



Programmable RF Attenuators  
R3 Series

Operation Manual

Rev C1

**Adaura Technologies**

[www.adauratech.com](http://www.adauratech.com)

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## Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instruction complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.



## SELF DECLARATION FOR \*ROHS COMPLIANCE

\*Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment

We, Adaura Technologies, 3017 Douglas Boulevard, Suite 300, Roseville CA 95661, declare in our sole responsibility that the following product does not contain six hazardous substances in RoHS compliance.

**Product Name:** X Channel USB & Ethernet Digital Attenuator Series

**Series covered:** AD-USB where X is custom designator for number of attenuation chains.

### Contents of Declaration:

The above mentioned model does not contain six hazardous substances in RoHS compliance except EU-RoHS exception items.

<u>6 substance</u>	<u>Regulation</u>
Lead (Pb)	<1000ppm
Mercury (Hg)	<1000ppm
Hexavalent Chromium (Cr6+)	<1000ppm
Cadmium (Cd)	<100ppm
PBB	<1000ppm
PBDE	<1000ppm

**Adaura Technologies**

# Table of Contents

<b>Chapter 1 – General Information</b> .....	<b>5</b>
1.1 Introduction .....	5
1.2 Warranty .....	5
1.3 Calibration .....	5
<b>Chapter 2 – Installation &amp; Setup</b> .....	<b>6</b>
2.1 Requirements.....	6
2.2 Physical Setup .....	6
2.3 Driver Installation.....	6
2.4 Upgrading Firmware .....	9
2.5 Setting up the Device for Ethernet Connectivity .....	11
<b>Chapter 3 – Control &amp; Scripting</b> .....	<b>12</b>
3.1 Platforms (Windows/Linux/Mac OS) .....	12
3.2 Serial control over USB with a terminal program.....	13
3.3 Serial control over USB with a script.....	13
3.4 Serial control over USB with the provided desktop GUI application.....	13
3.5 Ethernet control via Telnet connection .....	13
3.6 Ethernet control via RESTful HTTP .....	14
3.7 Ethernet control via HTTP website interface.....	14
<b>Chapter 4 – Command Definitions</b> .....	<b>15</b>
4.1 Attenuation Commands.....	16
4.1.1 SET .....	16
4.1.2 SAA .....	17
4.1.4 RAND .....	19
4.1.5 RANDALL.....	20
4.1.6 DEFAULT_ATTEN.....	21
4.1.7 ATTEN_AUTOSAVE .....	22
4.2 Ethernet Commands .....	23
4.2.1 DHCP.....	23
4.2.2 IP.....	24
4.2.3 GW.....	25
4.2.4 NETMASK.....	26

4.2.5 ETH_SAVE .....	27
4.2.6 ETH_DEFAULT .....	28
<b>4.3 Miscellaneous Commands .....</b>	<b>29</b>
4.3.1 INFO .....	29
4.3.2 STATUS .....	30
4.3.3 HELP .....	31
4.3.4 RESET .....	32
4.3.5 FW_BOOTLOAD .....	33

## Chapter 1 – General Information

### 1.1 Introduction

**Adaura Technologies USB/Ethernet RF Attenuator R3 Series is AdauraTech’s latest** high-performance digitally programmable attenuators with frequency coverage to 6 GHz with USB and Ethernet interfaces.

Founded by RF and microwave professionals with over 50 years of design and product experience, Adaura Technologies introduces the R3 Series of RF digital programmable attenuators. Multiple independent channels are housed in a single compact enclosure. Each unit is powered and controlled via a single USB connection to a PC and offers Ethernet connectivity. A simple to use graphical user interface (GUI) provides easy manual fixed attenuations as well as ramping functions.

### 1.2 Warranty

Visit the Adaura Tech website for warranty information.

<https://adauratech.com/info/>

### 1.3 Calibration

AdauraTech programmable RF attenuators do not require calibration.

## Chapter 2 – Installation & Setup

### 2.1 Requirements

**Power:** To power an R3 series device, a USB port will be required. Please check datasheets for power requirements.

**Communication:** USB Type B and Ethernet RJ45

**Attenuator GUI Application:**

.NET Framework 4.0 or higher

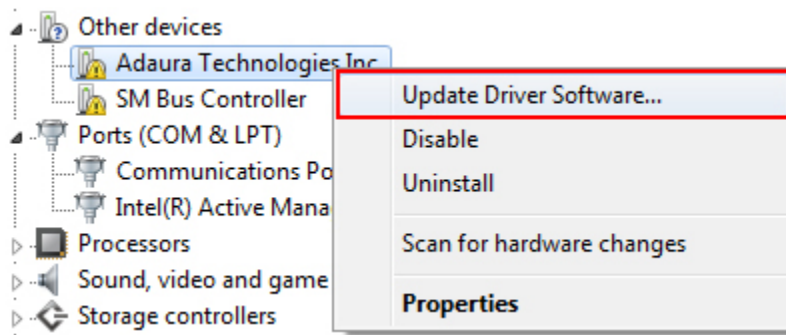
Windows 2000, XP, 7, and 8.

### 2.2 Physical Setup

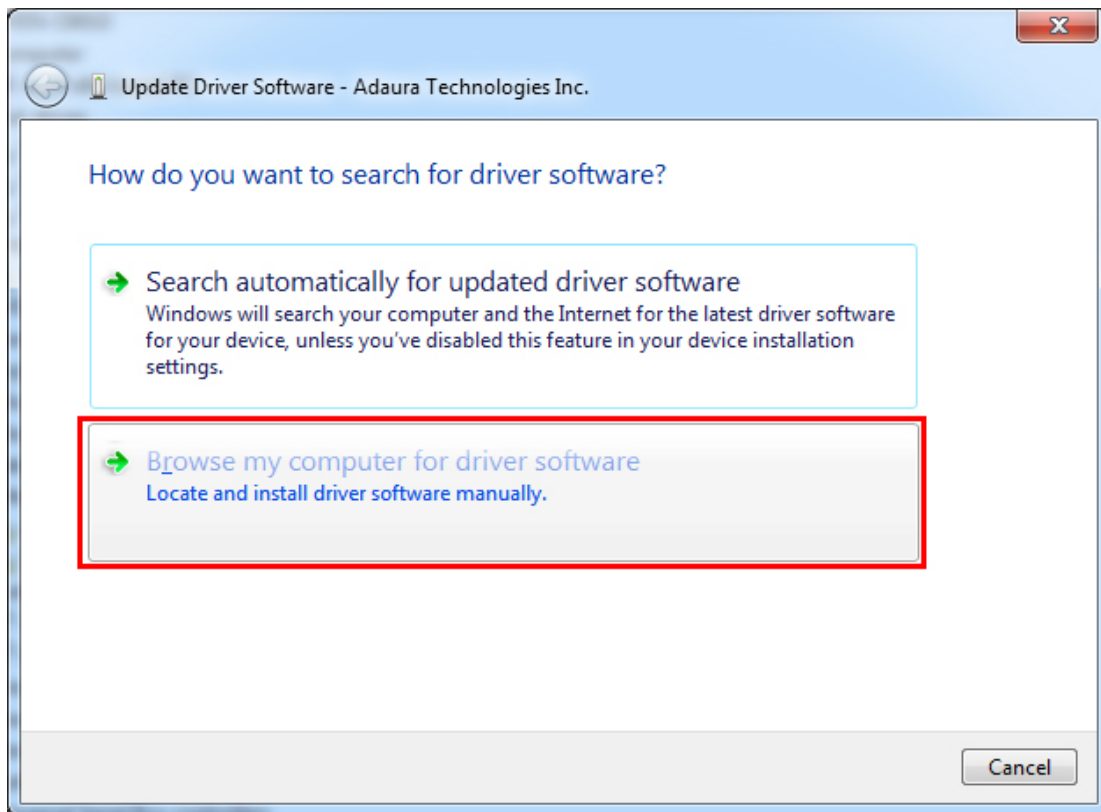
- When connecting RF cables, note that the RF channel ports are bidirectional.
- A USB connection is required to power the RF attenuator even when utilizing the Ethernet port to control the device.
- It is recommended to place terminators on all unused ports.

### 2.3 Driver Installation

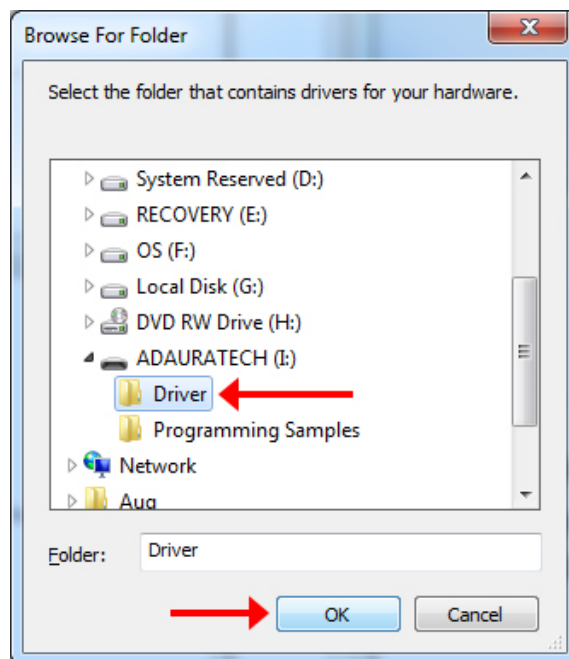
Due to the simple virtual serial connection, driver installation is quick and easy. Device drivers are location on the USB flash drive. When the device is connected to the test computer, Windows will search for the driver. Skip this process and choose to browse for the driver manually. Direct Windows to the driver location and have it search the directory for the appropriate drivers. Windows will locate and install the drivers automatically.



Open Windows Device Manager. Find the Adaura Technologies device listed under Other Devices. Right click on it and select “Update Driver Software”

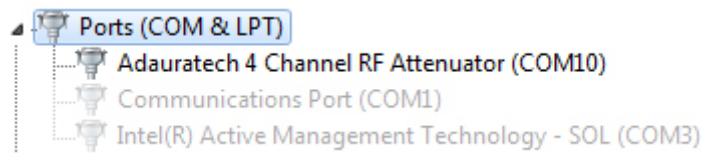
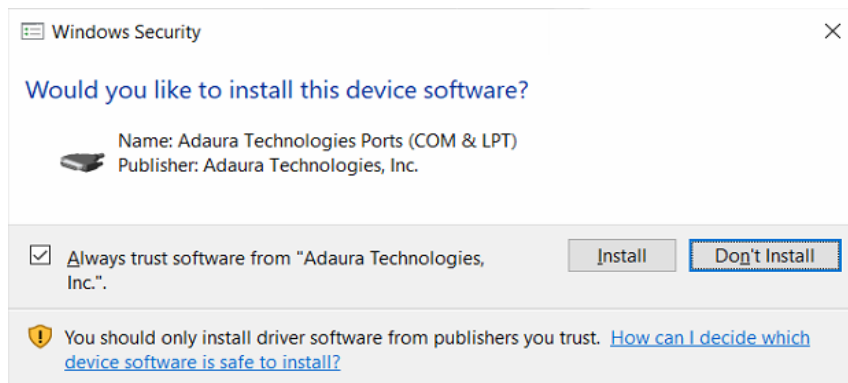
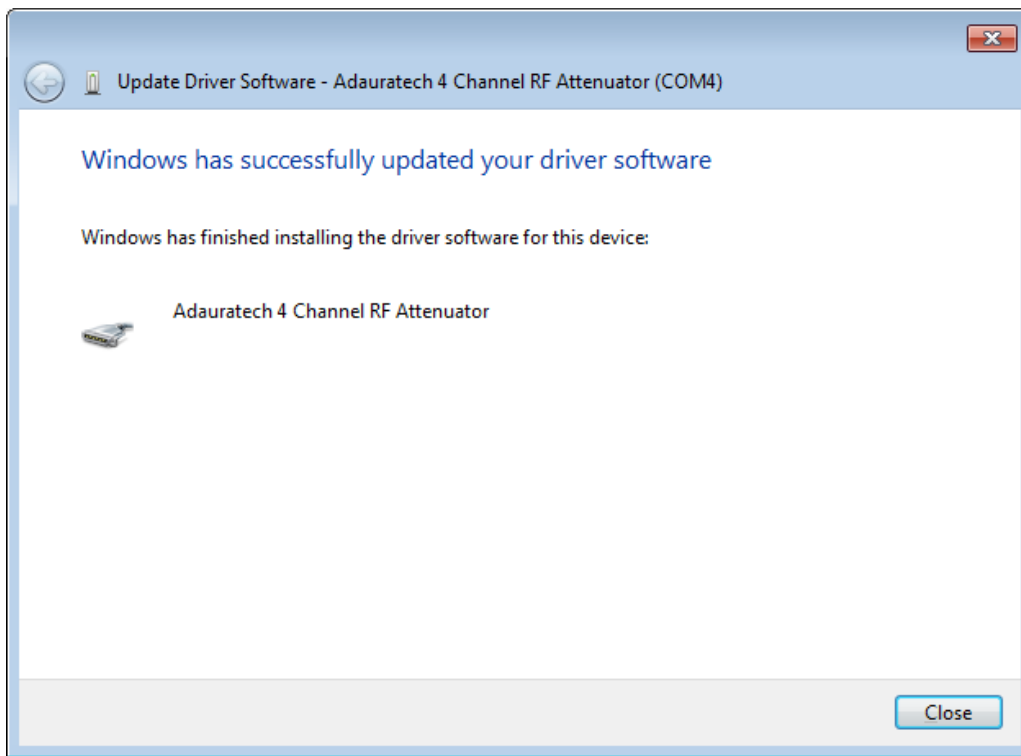


When prompted, choose to browse the computer for the correct driver.



Locate the Driver folder on the provided ADAURATECH USB flash drive. Select the folder and press OK

When Windows is able to verify Adaura Technologies as the publisher, continue to install the driver.



Once Windows has installed the driver, the AdauraTech RF Attenuator should now be listed as an installed driver in the Ports section of the Device Manager. Note the COM port # as this is what will be required to connect.



## 2.4 Upgrading Firmware

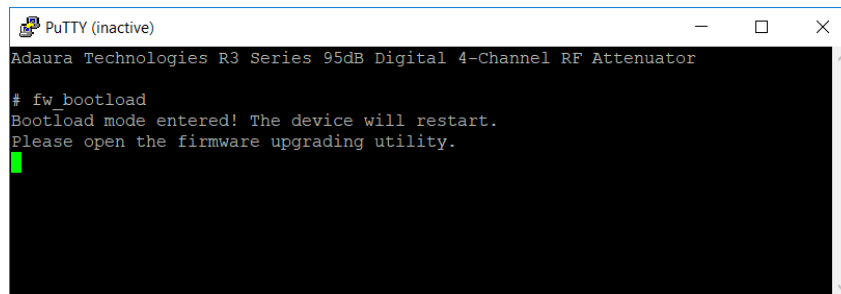
### Requirements:

1. Windows PC
2. AdauraTech's Bootloader Application
3. Firmware .hex file to load onto the device

### Step 1:

Open a terminal connection to the device and enter the “fw\_bootload” command.

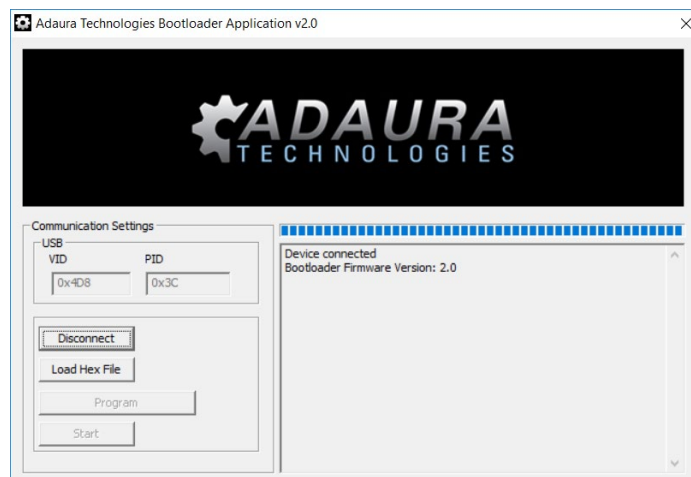
*Warning! Issuing the “fw\_bootload” command enters the device into bootloading state which cannot be reversed. A confirmation prompt will not appear. Please only use this command if you have the new .hex firmware file ready to load.*



```
PuTTY (inactive)
Adaura Technologies R3 Series 95dB Digital 4-Channel RF Attenuator
# fw_bootload
Bootload mode entered! The device will restart.
Please open the firmware upgrading utility.
```

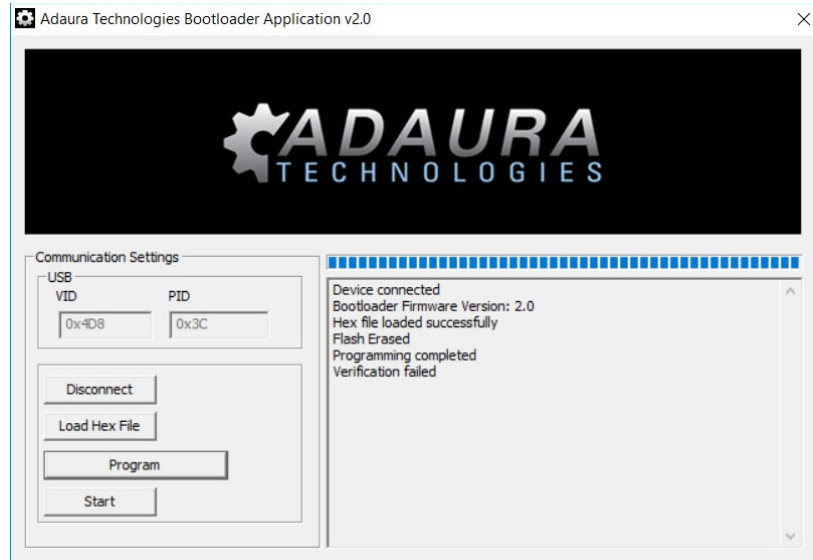
### Step 2:

Open the AdauraTech Bootloader Application and connect to the device.



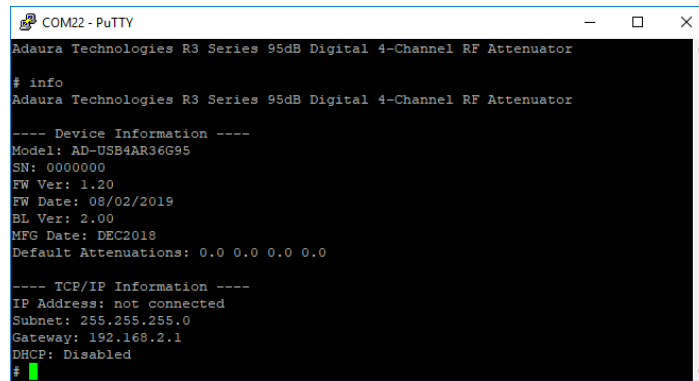
**Step 3:**

Load the .hex firmware file and Program the device.



Clicking the Start button will boot the device with its new firmware loaded.

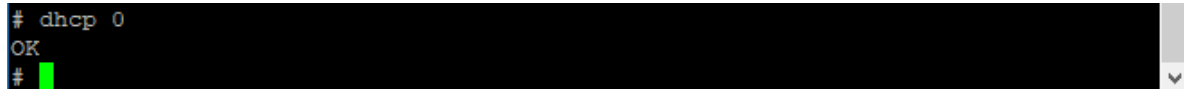
## 2.5 Setting up the Device for Ethernet Connectivity



```
COM22 - PuTTY
Adaura Technologies R3 Series 95dB Digital 4-Channel RF Attenuator
# info
Adaura Technologies R3 Series 95dB Digital 4-Channel RF Attenuator
---- Device Information ----
Model: AD-USB4AR36G95
SN: 0000000
FW Ver: 1.20
FW Date: 08/02/2019
BL Ver: 2.00
MFG Date: DEC2018
Default Attenuations: 0.0 0.0 0.0 0.0
---- TCP/IP Information ----
IP Address: not connected
Subnet: 255.255.255.0
Gateway: 192.168.2.1
DHCP: Disabled
#
```

How to setup via static IP:

1. Turn DHCP off with command “dhcp 0”



```
# dhcp 0
OK
#
```

2. Set a static IP address with “ip [desired ip]”



```
# ip 192.168.2.5
OK
#
```

3. Set your gateway address with “gw [desired gateway ip]”



```
# gw 192.168.2.1
OK
#
```

4. Set your subnet address with “netmask [desired subnet ip]”



```
# netmask 255.255.255.0
OK
#
```

5. Save your Ethernet configuration changes with “eth\_save”

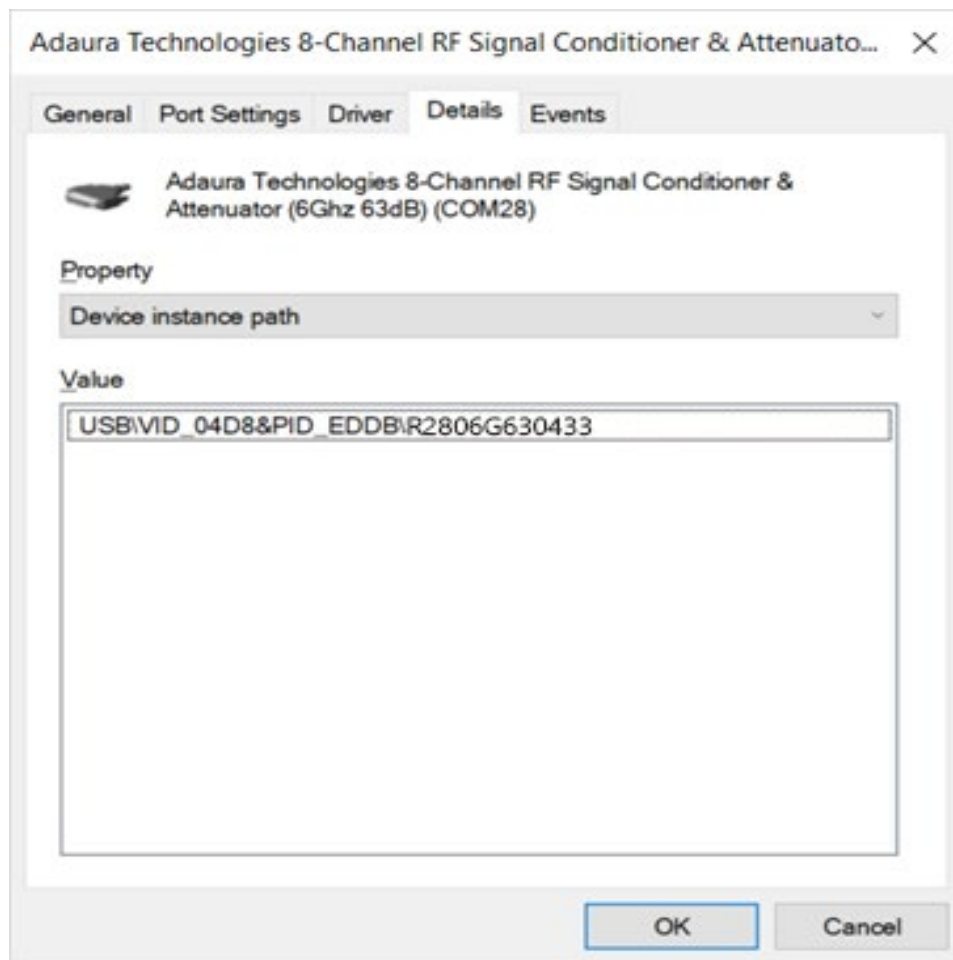
The device will automatically reboot with the newly configured changes.

## Chapter 3 – Control & Scripting

There are multiple methods of controlling an R3 series device.

- Serial control over USB with a terminal program such as PuTTY.
- Serial control over USB with a script such as Python.
- Serial control over USB with the provided desktop GUI application.
- Ethernet control via Telnet connection.
- Ethernet control via RESTful HTTP.
- Ethernet control via HTTP website interface.

The device can be automatically found by searching the USB descriptors for its serial number regardless of the assigned COM port number.



### 3.1 Platforms (Windows/Linux/Mac OS)

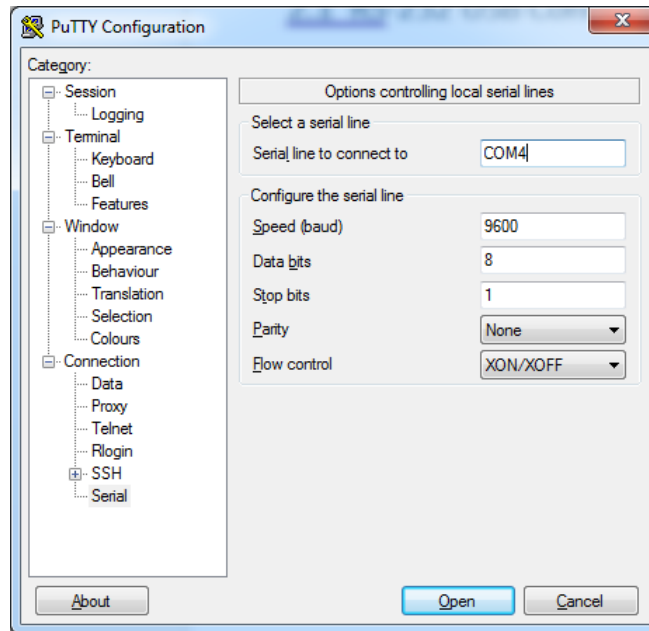
Windows OS requires a small driver installation for the device to be recognized. However, Linux and Mac OS does not. Instead, the unit will appear as a virtual serial device.

## 3.2 Serial control over USB with a terminal program

The AdauraTech R3 Series RF Attenuator utilizes software RS232 emulation over a USB connection. This connection type provides easy access via any terminal serial communication software such as PuTTY, HyperTerminal, or RealTerm.

As this device is emulating RS232 via its firmware, it is not required to specify baud rate, data bits, stop bits, parity, or flow control.

Example PuTTY configuration:



## 3.3 Serial control over USB with a script

Controlling the device via scripting languages such as Python is typical in most automated setups. See the example scripts located on the USB drive.

## 3.4 Serial control over USB with the provided desktop GUI application

Located on the USB drive is a desktop GUI for Windows and Linux systems. For windows, the executable does not need to be installed. This simple-to-use GUI allows for rapid deployment and executes the primary commands built into the device.

## 3.5 Ethernet control via Telnet connection

Examples of methods for opening a Telnet connection to the device

1. PuTTY
2. Command Line (Windows)
3. Terminal (Mac OS / Linux)

### 3.6 Ethernet control via RESTful HTTP

The format for controlling R3 series devices via HTTP is <http://ip/execute.php?COMMAND>

Variable **COMMAND** is a string that includes spaces.

**Example:** <http://192.168.1.10/execute.php?SET 1 95> **Result:** Sets Channel 1 to 95dB

### 3.7 Ethernet control via HTTP website interface

R3 series attenuators can be controlled by opening a web browser and directing to the device's URL.

**Example:** <http://192.168.1.10/>

*NOTE: This feature requires firmware version 1.2 or higher*

## Chapter 4 – Command Definitions

This section describes the various built-in commands that can be executed via software.

### 4.1 ATTENUATION COMMANDS

Section	Command	Description
4.1.1	SET	Sets designated chain's attenuation
4.1.2	SAA	Sets all chains to designated attenuation
4.1.3	RAMP	Ramps two (2) channels bidirectionally
4.1.4	RAND	Random attenuation
4.1.5	RANDALL	Random all channels
4.1.6	DEFAULT_ATTEN	Get/set default attenuation values
4.1.7	ATTEN_AUTOSAVE	Get/set default attenuation auto-save values

### 4.2 MISCELLANEOUS COMMANDS

Section	Command	Description
4.2.1	INFO	Displays the device's information
4.2.2	STATUS	Displays the current attenuation levels of all channels
4.2.3	HELP	Displays help information
4.2.4	RESET	Software reset of device
4.2.5	FW_BOOTLOAD	Enables bootload mode for device

### 4.3 ETHERNET COMMANDS

Section	Command	Description
4.3.1	DHCP	Get/set DHCP state
4.3.2	IP	Get/set IP address
4.3.3	GW	Get/set gateway address
4.3.4	NETMASK	Get/set subnet address
4.3.5	ETH_SAVE	Save new network settings
4.3.6	ETH_DEFAULT	Apply default network settings

## 4.1 Attenuation Commands

### 4.1.1 SET

**Command format:** SET [Ch] [Atten]

**Description:** Sets designated channel's attenuation level

#### Parameters

Parameter	Type	Description
[Ch]	Integer	Specific channel to change
[Atten]	Decimal	Attenuation amount

#### Example

Command Sent	Result
SET 1 95	Attenuation on channel 1 is changed to 95dB.

#### HTTP Equivalent

<http://192.168.1.10/execute.php?SET 1 95>



## 4.1.2 SAA

**Command Format:** SAA [Atten]  
or  
SAA [Atten Ch.1] [Atten Ch.2] ... [Atten Ch.N]

**Description:** Sets all attenuators to a designated attenuation level. Entering a single attenuation amount will set all channels to that amount. Meanwhile, specifying attenuation levels for each channel in a multi-channel device will set each channel to the specified amount.

### Parameters

Parameter	Type	Description
[Atten]	Decimal	Attenuation amount

### Examples

1.

Command Sent	Result
SAA 95	All channels set to 95dB

### HTTP Equivalent

<http://192.168.1.10/execute.php?SAA 95>

2.

Command Sent	Result
SAA 20 30 40 95	For a four (4) channel device, this command sets the attenuation levels of each channel to 20, 30, 40, and 95dB respectively.

### HTTP Equivalent

<http://192.168.1.10/execute.php? SAA 20 30 40 95>

### 4.1.3 RAMP

**Command Format:** RAMP [Ch. 1] ... [Ch. N] [Atten Start] [Atten Stop] [Step] [Dwell]

**Description:** Fades the attenuation levels across each channel.

#### Parameters

Parameter	Type	Description
[Ch. N]	Single Character "A" = Ascend "D" = Descend "E" = Exclude from ramp	Attenuation amount
[Atten Start]	Decimal	Low end of attenuation range
[Atten Stop]	Decimal	High end of attenuation range
[Step]	Decimal	Amount of attenuation per step
[Dwell]	Integer	Time per step in milliseconds (ms)

#### Examples

1.

Command Sent	Result
RAMP A A E D 0 63 4 50	See table below

Time (ms)	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800
Chain 1 (dB) (Ascending)	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Chain 2 (dB) (Ascending)	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Chain 3 (dB) (Excluded)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chain 4 (dB) (Descending)	63	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3

#### HTTP Equivalent

<http://192.168.1.10/execute.php?RAMP A A E D 0 63 4 50>

**\*Note** The terms used for "Ascending" and "Descending" refer to the absolute values of the attenuation levels. For example, "Descending" refers to the rate of decline from |-63|dB to |-0|dB where "Ascending" is the increase from |-0| to |-63|

#### 4.1.4 RAND

**Command Format:** RAND [Ch. N] [Atten Start] [Atten Stop]

**Description:** Changes a specified channel to a random attenuation level between two limits

##### Parameters

Parameter	Type	Description
[Ch. N]	Integer	Change to change
[Atten Start]	Decimal	Low end of attenuation range
[Atten Stop]	Decimal	High end of attenuation range

##### Example

Command Sent	Result
RAND 1 30 62	Changes channel 1 to a random attenuation level between 30dB and 62dB

##### HTTP Equivalent

<http://192.168.1.10/execute.php?RAND 1 30 62>

#### 4.1.5 RANDALL

**Command Format:** RANDALL [Atten Start] [Atten Stop] [Consistent?]

**Description:** Changes all channels to random attenuation levels between two limits

#### Parameters

Parameter	Type	Description
[Atten Start]	Decimal	Low end of attenuation range
[Atten End]	Decimal	High end of attenuation range
[Consistent?]	Integer	Specifies if all channels to be changed to the same random value or if each channel should have an individual random attenuation. [1 = YES, 0 = NO]

#### Examples

1.

Command Sent	Result
RANDALL 20 40 1	Changes all channels to a random attenuation value between 20 and 40 <i>Example:</i> Channel 1 changed to 26.75dB Channel 2 changed to 26.75dB Channel 3 changed to 26.75dB Channel 4 changed to 26.75dB

#### HTTP Equivalent

<http://192.168.1.10/execute.php?RANDALL 20 40 1>

2.

Command Sent	Result
RANDALL 20 40 0	Changes all channels to random attenuation values between 20 and 40 <i>Example:</i> Channel 1 changed to 22.25dB Channel 2 changed to 38.75dB Channel 3 changed to 31.25dB Channel 4 changed to 20.50dB

#### HTTP Equivalent

<http://192.168.1.10/execute.php?RANDALL 20 40 0>

## 4.1.6 DEFAULT\_ATTEN

**Command Format:** DEFAULT\_ATTEN [Atten]  
or  
DEFAULT\_ATTEN [Atten Ch.1] ... [Atten Ch.N]

**Description:** Changes the default attenuation level upon powering up. Entering the command with no parameters will return the current setting.

### Parameters

Parameter	Type	Description
[Atten Ch.N]	Decimal	Attenuation level to set as default for each or all channels

### Examples

1.

Command Sent	Result
DEFAULT_ATTEN 95	Changes default power up attenuation for channels to 95dB

### HTTP Equivalent

<http://192.168.1.10/execute.php?RANDALL 20 40 1>

2.

Command Sent	Result
DEFAULT_ATTEN 95 0 50 95	Changes default power up attenuation for channels <i>Example:</i> <i>Default attenuation for channel 1 changed to 95</i> <i>Default attenuation for channel 1 changed to 0</i> <i>Default attenuation for channel 1 changed to 50</i> <i>Default attenuation for channel 1 changed to 95</i>

### HTTP Equivalent

<http://192.168.1.10/execute.php?RANDALL 20 40 0>

#### 4.1.7 ATTEN\_AUTOSAVE

**Command Format:** ATTEN\_AUTOSAVE [1/0]

**Description:** This setting determines if the default power up attenuation value should be updated after every change in attenuation.

#### Parameters

Parameter	Type	Description
[1/0]	Integer	Enable or disable

#### Examples

1.

Command Sent	Result
ATTEN_AUTOSAVE 1	Enables the autosave feature so that the default power up attenuation level is updated after every change in attenuation

#### HTTP Equivalent

[http://192.168.1.10/execute.php?ATTEN\\_AUTOSAVE 1](http://192.168.1.10/execute.php?ATTEN_AUTOSAVE 1)

## 4.2 Ethernet Commands

### 4.2.1 DHCP

**Command Format:** DHCP  
or  
DHCP [1/0]

**Description:** Returns the current state of DHCP or sets a new state

*Note: Any changes made to Ethernet settings must be saved to the device prior to utilization*

#### Parameters

Parameter	Type	Description
[1/0]	Integer	Enable or disable DHCP 1 = Enable 0 = Disable

#### Examples

1.

Command Sent	Result
DHCP 1	Enables DHCP

#### HTTP Equivalent

<http://192.168.1.10/execute.php?DHCP 1>

## 4.2.2 IP

**Command Format:** IP  
or  
IP [ip]

**Description:** Returns the IP address or sets a new one

*Note: Any changes made to Ethernet settings must be saved to the device prior to utilization*

### Parameters

Parameter	Type	Description
[ip]	IP Address	Enter a desire static IP address. DHCP must be disabled to set a new static IP address.

### Examples

1.

Command Sent	Result
IP	Returns the current IP address for the Ethernet port

### HTTP Equivalent

<http://192.168.1.10/execute.php?DHCP 1>

2.

Command Sent	Result
IP 192.168.1.100	Sets the IP address to 192.168.1.100

### HTTP Equivalent

<http://192.168.1.10/execute.php?IP 192.168.1.100>



### 4.2.3 GW

**Command Format:** GW  
or  
GW [ip]

**Description:** Returns the gateway address or sets a new one

*Note: Any changes made to Ethernet settings must be saved to the device prior to utilization*

#### Parameters

Parameter	Type	Description
[ip]	IP Address	Enter a desire gateway IP address.

#### Examples

1.

Command Sent	Result
GW	Returns the current gateway IP address

#### HTTP Equivalent

<http://192.168.1.10/execute.php?GW>

2.

Command Sent	Result
GW 192.168.1.100	Sets the gateway IP address to 192.168.1.100

#### HTTP Equivalent

<http://192.168.1.10/execute.php?GW 192.168.1.100>

## 4.2.4 NETMASK

**Command Format:** NETMASK  
or  
NETMASK [ip]

**Description:** Returns the subnet IP address or sets a new one

*Note: Any changes made to Ethernet settings must be saved to the device prior to utilization*

### Parameters

Parameter	Type	Description
[ip]	IP Address	Enter a desire static IP address for the new subnet. DHCP must be disabled to set a new static IP address.

### Examples

1.

Command Sent	Result
NETMASK	Returns the current subnet IP address

#### HTTP Equivalent

<http://192.168.1.10/execute.php?NETMASK>

2.

Command Sent	Result
NETMASK 255.255.255.0	Sets the new subnet address to 255.255.255.0

#### HTTP Equivalent

<http://192.168.1.10/execute.php?NETMASK 255.255.255.0>

## 4.2.5 ETH\_SAVE

**Command Format:** ETH\_SAVE

**Description:** Saves any changes made to the Ethernet settings

*Note: Any changes made to Ethernet settings must be saved to the device prior to utilization*

### Parameters

Parameter	Type	Description
None	None	None

### Examples

1.

Command Sent	Result
ETH_SAVE	Saves changes made to the Ethernet settings

### HTTP Equivalent

[http://192.168.1.10/execute.php?ETH\\_SAVE](http://192.168.1.10/execute.php?ETH_SAVE)

## 4.2.6 ETH\_DEFAULT

**Command Format:** ETH\_DEFAULT

**Description:** Returns all Ethernet settings to factory defaults

*Note: Any changes made to Ethernet settings must be saved to the device prior to utilization*

### Parameters

Parameter	Type	Description
None	None	None

### Examples

1.

Command Sent	Result
ETH_DEFAULT	Returns all Ethernet settings to factory defaults

### HTTP Equivalent

[http://192.168.1.10/execute.php?ETH\\_DEFAULT](http://192.168.1.10/execute.php?ETH_DEFAULT)

## 4.3 Miscellaneous Commands

### 4.3.1 INFO

**Command Format:** INFO

**Description:** Displays the device's information

#### Parameters

Parameter	Type	Description
<i>None</i>	<i>None</i>	<i>None</i>

#### Examples

1.

Command Sent	Result
INFO	---- Device Information ---- Model: AD-USB4AR3 SN: R3460950000 FW Ver: 1.00 FW Date: 13/12/2018 BL Ver: 1.00 MFG Date: NOV2018 Default Attenuations: 95.0 95.0 95.0 95.0  ---- TCP/IP Information ---- IP Address: not connected Subnet: 255.255.255.0 Gateway: 192.168.0.1 DHCP: Enabled

#### HTTP Equivalent

<http://192.168.1.10/execute.php?INFO>

## 4.3.2 STATUS

**Command Format:** STATUS

**Description:** Displays the current attenuation levels for each channel

### Parameters

Parameter	Type	Description
None	None	None

### Examples

1.

Command Sent	Result
STATUS	Displays the current attenuation levels for each channel  <i>Example output:</i> <i>Channel 1: 95.0</i> <i>Channel 2: 14.0</i> <i>Channel 3: 35.0</i> <i>Channel 4: 0.0</i>

### HTTP Equivalent

<http://192.168.1.10/execute.php?STATUS>

### 4.3.3 HELP

**Command Format:**    HELP

**Description:** Displays help information

#### Parameters

Parameter	Type	Description
<i>None</i>	<i>None</i>	<i>None</i>

#### Examples

1.

Command Sent	Result
HELP	

#### HTTP Equivalent

<http://192.168.1.10/execute.php?HELP>

#### 4.3.4 RESET

**Command Format:**     RESET

**Description:** Software reset of the device

#### Parameters

Parameter	Type	Description
<i>None</i>	<i>None</i>	<i>None</i>

#### Examples

1.

Command Sent	Result
RESET	Resets the software. All current connections will be lost and need to be reestablished.

#### HTTP Equivalent

<http://192.168.1.10/execute.php?RESET>



### 4.3.5 FW\_BOOTLOAD

**Command Format:** FW\_BOOTLOAD

**Description:** Sets the device's firmware into bootload mode. This can be used to upgrade or downgrade firmware versions.

*WARNING: Once this command is sent, it cannot be reversed and new firmware will need to be loaded onto the device using the provided Bootloader application.*

#### Parameters

Parameter	Type	Description
None	None	None

#### Examples

1.

Command Sent	Result
FW_BOOTLOAD	Sets the device's firmware into bootload mode

#### HTTP Equivalent

[http://192.168.1.10/execute.php?FW\\_BOOTLOAD](http://192.168.1.10/execute.php?FW_BOOTLOAD)

