TEENSY MMDVM Multi-Mode Digital Voice Modem



User's Manual REVISION 1.03

Micro-Node International, Inc. - Henderson, Nevada



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.



2.0 System Software Installation

MMDVM open source software must be installed on the Teensy before use. The software source code can be downloaded from the G4KLX/MMDVM GitHub repository.

https://github.com/g4klx/MMDVM/archive/master.zip

After downloading the Master.zip file unzip it into your "My Documents" folder. A MMDVM-master directory will be created.

At this point the Arduino IDE must be downloaded and installed to compile the MMDVM software.

https://www.arduino.cc/en/Main/Software

Select the top link to download the Windows Installer This will download a file called *arduino-1.8.2-windows.exe*

Right click this exe and select "Run as Administrator" to start the IDE installation.



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Version 3, 29 June 2007		
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Destination Folder	
C:\Program Files (x86)\Arduino	Browse
Space required: 418.6MB Space available: 312.4GB	
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3) Click Install	
💿 Arduino Setup: Completed	
Show <u>d</u> etails	
Cancel Nullsoft Install System v3.0	< Back
4) Click Close	
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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"

Teensyduino 1.36 Installe	ł		Teensyduino 1,36 Installer
	Teensyduin	o	Virtual Serial Driver
<pre>const int ledPin = 1 void setup() { Serial.begin(9600) pinMode(ledPin.0U)</pre>	Version 1.36		
<pre>digitalWrite(ledPi } void loop() { Serial.println("Be Keyboard.println(" digitalWrite(ledPi delay(100); Keyboard.println(" digitalWrite(ledPi </pre>	for Arduino 1.0.6, 1.6.5-r5, 1.6.9, 1.6.12, 1.6.13, 1 This installer adds files to your Arc	1.8.1, 1.8.2 Juino	USB Serial driver is installed.
delay(100); Keyboard.println(" digitalWrite(ledPi delay(100).	software so you can build and run on Teensy.	sketches	Update Driver
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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)

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3) Now you must select the MMDVM project you downloaded previously Select the "Open" menu and browse to the MMDVM-master project folder you downloaded previously



Select the MMDVM.ino Arduino file located in the MMDVM-master folder you created in the "My Documents" directory – then click "Open"

ch_apr28a					
put your setup code here, to hum ouces					
loop() (
he for with cost set of the theorem?)					
	Constant				
	Gin Open an Ardu	ino sketch.			
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	Network		1		
		Object name	1		Open
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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 – <u>https://etcher.io/</u> WIN 32 Disk Imager – <u>https://sourceforge.net/projects/win32diskimager/</u>

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	1:20170609
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D-Star DMR	2017-06-12 13:18:	59 DMR	Slot 2	KAGTRS	TG 3100	Net	TX	LUSS	DEK
TSF P25	2017-06-12 13:18:	51 DMR	Slot 2	MIFOR	TG 3100	Net	5.5	0%	0.0%
Network Status	2017-06-12 13:18:	44 DMR	Slot 2	M6XTD	TG 3100	Net	4.4	0%	0.0%
D-Stor Net DMR Net	1011 00 11 151101		5101 2	Plotte	14 5100	nee		0,0	0.00
YSF Net P25 Net		Last 2	0 calls tha	at accessed t	this Gatewa	y	_		
Internet	Time (PDT)	Mode	Calls	ign [']	Target	Src	Dur(s)	BER
Radio Info									
Trx TX DMR Slot 2									
Tx 448.900000 MHz									
Rx 448.900000 MHz									
D-Star Repeater									
PDT2 WZVTY C									
D-Stan Network									
APRS texas aprs2 net									
TRC rr. openguad. net									
Linked to REF012 A									
(DPlus Outgoing)									
DMR Repeater									
DMR ID 3153244									
DMR CC 1									
IS1 enabled									
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IG 3100/Hot Linked									
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	Pi-Star / Pi- ircDD	Star Dashboard, © BGateway Dashboar	Andy Taylor (M d by Hans-J. Ba	W0MWZ) 2014-20 arthen (DL5DI),					
	MI	MDVMDash develope Need help? Click be	d by Kim Huebe	el (DG9VH), ort Group					
		Get your copy of	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		Set Password				
	WARNING: This changes the passowrd 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

		Genera	Configuration				
Setting		Value					
Node Callsign:	W7VTX						
CCS7/DMR ID:	3153244						
Radio Frequency:	448.900.000	MHz					
Latitude:	50.000	degrees (posi	tive value for Nor	rth, negative for South)			
Longitude:	0.000	degrees (posi	tive value for Eas	st, negative for West)			
Town:	Seattle						
Country:	USA						
URL:	http://www.qrz	.com/db/W7VTX		💿 Auto i Manual			
Radio/Modem Type:	Zum Board / D	Zum Board / DV-Mega USB Radio / DV-Mega USB GMSK Node (Old Firmware) 🗘					
Node Type:	○ Private (● 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

		WITCHESS CO	ingulatio				
WiFi Info							
Scan for Networks (10 secs) Add Network Save (and connect)							
Networks fou	nd :						
Connect	SSID	Channel	Signal	Security			
Connect	B2	Channel 6	-27 dBm	WPA2-PSK (AES)			
Connect	BLAST	Channel 11	-32 dBm	WPA2-PSK (AES)			
Connect	QSO	<mark>Channel 1</mark>	-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]			
The second se							

Now configure the MMDVM Configuration;

MMDVMHost Configuration					
Value					
● ON ○ OFF					
• ON _ OFF					
● ON ○ OFF					
• ON _ OFF					
● ON ○ OFF					
• ON _ OFF					
● 0N ○ 0FF					
• ON _ OFF					
3 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.

	DMB Configuration
Settina	Value
DMR Master:	BM USA 3108
BrandMeister Network:	Repeater Information Edit Repeater (BrandMeister Selfcare)
DMR Color Code:	
DMR EmbeddedLCOnly:	○ Enabled ● Disabled
DMR DumpTAData:	○ Enabled ● Disabled
	Apply Changes
	D-Star Configuration
Setting	Value
RPT1 Callsign:	W7VTX B
RPT2 Callsign:	W7VTX G
ircDDBGateway Password:	•••••
Default Reflector:	REF012 A \$ • Startup Manual
APRS Host:	texas.aprs2.net
ircDDBGateway Language:	English_(UK)
	Apply Changes
	Yaesu System Fusion Configuration
Setting	Value
YSF Startup Host:	02034 - Alabama-Link 🔶
APRS Host:	texas.aprs2.net
	Apply Changes
Sotting	P25 Configuration
P25 Stantun Host:	
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 – <u>https://www.facebook.com/groups/pistar/</u>

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

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

BrandMeister - https://brandmeister.network/



