eMDee Technology, Inc.

User's Manual

**VCTS
Communications Software**

Part No: **10917**

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1. GETTING STARTED

1.1 System Requirements

This software requires the following hardware:

- a standard Windows PC with the following *minimum* requirements:
    - Windows XP/Windows 7 operating system
    - 2GHz Intel processor
    - 1GB RAM
    - 100GB Hard drive
    - CDROM drive
    - 1 USB 2.0 port
- Audio interface gear (headsets, speakers, and appropriate amplifiers)

1.2 Software Installation

Insert the product CD into your CDROM drive. The installation program should launch automatically. If it does not, run **setup.exe** from the root folder of the CD.
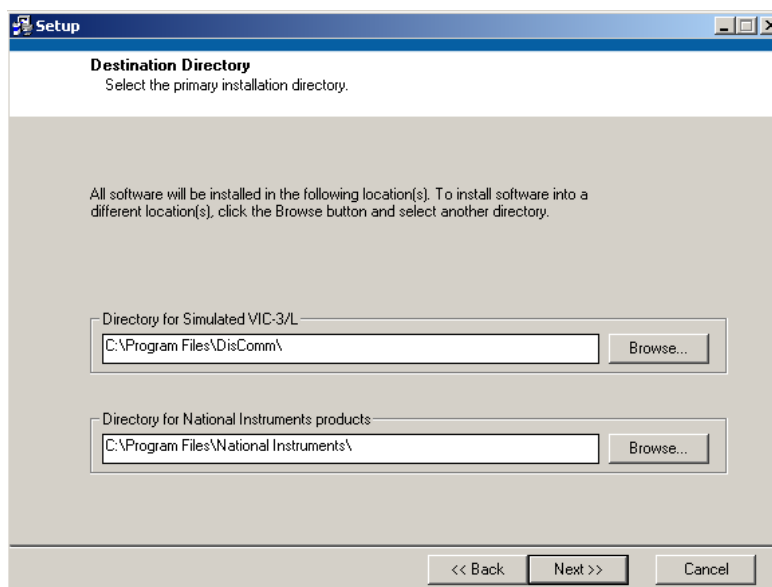
Follow the instructions in the installation program and keep the default settings unless there is a specific need to change them. Once the installation program is complete, you may be prompted to restart your computer.

1.3   Installing USB Drivers

After you have installed the software applications, the driver files for the USB interface boxes will be saved on your local hard drive. Follow these steps to install the driver and get it ready for use:

1.   Plug the USB interface box into the computer and wait a few seconds for Windows to load the default drivers for the device. Launch the Device Manager and expand the list of devices under "Universal Serial Bus controllers" to view the list of available USB devices on your system.

2.   You should see one or more USB devices named "USB Composite Device". Verify that you have the correct device by righ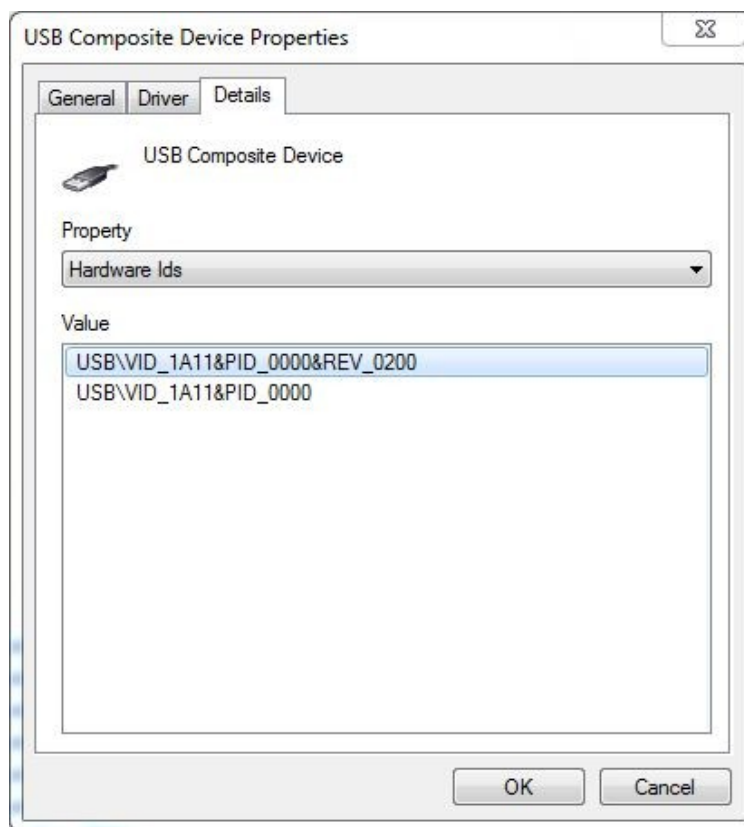t-clicking on the name of the device and select Properties. In the Properties window, select the Details tab and select Hardware Ids in the Properties drop-down list. The hardware identifiers for all USB interface boxes compatible with this software are VID=1A11 and PID=0000.

3.   From the Properties window, select the Driver tab and click the Update Driver... button.

4.   Select the option to manually select the driver for this device. Then choose the selection that allows you to pick from a list of device drivers to install.

5.   Click the Have Disk button and browse to the location on your system where the driver files are saved (default: \Program Files\DisComm\USBDriver). Select the driver file eMDeeUac2.inf. Click Next to install this driver file.
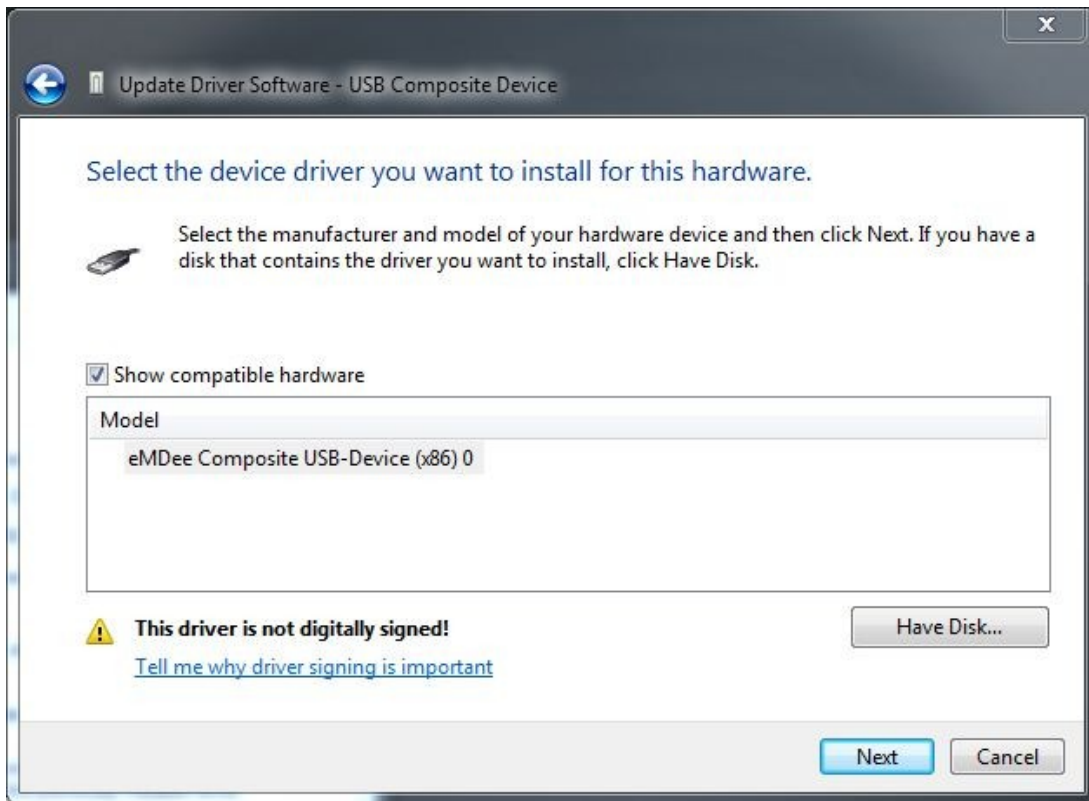
6. During the installation of the driver, Windows may prompt you with a warning about the driver being unsigned. You can ignore this warning and continue with the driver installation.

7. Once the driver installation is complete, the device is ready to use. Your Device Manager should list two drivers as shown below:

8. NOTE: On some Windows XP systems, it may be necessary to perform these steps twice in order to load the driver completely – once for the eMDee Composite USB Device and once for the eMDee Control Device. In this case, the same INF file is used for both drivers.

2.   COMMON SOFTWARE FUNCTIONAL DESCRIPTION

The software is composed of several different applications, each specifically configured for the different types of interface boxes and functionality needed in the VCTS system. The applications have a set of common features that are described in this section.

2.1   Microphone Gains

The block diagram in Figure 2.1 shows a conceptual diagram of the hardware gain stages inside each of the interface boxes. The gain settings for the microphone are software selectable and can be set to automatically switch between different microphone types (powered vs. un-powered, etc.).
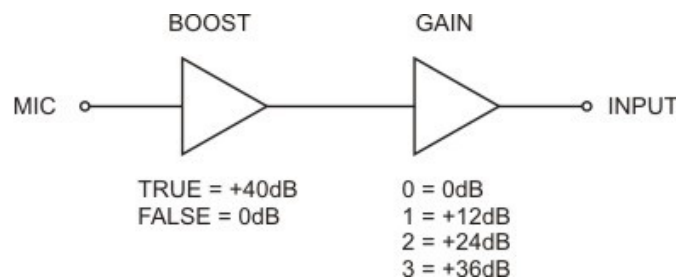
Figure 2.1: Microphone Gain Block Diagram

Figure 2.2 shows the software control features that are available from within each software application. The application allows the user to set 3 different gain settings based on the the three different types of microphones that are compatible with the interface boxes. The 3 types of compatible microphones are:

•   Powered – e.g.: Bose Triport headset or CVC with powered microphone

•   Un-powered – e.g.: CVC with in-powered microphone or H-250 handset

•   PC – e.g.: standard PC-style headset (requires adapter cable)

The software application can detect which type of microphone is plugged in and the currently detected mic is shown by an illuminated indicator under the column heading "Active Mic". The gain and boost settings to the right of the indicator are the gain settings that are currently active in the hardware. As the example in the figure shows, the hardware is showing that a PC microphone is currently being used. The software has set the gain settings to Mic Gain = 3 (+36dB) and no boost (0db).

Values in the Mic Gain and 40dB Boost columns can be changed in real time. This allows the gain settings to be changed while the system is active and the best setting can be found while actively using the system. To make the change permanent, the values in the configuration file will need to change (see configuration file description later in this document).

Indicator shows which
microphone is currently
in use

Enables/disables the +40 dB
mic boost; initialized from the
configuration file

Sets the variable gain stage
of the mic amplifier; initialized
from the configuration file
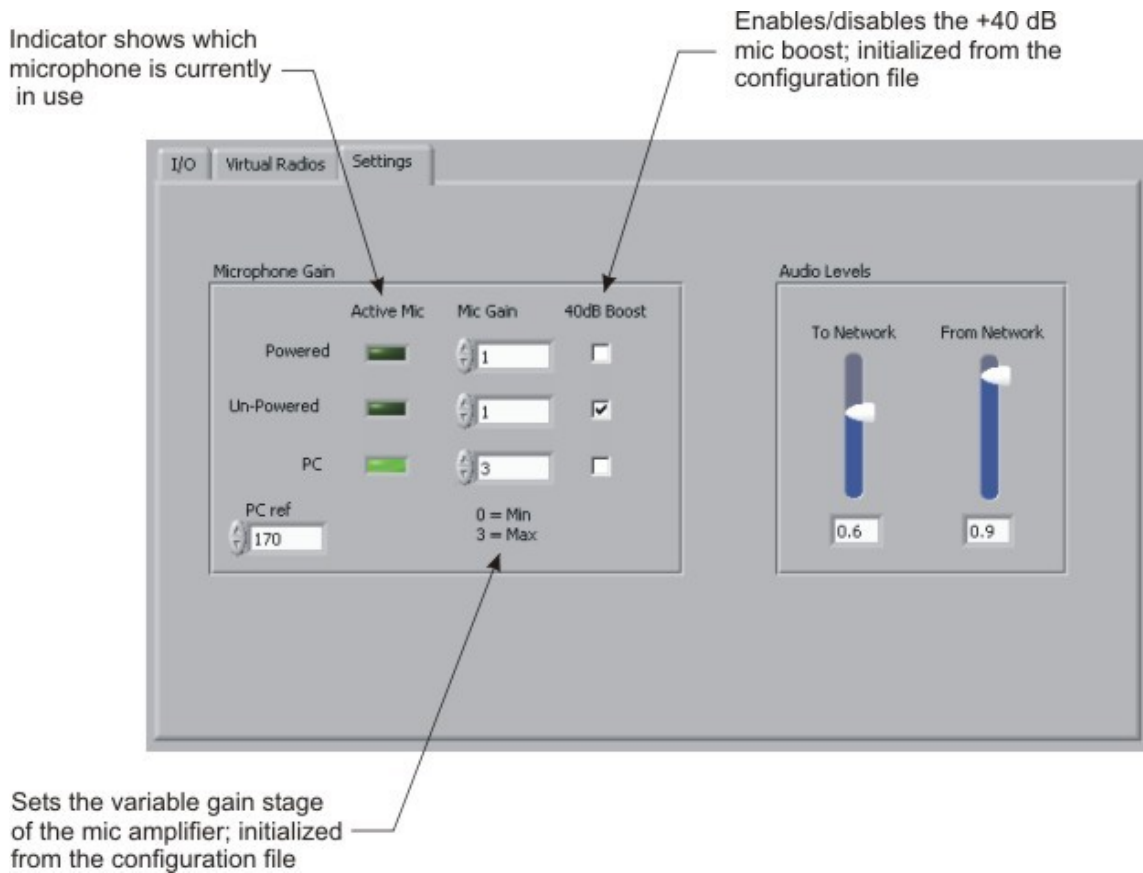
Figure 2.2: Runtime microphone gain tuning

The value in the "PC ref" edit box is also an important parameter. The software requires a threshold where it can tell the difference between an un-powered microphone and a PC microphone. Since there is a wide range of PC microphone types, it will be necessary to set the threshold level for the specific brand of PC microphone being used. To set the proper "PC ref" level, perform the following steps:

1. Unplug all microphones from the interface box and view the "Settings" page in the software application as shown in Figure 2.2.

2. Decrement the value in the "PC ref" edit box until the "PC" indicator is extinguished and the indicator for "Un-Powered" is illuminated (A value of 150 makes a good threshold for most PC mics, but this value will vary depending on the brand of microphone being used).

3. Reduce that number by 5 to make sure the threshold is solid.

4. Plug in the PC microphone and verify that the "Active Mic" indicator switches from Un-Powered to PC.

NOTE: When using the PC microphone with adapter cable, make sure the DIP switch setting on the interface box is set properly. Refer to the hardware manual for the interface box for the correct DIP switch setting.

2.2   Audio Levels

The "Audio Levels" section (ref Figure 2.2) can be used to change the software level of the recorded and playback audio. These levels control the volume of the sampled signal inside the USB CODEC and will affect the signal that is sent to the network and the signals that are received from the network. Some experimentation may be necessary to achieve the optimal results for the audio levels, but the following may be used as a guide:

1.   Establish 2-way communications between 2 different interface boxes.

2.   Set the "From Network" slider on both applications to 0.9.

3.   Talk back and forth between the two interface boxes and vary the "To Network" slider for comfortable listening level. Also be sure that the audio is not distorted by using too much volume.

4.   If the desired volume cannot be achieved by adjusting the sliders, you may need to go back and adjust the hardware gains for the microphones (see Section 2.1) before attempting to adjust the Audio Levels.

2.3   Virtual Radios

Virtual radios are the means by which audio signals are transmitted over the network to establish 2-way communications between interface boxes. The FFCS and FFCS/L both have 8 virtual radios named INT2, INT, A, B, C, D, E, and F. The VRCU has 2 radios named A and B (see Figure 2.3).
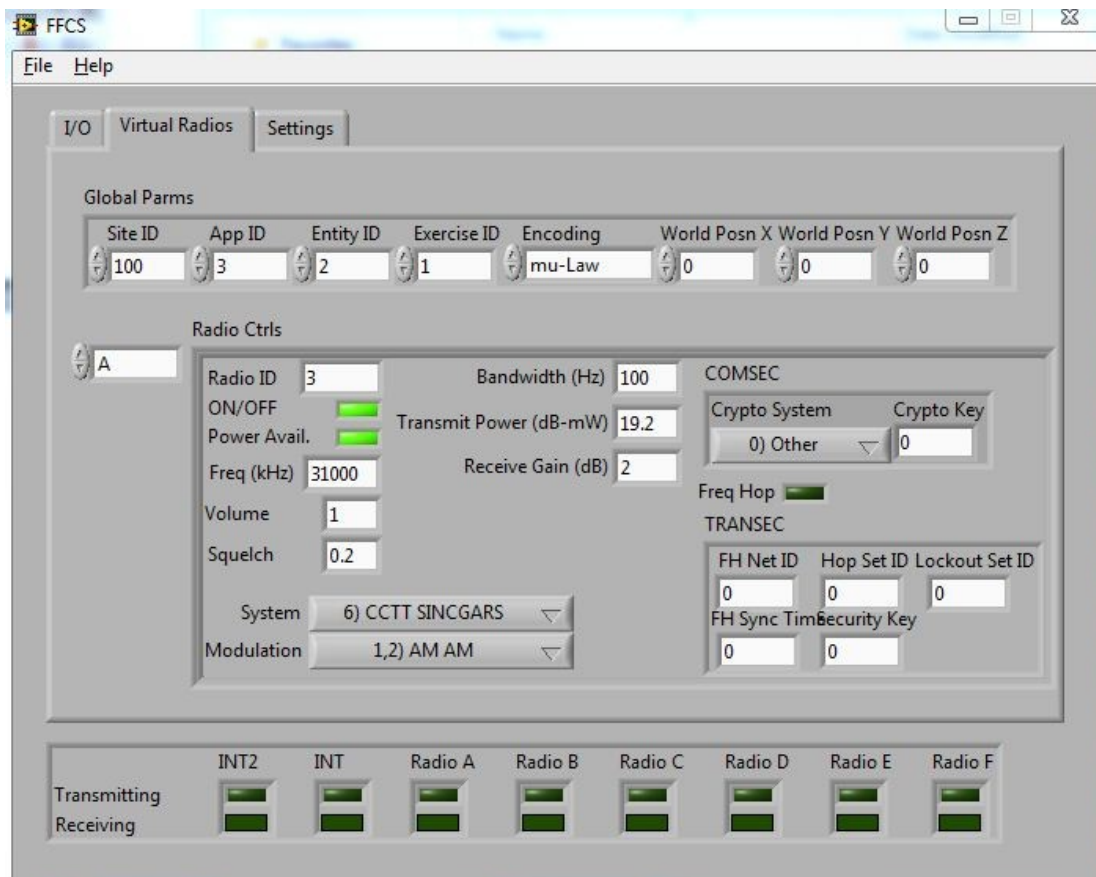

Figure 2.3: Virtual Radio Settings

The basic function of a virtual radio is to allow the digitized audio signals on the network to have parameters that mimic a real-world radio. This allows a receiving radio to decide whether or not to accept the transmitted signals based on the settings of the transmitting virtual radio and the settings of the receiving virtual radio.

Several factors are used to decide how the radios will communicate, but basically speaking, the following parameters must match between a set of radios before they will be able to communicate:

- Frequency

- Exercise ID

- System

- Modulation

- COMSEC

- TRANSEC

Also, the World Position of a virtual radio can affect communication. For the purposes of this document and application, it will be assumed that the position of the radios will be kept at (0, 0, 0). This is a fictitious "center of the Earth" position that bypasses the radio's propagation model.

2.3.1   DIS Identifiers

The parameters labeled "Site ID", "App ID", "Entity ID", and "Radio ID" are very important for proper networked communications. Based on the DIS protocol, each entity within a network domain shall have a unique DIS identifier. The DIS identifier is made up of the combination of the Site ID, App ID, Entity ID, and Radio ID. The combination of these values *must* be unique throughout the network (much like an IP address must be unique within a local area network).

The configuration file for each application has a default set of values for the DIS identifiers, but if the same configuration file is simply copied to each target machine without modification, the DIS identifiers will not be unique and communications will not be possible. One method for ensuring that the DIS identifiers are unique is to launch the application with the default configuration file, and then change at least one of the values during run-time using the Host interface mechanism described in Section 2.4.

2.4   Host Interface Control

Each of the software applications have a standard mechanism that can accept commands from a remote process. The protocol is based on simple UDP/IP network packets that are sent between the Host process and the communications system process. The processes may be on different computers on the same network or can be different processes on the same computer. Regardless, the mechanism is the same.

The Host interface has been standardized among all of our products and as such is documented on our website. Use the following web page to view details about the Host interface:

http://www.emdee.com/icd.php?pn=10917

Use the configuration file to set the network parameters such as IP port, etc. Details about the configuration files are found in the application specific section for each of the interface boxes.

3.   APPLICATION-SPECIFIC SOFTWARE FUNCTIONAL DESCRIPTION

The software is composed of several different applications, each specifically configured for the different types of interface boxes and functionality needed in the VCTS system. Applications are available for the following:

- •   FFCS/L

- •   FFCS

- •   VRCU

3.1   FFCS/L Application

The FFCS/L application window shows the current state of the interface box hardware. With the "USB I/O – Virtual" switch set to the "USB I/O" position, the Panel window reflects the current setting of the FFCS/L interface box switch settings. When a switch is changed on the interface box, the virtual panel should reflect the change automatically. This feature is useful when debugging to make sure that the interface box and the USB interface are operating properly.

You can also set the "USB I/O – Virtual" switch to "Virtual" and control the virtual panel with a mouse. In virtual mode, the system will ignore the USB I/O interface and controls for the application will come from the virtual panel rather than the interface box. However, the audio interface will continue to work in the same manner in USB I/O mode and Virtual mode.
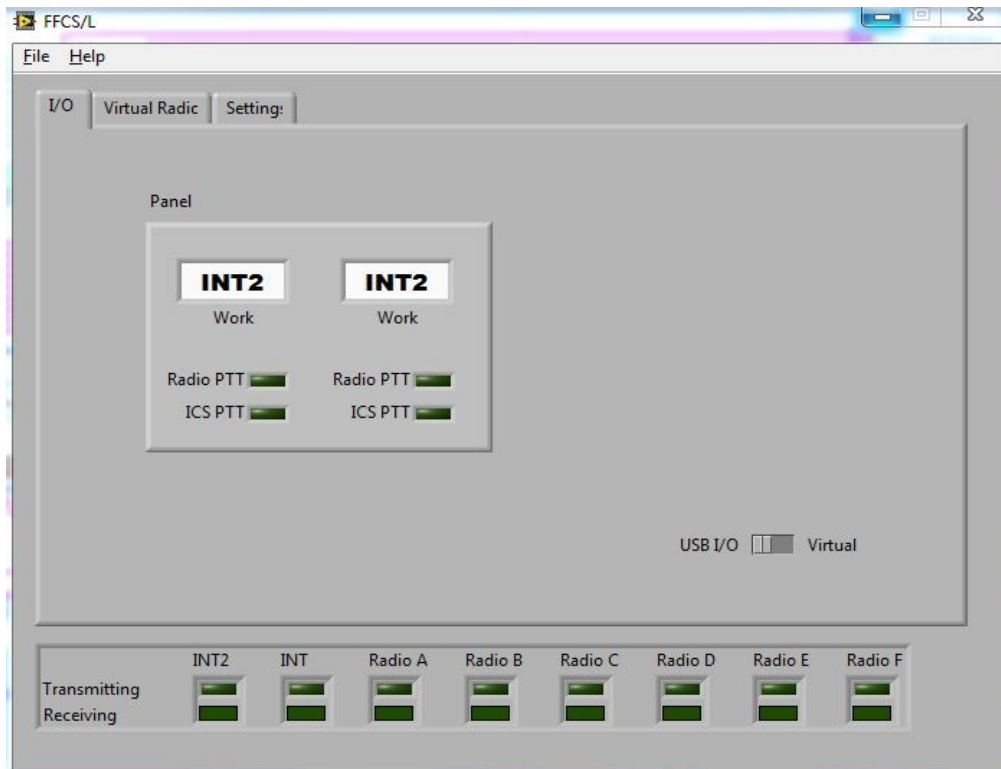
Figure 3.1: FFCS/L Interface Box I/O Virtual Panel

3.2   Configuration File Description for FFCS/L Application (Ffcs-L.cfg)

The following sections detail the entries in the configuration file for the FFCS/L Communications software. The configuration file can be found in C:\Program Files\DisComm and is named Ffcs-L.cfg. It can be edited with any ASCII text editor such as Windows Notepad.

3.2.1   [Host] Section

This section sets the Host networking interface parameters between the main application and remote application(s).

```
[Host]
ReadPort=3030
```
<--- The IP port for communications from the Host computer to the FFCS/L application.

```
WritePort=3031
```
<--- The IP port for communications from the FFCS/L application to the Host computer.

```
WriteAdx=2.2.2.2
```
<--- The IP address of the Host computer.

```
ByteSwap=TRUE
```
<--- Sets the byte-swapping mode of the IP packets for the Host interface. In most cases, the packet will need to be byte-swapped to convert from machine byte order (little endian) to network byte order (big endian) or vice versa.

3.2.2   [DIS] Section

This section sets the network parameters for DIS networking mode.

```
[DIS]
DISVersion=6
```
<--- An enumerated DIS value that indicates the DIS protocol version being used:
   4 = Ver 2.0 4th Draft
   5 = IEEE 1278-1995
   6 = IEEE 1278-1998
The Radio Software is compatible with version 4, 5, or 6. The default value should always be used except in cases where compatibility with other systems is required.

```
BroadcastIP=255.255.255.255
```
<--- The IP broadcast address for all DIS-transmitted packets. In most cases the broadcast address can be set to 255.255.255.255 which means "transmit to all subnets". In some cases, especially when there is more than one network interface, this address will need to be set to the subnet of the DIS network. For example, if your IP address is 131.3.4.5 and the subnet mask is 255.255.0.0, then the broadcast address should be set to 131.3.255.255 to broadcast to that subnet. The broadcast IP address does not affect received packets, only transmitted packets. Any valid packet that is on the network will be received, regardless of the broadcast IP setting.

```
Port=3000
```
<--- The IP port of all DIS network communications. All other systems that communicate with this system using DIS will need to be on the same IP port.

3.2.3   [Audio] Section

This section sets the basic audio parameters for the application.

```
[Audio]
CaptureSize=512
```
<--- The size of the audio capture buffer, in bytes. Lower values will reduce audio delays but increase CPU and network load.

```
SampleRate=8000
```
<--- The sample rate, in bytes per second, of the audio capture buffer. This value may need to be changed for compatibility with other systems.

```
UseDSCapture=FALSE
```
<--- When set to TRUE, the audio capture routines will use the newer DirectSoundCapture interface. When set to FALSE, the audio capture routines will use the legacy Windows multimedia interface. The legacy interface is faster but may not be compatible with newer operating systems such as Vista and Windows 7. When using DirectSoundCapture you may need to increase the CaptureSize (>= 2048) to prevent audio break-ups.

```
Input=[default]
```
<--- The name of the sound device to be used for audio input for this application. The value "[default]" will use the default sound device that as configured by the Windows OS.

```
Output=[default]
```
<--- The name of the sound device to be used for audio playback for this application. The value "[default]" will use the default sound device that as configured by the Windows OS.

```
LevelToNetwork=0.9
```
<--- Level of audio that will be sent over the network. The range of values is from 0.0 (0%) to 1.0 (100%). This is the "capture" volume of the audio from the microphone.

```
LevelFromNetwork=0.9
```
              <---   Level of audio that is received from the network. The
                     range of values is from 0.0 (0%) to 1.0 (100%). This is
                     the "playback" volume of the audio to the headphones.

3.2.4   [MicGains] Section

This section sets the parameters for the FFCS/L hardware gain stages for the microphone audio input.
Reference section 2.1 for details on the gain settings and what they mean.

```
[MicGains]

PoweredGain=1
```
                 <---   Gain setting for a powered mic

```
PoweredBoost=FALSE
```
           <---   +40dB Boost setting for a powered mic

```
UnpoweredGain=1
```
               <---   Gain setting for an un-powered mic

```
UnpoweredBoost=TRUE
```
          <---   +40dB Boost setting for an un-powered mic

```
PCGain=3
```
                     <---   Gain setting for a powered mic

```
PCBoost=FALSE
```
                <---   +40dB Boost setting for a PC mic

```
PCRef=170
```
                    <---   Threshold setting for a PC mic

3.2.5   [Panel] Section

This section sets the parameters for the FFCS/L operator panel.

```
[Panel]

RadioAccess_L=11110000
```
       <---   Sets the access to the radios for the operator on the left
                     side of this panel (the left channel of the attached sound
                     device). The value is a string of eight 1's and 0's that
                     represent access (1) or no access (0) to the intercom
                     and radios A through F; i.e.: the string 11110000 would
                     allow access to INT2, INT, and radios A and B but no
                     access to radios C through F. The order of the eight
                     digits is: (INT2)(INT)(A)(B)(C)(D)(E)(F)

```
RadioAccess_R=11110000
```
       <---   Sets the access to the radios for the operator on the
                     right side of this panel (the right channel of the attached
                     sound device). The value is a string of eight 1's and 0's
                     that represent access (1) or no access (0) to the radios
                     A through F; i.e.: the string 11110000 would allow
                     access to INT2, INT, radios A and B but no access to
                     radios C through F. The order of the eight digits is:
                     (INT2)(INT)(A)(B)(C)(D)(E)(F)

3.2.6 [Global] Section

This section sets the global parameters that apply to all virtual radios in the system.

```
[Global]
SiteID=100
```
<--- The DIS Site ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
AppID=1
```
<--- The DIS Application ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
EntityID=2
```
<--- The DIS Entity ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
ExerciseID=1
```
<--- Sets the DIS exercise ID for the virtual radio. The exercise ID defines a "virtual world" that radios communicate in. This setting allows the physical network to be divided into separate "worlds" so that radio communication can be segregated. Radios and intercoms with different exercise IDs will not be able to communicate regardless of any other settings.

```
Encoding=1
```
<--- DIS enumeration for the type of encoding used in transmitted audio packets:
> 1 = mu-Law
> 2 = CVSD
> 3 = ADPCM
> 4 = 16 bit PCM
> 7 = CECOM CVSD

```
PosnX=0.0
```
<--- The distance in meters along the Earth's X axis. The positive X axis originates at the center of the Earth and extends through the prime meridian at the equator.

```
PosnY=0.0
```
<--- The distance in meters along the Earth's Y axis. The positive Y axis originates at the center of the Earth and extends through 90 degrees east longitude at the equator.

```
PosnZ=0.0
```
<--- The distance in meters along the Earth's Z axis. The positive Z axis originates at the center of the Earth and extends through the north pole.

3.2.7   [Radio] Sections

These sections set the simulated parameters of the virtual radios. The sections are labeled **INT2, INT, and RadioA** through **RadioF** and correspond to the 8 virtual radios available in the software.

```
[Radio]
```

`Enabled=TRUE`	<---	Causes the virtual radio to be created (=TRUE) or not created (=FALSE) when the application launches. If the radio is disabled, it will not be available for transmission or reception.
`HalfDuplex=FALSE`	<---	Creates the virtual radio as a half duplex radio (TRUE) or a full duplex radio (FALSE). A full duplex radio allows transmission and reception at the same time, while a half duplex radio does not allow reception while it is transmitting.
`RadioID=1`	<---	The DIS Radio ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533.
`PowerAvail=TRUE`	<---	Sets the ON/OFF state of the virtual radio. A virtual radio that is OFF (=FALSE) cannot transmit or receive radio signals, but still exists on the network as an active radio entity. A virtual radio that is ON (=TRUE) is considered ON and ready to transmit and receive radio signals.
`Vol=1.0`	<---	The receiver volume for the virtual radio. Each virtual radio has a separate and independent receiver volume. Valid values range from 0.0 (no volume) to 1.0 (full volume).
`Squelch=0.2`	<---	The receiver squelch for the virtual radio. A value of 0.0 will allow signals, including noise, to pass to the receiver. A value of 1.0 will allow no signals to pass to the receiver. Typical setting is 0.2
`Freq=31.0`	<---	Sets the tuned frequency of the virtual radio, in Megahertz. Virtual radios with the same frequency will be able to communicate.
`Power=20.0`	<---	Sets the simulated transmitter output power for the virtual radio. The output stage of the virtual radio includes the output amplifier to the radiating portion of the antenna. The combined power and gain of these stages represented here as the transmitter power and is expressed in decibel-milliwatts (dB-mW). Typical power settings range from 10.0 to 100.0.

```
Gain=1.0
```
      <---   Sets the gain of the input stage of the virtual radio model. The input stage consists of the combined effects of the antenna and input amplifier of the simulated radio system. The effects of the transmitter's power, the signal propagation loss due to relative positions, and the receiver gain determine the strength of the received signal. The input gain is measured in decibels (dB). Typical gain settings range from 1.0 to 20.0.

```
Bandwidth=100.0
```
      <---   Sets the bandwidth for a virtual radio tuner model. Along with the tuned frequency, this parameter sets a bandpass filter for the virtual radio whereas if an incoming signal's frequency is within this band, it will pass through the tuner model.

```
System=1
```
      <---   Sets the modulation system for a virtual radio. If the system parameters do not match between two radios, those radios will not be able to communicate. Valid values for this parameter are:

> 0 = Other
> 1 = Generic
> 2 = Have Quick
> 3 = Have Quick II
> 4 = Have Quick IIA
> 5 = SINCGARS
> 6 = CCTT SINCGARS

```
Modulation=11
```
      <---   Sets the modulation mode for a virtual radio. If the modulation parameters do not match between two radios, those radios will not be able to communicate. Valid values for this parameter are:

> 0 = AM AFSK (1, 1)
> 1 = AM AM (1, 2)
> 2 = AM CW (1, 3)
> 3 = AM DSB (1, 4)
> 4 = AM ISB (1, 5)
> 5 = AM LSB (1, 6)
> 6 = AM SSB Full (1, 7)
> 7 = AM SSB Reduced (1, 8)
> 8 = AM USB (1, 9)
> 9 = AM VSB (1, 10)
> 10 = Amplitude and Angular (2, 1)
> 11 = Angular FM (3, 1)
> 12 = Angular FSK (3, 2)
> 13 = Angular PM (3, 3)
> 14 = CM AAP (4, 1)
> 15 = Pulse (5, 1)
> 16 = Unmodulated (6, 1)

```
FreqHop=FALSE
```
      <---   Enable/disable frequency hopping mode for simulation of transmission security (TRANSEC).

CryptoSystem   <---   A DIS enumerated value for the simulated crypto
                                             system for the virtual radio. The combination of
                                             CryptoSystem and CryptoKey sets the simulated secure
                                             transmission mode. Basically, if the listening radio is
                                             set to the same crypto system and key, the
                                             transmission will be heard, otherwise only noise will be
                                             heard. Valid values for the CryptoSystem are:

                                                     0 = Other (disabled)
                                                     1 = KY-28
                                                     2 = KY-58
                                                     3 = NSVE
                                                     4 = WSVE
                                                     5 = ICOM

CryptoKey   <---   An arbitrary value that represents the software key that
                                             was used to scramble the transmitted signal. If a
                                             receiver has the same key to descramble the
                                             transmission, it will properly receive the transmission,
                                             otherwise only noise will be received. This value is only
                                             a simulated key and the transmitted data is not actually
                                             scrambled, but this allows simulation of the effects of a
                                             secure radio transmission.

3.3   FFCS Application

The FFCS application window shows the current state of the interface box hardware. With the "USB I/O – Virtual" switch set to the "USB I/O" position, the Panel window reflects the current setting of the FFCS interface box switch settings. When a switch is changed on the interface box, the virtual panel should reflect the change automatically. This feature is useful when debugging to make sure that the interface box and the USB interface are operating properly.

You can also set the "USB I/O – Virtual" switch to "Virtual" and control the virtual panel with a mouse. In virtual mode, the system will ignore the USB I/O interface and controls for the application will come from the virtual panel rather than the interface box. However, the audio interface will continue to work in the same manner in USB I/O mode and Virtual mode.
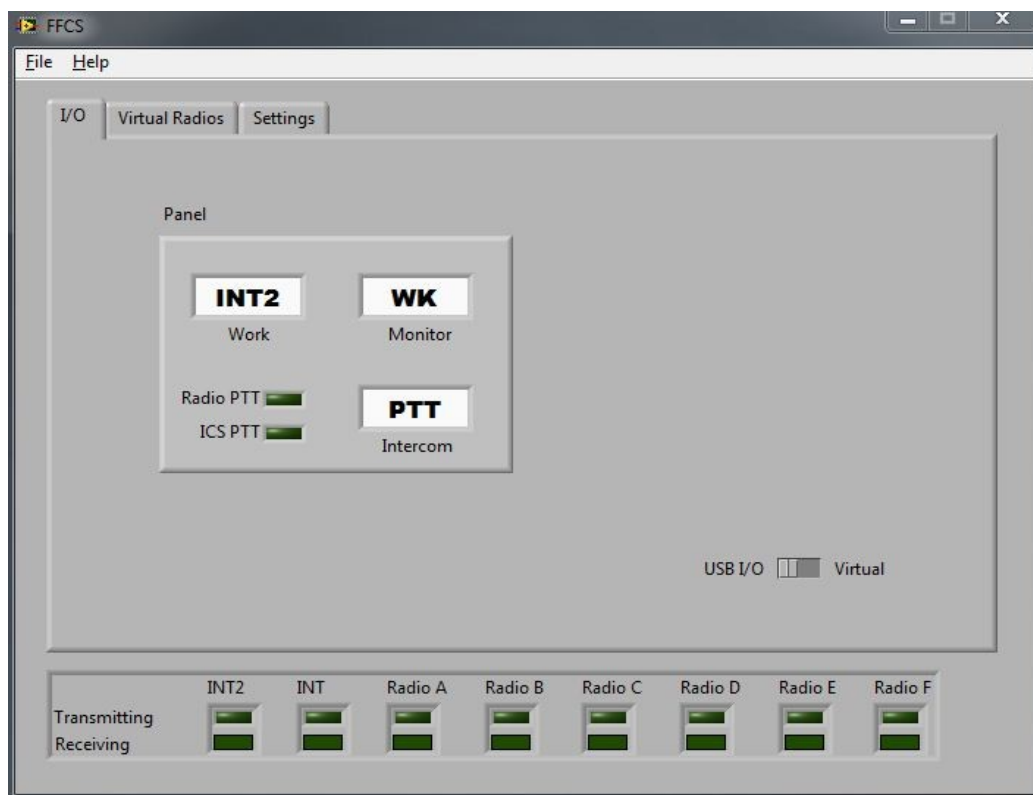
Figure 3.2: FFCS Interface Box I/O Virtual Panel

3.4   Configuration File Description for FFCS Application (Ffcs.cfg)

The following sections detail the entries in the configuration file for the FFCS Communications software. The configuration file can be found in C:\Program Files\DisComm and is named Ffcs.cfg. It can be edited with any ASCII text editor such as Windows Notepad.

3.4.1   [Host] Section

This section sets the Host networking interface parameters between the main application and remote application(s).

```
[Host]
ReadPort=3030
```
<--- The IP port for communications from the Host computer to the FFCS/L application.

```
WritePort=3031
```
<--- The IP port for communications from the FFCS/L application to the Host computer.

```
WriteAdx=2.2.2.2
```
<--- The IP address of the Host computer.

```
ByteSwap=TRUE
```
<--- Sets the byte-swapping mode of the IP packets for the Host interface. In most cases, the packet will need to be byte-swapped to convert from machine byte order (little endian) to network byte order (big endian) or vice versa.

3.4.2   [DIS] Section

This section sets the network parameters for DIS networking mode.

```
[DIS]
DISVersion=6
```
<--- An enumerated DIS value that indicates the DIS protocol version being used:

  4 = Ver 2.0 4th Draft
  5 = IEEE 1278-1995
  6 = IEEE 1278-1998

The Radio Software is compatible with version 4, 5, or 6. The default value should always be used except in cases where compatibility with other systems is required.

```
BroadcastIP=255.255.255.255
```
<--- The IP broadcast address for all DIS-transmitted packets. In most cases the broadcast address can be set to 255.255.255.255 which means "transmit to all subnets". In some cases, especially when there is more than one network interface, this address will need to be set to the subnet of the DIS network. For example, if your IP address is 131.3.4.5 and the subnet mask is 255.255.0.0, then the broadcast address should be set to 131.3.255.255 to broadcast to that subnet. The broadcast IP address does not affect received packets, only transmitted packets. Any valid packet that is on the network will be received, regardless of the broadcast IP setting.

```
Port=3000
```
<--- The IP port of all DIS network communications. All other systems that communicate with this system using DIS will need to be on the same IP port.

3.4.3   [Audio] Section

This section sets the basic audio parameters for the application.

```
[Audio]
CaptureSize=512
```
<--- The size of the audio capture buffer, in bytes. Lower values will reduce audio delays but increase CPU and network load.

```
SampleRate=8000
```
<--- The sample rate, in bytes per second, of the audio capture buffer. This value may need to be changed for compatibility with other systems.

```
UseDSCapture=FALSE
```
<--- When set to TRUE, the audio capture routines will use the newer DirectSoundCapture interface. When set to FALSE, the audio capture routines will use the legacy Windows multimedia interface. The legacy interface is faster but may not be compatible with newer operating systems such as Vista and Windows 7. When using DirectSoundCapture you may need to increase the CaptureSize (>= 2048) to prevent audio break-ups.

```
Input=[default]
```
<--- The name of the sound device to be used for audio input for this application. The value "[default]" will use the default sound device that as configured by the Windows OS.

```
Output=[default]
```
<--- The name of the sound device to be used for audio playback for this application. The value "[default]" will use the default sound device that as configured by the Windows OS.

```
LevelToNetwork=0.9
```
<--- Level of audio that will be sent over the network. The range of values is from 0.0 (0%) to 1.0 (100%). This is the "capture" volume of the audio from the microphone.

```
LevelFromNetwork=0.9
```
<---   Level of audio that is received from the network. The range of values is from 0.0 (0%) to 1.0 (100%). This is the "playback" volume of the audio to the headphones.

3.4.4   [MicGains] Section

This section sets the parameters for the FFCS hardware gain stages for the microphone audio input. Reference section 2.1 for details on the gain settings and what they mean.

```
[MicGains]
PoweredGain=1
```
<---   Gain setting for a powered mic

```
PoweredBoost=FALSE
```
<---   +40dB Boost setting for a powered mic

```
UnpoweredGain=1
```
<---   Gain setting for an un-powered mic

```
UnpoweredBoost=TRUE
```
<---   +40dB Boost setting for an un-powered mic

```
PCGain=3
```
<---   Gain setting for a powered mic

```
PCBoost=FALSE
```
<---   +40dB Boost setting for a PC mic

```
PCRef=170
```
<---   Threshold setting for a PC mic

3.4.5   [Panel] Section

This section sets the parameters for the FFCS operator panel.

```
[Panel]
RadioAccess_L=11110000
```
<---   Sets the access to the radios for the operator on the left side of this panel (the left channel of the attached sound device). The value is a string of eight 1's and 0's that represent access (1) or no access (0) to the intercom and radios A through F; i.e.: the string 11110000 would allow access to INT2, INT, and radios A and B but no access to radios C through F. The order of the eight digits is: (INT2)(INT)(A)(B)(C)(D)(E)(F)

```
RadioAccess_R=11110000
```
<---   Sets the access to the radios for the operator on the right side of this panel (the right channel of the attached sound device). The value is a string of eight 1's and 0's that represent access (1) or no access (0) to the radios A through F; i.e.: the string 11110000 would allow access to INT2, INT, radios A and B but no access to radios C through F. The order of the eight digits is: (INT2)(INT)(A)(B)(C)(D)(E)(F)

3.4.6   [Global] Section

This section sets the global parameters that apply to all virtual radios in the system.

```
[Global]
SiteID=100
```
           <--- The DIS Site ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
AppID=1
```
           <--- The DIS Application ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
EntityID=2
```
           <--- The DIS Entity ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
ExerciseID=1
```
           <--- Sets the DIS exercise ID for the virtual radio. The exercise ID defines a "virtual world" that radios communicate in. This setting allows the physical network to be divided into separate "worlds" so that radio communication can be segregated. Radios and intercoms with different exercise IDs will not be able to communicate regardless of any other settings.

```
Encoding=1
```
           <--- DIS enumeration for the type of encoding used in transmitted audio packets:
      1 = mu-Law
      2 = CVSD
      3 = ADPCM
      4 = 16 bit PCM
      7 = CECOM CVSD

```
PosnX=0.0
```
           <--- The distance in meters along the Earth's X axis. The positive X axis originates at the center of the Earth and extends through the prime meridian at the equator.

```
PosnY=0.0
```
           <--- The distance in meters along the Earth's Y axis. The positive Y axis originates at the center of the Earth and extends through 90 degrees east longitude at the equator.

```
PosnZ=0.0
```
           <--- The distance in meters along the Earth's Z axis. The positive Z axis originates at the center of the Earth and extends through the north pole.

3.4.7   [Radio] Sections

These sections set the simulated parameters of the virtual radios. The sections are labeled **INT2, INT, and RadioA** through **RadioF** and correspond to the 8 virtual radios available in the software.

```
[Radio]
```

`Enabled=TRUE`	<---	Causes the virtual radio to be created (=TRUE) or not created (=FALSE) when the application launches. If the radio is disabled, it will not be available for transmission or reception.
`HalfDuplex=FALSE`	<---	Creates the virtual radio as a half duplex radio (TRUE) or a full duplex radio (FALSE). A full duplex radio allows transmission and reception at the same time, while a half duplex radio does not allow reception while it is transmitting.
`RadioID=1`	<---	The DIS Radio ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533.
`PowerAvail=TRUE`	<---	Sets the ON/OFF state of the virtual radio. A virtual radio that is OFF (=FALSE) cannot transmit or receive radio signals, but still exists on the network as an active radio entity. A virtual radio that is ON (=TRUE) is considered ON and ready to transmit and receive radio signals.
`Vol=1.0`	<---	The receiver volume for the virtual radio. Each virtual radio has a separate and independent receiver volume. Valid values range from 0.0 (no volume) to 1.0 (full volume).
`Squelch=0.2`	<---	The receiver squelch for the virtual radio. A value of 0.0 will allow signals, including noise, to pass to the receiver. A value of 1.0 will allow no signals to pass to the receiver. Typical setting is 0.2
`Freq=31.0`	<---	Sets the tuned frequency of the virtual radio, in Megahertz. Virtual radios with the same frequency will be able to communicate.
`Power=20.0`	<---	Sets the simulated transmitter output power for the virtual radio. The output stage of the virtual radio includes the output amplifier to the radiating portion of the antenna. The combined power and gain of these stages represented here as the transmitter power and is expressed in decibel-milliwatts (dB-mW). Typical power settings range from 10.0 to 100.0.

```
Gain=1.0
```
<--- Sets the gain of the input stage of the virtual radio model. The input stage consists of the combined effects of the antenna and input amplifier of the simulated radio system. The effects of the transmitter's power, the signal propagation loss due to relative positions, and the receiver gain determine the strength of the received signal. The input gain is measured in decibels (dB). Typical gain settings range from 1.0 to 20.0.

```
Bandwidth=100.0
```
<--- Sets the bandwidth for a virtual radio tuner model. Along with the tuned frequency, this parameter sets a bandpass filter for the virtual radio whereas if an incoming signal's frequency is within this band, it will pass through the tuner model.

```
System=1
```
<--- Sets the modulation system for a virtual radio. If the system parameters do not match between two radios, those radios will not be able to communicate. Valid values for this parameter are:

    0 = Other
    1 = Generic
    2 = Have Quick
    3 = Have Quick II
    4 = Have Quick IIA
    5 = SINCGARS
    6 = CCTT SINCGARS

```
Modulation=11
```
<--- Sets the modulation mode for a virtual radio. If the modulation parameters do not match between two radios, those radios will not be able to communicate. Valid values for this parameter are:

    0 = AM AFSK (1, 1)
    1 = AM AM (1, 2)
    2 = AM CW (1, 3)
    3 = AM DSB (1, 4)
    4 = AM ISB (1, 5)
    5 = AM LSB (1, 6)
    6 = AM SSB Full (1, 7)
    7 = AM SSB Reduced (1, 8)
    8 = AM USB (1, 9)
    9 = AM VSB (1, 10)
    10 = Amplitude and Angular (2, 1)
    11 = Angular FM (3, 1)
    12 = Angular FSK (3, 2)
    13 = Angular PM (3, 3)
    14 = CM AAP (4, 1)
    15 = Pulse (5, 1)
    16 = Unmodulated (6, 1)

```
FreqHop=FALSE
```
<--- Enable/disable frequency hopping mode for simulation of transmission security (TRANSEC).

CryptoSystem   <---   A DIS enumerated value for the simulated crypto
                                           system for the virtual radio. The combination of
                                           CryptoSystem and CryptoKey sets the simulated secure
                                           transmission mode. Basically, if the listening radio is
                                           set to the same crypto system and key, the
                                           transmission will be heard, otherwise only noise will be
                                           heard. Valid values for the CryptoSystem are:

                                                   0 = Other (disabled)
                                                   1 = KY-28
                                                   2 = KY-58
                                                   3 = NSVE
                                                   4 = WSVE
                                                   5 = ICOM

CryptoKey   <---   An arbitrary value that represents the software key that
                                           was used to scramble the transmitted signal. If a
                                           receiver has the same key to descramble the
                                           transmission, it will properly receive the transmission,
                                           otherwise only noise will be received. This value is only
                                           a simulated key and the transmitted data is not actually
                                           scrambled, but this allows simulation of the effects of a
                                           secure radio transmission.

3.5   VRCU Application

The VRCU application window shows the current state of the interface box hardware. With the "USB I/O – Virtual" switch set to the "USB I/O" position, the Panel window reflects the current setting of the VRCU interface box switch settings and display. When a switch or button is changed on the interface box, the virtual panel should reflect the change automatically. This feature is useful when debugging to make sure that the interface box and the USB interface are operating properly.

You can also set the "USB I/O – Virtual" switch to "Virtual" and control the virtual panel with a mouse. In virtual mode, the system will ignore the USB I/O interface and controls for the application will come from the virtual panel rather than the interface box. However, the audio interface and LCD display will continue to work in the same manner in USB I/O mode and Virtual mode.

Figure 3.3: VRCU Interface Box I/O Virtual Panel

3.6 Configuration File Description for VRCU Application (Vrcu.cfg)

The following sections detail the entries in the configuration file for the VRCU Communications software. The configuration file can be found in C:\Program Files\DisComm and is named Vrcu.cfg. It can be edited with any ASCII text editor such as Windows Notepad.

3.6.1 [Host] Section

This section sets the Host networking interface parameters between the main application and remote application(s).

```
[Host]
ReadPort=3030          <---   The IP port for communications from the Host computer
                              to the FFCS/L application.
WritePort=3031         <---   The IP port for communications from the FFCS/L
                              application to the Host computer.
WriteAdx=2.2.2.2       <---   The IP address of the Host computer.
ByteSwap=TRUE          <---   Sets the byte-swapping mode of the IP packets for the
                              Host interface. In most cases, the packet will need to
                              be byte-swapped to convert from machine byte order
                              (little endian) to network byte order (big endian) or vice
                              versa.
```

3.6.2 [DIS] Section

This section sets the network parameters for DIS networking mode.

```
[DIS]
DISVersion=6           <---   An enumerated DIS value that indicates the DIS
                              protocol version being used:
                                    4 = Ver 2.0 4th Draft
                                    5 = IEEE 1278-1995
                                    6 = IEEE 1278-1998
                              The Radio Software is compatible with version 4, 5, or
                              6. The default value should always be used except in
                              cases where compatibility with other systems is
                              required.
```

```
BroadcastIP=255.255.255.255
```
<--- The IP broadcast address for all DIS-transmitted packets. In most cases the broadcast address can be set to 255.255.255.255 which means "transmit to all subnets". In some cases, especially when there is more than one network interface, this address will need to be set to the subnet of the DIS network. For example, if your IP address is 131.3.4.5 and the subnet mask is 255.255.0.0, then the broadcast address should be set to 131.3.255.255 to broadcast to that subnet. The broadcast IP address does not affect received packets, only transmitted packets. Any valid packet that is on the network will be received, regardless of the broadcast IP setting.

```
Port=3000
```
<--- The IP port of all DIS network communications. All other systems that communicate with this system using DIS will need to be on the same IP port.

3.6.3 [Audio] Section

This section sets the basic audio parameters for the application.

```
[Audio]
CaptureSize=512
```
<--- The size of the audio capture buffer, in bytes. Lower values will reduce audio delays but increase CPU and network load.

```
SampleRate=8000
```
<--- The sample rate, in bytes per second, of the audio capture buffer. This value may need to be changed for compatibility with other systems.

```
UseDSCapture=FALSE
```
<--- When set to TRUE, the audio capture routines will use the newer DirectSoundCapture interface. When set to FALSE, the audio capture routines will use the legacy Windows multimedia interface. The legacy interface is faster but may not be compatible with newer operating systems such as Vista and Windows 7. When using DirectSoundCapture you may need to increase the CaptureSize (>= 2048) to prevent audio break-ups.

```
Input=[default]
```
<--- The name of the sound device to be used for audio input for this application. The value "[default]" will use the default sound device that as configured by the Windows OS.

```
Output=[default]
```
<--- The name of the sound device to be used for audio playback for this application. The value "[default]" will use the default sound device that as configured by the Windows OS.

```
LevelToNetwork=0.9
```
<--- Level of audio that will be sent over the network. The range of values is from 0.0 (0%) to 1.0 (100%). This is the "capture" volume of the audio from the microphone.

```
LevelFromNetwork=0.9
```
                        <---   Level of audio that is received from the network. The
                                range of values is from 0.0 (0%) to 1.0 (100%). This is
                                the "playback" volume of the audio to the headphones.

3.6.4   [MicGains] Section

This section sets the parameters for the VRCU hardware gain stages for the microphone audio input. Reference section 2.1 for details on the gain settings and what they mean.

```
[MicGains]
PoweredGain=1                    <---   Gain setting for a powered mic
PoweredBoost=FALSE              <---   +40dB Boost setting for a powered mic
UnpoweredGain=1                 <---   Gain setting for an un-powered mic
UnpoweredBoost=TRUE            <---   +40dB Boost setting for an un-powered mic
PCGain=3                        <---   Gain setting for a powered mic
PCBoost=FALSE                  <---   +40dB Boost setting for a PC mic
PCRef=170                       <---   Threshold setting for a PC mic
```

3.6.5   [Panel] Sections

This section sets the parameters for the VRCU operator panels. There is a section for each of the two available panels: `[PanelA]` and `[PanelB]`.

```
[Panel]
Power=1
```
            <---   Sets the initial condition for the Power setting of the
                    panel. Possible values are:
                            0 = LO
                            1 = M
                            2 = HI
                            3 = PA
```
Mode=2
```
            <---   Sets the initial condition for the Mode setting of the
                    panel. Possible values are:
                            0 = FH
                            1 = FHM
                            2 = SC

```
Channel=1
```
                         <---   Sets the initial condition for the Channel setting of the
                                panel. Possible values are:
                                        0 = M
                                        1 = 1
                                        2 = 2
                                        3 = 3
                                        4 = 4
                                        5 = 5
                                        6 = 6
                                        7 = C

```
Comsec=3
```
                          <---   Sets the initial condition for the COMSEC setting of the
                                panel. Possible values are:
                                        0 = CT
                                        1 = RV
                                        2 = TD
                                        3 = PT

```
Volume=7
```
                          <---   Sets the initial condition for the Volume setting of the
                                panel. Possible values are:
                                        0 = WHSP
                                        1 = 1
                                        2 = 2
                                        3 = 3
                                        4 = 4
                                        5 = 5
                                        6 = 6
                                        7 = 7
                                        8 = 8
                                        9 = 9

```
PresetM=31.0
Preset1=32.0
Preset2=32.0
Preset3=32.0
Preset4=32.0
Preset5=32.0
Preset6=32.0
PresetC=32.0
```
                      <---   Sets the initial conditions for all of the preset channels
                                of the panel. Each panel has 8 different preset
                                frequencies (M, 1 through 6, and C) that are selected
                                when the user selects a channel. The values are
                                expressed in MHz. The range of frequencies is
                                equivalent to the range of SINCGARS frequencies,
                                however, other "out of range" frequencies can be used.

3.6.6   [Global] Section

This section sets the global parameters that apply to all virtual radios in the system.

```
[Global]

SiteID=100
```
                        <---   The DIS Site ID for this virtual radio. The combination
                                of Site ID, App ID, Entity ID, and Radio ID must be
                                unique throughout the network. Valid values are 1 –
                                65533. A randomized value will be used when set to
                                zero.

```
AppID=1
```
<--- The DIS Application ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
EntityID=2
```
<--- The DIS Entity ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533. A randomized value will be used when set to zero.

```
ExerciseID=1
```
<--- Sets the DIS exercise ID for the virtual radio. The exercise ID defines a "virtual world" that radios communicate in. This setting allows the physical network to be divided into separate "worlds" so that radio communication can be segregated. Radios and intercoms with different exercise IDs will not be able to communicate regardless of any other settings.

```
Encoding=1
```
<--- DIS enumeration for the type of encoding used in transmitted audio packets:
         1 = mu-Law
         2 = CVSD
         3 = ADPCM
         4 = 16 bit PCM
         7 = CECOM CVSD

```
PosnX=0.0
```
<--- The distance in meters along the Earth's X axis. The positive X axis originates at the center of the Earth and extends through the prime meridian at the equator.

```
PosnY=0.0
```
<--- The distance in meters along the Earth's Y axis. The positive Y axis originates at the center of the Earth and extends through 90 degrees east longitude at the equator.

```
PosnZ=0.0
```
<--- The distance in meters along the Earth's Z axis. The positive Z axis originates at the center of the Earth and extends through the north pole.

3.6.7   [Radio] Sections

These sections set the simulated parameters of the virtual radios. The sections are labeled **RadioA** and **RadioB** and correspond to the 2 virtual radios available in the software.

```
[Radio]

Enabled=TRUE
```
<--- Causes the virtual radio to be created (=TRUE) or not created (=FALSE) when the application launches. If the radio is disabled, it will not be available for transmission or reception.

`HalfDuplex=FALSE`	`<---`	Creates the virtual radio as a half duplex radio (TRUE) or a full duplex radio (FALSE). A full duplex radio allows transmission and reception at the same time, while a half duplex radio does not allow reception while it is transmitting.
`RadioID=1`	`<---`	The DIS Radio ID for this virtual radio. The combination of Site ID, App ID, Entity ID, and Radio ID must be unique throughout the network. Valid values are 1 – 65533.
`PowerAvail=TRUE`	`<---`	Sets the ON/OFF state of the virtual radio. A virtual radio that is OFF (=FALSE) cannot transmit or receive radio signals, but still exists on the network as an active radio entity. A virtual radio that is ON (=TRUE) is considered ON and ready to transmit and receive radio signals.
`Vol=1.0`	`<---`	The receiver volume for the virtual radio. Each virtual radio has a separate and independent receiver volume. Valid values range from 0.0 (no volume) to 1.0 (full volume).
`Squelch=0.2`	`<---`	The receiver squelch for the virtual radio. A value of 0.0 will allow signals, including noise, to pass to the receiver. A value of 1.0 will allow no signals to pass to the receiver. Typical setting is 0.2
`Freq=31.0`	`<---`	Sets the tuned frequency of the virtual radio, in Megahertz. Virtual radios with the same frequency will be able to communicate.
`Power=20.0`	`<---`	Sets the simulated transmitter output power for the virtual radio. The output stage of the virtual radio includes the output amplifier to the radiating portion of the antenna. The combined power and gain of these stages represented here as the transmitter power and is expressed in decibel-milliwatts (dB-mW). Typical power settings range from 10.0 to 100.0.
`Gain=1.0`	`<---`	Sets the gain of the input stage of the virtual radio model. The input stage consists of the combined effects of the antenna and input amplifier of the simulated radio system. The effects of the transmitter's power, the signal propagation loss due to relative positions, and the receiver gain determine the strength of the received signal. The input gain is measured in decibels (dB). Typical gain settings range from 1.0 to 20.0.
`Bandwidth=100.0`	`<---`	Sets the bandwidth for a virtual radio tuner model. Along with the tuned frequency, this parameter sets a bandpass filter for the virtual radio whereas if an incoming signal's frequency is within this band, it will pass through the tuner model.

```
System=1
```
 <--- Sets the modulation system for a virtual radio. If the system parameters do not match between two radios, those radios will not be able to communicate. Valid values for this parameter are:

> 0 = Other
> 1 = Generic
> 2 = Have Quick
> 3 = Have Quick II
> 4 = Have Quick IIA
> 5 = SINCGARS
> 6 = CCTT SINCGARS

```
Modulation=11
```
 <--- Sets the modulation mode for a virtual radio. If the modulation parameters do not match between two radios, those radios will not be able to communicate. Valid values for this parameter are:

> 0 = AM AFSK (1, 1)
> 1 = AM AM (1, 2)
> 2 = AM CW (1, 3)
> 3 = AM DSB (1, 4)
> 4 = AM ISB (1, 5)
> 5 = AM LSB (1, 6)
> 6 = AM SSB Full (1, 7)
> 7 = AM SSB Reduced (1, 8)
> 8 = AM USB (1, 9)
> 9 = AM VSB (1, 10)
> 10 = Amplitude and Angular (2, 1)
> 11 = Angular FM (3, 1)
> 12 = Angular FSK (3, 2)
> 13 = Angular PM (3, 3)
> 14 = CM AAP (4, 1)
> 15 = Pulse (5, 1)
> 16 = Unmodulated (6, 1)

```
FreqHop=FALSE
```
 <--- Enable/disable frequency hopping mode for simulation of transmission security (TRANSEC).

```
CryptoSystem
```
 <--- A DIS enumerated value for the simulated crypto system for the virtual radio. The combination of CryptoSystem and CryptoKey sets the simulated secure transmission mode. Basically, if the listening radio is set to the same crypto system and key, the transmission will be heard, otherwise only noise will be heard. Valid values for the CryptoSystem are:

> 0 = Other (disabled)
> 1 = KY-28
> 2 = KY-58
> 3 = NSVE
> 4 = WSVE
> 5 = ICOM

`CryptoKey`   `<---`   An arbitrary value that represents the software key that was used to scramble the transmitted signal. If a receiver has the same key to descramble the transmission, it will properly receive the transmission, otherwise only noise will be received. This value is only a simulated key and the transmitted data is not actually scrambled, but this allows simulation of the effects of a secure radio transmission.