CasaTunes®
music by the roomful

A/V Receiver integration
Seamlessly integrating stand alone A/V Receivers into a whole house
CasaTunes-based music solution

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Introduction

CasaTunes provides installers and integrators with many different options for controlling CasaTunes using a 3rd party application, typically a 3rd party home automation control system. These options, listed in order of complexity and programming skill required to use these, include:

1. Command Line interface
2. Serial (RS-232) API (including IP support)
3. SOAP based web services

While these solutions are ideal for integrating CasaTunes with whole house automation systems, there is another increasingly common issue facing installers, which are not easily solved by these tools. How do you seamlessly integrate A/V Receivers into a whole house audio solution?

In this Tech Note, we will show you how CasaTunes tackles this problem, and the steps required to implement such a solution. As an example, we will "seamlessly" integrate a networked Denon A/V Receiver located in the Living Room into a CasaTunes-based whole house music solution. This "seamless" integration allows the user to use any of the various CasaTunes GUIs available on Android, iOS and other browser based devices, to control not only the music that is being played in the Living Room, but also controlling the A/V Receiver. From a users perspective there is no difference controlling the Living Room and any other room in the home.

This CasaTunes-based solution is music system agnostic, and works equally well with whole house music systems from CasaTunes, ChannelVision, Nuvo and Russound.

While this example illustrates how to integrate a networked Denon A/V Receiver, CasaTunes also provides built-in support for A/V Receivers from Integra/Onkyo, Marantz and Pioneer. In addition, CasaTools and installers can easily expand the solution to support additional devices through the creation of XML control modules (text files).

Integrating a 3rd party A/V Receiver

Most A/V receivers are capable of being controlled either via IR, serial (RS-232), TCP/IP, or any combination of all of these. In CasaTunes v2.9 or later, we provide support for controlling serial and IP based A/V Receivers. If the A/V Receiver only supports IR control, then you can use CasaTunes in combination with Bitwise Controls to provide the same capabilities.

Connections

To integrate the Denon A/V Receiver, you will need to connect the pre-amplified output of the Living Room zone from your multi-room music system to the CD input on your A/V Receiver. Although we have used the CD input in this example, you may customize the control module to use a different input source.

If you are using the serial or RS-232 capability to control the A/V Receiver, you will need to connect a serial cable from the CasaTunes music server to the serial port on the A/V Receiver. When making this connection you should make a note of the PC Serial Port or COM Port you are using to communicate with A/V Receiver. You will need this information during CasaTunes Setup.

In this example, since we are communicating with the A/V Receiver via IP, you need to make sure the receiver is connected to the network, and you should note the IP address the device is using. Ideally, this IP Address should either be configured as a Static IP Address, or you should configure the DHCP server to reserve an IP Address, and have the DHCP server assign this IP Address to the A/V Receiver based on its MAC address. It is critical to make sure the IP Address assigned to the A/V Receiver does not change over time. In addition, check the manual for you're A/V Receiver and make sure it is configured to accept commands via the network (and can accept commands when in sleep mode).

In this example, we will assume the IP Address assigned to the Denon A/V Receiver is 192.168.1.20

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CasaTunes Setup

After you have completed making the physical connections between your A/V Receiver and your CasaTunes-based music server you must configure CasaTunes.

1. Start CasaTunes Setup by double clicking on the CasaTunes Setup icon on your desktop
2. Select the Zones setup tab
3. Select the Living Room zone
4. Click on the Advanced Settings button

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5. Check "Enabled Fixed Volume Output for Zone" and adjust the fixed volume level to match the volume levels of the other sources on your A/V Receiver. When this option is enabled, CasaTunes will always output its music to your A/V Receiver at this fixed volume level. Now, when you change the volume in, CasaTunes will issue volume up and down commands to your A/V Receiver to adjust the volume.
6. Select the "CasaTunes 3rd Party Device Control" tab
7. Check "Enable CasaTunes 3rd Party Device Control"

8. Select the device to control. In this case, select the "Generic Networked Denon Receiver" module which is used to communicate with a Denon A/V Receiver over IP.
9. Select "Ethernet" protocol. The currently configured IP Address and Port values will be displayed.
10. Configure the IP Address for the Denon A/V Receiver (in this case, 192.168.1.20)
11. Configure the Port. It should already be configured to communicate over TCP/IP Port number 23 (which is the Telnet port number).
12. Save your changes.
13. Click the Summary tab and click Finish

Operation

To test your setup, grab your CasaTunes control device (Android, iOS or browser based device) and switch to the Living Room. Click the power button and you should see the A/V Receiver switch on, and the input source switch to the CD input.

You will also notice the volume controls for the room have changed to include Volume Up, Down and Mute buttons. Pressing these should adjust the volume in the room.

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Advanced Options

In the previous example we illustrated just how easy it is to integrate an A/V Receiver when you use the built-in control modules as-is, and connect your A/V Receiver to match the control module setup. In our example, we used the Generic Networked Denon Receiver control module and connected the output from our pre-amp zone to the CD input on the A/V Receiver.

In this section we will show you how you can modify and create your own control modules.

How it works

Before we describe how to create your own control modules it is important for you to understand what is happening under the hood.

When the CasaTunes Windows service starts, it checks the folder, C:\Program Files\CasaTools\CasaTunes2\Modules\Control to discover the list of control modules available. A control module is a small simple XML file that describes the "protocol" to use to communicate with a device (in our previous example, the Denon A/V Receiver), and which commands to send to a device in response to a CasaTunes "event".

During the installation process, CasaTunes creates a template folder, where it installs all the original control modules. Control Modules are provided for Denon, Onkyo/Integra, Marantz and Pioneer A/V Receivers. During install, CasaTunes will copy all the original control module files into the main Modules\Control folder so they are selectable in CasaTunes Setup.

You must use a separate control module file for the device associated with each zone. So, even if you were using two or more Denon A/V Receivers, you would have two or more different control module files. When using multiple control modules for the same type of A/V Receiver you should copy the original file from the template folder into the main folder and assign each control module file a different name. For example, you could customize the control module filename to be associated with the zone or room, such as, denon-ip-mbr.xml, denon-ip-living.xml, denon-ip-mediaroom, etc.

In addition, you should edit the control module file and change the "Name" attribute for the <Module></Module> element, since this name is used by the "Select Device To Control" option in CasaTunes Setup.

Control Module XML Format

Below are examples of typical control module files. The first is the control module for a generic IP-controlled Denon A/V Receiver, and the second is the control module for a generic Serial-controlled Denon controlled A/V Receiver:

Denon-ip.xml file

```xml
<?xml version="1.0" encoding="utf-8"?>
<Module Name="Generic Networked Denon Receiver - Uses IP Control">
  <Protocols>
    <Protocol Name="Ethernet" Type="IP" IPAddress="192.168.1.20" Port="23"
/>
  </Protocols>
  <Events>
    <Event Name="PowerOn">
      <Command Name="Power On" ProtocolName="Ethernet" DataType="ASCII"
PostCommandDelay="1000" TerminateDataWith="CR">
        <Data>PWON</Data>
      </Command>
      <Command Name="Select CD Input" ProtocolName="Ethernet"
DataType="ASCII" TerminateDataWith="CR">
        <Data>SICD</Data>
      </Command>
    </Event>
    <Event Name="PowerOff">
      <Command Name="Power Off" ProtocolName="Ethernet" DataType="ASCII"
TerminateDataWith="CR">
        <Data>PWSTANDBY</Data>
      </Command>
    </Event>
    <Event Name="VolumeUp">
      <Command Name="Volume Up" ProtocolName="Ethernet" DataType="ASCII"
TerminateDataWith="CR">
        <Data>MVUP</Data>
      </Command>
    </Event>
    <Event Name="VolumeDown">
      <Command Name="Volume Down" ProtocolName="Ethernet" DataType="ASCII"
TerminateDataWith="CR">
        <Data>MVDOWN</Data>
      </Command>
    </Event>
  </Events>
</Module>
```

Denon-serial.xml file

```xml
<?xml version="1.0" encoding="utf-8"?>
<Module Name="Generic RS-232 Denon Receiver - Uses Serial (RS232) Control">
  <Protocols>
    <Protocol Name="Serial" Type="Serial" COMMPort="10" Baud="9600"
DataBits="8" StopBits="One" Parity="None" Handshake="None" />
  </Protocols>
  <Events>
    <Event Name="PowerOn">
```

```xml
        <Command Name="Power On" ProtocolName="Serial" DataType="ASCII"
PostCommandDelay="1000" TerminateDataWith="CR">
          <Data>PWON</Data>
      </Command>
      <Command Name="Select CD Input" ProtocolName="Serial" DataType="ASCII"
TerminateDataWith="CR">
          <Data>SICD</Data>
      </Command>
    </Event>
    <Event Name="PowerOff">
      <Command Name="Power Off" ProtocolName="Serial" DataType="ASCII"
TerminateDataWith="CR">
          <Data>PWSTANDBY</Data>
      </Command>
    </Event>
    <Event Name="VolumeUp">
      <Command Name="Volume Up" ProtocolName="Serial" DataType="ASCII"
TerminateDataWith="CR">
          <Data>MVUP</Data>
      </Command>
    </Event>
    <Event Name="VolumeDown">
      <Command Name="Volume Down" ProtocolName="Serial" DataType="ASCII"
TerminateDataWith="CR">
          <Data>MVDOWN</Data>
      </Command>
    </Event>
  </Events>
</Module>
```

To create your own control modules, you should copy an existing control module from the Templates folder and rename it, then make changes to it.

Protocols

CasaTunes supports communicating with devices using several different types of "protocols", including:

1. Serial (RS-232)
2. IP
3. HTTP (Get)

When you define a protocol you give it a name as well as configure various properties required by the protocol. For example, for the serial protocol, you can specify the baud rate, number of start, data, and stop bits, parity, handshake, etc.

The number of <Protocol></Protocol> elements you can define are unlimited. This means that an event can execute multiple commands each controlling a different device (and even using a different communication protocol). The table below describes the different attributes for each supported Protocol Type (IP, Serial and HTTP Get)

Protocol	Attribute	Values	Default

Type			
IP	IPAddress		
	Port		
Serial	COMMPort		1
	Baud		19200
	DataBits		8
	StopBits	None, One, OnePointFive, Two	One
	Parity	None, Even, Odd, Space, Mark	None
	Handshake	None, RequestToSend, RequestToSendXOnXOff, XOn,XOff	None
HTTP Get	BaseURL		

Events

You can configure which CasaTunes events you want to handle and what commands to execute in response to these events.

CasaTunes generates the following events:
- PowerOn – Generated when the zone is turned on
- PowerOff – Generated when the zone is turned off
- VolumeUp – Generated when the volume for a zone is incremented
- VolumeDown – Generated when the volume for a zone is decremented
- MuteOn – Generated when the zone is muted
- MuteOff – Generated when the zone is unmuted
- VolumeChanged – Generated when the volume for a zone is changed
- SourceChanged – Generated when the source for a zone is changed

In the control module file you specify which events to handle. You only need to handle the events you are interested in. For each event of interest, you define one or more commands to be executed in response to the event. For example, the generic control module for the Denon A/V Receiver we used in the initial example, defines two commands for the PowerOn event. The first command is used to power on the A/V Receiver, and the second command will switch the A/V Receiver input to the CD Input source.

For each command you specify a name, the name of the protocol to use to issue the command, and optionally whether to wait before or after issuing the command. This delay is specified in milliseconds. You also specify whether the command data is formatted as ASCII or Hexadecimal bytes, and if ASCII, whether the ASCII command should be terminated with a Carriage Return (CR), Line Feed (LF) or a combination of CR+LF characters.

The data for the command itself is wrapped in it's own <Data></Data> element. As mentioned previously, the command data can be formatted as an ASCII string or as Hex Bytes. Here are a couple examples of the same string "Hello" formatted in ASCII and Hex Bytes.

ASCII: <Data>Hello</Data>

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HEX: <Data>48,65,69,69,6f<Data>

You should use the ASCII format whenever possible. Use the HEX format when the command data cannot be represented using the ASCII character set.

Sometimes you need to inject, at execution time, the Zone ID, Source ID or Volume level in to your command. This is often the case when handling the VolumeChanged and SourceChanged events. For example, you may need to know the Source ID to switch to when synchronizing a Video Switch on a SourceChanged event. In this case you can specify a special character sequence in your ASCII or HEX data, which will be substituted with the value of the Zone ID, Source ID or Volume level when the command is executed. The special character sequence is as follows:

%Zone%   Substitutes the string for the Zone ID

%Zone:2%   Substitutes the string for the Zone ID and includes 2 digits. If the Zone ID is less than 10, it inserts a 0, for example, if Zone ID = 6, then it would substitute "%Zone:2%" with "06".

%Zone:X%   Substitutes the string for the Zone ID in hexadecimal format

%Zone:X2%   Substitutes the string for the Zone ID and includes 2 digits in hexdecimal format. If the Zone ID is less than 16, it inserts a 0, for example, if Zone ID = 13, then it would substitute "%Zone:2%" with "0D".

Similar options are available for %Source% and %Volume%.

The following attributes are defined for each <Command></Command> Element.

Attribute	Values	Comments
Name		
ProtocolName		Must match the "Name" attribute of a <Protocol> element
DataType	ASCII HEX UrlEncoded	UrlEncoded is used with REST commands
PreCommandDelay		Value specified in milliseconds
PostCommandDelay		Value specified in milliseconds
TerminateDataWith	None CR LF CRLF	Used to append a Carriage Return, Line Feed or both to an ASCII string