JP1 For Beginners

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By Tommy N. Tyler

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1. INTRODUCTION

If you browse through the JP1 site you'll find several guides and instructions on how to use available software to program remote controls. JP1 is primarily a hackers' forum, so it is appropriate that much of this information is written on a fairly high level. It is to a relatively small group of talented and dedicated hackers that we are indebted for the knowledge of how to do amazing things with an interface and a few pieces of software. These guys can talk to each other with a level of understanding that doesn't require explaining every detail.

But I'm not a hacker, and I've had to struggle with some of the concepts involved. There's also a growing number of members who want to use JP1 technology on a fast learning curve, which means finding all the information they need quickly, in one place. It is probably hopeless to expect that anyone without computer literacy and some technical experience will ever be able to deal with the complexities of customizing remote controls, and that's not the goal of these instructions. But I will explain as simply as I can, using detailed examples, the steps involved in using the **IR** program to upload changes to a remote, and those for creating an upgrade spreadsheet. My qualifications for doing this are the experience gained by asking a million questions before I could do it myself.

For some time now I've been collecting messages passed through the forum to get an idea of the kinds of questions that confront many first-time users. These instructions borrow shamelessly from Chris Nappi's JP1 Device Upgrade Code Guide, his JP1 FAQ, Rob Crowe's Instructions for Using the Keymap-Master Spreadsheet and his Readme file, and contributions from Jim Henry, Ellen Tunstall, and too many others to mention. To all these people I acknowledge true authorship of this document. I consider myself just an editor. And a special thanks to Rob for proofreading this and helping so much to make it sound like I know what I'm talking about.

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2. GETTING STARTED

Perhaps one of the most frequently asked questions is "How do I get started?" The very first thing you should do is familiarize yourself with the wealth of information available at **http://www.hifi-remote.com/jp1/faq.shtml** and **http://www.hifi-remote.com/jp1/upgrade.shtml**. If you haven't already done so you should join the JP1 Group at **http://groups.yahoo.com/group/jp1**. Read as many of the forum messages as you can to get ideas of how other members are using their remotes and the kinds of problems discussed. This is the place to go for help if you can't find information on an obscure or new consumer product you would like to add to your remote control, but only after you have researched it yourself and looked in all the places suggested in the above web sites. As a JP1 member you'll have access to many files related to the hardware and software needed for programming a remote. If you need help with some of the jargon there's a **Glossary of Terms** at the end of these instructions.

One of your first tasks will be to acquire an interface for connecting your remote to your PC. They are relatively easy to build if you know how to use a soldering iron. Otherwise, get a friend or relative with some experience in this area to make one for you. There are several designs in the **Files>Interface Designs** folder at the JP1 site. They all have complete parts lists and illustrated step-by-step details on how to assemble them. A good choice is the "Simple" interface, so-called because it has so few parts and is so easy to build. The parts cost for one of these can be less than $5. You can also purchase one from the suppliers listed at **http://groups.yahoo.com/group/jp1/database** in the seller's area.

There are three or four key pieces of software required, and one of these will be necessary to checkout your interface to make sure it is functioning properly. So while you're in the neighborhood downloading interface construction plans, download a few software programs as well. The first program you'll need is **IR3.01.zip** (or latest), which you can download from the **Files>Programs** folder at the JP1 site. When you unzip this package you will find **IR.exe** bundled with about a dozen **RDF** files (Remote Definition Files) for the different model remotes supported. The **RDF** file for any remote you are programming *MUST* reside in the same directory as **IR.exe**. You won't use these files directly, but **IR** must have access to them to identify and work with a remote.

For adding a device to your remote you will need three spreadsheet files: **Keymap-Master.zip**, **Devices4.zip**, and **Devices.zip**. These can all be downloaded from the **Files>Spreadsheets** folder at the JP1 site. You must have either **Excel 97, Excel 2000**, or **Excel XP** installed in your computer to use these spreadsheets. You will also need to have analysis toolpak addin enabled. Even if you don't have Excel you can still do a lot of programming using just **IR** alone.
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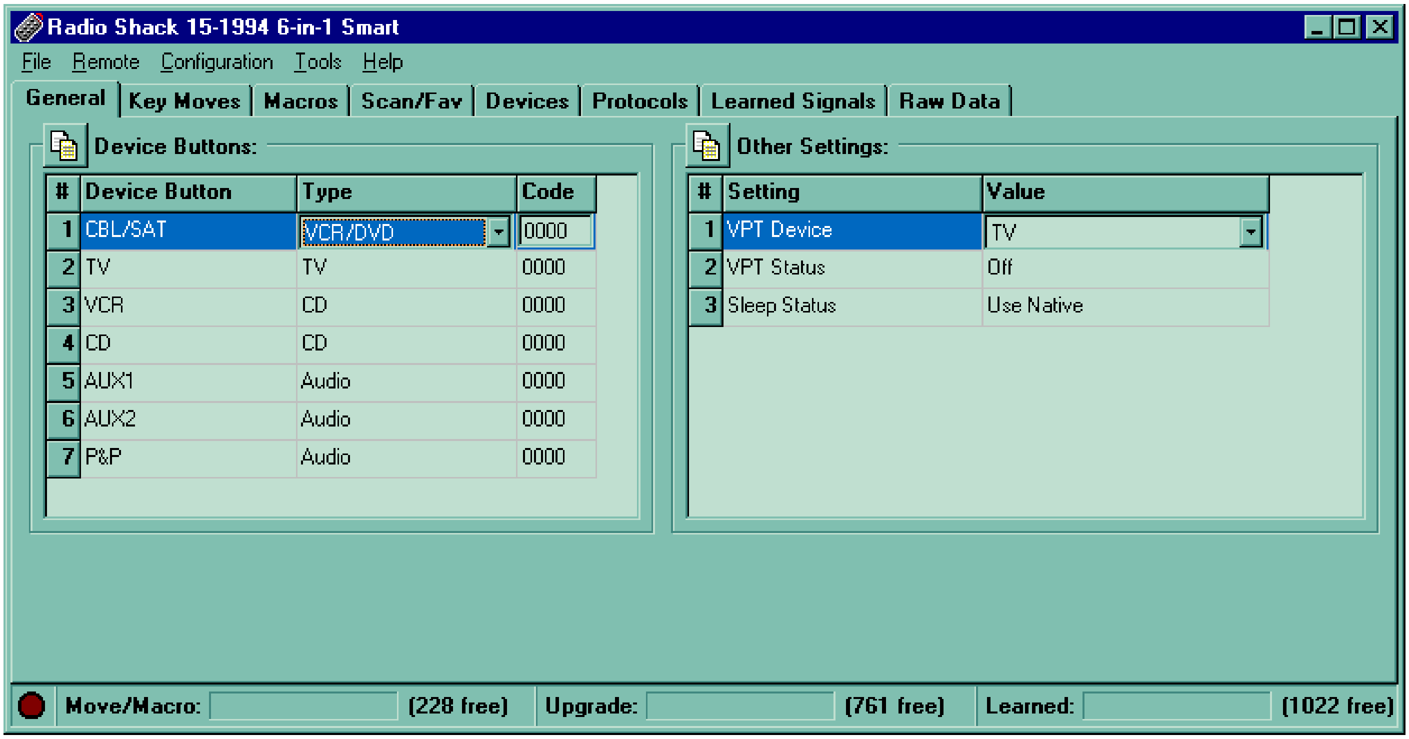
3. DOWNLOADING A REMOTE

The first time you open **IR** the display will probably look like Figure 1. The left portion of the display shows the **Device** buttons for the model remote identified in the title bar. This default display is for a **Radio Shack 15-1994** remote, and shows seven device keys, **Device 1 [CBL/SAT]** through **Device 7 [P&P]**. Other model remotes will show devices appropriate for that remote. When we download our remote, **IR** will identify it (using its library of RDF files) and automatically change this portion of the display to correspond. Thereafter, each time **IR** runs it saves configuration information in the Windows Registry (Figure 2). Included in this information is the RDF filename of the last remote downloaded, so you won't have to reconfigure it every time you use it.



Device Buttons:

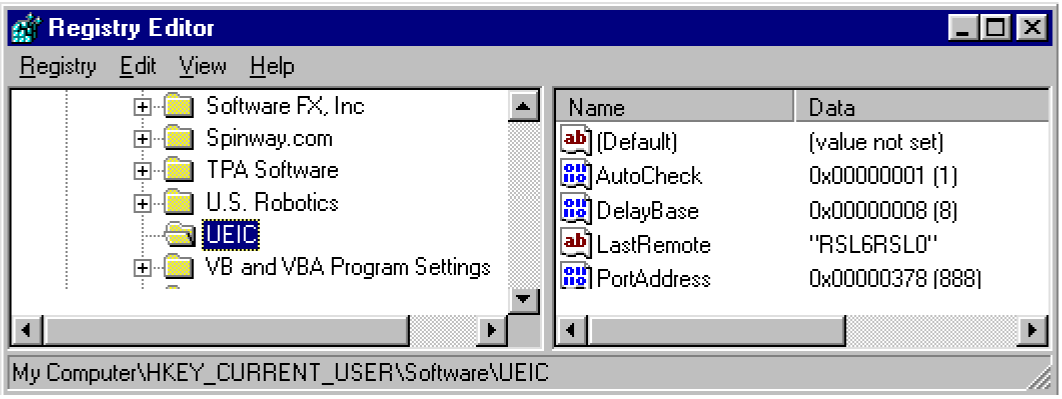
#	Device Button	Type	Code
1	CBL/SAT	VCR/DVD	0000
2	TV	TV	0000
3	VCR	CD	0000
4	CD	CD	0000
5	AUX1	Audio	0000
6	AUX2	Audio	0000
7	P&P	Audio	0000

Other Settings:

#	Setting	Value
1	VPT Device	TV
2	VPT Status	Off
3	Sleep Status	Use Native

Move/Macro: (228 free) Upgrade: (761 free) Learned: (1022 free)

Figure 1. Typical IR Start-up Screen



Software FX, Inc
Spinway.com
TPA Software
U.S. Robotics
UEIC
VB and VBA Program Settings

Name	Data
(Default)	(value not set)
AutoCheck	0x00000001 (1)
DelayBase	0x00000008 (8)
LastRemote	"RSL6RSL0"
PortAddress	0x00000378 (888)

My Computer\HKEY_CURRENT_USER\Software\UEIC

Figure 2. Registry Display Showing IR Configuration Information

Plug your interface into the PC but leave the remote disconnected. Drop down the **Configuration** menu (Figure 3) and you'll notice a checkmark beside **Auto Check**. That means every time you start to do an upload or download IR will automatically run the **Check Interface** test. This is a routine that confirms the interface is detected at the selected parallel port and is communicating with the remote. Unless you have problems with the auto check you'll probably just leave it checked. To de-select **Auto Check**, click on it. You can still run the test any time you want to by selecting **Check Interface** in the **Configuration** menu, or you can restore the **Auto Check** feature by just clicking it.

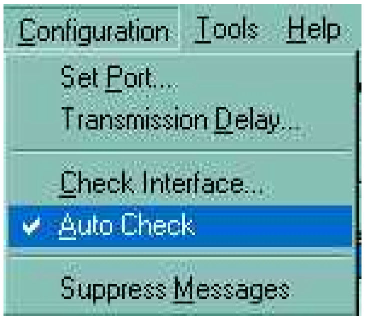
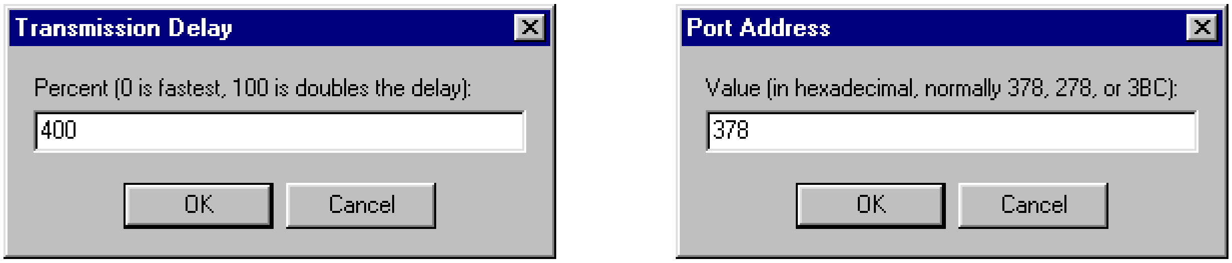


Figure 3. Configuration Menu

If you have a problem communicating with the remote you may need to adjust the following parameters. On the **Configuration** menu select **Transmission Delay** (Figure 4) and change it **400** to start, which slows things down a bit so we're not trying to outrun the interface. You may have to adjust it a few times to get a setting that works for your remote/interface/computer. Also change the **Port Address** if the default value (**378**) is not the address of the port you're working with. Be sure you're plugged into a parallel port (like the one your printer is normally connected to) and not a serial port. If you don't know your parallel port address and can't find out by reference to the documentation that came with your computer, you can try each of the three settings in the **Port Address** selection box and see which one responds to the **Check Interface** test.



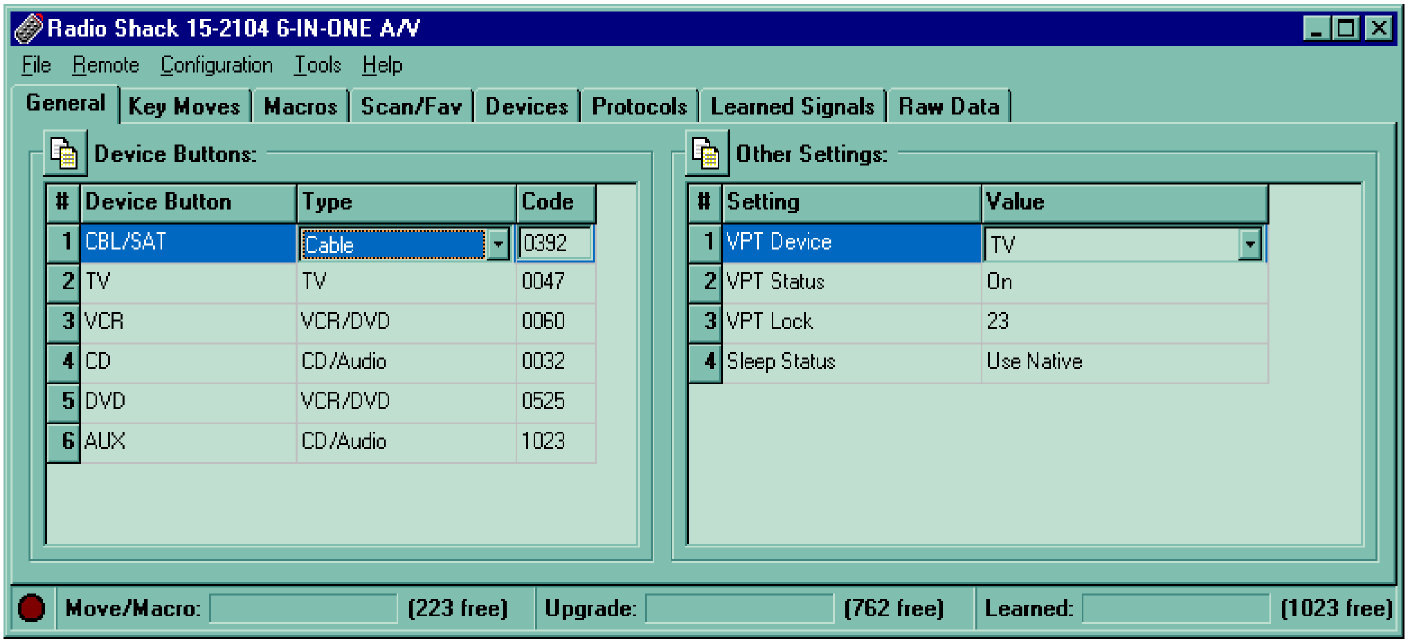
Percent (0 is fastest, 100 is doubles the delay): 400

Value (in hexadecimal, normally 378, 278, or 3BC): 378

Figure 4. Setting the Transmission Delay and Port Address

Unless things change, you won't have to do any of this again because of the Registry file mentioned earlier. To make sure everything is setup and ready to go, run the interface test. You must be able to pass this test or you won't be able to download your remote. Plug the interface into the remote (check for proper orientation) and click on **Check Interface** and then the **OK** button in the **Confirm** window. When you see a message that says, **"The remote interface check succeeded. . . .** " you have successfully passed the test. If you have problems passing this test make note of the error message and refer to the troubleshooting information included with the instructions for building your interface.

From the main display, drop down the **Remote** menu and click on **Download from Remote**. Normally when **IR** completes a download and releases its reset of the remote, the red LED blinks twice to indicate the remote has been re-enabled. There are some circumstances where the LED doesn't blink, and in that case you must unplug the remote before you can use it. The causes of this and possible remedies are discussed in detail elsewhere, so we won't elaborate on it here. Just keep in mind that it does not interfere with upload or download. To compensate for this, **IR** simulates the LED with a little red dot at lower left of the display. When that dot blinks after about two seconds you know the operation has been completed successfully. Otherwise you'll usually see error messages displayed.



Device Buttons:

#	Device Button	Type	Code
1	CBL/SAT	Cable	0392
2	TV	TV	0047
3	VCR	VCR/DVD	0060
4	CD	CD/Audio	0032
5	DVD	VCR/DVD	0525
6	AUX	CD/Audio	1023

Other Settings:

#	Setting	Value
1	VPT Device	TV
2	VPT Status	On
3	VPT Lock	23
4	Sleep Status	Use Native

● Move/Macro: (223 free) Upgrade: (762 free) Learned: (1023 free)

Figure 5. Initial Download from RS 15-2104

Figure 5 shows the **IR** display after we complete our download. (Of course if you're following along with a different remote the display may look different from that shown.) Notice the title bar now identifies the remote we're using for demonstration. This remote happens to have six **Device** buttons. The name under the **Device** number is the label of that device button permanently marked on the remote, and you can see that **Devices 5** and **6** are marked differently on the 15-2104 than they were on the 15-1994. The name in the drop-down menu immediately to the right of that is the **Type** of device presently assigned to that button, and the **Code** number to the right of that is the **Setup Code** for the assigned device. The six **Setup Codes** you see here are factory default selections. These are in ROM, so any time you clear the remote's memory to start over this is what you'll get. The odds are pretty slim that any of these are of use to you, but of course that's why UEIC gave you an owner's manual with lists of **Setup Codes**.

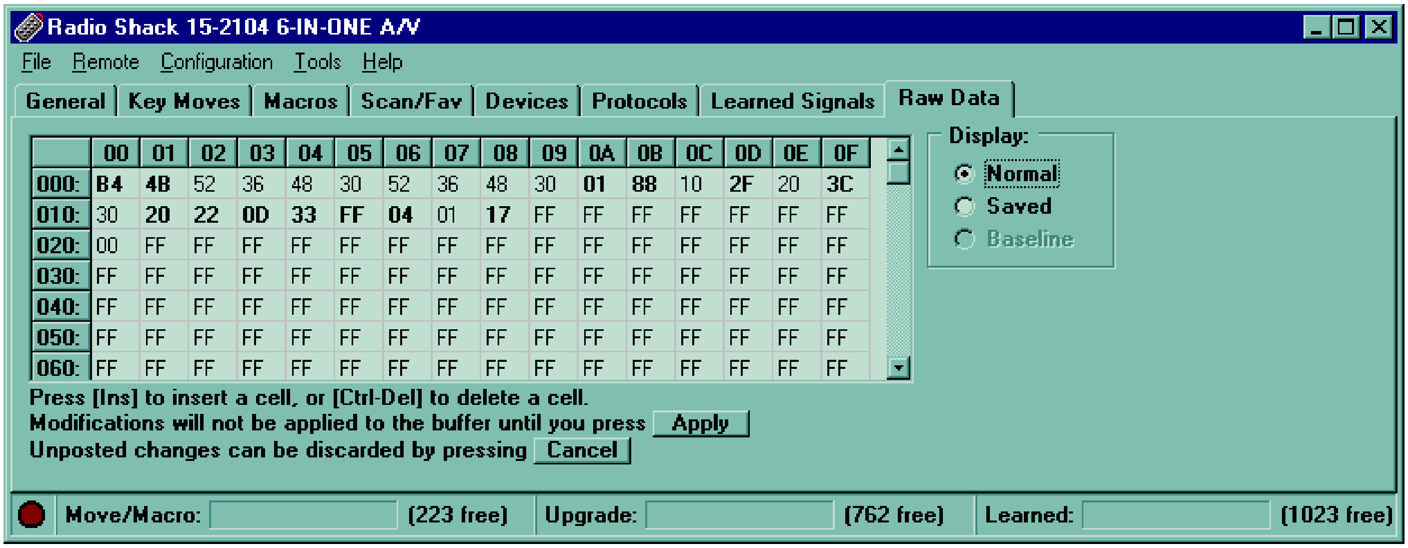
The other settings window contains items such as the **Volume Punch-Thru (VPT) Device** and **Sleep Function.** The **VPT Device** allows you to select one device to which all volume and mute commands will be sent. The **VPT Status** allows you to turn the VPT on or off. The VPT Lock box sets the VPT to a particular area in memory, in the 2104 its hex $17 or dec 23. In most remotes, Volume Punch-Thru (VPT) works only in **TV**, **VCR**, and **CBL/SAT** modes.

The **Move/Macro**, **Upgrade**, and **Learned** displays across the bottom of the screen provide bar graphs showing the relative amounts of special programming memory used, and the values in parentheses show the exact number of bytes of free memory remaining in each partition. This makes it easy to tell if you're nearing the limit of memory as you modify and upgrade your remote.

The lower portion of the main display is devoted to eight pages of data, which are accessed by clicking on the tabs. Try this now to get an idea what the pages look like. Here's a brief description of the contents.

TAB NAME	WHAT IT SHOWS
General	All device buttons and their settings as well as any other settings pertaining to them.
Key Moves	All buttons that have **Advanced Codes (EFC's)** assigned.
Macros	Macros that have been created, showing bound keys and command sequences.
Scan/Fav	Scan lists (applies only to remotes with **SCAN/FAV** button, such as 15-1994).
Devices	All upgrade devices added to the remote, a keymap for each, and some other data.
Protocols	Any protocols that have been added to the remote.
Learned Codes	Buttons that have been programmed using the learning feature.
Raw Data	Contents of the remote's EEPROM and locations of important pieces of data.

Initially all the pages are blank except the **Raw Data** page, a portion of which is shown below. This page shows the



	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000:	**B4**	**4B**	52	36	48	30	52	36	48	30	**01**	**88**	10	**2F**	20	**3C**
010:	30	**20**	**22**	**0D**	**33**	**FF**	**04**	01	**17**	FF	FF	FF	FF	FF	FF	FF
020:	00	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
030:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
040:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
050:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
060:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

Display:
● Normal
○ Saved
○ Baseline

Press [Ins] to insert a cell, or [Ctrl-Del] to delete a cell.
Modifications will not be applied to the buffer until you press Apply
Unposted changes can be discarded by pressing Cancel

Move/Macro: (223 free) Upgrade: (762 free) Learned: (1023 free)

Figure 6. Portion of Raw Data Display

EEPROM contents in **hexadecimal** format, starting at address **000** and ending at the ending address of the remote. This page is fun to look at and see how the memory changes as our remote's features evolve, but you should not change anything here. The Bold numbers are the areas that have been changed since the last download of the remote.

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4. SELECTING DEVICE SETUP CODES

Rather than manually selecting our device **Setup Codes** using the **SETUP** button, we'll do it with **IR**. It's not only faster and easier, you also create a text file that can be saved for backup or cloning. Once you've learned how much fun it is to program your remote you'll be using this file again and again to experiment with changes. In fact, you should adopt a good file naming system at the outset so that you can keep track of experimental configurations. When you start a session with **IR** just click on **File>Open>**, select your file, and you'll be right back where you last left off.

If you've already done some manual programming, or if you do any later, it will show up in a download. If you're just starting out and this is your first experience with JP1 programming, your first download presents an opportunity. Suppose, for example, you've invested a lot of time searching out **Setup Codes** for your equipment, and perhaps manually tweaking a few key moves, macros, etc., to get them just the way you like. Once you've made a download of your remote those changes can be preserved forever in an **IR** text file. The chances are you'll accomplish all that and more, with greater efficiency, after you start using **IR**. But you'll have the comfort of knowing you can always upload that file and get back to square one, if worse comes to worse. And you can throw away all those scribbled notes on scraps of paper because any time you want to see how your remote is programmed it's all right there on the screen.

For purposes of our example let's assume we're setting up our remote to control a home theater system containing the components shown in Figure 7. Looking in the Cinema 7 owners manual we find three different **Setup Codes** for

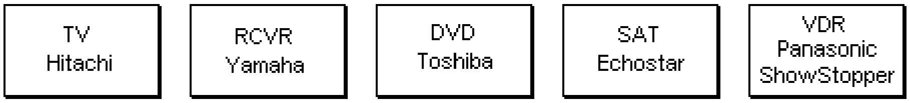
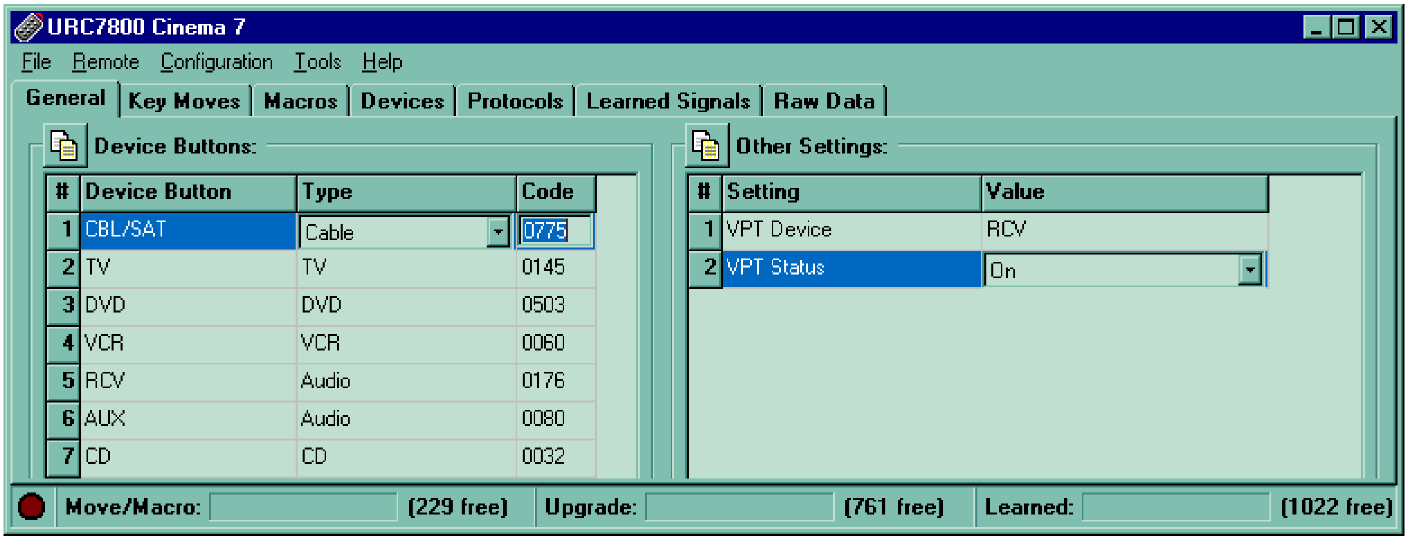


Figure 7. Example Home Theater System

Hitachi TV's, two for Yamaha receivers, and one each for our Toshiba DVD and Echostar satellite receiver. There are lots of Panasonic VCR codes but these probably won't work with our ShowStopper (Panasonic's version of ReplayTV). We'll deal with that later. Finding which of several codes is the right one is no different with **IR** than doing it manually, you just have to try them. As long as we're going to do an upload we may as well take a guess at **Setup Codes** for all the components at one time and see if we get lucky. Since we want our TV to be selected by the button marked **TV** on the remote, we type the Hitachi TV **Setup Code** (0145) in the **Code** cell for **Device 2 [TV]**. Likewise, type the Yamaha receiver **Setup Code** (0176) in the **Code** cell for **Device 5 [RCV]**, and the Echostar **Setup Code** (0775) in the **Code** cell for **Device 1 [CBL/SAT]**. The Toshiba DVD **Setup Code** (0503) already appears in the **Code** cell for **Device 3 [DVD]** because that's the default device for a Cinema 7 remote. We don't yet have a need for **Devices 6** or **7** so we'll just leave those for now. While we're at it let's assign the A/V receiver as our master audio control. Drop down the **VPT Device** menu, select **RCV** for **Value**, and set the **VPT Status** to **On**. The upper portion of our display now looks like Figure 8.



#	Device Button	Type	Code
1	CBL/SAT	Cable	0775
2	TV	TV	0145
3	DVD	DVD	0503
4	VCR	VCR	0060
5	RCV	Audio	0176
6	AUX	Audio	0080
7	CD	CD	0032

#	Setting	Value
1	VPT Device	RCV
2	VPT Status	On

Move/Macro: (229 free) Upgrade: (761 free) Learned: (1022 free)

Figure 8. Main Display After Selecting Setup Codes

You may notice the **Type** of device shown for **Device 1** is **Cable**, and that for **Device 5** is **Audio**. If you drop down any of the **Type** menu's you'll see that the Cinema 7 remote supports six device types, whereas a 15-1994 remote supports only five because it combines **VCR/DVD**. In both these remotes, satellite receivers fall within the **Cable** group and receivers and tuners fall within the **Audio** group. Some remotes with only three or four device buttons group **CD** together with **Audio**. But regardless of how many device types your remote supports you can assign any one of them to any device button. It doesn't have to agree with the name for that button on the remote. It wouldn't make sense to make the **TV** button (**Device 2**) a **VCR**, but nothing prevents it. But suppose we had two **VCR's** in our theater. If we wanted to assign the second one to the **AUX** button (**Device 6**) we would click on the **Type** drop-down menu under **Device 6 [AUX]** and select **VCR**, then enter a **Setup Code**.

We are now ready to upload to the remote and try our **Setup Code** selections. Note: Upload is to the remote and Download is from the remote. Any time you upload, the data in the **IR** session at that moment completely overwrites whatever is in the remote. By the same token, any time you download, whatever is in the remote completely overwrites the data in **IR**. There is no protection against accidental overwriting as there is with file management. So be very careful not to confuse upload with download, and always save a copy of your **IR** text file immediately before uploading and immediately after downloading.

Drop down the **Remote** menu and click on **Upload to Remote**. In a few seconds the little red dot will blink to signal completion of upload. Unplug the remote (if necessary) and see if it works with each device by turning power ON and

OFF, and maybe a few other commands. In our case the first **Setup Codes** we picked from the Hitachi and Yamaha lists just happened to be the right ones for our components, so no changes are necessary. Otherwise we would simply type a new number in the **Code** cells and upload again.
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5. CREATING AN UPGRADE SPREADSHEET

As we learned, there's no **Setup Code** in the Cinema 7 owners manual for any kind of ReplayTV device such as the Panasonic ShowStopper. After a little checking around we learn that **UEIC** has assigned a **Setup Code** (VCR/0616) for ShowStopper but it's only available in newer model remotes. Remember that the **Setup Codes** in the owner's manual are the only ones placed in ROM at the factory, and our Cinema 7 was built before ShowStopper was introduced. If we were to go ahead and enter **Code** 0616 for **Device 3** and upload, the remote would ignore it because it doesn't recognize that code. (A later download would show that **Device 3** had in fact been changed back to the default **Code** 0060 to avoid any confusion about why it didn't work.) We need to upgrade the remote by adding a new **Setup Code** to its repertoire. Then we can assign that code to one of our devices.

The spreadsheet is a tool for creating blocks of code that can be pasted into **IR** and uploaded to a remote to provide it with a new **Setup Code**, which is the process we call "upgrading". There are several reasons we might want to upgrade a remote. The most common is the situation we have here; a device we want to control that is not supported by the remote. Another reason might be that we have done so many key moves and programming of **EFC's** on a supported device that we are running out of memory. The spreadsheet lets us assemble all these changes and assign a new **Setup Code** to them, just as if we were designing a newly manufactured device, then generates upgrade code that is much more compact and efficient so we can do more with less memory.

We will want to pick a 4-digit **Setup Code** number to identify our upgrade. It can actually be any number from 0000 to 2047, but there are a couple of factors to consider. It is generally a good idea to avoid using a number that's the same as one of the built-in **Setup Codes** already used by your remote to identify a device of the same type. By "type" we mean one of the types that you see in the drop-down menu for **Device Type**. If you look through a Cinema 7 owners manual you'll see **Setup Code** 0039 used for three different types of devices: an Emerson TV, an Admiral VCR, and a Marantz receiver. But there's no 0039 **Setup Code** for CD players. Since the Cinema 7 treats CD's as a separate type from Audio, if we were creating a CD upgrade we could use that number. But the simplest way to be sure the number you've picked isn't already supported by your remote is to try manually entering it. If you get two short blinks of the red LED the remote accepted it. That means the remote already knows that **Setup Code**, so you've got to pick another one. If you get one long blink of the LED the remote has rejected that code because it doesn't yet support it, so it's OK to use that number as your new **Setup Code**.

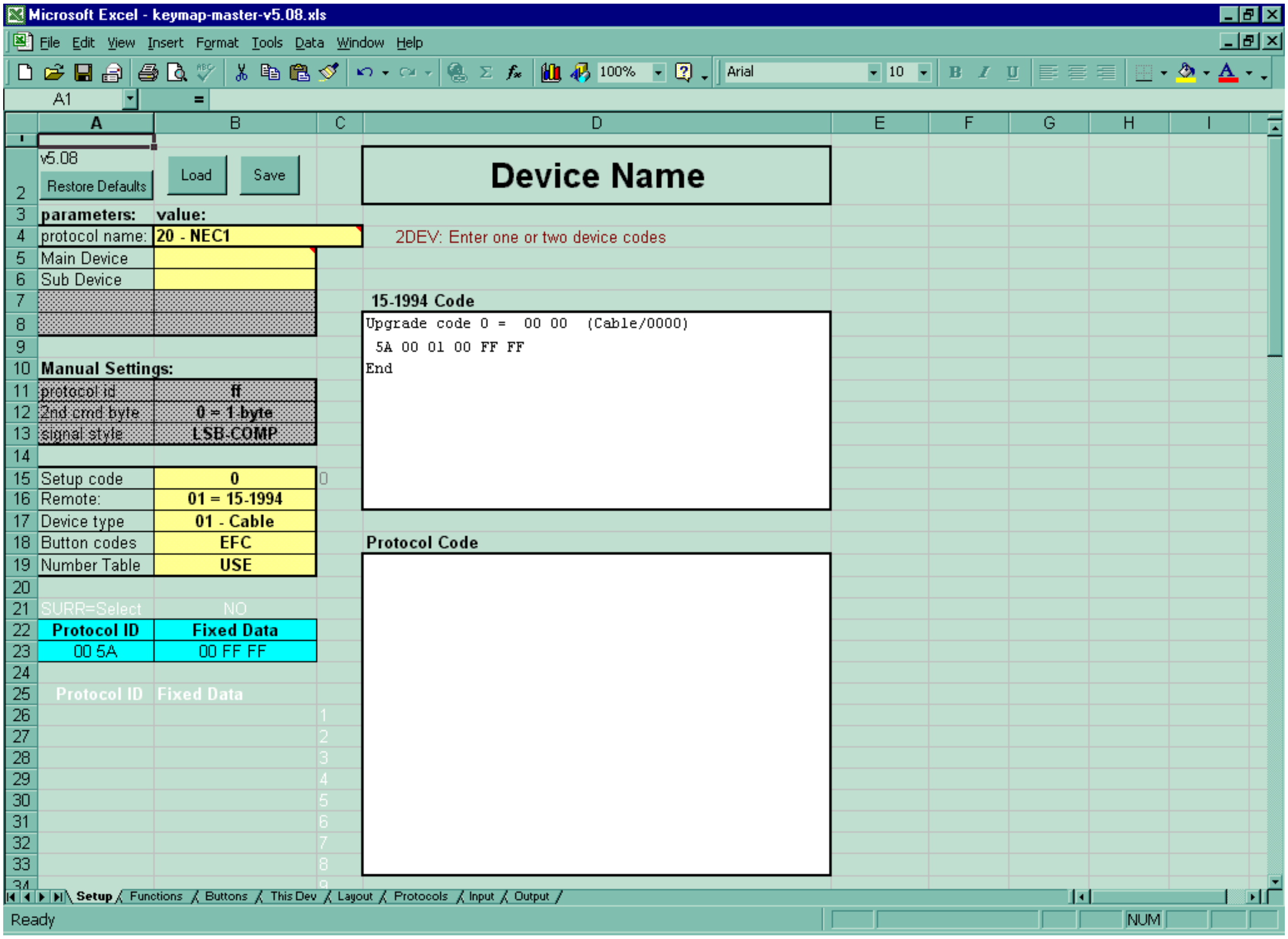
If the upgrade happens to be a modification of a supported device, selecting a different number will keep both **Setup Codes** accessible, which might come in handy for troubleshooting the new upgrade as well as avoiding confusing the two. For example, suppose we wanted to create an upgrade for our Hitachi TV, not because it's an unsupported device as is the case with ShowStopper, but just to remap some button functions or add a function that wasn't supported by the OEM remote. A very common practice when modifying a built-in **Setup Code** like this is to give it a number 1000 higher than the original number, in this case, 1145 for an upgrade of our 0145 Hitachi TV.

On the other hand, if the upgrade is an unsupported device, but one for which UEIC has already established a **Setup Code**, its not a bad idea to use the number they have already assigned. In our case the **Setup Code UEIC** has assigned to ShowStopper is VCR/0616, so that's the code we'll use.

Before using the spreadsheet to create a new **Setup Code** from scratch you should first check the JP1 Files section to see if someone has already setup a spreadsheet for the device you are trying to add. Many of the popular new devices, such as TiVo, ReplayTV, Dishplayer, etc., have already been programmed on a few types of remotes. If you find one that has been setup for a different type of remote you may be able to adapt it to your needs by just changing the remote to the one you're using. One word of advice. If you encounter problems when trying to use a spreadsheet that was prepared on an early version of **Keymap-Master**, try downloading the latest version and copy the data over to it to see if that solves the problem. If you look through the revision list on the **Setup** page of the latest version you may even see an update mentioned that relates to the problem you're having. Even if there isn't a spreadsheet for your exact device, it might help to take a look at someone else's spreadsheet before you attempt to create a new **Setup Code** for the first time. In our case there are some relevant spreadsheets on file, but we'll pretend we can't find one for the ShowStopper for the sake of our exercise.

If you've already downloaded the three spreadsheet files mentioned in section 2 you're all set. Otherwise, do that now. The one we'll use to create the upgrade is **Keymap-Master-v5.08** (which was the latest version at the time this was written), and when I refer to "the spreadsheet" that's the one I mean. The other two are for reference when we need certain information. Make sure you install the **Excel Analysis ToolPak**. Click on **Tools**>**Add-Ins** and select **Analysis Toolpak** and **Analysis Toolpak - VBA**.

Although you must have **Excel** installed in your computer to use the spreadsheet, you don't really have to be proficient in using **Excel**. The reason for this is that the spreadsheet is designed as a form that you fill in by typing values and pulling down selection menus. It is very intuitive and has many explanatory notes and pop up text labels. All the work is done in the background as fast as you enter data. There are, to be sure, many places in the spreadsheet where serious hackers can override the form with manual entries, but these instructions will avoid those areas.



v5.08

Device Name

parameters:	value:
protocol name:	20 - NEC1
Main Device	
Sub Device	
Manual Settings:	
protocol id	ff
2nd cmd byte	0 = 1 byte
signal style	LSB-COMP
Setup code	0
Remote:	01 = 15-1994
Device type	01 - Cable
Button codes	EFC
Number Table	USE
SURR=Select	NO
Protocol ID	Fixed Data
00 5A	00 FF FF
Protocol ID	Fixed Data

2DEV: Enter one or two device codes

15-1994 Code

```
Upgrade code 0 =  00 00  (Cable/0000)
 5A 00 01 00 FF FF
End
```

Protocol Code

Figure 9. Keymap-Master Setup Page

When you start **Keymap-Master** you'll see a display somewhat like Figure 9. The reason there's already data in the **Upgrade Code** box is that the spreadsheet automatically calculates the code for whatever upgrade parameters are shown in the display. The default configuration just happens to represent adding a Cable device in the 'Device Type' cell (B17) with **Setup Code** 0000 in the 'setup code' cell (B15) to a Radio Shack 15-1994 remote in the 'remote' cell (B16). You will see the code change each time we modify one of these parameters to match our situation. The box labeled **Protocol Code** will remain blank unless the spreadsheet determines that a protocol upgrade is required by your remote.

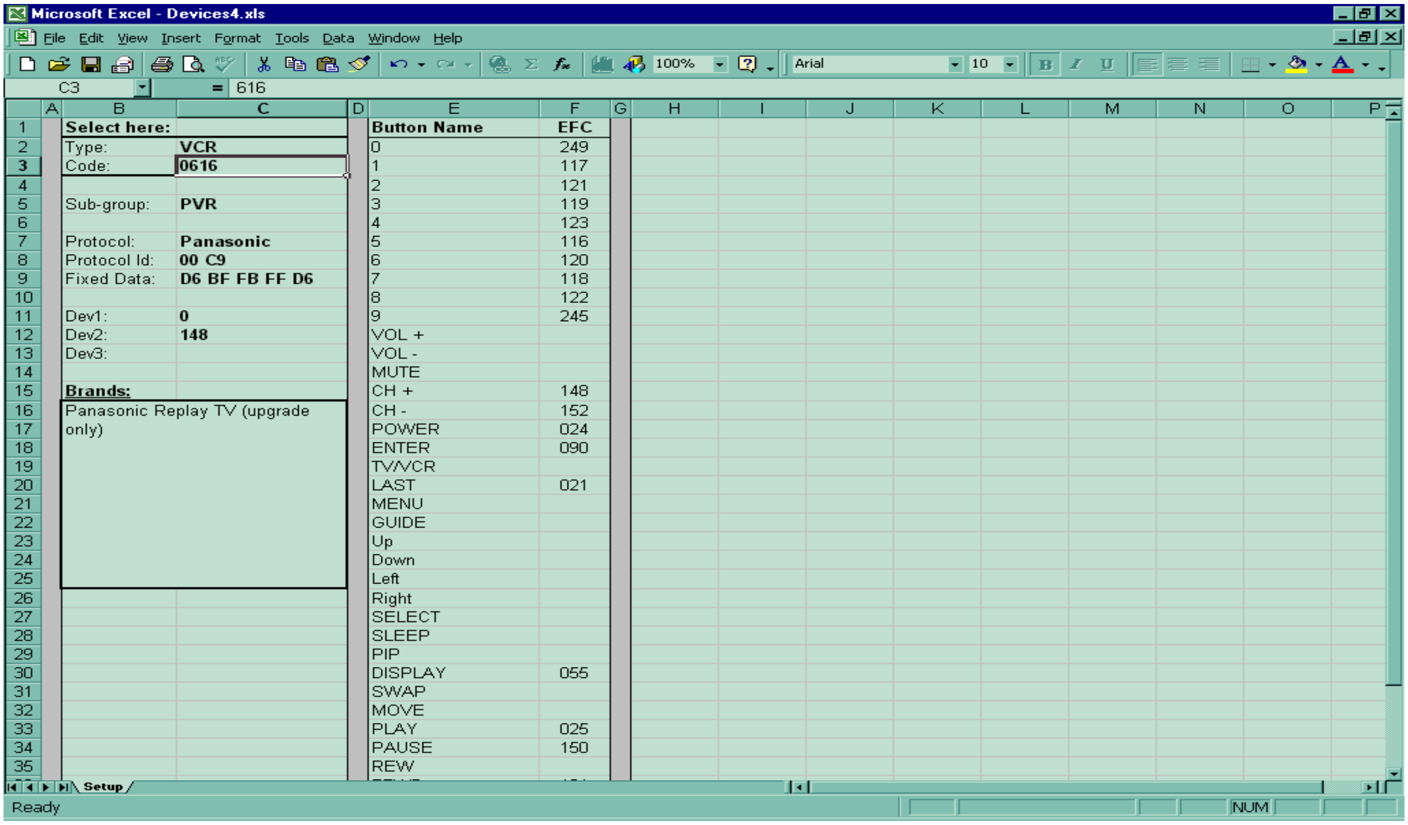
The first prerequisite to using the spreadsheet, is knowing the code for every function that will be used to control the upgrade device, usually in **EFC** format. You can also work with **OBC** codes, but these are not as readily available so we won't use them. Most people will have **EFC** codes that they got from published lists on the web or from **UEIC**, or from the **Devices4.xls** spreadsheet. Another method sometimes necessary to get **EFC** codes is to use your remote to "learn" the buttons from an OEM remote, download, and read their descriptions off the **Learned Codes** page. To obtain **EFC's** for all the buttons of an OEM remote requires several passes because, as we saw at the bottom of Figures 1 and 5, the **Learned** memory partition is only 1022 bytes, which limits you to learning approximately two dozen buttons at a time.

Another prerequisite is that you know the protocol for controlling the upgrade device. Simply stated, a protocol specifies how the remote communicates with a certain device, including such things as infrared carrier frequency, bit timing, message organization, etc. At present, the spreadsheet knows and supports over 50 different protocols, each with a distinctive name, and more are constantly being added. The **Devices** spreadsheet is a handy resource for obtaining protocol information on a great many devices.

Notice the row of tabs across the bottom of the spreadsheet, for selecting pages. The **Setup** page is where you specify the device this upgrade is for, and the remote you're using. It's also the output page for all the work done by the spreadsheet. The **Functions** page shows all the control functions available, and the **Buttons** page shows how they are mapped to various buttons. Most of your work can be accomplished using only these three pages.

For reasons explained previously, we've decided to use **Setup Code** 0616 to identify our VCR upgrade. We'll start by replacing **Device Name** in the 'Device Name' cell (D2) with the name **0616 ShowStopper**. We can also use that as the filename when we save the spreadsheet. Click on **'Setup Code'** cell (B15) and enter **0616**. Click on **'Remote'** cell (B16), drop down the menu, and select **02 = URC-7800/6800**. Click on the **'Device type'** cell (B17), drop down the menu, and select **03 - VCR**. (Note: The Device type specified for an upgrade does not have to correspond to the actual type of device. We could have selected 01 - Cable or 02 - TV, for example.) Leave **Button codes** set on **EFC** because that's the type of data we'll be using. Also leave the **Number Table** set on **USE**. A **Number Table** is a standardized method of handling numeral buttons that uses less memory. Always try to use the **Number Table** unless you have problems with it or you know it doesn't apply.

Open the **Devices4.xls** spreadsheet as a second file so that you can easily switch between it and the upgrade spreadsheet. This is where we'll get the remaining data for the spreadsheet, including **Protocol** name, device codes, and button codes. After selecting **VCR** beside the 'Type' cell (C2) (always select the **Type** with the drop-down menu, don't try and type it in) and typing **0616** in the 'Code:' cell (C3) the display should look like Figure 10. (Be sure to hit **Enter** after typing in the **Setup Code** number.)


Microsoft Excel - Devices4.xls
File Edit View Insert Format Tools Data Window Help
100%
Arial
10
C3
= 616
Setup
Ready
NUM

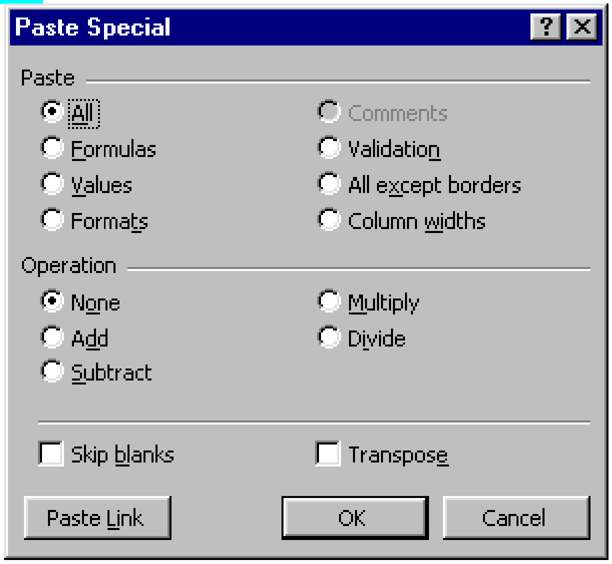
	B	C	E	F
1	**Select here:**		**Button Name**	**EFC**
2	Type:	**VCR**	0	249
3	Code:	**0616**	1	117
4			2	121
5	Sub-group:	**PVR**	3	119
6			4	123
7	Protocol:	**Panasonic**	5	116
8	Protocol Id:	**00 C9**	6	120
9	Fixed Data:	**D6 BF FB FF D6**	7	118
10			8	122
11	Dev1:	**0**	9	245
12	Dev2:	**148**	VOL +	
13	Dev3:		VOL -	
14			MUTE	
15	**Brands:**		CH +	148
16	Panasonic Replay TV (upgrade only)		CH -	152
17			POWER	024
18			ENTER	090
19			TV/VCR	
20			LAST	021
21			MENU	
22			GUIDE	
23			Up	
24			Down	
25			Left	
26			Right	
27			SELECT	
28			SLEEP	
29			PIP	
30			DISPLAY	055
31			SWAP	
32			MOVE	
33			PLAY	025
34			PAUSE	150
35			REW	

Figure 10. Devices4.xls Spreadsheet with ShowStopper Information

Go back to the KM spreadsheet, click on **'protocol name:'** cell (B4), drop down the menu, and select the protocol that we found in the 'Protocol' cell (B5) of **Devices4.xls**, which was **Panasonic**. (Disregard the number preceding **Panasonic**. It's just a reference number for that protocol.) As soon as we select a protocol name a device code instruction appears just to the right of the drop down button (cell D4), and one or more **DeviceCode** cells (B5-B8) may be blocked out with gray shading. Some instructions say **No device codes need be entered**, or **Enter one device code**, etc. An instruction that says **COMBO: Enter . . . device codes** usually means this is a protocol that allows you to combine multiple **Device Codes** into a single **Setup Code**. In our example the instruction says **2DEV: Enter one or two device codes**. This means that both **DeviceCode1** and **DeviceCode2** will be used in each signal. It's not a **COMBO** code. From the 'Dev1' and 'Dev2' cells (C11 and C12) of **Devices4.xls** we get the values for the two **Device Codes** (0 and 148) and enter them into the 'Main Device:' and 'Sub Device:' cells (B5 and B6) of our spreadsheet. That completes our manual entries on the **Setup** page, but the upgrade code calculations can't be done until we complete the **Functions** and **Buttons** pages.

The **Functions** page is where we must show all the functions and their **EFC's** that we plan to use in our upgrade. Think of it as a page where you specify all the things the remote "can" do without regard to "which" buttons do them. Looking at the **Functions** page you'll see it provides a starting point by listing the buttons associated with the selected remote, but not necessarily all of them. For convenience, both the **Devices4.xls** spreadsheet and the **Buttons** page list buttons, functions, and EFC's in this exact same order. So if you're working from a **Setup Code** that's known and listed in **Devices4.xls** (as we are), the fastest way to get started is to copy the entire block of **EFC's** from **Devices4.xls** to the **Functions** page and then make any changes or additions necessary.

In **Devices4.xls**, copy the entire **EFC** column to the Clipboard. The easiest way to do this is to first click on the space above the column, the cell with a letter in it. Then copy it using either **Edit>Copy** or **Ctrl + c**. Return to the spreadsheet, click on the lettered space above the **EFC** column, then hit **Edit>Paste Special**. That will pop up the specification box shown in Figure 11.



Paste

● All
○ Formulas
○ Values
○ Formats
○ Comments
○ Validation
○ All except borders
○ Column widths

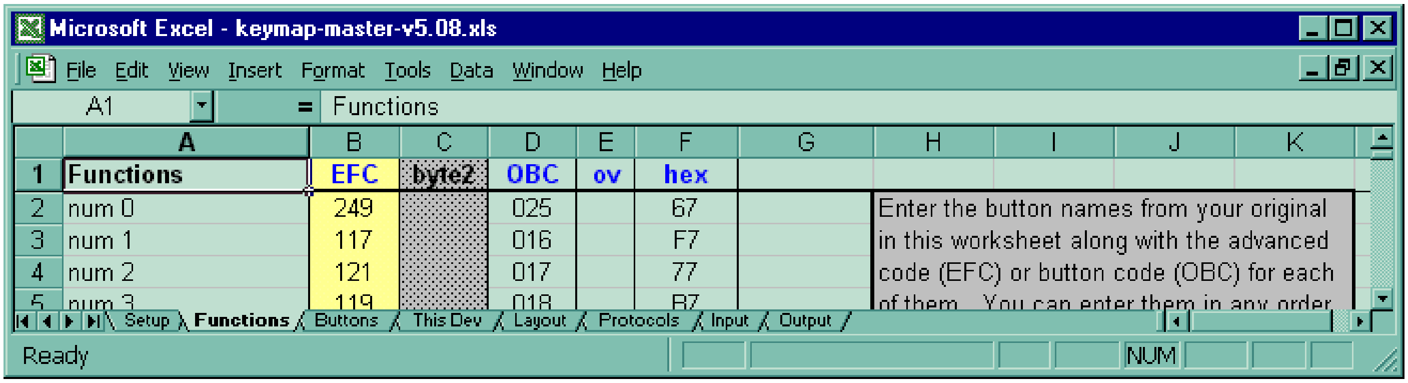
Operation

● None
○ Add
○ Subtract
○ Multiply
○ Divide

□ Skip blanks
□ Transpose

Figure 11. Paste Special Specification Box

Change the **Paste** option from **All** (the default) to **Values**, then click on **OK**. Presto! Our **Functions** page now has **EFC's** for all the buttons for which there is a control function relevant to the ShowStopper device (Figure 12).


Microsoft Excel - keymap-master-v5.08.xls
File Edit View Insert Format Tools Data Window Help

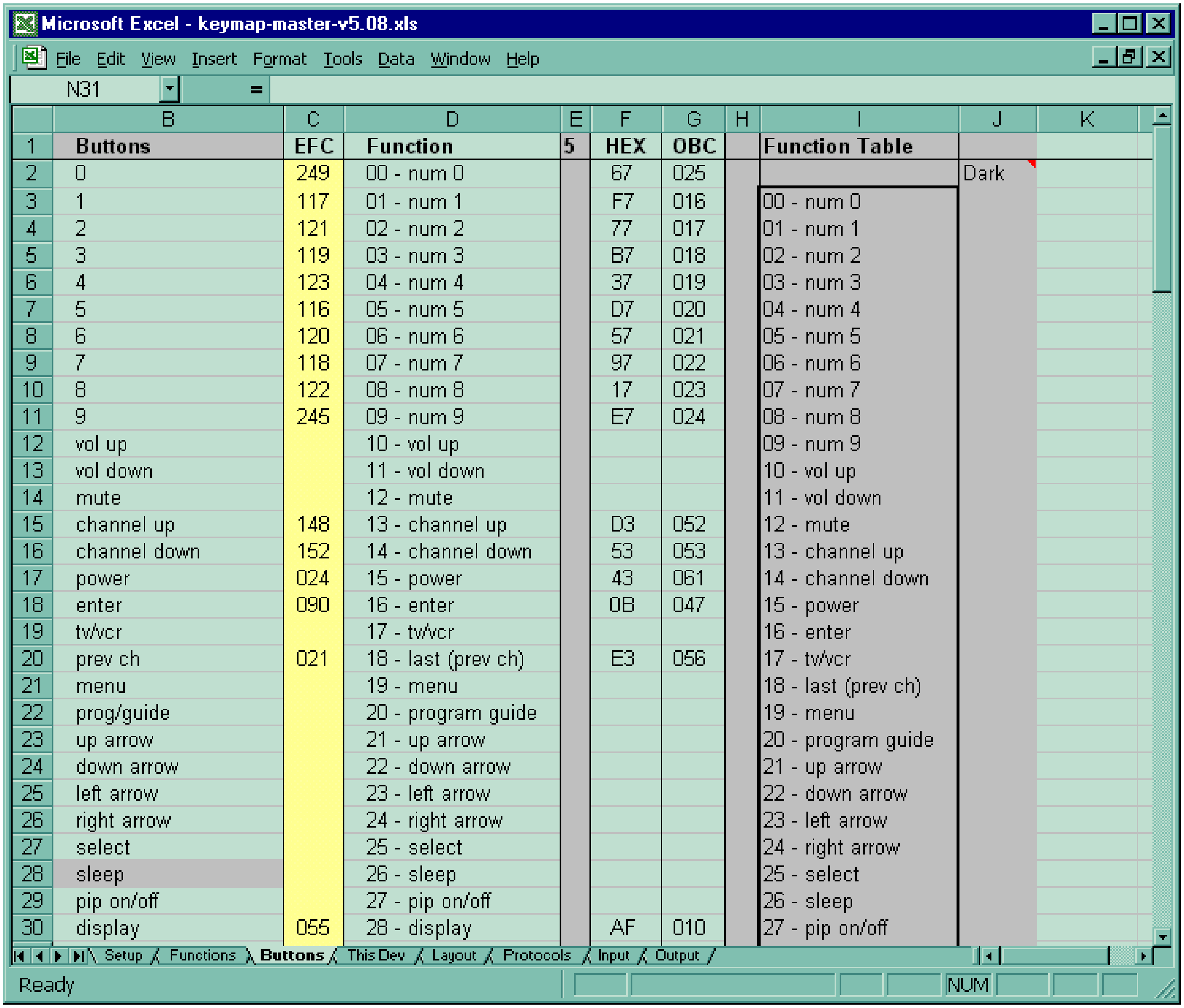
A1 = Functions

	A	B	C	D	E	F	G	H	I	J	K
1	Functions	EFC	byte2	OBC	ov	hex					
2	num 0	249		025		67		Enter the button names from your original			
3	num 1	117		016		F7		in this worksheet along with the advanced			
4	num 2	121		017		77		code (EFC) or button code (OBC) for each			
5	num 3	119		018		B7		of them. You can enter them in any order			

Setup
Functions
Buttons
This Dev
Layout
Protocols
Input
Output
Ready
NUM

Figure 12. Functions Page after Copying EFC's from Devices4.xls

If we turn to the **Buttons** page we see the display shown in Figure 13. The upper part of the display shows the same generic list of functions, in most cases matched up with buttons of the same name, and with **EFC** values carried over from the **Functions** page. The **OBC** and **HEX** values have been automatically calculated by the spreadsheet.


Microsoft Excel - keymap-master-v5.08.xls
File Edit View Insert Format Tools Data Window Help
N31
=
Setup
Functions
Buttons
This Dev
Layout
Protocols
Input
Output
Ready
NUM

	B	C	D	E	F	G	H	I	J	K
1	Buttons	EFC	Function	5	HEX	OBC		Function Table		
2	0	249	00 - num 0		67	025			Dark	
3	1	117	01 - num 1		F7	016		00 - num 0		
4	2	121	02 - num 2		77	017		01 - num 1		
5	3	119	03 - num 3		B7	018		02 - num 2		
6	4	123	04 - num 4		37	019		03 - num 3		
7	5	116	05 - num 5		D7	020		04 - num 4		
8	6	120	06 - num 6		57	021		05 - num 5		
9	7	118	07 - num 7		97	022		06 - num 6		
10	8	122	08 - num 8		17	023		07 - num 7		
11	9	245	09 - num 9		E7	024		08 - num 8		
12	vol up		10 - vol up					09 - num 9		
13	vol down		11 - vol down					10 - vol up		
14	mute		12 - mute					11 - vol down		
15	channel up	148	13 - channel up		D3	052		12 - mute		
16	channel down	152	14 - channel down		53	053		13 - channel up		
17	power	024	15 - power		43	061		14 - channel down		
18	enter	090	16 - enter		0B	047		15 - power		
19	tv/vcr		17 - tv/vcr					16 - enter		
20	prev ch	021	18 - last (prev ch)		E3	056		17 - tv/vcr		
21	menu		19 - menu					18 - last (prev ch)		
22	prog/guide		20 - program guide					19 - menu		
23	up arrow		21 - up arrow					20 - program guide		
24	down arrow		22 - down arrow					21 - up arrow		
25	left arrow		23 - left arrow					22 - down arrow		
26	right arrow		24 - right arrow					23 - left arrow		
27	select		25 - select					24 - right arrow		
28	sleep		26 - sleep					25 - select		
29	pip on/off		27 - pip on/off					26 - sleep		
30	display	055	28 - display		AF	010		27 - pip on/off		

Figure 13. Buttons Page of Spreadsheet

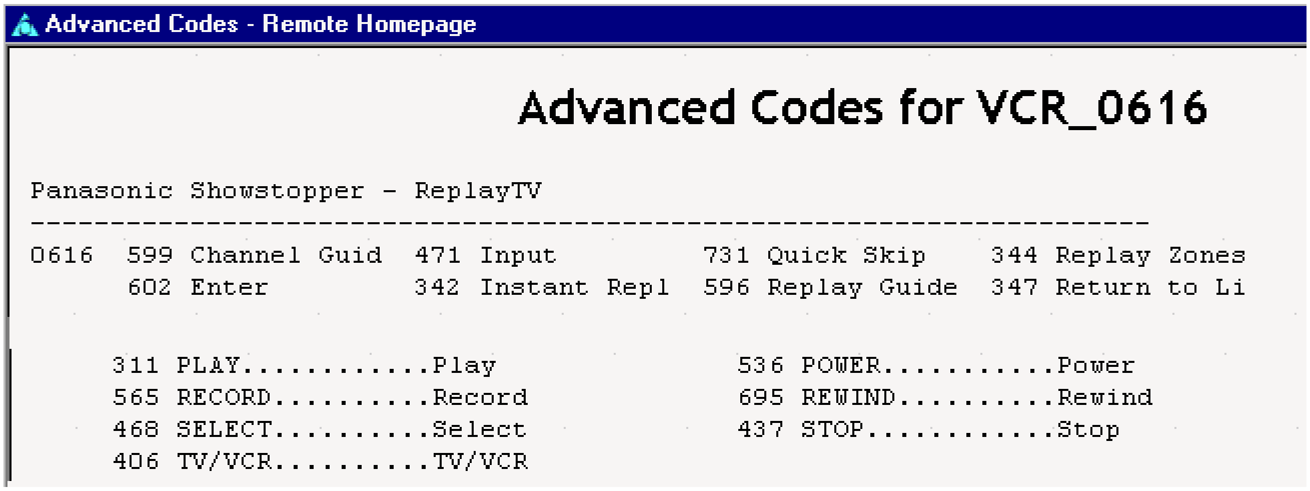
Depending on the remote you are programming and the type of device this spreadsheet is for, some buttons may be shaded dark, meaning either that they can't be used in that control mode or that they don't physically exist on the remote. In our example you'll notice the **SLEEP** button is shaded, which tells you that button is useless on a Cinema 7 remote when controlling a VCR type device. (If we wanted to program the **SLEEP** button we could change the **Device Type** on the **Setup page** to **Cable**, because the **SLEEP** button is available in that mode. Earlier we explained that the **Device type** of an upgrade doesn't have to match the actual device.)

If we were using a 15-1994 the **SLEEP** button wouldn't be shaded, but the **SURROUND** button would, and it would be useless on that remote in VCR mode. Although you can't use shaded buttons in the spreadsheet, you can sometimes use **Advanced Codes** in **IR** to assign some other function to those buttons. (The **SLEEP** and the **FAV/SCAN** buttons are exceptions. They can't be programmed using **Advanced Codes**.) The groups of buttons below the generic list are shaded because they are unique to the specific remotes indicated, such as the ReplayTV remote, the Millenium 4 remote, etc.

If the button assignments shown in Figure 13 are satisfactory to you, fine. But suppose, for example, we wanted to change the **DISPLAY** button to function as an **ENTER** button. The general procedure for mapping a function to a button is to click on the **'Function'** cell (column D) for the button, drop down a menu of all the possible functions that can be mapped to that button, and select one. The **Function Table** shows this same menu, as well as providing a visual indication (by light and dark cells), which functions have been used and which are unassigned. If a function you want to use isn't in the menu, that's because it hasn't yet been defined on the **Functions** page. For our example we would click on the **Function** for the **DISPLAY** button, drop down the menu, scan through the list and select the **enter** function. Notice that the **EFC**, **HEX**, and **OBC** values immediately change to the correct values for the new function. Also notice that the **display** function in the **Function Table** changes color to indicate that it is now unassigned.

The **Function** column is the only place on the **Buttons** page you can make manual changes. All other data is controlled by the spreadsheet and protected. If you try make any change other than to select from a function menu you'll see a message that says **The cell or chart you are trying to change is protected and therefore read-only**. Disregard the comment about un-protecting the page. That's strictly for qualified hackers. Any changes that you need on the **Buttons** page (other than mapping) can be obtained by changing the **Functions** page.

Let's assume we are familiar with the ShowStopper OEM remote and we see that some of its most useful functions are missing in Figure 13. We decide we want to add **channel guide**, **replay guide**, **quick skip**, and **instant replay** functions, none of which is in the generic list. And our Cinema 7 doesn't have buttons with any of those labels either, so we'll have to pick some existing buttons to assign them to. For starters we'll need the **EFC's** for these functions, and we can get them from a list we download from **www.hifi-remote.com** (Figure 14).



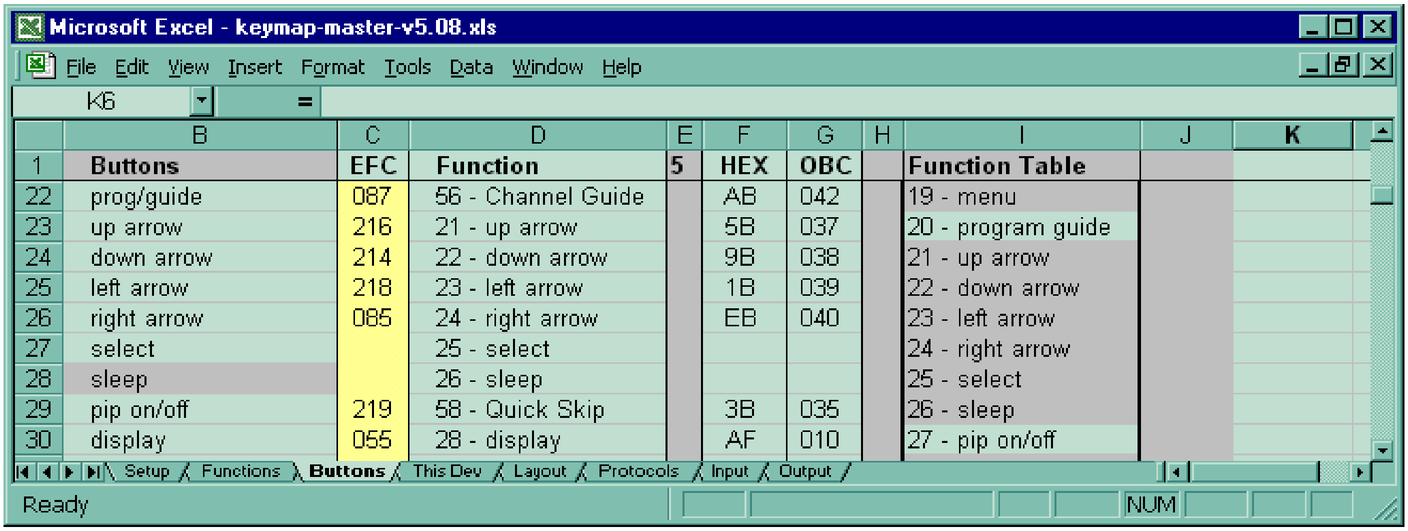
Advanced Codes for VCR_0616

```
Panasonic Showstopper - ReplayTV
----------------------------------------------------------------------
0616  599 Channel Guid  471 Input         731 Quick Skip    344 Replay Zones
      602 Enter         342 Instant Repl  596 Replay Guide  347 Return to Li

     311 PLAY............Play                536 POWER...........Power
     565 RECORD..........Record              695 REWIND..........Rewind
     468 SELECT..........Select              437 STOP............Stop
     406 TV/VCR..........TV/VCR
```

Figure 14. List of EFC's for VCR 0616

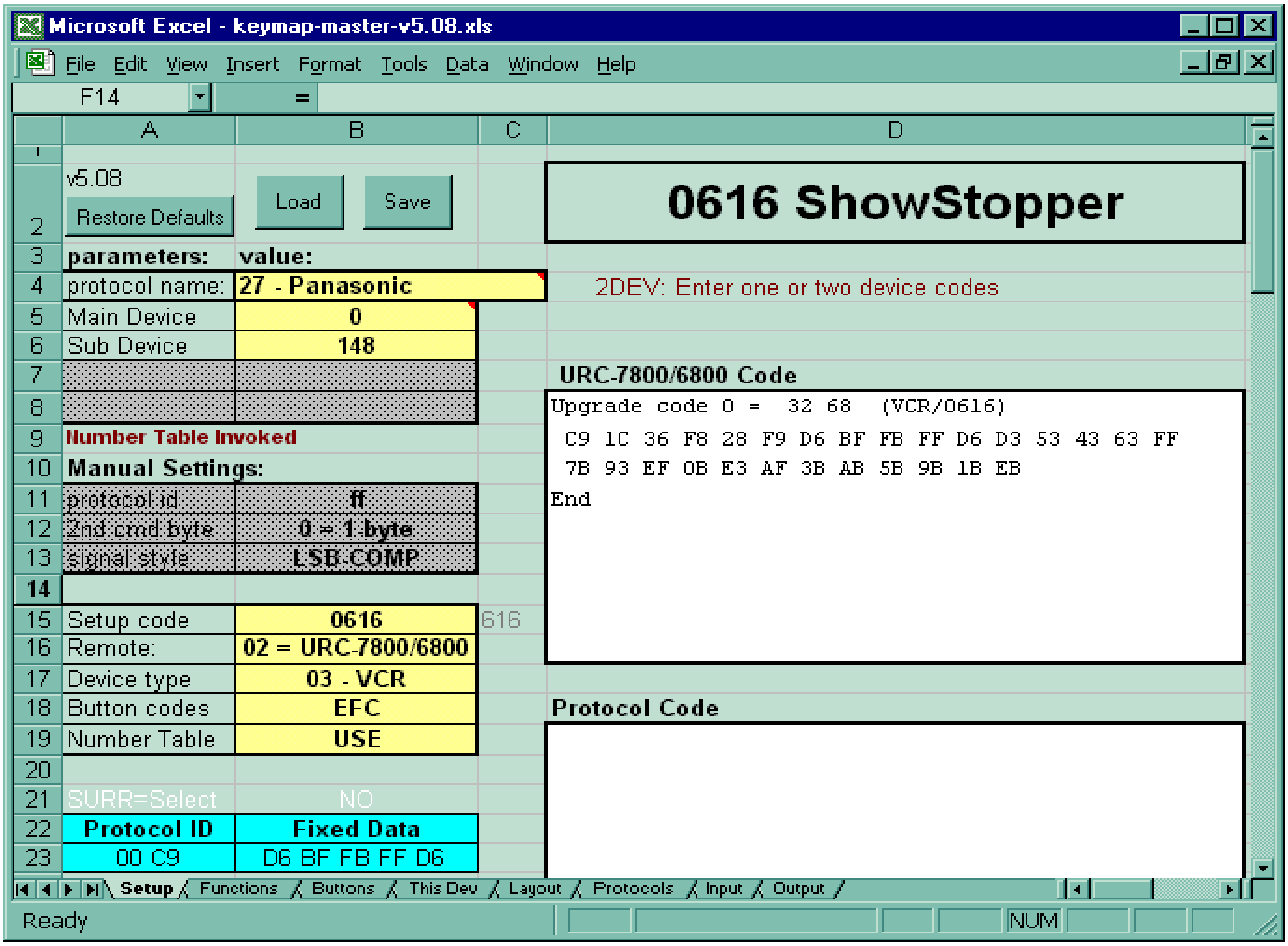
First we must go to the **Functions** page, add these four functions to the list, and enter their **EFC's**. Now when we go back to the **Buttons** page we see they have been added to the end of the **Function Table**, which means they have also been added to the **Function** drop down menu. Let's say we decide to use the **PROGRAM GUIDE** button for the **channel guide** function. Click on the function for the **PROGRAM GUIDE** button to drop down the **Function** menu, then change the function from **program guide** to **channel guide**. The **OBC**, **EFC**, and **HEX** values appear immediately, and the shading in the **Function Table** changes to show the **channel guide** function is now selected and the **program guide** function is not. Now assign the remaining three functions to three more buttons.


Microsoft Excel - keymap-master-v5.08.xls
File Edit View Insert Format Tools Data Window Help
K6
Setup Functions Buttons This Dev Layout Protocols Input Output
Ready
NUM

	B	C	D	E	F	G	H	I	J	K
1	Buttons	EFC	Function	5	HEX	OBC		Function Table		
22	prog/guide	087	56 - Channel Guide		AB	042		19 - menu		
23	up arrow	216	21 - up arrow		5B	037		20 - program guide		
24	down arrow	214	22 - down arrow		9B	038		21 - up arrow		
25	left arrow	218	23 - left arrow		1B	039		22 - down arrow		
26	right arrow	085	24 - right arrow		EB	040		23 - left arrow		
27	select		25 - select					24 - right arrow		
28	sleep		26 - sleep					25 - select		
29	pip on/off	219	58 - Quick Skip		3B	035		26 - sleep		
30	display	055	28 - display		AF	010		27 - pip on/off		

Figure 15. Portion of Buttons Page Showing Additional Mapping

Let's also assume we want to activate the four **ARROW** buttons so we can navigate on-screen guides and menus. Again, we must start by enabling these functions on the Functions page, only this time they are already on the generic list. All we have to do is assign **EFC's** to them. We don't have to do anything on the **Buttons** page (Figure 15) because those functions were already matched to buttons with the same name.


Microsoft Excel - keymap-master-v5.08.xls
File Edit View Insert Format Tools Data Window Help
F14
Restore Defaults
Load
Save
Setup Functions Buttons This Dev Layout Protocols Input Output
Ready
NUM

	A	B	C	D
2	v5.08			0616 ShowStopper
3	parameters:	value:		
4	protocol name:	27 - Panasonic		2DEV: Enter one or two device codes
5	Main Device	0		
6	Sub Device	148		
7				URC-7800/6800 Code
8				
9	Number Table Invoked			
10	Manual Settings:			
11	protocol id	ff		
12	2nd cmd byte	0 = 1 byte		
13	signal style	LSB-COMP		
14				
15	Setup code	0616	616	
16	Remote:	02 = URC-7800/6800		
17	Device type	03 - VCR		
18	Button codes	EFC		Protocol Code
19	Number Table	USE		
20				
21	SURR=Select	NO		
22	Protocol ID	Fixed Data		
23	00 C9	D6 BF FB FF D6		

```
Upgrade code 0 =  32 68  (VCR/0616)
 C9 1C 36 F8 28 F9 D6 BF FB FF D6 D3 53 43 63 FF
 7B 93 EF 0B E3 AF 3B AB 5B 9B 1B EB
End
```

Figure 16. Spreadsheet for ShowStopper (Panasonic protocol)

Our **Setup** page now looks like Figure 16. The data in the box titled **URC-7800/6800 Code** is the upgrade code all this effort has been for. Amazingly, that little bit of code is all we have to tell our remote for it to understand how to control ShowStopper the way we want it to. In this example there is no **Protocol Code** because the **Panasonic** protocol, a fairly common one, is already resident in our remote's ROM. In section 7 we'll go through an example where the spreadsheet generates both **Upgrade Code** and **Protocol Code**.

Now lets save a copy of our upgrade before we continue. First scroll to the notes area of the **"Setup"** Sheet and enter any notes about the setup, such as the keymaps you added. Then scroll back to the top of the page and press the save button. A SaveDevice dialog window will open prompting you for a file name. You can use the name that you assigned in the Device Name cell of KM or you may want to use a more descriptive name for the upgrade. Type in the name and press the Save button to save your file. You do not have to save the spreadsheet. Then anytime you want to edit your setup or share it with another user you have a text file to work with.

To Load an existing setup into KM open KM and go to the **"Setup"** Sheet. Click on the "Load" button and a LoadDevice dialog window will prompt you for a file name to load. Navigate to the folder where the file is and click on the file name and then click on the open button. This setup will then be loaded into KM and you can edit it.

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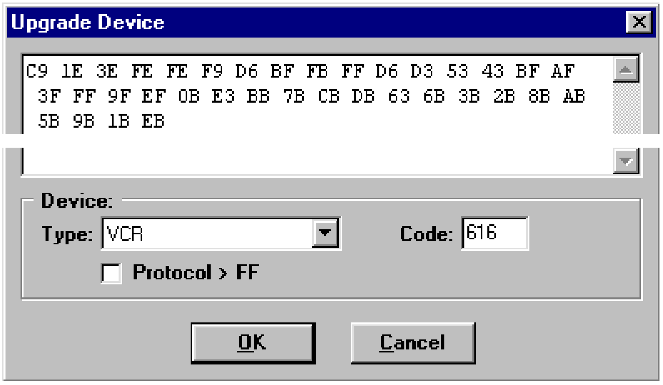
6. TRANSFERRING UPGRADE CODE TO IR

From the **Setup** page of the spreadsheet, copy ***everything*** inside the box labeled **URC-7800/6800 Code** to the Clipboard by using **Edit>Copy** or **Ctrl + c**. Without closing the spreadsheet, open **IR** to the **Devices** page and click on **Add** to open the **Upgrade Device** window. Paste the clipboard contents into the **Upgrade Device** window using **Ctrl + v**.



Upgrade Device

```
C9 1E 3E FE FE F9 D6 BF FB FF D6 D3 53 43 BF AF
 3F FF 9F EF 0B E3 BB 7B CB DB 63 6B 3B 2B 8B AB
 5B 9B 1B EB
```

Device:

Type: VCR

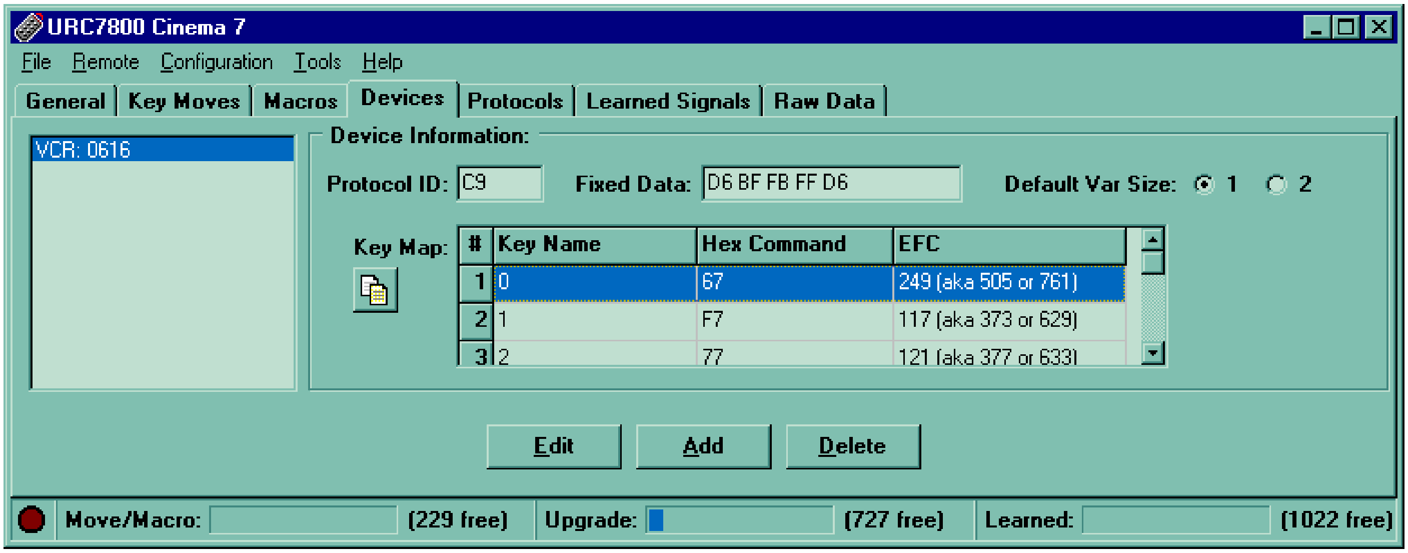
Code: 616

□ Protocol > FF

Figure 17. Upgrade Code Copied from Spreadsheet to IR

When done correctly the **Setup Code** number (0616) will appear automatically in the **Code** window and the **Device Type** will show **VCR**. The **Upgrade Device** window display should now look like Figure 17.

If both the **Device Type** and **Code** windows are blank it's probably because you didn't include the first line (starting with **Upgrade code 0 =**) in the data you copied from the spreadsheet. Hit the **Cancel** button to wipe everything out, and try again. The box labeled **Protocol > FF** will be checked automatically whenever required, so you never have to worry about that. When you think the **Upgrade Device** window looks correct hit the **OK** button to enter everything into the **Devices** page. Figure 18 shows what the **Devices** page looks like after you have made the entry.


URC7800 Cinema 7
File Remote Configuration Tools Help
General | Key Moves | Macros | Devices | Protocols | Learned Signals | Raw Data

VCR: 0616

Device Information:

Protocol ID: C9

Fixed Data: D6 BF FB FF D6

Default Var Size: ● 1 ○ 2

Key Map:

#	Key Name	Hex Command	EFC
1	0	67	249 (aka 505 or 761)
2	1	F7	117 (aka 373 or 629)
3	2	77	121 (aka 377 or 633)

Move/Macro: (229 free) Upgrade: (727 free) Learned: (1022 free)

Figure 18. Devices Page with Setup Code 0616 Added

The **Key Map** allows you to scan through and see what codes have been assigned to various buttons and which ones are not mapped. This can sometimes be helpful in troubleshooting a problem where a device doesn't seem to respond to a certain button. If you hit the **Edit** button you will be returned to the **Upgrade Device** window shown in Figure 17. But unless you are a pro, don't try editing in that window. Instead, delete the device and transfer corrected data over from the spreadsheet.

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7. TRANSFERRING PROTOCOL CODE TO IR

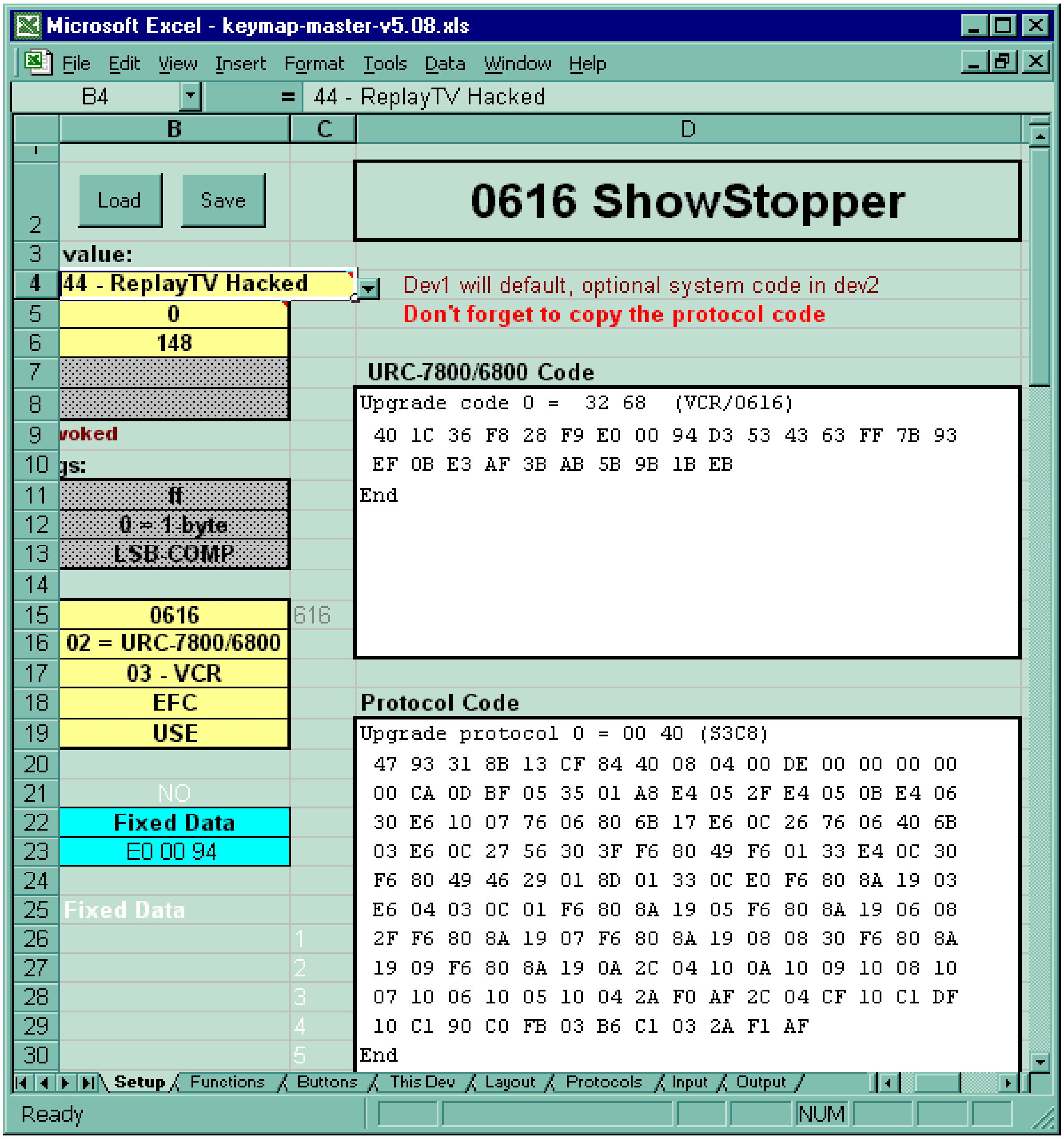
Suppose we've been reading over some of the messages posted on JP1 and we've learned there are three options available as far as protocols go when creating a new **Setup Code** for ReplayTV (either the Replay brand or the Panasonic brand).

1) **Panasonic** protocol, which takes up little memory, and allows the learning buttons to function. It's not compatible with multiple ReplayTV units, and it lacks a number of commands.

2) **ReplayTV Official** protocol, which uses a lot of memory and doesn't support **Advanced Codes**, but allows multiple Replay devices.

3) **ReplayTV Hacked** protocol, which also allows multiple devices, uses less memory, allows you to use **Advanced Codes**, and has some special features such as a 3-minute commercial skip.

If we had selected the third protocol option instead of the first, the **Setup** page of our spreadsheet would look more like Figure 19, with a considerable amount of code in the **Protocol Code** box. In this case we have to transfer this code to the **Protocols** page of **IR** using a procedure similar to that we used for the **Upgrade Code**.


Microsoft Excel - keymap-master-v5.08.xls
File Edit View Insert Format Tools Data Window Help
B4
Load
Save
Setup
Functions
Buttons
This Dev
Layout
Protocols
Input
Output
Ready
NUM

B4 = 44 - ReplayTV Hacked

0616 ShowStopper

Row	B	C
3	value:	
4	44 - ReplayTV Hacked	
5	0	
6	148	
9	voked	
10	gs:	
11	ff	
12	0 = 1 byte	
13	LSB COMP	
15	0616	616
16	02 = URC-7800/6800	
17	03 - VCR	
18	EFC	
19	USE	
21	NO	
22	Fixed Data	
23	E0 00 94	
25	Fixed Data	
26		1
27		2
28		3
29		4
30		5

Dev1 will default, optional system code in dev2

Don't forget to copy the protocol code

URC-7800/6800 Code

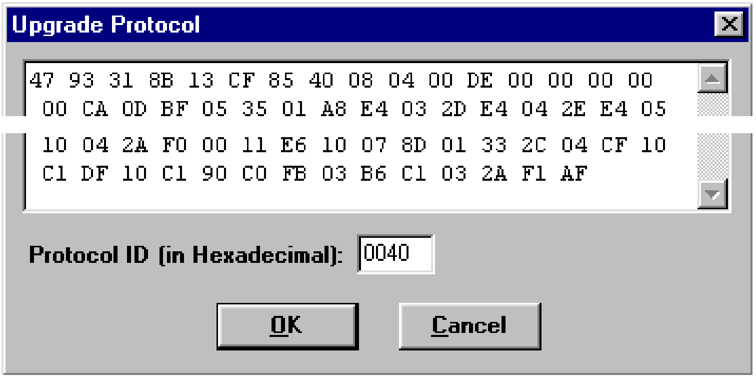
```
Upgrade code 0 =  32 68  (VCR/0616)
 40 1C 36 F8 28 F9 E0 00 94 D3 53 43 63 FF 7B 93
 EF 0B E3 AF 3B AB 5B 9B 1B EB
End
```

Protocol Code

```
Upgrade protocol 0 = 00 40 (S3C8)
 47 93 31 8B 13 CF 84 40 08 04 00 DE 00 00 00 00
 00 CA 0D BF 05 35 01 A8 E4 05 2F E4 05 0B E4 06
 30 E6 10 07 76 06 80 6B 17 E6 0C 26 76 06 40 6B
 03 E6 0C 27 56 30 3F F6 80 49 F6 01 33 E4 0C 30
 F6 80 49 46 29 01 8D 01 33 0C E0 F6 80 8A 19 03
 E6 04 03 0C 01 F6 80 8A 19 05 F6 80 8A 19 06 08
 2F F6 80 8A 19 07 F6 80 8A 19 08 08 30 F6 80 8A
 19 09 F6 80 8A 19 0A 2C 04 10 0A 10 09 10 08 10
 07 10 06 10 05 10 04 2A F0 AF 2C 04 CF 10 C1 DF
 10 C1 90 C0 FB 03 B6 C1 03 2A F1 AF
End
```

Figure 19. Spreadsheet for ShowStopper (ReplayTV Hacked protocol)

Copy ***everything*** inside the box labeled **Protocol Code** to the Clipboard by using **Edit>Copy** or **Ctrl + c**. Then open **IR** to the **Protocols** page, click on **Add** to open the **Upgrade Protocol** window, and paste the clipboard contents into this window using **Ctrl + v** (Figure 20).



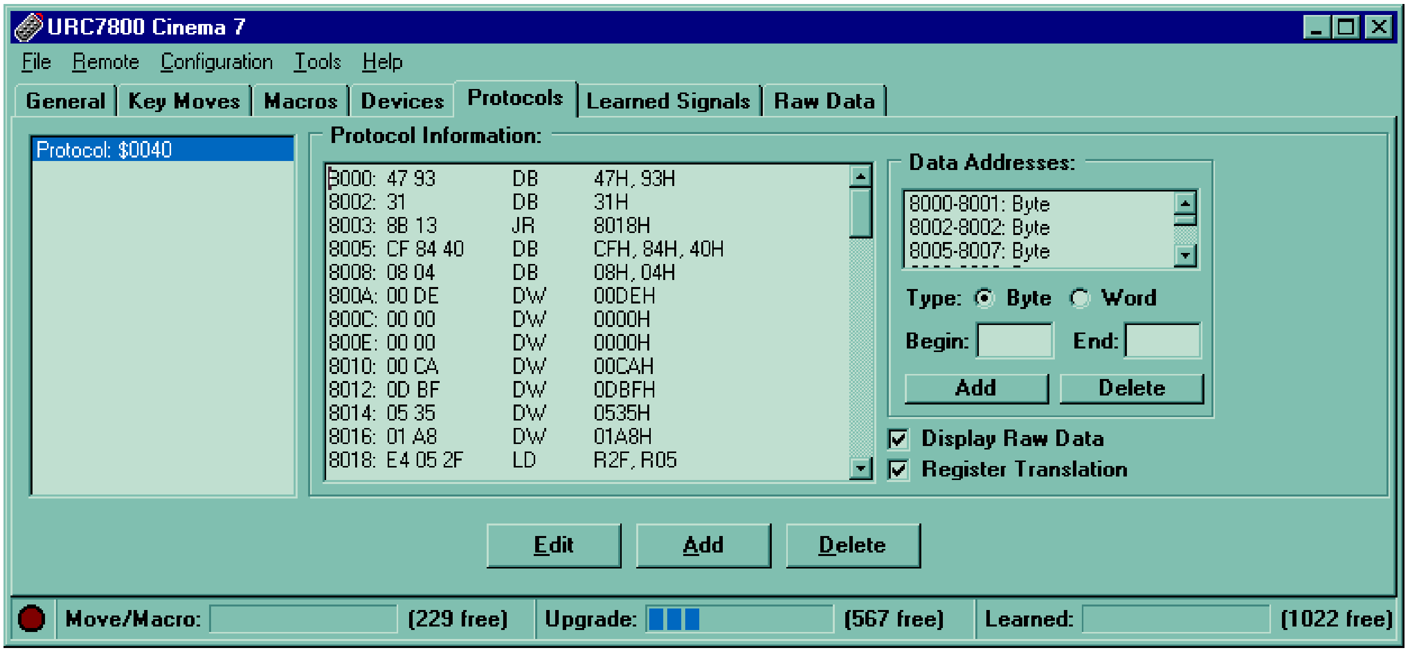
```
47 93 31 8B 13 CF 85 40 08 04 00 DE 00 00 00 00
 00 CA 0D BF 05 35 01 A8 E4 03 2D E4 04 2E E4 05

 10 04 2A F0 00 11 E6 10 07 8D 01 33 2C 04 CF 10
 C1 DF 10 C1 90 C0 FB 03 B6 C1 03 2A F1 AF
```

Protocol ID (in Hexadecimal): 0040

Figure 20. Upgrade Protocol Copied from Spreadsheet to IR

When done correctly the **Protocol ID** number (0040) will appear automatically. If the **Protocol ID** is blank it is probably because you either didn't include the first line (starting with **Upgrade protocol 0 =**) or the last line (**End**) in the data you copied from the spreadsheet. Hit the **Cancel** button to wipe everything out, and try again.

When the **Upgrade Protocol** window looks correct hit the **OK** button to enter everything into the **Protocols** page, which should then look like Figure 21.



Protocol: $0040

Protocol Information:

```
8000: 47 93      DB     47H, 93H
8002: 31         DB     31H
8003: 8B 13      JR     8018H
8005: CF 84 40   DB     CFH, 84H, 40H
8008: 08 04      DB     08H, 04H
800A: 00 DE      DW     00DEH
800C: 00 00      DW     0000H
800E: 00 00      DW     0000H
8010: 00 CA      DW     00CAH
8012: 0D BF      DW     0DBFH
8014: 05 35      DW     0535H
8016: 01 A8      DW     01A8H
8018: E4 05 2F   LD     R2F, R05
```

Data Addresses:

```
8000-8001: Byte
8002-8002: Byte
8005-8007: Byte
```

Type: ● Byte ○ Word

Begin: End:

Add Delete

☑ Display Raw Data

☑ Register Translation

Move/Macro: (229 free) Upgrade: (567 free) Learned: (1022 free)

Figure 21.   Protocols Page with Upgrade Protocol Added

Looking at the bottom of Figures 18 and 21, the **Upgrade** bar graph indicates we used about 24% of available upgrade memory. If we had more upgrade devices we would fill out more spreadsheets and paste their code(s) onto this page the same as we did these, and they would be listed in the box at left. To make a change to an upgrade protocol, select it in the left box, hit **Delete**, then **Add** it again after making your changes in the spreadsheet.

One very important thing we must remember to do before uploading for a tryout is to make sure we have specified **0616** as the **Code** for **Device 3 [VCR]**.
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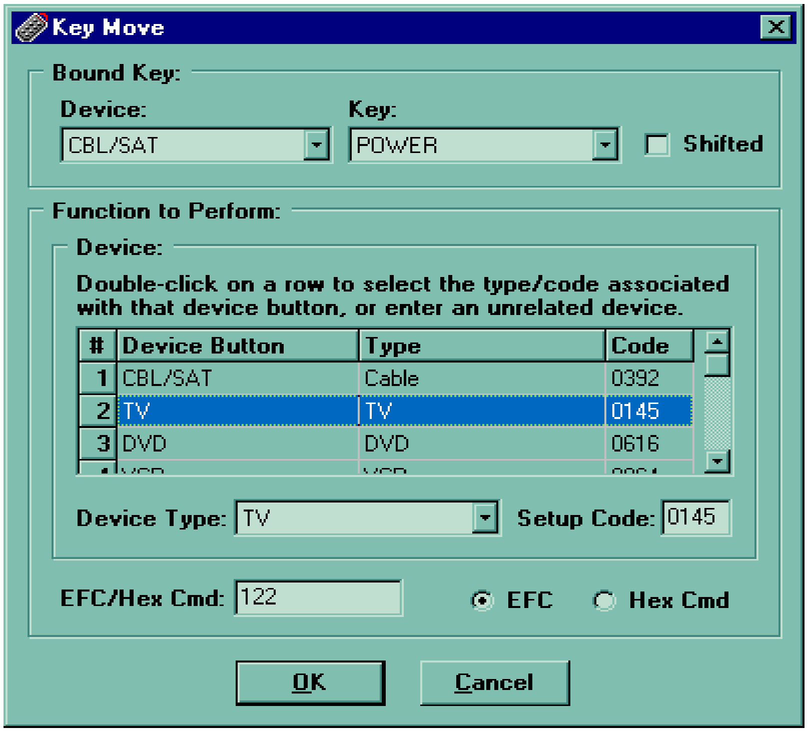
8.   CREATING ADVANCED CODES

Advanced Codes/Key Moves can be added using **IR** alone, and the result is the same as if we had added them manually using <Setup> + code 994. As with other types of programming, any manual additions or deletions will be displayed on the **Key Moves** page after a download.

In our home theater example the program received by satellite is distributed throughout the home, so we want the satellite receiver to remain ON continually, not just when the theater is on. To prevent accidentally turning it OFF we will program the **POWER** button so that if it is pressed while in **CBL/SAT** mode the TV is turned OFF instead of the satellite receiver. A consequence of this change will be that the only way to actually turn the satellite receiver ON or OFF is from its front panel, but that's acceptable. We will need an **EFC** for the TV, and we can get it from the **Devices4.xls** spreadsheet. Just enter TV for **Type** and 0145 for **Code** and **Devices4.xls** displays all the button codes (well, most of them, anyway). As with many TV's, this one doesn't have a discrete OFF command, only a POWER toggle command, and the **EFC** for that is 122.

Select the **Key Moves** page in **IR** and click on the **Add** button to get the **Key Move** work pad. First we must specify the **Bound Key**, which is the combination of device mode and button we're assigning the **Key Move** to. Drop down the **Device** menu and select **CBL/SAT**, then drop down the **Key** menu and select the **POWER** button. Leave the **Shifted** box unchecked because we want the function to apply to the **POWER** button alone. Next we must specify an output **Function**. Double click the **TV** row in the Device window to select the Device type and setup code automatically. You could also use the pulldown menu to select it then enter **Setup Code** 0145 in the **Setup Code** box.

Finally, check **EFC**, since that's the format of data we're providing, and enter the EFC code (122). (Don't try to use **Hex Command** format. That's for pro's.)



Bound Key:

Device: CBL/SAT

Key: POWER

□ Shifted

Function to Perform:

Device:

Double-click on a row to select the type/code associated with that device button, or enter an unrelated device.

#	Device Button	Type	Code
1	CBL/SAT	Cable	0392
2	TV	TV	0145
3	DVD	DVD	0616

Device Type: TV

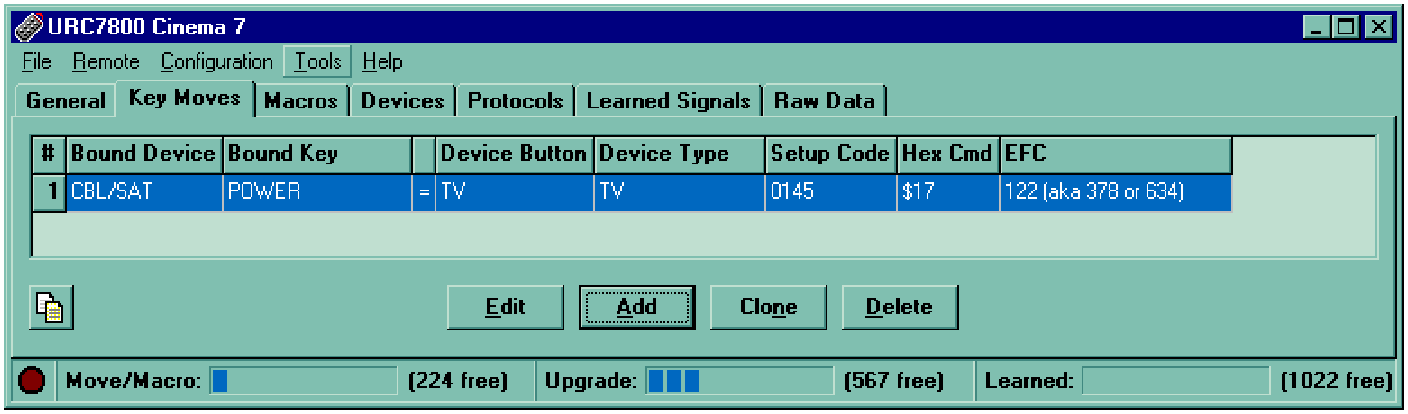
Setup Code: 0145

EFC/Hex Cmd: 122

● EFC ○ Hex Cmd

Figure 22. Advanced Code Work Pad

The **Key Move** work pad should look like Figure 22, and clicking on **OK** enters it into the **Key Moves** page of **IR** as shown in Figure 23.



#	Bound Device	Bound Key		Device Button	Device Type	Setup Code	Hex Cmd	EFC
1	CBL/SAT	POWER	=	TV	TV	0145	$17	122 (aka 378 or 634)

Move/Macro: (224 free) Upgrade: (567 free) Learned: (1022 free)

Figure 23. Advanced Codes Page After Clicking on OK Button

It is important to note that we are not constrained in the output **Function** to one of the devices assigned to our **Device** buttons. Rather, we are allowed to specify any device (**Device Type**) and **Setup Code** (**Device Code**) supported by our remote. Here's an example that shows how that comes in handy. Suppose we want to use an X10 infrared transceiver for Lights ON and OFF commands. Cinema 7 supports X10 as a CD device with **Setup Code** 0167, so we could assign that code to **Device 7** **[CD]** and pick a couple of buttons for ON and OFF in that mode. But let's imagine that we're planning to add a real CD player to the theater in the near future, and we want to reserve our **CD** button for that. Furthermore, we would like to control the lights while in TV mode rather than having to go into CD mode, do the lights, then return to TV mode. Of course that will require a couple of unused buttons in TV mode, so let's use the **FFW** button for ON and the **REW** button for OFF. Here's the way we might set this up.

	Bound Key		Function		
Command	**Device**	**Key**	**Device**	**Code**	**Advanced Code**
Lights ON	TV	FFW	CD	0167	558
Lights OFF	TV	REW	CD	0167	238

You can get the **EFC's** for CD/0167 from **Devices4.xls**, but you had to know beforehand that POWER (EFC = 558) is the All Lights ON function, and MUTE (EFC = 238) is the All Lights OFF function.) That information can be found at **www.hifi-remote.com**.

The point of all this is that we can add those two X10 commands as **Advanced Codes** for CD/0167 even though that CD is not one of our selected **Devices**. So even though a 7-in-one remote has only seven **Device** buttons, by using **IR** you can get it to perform some limited control on any of the hundreds of devices supported by the remote.

We're now ready to save the **IR** file, then upload and test the new features. If an **Advanced Code** needs tweaking go back to the **Advanced Codes** page, select it, and hit the **Edit** button to return to the display shown in Figure 22.
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9. CREATING MACROS

Programming a macro with **IR** is faster, easier, and more fun than doing it manually. All your work is visible, you can make changes without re-entering the whole macro, and you don't have to watch for those LED blinks or hurry to beat the 10-second clock. For an example we'll build a macro that uses **<Shift> POWER** to turn on the TV and the A/V receiver, switch the TV input source to Ant A (the input our cable is hooked up to), and select TV as the A/V source.

In the previous section we learned that our Hitachi has only a toggle POWER function. Like many TV's, it also doesn't have discrete source selection. But also like many TV's when you send any kind of channel command (such as LAST, CH+, or CH-) it switches to Ant A, so we'll take advantage of that. Looking at the Yamaha 0176 Audio device in **Devices4.xls** shows only a toggle POWER command with an EFC of 250, and no functions for source selection. But a little research at **www.hifi-remote.com** turns up the fact that discrete power ON command is EFC 248, and TV input select is EFC 360. We could put those EFC's in our macro (Setup + EFC) but that's generally not a good idea because it takes so long to transmit a command that way. Instead, we'll assume for this example that we have already programmed **Key Moves** (using the procedure described in the previous section) so that, when in receiver mode, the **ENTER** button turns power ON and the **MENU** button selects TV input. If we didn't have a physical button available, or if we wanted to avoid the consequences of someone accidentally hitting one of those buttons, we could have assigned the functions to two of the four **Phantom** buttons you'll find listed at the end of the **Key** menu in Figure 22.

Select the **Macros** page in **IR** and click on the **Add** button, then pull down the **Key** menu as shown in Figure 24. For the **Bound Key**, select **POWER** in the drop down menu and click on **Shifted**. Now build the macro in the order you want it to be transmitted by highlighting buttons in the **Available Keys** window and clicking on **Add**. As you do this the

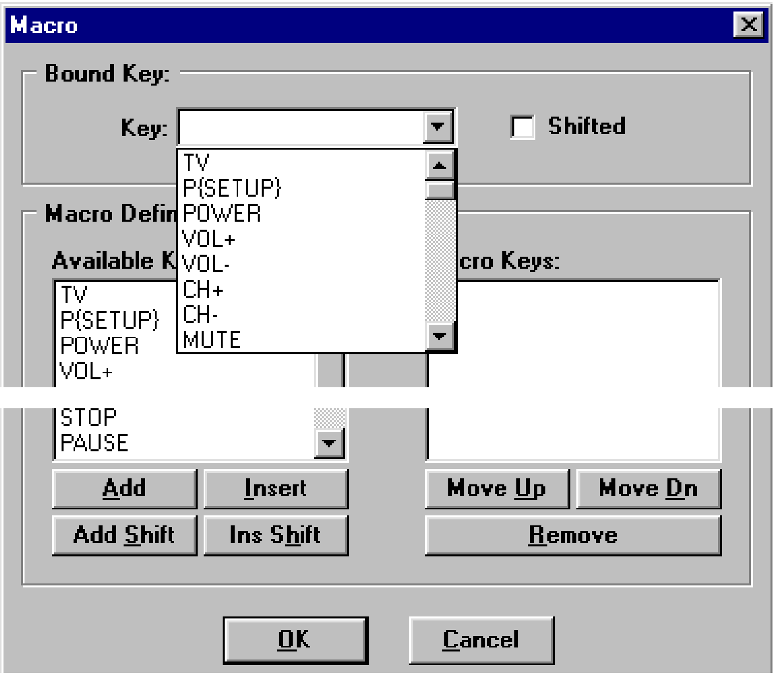
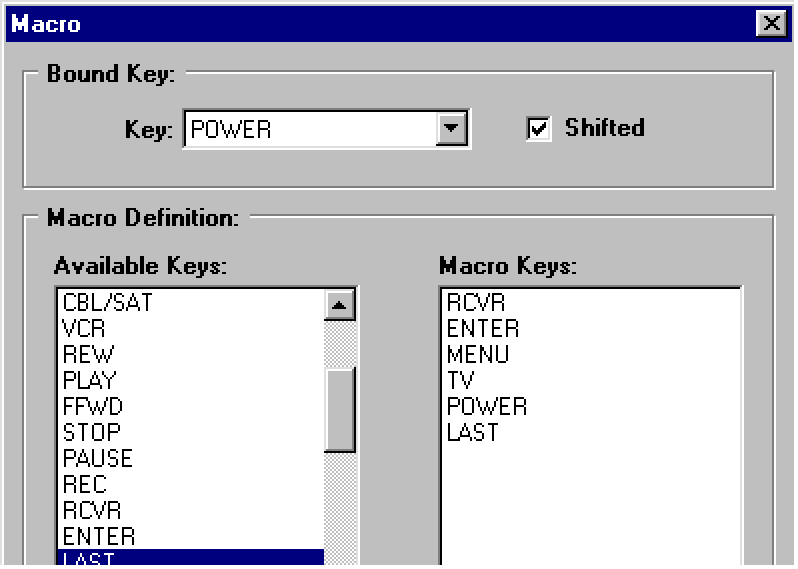


Figure 24. Macro Work Pad with Key Menu Dropped Down

string will grow in the **Macro Keys** window. The editing buttons at the bottom of the windows are self-explanatory for inserting or deleting items to make changes without starting over. For our macro we'll turn on the receiver and select its input first, then do the TV stuff and leave the remote in TV mode.


Macro

Bound Key:

Key: POWER

☑ Shifted

Macro Definition:

Available Keys:

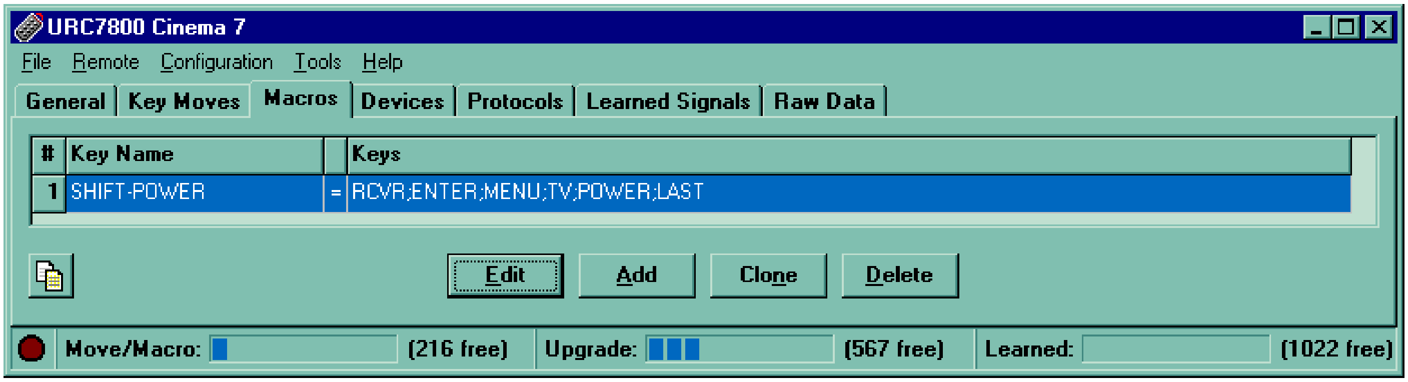
CBL/SAT
VCR
REW
PLAY
FFWD
STOP
PAUSE
REC
RCVR
ENTER
LAST

Macro Keys:

RCVR
ENTER
MENU
TV
POWER
LAST

Figure 25. Completed Macro on the Work Pad

Figure 25 shows our work pad after completing the 6-step macro, and Figure 26 shows the **Macros** page after clicking on **OK** to enter it.



#	Key Name		Keys
1	SHIFT-POWER	=	RCVR;ENTER;MENU;TV;POWER;LAST

Move/Macro: (216 free) Upgrade: (567 free) Learned: (1022 free)

Figure 26. Macros Page After Clicking on OK Button

At this point we can upload and try out the macro. If it doesn't work the way we want it to we can highlight it on the **Macros** page, click on **Edit** to get back to the work pad, make our changes, select **OK** and upload again. To remove a macro, use the **Delete** button on the **Macros** page.

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10. EXPERIMENTING WITH IR

You'll find that **IR** removes many of the restrictions placed on manually programming a remote. A few examples of things you can do with **IR** that aren't possible manually are assigning macros to shifted device buttons, adding **Advanced Codes/Key Moves** using supported devices other than those assigned to your **Device** buttons, and using **Phantom** buttons. You may also discover that **IR** will allow you to setup some control functions that are not really possible on the remote. Although this might seem like sandbagging, it was designed that way deliberately so that users can experiment to find out what works and what doesn't. For example, using **IR** you can "apparently" program **Key Moves** to the actual **Device** buttons. But when you upload this data to the remote you'll find it just doesn't work.

You are encouraged to experiment with **IR** and the spreadsheet. That's the best way to learn. Try some goofy macros and advanced codes just for the fun of it. You may upload something that doesn't work, but you can't hurt your remote. Just make sure you have a good **IR** text file to fall back on in case things really get messed up.

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11. GLOSSARY OF TERMS

a. **Device**
A consumer product operated by a remote control, such as a TV, VCR, or DVD.

b. **Setup Code (Previously referred to as Device Code)**
A four-digit number, usually within the range 0000 to 2047, that identifies a specific device (or group of devices) and the keyboard commands they respond to. Universal remotes are manufactured with hundreds of Setup Codes built-in so they may be setup to control many different brands and models of devices.

c. **Upgrading**
The process of adding a new Setup Code to a remote for either or both of the following reasons:

1) To add control for a device not included in the factory supplied Setup Codes;

2) To change the way a remote controls a device, i.e., to modify a standard Setup Code.

d. **Command Code and Device Code**
Most infrared signals comprise two parts, a fixed portion, which is the target **Device Code**, and a variable portion, which is the **Command Code**.

e. **OBC (Original Button Code)**
Another term used for **Command Code**.

f. **Advanced Code**
A 3-digit code used to program a button within a specified **Setup Code**.

g. **EFC (Extended Function Code)**
Another term used for **Advanced Code**.

h. **JP1**
The designation of a 6-pin connector in remote controls that have the capability of being programmed with a PC and interface.

i. **Interface**
A device that links the JP1 connector of a remote control to the parallel port of a PC.

j. **OEM Remote**
Original Equipment Manufacturer's remote, the one supplied with a consumer product.

k. **IR (also referred to as Ir, or IR.exe)**
A WIN9x program used to upload/download a remote's memory, with a GUI that enables displaying the data and making changes.

l. **Keymap-Master Spreadsheet**
An Excel file that generates upgrade code after inputting device data, remote data, and button configuration.

m. **Devices4.xls Spreadsheet**
An Excel file that contains device data for all the Setup Codes found in a 15-1994 remote, and some others.

n. **Devices Spreadsheet**
An Excel file containing protocol and device specifications for a very large number of devices.

o. **RDF (Remote Definition File)**
A file that provides **IR** with all the information it needs about a particular model remote control, such as what keys it has, how they are coded, etc.

p. **Protocol**
A segment of code that tells a remote how to format an infrared signal, including carrier frequency, signal timing, etc.

q. **Signal Style**
The order in which bits are transmitted, and whether or not they are complimented from the raw data supplied to the protocol. There are four Signal Styles, as follows:

1) MSB
The Most Significant Bit of a data word is transmitted first.

2) MSB-Comp
The Most Significant Bit of a data word is transmitted first and the bits are complimented.

3) LSB
The Least Significant Bit of a data word is transmitted first.

4) LSB-Comp
The Least Significant Bit of a data word is transmitted first and the bits are complimented.

r. **UEIC (Universal Electronics Incorporated)**
The company that manufactures all of the remotes used in the JP1 group.

s. **OFA (One For All)**
The main brand name under which UEIC markets its universal remote controls.

t. **RS (Radio Shack)**
Most Radio Shack remotes, including the 15-1994, are made by UEIC.

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