ADDING MORE DVR POWER TO THE ARCOM RC-210 Part I

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REMEMBER… DO THIS DVR BOARD ADDITION AT YOUR OWN RISK!!!
The information contained in this article has been carefully checked for accuracy and is believed to be reliable. However, no responsibility is assumed for inaccuracies.

Recently, there has been a release of new Digital Voice Recorder (DVR) chips and boards on the market that are simple, easy to use and rather cheap. Our goal here is to get passed the hardware limitations placed on DVR storage capacity in most repeater controllers. What I have found is a DVR board that has virtually unlimited storage ability and can be added on without any software or hardware modification to your RC-210. So please, ***don't call*** up ARCOM and ask them what to do to make this work. **THE FUNCTIONALITY IS ALREADY PROVIDED AS PART OF THE RC-210 FIRMWARE AND BY THE DVR BOARD MANUFACTURER! REMEMBER… ADDING THIS DVR BOARD IS AT YOUR OWN RISK!!! YOUR RC-210 CONTROLLER MUST BE AT v5.30 FIRMWARE OR LATER**. You will need in addition to the new DVR board is some way to mount it, mounting screws and stand-offs, multi-color wire, a soldering iron, solder, a 5K upright pc pot, (1) 22K and a LM7805 voltage regulator (TO-220 package). I'll try not to be long winded but I do write in a magazine style. I would like everyone to understand the theory, how to get a DVR board, the different hookups and the programming of the RC-210. *I do ask that you read completely through this file first before you begin the project.*

What we needed in our repeater group was a way to expand voice messages beyond just basic IDs and short memos in the RC-210. Our DVR internal to the RC-210 is tied up with custom courtesy tone tracks and the DVR user test track, so this means that any longer notices concerning club activities or exclusive IDs needs to be stored and played back outside the controller. Yes, we could have used the IRLP or EchoLink computer at a site to function as an external DVR, but we knew that not all of our sites have that feature and also that dedicated equipment for a specific purpose was a better idea in case the computer failed at the site for some reason. And another concern (although there may be a way around it) was that it would tie up a port on the controller needing to decode T-T commands. Plus, the RC-210 can fire a 'Tail Message' as a 'Command Macro' which in turn can contain 'User Function' (UF) Output logic. Also by 'scheduling' a message to occur every so often, you can fire an external DVR trigger to play your track(s). This doesn't only apply to the RC-210 but to other controllers as well. The RC-210 happens to be our controller of choice for this article and is set up perfectly for this unit to work in the way described below.

I came across this small DVR board that has almost an unlimited storage capacity (depending on the size of the SD memory chip used), does multiple track playback, works on 3.3-6 volts, uses a computer to record high quality .wav files (and other file types) for tracks, has two 'Activity' logic outputs, drives a headset or speaker for monitoring and is fully assembled all for the price of $99 dollars minus the SD memory chip. This unit has superior audio quality at 44.1 KHz, more flexibility and the ability to have selected track playback. The one draw back I can see is its unusual way to 'interrupt' a track while in playback mode (firmware mod from factory in the works by March 2011 to add a hardwire interrupt to the board) and I will discuss that option last in the article. It also appears to be a completely digital device and doesn't provide for any analog audio input in the existing hardware layout.

There are a few options on this unit that cause it to function in different modes. For this document, we will only use two of them. Each track must be recorded, edited in advance on a computer and then stored on an SD memory chip. The SD chip then plugs into the DVR board. After you play a DVR board track, the chip stops until another start input line or address is chosen. This means the 'Activity' logic output can act as a PTT. Tripping an empty track acts as a 'stop or interrupt' function during a playback. In Mode 1 (called the 8 Switch Mode), you can play 8 tracks accessed individually which don't all have to be the same length. Some of our repeater tracks are 20 to 30 seconds each. In Mode 2 (called the 7 Bit Parallel Mode), you can play up to

128 tracks of various lengths using binary coded programming of the DVR board track select pins. I'll have more to say about these two modes later on.

HOW TO AQUIRE THE DVR BOARD

This fully assembled DVR board is called a uMP3 Playback Module. The company that makes the unit is the Rogue Robotics Corporation. The datasheets can be found and downloaded at www.roguerobotics.com. The paperwork available there is very clear and well documented. You will see that they wanted to make the chip design as easy as possible without using a lot of external components. The only external part is the SD memory chip. This board is available directly from the Rogue online store. There are other dealers out there that carry this unit but the price I found so far is about the same. **Important: Please read "THE DVR BOARD OPERATIONS" below completely before placing your order.**
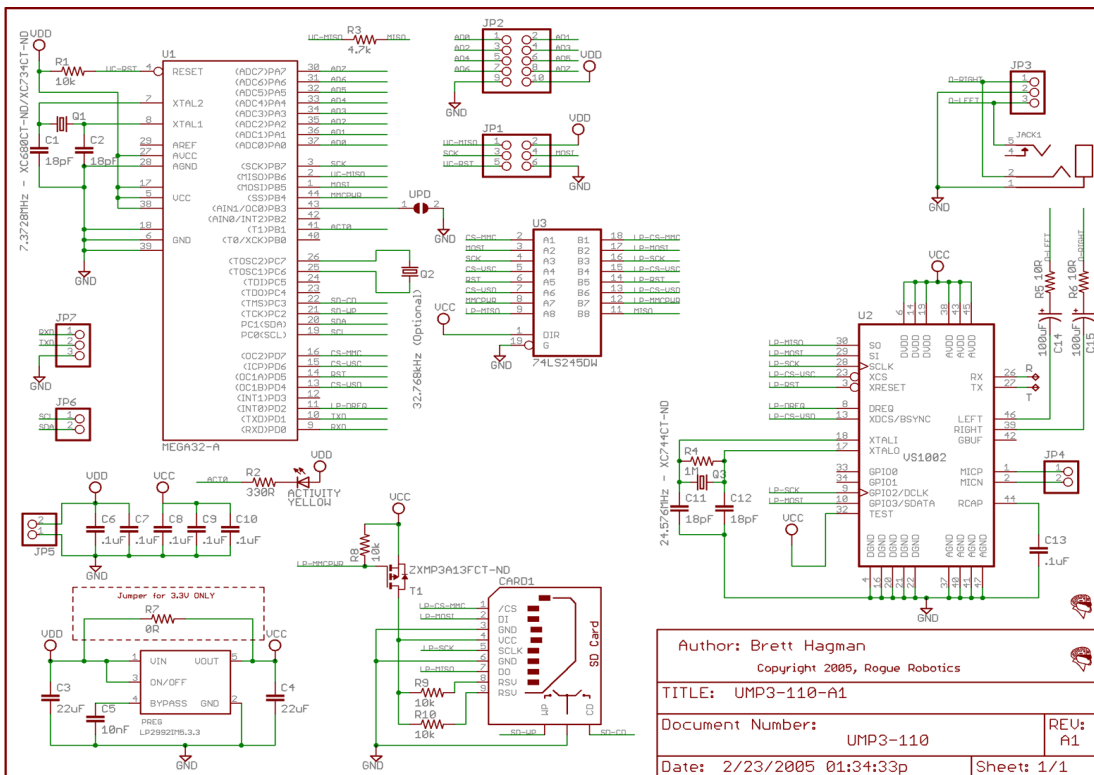
ABOUT THE DVR BOARD

Here's what the board looks like from the top & bottom (where the optional SD chip plugs in):
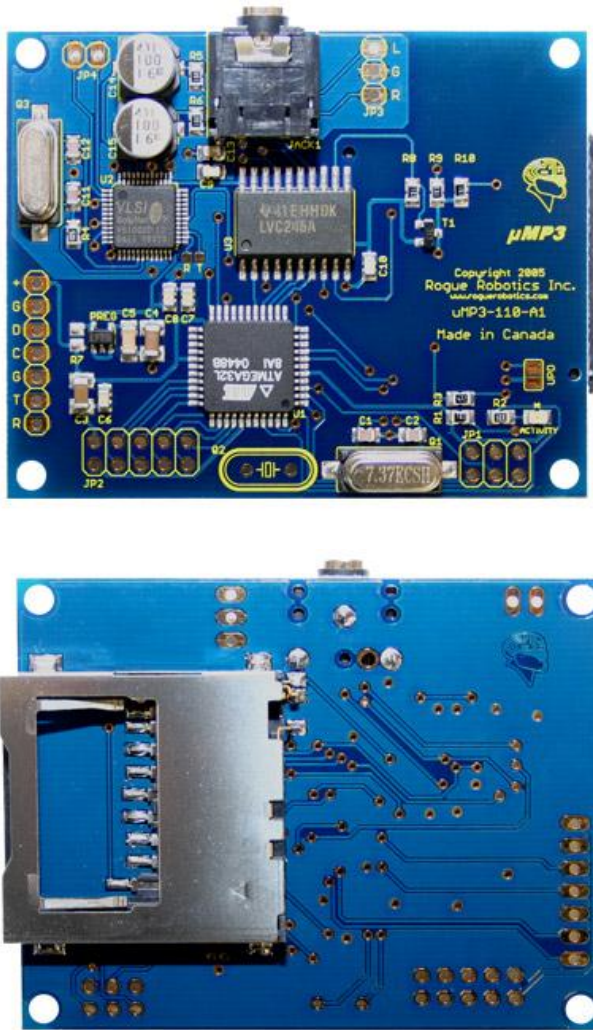
NOTE: The board above is reflective of the schematic below and will be used for this article thanks to the Rogue Robotics Corporation.

Here's the schematic:

As you have probably noticed, the board is small and there are very few parts. Connections are made simple and optional headers can be added if necessary. All the line inputs are connections to ground making the logic all low-true. Please read all the operational information before you try to use the board. This DVR board does require a few simple modifications to ready it for interfacing to a controller. **NOTE: The DVR board has other functions and commands that are not listed in this article. We chose a standard hookup but you may want to experiment and make additional connections.**

First, check out the DVR board according to the instructions with a speaker or headset to make sure it works. Go to your local Staples, Target, Best Buy, Wal-Mart, Walgreen's, Fry's, CVS, etc. or find one online and purchase the proper SD memory chip that will work as storage for your board. There are many sizes to choose from but for the most part, they're all pretty cheap. Check the DVR board manual for which one to buy. You may also need a SD memory drive for your computer to store the files. At this writing, the uMP3 works in the FAT16 or FAT32 formats only.

I want to interject this statement here… **By reading the uMP3 DVR board manual, you can see while programming your SD memory chip that you need to give each stored audio file a specific name in order for it to playback as a track when started by an input trigger. Make sure that you are very clear on this because I won't go into detail on this point. I will assume that you have programmed your SD chip and assigned them correct filenames for track number playback. Please also read the section of the manual that talks about the setting for the "Input File Number Offset" in case you want to program several 'banks' of files in the SD chip.**

If you're happy with the DVR board so far, power it down, remove the SD chip and let's move on. First, take a look at the LM7805 regulator drawing below. We'll use this to make sure the DVR

board only gets 5 volts input and that we don't cipher any voltages from the RC-210 controller board. **NOTE: Don't use an LM78L05 series part as they are not rated high enough to handle the current needed.**
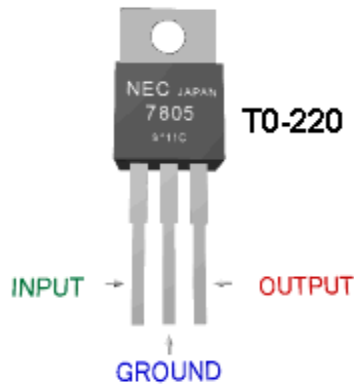
Now look at your LM7805 regulator the same way as the photo above. Bend the 'Input' lead behind the device at a 90 degree angle so it's out of the way of the other two leads when it gets placed on the DVR board. Position the regulator so that the 'Output' led plugs into the hole on the DVR board marked '+' and the 'Ground' led plugs into the hole on the DVR board marked 'G'. It should just slide right into the two holes on the board with the 'Input' led folded back out of the way and not touching the DVR board. This 'Input' led will get power supply voltage later. Solder the wires to the DVR board on the bottom side. No heat sink is necessary for the regulator. You can bend the entire body of the regulator if necessary later for mounting.

Next, install the 5K upright pc pot at the JP3 Line Out position. Install the pot so that the top leg connects to where the "L" is marked on the DVR board, the center leg (wiper) is curled up-words free and the bottom leg is connected to where the "G" is marked on the board. Solder the pot wire legs to the DVR board. The "L" represents the 'Left Channel' output of the DVR board. We only need to be concerned with one output channel. On the center leg (wiper) that does not solder to the board, solder one end of the 22K resistor to it. The other end of the resistor will connect to the controller audio input later.

THE DVR BOARD OPERATIONS

OK, I hope all of the following makes sense… Because this DVR board manufacturer made their device with the industry professional in mind, they didn't exactly make it easy for the weekend hobbyist. If you're good at building and interfacing, you won't have a problem with this particular unit. If you know enough to get by but are not too technically savvy, you can tag along with me and pick out the stuff just for you. Here we go…

Rogue Robotics Corporation designed a very nice and unique board in the uMP3. What you have to do is use your computer not just to record audio files to the SD memory card, but to also pre-program the actual DVR board with an initial setup. There is a program that you can download for free at their website that allows you to set these parameters on your uMP3 board. This requires you to have a TTL Level Converter (such as the MAX232) in between your computer port and the DVR board. **Important: The DVR board will be damaged if you connect it directly to your computer!** I would like to go over the items that must be pre-programmed into the DVR board before it can work for us. Please consider the following:

- Decide whether your unit will work in Mode 1 or Mode 2 (as mentioned earlier)
- Decide whether or not your tracks can be 'interrupted' during playbacks
- Decide whether you want to recall banks of 'offset' playback tracks
- Turn on 'Active' logic output at Point 'D' on the DVR board
- Set 'Volume' of audio at the output

Those are the main parameters to be concerned about. All the 'Settings' are listed in the DVR board instruction sheets in case you need to view them. Volume output may be a concern if the level is too hot at 1.8 Vpp for your headset or speaker.

We talked a little earlier about Modes 1 and 2 and now we need to go into further detail. Simply put, conventional Mode 1 (called the 8 Switch Mode), allows us to attach up to 8 controller UFs to a socket on the DVR board and play 8 different tracks when one of those lines is pulled low-true. Sounds easy enough right? This mode also allows you to 'interrupt' a playback by triggering an empty track while the DVR is playing. With recent firmware changes to the RC-210, we can easily handle this in programming which we will address later to 'interrupt' a track during receiver activity. Therefore, you get the basic operation using controllable UF outputs (those are expandable on the RC-210 to get more if the others are already tied up) and selective track assignments 1 thru 8. You also have the option of selecting *non-interrupt* as a feature in the DVR board pre-programming; you can have all 8 tracks and not use the interrupt function at all. In this mode, I would leave interrupt 'turned on' in the DVR board pre-programming and let the RC-210 handle whether it's on or off.

Now, Mode 2 (called the 7 Bit Parallel Mode and the one I elected to use), allows us to attach up to 7 UF Outputs to a socket on the DVR board and play 128 different tracks when those lines are pulled low-true in a 'binary' coded sequence. By using binary numbers to explain, those 7 output wires represent a 7 digit place holder of 0's and 1's all the way from 0000000 to 1111111. Examples would be 0000001 = 1, 0000010 = 2, 0000111 = 7, 0110010 = 50, 1110101 = 117, etc. just to give you an idea. So all those binary numbers equal decimal values from 0 to 127 which in turn happen to equal the amount of assigned tracks we can play of 128. The 8th UF wire connection this time is used to start the DVR board to play back the tracks once the binary code is assigned. This gives us so many other options now for playing tracks from the repeater controller or any other binary programming source.

Let's see why this method works but feel free to skip this if you already understand the binary encoding theory:

Unlike using the conventional way of pressing dedicated buttons or relays to start and select the DVR board tracks (as in Mode 1), we can take those same wires we used in the Mode 1 example and give them tremendous power in our Mode 2 setup. According to our binary chart below:

7 Binary numbers (1111111) equals a decimal value of 128
6   "   "   (111111)   "   "   "   "   "   64
5   "   "   (11111)   "   "   "   "   "   32
4   "   "   (1111)   "   "   "   "   "   16
3   "   "   (111)   "   "   "   "   "   8

So, 7 wires connected to emulate binary numbers between 0000000 and 1111111 will play 128 DVR tracks. 6 wires connected to emulate binary numbers between 000000 and 111111 will play 64 DVR tracks and so on… Get it? The 8th wire as described earlier is used to start the DVR board tracks to play. So how can we easily get these binary codes without a computer or intense outboard programming? Simply by using your repeater controller Macros to program binary encoded UF Outputs. Although I will give programming examples later, I want to drive this point home now.

Most repeater controllers have plenty of spare Macros that we never use. For our repeater system, we went with the 4 binary numbers method that gives us 16 tracks to play back. We used a total of 5 UFs from the RC-210 controller to program and start the DVR board (again, other controllers work in a similar fashion). This means we will only use 16 Macros to create binary encoding for all 16 DVR board tracks. Obviously, you can use as many wires and Macros as your controller can spare. For this example, we want to play DVR board track #6. Connect UF Outputs

1 thru 4 to the DVR board track select pins 1 thru 4 in a Least Significant Bit (LSB) to Most Significant Bit (MSB) order. Ground track select pins 5, 6 and 7 on the DVR board. Connect UF Output 5 to the 'start' pin 8 on the DVR board. We'll use Macro 26 on the RC-210 to setup the outputs to play track #6. Have the Macro setup UF 1 Output low (0), UF 2 Output high (1), UF 3 Output high (1), UF 4 Output low (0) all done right-to-left in LSB to MSB fashion. Macro 26 is now set at binary 0110 to equal decimal or track #6. For grins, we can send the start command out of Macro 26 as well as the last parameter. You would just pre-build 15 other Macros to binary encode the UF Outputs and start the remaining 15 tracks. That's it! We used track 16 as our empty track for the interrupt option.

With all that said, all you have to do now is record your audio track files. The really good thing about this type of message making is that you have access to an endless source of audio product. There are several PC programs you can use to edit and export the proper high quality files for the DVR board. Some are even free if you look around on the internet. You may want to also make sure that the volume level of your tracks is consistent between messages. Please make sure all your tracks are 'Mono' recordings and have the proper file names that correspond to each track number.

THE CONNECTIONS TO THE DVR BOARD

Now we get down to the easy part. Let's look at the RC-210 first. If you are using the factory rack chassis that houses the RC-210, then you will see that there is limited room to mount the DVR board if you have all the older RAD boards installed. If you have the new RAD board installed, it does free up some room for possibly mounting a DVR board. ARCOM has also made it easy to extend connections to the outside world by adding a DB-25 connector on the rear of the chassis. Ordinarily, there are several open pins available to interface external devices. We do have to route some wires from the RC-210 board either to the DVR board itself or to this connector. All but one connection (Power) appears on a header or main DB-25 connector of the RC-210. Remove all power and connections to the RC-210.

Since we have to make a few decisions before we make the connections from the DVR board to the RC-210, we do that now. We use an Aux Audio Input, Alarm Input and User Function (UF) Outputs on the RC-210 so we don't have to tie up a port. Here's what these ties do:

- There are 3 different Aux Audio Inputs that are high-impedance and can be enabled and disable. They can all be routed to whichever port you want to hear the messages on. The Audio Out pot from the DVR board connects here to supply playback audio. Choose an Aux Audio Input that is not being used.
- There are 5 different Alarm Inputs. The 'Activity' Output from the DVR board connects here to tell the controller that it's playing a track. Choose an Alarm Input that is not being used.
- There are 7 different UF Outputs (you may have to expand them to get more). These outputs fires the 'Start' pin and selects the tracks lines on the DVR board. You will need up to 8 UFs for Mode 1 and 4 to 8 UFs for Mode 2. Choose a set of UF Outputs that are not being used.

Whether you are installing the board inside the RC-210 chassis or not, solder several multi-color wires to the DVR board as follows: **Power** (I cleanly soldered to the 'Input' led [cutting off excess] of the LM7805 we installed on the DVR board), **Ground** (I soldered to a ground lug that I screwed into the top hat of the LM7805 we installed on the DVR board. You can solder to a ground on the DVR board if you wish), **Audio Out** (I soldered to the 22K resistor leading to the Audio Out pot wiper on the DVR board), **'Start' line** (Only for Mode 2, I soldered to JP2 Pin 8 on the DVR board), **'Activity' Output** (You can use Point 'D' on the DVR board for high-true for the Alarm Input), and **Track Select lines** (I soldered as many wires as I needed [depending on the mode and amount of tracks I selected] to JP2 pins 1 thru 8. For my needs, I selected Mode 2 using 5

UFs connected to JP2 pins 1 thru 4 and 8). Ground any track select pins on JP2 that are not being used. Again, according to the presets and items we talked about earlier, this will determine the amount of UFs to use. We will talk about possibly using an additional UF for optional receiver interrupt later.

NOTE: DO NOT TAKE THE DVR BOARD POWER CONNECTION FROM THE RC-210 POWER SUPPLY. You can take it from where the source power comes into the RC-210 board or battery backup. You will damage the RC-210 if you don't heed this warning!

I'm sure you know which multi-color wire you used to make the connections on the DVR board. Either connect them with the DVR board mounted internally or externally via the DB-25 (you decide which pins to use) to the RC-210. Here are the connection points:

DVR board	**RC-210**
• Ground	Power Supply Input (Negative)
• Power	Power Supply Input (Positive)
• Audio Out	J9 Pins 6 (Aux Audio In 1), 5 (Aux Audio In 2), or 4 (Aux Audio In 3). Select one of the three.
• Activity Out	Main DB-25 Connector RC-210 board, Pins 16 (Alarm In 1), 17 (Alarm In 2), 18 (Alarm In 3), 19 (Alarm In 4), or 20 (Alarm In 5). Select one of the five.
• 'Start' line	Main DB-25 Connector on RC-210 board, Pins 9 (UF Logic 1), 10 (UF Logic 2), 11 (UF Logic 3), 12 (UF Logic 4), 13 (UF Logic 5), 14 (UF Logic 6), or 15 (UF Logic 7). Select one of the seven or one from the optional expanded UF lines.
• Track Select lines	Main DB-25 Connector on RC-210 board, Pins 9 (UF Logic 1), 10 (UF Logic 2), 11 (UF Logic 3), 12 (UF Logic 4), 13 (UF Logic 5), 14 (UF Logic 6), or 15 (UF Logic 7). Select from the seven or from the optional expanded UF lines.
• Track Interrupt line	(Please read below under 'Adding a DVR Track 'Interrupt')

As always, use the proper soldering and grounding techniques while making connections. Check all your work and re-connect the controller and power it up for programming. In theory unless something has happened, the RC-210 should function exactly the way it did before you powered it down for the installation. If it doesn't, try removing or disconnecting the DVR board from the RC-210 and try it again. If it works, backtrack your connections to the DVR board and verify your connections to the RC-210. Existing programming of the RC-210 I/O connections may be an issue here as well.

PROGRAMMING THE RC-210 FOR THE DVR BOARD

Now that the hardware connections are made, we need to program the RC-210 for the behavior we want. There are several ways to do this. The easiest is just to tell the controller to send a Tail Message command at a timed interval after the repeater carrier drops or you could have the Scheduler tell the DVR board to play every 60 minutes. I'll give a few examples. Most of the programming for this was actually posted by ARCOM back in 2006 for adding IRLP, Echo Link, WIRES, etc to the RC-210 without having to tie up a port. I just borrowed it and included a few more lines to include the Tail Message generator and Scheduler. The following should work just fine for our DVR board project:

NOTE: For the programming examples, we will assume Radio Port 1, Aux Audio In 1, Alarm In 1 and UF Outputs 1 thru 7. You can check the ARCOM RC-210 Operations Manual for codes reflecting the other connection pins, expansions and programming. Your RC-210 controller must be at v5.30 firmware or later.

Example 1 - Using 'Tail Messages' to start the DVR board in Mode 1

This example will program the RC-210 to send DVR board track #4 message 5 minutes after the end of repeater transmission. *Remember in this mode, tracks 1 thru 8 can be selected and played just by choosing and pulsing the right UF line.*

First, we program a few Macros for routing to Radio Port 1. In our example, we'll use Macros 2 through 5 but you can use whatever Macros are free in your setup:

Macro 2 will simulate activity from the DVR board, so we want it to turn on Aux Audio In 1:

*4002 02 162 146

Macro 3 will simulate inactivity from the DVR board, so we want to turn the Aux Audio In 1 back off:

*4002 03 162 149

Macro 4 will cause the UF Output 4 to trigger Track Select line 4 of the DVR board to play. This will be a momentary start. It will also turn on Alarm In 1 which turns on the repeater transmitter:

*4002 04 152 112

Macro 5 will turn off Alarm In 1 which will turn off the repeater transmitter.

*4002 05 157

We need to program up Alarm In 1 to call the appropriate Macros for active/inactive from the DVR board:

*2101 1 2   Alarm In 1 low-to-high transition calls Macro 2
*2101 1 3 5   Alarm In 1 high-to-low transition calls Macro 3 & Macro 5

Next, let's make sure the Aux Audio In 1 will timeout no matter what in 1 minute (60 seconds):

*1013 60

And finally, we have to program the Tail Message to send the command to Macro 4 starting the DVR board to play:

Now we program Tail Message 1 to use Command Macro 4:

*2110 1 4

Next we program Radio Port 1 to use Tail Message 1:

*2111 1

We elected to turn off the Tail Counter and use the Periodic Timer instead:

*2112 0   Turns off the Tail Counter

We now set the Periodic Timer to start a DVR board track 5 minutes after the repeater carrier drops. *NOTE: You may want to set this value low at first to make tests and to set the audio level without having to wait for a long interval:*

*1020 300

Example 2 - Using 'Scheduler' setpoints to start the DVR board in Mode 1

This example is basically the same as the other except we exchange the Tail Message programming for Scheduler setpoints. Program the following as before:

*4002 02 162 146
*4002 03 162 149
*4002 04 152 112
*4002 05 157
*1013 120
*2101 1 2
*2101 1 3 5

We now add the Scheduler programming and have the DVR board send the track #4 message every hour from 6am to 7pm weekdays only.

Add new Macros 6 & 7:

*4002 06 371   This will tell the DVR board to Resume tracks at 6am
*4002 07 351   This will tell the DVR board to Suspend tracks at 7pm

Program the Scheduler setpoints in this manner:

*4001 01 8 0A 00 04   This will call Macro 4 every hour during weekdays
*4001 02 8 06 00 06   This will call Macro 6 at 6am during weekdays
*4001 03 8 19 00 07   This will call Macro 7 at 7pm during weekdays

Example 3 - Using 'Tail Messages' to start the DVR board in Mode 2
This example will program the RC-210 to send DVR board track #13 message 2 minutes after the end of repeater transmission. *Remember in this mode, tracks 1 thru 128 can be selected by choosing the right pre-built binary Macro.*
First, we program Aux Audio In 1 to be routed to Radio Port 1. In our example, we'll use Macros 2 thru 4 and 13 but you can use whatever Macros are free in your setup:
Macro 2 will simulate activity from the DVR board, so we want it to turn on Aux Audio In 1:
*4002 02 162 146
Macro 3 will simulate inactivity from the DVR board, so we want to turn the Aux Audio In 1 back off:
*4002 03 162 149
Macro 4 will turn off Alarm In 1 which will turn off the repeater transmitter.
*4002 04 157
Macro 13 will set the binary number of 1101 in UF Outputs 1 thru 4 (LSB to MSB) and cause UF Output 7 to trigger Track Select line 8 of the DVR board to play. This will be a momentary start. It will also turn on Alarm In 1 which turns on the repeater transmitter:
*4002 13 102 096 104 105 152 115
We need to program up Alarm In 1 to call the appropriate Macros for active/inactive from the DVR board:
*2101 1 2   Alarm In 1 low-to-high transition calls Macro 2
*2101 1 3 4   Alarm In 1 high-to-low transition calls Macro 3 & Macro 4
Next, let's make sure the Aux Audio In 1 will timeout no matter what in 1 minute (60 seconds):
*1013 60
And finally, we have to program the Tail Message to send the command to Macro 13 starting the DVR board to play:
Now we program Tail Message 1 to use Command Macro 13:
*2110 1 13
Next we program Radio Port 1 to use Tail Message 1:
*2111 1
We elected to turn off the Tail Counter and use the Periodic Timer instead:
*2112 0   Turns off the Tail Counter
We now set the Periodic Timer to start a DVR board track 2 minutes after the repeater carrier drops. *NOTE: You may want to set this value low at first to make tests and to set the audio level without having to wait for a long interval:*
*1020 120

Example 4 - Using 'Scheduler' setpoints to start the DVR board in Mode 2
This example is basically the same as the other except we exchange the Tail Message programming for Scheduler setpoints. Program the following as before:
*162 146
*4002 02 162 146
*4002 03 162 149
*4002 04 157
*4002 13 102 096 104 105 152 115
*1013 120
*2101 1 2
*2101 1 3 4
We now add the Scheduler programming and have the DVR board send the track #13 message <u>every hour from 9am to 5pm weekdays only.</u>
Add new Macros 6 & 7:
*4002 06 371   This will tell the DVR board to Resume tracks at 9am
*4002 07 351   This will tell the DVR board to Suspend tracks at 5pm
Program the Scheduler setpoints in this manner:
*4001 01 8 0A 00 13   This will call Macro 13 every hour during weekdays
*4001 02 8 09 00 06   This will call Macro 6 at 9am during weekdays
*4001 03 8 17 00 07   This will call Macro 7 at 5pm during weekdays

Adding a DVR Track 'Interrupt' Feature (optional)

In either DVR Mode 1 or 2, recent software features added to the RC-210 allow us to provide an option for interrupt to the playback of a DVR track with repeater receiver activity macro. At present, to interrupt this DVR board, you have to play an 'empty or un-programmed' track taking away a track in both DVR modes (i.e. 7 instead of 8 in Mode 1 and 127 instead of 128 in Mode 2). The hardware pin that would normally interrupt a playback and gives you all the tracks was unfortunately an oversight and left out in the initial design. But not to fear, the designers at Rogue Robotics realized this fact and issued a special beta release of new firmware fixing this problem in the uMP3. For now as of this writing, that beta firmware is only available here prior to the official release. Use the RogueUpdater (www.roguerobotics.com/wikidocs/tools/rogueupdater) to upload the firmware file (ump3-100.rfw) with this article. It will enable Pin C on the board to act as an interrupt line with a low-true pulse. This pin will stop the playback of a track, reset the track queue and turn off the Activity output in either Mode 1 or 2.

Now for hookup purposes, use an extra UF output to trigger Pin C on the DVR board or use the existing method of adding one of your track start/programming input wires to fire an empty track in either Mode 1 or 2. No additional software updates to the DVR board are needed for the latter.

Any UF logic output pulsing on an empty DVR input line acts as an interrupt in Mode 1. Any UF logic output programmed with a binary number to set and fire off an empty track will cause an interrupt in Mode 2. And again, only one method of interrupt is needed in either mode if Pin C on the DVR board is used. The "Receiver Macro" function is what we program on the RC-210 (firmware v5.30 and above) to make this work. We will give receiver interrupt examples for DVR Modes 1 and 2 as well as for Pin C:

Example 5 - Using Receiver Interrupt with the DVR board in Mode 1
In the following Examples 5, 6 & 7 we will modify a few of the previous lines and add a few more.
Use Example 1 exactly from above and make the following additions and changes:
First, build a new macro to call (in our example, we are going to unlock Port 1 and use Macro 90):
*2113 1 90   Program Port 1's receiver going active to call Macro 90
Now we also want to program a couple of Macros to allow us to turn this feature ON & OFF as needed (we'll use Macros 92 & 93):
*4002 92 358   Enable Port 1 Receiver Active Function
*4002 93 361   Disable Port 1 Receiver Active Function
Next, we program up Macro 90 to handle pulsing UF7 on and off in response to receiver activity:
*4002 90 115   Pulsing UF7 wired as Track Line #7 to play a blank (non-programmed) track
Modify existing Macros 4 & 5 with the following:
Macro 4 will cause the UF Output 4 to trigger Track Select line 4 of the DVR board to play. This will be a momentary start. Next, it will also turn on Alarm In 1 which turns on the repeater transmitter. And finally, enable the Receiver Active function for the interrupt:
*4002 04 152 112 92
Macro 5 will turn off Alarm In 1 which will turn off the repeater transmitter. It will also disable the Receiver Active function:
*4002 05 157 93
Example 2 above will work basically the same.

Example 6 - Using Receiver Interrupt with the DVR board in Mode 2
Use Example 3 exactly from above and make the following additions and changes:
First, build a new macro to call (in our example, we are going to unlock Port 1 and use Macro 90):
*2113 1 90   Program Port 1's receiver going active to call Macro 90
Now we also want to program a couple of Macros to allow us to turn this feature ON & OFF as needed (we'll use Macros 92 & 93):
*4002 92 358   Enable Port 1 Receiver Active Function

*4002 93 361 Disable Port 1 Receiver Active Function

Next, we program up Macro 90 to handle setting binary UF Outputs 1 thru 4 (LSB to MSB) to play a blank (non-programmed) track #16 (or binary 1111). We then pulsing UF7 on and off to play the track:

*4002 90 102 103 104 105 115

Modify existing Macros 4 & 13 with the following:

Macro 4 will turn off Alarm In 1 which will turn off the repeater transmitter. It will also disable the Receiver Active function:

*4002 04 157 93

Macro 13 will set the binary number of 1101 in UF Outputs 1 thru 4 (LSB to MSB) and cause UF Output 7 to trigger Track Select line 8 of the DVR board to play. This will be a momentary start. It will also turn on Alarm In 1 which turns on the repeater transmitter. And finally, enable the Receiver Active function for the interrupt:

*4002 13 102 096 104 105 152 115 92

Example 4 above will work basically the same.

Example 7 - Using Receiver Interrupt with the DVR board with Pin C (firmware modified)

Using either the Mode 1 or 2 examples from above, select a UF Output and connect it to Pin C. Setup the same scenario as in either Example 5 or 6 except Macro 90 this time will handle pulsing UF6 (or any other designated UF Output connected to DVR board at Pin C) on and off in response to receiver activity:

*4002 90 114 Pulsing UF6 wired to Pin C on the DVR board will interrupt track playback in either Modes 1 or 2.

Please remember that you can also use the 'Extended Logic Outputs' to yield more user functions. You just have to make sure to use their designators listed in the manual in the examples above.

Once you have the unit functioning, you still have to adjust the audio level into the repeater transmitter. Use the pot we installed on the DVR board for this job. You can set the level accurately with a station monitor (the best way) or by ear off the air.

I tried to pick the simplest approach to interface this unit to the ARCOM RC-210. Remember, you can also make this DVR board work with other repeater controllers. You may find other features, connections and additions, but this method worked out best for us. I will eventually follow this article up with the new rMP3 unit that offers similar specs, wiring hookups, performance and a cheaper price point. You can use this writing as a guideline and do it yourself if you don't want to wait. Special thanks go the Ken Arck at ARCOM and Brett Hagman at Rogue Robotics for their input. Thank you for your interest and I hope it works for your repeater group as well.

Cheers, WA6TFD / Keith wa6tfd@att.net

REMEMBER… DO THIS DVR BOARD ADDITION AT YOUR OWN RISK!!!
The information contained in this article has been carefully checked for accuracy and is believed to be reliable. However, no responsibility is assumed for inaccuracies.

All pictures, information and schematics are courtesy of ARCOM, NEC and Rogue Robotics Corporation