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ASTi
Intercom Hand-Held Terminal and Intercom System User Guide

Version 1

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Advanced Simulation Technology inc. 441-A Carlisle Drive, Herndon, Virginia, 20170 USA
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INTRODUCTION

When used with ASTi's line of XiComm radio/communications and sound simulation products, the Intercom Hand Held Terminal (HHT) is an integral component in configuring highly flexible, distributed, local and network intercom systems.

The Intercom HHT is generally part of a preconfigured intercom system providing a customer-specified number of operators and communications buses. The intercom system typically consists of one or more XiComm base stations (also known as a DACS) equipped with a Time Division Multiplex (TDM) card and 10/100 Mbs ethernet card. One or more Remote Interface Units (RIUs) are provided which allow remote distribution of operators from a base station. One or more Intercom HHTs will also be provided.

Accessories such as Audio Interface Units (AIUs), Headsets, Footswitches, In-Line Push-To-Talk switches, Cables, Monitor speakers, etc. may also be provided depending on customer requirements.

In addition, each system is supplied with preconfigured communications switching model(s) to support the purchased number of operators and intercom buses. Custom configuration to a particular user application is available as a purchase option (contact ASTi for details), or may be performed by a suitably experienced user, aided by the content of this User Guide and the Model Builder software documentation. Training courses are also available.

Each base station can support up to 16 operators and 16 communications buses, depending on the type of base unit purchased. Multiple base stations may also be linked together over standard ethernet networks to further extend communications buses to as many operators as desired. This capability allows the intercom system to easily scale from small local applications to large distributed applications.

The HHT unit itself provides the operator interface to the network intercom buses. The functionality is designed to provide an intuitive display interface into a multi-bus environment and provide access to the key parameters of the individual buses themselves.

An initialization file also provides customization of default operator and system parameters such as operator name, initial bus talk/listen, volume, and duplex modes, and initial operator volume, sidetone and VOX/PTT mode. A sample initialization file is included with each system and is intended to act as a template for user-specific applications. Users are encouraged to become familiar with the format and content of this file. Configuration commands are covered later in this document.

The remainder of this document covers system overview and set-up, operating concepts, keypad operation, and HHT file commands.

CHAPTER 1: HARDWARE OVERVIEW AND SETUP

Set-up Instructions

Overview

Figure 1 shows a typical intercom system installation. From the figure it can be seen that the main components of a typical intercom system consist of an ASTi XiComm base station (DACS) chassis equipped with a TDM DSP card. Also included are: an ethernet card, a number of RIUs with power supplies, and a number of Hand Held Terminal units. The numbers supplied for the various units will vary according to the user requirement. In order to complete the system, cables to interconnect the RIUs, and operator headsets will be required. These may be user-supplied or purchased from ASTi. Ten (10) foot coil cables are supplied with each HHT, but longer cables may also be purchased.

Base Station Installation

Base station configurations include either a desktop PC, 2U or 4U industrial rack-mount chassis. Desktop PC configurations can often be shelf mounted in a 19" rack for convenience, but do not include any special rackmount kits or equipment. Size is typically 7"h x 16.5w x 18"d but may vary. The industrial rackmount chassis' include rack mount ears, but it is also recommended that angle bracket supports (not included) be installed when rackmounting for additional support.

All cable connections are off the rear of the chassis. Monitor and keyboard are not required for operation but will be needed during installation and set-up or for trouble shooting any problems that arise. Any standard SVGA monitor and PS/2 style key-board may be used. Monitor and keyboard can also be purchased directly through ASTi.

A standard 4 foot PC power cord is provided for power connection. Systems typi-cally have either an autosensing power supply or a switch to accommodate overseas voltages.

TDM/RIU Installation

Each RIU supports two operator headsets and two HHTs. Ideally, RIUs should be installed as near their respective operators as possible to shorten the analog audio run from the headset to the RIU and take advantage of the digital TDM link.

RIUs are connected in daisy-chain fashion, with the first cable originating at the DACS TDM card connecting to the first RIU. The next cable links the first RIU to the second, and so on, with the last RIU being connected back to the DACS TDM card, completing the loop. Therefore, the TDM card and each RIU should have two cables connected, running from one to the next. It is not important as to which TDM socket is used for the “in” or “out” connections. Standard category 5, eight conductor ether-net cable should be used to interconnect the TDM and RIUs. Total length of the ring should not exceed 100m.

Each RIU is powered by a small, external power supply provided with each unit. The TDM ring remains operational even if one or more RIUs are powered down, as long as all data cables remain connected. Note that depending on the orientation and spac-ing of outlet strips, the power supply could cover more than one outlet.

When installing, each RIU must be uniquely identified by setting an address via the rotary address switch on the front panel. Addresses must be sequential, beginning with 1.The system maps RIU #1 to handle system operators 1 and 2, RIU #2 to han-dle operators 3 and 4 and so on. Each base system can support up to 16 operators (8 RIUs).

Note: If two or more RIUs are inadvertently set to the same address, the system will not function correctly; only the first RIU on the loop that has the duplicate address will be recognized.

The HHT units are connected to the serial port connections on the RIU. For RIU #1, channel A connects operator 1, channel B connects operator 2, and so on for subsequent RIUs.

Analog audio signals are kept to a minimum within this architecture, since all information is converted from digital to analog by the RIUs. The only analog signals are those between the RIUs and the operator headsets. Each RIU can accommodate two headsets, one per HHT operator. These must be connected to the RIU rear panel connections identified as CHAN A and CHAN C, for operators 1 and 2, respectively.

RIU audio inputs and outputs are default configured for line level audio operation. Resistor packs internal to the RIU may be changed to accommodate different types of headsets or other audio devices such as powered speakers, VCRs, etc. Configuration information is contained in the RIU documentation provided. An Audio Interface Unit may also be connected to accommodate an even wider range of audio equipment and peripherals including observer channels.

Press-To-Talk activation is accomplished via a key on the HHT or by a physical switch such as an in-line PTT box or foot switch. This peripherals may be built and installed by the customer or can be purchased from ASTi directly.

Software Installation

The following table displays the primary intercom system software components and diskettes provided:

Description	Disks Included?	Preinstalled?
Operating System	Y	Y
Model Builder Application Software	Y	Y
Model Builder Utilities Software	Y	Y
Operator/Bus Communications Model[1]	Y	Y
Options/Software Key[2]	Y	Y
Intercom Hand-Held Terminal Software	Y[3]	Y

[1] Preconfigured for number of operators and buses purchased

[2] Functional capability is keyed per base station

[3] An separate disk may be provided or software may be included as part of Model Builder Application Software

No additional software installation is required.

Several configuration files will need to be edited prior to operation. These include:

File Name	Description	Default Location
Default.cfg	Base Station Configuration	c:\mbuilder\user\models
HHTCom.ini	Hand-Held Terminal Configuration	c:\mbuilder\user\models

Default.cfg contains several system configuration commands required for correct intercom system and terminal operation. All required commands are listed in Appendix A. A preconfigured default.cfg is included with each base station.

Note: In general, the user is only required to modify the network related commands in order to set proper IP addresses and port numbers. All other commands should remain unedited unless the user has a clear understanding of their impact.

HHTCom.ini is used to modify the Hand Held Terminal standard default parameters. Features such as Operator Volume, Sidetone, and VOX/PTT mode can be preset. Other modifiable parameters include individual bus talk/listen and duplex modes and bus volumes. A complete list of available commands are identified in Appendix A. A sample *HHTCom.ini* file is included with each base station.

Network Configuration

For applications which use two or more base stations networked together the user may need to set the IP address and port numbers of each individual unit for proper operation.

If unmodified, each system will come up with a unique IP address automatically and be able to transmit and receive voice to/from other base stations. The default IP addresses, however, may not conform to an existing network and should be modified to avoid any problems with other devices or network equipment.

To set the IP address, network commands are placed in the start-up file default.cfg (see previous section). Appendix A lists the proper syntax. The user should set the local IP address and if desired the broadcast IP address to conform to the network. Remember that each base station should have a unique local IP address.

Multicast addressing is also available - see the configuration file section of Model Builder Reference guide shipped with the system for further details.

The port numbers do not need to be changed since all base stations boot up with the same port numbers. The user, however, may also change the port number to satisfy network requirements.

All units must have the same UDP port number for proper operation.

Note that if a value of 0 is used in the third position of the IP address (a value of 0 in the first or fourth position would be invalid). The user will need to add additional commands to the default.cfg file.

When the system starts up two ID#s for system voice packet identification are generated using the last two digits of the IP address. If either or both of these fields are 0, voice packets will not be received by other base stations.

To counteract this problem the user should add the DIS:Site and DIS:Host commands to the configuration file. These commands allow the user to assign unique non-zero IDs to the voice packets. For proper operation the Host ID should be unique for each base station. The Site ID may either be unique or the same on all base stations. See Appendix A for command syntax.

Verification

Once the equipment is installed and configured there are several checks that can be made to verify the system is operational. Some checks require a monitor and keyboard to be connected.

Before performing any checks be sure that all RIUs have power applied - indicated by activity on either the green or red LEDs. Also make sure that the base station has had time to boot up.

Note that some desktop base stations require the user to press the power button on the front of the system if it has been turned off or has lost power previously.

TDM/RIU checks

One of the most common problems with RIU installations is bad TDM cables particularly with those not purchased off-the-shelf from a commercial supplier.

During base station boot up, the RIU LEDs should transition from RED to a fast flashing Green. Once all RIUs are synched the Green LED will transition from a fast flash to a slow steady flash.

If all RIUs fail to synch then there is a possible problem with base station configuration or the TDM card. If an individual RIU fails to synch (sometimes indicated by a RED and Green LED simultaneously or a fast flashing Green LED) the unit can be reset by pressing the reset button.

In addition to checking for slow flashing Green LEDs on each RIU, the operator should also check for two solid RED LEDs on the TDM card (located on the rear of the base station). An unlit LED indicates a possible cable problem and must be cleared for proper operation.

An additional check for TDM/RIU integrity can be made by examining the TDM/RIU monitor screens found in the application environment. A monitor and keyboard is required to vies these screens.

From the top level menu in the application software environment, cursor down to the “Waveform DSPs” selection and press <return>. Select “Times” and press return. Examine the Frame counter for DSP 1 (corresponds to the TDM card DSP). This counter should be continuously incrementing if the TDM card is operating properly.

Next use the PageUp/PageDown keys until the TDM bus status page is displayed. The operator should see a number posted for each active RIU. For example a system with one TDM card and 4 RIUs will be displayed as follows:

DSP	RIUs Present
1	1 2 3 4

If one or more RIUs fail to show up on the status page. Recheck cabling and be sure all RIUs are powered on and in synch.

HHT checks

After start up - the standard display information should be shown on each HHT. If there is no information displayed on any of the terminals check RIU and base station power and make sure that the base station has had time to boot. Reboot the base station if you are unsure. Further trouble shooting may be required if this is not the problem.

If you have information displayed on the screen check key response and audio I/O by entering the terminal test mode (see chapter 3 for instructions). In test each key pressed will be displayed on the screen. In addition a beep tone is played continuously in the background and microphone audio is routed back to the headset.

Note: Failure to hear microphone audio in test mode may could be a result of improperly configuring the RIU for proper mic preamp gain and does not necessarily indicate a problem with the RIU.

If all units have a display but do not respond to key presses the likely cause is a TDM cabling problem. This can be verified by checking for two solid RED LEDs on the TDM card (visible from the rear of the chassis). If one of the LEDs is unlit there is a problem with the TDM cabling.

General checks

Other checks that can be made to verify proper operation:

Ping

Any base station can be “pinged” by another computer using the standard Ping command. This is useful for checking if one or more base stations are up and operational from a central location. Note that the Ping command cannot be initiated from a base station itself.

Errors Screen

From the top level menu in the application software, cursor to the “Errors” section and then <return>. No errors should appear on the screen. If there are any errors, they must be cleared to ensure proper operation. Most error message will be descriptive enough to determine the cause of the problem. Possible messages might include:

Cannot open command file default.cfg

Indicates the system could not find the start up configuration file

File Not Found, Model

Indicates the system could not find the model file identified in the default.cfg file

Cannot open file default.pth

Indicates the system could not find the data routing path file identified in the default.cfg file

DLL Error: file hhtcom.ini not found

Indicates the system could find the HHT initialization file identified in the default.cfg file

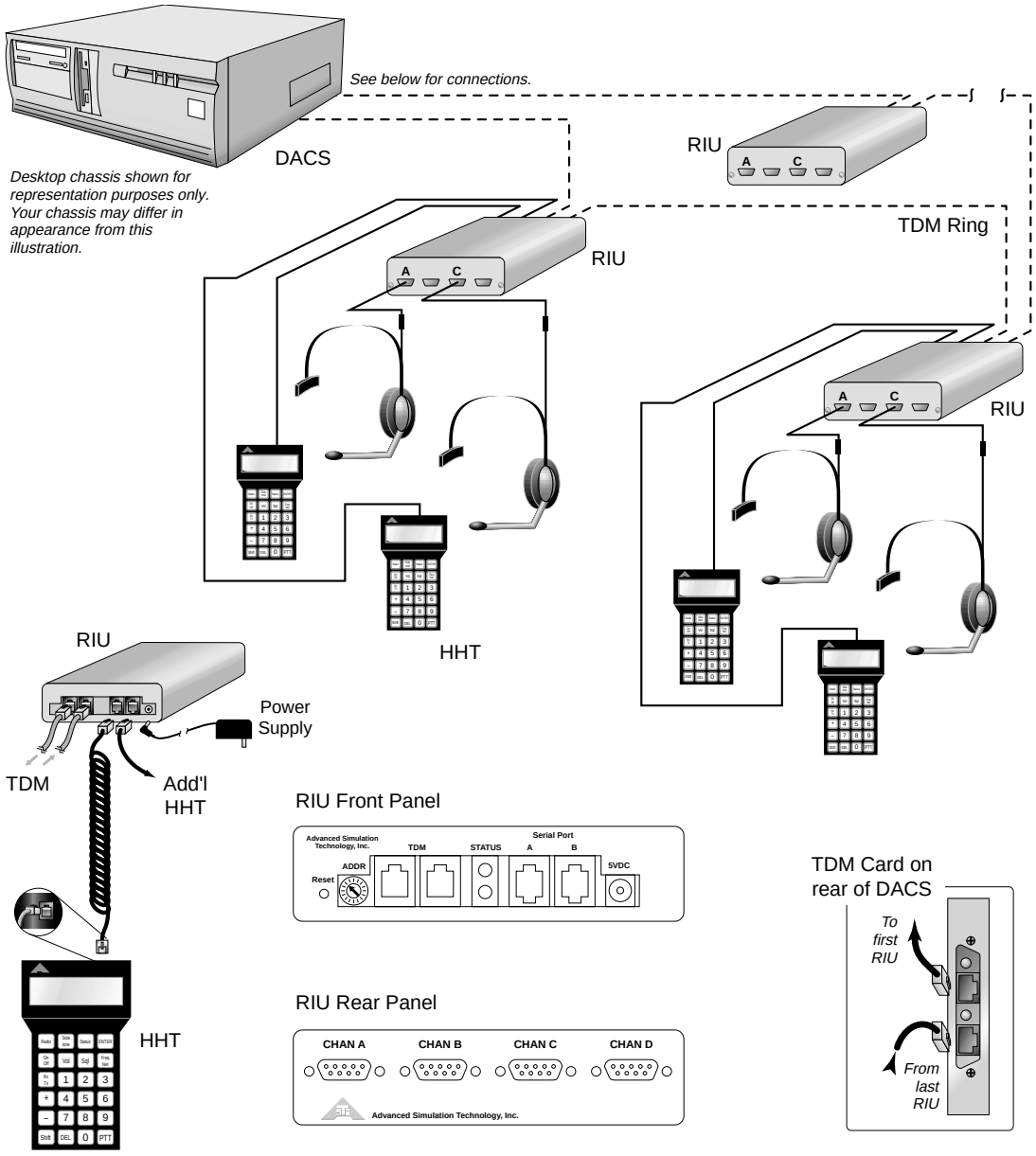
DLL Load Error: hhtcom.dll

Indicates the system could not find or load the HHT software file identified in the default.cfg file (file should be located in the c:\mbuilder\bin directory)

No valid option File

Basic Model Builder Only - indicates the system could not find the correct options key file in the c:/mbuilder bin directory

Figure 1: Typical Hardware Configuration



Notes:

- RIU # is set via rotary address switch on the front of the RIU.
- RIU addresses must be sequential, beginning with 1.
- Audio channel and HHT connections set up as follows:

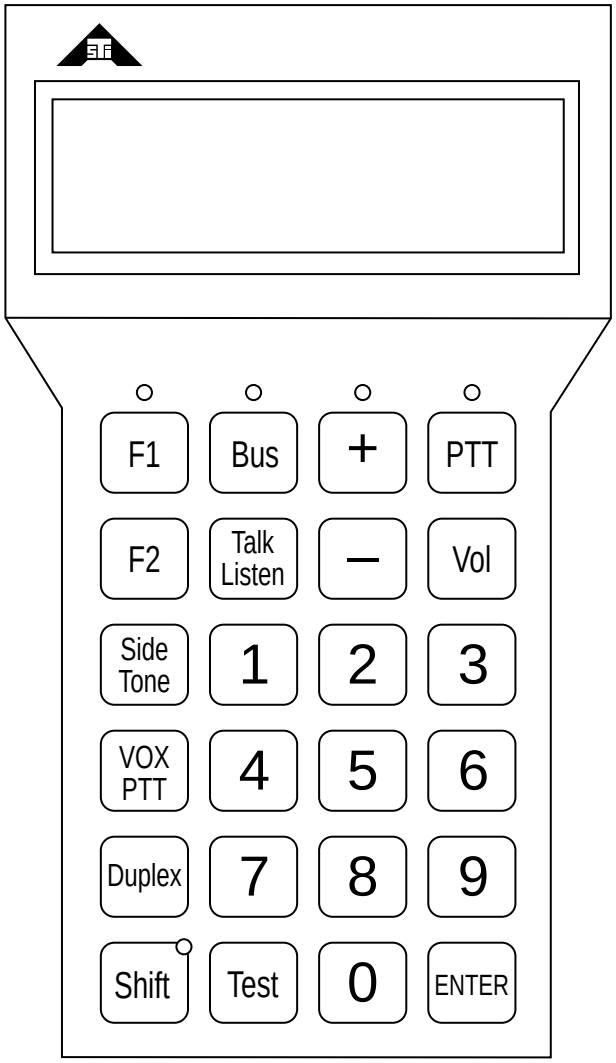
RIU1: Serial Port A = HHT#1, Chan. A = Operator 1 audio in/out
Serial Port B = HHT#2, Chan. C = Operator 2 audio in/out

RUI2: Serial Port A = HHT#3, Chan. A = Operator 3 audio in/out
Serial Port B = HHT#4, Chan. C = Operator 4 audio in/out

•••

RUI8: Serial Port A = HHT#15, Chan. A = Operator 15 audio in/out
Serial Port B = HHT#16, Chan. C = Operator 16 audio in/out

Figure 2: Intercom System Hand Held Terminal



Actual length is 7 5/8”

CHAPTER 2: OPERATING CONCEPTS

Applicability

This Guide applies to the following ASTi equipment:

- ASTi Intercom systems with Intercom Hand-Held Terminals and Remote Interface Units (RIUs) running Model Builder version 4.03b or later.

The Intercom Environment

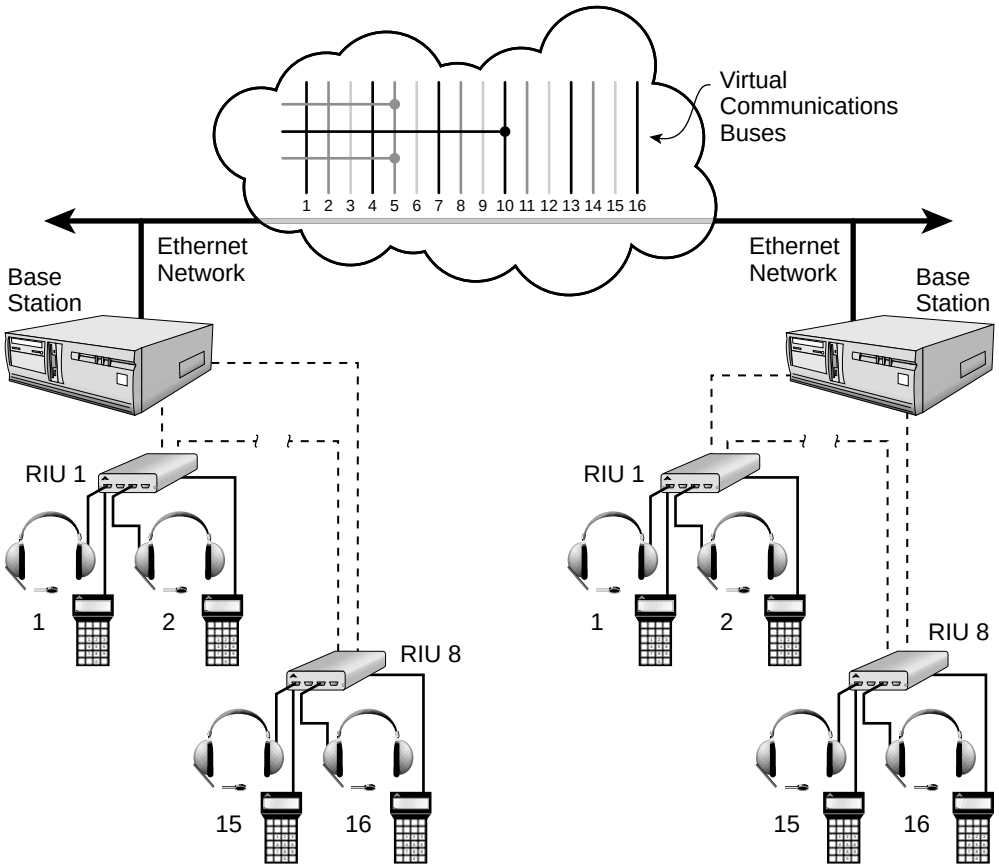
The Intercom System environment is based on a strict software and hardware configuration. An individual base station can support up to 16 operators each with access to up to 16 communications buses. The number of operators and buses are customer specified. Additional operators and buses may be added at any time.

Some systems may require processor upgrades when adding additional functionality. System operation can also be modified for custom applications. Always contact ASTi if you are planning to upgrade or if you have an application which may require modification to a standard system.

Base stations may also be interconnected via a standard ethernet network. This feature allows the communications buses to be extended to additional operators locally or at remote sites (local and wide area network applications).

The figure below shows the scalability of the intercom system.

Figure 3: Networked Intercom System



Each operator uses his/her Hand Held Terminal to choose which of the available buses to Talk/Listen on or Listen to. No restrictions are placed on the operator's access to the buses (unless specified in the start-up initialization file).

For example a single operator may choose to Listen to all available buses but only talk on bus 2 when he keys. Or he may choose to Talk and Listen on bus 1 and 2 only, in which case he will both monitor incoming audio on these buses and be able to talk on both buses at the same time.

The operator may also modify other parameters via the HHT such as headset volume, sidetone level and the VOX/PTT mode (PTT mode requires the operator to key using the HHT or other keying device; VOX allows for voice activated keying).

Individual bus parameters for each individual operator can also be modified via the HHT such as Duplex Mode (Half or Full), Volume, of Talk/Listen mode.

Hot key sequences allow the operator to quickly hop from bus to bus with a minimum of key presses.

Communications buses operate in a full duplex mode. However, each operator can modify his duplex mode on a particular bus to operate in either full or half duplex.

System Basics

The Hand-Held Terminal operator interface is a generic, all-purpose interface for operator access to one or more intercom buses within a complex, reconfigurable communications network.

Figure 4: HHT Operation Overview

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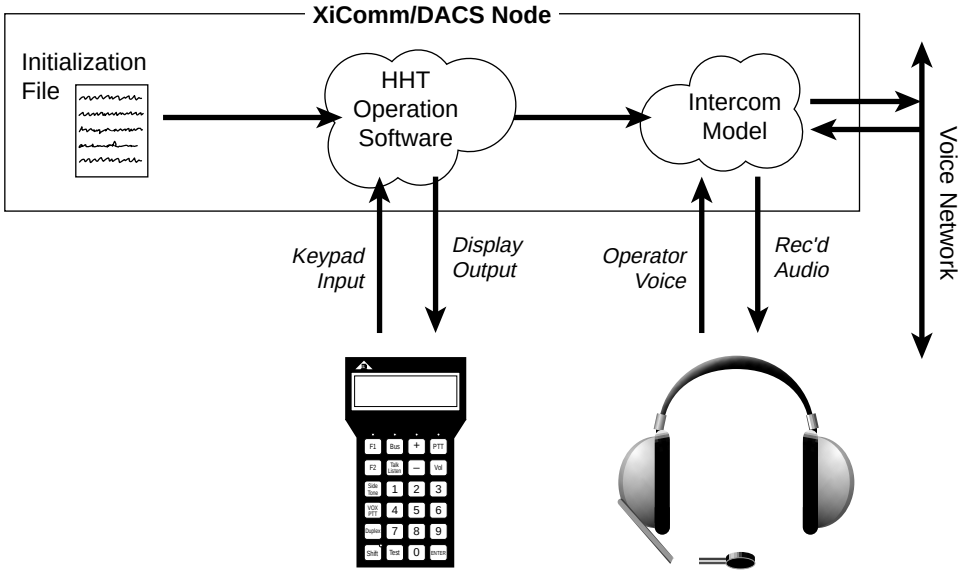


The only “brains” that the HHT contains is an interface unit (in place of an intercom control panel or switchboard) which bundles the keypad input information, and updates the panel displays based on the information received from the intercom model.

Within the processing node is the HHT software in the form of a Dynamic Link Library (dll) which interprets the information from the HHT. In addition to receiving and sending information to/from the HHT, the dll also passes information into the intercom model.

The audio switching functionality and intercom operation is defined by the intercom model running under the Model Builder application software. Control parameters--such as volume, sidetone, available intercom nets, etc.--can be set from several different sources (different HHTs, configuration or initialization files, etc.). The intercom model is all-purpose in that it is immaterial to the model as to the source of this information. The same intercom model can be interfaced to a multitude of communications network types without requiring a different model for each type of network.

At model start-up, an initialization file sends information to the dll which, in turn, passes information to the HHT and intercom model. These include parameters such as the default volume, sidetone and available intercom buses to be used for each operator, as well as the HHTs' default display outputs. Each intercom and operator station can be programmed with a different set of parameters. Configuration & initialization file commands are covered in detail in Appendix A.

Terminal Operating Concepts

When powered on or reset, the HHT shows the Main Display. This page presents information relating to that operator's status in the intercom network.

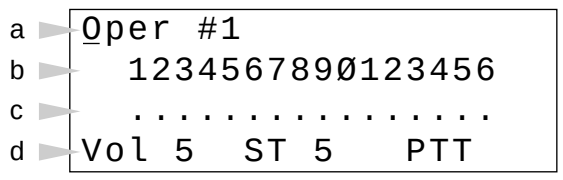
The top line of the display contains an identifier for the HHT which can be assigned at start-up through an initialization file (more information about configuration and initialization file parameters can be found in Appendix A). If no identifier is assigned, the display will default to "Oper #1" for the first operator's HHT with each following HHT numbered sequentially. When performing Bus Actions (as explained later in this chapter), this top line will also display the Intercom Bus being modified.

The second line of the display contains a line of digits representing the intercom bus number of the symbols directly beneath it in the Activity/Bus Mode line. Intercom bus numbers start from one (1) and go to nine (9) for the first nine intercom buses, then zero (0) through six (6) for buses ten through sixteen.

The next line is the Activity/Bus Mode line. During standard operation, this line displays the operator's activity status with respect to the intercom bus numbers above it. An "L" on this line represents Listen Only mode for that intercom bus, whereas a "T" represents Talk & Listen mode. If the operator employs the use of Hot Key shortcuts to subscribe to an intercom bus, a "#" symbol also indicates Talk & Listen mode. This line also displays various other symbols when performing Bus Actions, described later.

The last line of the display is the Options/Talk Mode line. The operator's overall volume and sidetone settings, as well as talk mode (PTT or VOX) are always displayed on this line. If the operator is in VOX mode, the VOX threshold level will also be displayed here.

Figure 5: HHT Main Display



a) Identifier, b) Intercom Bus Number,
c) Activity/Bus Mode, d) Options/Talk Mode

It is important to note that a cursor indicator is displayed beneath the “Oper #1” identifier in the above figure. As the operator performs various actions--like adjusting volume, changing talk mode, or editing intercom bus attributes--this cursor indicator will change its position to indicate the action being performed.

The HHT has three modes: Standard, Bus Action, and Test. To toggle between Standard and Bus Action modes, press Bus . To enter Test mode, press Shift Test .

In Standard Mode, each operator can modify the following parameters:

- Overall Volume and Sidetone Level
- Talk Mode (PTT or VOX)
- VOX Threshold Level (only when in VOX talk mode)
- Intercom Bus Talk & Listen or OFF via use of Hot Keys

In Bus Action Mode, each operator can modify the following parameters:

- Intercom Bus Listen Only, Talk & Listen, or OFF
- Specific Intercom Bus Volume
- Specific Intercom Bus Duplex mode (full- or half-duplex)

Test Mode allows the operator to verify correct operation of the LED display and individual keypresses.

The system starts up with various default values for the above parameters. It is possible, through initialization file commands, to predefine these parameters. See Appendix A for details.

The panel logic is designed such that if an operator uses a key that is not a logical part of the entry sequence, the entry is ignored.

To modify a value, the operator can either enter the data numerically, or press + or — to ramp the value up or down, followed by ENTER to indicate that the desired value has been attained.

CHAPTER 3: KEYPAD OPERATION

Hot Key Concepts

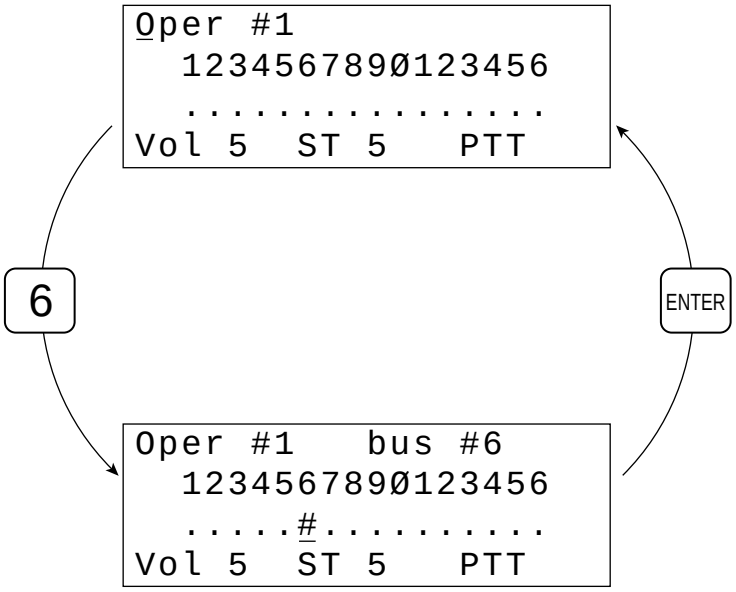
The Standard mode employs a “hot key” concept to allow quick access to a singular Intercom Bus in Talk & Listen mode.

To select a particular intercom bus for Talk & Listen, press the number of the intercom bus from the Main Display. For intercom buses 1 through 9, enter only the one-digit bus number; for buses 10 through 16, enter the two-digit bus number.

Upon subscription to an intercom bus, a “#” symbol will appear in the Activity/Bus Mode line below the intercom bus number. Additionally, the bus number selected will be shown in the Identifier line of the display.

To turn off an intercom bus, press ENTER .

Figure 6: Hot Key Operation



Remember to keep an eye on the cursor; its location reminds you of the action being performed.

Note: Use of the hot key method for selection of Talk & Listen status selects only a single intercom bus for subscription at any one time. Using the method described in the “Bus Actions” section below, an operator may select multiple buses for simultaneous activity.

Standard Mode Controls

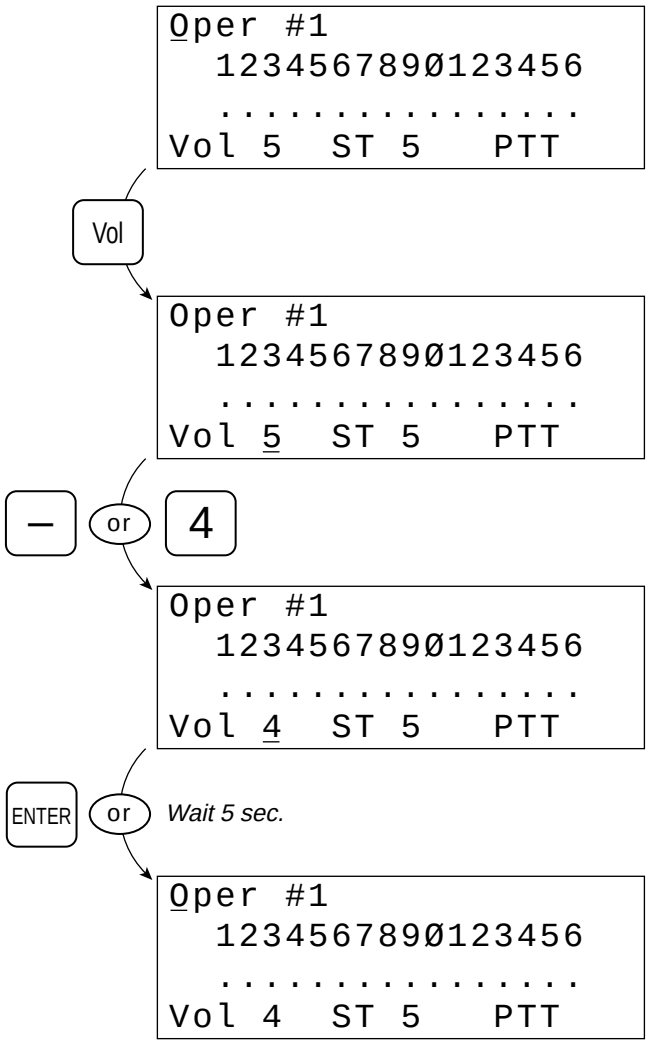
In addition to Hot Key operation, each operator can modify the following parameters in Standard Mode:

- Overall Volume
- Sidetone
- Talk Mode (PTT or VOX)
- VOX Threshold (only when in VOX talk mode)

Setting Overall Volume Level

From the Main Display, press Vol . The cursor will move below the current volume setting (default = 5) in the Options/Talk Mode line of the display; then either press the numeric key 0-9 for the desired volume, or ramp up or down using + and −. If desired, the operator can press ENTER after setting the volume (the cursor will immediately return to the upper left), but it is not necessary. Alternately, five (5) seconds after the last keypress, the cursor will return to the upper left corner of the display, indicating that the value has been set.

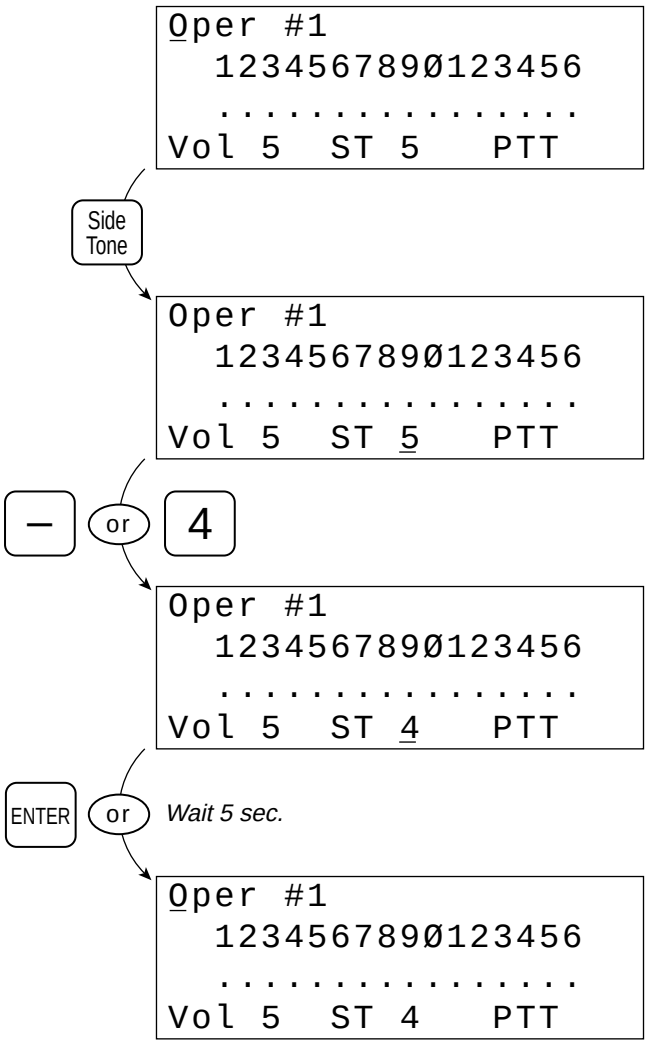
Figure 7: Setting Overall Volume Level



Setting Sidetone Level

From the Main Display, press [Side Tone]. The cursor will move below the current sidetone setting (default = 5) in the Options/Talk Mode line of the display; then either press the numeric key 0-9 for the desired volume, or ramp up or down using [+] and [–]. If desired, the operator can press [ENTER] after setting the sidetone (the cursor will immediately return to the upper left), but it is not necessary. Alternately, five (5) seconds after the last keypress, the cursor will return to the upper left corner of the display, indicating that the value has been set.

Figure 8: Setting Sidetone Level



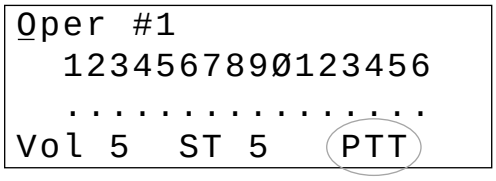
Note: Overall Volume and Sidetone levels are completely independent options. Lowering the overall volume setting will not reduce the level of the operator's own-voice audio (the sidetone).

PTT Talk Mode

By default, each operator's HHT is configured to start in Press-To-Talk (PTT) Talk Mode. See Appendix A for initialization file commands to change this default setting.

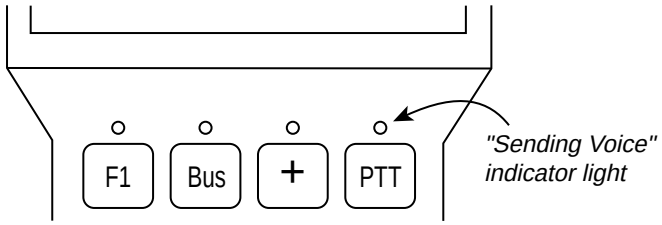
PTT Talk Mode is indicated in the Options/Talk Mode line of the Main Display.

Figure 9: PTT Talk Mode Indicator



While in PTT Talk Mode, the operator must press and hold PTT to send his voice to the intercom bus(es) to which he is subscribed. While the PTT key is pressed, the "Sending Voice" indicator LED situated above the key itself will light. Upon releasing the PTT key, the operator's voice will no longer be sent to the communications network, and the indicator LED will turn off.

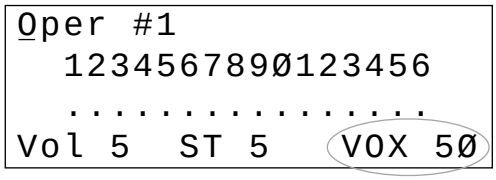
Figure 10: "Sending Voice" Indicator Light



VOX Talk Mode

VOX Talk Mode is indicated in the Options/Talk Mode line of the Main Display.

Figure 11: VOX Talk Mode Indicator



When the operator's HHT is set for VOX Talk Mode, the volume of his voice must exceed a certain level (called the "VOX Threshold") for it to be sent to the communications network. The VOX Threshold setting is also shown in the Options/Talk Mode line of the Main Display (VOX Threshold default = 50 as shown above).

When the operator's voice volume exceeds the VOX Threshold, the "Sending Voice" indicator LED will light. If his voice volume falls below the specified VOX Threshold, the indicator LED will turn off.

Note: Setting the VOX Threshold to a value of 0 (zero) allows the operator to use "Hot Mic" capability; the "Sending Voice" indicator LED will remain lit for the duration of "Hot Mic" operation.

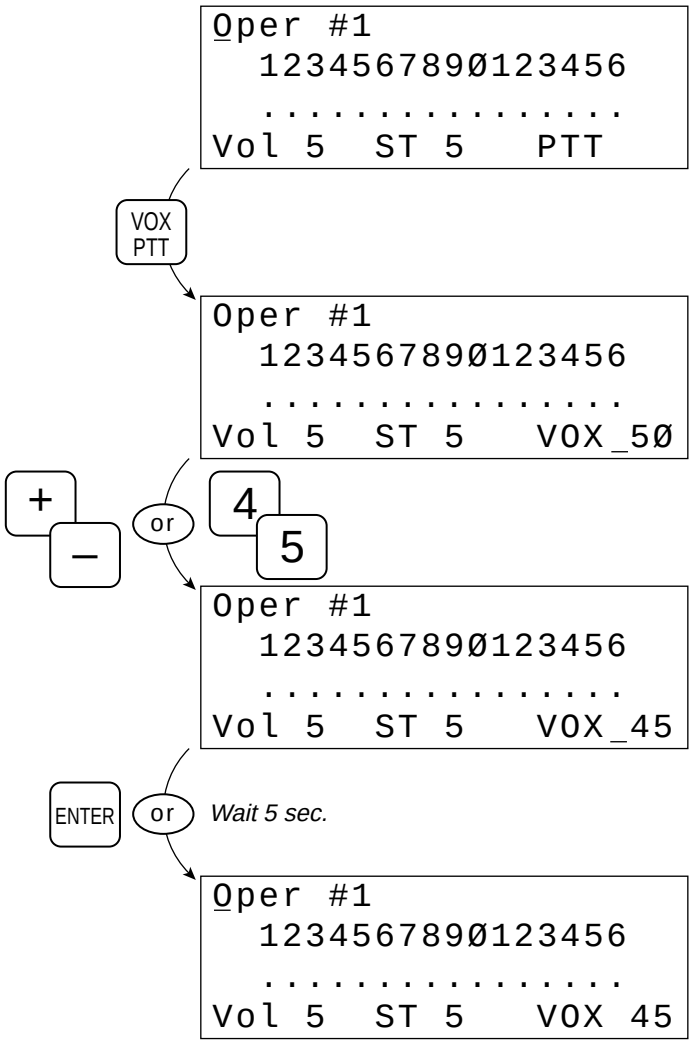
Changing Talk Mode and VOX Threshold Level

Changing from PTT to VOX Talk Mode

From PTT Talk Mode, press [VOX PTT]. The cursor will move to the far right of the Options/Talk Mode line of the Main Display, and the Talk Mode indicator will change from "PTT" to "VOX" followed by the current VOX Threshold setting.

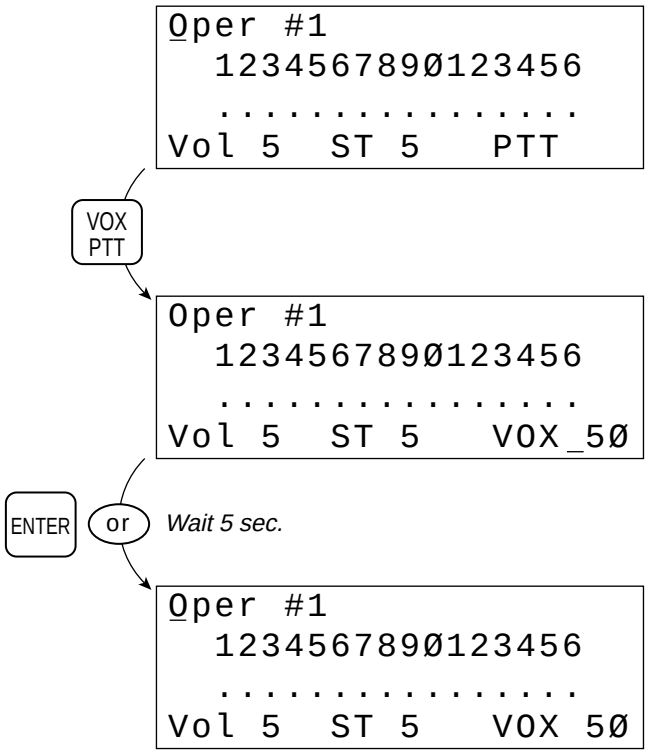
If desired, the operator can change the VOX Threshold setting at this time. Press [+] or [–] to ramp the VOX Threshold value up or down in increments of 5, or use the number keys 0-9 to enter a numerical value. The operator can then press [ENTER] after setting the VOX Threshold (the cursor will immediately return to the upper left), but it is not necessary. Alternately, five (5) seconds after the last keypress, the cursor will return to the upper left corner of the display, indicating that the value has been set.

Figure 12: Changing from PTT to VOX & Setting VOX Threshold



If the operator does not wish to change the VOX Threshold setting, he should either press ENTER immediately following the initial VOX PTT keypress, or do nothing for five (5) seconds after the initial VOX PTT keypress.

Figure 13: Changing from PTT to VOX, no Threshold Adjustment

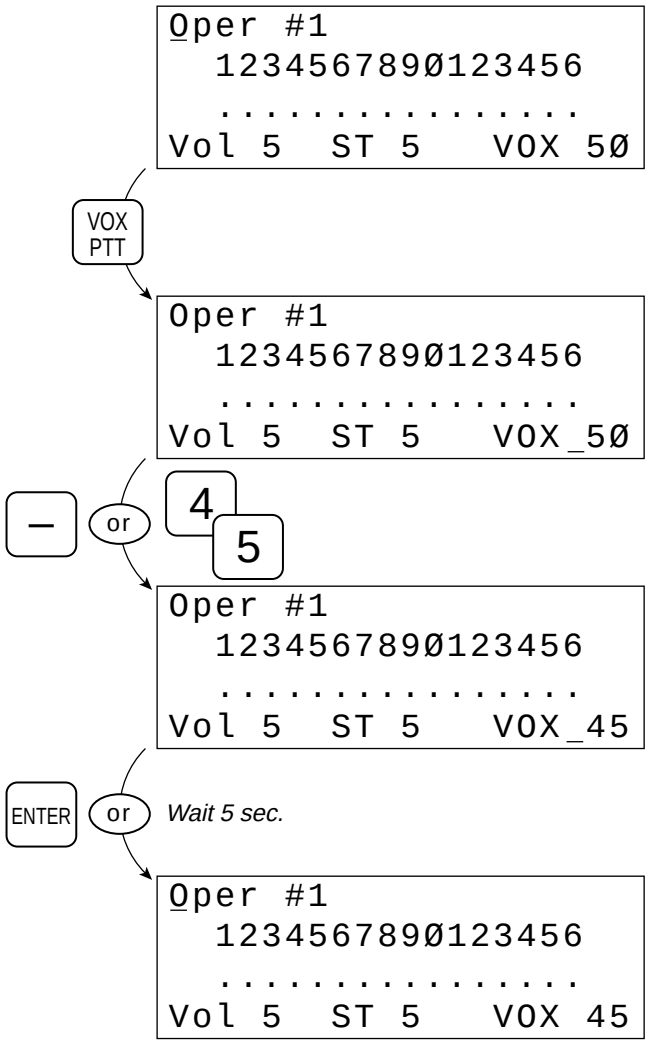


Changing VOX Threshold from VOX Talk Mode

While in VOX Talk Mode (i.e., after changing to VOX Talk Mode, ***and after the cursor has returned to the upper left corner of the Main Display***), the operator can adjust the VOX Threshold by performing the following steps:

- Press VOX PTT once.
- Press + or – to ramp the VOX Threshold value up or down in increments of 5, or use the number keys 0-9 to enter a numerical value.
- Press ENTER or do nothing for five (5) seconds.

Figure 14: Changing VOX Threshold

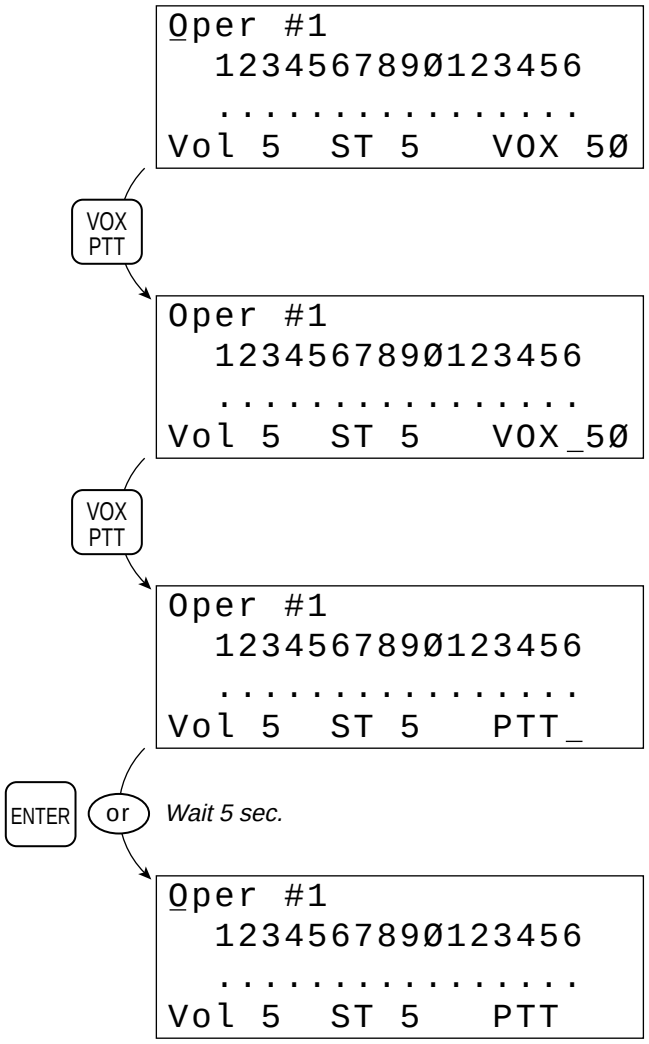


Changing from VOX to PTT Talk Mode

While in VOX Talk Mode, pressing [VOX PTT] will bring the cursor to the VOX Threshold setting, expecting the VOX Threshold level to be adjusted, as described above. Pressing [VOX PTT] again (i.e., ***while the cursor is still next to the VOX Threshold***) will change the operator to PTT Talk Mode.

Note: To change quickly from VOX to PTT Talk Mode, you must press the VOX/PTT key twice, with little or no wait time in between keypresses. If you wait more than five (5) seconds between keypresses, the HHT will remain in VOX Talk Mode. Remember to watch the position of the cursor.

Figure 15: Changing from VOX to PTT



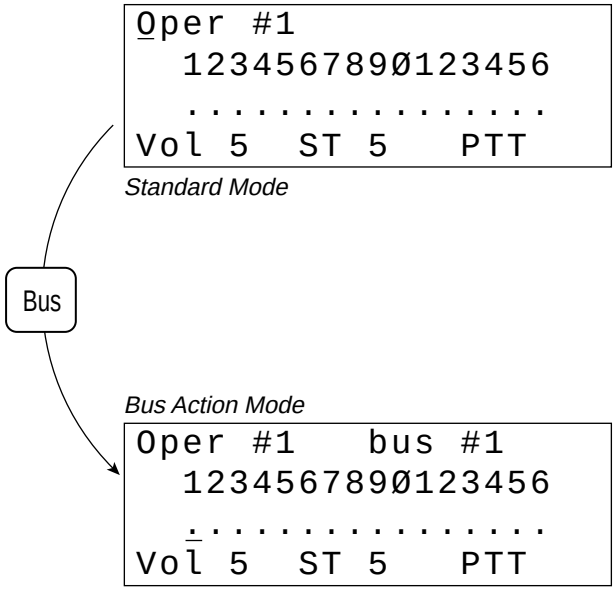
Bus Action Mode Controls

In Bus Action Mode, each operator can modify the following parameters:

- Intercom Bus Status (Listen Only, Talk & Listen, or OFF)
- Specific Intercom Bus Volume
- Specific Intercom Bus Duplex mode (full- or half-duplex)

To enter Bus Action Mode, press the Bus key while in Standard Mode. The Main Display will change slightly to indicate you are in Bus Action mode.

Figure 16: Entering Bus Action Mode



Entering Bus Action Mode will display “bus #1” in the top line of the display, and move the cursor below the Activity/Bus Mode line for intercom bus 1.

Then, you must select the intercom bus you wish to change. You can do this in one of three ways.

1. Press Bus repeatedly to scroll through the intercom buses,
2. Press + or — repeatedly to scroll through the intercom buses, ***or,***
3. Using the numeric keys 0-9, press the number of the intercom bus. For intercom buses 1 through 9, enter only the one-digit bus number; for buses 10 through 16, enter the two-digit bus number.

Remember to keep an eye on the cursor, as its position changes with any of the above keypress sequences.

Although these steps are common to all of the Bus Action Mode Controls, they will be reiterated in every example for clarity.

Changing Intercom Bus Status

Unlike the previously described Hot Key shortcuts, the operator can subscribe to multiple intercom buses for Listen Only or Talk & Listen status while in Bus Action Mode.

Enter Bus Action Mode by pressing [Bus]. Next, select the intercom bus you wish to change by pressing [Bus], [+] or [—], or by using the numeric keys.

Each of the intercom buses have a default status setting of OFF, indicated by the dots below each bus number. See Appendix A for initialization file commands to change this default setting.

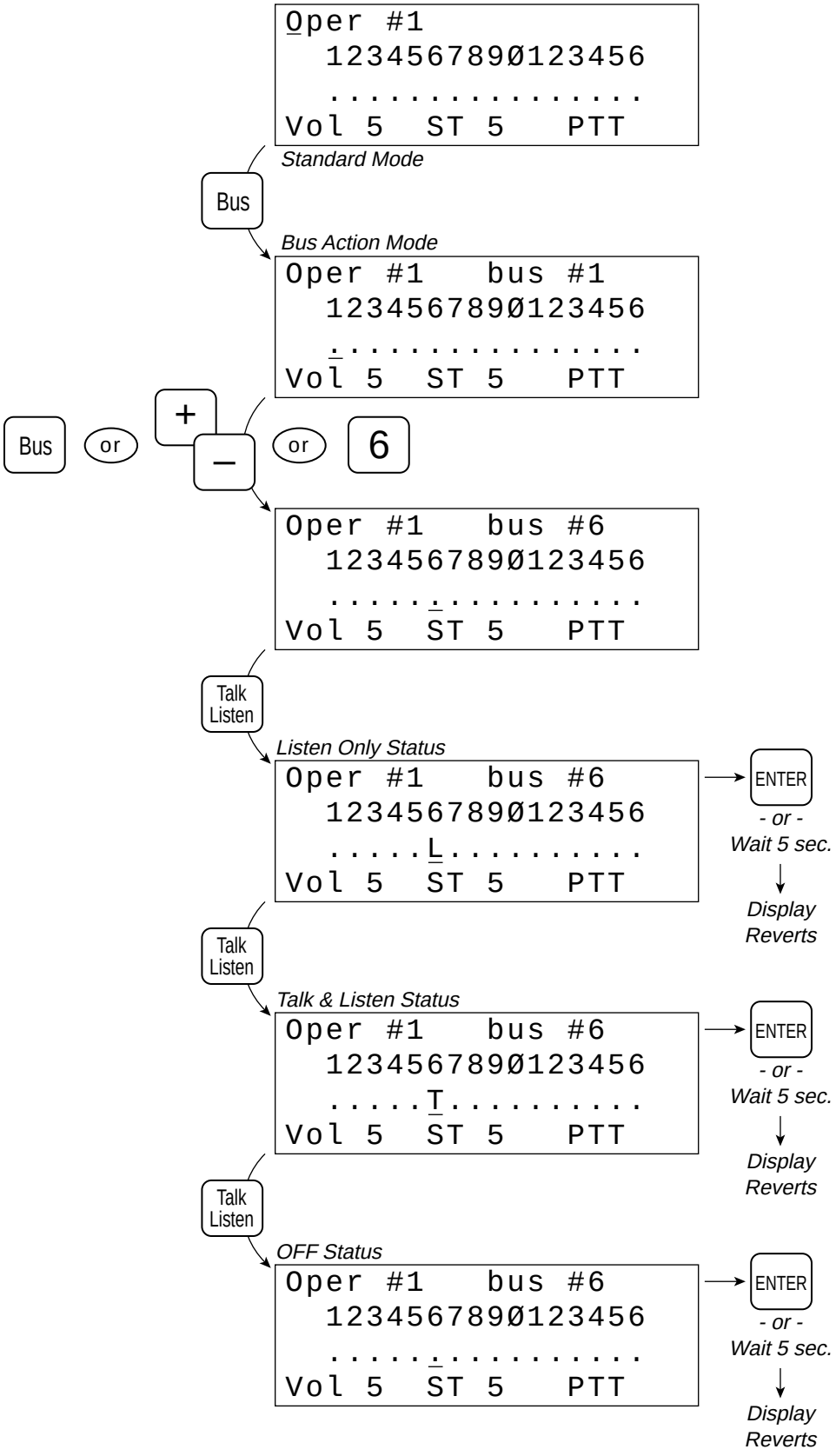
After choosing the desired intercom bus, press [Talk Listen] to change from OFF to Listen Only status, indicated by an "L" in the Activity/Bus Mode line of the display. If Listen Only is not the desired setting, press [Talk Listen] again (*make sure the cursor is still below the desired bus number*) to change from Listen Only status to Talk & Listen status. Talk & Listen status is indicated by a "T" in the Activity/Bus Mode line of the display. If Talk & Listen status is not the desired setting, press [Talk Listen] a third time to return the intercom bus to OFF status.

Once the desired status setting has been achieved for that specific intercom bus, you have two options:

- Before the display reverts back to the Main Display (and Standard Mode), you can select another intercom bus to change, ***or***
- If you are finished editing bus information, press [ENTER] or do nothing for five (5) seconds. The display will revert to the Main Display, and the "L" or "T" indicators will remain below the intercom bus numbers, as specified.

Note: If you have already selected an intercom bus for Talk & Listen using the Hot Key shortcut, pressing the Bus key will clear the associated "#" symbol from your display. You will still be able to Talk & Listen on the Hot-Key-selected intercom bus. But, remember that the Hot Key shortcut overrides any Bus Status changes you make in Bus Action Mode; pressing the Enter key to clear your Hot Key selection in Standard Mode will convert the "#" symbol to an "L", "T", or "." depending on any changes made in Bus Action Mode.

Figure 17: Changing Intercom Bus Status



Changing Intercom Bus Volume

Operators can change the volume of audio being received from individual intercom buses while in Bus Action Mode. Changes in individual intercom bus volumes will be multiplied by any subsequent change in the Overall Volume level.

Enter Bus Action Mode by pressing Bus. Next, select the intercom bus you wish to change by pressing Bus, +, or –, or by using the numeric keys.

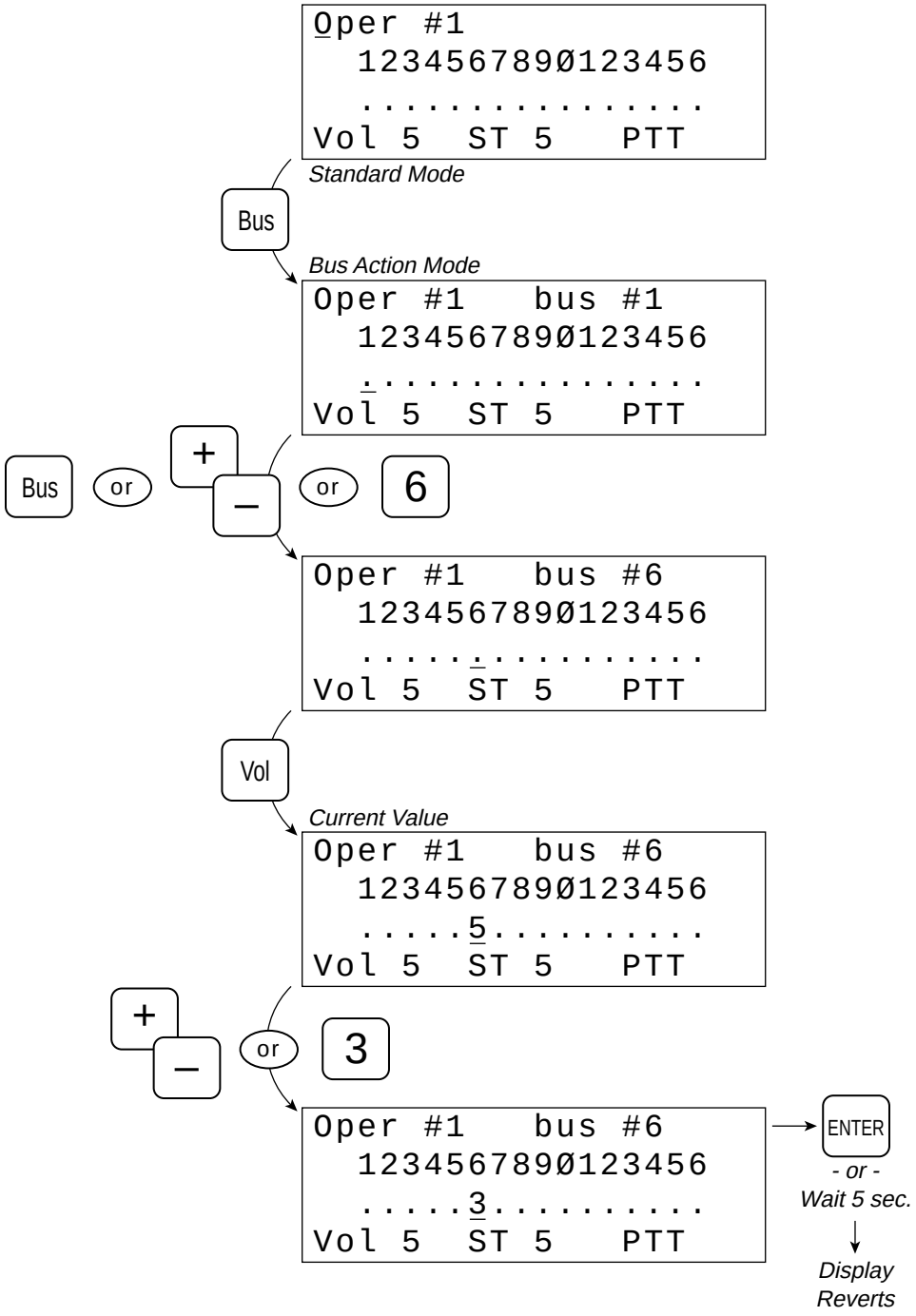
Each of the intercom buses have a default volume setting of 5. See Appendix A for initialization file commands to change this default setting.

After choosing the desired intercom bus, press Vol to access the volume setting for that bus, indicated by a number directly above the cursor. Then either press the numeric key 0-9 for the desired volume, or ramp up or down using + and –.

Once the desired volume setting has been achieved for that specific intercom bus, you have two options:

- Before the display reverts back to the Main Display (and Standard Mode), you can select another intercom bus to change, ***or***
- If you are finished editing bus information, press ENTER or do nothing for five (5) seconds. The display will revert to the Main Display.

Figure 18: Changing Intercom Bus Volume



Changing Intercom Bus Duplex Mode

Operators can toggle the duplex mode of individual intercom buses while in Bus Action Mode between full-duplex and half-duplex. If in half-duplex mode, the operator will not be able to hear received audio from the intercom bus while he is speaking. In full-duplex mode, however, the operator will be able to hear received audio and speak at the same time. This concept is demonstrated by thinking of the difference between talking on a CB radio versus talking on a telephone.

Enter Bus Action Mode by pressing [Bus]. Next, select the intercom bus you wish to change by pressing [Bus], [+] or [—], or by using the numeric keys.

Each of the intercom buses have a default duplex setting of “Full”. See Appendix A for initialization file commands to change this default setting.

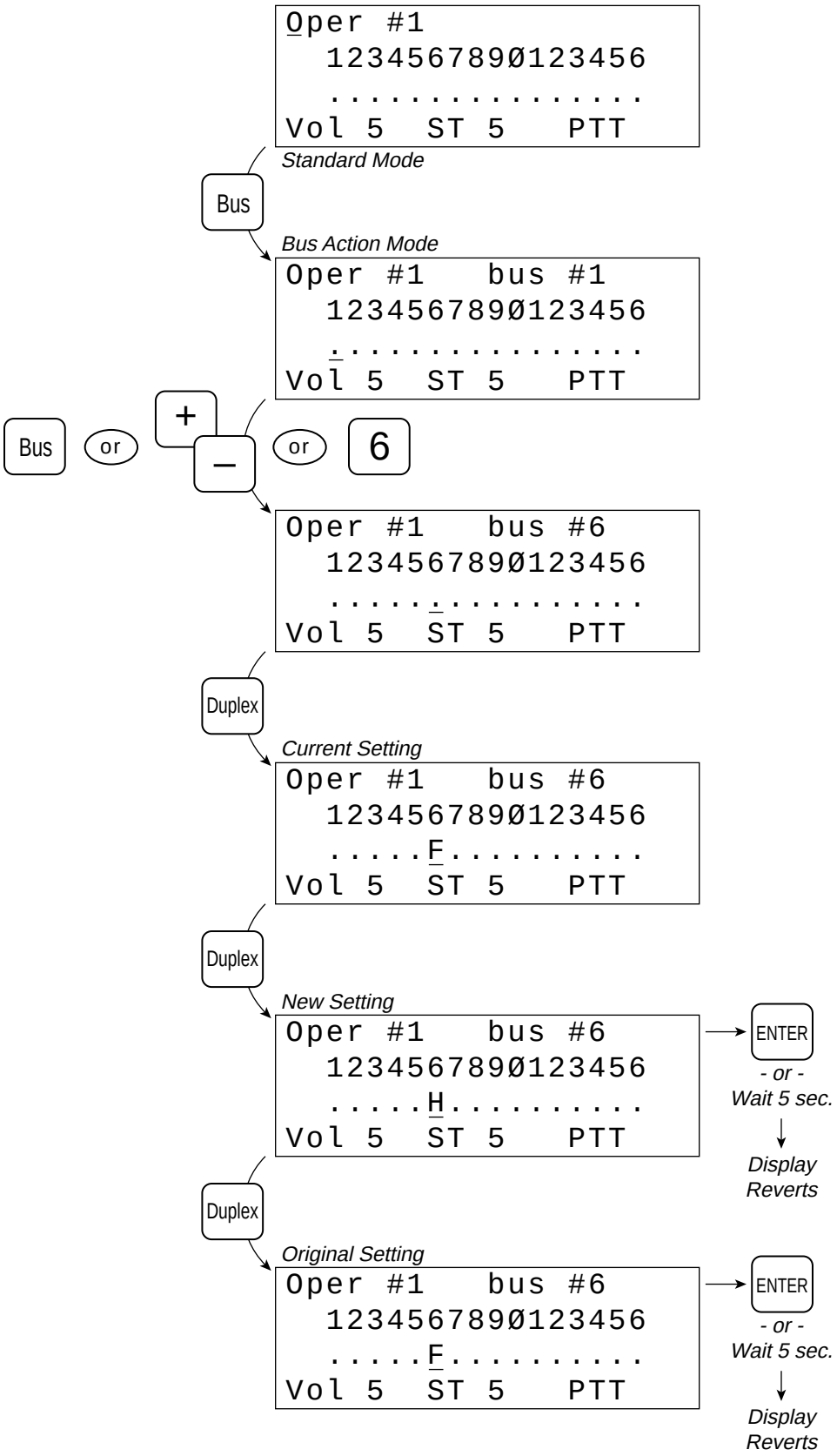
After choosing the desired intercom bus, press [Duplex] to access the current duplex setting for that bus. If the intercom bus is set to full-duplex mode, an “F” will appear directly above the cursor. If it is set to half-duplex, an “H” will appear instead.

Pressing the [Duplex] key while the cursor is below the current setting will toggle the duplex setting between full-duplex (“F”) and half-duplex (“H”).

Once the desired duplex setting has been achieved for that specific intercom bus, you have two options:

- Before the display reverts back to the Main Display (and Standard Mode), you can select another intercom bus to change, ***or***
- If you are finished editing bus information, press [ENTER] or do nothing for five (5) seconds. The display will revert to the Main Display.

Figure 19: Changing Intercom Bus Duplex Mode



It is possible for the operator to change more than one attribute for multiple intercom buses while in Bus Action Mode. Care should be taken, however, when switching to a different intercom bus after changing an intercom bus volume level.

For example, if you just changed Bus 5 volume to 6, pressing the [3] key to access Bus 3 may inadvertently change the volume for Bus 5 to a value of 3. In this instance, you are advised to use the [+] or [–] keys to scroll to the next intercom bus which you intend to edit.

Test Mode

The HHT Test Mode allows the operator to verify correct operation of the LED display and individual keypresses.

While in Test Mode, operators are taken out of the communications system.

To enter Test Mode, press [Shift] then [Test].

The HHT display will begin to cycle through various characters to verify that the terminal's LED display is working correctly. Pressing any key on the HHT keypad will elicit a key indicator to be displayed in the lower left corner of the display as it continues to cycle characters.

The operator will hear his/her mic audio in the headset, and a beeping tone in the background.

To exit Test Mode, and re-establish communication, press [Test].

HHT Display Settings

In the event of a system problem, the information in the HHT display will disappear after 60 seconds of system inactivity. Some conditions that may cause this shut-down are:

- DACS Processing Node is turned-off or loses power.
- Model Builder software is quit or put in "model freeze" state. (F3 will unfreeze model.)
- Faulty cable connection somewhere along the TDM ring.

If the HHT connection to the RIU is faulty, the HHT display will disappear and the unit will cease functioning immediately.

Setting HHT Display Contrast

To change the contrast of the HHT display, follow these steps:

- Hold [+] while plugging the cable into the top of the HHT.
- Use [PTT] to increase the contrast; use [+] to decrease the contrast.
- When done, press [Bus] three (3) times to return to the Main Display.

DO NOT change the "BR:" or "DF:" settings that are shown as you return to the Main Display.

APPENDIX A: INTERCOM HHT FILE COMMANDS

The information contained in Appendix A pertains only to those systems running Model Builder version 4.xx **without** a separate Model Server platform.

Configuration Overview

The Model Builder software requires a number of specified parameters to operate correctly. For the most part, these parameters can be changed, allowing you to configure your communications environment to better fit your application.

Configuration File Commands

Model Builder starts by loading the contents of the default.cfg file. In addition to the command lines described here, the user should also reference the Model Builder Reference Manual/User's Guide for an explanation of the available DIS configuration commands.

DIS configuration commands should be added to the "default.cfg" file, not an initialization (.ini) file.

The default.dfg file may be edited using a DOS-based editor. Type "edit default.cfg" at the c:\mbuilder\user\models> prompt.

To have the model and supporting state machine software load and run correctly, the following commands must be included in the "default.cfg" file.

Command 1

DLL1 = <filename.dll>,<filename.ini>,<# of HHTs>

<**filename.dll**> is the .dll file containing the code for running the HHT state machines.
<**filename.ini**> is the initialization file that sets system parameters and individual operator characteristics. This file is covered in more detail in the next section of this appendix, "Initialization File Commands".
<**#of HHTs**> is the number of Hand-Held Terminals to be supported by the .dll file.
Example: DLL1 = hhtcom.dll, hhtcom1.ini, 6
Model Builder will: 1) use the HHT state machines contained within the *hhtcom.dll* file, 2) load the contents of the *hhtcom1.ini* initialization file, and 3) support *6* Hand-Held Terminal units.

Command 2

MODEL1 = <filename.mdl>

This specifies which model to load at Model Builder start-up.
<**filename.mdl**> will be in **ICSx_y.mdl** format, where **x** is the number of operators, and **y** is the number of intercom buses.
Check in the c:\mbuilder\user\models directory for a list of available models. The model filename that is referenced in the command line must be present in this directory when Model Builder is launched, or the simulation will not run. Model Builder will load, but it will not contain any of the necessary objects needed to support user interface and DIS communications.
Example: MODEL1 = ICS6_4.mdl
This will load a 6 operator, 4 intercom bus model upon start-up.

Command 3 **MODEL_RATE = <value>**

<**value**> is the number which determines, in hertz, how fast the DACS will service the network. The recommended setting for Intercom applications is 60. However, the maximum value is 100, and the minimum value is 24.
A higher model rate is better, especially in a heavy-traffic environment, but too high a model rate can overload the system.
Refer to the Model Builder Reference Manual/User's Guide for techniques to optimize system performance.
Example: MODEL_RATE = 60

Command 4 **CELL = ON**

(default = OFF)
This command enables cell communication in Model Builder necessary for HHT support.

Command 5 **CELL:PATHS = default.pth**

This command specifies the flow of information to/from the software model and to/from the Hand-Held Terminals via the TDM card and Remote Interface Units (RIUs). This file is factory-configured to support the maximum number of operators. ***Do not edit the default.pth file unless specifically instructed by ASTi***.

Command 6 **DIS = ON**

(default = OFF)
This command is required for voice distribution between base systems over a network. Refer to the Model Builder Reference Manual/User's Guide for further information about setting IP addresses, UDP ports, and assigning site and host values.

Command 7 **DIS:LOCAL_IP = <IP Address>**

<IP Address>: in the format Y.Y.Y.Y where each Y is a decimal number in the range 0 through 255.

Command 8 **DIS:UDP_PORT = <number>**

This command sets both the source and destination UDP port adresses.
<number>: decimal number in the range 0 through 65535.
The default value is DIS:UDP_PORT = 6994

Command 9 **DIS:SITE = <number>**

This command sets the Site Address for the own device. The Site Address is the same for all PDUs emanating from the processing node.
<number>: decimal number.
The default value is DIS:SITE = 1

Command 10 **DIS:HOST = <number>**

This command sets the Host Address for all PDUs emanating from the processing node.
<number>: decimal number.
The default value is DIS:HOST = 1

Initialization File Commands

These options are available to tailor the configuration of the hand-held terminals to your requirements. There is no particular order required; however, if an option is duplicated, only the last value will be used.

For each of the available options, the common parameters are defined as follows:

<operator #>: an integer 1 through N, where N is the number of operator positions provided with the system.

<bus #>: an integer 1 through N, where N is the number of intercom buses available on the system.

INTERCOM:OP = <operator #>,<identifier>,<volume>,<sidetone>

This option sets the identifier shown on the status page of each operator's terminal, as well as start-up volume and start-up sidetone settings.

<identifier>: a text string up to 10 characters in length containing ASCII letters or numbers. Placing this string withing quote marks (e.g., "Zam 7") will allow the HHTs to display the identifier with capital letters, spaces, or special characters. Excluding the quote marks will cause the system to remove spaces and letter case. If no value is specified, the identifier will default to “Oper #1”, “Oper #2”, etc.

<volume>: an integer in the range of 0 to 9 where 9 is full volume. If no value is specified for a particular operator, the volume defaults to a setting of 5.

<sidetone>: an integer in the range of 0 through 9. If no value is specified, the sidetone defaults to a setting of 5.

> Example: INTERCOM:OP = 2, "Zam 7",7,3
> Sets Operator 2's terminal identifier to "Zam 7", volume to 7, and sidetone to 3.

INTERCOM:OP_PTT = <operator #>,<talk mode>,<VOX level>

This option sets the start-up Talk Mode and VOX levels for each of the operators.

<talk mode>: one of two valid modes, PTT or VOX. If no value is specified, the operator will default to PTT Talk Mode.

<VOX level>: an integer in the range of 0 to 99. Setting VOX level to 0 results in "hot mic" functionality. If PTT is chosen for talk mode, this value is used when/if that operator changes his Talk Mode to VOX. If no value is specified, the default VOX level is 50.

> Example: INTERCOM:OP_PTT = 3,VOX,35
> Sets Operator 3’s start-up Talk Mode to VOX, and his VOX threshold level to 35.

INTERCOM:NUMBER_BUSES = <number>

This option sets the maximum number of intercom buses to be displayed for every operator (system-wide).

<number>: an integer in the range 1 to 16. If no value is specified, the terminals will display 16 intercom buses (regardless of the actual number of functioning intercom buses).

Example: INTERCOM:NUMBER_BUSES = 4
Sets the maximum number of intercom buses displayed on any system HHT to 4.

INTERCOM:OP_BUS = <operator #>,<bus #>,<bus status>,<volume>, <duplex>

This option sets various attributes for individual intercom buses for each operator.

<bus status>: one of three valid modes: T, L, or O (the letter, not zero). "T" sets the bus status to Talk/Listen. "L" sets the bus status to Listen Only. "O" sets the bus status to OFF. If no value is specified, the bus status defaults to OFF.

<volume>: an integer in the range of 0 to 9 where 9 is full volume. If no value is specified for a particular bus, the volume defaults to a setting of 5. Please note that this volume level does not override the overall system volume for each operator.

<duplex>: one of two valid modes: F or H. "F" sets the bus duplex to full-duplex. "H" sets the bus duplex to half-duplex. If no value is specified, the bus defaults to full-duplex.

Example:
INTERCOM:OP_BUS = 1,1,T,4,F
INTERCOM:OP_BUS = 1,2,L,2,H
Sets Operator 1's Bus #1 to Talk/Listen mode at a bus volume of 4, in full-duplex mode. Sets Operator 1's Bus #2 to Listen Only mode at a bus volume of 2, in half-duplex.

INTERCOM:OP_BUS_BLOCK = <operator #>,<list>

This option allows operators to be denied access to certain system intercom buses.

<list>: a series of numbers representing system intercom buses that should be blocked from the operator. Each intercom bus number should be separated by a comma. If no value is specified, all operators have access to all system buses.

Example:
INTERCOM:OP_BUS_BLOCK = 1,1,2
INTERCOM:OP_BUS_BLOCK = 2,3,4
Operator 1 can access all system buses except for buses 1 and 2. Operator 2 can access all system buses except for buses 3 and 4.

INTERCOM:BUS_NAME = <bus #>,<bus name>

This option sets the bus name shown on the status page of each operator's terminal.

<bus name>: a text string up to 10 characters in length containing ASCII letters or numbers. Placing this string withing quote marks (e.g., "Tucker 16") will allow the HHTs to display the bus name with capital letters, spaces, or special characters. Excluding the quote marks will cause the system to remove spaces and letter case. If no value is specified, the identifier will default to “bus #1”, “bus #2”, etc.

Example:
INTERCOM:BUS_NAME = 1,"Tour Bus 1"
INTERCOM:BUS_NAME = 2,Generic2
Sets system intercom bus #1’s name to: Tour Bus 1, and system intercom bus #2’s name to: generic2 (note lack of quote marks).

Sample System Files

Default.cfg

The following is an example of the default.cfg file for a 6 operator, 4 bus Intercom application.

```
; File Name:    Default.cfg
; Location:     File should be placed in start up directory
;               Typically c:\mbuilder\user\models
; Description:  Model Builder Configuration File.
;               This file provides start up configuration commands
;               for ASTi’s Model Builder application software.
; Application:  Networked Intercom System with TDM/RIU and HHTs
;               Commands structured for 6 operator, 4 bus platform
;               System Serial #19049
;
; ------------------------------------------------------------------
;
; -- Identify Number Of System DSP/TDM Cards
cell = on
Number_dsps = 1
;
; -- Communications/Sound Model Load At Start Up
; -- Load 4 operator 4 bus model
model1 = ICS6_4.mdl
;
; -- Intercom Hand Held Terminal DLL Software Load At Start Up
; -- Reference .ini file containing Hand Held Terminal initialization
; -- commands (see Intercom System/HHT User Guide)
; -- Instantiate 6 operators (instantiating more oprators than purchased
; -- will exhaust system credits and render additional operators useless)
dll1 = hhtcom.dll, hhtcom.ini, 6
;
; -- Reference .pth file containing cell data routing paths for data comms
; -- between RIU serial ports/HHTs, Models, and Intercom Hand Held Terminal
; -- DLL sotware.
cell:paths = hhtcom.pth
;
; -- Set System/Model Iteration Rate
; -- For Network Voice/DIS Operation Master Model Rate should be set
between
; -- 50 and 100Hz and each individual model saved at 1/2, 1/4, 1/8 rates
; -- as required to avoid overruns.  Systems with 10/100 Mbs PCI enet cards
; -- in particular may be run as low as 50Hz without any serious
; -- degradation in network voice streams.
```

```
Model_rate = 50
;
; -- Enable Network Voice between base stations by setting DIS
; -- capability flag On
DIS=On
;
; -- Set Network Voice/DIS Ethernet Interface Port and IP Address
; -- !!!!! Each Base Station Must Have a Unique IP Address   !!!!!
; -- !!!!! and reside on the same network. It is recommended !!!!!
; -- !!!!! that you modify the fourth number of the address  !!!!!
; -- !!!!! shown below ONLY.  Port numbers should be the     !!!!!
; -- !!!!! SAME on all systems                               !!!!!
;
; -- Last digit of IP address is system serial # - 20
DIS:Local_IP = 10.0.0.29
DIS:RX_UDP_Port = 6999
DIS:TX_UDP_Port = 6999
;
; -- Set Site and Host IDs for voice ops
DIS:Site = 100
DIS:Host = 29
```

HHTCom.ini

The following is an example of the hhtcom.ini file for the same 6 operator, 4 bus Intercom application.

```
; File Name:    hhtcom.ini
; Description:  Intercom Hand Held Terminal Initialization File
;               This file provides start up configuration commands
;               for the dll file hhtcom.dll.
; Notes:        Available configuration commands and syntax can be
;               found in the Intercom System and Hand Held Terminal
;               User Guide.  If multiple instantiations of the
;               hhtcom.dll are used, a separate .ini file will need
;               to be created for each instance. Again see User Guide.
;
; ------------------------------------------------------------------
;
; -- Initialize Operator Name, Volume, Sidetone
; -- Left VCR is connected to Operator 1 Audio I/O
; -- Right VCR is connected to Operator 3 Audio I/O
; -- Sidetone must be set to 0 for VCR operators
;Intercom:Op = 1, “TCR L VCR”, 7, 0
;Intercom:Op = 2, “TCR Oper2”, 7, 5
;Intercom:Op = 3, “TCR R VCR”, 7, 0
;Intercom:Op = 4, “TCR Oper4”, 7, 5
;Intercom:Op = 5, “TCR Oper5”, 7, 5
;Intercom:Op = 6, “TCR Oper6”, 7, 5
;
; -- Initialize Operator PTT/Vox Mode, Vox Level
; -- Operator 1 and 3 (Left VCR and Right VCR) Must be in VOX mode
; -- for proper VCR opertation.
; -- VOX level is set to default of 25 for VCR inputs.  Level should
; -- be adjusted via Hand Held Terminal such that transmission does not
; -- occur when there is no audio.  This will prevent unnecessary use of
; -- network bandwidth.
;Intercom:Op_PTT = 1, VOX, 25
;Intercom:Op_PTT = 2, PTT, 35
;Intercom:Op_PTT = 3, VOX, 25
;Intercom:Op_PTT = 4, PTT, 35
;Intercom:Op_PTT = 5, PTT, 35
;Intercom:Op_PTT = 6, PTT, 35
;
; -- Initialize Max Bus Display - System Wide
```

```
;Intercom:Number_Buses = 4
;
; -- Initialize Operator Bus Talk/Listen, Volume, Duplex
;
; -- Operator 1 and 3 are connected to Left and Right VCRs respectively
; -- Left VCR (Operator 1) is default attached to bus1
; -- Right VCR (Operator 3) is default attached to bus4
; -- Bus access must be Half Duplex for correct VCR operation
; -- All bus access for Left and Right VCR operators is default half duplex
;
; -- Wireless Intercom is attached to Bus 4
; -- Bus 4 is default Half Duplex for all standard headset operators to
; -- accomodate wireless intercom operation.
;
; -- Left VCR (Operator 1) Settings
;Intercom:Op_Bus = 1, 1, L, 7, H
;Intercom:Op_Bus = 1, 2, O, 7, H
;Intercom:Op_Bus = 1, 3, O, 7, H
;Intercom:Op_Bus = 1, 4, O, 7, H
; -- Operator 2 Settings
;Intercom:Op_Bus = 2, 1, L, 7, F
;Intercom:Op_Bus = 2, 2, O, 7, F
;Intercom:Op_Bus = 2, 3, O, 7, F
;Intercom:Op_Bus = 2, 4, O, 7, H
;
; -- Right VCR (Operator 3) Settings
;Intercom:Op_Bus = 3, 1, O, 7, H
;Intercom:Op_Bus = 3, 2, O, 7, H
;Intercom:Op_Bus = 3, 3, O, 7, H
;Intercom:Op_Bus = 3, 4, L, 7, H
; -- Operator 4 Settings
;Intercom:Op_Bus = 4, 1, L, 7, F
;Intercom:Op_Bus = 4, 2, O, 7, F
;Intercom:Op_Bus = 4, 3, O, 7, F
;Intercom:Op_Bus = 4, 4, O, 7, H
; -- Operator 5 Settings
;Intercom:Op_Bus = 5, 1, L, 7, F
;Intercom:Op_Bus = 5, 2, O, 7, F
;Intercom:Op_Bus = 5, 3, O, 7, F
;Intercom:Op_Bus = 5, 4, O, 7, H
; -- Operator 6 Settings
;Intercom:Op_Bus = 6, 1, L, 7, F
;Intercom:Op_Bus = 6, 2, O, 7, F
;Intercom:Op_Bus = 6, 3, O, 7, F
;Intercom:Op_Bus = 6, 4, O, 7, H
;
; -- Initialize Operator Bus Blocking
;
;Intercom:Op_Bus_Block = 1, 1, 3
;Intercom:Op_Bus_Block = 2, 2, 4
;Intercom:Op_Bus_Block = 3, 1, 2, 3
;Intercom:Op_Bus_Block = 4, 2, 3, 4
;Intercom:Op_Bus_Block = 5, 1
;Intercom:Op_Bus_Block = 6, 2
;
; -- Initialize Bus Names
;
;Intercom:Bus_Name = 1, “School1”
;Intercom:Bus_Name = 2, “GrayHound2”
;Intercom:Bus_Name = 3, “Tour3”
;Intercom:Bus_Name = 4, “2Decker4”
```

HHTCom.pth

The following is an example of the httcom.pth file for the same application. It is included only for reference, and to make this document complete.

DO NOT edit or change any part of the httcom.pth file on your system unless specifically instructed by ASTi.

```
; Title:        Path File - Cell Routing Configuration - Intercom
; Description:  Provides cell routing information for passing data
;               between various intercom system components - Model,
;               HHT, State Machine Software
; Application:  Used with intercom system state machine software
;               hhtcom.dll. This dll file must be loaded at start up
;               using commands in the .cfg configuration file.
;               As configured this file supports all 16 operators and
;               16 buses available in hhtcom.dll.  Configuration of
;               system purchased will limit the number of operators
;               and busses.
;
;              !!!!!!!!!!!!!!!!!!!  WARNING !!!!!!!!!!!!!!!!!!!!
;                For Correct Operation, this file should not be
;                                    modified!
; ------------------------------------------------------------------
;
; ***********************************************************
; Set up data RX/TX path to/from communications model1 (running
; on DSP1) and state machine software for bus activity.
;
; T# buffer selected in model control objects must map to txc:#
; See Intercom System and ICS HHT documentation for ICD
; ***********************************************************
;
;One Path for activity indication
path:add = mdl1, sys, con, txc:200 > dll1, vpi:1, vci:1, prt:10
;
; ***********************************************************
; Set up data RX/TX path to/from operator HHT (via RIU) to
; operator state machine software (dll) for operators 1 - 16.
;
; See Intercom System and ICS HHT documentation for Connection
; Information.
; ***********************************************************
;
; Operator1 HHT Connects To: RIU1 (Address 1), Serial Port A
path:add = dll1, vpi:1, vci:1, prt:1 <> dsp1, riu:1, hha:1
;
; Operator2 HHT Connects To: RIU1 (Address 1), Serial Port B
path:add = dll1, vpi:1, vci:2, prt:1 <> dsp1, riu:1, hhb:1
;
; Operator3 HHT Connects To: RIU2 (Address 2), Serial Port A
path:add = dll1, vpi:1, vci:3, prt:1 <> dsp1, riu:2, hha:1
;
; Operator4 HHT Connects To: RIU2 (Address 2), Serial Port B
path:add = dll1, vpi:1, vci:4, prt:1 <> dsp1, riu:2, hhb:1
;
; Operator5 HHT Connects To: RIU3 (Address 3), Serial Port A
path:add = dll1, vpi:1, vci:5, prt:1 <> dsp1, riu:3, hha:1
;
; Operator6 HHT Connects To: RIU3 (Address 3), Serial Port B
path:add = dll1, vpi:1, vci:6, prt:1 <> dsp1, riu:3, hhb:1
;
; Operator7 HHT Connects To: RIU4 (Address 4), Serial Port A
path:add = dll1, vpi:1, vci:7, prt:1 <> dsp1, riu:4, hha:1
;
```

```
; Operator8 HHT Connects To: RIU4 (Address 4), Serial Port B
path:add = dll1, vpi:1, vci:8, prt:1 <> dsp1, riu:4, hhb:1
;
; Operator9 HHT Connects To: RIU5 (Address 5), Serial Port A
path:add = dll1, vpi:1, vci:9, prt:1 <> dsp1, riu:5, hha:1
;
; Operator10 HHT Connects To: RIU5 (Address 5), Serial Port B
path:add = dll1, vpi:1, vci:10, prt:1 <> dsp1, riu:5, hhb:1
;
; Operator11 HHT Connects To: RIU6 (Address 6), Serial Port A
path:add = dll1, vpi:1, vci:11, prt:1 <> dsp1, riu:6, hha:1
;
; Operator12 HHT Connects To: RIU6 (Address 6), Serial Port B
path:add = dll1, vpi:1, vci:12, prt:1 <> dsp1, riu:6, hhb:1
;
; Operator13 HHT Connects To: RIU7 (Address 7), Serial Port A
path:add = dll1, vpi:1, vci:13, prt:1 <> dsp1, riu:7, hha:1
;
; Operator14 HHT Connects To: RIU7 (Address 7), Serial Port B
path:add = dll1, vpi:1, vci:14, prt:1 <> dsp1, riu:7, hhb:1
;
; Operator15 HHT Connects To: RIU8 (Address 8), Serial Port A
path:add = dll1, vpi:1, vci:15, prt:1 <> dsp1, riu:8, hha:1
;
; Operator16 HHT Connects To: RIU8 (Address 8), Serial Port B
path:add = dll1, vpi:1, vci:16, prt:1 <> dsp1, riu:8, hhb:1
;
; ************************************************************
; Set up data RX/TX path from state machine to model for
; operator control parameters - operators 1 - 16
;
; R# buffer selected in model control objects must map to rxc:#
; See Intercom System and ICS HHT documentation for ICD
; ************************************************************
;
path:add = dll1, vpi:1, vci:1, prt:2 <> mdl1, sys, con, rxc:1
path:add = dll1, vpi:1, vci:2, prt:2 <> mdl1, sys, con, rxc:2
path:add = dll1, vpi:1, vci:3, prt:2 <> mdl1, sys, con, rxc:3
path:add = dll1, vpi:1, vci:4, prt:2 <> mdl1, sys, con, rxc:4
path:add = dll1, vpi:1, vci:5, prt:2 <> mdl1, sys, con, rxc:5
path:add = dll1, vpi:1, vci:6, prt:2 <> mdl1, sys, con, rxc:6
path:add = dll1, vpi:1, vci:7, prt:2 <> mdl1, sys, con, rxc:7
path:add = dll1, vpi:1, vci:8, prt:2 <> mdl1, sys, con, rxc:8
path:add = dll1, vpi:1, vci:9, prt:2 <> mdl1, sys, con, rxc:9
path:add = dll1, vpi:1, vci:10, prt:2 <> mdl1, sys, con, rxc:10
path:add = dll1, vpi:1, vci:11, prt:2 <> mdl1, sys, con, rxc:11
path:add = dll1, vpi:1, vci:12, prt:2 <> mdl1, sys, con, rxc:12
path:add = dll1, vpi:1, vci:13, prt:2 <> mdl1, sys, con, rxc:13
path:add = dll1, vpi:1, vci:14, prt:2 <> mdl1, sys, con, rxc:14
path:add = dll1, vpi:1, vci:15, prt:2 <> mdl1, sys, con, rxc:15
path:add = dll1, vpi:1, vci:16, prt:2 <> mdl1, sys, con, rxc:16
;
```

APPENDIX B: INTERFACE CONTROL DEFINITION (ICD)

The following ICD is for a 6 operator / 4 bus Intercom model running under Model Builder version 4.03a21 or later. If you require an ICD for a different configuration, please contact ASTi at (703)471-2104.

Name	Description	Type	Pkt	Offset	Size
Op1_PTT_HHT	Operator 1 PTT Signal from HHT	In_Bool	R1	19 bit0 (x01)	
Op1_Volume	Operator 1 Volume Level Range: 0-9	In_Int	R1	16	1 bytes
Op1_SideTone	Operator 1 Sidetone Level Range: 0-9	In_Int	R1	17	1 bytes
Op1_Vox_Lvl	Operator 1 Vox Level Range: 0-99	In_Int	R1	18	1 bytes
Op1_Vox_On/Off	Operator 1 Vox Enable	In_Bool	R1	19 bit1 (x02)	
Op1_Test	Operator 1 Test Mode Active On = Test Mode	In_Bool	R1	26 bit0 (x01)	
Op1_Test_Inv	Operator 1 Test Mode Inactive Inverse of Op1_Test	In_Bool	R1	26 bit0 (x01)	
Op1_Tlk_Bus1-8	Operator 1 Talk Select Bus 1-8	In_Bit8			
	Bus1_Talk		R1	20 bit 0 (x01)	
	Bus2_Talk		R1	20 bit 1 (x02)	
	Bus3_Talk		R1	20 bit 2 (x04)	
	Bus4_Talk		R1	20 bit 3 (x08)	
	Bus5_Talk		R1	20 bit 4 (x10)	
	Bus6_Talk		R1	20 bit 5 (x20)	
	Bus7_Talk		R1	20 bit 6 (x40)	
	Bus8_Talk		R1	20 bit 7 (x80)	
Op1_Lst_Bus1-8	Operator 1 Listen Select Bus 1-8	In_Bit8			
	Bus1_Listen		R1	22 bit 0 (x01)	
	Bus2_Listen		R1	22 bit 1 (x02)	
	Bus3_Listen		R1	22 bit 2 (x04)	
	Bus4_Listen		R1	22 bit 3 (x08)	
	Bus5_Listen		R1	22 bit 4 (x10)	
	Bus6_Listen		R1	22 bit 5 (x20)	
	Bus7_Listen		R1	22 bit 6 (x40)	
	Bus8_Listen		R1	22 bit 7 (x80)	
Op1_Dpl_Bus1-8	Operator 1 Duplex Select Bus 1-8	In_Bit8			
	Bus1_Duplex		R1	24 bit 0 (x01)	
	Bus2_Duplex		R1	24 bit 1 (x02)	
	Bus3_Duplex		R1	24 bit 2 (x04)	
	Bus4_Duplex		R1	24 bit 3 (x08)	
	Bus5_Duplex		R1	24 bit 4 (x10)	

	Bus6_Duplex		R1	24 bit 5 (x20)
	Bus7_Duplex		R1	24 bit 6 (x40)
	Bus8_Duplex		R1	24 bit 7 (x80)
Op1_Tlk_Bus9-16	Operator 1 Talk Select Bus 9-16	In_Bit8		
	Bus9_Talk		R1	21 bit 0 (x01)
	Bus10_Talk		R1	21 bit 1 (x02)
	Bus11_Talk		R1	21 bit 2 (x04)
	Bus12_Talk		R1	21 bit 3 (x08)
	Bus13_Talk		R1	21 bit 4 (x10)
	Bus14_Talk		R1	21 bit 5 (x20)
	Bus15_Talk		R1	21 bit 6 (x40)
	Bus16_Talk		R1	21 bit 7 (x80)
Op1_Lst_Bus9-16	Operator 1 Listen Select Bus 9-16	In_Bit8		
	Bus9_Listen		R1	23 bit 0 (x01)
	Bus10_Listen		R1	23 bit 1 (x02)
	Bus11_Listen		R1	23 bit 2 (x04)
	Bus12_Listen		R1	23 bit 3 (x08)
	Bus13_Listen		R1	23 bit 4 (x10)
	Bus14_Listen		R1	23 bit 5 (x20)
	Bus15_Listen		R1	23 bit 6 (x40)
	Bus16_Listen		R1	23 bit 7 (x80)
Op1_Dpl_Bus9-16	Operator 1 Duplex Select Bus 9-16	In_Bit8		
	Bus9_Duplex		R1	25 bit 0 (x01)
	Bus10_Duplex		R1	25 bit 1 (x02)
	Bus11_Duplex		R1	25 bit 2 (x04)
	Bus12_Duplex		R1	25 bit 3 (x08)
	Bus13_Duplex		R1	25 bit 4 (x10)
	Bus14_Duplex		R1	25 bit 5 (x20)
	Bus15_Duplex		R1	25 bit 6 (x40)
	Bus16_Duplex		R1	25 bit 7 (x80)
Op1_Bus1_Dpl	Operator 1 Bus1 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit0 (x01)
Op1_Bus1_TX	Operator 1 Bus1 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit0 (x01)
Op1_Bus2_Dpl	Operator 1 Bus2 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit1 (x02)
Op1_Bus2_TX	Operator 1 Bus2 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit1 (x02)
Op1_Bus3_Dpl	Operator 1 Bus3 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit2 (x04)
Op1_Bus3_TX	Operator 1 Bus3 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit2 (x04)
Op1_Bus4_Dpl	Operator 1 Bus4 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit3 (x08)
Op1_Bus4_TX	Operator 1 Bus4 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit3 (x08)

Op1_Bus5_Dpl	Operator 1 Bus5 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit4 (x10)
Op1_Bus5_TX	Operator 1 Bus5 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit4 (x10)
Op1_Bus6_Dpl	Operator 1 Bus6 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit5 (x20)
Op1_Bus6_TX	Operator 1 Bus6 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit5 (x20)
Op1_Bus7_Dpl	Operator 1 Bus7 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit6 (x40)
Op1_Bus7_TX	Operator 1 Bus7 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit6 (x40)
Op1_Bus8_Dpl	Operator 1 Bus8 Duplex Setting On = Full Duplex Operation	In_Bool	R1	24 bit7 (x80)
Op1_Bus8_TX	Operator 1 Bus8 Transmit Select On = Transmit Capability Selected	In_Bool	R1	20 bit7 (x80)
Op1_Bus9_Dpl	Operator 1 Bus9 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit0 (x01)
Op1_Bus9_TX	Operator 1 Bus9 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit0 (x01)
Op1_Bus10_Dpl	Operator 1 Bus10 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit1 (x02)
Op1_Bus10_TX	Operator 1 Bus10 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit1 (x02)
Op1_Bus11_Dpl	Operator 1 Bus11 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit2 (x04)
Op1_Bus11_TX	Operator 1 Bus11 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit2 (x04)
Op1_Bus12_Dpl	Operator 1 Bus12 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit3 (x08)
Op1_Bus12_TX	Operator 1 Bus12 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit3 (x08)
Op1_Bus13_Dpl	Operator 1 Bus13 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit4 (x10)
Op1_Bus13_TX	Operator 1 Bus13 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit4 (x10)
Op1_Bus14_Dpl	Operator 1 Bus14 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit5 (x20)
Op1_Bus14_TX	Operator 1 Bus14 Transmit Select	In_Bool	R1	21 bit5 (x20)

	On = Transmit Capability Selected				
Op1_Bus15_Dpl	Operator 1 Bus15 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit6 (x40)	
Op1_Bus15_TX	Operator 1 Bus15 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit6 (x40)	
Op1_Bus16_Dpl	Operator 1 Bus16 Duplex Setting On = Full Duplex Operation	In_Bool	R1	25 bit7 (x80)	
Op1_Bus16_TX	Operator 1 Bus16 Transmit Select On = Transmit Capability Selected	In_Bool	R1	21 bit7 (x80)	
Op1_Bus1_Vol	Operator 1 Bus 1 Volume Range: 0-9	In_Int	R1	0	1 bytes
Op1_Bus2_Vol	Operator 1 Bus 2 Volume Range: 0-9	In_Int	R1	1	1 bytes
Op1_Bus3_Vol	Operator 1 Bus 3 Volume Range: 0-9	In_Int	R1	2	1 bytes
Op1_Bus4_Vol	Operator 1 Bus 4 Volume Range: 0-9	In_Int	R1	3	1 bytes
Op1_Bus5_Vol	Operator 1 Bus 5 Volume Range: 0-9	In_Int	R1	4	1 bytes
Op1_Bus6_Vol	Operator 1 Bus 6 Volume Range: 0-9	In_Int	R1	5	1 bytes
Op1_Bus7_Vol	Operator 1 Bus 7 Volume Range: 0-9	In_Int	R1	6	1 bytes
Op1_Bus8_Vol	Operator 1 Bus 8 Volume Range: 0-9	In_Int	R1	7	1 bytes
Op1_Bus9_Vol	Operator 1 Bus 9 Volume Range: 0-9	In_Int	R1	8	1 bytes
Op1_Bus10_Vol	Operator 1 Bus 10 Volume Range: 0-9	In_Int	R1	9	1 bytes
Op1_Bus11_Vol	Operator 1 Bus 11 Volume Range: 0-9	In_Int	R1	10	1 bytes
Op1_Bus12_Vol	Operator 1 Bus 12 Volume Range: 0-9	In_Int	R1	11	1 bytes
Op1_Bus13_Vol	Operator 1 Bus 13 Volume Range: 0-9	In_Int	R1	12	1 bytes
Op1_Bus14_Vol	Operator 1 Bus 14 Volume Range: 0-9	In_Int	R1	13	1 bytes
Op1_Bus15_Vol	Operator 1 Bus 15 Volume Range: 0-9	In_Int	R1	14	1 bytes

Op1_Bus16_Vol	Operator 1 Bus 16 Volume Range: 0-9	In_Int	R1	15	1 bytes
Op1_LED_Output	Operator 1 LED On/Off Setting Output 4 LEDs; LSB -> MSB = Right -> Left	Out_Int	T1	0	1 bytes
Op2_PTT_HHT	Operator 2 PTT Signal from HHT	In_Bool	R2	19 bit0 (x01)	
Op2_Volume	Operator 2 Volume Level Range: 0-9	In_Int	R2	16	1 bytes
Op2_SideTone	Operator 2 Sidetone Level Range: 0-9	In_Int	R2	17	1 bytes
Op2_Vox_Lvl	Operator 2 Vox Level Range: 0-99	In_Int	R2	18	1 bytes
Op2_Vox_On/Off	Operator 2 Vox Enable	In_Bool	R2	19 bit1 (x02)	
Op2_Test	Operator 2 Test Mode Active On = Test Mode	In_Bool	R2	26 bit0 (x01)	
Op2_Test_Inv	Operator 2 Test Mode Inactive Inverse of Op1_Test	In_Bool	R2	26 bit0 (x01)	
Op2_Tlk_Bus1-8	Operator 2 Talk Select Bus 1-8	In_Bit8			
	Bus1_Talk		R2	20 bit 0 (x01)	
	Bus2_Talk		R2	20 bit 1 (x02)	
	Bus3_Talk		R2	20 bit 2 (x04)	
	Bus4_Talk		R2	20 bit 3 (x08)	
	Bus5_Talk		R2	20 bit 4 (x10)	
	Bus6_Talk		R2	20 bit 5 (x20)	
	Bus7_Talk		R2	20 bit 6 (x40)	
	Bus8_Talk		R2	20 bit 7 (x80)	
Op2_Lst_Bus1-8	Operator 2 Listen Select Bus 1-8	In_Bit8			
	Bus1_Listen		R2	22 bit 0 (x01)	
	Bus2_Listen		R2	22 bit 1 (x02)	
	Bus3_Listen		R2	22 bit 2 (x04)	
	Bus4_Listen		R2	22 bit 3 (x08)	
	Bus5_Listen		R2	22 bit 4 (x10)	
	Bus6_Listen		R2	22 bit 5 (x20)	
	Bus7_Listen		R2	22 bit 6 (x40)	
	Bus8_Listen		R2	22 bit 7 (x80)	
Op2_Dpl_Bus1-8	Operator 2 Duplex Select Bus 1-8	In_Bit8			
	Bus1_Duplex		R2	24 bit 0 (x01)	
	Bus2_Duplex		R2	24 bit 1 (x02)	
	Bus3_Duplex		R2	24 bit 2 (x04)	
	Bus4_Duplex		R2	24 bit 3 (x08)	
	Bus5_Duplex		R2	24 bit 4 (x10)	
	Bus6_Duplex		R2	24 bit 5 (x20)	
	Bus7_Duplex		R2	24 bit 6 (x40)	
	Bus8_Duplex		R2	24 bit 7 (x80)	
Op2_Tlk_Bus9-16	Operator 2 Talk Select Bus 9-16	In_Bit8			
	Bus9_Talk		R2	21 bit 0 (x01)	

	Bus10_Talk		R2	21 bit 1 (x02)
	Bus11_Talk		R2	21 bit 2 (x04)
	Bus12_Talk		R2	21 bit 3 (x08)
	Bus13_Talk		R2	21 bit 4 (x10)
	Bus14_Talk		R2	21 bit 5 (x20)
	Bus15_Talk		R2	21 bit 6 (x40)
	Bus16_Talk		R2	21 bit 7 (x80)
Op2_Lst_Bus9-16	Operator 2 Listen Select Bus 9-16	In_Bit8		
	Bus9_Listen		R2	23 bit 0 (x01)
	Bus10_Listen		R2	23 bit 1 (x02)
	Bus11_Listen		R2	23 bit 2 (x04)
	Bus12_Listen		R2	23 bit 3 (x08)
	Bus13_Listen		R2	23 bit 4 (x10)
	Bus14_Listen		R2	23 bit 5 (x20)
	Bus15_Listen		R2	23 bit 6 (x40)
	Bus16_Listen		R2	23 bit 7 (x80)
Op2_Dpl_Bus9-16	Operator 2 Duplex Select Bus 9-16	In_Bit8		
	Bus9_Duplex		R2	25 bit 0 (x01)
	Bus10_Duplex		R2	25 bit 1 (x02)
	Bus11_Duplex		R2	25 bit 2 (x04)
	Bus12_Duplex		R2	25 bit 3 (x08)
	Bus13_Duplex		R2	25 bit 4 (x10)
	Bus14_Duplex		R2	25 bit 5 (x20)
	Bus15_Duplex		R2	25 bit 6 (x40)
	Bus16_Duplex		R2	25 bit 7 (x80)
Op2_Bus1_Dpl	Operator 2 Bus1 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit0 (x01)
Op2_Bus1_TX	Operator 2 Bus1 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit0 (x01)
Op2_Bus2_Dpl	Operator 2 Bus2 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit1 (x02)
Op2_Bus2_TX	Operator 2 Bus2 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit1 (x02)
Op2_Bus3_Dpl	Operator 2 Bus3 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit2 (x04)
Op2_Bus3_TX	Operator 2 Bus3 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit2 (x04)
Op2_Bus4_Dpl	Operator 2 Bus4 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit3 (x08)
Op2_Bus4_TX	Operator 2 Bus4 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit3 (x08)
Op2_Bus5_Dpl	Operator 2 Bus5 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit4 (x10)
Op2_Bus5_TX	Operator 2 Bus5 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit4 (x10)

Op2_Bus6_Dpl	Operator 2 Bus6 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit5 (x20)
Op2_Bus6_TX	Operator 2 Bus6 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit5 (x20)
Op2_Bus7_Dpl	Operator 2 Bus7 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit6 (x40)
Op2_Bus7_TX	Operator 2 Bus7 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit6 (x40)
Op2_Bus8_Dpl	Operator 2 Bus8 Duplex Setting On = Full Duplex Operation	In_Bool	R2	24 bit7 (x80)
Op2_Bus8_TX	Operator 2 Bus8 Transmit Select On = Transmit Capability Selected	In_Bool	R2	20 bit7 (x80)
Op2_Bus9_Dpl	Operator 2 Bus9 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit0 (x01)
Op2_Bus9_TX	Operator 2 Bus9 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit0 (x01)
Op2_Bus10_Dpl	Operator 2 Bus10 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit1 (x02)
Op2_Bus10_TX	Operator 2 Bus10 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit1 (x02)
Op2_Bus11_Dpl	Operator 2 Bus11 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit2 (x04)
Op2_Bus11_TX	Operator 2 Bus11 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit2 (x04)
Op2_Bus12_Dpl	Operator 2 Bus12 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit3 (x08)
Op2_Bus12_TX	Operator 2 Bus12 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit3 (x08)
Op2_Bus13_Dpl	Operator 2 Bus13 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit4 (x10)
Op2_Bus13_TX	Operator 2 Bus13 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit4 (x10)
Op2_Bus14_Dpl	Operator 2 Bus14 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit5 (x20)
Op2_Bus14_TX	Operator 2 Bus14 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit5 (x20)
Op2_Bus15_Dpl	Operator 2 Bus15 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit6 (x40)
Op2_Bus15_TX	Operator 2 Bus15 Transmit Select	In_Bool	R2	21 bit6 (x40)

	On = Transmit Capability Selected				
Op2_Bus16_Dpl	Operator 2 Bus16 Duplex Setting On = Full Duplex Operation	In_Bool	R2	25 bit7 (x80)	
Op2_Bus16_TX	Operator 2 Bus16 Transmit Select On = Transmit Capability Selected	In_Bool	R2	21 bit7 (x80)	
Op2_Bus1_Vol	Operator 2 Bus 1 Volume Range: 0-9	In_Int	R2	0	1 bytes
Op2_Bus2_Vol	Operator 2 Bus 2 Volume Range: 0-9	In_Int	R2	1	1 bytes
Op2_Bus3_Vol	Operator 2 Bus 3 Volume Range: 0-9	In_Int	R2	2	1 bytes
Op2_Bus4_Vol	Operator 2 Bus 4 Volume Range: 0-9	In_Int	R2	3	1 bytes
Op2_Bus5_Vol	Operator 2 Bus 5 Volume Range: 0-9	In_Int	R2	4	1 bytes
Op2_Bus6_Vol	Operator 2 Bus 6 Volume Range: 0-9	In_Int	R2	5	1 bytes
Op2_Bus7_Vol	Operator 2 Bus 7 Volume Range: 0-9	In_Int	R2	6	1 bytes
Op2_Bus8_Vol	Operator 2 Bus 8 Volume Range: 0-9	In_Int	R2	7	1 bytes
Op2_Bus9_Vol	Operator 2 Bus 9 Volume Range: 0-9	In_Int	R2	8	1 bytes
Op2_Bus10_Vol	Operator 2 Bus 10 Volume Range: 0-9	In_Int	R2	9	1 bytes
Op2_Bus11_Vol	Operator 2 Bus 11 Volume Range: 0-9	In_Int	R2	10	1 bytes
Op2_Bus12_Vol	Operator 2 Bus 12 Volume Range: 0-9	In_Int	R2	11	1 bytes
Op2_Bus13_Vol	Operator 2 Bus 13 Volume Range: 0-9	In_Int	R2	12	1 bytes
Op2_Bus14_Vol	Operator 2 Bus 14 Volume Range: 0-9	In_Int	R2	13	1 bytes
Op2_Bus15_Vol	Operator 2 Bus 15 Volume Range: 0-9	In_Int	R2	14	1 bytes
Op2_Bus16_Vol	Operator 2 Bus 16 Volume Range: 0-9	In_Int	R2	15	1 bytes
Op2_LED_Output	Operator 2 LED On/Off Setting Output 4 LEDs; LSB -> MSB = Right -> Left	Out_Int	T2	0	1 bytes

Op3_PTT_HHT	Operator 3 PTT Signal from HHT	In_Bool	R3	19 bit0 (x01)	
Op3_Volume	Operator 3 Volume Level Range: 0-9	In_Int	R3	16	1 bytes
Op3_SideTone	Operator 3 Sidetone Level Range: 0-9	In_Int	R3	17	1 bytes
Op3_Vox_Lvl	Operator 3 Vox Level Range: 0-99	In_Int	R3	18	1 bytes
Op3_Vox_On/Off	Operator 3 Vox Enable	In_Bool	R3	19 bit1 (x02)	
Op3_Test	Operator 3 Test Mode Active On = Test Mode	In_Bool	R3	26 bit0 (x01)	
Op3_Test_Inv	Operator 3 Test Mode Inactive Inverse of Op1_Test	In_Bool	R3	26 bit0 (x01)	
Op3_Tlk_Bus1-8	Operator 3 Talk Select Bus 1-8	In_Bit8			
	Bus1_Talk		R3	20 bit 0 (x01)	
	Bus2_Talk		R3	20 bit 1 (x02)	
	Bus3_Talk		R3	20 bit 2 (x04)	
	Bus4_Talk		R3	20 bit 3 (x08)	
	Bus5_Talk		R3	20 bit 4 (x10)	
	Bus6_Talk		R3	20 bit 5 (x20)	
	Bus7_Talk		R3	20 bit 6 (x40)	
	Bus8_Talk		R3	20 bit 7 (x80)	
Op3_Lst_Bus1-8	Operator 3 Listen Select Bus 1-8	In_Bit8			
	Bus1_Listen		R3	22 bit 0 (x01)	
	Bus2_Listen		R3	22 bit 1 (x02)	
	Bus3_Listen		R3	22 bit 2 (x04)	
	Bus4_Listen		R3	22 bit 3 (x08)	
	Bus5_Listen		R3	22 bit 4 (x10)	
	Bus6_Listen		R3	22 bit 5 (x20)	
	Bus7_Listen		R3	22 bit 6 (x40)	
	Bus8_Listen		R3	22 bit 7 (x80)	
Op3_Dpl_Bus1-8	Operator 3 Duplex Select Bus 1-8	In_Bit8			
	Bus1_Duplex		R3	24 bit 0 (x01)	
	Bus2_Duplex		R3	24 bit 1 (x02)	
	Bus3_Duplex		R3	24 bit 2 (x04)	
	Bus4_Duplex		R3	24 bit 3 (x08)	
	Bus5_Duplex		R3	24 bit 4 (x10)	
	Bus6_Duplex		R3	24 bit 5 (x20)	
	Bus7_Duplex		R3	24 bit 6 (x40)	
	Bus8_Duplex		R3	24 bit 7 (x80)	
Op3_Tlk_Bus9-16	Operator 3 Talk Select Bus 9-16	In_Bit8			
	Bus9_Talk		R3	21 bit 0 (x01)	
	Bus10_Talk		R3	21 bit 1 (x02)	
	Bus11_Talk		R3	21 bit 2 (x04)	
	Bus12_Talk		R3	21 bit 3 (x08)	
	Bus13_Talk		R3	21 bit 4 (x10)	
	Bus14_Talk		R3	21 bit 5 (x20)	
	Bus15_Talk		R3	21 bit 6 (x40)	

	Bus16_Talk		R3	21 bit 7 (x80)
Op3_Lst_Bus9-16	Operator 3 Listen Select Bus 9-16	In_Bit8		
	Bus9_Listen		R3	23 bit 0 (x01)
	Bus10_Listen		R3	23 bit 1 (x02)
	Bus11_Listen		R3	23 bit 2 (x04)
	Bus12_Listen		R3	23 bit 3 (x08)
	Bus13_Listen		R3	23 bit 4 (x10)
	Bus14_Listen		R3	23 bit 5 (x20)
	Bus15_Listen		R3	23 bit 6 (x40)
	Bus16_Listen		R3	23 bit 7 (x80)
Op3_Dpl_Bus9-16	Operator 3 Duplex Select Bus 9-16	In_Bit8		
	Bus9_Duplex		R3	25 bit 0 (x01)
	Bus10_Duplex		R3	25 bit 1 (x02)
	Bus11_Duplex		R3	25 bit 2 (x04)
	Bus12_Duplex		R3	25 bit 3 (x08)
	Bus13_Duplex		R3	25 bit 4 (x10)
	Bus14_Duplex		R3	25 bit 5 (x20)
	Bus15_Duplex		R3	25 bit 6 (x40)
	Bus16_Duplex		R3	25 bit 7 (x80)
Op3_Bus1_Dpl	Operator 3 Bus1 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit0 (x01)
Op3_Bus1_TX	Operator 3 Bus1 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit0 (x01)
Op3_Bus2_Dpl	Operator 3 Bus2 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit1 (x02)
Op3_Bus2_TX	Operator 3 Bus2 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit1 (x02)
Op3_Bus3_Dpl	Operator 3 Bus3 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit2 (x04)
Op3_Bus3_TX	Operator 3 Bus3 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit2 (x04)
Op3_Bus4_Dpl	Operator 3 Bus4 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit3 (x08)
Op3_Bus4_TX	Operator 3 Bus4 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit3 (x08)
Op3_Bus5_Dpl	Operator 3 Bus5 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit4 (x10)
Op3_Bus5_TX	Operator 3 Bus5 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit4 (x10)
Op3_Bus6_Dpl	Operator 3 Bus6 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit5 (x20)
Op3_Bus6_TX	Operator 3 Bus6 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit5 (x20)

Op3_Bus7_Dpl	Operator 3 Bus7 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit6 (x40)
Op3_Bus7_TX	Operator 3 Bus7 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit6 (x40)
Op3_Bus8_Dpl	Operator 3 Bus8 Duplex Setting On = Full Duplex Operation	In_Bool	R3	24 bit7 (x80)
Op3_Bus8_TX	Operator 3 Bus8 Transmit Select On = Transmit Capability Selected	In_Bool	R3	20 bit7 (x80)
Op3_Bus9_Dpl	Operator 3 Bus9 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit0 (x01)
Op3_Bus9_TX	Operator 3 Bus9 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit0 (x01)
Op3_Bus10_Dpl	Operator 3 Bus10 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit1 (x02)
Op3_Bus10_TX	Operator 3 Bus10 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit1 (x02)
Op3_Bus11_Dpl	Operator 3 Bus11 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit2 (x04)
Op3_Bus11_TX	Operator 3 Bus11 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit2 (x04)
Op3_Bus12_Dpl	Operator 3 Bus12 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit3 (x08)
Op3_Bus12_TX	Operator 3 Bus12 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit3 (x08)
Op3_Bus13_Dpl	Operator 3 Bus13 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit4 (x10)
Op3_Bus13_TX	Operator 3 Bus13 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit4 (x10)
Op3_Bus14_Dpl	Operator 3 Bus14 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit5 (x20)
Op3_Bus14_TX	Operator 3 Bus14 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit5 (x20)
Op3_Bus15_Dpl	Operator 3 Bus15 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit6 (x40)
Op3_Bus15_TX	Operator 3 Bus15 Transmit Select On = Transmit Capability Selected	In_Bool	R3	21 bit6 (x40)
Op3_Bus16_Dpl	Operator 3 Bus16 Duplex Setting On = Full Duplex Operation	In_Bool	R3	25 bit7 (x80)
Op3_Bus16_TX	Operator 3 Bus16 Transmit Select	In_Bool	R3	21 bit7 (x80)

	On = Transmit Capability Selected				
Op3_Bus1_Vol	Operator 3 Bus 1 Volume Range: 0-9	In_Int	R3	0	1 bytes
Op3_Bus2_Vol	Operator 3 Bus 2 Volume Range: 0-9	In_Int	R3	1	1 bytes
Op3_Bus3_Vol	Operator 3 Bus 3 Volume Range: 0-9	In_Int	R3	2	1 bytes
Op3_Bus4_Vol	Operator 3 Bus 4 Volume Range: 0-9	In_Int	R3	3	1 bytes
Op3_Bus5_Vol	Operator 3 Bus 5 Volume Range: 0-9	In_Int	R3	4	1 bytes
Op3_Bus6_Vol	Operator 3 Bus 6 Volume Range: 0-9	In_Int	R3	5	1 bytes
Op3_Bus7_Vol	Operator 3 Bus 7 Volume Range: 0-9	In_Int	R3	6	1 bytes
Op3_Bus8_Vol	Operator 3 Bus 8 Volume Range: 0-9	In_Int	R3	7	1 bytes
Op3_Bus9_Vol	Operator 3 Bus 9 Volume Range: 0-9	In_Int	R3	8	1 bytes
Op3_Bus10_Vol	Operator 3 Bus 10 Volume Range: 0-9	In_Int	R3	9	1 bytes
Op3_Bus11_Vol	Operator 3 Bus 11 Volume Range: 0-9	In_Int	R3	10	1 bytes
Op3_Bus12_Vol	Operator 3 Bus 12 Volume Range: 0-9	In_Int	R3	11	1 bytes
Op3_Bus13_Vol	Operator 3 Bus 13 Volume Range: 0-9	In_Int	R3	12	1 bytes
Op3_Bus14_Vol	Operator 3 Bus 14 Volume Range: 0-9	In_Int	R3	13	1 bytes
Op3_Bus15_Vol	Operator 3 Bus 15 Volume Range: 0-9	In_Int	R3	14	1 bytes
Op3_Bus16_Vol	Operator 3 Bus 16 Volume Range: 0-9	In_Int	R3	15	1 bytes
Op3_LED_Output	Operator 3 LED On/Off Setting Output 4 LEDs; LSB -> MSB = Right -> Left	Out_Int	T3	0	1 bytes
Op4_PTT_HHT	Operator 4 PTT Signal from HHT	In_Bool	R4	19 bit0 (x01)	
Op4_Volume	Operator 4 Volume Level Range: 0-9	In_Int	R4	16	1 bytes

Op4_SideTone	Operator 4 Sidetone Level Range: 0-9	In_Int	R4	17	1 bytes
Op4_Vox_Lvl	Operator 4 Vox Level Range: 0-99	In_Int	R4	18	1 bytes
Op4_Vox_On/Off	Operator 4 Vox Enable	In_Bool	R4	19 bit1 (x02)	
Op4_Test	Operator 4 Test Mode Active On = Test Mode	In_Bool	R4	26 bit0 (x01)	
Op4_Test_Inv	Operator 4 Test Mode Inactive Inverse of Op1_Test	In_Bool	R4	26 bit0 (x01)	
Op4_Tlk_Bus1-8	Operator 4 Talk Select Bus 1-8	In_Bit8			
	Bus1_Talk		R4	20 bit 0 (x01)	
	Bus2_Talk		R4	20 bit 1 (x02)	
	Bus3_Talk		R4	20 bit 2 (x04)	
	Bus4_Talk		R4	20 bit 3 (x08)	
	Bus5_Talk		R4	20 bit 4 (x10)	
	Bus6_Talk		R4	20 bit 5 (x20)	
	Bus7_Talk		R4	20 bit 6 (x40)	
	Bus8_Talk		R4	20 bit 7 (x80)	
Op4_Lst_Bus1-8	Operator 4 Listen Select Bus 1-8	In_Bit8			
	Bus1_Listen		R4	22 bit 0 (x01)	
	Bus2_Listen		R4	22 bit 1 (x02)	
	Bus3_Listen		R4	22 bit 2 (x04)	
	Bus4_Listen		R4	22 bit 3 (x08)	
	Bus5_Listen		R4	22 bit 4 (x10)	
	Bus6_Listen		R4	22 bit 5 (x20)	
	Bus7_Listen		R4	22 bit 6 (x40)	
	Bus8_Listen		R4	22 bit 7 (x80)	
Op4_Dpl_Bus1-8	Operator 4 Duplex Select Bus 1-8	In_Bit8			
	Bus1_Duplex		R4	24 bit 0 (x01)	
	Bus2_Duplex		R4	24 bit 1 (x02)	
	Bus3_Duplex		R4	24 bit 2 (x04)	
	Bus4_Duplex		R4	24 bit 3 (x08)	
	Bus5_Duplex		R4	24 bit 4 (x10)	
	Bus6_Duplex		R4	24 bit 5 (x20)	
	Bus7_Duplex		R4	24 bit 6 (x40)	
	Bus8_Duplex		R4	24 bit 7 (x80)	
Op4_Tlk_Bus9-16	Operator 4 Talk Select Bus 9-16	In_Bit8			
	Bus9_Talk		R4	21 bit 0 (x01)	
	Bus10_Talk		R4	21 bit 1 (x02)	
	Bus11_Talk		R4	21 bit 2 (x04)	
	Bus12_Talk		R4	21 bit 3 (x08)	
	Bus13_Talk		R4	21 bit 4 (x10)	
	Bus14_Talk		R4	21 bit 5 (x20)	
	Bus15_Talk		R4	21 bit 6 (x40)	
	Bus16_Talk		R4	21 bit 7 (x80)	
Op4_Lst_Bus9-16	Operator 4 Listen Select Bus 9-16	In_Bit8			
	Bus9_Listen		R4	23 bit 0 (x01)	
	Bus10_Listen		R4	23 bit 1 (x02)	
	Bus11_Listen		R4	23 bit 2 (x04)	

	Bus12_Listen		R4	23 bit 3 (x08)
	Bus13_Listen		R4	23 bit 4 (x10)
	Bus14_Listen		R4	23 bit 5 (x20)
	Bus15_Listen		R4	23 bit 6 (x40)
	Bus16_Listen		R4	23 bit 7 (x80)
Op4_Dpl_Bus9-16	Operator 4 Duplex Select Bus 9-16	In_Bit8		
	Bus9_Duplex		R4	25 bit 0 (x01)
	Bus10_Duplex		R4	25 bit 1 (x02)
	Bus11_Duplex		R4	25 bit 2 (x04)
	Bus12_Duplex		R4	25 bit 3 (x08)
	Bus13_Duplex		R4	25 bit 4 (x10)
	Bus14_Duplex		R4	25 bit 5 (x20)
	Bus15_Duplex		R4	25 bit 6 (x40)
	Bus16_Duplex		R4	25 bit 7 (x80)
Op4_Bus1_Dpl	Operator 4 Bus1 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit0 (x01)
Op4_Bus1_TX	Operator 4 Bus1 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit0 (x01)
Op4_Bus2_Dpl	Operator 4 Bus2 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit1 (x02)
Op4_Bus2_TX	Operator 4 Bus2 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit1 (x02)
Op4_Bus3_Dpl	Operator 4 Bus3 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit2 (x04)
Op4_Bus3_TX	Operator 4 Bus3 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit2 (x04)
Op4_Bus4_Dpl	Operator 4 Bus4 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit3 (x08)
Op4_Bus4_TX	Operator 4 Bus4 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit3 (x08)
Op4_Bus5_Dpl	Operator 4 Bus5 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit4 (x10)
Op4_Bus5_TX	Operator 4 Bus5 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit4 (x10)
Op4_Bus6_Dpl	Operator 4 Bus6 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit5 (x20)
Op4_Bus6_TX	Operator 4 Bus6 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit5 (x20)
Op4_Bus7_Dpl	Operator 4 Bus7 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit6 (x40)
Op4_Bus7_TX	Operator 4 Bus7 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit6 (x40)

Op4_Bus8_Dpl	Operator 4 Bus8 Duplex Setting On = Full Duplex Operation	In_Bool	R4	24 bit7 (x80)	
Op4_Bus8_TX	Operator 4 Bus8 Transmit Select On = Transmit Capability Selected	In_Bool	R4	20 bit7 (x80)	
Op4_Bus9_Dpl	Operator 4 Bus9 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit0 (x01)	
Op4_Bus9_TX	Operator 4 Bus9 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit0 (x01)	
Op4_Bus10_Dpl	Operator 4 Bus10 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit1 (x02)	
Op4_Bus10_TX	Operator 4 Bus10 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit1 (x02)	
Op4_Bus11_Dpl	Operator 4 Bus11 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit2 (x04)	
Op4_Bus11_TX	Operator 4 Bus11 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit2 (x04)	
Op4_Bus12_Dpl	Operator 4 Bus12 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit3 (x08)	
Op4_Bus12_TX	Operator 4 Bus12 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit3 (x08)	
Op4_Bus13_Dpl	Operator 4 Bus13 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit4 (x10)	
Op4_Bus13_TX	Operator 4 Bus13 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit4 (x10)	
Op4_Bus14_Dpl	Operator 4 Bus14 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit5 (x20)	
Op4_Bus14_TX	Operator 4 Bus14 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit5 (x20)	
Op4_Bus15_Dpl	Operator 4 Bus15 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit6 (x40)	
Op4_Bus15_TX	Operator 4 Bus15 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit6 (x40)	
Op4_Bus16_Dpl	Operator 4 Bus16 Duplex Setting On = Full Duplex Operation	In_Bool	R4	25 bit7 (x80)	
Op4_Bus16_TX	Operator 4 Bus16 Transmit Select On = Transmit Capability Selected	In_Bool	R4	21 bit7 (x80)	
Op4_Bus1_Vol	Operator 4 Bus 1 Volume Range: 0-9	In_Int	R4	0	1 bytes
Op4_Bus2_Vol	Operator 4 Bus 2 Volume	In_Int	R4	1	1 bytes

	Range: 0-9				
Op4_Bus3_Vol	Operator 4 Bus 3 Volume Range: 0-9	In_Int	R4	2	1 bytes
Op4_Bus4_Vol	Operator 4 Bus 4 Volume Range: 0-9	In_Int	R4	3	1 bytes
Op4_Bus5_Vol	Operator 4 Bus 5 Volume Range: 0-9	In_Int	R4	4	1 bytes
Op4_Bus6_Vol	Operator 4 Bus 6 Volume Range: 0-9	In_Int	R4	5	1 bytes
Op4_Bus7_Vol	Operator 4 Bus 7 Volume Range: 0-9	In_Int	R4	6	1 bytes
Op4_Bus8_Vol	Operator 4 Bus 8 Volume Range: 0-9	In_Int	R4	7	1 bytes
Op4_Bus9_Vol	Operator 4 Bus 9 Volume Range: 0-9	In_Int	R4	8	1 bytes
Op4_Bus10_Vol	Operator 4 Bus 10 Volume Range: 0-9	In_Int	R4	9	1 bytes
Op4_Bus11_Vol	Operator 4 Bus 11 Volume Range: 0-9	In_Int	R4	10	1 bytes
Op4_Bus12_Vol	Operator 4 Bus 12 Volume Range: 0-9	In_Int	R4	11	1 bytes
Op4_Bus13_Vol	Operator 4 Bus 13 Volume Range: 0-9	In_Int	R4	12	1 bytes
Op4_Bus14_Vol	Operator 4 Bus 14 Volume Range: 0-9	In_Int	R4	13	1 bytes
Op4_Bus15_Vol	Operator 4 Bus 15 Volume Range: 0-9	In_Int	R4	14	1 bytes
Op4_Bus16_Vol	Operator 4 Bus 16 Volume Range: 0-9	In_Int	R4	15	1 bytes
Op4_LED_Output	Operator 4 LED On/Off Setting Output 4 LEDs; LSB -> MSB = Right -> Left	Out_Int	T4	0	1 bytes
Op5_PTT_HHT	Operator 5 PTT Signal from HHT	In_Bool	R5	19 bit0 (x01)	
Op5_Volume	Operator 5 Volume Level Range: 0-9	In_Int	R5	16	1 bytes
Op5_SideTone	Operator 5 Sidetone Level Range: 0-9	In_Int	R5	17	1 bytes
Op5_Vox_Lvl	Operator 5 Vox Level Range: 0-99	In_Int	R5	18	1 bytes

Op5_Vox_On/Off	Operator 5 Vox Enable	In_Bool	R5	19 bit1 (x02)
Op5_Test	Operator 5 Test Mode Active On = Test Mode	In_Bool	R5	26 bit0 (x01)
Op5_Test_Inv	Operator 5 Test Mode Inactive Inverse of Op1_Test	In_Bool	R5	26 bit0 (x01)
Op5_Tlk_Bus1-8	Operator 5 Talk Select Bus 1-8	In_Bit8		
	Bus1_Talk		R5	20 bit 0 (x01)
	Bus2_Talk		R5	20 bit 1 (x02)
	Bus3_Talk		R5	20 bit 2 (x04)
	Bus4_Talk		R5	20 bit 3 (x08)
	Bus5_Talk		R5	20 bit 4 (x10)
	Bus6_Talk		R5	20 bit 5 (x20)
	Bus7_Talk		R5	20 bit 6 (x40)
	Bus8_Talk		R5	20 bit 7 (x80)
Op5_Lst_Bus1-8	Operator 5 Listen Select Bus 1-8	In_Bit8		
	Bus1_Listen		R5	22 bit 0 (x01)
	Bus2_Listen		R5	22 bit 1 (x02)
	Bus3_Listen		R5	22 bit 2 (x04)
	Bus4_Listen		R5	22 bit 3 (x08)
	Bus5_Listen		R5	22 bit 4 (x10)
	Bus6_Listen		R5	22 bit 5 (x20)
	Bus7_Listen		R5	22 bit 6 (x40)
	Bus8_Listen		R5	22 bit 7 (x80)
Op5_Dpl_Bus1-8	Operator 5 Duplex Select Bus 1-8	In_Bit8		
	Bus1_Duplex		R5	24 bit 0 (x01)
	Bus2_Duplex		R5	24 bit 1 (x02)
	Bus3_Duplex		R5	24 bit 2 (x04)
	Bus4_Duplex		R5	24 bit 3 (x08)
	Bus5_Duplex		R5	24 bit 4 (x10)
	Bus6_Duplex		R5	24 bit 5 (x20)
	Bus7_Duplex		R5	24 bit 6 (x40)
	Bus8_Duplex		R5	24 bit 7 (x80)
Op5_Tlk_Bus9-16	Operator 5 Talk Select Bus 9-16	In_Bit8		
	Bus9_Talk		R5	21 bit 0 (x01)
	Bus10_Talk		R5	21 bit 1 (x02)
	Bus11_Talk		R5	21 bit 2 (x04)
	Bus12_Talk		R5	21 bit 3 (x08)
	Bus13_Talk		R5	21 bit 4 (x10)
	Bus14_Talk		R5	21 bit 5 (x20)
	Bus15_Talk		R5	21 bit 6 (x40)
	Bus16_Talk		R5	21 bit 7 (x80)
Op5_Lst_Bus9-16	Operator 5 Listen Select Bus 9-16	In_Bit8		
	Bus9_Listen		R5	23 bit 0 (x01)
	Bus10_Listen		R5	23 bit 1 (x02)
	Bus11_Listen		R5	23 bit 2 (x04)
	Bus12_Listen		R5	23 bit 3 (x08)
	Bus13_Listen		R5	23 bit 4 (x10)
	Bus14_Listen		R5	23 bit 5 (x20)
	Bus15_Listen		R5	23 bit 6 (x40)
	Bus16_Listen		R5	23 bit 7 (x80)

Op5_Dpl_Bus9-16	Operator 5 Duplex Select Bus 9-16	In_Bit8		
	Bus9_Duplex		R5	25 bit 0 (x01)
	Bus10_Duplex		R5	25 bit 1 (x02)
	Bus11_Duplex		R5	25 bit 2 (x04)
	Bus12_Duplex		R5	25 bit 3 (x08)
	Bus13_Duplex		R5	25 bit 4 (x10)
	Bus14_Duplex		R5	25 bit 5 (x20)
	Bus15_Duplex		R5	25 bit 6 (x40)
	Bus16_Duplex		R5	25 bit 7 (x80)
Op5_Bus1_Dpl	Operator 5 Bus1 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit0 (x01)
Op5_Bus1_TX	Operator 5 Bus1 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit0 (x01)
Op5_Bus2_Dpl	Operator 5 Bus2 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit1 (x02)
Op5_Bus2_TX	Operator 5 Bus2 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit1 (x02)
Op5_Bus3_Dpl	Operator 5 Bus3 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit2 (x04)
Op5_Bus3_TX	Operator 5 Bus3 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit2 (x04)
Op5_Bus4_Dpl	Operator 5 Bus4 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit3 (x08)
Op5_Bus4_TX	Operator 5 Bus4 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit3 (x08)
Op5_Bus5_Dpl	Operator 5 Bus5 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit4 (x10)
Op5_Bus5_TX	Operator 5 Bus5 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit4 (x10)
Op5_Bus6_Dpl	Operator 5 Bus6 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit5 (x20)
Op5_Bus6_TX	Operator 5 Bus6 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit5 (x20)
Op5_Bus7_Dpl	Operator 5 Bus7 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit6 (x40)
Op5_Bus7_TX	Operator 5 Bus7 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit6 (x40)
Op5_Bus8_Dpl	Operator 5 Bus8 Duplex Setting On = Full Duplex Operation	In_Bool	R5	24 bit7 (x80)
Op5_Bus8_TX	Operator 5 Bus8 Transmit Select On = Transmit Capability Selected	In_Bool	R5	20 bit7 (x80)

Op5_Bus9_Dpl	Operator 5 Bus9 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit0 (x01)	
Op5_Bus9_TX	Operator 5 Bus9 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit0 (x01)	
Op5_Bus10_Dpl	Operator 5 Bus10 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit1 (x02)	
Op5_Bus10_TX	Operator 5 Bus10 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit1 (x02)	
Op5_Bus11_Dpl	Operator 5 Bus11 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit2 (x04)	
Op5_Bus11_TX	Operator 5 Bus11 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit2 (x04)	
Op5_Bus12_Dpl	Operator 5 Bus12 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit3 (x08)	
Op5_Bus12_TX	Operator 5 Bus12 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit3 (x08)	
Op5_Bus13_Dpl	Operator 5 Bus13 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit4 (x10)	
Op5_Bus13_TX	Operator 5 Bus13 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit4 (x10)	
Op5_Bus14_Dpl	Operator 5 Bus14 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit5 (x20)	
Op5_Bus14_TX	Operator 5 Bus14 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit5 (x20)	
Op5_Bus15_Dpl	Operator 5 Bus15 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit6 (x40)	
Op5_Bus15_TX	Operator 5 Bus15 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit6 (x40)	
Op5_Bus16_Dpl	Operator 5 Bus16 Duplex Setting On = Full Duplex Operation	In_Bool	R5	25 bit7 (x80)	
Op5_Bus16_TX	Operator 5 Bus16 Transmit Select On = Transmit Capability Selected	In_Bool	R5	21 bit7 (x80)	
Op5_Bus1_Vol	Operator 5 Bus 1 Volume Range: 0-9	In_Int	R5	0	1 bytes
Op5_Bus2_Vol	Operator 5 Bus 2 Volume Range: 0-9	In_Int	R5	1	1 bytes
Op5_Bus3_Vol	Operator 5 Bus 3 Volume Range: 0-9	In_Int	R5	2	1 bytes
Op5_Bus4_Vol	Operator 5 Bus 4 Volume	In_Int	R5	3	1 bytes

	Range: 0-9				
Op5_Bus5_Vol	Operator 5 Bus 5 Volume Range: 0-9	In_Int	R5	4	1 bytes
Op5_Bus6_Vol	Operator 5 Bus 6 Volume Range: 0-9	In_Int	R5	5	1 bytes
Op5_Bus7_Vol	Operator 5 Bus 7 Volume Range: 0-9	In_Int	R5	6	1 bytes
Op5_Bus8_Vol	Operator 5 Bus 8 Volume Range: 0-9	In_Int	R5	7	1 bytes
Op5_Bus9_Vol	Operator 5 Bus 9 Volume Range: 0-9	In_Int	R5	8	1 bytes
Op5_Bus10_Vol	Operator 5 Bus 10 Volume Range: 0-9	In_Int	R5	9	1 bytes
Op5_Bus11_Vol	Operator 5 Bus 11 Volume Range: 0-9	In_Int	R5	10	1 bytes
Op5_Bus12_Vol	Operator 5 Bus 12 Volume Range: 0-9	In_Int	R5	11	1 bytes
Op5_Bus13_Vol	Operator 5 Bus 13 Volume Range: 0-9	In_Int	R5	12	1 bytes
Op5_Bus14_Vol	Operator 5 Bus 14 Volume Range: 0-9	In_Int	R5	13	1 bytes
Op5_Bus15_Vol	Operator 5 Bus 15 Volume Range: 0-9	In_Int	R5	14	1 bytes
Op5_Bus16_Vol	Operator 5 Bus 16 Volume Range: 0-9	In_Int	R5	15	1 bytes
Op5_LED_Output	Operator 5 LED On/Off Setting Output 4 LEDs; LSB -> MSB = Right -> Left	Out_Int	T5	0	1 bytes
Op6_PTT_HHT	Operator 6 PTT Signal from HHT	In_Bool	R6	19 bit0 (x01)	
Op6_Volume	Operator 6 Volume Level Range: 0-9	In_Int	R6	16	1 bytes
Op6_SideTone	Operator 6 Sidetone Level Range: 0-9	In_Int	R6	17	1 bytes
Op6_Vox_Lvl	Operator 6 Vox Level Range: 0-99	In_Int	R6	18	1 bytes
Op6_Vox_On/Off	Operator 6 Vox Enable	In_Bool	R6	19 bit1 (x02)	
Op6_Test	Operator 6 Test Mode Active On = Test Mode	In_Bool	R6	26 bit0 (x01)	
Op6_Test_Inv	Operator 6 Test Mode Inactive	In_Bool	R6	26 bit0 (x01)	

	Inverse of Op1_Test			
Op6_Tlk_Bus1-8	Operator 6 Talk Select Bus 1-8	In_Bit8		
	Bus1_Talk		R6	20 bit 0 (x01)
	Bus2_Talk		R6	20 bit 1 (x02)
	Bus3_Talk		R6	20 bit 2 (x04)
	Bus4_Talk		R6	20 bit 3 (x08)
	Bus5_Talk		R6	20 bit 4 (x10)
	Bus6_Talk		R6	20 bit 5 (x20)
	Bus7_Talk		R6	20 bit 6 (x40)
	Bus8_Talk		R6	20 bit 7 (x80)
Op6_Lst_Bus1-8	Operator 6 Listen Select Bus 1-8	In_Bit8		
	Bus1_Listen		R6	22 bit 0 (x01)
	Bus2_Listen		R6	22 bit 1 (x02)
	Bus3_Listen		R6	22 bit 2 (x04)
	Bus4_Listen		R6	22 bit 3 (x08)
	Bus5_Listen		R6	22 bit 4 (x10)
	Bus6_Listen		R6	22 bit 5 (x20)
	Bus7_Listen		R6	22 bit 6 (x40)
	Bus8_Listen		R6	22 bit 7 (x80)
Op6_Dpl_Bus1-8	Operator 6 Duplex Select Bus 1-8	In_Bit8		
	Bus1_Duplex		R6	24 bit 0 (x01)
	Bus2_Duplex		R6	24 bit 1 (x02)
	Bus3_Duplex		R6	24 bit 2 (x04)
	Bus4_Duplex		R6	24 bit 3 (x08)
	Bus5_Duplex		R6	24 bit 4 (x10)
	Bus6_Duplex		R6	24 bit 5 (x20)
	Bus7_Duplex		R6	24 bit 6 (x40)
	Bus8_Duplex		R6	24 bit 7 (x80)
Op6_Tlk_Bus9-16	Operator 6 Talk Select Bus 9-16	In_Bit8		
	Bus9_Talk		R6	21 bit 0 (x01)
	Bus10_Talk		R7	21 bit 1 (x02)
	Bus11_Talk		R6	21 bit 2 (x04)
	Bus12_Talk		R6	21 bit 3 (x08)
	Bus13_Talk		R6	21 bit 4 (x10)
	Bus14_Talk		R6	21 bit 5 (x20)
	Bus15_Talk		R6	21 bit 6 (x40)
	Bus16_Talk		R6	21 bit 7 (x80)
Op6_Lst_Bus9-16	Operator 6 Listen Select Bus 9-16	In_Bit8		
	Bus9_Listen		R6	23 bit 0 (x01)
	Bus10_Listen		R6	23 bit 1 (x02)
	Bus11_Listen		R6	23 bit 2 (x04)
	Bus12_Listen		R6	23 bit 3 (x08)
	Bus13_Listen		R6	23 bit 4 (x10)
	Bus14_Listen		R6	23 bit 5 (x20)
	Bus15_Listen		R6	23 bit 6 (x40)
	Bus16_Listen		R6	23 bit 7 (x80)
Op6_Dpl_Bus9-16	Operator 6 Duplex Select Bus 9-16	In_Bit8		
	Bus9_Duplex		R6	25 bit 0 (x01)
	Bus10_Duplex		R6	25 bit 1 (x02)
	Bus11_Duplex		R6	25 bit 2 (x04)
	Bus12_Duplex		R6	25 bit 3 (x08)
	Bus13_Duplex		R6	25 bit 4 (x10)

	Bus14_Duplex		R6	25 bit 5 (x20)
	Bus15_Duplex		R6	25 bit 6 (x40)
	Bus16_Duplex		R6	25 bit 7 (x80)
Op6_Bus1_Dpl	Operator 6 Bus1 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit0 (x01)
Op6_Bus1_TX	Operator 6 Bus1 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit0 (x01)
Op6_Bus2_Dpl	Operator 6 Bus2 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit1 (x02)
Op6_Bus2_TX	Operator 6 Bus2 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit1 (x02)
Op6_Bus3_Dpl	Operator 6 Bus3 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit2 (x04)
Op6_Bus3_TX	Operator 6 Bus3 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit2 (x04)
Op6_Bus4_Dpl	Operator 6 Bus4 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit3 (x08)
Op6_Bus4_TX	Operator 6 Bus4 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit3 (x08)
Op6_Bus5_Dpl	Operator 6 Bus5 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit4 (x10)
Op6_Bus5_TX	Operator 6 Bus5 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit4 (x10)
Op6_Bus6_Dpl	Operator 6 Bus6 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit5 (x20)
Op6_Bus6_TX	Operator 6 Bus6 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit5 (x20)
Op6_Bus7_Dpl	Operator 6 Bus7 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit6 (x40)
Op6_Bus7_TX	Operator 6 Bus7 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit6 (x40)
Op6_Bus8_Dpl	Operator 6 Bus8 Duplex Setting On = Full Duplex Operation	In_Bool	R6	24 bit7 (x80)
Op6_Bus8_TX	Operator 6 Bus8 Transmit Select On = Transmit Capability Selected	In_Bool	R6	20 bit7 (x80)
Op6_Bus9_Dpl	Operator 6 Bus9 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit0 (x01)
Op6_Bus9_TX	Operator 6 Bus9 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit0 (x01)

Op6_Bus10_Dpl	Operator 6 Bus10 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit1 (x02)	
Op6_Bus10_TX	Operator 6 Bus10 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit1 (x02)	
Op6_Bus11_Dpl	Operator 6 Bus11 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit2 (x04)	
Op6_Bus11_TX	Operator 6 Bus11 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit2 (x04)	
Op6_Bus12_Dpl	Operator 6 Bus12 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit3 (x08)	
Op6_Bus12_TX	Operator 6 Bus12 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit3 (x08)	
Op6_Bus13_Dpl	Operator 6 Bus13 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit4 (x10)	
Op6_Bus13_TX	Operator 6 Bus13 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit4 (x10)	
Op6_Bus14_Dpl	Operator 6 Bus14 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit5 (x20)	
Op6_Bus14_TX	Operator 6 Bus14 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit5 (x20)	
Op6_Bus15_Dpl	Operator 6 Bus15 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit6 (x40)	
Op6_Bus15_TX	Operator 6 Bus15 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit6 (x40)	
Op6_Bus16_Dpl	Operator 6 Bus16 Duplex Setting On = Full Duplex Operation	In_Bool	R6	25 bit7 (x80)	
Op6_Bus16_TX	Operator 6 Bus16 Transmit Select On = Transmit Capability Selected	In_Bool	R6	21 bit7 (x80)	
Op6_Bus1_Vol	Operator 6 Bus 1 Volume Range: 0-9	In_Int	R6	0	1 bytes
Op6_Bus2_Vol	Operator 6 Bus 2 Volume Range: 0-9	In_Int	R6	1	1 bytes
Op6_Bus3_Vol	Operator 6 Bus 3 Volume Range: 0-9	In_Int	R6	2	1 bytes
Op6_Bus4_Vol	Operator 6 Bus 4 Volume Range: 0-9	In_Int	R6	3	1 bytes
Op6_Bus5_Vol	Operator 6 Bus 5 Volume Range: 0-9	In_Int	R6	4	1 bytes
Op6_Bus6_Vol	Operator 6 Bus 6 Volume	In_Int	R6	5	1 bytes

	Range: 0-9				
Op6_Bus7_Vol	Operator 6 Bus 7 Volume Range: 0-9	In_Int	R6	6	1 bytes
Op6_Bus8_Vol	Operator 6 Bus 8 Volume Range: 0-9	In_Int	R6	7	1 bytes
Op6_Bus9_Vol	Operator 6 Bus 9 Volume Range: 0-9	In_Int	R6	8	1 bytes
Op6_Bus10_Vol	Operator 6 Bus 10 Volume Range: 0-9	In_Int	R6	9	1 bytes
Op6_Bus11_Vol	Operator 6 Bus 11 Volume Range: 0-9	In_Int	R6	10	1 bytes
Op6_Bus12_Vol	Operator 6 Bus 12 Volume Range: 0-9	In_Int	R6	11	1 bytes
Op6_Bus13_Vol	Operator 6 Bus 13 Volume Range: 0-9	In_Int	R6	12	1 bytes
Op6_Bus14_Vol	Operator 6 Bus 14 Volume Range: 0-9	In_Int	R6	13	1 bytes
Op6_Bus15_Vol	Operator 6 Bus 15 Volume Range: 0-9	In_Int	R6	14	1 bytes
Op6_Bus16_Vol	Operator 6 Bus 16 Volume Range: 0-9	In_Int	R6	15	1 bytes
Op6_LED_Output	Operator 6 LED On/Off Setting Output 4 LEDs; LSB -> MSB = Right -> Left	Out_Int	T6	0	1 bytes
Bus1-8_Act	Bus 1-8 Activity Indication TX Port T2, Bytes 0-7	Out_Sig8	T200	0	1 bytes
Bus9-16_Act	Bus 9-16 Activity Indication TX Port T2, Bytes 8-15	Out_Sig8	T200	8	1 bytes