

WinterHill - 4 Channel DATV Receiver

Operations Manual – 3v20a Rev4

This manual covers the Raspberry Pi and the Receive Commander and Viewer on a PC.

Contents

Links	2
Overview	3
Terminology	3
FTS433x NIMs	4
WinterHill Log File	4
LEDs	4
LNB PSU Voltage Generator Board LEDs	4
PIC LEDs	4
Automatic PIC Programming	4
Single NIM Use	4
RPi4 Default Startup	5
WinterHill System Block Diagram and NIM Antenna Connections for QO-100	7
RPi4 VLC Display Limitations	8
RPi4 Recommended Configuration	8
Operation Modes	9
Local	9
AnyHub	9
AnyWhere	9
Fixed	9
MultiHub	9
‘Headless’ Operation	9
Starting and Stopping WinterHill	10
Changing the Startup Mode	10
Starting WinterHill	10
Stopping WinterHill	10
Antenna Power Out	11
QO-100 Minimal Configuration	11
QO-100 with LNB Voltage Generator Board X	12
Multiple Use Configuration	12
Volume Control	13
VLC Title Bar	13
Sending Receive Commands to WinterHill	14
QuickTune	14
QuickTune Network Configuration	14
QuickTune Auto Tune Configuration	15
WinterHill Receive Commander	16
Sending Receive Commands from the RPi4	16
QO-100 Frequency Auto Calibration	17
Initialisation File	17

VLC and Firewall.....	19
Viewing on a PC	19
VLC Auto Reset	20
VLC Keyboard and Mouse Commands	20
Miscellaneous Parameters and Functions.....	21
Receive Frequency Lock Range.....	21
Symbol Rate Lock Range.....	21
Auto DVB-S Off	21
Multi Programme Detection	21
SR27500, SR22000 Special Mode	22
Fake Null Packet Detection	22
Transport Stream Modification – Null Packets	22
Transport Stream Modification – Event Information Table on PID 18.....	22
RPi4 WinterHill Software Components.....	23
Launcher	23
Second Stage.....	24
Changing the Base IP Port Number for Multiple WinterHills	24
Using WinterHill Remotely (from outside your house)	24
Pseudo QuickTune Commands	25
Bugs and Oddities.....	25
QuickTune-WinterHill Link	25
I2C Error.....	25
DVB-S Transport Stream does not appear	26
WinterHill UDP Port Usage	26

Links

See the WinterHill Raspberry Pi Installation Manual for Raspberry Pi software download details.

- WinterHill manuals and PC viewing and control software

https://wiki.batc.org.uk/WinterHill_Receiver_Project

- BATC Advanced Receiver PCB

https://wiki.batc.org.uk/Advanced_receiver_hardware

- BATC WinterHill Forum

<https://forum.batc.org.uk/viewforum.php?f=136>

- QO-100 QuickTune

<https://github.com/m0dts/QO-100-WB-Live-Tune/releases/tag/1.22b>

- WinterHill CAT20 Presentation

<https://www.youtube.com/watch?v=ZmUHBH7J8Ss>

Overview

- WinterHill is a 4 channel DVB-S/S2 receiver based on the BATC Advanced Receiver PCB
- The main components are a Raspberry Pi 4 (RPi4), 2 PICs and 2 FTS433x NIMs
- The PICs are programmed in-circuit
- The RPi4 software is based on LongMynd designed by M0HMO
- New RPi4 software, PIC software, PC software and LongMynd mods designed by G4EWJ
- PCB designed by G0MJW
- Installation and configuration software designed by G8GKQ
- The RPi4 interfaces to each NIM using a PIC, rather than an FT2232H USB module
- The four received transport streams (TS) can be sent to any location using UDP protocol
- Transport streams are displayed either locally or remotely using VLC
- Receive commands can come from any location and various sources, including QO-100 QuickTune designed by M0DTS
- The highest symbol rate is limited by the speed of the serial connections between devices and is about 10M bit/s per NIM. E.g. the QO-100 beacon at SR1500 FEC4/5 (2.4Mbps) and a terrestrial repeater at SR4000 FEC7/8 (7Mbps)
- Currently, the lowest symbol rate that can be received is 66kS
- WinterHill is named in memory of Brian G3SMU, who was a huge presence on ATV and microwaves from his Winter Hill QTH in Lancashire, North-West England

Terminology

It is suggested that use of the term 'tuner' is avoided to prevent confusion. The tuner has so far been the 'tin can'. In the WinterHill system, "the tuner has a tuner chip which has 2 tuners". ☺

- | | |
|---------------------------------|--|
| • NIM | network interface module – the 'tin can' |
| • PIC | 28 pin microcontroller |
| • The system has two NIMs | NIM_A and NIM_B |
| • Each NIM interfaces to a PIC | PIC_A and PIC_B |
| • Each NIM has two antennas | TOP and BOT |
| • Each NIM has two receivers | first receiver and second receiver. |
| • The system has four receivers | RX1 – RX4 |

FTS433x NIMs

- Either FTS4334L or FTS4335 NIMs can be used in any combination
- The difference between the FTS4334L and FTS4335 NIMs is that the FTS4335 does not have a preamp
- For QO-100 operation, the signal level from an LNB is so high that the lack of a preamp is not important and the FTS4335 works just as well as the FTS4334L

WinterHill Log File

For any problems, always look at the file **/home/pi/winterhill/whlog.txt**

LEDs

LNB PSU Voltage Generator Board LEDs

The LED in front of each PCB lights when a short circuit condition is sensed

PIC LEDs

- The LED in front of each PIC will give a burst of flashing at boot up and when WinterHill is started
- In normal operation, each LED flashes in proportion to the data rate from the NIM

Automatic PIC Programming

Every time that WinterHill starts, the PICs are checked and automatically re-programmed with the latest version, if required.

Single NIM Use

WinterHill can be used with a single NIM and PIC, but it must be NIM_A and PIC_A.

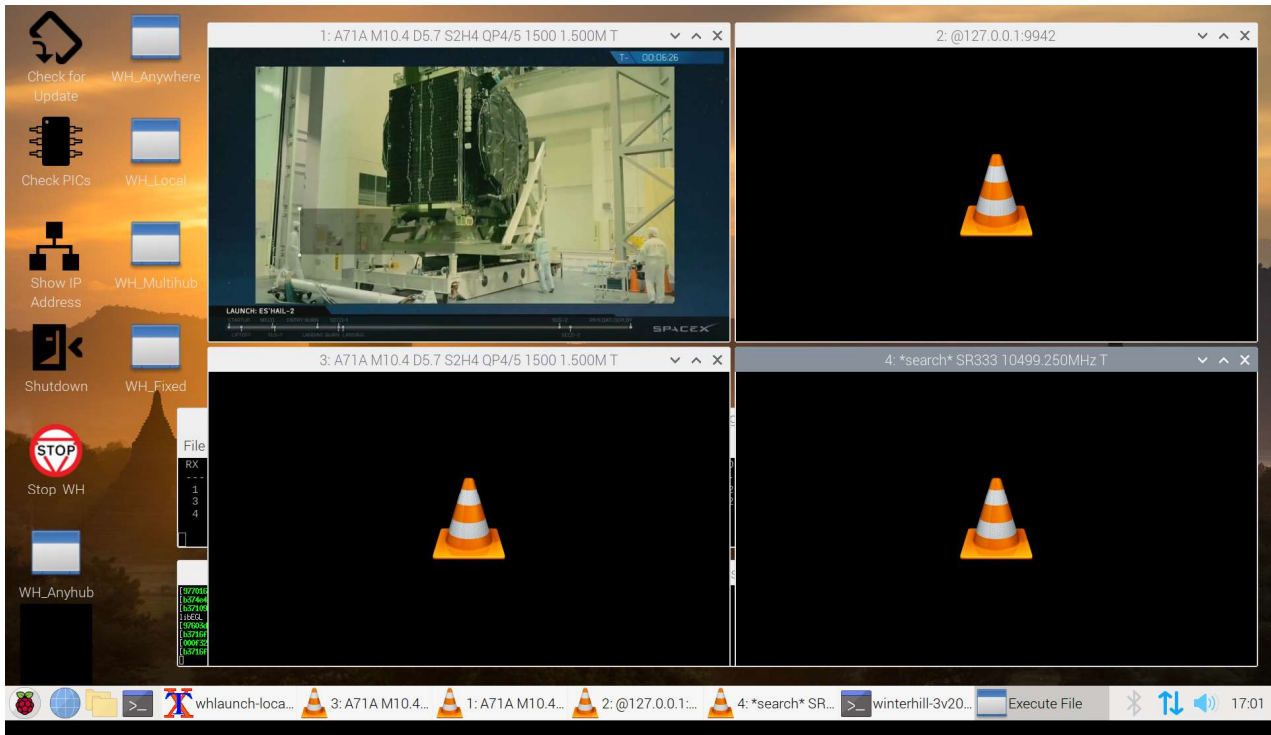
Four VLC windows may still be shown.

Both Voltage Generators are controlled by PIC_A, so they can both still be used.

RPi4 Default Startup

After re-booting for the first time, WinterHill will start in the default **LOCAL** launch mode. The RPi4 screen will look something like this. The **whlaunch** window and the **winterhill** window are behind the VLC windows.

The screen icons may have slightly different names from the ones shown.



It may be displaying the beacon on RX1, which uses the software codec, if the default WinterHill initialisation file `/home/pi/winterhill/winterhill.ini` is already compatible with your antenna setup. See further down for details about the initialisation file.

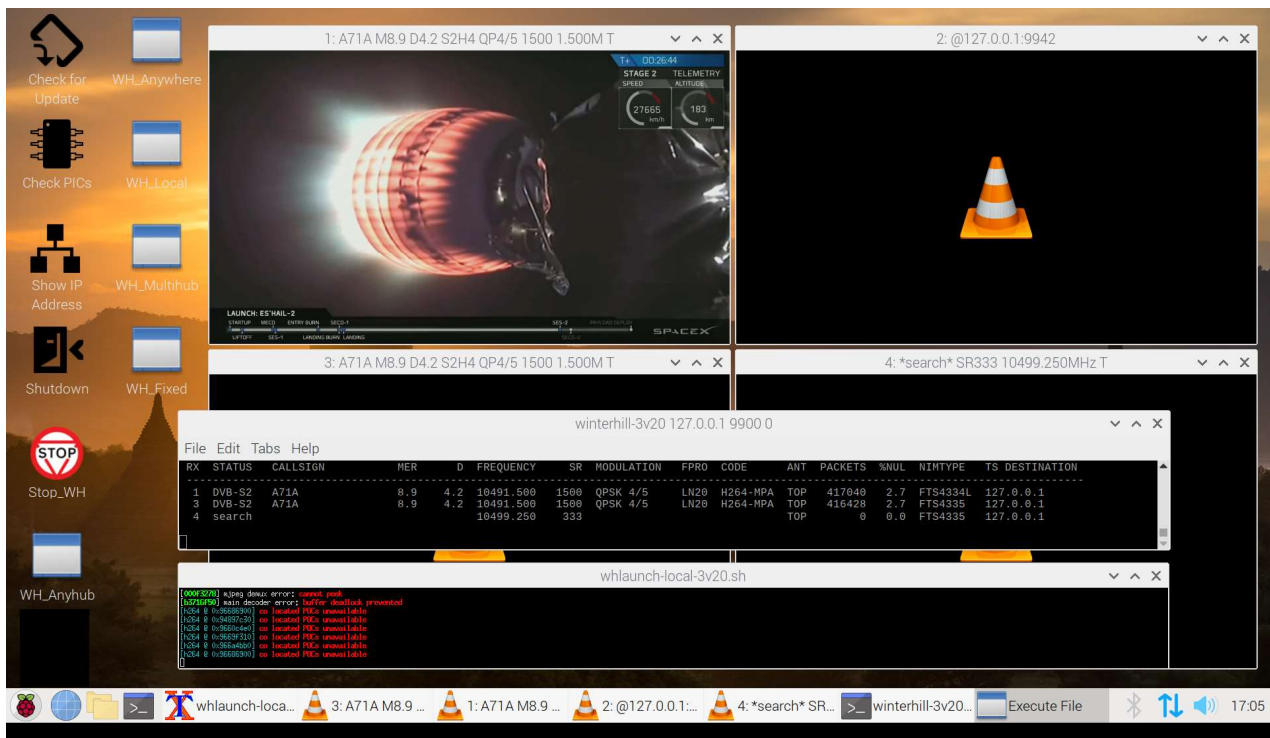
The beacon will not display on RX3, which uses the hardware codec, because of a known problem, but there may be sound, giving an echo effect. Only RX1 uses the software codec.

If the screen does not look like this, maximise the **winterhill** window, if present and look for error messages. Also look at the file `/home/pi/winterhill/whlog.txt`

The four VLC windows are looking for transport streams sent to IP address 127.0.0.1 and on IP ports 9941-9944.

127.0.0.1 is a special IP address known as LOCALHOST, which means 'this computer'.

Click on the two windows behind the VLC windows to bring them forward temporarily.



- If a hub launch mode is used in the future, only the two smaller windows are displayed.
- The **whlaunch** window will show any messages from VLC. It is not particularly significant, but may be useful for debugging. There can sometimes be lots of errors, even if video is still displayed. There will be errors shown at start up, as it waits for the windows to appear so that it can position them.
- The **winterhill** window will show a status line for each of the 4 receivers. It will also show information briefly as receive commands arrive. It can be enlarged for debugging purposes.

In normal operation, the **winterhill** window will display something like:

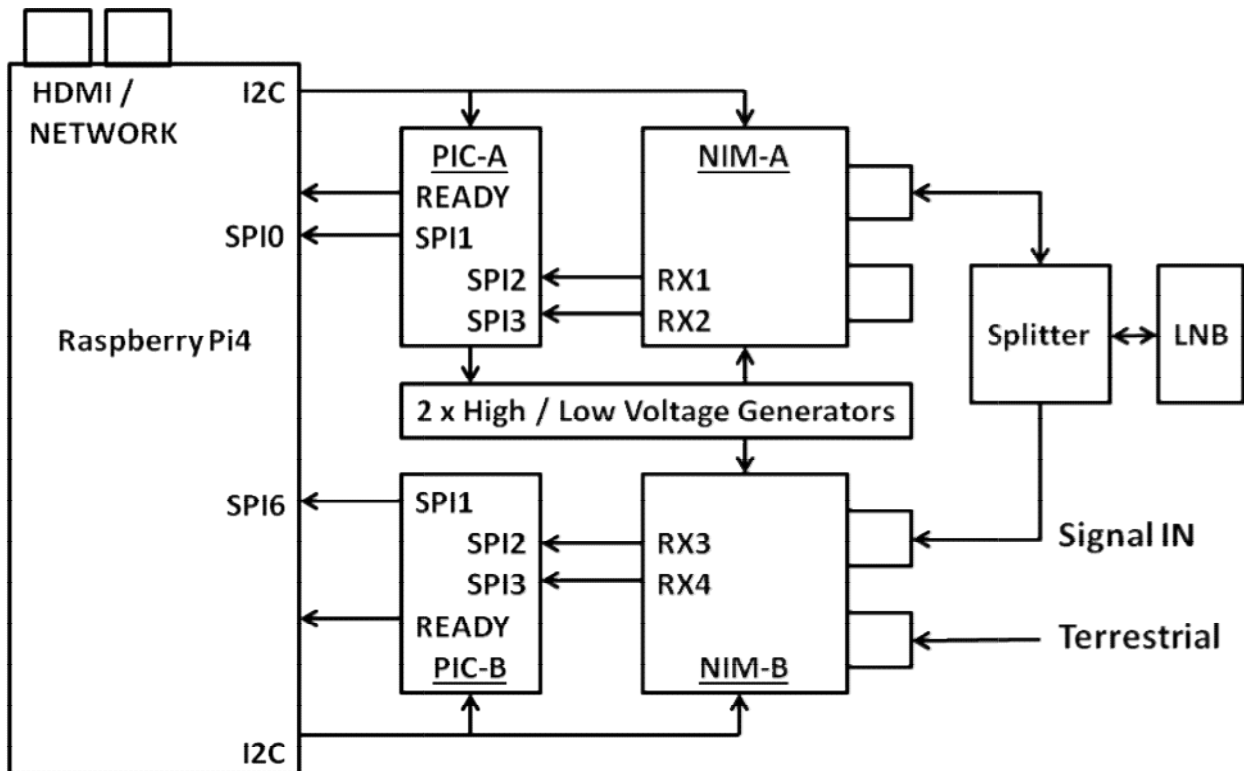
winterhill-3v20 0 9900 0															
File Edit			Tabs Help												
RX	STATUS	CALLSIGN	MER	D	FREQUENCY	SR	MODULATION	FPRO	CODECS	ANT	PACKETS	%NUL	NIMTYPE	TS	DESTINATION
1	DVB-S2	D03ASE	0.4	2.7	10498.758	250	QPSK 1/4	LN35	H264-AAC	TOP	4013	1.5	FTS4334L	192.168.77.237	
2	DVB-S2	D600PK	10.8	2.9	10498.254	333	QPSK 3/4	LY20	H265-AAC	TOP	15193	8.6	FTS4334L	192.168.77.237	
3	DVB-S2	IK4IDY	10.0	4.8	10499.255	333	QPSK 5/6	LN20	H265-AAC	TOP	6964	7.7	FTS4335	192.168.77.237	
4	DVB-S	G4EWJ	27.4	21.6	1249.019	4000	QPSK 7/8		H262-MPA	BOT	16.467M	2.4	FTS4335	192.168.77.237	

It may be necessary to change the window text size parameters to get the display exactly as above. Use **Edit / Preferences**.

- Click VLC windows 3 and 4 to bring them to the front again.

WinterHill System Block Diagram and NIM Antenna Connections for QO-100

- Either receiver in a NIM can be fed from either the top or bottom antenna socket, so to receive four QO-100 signals requires only the top two antennas to be fed from a splitter.
- The bottom two antennas can be connected to terrestrial antennas.
- See later for antenna power out options for LNBs and preamps.



RPi4 VLC Display Limitations

- By default, VLC on the RPi4 uses the hardware H.264 and H.265 codecs. These are very efficient and considerably reduce the processing power that would be needed for software codecs.
- The hardware codecs do not like some received data and will not display video, most noticeably the QO-100 beacon.
- The hardware H.265 codec sometimes displaces the colour plane vertically.
- WinterHill configures the VLC window for RX1 to use the ffmpeg codec. This will display the beacon, but it is a software codec that uses a lot of resources, especially for H.265.
- When using the hardware codec, VLC can display only one H.265 signal at a time, or all VLCs displaying H.265 using the hardware codec will lock up.
- WinterHill is configured to display H.265 only from RX1 and RX2; RX1 using the ffmpeg codec and RX2 using the hardware codec.
- If H.265 is being received on receivers 3 and 4, no video will be displayed and the VLC title bar will use asterisks as a reminder. E.g. *S2H5*.
- These limitations do not apply when using VLC remotely on a PC.
- CPU activity and memory usage can rise for no apparent reason.

RPi4 Recommended Configuration

- Ethernet is recommended rather than WiFi, both on the RPi4 and when viewing on a PC.
- If Ethernet is used, the RPi4 WiFi should be turned off using the icon in the bottom right of the task bar. Also turn off Bluetooth if not needed.
- If Ethernet is connected and WiFi is connected to a router, the RPi4 will have 2 IP addresses and the IPINTERFACEADDRESS parameter would need to be set in WH launch files to select the required IP address.
- Starting WinterHill in **AnyHub** mode and viewing on a remote PC will avoid the RPi4 limitations detailed in the section above.

Operation Modes

For all modes, receive commands can come from any IP location.

Local

- Received data is sent only locally to the RPi4
- Four VLC windows are started on the RPi4
- VLC1 uses the ffmpeg codec, so it should display any transport stream
- VLC2, VLC3, VLC4 use the hardware codec
- Only VLC1 and VLC2 can display H.265 video

AnyHub

- Received data is sent to wherever the receive command came from
- Different receivers can send to different locations, but only one location can receive any one receiver's data
- No VLC windows are started on the RPi4

AnyWhere

- Received data is sent to wherever the receive command came from
- Different receivers can send to different locations, but only one location can receive any one receiver's data
- Four VLC windows are started on the RPi4
- VLC1 uses the ffmpeg codec, so it should display any transport stream
- VLC2, VLC3, VLC4 use the hardware codec
- Only VLC1 and VLC2 can display H.265 video

Fixed

- Received data is sent only to the IP address specified in the launcher
- No VLC windows are started on the RPi4

MultiHub

- Received data is sent to the multicast address specified in the launcher
- Multicast may not work over Wi-Fi
- Any number of remote VLC instances can view the received data at the same time
- No VLC windows are started on the RPi4
- WinterHill will still respond to receive commands set to the native IP address of the RPi4, so it is not necessary to configure QuickTune with the multicast address
- Some strange system behaviour has been seen with Multicast addresses, so use with caution

'Headless' Operation

- Headless operation is when the RPi4 does not have a monitor or keyboard and WinterHill operates in a hub mode, viewing on a PC, with no VLC windows on the RPi4.
- Edit the file `/home/pi/winterhill/startup.sh` to select the required startup hub mode.
- **AnyHub** mode is most suitable for this.

Starting and Stopping WinterHill

Changing the Startup Mode

- Log in with ssh, or open a terminal screen (the dark >_ icon to the left of the task bar.
- Edit the WinterHill configuration file with **nano /home/pi/winterhill/winterhill.ini**
- Find the lines:

The line below sets the behaviour on boot. Options are:
local, anywhere, anyhub, multihub, fixed or nil
Must be lower case with one space either side of the equals sign.
BOOT = anywhere
- Change **BOOT =** to one of the other options.
- Save the file with **CTRL_X** then **Y** then **ENTER**
- Type **sudo reboot** to restart.

Starting WinterHill

- The WinterHill installation procedure configures the system to automatically start in **Local** mode after boot up. This can be changed, as shown above.
- To change to another mode:

Double-click STOP_WH on the desktop.

Double-click one of the WH launch icons on the desktop and execute in terminal.

Stopping WinterHill

- Double-click the Kill-WH icon on the desktop or
- Close the **whlaunch** tab in the taskbar or
- Log in remotely and type: **/home/pi/winterhill/whstop-3v20.sh**

The **Shutdown** icon on the desktop will stop WinterHill and power down the RPi4.

Antenna Power Out

A voltage can be fed out of any of the four NIM antenna sockets from one of three sources. The voltage source for each socket is selected using the jumper matrix between NIM_A and the RPi4.

- Fixed 12v with current limit
- LNB PSU Voltage Generator X
- LNB PSU Voltage Generator Y

The LNB PSUs X and Y are optional, separate boards which plug into the main PCB.

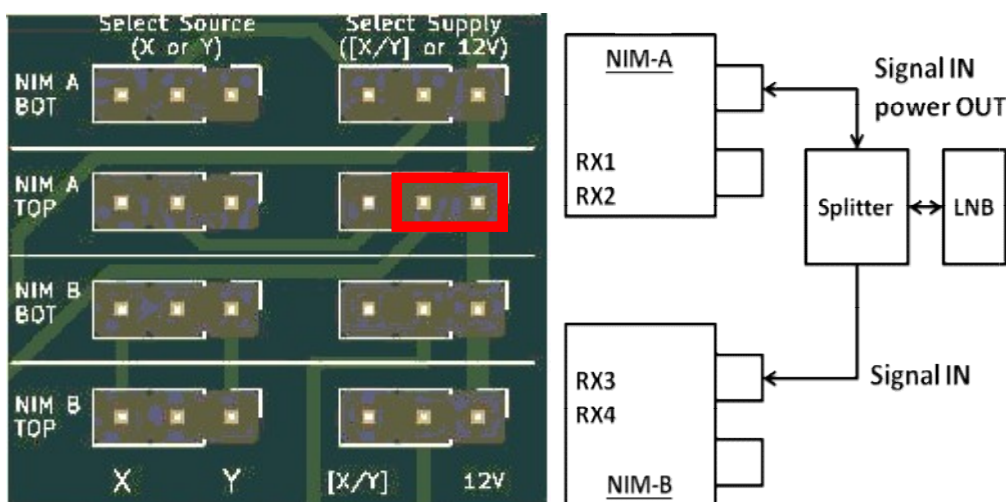
- Zero, 13v (vertical) or 18v (horizontal) output
- 22kHz tone control, to change the LNB local oscillator
- Software controlled by QuickTune and other utilities
- Current limited

The LED in front of each PCB lights when a short circuit condition is sensed.

The normal configuration for QO-100 DATV use would be 18v with tone off, to select horizontal polarisation. The voltage could be set to 13v to enable narrowband reception on other equipment.

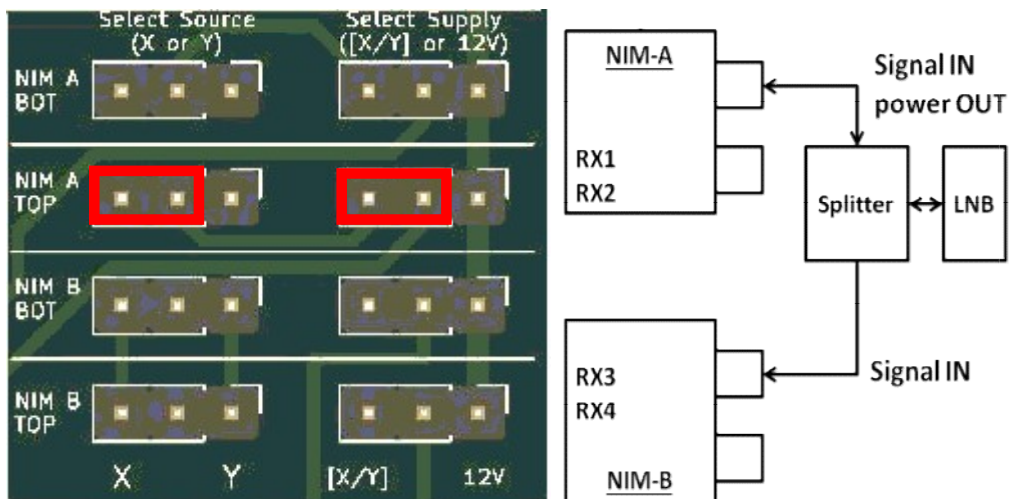
The simplest configuration would be to mount the LNB on its side and use the fixed, 12v current-limited output. In this case, Voltage Generator boards are not needed.

QO-100 Minimal Configuration



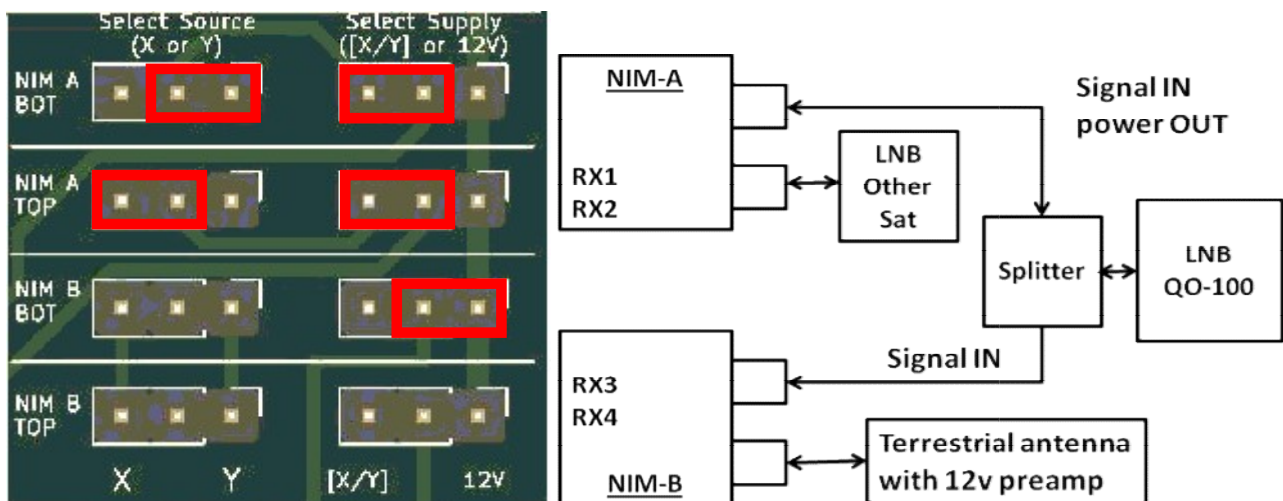
- The LNB is turned on its side and the current-limited, fixed 12v LNB supply is used.
- No Voltage Generator boards are required.
- The voltage setting in QuickTune does not matter.
- If the splitter does not block DC to NIM_B, make sure that no NIM_B TOP jumpers are fitted.

QO-100 with LNB Voltage Generator Board X



- NIM_A TOP for QO-100 is fed from Voltage Generator board X
- The LNB is in the correct orientation and is fed with 18v.
- The QuickTune LNB Volts setting should be 18v
- If the splitter does not block DC to NIM_B, make sure that no NIM_B TOP jumpers are fitted.

Multiple Use Configuration

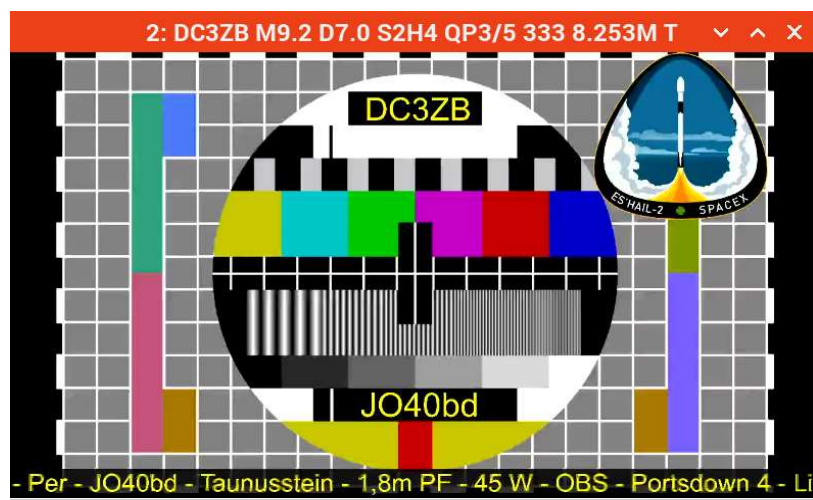


- NIM_A TOP for QO-100 is fed from Voltage Generator X
- The QuickTune LNB Volts setting should be 18v
- NIM_A BOT for Other Sat is fed from Voltage Generator Y
- NIM_B BOT for terrestrial is fed from fixed 12v
- If the splitter does not block DC to NIM_B, make sure that no NIM_B TOP jumpers are fitted.

Volume Control

- When hovering over a VLC window on the RPi, the mouse wheel will adjust the volume, even if the window is not currently selected.
- When a VLC window is selected, the up and down arrow keys will change the volume and **m** will toggle the mute function. A mute icon will be displayed temporarily when muted.
- Right-click on the VLC window, or select the Audio tab (if visible) for more volume options. Muting from this list does not show the mute icon.
- It is possible to display the volume control and menu bar on VLC windows, but this reduces the size of the video display. Typing CTRL-h will toggle visibility of the volume slider and other functions, but it will affect the window size.

VLC Title Bar



The VLC window title bar shows abbreviated receiver information:

2:	receiver 2
DC3ZB	callsign
M9.2	MER value
D7.0	D value
S2H4	DVB-S2, H.264
QP3/5	QPSK, FEC 3/5
333	symbol rate
8.253M	lower part of frequency
T	top antenna of NIM

- The MER value is effectively a signal to noise ratio.
- The D value shows the signal level relative to the minimum required MER value.
- A negative D value would indicate that the DVB-S2 frame header has been decoded, but the signal is too weak to display video.
- The DVB-S2 frame header is always transmitted with an FEC equivalent to 1/4 and contains the modulation, FEC, frame type and pilot settings.
- The font in the title bar can be changed: right-click the desktop, select **Desktop Preferences**, select **System**.
- Other items that appear in the title bar are:

search	the receiver is looking for a signal
header	the frame header is being decoded
lost	a signal had been received, but has gone - the receiver is still active
idle	the receiver has been powered down and is waiting for a command

[Sending Receive Commands to WinterHill](#)

QuickTune

The easiest way to control WinterHill for QO-100 is with QuickTune (aka LiveTune) on a PC.

At the time of writing, the latest version of QuickTune is 1.22b. Earlier versions can be used, although the setup is slightly different.

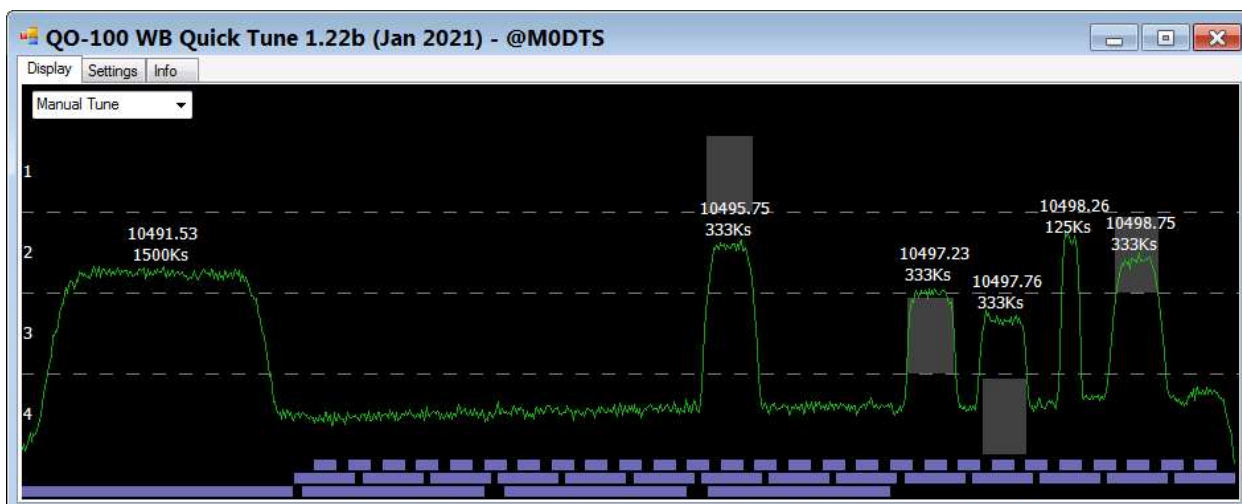
Look here for the most recent release and download and expand the zip file:

<https://github.com/m0dts/QO-100-WB-Live-Tune/releases>

More information on QuickTune can be found here:

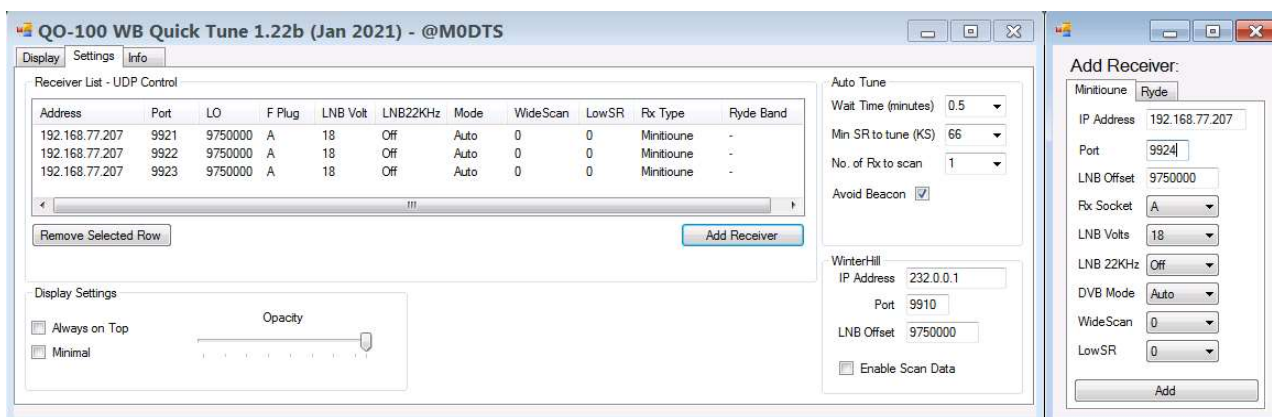
https://wiki.batc.org.uk/Receiving_Oscar_100_DATV_signals#QO100_Live_Tune

Below is a typical QuickTune screen. After configuring QuickTune, click on a received signal in the row corresponding to the required receiver.



QuickTune Network Configuration

Start **QuickTune**, click **SETTINGS**, click **Add Receiver**



- The images above show the QuickTune windows just before the fourth receiver is added. Click **ADD** in the right hand window.
- Set **LNB Volts** to 18v if a Voltage Generator board is fitted. This setting will only control Voltage Generator X.
- **FPlugA / RxSocketA** is the TOP antenna on the NIM
- The WinterHill IP address is the IP address of the RPi4. Note that it is not 127.0.0.1, which the VLC windows on the RPi4 may be showing. There is an icon on the RPi4 desktop which will display the IP address. Alternatively, log in to the RPi4 and type **ifconfig**.
- **Port** numbers are relative to the **BASEIPPORT** in the whlaunch.sh files. If the **BASEIPPORT** is 9900, WinterHill will listen for receive commands on ports 9921-9924.
- The **WinterHill** section bottom right of the main window is a scan output utility. It is not used at the moment.

QuickTune Auto Tune Configuration

- QuickTune can automatically send receive commands to WinterHill when either **Auto Tune (Timed)** or **Auto Tune (Hold)** is selected on the main QuickTune screen.
- After finding a signal and sending a receive command to WinterHill, in **Hold** mode, QuickTune waits until the signal disappears before looking for another signal.
- In **Timed** mode, QuickTune waits for the **Wait Time** in the Auto Tune box and then selects a new signal, if present.
- Normal settings for WinterHill would be **Min SR** = 66kS and **Rx to scan** = 4.
- To prevent QuickTune moving off a signal, select 3 receivers and manually select the required signal on receiver 4.

WinterHill Receive Commander

whpcrxcom is a PC utility for sending receive commands to WinterHill.

It is mainly for terrestrial use, but can also be used for QO-100.

RX	Frequency	Symbol Rate	Loc Osc	Antenna	Voltage
1	10491.500	1500	9750.000	TOP	X-HORIZ
2	1318.000	4167	0.000	BOT	
3	11996.000	27500	10600.000	TOP	X-HORIZ-TONE
4	1249.000	4000	0.000	BOT	

- The WinterHill IP address is the IP address of the RPi4. Note that it is not 127.0.0.1, which the VLC windows on the RPi4 may be showing. There is an icon on the RPi4 desktop which will display the IP address. Alternatively, log in to the RPi4 and type **ifconfig**.
- The WinterHill Base IP Port is the value specified in the launcher on the RPi4
- Settings are selected from, or typed into, the upper row of boxes and then copied to the lower grid
- Settings may be copied from the lower grid to the upper row of boxes for re-editing
- If the frequency is in the QO-100 band. Right-clicking the SEND button will send the QO-100 uplink frequency on 2.4GHz for the specified downlink frequency, on the alternate (TOP/BOT) antenna socket

Sending Receive Commands from the RPi4

Currently, there is no utility to do this. If you know how to program a graphical interface on the RPi4, please get in touch.

QO-100 Frequency Auto Calibration

- If WinterHill sees a receive request for RX1 or RX3 where the frequency is near the QO-100 beacon, it changes that frequency to the nominal beacon frequency. QuickTune may be off by several kHz.
- While the beacon is being received, WH tracks the actual received frequency from the demodulator to work out the combined error offset of the local oscillator in the LNB and the local oscillator in the NIM.
- This value is applied to any other receive request in the QO-100 band. This should make the frequency passed to the NIM to be as close to correct as possible, given that QuickTune frequencies can vary by several kHz.
- If the beacon is no longer being received when a receive request arrives, the last value of the error offset is used.
- The actual receive frequency displayed for any station also takes into account the error offsets, so it should be very accurate, after calibration.
- The QO-100 frequency for calibration may be changed in the initialisation file.

Initialisation File

The file `/home/pi/winterhill/winterhill.ini` contains configuration parameters which are applied at start up. It can also send a command to each receiver. The values shown are the default after installation. WinterHill should be restarted after a parameter change.

- `NULL_8190 = 1`

Packets with PID (packet ID) = 8190 are treated as null packets (PID = 8191). Some transmission software can insert these packets for timing purposes. They are known as false null packets on MiniTioune. 1 = treat as null.

- `NULL_REMOVE = 0`

VLC does not seem to need the null packets, so they can be removed from the transport stream to reduce the amount of network data. 0 = do not remove.

- `EIT_REMOVE = 1`

An EIT packet (PID = 18) contains info about the programs in the transport stream. VLC will show this data in its title bar. This should normally be removed for WinterHill, so that it can put its own info into the title bar. 1 = remove.

- `EIT_INSERT = 0`

WinterHill can create its own EIT packet and insert it into the transport stream. When viewing on the RPi4 or using a viewing program on the PC like whpcviewer, this is not necessary, as the info is put into the VLC title bar by other means. This should be set to 1 if using VLC stand alone, so that the receiver information will be seen in the VLC title bar. 0 = do not insert.

Note: the four parameters above should be all be set to zero when sending a transport stream to an analyser program, so that WinterHill does not modify the transport stream in any way.

- H265_MAX = 1

This is the number of VLC windows (other than RX1) that H.265 transport streams will be sent to. There can be problems when sending H.265 to more than one window using the H.265 hardware codec. It can be changed for experimentation. The VLC title bar will show *S2H5* to indicate that H.265 cannot be displayed.

- CALIB_FREQ = 10491500

When RX1 or RX3 receives a command on or near this frequency, the receiver will auto-calibrate to discover the combined frequency error in the LNB and NIM. It only works for the QO-100 band.

- IDLE_TIME = 0

When a receiver has not detected a signal for this many seconds, the receiver is disabled to save power and will wait for another receive command. Do not use this when receiving repeaters or when waiting on a frequency for a signal to appear at some time.

- OFFNET_TIME = 3600

When a receiver is sending its transport stream off the local subnet (e.g. outside your house) the receiver will be reset after this many seconds and will wait for another receive command. The timer for this receiver will be reset if a receive command, for any receiver, is received from the IP address that the transport stream is going to.

- COMMAND = [to@wh],rcv=1,freq=10491500,offset=9750000,srate=1500,fplug=A
- COMMAND = [to@wh],rcv=3,freq=10491500,offset=9750000,srate=1500,fplug=A
- COMMAND = 3
- COMMAND = [to@wh],rcv=4,freq=10499250,offset=9750000,srate=333,fplug=A

These MiniTioune-like commands are sent at start up. This would usually be to put the beacon on RX1 and RX3 for frequency calibration. A single digit causes a delay of that many seconds, usually to give time for the auto-calibration to occur. The transport streams will be sent to the RPi4 and will be displayed in Local or Anywhere mode.

The local oscillator offset may need to be changed for your LNB.

If the optional Voltage Generator boards have been fitted, comment out the commands above with # and uncomment the lines below.

```
COMMAND = [to@wh],rcv=1,freq=10491500,offset=9750000,srate=1500,fplug=A,vgx=hi
COMMAND = [to@wh],rcv=3,freq=10491500,offset=9750000,srate=1500,fplug=A,vgx=hi
COMMAND = 3
COMMAND = [to@wh],rcv=4,freq=10499250,offset=9750000,srate=333,fplug=A,vgx=hi
```

HI = 18v (horizontal), **LO** = 13v (vertical), **OFF** = OFF. Use **HIT** or **LOT** to also turn on the 22kHz tone generator.

The second LNB PSU board is controlled with the **VGY** parameter.

Case is not important.

FPlug=A selects the TOP antenna on the NIM.

VLC and Firewall

- When using VLC on a PC for the first time, a box may appear asking for access to Private and Public networks.
- Tick Private
- If Multicast addresses are used with WinterHill, it may not work if Public access is unavailable, even though the multicast addresses are actually local

Viewing on a PC

whpcviewer is a utility that displays 4 VLC windows, giving a display similar to that on the RPi.



It is a collection of windows rather than a single integrated program. Other integrated multi viewers are becoming available and it is hoped that they may be WinterHill compatible.

The font in the VLC title bar can be changed in Windows. The font in the info window may be changed by clicking the icon at the left of the title bar and selecting **Preferences**.

There are a few single letter commands available when the info window is selected:

ENTER quit
h hide all windows
v view /display all windows
y toggle a half size version

VLC Auto Reset

On some other receivers, when another station comes on the frequency, VLC does not always react to the change in received data and may stop displaying. WinterHill handles this automatically when displaying on the RPi4 and when using **whpcviewer**. VLC is reset when a change of callsign or video codec or audio codec is detected, so that no operator intervention is necessary.

VLC Keyboard and Mouse Commands

Right-clicking on a VLC window gives access to most of its functions. Many of these are also available as a keyboard command.

These commands are valid on the RPi4 and on the PC.

Except for the mouse wheel on the RPi, the required VLC window must be selected. Case **IS** important.

mouse wheel	volume
up/down arrows	volume
m	toggles mute
a	changes aspect ratio
f	toggles full screen and shows the volume slider
R	toggles recording on / off
CTRL-h	toggles the volume slider and menu bar view
	select the info window and hit v to resize the VLC windows

To set the VLC Recordings folder:

Tools, Preferences, Input/Codecs, Record, Files section then **SAVE**

Miscellaneous Parameters and Functions

Receive Frequency Lock Range

When a NIM has been calibrated on the QO-100 beacon, its lock range is set to +/- half the symbol rate.

I.e. when setting a receive frequency of 10498.750MHz SR333, the lock range is 10498.584 to 10498.916, so it will not find signals on the adjacent SR333 channels 10498.250 and 10499.250.

When a NIM has not been calibrated, the frequency lock range is +/- 1MHz.

Symbol Rate Lock Range

The symbol rate lock range is +/- 0.8% of the symbol rate. I.e. 2.6kS at SR333.

This seems very tight, but even a signal based on a 50ppm crystal would only be 17S off at SR333.

It does mean that if QuickTune identifies a 350kS signal as 333kS, it will not be received.

Auto DVB-S Off

Below SR1000, DVB-S detection is disabled, to potentially reduce the lock time for low SR signals.

Multi Programme Detection

Broadcast transport streams may contain several programmes: BBC1, BBC2, BBC News etc. Normally, for amateur use, there is only one programme, but occasionally a station will transmit a second programme.

WinterHill detects this and puts a plus sign in front of the callsign in the 4 line info window and in the VLC title bar. E.g. +PE2JKO.

By default, VLC displays the first program in the transport stream. To display other programmes in the transport stream:

- right-click the VLC window
- hover over **Playback**
- hover over **Programme**
- click the required programme

SR27500, SR22000 Special Mode

WinterHill is limited to receiving a combined transport stream rate of about 10M bits/s per NIM.

For broadcast transponders, it can lock onto a transponder using SR27500 or SR22000 **ONLY** and display the MER, but not display video.

The other receiver on the same NIM may be unable to display video, but will display the MER..

Useful transponders at the same satellite location as QO-100 are 12073MHz (DVB-S2) and 11996MHz (DVB-S).

Fake Null Packet Detection

Null packets have a PID (packet ID) of 8191. Some transmission software inserts null packets with a PID of 8190, for timing purposes.

WinterHill can detect these and include them in the null packet percentage calculation displayed in the info window.

See the section on the initialisation file.

Transport Stream Modification – Null Packets

VLC does not seem to need the null packets, so WinterHill has the option of not sending null packets to VLC, to reduce network traffic.

See the section on the initialisation file.

Transport Stream Modification – Event Information Table on PID 18

When using other receivers, sometimes the station callsign or other information is displayed in the VLC title bar. This comes from an EIT packet on PID 18.

WinterHill can optionally remove EIT packets from the transport stream and can optionally insert its own EIT packets with receiver info.

Inserting EIT packets would be useful when displaying video on a stand-alone VLC, outside **whpcviewer**.

See the section on the initialisation file.

RPi4 WinterHill Software Components

WinterHill runtime has 3 stages. The files used can be copied and modified to customise the system, although the setup provided should cover most requirements.

- Stage 1: Launch – passes the required network IP parameters to stage 2
- Stage 2: starts VLC windows on the RPi4 if required.
Starts the main application and passes the IP settings and VLC window identifiers.
- Stage3: the main application

E.g.

- Stage 1 filename: whlaunch-anyhub-3v20.sh
- Stage 2 filename: winterhill-anyhub-3v20.sh
- Stage 3 filename: winterhill-3v20

The files are located at **/home/pi/winterhill/RPi-3v20**

Launcher

The launcher sets the IP address where the received data should be sent and sets the stage 2 operation mode.

The launcher files can be copied and customised.

E.g.

whlaunch-anywhere-3v20.sh contains

```
./winterhill-anywhere-3v20.sh      0          9900    0
```

- IPADDRESS received data (transport stream) is sent to this address
- BASEIPPORT all port functions are relative to this
- IPINTERFACE if the RPi4 has more than one IP address, select one of them using this

Other launchers may contain:

```
./winterhill-local-3v20.sh      127.0.0.1    9900    0  (127.0.0.1 is LOCALHOST)
./winterhill-multihub-3v20.sh   230.0.0.230  9900    0
./winterhill-anyhub-3v20.sh     0           9900    0
```


If IPADDRESS is zero, the received transport stream is sent to wherever the receive command came from.

Second Stage

The second stage starts any required VLC windows, positions all windows and passes the IP settings and window IDs to the main application.

If you copy and modify a launcher, the line in the second stage file **MYLAUNCH=** should be changed to the name of the new launcher file.

Changing the Base IP Port Number for Multiple WinterHills

- The launcher files in **/home/pi/winterhill/RPi-3v20** (e.g. whlaunch-anyhub-3v20.sh) contain a base IP port number (BIP). All port usage is relative to this. This is normally xx00 (or xxx00). 9900 is the default value after installation.
- The BIP must be xx00, xx04, xx08 or xx12.
- If a second WinterHill system is used, the BIP should be set to 9904 in the whlaunch files. This second system will configure itself to be receivers 5-8 and its port number usage will be shifted up by 4.
- E.g. the first system with BIP 9900 will listen for commands on ports 9921-9924 and send transport streams to ports 9941-9944.
- The second system with BIP 9904 will listen for commands on ports 9925-9928 and send transport streams to ports 9945-9948.
- This enables command programs and viewing programs to use consecutive port ranges.

Using WinterHill Remotely (from outside your house)

- It would be advisable to use a different Base IP Port number, to avoid any confusion with both local and remote commands arriving.
- The WinterHill end would need ports xx20-24 opening through the router, for incoming commands.
- The remote end would need ports xx01, xx02 and xx41-xx44 opening through the router, for status streams and transport streams.
- When sending off the local subnet, the 4 line info display sent has the last 2 octets zeroed for security. A receiver will be reset after no commands have been received from the remote location for **OFFNET_TIME** (defined in **/home/pi/winterhill/winterhill.ini**).
- When using a remote WinterHill, make sure it is someone you know and trust, as they could send any video to you.

Pseudo QuickTune Commands

- WinterHill listens for MiniTioune format commands for the four receivers on ports xx21-xx24.
- Commands can be sent to port xx20 with a slightly different format. This format is used in the **/home/pi/winterhill/winterhill.ini** file.
- [to@wh] RCV=1 FREQ=10491500 OFFSET=9750000 SRATE=1500 FPLUG=A VGX=HI
- Case is not important. Commas may be used instead of spaces. Unrecognised items will be ignored, but the command will still succeed if it has the minimum requirements.
- The minimum requirements are RCV, FREQ, SRATE, FPLUG.

Bugs and Oddities

QuickTune-WinterHill Link

Sometimes receive commands do not get through and WinterHill is out of step with the QuickTune display.

I2C Error

On the RPi, the winterhill window may occasionally show a message like:

Error@: Cannot write byte to device 0xD8 register 0x95 (Remote I/O error)

This is an error on the I2C bus when writing the Voltage Generator settings to PIC_A.

Operationally, it is not a problem, as the data is sent every 0.5s.

After installation, to check the I2C bus, when WinterHill is not running, log in and type:

i2cdetect -y 1

The display should show the NIMs on 7-bit address 68 and 69 and the PICs on addresses 6c and 6d.

	0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
00:				--	--	--	--	--	--	--	--	--	--	--	--	--
10:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
50:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60:	--	--	--	--	--	--	--	--	68	69	--	--	6c	6d	--	--
70:	--	--	--	--	--	--	--	--								

DVB-S Transport Stream does not appear

Sometimes when receiving a DVB-S signal, the transport stream does not appear immediately, although its parameters have been received. Sending a command to the other receiver in the NIM makes the DVB-S transport stream start.

WinterHill UDP Port Usage

All the ports are relative to the BASEIPPORT (BIP) specified in the launcher.

BIP + 01	WH sends extended LongMynd style parameters for all receivers
BIP + 02	WH sends the 4 line status display
BIP + 03	Copy of BIP + 01
BIP + 04	Copy of BIP + 02
BIP + 20	WH listens for pseudo QuickTune commands
BIP + 21	WH listens for QuickTune commands for RX1
BIP + 22	WH listens for QuickTune commands for RX2
BIP + 23	WH listens for QuickTune commands for RX3
BIP + 24	WH listens for QuickTune commands for RX4
BIP + 41	WH sends the UDP transport stream from RX1
BIP + 42	WH sends the UDP transport stream from RX2
BIP + 43	WH sends the UDP transport stream from RX3
BIP + 44	WH sends the UDP transport stream from RX4
BIP + 61	WH sends the LongMynd \$ parameter stream for RX1
BIP + 62	WH sends the LongMynd \$ parameter stream for RX2
BIP + 63	WH sends the LongMynd \$ parameter stream for RX3
BIP + 64	WH sends the LongMynd \$ parameter stream for RX4

The LongMynd \$ parameter streams are incomplete at the moment.

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