HOMEWORKS.QS

Integration with Ethernet and RS-232 Devices

Revision D

Overview

HomeWorks QS is a system capable of integrating with other equipment in many ways. In most instances this integration can be accomplished using TCP/IP and an Ethernet network, however, it is sometimes necessary to integrate with legacy devices utilizing RS-232 serial connections. HomeWorks QS does not include an on-board RS-232 port, but a simple inexpensive device can be added that will convert Ethernet to RS-232 to accomplish this integration. This application note describes how to set up and configure integration with the HomeWorks QS system using both Ethernet and RS-232. There are four integration scenarios that will be described in this document.

Scenario 1: Integration with Ethernet Connected Devices Using the Lutron Integration Protocol

Overview:

In this scenario, integration between HWQS and 3rd-party devices is accomplished using an Ethernet connection and the Lutron Integration Protocol, which is well documented and freely available. This is the most common type of integration with a HWQS system. Many 3rd-party systems and devices have fully functional two-way integration drivers for HWQS that utilize the Lutron Integration Protocol and allow for simplified bi-directional integration. The 3rd-party device must open and maintain a Telnet session with the HWQS system.

Equipment Required:

All versions of HWQS software can be used in this scenario. No additional equipment is required when integrating with Ethernet connected devices using the Lutron Integration Protocol.

Set Up Steps:

1. Configure integration IDs and Telnet logins in the HWQS software. This is accomplished by clicking on "configure integration" in the Tools drop-down menu.
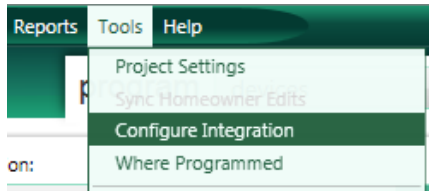

    A separate Telnet login must be created for each device. If the homeowner prefers to have the ability to edit some aspects of their system programming through the Lutron Home Control+ mobile app, make sure that the "Allow Homeowner Editing" box is checked. Click on "Add Telnet Login" in the lower left corner of the "Configure Integration" window to add another telnet login.
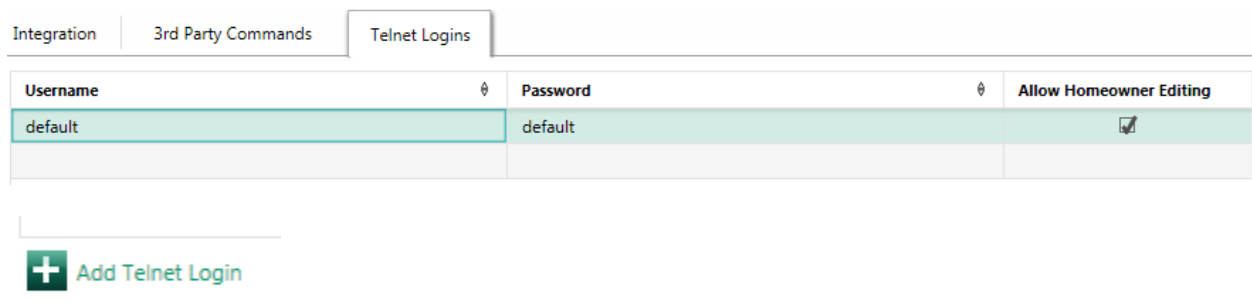
    Be sure to enable integration IDs for all the devices, shades, areas, zones, timeclocks, and HVAC controls that you desire to integrate with. Everything should be checked by default. If any of these are not checked, they will not be available through integration. These settings are also used by the Lutron Home Control+ mobile apps, so do not uncheck anything you would like to access from these apps.
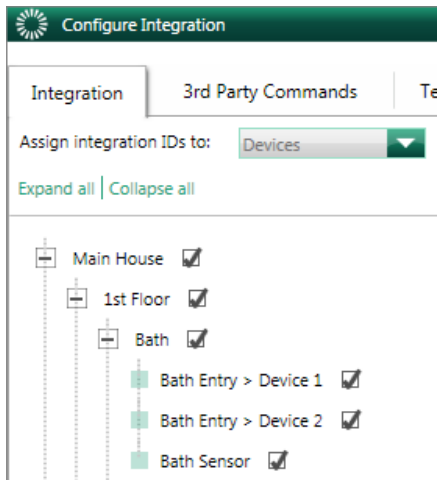
2. Configure the Ethernet connected devices to establish a Telnet session with the HWQS processor. This is done using the 3rd-party device or associated software. Consult that product's documentation for details.

3. Configure the 3rd-party devices and systems to utilize the Lutron Integration Protocol with the appropriate integration IDs. Many 3rd-party devices have drivers for Lutron systems and devices that will allow easy integration between the two. In other cases, you may be required to configure the 3rd-party device to send the appropriate command. Consult the Lutron Integration Protocol, available within the HWQS software for details. The Integration ID is listed beside each device you have enabled for integration or can be found in the Integration Report, available in the Report Center.
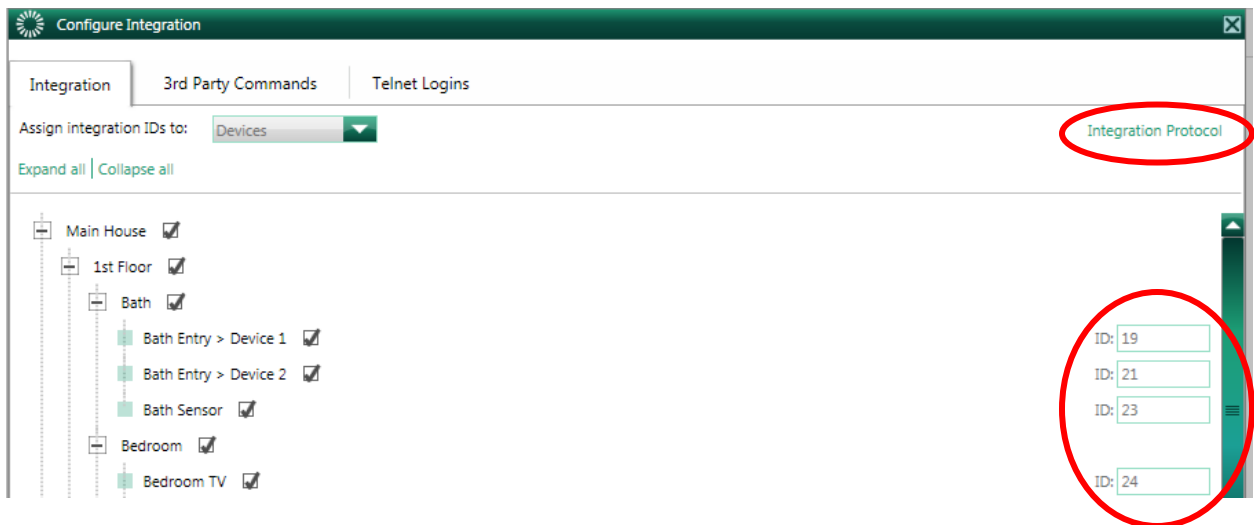
4. Connect all devices to the same Ethernet network and subnet (refer to the HWQS Networking Guide for details). The devices must be able to communicate over the Ethernet network for the integration to function properly.

Scenario 2: Integration with Ethernet Connected Devices Using Custom Integration Commands

Overview:

In this scenario, integration between HWQS and 3rd-party devices is accomplished using an Ethernet connection and the 3rd-party device's communication commands. Common examples include spa/pool controllers, A/V components, and thermostats. The HWQS system will open and maintain the Telnet session or TCP connection with the 3rd-party device. Communication between the 3rd party system and the HWQS system is bi-directional. A driver must be created within the HWQS software to allow the HWQS system to be able to send and receive the 3rd party commands.

Equipment Required:

HWQS software version 2.0 or later must be used in this scenario. Prior to the 6.x version of the software, only commands sent to the 3rd party device were supported. Bi-directional communication support is available in software versions 6.x and newer. No additional equipment is required when integrating with Ethernet connected devices using custom integration commands.

Set Up Steps:

1. Add a "Control 3rd Party" device to your project on the "design" tab under the "define equipment" task. A "Control 3rd Party" device must be added for each device you intend to integrate with using custom integration commands. If the device is not shown in your toolbox, you may need to edit your toolbox to add the device.
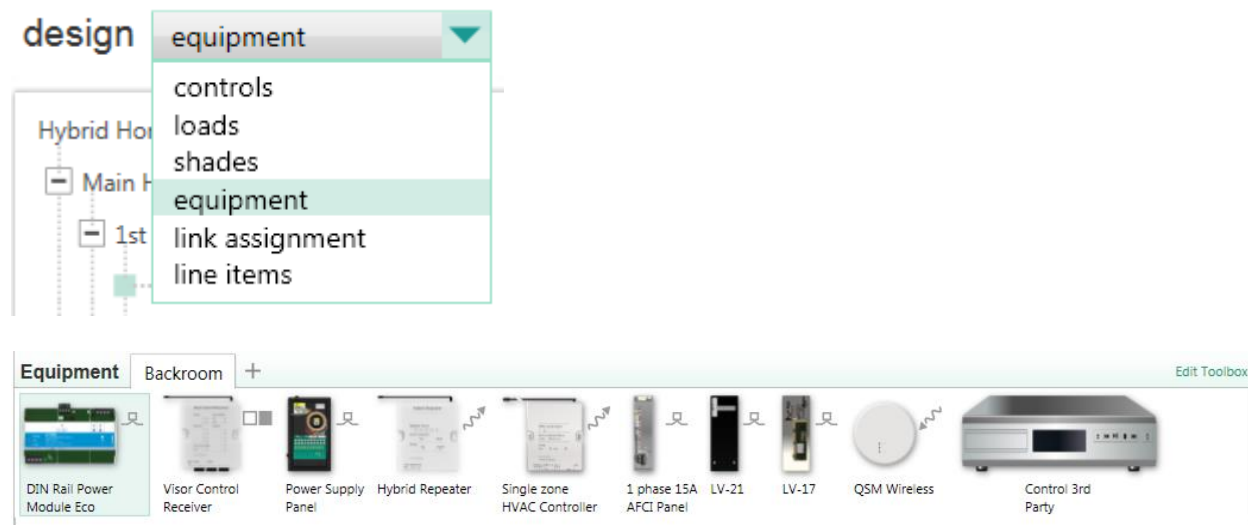

2. The Ethernet integration can be accomplished in one of two ways: using Telnet (the HWQS system will open and maintain a Telnet session with the 3rd-party device) or by sending raw TCP data to a specified port on the 3rd-party device.

    If using Telnet, the IP address of the 3rd-party device, Telnet port (default is 23), and the Telnet username and password must be entered. These settings must match the 3rd-party device.
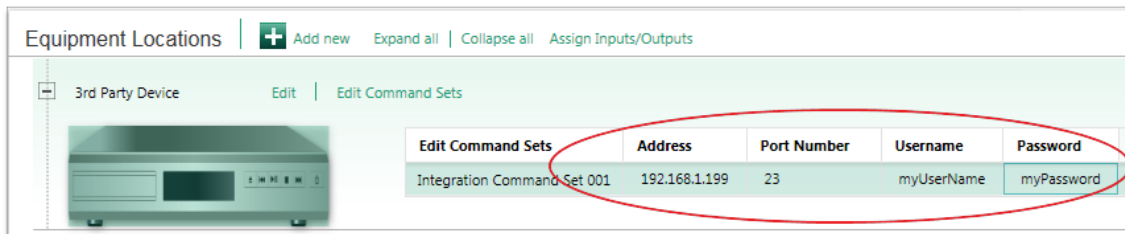
If sending raw TCP data, the username and password fields must be left blank, however, the IP address of the 3rd-party device must be entered in the address field and the TCP port to send the data to must be entered in the Port field.
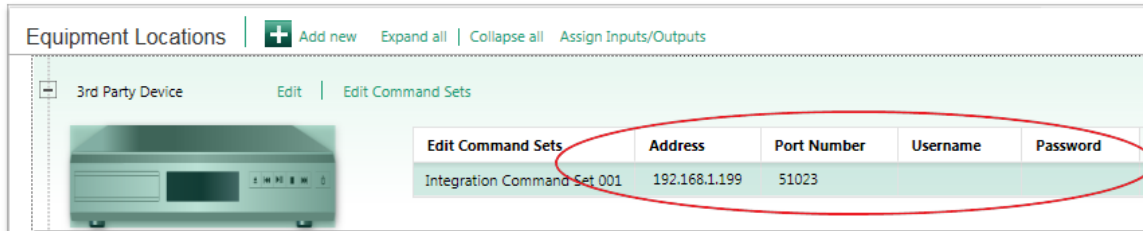

3.   "Edit Command Sets" to create a custom command set for the 3rd-party device. This screen can be opened by clicking the "Edit Command Sets" link in the "Equipment Locations" box, or by going to the "Tools" menu and choosing "Configure Integration". Once in this window, you can "Add Command Sets" and "Add Commands" to existing command sets. The data can be entered in ASCII text or Hex values. You also have the option of appending an RS-232 terminator to each command, if required by the 3rd-party device. Telnet typically requires <CR> <LF> terminators, but this can vary based on the device used.

Commands are assigned a Nickname to identify the command when programming. In versions 6.0 and later, communication direction indicates whether the command is To, From, or both To and From. The actual command is then typed into the Command field.
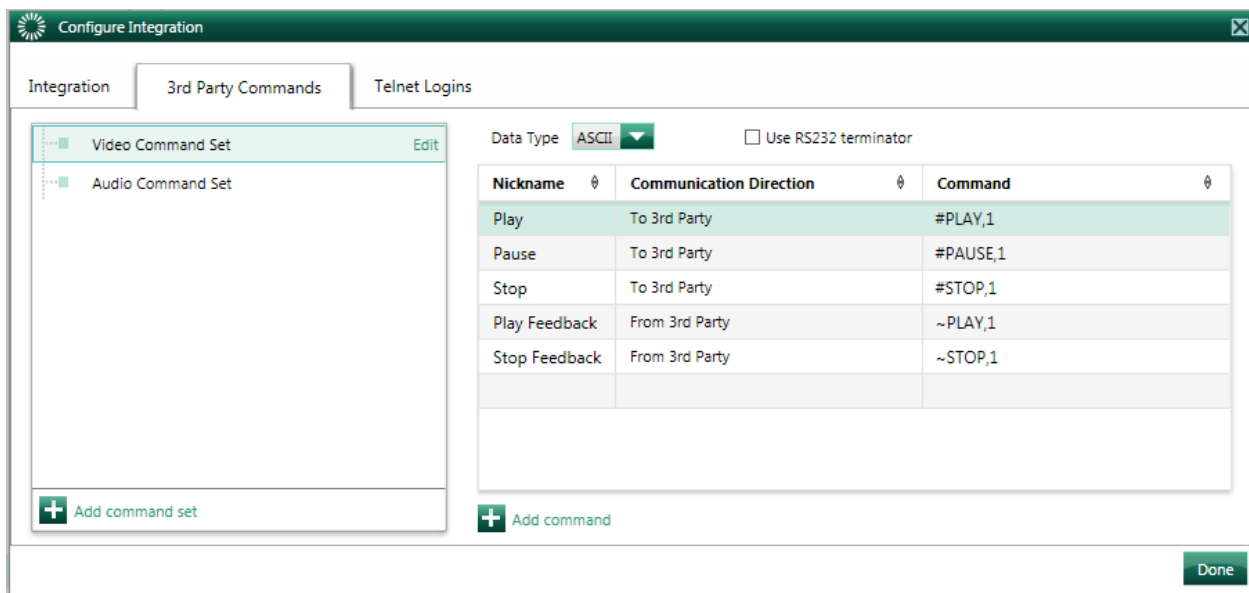

4.   Assign this command set to the 3rd-party device in the project. This can be chosen from the drop-down box on the device. If using software versions 7.x and newer, proceed to Step 5. If using a prior version of software, skip ahead to step 6.
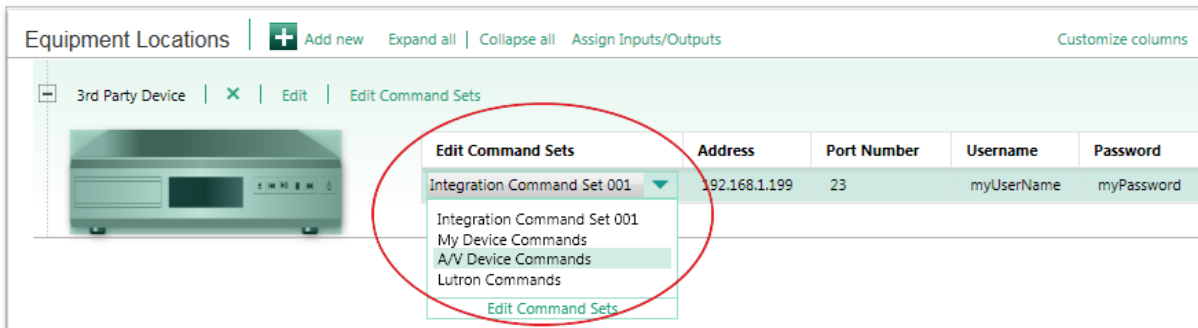
5.   FOR SOFTWARE VERSION 7.x AND NEWER ONLY – 3rd Party Controls need to be assigned to a specific processor in the database. Go to "Link Assignment" on the Design tab. Click on the appropriate Ethernet link to assign the 3rd Party Control. On the right-hand side of the screen, find the 3rd Party Control that is to be assigned and check the box to assign it to 1 of the 5 available Ethernet Connections for the specific processor. NOTE: Processor 1 has two of its Connections occupied, by default, for the Remote Access feature of Home Control+. It is possible to regain these two Connections by disabling the Home Control+ Remote Access feature. To disable this feature, check the "Disable Home Control+ Remote Access" option.
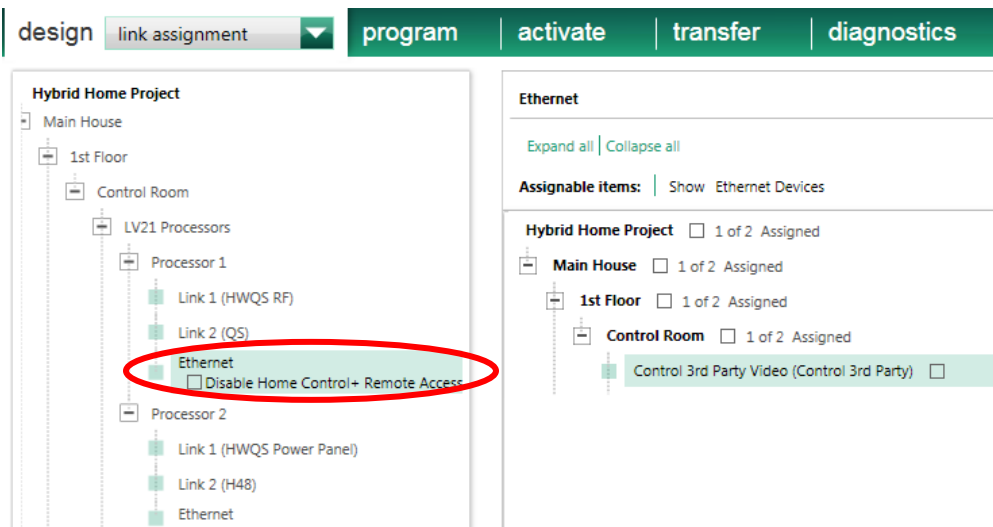
6.   Program keypads, timeclocks, etc. to send commands to the 3rd-party device. This is done on the "program" tab. Choose "Control 3rd Party" from the "Assignable Items" list to view the devices in your project. The "Settings" drop down will display the integration commands that were configured for that device.
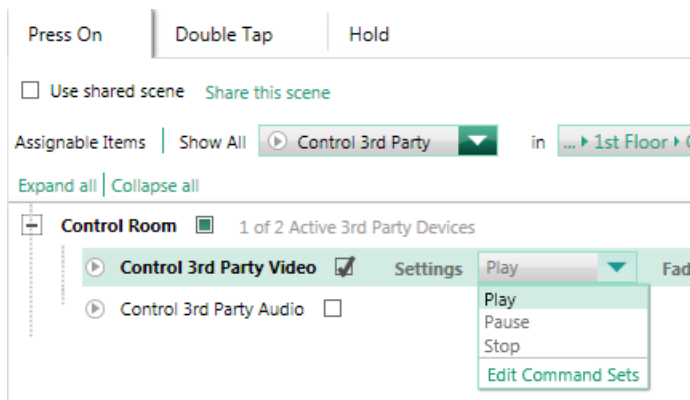
7.   If you would like LED feedback on the buttons, you should create a state variable and assign it to the button in addition to assigning the custom output strings.
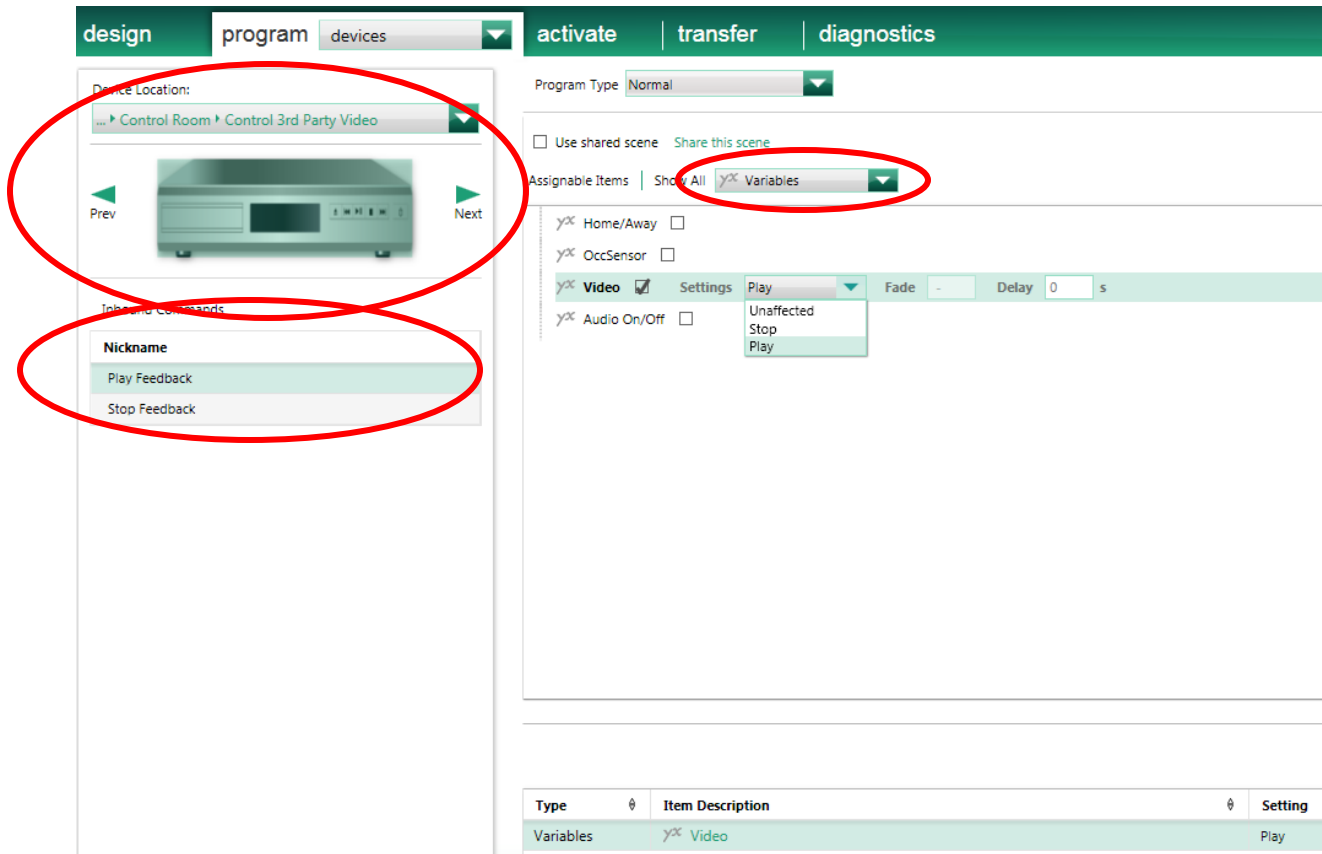
In versions 6.0 and later, the variable state should then also be assigned to the incoming 3rd party command. Programming the incoming 3rd party commands is similar to programming keypads. You can find the 3rd Party Controls in the Device Location menu and select the 3rd Party Control as if you were selecting a keypad, in an area, to program. For example, when controlling a media playback device with commands to Play, Pause, and Stop, create a state variable with these same states and assign the variable states to the button that sends the corresponding command to the media playback device. Similarly, the variable will then need to be assigned to the appropriate incoming 3rd Party command. Using scene LED logic on the button will ensure that the LED will be lit only when that state is true.

design | program devices ▼ | activate | transfer | diagnostics

Device Location:
... ▸ Control Room ▸ Control 3rd Party Video ▼

◀ Prev   ▶ Next

Inbound Commands

Nickname
Play Feedback
Stop Feedback

Program Type Normal ▼

☐ Use shared scene   Share this scene

Assignable Items | Show All y^x Variables ▼

y^x Home/Away ☐
y^x OccSensor ☐
y^x **Video** ☑   Settings Play ▼   Fade -   Delay 0   s
　　　　　　　　　　　 Unaffected
　　　　　　　　　　　 Stop
y^x Audio On/Off ☐   Play

Type	◊	Item Description	◊	Setting
Variables		y^x Video		Play

8.　　Connect all devices to the same Ethernet network and subnet (refer to the HWQS Networking Guide for details). The devices must be able to communicate over the Ethernet network for the integration to function properly.

Scenario 3: Integration with RS-232 Devices Using the Lutron Integration Protocol

Overview:

In this scenario, integration between HWQS and 3rd-party devices is accomplished using an RS-232 serial connection and the Lutron Integration Protocol, which is well documented and freely available. Many 3rd-party systems and devices have fully functional two-way integration drivers for HWQS that utilize the Lutron Integration Protocol and allow for simplified bi-directional integration. An Ethernet to RS-232 converter will be required, since the HWQS system has Ethernet connections and the 3rd-party device has only an RS-232 port. The converter device must open and maintain a Telnet session with the HWQS system, which will then allow the Lutron Integration Protocol data to pass through to the RS-232 port. This scenario is identical to Scenario 1 in this document with the exception that the Ethernet to RS-232 converter device is used between the HWQS system and the 3rd-party device.

Equipment Required:

All versions of HWQS software will work with this scenario. An Ethernet to RS-232 converter device is required to communicate with RS-232 devices from a HWQS system. There are many devices with these capabilities, however, two such devices that Lutron has had success with are the following:
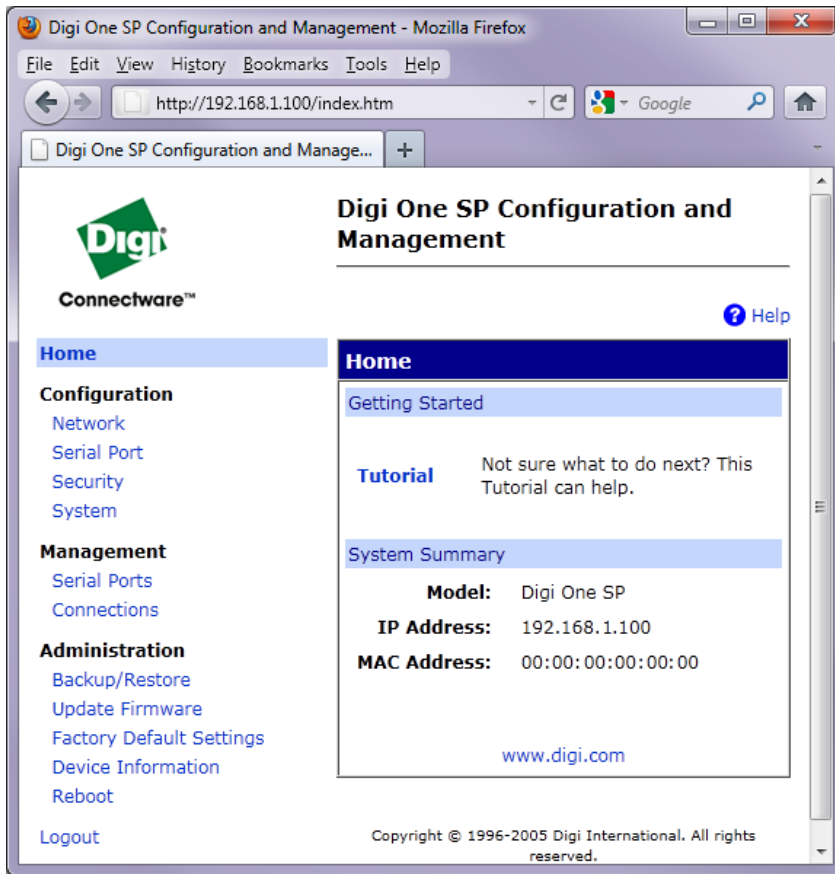
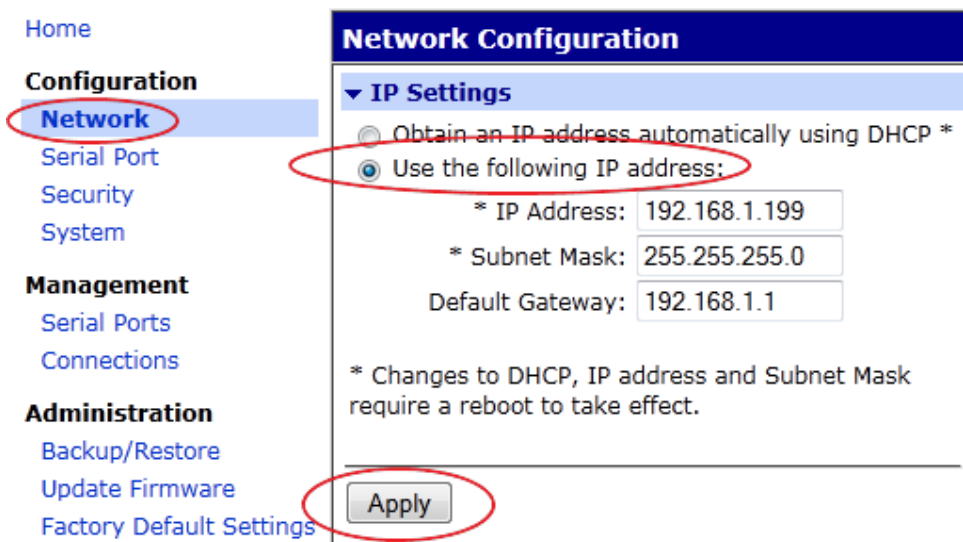| Digi One SP	B & B Electronics ES1A
www.digi.com	www.bb-elec.com

Set Up Steps:

1. Connect the Ethernet port on the Ethernet to RS-232 converter device to the same Ethernet network as the HWQS system and your computer. A standard Ethernet patch cable can be used.

2. Open the web-based configuration and management portal for the device. This can be accomplished by using the setup utility included with the device, or by using the web-based configuration and management portal. The steps contained in this document are for the Digi One SP device using the web-based setup, but are similar to those for the B & B Electronics ES1A device. The configuration and management portal is accessed by pointing your internet browser

to the IP address of the device. The default username is "root" and the default password is
"dbps". The home screen is shown below.

3.   Configure the network settings on the Ethernet to RS-232 converter device by clicking on the
        "Network" option on the left side. It is recommended to use a static IP address. This address
        should be outside the DHCP range of the router. The device must be on the same network and
        subnet as the HWQS processor. Be sure to Apply the settings. The device may need to reboot
        for the settings to take effect.

4.   Configure the serial port port profile on the converter device by clicking on the "Serial Port"
        option on the left side and then selecting "Port Profile" at the top. Choose the "TCP Sockets"

port profile. Under "TCP Client", check the box to "Automatically establish TCP connections". Enter the IP address of the HWQS processor in the "Connect To:" field. Choose "Telnet" in the "Service:" field. Enter "23" in the "TCP Port Number:" field. Be sure to Apply the settings. The image below contains the appropriate settings, however, you must replace the displayed IP address with the IP address of your HWQS processor.

Home

Configuration
Network
Serial Port
Security
System

Management
Serial Ports
Connections

Administration
Backup/Restore
Update Firmware
Factory Default Settings
Device Information
Reboot

Logout

Serial Port Configuration

▼ **Port Profile**

Current Port Profile: **TCP Sockets**   Change Profile...
The TCP Sockets Profile allows a serial device to communicate over a TCP network.

Profile Settings

TCP Server
Connect to the following TCP ports on the network (calculated from Base Socket).

Telnet TCP Port: 2001   *Unavailable*
Raw TCP Port: 2101   *Unavailable*

TCP Client
Automatically establish TCP connections to a server or other networked device.

☑ Automatically establish TCP connections

Connect: ⦿ Always
              ○ When data arrives
   ○ When DCD goes high

Connect To: 192.168.1.200
Service: Telnet ▾
TCP Port Number: 23
Flush Start Character: Auto ▾
Send Keepalive Packets: ☑

Apply

5. Configure the serial port parameters by clicking the "Serial Port" option on the left side and then selecting "Basic Serial Settings". Set the baud rate, data bits, parity, stop bits, and flow control. These are determined by the 3rd-party device that will be connected to the RS-232 port on the device, and must match.
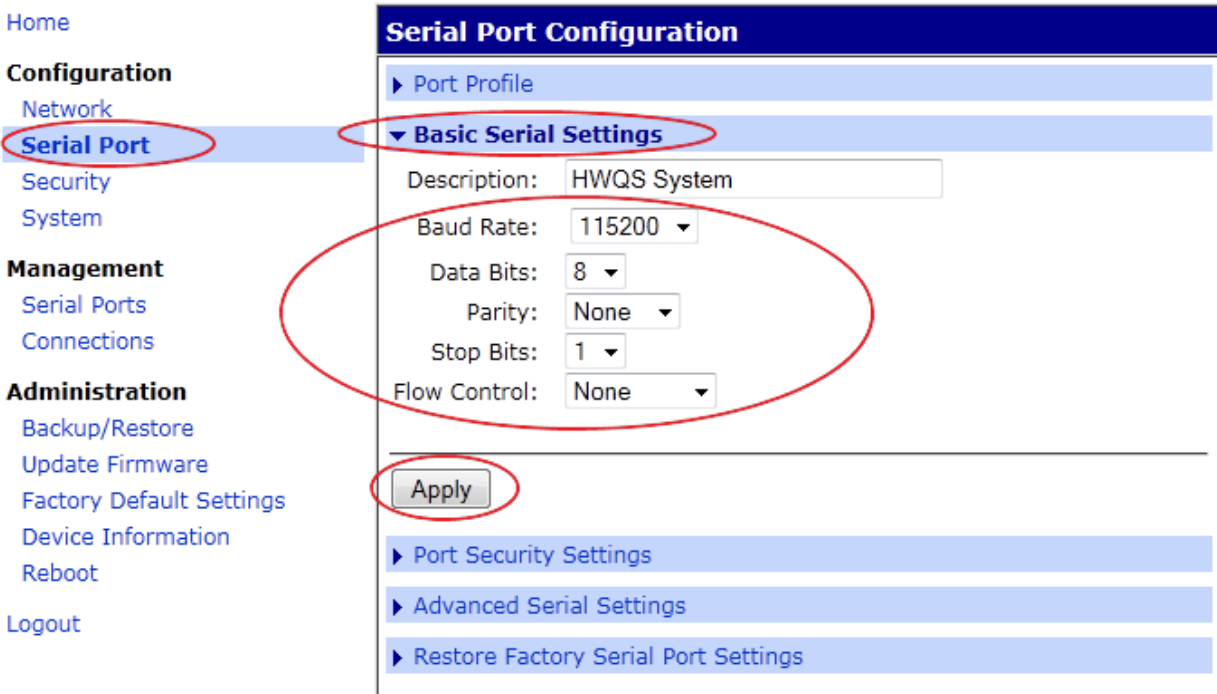
6. Refer to Scenario 1 in this document to set up the HWQS system to use the Lutron Integration Protocol. From the HWQS system perspective, this scenario is identical to Scenario 1, as the Ethernet to RS-232 conversion occurs outside the HWQS system.

7. Connect an RS-232 cable between the 3rd-party device and the converter. Depending on the configuration of the 3rd-party device, you may require a null-modem cable and/or gender adapters. The Ethernet to RS-232 converter devices in this document are DTE (Data Terminal Equipment) devices. Refer to Appendix A at the end of this document for an RS-232 pinout diagram of the converter.

8. The Ethernet to RS-232 converter device will automatically open the Telnet session with the HWQS processor, however, the 3rd-party device must send the Telnet username/password via RS-232 when prompted. After the login occurs, the 3rd-party device can then utilize the Lutron Integration Protocol, as if the device was connected via Ethernet.

Scenario 4: Integration with RS-232 Devices Using Custom Integration Commands

Overview:

In this scenario, integration between HWQS and 3rd-party devices is accomplished using an RS-232 connection and the 3rd-party device's communication commands. This type of integration is commonly used when the 3rd-party device is capable of being controlled, however the HWQS system will not receive any feedback from the device. Common examples include spa/pool controllers, A/V components, and thermostats. An Ethernet to RS-232 converter will be required, since the HWQS system has Ethernet connections and the 3rd-party device has only an RS-232 port. The HWQS processor will open and maintain a TCP connection with the converter device, which will then allow the custom command strings to pass through to the RS-232 port. This scenario is identical to Scenario 2 in this document with the exception that the Ethernet to RS-232 converter device is used between the HWQS system and the 3rd-party device.

Equipment Required:

 HWQS software version 2.0 or later must be used in this scenario. An Ethernet to RS-232 converter device is required to communicate with RS-232 devices from a HWQS system. There are many devices with these capabilities, however, two such devices that Lutron has had success with are the following:
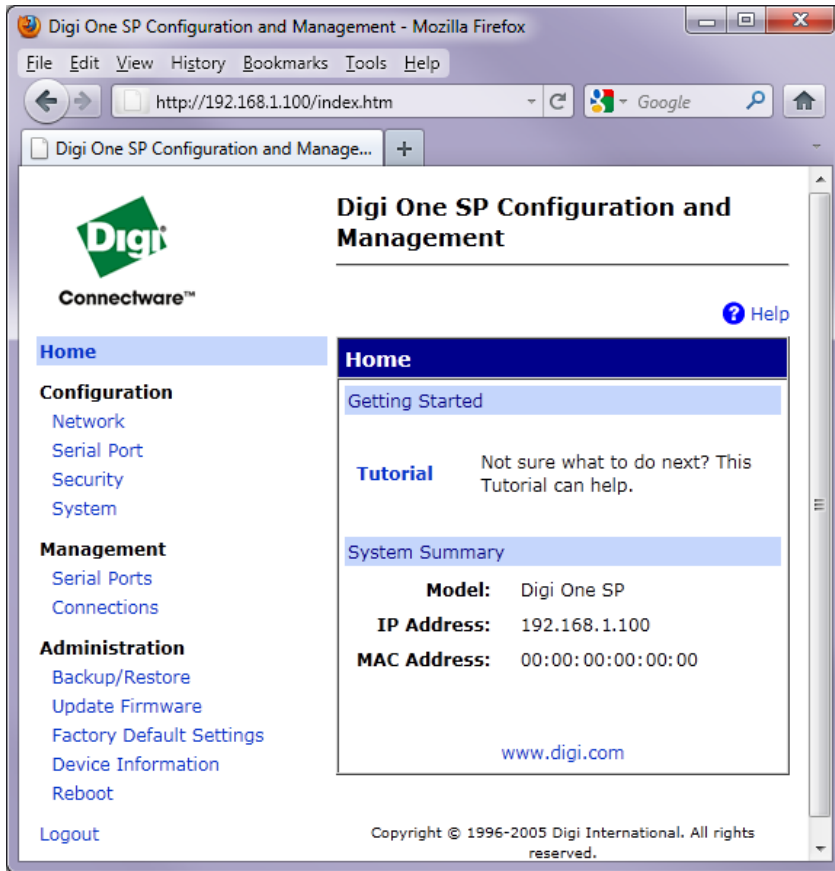
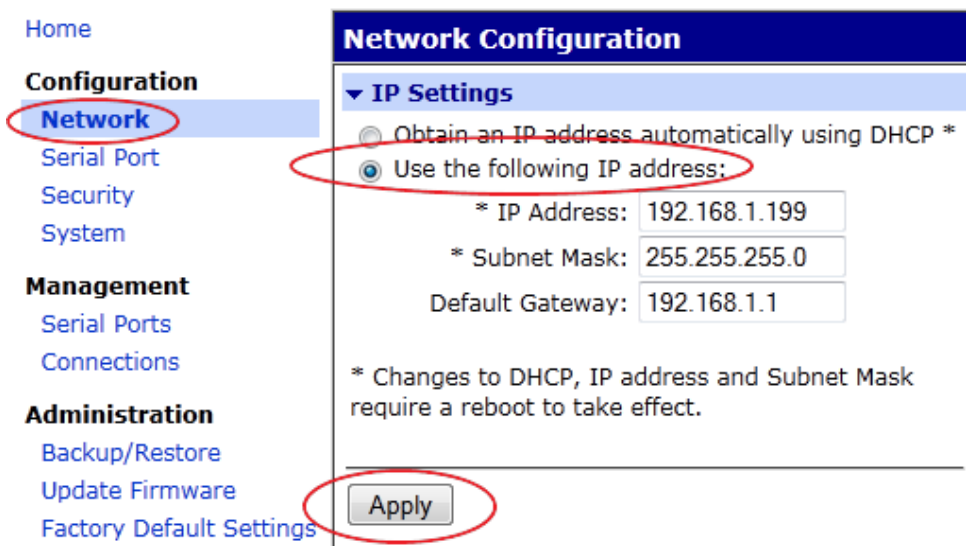| Digi One SP	B & B Electronics ES1A
www.digi.com	www.bb-elec.com

Set Up Steps:

1.   Connect the Ethernet port on the Ethernet to RS-232 converter device to the same Ethernet network as the HWQS system and your computer. A standard Ethernet patch cable can be used.

2.   Open the web-based configuration and management portal for the device. This can be accomplished by using the setup utility included with the device, or by using the web-based configuration and management portal. The steps contained in this document are for the Digi One SP device using the web-based setup, but are similar to those for the B & B Electronics ES1A device. The configuration and management portal is accessed by pointing your internet browser

to the IP address of the device. The default username is "root" and the default password is "dbps". The home screen is shown below.

3.   Configure the network settings on the Ethernet to RS-232 converter device by clicking on the "Network" option on the left side. It is recommended to use a static IP address. This address should be outside the DHCP range of the router. The device must be on the same network and subnet as the HWQS processor. Be sure to Apply the settings. The device may need to reboot for the settings to take effect.

4. Configure the Advanced Network Settings on the Ethernet to RS-232 converter device by clicking on the "Network option on the left side and then clicking on "Advanced Network Settings". The settings must be set to the following:

TCP Time-To-Live:	30 hops
IP Time-To-Live:	60 hops
Probe Interval:	10 secs
Probe Count:	5
Retransmission Timeout:	30 secs
Enable TCP Keepalive	(checked)
Idle Timeout:	1 min

The settings are shown below. Be sure to Apply the settings at the bottom of the page when done. These settings are important because they allow the HWQS processor to maintain the connection with the converter device and quickly re-establish the connection if it is lost.

5. Configure the serial port profile on the converter device by clicking on the "Serial Port" option on the left side and then selecting "Port Profile" at the top. Choose the "TCP Sockets" port profile. Make note of the "Raw TCP Port" number (2101) listed under the "TCP Server". This is the port you will program the HWQS software to send the 3rd-party device commands to. Ensure the box is unchecked to "Automatically establish TCP connections". Be sure to Apply the settings. The image below contains the appropriate settings.

6. Configure the serial port parameters by clicking the "Serial Port" option on the left side and then selecting "Basic Serial Settings". Set the baud rate, data bits, parity, stop bits, and flow control. These are determined by the 3rd-party device that will be connected to the RS-232 port on the device, and must match.
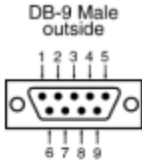

7. Refer to Scenario 2 in this document to set up the HWQS system to use custom integration commands to communicate with a 3rd-party device. For the Address of the 3rd-party device in the HWQS software, use the IP address of the converter device set in step 3 and enter that IP address in the Address field. Enter the Raw TCP port number from step 5 in the Port Number field. Leave the Username and Password fields blank. From the HWQS system perspective, this scenario is identical to Scenario 2, as the Ethernet to RS-232 conversion occurs outside the HWQS system.
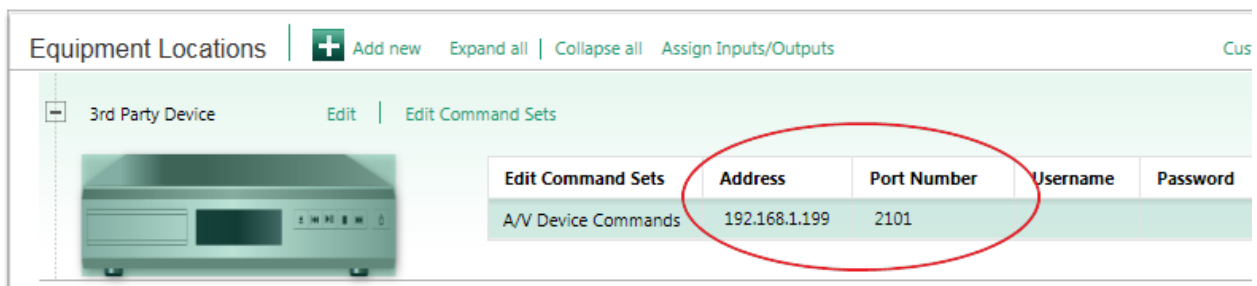
8. Connect an RS-232 cable between the 3rd-party device and the converter. Depending on the configuration of the 3rd-party device, you may require a null-modem cable and/or gender adapters. The Ethernet to RS-232 converter devices in this document are DTE (Data Terminal Equipment) devices. Refer to the Appendix at the end of this document for an RS-232 pinout diagram of the converter.

9. The HWQS system will send the command strings to the Ethernet to RS-232 converter device on the specified port, which will then be passed out the RS-232 port to the 3rd-party device. No login/password is required.

Appendix

Digi One SP / B&B Electronics ES1A RS-232 Pinout

DB-9 Male
outside

DB-9M Pin	Signal	RS-232	DTE
1	Carrier Detect	DCD	In
2	Receive Data	RXD	In
3	Transmit Data	TXD	Out
4	Data Terminal Ready	DTR	Out
5	Signal Ground	GND	---
6	Data Set Ready	DSR	In
7	Request To Send	RTS	Out
8	Clear To Send	CTS	In
9	Not Connected	NA	NA