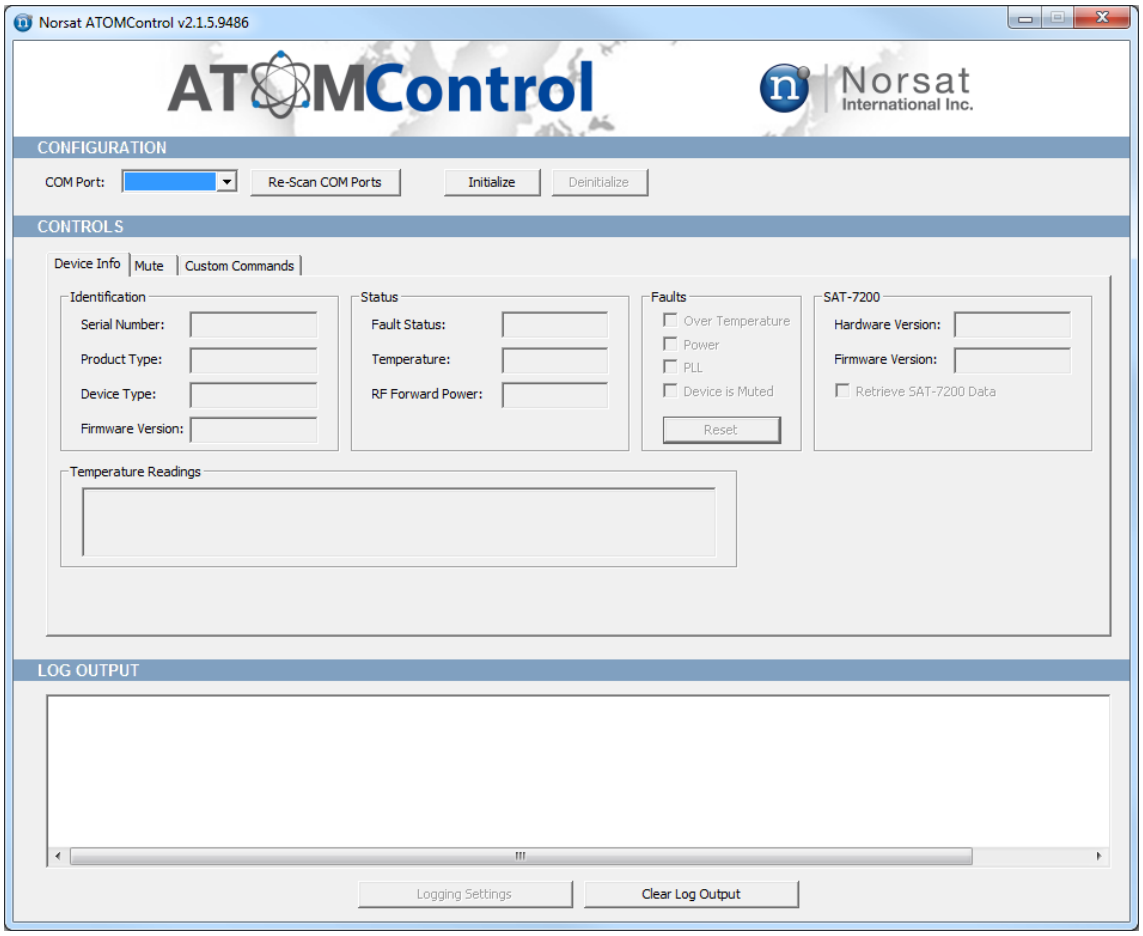
Norsat International Inc.

ATOMControl

Software Manual



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Purpose and Scope of the User Guide

The user guide explains the usage of the Norsat ATOMControl monitor and control application for ATOM Series Block UpConverters (BUCs) and Solid-State Power Amplifiers (SSPAs).

This user guide is specifically written for the ATOMControl application. Additional information can be found in the ATOM Series BUC or SSPA User Manual.

Audience

The guide will be of interest to the following personnel:

- Field users
- Systems administrators (or IT; Lifecycle/Sustainment Managers)

Revision History

Date	Nature of Revision	Release
May 2014	Initial Release	1.0

READ THE MANUAL BEFORE USING
THE ATOMControl APPLICATION

1 ATOMControl Basics

1 ATOMControl Basics

ATOMControl is a program designed for monitoring and controlling Norsat's ATOM Series of BUCs and SSPAs.

Overview

Norsat's ATOMControl software features an intuitive User Interface that provides the ability to monitor and control Norsat's ATOM Series of Block Up-Converters and Solid-State Power Amplifiers. Basic device information can be monitored along with fault, temperature, and RF power data. ATOMControl also provides full control over an ATOM Series device's mute state, and gives users the ability to communicate directly with the BUC or SSPA using a custom communication protocol.

ATOMControl is a stand-alone application that communicates with ATOM Series BUCs and SSPAs using a serial RS-485 connection via a COM Port on a host PC or laptop computer.

ATOMControl is currently supported on Windows® XP and 7.

1 ATOMControl Basics

Launching ATOMControl

ATOMControl should be launched like any other standard application: by double-clicking on the application's EXE file. ATOMControl does not require any Administrator-level privileges to run, and can thus be run by any user on the host PC.

At startup, ATOMControl will scan the host PC's available COM Ports and will populate the **COM Port** drop-down list with the names of the COM Ports that are discovered. The drop-down list can be repopulated at any time by pressing the **Re-Scan COM Ports** button. ATOMControl will not attempt to communicate with the BUC or SSPA until the **Initialize** button is pressed.

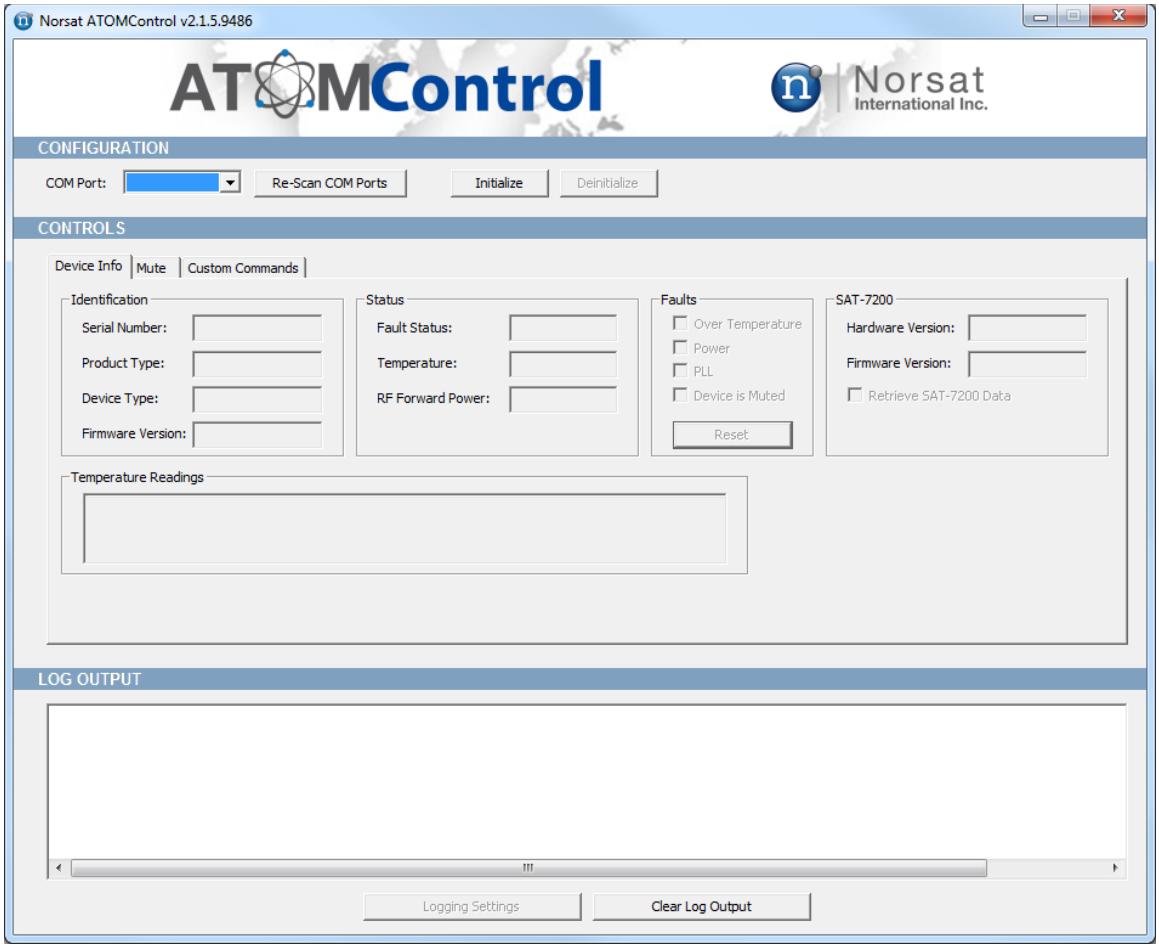

Figure 1: ATOMControl Start-Up Screen

1 ATOMControl Basics

ATOMControl User Interface

ATOMControl's User Interface is made up of three main sections: the Configuration section, the Controls section, and the Log Output section. Additionally, the application's version number is displayed at the top of the application window in the title bar.

The *Configuration* section provides controls that let the user configure the communication settings that allow ATOMControl to communicate with an ATOM BUC or SSPA. The user has the ability to select the COM Port that will be used for communication, repopulate the drop-down list of available COM Ports, initialize the communication interface, and deinitialize the communication interface.

The *Controls* section provides controls that facilitate the monitoring and control of an ATOM Series BUC or SSPA. A tabbed interface provides controls related to Device Information, Mute controls, and Custom Commands that can be sent to the BUC or SSPA.

The Log Output section contains a text field that will display messages related to ATOMControl operations performed on the ATOM BUC or SSPA. Any errors encountered by the application will result in error messages being printed in this text field. Status information may also be printed in the text field. Text may be copied from this field so that it can be pasted into a text editor; the text field can also be cleared using the **Clear Log Output** button.

Initializing Communication

Communication with the ATOM BUC or SSPA cannot be established unless the BUC or SSPA is physically connected to the Host PC (or laptop) running ATOMControl. Since most PCs and laptops lack an RS-485 serial port connection, it is recommended that a 4-Wire RS-485-to-RS-232 adapter be used to connect the ATOM device to the Host PC. A 4-Wire RS-485-to-USB adapter may also be used to facilitate the connection.

The Host PC's operating system should map the BUC or SSPA connection to a COM Port that can be used by ATOMControl to communicate with the ATOM device. ATOMControl will display the available COM Ports in the **COM Port** drop-down list in the Configuration section of the User Interface. The list of available COM Ports can be repopulated by pressing the **Re-Scan COM Ports** button. This allows the appropriate COM Port to be selected even if the ATOM BUC or SSPA is connected to the Host PC after the ATOMControl application has been launched.

Once a COM Port has been selected in the **COM Port** drop-down list, communication with the BUC or SSPA can be established by pressing the Initialize button. ATOMControl will automatically detect the type of device it is communicating with (BUC or SSPA, plus the maximum output power of the device) and use this information to facilitate proper

communication with the ATOM BUC or SSPA. The controls in the Controls section of the User Interface will also be enabled.

If communication cannot be established with the BUC or SSPA, an error message explaining the problem will be printed in the text field in the Log Output section of the User Interface. Successful communication will also be indicated in this text field. If communication with the BUC or SSPA is successfully established, the **COM Port** drop-down list, the **Re-Scan COM Ports** button, and the **Initialize** button will be disabled and the **Deinitialize** button will be enabled.

Deinitializing Communication

Deinitializing the ATOMControl communication interface halts all communication with the BUC or SSPA, and allows the settings in the Configuration section of the User Interface to be changed. The communication interface can be deinitialized by pressing the **Deinitialize** button in the Configuration section of the User Interface. If the communication interface is successfully deinitialized, the **COM Port** drop-down list, the **Re-Scan COM Ports** button, and the **Initialize** button will be enabled and the **Deinitialize** button will be disabled. A status message will also be printed in the text field in the Log Output section of the User Interface. If the communication interface could not be deinitialized, an error message will be printed in the text field in the Log Output section of the User Interface.

ATOMControl has been configured to automatically deinitialize the communication interface when the application is closed.

2 Monitoring Device Information

2 Monitoring Device Information

This chapter explains how to use ATOMControl to monitor identification,status, fault, and temperature data for an ATOM Series BUC or SSPA.

Monitoring Device Information

The tabbed interface in the Controls section of the ATOMControl User Interface contains three tabs: the Device Info tab, the Mute tab, and the Custom Commands tab. The Device Info tab can be used to monitor basic information for the BUC or SSPA.

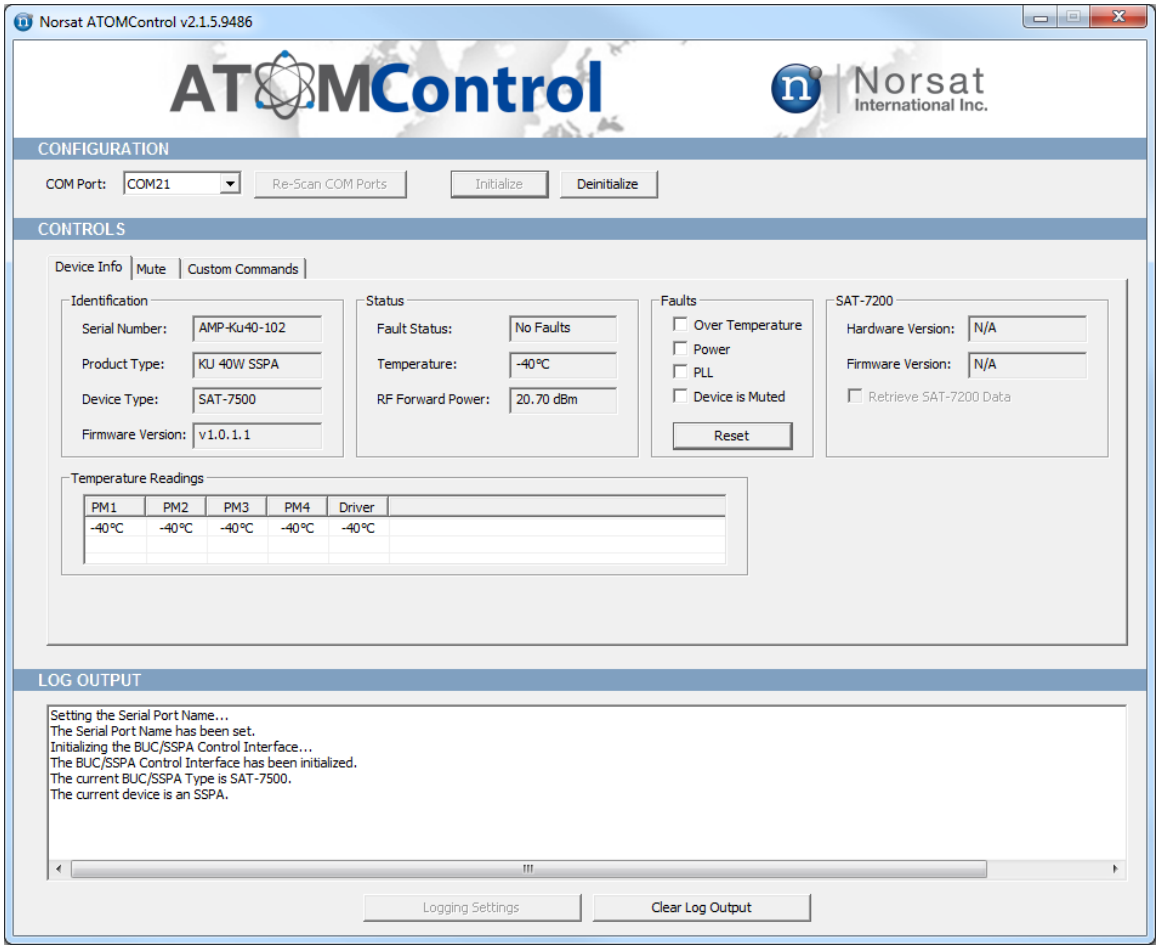

Figure 2: The Device Info Tab

If the Device Info tab is selected, device information monitoring will begin automatically when the ATOMControl communication interface is successfully initialized. Monitoring is automatically disabled when switching to a different tab, and is automatically enabled when switching back to the Device Info tab. Deinitializing the communication interface while the Device Info tab is selected will also disable device information monitoring.

2 Monitoring Device Information

The Device Info tab contains five sets of data: Identification data, Status data, Faults data, SAT-7200 data, and Temperature Readings data. Data for each set will be populated automatically and continuously updated while the Device Info tab remains selected.

The *Identification* data set contains information that can be used to identify a BUC or SSPA. The **Serial Number** field will list the unique serial number for the device. The **Product Type** field indicates the maximum output power and the device type; possible values are provided in Table 1 below. The **Device Type** field indicates the type of Distribution Board used in the ATOM device, and can be set to either SAT-7500 or SAT-9000. The **Firmware Version** field provides the four-part version number for the firmware running on the ATOM device's Distribution Board.

Type of BUC	Type of SSPA
KU 25W BUC	KU 25W SSPA
KU 40W BUC	KU 40W SSPA
KU 50W BUC	KU 50W SSPA
KU 100W BUC	KU 100W SSPA

Table 1: Product Type Values

The *Status* data set contains basic status information for the ATOM BUC or SSPA. The **Fault Status** field indicates whether any fault has been detected on the device; detailed fault information is available in the *Faults* data set described below. The **Temperature** field indicates the system temperature for the device. This is the temperature of Power Module 8 for 100W BUCs and SSPAs, or Power Module 2 for all other ATOM devices. The **RF Forward Power** field shows the current output power for the device in dBm.

Detailed fault information is provided in the *Faults* data set. A checkbox is shown for each of the four faults that can be detected for a device. If the checkbox is checked, then the corresponding fault has been detected. Table 2 below shows the detectable faults and their cause:

Fault	Cause
Over Temperature	The system temperature exceeds 90°C
Power	The Voltage Monitor has detected that one of the input voltages is too low.
PLL	At least one Phase Lock Loop (PLL) Lock has been lost
Mute	The device has been muted

Table 2: Detectable Faults

Note that the Power fault is only detected on 100W BUCs and SSPAs.

Also note that the PLL Fault is only detected for BUCs, not SSPAs.

The *SAT-7200* data set provides version information for the SAT-7200 Synthesizer board used with ATOM BUCs. This information is only available for BUCs; SSPAs do not use the SAT-7200 and thus do not provide any version information. The **Hardware Version** field shows the hardware version for the SAT-7200 board, while the **Firmware Version** field shows the version of the firmware running on the board.

The *Temperature Readings* data set shows the current temperature for each of the Power Modules contained within the ATOM device in addition to the current temperature of the device's Driver Module. Measured temperatures range from -40°C to 125°C. Table 3 below shows the expected number of Power Modules for each type of ATOM device:

Device Type	Number of Power Modules
KU 25W BUC or SSPA	2 + 1 Driver Module
KU 40W BUC or SSPA	4 + 1 Driver Module
KU 50W BUC or SSPA	4 + 1 Driver Module
KU 100W BUC or SSPA	8 + 1 Driver Module

Table 3: Number of Expected Power Modules for Each ATOM Device Type

3 Controlling ATOM Devices

3 Controlling ATOM Devices

This chapter explains how to use ATOMControl to configure the Mute State of an ATOM BUC or SSPA, and how to send custom commands to an ATOM device.

Controlling the Mute State

The tabbed interface in the Controls section of the ATOMControl User Interface contains three tabs: the Device Info tab, the Mute tab, and the Custom Commands tab. The Mute tab can be used to monitor and control the Mute configuration for the BUC or SSPA.

If the Mute tab is selected, then Mute Configuration monitoring will begin automatically when the ATOMControl communication interface is successfully initialized. Monitoring is automatically disabled when switching to a different tab, and is automatically enabled when switching back to the Mute tab. Deinitializing the communication interface while the Mute tab is selected will also disable Mute Configuration monitoring.

Figure 3 below shows the Mute tab controls:

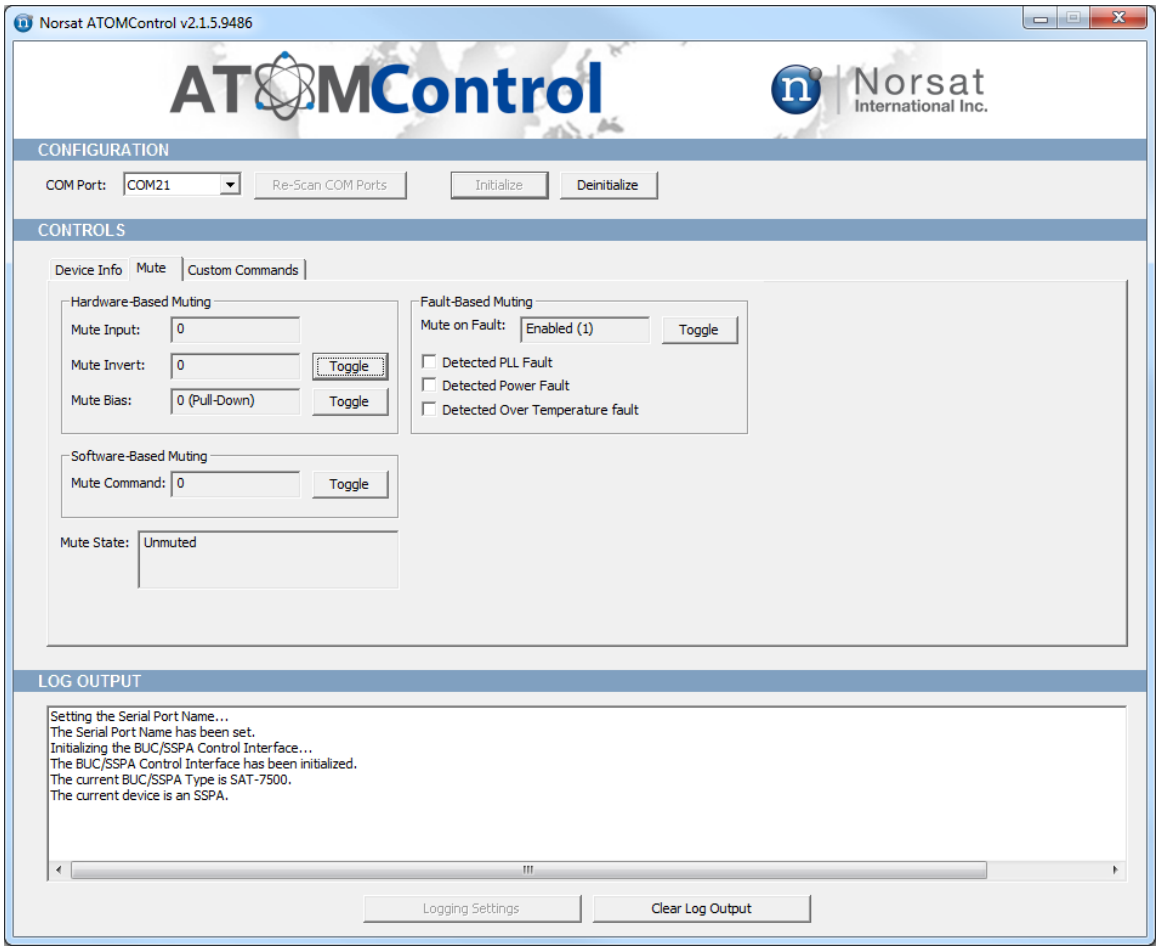

Figure 3: Mute Tab Controls

3 Controlling ATOM Devices

An ATOM Series device's Mute State is controlled by one hardware input signal, four user-controllable software parameters, and three fault indicators. ATOMControl monitors the values of all of these and displays them in the Mute Tab of the User Interface.

The signals are:

- Mute Input: The hardware input line corresponding to pin D of the MIL-C-26482 control interface
- Mute Invert: Determines which value of the Mute Input line represents Mute and which value represents Unmute
- Mute Bias: Determines the value of the Mute Input line if the hardware input is left floating
- Mute Command: Software mute setting
- Mute On Fault: Indicates whether the device will be muted if a fault is detected

Muting can thus be caused by three potential sources: a hardware-based mute triggered through the Mute Input hardware signal, fault-based muting triggered by one of three faults, and software-based muting triggered using the Mute Command parameter. Software-based muting will override both fault-based muting and hardware-based muting. Fault-based muting will also override hardware-based muting.

The hardware signal, four software parameters, and three faults interact with each other to produce the overall Mute State as shown in Figure 4 below:

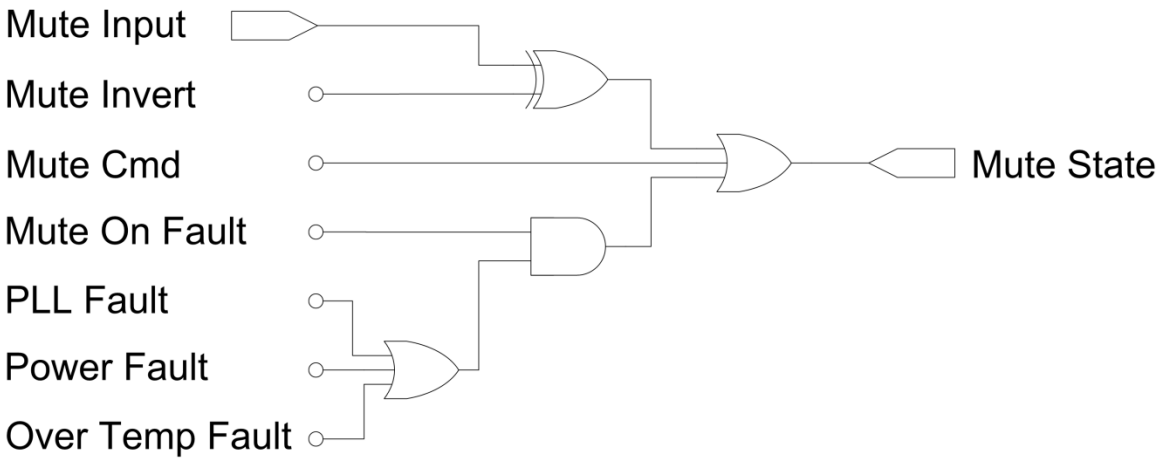

Figure 4: Mute State Logic

Hardware-Based Muting

Hardware-based muting is controlled by three values: the Mute Input hardware line, the Mute Invert software parameter, and the Mute Bias software parameter. The Mute Input line allows external devices to control whether the ATOM Series BUC or SSPA is muted or unmuted. The signal value required to mute or unmute the ATOM device is determined by the value of the Mute Invert parameter. If Mute Invert is 0, then setting Mute Input to 0V will unmute the device and setting Mute Input to 5V will mute the device. If Mute Invert is 1, then setting Mute Input to 0V will mute the device and setting Mute Input to 5V will unmute the device.

The Mute Bias signal controls the value of the Mute Input hardware line if the hardware line is left floating. If Mute Bias is 0, then a floating Mute Input line will be pulled down to 0V. If Mute Bias is 1, then a floating Mute Input line will be pulled up to 5V.

By default, both Mute Bias and Mute Invert are set to 0.

The hardware-based muting parameter interactions are summarized in Table 4 below:

Mute Input Voltage	Mute Input Logical Value	Mute Invert Logical Value	Mute Bias Logical Value	Hardware Mute Result
0V	0	0	0	Unmuted
0V	0	0	1	Unmuted
0V	0	1	0	Muted
0V	0	1	1	Muted
5V	1	0	0	Muted
5V	1	0	1	Muted
5V	1	1	0	Unmuted
5V	1	1	1	Unmuted
Floating	Z	0	0	Unmuted
Floating	Z	0	1	Muted
Floating	Z	1	0	Muted
Floating	Z	1	1	Unmuted

Table 4: Hardware-Based Muting

ATOMControl shows all of the values relevant to hardware-based muting in the top-left groupbox in the Mute tab in the Controls section of the User Interface. The logical value of the Mute Input line, the Mute Invert parameter, and the Mute Bias parameter are all displayed along with buttons that allow the Mute Invert and Mute Bias signal values to be toggled between 0 and 1. Figure 5 below shows the hardware-based muting controls:

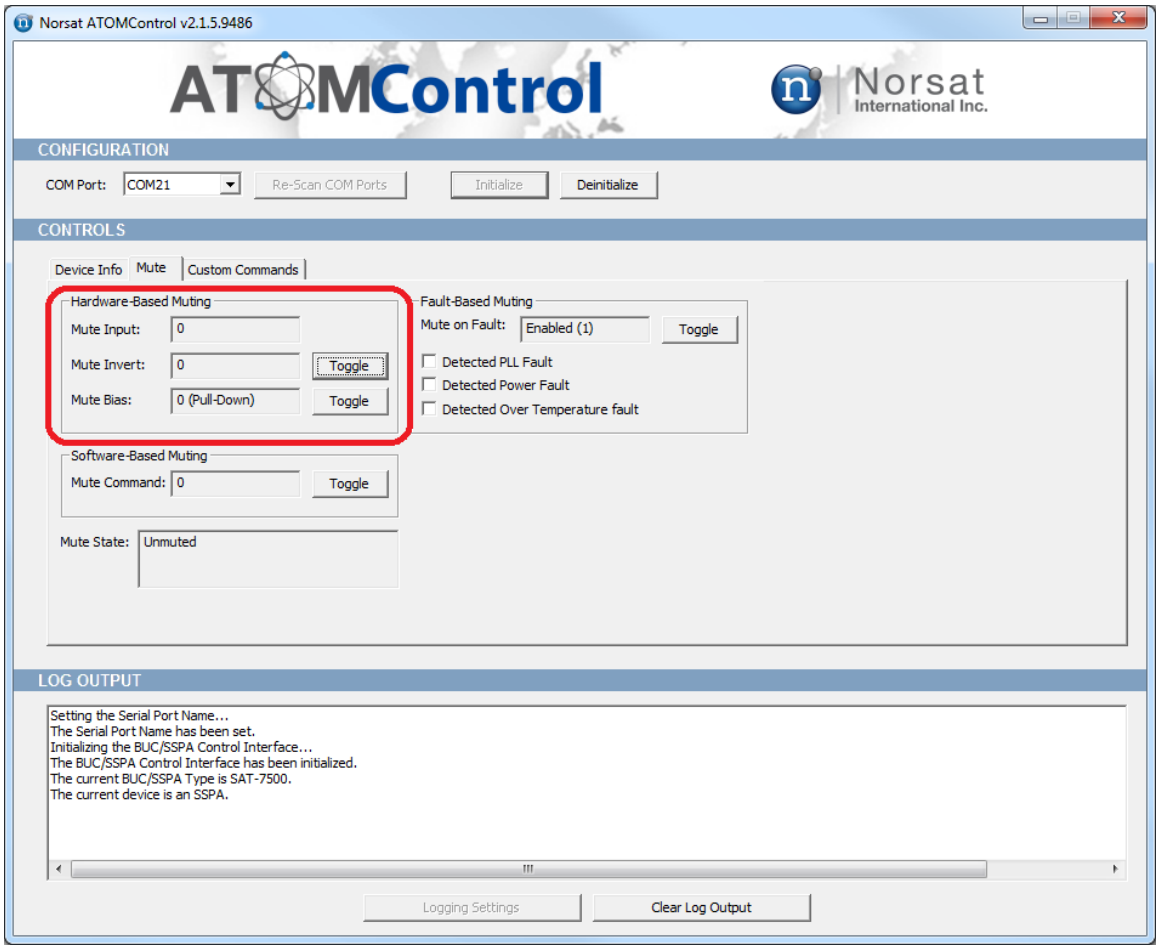

Figure 5: Hardware-Based Muting Controls

The value represented in the Mute Input field depends on the type of device that ATOMControl is monitoring. If the device is a 25W, 40W, or 50W BUC or SSPA, then the Mute Input field will display the value of the Mute Input hardware line. A value of 0 represents 0V, and a value of 1 represents 5V. For 100W BUCs and SSPAs, the value shown will represent the overall Mute State, with 0 indicating that the device is unmuted and 1 indicating that the device is muted.

Fault-Based Muting

Fault-based muting automatically mutes the device if one of three faults is detected on the ATOM Series BUC or SSPA. A PLL Fault, a Power Fault, and an Over Temperature Fault can all trigger automatic muting. These faults will only mute the device, however, if the Mute On Fault software parameter is set to 1. If Mute On Fault is set to 0 then the device will not be automatically muted if a fault is detected on the device. By default, the Mute On Fault parameter is set to 1.

Table 5 below shows the interaction of the fault-based muting signals:

Mute On Fault	Power Fault	OverTemp Fault	PLL Fault	Fault Mute Result
0	0	0	0	Unmuted
0	0	0	1	Unmuted
0	0	1	0	Unmuted
0	0	1	1	Unmuted
0	1	0	0	Unmuted
0	1	0	1	Unmuted
0	1	1	0	Unmuted
0	1	1	1	Unmuted
1	0	0	0	Unmuted
1	0	0	1	Muted
1	0	1	0	Muted
1	0	1	1	Muted
1	1	0	0	Muted
1	1	0	1	Muted
1	1	1	0	Muted
1	1	1	1	Muted

Table 5: Fault-Based Muting

ATOMControl shows all of the values relevant to fault-based muting in the top-right groupbox in the Mute tab in the Controls section of the User Interface. The value of the Mute On Fault parameter is displayed along with a button that allows the Mute On Fault value to be toggled between 0 and 1. Additionally, the groupbox contains three read-only checkboxes that indicate whether each of the three mute-inducing faults has been detected. Figure 6 below shows the hardware-based muting controls:

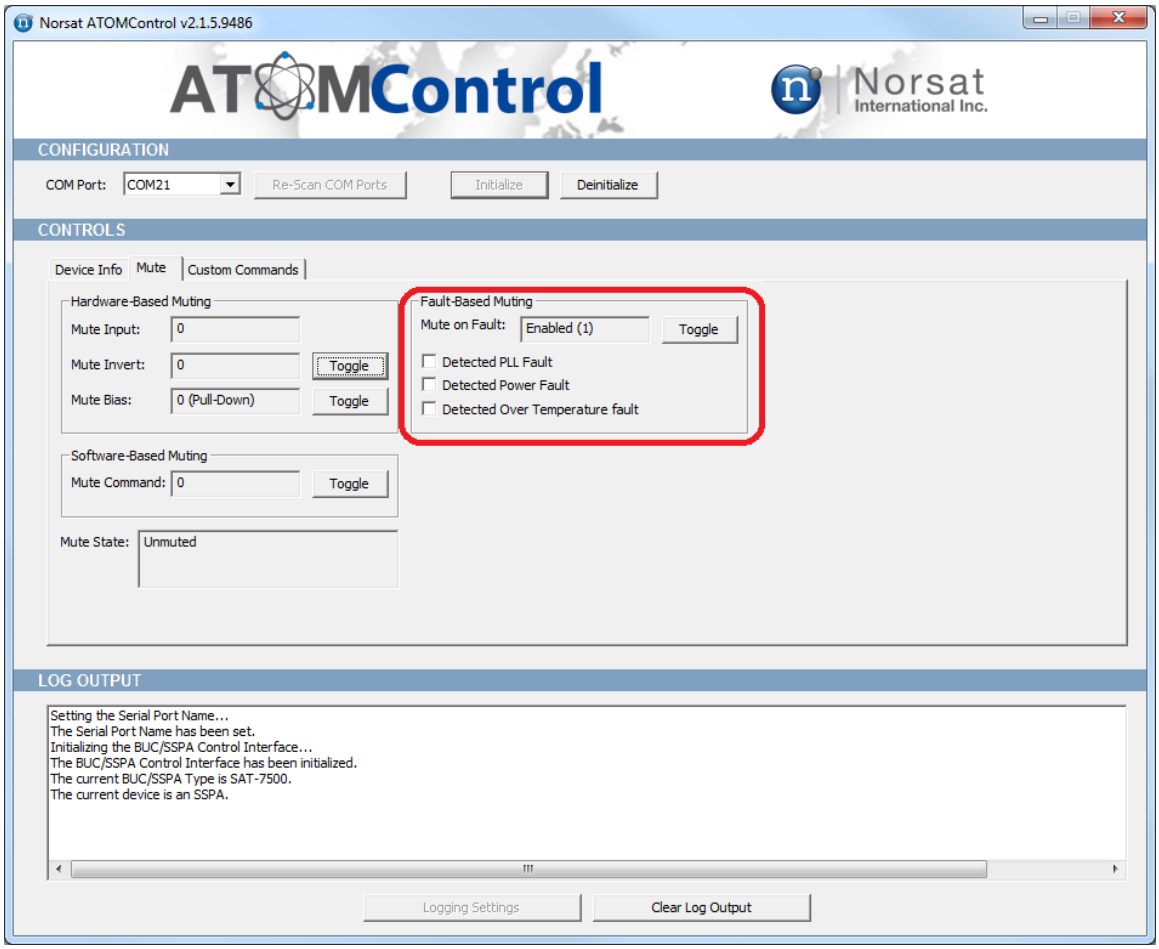

Figure 6: Fault-Based Muting Controls

Software-Based Muting

Software-based muting is controlled by a single parameter that overrides all other muting controls: the Mute Command parameter. If Mute Command is set to 1 then the ATOM Series device will be muted. If the Mute Command signal is set to 0 then the device will be unmuted (assuming it is not muted by hardware or by faults). By default, the Mute Command parameter is set to 0.

ATOMControl shows all of the values relevant to software-based muting in the bottom-left groupbox in the Mute tab in the Controls section of the User Interface. The value of the Mute Command parameter is displayed along with a button that allows the Mute Command value to be toggled between 0 and 1. Figure 7 below shows the software-based muting controls:

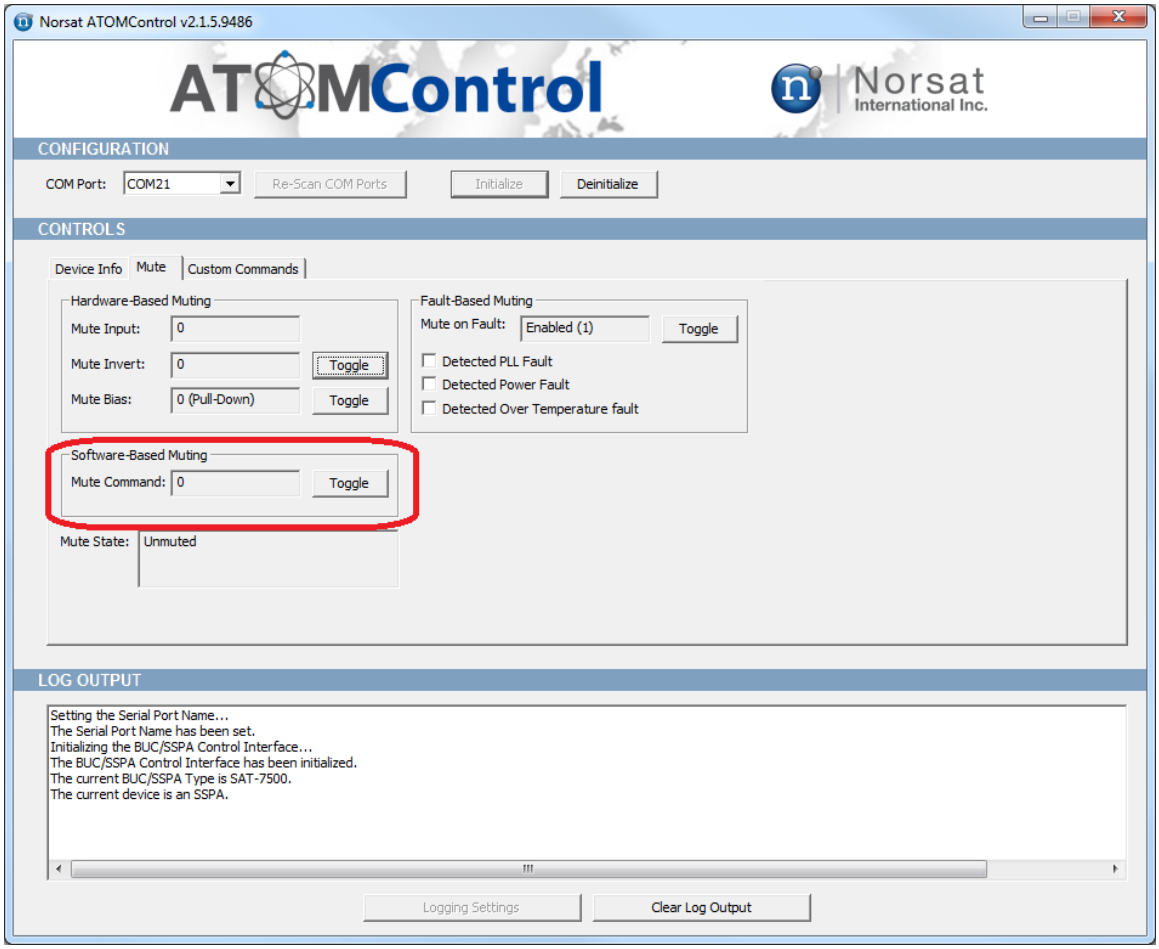

Figure 7: Software-Based Muting Controls

Unmuting the Device

ATOM Series devices are unmuted only if nothing is causing them to be muted. The parameters for hardware-based muting, fault-based muting, and software-based muting must **all** be in a state that does not cause the BUC or SSPA to be muted in order for the device to be in an unmuted state. ATOMControl displays the overall Mute State below the Software-Based muting groupbox in the Mute tab in the Controls section of the User Interface as shown in Figure 8 below:

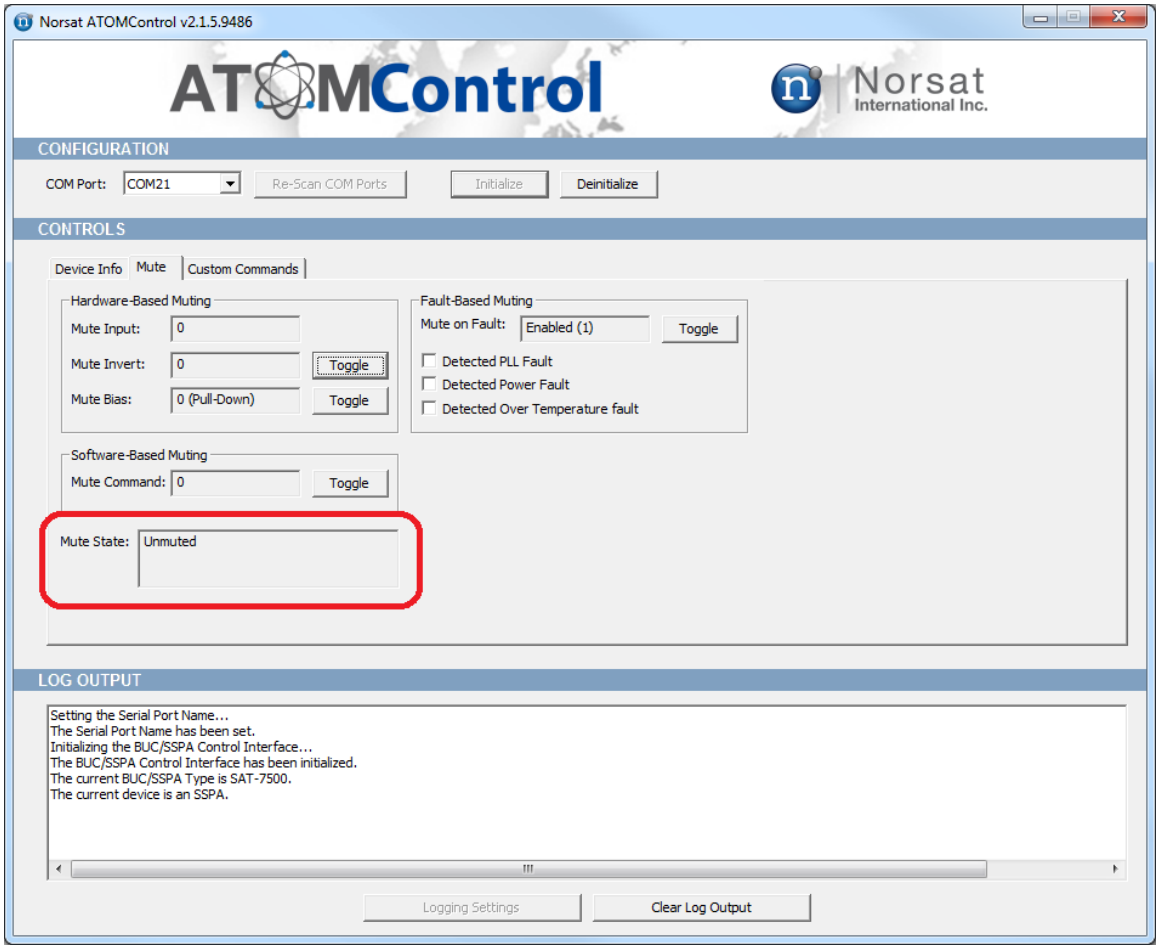

Figure 8: Mute State

Sending Custom Commands

The tabbed interface in the Controls section of the ATOMControl User Interface contains three tabs: the Device Info tab, the Mute tab, and the Custom Commands tab. The Custom Commands tab can be used to communicate with the ATOM BUC or SSPA directly using a series of command strings that follow the ATOM Communication Protocol.

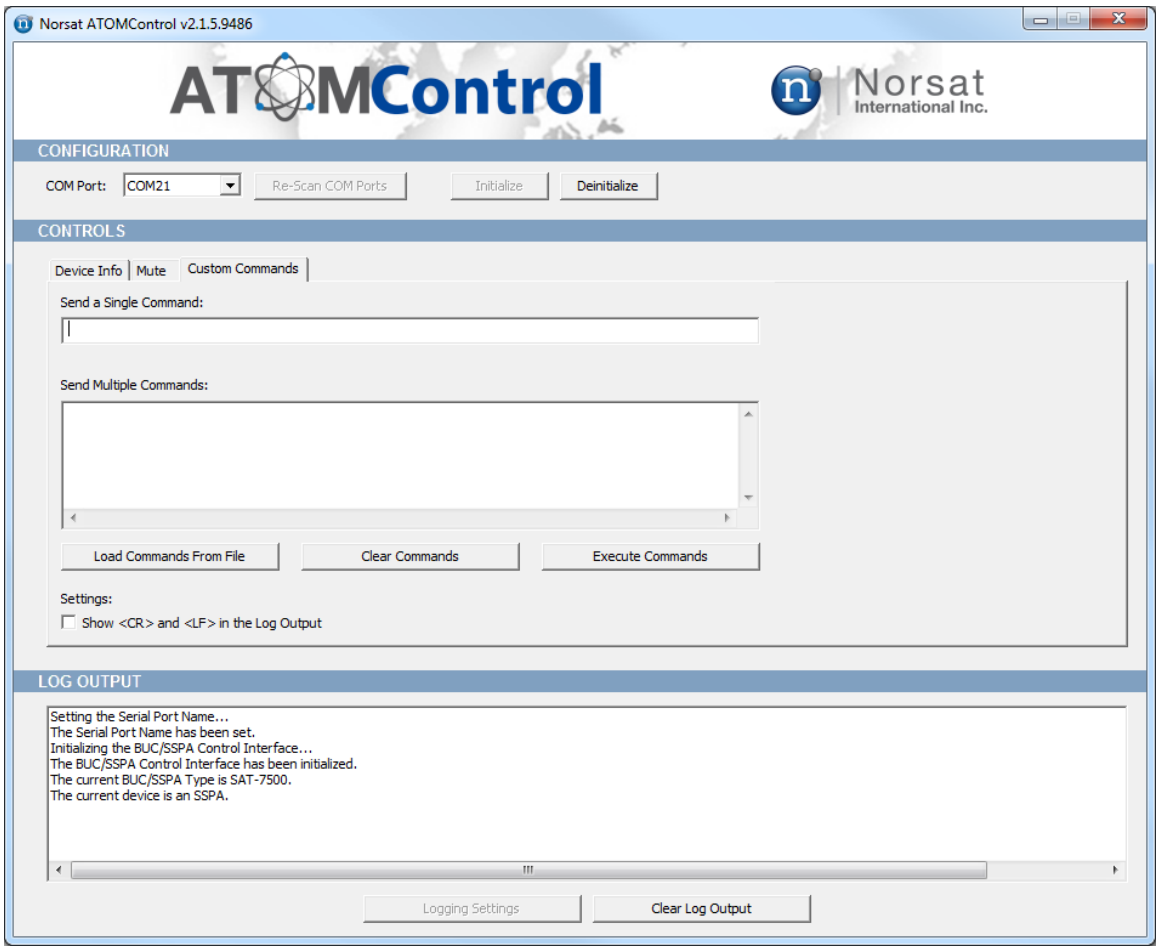

Figure 9: The Custom Commands Tab

ATOM Series BUCs and SSPAs are controlled using character-based command strings sent over a serial interface. ATOMControl provides users with the ability to send command strings to an ATOM Series device and to see the corresponding response string received from the device. A single response string will be generated for all commands sent to the device, but improperly-formatted or invalid command strings will produce error response strings. Response strings are typically received immediately

after sending the command string, though some response strings are received only after a short delay.

All command strings follow the same basic format: a Command Name, followed by zero or more pairs of Command Parameters and Values, followed by a terminating Carriage Return character. Sample commands include:

```
getident<CR>

setmute cmd 1<CR>

setmute value 0<CR>
```

All response strings also follow a common format: a Carriage Return character and a Line Feed character at the start of the response, followed by a status string, followed by zero or more pairs of Response Parameters and values, followed by a terminating Carriage Return character and Line Feed character. Sample response strings (and the commands that generated them) are as follows:

```
getstatus<CR>
<CR><LF>ok fault 0x0 fwdpwr +17.3 revpwr -15.8 temp 42<CR><LF>

setmute cmd 1<CR>
<CR><LF>ok<CR><LF>

bad command<CR>
<CR><LF>err "Invalid Command"<CR><LF>
```

Please consult the ATOM device's Operator Manual for more details concerning the command strings that can be sent down and the expected corresponding response strings.

ATOMControl provides two sets of controls that can be used to send command strings to an ATOM Series BUC or SSPA. The **Send a Single Command** text field allows the user to type in a single command string to be sent to the device. Pressing the Enter key while in this field will send the contents of the field to the device along with a terminating Carriage Return character. Pressing the Up or Down Arrow keys while in this field will cycle backwards or forwards through the history of previously-sent command strings.

Multiple commands can be sent one after the other using the **Send Multiple Commands** multi-line text field. Commands may be typed into this field, copied-and-pasted into this field, or loaded into the field from a text file using the **Load Commands From File** button. All text can be removed from the field using the **Clear Commands** button. Pressing the **Execute Commands** button will send each non-blank line in the field down to the device, automatically adding a terminating Carriage Return character to each command string.

Command strings that are sent to an ATOM BUC or SSPA will be displayed in the Log Output text field, as will the corresponding response string. If the **Show <CR> and <LF> in the Log Output** checkbox is checked, then both the command string and the response string will show the Carriage Return and Line Feed characters used in the ATOM Communication Protocol. If the checkbox is unchecked, then the Carriage Return and Line Feed characters will be stripped out of the command and response strings, leaving only the content of the outgoing or incoming messages. Figure 10 and Figure 11 show sample command and response strings with and without the Carriage Return and Line Feed characters displayed:

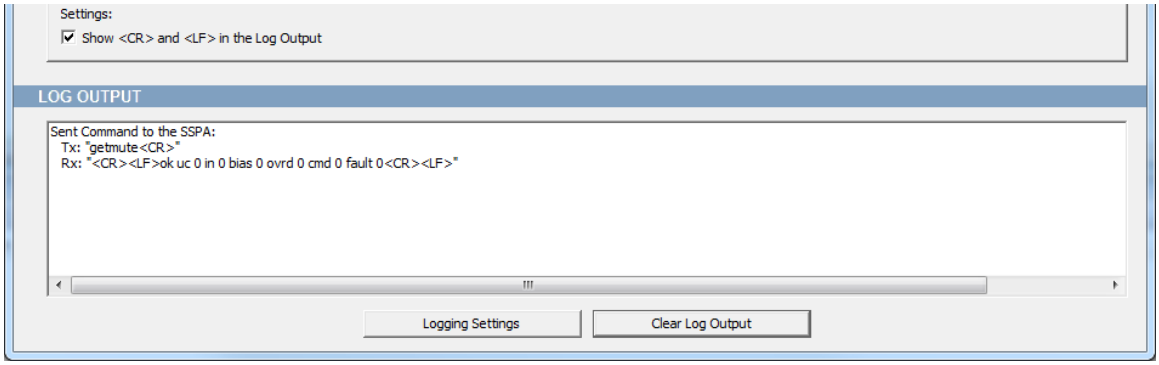

Figure 10: Command and Response Strings Showing <CR> and <LF>

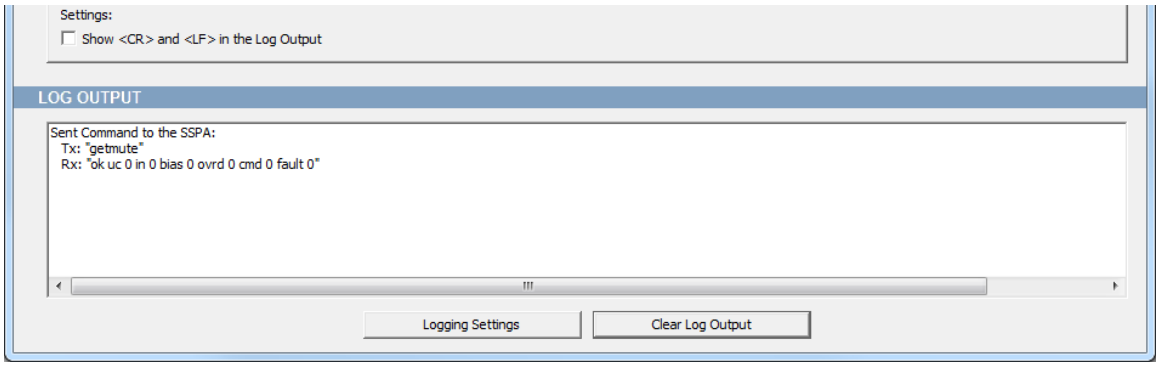

Figure 11: Command and Response Strings Without <CR> and <LF>