Using Non-X10 Lighting Systems With HomeVision

1.0 Introduction

Some users would like to use HomeVision or HomeVision-Pro (hereafter referred to jointly as "HomeVision") with lighting systems other than X-10 (such as Lutron, C-Bus, CentraLite, UPB, etc.). To facilitate this, HomeVision version 3.4 supports what we call "custom lighting" commands. The HomeVision controller does not provide built-in control of such lighting systems. Instead, it provides a framework to allow either macros loaded into the controller or special PC software to control the lighting system. A user or system developer must do one of the following:

1. Create a macro within the HomeVision schedule that controls the lighting system. It is expected that the macro would transmit serial messages to an external lighting system controller. However, the macro could also control HomeVision relay outputs that directly connect to the external lights. We call this method the "User-Created Macro and Variables Method".

2. Create PC software that controls the lighting system. The HomeVision controller would then transmit serial messages to the PC, and the PC software would control the lighting system. We call this method the "HomeVision Default Method".

With either method, it is anticipated that once someone has created a macro or software, others could use it rather easily. Once this is done, HomeVision will provide the following capabilities:

- Define and name up to 255 lights.
- Track light levels in an internal state table.
- Enter commands in the schedule for these lights, such as "Light 3 (Porch light) On", "Light 7 (Kitchen light) to level 50", and "Light 45 (Master bath) select scene 6".
- Use the HomeVision software, web browser, or other PC software to control the lights and read status.
- View a TV screen showing the light status and allowing them to be controlled.
- Check the current light status in If-Then conditions.

This paper describes how to use this capability. It's important to understand the following terms that we use in this paper:

External Lighting System Controller: Our approach assumes that the lighting system can be controlled by an RS232 or RS485 serial interface. HomeVision would use a built-in or add-on serial port to communicate with the lighting system's "controller", which we call the "external lighting system controller".

Developer: The developer is the person writing the PC software or the HomeVision macro that communicates with the external lighting system controller. This person must be very familiar with the lighting system and its serial communications protocol. The majority of this paper was written to aid the developer in developing the software or HomeVision macro.

User: The user is the person putting commands in the HomeVision schedule to control the lighting system. He/she doesn't have to understand the detailed workings of the lighting system. However, he/she must install the PC software or HomeVision macro, and then make some configuration settings within the HomeVision software. Of course, the user and developer could be the same person.

Following are separate sections aimed at the user and the developer (although the developer should read both sections).

Note that we have developed macros for control of Universal Powerline Bus (UPB) lighting devices from Powerline Control Systems. Also, a partner has developed macros for control of C-Bus devices. See our web site for more information.

2.0 User Information

2.1 Set Up Process

Whoever developed the software or macros enabling HomeVision to control a lighting system should provide instructions for how to set it up with HomeVision. What follows is a brief overview of what you would have to do to get it running:

1. If you're using the "HomeVision Default Method" of control, you will need to install special software on the PC. The developer must provide this software to you. If you're using the "User-Created Macro and Variables Method" of control, you will need to put one macro in your HomeVision schedule. The developer should provide you a schedule file so that you can copy the macro and paste it into your schedule. You will also need to create six variables in the HomeVision software.

2. Use the Custom Lighting Configuration Screen, located under the "Configure" menu, to configure the system. The key settings are as follows:

   - Select which type of control method you're using.

   - Select the maximum lighting "level" used by the lighting system. Some systems may allow each light to have one of 256 different levels (ranging from 0 being off to 255 being on at full brightness), while others may have only 100, 32, or some other number of levels. HomeVision needs to know the number of levels in order to properly control the system. You enter the maximum level (i.e., the number that corresponds to "full-on") in this field.

   - You can select where the "Lighting" button appears on the Toolbar on the Actions Entry Screen. This is the button you would use to enter custom lighting commands or conditions in your schedule. By default, lighting commands and conditions appear under the "Other" button on the Toolbar. Many users with a non-X10 lighting system will not be using X10 at all. In this case, the user can check the "Swap X10 and lighting buttons on toolbar" checkbox. This will cause the Lighting button to appear on the Toolbar in place of the X10 button (which is conveniently located at the top of the Toolbar), and the X10 button to move under "Other" button. This will make it easier for users to enter lighting system commands.

   - For the HomeVision Default Method, you'll make several settings related to the serial port.

   - For the User-Created Macro and Variables Method, you'll identify what the macro ID number is and which variables it uses.

3. Configure the serial port that will be communicating with the PC or external lighting system.

4. Use the Lighting Device Screen, located under the "Objects/Events" menu, to configure the individual lights. In addition to naming the lights, giving them descriptions, and setting their initial and power failure state, you can set the two values shown below for each light. The developer should provide instructions on the values you should enter.

   - **Address**: It is expected that each light in the lighting system will have a unique address. You enter the light's address in this field. The address can range from 0 to 255.

- **Extra Byte**: This is an extra data byte that can be used for anything the developer wants. The value can range from 0 to 255. There are several different ways this might be used (although it doesn't have to be used at all). Some lighting systems might use multiple address bytes, or have addresses larger than 255. For such systems, this extra byte can be used to hold a portion of the light's address. Alternatively, the lighting system may support different light types, and it may be important to know each light's type. This extra byte could then be used to indicate the light's type.

When a lighting command is performed in your schedule, the value of the address byte and the extra byte are either transmitted out the serial port (if using the HomeVision Default Method) or provided to the macro (if using the User-Created Macro and Variables Method). The software or macro can then use them to perform the appropriate command.

5. If your lighting system allows lights to turn slowly on or off over a period of seconds or minutes, set up the "RampRates.txt" file as described in the "Ramp Rates" paragraph.

6. You can now enter lighting commands or If-Then conditions in your schedule. The software will provide the following commands. However, your lighting may not support some of them. The developer should indicate which commands could be used with the system.

   - Light ## off
   - Light ## on
   - Light ## toggle
   - Light ## brighten XX times
   - Light ## dim XX times
   - Light ## to level XX at rate YY
   - Light ## to level in variable XX at rate YY
   - Light ## select scene XX
   - Light ## refresh (command light to whatever level controller currently thinks light is at)
   - Light ## put current level into variable XX
   - Light ## set state to OFF
   - Light ## set state to ON at level XX
   - Light ## set state to ON at level in variable XX
   - Light ## set state to ON at unknown level
   - Light ## set state to UNKNOWN
   - Set state of current light to OFF
   - Set state of current light to ON at level in variable XX

   Note that the "Select scene" command allows you to select which light it applies to. For some lighting systems, this is meaningless, as a scene command applies to a group of lights, not just one light. For such systems, it doesn't matter which light you select when entering the command – only the scene number matters.

2.2 Unknown Light State

The lighting feature introduces a new state named "Unknown". A light state can be On, Off, or Unknown. While HomeVision will adjust the state when it performs a command, the lights may also be controlled manually. When this happens, HomeVision will only know about it if the external lighting controller sends a serial message to HomeVision telling it the new state. If your lighting system doesn't do this, HomeVision may not properly track the state. In this case, you might want to set the HomeVision tracking state to "Unknown". This would indicate to the other software or devices that HomeVision doesn't know the correct light. This same concept also applies to the light level. h other words, HomeVision might send an On command, and thereby know the light is on, but not know what level the light turned on at (as some lighting systems allow different lights to turn on at different levels). In this case, you might want to set the HomeVision tracking state to “On at unknown level”.

2.3 Ramp Rates

Some lighting systems allow lights to turn slowly on or off over a period of seconds or minutes. HomeVision supports this feature by allowing the user to specify “ramp rates” with some commands. However, because different lighting systems may allow only certain rates, HomeVision provides a way for the user to specify the supported rates. This is done by creating a text file that holds the allowed rates. The text file must be named “RampRates.txt” and placed in the same directory as the HomeVision application. The HomeVision software reads this file each time it starts up.

Here is an example of what the text file for a UPB lighting system would look like:

```
0 = instantly
1 = over 0.8 seconds
2 = over 1.6 seconds
3 = over 3.3 seconds
4 = over 5 seconds
5 = over 6.6 seconds
6 = over 10 seconds
7 = over 20 seconds
8 = over 30 seconds
9 = over 1 minute
10 = over 2 minutes
11 = over 5 minutes
12 = over 10 minutes
13 = over 15 minutes
14 = over 30 minutes
15 = over 60 minutes
```

Here is an example of what the text file for a C-Bus lighting system would look like:

```
0 = instantly
1 = over 4 seconds
2 = over 8 seconds
3 = over 12 seconds
4 = over 20 seconds
5 = over 30 seconds
6 = over 40 seconds
7 = over 1 minute
8 = over 1.5 minutes
9 = over 2 minutes
10 = over 3 minutes
11 = over 5 minutes
12 = over 7 minutes
13 = over 10 minutes
14 = over 15 minutes
15 = over 17 minutes
```

Here is an example of what the text file for a CentraLite Elegance lighting system would look like:

```
0 = instantly
1 = 1 second
2 = 2 seconds
3 = 3 seconds
```

```
4 = 4 seconds
5 = 5 seconds
6 = 6 seconds
7 = 7 seconds
8 = 9 seconds
9 = 11 seconds
10 = 13 seconds
11 = 16 seconds
12 = 19 seconds
13 = 23 seconds
14 = 28 seconds
15 = 34 seconds
16 = 41 seconds
17 = 49 seconds
18 = 60 seconds
19 = 75 seconds
20 = 90 seconds
21 = 110 seconds
22 = 140 seconds
23 = 175 seconds
24 = 210 seconds
25 = 250 seconds
26 = 300seconds
27 = 380 seconds
28 = 450 seconds
29 = 550 seconds
30 = 675 seconds
31 = 800 seconds
```

Each line describes one of the allowed ramp rates. The text to the right of the equal sign will be displayed in the drop-down ramp rate list box when entering lighting commands. Each line has a specific number associated with it. When you enter a lighting command in your schedule, HomeVision stores the ID number of the line. When it performs the command, the ID number will either be transmitted out the serial port (if using the Default Control Method) or put in one of your variables (if using the User-Created Macro and Variables Method). The first line that contains an equal sign is always number 0, the next is number 1, the next is number 2, and so on. ***This numbering system is used regardless of what numbers you put in the text file***. In fact, you could leave the numbers out, as HomeVision ignores them (but the equal sign is required for any line you want HomeVision to use). You have the option of entering the numbers if they help you to keep track of the number used for each rate.

If your lighting system doesn't support ramp rates, you don't need to use the "RampRates.txt" file. The software will then always show the commands as being performed "instantly", and will always use a ramp rate value of zero when performing the commands.

3.0 Developer Information

3.1 Tracking the Light Level

When the HomeVision controller performs a lighting command, it will attempt to track the light level. It will use a range of values between 0 and the maximum light level (which the user enters in the Custom Lighting Configuration Screen). However, there are some limitations to how the controller tracks the level. The tracking process is outlined below:

- Lights are assumed to turn on at the maximum level. When HomeVision performs an "On" command, it will set its internal level-tracking variable to the maximum light level. However, with some lighting systems, lights may actually go on to different levels when turned on. For these systems, HomeVision has no way of automatically knowing what level a particular light will turn on at, and so assumes lights go on at the maximum level.

- When an OFF command is performed, the internal level tracking value is set to zero.

- When a "BRIGHTEN XX TIMES" or "DIM XX TIMES" command is performed, the tracking level will be incremented or decremented by the number of steps.

- When a LEVEL XX command is performed, the tracking level is set to the value of the level.

- When a SCENE XX command is performed, HomeVision has no idea how the light will respond, so the tracking level is left unchanged.

If you're using the "User-Created Macro and Variables Method", it is possible for the macro to override this standard level-tracking behavior. You do this by having the macro specifically set the tracking value to the desired value. An example will be shown later of how to do this. When using the "HomeVision Default Method", the PC software could send a command back to HomeVision to set the HomeVision internal tracking level appropriately.

3.2 Control Method Overview

The two methods of controlling non-X10 lighting system are summarized below:

1. **HomeVision Default Method:** This method generally requires that a PC running custom software be connected to the HomeVision serial port. Whenever the HomeVision controller performs a lighting command, it will transmit a serial message in a predefined format. The PC software must receive this message, process it, and perform the command. This generally means the PC must send another message out a different PC serial port to the lighting control system. In effect, the PC software performs a conversion between the HomeVision predefined serial message protocol and the lighting system's unique protocol.

2. **User-Created Macro and Variables Method:** With this method, the developer or user creates one macro and six variables. The macro must control the lighting system based on the value of the six variables. The macro would typically do this by transmitting serial messages to the lighting system controller. However, it could instead control output ports that turn on and off relays, which in turn control the lights. When the HomeVision controller performs a lighting command, it will automatically set the six variables appropriately, update the internal level-tracking variable, and then run the macro. The macro then does the rest of the work. Unlike the HomeVision default lighting control method, this approach doesn't require a PC to be running.

The user selects which method to use with the Custom Lighting Configuration Screen, located under the "Configure" menu. The two different control methods are described in detail in the following sections.

3.3 HomeVision Default Method Details

When this method is used, the HomeVision controller will transmit a serial message each time a lighting command is performed in the schedule. The serial message will normally go to a PC running a special program. The program must receive the message, process it, and perform the command. This generally means the PC must send another message out a different PC serial port to the lighting control system. In effect, the PC software performs a conversion between the HomeVision standard serial message and the lighting system's unique protocol. Custom Solutions, Inc. does not provide software that does this. It is expected that other companies or software developers will make such software to control various lighting systems.

When first configuring this method, the user sets two parameters in the Custom Lighting Configuration Screen:

1. The serial port number to transmit the data.
2. The serial message "header" character. This is a single character that will be sent at the start of each message.

Each serial message sent from the controller will follow this format:

HAAXXCCDDEE<CR>

Where all characters are standard ASCII characters with the follow meanings:

H is the header character (an ASCII character of the user's choosing).

AA is the two-character address (NOT ID number) of the light, in hex format (ranging from 00 to FF).

XX is an "extra" two-character data byte, in hex format (ranging from 00 to FF). This byte may or may not have any meaning. When the user creates lights in the HomeVision software, they can optionally specify an "extra" value (ranging from 0 to 255 decimal). Whenever the controller transmits a serial message, it will transmit this "extra" byte value in this "XX" field. This value could indicate the device type, a second address byte, or anything else the developer wants to use it for. You are not required to use this byte, but the controller will always transmit it.

CC is the two-character command byte, in hex format (ranging from 00 to FF).

DD is the first data byte, in hex format (ranging from 00 to FF). This will only be sent for commands that require data (such as bright, dim, level, and scene commands).

EE is the second data byte, in hex format (ranging from 00 to FF). This will only be sent for commands that require two extra data bytes (such as level commands).

<CR> is a carriage return.

Command (CC) values are described in the table below. Values not shown are reserved for future use.

COMMAND VALUE (hex)	**COMMAND NAME**	**# OF DATA BYTES**	**EXAMPLE ***
00	Off	0	L14FF00<CR>
01	On	0	L14FF01<CR>
02	Brighten XX times	1 (number of times)	Brighten 8 times: L14FF0208<CR>
03	Dim XX times	1 (number of times)	Dim 12 times: L14FF030C<CR>
04	Level XX at rate YY	2 (first byte=level, second byte=ramp rate)	Level 50 decimal (32 hex) at rate 8: L14FF043208<CR> ***Note: The level value is transmitted as an absolute level value (00-FF), not a percentage value.***
05	Scene XX	1 (scene number)	Scene 2: L14FF0502<CR>

* These examples assume the header character is the letter “L”, the light’s address is 20 decimal (14 hex) and the light’s “extra” byte value is 255 decimal (FF hex).

3.3.1 Tips for Writing PC Software

Following are some tips for those writing PC software that receives the HomeVision serial lighting messages and uses them to control an external lighting system:

- In most cases, it will work best if users use one of the HomeVision “add-on” serial ports to connect to the PC running the lighting software. This leaves the main serial port free for use by the HomeVision software for downloading schedules.

- In the simplest system, the PC software would only receive serial messages from the HomeVision controller and not transmit to it. In this case, HomeVision would have no way of knowing when lights were changed manually.

- The software should handle several lighting messages coming from HomeVision sequentially with no gap between them. The HomeVision software will allow users to put multiple lighting commands in series. The HomeVision controller will transmit these out back-to-back with little, if any, delay between the messages. Thus, the PC software needs to buffer the received messages so that none are missed.

- If the PC software also needs to send serial messages to the HomeVision controller (either to provide lighting status or to issue other commands), the software must adhere to the HomeVision standard serial communications protocol (as described in the “Serial Protocol.pdf” file). Among other things, this means that after sending a command, the software must wait for an acknowledgement from the HomeVision controller before sending another command. If using one of the HomeVision “add-on” serial ports, HomeVision PROM version 3.4 or higher is required (this PROM allows the add-on ports to support the HomeVision standard serial protocol).

3.4 User-Created Macro and Variables Method Details

3.4.1 Macro and Variable Usage

With this control method, the user creates one macro and six variables (using the regular HomeVision software screens and commands). The user then specifies which macro and variables are being used via the Custom Lighting Configuration Screen (under the “Configure” menu). The six variables and macro are used as follows:

- One variable holds the light’s ID number – you might name it “Light number”.
- One variable holds the light’s “address” – you might name it “Light address”.
- One variable holds the light’s “extra” byte – you might name it “Light extra byte”.
- One variable holds the command – you might name it “Light command”.
- One variable, which is only used for certain commands, holds a data value – you might name it “Light data 1”.
- One variable, which is only used for certain commands, holds a second data value – you might name it “Light data 2”.
- The macro – which you might name “Perform light command” – must perform the lighting command based on the six variable values.

Whenever the HomeVision controller performs a lighting command that requires sending a command to the lighting system, it will set the six variables appropriately, adjust its internal level-tracking variable appropriately, and then run the macro. The six variables are explained below:

- HomeVision will set the “Light number” variable to the ID number of the light to control. The ID number is shown in the PC software in the left-hand column on the Lighting Device Screen.

- HomeVision will set the “Light address” variable to the address of the light to control. The user would have previously entered the address for each light in the Lighting Device Screen. It may be any value between 0 and 255, and normally would correspond to the physical address set for each light.

- HomeVision will set the “Extra byte” variable to the value the user previously entered for the light in the Lighting Device Screen. It may be any value between 0 and 255, and may be used for any purpose (or it may be ignored). The developer should provide instructions on whether and how to use this.

- HomeVision will set the “Light command” variable to a value indicating the user’s command. The possible values and their meanings are as follows:

  0 = Off
  1 = On
  2 = Not used (will not occur)
  3 = Brighten XX times (where XX is specified in a variable)
  4 = Dim XX times (where XX is specified in a variable)
  5 = To level XX at rate YY (where XX and YY are specified in two variables)
  6 = Not used (will not occur)
  7 = Select scene XX (where XX is specified in a variable)

  Note: There are actually more commands then this that the user can enter. Some of the available commands do not require running the macro, or are automatically converted to one of the above commands. For example, consider the “Put current level into variable XX “ command that the user may enter. When the controller performs this command, it looks at its internal state table to determine what level the light is currently at. It then puts this value into the specified variable. It doesn’t actually send a command to the lighting system, so there’s no need to run your macro. As another example, consider the “To level in variable XX at rate YY” command. When the controller performs this command, it first looks up the value of the specified variable and puts it into your “Light data 1” variable. It puts the rate value into your “Light data 2” variable. It then puts the value 5 into the “Light command” variable, letting your macro know to perform the “To level XX at rate YY” command. Your macro has no need to know that the level value was obtained from a variable instead of being directly entered. Therefore, you won’t find a “To level in variable XX at rate YY” command in the above list – the “To level XX at rate YY” command suffices.

- For commands that require a data value (the “XX” value in the command), HomeVision will set the “Light data 1” variable to the first data value. For the “Perform scene XX” command, the scene number will be placed in the “Light data 1” variable. For the “Brighten XX times” and “Dim XX times” commands, the number of times will be placed in the “Light data 1” variable. For the “To level XX at rate YY” command, the level will be placed in the “Light data 1” variable. The level value is an absolute level value (between 0 and the maximum light level), not a percentage value.

  The XX value in the “To level XX at rate YY” command will be the absolute light level, not a percentage. For example, assume the lighting system has levels of 0 to 31, and that the user has set the “maximum light level” configuration setting to 31. When entering commands (or If-Then conditions), the user always enters a % value between 0 and 100. The HomeVision software will then convert this to the nearest level value, and then recalculate the percentage. When the software displays the command, it will display both the level value and a percentage between 0% and 100%. When the controller performs this command, it always uses the absolute level value. For example, level 16 may equate to 50%. The “Light data 1” variable will be set to 16 before the macro runs. This should simplify your macro, as it can transmit a serial message using the actual level value (which is presumably what the lighting system would require).

- For the "level" commands, which require two data values, HomeVision will set the "Light data 2" variable to the second data value (the "YY" value in the command). This will be the "ramp rate" value. See the "Ramp Rates" paragraph for an explanation of the rate value. For the "refresh" command, the second data value isn't used. For all other commands, this byte will hold the current light level (prior to any changes the command might make).

After setting these variables to specify the user's command, the controller will then adjust its internal level-tracking variable appropriately. Finally, it will run the macro. The macro must use the six variables, determine the appropriate command to send to the external lighting system controller, and then perform those commands. Following is an example.

3.4.2 Example

Assume the lighting system is controlled by a simple serial protocol. Assume it supports only 4 commands:

- Off
- On
- Level ##
- Scene ##

Assume that to perform these commands, you must transmit serial messages in the following formats (where "AA" is the address of the desired light and "##" is the desired level or scene number, in decimal, not hex, format):

- Light AA off
- Light AA on
- Light AA level ##
- Scene ##

Further assume you created the following six variables:

- Variable 200, "Light ID number"
- Variable 201, "Light address"
- Variable 202, "Light extra byte"
- Variable 203, "Light command"
- Variable 204, "Light data 1"
- Variable 205, "Light data 2"

Following is an example macro that implements this serial protocol over serial port 2:

```
If
   Var #203 (Light command) = 0
Then
   Serial port 2 transmit: “Light ”
   Serial port 2 transmit: Var #201 (Light address) value as 3 ASCII bytes
   Serial port 2 transmit: “ off”
   Serial port 2 transmit: Carriage return and line feed
End If

If
   Var #203 (Light command) = 1
```

```
Then
   Serial port 2 transmit: “Light ”
   Serial port 2 transmit: Var #201 (Light address) value as 3 ASCII bytes
   Serial port 2 transmit: “ on”
   Serial port 2 transmit: Carriage return and line feed
End If

If
   Var #203 (Light command) = 5
Then
   Serial port 2 transmit: “Light ”
   Serial port 2 transmit: Var #201 (Light address) value as 3 ASCII bytes
   Serial port 2 transmit: “ level ”
   Serial port 2 transmit: Var #204 (Light data 1) value as 3 ASCII bytes
   Serial port 2 transmit: Carriage return and line feed
End If

If
   Var #203 (Light command) = 7
Then
   Serial port 2 transmit: “Scene ”
   Serial port 2 transmit: Var #204 (Light data 1) value as 3 ASCII bytes
   Serial port 2 transmit: Carriage return and line feed
End If
```

This macro checks the “Light command” variable to determine the command. For each of the four supported commands, it then transmits the appropriate serial message out serial port # 2. That’s all there is to it. Note that three variables (“Light ID number”, “Light extra byte”, and “Light data 2”) are not used by the macro. That’s OK. These variables are available to the macro to use if necessary, but may not be needed by your lighting system.

3.4.3 Adjusting Tracking Level

For many of the lighting commands, the HomeVision controller will automatically adjust its internal level-tracking variable to the level it thinks the light will go to. As discussed previously, this level may be incorrect. It is possible for the macro to override the standard level-tracking behavior to correct such problems. This is possible because the macro runs ***after*** HomeVision sets the tracking variable, so the macro can then change it. This is done by having the macro specifically set the tracking state using one of the following commands:

- Light ## set state to OFF
- Light ## set state to ON at level XX
- Light ## set state to ON at level in variable XX
- Light ## set state to ON at unknown level
- Light ## set state to UNKNOWN
- Set state of current light to OFF
- Set state of current light to ON at level in variable XX

The first five commands require entering the ID number of the light to control. In contrast, the last two commands always affect the “current light”, as will be discussed shortly.

As an example, assume the lighting system has levels of 0 to 31, and that the user has set the “maximum light level” configuration setting to 31. Assume that all the lights are programmed to go to level 16 (i.e., 50%) when they receive an ON command. By default, HomeVision will set the tracking level to 31 when an ON command is performed. You can override this putting the following commands in your macro (inside of the actions performed when an ON command is received):

```
If
   Var #203 (Light command) = 1
Then
   Var #5 (Level) = 16
   Lighting: Set state of current light to ON at level in var #5 (Level)
End If
```

The IF statement checks to see if this is an ON command (command number 1), which is the only command where we need to override HomeVision's default behavior. If it is, the first command sets a temporary variable to the correct full-on level value (not percentage). The second command then sets HomeVision's internal level tracking variable to the value of the temporary variable, which contains the desired value of 16. In this way, you've overridden HomeVision's level-tracking value. Remember that when doing this, you should set the absolute level (16), not the percentage (50%).

Note that the lighting command shown above doesn't allow the user to specify a particular lighting address. Instead, it always uses the "current light" (the light most recently used). For example, if the schedule includes a command to turn on light number 8, then while the command is performed (and until the next light command is performed), light number 8 is the "current light". When HomeVision runs the macro for that command, light 8 will still be the current light. So when the macro performs the "Set state of current light to ON at level in variable XX" command, it will be setting the state of light number 8. In this way, the above two commands are all that are needed to make HomeVision know that all lights turn on at level 16. No matter which light was turned on, this code will set the level to 16.

It is also possible that a user may have programmed different lights to turn on at different levels (rather than all turning on at the same level, as assumed in the above example). This could be handled by having the macro look at the light's ID number, and then set the level accordingly. Here's an example:

```
If
   Var #203 (Light command) = 1
Then
   If
      Var #200 (Light number) = 0
   Then
      Var #5 (Level) = 16
      Light #0 (Hall light): Set state to On at level in var #5 (Level)
   End If
   If
      Var #200 (Light number) = 1
   Then
      Var #5 (Level) = 31
      Light #1 (Den light): Set state to On at level in var #5 (Level)
   End If
   If
      Var #200 (Light number) = 2
   Then
      Var #5 (Level) = 25
      Light #2 (Porch): Set state to On at level in var #5 (Level)
   End If
End If
```

As with the previous example, the first IF statement checks to see if this is an ON command. If it is, a series of IF-THEN statements check the ID number of the light. Each THEN section has two commands. The first command sets a temporary variable to the correct full-on level value, which can be different for each light. The second command then sets that light's level tracking variable to the value of the temporary variable. Note that this is a different command than in the previous example. This command requires the user to enter the ID number of the light, while the other command always used the current light. The first example requires fewer schedule lines, but the second example allows HomeVision to properly track the levels even if each light turns on at a different level.

3.4.4 Tips for Writing Macro

Following are some tips for those writing a macro to control an external lighting system:

- The following lighting commands ***must not*** be used inside the macro. If one is, it could cause an endless loop where the lighting command will cause the macro to run again, which causes the lighting command to be performed again, and so on. However, the macro ***can*** perform any of the other lighting commands.

  - Off
  - On
  - Toggle
  - Brighten
  - Dim
  - To level XX at rate YY
  - To level in variable XX at rate YY
  - Select scene XX
  - Refresh light

- It is expected that a macro only needs to be created one time for a particular lighting system. After it's created, other users should be able to copy the macro and paste it into their schedule. However, for this to work well, the variables used by the macro must not conflict with already-used variables. If they do conflict, the user would have to edit the macro to use different variables. It would be easy to make a mistake, so this situation should be avoided if possible. One approach is to create the macro using very high variable numbers, perhaps even variables 249 through 254 (the highest-possible values). It is unlikely many users are using these variables. The user would then have to add variables (using the "Add" button on the Variable Summary Screen") until all 255 were added. At this point, the macro could safely use these variables. Since it is possible to copy and paste an entire macro from one schedule to another, the user wouldn't have to reenter or edit the macro (which might be very complex).

3.4.5 UPB Control

Powerline Control Systems makes Universal Powerline Bus (UPB) lighting devices. HomeVision can control these devices by using this User-Created Macro and Variables Method. We've written macros that perform these functions. More information is available on the HomeVision web site (http://www.csi3.com/UPB.htm).