

DEBUGGING SERIAL COMMUNICATIONS WITH OTHER DEVICES

NOTE: This application note is intended for users connecting an external device to a HomeVision serial port. It may be helpful to users connecting to HomeVision-supported devices such as RCS thermostats and CADDX security systems, as well as users connecting to other serial devices.

COMMON PROBLEMS

Following are the most common mistakes users make and problems they face when connecting to external devices:

- Wrong baud rate. Be sure the HomeVision serial port is set to the same baud rate that the external device is using.
- External device requires hardware flow control. “Flow control” is used to temporarily halt transmission to a device that isn’t ready to receive yet. The built-in HomeVision serial port uses “software” flow control (called XON/XOFF), while the add-on serial ports do not support any type of flow control. Some devices require the use of “hardware” flow control (called CTS/RTS), which HomeVision doesn’t support, and they may not work with HomeVision. Fortunately, such devices are rare.
- Wrong serial cable type. There are two types of RS232 serial cables: “standard” and “null modem”. The type of cable to use depends on which HomeVision serial port you are connecting to and the port type on the external device. There are two port types: DTE (Data Terminal Equipment) and DCE (Data Communications Equipment). DTE ports are typically found on a PC and use 9-pin male connectors. DCE ports are typically found on other devices that connect to a PC (such as a modem) and use 9-pin female connectors. HomeVision’s built-in serial port is a DCE port, while the add-on ports are DTE ports. A standard serial cable (which HomeVision ships with) is used to connect a DTE port to a DCE port. A null-modem cable is used to connect two ports of the same type (DEC-to-DCE or DTE-to-DTE). You will need to determine which type of port your device has. Note that you can’t look at the connector to tell – sometimes DTE ports use a female connector, and sometimes DCE ports use a male connector (with these “backwards” connectors, you’ll usually need to also use a male-to-male or female-to-female adapter). The following table shows the type of cable for connecting both DTE and DCE devices to each of the HomeVision serial ports.

HomeVision Port Number and Type	External Device Port Type	
	DTE (PC)	DCE
1 (port built into HomeVision): DCE	Standard	Null-modem
2 (HomeVision-Phone/Serial): DTE	Null-modem	Standard
3 (HomeVision-Serial): DTE	Null-modem	Standard
4 (HomeVision-Serial): DTE	Null-modem	Standard

- RS485 port wires connected wrong. It is quite easy to misconnect wires of an RS485 port. Reread the documentation for the HomeVision-Serial RS485 port, as well as the external device’s documentation, and recheck the wiring.
- Trying to receive binary data. Most devices use a serial communications protocol with “ASCII”, “hex”, “ASCII-hex”, or other similarly named data types. HomeVision can receive such data fine over any serial port. However, a small number of devices use “binary” data, which means a character (byte) can be any of 256 possible values. If you are trying to get HomeVision to receive this binary data, you may run into difficulties. The common issues are:
 - The add-on serial ports will remove “line feeds” (a character with a value of 10). If the external device transmits this character, HomeVision will ignore it. If this is a problem for you, contact us about obtaining a chip that doesn’t remove line feeds). *Note that the built-in HomeVision serial port does not have this limitation.*

- The add-on serial ports cannot receive a binary value of zero. If the external device transmits this character, HomeVision will ignore it. *Note that the built-in HomeVision serial port does not have this limitation.*
- The built-in HomeVision serial port cannot receive a message that starts with a comma, an “XON” character (value of 17), or an “XOFF” character (value of 19). A comma is used as the first character of the HomeVision communications protocol, so HomeVision will interpret messages starting with a comma as a command. Since the rest of the data probably won’t match a HomeVision command, it would get ignored (and if it did happen to match a complete command, HomeVision would perform the command!). XON and XOFF characters are used as software “flow control” for the built-in serial port. If one of these characters is the first character of a message, HomeVision will interpret this as a flow control signal instead of a data character (so the character is essentially lost). Note that an XON, XOFF, or comma *can* occur anywhere else in the message; it just can’t be the first character.

VIEWING SERIAL DATA

Data HomeVision Receives

If you’re having problems getting an external device working with HomeVision, one of the first steps is to see if each device is transmitting what it should be. Ideally, you could see all the data being sent in both directions. However, this usually isn’t easy to accomplish. Following are some ways to see what HomeVision is transmitting and receiving.

There are three relatively easy ways to see what ASCII data the HomeVision port is receiving (these methods do not work as well with binary data):

1. If you’re using an add-on HomeVision port, and you have HomeVision PROM 3.3 or later, you can use “port forwarding”. You can use this feature to take data received from the add-on serial port and transmit it out HomeVision’s built-in port (or another port if you prefer). To do this, open the Controller Settings Screen under the Configure menu. Select the Serial tab and then check the direction to forward the serial data. For example, to forward data from HomeVision port 3 to port 1 (the built-in serial port), check “3 to 1”. To forward data from HomeVision port 4 to port 1, check “4 to 1”. Load the revised schedule into the controller. Use the Terminal Emulator Screen (under the Other menu) to view all data being transmitted out the built-in HomeVision serial port. This will allow you to see all data received by the add-on port. Note that if your schedule is set up to transmit other data out the built-in serial port, or one of HomeVision’s reporting modes is enabled, you may see other transmissions in the terminal emulator mixed in with the add-on port’s data. If this makes it difficult to see what the add-on port is receiving, you may want to temporarily modify your schedule to stop these other transmissions.
2. You can view video screen number 60 on your TV. Open the Video Control Screen (under the Control menu). Click the “Start Video Menu System” button to start the video menu. In the text box next to “Display Video Screen Number”, enter 60 and then click the button. The TV screen will display data received from all three add-on serial ports (as well as some phone information that you can ignore). If nothing is received, all zeros will be displayed. One difficulty with this screen is that if the port is repeatedly receiving the same data, it will not be apparent. Only if the data changes periodically will you notice something change on the screen.
3. Use the “text storage buffer” to store received data and display it. In the “Serial Data Input Event” for the port that receives the data, include the serial command to copy the received data into text storage buffer, like this:

```
Copy 64 characters of received serial text, start at char #1, into text storage
starting at location #1
```

Next, create a macro (or periodic event, if you prefer) that displays the text storage buffer onto video screen #0, like this:

```
Video: Start video menu system
Video: Display video screen #0
```

Video: Display 64 character long stored text string starting at stored character #1

You can now view the screen to look at what data HomeVision has received.

If you are using methods 2 or 3 to view the data on your TV, you should note that certain characters cannot be displayed. The HomeVision video chip has a limited set of characters, and HomeVision will convert unsupported characters to ones the chip uses. All numbers and letters will be correctly displayed, but some other characters may not.

Also, note that all three of the above methods work best for ASCII data. It is more difficult to display binary data. Following are several ways to handle binary data:

4. Copy received data into variables. In the "Serial Data Input Event" for the port that receives the data, you can put each received character into HomeVision's internal variable "Result Value", then move it into one of your own variables. Repeat this for each received character. You can then view the variable values on HomeVision's video screen or software screen. The following example shows reading the first three received characters into variables:

```
If
  Serial port 3: >= 1 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 1 into Result Value
  Var #1 (Received byte 1) = Result Value
Endif
If
  Serial port 3: >= 2 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 2 into Result Value
  Var #2 (Received byte 2) = Result Value
Endif
If
  Serial port 3: >= 3 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 3 into Result Value
  Var #3 (Received byte 3) = Result Value
Endif
```

5. Convert received data to hex (or ASCII) and transmit it out another serial port. In the "Serial Data Input Event" for the port that receives the data, you can put each received character into HomeVision's internal variable "Result Value", then move it into a temporary variable, and then transmit it out another serial port. Repeat this for each received character. The following example shows doing this with the first three received characters. You could also transmit the data as ASCII text instead of hex if you prefer.

```
If
  Serial port 3: >= 1 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 1 into Result Value
  Var #1 (Temporary var 1) = Result Value
  Serial port 1 transmit: Var #1 (Temporary var 1) value as 2 hex bytes
  Serial port 1 transmit: " "
Endif
If
  Serial port 3: >= 2 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 2 into Result Value
  Var #1 (Temporary var 1) = Result Value
  Serial port 1 transmit: Var #1 (Temporary var 1) value as 2 hex bytes
  Serial port 1 transmit: " "
```

```

Endif
If
  Serial port 3: >= 3 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 3 into Result Value
  Var #1 (Temporary var 1) = Result Value
  Serial port 1 transmit: Var #1 (Temporary var 1) value as 2 hex bytes
  Serial port 1 transmit: " "
Endif
Serial port 1 transmit: Carriage return and line feed

```

6. Write received data onto video screen #0 as decimal data. In the "Serial Data Input Event" for the port that receives the data, you can put each received character into HomeVision's internal variable "Result Value", then move it into one of your own variables, and finally include the video command to display a received character into text storage buffer. Repeat this for each received character. The following example shows doing this with the first three received characters. Note that the "Display video screen # 0" command will cause the video screen flash briefly each time this code runs. This will alert you to the fact a new message was received (otherwise, if the data was the same as the previous message, you might not realize a new message was received).

```

Video: Start video menu system
Video: Display video screen # 0
Video: Display text 'PORT 3 RECEIVED DATA'
Video: Do line feed and carriage return
If
  Serial port 3: >= 1 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 1 into Result Value
  Var #1 (Temporary var 1) = Result Value
  Video: Display all 3 digits of variable #1 (Temporary var 1)
  Video: Display text ' '      {blank space to separate values}
End If
If
  Serial port 3: >= 2 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 2 into Result Value
  Var #1 (Temporary var 1) = Result Value
  Video: Display all 3 digits of variable #1 (Temporary var 1)
  Video: Display text ' '      {blank space to separate values}
End If
If
  Serial port 3: >= 3 serial characters are received
Then
  Serial port 3: Put binary value of received serial character # 3 into Result Value
  Var #1 (Temporary var 1) = Result Value
  Video: Display all 3 digits of variable #1 (Temporary var 1)
End If

```

Data HomeVision Transmits

There are several ways to verify what HomeVision is transmitting, depending on the type of serial port you are using. If you're using an RS232 serial port, connect that port to a PC port (be sure to use the correct cable type, as discussed above). In the HomeVision software, select Serial Interface (under the Configure menu) and set the baud rate to match the HomeVision port's rate. Next, open the Terminal Emulator Screen (under the Other menu). In the Controller Response field you will see any data being transmitted from HomeVision. If you see what you expect, then you know

HomeVision is properly transmitting. If you see garbage characters, then you probably have the baud rate set incorrectly. If you see nothing, then either:

- The cable is connected wrong
- Your HomeVision schedule is not doing what you think
- The HomeVision serial port is not operating properly

If you are using the RS485 port of an add-on HomeVision-Serial device, it can be harder to see what HomeVision is transmitting. Here are three ways to do it:

1. If you happen to have an RS485-to-RS232 converter, you can connect the 485 portion to HomeVision's 485 lines and connect the 232 connector to a PC serial port.
2. It is possible for the HomeVision-Serial device to receive its own transmission. You can use this capability to test whether it is properly transmitting. If the HomeVision RS485 is configured in the "2-wire" mode (the most common configuration), its transmit output lines are also connected to its receive input lines, allowing HomeVision to receive its own transmission. For this test, you may want to disconnect the wires from the external device to ensure it doesn't interfere. Next, under the Configure menu, select Expansion Boards, then select the Other tab, then configure the serial port for the full-duplex "4-wire" mode. This is necessary because in the 2-wire mode, the HomeVision-Serial device disables its receiver while it is transmitting. By selecting the 4-wire mode, it will instead leave the receiver enabled, allowing it to receive its own transmission. Now load the revised schedule into the controller. Next use one of the methods described above to see what data the HomeVision port is receiving. Since it is receiving its own transmission, you are actually looking at what HomeVision is transmitting.
3. If you have two HomeVision-Serial devices, you could connect them together, one transmitting to the other. Use one of the methods described above to see what data the receiving HomeVision port is receiving.