

MABEL, PiTone and Control Functions Installation Procedure for hamVOIP.org version 1.5 Allstar Distribution

Overview and preparation

These installation instructions describe a method of adding MABEL and PiTone to the hamVOIP.org version 1.5 Allstar distribution for use with a Yaesu DR-1X repeater. They also include installation instructions for numerous Bash Scripts and audio files which can be used to control the repeater via an 8 relay Sainsmart module, The added control functions can be accessed via SSH to the Raspberry Pi by clicking on menu items added into the version 1.5 Admin menu or they can be accessed via DTMF tones over the air.

Finally, a Bash Script is included to generate a 1 Hz watchdog signal which can be routed through a suitably programmed ATmega85 (Adafruit Trinket) to reset the Raspberry Pi running the Allstar, MABEL and PiTone programs in the event the watchdog signal disappears (e.g. the Raspberry Pi is accidentally halted). A block diagram showing the required wiring can be found at the end of these instructions. The installation procedure utilizes three freeware PC programs – Win32disk imager, WinSCP and Notebook++. Download and install them on your PC.

Win32DiskImager is used to install the hamVOIP version 1.5 Allstar Allstar image onto your microSD card. Win32DiskImager can be downloaded from:

<http://sourceforge.net/projects/win32diskimager/files/latest/download>

WinSCP is used to move files from your PC to the rPi (or rPi to your PC). It can also be used to view and edit files by right-clicking on the file and selecting EDIT.

CAUTION: The internal editor in WinSCP creates a “DOS” file when editing a file located on the PC (i.e. it places a linefeed and return after each line). A DOS file can not be executed in Archlinux. Linux requires each line of an executable file (e.g. *rc.local*, *initialize.sh*, etc) to end with a linefeed only. Therefore do not use the WinSCP built-in editor - instead use Notepad++ (right click on the file to be edited and select EDIT>Notepad++) to edit files on the PC side as necessary in the following procedure. On the Raspberry Pi side you may use the WinSCP built-in editor (double left click on the file to be edited) as it does not add <CR> in this case.

HINT: You can always check a file using Notepad++ to ensure it does not use <LF><CR> by selecting View>Show Symbol>Show all characters. You can delete all <CR> characters using search and replace. Find “\r\n” and Replace” \n” – (no quote sign)

WinSCP can be downloaded from:

<https://winscp.net/download/WinSCP-5.11.2-Setup.exe>

Notepad++ can be downloaded from:

<https://notepad-plus-plus.org/download/v7.5.1.html>

Initial setup

1. Begin by copying the *MABEL setup for the DR-1X repeater with hamVOIP v1.5 Allstar.zip* file to your PC and extracting it. You will see a number of different directories.

boot
etc
etc_modules-load.d
rpt.conf
simpleusb.conf
simpleusb_tune_usb.conf
usr_local_bin
usr_local_sbin
usr_local_sbin_firsttime
var_lib_asterisk_sounds_rpt

The directory names correspond to directories or files in the Allstar distribution. For instance, the *usr_local_sbin* directory corresponds to the */usr/local/sbin* directory on the Raspberry Pi.

2. Next, download the hamVOIP version 1.5 Allstar distro for Raspberry Pi (rPi) to your PC. Use 'Win32DiskImager' to install the image on your microSD card. Insert the microSD card containing the Allstar distro into your rPi and apply power to the rPi.
3. Open a WinSCP session on your PC and connect to your rPi.
 - a. Hostname is your rPi IP address as assigned by your router. (Hint: Use the address reservation feature of your router to always assign this IP address to your rPi.)

- b. Port Number = 222
- c. Login to the Raspberry Pi
 - i. User Name = root
 - ii. Password = root

Modify the rc.local file

The *rc.local* file on the rPi is like a Microsoft batch file. It runs once at boot time. It needs to be modified to initialize the relays in the Sainsmart relay module (if used), start the generation of the 1 Hertz watchdog signal (if used), start the MABEL program and start the PiTone program with the desired PL frequency (if used). Proceed as follows:

1. In the PC panel (left side) of WinSCP, navigate to the directory location where you placed the *MABEL setup for the DR-1X repeater with hamVOIP v1.5 Allstar* setup files you created from the zip file in step 1. Double left click to open the *etc* directory.
2. Right click the *rc.local* file then select EDIT>Notepad++ to open it. You should see the following:

```
#!/bin/bash
# rc.local file modified for MABEL and PiTone on N8BHT repeater

# Start the Watchdog 1 Hz Waveform
/usr/local/sbin/watchdog1hz.sh &

# Initialize relays and optoisolator inputs
sudo /usr/local/sbin/initialize.sh

sleep 1

# Start MABEL
mabel &

sleep 1

# Apply 12 VDC to the repeater via K3
/usr/local/sbin/firsttime/./rpton.sh

sleep 1

# Start Allstar
echo -1> /proc/sys/kernel/sched_rt_runtime_us
/usr/local/etc/rc.allstar

sleep 30
```

```
# Start PiTone at 100.0 Hz, 32 steps, 70% of full scale level
pitone 100.0 32 70 &

# Set PiTone to real time priority
pid=$(pidof pitone)
sleep 1
chrt -r -p 99 $pid

exit 0
```

If you are not using the 1 Hertz watchdog signal with the ATTiny 85 to reset the rPi if it is halted, then delete the following two lines from rc.local.

```
# Start the Watchdog 1 Hz Waveform
/usr/local/sbin/watchdog1hz.sh &
```

Next, if you are not using the Sainsmart 8 relay module in your repeater system configuration then delete the following two lines:

```
# Initialize relays and optoisolator inputs
/usr/local/sbin/initialize.sh
```

Next, , if you are not using the Sainsmart relay module then delete the following lines.

```
# Apply 12 VDC to the repeater via K3
sudo /usr/local/sbin/firsttime/./rpton.sh
```

If you are using PiTone then do not delete any lines but do change the PL frequency from 100.0 Hertz to your PL frequency.

Finally, if you are not using the PiTone program to generate a transmit PL tone then delete the following lines.

```
sleep 30

# Start PiTone at 100.0 Hz, 32 steps, 70% of full scale level
sudo ./pitone 100.0 32 70 &

sleep 1

# Set PiTone to real time priotity
pid=$(pidof pitone)
sleep 1
chrt -r -p 99 $pid
```

3. Save the edited *rc.local* file to the PC (File>Save As) in Notepad++ replacing *rc.local*. Close the Notepad++ editor.
4. In the rPi panel (right side) of WinSCP, navigate to the */etc* directory.
5. In the PC panel (left side), left click to highlight the *rc.local* file and then left click the Upload icon to upload it to the */etc* directory on the rPi. OK the replacing of the file on the rPi.

Install the MABEL and PiTone programs

MABEL is a program designed to run on a Raspberry Pi 3 (rPi) in conjunction with Allstar/app-rpt controlling a Yaesu Fusion DR-1X repeater. PiTone is a program that can also run on the same Raspberry Pi as MABEL and produces a high fidelity sinewave CTCSS tone to be transmitted by the repeater so that FM only stations do not hear C4FM digital transmissions. You must install MABEL. Install PiTone if you want to generate a transmit PL tone.

1. In the rPi panel (right side) of WinSCP, navigate to the */usr/local/bin* directory.
2. In the PC panel (left side) of WinSCP, navigate to the *usr_local_bin* directory. Left click to highlight *mabel*. If you are also using *pitone*, then CTRL-Left Click to highlight it. Left click the Upload icon to upload them to the *mabel* directory on the rPi.
4. In the rPi panel (right side) of WinSCP, for each of these files – *mabel* and *pitone*, right-click and select Properties. Then check the three boxes labeled "X" in each Permissions section. Click OK

Install the watchdog1hz and initialize scripts

The *watchdog1hz.sh* script ensures that if the rPi is accidentally shut down, it will be automatically restarted. The script, which is started by a call in the *rc.local* file at boot, generates a 1 Hertz squarewave signal that is routed to the K1 terminal interface from the MABEL/DR-1X Interface board. This 1 hz signal is connected to an ATTiny85 programmed to watch for the loss of this signal. If it disappears for more than 20 seconds, the ATTiny85 activates the K1 relay on the Sainsmart module to close

contacts for about 1 second. These contacts are wired to the RUN terminals on the rPi and thus, reset it. .

The *initialize.sh* script, which is also started by a call in *rc.local*, is used to initialize the Sainsmart relay module at boot. If you do not use the relay module, this script should not be copied into the rPi. If you do use a relay module but your control scheme differs from the one shown in the N8BHT wiring diagram in this procedure, you will have to modify this script for your configuration.

1. In the rPi panel (right side) of WinSCP, navigate to the */usr/local/sbin* directory.
2. In the PC panel (left side) of WinSCP, navigate to the *usr_local_sbin* directory. Ctrl - Left click to highlight the applicable program files – *initialize.sh* and/or *watchdog1hz.sh*. Left click the Upload icon to upload them to the */usr/local/sbin* directory on the rPi.
3. For each uploaded file, right-click and select Properties. Then check the three boxes labeled "X" in each Permissions section and click OK

Install scripts used to control the repeater from the ADMIN menu

As you are probably aware, *hamVOIP v1.5 Allstar* boots to an ADMIN menu so that Allstar can be controlled by selecting an item in the preconfigured menu. A convenient feature of *hamVOIP v1.5 Allstar* is the provision for the user to add additional items to the ADMIN menu. Instructions on how to add items to the menu can be found at:

<https://hamvoip.org/hamradio/arm-allstar/documents/howtos/admin-menu-howto.pdf>

The additional control capabilities added to the Admin menu used for the N8BHT repeater are included in here for your use and/or modification. They include the following features.

- Check the repeater status
- Turn the AC power to the Micor power supply ON/OFF
- Turn ON/OFF/Cycle the 12 volt DC power to the repeater
- Switch IN/OUT the Micor 100 watt RF amplifier
- ENABLE/DISABLE the repeater transmitter (receiver left on)
- Turn ON/OFF the transmitted PL

In addition to providing on-screen feedback as the selected menu item is executed, audio feedback is provided via the repeater. The audio files used for this purpose are provided in a separate section of this document.

Finally, all of the menu items can be executed over the air using DTMF commands. The modifications to the *rpt.conf* required for DTMF control are also provided in a separate section of this document.

To install these additional control capabilities to the Admin menu do the following:

1. In the rPi panel (right side) of WinSCP, navigate to the */usr/local/sbin/firsttime* directory.
2. In the PC panel (left side) of WinSCP, navigate to the *usr_local_sbin_firsttime* directory. Use the editing capability of WinSCP with Notepad++ to modify the scripts to meet your requirements then Ctrl - Left click to highlight each bash script that you want to transfer to the rPi. Left click the Upload icon to upload them to the */usr/local/sbin* directory on the rPi.
4. For each uploaded file, right-click and select Properties. Then check the three boxes labeled "X" in each Permissions section and click OK. **HINT:** In the Rights column, all files in this directory should show *rw-r-xr-x*.

Install sound files used with the added Admin menu items

As explained above, audio feedback for the added Admin items is provided by playing audio files (in the ulaw format) from the provided bash scripts. To use these audio files do the following:

1. In the rPi panel (right side) of WinSCP, navigate to the */var/lib/asterisk/sounds/rpt* directory.
2. In the PC panel (left side) of WinSCP, navigate to the *var_lib_asterisk_sounds_rpt* directory. Highlight the sound files you want to transfer to the rPi. Left click the Upload icon to upload them to */var/lib/asterisk/sounds/rpt* directory on the rPi.

Modify the *simpleusb.conf* and *simpleusb_tune_usb.conf* files.

Since this installation is specifically for the Yaesu Fusion DR-1X repeater using the MABEL/DR-1X Interface board, we can copy these files into the rPi rather than setting

them up during installation of the Allstar program during firsttime setup. **Note: When doing the firsttime setup at the end of this procedure, you should choose not to modify these files.**

1. .
3. In the PC panel (left side) of WinSCP, navigate to the *simpleusb.conf* directory. Highlight and upload the *simpleusb.conf* file.
4. In the PC panel (left side) of WinSCP, navigate to the *simpleusb_tune_usb.conf* directory. Highlight and upload the *simpleusb_tune_usb.conf* file.

Changes required for PiTone to run on the Raspberry Pi3

The PiTone program uses the I2C bus to communicate with the DAC (digital to analog converter) module that plugs into the MABEL/DR-1X Interface board. In order for this bus to work, changes are required to the *raspberrypi.conf* and the *config.txt* files on the rPi. If you are not using PiTone you do not have to perform the following steps.

1. In the rPi panel (right side) of WinSCP navigate to the */etc/modules-load.d* directory. In the PC panel (left side) of WinSCP, navigate to the *etc/modules-load.d* directory. Highlight and upload the *raspberrypi.conf* file.
2. In the rPi panel (right side) of WinSCP navigate to the */boot* directory In the PC panel (left side) of WinSCP, navigate to *boot* directory. Highlight and upload the *config.txt* file.

Complete the firsttime Allstar setup

1. Close the WinSCP program.
2. From your Windows PC, launch PuTTY and connect remotely to the rPi
 - d. IP address as assigned by your router
 - e. Port = 222
 - f. Login to the Raspberry Pi
 - i. User Name = root
 - ii. Password = root
5. Click on “Yes” to retrieve the latest system updates.

6. Click on OK to restart. Click on “No” to refuse system updates since you just did them.
7. Click on “Yes” to run first setup. Complete the firsttime setup.
8. When first time setup is complete, the rPi will reboot. Before rebooting, turn on a receiver set to your repeater output with receive PL turned off. **NOTE:** In the boot-up process, the PiTone program which generates the transmit PL is started about 30 seconds after Allstar so turning off the receiver PL at this point ensures you will hear the repeater messages that are broadcast at startup.
9. Wait about 15 seconds then reconnect using PuTTY. Be sure to use your new password.
10. Click on Yes to configure the Asterisk Configuration Files. Follow the prompts, enter information as requested. **DO NOT configure the Simple USB settings. Select “No”.**
11. Select “Yes” to restart Asterisk.
12. Allow about 10 seconds for Allstar to load and take control of the DR-1X repeater. The DR-1X front panel should display AUTO-AUTO. Transmit in FM (with your selected CTCSS tone) and the repeater should automatically switch to FM-FM. You should hear a courtesy tone when you unkey. After about 5 seconds MABEL will switch the DR-1X repeater back to displaying AUTO-AUTO.
13. The audio levels should be close to correct. If they need fine tuning, adjust them using item 12 of the Admin menu. Consult www.hamvoip.com and www.repeaterlink.org for more information on configuring audio levels and Asterisk.

Modify the *rpt.conf* file

The DTMF commands for the added control capabilities that are activated over the air are set up in the *rpt.conf* file. To include the DTMF activated commands in Allstar, open WinSCP, SSH into your Raspberry PI and do the following:

1. In the PC panel (left side) of WinSCP, navigate to the *rpt.conf* directory. Double left click on *Changes to rpt.conf* file to use the WinSCP built-in editor. Highlight, right click and copy the contents. Close the editor.

2. In the rPi panel (right side) of WinSCP, navigate to the */etc/asterisk* directory. Double left click the *rpt.conf* file to use the WinSCP built-in editor. Paste the contents to the end of the functions1998 stanza and place them just before the “; Place command macros here” line near the end of the file. Click on the floppy disk icon to save the file and then close the WinSCP editor.
3. SSH into your Raspberry PI and use Admin menu item 13 to Restart the Asterisk Server.

CONFIGURING THE PiTone CTCSS TRANSMIT TONE GENERATOR LEVEL

Use an oscilloscope to verify that you have a CTCSS sinewave signal of about 600 mV P-P and the proper frequency on the TONE(6) output terminal of the MABEL/DR-1X Interface board. This should produce about 700 HZ deviation. If available, use a deviation meter to verify the deviation. If the level is incorrect, adjust it using the TM1 potentiometer on the board. CW decreases the level. Should the need arise, you can adjust this level remotely at any time by editing the command line parameters in the */etc/rc.local* file where PiTone is invoked and rebooting the Raspberry Pi. The last command line parameter in the line starting PiTone is the level as a percentage of full scale. Initially, it is set to 70 (i.e. 70% of full scale). You will also have to change this parameter in the *txplon.sh* bash script so that it is not changed if you invoke Admin menu items 25 and 26.