



VSTx

HD/SD COFDM Transmitter



User Manual

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IMT VSTx Users Manual

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This product has been approved by the following regulatory bodies at 2400 – 2483.5 MHz:

FCC (USA)
IC (Canada)

CAUTION!

**RISK OF ELECTRICAL SHOCK.
DO NOT REMOVE COVERS.**

- Do not remove any covers
- Refer servicing to qualified technicians only
- Disconnect all power before servicing
- Read and perform all instructions carefully
- Failure to follow suggested instructions and guidelines may void all warranties

PRUDENCE!

RISQUE DE CHOC ÉLECTRIQUE. NE SUPPRIMEZ PAS LES COUVERTURES.

- Ne supprimez pas les couvertures
- Voir entretien à qualifiés Techniciens seulement.
- Déconnectez tous les pouvoir avant l'entretien.
- Lecture et effectuer toutes les instructions attentivement.
- Échec de suivre les lignes directrices et les instructions proposées peut-être annuler toutes les garanties.

FCC STATEMENT

This equipment (FCC ID: I4U-25VST) has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

DÉCLARATION DE FAC

Cet équipement (FCC ID: I4U-25VST) a été testé et de respecter les limites pour une classe b dispositif numérique, conformément à la partie 15 des règles de la FCC.

FCC CAUTION/ PRUDENCE DE FAC

Any change or modification not approved by the party responsible for compliance could void the user's authority to operate this device.

This device requires professional installation.

For operation within 2400 – 2483.5 MHz frequency range, the maximum EIRP must be less than 36 dBm. The qualified antenna types to be used with this device include:
dipole antenna (3dBi or 5dBi)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

In order to maintain compliance with the FCC RF exposure guidelines, this device should be installed and operated with a minimum distance of 20cm between the radiator, and the body of the operator and/or nearby persons.

Tout changement ou modification non approuvé par la partie responsable de la conformité pouvait annuler l'autorisation de l'utilisateur pour l'exploitation de ce dispositif.

Ce dispositif nécessite l'installation professionnelle.

Pour l'opération au sein de la gamme de fréquences de 2400 – 2483.5 MHz, la pire maximale doit être inférieure à 36 dBm. Les types d'antenne qualifiés pour être utilisé avec ce dispositif, citons :

Antenne dipôle faible Gain (3dBi ou 5 dBi).

Cet appareil est conforme à la partie 15 des règles de la FCC. Opération est soumis à deux conditions suivantes: (1) ce dispositif ne peut pas causer de brouillage préjudiciable, et (2) ce dispositif doit accepter toute ingérence a reçu, y compris le brouillage qui peut provoquer l'opération non désirée.

Afin de maintenir la conformité avec les directives d'exposition RF FCC, ce dispositif doit être installé et exploité avec une distance minimale de 20 cm entre le radiateur et le corps de l'opérateur ou à proximité de personnes.

IC Notice/IC Avis

1. Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

2. This radio transmitter (IC: 9479A-25VST) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

<u>Antenna Approved/Antenne approuvé</u>		
<u>Type/Type</u>	<u>Max. Gain/Max. Gain</u>	<u>Impedance/Impédance</u>
<u>Dipole Antennas/ dipôle antennes</u>	<u>5 dBi</u>	<u>50 Ω</u>

3. This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

4. In order to maintain compliance with the IC RF exposure guidelines, this device should be installed and operated with a minimum distance of 20 cm between the radiator, and the body of the operator and/or nearby persons.

Afin de maintenir la conformité avec les directives d'exposition RF IC, ce dispositif doit être installé et exploité avec une distance minimale de 20 cm entre le radiateur et le corps de l'opérateur ou à proximité de personnes.

FCC / IC Label Requirement

If the FCC /IC ID is not visible when the I4U-25VST / 9479A-25VST module is installed inside another OEM device, then the outside of the OEM device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: I4U-25VST”/ IC: 9479A-25VST” or “Contains FCC ID: I4U-25VST. / IC: 9479A-25VST” Any similar wording that expresses the same meaning may be used.

FAC / IC Label exigence

SI LE FCC /IC ID N'EST PAS VISIBLE LORSQUE LA I4U-25VST / 9479A-25VST MODULE EST INSTALLÉ À L'INTÉRIEUR D'UN AUTRE PÉRIPHÉRIQUE OEM, ALORS QUE L'EXTÉRIEUR DE L'APPAREIL OEM DANS LEQUEL EST INSTALLÉ LE MODULE DOIT ÉGALEMENT AFFICHER UNE ÉTIQUETTE SE RÉFÉRANT AU MODULE CI-JOINT. CETTE ÉTIQUETTE EXTÉRIEURE PEUT UTILISER LIBELLÉ COMME SUIV : "CONTAINS ÉMETTEUR MODULE ID FCC: I4U-25VST" / IC: 9479A-25VST "OU" CONTAINS FCC ID: I4U-25VST. / IC: 9479A-25VST "TOUTE FORMULATION SEMBLABLE QUI EXPRIME LE MÊME SENS PEUT-ÊTRE ÊTRE UTILISÉE.

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Chapter One **1**

Introduction

1 Introduction

This document is a user manual for IMT's VSTx microwave video transmitter. The VSTx is a compact transmitter that digitally encodes video signals and transmits them using COFDM modulation over microwave frequencies using secure methods. The unit accepts Composite video inputs in NTSC ~~or PAL~~ format. It has a built in MPEG4 (H.264) encoder and COFDM modulator. The VSTx is housed in an ultra compact, lightweight enclosure ~~that can be used in harsh environments.~~

The VSTx comes in two versions, a "connectorized" version which has connectors for typical user inputs and outputs and a user interface panel, and a "ribbon cable" version which has no external connectors or controls.

Throughout this manual, the product is referred to as the "VSTx," the "VSTx transmitter", or simply the "transmitter."

1.1 Manual Overview

The contents of this manual are as follows:

Chapter 2 - Describes the theory of operation and the features of the VSTx.

Chapter 3 - Contains a list of the VSTx specifications. The specifications include transmitter feature specifications, power requirements, environmental specifications, and I/O specifications.

Chapter 4 - Explains how to install the VSTx.

Chapter 5 - Describes operating procedures for the VSTx. It also contains an overview of the VSTx programmable serial interface.

A preface at the front of this manual contains Warranty and Repair information.

The rear of this manual contains warranty and repair information.

Chapter Two **2**

Description

2 VSTx Description

This chapter describes the VSTx transmitter theory of operation, features, and benefits. It also contains a block diagram of the VSTx transmitter circuitry and a typical application example.

The VSTx is available in two basic versions:

- VSTx with external input connectors
- VSTx with ribbon cable interface

The VSTx with external connectors features direct plug-in compatibility with off the shelf equipment using industry standard interfaces.

The VSTx using a ribbon cable interface is slightly smaller and is useful for space optimized solutions. Audio and Video are input to the VSTx through the ribbon cable. A programmable user interface is also accessed via a serial port in the ribbon cable. This can be used to pre-configure the VSTx settings and to check the status of the VSTx settings. Power is also supplied to the VSTx through the ribbon cable.

The VSTx internal circuitry compresses the audio and video signals, organizes the compressed data into ISO digital video transport streams, and optionally encrypts the data. The transmitter uses COFDM modulation and transmits at microwave frequencies in the bands supported by the unit.

Though the unit ships pre-configured, a graphical user interface that runs on a PC is available to modify the operating parameters. Optionally, custom software written to implement the RS232 command set may be used. Refer to Chapter 5, “Operation” for more information.

IMT has the ability, should the need ever arise, to provide the user with firmware files and instructions for local firmware installation, such as for feature upgrades, etc.

2.1 VSTx Features and Benefits

Table 2-1: VSTx - Summary of High Level Features and Benefits

Feature	Benefit
COFDM Microwave Digital Video Transmitter	Microwave output frequencies in the L, S, C , and <u>C bands</u> . X bands .
L, S, C, and <u>X-C</u> Band Transmitter Output Frequencies	User orderable frequency band options. User programmable channels and offsets within frequency ranges.
Accepts NTSC or PAL Composite Video Inputs	Compatible with industry standard video camera outputs.
Optional Stereo Analog Audio Inputs	Direct audio input option for use with video signals that do not contain audio.

MPEG4 (H.264) Encoder	Industry standard video compression. Implements latest algorithms including B frames.
User Data Channel	Data can be transmitted along with audio and video to the receiver <u>on the ribbon version only</u> .
Remote Control GUI for Programming the VSTx	Convenient menu and button based graphical user interface for Windows PC's. Can be used to program the preset settings on the top panel. GUI uses VSTx RS-232 remote control serial port.
Ultra Compact Housing	Fits in small form factor products.
Optional Ribbon I/O Cable	The VSTx uses a compact, flexible ribbon cable to connect to other equipment.

2.1.1 VSTx Application Diagram

Figure 2-1 shows a typical VSTx transmitter application. The External Equipment Interface connects to other circuits using a ribbon cable. An antenna is connected to the SMA (or RP-SMA for 25VST) antenna output port.

The VSTx may be programmed by a host processor in the application, or it may be pre-configured and installed in the application without programming during operation. The latter approach can save expense in cost sensitive applications.

Commonly used configurations can be setup and stored in the VSTx memory as “preset” configurations. Up to 16 presets can be stored. Once presets have been stored, fewer commands are required to change between configurations.

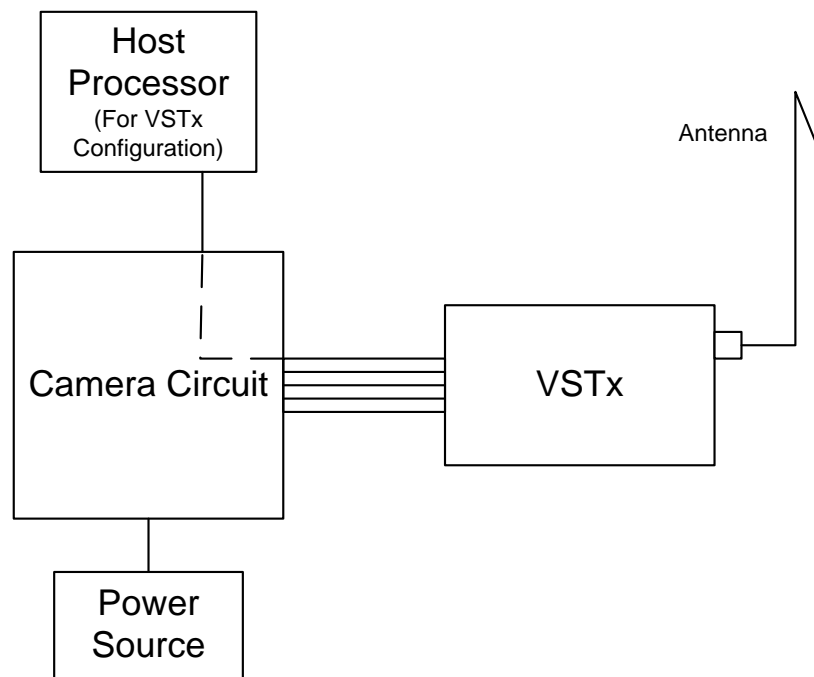


Figure 2-1: VSTx Application

2.1 VSTx Theory of Operation

2.1.1 VSTx Block Diagram

Figure 2-2 is a block diagram of the VSTx internal circuitry.

Major blocks in the VSTx include:

- NTSC Composite Video Input Interface
- Stereo Audio Input Interface
- MPEG4 Video Compression Circuit
- Data Encryption Circuit
- COFDM Modulator
- Microwave Transmitter and Antenna Connector
- Programmers Serial Interface for Remote Control Purposes
- Internal Microprocessor and Memory
- USB Interface for Firmware Updates
- Power Circuitry

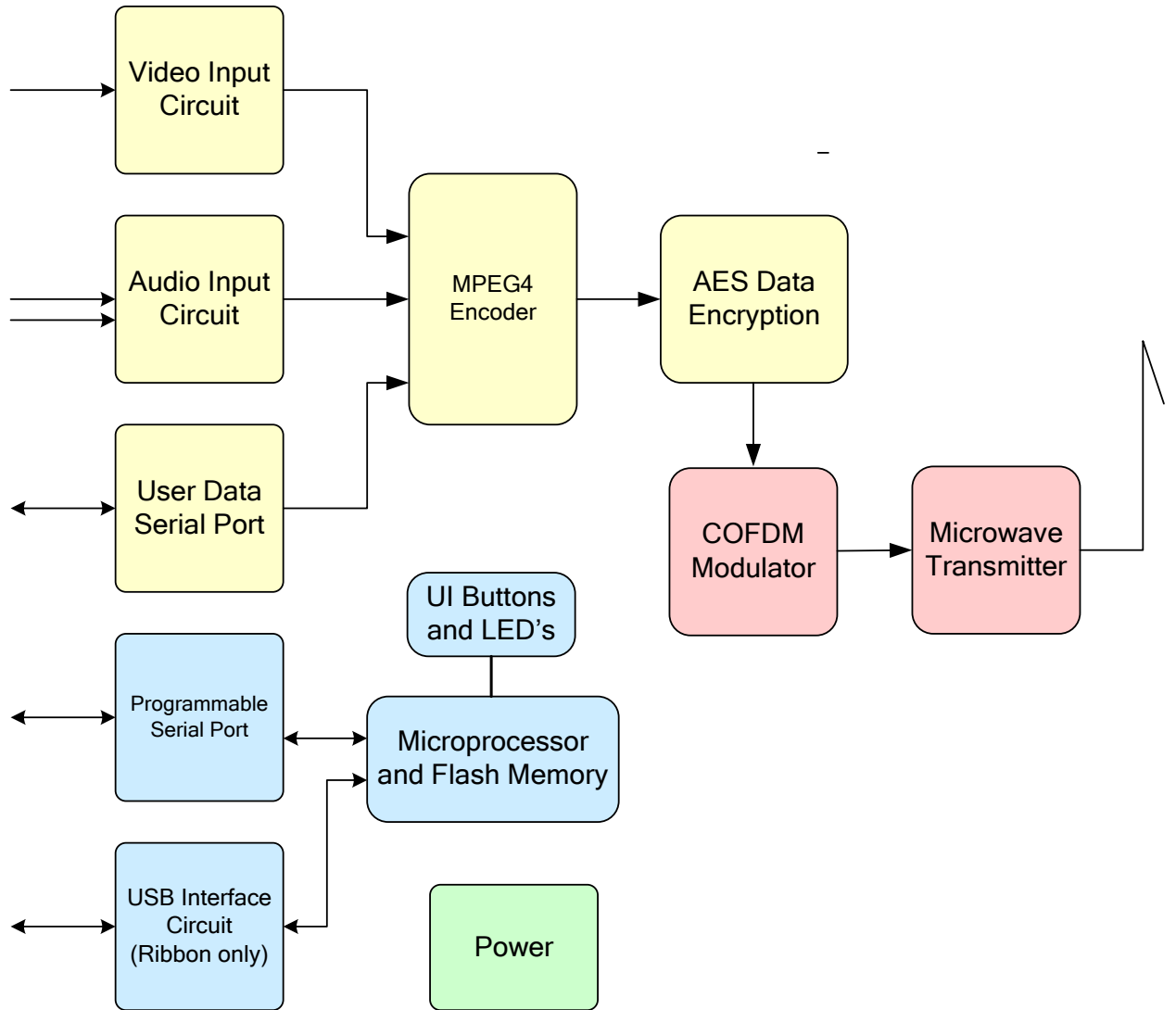


Figure 2-2: ~~IMT-Nucomm~~ VSTx Internal Block Diagram

2.1.2 Power and Control Interface Connector

The VSTx Power and Control Interface includes power and ground connections plus two RS-232 serial port interfaces. One of the RS-232 interfaces can be connected to a laptop or other PC to program the transmitter configuration. The second RS-232 interface can be used to transmit user data through the transmitter along with the audio and video streams.

2.1.3 Audio and Video Input Connectors

This VSTx model has two analog audio inputs that can be used for stereo audio and one NTSC or PAL composite video input. Refer to Chapter 3 for specifications of these signals.

2.1.4 User Data Input

User Data is available on the ribbon version only. In the “ribbon” version a data channel may be transmitted along with the audio and video information. The data channel is accessed through a separate RS-232 serial interface on the ribbon connector in the Power/Control connector.

2.1.5 MPEG4 Encoder

The VSTx compresses the input video signal before modulation and transmission to reduce bandwidth. The VSTx contains a built-in MPEG4 (H.264) compliant encoder for this purpose. The VSTx features the latest compression methods utilizing B frames for more accurate encoding of compressed video signals.

2.1.6 Encryption

The transmitter supports BCRYPT1 and BCRYPT2. BCRYPT2 is very similar to BCRYPT1 with improvements made to support re-multiplexing. Both encryption modes support AES 128 and AES256 key lengths.

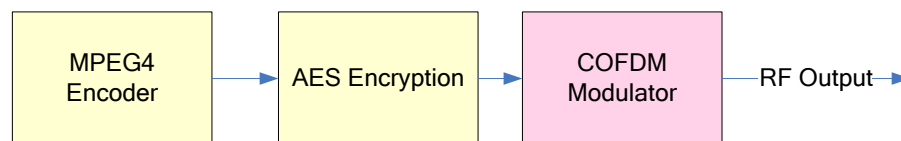


Figure 2-3 - Encryption Circuit

2.1.7 COFDM Modulator

The COFDM modulator receives data from the output of the MPEG4 encoder through a circuit that enhances the security of transmissions.

The VSTx is able to transmit data at high data rates and with low error rates using COFDM modulation techniques. The data rate used by the transmitter depends upon the COFDM modulator settings used.

Refer to Chapter 5, “Operation” for more information.

2.1.8 L, S, ~~and C Band~~, and X-Band Transmitter

The VSTx microwave transmitter circuits mix the signal to the desired microwave frequency. The signal is filtered and boosted through a low noise output amplifier.

The VSTx has a single SMA (or RP-SMA for 25VST) style antenna connector. The output impedance of the antenna connector is 50 ohms.

Refer to Chapter 3, “Specifications” for frequency band and channel tuning specifications.

2.1.9 Ultra Compact Case

The VSTx case is compact and can be screw mounted to other surfaces.

The VSTx contains a PCB near the lower surface of the unit. The bottom of the VSTx dissipates most of the VSTx heat. Thus it is important to mount the VSTx in a manner which keeps the bottom surface of the VSTx within the transmitter’s operating temperature range.

Refer to Chapter 4, “Installation,” for more information about the VSTx housing, connector pin assignments, and antenna port.

2.1 Remote Control and Firmware

2.1.1 Remote Control via Serial Interface

An RS-232 command set is implemented to allow remote control of all configuration options, as well as monitoring of internal status and settings. Commands and responses are sent via the RS-232 serial interface located on the Power/Control connector.

The IMT “Nano Controller” GUI is available for controlling the unit via the RS-232 serial interface. Any Windows compatible computer running Windows XP or Vista with 500 MB of memory and 1 GHz Pentium or above can be used. Refer to Chapter 5, “Operation” for more information.

Optionally, users can create custom control interfaces as required to suit their applications. The RS-232 command set, or “remote protocol”, is available upon request for this purpose.

2.1.2 Firmware updates

The unit firmware may be updated via the USB interface on the Power/Control connector, using the Nucomm *NanoTx Programmer* software. A programming cable (IMT part number 922-B963-01A-R, or equivalent) is required. Contact IMT Tech Support for additional details.



Chapter Three **3**

Specifications

3 Specifications

3.1 Frequency Bands

Base Part Number	Frequency (GHz)	RF Power (dBm)	DC Power (W)
13VST-13	1.200-1.400	13	4
13VST-20	1.200-1.400	20	6
23VST-13	2.200-2.400	13	6 4
<u>23VST-20</u>	<u>2.200-2.400</u>	<u>20</u>	<u>6</u>
25VST-13	2.400-2.500	20	4
47VST-13	4.400-5.000	13	6 5
<u>47VST-20</u>	<u>4.400-5.000</u>	<u>20</u>	<u>6</u>
<u>47VST-23</u>	<u>4.400-5.000</u>	<u>23</u>	<u>8</u>

(Other bands may be available. Contact IMT)

Tuning step size:1MHz step size
 Frequency stability:± 10ppm

Transmit Modes:
 Standby:No RF output
 Normal:Instantly on frequency transmission

3.2 Modulation Modes

Modulation 1

Modulation Formats:COFDM (DVB-T)
 Carriers:2K
 Constellation:QPSK, 16QAM
 Code Rate:1/2, 2/3, 3/4, 5/6, 7/8
 Guard Interval:1/32, 1/16, 1/8, 1/4
 Bandwidth:6 MHz, 7 MHz, and 8 MHz

Modulation 2 (Optional)

Modulation Formats:COFDM (Proprietary)
 Carriers:2K
 Constellation:QPSK
 Code Rate:1/2, 3/4
 Guard Interval:1/32
 Bandwidth:1.25MHz, 2.5MHz

(Other modulations available per user requirements)

3.3 MPEG Encoder

Method:MPEG-4 Part 10/H.264

Video

Video Coding:.....AVC

Video Input:.....Composite

NTSC:720 x 480(4:2:0)

~~PAL:720 x 576(4:2:0)~~

Audio

Audio Coding:ISO/IEC 11172-3(Layer II)

Audio Sample Rate:..... 48Khz

Audio Channels:1 Stereo, 2Mono Standard,

Audio Input:Line, Gain selectable

.....Mic, Gain selectable

.....Phantom power or external bias.

~~Tone:10dBfs/8dBm~~

~~.....Level Adjustable -10 to -26dBfs~~

3.4 System

Video Present:..... Remote Standby or Test Generator

Test Generator (Dynamic):SMPTE CB(NTSC)/100%

~~.....CB(PAL)~~

.....16 Character ID (Matches SDT Service name).

~~.....1KHz Tone/Pulse~~

Encryption (optional):..... AES Block Cypher, supporting key size of 128 and 256bit (FIPS PUB 197)

User Data (~~;-Ribbon Version only~~): RS232 Side channel, 300-115K Baud

Remote Control:Remote RS232

Local Control:See Figure 1: Local Control Panels

Presets:16 user configurable presets ~~with~~through windows GUI.

3.5 Power Requirements

Input range:DC: +9 to +18

Power consumption:See table above

3.6 Environmental


Item	Specification
Temperature Range, Operational, Bottom Surface	-10° to +65°C (Base plate temperature. The bottom surface of the VSTx must be maintained within the temperature range listed here.)
Temperature Range, Storage	-40° to +80°C
Humidity	0% to 95% RH, non-condensing
Altitude, Operating	0 to 20,000ft (6,000 m) Maximum
Altitude, Storage	0 to 50,000ft (15,000 m) Maximum

3.7 Physical Specifications

Size (Flex version):2.1" x 0.3" x 1.6"
 Weight:26.3g
 Size (Connector version):2.1" x 0.48" x 1.95"
 Weight: 45.4g
 (Sizes do not include connectors)

Connector Part Numbers:

7 pin Lemo (on TX).....ECG.0B.307.CLN
 IMT PN512-F3022-007-R
 7 pin Lemo (mating)FGG.0B.307.CLAD52
 IMT PN512-F3022-007-R



Chapter Four **4**

Installation

4 Installation

This chapter contains steps for installing the VSTx transmitter in typical environments where it may be used.

! WARNING – DO NOT OPEN THE VSTx

The VSTx contains no user serviceable parts. Do not open the VSTx housing. Failure to comply will result in voiding of the VSTx warranty.

4.1 Overview

The VSTx is used in compact systems that typically contain a camera and power supply. VSTx applications may also contain a host processor that is used in the field to re-configure settings in the VSTx.

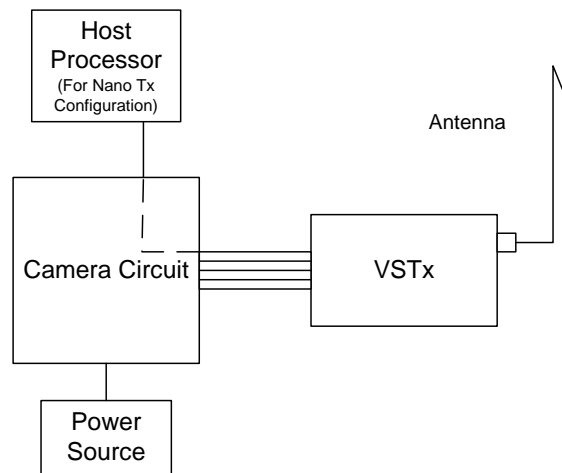
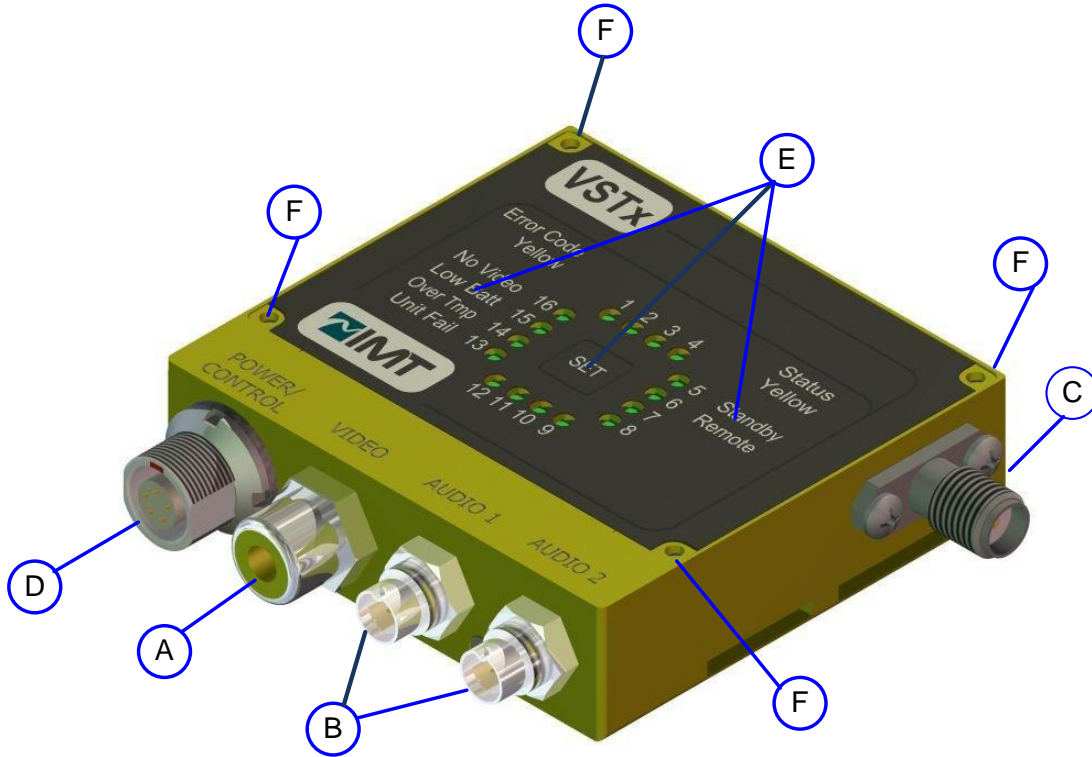


Figure 4-1: VSTx Application With Optional Host Processor

4.2 Identifying VSTx Physical Features and Interfaces

The VSTx will have either a Connector or Ribbon style housing. The Connector style unit will have either a Button & LED faceplate, ~~or a~~ Rotary/Key, or a Blank faceplate.

4.2.1 Connector Housing



(A) Video Input	(D) Power and RS-232 Interface
(B) Audio 1 & Audio 2 inputs	(E) Faceplate User Interface
(C) RF Output /Antenna Port	(F) Mounting Screw Holes

Figure 4-2: VSTx – Connector Housing (Button & LED version shown)

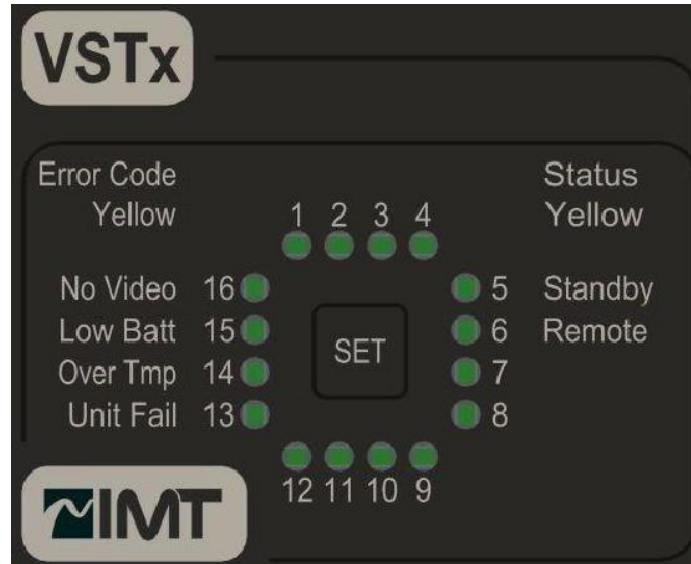


Figure 4-3: VSTx – Button & LED faceplate

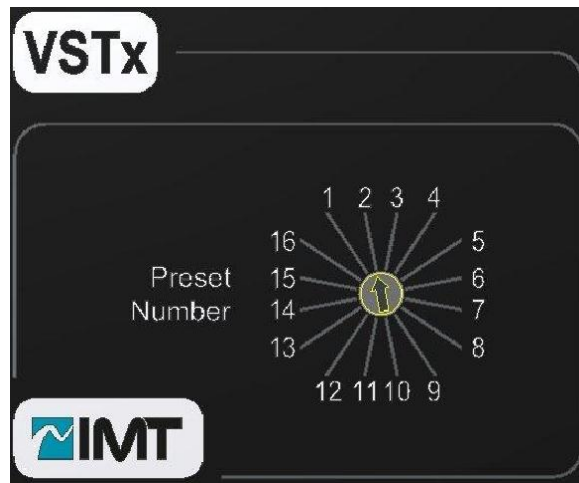
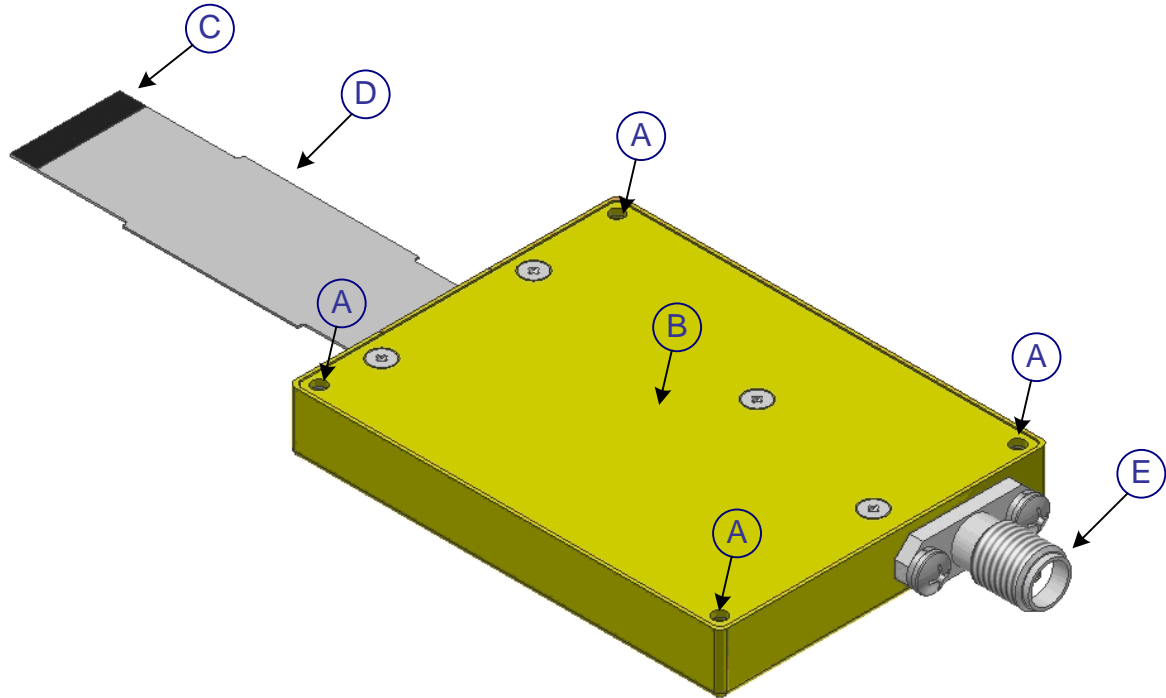


Figure 4-4: VSTx – Rotary/Key faceplate

4.2.2 Ribbon Housing



<p>A Screw Holes for Mounting</p>	<p>D Ribbon Cable</p>
<p>B VSTx Top Surface</p>	<p>E Antenna Port</p>
<p>C Ribbon Cable Connector; <i>Arrow points to Pin 1. (26 pins total)</i></p>	

Figure 4-5: VSTx - Ribbon Housing

4.3 Physical Installation

Note: The VSTx is configured via the programmable serial interface. Should you desire to program the unit while in your application, then your application design must provide a means to connect to the serial interface. If your application cannot support a means to connect to the serial interface, then you must pre-configure the unit prior to installation. Refer to Section 5.

The VSTx can be mounted using the four screw holes located on the corners of the housing, using four #2-56 screws. Tighten the four screws gradually in rotation, without applying excess force on one before starting the others.

The STx requires installation using proper thermal dissipation methods. During operation, energy is dissipated to the outside environment, especially on the lower surface of the unit.

The bottom surface of the VSTx must be kept at a temperature within the operating temperature range specified in Chapter 3.

The unit has an internal fan and the fan openings must not be blocked.

The unit should not be operated inside another enclosure unless sufficient cooling is provided that the case temperature is within the range specified in Chapter 3.

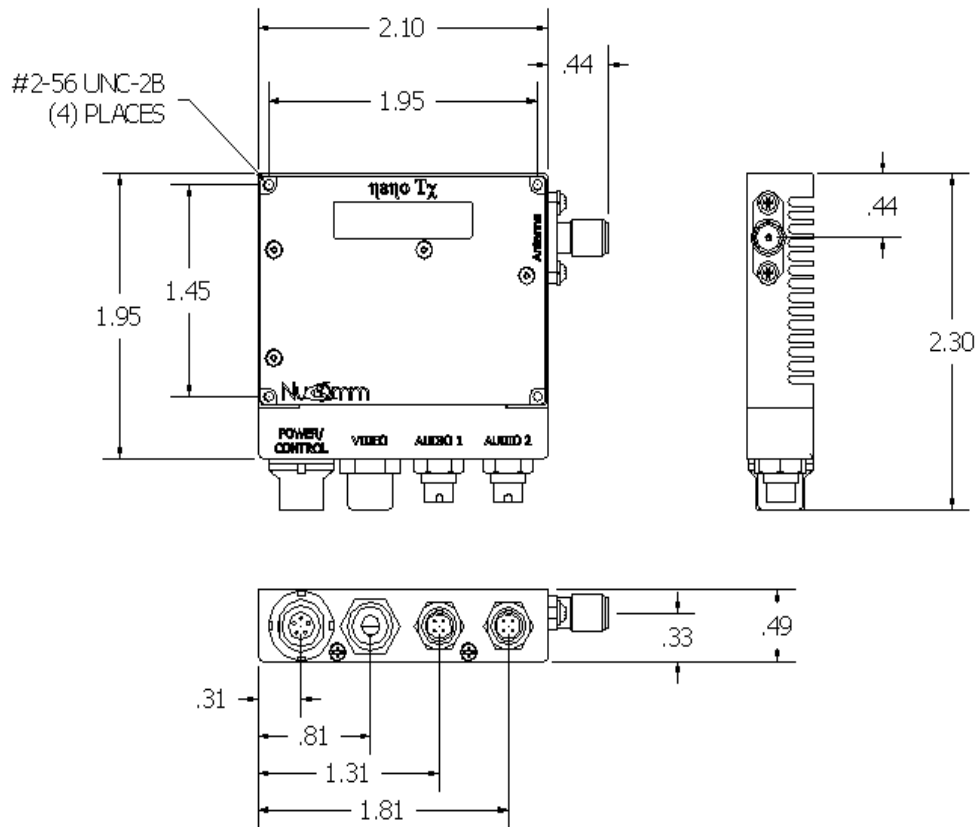


Figure 4-6: VSTx Outline Drawing, Connector Housing (Dimensions in Inches)

4.4 Connect External Signals (Connector Housing)

The VSTx connectors include the following major interfaces:

- Power and Ground Plus RS-232 programming interface
- Video Input Connector Accepts Composite Video
- Analog Audio 1 and 2 Line Inputs

4.4.1 Power and Control (Connector Housing)

IMT has pre-made cables available that support Power and/or RS232 Control. The power portion of the IMT cable has two bare tin leads for connection -to an appropriate power source. The control portion of the IMT cable is terminated on a 9-pin D connector.

Connect an appropriate DC power source to the Power/Control connector. The power source requirements are listed in Chapter 3, Specifications.

The Power/Control connector also includes an RS-232 interface for connection to a PC or host processor for programming the VSTx. A cable that supports both power and control is required in order to program or pre-configure the unit. Spare cables are available from IMT.

Table 4-1: VSTx (Connector Housing) Power/Control Cables

IMT part #	Cable Description	CableType
	7pin LEMO to bare tin strip leads	Power Input cable
	7pin LEMO to bare tin strip leads, w/DB9	Power Input cable (w/Control)

Table 4-2: VSTx (Connector Housing) Power/Control Pinout

Pin	Function	Notes
1	+12VDC	
2	RS232 RX	
3	USB DM	
4	USB DP	
5	RS232 TX	
6	USB POWER	<u>Not Active</u>
7	GROUND	

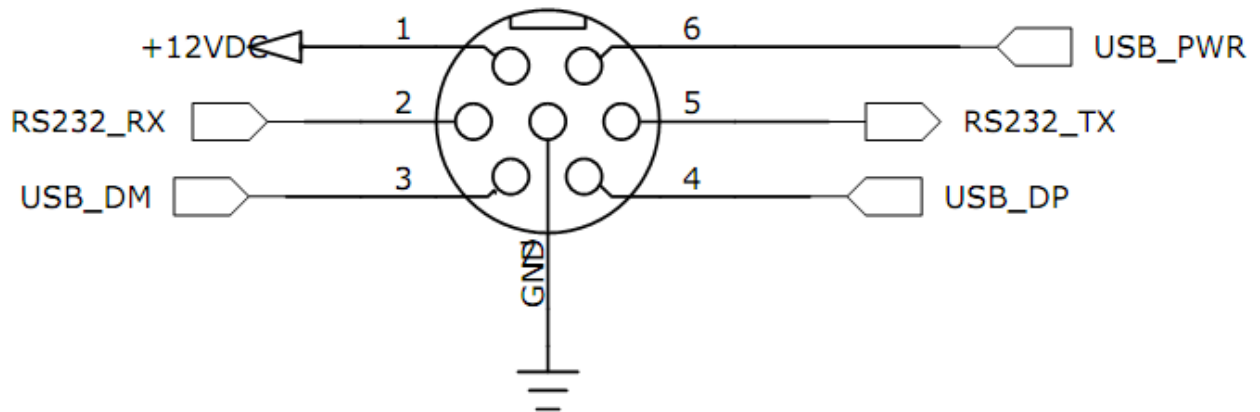


Figure 4-7: VSTx (Connector Housing) Power/Control Detail

4.4.2 Video Input (Connector Housing)

Connect a Composite video source to the video input.

4.4.3 Audio Input (Connector Housing)

Connect audio sources to the two analog audio line inputs.

Table 4-3: VSTx (Connector Housing) Audio Pinout

Pin	Function	Notes
1	LINE SELECT	<u>Not Active</u>
2	+5V MIC BIAS	
3	AUDIO IN	Audio line input.
4	GROUND	Connected internally to signal & chassis ground

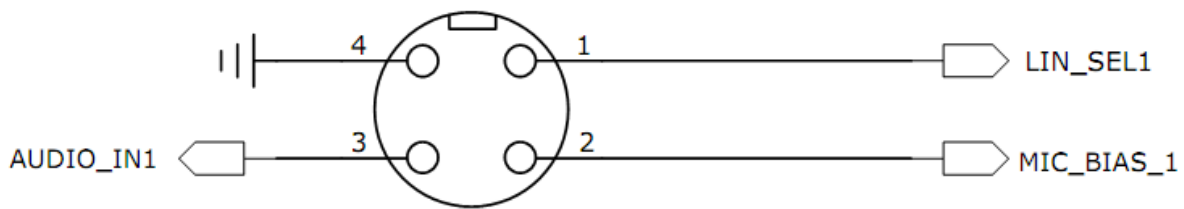


Figure 4-8: VSTx (Connector Housing) Audio Detail

4.5 Connect External Signals (Ribbon Housing)

For best grounding, the VSTX ribbon cable should be connected to an interface that terminates all the signals. (Do not attempt to split the cable or use multiple connectors on the end of the ribbon).

To terminate the VSTX ribbon cable, you may use an interface board which is available from IMT, or the following connector: Hirose Electronics Model Number FH33-26s-0.6sh(10)

When planning your system grounding scheme, provide both power and ground to the VSTX ribbon cable from a PCB mounted connector. Follow appropriate grounding methods in your system to facilitate good EMC, including use of a single point of origin for grounds.

See Section 5 “Operation” for additional detail on the ribbon cable pins and their usage.

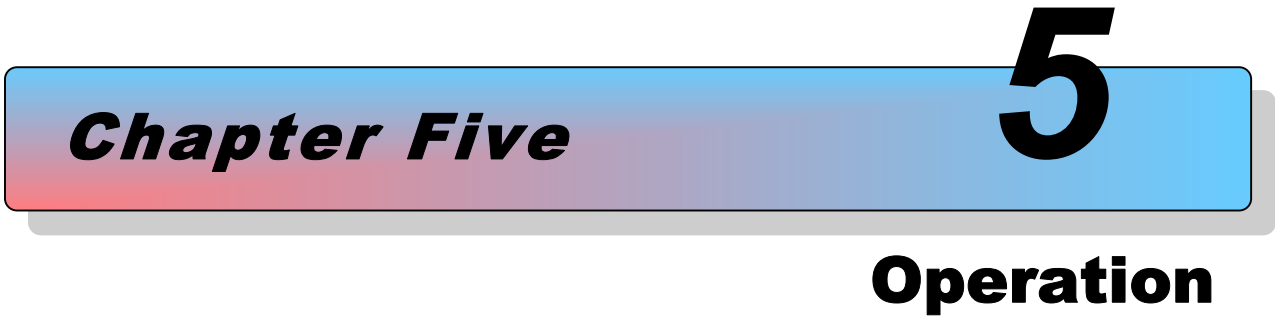
Table 4-4: Ribbon Cable Connector Cable Pin Assignments

Pin #	Pin on IMT provided Interface Board (Z036/Z042/etc)	Signal Name	Direction	Description
1	1	GND	In	
2	2	PA AGC	In	PA AGC input for external PA (0 to 3.3VDC)
3	3	n/aGPI1	In	General Purpose Inputs
4	4	n/aGPI2	In	General Purpose Inputs
5	5	RS232 RX UD	In	RS232 User data
6	6	RS232 TX UD	Out	RS232 User data
7	7	RS232 RX_RC	In	RS232 Remote control
8	8	RS232 TX RC	Out	RS232 Remote control
9	9	GND	In	
10	10	n/aUSB_PWR	In	USB Interface
11	11	USB_DP	In/Out	
12	12	USB_DM	In/Out	
13	13	GND		
14	14	n/aAUDIO1 W/ Bias	In/Out	Audio 1 single ended with Mic Bias.
15	15	n/aAUDIO2 W/ Bias	In/Out	Audio 2 single ended with Mic Bias.
16	16	AUDIO1	In	Audio 1 Single ended.
17	17	AUDIO2	In	Audio 2 Single ended.
18	18	GND		
19	19	CHROMAn/a	In	Chroma input for S-video.
20	20	COMPOSITE /S-Video	In	Composite video /S-video Luminance
21	21	GND		
22	22	n/aNG		
23	23	n/aNG		
24	24	GND		
25	25	+12VDC	In	Power Input +9 to + 18 V
26	26	+12VDC	In	Power Input +9 to + 18 V

4.6 Antenna Installation

Connect a suitable antenna directly to the SMA (RP-SMA for 25VST) antenna connector, or via a suitable 50 ohm cable.

Before applying power: Ensure proper antenna termination on RF output.

A horizontal bar with a blue-to-red gradient background. The text "Chapter Five" is on the left, "5" is on the right, and "Operation" is centered below the bar.

Chapter Five **5**
Operation

5 Operation

While this chapter contains basic information about the operation of the VSTx transmitter, the programming of the unit (including preset configuration) via the Nano Controller GUI is not covered. Please refer to the “Nano Controller” manual (IMT Publication: M27-0001-00A) for detailed information on how to program and configure the unit.

In this section you will find info on how to use the transmitter to transmit video, audio, and user data. At the end of the chapter you will find troubleshooting and maintenance information.

5.1 Power Up the VSTx

Before applying power: Ensure proper antenna termination on RF output connector.

Before applying power: Ensure that the VSTx installation includes an appropriate heat sink. Refer to the thermal specifications in Chapter 3, “Specifications.” The VSTx must be mounted using appropriate methods to ensure that the bottom surface of the unit is kept within the operating temperature specifications at all times.

Turn on the power to the overall system.

Note: The VSTx requires up to 20 seconds to complete its internal power up sequence. Supply current will jump up in steps as internal circuits are powered. The final DC supply current will settle after 20 seconds.

5.2 Pre-Configure the VSTx user options

The VSTx has a wide range of programmable settings. Before using the VSTx in your application, you should pre-configure it to for the settings you want to use in your application. Settings are selected and configured using the Nano Controller software, or a third party alternative. Please refer to the Nano Controller documentation for details, or contact IMT Technical Support.

5.3 User Interfaces

The VSTx will have either a Connector or Ribbon style housing. The Connector style unit will have either a Button & LED faceplate, ~~or a Rotary/Key,~~ or a Blank faceplate. The user interfaces for the various types are described below.

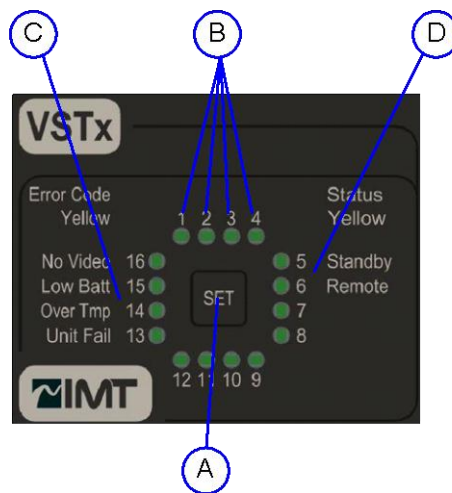
5.3.1 Button & LED Interface

This interface allows the user to select presets and view basic unit status without requiring a remote control. Any changes made remotely will also be reflected on the front panel. The interface consists of a “Set” button, and 16 LED’s which are used to display status.

The “Set” button is used to scroll through the unit presets, from 1-16. The LED’s will indicate which preset is currently selected. The unit will begin to implement the selected preset five seconds after the last button push. The appropriate LED will blink Red as the changes are made, and then go to solid green when the reconfiguration process has been completed.

If a preset change is requested through the remote control port, the LED changes to the new preset number and blinks yellow while the preset is configured. Once complete it turns a steady green.

In addition to indicating the selected preset, LED’s 5, 6 and 13-16 are also used to display alarm and status information. These LED’s will display solid Red when indicating status information only, or alternating Red/Green when indicating both preset and status.



<p>A SET Button</p>	<p>C Error Indicators</p>
<p>B Preset Numbers</p>	<p>D Status Indicators</p>

Figure 5-1: VSTx – Button & LED interface

5.3.2 Rotary/Key Interface

This interface allows the user to select presets without requiring a remote control. Changes made remotely will **NOT** be reflected on the front panel. The interface consists of a 16 position rotary switch.

The switch is used to advance through the unit presets, from 1-16. The unit will begin to implement the selected preset after the switch has been idle for 5 seconds. The rotary interface unit will always boot up on the physical preset it is set to.

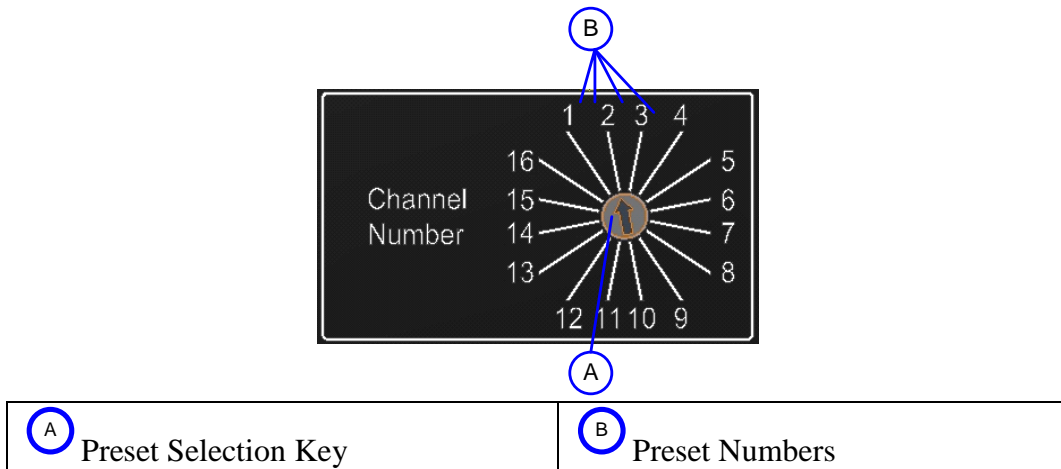


Figure 5-2: VSTx – Rotary/Key interface

5.3.3 Ribbon Version

This interface provides no local control or indications. Changes made remotely will **NOT** be reflected on the unit. The interface consists of a 26 pin ribbon cable. See Section 4 “Installation” for pin assignments.

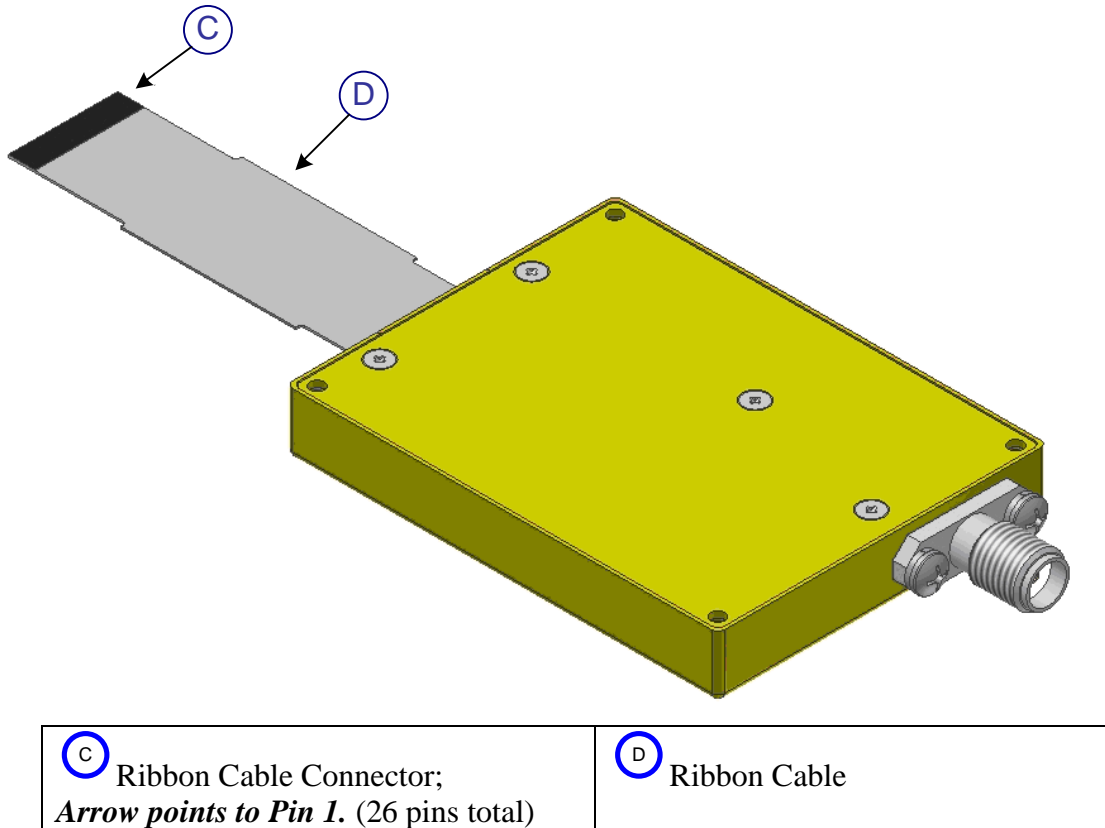


Figure 5-3: VSTx - Ribbon Version interface

5.3.3.1 PA AGC Signal

Controls the VSTx RF output level when an external PA is used. The input range is 0 to 3.3VDC.

5.3.3.2 RS232 RX UD

This is a RS232 input used to transport RS232 data through the RF link. This signal receives data at a user defined baud rate and encapsulates this data into the MPEG Transport stream. RS232 Tx UD

5.3.3.3 RS232 Remote Control RS-232 Tx / Rx

This is the RS232 remote control interface. The Tx line is the output from the unit and the Rx is the input. The baud rate of this interface is user programmable.

5.3.3.4 USB_PWR

This is an input to the VSTx. It is used to signal the system to enter download mode.

5.3.3.5 USB_DP/USB_DM

+/- USB signal

5.3.3.6 Composite Video/S-Video

~~The unit activates these inputs based on the video input selection made by the user, either Composite Video or S-Video. Composite is terminated to ground with a 75Ω resistor.~~

5.3.3.7 +12VDC

Main power input.

5.3.3.8 Audio 1 With Bias

~~In Mode 1, this is an audio input with +3.3VDC output.~~

~~In Mode 2, this is a simple +3.3VDC bias output.~~

5.3.3.9 Audio 2 With Bias

~~In Mode 1, this is an audio input with +3.3VDC output.~~

~~In Mode 2, this is a simple +3.3VDC bias output.~~

~~5.3.3.10~~ 5.3.3.8 Audio 1, Audio 2 Inputs

~~There are two audio modes, Mode 1 & Mode 2. In Mode 1, Audio 1 and Audio 2 are two single ended audio input signals. In Mode 2 (differential mode), Audio 1 is the positive terminal and Audio 2 is the negative terminal. Note that in differential mode the audio encoder is placed in mono mode.~~

5.4 Using the VSTx to Transmit Audio and Video Signals

The VSTx uses a COFDM modulation scheme. Receiver systems used with the VSTx must be compatible and capable of receiving the type of video transport streams transmitted by the VSTx. Compatible receivers include the IMT VSRx receivers and certain other IMT products. Contact IMT for more information.

5.4.1 Select User Level Settings

By use of the available interface(s), make appropriate settings so that your transmitter and suitable receiver are on the same RF and modulation settings.

5.4.2 Put the unit in Transmit Mode

Via the Remote Control, place the unit in to TX mode

NOTE: When no video signal is present, the unit enters “Standby Mode.” When a video signal is present, the unit automatically exits “Standby Mode” and resumes transmission. Depending on unit type, Standby mode status may be indicated by a front panel LED.

5.4.3 Select Power Level

Use the remote control to select the power level desired (HI / LOW). In HI mode, the unit will output its full rated power. In LOW mode, the output will be approximately 6dB down from the HIGH power output.

5.4.4 Verify Operation

Verify unit operation by one of the following methods:

- (1) If your system contains a host processor capable of communicating with the unit via the serial interface, use interrogation commands to check the status of the unit.
- (2) Detect the transmitted signal using a spectrum analyzer.
- (3) Using an appropriate receiver, verify that you are receiving audio and video from your application setup.

5.5 Using the VSTx To Transmit User Data (Ribbon version only)

The User Data Interface can be used to packetize user data along with the main audio and video information. The User Data can be received and output by compatible IMT receivers. The user data interface must be programmed using the serial interface.

5.6 Using alternate/custom controllers

The implementation of an RS-232 command set, or Remote Protocol, allows the use of customized interfaces to perform virtually all unit operations, including:

- Configure Settings
- Query Status

The Remote Protocol consists of command and response messages, or packets. The internal CPU handles interpretation of the packets to set unit parameters, and provide responses back through the serial interface.

In addition to IMT's Nano Controller, alternate control interfaces may be developed, or available from third parties. Additionally, commands and responses may be entered and viewed manually using a command terminal.

The Remote Protocol is available upon request from IMT.

5.6.1 Serial Interface Rate, Parity, and Stop Bit Specifications

Refer to the Remote Protocol for information about the baud rate, number of data bits, stop bits, and flow control methods.

5.6.2 Command and Response Packet Formats

This section provides a brief introduction to the serial interface command and response packet formats. The command packets use the following format:

NU <tt> <ss><##><cc><dd><CS><CR><LF>

Where the fields are ASCII and are defined as follows:

NU	Literal
<tt>	Address of target (0x01 – 0xFF)
<ss>	Address of source (0x00 – 0xFF)
<##>	Packet Length (Packet Length = Command Length + Data Length)
<cc>	Command (0x00-0xFF) – Different values are used for each command.
<dd>	Data (Hex Format) – Data values are encoded with a variety of meanings.
<CS>	(1's complement of <tt> to end of data)
<CR>	Carriage Return
<LF>	Line Feed

After a command packet is received, the unit returns a response packet. Response packets have the same basic format as command packets, except that the source and destination are reversed, and the command field specifies the type of response being sent.

5.7 Troubleshooting

Table 5-1: Table of Troubleshooting Tips

Problem	Possible Explanations	Actions to Take
No video	No Power	Check power source
	Camera Malfunction	Try a different camera
	Possible Receiver system issue	Verify that all modulation type and encryption/decryption parameters match at transmitter and receiver.
Video Signal Reception Poor	Receiver not properly positioned	Try improved location
VSTx Programmable Serial Interface Does Not Respond	No Power	Check power source
	Poor connection via ribbon cable	Check connections
	Host processor GUI settings issues	Verify that the host processor running a GUI interface for programming the VSTx is setup and operating correctly.

5.8 Maintenance Information

Follow these procedures when maintaining the device:

- Dry the device immediately if it comes into contact with water or other liquids. Warranty does not cover liquid damage.
- Do not submerge the device or use it directly in rain.
- Use ESD Precautions whenever handling the device
- Do not touch electrical connections.
- Do not open the device. This voids the warranty.
- Keep the device clean by wiping with a soft, dry cloth. If necessary, dampen only using a solution suitable for cleaning electronic devices. Warranty does not cover cleaning damage.



Proprietary Information and Disclaimer Notice

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IMT has made every effort to ensure the accuracy of this material at the time of printing. However, as the specifications, equipment, and this manual are subject to change without notice, IMT assumes no responsibility or liability whatsoever for any errors or inaccuracies that may appear in this manual, or for any decisions based on its use. This manual is supplied for informational purposes only and should not be construed as a commitment by IMT.

Warranty

Equipment manufactured by IMT, LLC is warranted to meet all published specifications and to be free from defects in material and workmanship within a period of two years from date of original shipment. The company's liability under this warranty is limited to:

- Servicing or adjusting equipment.
- Replacement of defective parts.

Any equipment returned to the factory shall have the freight paid for by the buyer.

Equipment showing damage by misuse, abnormal conditions of operation, or attempts to repair by other than authorized service personnel shall be excluded from this warranty. IMT shall in no event be responsible for incidental injury or property damage. Since IMT has no control over conditions of use, no warranty is made or implied as to suitability for the customer's intended use, beyond such performance specifications as are made part of the purchase order. There are no warranties expressed or implied, except as stated herein. This limitation on warranties shall not be modified by verbal representations.

Shipping Damage

Equipment shipped FOB IMT shall become the property of buyer upon delivery and receipt from carrier. Any damage in shipment should be handled by the buyer directly with the carrier. Immediately request the carrier's inspection upon evidence of damage in shipment.

Field Service

IMT products are designed with easy access to components to facilitate service. However, some modules cannot be service in the field. To prevent voiding of the warranty, please contact Tech Support before servicing or making any repairs. The user is cautioned to read all module descriptions in this manual. Warnings are included in the circuit descriptions and on certain modules themselves.

Replacement Modules

Troubleshooting to the component level is often not cost-effective and frequently impossible. Often the practical method of effecting repairs is to substitute known good spare modules for suspect units. Replacement modules for our standard product line are usually available.

Technical Support Information

Technical Support personnel are available to extend technical assistance to customers while installing, operating, or troubleshooting IMT equipment. Please have your model number and serial number available.

Telephone

During IMT business hours, 8:30am - 5:30pm EST (-5 Hours, GMT), call:

US908-852-3700

International001-1-908-852-3700

After hours, call:

US or International888-531-3892

Email

Email addressservice@nucomm.com

Internet

Web addresswww.imt-solutions.com

Equipment Returns

If equipment cannot be successfully restored through telephone consultation, return to the factory may be required. Loaner items may be available until the repaired items are returned.

For out-of-warranty equipment only: We evaluate all returned units, and then confers with the client on corrective action. If no fault is found, or no corrective action is authorized, a diagnostic fee may be charged.

Prior to returning products to the factory, please obtain a return material authorization (RMA) number and shipping instructions from Tech Support.

When returning equipment, it is very helpful to enclose a note containing the following:

- RMA number.
- Serial number.
- A detailed description of the problem.
- Name of an engineer or technician we may contact regarding problems encountered.
- A "ship to" and "bill to" address.

Ship all returns to:

IMT, LLC

Attn: RMA# (your RMA number)

200 International Drive

Mt. Olive, NJ, 07828, USA

(908) 852-3700

For International returns:

In addition to the instructions above, when shipping internationally we recommend the use of a courier such as Federal Express, UPS, etc, and that the goods be shipped DOOR-TO-DOOR PRE-PAID. This will reduce Customs costs, handling charges and delays. Enclose all the information above, plus a statement that the equipment was manufactured in the United States (*the latter is needed to expedite customs processing*).





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