

TEENSY MMDVM

Multi-Mode Digital Voice Modem



User's Manual

REVISION 1.03



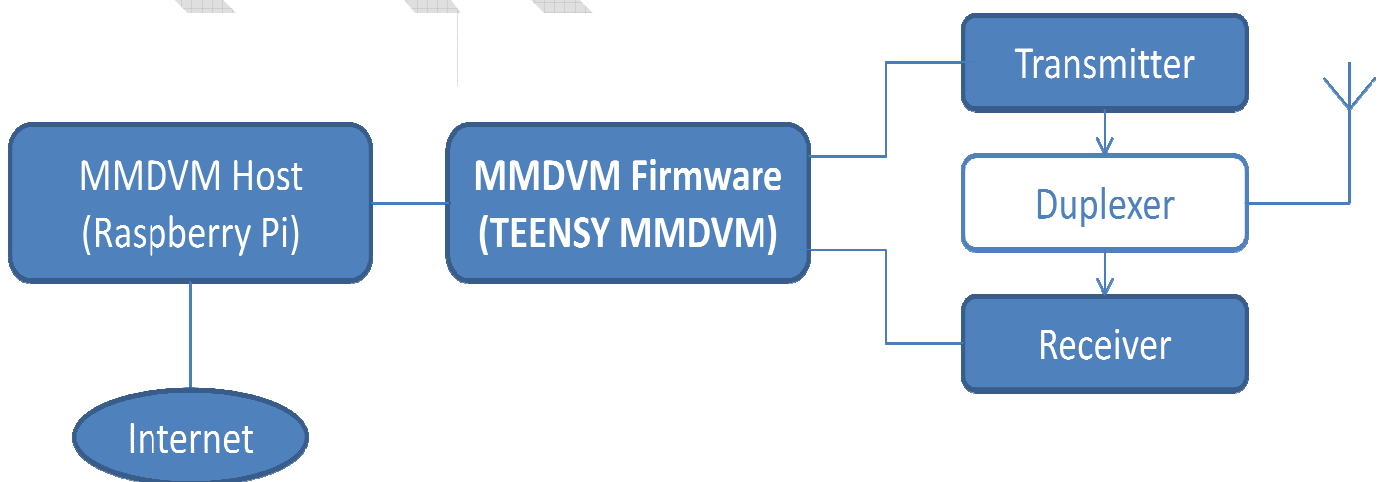
1.0 Introduction to TEENSY MMDVM

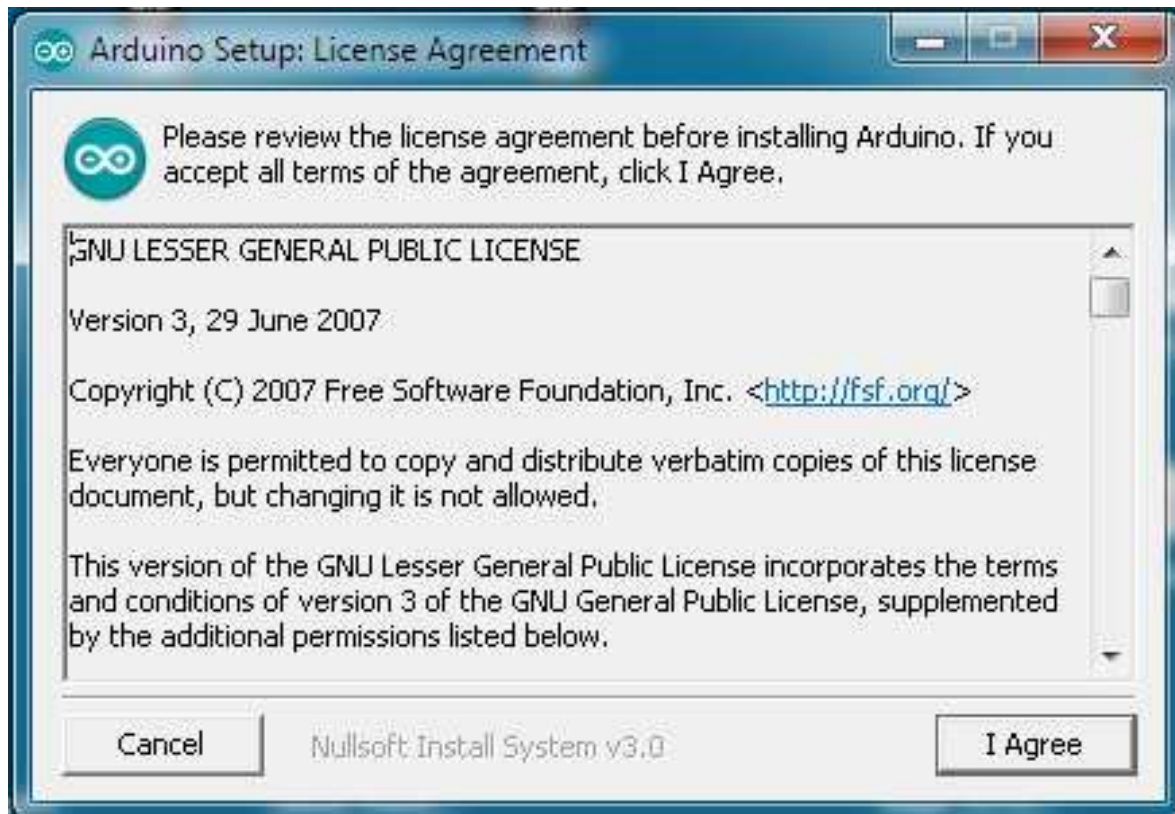
TEENSY MMDVM (Multi-Mode Digital Voice Modem) is a combined hardware and software modem that supports DMR, DMR (DMO), D-Star, System Fusion and P.25 Digital Formats.

The modem integrates the MMDVM software developed by Jonathan G4KLX with a Teensy 3.2 or 3.6 32 bit microcontroller and Radio interfacing hardware. Includes Op-Amp low pass filters, 20 turn trim pots for RX and TX level adjustments and LED status indicators for mode of operation and radio status.

MMDVM Systems are composed of three physical parts.

1. **MMDVM HOST COMPUTER** - A Raspberry PI 2 or 3 running the MMDVMHost software that interfaces to the Teensy MMDVM modem on the one side, and a suitable network on the other. It supports D-Star, DMR, P.25 Phase 1, and System Fusion.
2. **MMDVM TEENSY MODEM** - For decoding and encoding the various digital formats necessary for interfacing with analog radios or repeaters.
3. **MMDVM RF Subsystem** - Consisting of a Simplex or Duplex radio configuration allowing users to access the system with a handheld or mobile radio.

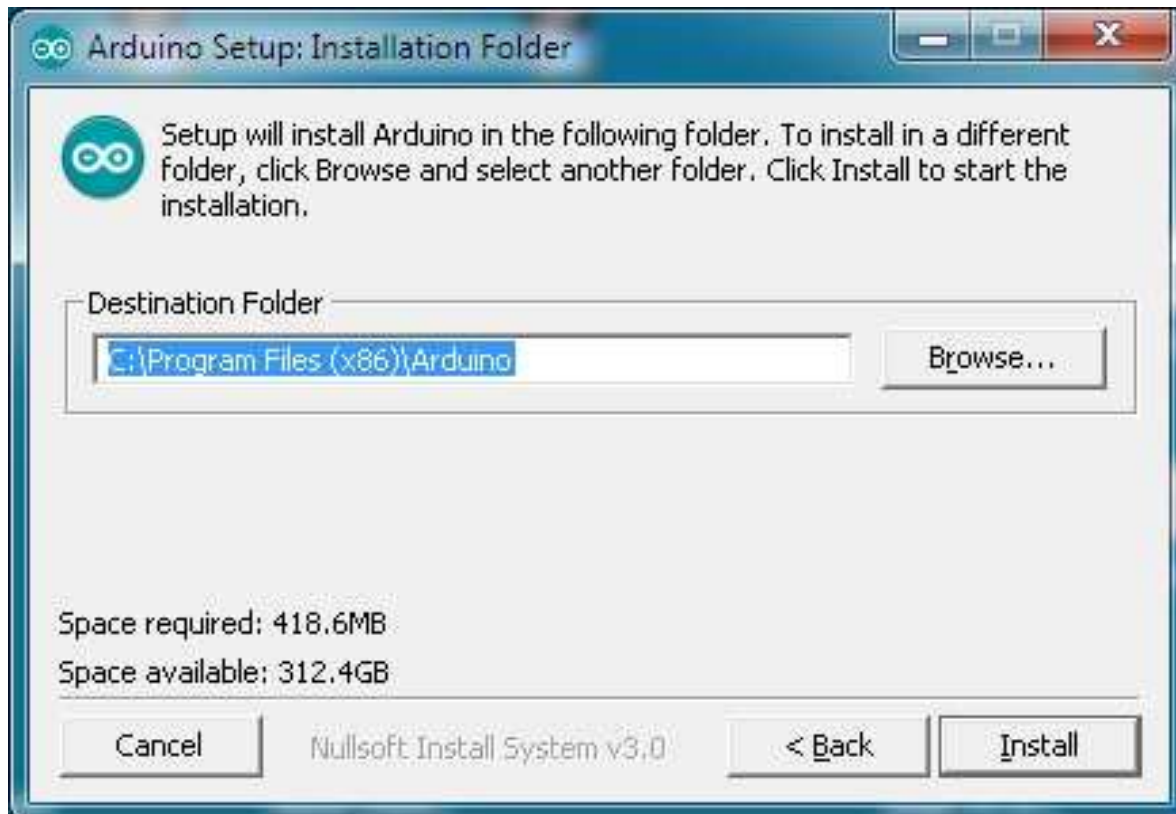




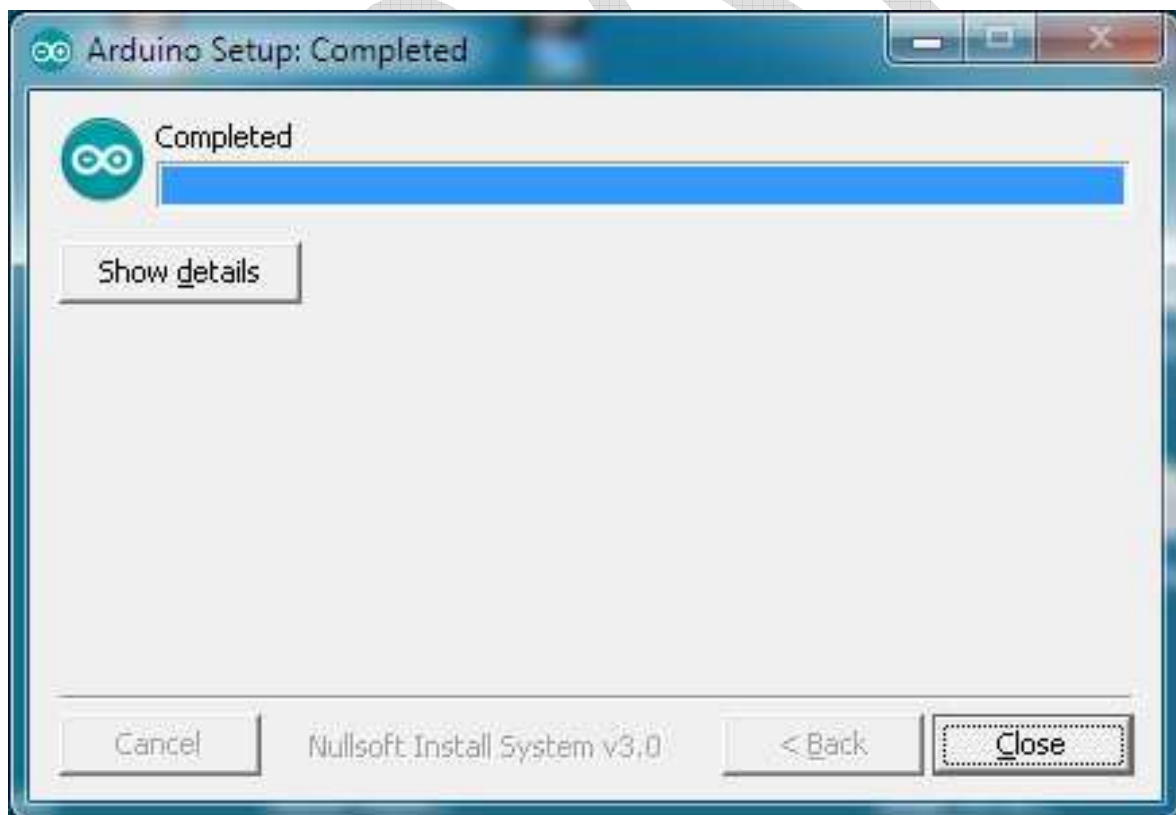
1) Agree to the licensing agreement.



2) Click Next



3) Click Install

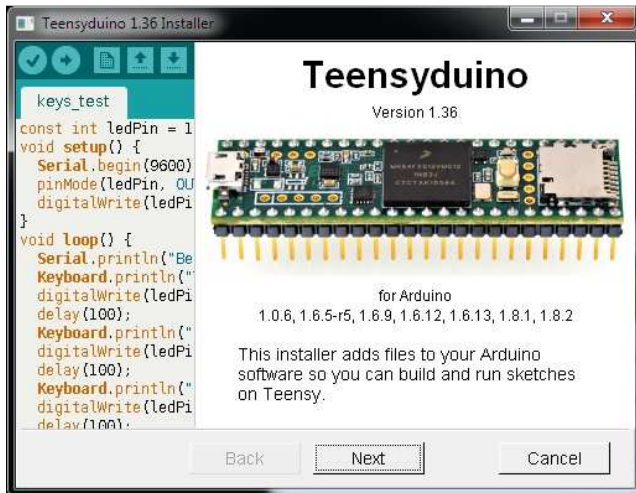


4) Click Close

3.0 DOWNLOAD AND INSTALL THE TEENSYDUINO INSTALLER.

https://www.pjrc.com/teensy/td_136/TeensyduinoInstall.exe

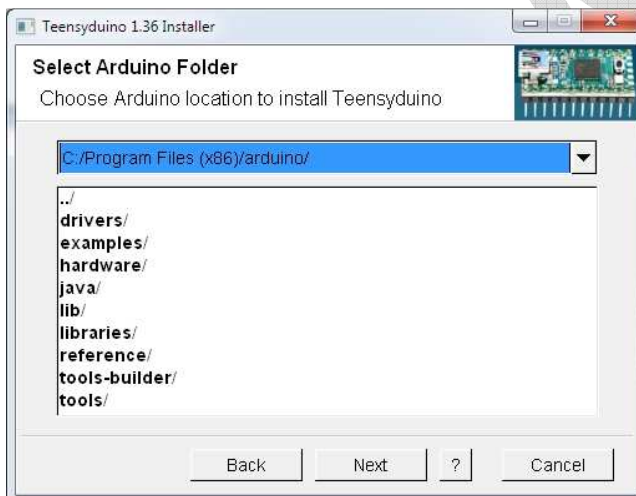
Right click on the TeensyduinoInstall.exe and “Run as Administrator”



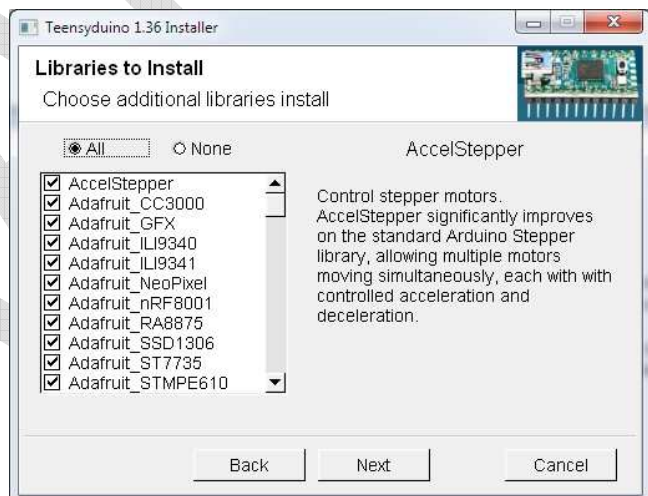
1) Click next



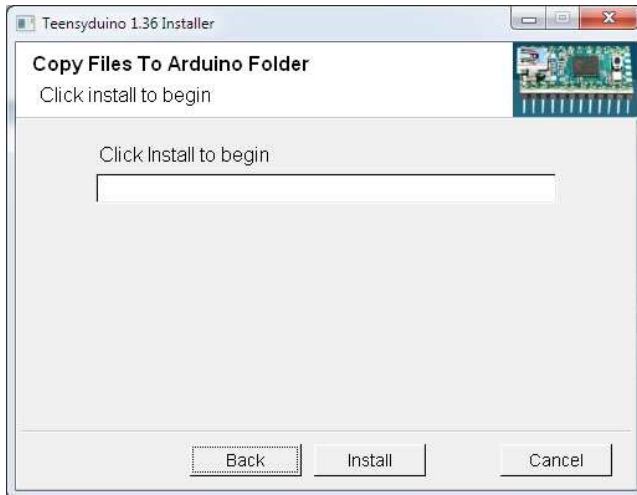
2) Click next



3) Click Next



4) Click Next



5) Click Install



6) Click Done

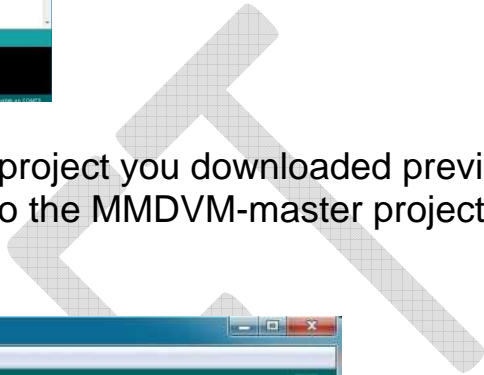
4.0 EDIT THE CONFIG.H FILE THEN COMPILE THE CODE

The next step is to edit the config.h file then compile the code and push it to the Teensy board.

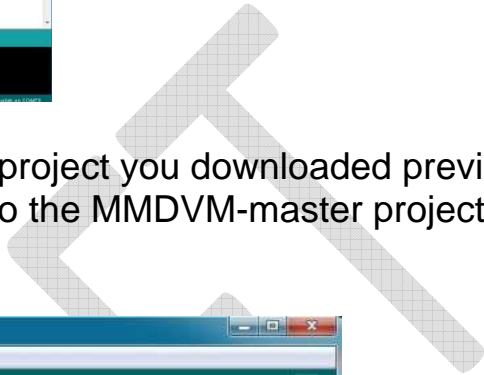
1) From the start menu execute the Arduino IDE software.



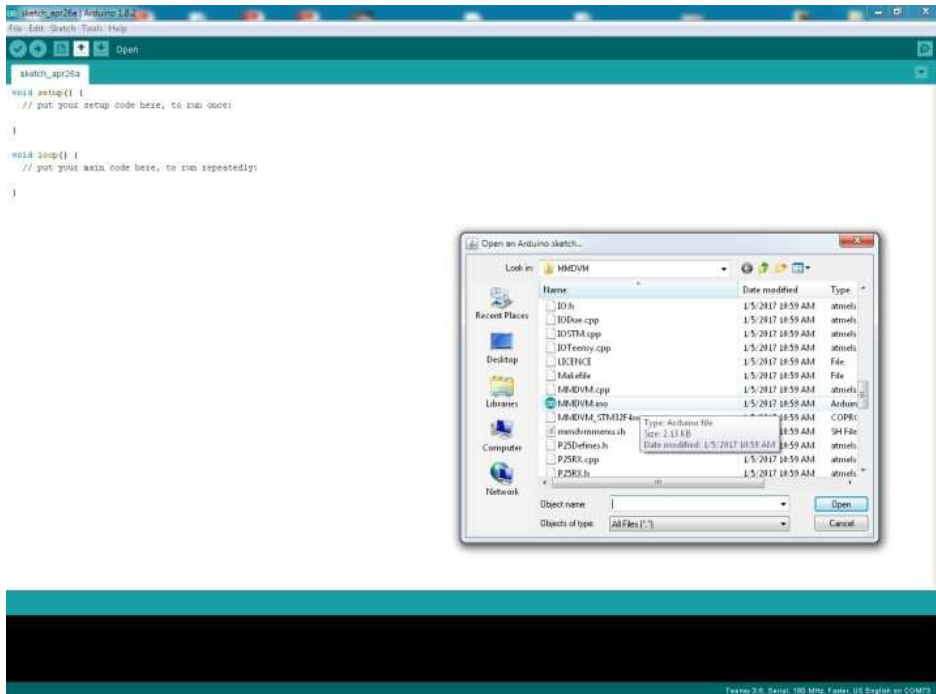
2) Select the “Tools” menu and select the “Boards” menu item and select the Teensy board version you purchased (Teensy 3.2 or 3.6 as appropriate)



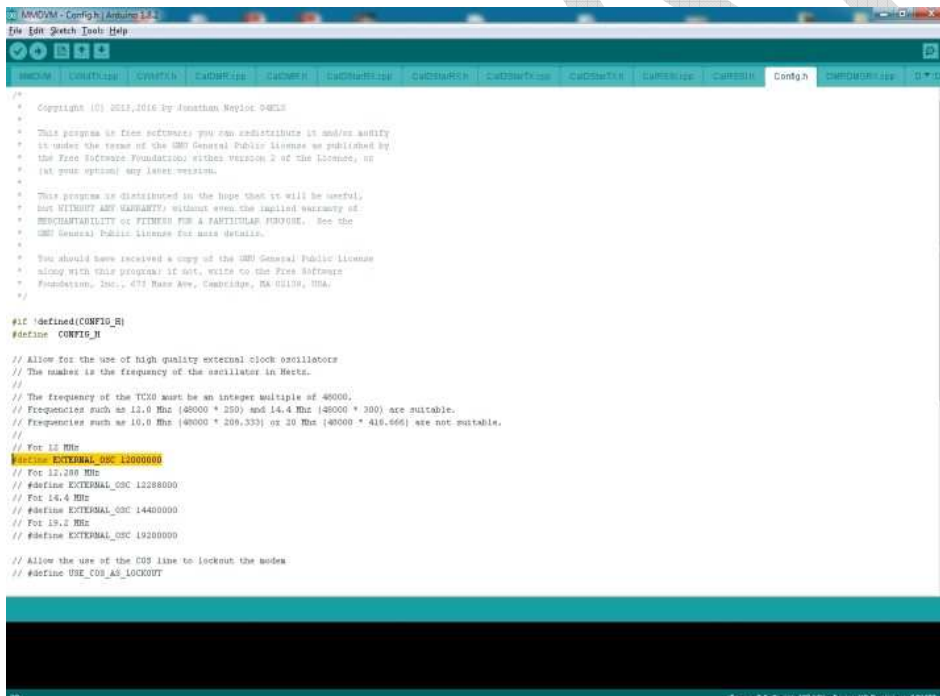
project you downloaded previously
to the MMDVM-master project



project you downloaded previously
to the MMDVM-master project



You will see many tabs at the top of the program – click on the “Config.h” tab and make the following changes:



#define EXTERNAL_OSC 12000000 (**Remove the // from the start of this line**)

// Use pins to output the current mode

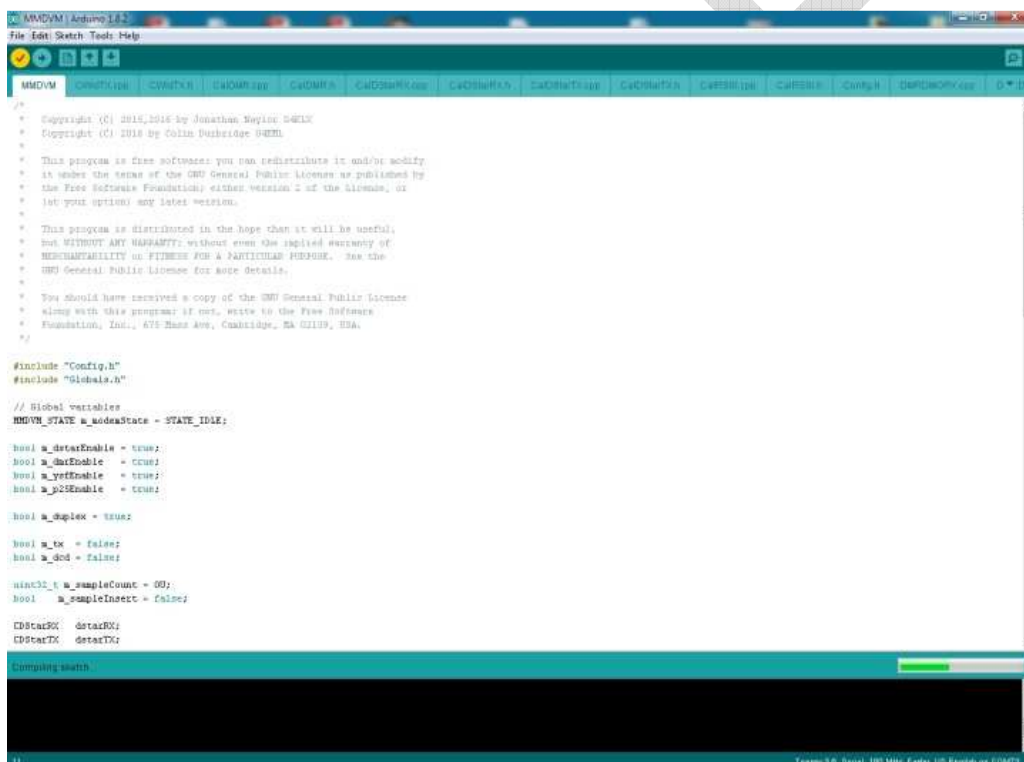
#define ARDUINO_MODE_PINS (**Make sure the // is removed from this line as well**)

// For the ZUM V1.0 and V1.0.1 boards pin layout

#define ARDUINO_DUE_ZUM_V10 (**Make sure the // is removed from this line as well**)

Those are the only changes needed to compile and push the code to the Teensy board.

Once you have made the above changes click on the Checkmark icon (Verify)
This will compile the code with the changes made and allow you to push it to the Teensy board.



After the code is compiled you will need to press the orange button on the MMDVM unit which is between the Status lights and the Mode lights
Once that is pressed it will load the software onto the Teensy board and will then return to the screen that says, "Reboot OK"



That is the last step in preparing the hardware for use – that was the most complicated part of the setup!

The next step is to prepare the Raspberry pi for use with the pi-STAR image.

You will need an 8GB SD card (or larger) to burn the pi-Star image

You will also need an SD card imager such as;

Etcher – <https://etcher.io/>

WIN 32 Disk Imager – <https://sourceforge.net/projects/win32diskimager/>

Download one of the SD card disk images then download the latest pi-STAR image from <http://www.mw0mwz.co.uk/pi-star/>

Steps:

- 1) Right click on WIN32Diskimager and run as Administrator
- 2) Select the pi-Star image you downloaded and select the SD card you have inserted into the computer
- 3) Select "Write" and the image will be burned to the disk
- 4) Put the SD Card with the freshly created image into the pi
- 5) Connect the pi to your network via an Ethernet cable and power up the pi
- 6) You will not need to connect a keyboard or monitor to the pi to configure the software but you will need to know the IP address – you can get this from your router
- 7) Once you know the IP of the pi-star server open a web browser and go to http://IP_OF_pi-star/admin/

Log in with the following:

Default Username: pi-star
Default Password: raspberry

You will need to configure the following items in pi-star

Click on the “Config” menu item

Pi-Star: 3.3.9 / Dashboard: 20170609

Pi-Star Digital Voice Dashboard for W7VTX

Dashboard | Admin | Config

Modes Enabled

D-Star	DMR
YSF	P25

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
Internet	

Radio Info

Trx	TX DMR Slot 2
Tx	448.900000 MHz
Rx	448.900000 MHz

D-Star Repeater

RPT1	W7VTX B
RPT2	W7VTX G

D-Star Network

APRS	texas.aprs2.net
IRC	rr.openquad.net
Linked to REF012 A (DPlus Outgoing)	

DMR Repeater

DMR ID	3153244
DMR CC	1
TS1	enabled
not linked/not linked	
TS2	enabled
TG 3100/not linked	
DMR Master	
3108.repeater.net	

Last 20 calls heard via this Gateway

Time (PDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
2017-06-12 13:18:59	DMR Slot 2	KA9IBS	TG 3100	Net	TX	0%	0.0%
2017-06-12 13:18:51	DMR Slot 2	M1EQB	TG 3100	Net	5.5	0%	0.0%
2017-06-12 13:18:44	DMR Slot 2	M6XTD	TG 3100	Net	4.4	0%	0.0%

Last 20 calls that accessed this Gateway

Time (PDT)	Mode	Callsign	Target	Src	Dur(s)	BER
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Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2017.
ircDDBGateway Dashboard by Hans-J. Barthen (DL5DI),
MMDVMDash developed by Kim Huebel (DG9VH),
Need help? Click here for the Support Group.
Get your copy of Pi-Star from here.

The first thing you should do is change the remote access password. Changing the remote access password here also changes the SSH password. DO NOT forget this password because if you do there is no way to reset it without burning a new image.

Scroll to the bottom of the Config section and you will see the section for changing the password

Remote Access Password

User	Password	
pi-star	<input type="password"/>	<input type="button" value="Set Password"/>

WARNING: This changes the password for this admin page
AND the "pi-star" SSH account

type in the password for the user pi-star and click the “Set Password” button

The next step is to configure the “General Configuration” section

General Configuration		
Setting	Value	
Node Callsign:	W7VTX	
CCS7/DMR ID:	3153244	
Radio Frequency:	448.900.000 MHz	
Latitude:	50.000	degrees (positive value for North, negative for South)
Longitude:	0.000	degrees (positive value for East, negative for West)
Town:	Seattle	
Country:	USA	
URL:	http://www.qrz.com/db/W7VTX	<input checked="" type="radio"/> Auto <input type="radio"/> Manual
Radio/Modem Type:	Zum Board / DV-Mega USB Radio / DV-Mega USB GMSK Node (Old Firmware) ▾	
Node Type:	<input type="radio"/> Private <input checked="" type="radio"/> Public	
System Time Zone:	America/Los_Angeles ▾	

Apply Changes

Input your Callsign

Input your DMR ID or CCS7 ID

Input the Radio Frequency

Update the lat/lon data

Update the Town and Country settings

Change the URL to your QRZ link

Select the Zum Board / DV-Mega as the Radio/Modem type

Select “public” as the node type

Update your timezone to your local time

You can configure Wi-Fi using the wireless configuration tool – click the “Scan for Networks” button and it will find the available Wi-Fi Access points – Select the one you want to connect to, supply the password and click “Save and Connect” now it will automatically connect to that Wi-Fi Access Point

Wireless Configuration

WiFi Info

Scan for Networks (10 secs)
Add Network
Save (and connect)

Networks found :

Connect	SSID	Channel	Signal	Security
Connect	B2	Channel 6	-27 dBm	WPA2-PSK (AES)
Connect	BLAST	Channel 11	-32 dBm	WPA2-PSK (AES)
Connect	QS0	Channel 1	-34 dBm	WPA2-PSK (AES)
Connect	BLAST	Channel 11	-52 dBm	WPA2-PSK (AES)
Connect	B2	Channel 11	-58 dBm	WPA2-PSK (AES)
Connect	BLAST	Channel 11	-62 dBm	WPA2-PSK (AES)
Connect	BLAST	Channel 11	-65 dBm	WPA2-PSK (AES)
Connect	DIRECT-eG-FireTV_21f3	Channel 10	-76 dBm	[WPA2-PSK-CCMP][WPS][ESS][P2P]
Connect	joannecheever	Channel 1	-90 dBm	WPA/WPA2-PSK (TKIP/AES) with WPS
Connect	NETGEAR13	Channel 6	-92 dBm	WPA2-PSK (TKIP) with WPS
Connect	prfoyrfile_2GEXT	Channel 1	-83 dBm	[WPS][WEP][ESS]

Now configure the MMDVM Configuration;

MMDVMHost Configuration

Setting	Value
DMR Mode Enable:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
DMR Network:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
D-Star Mode Enable:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
D-Star Network:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
Fusion Mode Enable:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
Fusion Network:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
P25 Mode Enable:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
P25 Network:	<input checked="" type="radio"/> ON <input type="radio"/> OFF
Mode Hangtime:	3 <input style="width: 50px;" type="text"/> in seconds (20 secs works well)

Apply Changes

Enable or disable the modes you like, input a hangtime and apply changes

You can now edit and manage your D-Star, DMR, Fusion and P25 settings as you wish.

DMR Configuration

Setting	Value
DMR Master:	BM_USA_3108
BrandMeister Network:	Repeater Information Edit Repeater (BrandMeister Selfcare)
DMR Color Code:	1
DMR EmbeddedLCOnly:	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
DMR DumpTADData:	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled

Apply Changes

D-Star Configuration

Setting	Value
RPT1 Callsign:	W7VTX B
RPT2 Callsign:	W7VTX G
ircDDBGateway Password:
Default Reflector:	REF012 A <input checked="" type="radio"/> Startup <input type="radio"/> Manual
APRS Host:	texas.aprs2.net
ircDDBGateway Language:	English_(UK)

Apply Changes

Yaesu System Fusion Configuration

Setting	Value
YSF Startup Host:	02034 - Alabama-Link - Alabama-Link
APRS Host:	texas.aprs2.net

Apply Changes

P25 Configuration

Setting	Value
P25 Startup Host:	10100 - 85.119.82.151
P25 NAC:	293

Apply Changes

You should now be able to receive and transmit on the configured modes so long as you have a properly configured radio that supports the intended mode you are using.

Useful links:

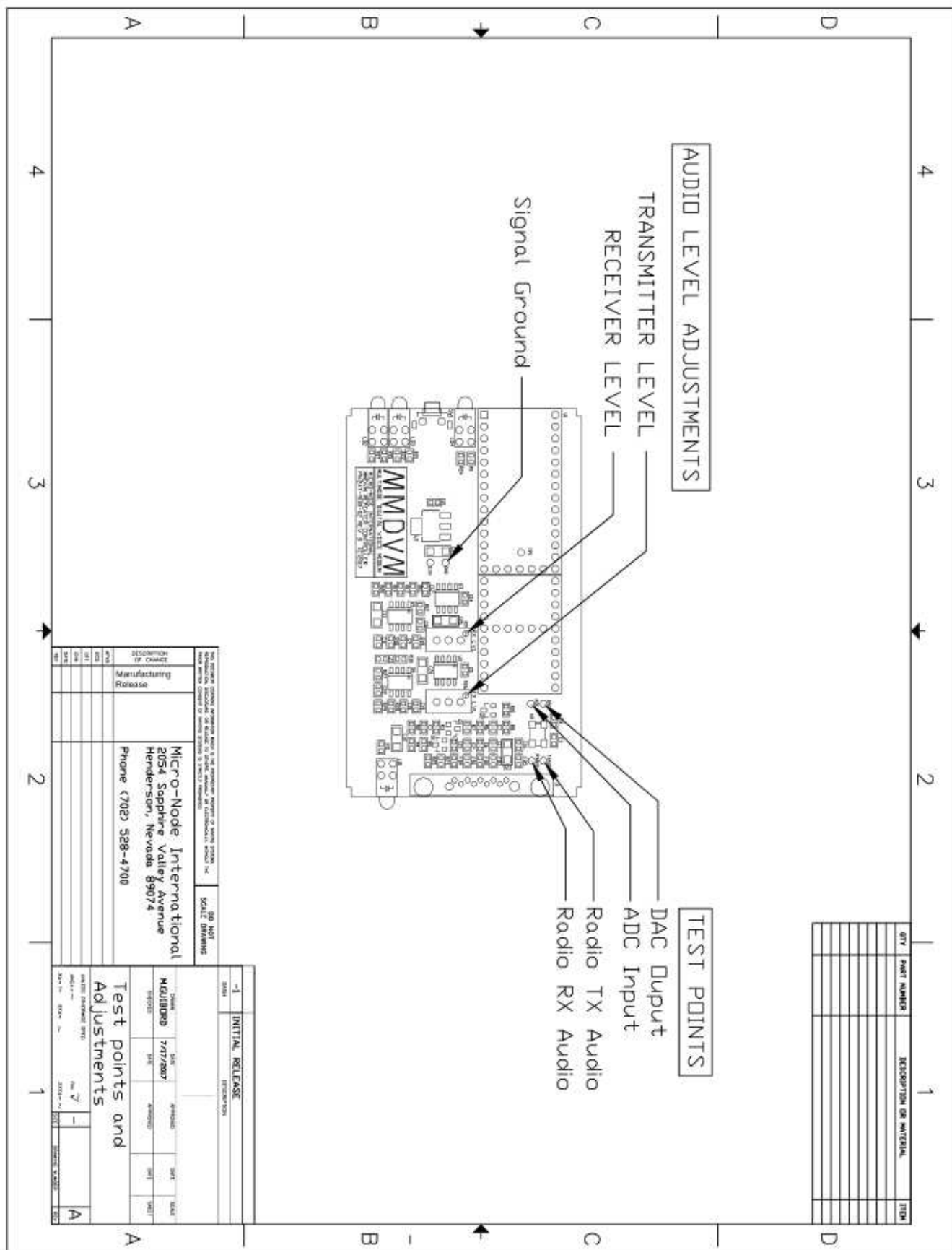
Pi-Star Video – <https://www.youtube.com/watch?v=qKsmR9sJXHU>

Pi-Star Support – <https://www.facebook.com/groups/pistar/>

Pi-Star Wiki: <http://wiki.pistar.uk>

DMR ID Database – <https://dmr-marc.net/cgi-bin/trbo-database/>

BrandMeister – <https://brandmeister.network/>



TEENSY MMDVM

MICRO-NODE INTERNATIONAL



E-mail: support@micro-node.com Phone Support: 702-528-4700
Website: www.micro-node.com

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