SE4000

DVB MPEG-2 Contribution Encoder

Installation and Operation Manual

01-0934-401, Rev E

Tiernan, A Radyne Company • 7330 Trade Street • San Diego, CA 92121 • (858) 805-7000 • Fax: (858) 805-7001 • www.radn.com


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A Radyne Company

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

WARNING! Electric Shock Hazard

Do Not Open The Equipment!
Service Only by Tiernan, A Radyne Company.

Gefährliche Spannung!
Öffuen des Gerätes und Service nur dur Tiernan, A Radyne Company

The SE4000 contains no user-serviceable parts. Do not attempt to service this product yourself. Any attempt to do so will invalidate any and all warranties.

Preface

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Using This Manual

This manual is your sourcebook for using the Tiernan SE4000 and describes the installation, operation, and configuration for this product. An overview of system and product level requirements, technical specifications, and troubleshooting procedures are also provided.
This manual is designed to help you find information quickly and easily. To take full advantage of this design, please take a moment to review the specific formats.

Locating Information

To help you quickly locate information, this manual includes:

- Table of contents
- Index
- Glossary
- Quick reference cards

Important Information

Throughout this manual you will find icons designed to help you identify important information. These icons are the:

A caution icon indicates a hazardous situation that if not avoided, may result in minor or moderate injury. Caution may also be used to indicate other unsafe practices or risks of property damage.

A warning icon indicates a potentially hazardous situation that if not avoided, could result in death or serious injury.

A note icon identifies information for the proper operation of your equipment, including helpful hints, shortcuts, or important reminders

Illustrations

Some illustrations contained in this manual may differ slightly from those shown on your front panel display, rear panel, or remote terminal due to variations in your system components, configuration, or customization.

Figures depicting equipment may differ from those at your site; therefore, refer to the labeling on your Tiernan equipment to identify the components. An effort has been made to use illustrations that reflect basic equipment and configurations of the majority of customers.

Issuing Commands

Tasks and examples are presented in a series of step-by-step instructions. Commands or information that you enter into the system appear in a different type, as shown in the following example:

> To restore the factory default configuration, select Quickset>dvb from the front panel, or issue the remote command `cm restore dvb.`

If the command contains variable information that is to be typed into the system, the variable information is found within karats < >. In the following example, `TCA DELETE` then the correct value for `<label>` is typed:

> Type `TCA DELETE <label>`

Front Panel Navigation

This manual uses right angle brackets (>) to indicate a sequence of menus, submenus, and menu items.
For example, select `Control>DateTime>03 September, 2003` means:

- From the main menu, select control.
- From the control menu, select clock.
- From the Date time menu, select date.
- At the date option, enter the date, 03 September, 2003, in the correct format.

Displays

The system may return values and messages on a front panel LCD, remote terminal, or both. In this manual these values and messages appear in a different type:

```
date = 06/23/2003
restore = dvb
```

Revision History

This manual is periodically updated and revised. For documentation updates, call Customer Service Support.

Revision	Date	Type of Revision
A	09-22-03	Initial release.
B	11-24-03	Front panel command revisions
C	10-08-04	Corrected front and rear panel views and fault tables

Product Support

We hope this manual provides all the information and instructions you need to operate the SE4000. However, if you need assistance, contact Tiernan Product Support at our corporate headquarters, located in the United States, through any of the following methods:

Phone: 858-805-7000
Fax: 858-805-7001
Email: customerservice@radn.com
Website: http://www.radn.com

Product Shipments

Please verify that your company name and address are correct on the packing slip that is included with your equipment. Notify Tiernan Product Support if any of the information is incorrect.

Ensure that you write down the following numbers and include them in any correspondence with Tiernan, A Radyne Company concerning your order:

- Purchase order
- Model
- Reference line
- Sales order

Errors

If any part of your shipment is missing or incorrect, call Tiernan Product Support.

Cartons and Packing Materials

The factory-shipping carton and packing materials are designed to protect the equipment from excessive shock and vibration that can occur during shipping.

Use the original shipping carton and packing materials to repack the unit for shipment to another location or to return the unit to Tiernan, A Radyne Company for repair.

For additional information on equipment repacking, refer to the Warranty booklet that accompanied the product shipment.

LCD Display

When you receive your SE4000, the LCD display may be covered with a plastic protective covering. To remove the protective covering, gently lift one of the corners and peel off the covering.

Warranty Information

For warranty or return material authorization information, refer to the Warranty booklet that accompanied the product shipment.

Other Tiernan Products

Visit the corporate website at www.radn.com. This provides information about the entire line of Tiernan products and systems, including encoders, integrated receivers/decoders (IRD), switches, ATM products, network interfaces, and network management software.

Safety Precautions

Carefully read and follow all safety, use, and operating instructions before operating the SE4000. Heed all warnings and cautions contained in this manual. Retain these instructions for future reference.

Follow Startup Procedure

Do not plug in the SE4000 until you have connected the system and read the chapter on installation.

Provide a Safe Location

Place the SE4000 in a rack or on a stable surface of sufficient size and strength, where it will not be jarred, hit, or pushed off its surface. Ensure that all cables and cords are out of the way and will not be tripped over, as this could cause personal injury or serious damage to the equipment.

Avoid Water and Moisture

If the equipment is exposed to any liquid, contact Tiernan, A Radyne Company, as serious damage could occur to the SE4000 or its components.

Avoid Heat, Humidity, and Dust

To avoid internal damage, the SE4000 should be placed away from all heat sources, including radiators, heater ducts, and so on, out of direct sunlight and away from high humidity, excessive dust, or mechanical vibrations that can cause damage to internal parts.

Provide Adequate Ventilation

Slots and openings on the SE4000 are provided for ventilation that is needed to ensure reliable operation. To avoid overheating and ensure that the ventilation slots are not blocked, place the SE4000 on a smooth, hard surface that has at least two inches of clearance around the unit and adequate air circulation. If the equipment is placed in a closed area, such as a rack, ensure that proper ventilation is provided and that the internal rack operating temperature does not exceed the maximum rated temperature at the position of the SE4000.

Never place the SE4000 on a soft surface that would obstruct the required airflow into the ventilation slots.

Use the Correct Power Source

For units equipped with a North American power cord, the cord has an IEC-compatible female plug on one end, and a male plug on the other end. This cord is UL and CSA approved up to 125 VAC at 10 A and is ready to use with no user wiring required.

For units equipped with an International power cord, the cord has an IEC-compatible female plug on one end, and three stripped and tinned bare wires on the other end. This cord is approved up to 250 VAC at 6 A and complies with the international color codes of green/yellow (ground), blue (neutral), and brown (line).

If these color codes do not correspond to the colored markings on the terminals in the plug, use the following standards:

The green/yellow wire must be connected to the plug terminal marked by the letter E or by the earth symbol (⏚) or color-coded green and yellow.

The blue wire must be connected to the plug terminal marked with the letter N or color-coded black.
The brown wire must be connected to the plug terminal marked with the letter L or color-coded red.

An AC plug must be attached to the International power cord in accordance with government standards and codes in effect at the installation site. If an unterminated power cord is supplied with the unit, the appropriate certified termination plug must be installed. The following is a list of the required certifying agencies for various countries:

Country	Agency	Country	Agency
Australia	SAA	Italy	IMQ
Austria	OVE	Japan	MITI
Belgium	CEBEC	Netherlands	KEMA
Canada	CSA	New Zealand	SECV, SECQ, SECWA, EANSW, ETSA, HECT, SANZ
Denmark	DEMKO	Norway	NEMKO
Finland	FEI	Rep. S. Africa	SABS
France	UTE	Spain	AEE
Germany	VDE	Sweden	SEMKO
India	ISI	Switzerland	SEV
Ireland	IIRS	United Kingdom (UK)	ASTA, BSI

Route Power Cords Safely

Route power cords so they are not walked on or pinched. Pay particular attention to cords and connections at the plugs, receptacles (such as power strips), and the point where they exit from the SE4000 and attach to other equipment. Do not place any items on or against power cords.

No Stacking

Do not place or stack any objects on top of the SE4000. Other equipment may be placed in a rack or on a shelf above or below the SE4000, but never stacked directly on top of it.

Protect Against Lightning and Power Surges

When the SE4000 is installed, have the professional installer ground the system to protect against voltage surges and built-up static charges. For information on grounding standards for electrical and radio equipment, refer to the electrical code in the country of installation.
Protect the SE4000 from lightning and power-line surges during a storm by unplugging it from the wall outlet and disconnecting the coaxial cable.

Do Not Open the SE4000

There are no user serviceable parts inside the SE4000. It should be returned to and/or serviced by Tiernan, A Radyne Company.

Keep Objects Outside

Touching internal SE4000 parts is dangerous to both the user and equipment. Never put any object, including fingers, through slots or openings, as this could result in touching dangerous voltage points, short-circuiting parts, electric shock, or fire.

There are no user-serviceable parts inside the SE4000. If an object falls into the equipment, unplug the unit and contact the Radyne ComStream, Inc. Customer Service Department, as serious damage could occur to the SE4000 or its components.

Clean the SE4000

Before cleaning the SE4000, unplug it from the wall outlet. Do not use any type of abrasive pads, scouring powders, aerosol cleaners, or solvents such as alcohol or benzene.

Use only a clean, soft cloth lightly moistened with a mild detergent solution. Wipe all equipment with a clean, soft cloth lightly moistened with water to remove the detergent solution.

Service the SE4000

Do not attempt to service the SE4000 yourself, as there are no user-serviceable parts. Opening or removing covers may expose you to dangerous voltages or other hazards as well as void your warranty. Contact the Tiernan Customer Service Department to obtain qualified service personnel.

The following are some of the conditions that indicate the equipment needs servicing:

- The power cord or plug has been damaged.
- An object has fallen into the SE4000.
- Liquid has been spilled into the SE4000, or it has been exposed to rain or water.
- The unit has been dropped or the cover has been damaged.

The SE4000 does not operate normally, or it shows a marked change in performance.

Perform Safety Checks

Upon completion of any service or repairs to the SE4000, ask the service technician to perform safety checks to verify that the system is in safe operating condition.


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Overview

1

The SE4000 is a rugged, compact MPEG-2 encoder designed for newsgathering and professional broadcast applications. Video input may be analog, PAL or NTSC, or serial digital 525/625. Two stereo audio inputs may be either analog or AES/EBU. Video encoding may be 4:2:0 in accordance with MPEG-2 Main Profile @ Mail Level or optional 4:2:2 Studio Profile @ Main Level. The compressed digital output is a DVB® MPEG-2 or ATSC-compliant transport stream. Audio compression may be MPEG, AC-3 2.0, or uncompressed pass-through.

The SE4000 compresses the incoming video with the latest adaptive field-frame MPEG-2 algorithm. The video compression is performed with I, B, and P frames using bi-directional predictive coding and motion estimation. The two stereo or four mono audio channels are compressed using either MPEG or AC-3 2.0 audio encoding standard. The two auxiliary data channels support both synchronous and asynchronous serial formats.

A push button front panel with an illuminated LCD and bright LED indicators provides control and system status. The optional integrated DVB®, QPSK, 8PSK, 16QAM satellite modulator is controlled by one-touch buttons for carrier on/off and modulate. Additionally, remote control is available using ASCII or SNMP commands via the EIA-232 remote control and Ethernet ports. The SE4000's rugged chassis is a 1U high (4.45 cm), 19" width rack-mount unit providing full rear panel cabling. The main power switch is conveniently located on the front panel.

1.0 Features

The SE4000 consists of the following standard feature set:

- Advanced video compression chip-set which encodes the input video following either 4:2:0 Main Profile @ Mail Level or optional 4:2:2 Studio Profile @ Main Level standards.
- A high-quality horizon decimation filter for intermediate horizontal resolutions.
- Supports compressed audio rates of 64 to 384 Kbps and four different audio channel compression methods.
- MPEG or AC-3 2.0 coding.
- Accepts two high-speed, independently programmable auxiliary data channels.
- Automatic configuration of video and audio rates to match the available transmission bandwidth for optimum performance.
- Dedicated modulator control buttons are provided on the front panel for one-touch control.
- Optional BISS conditional access.
- Extensive VBI data support of DVB teletext.
- Front panel lockout to prevent accidental configuration changes.
- *At-a-glance* status monitoring via a tri-colored Status LED indicator.
- Status *hot key* enables the user to toggle between fault lists and other front panel menus.
- Remote control via Ethernet or EIA-232 providing all configuration, monitor, and control functions
- Built-in self-tests and extensive self-diagnostics to assist with system checkout and problem solving.
- Non-volatile, field-programmable memory.
- User configuration sets that can store and recall commonly used parameters sets
- Auto-ranging, auto-sensing power supply
- Rugged chassis construction

1.1 Video

The SE4000 uses an advanced video compression ship-set which encodes the input video following either the 4:2:0 Main Profile @ Main Level or the optional 4:2:2 Studio @ Main Level, according to MPEG-2 standards (ISO/IEC 13818-2).
The SE4000 supports the following compressed video rates:

- MPEG-2 4:2:0 Main Profile @ Main Level: 1 to 15 Mbps
- MPEG-2 4:2:2 Studio Profile @ Main Level (optional): 2.5 to 50 Mbps, which provides superior quality compressed images at high data rates.

The video encoder features a low latency mode for interactive applications and a Tiernan proprietary, high-quality horizontal resampling filter for intermediate horizontal resolutions.

1.2 Audio

Two stereo or four mono audio channels are compressed using MPEG or AC-3 2.0 audio encoding standards.

The SE4000 supports compressed audio output rates of 64 to 384 Kbps and four different audio channel compression methods.

1.3 Auxiliary Data

One channel of synchronous data up to 20 Mbps (RS-422) and one channel of asynchronous data up to 115 Kbps (RS-232) are supported by the SE4000.

1.4 Conditional Access

The SE4000 optionally supports BISS, Modes 1 and E, as well as Tiernan's proprietary conditional access schemes.

1.5 VBI (Vertical Blanking Interval)

Extensive VBI data support is provided via the SE4000. Supported formats include:

- Proprietary passage of NTSC line 21 closed-caption.
- ATSC closed captioning.
- DVB Teletext for World System Teletext (WST) on PAL.
- DVB 4:2:2 expanded windows carries WSS, VPS, VITC, CC, AMOL, XDS, etc.

1.6 Modulator

The SE4000 has a built-in DVB®-compatible QPSK, 8PSK and 16QAM modulator with a 70 MHz, 140 MHz, and direct L-Band output carrier capable of supporting up to 45 Msps. An L-Band monitor output is provided for direct IRD connection.

1.7 Modulator Control Buttons

The SE4000 provides dedicated modulator control buttons on the front panel. These are designed to bring carriers up onto satellites in a fast and efficient manner.

1.8 ASI Output

An ASI output is also available for connection to an external multiplexer or modulator.
The SE4000 accepts all commonly used video and audio input formats and provides an MPEG-2 DVB compliant transport stream in addition to a DVB®-compatible QPSK modulator with a 70 MHz, 140 MHz, and direct L-Band output.

Within the data rate limitations of the channel, the SE4000 can be reconfigured for different video resolutions, video optimization, and audio compressed bit rates to get the best video performance. Higher compressed bit rates result in better-decoded video quality.

For high reliability applications, the SE4000 provides exceptional MTBF performance with its extensive digital processing and proprietary FPGA circuits. In addition, the SE4000 can automatically configure the video and audio rates in order to match the available transmission bandwidth for optimum performance.

1.9 Monitor and Control Functions

The SE4000 monitor and control functions include:

- Fault Relay with passive normally open and normally closed contacts.
- Front panel operator control utilizing an easy-to-use, intuitive menu and backlit push buttons.
- Remote control using either an Ethernet or RS-232 interface.

1.10 Front Panel

The SE4000 front panel interface allows you to scroll through a standard set of menus to easily set your operating parameters. All configuration and monitoring functions can be efficiently performed using the front panel.

*At-a-glanc*e system status can be quickly determined by checking the tri-colored front panel status LED:

- Green: indicates that the unit is receiving AC power and that there are no faults.
- Yellow: indicates that the unit has a current fault.
- Red: indicates that the unit has a hard fault.

If the Status LED indicates that there is a fault, the Status hot key enables you to go directly to the current faults list with the press of a button.

1.11 Remote Control

A remote unit, such as a computer terminal, is easily connected to either the EIA-232 remote control port or Ethernet port allowing the SE4000 to be configured, monitored, and controlled using character-based ASCII protocol or SNMP.

1.12 Programmable Memory

The SE4000 is a field-deployable unit with non-volatile, field-programmable memory that ensures retention of configuration parameters during power outages, power off, and transportation. The SE4000 maintains the last user configuration in flash memory.

1.13 Configuration Sets

The SE4000 has a number of default configurations that can be restored as well as numerous user-defined configuration sets that can be saved and restored.

1.14 Construction

The SE4000 is a small, rugged, 1RU (4.45 cm/1.75”) high, 19” wide rack-mount chassis with an international, auto-sensing, AC power supply.

Introduction

2

This chapter provides step-by-step procedures for installing and cabling the SE4000.

WARNING!!

Do Not Remove the SE4000 Top Cover! The SE4000 is powered by an exposed, switching AC power supply, which presents an electric shock hazard when the top cover is removed. Personal injury or damage to the equipment can occur when the top cover is removed. None of the procedures in this manual require the removal of the SE4000 top cover.

CAUTION!!

Before beginning your installation, read the Safety Precautions as they contain important safety information and other instructions required to install the SE4000.

2.0 Placement

The SE4000 can be installed on a tabletop or in a rack. Use the following guidelines to determine the appropriate installation:

- If the equipment must be moved frequently, install the SE4000 on a tabletop or other flat surface.
- If the equipment is going to be installed permanently, install the SE4000 in a rack using rack mount brackets.

Whichever installation is used, always position the equipment to allow easy access to the rear panel and provide adequate ventilation.
To properly install the SE4000, follow the instructions provided in the appendix on tabletop and rack mount installation instructions.

2.0.1 Ventilation

The SE4000 must be positioned to receive adequate ventilation at all times. The cooling fan pulls air in through the side vents, circulates the air, and exhausts it out the side vents. The minimum airflow clearance required on both sides of the chassis is three (3) inches.

2.1 Powering On The SE4000

The rear panel AC power supply interface includes a fuse holder, and an IEC 320 power cord receptacle. The typical SE4000 configuration requires 70 Watts.

An auto-sensing, auto-ranging AC switching power supply powers the SE4000 unit. The supply accepts 100 to 240 VAC nominal input voltage levels cycling at 50 to 60 Hz. A 1 Amp fuse on the rear panel protects the power supply from excessive current.

The On/Off (1/0) power switch is located on the front panel.

2.1.1 AC Power Cords

The SE4000 shipping kit includes two AC power cords, one for North American applications, specifically the United States and Canada, and the other for international applications.

AC wiring must be done in accordance with governmental standards and codes in effect at the SE4000 installation site. Refer to the Safety Precautions for additional information.

2.1.2 North American Applications

One cord has an IEC- compatible female plug on one end and a North American male plug on the other. This cord is UL and CSA approved up to 125 VAC at 10 A. This cord is ready to use with no user wiring required.

2.1.3 International Applications

The international cord has an IEC-compatible female plug on one end and three stripped and tinned bare wires on the other end. This cord is approved by many international safety agencies, including VDE, up to 250 VAC at 6 A.

2.1.4 Connecting to a Power Source

To connect to an AC power source, follow these steps:

1. Select an AC power cord. If an international power cord is selected, attach a connector in accordance with local regulations and laws.
2. Ensure the SE4000 power switch is in the Off, or 0 position.
3. Connect the female plug of the AC power cord to the AC power receptacle on the SE4000 rear panel.
4. Connect the male plug of the AC power cord to an external AC power conditioning surge suppressor.
5. Connect the AC power conditioning surge suppressor to an AC outlet.

Corrupted AC input power can interrupt SE4000 operations and cause permanent damage to the unit. You should purchase and install a commercially available, external AC power conditioning surge suppressor to protect the SE4000 against power spikes and line transients..

2.1.5 Power-up Sequence

Once the cabling and interconnections for the SE4000 are completed, the unit may be powered up. The SE4000 power switch is a rocker switch located on the front panel. The power switch is labeled 1/0 where the 1 represents the On position and the 0 represents the Off position.

To power up the SE4000, press the power switch to the On, or 1 position. The power-on cycle takes approximately 20 seconds, as the unit performs extensive self-diagnostics in this time period.

During the powered- up cycle, the SE4000 displays `SE4000 Standard Definition Encoder Initializing...`, various messages may scroll across the LCD display, and the tri-colored Status LED illuminates and may flash.

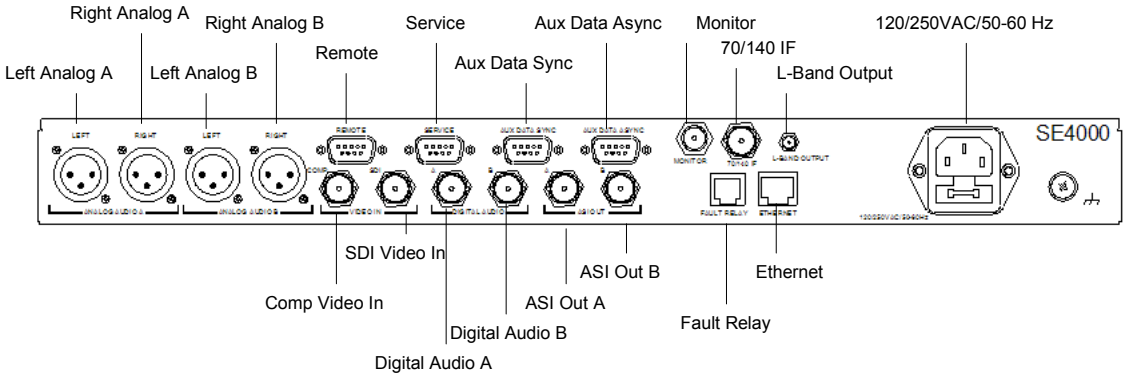
After the unit is initialized, the LCD displays the SE4000 Main Menu.

```
SE4000
[Quickset]  Service  Output  Status
```

When beginning the initial SE4000 installation and configuration, the modulator output (Mod State) should be turned off until ready to begin satellite transmissions.

2.2 Rear Panel Connections

All SE4000 external connections are located on the rear panel, as shown in the following illustration.



2.3 Video Ports

The SE4000 provides connections for both analog and digital video.

2.3.1 Analog Video In

Analog Video In is a female BNC connector with 75Ω impedance, accepting a NTSC or PAL composite analog video input that is 1.0 Vp-p nominal level. The analog composite video input must be compliant with SMPTE 170M NTC, ITU-R BT.470, or PAL-I/B/D. The connector shell is connected to signal ground.

Connect the video input cable to the Analog Video In connector on the rear panel.

2.4 Audio Ports

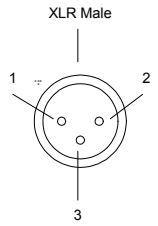
2.4.1 Analog Audio

The SE4000 has the following sets of analog audio input ports:

- Analog Audio A Right and Left.
- Analog Audio B Right and Left.

The ports can be configured for two stereo or four independent analog mono channels.

Each port has a male XLR connector with high impedance (>10 kΩ) termination.



Note: Four XLR Female to Female Adapter Connectors are included in the shipping kit.

The pin assignments for all the analog audio ports are listed in the following table:

Audio Port Pin Assignments	
Pins	**Signal**
1	Gnd
2	+
3	-

2.4.2 Digital Audio Ports

The SE4000 has the following two digital audio input ports:

- Audio Input A.
- Audio Input B.

Each port has a female BNC connector with a 75Ω nominal termination. The ports accept AES/EBU serial digital input that is compliant with ANSIAES3-1992 (ANSI S4.40-1992) recommendations. The ports are typically configured for two stereo channels.

2.5 Data Ports

2.5.1 Synchronous Port

The synchronous port accepts RS-422 input at 1 Kbps to 20 Mbps. The auxiliary data synchronous port pin assignment is listed in the following table:

Aux Data Port Pin Assignments: Synchronous - RS-422			
Pins	**Signal**	**Direction**	**Definition**
1	Unused	-	-
2	ST+	Out	Send Timing
3	SD+	In	Transmit Data
4	TT-	In	Terminal Timing
5	GND	-	Ground
6	ST-	Out	Send Timing
7	Unused	-	-
8	SD-	In	Transmit Data
9	TT+	In	Terminal Timing
Shell	GND	-	Ground-

2.5.2 Configuring the DTE and SE4000 Clock Interfaces

After you have cabled the data termination equipment (DTE) to the SE4000, you must determine the most effective SE4000 and DTE clock source arrangements. There are three different ways to configure the clock interface for the SE4000 and the DTE:

- Clock Interface Configuration 1 is the most reliable clock source arrangement. This configuration requires the DTE to provide a clock (TT) synchronous with the data (SD) to the SE4000.
- Clock Interface Configuration 2 is the second most reliable clock source arrangement. This configuration is used when the DTE cannot turn around the ST, but has an internal clock source that can be provided as TT to the SE4000.

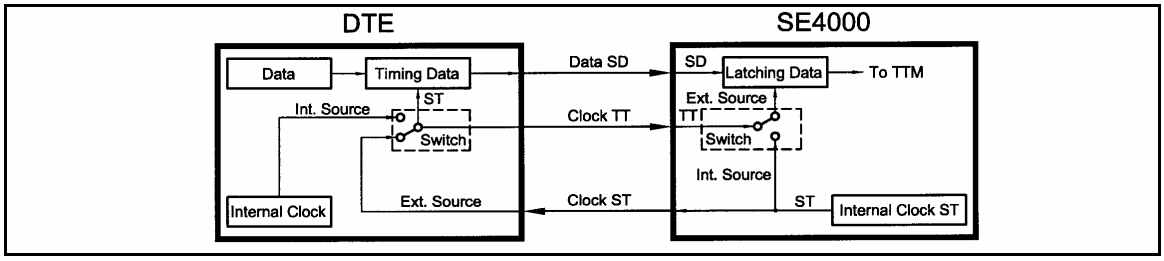
Clock Interface Configuration 3 is the least reliable clock source arrangement - it should only be used if the first two clock configurations cannot be used. In this configuration the SE4000 is configured to use ST to latch the data.

2.5.2.1 Clock Interface Configuration 1

The most reliable auxiliary data channel clock source configuration requires the DTE to provide a clock (TT) synchronous with the data (SD) to the SE4000. This scenario allows the SE4000 to latch the data using a clock that has traveled the same path as the data, which ensures that both the clock and the data are received in phase at the SE4000.

The following block diagram shows the clock configuration for a DTE configured to turn around the ST clock source, and a SE4000 auxiliary data channel configured for an external clock source.

Notice in the illustration that the switch for the SE4000 auxiliary data channel clock source is configured for external even though the SE4000 is providing ST to the DTE.



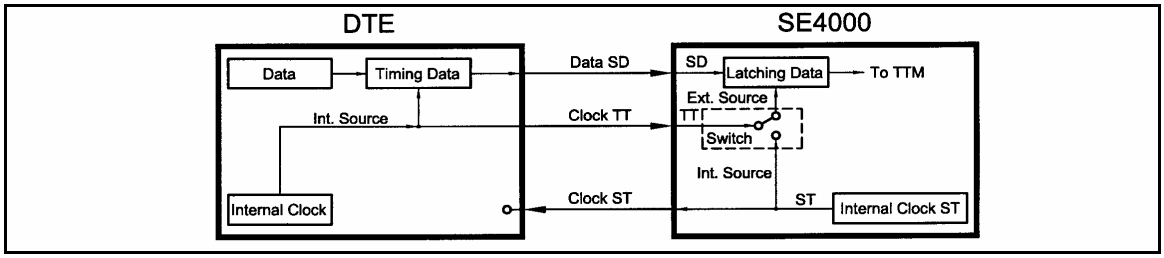
In this configuration, the SE4000 provides clock (ST) to the DTE. The switch for the DTE clock source is configured to accept the external clock (ST) provided by the SE4000. The DTE uses the ST to time the data, sends the data to the SE4000 on SD, and returns the ST to the SE4000 on TT. The SE4000 uses TT to latch the data.

The SE4000 auxiliary data channel must be configured for an external clock source to accept TT from the DTE.

2.5.2.2 Clock Interface Configuration 2

If the DTE cannot turn around the ST, but has an internal clock source that can be provided as TT to the SE4000, use this option to configure the auxiliary data channel.

The following block diagram shows the clock configuration for a DTE providing an internal clock source as TT to the SE4000.

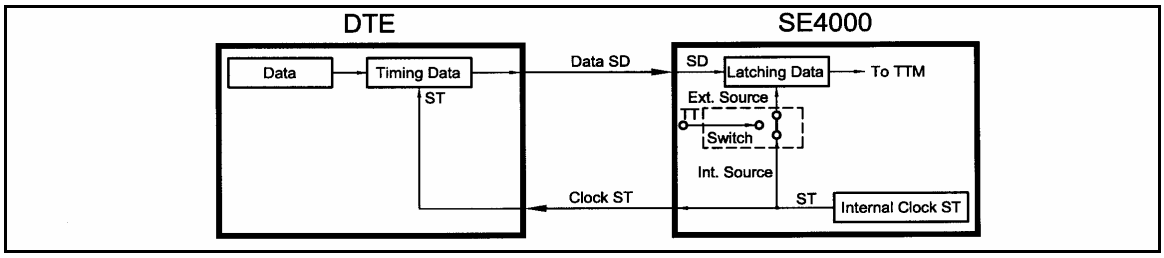


In this configuration, the DTE clock is set to internal and the SE4000 auxiliary data channel clock source is set to external. The DTE uses its internal clock source to time the data, sends the data to the SE4000 on SD, and sends its internal clock to the SE4000 as TT. The SE4000 uses TT to latch the data. The SE4000 auxiliary data channel must be configured for an external clock source.

2.5.2.3 Clock Interface Configuration 3

If the DTE cannot turn around the ST, and does not have an internal clock source that can be provided as TT to the SE4000, configure the SE4000 to use the ST to latch the data. However, this scenario is not recommended and should be considered only if neither of the other two-clock source configurations can be used.

The following block diagram shows the clock configuration for a DTE configured for an external clock and a SE4000 auxiliary data channel configured for an internal clock.



In this scenario, both the DTE and the SE4000 use ST, but the ST is provided to the DTE on one path and to the SE4000 on a different path. Depending upon the length of cable between the DTE and the SE4000, the clock may be received out of phase at the SE4000. The longer the cable, the further out of phase the clock will be.

CAUTION!!

If the internal clock is used to latch the data, the length of cable between the DTE and the SE4000 must be limited to one meter (3 feet). Additionally, the auxiliary data rate must be limited to not more than 64 Kbps. If the cable length exceeds one meter, or if it is attempted to process data at rates above 64 Kbps, the auxiliary data may be corrupted.

2.5.3 Asynchronous Configuration

In asynchronous configurations, ports are configured to accept RS-232 input at rates of 1200 bps to 115000 bps.

2.5.3.1 RS-232

The DB-9 connector allows a standard RS-232 DCE connection. The auxiliary data asynchronous port pin assignments for RS-232 are listed in the following table:

Aux Data Port Pin Assignments: Asynchronous - RS-232			
Pins	**Signal**	**Direction**	**Definition**
1	Unused	-	-
2	Unused	-	-
3	TD	In	Transmit Data
4	Unused	-	-
5	GND	-	Ground
6	Unused	-	-
7	RTS	In	Ready to Send
8	CTS	Out	Clear to Send
9	Unused	-	-

2.6 Remote Control Ports

A remote unit can be connected through either of two ports located on the SE4000:

- RS-232
- Ethernet Control

2.6.1 RS-232 Control Port

The RS-232 port is a DB-9 female connector. The port is configured as a DTE

2.6.1.1 DCE Configuration

The pinouts for the RS-232 port configured as DCE are listed in the following table:

RS-232 Port Pin Assignments: DTE			
Pins	**Signal**	**Direction**	**Definition**
1	Unused	-	-
2	TXD	Out	Transmit Data
3	RXD	In	Receive Data
4	DSR	In	Data Set Ready
5	GND	-	Ground
6	DTR	Out	Data Terminal Ready
7	CTS	In	Clear to Send
8	RTS	Out	Request to Send
9	RI	In	Ring Indicator

2.6.2 Connecting to the RS-232 Control Port

To connect a remote unit to the SE4000 through the RS-232 control port, a cable is needed that is the appropriate length for the application. The cable must be made to the following specifications:

- RS-232 electrical.
- DB-9 female connector on one end.
- An appropriate connector for the remote unit on the other end.

A standard direct connect DB-9 male to DB-9 female cable is included in the shipping kit.

Using the direct connect cable provided with the SE4000, attach one end to a remote unit and the other end to the RS-232 control port.

2.6.3 Ethernet Control Port

The Ethernet control port is an RJ-45 connector. Remote control using this port requires the following:

- Tiernan Network Management Software (NMS) program or alternate SNMP controller.
- Category 5 UTP patch cable (not supplied).

2.6.3.1 Connecting to a Network Using the Ethernet Port

The SE4000 can be connected to a LAN using the Ethernet port, which enables monitoring and control the SE4000 through a remote unit not directly connected to the SE4000.

When connecting the SE4000 to a LAN using Ethernet, contact your Information System department to coordinate installation and setup.

Perform the following steps to connect to the network using the Ethernet port:

1. Connect a Category 5 cable with RJ-45 connectors (standard Ethernet cable) between the SE4000 Ethernet port and a LAN hub.

2. Assign the device a unique IP address, if necessary.

   The SE4000 default IP address is 0.0.0.0. Contact your Information Systems department for a valid IP address.

   To change the IP address using the front panel:

   a. Select Control>Network>IP Addr
   b. Using the keypad, enter the IP address in the format xxx.xxx.xxx.xxx where xxx is a decimal number between 0 and 999.
   c. Press the Enter button

   To change the IP address using a remote unit, issue the following command

   `MC IP XXX.XXX.XXX.XXX`

   where XXX is a decimal number between 0 and 999.

3. Assign additional network information, if necessary. Depending on the configuration of the LAN, you may need to enter additional parameters including:

   - Ethernet IP address mask (IP subnet mask).
   - Ethernet IP gateway.

4. From a personal computer connected to the LAN, try to ping the SE4000. At the command prompt of the personal computer, type ping <SE4000 IP address> where <SE4000 IP address> is the address assigned in step 2.

   If a reply is received, the SE4000 is correctly configured.

For information on establishing remote communications or on Ethernet commands, refer to the chapter on using a remote unit.

2.6.4 Fault Relay

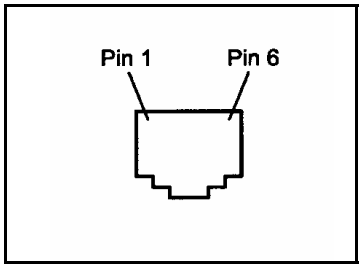
The Fault Relay is an RJ-11 connector. The fault relay is used in a redundant configuration. In this configuration input is fed from distribution amplifiers into each of two SE4000s. A Tiernan redundancy switch monitors the output through the Fault Relay. If the primary SE4000 faults, the secondary SE4000 automatically takes over operation.
A relay fault condition is defined as:

- A unit power failure.
- Unit power switch turned off.
- Unit is unplugged.
- A unit hardware failure.

The fault condition is indicated by contact closure between pins one (1) and three (3) and open contacts between pins one (1) and six (6). The non-fault condition is indicated by contact closure between pins one (1) and six (6) and open contacts between pins one (1) and three (3).

The illustration indicates the physical locations of pins 1 and 6 within the fault relay port, as viewed from the rear panel.

When the fault relay detects a fault condition, the fault relay trips, and the Status LED located on the SE4000 front panel illuminates red.



The SE4000 multiplexer outputs an ASI transport stream with a variable rate of 1 to 80 Mbps. This transport stream is the combination of the video, audio, and auxiliary data streams in an MPEG-2 compliant transport stream. The transport stream is always available at the ASI output ports even if a modulator is installed and operating

2.7 Transport Connection Ports

2.7.1 ASI Out Primary

ASI Out Primary is a female BNC connector with 75Ω impedance. The port outputs a DVB-compliant ASI transport stream at rates between 1 and 80 Mbps.

ASI Out Primary is used for normal operation and is typically cabled to the Mod ASI In connector with a short (14”) coaxial cable.

2.7.2 ASI Out Secondary

ASI Out Secondary is a female BNC connector with 75Ω impedance. The port outputs a copy of the primary transport out.

ASI Out Secondary port can be used to output the transport stream of one SE4000 to the multiplexer of the SE4000 for MPTS operation. In this configuration, this port is cabled to the Mux ASI In port of the SE4000 in the MPTS chain.

2.8 Modulator Output to Upconverter

The internal modulator outputs a modulated IF signal, which is connected to an upconverter. Connections are made through the Tx If Out port. This port is a female BNC connector that outputs a 70 MHz, 140 MHz, or L-Band DVB-compliant, QPSK, 8PSK, or 16QAM modulated, FEC encoded IF signal at symbol rates from 1 to 45 Msps.

Before attaching cables from the modulator output to the upconverter, verify that the modulator power is off until ready to begin satellite transmissions.

To cable the modulator output to an upconverter, connect the output of the internal modulator from Tx IF Out to an IF-to-RF upconverter.

There is also an L-Band Monitor port available for direct monitoring connection to an IRD.

Using the Front Panel

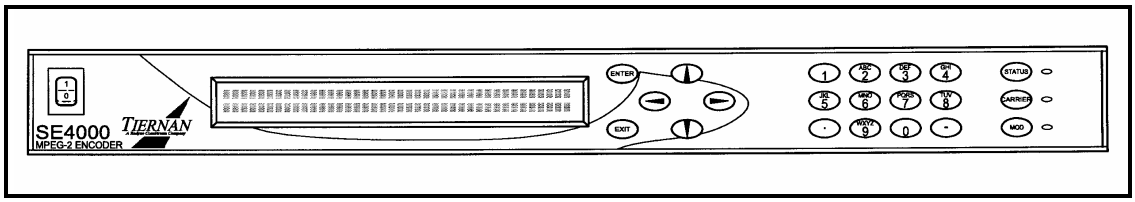
3

This chapter describes the following SE4000 front panel information:

- Components
- Commands, including navigating, setting and changing parameters
- Menus, options, and parameters

3.0 Front Panel Components

The front panel enables you to easily and efficiently configure and monitor the SE4000.

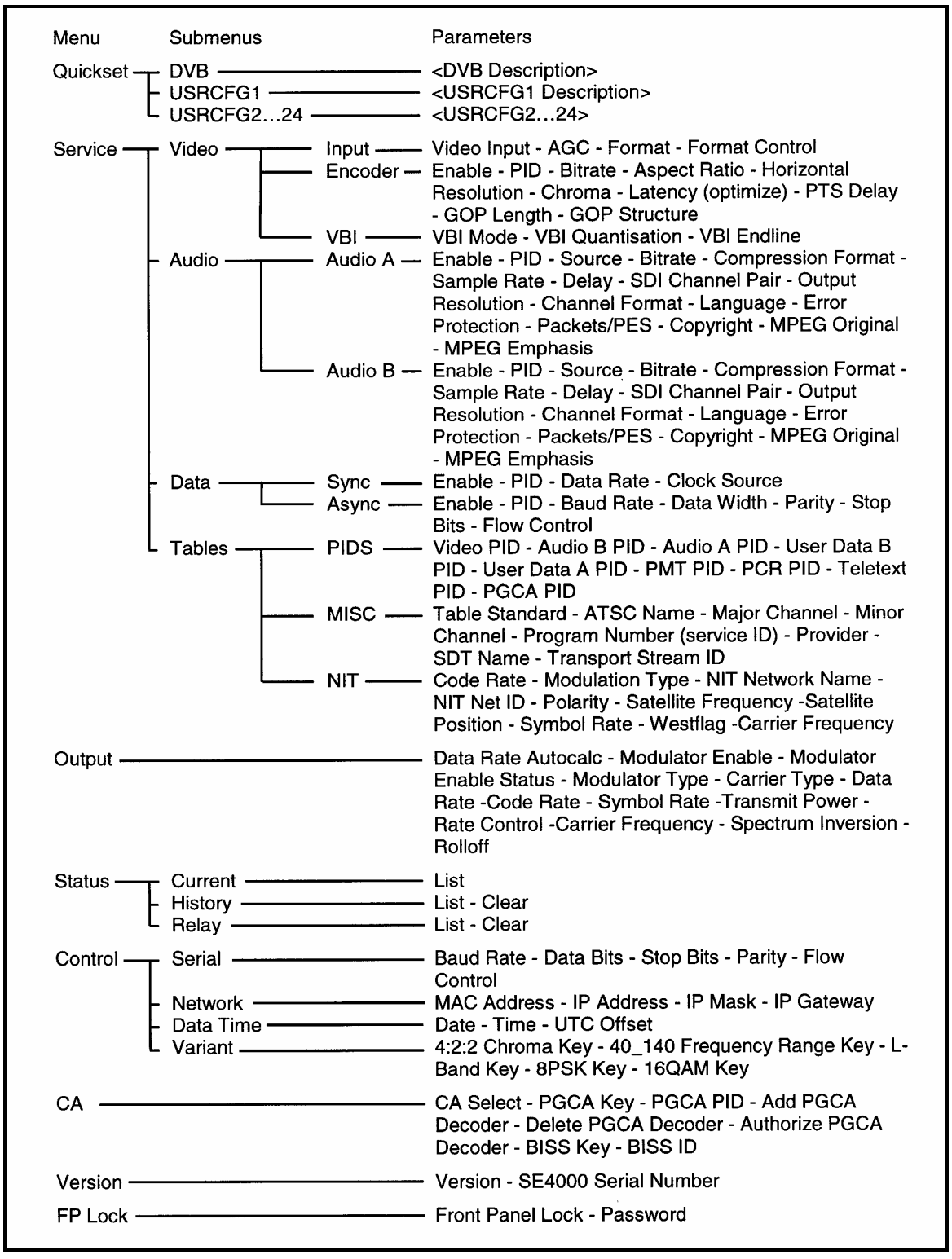


The front panel consists of:

- LCD – displays menus, parameters, information, and messages
- Enter button – used to select a menu item, issue a command, or set a parameter
- Exit button – used to scroll up to a previous menu level or leave a parameter without changing it's option
- Left and Right buttons – used to scroll within the current menu level, or to scroll through a list of parameters
- Up and Down buttons – used to scroll through parameter options and increase and decrease parameter values
- Alphanumeric keypad – used to enter alphabetic and numeric parameter values
- Status button – hot key which toggles between the current front panel menu and the current faults list
- Status LED – tri-color LED alerts you to status and fault conditions
- Modulator control buttons and LEDs – these two buttons affect the power and form of the output IF transmit carrier from the encoder:
- Carrier – enables carrier wave at nominal power
- Mod – enables modulated carrier at nominal power

3.1 SE4000 Menu Structure

The following illustration shows the SE4000 menu structure:



3.2 Navigating Through the Menus

The front panel LCD display and buttons were designed maximize speed and efficiency of navigation through the SE4000 menu structure.

3.3 LCD Display

The flowing figure shows a sample SE4000 menu on the front panel:

```
SE4000/SERVICE/VIDEO/INPUT      2/7    >

VIDEO INPUT = SDI
```

3.4 LCD Symbols

Listed below are the important symbols that appear on the LCD Display:

- Brackets [ ]
- Arrows (→ ←)
- Asterisk (*)
- Equal Sign (=)
- Colon (:)

3.4.1 Brackets

As the menus, parameters, and options are navigated, the brackets indicate which item is currently selected.

3.4.2 Arrows

A right arrow will often display on the LCD Display as the SE4000 parameters are navigated. This arrow indicates that there are additional items available in that parameter list.

3.4.3 Asterisk

While the SE4000 is executing a command or setting a parameter option, an asterisk (*) appears on the LCD Display, indicating that the SE4000 is processing information. When the asterisk disappears, the process is complete.

3.4.4 Equal Sign

Most parameters, though not all, can be modified in order to configure the SE4000. Configurable parameters are followed by an equal sign, denoting that the parameter can be modified.

3.4.5 Colon

There are some parameters that are either automatically set for the system or that are query-only parameters. A colon follows these type of parameters. When a colon follows a parameter, that parameter can be viewed but not changed.

3.5 LCD Text Formats

All menus, parameter options, and system information are displayed on the front panel LCD.

3.5.1 Menus

All menus are displayed in the following format:

```
SE4000/SERVICE/VIDEO/INPUT       2/7     >

VIDEO INPUT = SDI
```

- The first line identifies the current menu level. This example shows the Service menu.
- The second line identifies the selected menu option.
- The 2/7 indicates that you are currently on the second item of seven available choices.
- The arrow, when displayed, signifies that there are additional menu options available at that level.

3.5.2 Parameter Options

All parameter options are displayed in the following format:

```
SE4000/SERVICE/VIDEO/INPUT       2/7     >

VIDEO INPUT = [SDI]
```

- The first line identifies the current menu level, in this example, the video input menu.
- The second line displays the parameter, Video input. The current setting, SDI, is surrounded by brackets.
- Only one option can be displayed on the LCD at one time. For more options, the Up and Down buttons would be used to scroll through the list of options.
- The equal sign (=) denotes that this parameter can be modified. If this parameter was followed by a colon (:) the parameter would be view-only.
- The arrow indicates that there are additional Video Input parameters.

To move to another parameter, the right and left buttons would be used to scroll through the list of parameters.

3.5.3 Information

Information, such as current faults, faults in the history log, and system messages are displayed as ASCII text strings as shown in the following example:

```
SE4000/STATUS/CURRENT          1/3      >

AUDIO ENCODER   AUDB SRATE MISMATCH
```

- The first line identifies the current menu level, in this example, the current faults (status) menu.
- The second line indicates the current faults, in this example, there are three current faults.

To view the other current faults, up and down buttons would be used to scroll through the list of faults.

3.6 Screen Saver

When the SE4000 has detected no front panel activity for more than five minutes, the screen saver is activated. The screen saver displays the following information for the service currently being processed.

```
SE4000 STATUS SUMMARY    >

TBD
```

To exit screen saver mode and return to normal front panel operations, press the Exit button.

The Enter button should <u>not</u> be used to exit screen saver mode, as this button may issue new commands to the SE4000.

The following front panel buttons are used to move through menus in order to issue commands and view status and fault information:

- Right and Left Buttons
- Up and Down Buttons
- Enter Button
- Numeric Keypad
- Exit Button
- Status Button

3.7 Right and Left Buttons

The Right and Left buttons are used to scroll through menu items, or through a list of parameters. These buttons movement through the menu structure in the following manner:
At a menu level these buttons move the selection brackets [ ] and scroll right and left, (forward and backwards), respectively, through all available menu items at that current level. The following graphic illustrates how the right button functions at a menu level.

```
SE4000/STATUS                                    >

[CURRENT]  HISTORY  RELAY
```

- To navigate from one menu line to another, use the left and right buttons. For example, to move from the current to the history menu, press the right button.

```
SE4000/STATUS                                    >

 CURRENT  [HISTORY]  RELAY
```

- In a *parameter list*, the up and down left buttons scroll through the parameter list. When the last parameter is reached, the SE4000 scrolls through the list again.

```
SE4000/OUTPUT                                    >

DATARATE AUTOCALCULATION = AUTO
```

- Using both the up and down buttons enables a parameter list to be scrolled through in either a forward or backward motion.
- If the required parameter is accidentally scanned past, use the appropriate up or down button to go back to the required parameter.
- When entering alphanumeric characters, the left button is used to delete characters.

3.8 Enter Button

The Enter button is used to:

- Select the menu item displayed in brackets [ ] on the LCD.
- Issue a command.
- Set a new parameter option.

To select a menu item, use the Left/Right buttons until the brackets encompass the menu item, then press the Enter button. The Enter button moves you to the selected submenu.

To issue a command, such as the clear history log command, press the Enter button to execute the command.

To set a parameter option, such as a new video frame rate, use the Up/Down buttons until the brackets encompass the option (the option should be flashing) then press the Enter button. The SE4000 is configured with the new parameter value and the new value is stored in nonvolatile memory.

3.9 Exit Button

The Exit button moves you through the menu structure in the following manner:

- At a menu level, the Exit button moves you up one menu level.
- In a parameter list, the Exit button moves you up to the previous menu level.
- When selecting a parameter option, the Exit button leaves the parameter without changing it, and moves up to the previous menu level.

The exit button is also used to exit screen saver mode.

3.10 Up and Down Buttons

Once a parameter is displayed, use the Up and Down buttons to scroll through all available options until the brackets encompass the required option.

The Up and Down buttons will also increase and decrease the numeric value, if they are pressed before any keys on the keypad are pressed.

3.11 Alphanumeric Keypad

The alphanumeric keypad is used to enter both alphabetic and numeric parameter values. To correct any alphanumeric characters, use the left arrow to delete the characters.

3.11.1 Alphabetic Entries

When entering values in an alphanumeric field, the following alphabetic and numeric characters are displayed when a key is pressed:

Alphabetic Entries	
Pins	**Signal**
1	. , ? ! - 1
2	A B C 2
3	D E F 3
4	G H I 4
5	J K L 5
6	M N O 6
7	P Q R S 7
8	T U V 8
9	W X Y Z 9
0	<space> 0 ‘ +

The first press of a number key displays the first character in the set; sequential presses of the same key advance through the character set, in a circular fashion. The cursor is advanced by either pressing another number key, or by pressing the right arrow key. For example: To enter the word ALL that has two of the same character in a row, the following keys would be pressed:

2 selects A
555 selects L
→ advances the cursor so the next letter can be selected
555 selects L

A space can be entered by either a single press of the “0” key, or by two or more presses of the right cursor key. For example, to enter the words LA Default the following keys would be pressed:

555 selects L
2 selects A
0 selects space
3 selects D
→ advances the cursor so the next letter can be selected
33 selects E
→ advances the cursor so the next letter can be selected
333 selects F
2 selects A
88 selects U
555 selects L
8 selects T
Enter to issue the command

3.11.2 Numeric Entries

When entering values in numeric field, the required numeric value is simply typed using the keypad and press Enter.

The default value that is initially displayed disappears upon the first numeric key press. Once a numeric key is pressed, the Up and Down buttons are nonfunctional; they resume their normal functions once the Enter or Exit buttons are pressed.

To delete an alphanumeric character, use the left arrow key.

To enter a negative value, press the minus key (-) on the keypad; this toggles the value between negative and positive.

3.11.3 Status Button

The Status button is a hot key, which enables immediate viewing of any faults currently occurring on the SE4000 and then toggling back to the front panel menu on which work was being done.

When leaving the current faults using the Status button hot key, you are returned to the menu level at which you were working, not to the parameter level.

3.5 Issuing Commands

To issue a command from the front panel, perform the following steps:

1. Navigate through the menus to the required command or parameter using the navigation buttons.

2. Change the parameter option as required:

   - Scroll through the options using the Up or Down buttons. Ensure that the required option is selected with the brackets [ ].
   - If the option requires a numeric value to be entered, enter the value using either the Up and Down buttons to increment the value or the numeric keypad to type in the value.
   -

3. Issue the command by pressing the Enter key. An asterisk will display and then disappear when the system is finished processing the request. The parameter, with its updated value, is then displayed in brackets and does not flash.

   - If the Enter button is not pressed, the option is not changed.
   - While the SE4000 is setting the parameter to the new value, the front panel is temporarily disabled.

When the SE4000 configuration is changed using the front panel, the changes are automatically stored in non-volatile memory. The SE4000 automatically restores to the saved configuration whenever the unit is reset or powered up.

3.6 Correcting Mistakes

3.6.1 Selecting Options

If an option is selected and the Enter button has not been pressed, use the Up or Down buttons to scroll to the correct option.

3.6.2 Using the Keypad

If a value is entered via the keypad and the Enter button has not been pressed, the following may be done:

- Left button to delete the numbers and then enter the correct value.
- Exit button which returns you to the previous menu level.

3.6.3 Leaving a Parameter

If the Enter button has not been pressed, a parameter can be left without modifying it by pressing either the:

- Exit button which returns you to the previous menu level
- Left or Right buttons which take you to the next parameter

In either situation, the SE4000 will ignore any values entered and return the parameter to its original setting.

3.6.4 After Pressing the Enter Button

If you accidentally issue an incorrect parameter value to the SE4000, you can correct the error by:

1. Selecting the correct option using the Up and Down buttons. The parameter will begin to flash.

2. Pressing the Enter button to set the correct option.

Example: The following example describes how to move through menus and select options. In this example the SE4000 video will be enabled.

1. From the main menu select Service and press Enter.

2. Select Video.

```
SE4000/SERVICE/VIDEO                              >

[INPUT]     ENCODER       VBI
```

3. Select encoder. Press the Right button to move the brackets to Encoder. Press Enter.

```
SE4000/SERVICE/VIDEO/ENCODER          1/3       >

ENABLE = ON
```

4. The enable menu displays. Use the up and down buttons to select On. Then press enter to select.

```
SE4000/SERVICE/VIDEO/ENCODER          1/3       >

ENABLE = ON
```

3.7 Modulator Control Buttons

The two modulator control buttons, located at the far right of the front panel, affect the power and form of the output IF transmit carrier from the encoder. Each button has an associated LED indicator. Only one of the LEDs is illuminated at a time. These buttons cause the output carrier to be one of the following:

- Off
- Carrier on - full-power CW (constant wave)
- Modulate on - full-power modulated

A blinking LED indicates that the button is busy implementing its command. When the command is executed the LED stops blinking. Command execution takes 5 to 10 seconds to complete. Each time you press the button, even if the LED is blinking, the command is executed.

The purpose of the buttons is to allow fast and simple operation of the encoder when a DSNG operator is coming up on a satellite or taking down a link.

Pressing the modulator control buttons causes the SE4000 to toggle the modulator as follows:

Current Modulator State	Key Press	Resulting Modulator State
Off	Mod	Modulate On Carrier Off
Carrier On	Mod	Modulate On Carrier Off
Modulator On	Mod	All Off
Off	Carrier	Modulate Off Carrier On
Carrier On	Carrier	All Off
Modulate On	Carrier	Modulate Off Carrier On

3.8 Front Panel Menu Summary

The following table lists detailed descriptions of the SE4000 front panel commands. The commands are organized in the order in which they appear on the front panel. Included are:

- Menu level to which the command is attached.
- Front panel command.
- Command function.
- Available options for that command or the response format if the command is query-only.

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Main Menu - consists of the following submenus: ● QuickSet - used to quickly and easily re-initialize the encoder using predefined factory default configuration settings or user-defined configuration settings. ● Service - used to setup and configure the video, VBI, audio, data, and PCR services ● Output - used to configure and monitor the SE4000 internal modulator ● Status – Used to quickly query either the current or status or the fault history log. ● CA - Conditional Access menu is used to setup the SE4000 for conditional access and to create and modify a list of authorized decoders ● Control - allows you to configure and manage the SE4000 hardware. ● Version – Displays the Software version number and unit serial number ● FP LOCK – Provides a method of “locking out the front panel to read-only mode.		
Main>QuickSet Menu	**Consists of 24 Quickset choices, which allow quick and easy saving and recalling of user-defined configurations sets, management of the user-defined list, and then re-initialize the SE4000 using either the user-defined configuration sets or predefined factory default configuration settings. These configuration sets are not altered by reset, power cycling, or factory DVB default setting of the encoder.**	
DVB	Initializes the SE4000 to the factory default configuration parameters.	● DVB (default) ● This configurationcan not be modified by the user.
Empty 1 - 23	Saves the current site-specific	Up to 24 user-defined configuration sets may be

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
	configuration in non-volatile (flash) memory under the selected user configuration label.	saved. Configuration sets must be saved to existing user-defined labels. If there are no user labels defined, *<empty list>* is displayed. User-defined labels are set using the Config>Quickset>New feature.
Config>Service #>Video>Input	**Used to configure the SE4000 video input section.** ***Note: for embedded audio, Config>Service # >Video>Input Source must be set to digital, Config>Service # >Audio must be set to digital, and Config>Service # >Audio>Source must be set to SDI.***	
Input Source	Sets the encoder input video source.	● SDI - Digital ● analog (default) Note: for embedded audio, Config>Service # >Video>Input Source must be set to digital; Config>Service # >Audio must be set to digital, and Config>Service #> Audio>Source must be set to SDI.
AGC	Sets Analog video AGC on or off – only available when Analog input is selected	● On (default) ● Off
Format	Query-only. Displays the analog video format.	● 525 ● 625 ● `no video` if there is no video input
Format Ctrl	Sets the video format mode when the input source is set to analog.	● auto – unit automatically senses incoming video signal format and configures the video mode to match (default). ● PAL – 625 line PAL-N mode. ● NTSC – 525 line NTSC mode. ● NTSC 0SU – no pedestals NTSC 0SU mode.

<table>
<tr><th colspan="3">Front Panel Menu Summary</th></tr>
<tr><th>Command</th><th>Function</th><th>Options/Response Format</th></tr>
<tr><td>Config>Service #>Video>Encoder</td><td colspan="2">Used to configure the SE4000 video encoding parameters.</td></tr>
<tr><td>Enable</td><td>Setting determines whether or not video is included in the output transport stream.</td><td>● on – video is included in the output transport stream (default).
● off – video is not include in the output transport stream.</td></tr>
<tr><td>PID</td><td>Query only. Displays the video PID number included in the output transport stream.</td><td>Default – 33 (21h)</td></tr>
<tr><td>Bit Rate</td><td>Sets the output compressed video bit rate for optimum video performance.
● If the Tx Strm>Rate Calc is set to auto, this command is query only.
● If the Tx Strm>Rate Calc is set to manual, the user sets the data rate.</td><td>If chroma set to 4:2:0: 1.0 to 15.0 Mbps
if chroma set to 4:2:2: 2.5 to 50.0 Mbps</td></tr>
<tr><td>Aspect Ratio</td><td>Sets the picture aspect ratio which is the ratio of the frame width to the frame height.</td><td>● 4x3 (default)
● 16x9</td></tr>
<tr><td rowspan="2">Horizontal Resolution</td><td>Selects the picture resizing that the SE4000 performs prior to video encoding.</td><td>720, 704, 544, 480, 352
default: 720</td></tr>
<tr><td colspan="2">Additional Information: As shown in the following table, the number of lines depends upon whether the video format is set to NTSC or PAL.

<table>
<tr><th>Resolution OptionNTSC Mode</th><th>PAL-I Mode</th><th>Encoding Type</th></tr>
<tr><td>AFF352</td><td>352 pixels by 480 lines</td><td>352 pixels by 576 lines</td><td>MPEG – 2</td></tr>
<tr><td>AFF480</td><td>480 pixels by 480 lines</td><td>480 pixels by 576 lines</td><td>MPEG – 2</td></tr>
<tr><td>AFF544</td><td>544 pixels by 480 lines</td><td>544 pixels by 576 lines</td><td>MPEG – 2</td></tr>
<tr><td>AFF704</td><td>704 pixels by 480 lines</td><td>704 pixels by 576 lines</td><td>MPEG – 2</td></tr>
<tr><td>AFF720 (default)</td><td>720 pixels by 480 lines</td><td>720 pixels by 576 lines (full resolution video)</td><td>MPEG – 2</td></tr>
</table></td></tr>
<tr><td>Chroma</td><td>Sets the chrominance compression algorithm.</td><td>4:2:0, 4:2:2 optional</td></tr>
</table>

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Latency	Sets the selected optimization mode ***Note: The custom parameter is for experienced users only. Changing custom optimization features requires advanced knowledge of MPEG compression theory and encoder commands, and, if set incorrectly, the video performance maybe adversely affected. It is recommended that users consult with the Radyne ComStream customer Service Department before using the custom configuration.***	● quality – optimizes the video performance without regard for throughput delay time. Quality mode is appropriate for action video scenes such as sports material (default). ● low-buffer – compensates for undersized decoder buffers. ● low-delay – reduces the throughput time required to process a signal from the encoder input, through the compression process, and to the decoder output. In low delay mode, the overall delay through a SE4000 to an IRD is 180 ms ± 40 ms. In low delay mode, the compressed audio bit rate is automatically set to 256 Kbps. Low delay mode is appropriate for real time news interviews. ● edit – video compression uses only one frame (no prediction) which makes it easier to edit the compressed bit stream. Edit requires a higher data rate to achieve the video performance of quality mode. ● custom – allows the user to set site-specific video compression parameters, such as GOP structure and VBV size. These parameters must be initially set through a remote terminal and then saved using the remote CM SAVE command. Once saved through a remote terminal, this custom setup will persist until the video optimize setting is changed. The custom parameter is for experienced users only. Changing custom optimization features requires advanced knowledge of MPEG compression theory and encoder commands, and, if set incorrectly, the video performance maybe adversely affected. It is recommended that users consult with the Radyne ComStream customer Service Department before using a custom configuration.
PTS Delay	Sets the video delay	+1000 to –1000 ms adjustable in 1 ms increments
GOP Length	Displays the GOP length – in custom mode sets the GOP length	GOP (Group of pictures) variants allow for adjustment of encoding parameters to optimize for various uses. (see the latency settings above). Custom GOP parameter settings may not work with all IRDs and may adversely affect Encoder bandwidth efficiency.
GOP Structure	Displays the GOP Structure – in custom mode sets the GOP Structure.	GOP parameters should only be changed by advanced users in special circumstances.

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Config>Service # >Video>VBI	**Used to configure the encoder to transmit teletext data.** ***Note: Teletext should not be enable with other VBI encoding formats, as teletext overwrites all other VBI data.*** ***Note: For additional information on Teletext, refer to the appendix on VBI Data Transmission.***	
VBI Mode	Enable and selects the VBI functions and format	● Off – Disables all VBI functions ● Tiernan CC - Configures the encoder to transmit Tiernan closed captioning information. The Tiernan CC transmission described in this document is Radyne ComStream proprietary. Only Tiernan decoders accommodate the Tiernan CC feature described in this document: ***Note: Tiernan CC should not be implemented in PAL mode, as the closed caption information will be decoded and placed on line 22 of the video.*** ● ATSC CC - Configures the encoder to transmit ATSC closed captioning information. ● 4:2:2 Expand - Configures the encoder to transmit either 16 or 32 lines of VBI information
VBI Quantization	Configures the encoder to transmit either 16 or 32 lines of VBI information	● Off – disables expanded windows mode (default). ● 16-line – enables 16-line expanded windows mode. ● 32-line – enables 16-line expanded windows mode.
VBI Endline	Sets the last line of encoded VBI when 4:2:2 expanded windows is enabled	● TBD
Teletext Enable	Configures the encoder to transmit teletext information.	● off – does not encode any teletext information (default). ● all – encodes the entire VBI teletext area; i.e., allocates bit-rate to include maximum number of teletext lines. ● auto – automatically allocates bit-rate to include only the number of detected teletext lines.
Teletext Data ID	Setting determines EBU data included in the teletext. Values from 0x10 to 0x1F reflect the EBU data	0 to 255 Default: 1
Teletext Data Unit ID	Defines if there are EBU teletext sub-lines included in the data.	Data Unit ID has range from 0 to 255. Values are: ● 2 = EBU teletext non-subtitle data is not included (default). ● 3 = EBU teletext subtitle data is included. ***Note: Data Unit ID must be set to 2 or 3 for proper decoder operation.***

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Config>Service # >Audio (A or B)	**Used to configure the SE4000 audio. Once the audio transmission is selected as Digital or Analog, the audio channel (or slot) to configure is configured. Audio Channels A or B can be configured as either Analog, Digital or Embedded.** ***Note: for embedded audio, Config>Service # >Video>Input Source must be set toSDI; Config>Service # >Audio must be set to digital, and Config>Service # >Audio>Source must be set to SDI.***	
Enable	Setting determines whether or not audio is included in the output transport stream.	● on – audio from that channel is included in the output transport stream (default). ● off – audio from that channel is not include in the output transport stream. default: ● if digital audio: off ● if analog audio: on
PID	Query-only; displays the audio PID number included in the output transport stream.	Default- Audio A 36 (24h) Default- Audio B 37 (25h)
Source	Sets the source of the audio.	● If digital audio: AESEBU, SDI (embedded audio). ● If analog audio: analog. ***Note: for embedded audio, Config>Service # >Video>Input Source must be set to digital; Config>Service # >Audio must be set to digital, and Config>Service # >Audio>Source must be set to SDI.***
Bit Rate	Sets the audio compression bit rate Additional Information: Selecting a high audio compressed bit rate will produce a high-quality audio signal at the output audio device; however, a high audio compressed bit rate reduces the total transport stream bit rate available for the video signal. An audio compressed bit rate should be selected that meets the audio requirements while allowing sufficient bandwidth to meet the video requirements.	● If compression set to MPEG or ATSC: 64, 128, 192, 256, 384 Kbps ● If compression set to none: 1 to 4096000 bps default: 256 Kbps
Compression Format	Sets the output compression format for the audio stream.	MPEG, AC3 2.0, AC3 Pass through, uncompressed pass through

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Sample Rate	Determines how often the SE4000 samples the analog waveform during the audio analog to digital conversion process. Additional Information: Selecting a high audio sample rate will produce a high-quality audio signal at the output audio device; however, a high audio sample rate reduces the total transport stream bit rate available for the video signal. An audio sample rate should be selected that meets the audio requirements while allowing sufficient bandwidth to meet the video requirements.	32, 44.1, 48 kHz default: 48 kHz
Delay	Sets the compressed audio bit stream buffer delay, which controls the time delay between the audio and video.	-300 to 300 milliseconds default: zero (0) msec ● Positive numbers cause the decoder to delay the audio output with respect to the video (i.e. lag). ● Negative numbers cause the decoder to advance the audio output with respect to the video (i.e. lead). ● Zero (0) represents nominal alignment between video and audio output from the decoder (i.e. lip sync). In addition, a zero lip sync value assumes that the video and audio has lip sync at the input of the encoder.
SDI Channel Pair	Selects one of the eight embedded audio channel pairs associated with the digital audio input ***Note: SDI Audio Chnl Pair is only available when digital audio channels are selected.***	1 through 8 default: 1
Output Resolution	Query-only; displays the number of bits per audio sample.	16-bit, 20-bit, 24-bit

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Channel Format	Sets the audio compression format which determines how the left and right channels of the audio input source are compressed.	● Stereo – left and right audio channels are compressed separately into two output waveforms. Stereo uses more bandwidth than mono; however, if the input audio source is stereo, the stereo effect will appear at the output audio device. ● Dual Mono – the left and right audio channels are compressed separately into two output waveforms. This option uses more bandwidth than mono, however, use this option when the left and right audio channel inputs represent separate and independent audio signals. ● Joint Stereo – the left and right audio channels are compressed jointly into two output waveforms. This option uses more bandwidth than mono but less than the stereo and dual mono options. Use this option when the left and right audio channel inputs are highly correlated (i.e., left and right stereo channels of one audio program source). The SE4000 uses the similarities between the two channels to save bandwidth without losing the stereo effect at the output audio device. ● Mono – during audio compression the SE4000 ignores the right audio channel input and produces a single output waveform based on the left channel input. This option saves bandwidth; however, if the input audio source is stereo, the stereo effect at the output audio device will be lost. default: stereo
Language	Sets the audio language descriptor for the selected service.	English, French, German, Italian, Japanese, Korean, Portuguese, Serbian, Spanish, Chinese, Danish, and Dutch.
Error protection		On/Off
Packet/PES	Read only	Default = 1
Copyright		On/Off
MPEG original		On/Off
MPEG emphasis		● None ● CCITTJ.17 ● 50_15_us

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Main>Service # >Data	**Used to configure the SE4000 auxiliary data. The Data menu has two data channels, A and B. Both data channels have identical parameters and options that are used to configure the auxiliary data ports.**	
Enable	Determines whether or not auxiliary data is included in the output transport stream.	● on – auxiliary data is included in the output transport stream. ● off – disables the port and does not include auxiliary data in the output transport stream (default).
PID	Query-only, displays the data PID number included in the output transport stream.	Default Async data- 42 (2Ah) Default Sync data – 43 (2Bh)
Baud	Sets the baud rate for the asynchronous auxiliary data channel ***Note: Baud is only available for the Asynchronous data channel.***	1200, 2400, 4800, 9600, 19200, 38400 bps default: 38400 bps
Data Width	Sets the character length for the asynchronous auxiliary data channel ***Note: Data Bits is only available for the Asynchronous data channel.***	7, 8 default: 8
Parity	Sets the parity for the asynchronous auxiliary data channel. ***Note: Parity is only available for the Asynchronous data channel.***	none, even, odd default: none
Stop Bits	Sets the number of stop bits for the asynchronous auxiliary data channel. Note: Stop Bits is only ***available for the Asynchronous data channel.***.	1, 2 default: 1
Flow Control	Sets the flow control for the asynchronous auxiliary data channel. Note: Flow Control is only ***available for the Asynchronous data channel.***.	None Hard
Data Rate	Sets the number of data bits for the synchronous auxiliary data channel ***Note: Data Rate is only available for the synchronous data channel.***	1 to 4096000 bps default:1024000 bps Additional Information: The data rate for the auxiliary data channel reduces the total transport stream bit rate available for the video signal; therefore, an auxiliary data rate should be selected that meets but does not exceed the site-specific operational requirements.

<table>
<tr><th colspan="3">Front Panel Menu Summary</th></tr>
<tr><th>Command</th><th>Function</th><th>Options/Response Format</th></tr>
<tr><td>Clock Source</td><td>Sets the clock source for the synchronous auxiliary data channel
Note: Clock Source is only available for the synchronous data channel.</td><td>● internal – uses ST to latch the data (default)
● external – uses TT to latch the data</td></tr>
<tr><td></td><td colspan="2">Additional Information: Clock Source allows you to select either an Internal (ST) or an External (TT) clock to latch the input auxiliary data (SD). There are three different ways to configure the clock sources for the SE4000 and a DTE. The following table lists these different configurations along with the circumstances under which each is used.
n The first option will produce the most reliable auxiliary data.
n You should use the last option only if you are unable to configure your DTE for either of the first two options.
<table>
<tr><th>Circumstance For Use Clock Source Configuration</th><th>SE4000 Data Used to Latch Data</th><th>SE4000 Clock Source Configuration</th><th>DTE Clock Sent to SE4000 on TT</th><th>DTE Clock</th></tr>
<tr><td>Option 1: DTE is able to turn around ST and provide ST back to the SE4000 as TT.</td><td>Internal</td><td>TT</td><td>External</td><td>ST</td></tr>
<tr><td>Option 2: DTE is not able to turn around ST, but has an internal clock that can be provided to the SE4000 as TT.</td><td>External</td><td>TT</td><td>Internal</td><td>Internal</td></tr>
<tr><td>Option 3: DTE is not able to turn around ST and does not have an internal clock to provide to the SE4000 as TT.</td><td>Internal</td><td>ST</td><td>External</td><td>None</td></tr>
</table>
For more information on configuring the auxiliary data channel clock source, refer to the chapter on installing the SE4000.</td></tr>
<tr><td>Config>Service # >Tables</td><td colspan="2">Used to set the program clock reference parameters.</td></tr>
<tr><td>PIDS</td><td>Query-only, displays the PID number.</td><td>• Video
• Audio A
• Audio B
• Async Data
• Sync Data
• PMT
• PCR</td></tr>
<tr><td>MISC</td><td>Query-only, displays table parameters</td><td>• Table Standard (DVB or None)
• Program Number
• Provider
• SDT Name
• TX Stream ID</td></tr>
<tr><td>NIT</td><td>Query-only, displays the NIT table parameters.</td><td>• Code RateVideo
• Mod Type
• Network Name
• Network ID
• Polarity
• Sat Freq
• Sat Pos
• Sym Rate
• Westflag</td></tr>
</table>

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Config>Output	**Used to configure and monitor the SE4000 internal modulator and the ASI transport stream output. When the initial SE4000 installation and configuration is begun, the modulator output (Mod State) should be turned off until ready to begin satellite transmissions.**	
Data Rate Auto Calc	Controls video bit rate calculation algorithm	● Auto – Video bit rate is automatically set to the maximum rate available (default) ● Manual – Video bit rate is manually set under the video menu.
Modulator Enable	Setting enables or disables the internal modulator.	● On - modulator is enabled (default) ● Off - modulator is disabled.
Modulator Enable Status	Displays the present enable status *Note: The modulator may be set Enabled, but automatically disabled due to a fault condition or a rate mismatch.*	● On - modulator is enabled (default) ● Off - modulator is disabled.
Modulation Type	Sets the modulation scheme.	● QPSK (default) ● 8PSK (optional) ● 16QAM (optional)
Carrier Type	Sets the modulation poutput into pure carrier mode	● Norm (default) ● CW – Pure carrier mode
Data Rate	Sets the data rate for the output transport stream or the modulator data rate.	● If modulator is disabled: 1 to 80 Mbps default: 8.448 Mbps. ● If modulator is enabled: 1 to 80 Mbps (to 30 Msps).
	Additional Information: The data rate that is entered using this parameter determines the transport output of the SE4000 when the modulator is enabled.	
Code Rate	Sets the code rate for forward error correction (FEC) of the modulated signal.	1/2, 2/3, 3/4, 5/6, 7/8 default: 5/6
	Additional Information: The rate selected indicates the number of error correcting bits that will be added to the data stream. For example, if you select the 5/6 rate, for every 5 bits that are input to the FEC encoder, the FEC encoder outputs 6 bits. The relationship between the selected code rate and the data stream prior to modulation, and an indication of the degree of error correction provided by each code rate is shown below. **Viterbi Code Rate** **Transport Stream Data Rate** **Error Correction** 1/2 Increases by a factor of 2 (100% increase) Maximum 2/3 Increases by a factor of 1.5 (50% increase) Very High 3/4 Increases by a factor of 1.33 (33% increase) High 5/6 Increases by a factor of 1.2 (20% increase) Moderate 7/8 Increases by a factor of 1.14 (14% increase) Low	
Sym Rate	Sets the current transmission symbol rate	SymRate sets the current transmission symbol rate 1.0 to 20.0 Msps default: 5.500187 Msps
	Additional Information: The symbol rate is the number of symbols required to transmit the data stream over a satellite link using quadrature phase shift keying (QPSK). The symbol rate is automatically calculated based on the modulator input transport stream data rate, the Viterbi code rate, and other fixed parameters that add overhead to the data stream. If the displayed symbol rate exceeds the allowable satellite bandwidth, the data will be corrupted during transmission.	

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Modulation Power	Sets the output transmit power of the SE4000 modulator.	-25.0 to -5.0 dBm default: -5.0 dBm
Rate Control	Sets whether the modulator output is calculated based on data rate or symbol rate.	● Auto – Either Data Rate or Symbol Rate may be entered – the other parameter is automatically calculated. ● Symbol Rate – Symbol rate in entered – Data Rate is calculated and is read only. ● Data Rate – Data rate in entered – Symbol Rate is calculated and is read only.
Carrier Freq	Sets the modulator carrier frequency.	52.0 to 88.0 MHz, 104 to 176 MHz, 950 to 2050 MHz. default: 70.0 MHz
	Additional Information: The acceptable frequency range is implemented with a band pass filter that filters out all frequencies below 52000000 Hz and above 88000000 Hz (similar for 140 MHz range and L-Band). When selecting a carrier frequency, take into account the satellite bandwidth required for transmission. If a carrier frequency is selected is too close to either end of the valid range, the modulated carrier may be clipped by the pass band filter. For information on calculating the satellite bandwidth, refer to the Main>Output>Sym Rate parameter.	
Spectrum Inversion	Used to instruct the modulator to invert, or not invert, the modulated IF output spectrum. Inverting the IF output spectrum eliminates spectral inversion in the RF chain caused by selecting lower side-band images of an upconverted carrier.	● normal – modulated IF output is not inverted (default) ● inverted – modulator inverts the IF output spectrum
Rolloff	Sets the baseband filter rolloff factor of the internal modulator. This parameter must match the demodulator filter rolloff	● .35 (default) normally used for DVB compliant demodulators ● .20 ● .25
ASI Packet Size	Sets the ASI output.	● 188 byte packet ● 204 byte packet ● 204 byte packet with Reed-Solomon encoding
Main>Status		
Current	Lists the current faults	Current faults are those presently faulted
History	Contains a log of historical faults	● LIST - Due to memory limitations, the first 50 faults occurring after a clear are saved along with the last 50 faults that have occurred ● Clear – Completely clears the fault log. Erases all fault history***. Note: Does not clear fault relay.***
Relay	Controls and displays the fault relay status	● Clear – Completely clears the fault log. Erases all fault history.

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Control>Serial	**Used to configure the remote control port.**	
Baud Rate	Sets the asynchronous interface baud rate for the remote port.	1200, 2400, 4800, 9600, 19200, 38400 bps default: 38400 bps
Data Bits	Sets the number of data bits for the remote port.	7, 8 default: 8
Stop Bits	Sets the number of stop bits for the remote control port.	1, 2 default: 1
Parity		none, even, odd default: none
Flow Control	Sets the remote control port flow control.	● soft: software XON/XOFF (default) ● hard: hardware RTS/CTS
Control>Network	**set to enter the network address of the SE4000.**	
MAC address	Query-only, displays the SE4000 network address.	text string
IP Address	Sets the IP address.	user defined default: 0.0.0.0
IP Mask	Query-only, displays the IP mask. This parameter can be set using a remote terminal and the appropriate remote command.	text string default: 225.225.0.0
Gateway	Query-only, displays the IP router address. This parameter can be set using a remote terminal and the appropriate remote command.	text string default: 0.0.0.0
ControlClock> DateTime	**Used to set the date and time.**	
Date	Sets the date. If the date is entered incorrectly, or an out-of-range value is entered, the SE4000 will display and continue to use the previously set date.	dd/mm/yyyy default: 00.00.0000
Time	Sets the time The hours are in a 24-hour format and must be set from 00 to 23, where 00 is midnight and 23 is 11 PM. Both minutes and seconds can be set from 00 to 59.	hh.mm.ss default: 00:00:00
Control>Variant	**Used to enter software keys to allow for field upgrades (for example – 4:2:2, 8PSK, and 16QAM are currently available as key driven field upgrades via front panel key entry).** ● **4:2:2 Chroma Key** ● **40_140 freq. Range Key** ● **L band Key** ● **8PSK Key** ● **16QAM Key**	

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Main>CA menu	**Conditional access (CA) is a method for securing and scrambling transmission streams so that only those decoders which are authorized to do so can receive the transmitted streams. The SE4000 provides two methods for conditional access:** ● **BISS – Basic Interoperable Scrambling System, an industry-standard, conditional access scheme used to secure and scramble DSNG broadcasts while allowing full operability between various vendor's DSNG equipment.** ● **PGCA – a Tiernan-proprietary conditional access scheme used to secure and scramble transmission streams within the Tiernan family of products.** ***Note: For additional information on BISS or PGCA configuration, refer to the appendix on Conditional Access.***	
Config>CA>Setup	**Allows selection of the following: a service, the type of conditional access scrambling method to be enabled, and to define the conditional access key.**	
Service	Displays the individual services that can be enabled or disabled for conditional access. If only one service is available, the service parameter is query-only, as this one service is automatically selected.	-
Config>CA>Setup>Service>Scramble	**Used to set the type of conditional access scrambling method for a selected service and to define the conditional access key.**	
None	No scrambling is enabled.	
PGCA	Enables and disables PGCA at a system level. When selected, this setting ensures that only those Tiernan decoders listed in the PGCA database and enabled at an individual level can receive the broadcast signals. Non-Tiernan IRDs cannot be authorized by PGCA; therefore only authorized Tiernan IRDs can decode a service that has been protected through PGCA.	● PGCA key – sets the PGCA scrambling key to a specified algorithmic table. Parameters are 0 to 255. ● PGCA message PID – Query-only, displays the PID for the program map table (PMT).
BISS Mode 1	Enables BISS Mode 1 for the selected service. With BISS Mode 1, all components of the transmission stream are scrambled by a fixed control word (CW).	BISS key: sets the BISS scrambling key, which is a 12-digit scrambling key, for the selected service.
Main>CA>PGCAcfg	**The three PGCA configuration menus allow modification of the PGCA database, enable and disable individual Tiernan IRDs for PGCA, and review the PGCA database.** **For additional information on adding, deleting and authorizing individual decoders, refer to the appendix on Conditional Access.**	
Add IRD	Adds a Tiernan decoder to the PGCA database. ***Note: Non-Tiernan IRDs cannot be added to the decoder database.***	To determine the Tiernan decoder's MAC address, refer to the appropriate Tiernan user guide which accompanied that product.
Lst IRD	Used to enable and disable individual IRDs for conditional access.	Displays a list of all Tiernan decoders entered in the PGCA database. Each decoder's MAC address, and its enabled/disabled status is also displayed. To enable and disable an IRD, use the minus key on the alphanumeric keypad to toggle between the

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
		On (enable) and Off (disable) parameters for the selected IRD.
Del IRD	Deletes a Tiernan decoder from the conditional access database.	Displays a list of Tiernan decoders and their MAC addresses.

Front Panel Menu Summary		
Command	**Function**	**Options/Response Format**
Version Menu	**Used to display the version of firmware and hardware currently in use on the SE4000.**	
Version	Queries the version of firmware currently in use on the SE4000.	Firmware version labels.
Control>FP Lock	**Used to lock and unlock the front panel.**	
State	Sets the state of the front panel.	● locked – disables the front panel; the front panel can only be used to view status and configuration parameters. ● unlocked – the front panel is unlocked and can be used to enter and change configuration parameters (default).
Password	Unlocks the front panel. Used in conjunction with the state command; password is only displayed when the front panel is set to locked.	7384 (default) ***Note: ensure that the front panel displays 7384, not alphabetic characters when using the default password to unlock the front panel.***

3.9 SE4000 Procedures

This section provides detailed steps for performing various SE4000 tasks.

Before beginning initial SE4000 installation and configuration, the modulator output (Mod State) should be turned off until ready to begin satellite transmissions.

3.10 Configuration Sets

3.10.1 Restoring a Default Factory Configuration

To restore a default configuration and set the table types:

1. From the main menu, select Config. The Configuration menu appears.
2. Select Presets. The Preset menu displays.
3. Select Restore. The Restore menu displays.
4. Use the Up or Down buttons to select the appropriate option and press Enter. The system will perform its initialization process and reconfigure the SE4000 with the selected parameters.

   The reconfiguration process may take up to two minutes. When the system has completed its configuration process, the LCD returns to the main menu.

The operating parameters in use at the time the restore process is executed are overwritten and will be lost if not previously saved as a configuration set.

3.10.2 Creating a New User Configuration

To create a new user-defined configuration label:

1. Select Config from the main menu. The Configuration menu displays.

2. Select Presets. The Preset menu appears.

3. Select New. The New Preset menu and its option `Enter Name = 0` displays. The zero is replaced with the first alphanumeric key press.

4. Using the alphanumeric keypad, enter a name for the configuration set. The name can be up to 15 characters in length. For alphanumeric characters, use numbers similar to a standard phone keypad. For example, to enter a “B”, press the 2 button until a B is displayed, then the right shift button.

5. Press Enter. The new level is added to the configuration list and the system returns to the Presets menu.

6. To save a configuration set under this label, follow the steps under *Saving a User Configuration Under an Existing Label.*

   The configuration process may take a minute. When the system has completed its configuration process, the LCD returns to the ATM Access DVB MPEG-2 Contribution Encoder menu.

3.10.3 Saving a User Configuration Under an Existing Label

To save a user-defined configuration set under an existing label:

1. Configure the SE4000 with the required parameters.

2. Once all the parameters are correctly set, select Config from the main menu. The Configuration menu displays.

3. Select Presets. The Preset menu displays.

4. Select Save. The Save menu displays.

5. Use the Up or Down buttons to scroll through the list and select the correct configuration label.

6. Press Enter. The Configuration process may take up to two minutes. When the system has completed its configuration process, the asterisk will disappear.

The operating parameters in use at the time the restore process is executed are overwritten and will be lost if not previously saved as a configuration set.

3.10.4 Deleting a User Configuration Label

To delete a user-defined configuration set:

1. From the main menu, select Config. The Configuration menu displays.
2. Select Presets. The Preset menu displays.
3. Select Delete. The Delete menu displays.
4. Scroll through the list and select the label that will be deleted.
5. Press Enter. The label is deleted from the configuration list and the system returns to the Presets menu.

3.10.5 Renaming a User Configuration Label

To rename a user-defined configuration set:

1. From the main menu, select Config. The Configuration menu displays.
2. Select Presets. The Preset menu displays.
3. Select Rename. The Rename menu displays.
4. Scroll through the list and select the label that will be renamed.
5. Press Enter. The name of the label to be renamed displays and a zero appears in the label entry field.
6. Using the alphanumeric keypad, enter a name for the configuration set. The name can be up to 15 characters in length.
7. Press Enter. The new label is added to the configuration list and the system returns to the Rename menu.

3.11 Front Panel Lock/Unlock

3.11.1 Locking the Front Panel

To lock the front panel:

1. From the main menu, select Config. The Configuration menu displays.
2. Select Control. The Control menu displays.
3. Select FP Lock. The status `State = Unlocked` displays.
4. Press the Up button once. `State = Locked` displays.
5. Press Enter. `State = Locked` displays indicating that the front panel is now locked.

3.11.2 Unlocking the Front Panel

To unlock the front panel:

1. From the main menu, select Config. The Configuration menu displays.
2. Select Control. The Control menu displays.
3. Select FP Lock. The status `State = Locked` displays.
4. Press the Left or Right button once. `Password = 0` displays.
5. Using the front panel keypad, type in the password and press Enter. The default password is 7384.
6. The front panel displays `State = Unlocked` indicating that the front panel is now unlocked.

If the wrong password is entered, the SE4000 displays `Password = 0`. ***If this occurs, use the front panel keypad to type in the correct password and press Enter.***

3.12 Date and Time

3.12.1 Setting the Date

To set the date:

1. From the main menu, select Config. The Configuration menu displays.
2. Select Control. The Control menu displays.
3. Select Clock. The Date parameter displays.
4. Use the keypad to type in the correct date in the format `mm/dd/yyyy`. The SE4000 automatically enters the "/".
5. Press the Enter button.

If the date is entered incorrectly, or an out-of-range value is entered, the SE4000 will display and continue to use the previously set date.

3.12.2 Setting the Time

The time is in a 24-hour format and must be set from 00 to 23, where 00 is midnight and 23 is 11 PM. For example, for 8 AM the hours would be set to 08, and for 8 PM the hours would be set to 20. Both minutes and seconds can be set from 00 to 59. To set the time:

1. From the main menu, select Config. The Configuration menu displays.

2. Select Control. The Control menu displays.

3. Select Clock. The Date parameter displays.

4. Scroll to the Time parameter using the right or left buttons.

5. Use the keypad to type in the correct hour, minutes, and seconds in the format `hh:mm:ss`. The SE4000 automatically enters the colons ":".

6. Press the Enter button.

3.13 System Reset

To reset the SE4000:

1. From the main menu, select Config. The Configuration menu displays.

2. Select Control. The Control menu displays.

3. Select Reset.

4. Press the Enter key.

The SE4000 is reset to the last configuration set; all programmable logic and firmware is reloaded; the unit is restarted; and the fault history log is cleared.

3.14 Embedded Audio Configuration

3.14.1 Configuring the Encoder for Embedded Audio

To configure the encoder for embedded audio, the following parameters must be set:

- Config>Service # >Video>Input Source must be set to digital
- Config>Service # >Audio must be set to digital
- Config>Service # >Audio>Source must be set to D1

3.15 Embedded Audio Configuration (BISS/PGCA)

For information on configuring the SE4000 for BISS or PGCA conditional access, refer to the appendix on conditional access.

3.16 VBI: Teletext, Closed Captions, and Expanded Windows

For information on configuring the SE4000 for teletext, closed captions, or expanded windows VBI operations, refer to the appendix on VBI data transmission.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Using a Remote Unit

4

In addition to the front panel, a remote unit can be used to configure and monitor the SE4000. The chapter presents the following information for remote command operation:

- Configuring remote software parameters
- An overview of remote communications
- Instructions for issuing remote commands
- Error messages
- Remote command listing

For remote cabling information, refer to the chapter on installation.

Any parameter changes made using a remote unit are not automatically stored in non-volatile memory. When the SE4000 configuration is changed using a remote unit, an operational test should be performed to verify that the system is operating correctly. The new configuration should then be saved by issuing the CM SAVE command.

If the SE4000 is reset prior to issuing the CM SAVE command, any changes made using the remote unit will not be restored.

4.0 Configuring the Remote Control Software Parameters

After the remote unit is cabled to the SE4000, perform the following steps to complete the installation:

1. Configure the communications software parameters of your remote unit to match the following SE4000 remote port factory default settings:

    - RS-232 signal
    - Baud rate = 38400 bps
    - Character length = 8
    - Parity = none
    - Number of stop bits = 1

Unless the remote settings are changed and the changes saved in non-volatile (flash) memory, the SE4000 restores these default communications settings whenever the SE4000 is reset or powered-up.

2. Press the Enter key on the remote keyboard several times to generate a prompt (>) on the remote display. Once a prompt appears on the remote display, successful communication has been established between the SE4000 and the remote unit. Once communications are established, the remote port parameters can be changed to a faster operating speed.

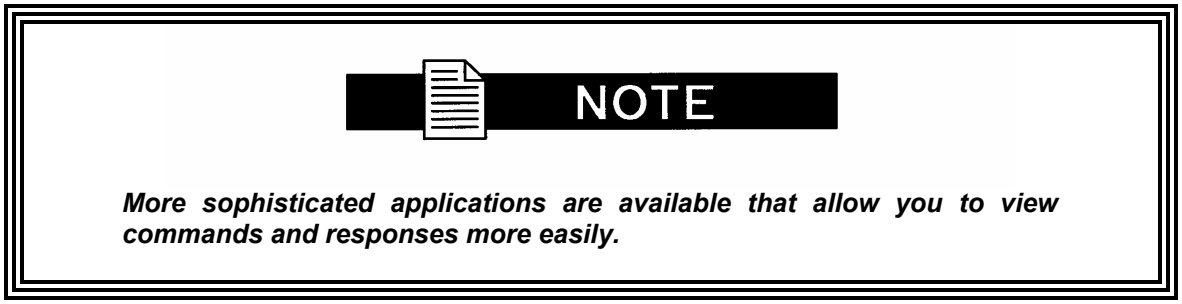
   If a prompt cannot be generated on the remote unit, follow these troubleshooting steps:

   - Ensure that the remote unit and the SE4000 are turned on and plugged into an active AC outlet.
   - Verify that the baud rate and parity of the remote unit communications package match the default factory setting of the SE4000 remote interface. Factory settings are 38400 baud, 8 data, no parity.
   - Verify that the cable between the terminal, the SE4000, and the Null Modem Adapter are properly connected.
   - Ensure that the DTE/DCE switch is set to the DTE position.

For assistance, contact the Radyne ComStream Customer Support Department.

4.1 Ethernet Port Telnet

After the SE4000 has been cabled to a network through the SE4000 Ethernet port, perform the following steps to establish remote communications using Windows Telnet:



1. From a remote unit, launch Telnet by typing `TELNET` at the command prompt. To access the command prompt, select the MS-DOS Prompt.

2. From the Connect menu, select Remote System. The Remote System dialog box appears.

3. At the Host Name or IP Address option, type the SE4000 IP address. For the procedure used to assign an IP Address, refer to the installation chapter.

4. For Port Type enter `21846` or `0x5556` (hex).

5. For Terminal Type, accept the default.

6. Click the Connect button. There should now be connection.

7. If connection is not successful, troubleshoot the installation and setup:

   - Ensure that the SE4000 is turned on and plugged into an active AC outlet.
   - Verify that the cable between the terminal and the SE4000 is properly connected.
   - In Telnet, verify that the correct IP address and port type have been selected.
   - Check with the Information Systems to determine if problems exist with the LAN.

For assistance, contact the Radyne ComStream Customer Support Department.

4.1 Ethernet Port Browser Window

The SE4000 contains an easy to use Browser configuration web-like interface. To configure the SE4000 through the browser interface, follow the instructions below.

1. From the front panel, configure the IP address to an unused address on your local network. Directions for setting the IP address can be found in the front panel section of this manual. See your IT department for more information if your are not sure of an available address.

2. Connect the Etherent port of the SE4000 to a hub or switch on your local network.

3. Open your Web browser on any networked PC. Enter the IP address of the SE4000 where the Web address normally would be. The SE4000 browser interface screen should appear.

4.2 Remote Communications Overview

The SE4000 can be configured, monitored, and controlled from a remote unit. Unlike front panel operations, the remote unit has no selection menus; instead, the remote terminal is used to type specific commands and parameters to communicate with the SE4000.

All SE4000 commands can be issued from a remote unit that is connected to the SE4000 remote port. The remote unit can be any remote unit capable of asynchronous communications, including a personal computer or ASCII terminal.

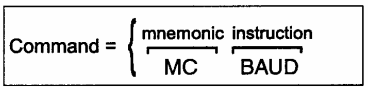
4.2.1 Command Types

The remote unit accepts two different types of commands:

- Execute commands direct the SE4000 to perform a specified action, such as changing a configuration parameter.
- Query commands direct the SE4000 to display the current setting of a specific parameter or to display current status information.

4.2.2 Command Elements

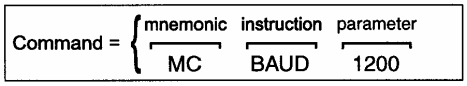
All commands consists of a command mnemonic, which is followed by a space, and the command instruction.



The SE4000 uses the following command mnemonics to group various commands:

- ***TBD***

Execute commands have an additional parameter which follows the command instruction.



4.3 Issuing Remote Commands

To issue a command from a remote unit, type the command at the remote prompt (>) with the appropriate parameter, and then press the ENTER key. The following syntax is used:

<command> <parameter>

where:

- <command> consists of its mnemonic and the instruction; ensure that the command is typed correctly and includes spaces and underscore (_) and period (.) characters as appropriate
- There must be one space between the command and the parameter. A space is typed by pressing the Space Bar key.
- <parameter> is the value pertaining to the command. Parameters can be numeric or alphanumeric. No spaces should be typed after the parameter; doing so will result in an error.

The SE4000 performs the required function and displays the prompt (>) when it is ready to accept another command.

For example, to set the remote port baud rate to 1200 bps, issue the command `MC BAUD 1200` and press Enter. In this example:

- The command mnemonic is `MC` followed by a space
- The command instruction is `BAUD` followed by a space
- The parameter is `1200.`

Query commands are issued by typing the command, without a parameter, and pressing Enter. The SE4000 responds to the query by displaying information on the remote display.

For example, to query the remote port baud rate, issue the command `MC BAUD` and press Enter. In this example:

- The command mnemonic is MC followed by a space
- The command instruction is BAUD followed by a space
- There is no parameter since this is a query command

The SE4000 responds by displaying the baud rate on the remote unit.

4.3.1 Typing Remote Commands

Remote commands are not case sensitive. Commands may be entered in lower case, upper case, or a combination of both.

4.3.2 Entering Parameter Values

Some command parameters must be enter as a numeric value, which is represented by the pound sign <#>. If more than one pound sign is shown for a given parameter <###>, a number must be entered for each pound sign. When a command is issued containing a numeric value, do not type in the (#) nor the bracket <> signs. Enter only the numerical value for the parameter.

4.4 Error Messages

If the SE4000 is not able to execute a command, an error message will be returned, indicating the command was not completed. SE4000 error messages, along with the action required to resolve the error, are listed in the following table.

Error Messages		
Error Message	**Explanation**	**Action Required**
ERROR:AMBIGUOUS_LOCAL_ INSTANCE	A designator, other than a slot designator, is required in order to set or query the command. For example, all audio commands require a port designator in order to correctly process a command.	Issue the command using the correct syntax, format, and parameter. Ensure that the appropriate designators are included in the command string.
ERROR:AMBIGUOUS_ SLOT	A slot designator is required in order to set or query the command. For example, all audio and auxiliary data commands require a slot designator.	Issue the command using the correct syntax, format, and parameter. Ensure that the appropriate designators are included in the command string.
ERROR:BAD_NUMBER_FORM AT	The parameter number format is incorrect. For example, a hexadecimal value was entered when a decimal value is required.	Issue the command using the correct parameter format.
ERROR:BAD_RC_INSTANCE	The command mnemonic cannot be matched to a card installed in the product..	Use the '?' command to view the current card types. Issue the command using the proper syntax and format.
ERROR:BAD_RESOURCE_ CONTROLLER_TYPE.	The command mnemonic is incorrect..	Use the '?' command to view the current command mnemonics. Issue the command using the proper syntax and format.

ERROR:COMMIT_ERROR	While attempting to set a command, the SE4000 may have entered an inconsistent state and may have an integrity error.	Reset the command to a known valid state. Then re-issue the new command. If the command still results in an error message, check the configuration of the unit and repeat the command. If the SE4000 still does not execute the command, reset the unit and attempt the command again. If the command cannot be executed, contact the Radyne ComStream Customer Service Department.
ERROR:CONFIGURABLE_NOT_QUERYABLE	The command cannot be queried. The command may be set-only or an action.	Review the lists of commands to ensure that a valid command was issued.
ERROR:CONFIGURABLE_NOT_SETTABLE	The command cannot be set. The command may be query-only.	Review the lists of commands to ensure that a valid command was issued.
ERROR:EXPECTED_END_OF_LINE	The command line contains too much information. The command may have been issued with extra characters or a space after the parameter.	Issue the command using the correct syntax, format, and parameter.
ERROR:INVALID_MNEMONIC	The issued command does not match any valid SE4000 command. The command may have been issued with extra characters, a missing underscore, a missing space, a space after the parameter, or in an improper order.	Issue the command using the proper syntax and format.
ERROR:INVALID_VALUE	The SE4000 rejected a request to change a configurable value based upon its own logic. This value is also returned to indicate that the change was attempted, detected to be in error, and then successfully reversed (this response is only valid if the attribute “Valid Values Depend on State” or equivalent flag is set).	Issue the command using the correct parameter.
ERROR:STRING_TOO_LONG	The parameter’s length has been exceeded.	Issue the command using the correct parameter.
ERROR:TOO_LARGE	The parameter’s numeric value is too large.	Issue the command using the correct parameter.
ERROR:TOO_SMALL	The parameter’s numeric value is too small.	Issue the command using the correct parameter.

In addition to the actions listed in the error messages table, you can also enter the following question mark (?) commands to receive additional information when errors are encountered or additional information is needed

Remote Question Mark (?) Commands	Response
?	Lists all available command mnemonics associated with the current version of code installed on the SE4000.
<mnemonic>.<designator> ?	Lists all commands associated with that mnemonic.

For example: AE.A?	
<mnemonic>.<designators> <instruction> ? For example: AE.A BRP?	Lists information available for that particular command, including all valid parameters.

4.5 Remote Command Descriptions

All standard SE4000 remote commands are listed in alphabetical order in the following tables, which provide the following information:

- Remote commands and any command designators
- Parameter values or value range
- Factory default value

Description of the command, including parameter definitions, the front panel command equivalent, and the SNMP command equivalent

Command designators and parameter values may be shown within brackets < >; these brackets are not typed when issuing commands.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
AE.<*port*> BR <*port*> *is A or B*	64, 80, 96, 112, 128, 160, 192, 224, 256, 320, 384 Kbps	256 Kbps	Sets the audio compressed bit rate. ***Note: Selecting a high audio compressed bit rate will produce a high-quality audio signal at the output audio device; however, a high audio compressed bit rate reduces the total transport stream bit rate available for the video signal. Select an audio compressed bit rate that meets the audio requirements while allowing sufficient bandwidth to meet the video requirements.*** Front panel command equivalent: Main>Service>Audio>Data Rate

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
AE.<*port*> CHFMT	Dual, Mono, Stereo, Jstereo	Stereo	Compressed audio format ; determines how the SE4000 will compress the audio channels. ● Dual – left and right audio channels are compressed separately into two output waveforms. Use dual when the left and right audio channel inputs represent separate and independent audio signals. ● Mono – during audio compression the right audio channel input is ignored and a single output waveform is produced based on the left channel input. Mono uses half the bit rate of dual; however, if the input audio source is stereo, the stereo effect at the output audio device will be lost. ● Stereo – left and right audio channels are compressed separately into two output waveforms. Stereo uses more bandwidth than mono; however, if the input audio source is stereo, the stereo effect will appear at the output audio device. ● Jstereo – the left and right audio channels are compressed jointly into two output waveforms. Jstereo uses more bandwidth than mono but less than stereo and dual. Use Jstereo when the left and right audio channel inputs are highly correlated (i.e., left and right stereo channels of one audio program source). The similarities between the two channels are used, saving bandwidth without losing the stereo effect at the output device. Front panel command equivalent: Config>Service>Audio>Format
AE.<*port*> COMPRESS	MPEG2, AC3, AC3PASS, UNCOMP	MPEG2	Sets the output compression format for the audio stream. Front panel command equivalent: Config>Service>Audio>Compression
AE.<*port*> SDI_CH_PAIR	1 to 8	1	Selects one of the eight embedded audio channel pairs associated with the digital audio input ***Note: SDI Audio Chnl Pair is only available when digital audio channels are selected.*** Front panel command equivalent: Config>Service>Audio>SDI Audio Chnl Pair

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
AE.<*port*> DELAY	-1000 to +1000 msec.	0 (zero)	Compressed audio stream time delay; enter a numeric value to adjust the audio presentation time stamp; affects the synchronization between the audio and video. Positive numbers cause the decoder to delay the audio output with respect to the video (i.e. lag). Negative numbers cause the decoder to advance the audio output with respect to the video (i.e. lead). Zero (0) represents nominal alignment between video and audio output from the decoder (i.e. lip sync). In addition, a zero value assumes that the video and audio has lip sync at the input of the encoder. ***Note: Depending on bit rate and delay set, it may be possible to set delay to inoperable values.*** Front panel command equivalent: Config>Service>Audio>Delay
AE.<*port*> ENABLE	Off, On	If digital audio: Off If analog audio: On	Enables or disables the audio channel in the transport stream. Parameters are: ● Off = audio is not included in the transport stream ● On = audio is included in the transport stream. Front panel command equivalent: Config>Service>Audio>Enable
AE.<*port*> LANGUAGE	ENG, JPN, CHI, KOR, DAN, POR, DUT, RUS, GER, SPA, ITA, FRE, UND	ENG	Sets the audio language descriptor for a selected audio channel. Parameters are: ● ENG (English) ● JPN (Japanese) ● CHI (Chinese) ● KOR (Korean) ● DAN (Danish) ● POR (Portuguese) ● DUT (Dutch) ● RUS (Russian) ● GER (German) ● SPA (Spanish) ● ITA (Italian) ● FRE (French) ● UND (undetermined) Front panel command equivalent: Config>Service>Audio>Language
AE.<*port*> SRATE	32, 44.1, 48 Ksps	48 Ksps	Audio sample rate: determines how often the SE4000 samples the analog waveform during the audio analog to digital conversion process. This command is query-only for digital audio input ports; it is both set and query for analog audio input ports. Front panel command equivalent: Config>Service>Audio>Sample Rate
AE.<*port*> SRC	Analog, SDI, AESEBU	AESEBU	
AE.<*port*> OUTRES	20-bit, 24-bit	Read-only	Only available In Digital input mode, this is a read-only parameter.
AE.<*port*> ER_PROTECT	ON/OFF	ON	Error protection
AE.<*port*> COPYRIGHT	ON/OFF	ON	Copyright flag in stream
AE.<*port*> ORIG	ON/OFF	ON	MPEG original flag set in stream
AE.<*port*> MPEG _EMPH	None, 50_15_us, CCITTJ.17	NONE	MPEG emphasis

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
AE.<*port*> user_ext	ON/OFF	OFF	User extensive processing enabled or disabled
AE.<*port*> PES_BLOCKS	1 - 14	1	Some decoders require more than one audio packet per PES packet. This is provided as an interoperability mode. Normally no used.
All AC3 parameters are only valid and settable in AC3 compression mode or AC3 pass-through mode			
AE.<*port*> AC3BSTRM	CM, ME, VI, HI,D,C,E,VO	CM	AC3 Bitstream descriptor CM= Complet Main ME = Music Effects VI = Visually Impaired HI = Hearing Impaired D = Dialogue C = Commentary E = Emergency VO = Voice Over
AE.<*port*> AC3COD	1/0, 2/0	2/0	AC3 Coding type
AE.<*port*> AC3SURR	NOTIND, NOTSUR, SUR	NOTIND	Ac3 Surround descriptor NOTIND = Not Indicated NOTSUR = Not Surround SUR = Surround
AE.<*port*> AC3INFO	OFF,ON	OFF	
AE.<*port*> AC3NORM	-1 - -31	-27	AC3 Normalization level
AE.<*port*> AC3PRES	FILMSTD, FILMLIGHT, MUSSTD, MUSLGHT, SPEECH	FILMSTD	FILMSTD = Film Standard FILMLIGHT = Film Light MUSSTD = Music Standard MUSLGHT = Music Light SPEECH
AE.<*port*> AC3mixlev	0 -31	25	AC3 Mixing Level
AE.<*port*> AC3ROOM	NI, SM, LG	SM	AC3 Room size descriptor
AE.<*port*> AC3DCFIL	ON, OFF	ON	AC3 DC Filter enable
AE.<*port*> AC3LPFIL	ON, OFF	ON	AC3 Low Pass Filter enable
AE.<*port*> AC3PRFIL	ON, OFF	OFF	AC3 Protection Filter enable
AE.<*port*> AC3BMOD	32, 16L, 16R	32	AC3 Pass- through Bit mode 32 bit 16 bit left 16bit right
AE.<*port*> AC3STRMN	0 - 7	0	AC3 Stream Number
AE.<*port*> AC3PREAM	ON, OFF	ON	AC3 Preamble enable
AE.<*port*> STATUS			A Complete status report concerning the associated channel
AE.<*port*> TEST			Debug commands to be used in assocaiation with Radyne Comstream technical personnel.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
AXD.A BAUD	1200, 2400, 4800, 9600, 19200, 38400 bps	38400 bps	Sets the asynchronous serial auxiliary data baud rate. Front panel command equivalent: Config>Service>Data>Baud
AXD.B DR	1200 to 20,000,000 bps	1024000 bps	Sets the data rate for the synchronous auxiliary data channel. ***Note: The data rate for the auxiliary data channel reduces the total transport stream bit rate available for the video signal; therefore, an auxiliary data rate should be selected that meets but does not exceed the site-specific operational requirements.*** Front panel command equivalent: Config>Service>Data>Data Rate
AXD.<*port*> EN	Off, On	Off	Enables or disables the auxiliary data channel in the transport stream. Parameters are: ● Off = auxiliary data is not included in the transport stream ● On = auxiliary data is included in the transport stream. Front panel command equivalent: Config>Service>Data>Enable
AXD.A PARITY	N, O, E	N	Sets the parity bit for asynchronous serial communication. Parameters are: N = none, O = odd, E = even. Front panel command equivalent: Config>Service>Data>Parity
AXD.B SRC	INT, EXT	INT	Sets the clock source for the synchronous auxiliary data channel; parameters are: ● INT = internal, uses ST to latch the data. ● EXT = external, uses TT to latch the data. AXD SRC is only available when AXD Mode is set to sync. Front panel command equivalent: Config>Service>Data>Clock Source
AXD.A STOP	1, 2	1	Sets the number of stop bits for the asynchronous serial protocol. Front panel command equivalent: Config>Service>Data>Stop Bits
AXD.A WIDTH	7,8	8	Sets the number of data bits for asynchronous serial data. Front panel command equivalent: Config>Service>Data>Data Bits
AXD.A FC	NONE, HARD	None	Sets the flow control for asynchronous serial data. Front panel command equivalent: Config>Service>Data>flow control
CM DELETE <*string*>	Where *string* specifies a user-defined label.	-	Deletes the specified user-defined configuration.
CM DUMP	-	-	Displays the complete list of parameters in the SE4000. A sample Configuration dump is shown at the end of this guide. **This process takes several seconds to display the entire configuration dump.**
CM LIST	-	-	Query-only. Displays a list of all current

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
			configuration labels. Front panel command equivalent: none

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
CM RENAME <*old label*>;<*new label*>	Where <*old label*> specifies the current user-defined label and <*new label*> defines the new label name.	-	Renames an existing label Fwont panel command equivalent: Config>Presets>Rename
CM RESTORE <string>[1]	Where *string* specifies a user-defined label or factory defined label of DVB, ATSC.	DVB	Recalls one of the factory- or user-defined configuration sets from memory and saves it in flash memory as the current configuration (i.e., power-up or reset restores the configuration set). For example, to restore or load the configuration set labeled SD MCPC, issue the command CM LOAD CD MCPC ***Note: When the SE4000 is set to the DVB default setting, the remote port baud rate is set to 38400 bps. If the remote unit is set to communicate with the SE4000 at a baud rate other than 38400 bps, immediately after the DVB default command is issued, the remote unit will not be able to communicate with the SE4000. To resolve this issue, the equivalent parameter in the software settings of the remote unit must be changed to 38400 bps. However, the remote unit software settings must not be changed before issuing the DVB default command to the SE4000, as the remote unit will not be able to communicate with the SE4000.*** Front panel command equivalent: Config>Presets>Restore
CM SAVE[1]	-	-	Saves the current configuration to flash memory. Front panel command equivalent: none
CM SAVE_CFG <*string*>[1]	Where *string* specifies a user-defined label.	-	Saves the current configuration settings to the specified user-defined label. The user label must be created using the CM CREATE command prior to storing the configuration settings. For example, to store the unit's current configuration settings to the existing user configuration label SD MCPC, issue the command: CM SAVE_CFG SD MCPC. ***Caution: Any configuration parameters previously saved under a specified label are overwritten and lost when a new configuration set is saved to the same location.*** Front panel command equivalent: Config>Presets>Save
FM CURR_LIST	-	-	Query only command, displays all current faults. Front panel command equivalent: Status>Current
FM CLR_HIST	-	-	Clears the fault history log.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
			Note: Clearing the fault history log does not clear the fault relay. Front panel command equivalent: Status>History>Clear

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
FM HIST_LIST	-	-	Query-only command; displays the fault history log with time stamps. For a complete description of the fault history log, refer to the chapter on troubleshooting. Front panel command equivalent: Status>History>List
FM RELAY_CLR	-	-	Clears the fault relay. Note: Clearing the fault relay does not clear the fault history log. Front panel command equivalent: Status>Relay>Clear
FM RLY_LIST	-	-	Query-only command; displays a list of faults which trigger the fault relay. Front panel command equivalent: Status>Relay>List
FM SAVE	ON, OFF	OFF	Enabling FM Save causes all faults to be written to flash memory. This is very useful when troubleshooting.
FM TYPES			Provides a complete list of all faults defined in the unit. Included is a description and activation status.
FM EN_FLT			See Troubleshooting section for detailed explanation
FM EN_FLT			See Troubleshooting section for detailed explanation
MC BAUD	1200,2400, 4800, 9600, 19200, 38400 bps	38400 bps	Sets the asynchronous interface baud rate for the RS-232 remote control port configuration. ***Note: The SE4000 and remote terminal baud rates must match in order for the remote terminal and SE4000 to communicate. Once the MC RS232_BAUD rate command is issued, the equivalent parameter in the remote unit software settings must be set to match the new baud rate. However, the remote unit software settings must not be changed before issuing the DVB default command to the SE4000, as the remote unit will not be able to communicate with the SE4000.*** Front panel command equivalent: Config>Comm>Serial>Baud
MC DATA	7, 8	8	Sets the number of data bits for the RS-232 remote control port configuration. CM LIST Front panel command equivalent: Config>Comm>Serial>Data Bits
MC DATE dd/mm/yyyy	numeric value in the format:	-	Sets the SE4000 internal date. The date is set in mm/dd/yyyy format where:

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
	mm/dd/yyyy		● mm = month from 01 to 12 ● dd = day of the month from 01 to 31 ● yyyy = current year For example, to set the date to June 21, 2003, issue the command MC DATE 06/21/2003 ***Note: The SE4000 real- time clock does have a battery backup source. If the unit loses power, is turned off, or reset, the real-time clock is set to the current (correct) day and time.*** Front panel command equivalent: Config>Control>Clock>Date
MC FLOW	Soft, Hard	Soft	Sets the remote control port flow control. Parameters are: ● Soft = Software XON/XOFF ● Hard = Hardware RTS/CTS. Front panel command equivalent: Config>Comm>Serial>Flow

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
MC FPLOCK	Locked	Unlocked	Used to query or set the state of the front panel. If queried, responses are: unlocked = the front panel is unlocked, operators can use the front panel to configure, monitor, and control SE4000 operations; locked = front panel is locked and is only available to monitor SE4000 operations. If used to set the state of the front panel, only a LOCKED parameter may be issued. **The front panel or the MC FPPASSWD must be used to unlock the unit.** For additional information on locking and unlocking the front panel, refer to the chapter on the front panel. Front panel command equivalent: Config>Control>FP Lock>State
MC FPPASSWD	7384		Unlocks the SE4000 front panel
MC GATEWAY #.#.#.#	Where # is a decimal number from 0 to 255	0.0.0.0	Sets the designated gateway in an IP network. Front panel command equivalent: Config>Comm>Network>IP Router
MC MAC	-	-	Displays the unit's Medium Access Control (MAC), or network, address. The format for the returned value is #:#:#:#:#:# where # represents a hexadecimal number. Front panel command equivalent: Config>Comm>Network>TMA
MC SN	-		Displays the unit Serial Number
MC IP #.#.#.#	Where # is a decimal number from 0 to 255	0.0.0.0	Sets the IP address. Front panel command equivalent: Config>Comm>Network>IP Addr
MC MASK #.#.#.#	Where # is a decimal number from 0 to 255	225.225.0.0	Sets the IP mask. Front panel command equivalent: Config>Comm>Network>IP Mask
MC PARITY	N, O, E	N	Sets the parity for the RS-232 remote control port configuration. Parameters are: ● N = No parity ● O = Odd parity ● E = Even parity Front panel command equivalent: Config>Comm>Serial>Parity

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
MC RE	-	-	Resets the SE4000, reloads all programmable logic and firmware, and restarts the system. All parameters return to the last settings stored in flash memory or the last changes made using the front panel. The SE4000 restores configuration settings as follows: ● All changes made using the front panel are automatically stored in flash memory. When the SE4000 is reset, any changes made using the front panel are restored. ● Changes made using a remote unit are not automatically stored in flash memory. If the SE4000 is reset before issuing the CM SAVE command, changes made using a remote unit are not restored. Instead, the last changes saved to flash memory are restored. ● If the SE4000 configuration is changed using a remote unit, an operational test should be performed to verify system operations. Then the new configuration should be saved by issuing the CM SAVE command. Once the configuration is saved, the SE4000 automatically restores the saved settings when the unit is reset or powered up. ***Note: The SE4000 real- time clock includes a battery backup source. If the unit loses power, is turned off, or reset, the real-time clock reverts to the current day and time. This backup power will only last for approximately one week.*** Front panel command equivalent: Config>Control>Reset
MC STOP	1, 2	1	Sets the number of stop bits for the RS-232 remote control port. Front panel command equivalent: Config>Comm>Serial>Stop Bits
MC TIME *hh:mm:ss*	Numeric value in the format: *hh:mm:ss*	-	Sets the SE4000 internal real-time clock. The time is set in hh:mm:ss format where: ● hh = hours, in a 24-hour format, from 00 to 23, where 00 is midnight and 23 is 11 PM ● mm = minutes from 00 to 59 ● ss = seconds from 00 to 59 For example, to set the time to 10:20:59 AM, issue the command MC TIME 10:20:59. To set the time to 10:20:59 PM, issue the command MC TIME 22:20:59. ***Note: The SE4000 real- time clock does have a battery backup source. If the unit loses power, is turned off, or reset, the real-time clock is set to the current (correct) day and time.*** Front panel command equivalent: Config>Control>Clock>Time
MC VERSION	-	-	Displays the firmware version of the master controller card. Front panel command equivalent: none
MC UPDATE			Software update – refer to software upgrade instructions provided with your new software

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
			package.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
MOD CAR_TYPE	NORM, CW	NORM	Norm – Normal modulation CW – Pure CW carrier
MOD CODE_RATE	1/2, 2/3, 3/4, 5/6, 7/8	5/6	Viterbi code rate; sets the code rate for forward error correction (FEC) of the modulated signal. The rate selected indicates the number of error correction bits that will be added to the data stream. For example, if you select the 5/6 rate, for every 5 bits that are input to the FEC encoder, the FEC encoder outputs 6 bits. Viterbi forward error correction increases the transmitted symbol rate by increasing the number of bits in the data stream. Front panel command equivalent: Config>Output>Code Rate
MOD DATA_RATE	1,000,000 to 108,000,000 bps	8448000	Data rate; used to set the modulator input transport stream data rate. The data rate you enter is a function of the symbol rate and the code rate. The data rate may be entered directly by issuing a MOD DR command or may be computed based upon the symbol rate you enter. Specifically, the data rate is equal to the Symbol Rate x 2 x 188/204 x V, where V = the Viterbi code rate. Front panel command equivalent: none
MOD SPEC_INV	Inverted, Normal	Normal	Spectrum Inversion; used to set the modulator so that the modulated IF spectrum is inverted. Parameters are: ● Inverted = the modulated IF spectrum is inverted. ● Normal = the modulated IF spectrum is not inverted. Front panel command equivalent: Config>Output>Spect Invert

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
MOD SYM_RATE	MOD SR 1000000 to 20000000 sps	-	Used to enter the modulator symbol rate. The symbol rate is the number of symbols required to transmit the data stream over a satellite link using quadrature phase shift keying (QPSK). The symbol rate is a function of the data rate and the code rate, including any overhead. The symbol rate may be entered directly by issuing a MOD_SR command or will be automatically computed based upon the entered data rate and code rate. The symbol rate is equal to the Data Rate x 1/2 x 204/188 x 1/V, where V = the Viterbi code rate. When the code rate is entered, the data rate remains unchanged, however, the symbol rate is recomputed. If the displayed symbol rate exceeds the allowable satellite bandwidth, the data will be corrupted during transmission. To determine the satellite bandwidth required to transmit the displayed symbol rate, use the following equation: symbol rate x 1.35 = required satellite bandwidth (measured in Hz) Front panel command equivalent: Config>Output>SymRate
MOD CF	52000000 to 88000000 Hz, 104 MHz to 176 MHz, 950 MHz to 2050 MHz in 1 Hz increments	70000000 Hz	Used to set the modulator carrier frequency. The acceptable range of options is implemented with a pass band filter that filters out all frequencies below and above the range. When selecting a carrier frequency, you must take into account the satellite bandwidth required for transmission. If you select a carrier frequency that is too close to either end of the valid range, data may be clipped by the pass band filter. For information on calculating the satellite bandwidth, see the MOD SR command. Front panel command equivalent: Config>Output>Tx Freq
MOD POW	-2500 to 0 dBm in 0.1 dB increments	-500 dBm	Modulator power set in hundredths of dBms. -2500 = -25.00 dBm
MOD ENABLE	ON/OFF		
MOD MOD_TYPE	DVB_QPSK, 8PSK, 16QAM	DVB_QPSK	
MOD TERR_TYPE	NONE, DVB188, DVB204	DVB_188	Sets the framing mode for the ASI output stream
MOD RATE_CTRL	SYMBOL_RATE, DATA_RATE, NONE	SYMBOL_RATE	Sets the “master rate setting mechanism for the modulator SYMBOL_RATE = symbol rate is settable – data rate is calculated and read only DATA_RATE = Data rate is settable – symbol rate is calculated and read only AUTO = Both data rate and symbol rate are settable and the other is calculated
MOD MOD_ROLLOFF	20, 25, 35	35	Modulator roll off factor 35 = 0.35 DVB standard 20 = 0.20 25 = 0.25
MOD STATUS			Provides a list of current modulator faults.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
OUT OUT_RATE	1,000,000 to 216,000,000	8448000	Sets the transport output rate
OUT ENABLE	ON/OFF	ON	Enables or disables the ASI output
OUT PACKET_SIZE	188, 204PAD, 204ENC	188	Sets the ASI output mode 188 = 188 byte mpeg packets 204PAD = 188 byte packets plus 16 stuffing bytes 204ENC = 188 byte packets plus 16 bytes Reed-Solomon encoded
OUT PCR_ENABLE	ON/OFF	ON	Enables PCR data in the transport stream
OUT PCR_DELAY	-1000 to 1000	0	Sets additional PCR delay – normally should be kept at 0.
OUT PCR_RATE	0 TO 100	30	Sets the number of PCR packets per second
OUT BITRT_CTRL	Auto, Manual	Auto	Video bit rate selection. Parameters are: Auto = automatically calculates the correct compressed video bit rate given other configured parameters. When in the Auto mode, you cannot change the video bit rate parameter using the VE.<port> BR command; Manual = allows you to manually set the compressed video bit rate. ***Note: When MC BITRT_CTL is set to Auto, the video bit rate setting is inversely proportional to the audio and user data bit rates; that is:*** ● ***if the audio and user data bit rates are high, a smaller portion of the transport stream bit rate can be allotted to the video bit rate*** ● ***if the audio and user data bit rates are low, a larger portion of the transport stream bit rate can be allotted to the video bit rate***
STATUS	-	-	Displays a complete status dump. Alternate command syntax “ST”. A sample Status dump is shown at the end of this guide.
TAB ATSC_NAME <*string*>	<*string*>	-	Sets the ATSC name; up to 8 characters may be used. Front panel command equivalent: none
TAB AUD_A_PID <#>	Where # is a valid PID	0	Sets the Audio A PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none
TAB AUD_B_PID <#>	Where # is a valid PID	0	Sets the Audio B PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none
TAB CARRIER_HZ	0-2000000000 in Hz	566310000 Hz	Sets the carrier frequency when ATSC table types are enabled. Front panel command equivalent: none
TAB MINORCH	1 to 99	2	Sets the minor channel in the ATSC tables. Front panel command equivalent: Config>Service>Setup>Minor Channel
TAB MAJORCH	1 to 99	30	Sets the major channel in the ATSC tables. Front panel command equivalent: Config>Service>Setup>Minor Channel
TAB NIT_CC	1/1, 1/2, 2/3, 3/4, 5/6, 7/8	5/6	Sets the current FEC Convolution Code Rate entered in the NIT. Front panel command equivalent: none
TAB NIT_MOD	QPSK	-	Sets the NIT modulation type.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
			Front panel command equivalent: none

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
TAB NIT_NAME	<string>	MPEG-2 Encoder	Used to enter the network name, up to 115 characters may be used. Front panel command equivalent: none
TAB NIT_NETID	0 to 65535 (decimal)	0	Used to enter the Network ID in the NIT. Front panel command equivalent: none
TAB NIT_POL	Hor, Vert, Left, Right	Vert	Sets the transmitted signal polarization. Parameters are: ● Hor =linear- horizontal polarization ● Ver = linear- vertical polarization ● Left = circular- left polarization ● Right = circular- right polarization Front panel command equivalent: none
TAB SATFREQ <###.#####>	000.00000 to 999.99999	011.75725	Sets the satellite frequency in GHz. Front panel command equivalent: none
TAB NIT_SATPOS <###.#>	000.0° to 999.9°	019.2°	Sets the satellite orbital position in degrees. Front panel command equivalent: none
TAB NIT_SR <###.#####>	###.####	-	Sets the NIT transmitted symbol rate (in sps). Front panel command equivalent: none
TAB NIT_WSTFLG	East, West	West	Sets the satellite orbital position. Parameters are: ● East = satellite orbital position is East ● West = satellite orbital position is West. Front panel command equivalent: none
TAB PCR_PID <#>	Where # is a valid PID.	0	Sets the PCR PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none
TAB PMT_PID <#>	Where # is a valid PID.	0	Sets the Program Map Table (PMT) PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none
TAB PROGNUM	1 to 223 (DVB) 2 to 223 (ATSC)	1 (DVB) 2 (ATSC)	Controls the program number for the PAT. Changing the PAT program number automatically sets the PMT to the same program number and sets the EIT and SDT service ID to match the program number. Front panel command equivalent: Config>Service>Setup>Service ID
TAB PROVIDER <*string*>	<*string*>	Unnamed	Used to enter the service provider name; name can be up to 115 characters in length. Front panel command equivalent: Config>Service>Setup>Provider
TAB SDT_NAME <*string*>	<*string*>	Service 1 (DVB) Ch2 (ATSC)	Used to enter the service name; name can be up to 115 characters in length. Front panel command equivalent: Config>Service>Setup>Name
TAB TSID	0 to 65535	1	Sets the transport stream ID for the PAT Transport Stream ID automatically changes the EIT, NIT, and SDT Transport Stream IDs to the same ID. Front panel command equivalent: none
TAB TYPE	None, MPEG, DVB, ATSC	DVB	Controls the type of PSI/SI tables to be provided. Works in conjunction with the CM Load Def command. Front panel command equivalent: Config>Tx Strm>Table Type

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
TAB USR_A_PID <#>	Where # is a valid PID.	0	Sets the Data A PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
TAB USR_B_PID <#>	Where # is a valid PID.	0	Sets the Data B PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none
TAB VID_PID <#>	Where # is a valid PID.	0	Sets the video PID to be included in the output transport stream. Zero is the default PID. Front panel command equivalent: none
TAB PGCA_PID	Where # is a valid PID	0	Sets the PID assigned to PGCA (TCA)
TCA ADD <*string*>	Where *string* is the alphanumeric label in the format *name@MAC address*	-	Adds a decoder to the conditional access database. The string can be up to 90 alphanumeric characters in length and must include a name, the @ sign, and the decoder's MAC address in the format name@mac address. The string cannot contain any spaces. The name parameter can be up to 15 characters in length. To determine the decoder's MAC address, refer to the appropriate Tiernan user guide which accompanied that product. ***Note: Decoders are automatically authorized when they are added to the list.*** ***Note: Non-Tiernan IRDs cannot be added to the decoder database.*** Front panel command equivalent: Config>CA>PGCAcfg>Add IRD
TCA AUTH <label>	Where label is the alphanumeric string specified in the TCA Add command.	-	Authorizes a Tiernan decoder to receive broadcast signals. ***Note: Non-Tiernan IRDs cannot be authorized.*** Front panel command equivalent: Config>CA>PGCAcfg>Lst IRD
TCA CLR	-	-	Clears the active subscriber list. Front panel command equivalent: none
TCA DEAUTH <*label*>	Where *label* is the alphanumeric string specified in the TCA Add command.	-	De-authorizes a Tiernan decoder so that it cannot receive broadcast signals. Front panel command equivalent: Config>CA>PGCAcfg>Lst IRD
TCA DELETE <*label*>	Where *label* is the alphanumeric string specified in the TCA Add command.	-	Deletes a Tiernan decoder from the conditional access database. Front panel command equivalent: Config>CA>PGCAcfg>Del IRD

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
TCA ENABLE	Off, On	Off	Enables and disables PGCA at a system level. Parameters are: ● on – enables PGCA; this setting ensures that only those Tiernan decoders listed in the PGCA database and authorized at an individual level can receive the broadcast signals. ● off – disables PGCA, all decoders, whether authorized or not, can receive the broadcast signal. ***Note: PGCA is a proprietary conditional access method used by Tiernan equipment that provides basic signal protection and the ability to authorize individual Tiernan IRDs. Non-Tiernan IRDs cannot be authorized by PGCA; therefore only authorized Tiernan IRDs can decode a service that has been protected through PGCA.*** ***Note: For additional information on system-level PGCA, or on adding, deleting and authorizing individual decoders, refer to the appendix on Conditional Access.*** ***Note: PGCA cannot be enabled if BISS is enabled.*** Front panel command equivalent: Config>CA>Setup>Service>Scramble> PGCA
TCA LIST	-	-	Displays a list of all Tiernan decoders registered in the PGCA database. The list includes the decoder's label, MAC address, and if the decoder is authorized. Front panel command equivalent: Config>CA>PGCAcfg>Lst IRD
TCA MASK	0 to FF	0	Sets the PGCA scrambling key to a specified algorithmic table. Front panel command equivalent: Config>CA>Setup>Service>Scramble> PGCA>PGCA Key
TCA UR	1 to 60 seconds	15 seconds	TCA update rate; specifies how often, in seconds, PGCA information is transmitted. Front panel command equivalent: none
TCA BISS_EN	ON, OFF	OFF	Enables BISS conditional access. Only available if the BISS feature has been purchased.
TCA BISS_HW			Provides a readout of the BISS hardware revision.
TCA BISS_1KEY			Used for entry of the BISS mode 1 key. Key may be any numeric entry up to 12 characters in length.
TCA BISS_EKEY			Used for entry of the BISS mode E key. Key may be any numeric entry up to 16 characters in length.
TCA BISS_EID			Used for entry of the BISS mode E Identifier. ID may be any numeric entry up to 14 characters in length.
TCA MODE	NONE, PGCA, BISS 1, BISS E	NONE	Sets the scrambling mode.
VAR <feature>	422_feature,		On the SE4000, various features are available as

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
<key>	70_140_feature, LBAND_feature, 8PSK_feature, 16QAM_feature		keyed software upgrades. To purchase a software upgrade contact Customer service. A software Key will be provided. Entering the key enables the feature.
VI.A FORMAT	525_lines (NTSC) 625_lines (PAL) NO_VIDEO	Read only	Displays the format of the detected analog video input.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
VI.A FMTCTL	PAL_N, NTSC, NTSC_0SU, AUTO	AUTO	Sets t he analog video input format detection. Auto = automatically detect video input. PAL_N = Set for PAL only NTSC_0SU = NTSC mode with no pedestal NTSC = Normal NTSC
VI.A AGC	ON/OFF	ON	Sets Video input AGC on or off.
VI.A STATUS			Status readout.
VI.B FORMAT	525_lines (NTSC) 625_lines (PAL) NO_VIDEO	Read only	Displays the format of the detected DIGITAL video input.
VI.B FMTCTL	PAL_N, NTSC, AUTO	AUTO	Sets t he analog video input format detection. Auto = automatically detect video input. PAL_N = Set for PAL only NTSC = Set for NTSC only
VI.B STATUS			Status readout.
VE ASP_RATIO	4x3, 16x9	4x3	Sets the picture aspect ratio. Front panel command equivalent: Config>Service>Video>Aspect Ratio
VE BR	0.8 to 50.0 Mbps	-	Sets the output compressed video bit rate. This command is query-only when the MC BITRATE_CTL command is set to Auto. Front panel command equivalent: Config>Service>Video>Data Rate
VE CHROMA	4_2_0, 4_2_2, 4_2_2_TIERNAN	4_2_0	Queries the chroma encoding format. 4_2_2_TIERNAN is a special mode that allows for interoperaton with certain early Tiernan IRD's. Front panel command equivalent: Config>Service>Video>Chroma
VE ENABLE	ON/OFF	ON	Enables or disables the video encoding engine
VE SRC	ANALOG, SDI, TESTPAT75%, TESTPAT100%, TESTPATBLUE, TESTPATMGNTA	SDI	Setting determines the source of video into the encoding engine. Parameters are: Analog SDI = Digital The four test patterns are internally generated for ease of troubleshooting and test. 75% = color bars 100% = color bars BLUE = Blue field MGNTA = Magenta field
VE HRES	352, 480, 544, 704, 720, 640, SIF	720	Sets the horizontal pixel resolution; the SE4000 uses this parameter, as well as the video format parameter, NTSC or PAL, to resize the picture prior

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
			to video encoding. For all parameters except SIF the number of lines per frame are: NTSC = 480; PAL = 576. SIF Mode: NTSC (352 x 240) PAL (352 x 288) Front panel command equivalent: Config>Service>Video>Resolution

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
VE LATENCY	Quality, Low_Delay, Low_Buff, Edit, Custom	Quality	Sets the video compression optimization. Parameters are: ● Quality = optimizes the video performance without regard for throughput delay time. Quality mode is appropriate for action video scenes such as sports material. ● Low_Delay = reduces the throughput time required to process a signal from the encoder input, through the compression process, and to the decoder output. In low delay mode, the overall delay through a TE60 to an IRD is 360 ms ±20 ms. In low delay mode, the compressed audio bit rate is automatically set to 256 Kbps. Low delay mode is appropriate for real time news interviews. ● Low_Buff = allows for small buffers. ● Edit = video compression uses only one frame (no prediction) which makes it easier to edit the compressed bit stream. Edit requires a higher data rate to achieve the video performance of quality mode. ● Custom = allows you to set site-specific video compression parameters, such as GOP structure and VBV size. These parameters must be initially set through a remote terminal and then saved using the remote CM SAVE command. Once saved, this custom setup will persist until the video optimize setting is changed. The custom parameter is for experienced users only. If this option set incorrectly, the video performance maybe adversely affected. It is recommended that users consult with Tiernan Customer Service before using the custom configuration. Front panel command equivalent: Config>Service>Video>Optimize
VE GOP_LENGTH	1 – 126	12	Sets GOP length in custom GOP mode GOP = (Group of Pictures) ***NOTE: GOP adjusting parameters will greatly affect coding efficiency and picture quality. Only advanced users should adjust GOP parameters. Setting GOP LENGTH to a non even multiple of the GOP will result in poor video encoding performance***
VE GOP	I, IP, IPB, IP2B	IP2B	Sets GOP configuration in custom GOP mode I = I frame only

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
			IP = I and P frame only – 12 frame IP GOP is IPPPPPPPPPPP IPB = 12 frame IPB GOP is IBPBPBPBPBPB IP2B = 12 frame GOP is IBBPBBPBBPBB
VE PTS_DELAY	-1000 to 1000	0	Sets the PTS to PCR video delay. ***NOTE: It is possible to set the delay larger than the available buffer size.***
VE STATUS			Provides status info.

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
VBI ENABLE	OFF, AUTO, ALL	OFF	OFF = No VBI AUTO = Sets the VBI mode based on the received video data. ALL = Transmits all VBI lines
VBI MODE	Off, 16_LINES_PT, 32_LINES_PT, TIERNAN_CC	Off	Configures the encoder to transmit either 16 or 32 lines of VBI information or Tiernan proprietary closed caption mode ● Off – disables expanded windows mode. ● 16_lines – enables 16-line expanded windows mode. ● 32_line – enables 16-line expanded windows mode. • TIERNAN_CC – Line 21 encoded Tiernan mode
DATA_ID	0-255	16	
DATA_UNIT_ID	2,3	2	
TT_TIME_STAMP	ENABLED, DISABLED	DISABLED	Enables time stamping of teletext data packets.
TT_MON_FREQ	NOP, 5MS,10MS, 20MS, 40MS, 50MS, 100MS, 200MS, 500MS, 1SEC, 2SEC, 3SEC, 10SEC, 20SEC, 30SEC, 60SEC,5SEC, 15SEC	50ms	
VBI VBI_QUANT	1 - 31	1	Sets the Quantization (number of pixels per data bit) for VBI. Setting higher quantization levels will provide lower bandwidth utilization at the expense of decreased VBI data resolution. ***NOTE: This parameter is for advanced users only.***
VBI VBI_END	6 - 23	21	Sets the last VBI encoded line. ***NOTE: This parameter is for advanced users only.***

SE4000 Remote Command Descriptions			
Remote Command	**Parameter Range**	**Factory Default**	**Description**
[1] The SE4000 contains a bank of flash memory that is used to store firmware, software, and hardware configuration files as well as unit configuration parameters. Parameter changes made using the front panel are automatically stored in flash memory. When the SE4000 is reset, any changes made using the front panel are restored. Any parameter changes made using a remote unit are not automatically stored in flash memory. If the SE4000 is reset prior to issuing the CM SAVE command, any changes made using the remote unit will not be restored. Instead, the SE4000 restores the last changes saved to flash memory. When the SE4000 configuration is changed using a remote unit, an operational test should be performed to verify that the system is operating correctly. Then the new configuration should be saved by issuing the CM SAVE command. Once the configuration is saved, the SE4000 automatically restores saved settings when the unit is reset or powered up. [2] Command only valid when MUX CM is set to Redund. [3] Refer to the MUX RED_STATE command for additional information.			

Tiernan standard product NMS backward compatability

For compatibility with NMS designs based around the Tiernan TE6000 modular products, the SE4000 will accept slot numbers in mnemonics. For example:
AE A BR 256000 sets the Audio A bit rate to 256000. The SE4000 will accept AE.1.A BR 256000 as an alternative. The slot number is accepted but ignored.

Configuration examples:
Here is a sample power up initialization screen:

```
>mc re
System is resetting...
SE4000 SDTV MPEG Encoder
Software Version: 1.0302
Date of Make: 12/23/2003
Time of Make: 14:38:39

Initializing Master Controller ...Done.
Investigating Optional Feature authorization ...Done.
Initializing Modulator ...Done.
Initializing Audio Encoder ...Done.
Initializing Video Encoder ...Done.
```

System initialization completing...

```
SE4000 initialization complete.

>
```

Here is a sample of a configuration dump using the CM DUMP command

```
>cm dump

MC          BAUD                38400
MC          DATA                8
MC          FLOW                HARD
MC          PARITY              N
MC          STOP                1
MC          MAC                 FF:FF:FF:FF:FF:FF
MC          SN                  ÿÿÿÿÿÿÿÿÿÿ
MC          IP                  239.239.239.239
MC          MASK                239.239.239.239
MC          GATEWAY             239.239.239.239
MC          DATE                20 Nov. 2003
MC          TIME                00:08:18
MC          VERSION             1.0302
MC          RE                  write-only
MC          UPDATE              write-only
MC          FPLOCK              UNLOCKED

AE.A        SRC                 AESEBU
AE.A        ENABLE              ON
AE.A        COMPRESS            MPEG
AE.A        OUTRES              24BIT
AE.A        SRATE               48
AE.A        CHFMT               STEREO
AE.A        BR                  256
AE.A        DELAY               0
AE.A        ER_PROTECT          ON
AE.A        COPYRIGHT           OFF
AE.A        MPEG_ORIG           OFF
AE.A        MPEG_EMPH           NONE
AE.A        USER_EXT            OFF
AE.A        SDI_CH_PAIR         2
AE.A        LANGUAGE            ENG
AE.A        PES_BLOCKS          1

OUT         OUT_RATE            8448000
OUT         ENABLE              ON
OUT         PACKET_SIZE         188
OUT         PCR_ENABLE          ON
OUT         PCR_DELAY           0
OUT         PCR_RATE            30
OUT         BITRT_CTL           AUTO

TAB         TYPE                DVB
TAB         PROGNUM             2
TAB         TSID                1
TAB         NIT_CC              5/6
```

```
TAB          NIT_MOD             QPSK
TAB          NIT_NETID           65535
TAB          NIT_NAME            MPEG-2 Encoder
TAB          NIT_SATPOS          019.2
TAB          NIT_POL             VERT
TAB          SATFREQ             011.75725
TAB          NIT_SR              005.5002
TAB          NIT_WSTFLG          WEST
TAB          PROVIDER            Unnamed
TAB          SDT_NAME            Service 2
TAB          ATSC_NAME           is UNAVAILABLE in the current state of the system. -
Only applicable for ATSC tables
TAB          MAJORCH             is UNAVAILABLE in the current state of the system. -
Only applicable for ATSC tables
TAB          MINORCH             is UNAVAILABLE in the current state of the system. -
Only applicable for ATSC tables
TAB          CARRIER_HZ          is UNAVAILABLE in the current state of the system. -
Only applicable for ATSC tables
TAB          VID_PID             33 (0x0021)
TAB          AUD_A_PID           36 (0x0024)
TAB          AUD_B_PID           37 (0x0025)
TAB          PCR_PID             33 (0x0021)
TAB          USR_A_PID           42 (0x002a)
TAB          USR_B_PID           43 (0x002b)
TAB          PMT_PID             32 (0x0020)

VI.A         FORMAT              525_LINE_VIDEO_INPUT
VI.A         FMTCTL              AUTO
VI.A         AGC                 ON

VI.B         FORMAT              525_LINE_VIDEO_INPUT
VI.B         FMTCTL              AUTO

VE           BR                  7466330
VE           HRES                720
VE           CHROMA              4_2_0
VE           GOP_LENGTH          12
VE           SRC                 SDI
VE           GOP                 IP2B
VE           PTS_DELAY           0
VE           LATENCY             QUALITY
VE           ENABLE              ON
VE           ASP_RATIO           4X3

AXD.B        EN                  OFF
AXD.B        SRC                 INT
AXD.B        DR                  1024000

AXD.A        BAUD                38400
AXD.A        STOP                1
AXD.A        PARITY              N
AXD.A        EN                  OFF
AXD.A        FC                  NONE
AXD.A        WIDTH               8

FM           FP_RELAY            0

TCA          BISS_EN             failed to retrive - Error
TCA          BISS_HW             failed to retrive - Error

CM           SAVE                write-only
CM           RENAME              write-only
CM           DELETE              write-only
CM           SAVE_CFG            write-only
CM           RESTORE             write-only
CM           LIST                Issue command for detail
CM           MODIFY              write-only
CM           DUMP                Issue command for detail

VBI          MODE                OFF
VBI          VBI_QUANT           1
```

```
VBI          VBI_END             21

MOD          ENABLE              OFF
MOD          MOD_TYPE            DVB_QPSK
MOD          SYM_RATE            5500187
MOD          DATA_RATE           8447999
MOD          CODE_RATE           5/6
MOD          CF                  70000000
MOD          POW                 -500
MOD          SPEC_INV            NORMAL
MOD          STATUS              Minor Tx Alarm
MOD          CAR_TYPE            NORM
MOD          TERR_TYPE           DVB188
MOD          RATE_CTRL           SYMBOL_RATE
MOD          MOD_ROLLOFF         35

VAR          422_FEATURE         Chroma 4:2:2 feature is now avaiable
VAR          70_140_FEATURE      feature not available. Enter code to enable
VAR          LBAND_FEATURE       feature not available. Enter code to enable
VAR          8PSK_FEATURE        feature not available. Enter code to enable
VAR          16QAM_FEATURE       feature not available. Enter code to enable
```

Here is a sample of a Status dump using the STATUS or ST command:

```
>statusAUD6022 Audio A Status
        Audio FPGA Version:      0x1c
        DSP Software Version:    1.3

        CS8420 Active: Yes
        Information From CS8420 Receiver:
                Subcode CRC Error:        No
                Channel Status CRC Error: No
                PLL Unlock:               No
                Data Invalid:             No
                Confidence Error:         No
                Bi-Phase Error:           No
                Parity CRC Error:         No
                Channel Status Bytes:     0x8140 0x0000

        Bitrate:              256000
        PES FIFO threshold:   6752
        PES FIFO Level:       7264
        PES FIFO Max Level:   7632
        STC Latch hi med lo:  0 56845 41209

        Information From DSP:
                AES Data:        Detected
                AES Input:       Locked
                AES Data:        Valid
                AES Confidence:  No Error
                AES Bi-Phase:    No Error
                AES Parity:      No Error
                AES Preemphasis: Not Detected
                AES Mode:        consumer
                AES Resolution:  Not Indicated
                AES Sample Rate: 48K
AUD6022 Audio B Status
        Audio FPGA Version:      0x1c
        DSP Software Version:    1.3

        CS8420 Active: Yes
        Information From CS8420 Receiver:
                Subcode CRC Error:        No
                Channel Status CRC Error: No
                PLL Unlock:               No
                Data Invalid:             No
                Confidence Error:         No
                Bi-Phase Error:           No
                Parity CRC Error:         No
                Channel Status Bytes:     0x8140 0x0000

        Bitrate:              256000
        PES FIFO threshold:   6752
        PES FIFO Level:       6850
        PES FIFO Max Level:   7632
        STC Latch hi med lo:  0 56845 41209

        Information From DSP:
                AES Data:        Detected
                AES Input:       Locked
                AES Data:        Valid
                AES Confidence:  No Error
                AES Bi-Phase:    No Error
                AES Parity:      No Error
                AES Preemphasis: Not Detected
                AES Mode:        consumer
                AES Resolution:  Not Indicated
                AES Sample Rate: 48K

  Analog Video Operational Status
-------------------------------------------------
Main analog video input is not present.
```

```
AGC is on.

  Digital Video Operational Status
-------------------------------------------------
Main SDI video input type NTSC is present.
Encoder Init:          Initialized
Video Input:           Present
Video Valid:           Yes
VBV size:            1835008 bits
Throughput delay:            347
STC/PTS Status:
    STC FIFO Level:    25
    STC Value:         2160696
    PTS Value:         1098903661
    STC minus PTS:     0

 ATSC Closed Captions are not present

  Modulator Operational Status
-------------------------------------------------
No Alarm
>
```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Configuring the SE4000

5

This chapter presents the following information:

- Configuration prerequisites.
- A high-level procedure used to configure a SE4000 using either the front panel or a remote unit.
- Detailed procedures for configuring a SE4000 to the default standards, using either the front panel or a remote unit
- Examples of common SE4000 configurations, including:
- Configuraing a basic DSNG setup using the front panel.

5.0 SE4000 Configuration Procedure

Whether the front panel or a remote unit is used to configure the SE4000, perform the following steps to configure the system:

1. Make a list of the operational requirements.

2. Compare the requirements to the corresponding SE4000 default parameter settings

3. Determine which SE4000 default parameters must be changed for the operational requirements.

4. Record the new SE4000 parameter values and the corresponding front panel or remote commands required to change those parameters.

5. Configure the SE4000 to the default configuration.

6. Configure the SE4000 with any new parameters.

7. Ensure that any decoders are correctly configured to operate with the SE4000 parameter settings.

All SE4000 configuration changes issued from the front panel are automatically save to non-volatile memory. Unlike front panel operations, SE4000 parameter changes made from a remote unit are not automatically saved to non-volatile memory. If configuration changes are made from a remote unit, issue the command `CM SAVE` ***to save the configuration to non-volatile memory. Multiple configurations can be saved using the Quickset commands.***

5.1 Setting the Default Configuration

The SE4000 is configured with a set of default, DVB-compliant parameters before it is shipped from the factory. This DVB configuration consists of a standard set of operating parameters that allow the user to quickly and easily begin operations. When configured to the DVB default settings, the SE4000:

- Encodes both audio channels and the video channel at the default DVB rate.
- Compresses the channels.
- Includes the channels with a standard set of table information in the internal transport stream.
- Does **not** include either of the Aux data channels in the transport stream.
- Adds modulator settings
  Modulation: QPSK
  Code Rate: 5/6
  Data Rate: 8448000
  Frequency: 70Mhz or ??? if the modulator is L-band only.

The SE4000 should be operated using either the DVB or ATSC default configuration unless site-specific operations require a change to the default settings. If a change is required, modify only those parameters meeting operational requirements.

When beginning operations using either the DVB or ATSC default configuration, ensure that the decoder is also initialized to the appropriate defaults. If the SE4000 operating parameters are modified, ensure that the decoder parameters are also modified to match the new SE4000 parameters.

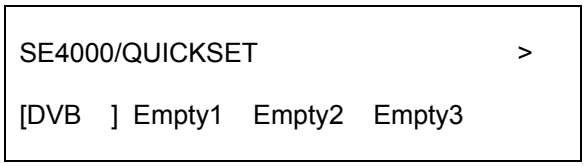
Setting the SE4000 to the default DVB configuration will return it to the factory delivered configuration with the exception that any user custom configurations are preserved.

5.1.1 Using the Front Panel to Set the Default Factory Configuration

To initialize the SE4000 to the default configuration using the front panel, perform the following steps.

1. From the main menu, select QuickSet.

2. The Quickset selection menu appears. Select DVB.



3. A message appears to confirm the selection. This helps to prevent accidental re-configuration. Press Enter to continue.

```
SE4000/QUICKSET/DVB                >

Press Enter to restore DVB Config.
```

4. A “last chance to turn back” menu appears. Press Enter to continue.

```
SE4000/QUICKSET/DVB                >

(ENTER) = Restore Config,   (EXIT) = abort
```

5. Various screens will appear indicating that the unit is re-configuring and then resetting. The process takes less than 1 minute. Once the basic SE4000 power on screen appears, the unit is ready for operation or configuration.

```
SE4000                                >

[QUICKSET]  SERVICE  OUTPUT  STATUS
```

5.1.2 Using a Remote Unit to Set the Default Configuration

To initialize the SE4000 to the default configuration using a remote unit issue the following command: `CM RESTORE <string>`, where `<string>` is the default parameter such as `DVB` or `ATSC`.

When the SE4000 is set to the default setting, the remote port baud rate is set to 38400 bps. If the remote unit is set to communicate with the SE4000 at a baud rate other than 38400 bps, immediately after the default command is issued, the remote unit will not be able to communicate with the SE4000. To resolve this issue, the equivalent parameter in the software settings of the remote unit must be changed to 38400 bps. However, the remote unit software settings must not be changed before issuing the default command to the SE4000, as the remote unit will not be able to communicate with the SE4000.

5.2.2 Configuring a Simple SCPC Setup Using the Remote Unit

This example configures the SE4000 to a simple SCPC setup. Use this example as a guideline, substituting site-specific parameter values as required.

Step 1

In this example, assume that the following is a list of your SE4000 operational parameters:
Input channels:

- Audio A: On
- Audio B: Off
- Video: On

Audio encoder parameters:

- Source of input audio: analog left and right input.
- Compressed output audio format: stereo
- Audio compressed bit rate: 256 Kbps
- Audio channel sample rate: 48 Ksps

Video encoder parameters:

- Source of input video: SDI serial digital
- Video format mode: PAL
- Pixel and line sample resolution: 480 x 576 resolution video.
- Output compressed video bit rate: auto-rate calculation.
- Aux data parameters: No aux data required.

Multiplexer transport stream parameters:

- SCPC Operation: ASI output at 4 Mbps.
- PSI tables: minimal complete set.

Steps 2 and 3

After comparing these operational requirements against the SE4000 DVB parameters, it is determined that all of the parameters with required to set the audio and video encoders to the basic SCPC configuration are DVB settings, with the exception of the following parameters:

- Video source.
- Video resolution
- Multiplexed transport rate

Step 4

To change these parameters, the following remote commands will be used:

Parameter	Remote Command
Video source = D1 serial digital	VE SRC DIGITAL
Video resolution = 480 x 576	VE HRES 480
Multiplexed transport rate = 4 Mbps	OUT OUT_RATE 4000000

Step 5

To configure the SE4000 for this example, the unit must first be initialized to the DVB default settings.

1. Issue the DVB default command `CM RESTORE DVB`.
   When the remote unit displays the system prompt (>), all of the SE4000 parameters have been set to the DVB default settings.

2. if the baud rate settings of the communications package in the remote unit is not set to 38400 bps, the baud rate must be changed before continuing.

When the SE4000 is set to the default setting, the remote port baud rate is set to 38400 bps. If the remote unit is set to communicate with the SE4000 at a baud rate other than 38400 bps, immediately after the default command is issued, the remote unit will not be able to communicate with the SE4000. To resolve this issue, the equivalent parameter in the software settings of the remote unit must be changed to 38400 bps. However, the remote unit software settings must not be changed before issuing the default command to the SE4000, as the remote unit will not be able to communicate with the SE4000.

Step 6

Once the SE4000 is set to the DVB default settings, issue the following commands to change the required parameters:

1. To set the source of the input video to D1 serial digital, issue the command `VE SRC DIGITAL`. After the SE4000 sets the parameter, the system prompt is displayed.

2. To set the pixel and line sample resolution to 480, issue the command `VE HRES 480`.

3. The SE4000 is now configured to a simple SCPC setup. To save this configuration to flash memory, issue the `CM SAVE` command.

Once the settings are saved, the SE4000 automatically restores to the simple SCPC setup whenever the unit is reset or powered-up.

Step 7

Ensure that the decoder is correctly configured to operate with the SE4000 parameter settings.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Troubleshooting

6

This chapter includes the following information:

- Fault reporting and monitoring, including the status LED and status button, viewing current faults, and viewing the fault history and fault relay logs.
- Initialization self-test diagnostic functions.
- Summary listing all SE4000 faults.
- Operational problems and their solutions.

6.0 Fault Reporting and Monitoring

The SE4000 has an internal microcontroller that continually performs real-time monitoring of system conditions. When the unit detects a fault, the front panel Status LED is triggered, the fault is then stored in the fault history log, and depending upon the type of fault, the fault may be viewed by querying the current faults.

6.1 Status LED

At-a-glance system status can be quickly determined by checking the tri-colored Status LED found on the front panel. The following color of the Status LED identifies the state of the SE4000:

- Green: the unit is operating correctly and has no current faults.
- Yellow: a current fault is detected.
- Red: internal hardware faults are detected, or the video or audio encoders are not processing data.

If the Status LED illuminates yellow or red, the Status Button can be pressed, which will display the current faults listing.

Refer to the Faults Summary List for a description of the faults and the actions to take to resolve them.

SE4000 units may have LED indicators that are visible through holes in the side and rear panel filler plates. These indicators are used by factory technicians during the production process but are not used during SE4000 operation. You should ignore these indicators.

6.2 Current Faults

Current faults are reported *real-time*, which means that only conditions that are present at the time of the query are displayed, regardless of what fault conditions have existed in the past. A current fault exists when the Status LED is yellow.

6.2.1 Viewing Current Faults on the Front Panel

To view the current faults on the front panel LCD, perform the following steps:

1. From the main menu, select Status.

```
SE4000                                  >
 QUICKSET   SERVICE  OUTPUT  [STATUS]
```

2. The Status menu displays. Select Current.

```
SE4000/Status                           >
 [ Current  ]   History    Relay
```

3. The Current Status menu displays. Only one fault is displayed on the LCD at one time. If there is mpore than one fault detected, they can be viewed by pressing the up and down buttons. In this case there are two faults detected and the first fault is displayed.

```
SE4000/Status/Current          1/2   >
 Digital Video Loss of Input
```

4. Pressing the down arrow will display the other fault.

```
SE4000/Status/Current          2/2   >
 Audio A AES Loss of Input
```

5. If there are no faults present in the SE4000, No Faults will be displayed.

```
SE4000/Status/Current                  >
 No Faults
```

NOTE

All current faults are recorded in the fault history log; however, not all faults that are detected by the SE4000 are shown on the current faults log. To determine if other hardware or operational problems exist, the fault history log must be viewed.

6.2.2 Viewing Current Faults Using a Remote Device

To view current faults using a remote unit, issue the `FM CURR_LIST` command. The SE4000 responds with either No Faults, if none are present, or one or more fault messages.

For example, to view current faults, issue the `FM CURR_LIST` command. The remote unit displays:

```
Current Faults (LIST)            16:25:43 08/21/2001
--------------------------------------------------
PHYS.A DS3 Red Indicator
```

The query response shows:

- The type of information queried — `current faults`
- The time the query was issued — `16:25:43`
- The day the query was issued — `08/21/2003`
- A listing of all current faults

Individual faults do not include a time tag since they were occurring at the time the query was issued, in this example at 16:25:43 on 08/21/2003.

To determine the time that the fault initially occurred, you must query the fault history log. For example, the red indicator could have occurred prior to 16:25:43 on this day.

6.3 Fault History Log

The fault history log is more than just a list of current faults that have occurred over a period of time. The SE4000 can detect a variety of other hardware and operational faults that are not reported as current faults. These faults are stored in the fault history log in addition to any current faults that have occurred.

The SE4000 fault history log records up to 20 repeated occurrences of the same fault condition. The SE4000 stops logging faults after they occur more than 20 times. The SE4000 saves all faults in the fault history log until the fault history log is cleared by selecting Clear from the Faults submenu or issuing the remote command `FM LOG_CLR`.

6.3.1 Viewing Fault History Log on the Front Panel

To view the fault history log on the front panel, perform these steps.

1. From the main menu, select the Status menu.

```
SE4000                                    >
 QUICKSET   SERVICE  OUTPUT  [STATUS]
```

2. The Status menu displays. Select History.

```
SE4000/Status                             >
  Current     [ History]     Relay
```

3. The History menu displays similarly to the current fault list.

```
SE4000/Status/History          1/2    >
 Digital Video Loss of Input
```

4. Pressing the right arrow will enable the Fault History clear operation.

```
SE4000/Status/History                     >
 Press Enter to Clear Fault History List
```

5. Press Enter to clear the Fault history log.

6. To view all faults in the history log, use the up or down buttons. Faults stored in the fault history log are displayed on the front panel LCD in ASCII string format and consist of:

   - A time tag.
   - The name of the fault.
   - For example, at 3:23 pm, the input source to the video encoder was interrupted. The fault history log, when queried, would display:
   - 15:23:17 VI.x Loss of input. Where:
   - `15:23:17` is the time tag.
   - `VI.x Loss of Input` is the name of the fault.

6.3.2 Viewing the Fault History Log Using a Remote Unit

To view the fault history log with a remote unit, issue the `FM LOG_LIST` command. The unit responds with either `No Faults` if none are present, or one or more fault messages.

The remote unit displays the fault history log beginning with the time and day tag followed by the fault descriptor.

For example, assume that the current day is August 21, 2003, at 4:25 pm. The status LED is illuminated. The fault history log is queried. The `FM LOG_LIST` command is issued. The remote terminal displays the following information:

```
Fault Log at              16:25:43 08/21/2003
-----------------------------------------------
15:23:17 08/21/2003, VI.x Loss of Input
08:57:39 08/20/2003, VI.x Loss of Input
```

The query response shows:

- The type of information queried: `fault log`
- The time the query was issued: `16:25:43`
- The day of the year the query was issued: `08/21/2001`
- A listing of all faults in the fault history log

6.4 Fault Relay Monitoring

The Form-C fault relay is a real-time indicator for specific fault conditions. The relay contacts are passive.

A Form-C relay has a common contact (C) and two other contacts (A and B). Normally the common contact is connected to A and not to B.

When the relay is indicating a fault condition, the common contact C is connected to B and not to A. this relay indicated a fault condition when power has failed. A power failure, power switch turned off, or an unplugged unit is defined as a fault condition.

When the fault relay detects a fault condition, the fault relay trips and the Status LED illuminates red.

Once a fault condition sets the fault relay and illuminate the status LED on the front panel, they must be cleared manually by either:

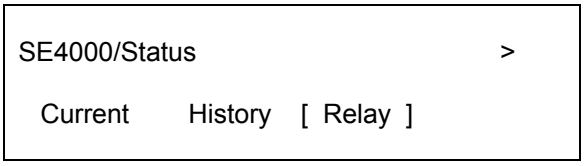
- Selecting the front panel Status>Relay>Clear option.
- Issuing a remote `FM RELAY_CLR` command.

6.4.1 Viewing Fault Relay Log on the Front Panel

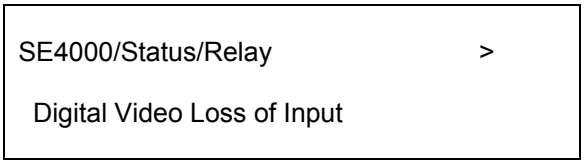
The Relay fault History works similarly to the History and Current menus. To view the fault history log on the front panel, perform these steps.

1. From the main menu, select the Status menu.

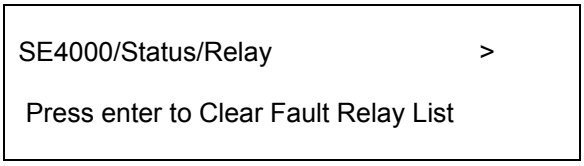
2. The Status menu displays. Select Relay.



3. The Fault Relay menu displays. You may scroll through the fault list displayed in a similar manner to the fault history described above.



4. The LCD displays the most recent faults. In order to clear rthe fault relay, you must press the right arrow. The display will be as below.



5. Pressing enter will reset the fault relay and clear all of the faults saved in the list. If no faults exist, the LCD displays `No Fault.`

SE4000/Status/Relay >
No Faults

6.5 Initialization Self-Test Function

In addition to internal fault monitoring, the SE4000 microcontroller performs built-in-self-tests (BIST) automatically during the initialization process. If a failure is detected, the LCD displays an error message to alert the user to the problem. The error messages are displayed in the same format as faults.

If the SE4000 did not display an error message during initialization, but is not operating properly, perform the following diagnostic steps.

1. Verify that the SE4000 is configured correctly for your requirements.

2. If your system is configured properly, but still not operating correctly, issue the front panel `QuickSet>DVB>Enter` command or the `CM RESTORE DVB` remote command to reset the SE4000 to the defaults.

3. Reset any site specific custom configuration parameters.

4. If the SE4000 is still not operating properly, query the current faults to determine if a current fault exists. Correct all current faults.

5. Query and review the fault history log. Correct all faults, if possible.

6. Record the fault history.

If your SE4000 continues to fail, contact the Radyne ComStream Customer Support Department for assistance.

6.6 Fault Summary

Most SE4000 faults are non-critical, informational faults. When faults occur, perform the following steps:

1. If the unit is functioning normally, clear the faults and continue operations.

2. If the unit continues to fail:

   - Reset the box to the defaults
   - Configure the unit to site specific parameters.
   - If the unit is still not operating properly, query the current faults to determine if a current fault exists. Correct all current faults.
   - Query and review the fault history log. Correct all faults, if possible.
   - Clear all faults.
   - Query the current faults and fault history log.

If the unit continues to fail, record the fault history and contact the Radyne ComStream Customer Support Department for assistance.

All SE4000 faults, whether current faults, faults listed in the fault history log, or faults that cause the fault relay to trip, are listed in alphabetical order in the following table:

SE4000 Fault Summary		
Description	**Fault Relay Trigger**	**Action Required**
Audio A Initialization	Yes	
Audio A AES/EBU Input Loss	No	Check the input connection
Audio A AES/EBU Invalid Input	No	Verify audio format
Audio A Sample Rate Mismatch	No	Verfiy sample rate settings
Audio A AC3 Input Loss	No	Check the input connection
Audio A AC3 Input Error	No	Check AC3 configuration
Audio A SDI Group does not Exist	No	Check SDI embedded audio configuration
Audio A SDI Pair does not Exist	No	Check SDI embedded audio configuration
Aduio A SDI FIFO Overflow Error	No	Check SDI embedded audio configuration
Audio A SDI FIFO Underflow	No	Check SDI embedded audio configuration
Audio A SDI DATA Count Count Error	No	Check SDI embedded audio configuration
Audio A PES FIFO Overflow Error	No	Power cycle the unit
Audio A PES FIFO Underflow	No	Power cycle the unit
Audio A DSP Compression Error	No	Power cycle the unit
Audio A DSP Stack Error	Yes	Power cycle the unit
Audio B Initialization Error	Yes	Power cycle the unit
Audio B AES/EBU Input Loss	No	Check the input connection
Auido B AES/EBU Invalid Input	No	Verify audio format
Audio B Sample Rate Mismatch	No	Verfiy sample rate settings
Audio B AC3 Input Loss	No	Check the input connection
Audio B AC3 Input Error	No	Check AC3 configuration
Audio B SDI Group does not Exist	No	Check SDI embedded audio configuration
Audio B SDI Pair does not Exist	No	Check SDI embedded audio configuration
Audio B SDI FIFO Overflow Error	No	Check SDI embedded audio configuration
Audio B SDI FIFO Underflow Error	No	Check SDI embedded audio configuration
Audio B SDI DATA Count Error	No	Check SDI embedded audio configuration
Audio B PES FIFO Overflow Error	No	Power cycle the unit
Audio B PES FIFO Underflow Error	No	Power cycle the unit
Audio B DSP Compression Error	No	Power cycle the unit
Audio B DSP Stack Error	Yes	Power cycle the unit
Modulator Initialization Error	Yes	Power cycle the unit
Modulator +5v Alarm	Yes	Power cycle the unit
Modulator +12v Alarm	Yes	Power cycle the unit
Modulator –12v Alarm	Yes	Power cycle the unit
Modulator Frame Sync	No	Power cycle the unit
Modulator Modulator Fifo	No	Power cycle the unit
Modulator Oversample Alarm	No	Power cycle the unit
Modulator FPGA Configuratin	Yes	Power cycle the unit
Modulator IF Synth Alarm	Yes	Power cycle the unit
Conditional Access Initialization Error	No	Power cycle the unit
Analog Video Initialization Error	No	Power cycle the unit
Analog Video Loss of Input	No	Verify input connection
Analog Video Timebase Error	No	Verify correct frame rate and format
Analog Video Format Mismatch	No	Verify correct frame rate and format
Analog Video Input Level Small	No	Verify input connection
Analog Video Input Level Large	No	Verify the input connection
Digital Video Initializaiton Error	Yes	Power cycle the unit
Digital Video Loss of Input	No	Verify the input connection
Digital Video SDI FIFO Underflow	No	Verify SDI signal integrity
Digital Video SDI FIFO Overflow	No	Verify SDI signal integrity
Digital Video SDI Sync Error	No	Verify SDI signal integrity
Digital Video SDI EDH Error	No	Verify SDI signal integrity
Digital Video Timebase Error	No	Verify SDI signal integrity

Video Enc. Initialization Error	Yes	Power cycle the unit
Video Enc. Video timestamp drift	No	Power cycle the unit
Video Enc. ATSC CC	No	Verify Closed Captioning present in input
Teletext Internal FIFO Error	No	Verfiy teletext has correct configuration
Teletext LPC Error	No	Verfiy teletext has correct configuration
Teletext VBI Parity Error	No	Verfiy teletext has correct configuration
Teletext Hamming Error	No	Verfiy teletext has correct configuration
Teletext TVP Word Count	No	Verfiy teletext has correct configuration

6.7 Fault Summary

The following troubleshooting tips were designed to help diagnosing and correcting minor operational problems in the unlikely event that there are difficulties encountered with the SE4000. If all of suggested solutions are tried and the unit still fails, contact the Radyne ComStream Customer Service Department.

Front Panel Symptoms	
Problem:	The front panel is not enabled, is in view-only mode, does not accept commands or button pushes.
Solutions:	The front panel may be in lock-out mode. Unlock the front panel.
Problem:	No video output from the decoder.
Solutions:	Verify that the video cabling to the encoder is correctly connected. Verify that the cabling from the decoder to the monitor is correctly connected. Ensure that the SE4000 is configured for the video input source that is being provided.
Problem:	No audio output from the decoder.
Solutions:	Verify that the audio cabling to the encoder is correctly connected. Verify that the cabling from the decoder to the audio monitor is correctly connected. Ensure that the SE4000 is configured for the audio input source that is being provided.
Problem:	No audio or video output from the decoder.
Solutions:	Data link problem between the encoder and decoder. This could be caused by excessive satellite noise or other data corruption.
Problem:	Green or black stripes across the middle of the video.
Solutions:	Noisy or “dirty” AC power. Change to a “clean” power source, or use an AC power filter or power conditioner. Ensure that the input source is in the proper format and conforms to specified input levels.

Remote Unit Monitor Symptoms	
Problem:	No sign-on message on the remote terminal after power-up.
Solutions:	Ensure that the remote unit and the SE4000 are turned on and plugged into an active AC outlet. Verify that the baud rate and parity of the remote unit communications package match the factory setting of the SE4000 remote control interface. Factory settings are 38400 baud, 8 data, no parity, and 1 stop bit. Verify that the cable between the terminal, the SE4000, and the Null Modem Adapter are properly connected.

6.8 Fault Management

The SE4000 contains a very sophisticated fault management system. The fault system may be customized by the sophisticated user for their particular requirements. Every defined fault may be individually enabled or disabled and every fault may be individually defined to affect or not affect the fault realy. All faults have been pre-defined at the factory. The pre-defined fault masking will suffice for most customers in most situations. Sophisticated fault mamangement is available for the advanced user.

The commands associated with Fault management are listed below.

FM TYPES			Provides a complete list of all faults defined in the unit. Included is a description and activation status. • See below for a sample of the Fault Types display. Your specific display will vary based on purchased options and software revision. • The Fault ID is a numeric code assigned to the fault • Activated – normally all faults are activated. De-activating a fault will cause that fault to be ignored. • Triggers relay – describes whether or not that particular fault drives the fault relay. • Description of the fault.
FM EN_FLT			The user enters FM en_flt xx where xx is the Fault ID to enable that fault
FM EN_FLT			The user enters FM dis_flt xx where xx is the Fault ID to disable that fault

>fm types
This are the Fault Types for the SE400:
Fault id , Activated?, Triggers Relay?, Description:

---
0 , Active , Ignores Relay , Begin of Fault List
1 , Active , Triggers Relay, Audio A Initialization Error
2 , Active , Ignores Relay , Audio A AES/EBU Input Loss
3 , Active , Ignores Relay , Audio A AES/EBU Invalid Input
4 , Active , Ignores Relay , Audio A Sample Rate Mismatch
5 , Active , Ignores Relay , Audio A AC3 Input Loss
6 , Active , Ignores Relay , Audio A AC3 Input Error
7 , Active , Ignores Relay , Audio A SDI Group does not Exist
8 , Active , Ignores Relay , Audio A SDI Pair does not Exist
9 , Active , Ignores Relay , Audio A SDI FIFO Overflow Error
10 , Active , Ignores Relay , Audio A SDI FIFO Underflow Error
11 , Active , Ignores Relay , Audio A SDI DATA Count Error
12 , Active , Ignores Relay , Audio A PES FIFO Overflow Error
13 , Active , Ignores Relay , Audio A PES FIFO Underflow Error
14 , Active , Ignores Relay , Audio A DSP Compression Error
15 , Active , Triggers Relay, Audio A DSP Stack Error
16 , Active , Triggers Relay, Audio B Initialization Error
17 , Active , Ignores Relay , Audio B AES/EBU Input Loss
18 , Active , Ignores Relay , Audio B AES/EBU Invalid Input
19 , Active , Ignores Relay , Audio B Sample Rate Mismatch
20 , Active , Ignores Relay , Audio B AC3 Input Loss

21 , Active , Ignores Relay , Audio B AC3 Input Error
22 , Active , Ignores Relay , Audio B SDI Group does not Exist
23 , Active , Ignores Relay , Audio B SDI Pair does not Exist
24 , Active , Ignores Relay , Audio B SDI FIFO Overflow Error
25 , Active , Ignores Relay , Audio B SDI FIFO Underflow Error
26 , Active , Ignores Relay , Audio B SDI DATA Count Error
27 , Active , Ignores Relay , Audio B PES FIFO Overflow Error
28 , Active , Ignores Relay , Audio B PES FIFO Underflow Error
29 , Active , Ignores Relay , Audio B DSP Compression Error
30 , Active , Triggers Relay, Audio B DSP Stack Error
31 , Active , Triggers Relay, Modulator Initialization Error
32 , Active , Triggers Relay, Modulator +5v Alarm
33 , Active , Triggers Relay, Modulator +12v Alarm
34 , Active , Triggers Relay, Modulator -12v Alarm
35 , Active , Ignores Relay , Modulator Terrestrial Clock
36 , Active , Ignores Relay , Modulator Terrestrial Data
37 , Active , Ignores Relay , Modulator Frame Sync
38 , Active , Ignores Relay , Modulator Modulator Fifo
39 , Active , Ignores Relay , Modulator Oversample Alarm
40 , Active , Triggers Relay, Modulator FPGA Configuration
41 , Active , Triggers Relay, Modulator IF Synth Alarm
42 , Active , Ignores Relay , Conditonal Access Initialization Error
43 , Active , Ignores Relay , Analog Video Initialization Error
44 , Active , Ignores Relay , Analog Video Loss of Input
45 , Active , Ignores Relay , Analog Video Timebase Error
46 , Active , Ignores Relay , Analog Video Format Mismatch
47 , Active , Ignores Relay , Analog Video Input Level Small
48 , Active , Ignores Relay , Analog Video Input Level Large
49 , Active , Triggers Relay, Digital Video Initialization Error
50 , Active , Ignores Relay , Digital Video Loss of Input
51 , Active , Ignores Relay , Digital Video SDI FIFO Underflow
52 , Active , Ignores Relay , Digital Video SDI FIFO Overflow
53 , Active , Ignores Relay , Digital Video SDI Sync Error
54 , Active , Ignores Relay , Digital Video SDI EDH Error
55 , Active , Ignores Relay , Digital Video Timebase Error
56 , Active , Triggers Relay, Video Enc. Initialization Error
57 , Active , Ignores Relay , Video Enc. Video timestamp drift
58 , Active , Ignores Relay , Video Enc. ATSC CC
59 , Active , Ignores Relay , Teletext Internal FIFO Error
60 , Active , Ignores Relay , Teletext LPC Error
61 , Active , Ignores Relay , Teletext VBI Parity Error
62 , Active , Ignores Relay , Teletext Hamming Error
63 , Active , Ignores Relay , Teletext TVP Word Count
64 , Active , Ignores Relay , Software Update Initiated Notification
65 , Active , Ignores Relay , Configuration Restore Initiated
66 , Active , Ignores Relay , User requested Manual system Reset
67 , Active , Ignores Relay , System Initialization complete Notificat
ion
68 , Active , Ignores Relay , User has changed Date/Time Notification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Maintenance and Software Upgrades

7

7.0 Maintenance

SE4000 encoders require no periodic or preventive maintenance other than keeping the cooling fan intake grills free of obstruction.

7.1 Field Software Upgrades

The SE4000 is controlled by a built-in microcontroller equipped with a non-volatile memory that is used to store configuration settings, operational software, operational firmware, and field programmable gate array (FPGA) configuration files.

Great care has been taken to provide for simple field software upgrade procedures in the SE4000. Software upgrades are much simpler for the user than in previous Tiernan encoder products.

For instructions on performing a field software upgrade, contact a Tiernan Product Support engineer.


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Technical Specifications

A

STANDARD FEATURES

Video Input	• PAL (625 line) or NTSC (525 line) formats.
Analog	• SMPTE 170M NTSC or ITU-R BT.470-6 PAL-I/B/D, BNC connector.
Serial Digital	• SMPTE 259M SDI @ 270 Mbps, BNC connector.
Video Processing	• MPEG-2 4:2:0 (Main Profile @ Main Level), 1.0 to 15.0 Mbps. • Horizontal resolutions: 720, 704, 640, 544, 480 and 352 pixels/line. • Vertical resolutions 240 or 480 lines (NTSC) or 288 or 576 lines (PAL). • 4:3 and 16:9 configurable aspect ratio. • TBC, AGC, and clamp for composite video signal restoration.
Vertical Blanking Interval	• Proprietary passing of NTSC line 21 closed-captions (composite or SDI). • ATSC closed-captions, per A/53 (composite or SDI). • DVB Teletext for World System Teletext on PAL composite video.
Latency	• Ultra-low latency: 150 ms (encode to decode). • Low latency: 200 ms (encode to decode). • Quality: 350 to 1000 ms (encode to decode).
Audio Inputs	• Two stereo or four independent analog mono channels on balanced XLR connectors. • Two AES/EBU digital stereo pairs on 75 Ohm BNC connectors.
Audio Processing	• MPEG-1 Layer II • Two stereo channels or four independent mono channels • Sampling rates of 32, 44.1 and 48 Ksps • Output rates from 64 to 384 Kbps.
Auxiliary Data	• One synchronous: 1 to 20 Mbps, resolution 1 bps, EIA-422, on female DB-9 connector. • One asynchronous: 1200 to 115 Kbps, EIA-232, on female DB-9 connector.
Control Tables	• Internally generated DVB-compatible PSI/SI tables.
Conditional Access	• PGCA proprietary conditional access, enable/disable IRDs from front panel or remote control.

Timing	• Lip synchronization adjustment ±500 ms.
Transport Output	• MPEG-2, DVB-compliant transport stream. • Two DVB ASI outputs (75Ω BNC connectors), 1 to 80 Mbps, in units of 1 bps.
Front Panel Control	• Back-lit, full-travel push buttons; three special purpose buttons: Carrier, Modulate, Status. • Recessed AC power switch on the front panel. • Backlit 2 x 40 LCD display. • 24 user-programmable preset configurations.
Remote Control	• EIA-232 on male DB-9 connector (DTE), ASCII commands. • IEEE 802.3 10/100Base-T (Ethernet) on RJ-45 connector, ASCII commands via Telnet.
Fault Monitoring	• Contact closure for alarm conditions on RJ-11 connector.
Software Upgrade	• Compact flash, EIA-232 remote port, Ethernet remote port.
Physical	• 1U high, rugged chassis suitable for mobile operations, 19” rack-mount, 17.7” (45 cm) deep. • Weighs less than 5.5 kg (12 lb)
Power Supply	• Autoranging 90 to 240 VAC, 50/60 Hz, 70 W typical consumption
Operating Conditions	• -10° to +50°C, up to 95% humidity, non-condensing. • Redundant fans with fault monitoring.
OPTIONAL FEATURES	
Video Processing	• MPEG-2 4:2:2 (Studio Profile @ Main Level), 2.5 to 50 Mbps.. • DVB 4:2:2 expanded windows carries WSS, VPS, VITC, CC, AMOL, XDS, NABTS, and others. • Field upgradeable from 4:2:0 to 4:2:2. • Spatial and temporal pre-filtering for compression efficiency and noise reduction.
Audio Input	• Two AES/EBU digital stereo pairs embedded in SDI, 48 Ksps sample rate.
Built-In Test	• Internally generated audio test tone and video test pattern.
Modulator Output	• DVB-compliant QPSK (optional 8PSK and 16QAM) • Symbol rate 1 - 30 Msps. • IF output 50 - 180 MHz , 0 to -25 dBm, 75Ω BNC. • L-Band output 950 - 1750 MHz, 0 to -25 dBm, SMA connector (950 - 2050 MHz option). • IF or L-Band monitor output F-connector.

Conditional Access

- BISS (Basic Interoperable Scrambling System) Modes 1, and E Contact closure for programmable alarm conditions on an RJ-11 connector.


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VBI Data Transmission

B

The Tiernan SE4000 and the latest series of Tiernan decoders, such as the TDR60, can be configured to transmit various types of Vertical Blanking Interval (VBI) data when it is present in the input video.

The following encoders and decoders support one or more methods for transmitting VBI data:

- SE4000 software V1.61 and TE6000 – software V2.21 or later
- TDR60 – software V4.10 or later

A standard NTSC TV signal consists of 525 horizontal lines, referred to as a frame. Each frame is divided into two fields, each with 262 ½ lines. The first 21 lines of each field are the VBI region; the remaining lines contain the active video picture.

A standard PAL TV signal consists of 625 horizontal lines, referred to as a frame. Each frame is divided into two fields, each with 312 ½ lines. The first 22 lines of each field are the VBI region; the remaining lines contain the active video picture.

For standard NTSC and PAL video encoding, the first 6 lines of the VBI region contain vertical timing pulses. VBI data is not allowed on these lines, however the remaining lines in the VBI region are available to carry any type of data.

B.0 MPEG and VBI

Typical forms of data included in the VBI of broadcast video transmissions are World System Teletext (WST), VPS, WSS, NABTS, Closed Captions, XDS, AMOL, Vchip, and VITC. Originally, the MPEG video compression scheme discarded all VBI information and included only the compressed, active video portion of the picture for transmission. This caused all VBI data to be lost when the video was digitally compressed for transmission using MPEG. Today, however, enhancements to the original MPEG compression system have provided two methods for including VBI data in digital-compressed MPEG streams:

- The first method is to extract the data from the baseband video input and insert that data digitally into the transport stream as either a dedicated PES stream on a dedicated PID, as in DVB-Teletext, or as an extended data field in the video frame header information as in ATSC-CC.
- The second method is to shift, or expand, the active video portion of the picture to include the VBI lines in the compressed picture frame, as in DVB 4:2:2 expanded windows.

For either of these methods to work, it is required that both the encoder and decoder are:

- Functionally capable of processing the required video.
- Correctly configured, either manually or via auto-sensing functionality, for the employed VBI method.

All of the VBI schemes described in this document, with the exception of Tiernan Proprietary Closed Captions, adhere to industry standards and formats, defined either by ATSC or DVB. Tiernan equipment does inter-operate with all other vendor's equipment that is found to be compliant with these industry standards.

Tiernan's TE6000 and SE4000 encoders and the TDR60 decoder can process data contained in the VBI region of a video signal according to the following methods and standards:

- DVB-Teletext: – DVB standard for transmission of World System Teletext (WST) included on a composite analog PAL format video signal.
- ATSC-CC – ATSC standard for transmission of Line 21 closed captions included on a composite analog NTSC format video signal.
- Tiernan-CC – A Tiernan proprietary scheme for transmission of Line 21 closed captions included on a composite analog NTSC or component digital (525) format video signal.
- DVB 4:2:2 Expanded Windows – DVB standard for transmission of 16 or 32 lines of VBI data included on a composite analog or component digital (SDI) format video signal. This standard supports both PAL/625 and NTSC/525 format video standards.

B.1 System Configuration

This section describes system configuration for successful end-to-end processing of VBI data for each VBI scheme. For a detailed description of the front panel or remote commands used to implement the various VBI schemes, refer to the appropriate command sections found in this manual.

B.1.1 DVB Teletext

Tiernan encoders and decoders process VBI teletext data within a video signal according to WST standards. Teletext is supported on composite analog PAL format video signal only.

B.1.1.1 Hardware Requirements

All SE4000 Encoders support all VBI modes. TE6000 Encoders require a TVIP-6025 module. The TDR60 decoder processes VBI data in its standard configuration.

B.1.1.2 Operational Considerations

VBI teletext should not be enable with other VBI encoding formats, as teletext overwrites all other VBI data.

B.1.1.3 End-to-End Configuration

To configure the encoder and decoder for Teletext processing, follow these steps:

Encoder

1. Ensure that Teletext VBI data is included in the selected service video input signal.

2. Ensure that the video input source is set to auto or analog. Use the front panel command Config>Service>Video>Input Source or the remote VI FMTCTL command.

3. Set the encoder to PAL mode. Issue the front panel command Config>Service>Video> Format Ctrl=PAL or the remote VI FMTCTL PAL_N command.

4. Enable the encoder for Teletext processing. Issue the front panel command Config>Service >VBI>Teletext>Enable=All or the remote. TT ENABLE ALL command.

5. Set the data ID to 1. Issue the front panel command Config>Service>VBI>Teletext>Data ID=1 or the remote TT DATA_ID 1 command.

6. Set the data unit ID to 2 or 3 as appropriate. Issue the front panel command Config>Service>VBI>Teletext>Data Unit ID=# or the remote TT UNIT_ID # command (where # = 2 or 3).

Decoder

7. Set the decoder VBI format control to manual. Issue the front panel command VBI>Format>VBI Format Cntrl=Manual or the remote VBI CONTROL MANUAL command.

8. Set the VBI format to off. Issue the front panel command VBI>Format>VBI Format= Off or the remote VBI FORMAT OFF command.

To ensure the proper display of Teletext data, VBI Format must be set to Off.

9. Enable Teletext mode. Issue the front panel command VBI>Teletext>Mode=On or the remote VBI TELETEXT MODE ON command.

10. Set the type of Teletext standard to be decoded, either the DVB standard or a vendor's proprietary standard. Issue the front panel command VBI>Teletext>Standard=type or the remote VBI TELETEXT STANDARD TYPE command.

11. To specify a particular PID within the selected service that contains Teletext data. Issue the front panel command VBI>Teletext>PID=PID number or the remote VBI TELETEXT PID NUMBER command.

B.1.2 ATSC Closed Captions

Tiernan encoders and decoders support industry-standard ATSC EIA-608 closed captions. On the encoder side, ATSC closed captions, the data found on line 21 is stripped out, placed in the picture header, encoded and transmitted. At the decoder end, the data is processed and re-inserted on line 21 for proper broadcasting.

ATSC closed captions are supported on a composite analog NTSC format video signal.

B.1.2.1 Operational Considerations

Ensure that VBI teletext is disabled when closed captions are enabled, as teletext overwrites all other VBI data.

B.1.2.2 End-to-End Configuration

To configure the encoder and decoder for ATSC closed captioning, follow these steps:

Encoder

1. Ensure that Teletext is disabled. Issue the front panel command Config>Service>VBI>Teletext>Enable=off or the remote TT ENABLE OFF command.

2. Ensure that closed caption VBI data is included in the selected service video input signal.

3. Enable the encoder for ATSC closed captions. Issue the front panel command Config>Service>VBI>CC=On or the remote VE ATSC_CC ON command.

Decoder

4. The set-top box should automatically detect and process ATSC closed captions.

B.1.3 Tiernan Proprietary Closed Captions (Tiernan CC)

Using Tiernan proprietary closed captions, two lines of VBI information are encoded per frame (one per field) at the expense of losing two lines of active video (one per field). The encoded picture is simply shifted up one line to include the last line of VBI and to exclude the last line of active video in each field.

This proprietary mode is intended as a method to transmit line 21 EIA-608 closed captions in an NTSC system without incurring more bandwidth requirements.

Tiernan proprietary closed captions are supported on a composite analog NTSC or component digital (525) format video signal.

B.1.3.1 Operational Considerations

Ensure that VBI teletext is disabled when closed captions are enabled, as teletext overwrites all other VBI data.

B.1.3.2 End-to-End Configuration

To configure the encoder and decoder for Tiernan proprietary closed captioning, follow these steps:

Encoder

1. Ensure that Teletext is disabled. Issue the front panel command Config>Service>VBI>Teletext>Enable=off or the remote TT ENABLE Off command.

2. Ensure that closed caption VBI data is included in the selected service video input signal.

3. Enable the encoder for Tiernan closed captions. Issue the front panel command Config>Service>VBI>Tiernan CC=On or the remote VE TCC ON command.

Decoder

4. Ensure that Teletext mode is set to off. Issue the front panel command VBI>Teletext>Mode=Off or the remote VBI TELETEXT MODE OFF command.

5. Set the decoder VBI format control to automatically detect the type of VBI data to decode. Issue the front panel command VBI>Format>VBI Format Cntrl=Auto or the remote VBI CONTROL AUTO command.

6. If your system requires you to manually set the type of VBI data to decode, follow these steps:

   a. Set the decoder VBI format control to manual. Issue the front panel command VBI>Format>VBI Format Cntrl=Manual or the remote VBI CONTROL MANUAL command.

   b. Set the VBI format to Tiernan closed captions. Issue the front panel command VBI>Format>VBI Format=Tiernan CC or the remote VBI FORMAT TIERNANCC command.

B.1.3.3 DVB 4:2:2 Expanded Windows, 16-Line and 32-Line

Tiernan encoders and decoders support both 16- and 32-line expanded windows operations. As with normal video encoding, the first 6 lines of the VBI region contain timing set-up information. Expanded Windows use the remaining lines in the VBI region, either 16 or 32 per frame (8 or 16 per field), to transmit data.

DVB 4:2:2 Expanded Windows is supported on a composite analog or component digital (SDI) format video signal. This standard supports both PAL/625 and NTSC/525 format video standards, and can transmit any of the following VBI services:
PAL mode: Teletext, PDC, WSS, and VPS

NTSC mode: ATSC Closed Captions, V-Chip, AMOL I and II, and VITC

B.1.3.4 Operational Considerations

Ensure that both VBI teletext and closed captions are disable when either 16- or 32-line expanded windows are enabled, as teletext and closed captions overwrite expanded windows data.

Chroma must be set to 4:2:2 for proper expanded windows operations.

B.1.3.5 Hardware Requirements

The TDR60 decoder processes VBI data in its standard configuration.

B.1.3.6 End-to-End Configuration

To configure the encoder and decoder for DVB 4:2:2 Expanded Windows operation, follow these steps:

Encoder

1. Ensure that all other VBI schemes are disabled, including Teletext, ATSC closed captions, and Tiernan closed captions.

2. Ensure that VBI data is included in the selected service video input signal.

3. Set chroma to 4:2:2 mode. Issue the front panel command Config>Service>Video>Chroma=4:2:2 or the remote VE CHROMA 4_2_2 command.

4. Configures the encoder to transmit either 16 or 32 lines of VBI information. Issue the front panel command Config>Service>VBI>Expand> VBI_Passthru=type or the remote VE VBI_PASS type command, where type is set to 16_lines or 32_lines.

Decoder

5. Ensure that Teletext mode is set to off. Issue the front panel command VBI>Teletext>Mode=Off or the remote VBI TELETEXT MODE OFF command.

6. Set the decoder VBI format control to automatically detect the type of VBI data to decode. Issue the front panel command VBI>Format>VBI Format Cntrl=Auto or the remote VBI CONTROL AUTO command.
7. If your system requires you to manually set the type of VBI data to Expanded Windows, follow these steps:

    a. Set the decoder VBI format control to manual. Issue the front panel command VBI>Format>VBI Format Cntrl=Manual or the remote VBI CONTROL MANUAL command.
    b. Set the VBI format to either 16- or 32-lines Expanded Windows.

From the front panel, issue the command VBI>Format>VBI Format=# where # is set to 16-line or 32-line.

From a remote terminal, issue the command VBI FORMAT # where # is set to lines16 or lines32.

B.4 Decoder Command Listing

B.4.1 Front Panel Commands for Decoder Configuration

The following front panel commands are used to configure the decoder for VBI teletext.

TDR60 Decoder VBI Front Panel Menu		
Menu>SubMenu	**Description**	**Parameters or Response Format**
VBI>Teletext: used to set the teletext parameters.		
Active Line	Query only, displays the number of the first active line of teletext received.	Displays either: • No active lines. The number of first active line received.
Mode	Providing that teletext is available in the selected service, the Mode function allows the option of having teletext data in the video output stream.	• On - Teletext data is included in the video output stream. • Off - Teletext data is ***not*** included in the video output stream (default). ***Note: to ensure proper display of teletext, VBI>Format>VBI Format must be set to Off.***
PID	Selects the teletext PIDs available in the selected service. The TDR60 automatically selects the fires PID available in the selected service.	List of teletext PIDs available in the selected service.
Standard	Sets the inversion or non-inversion of teletext data.	• DVB - sets DVB teletext standard (default). • Proprietary - sets proprietary teletext standard.
VBI>Format: used to set the teletext parameters.		
VBI Format	Providing that the selected VBI information is available in the selected service. This command determines if the data will be included in the video output stream. ***Note: this command is query-only when VBI>Format>VBI Format Cntrl is set to Auto.***	• Off - VBI mode is disabled (default). • Tiernan CC - Tiernan proprietary closed caption information will be included. • Lines 16 - Expanded windows lines-16 information will be included. For PAL modes, this includes VBI information found in lines 15 to 22. In NTSC mode, this includes VBI information in lines 14 to 21. • Lines 32 - Expanded windows lines-32 information will be included. For PAL modes, this includes VBI information found in lines 7 to 22. In NTSC mode, this includes VBI information in lines 7 to 21.
VBI Format Cntrl	Setting determines if the TDR60 will automatically detect incoming VBI data or if the VBI format will be manually configured by the operator.	• Auto - TDR60 automatically detects the format of the incoming VBI information. When Auto is selected, VBI>Format>VBI Format is query-only. • Manual - enables the operator to manually configure the VBI format (default).

B.4.2 Remote Commands for Decoder Configuration

The following front panel and remote commands are used to configure the decoder for VBI teletext.

Remote Command Mnemonic	Parameter Range	Description
VBI CONTROL	Auto, Manual	Setting determines if the TDR60 will automatically detect incoming VBI data or if the VBI format will be manually configured by the operator. • Auto - TDR60 automatically detects the format of the incoming VBI information. • Manual - enables the operator to manually configure the VBI format (default).
VBI FORMAT	Off, TiernanCC, Lines16, Lines32	Provided that VBI information is available in the selected service, this command determines if the data will be included in the video output stream. ***Note: this command is query-only when VBI FORMAT is set to AUTO.*** • Off - VBI mode is disabled (default). • Tiernan CC - Tiernan proprietary closed caption information will be included. • Lines 16 - Expanded windows lines-16 information will be included. For PAL modes, this includes VBI information found in lines 15 to 22. In NTSC mode, this includes VBI information in lines 14 to 21. • Lines 32 - Expanded windows lines-32 information will be included. For PAL modes, this includes VBI information found in lines 7 to 22. In NTSC mode, this includes VBI information in lines 7 to 21.
VBI TELETEXT LINES	-	Query-only, displays a list of the teletext lines detected in the selected service or the message `no active lines` when teletext is not present. Available only when VD MODE is set to NTSC. Front panel equivalent: VBI>Active Line
VBI TELETEXT MODE	On, Off	Provided that teletext data is available in the selected service, this function determines if teletext data will be included in the output stream. • On - data will be included. • Off - data will not be included (default). Teletext is only available when VD MODE is set to PAL. ***Note: this command is query-only when VBI FORMAT is set to AUTO.*** Front panel equivalent: VBI>Mode
VBI TELETEXT PID	<*available PIDs*> or Off	Selects the teletext data PID from the selected service. To query the available PIDs, enter the command VBI TELETEXT PID? Available only when VD MODE is set to PAL. Front panel equivalent: VBI>PID
VBI TELETEXT STANDARD	DVB, Proprietary	Sets the inversion or non-inversion of teletext data. • DVB - sets DVB teletext standard (default). Proprietary - sets proprietary teletext standard. Available only when VD MODE is set to PAL. Front panel equivalent: VBI>Standard

Conditional Access

C

C.0 Conditional Access Overview

Conditional access (CA) is a method for securing and scrambling transmission streams so that only those decoders which are authorized to do so can receive the transmitted streams.

The SE4000 provides two methods for conditional access:

- BISS – an industry-standard scheme which allows full conditional access operability between various vendor's DSNG equipment
- PGCA – a Tiernan proprietary scheme providing conditional access within the Tiernan family of products

C.1 BISS Overview

BISS, the Basic Interoperable Scrambling System, is an industry-standard, conditional access scheme used to secure and scramble DSNG broadcasts while allowing full inter-operability between various vendor's DSNG equipment.

The SE4000 currently supports BISS Mode 0, 1, and E scrambling. With Mode 1, all components of the transmission stream are scrambled by a fixed control word (CW). The control word must be manually entered into the encoder and decoder for BISS operations.

C.2 High-Level BISS Procedure

BISS is managed and enabled at an individual service level. To configure the SE4000 for BISS operations, follow these steps:

1. Select the service for BISS conditional access.

2. Enable BISS for that service.

3. Enter the Scramble key.

C.3 Configuring BISS from the Front Panel

To configure the SE4000 for BISS operations, follow these steps:

Select a Service

1. From the main menu, select Config>CA>Setup>Service. A list of all available services displays.

   If only one service is available, the service parameter is query-only, as this one service is automatically selected.

2. Scroll through the list to select the service to be configured for BISS scrambling and press Enter. The Scramble menu displays.

3. Ensure that the correct service name displays in the menu line. If the displayed service is incorrect, return to Step 1.

Enable BISS for that Service

4. From the Scramble menu, select BISS Mode 1 and press Enter.

5. When the asterisk disappears, press the right arrow key to go to the BISS key parameter.

Enter the Scramble Key

6. Use the numeric keypad to enter the 12-digit key. Once all 12 digits are entered, the key will begin to flash. Press Enter.

7. When the asterisk disappears, the BISS configuration settings are immediately implemented for that service.

Continue to Enable and Disable Individual Services, as Required

8. Continue selecting services and enabling/disabling each as required.

SE4000 is Now Processing Data Using the Current BISS Configuration

9. BISS is now enabled and will continue to use the current BISS configuration until BISS is disabled (turned off) or the BISS configuration is changed.

Disable BISS for an Individual Service

To disable BISS for a selected service, perform these steps:

1. From the main menu, select Config>CA>Setup>Service. A list of all available services displays.
2. Scroll through the list to select the service to be configured for BISS scrambling and press Enter. The Scramble menu displays. Ensure that the correct service name displays in the menu line.

   If the displayed service is incorrect, return to step 1.

3. From the Scramble menu, select None and press Enter.

4. Conditional access is now disabled for the selected service.

Even though BISS conditional access may be disabled for a service, the SE4000 retains the BISS scramble key set for that service.

C.4 Configuring BISS from a Remote Unit

Before beginning to configure the encoder for BISS conditional access, remote unit with a communications program installed, such as ProComm must be present.

Connect to a Remote Unit

1. Ensure that the remote unit has a communications program installed, such as ProComm.

2. Connect an RS-232 cable from the PC COM port 1 to the SE4000 RS-232 port.

3. Start the ProComm software. Configure ProComm to communicate via COM port 1 at a baud rate of 38400 bps.

4. Power on the encoder.

5. Wait for the main menu to display on the encoder's front panel.

6. ProComm should display various messages and then end with the prompt >.
   If the > prompt does not display, flip the DCE/DTE switch on the back of the SE4000 to the other position. Press the Enter key on the keyboard several times. The > prompt should display .

Configure BISS Parameters

1. Review the current BISS configuration parameters for all active services. Type mux prog_info and press Enter. The current conditional access settings for all services is displayed. Information includes: program number, program name, previous scrambling mode, current scrambling mode, and the key.

2. Enable BISS for a service. Type mux scram_en <*service#*> mode_1 and press Enter. This command enables BISS scrambling mode 1 for the service number entered in the <*service#*> parameter.

3. Enter the Scramble key for the selected service. Type mux scram_key <*service#*> <key> and press Enter. This command sets the BISS scrambling key for the service number entered in the <*service#*> parameter. The key is a 12-digit hexadecimal number.

4. Disable BISS for any services, as required. Type mux scram_en <*service#*> off and press Enter.

5. Review the current BISS configuration parameters for all active services to ensure that all BISS settings are correct. Type mux prog_info and press Enter.

6. Enable BISS at the system level. Type mux biss_en on and press Enter.

BISS cannot be enabled if PGCA is enabled.

Save the Current BISS Configuration

7. Save the current BISS configuration to either:
   - Flash memory using the CM Save command.
   - A user-defined configuration set, using the cm create and cm save_cfg commands.

Any parameter changes, including conditional access changes, that are made using a remote unit are not automatically stored in flash memory. When the SE4000 configuration is changed using a remote unit, an operational test should be performed to verify that the system is operating correctly. Then the new configuration should be saved by issuing the cm save command.

If the SE4000 is reset, or looses power prior to issuing the cm save command, any changes made using the remote unit will not be restored. Instead, the SE4000 restores the last changes saved to flash memory. Once the configuration is saved using the cm save command, the SE4000 automatically restores the saved settings when the unit is reset or powered up.

To Disable BISS

For a Service

Type mux scram_en <*service#*> off and press Enter.

C.5 Tiernan PGCA Overview

At the System Level

Type mux biss_en off and press Enter.

PGCA (Privacy Guard Conditional Access) is a Tiernan-proprietary conditional access scrambling system supported by all Tiernan DVB-compatible encoders and decoders.

PGCA is a fixed key scrambling system that is addressable. This means that the scrambling key is included in the transport stream, along with the list of individual decoder addresses authorized to descramble the transmission.

Using PGCA allows the uplink to control which decoders are authorized to receive the transmission, and what key is used to scramble the stream. The decoders automatically receive and process the authorization list. If they are authorized to receive the transmission, they extract the key and use it to descramble the service. If they are not authorized, they do not descramble or decode the service, and there is no output of video or audio from the decoder.

Although this is a fixed key system, the addressability and in-band transmission of all information required to authorize and descramble the service is very powerful for controlling groups of IRDs and the services they are allowed to receive, without compromising the security by distributing the scrambling key in the clear to the decoders. The “fixed” key is programmable and can be changed by the uplink encoder operator if desired.

Managing the key and the decoder authorization list is simple to do using the encoder front panel menu or remote control commands. No control computer or special software is necessary. PGCA is included in all Tiernan DVB-compliant encoders and decoders as a standard feature, so there are no additional costs to use PGCA in a system.

C.6 High-Level PGCA Overview

PGCA is managed at an individual IRD level and enabled at the system level. To configure the SE4000 for PGCA operations, follow these steps:

1. Manage the IRD List.
   a. Review the IRD conditional access list to ensure that all IRDs are listed and that all IRD information is correctly.
   b. Add IRDs to the conditional access list, as needed.
      A decoder's MAC address is required in order to create an authorized decoder database. This address must be entered in the following 16-character hexadecimal format. The SE4000 automatically enters the decimal points: XX.XX.XX.XX.XX.XX.XX.XX
      If the decoder's MAC address is unknown, navigate through the decoder's front panel menu to locate the information:
      - On the TDR600, TDR77, and TDR777 decoders, the MAC address is displayed on the System>Status>ID:xxxxxxxxxxxxxxxx menu.
      - On the TDR7 and TD3 decoders, the MAC address is displayed on the System>ID:xxxxxxxxxxxxxxx menu.
      - On the TDR6 decoder, the MAC address is displayed on the Control>Network>Addr:xxxxxxxxxxx menu.
        The MAC address on the TDR6 decoder is missing two bytes. To enter this number into the MAC address field when creating the authorized decoder database, simply add zeros to the most significant bits, for example: 00.00.xx.xx.xx.xx.xx.xx
   c. Delete IRDs from the conditional access list, if required
   d. Enable and disable individual IRDs, as appropriate.

2. Enable PGCA at the System Level

   e. Enable PGCA. When PGCA is enabled, all current PGCA configuration settings are immediately implemented. As the individual IRDs are enabled and disabled, those configuration settings are immediately implemented as well. If new PGCA configurations settings are not to be immediately implemented by the SE4000, Scramble should be set to None. When ready to implement PGCA, set Scramble to PGCA.
   f. Enter the PGCA Key.
   g. For front panel configurations, PGCA is now enabled and will continue to use the current PGCA configuration until PGCA is disabled (tuned off) or the PGCA configuration is changed. As with all other front panel configuration changes, PGCA changes are automatically saved and immediately implemented.
   h. For remote unit configuration, the new PGCA configuration must be saved.

During PGCA set-up and configuration, signals may be temporarily unscrambled.

The high-level procedure for configuring PGCA from the front panel or a remote unit is the same, however, at the detailed step-by-step level, there are a few important differences which must be followed. Before configuring the SE4000 from the front panel or remote unit, carefully read and follow these instructions.

C.7 High-Level PGCA Overview

Before beginning to configure the encoder for PGCA, the TMA addresses for each of the decoders must be in the system.

To configure the SE4000 for PGCA, perform the following:

C.7.1 Manage the IRD List

C.7.1.1 Review the IRD Conditional Access List

1. Review the IRD conditional access list to ensure that all IRDs are listed, all IRD information is correct, and that each IRD are correctly enabled and disabled.

   To review the IRD list, select Config>CA>PGCAcfg>LST IRD. The IRD List menu displays, showing the following information for each IRD: name of the IRD, it's MAC address, and if it is enabled (on) or disabled (off).

2. Add, deleted, and enable and disable IRDs as needed.

C.7.1.2 Add IRDs to the Conditional Access List, as Needed

3. From the PGCAcfg menu, select ADD IRD. The Name menu displays with the parameter Name = 0.

4. Enter the name for the IRD using the alpha-numeric keypad and press Enter.
   The Enter TMA Address menu displays.

5. Enter the 16-character MAC address for the IRD using the alphanumeric keypad. Press Enter.
   When the information is processed, the system returns to the Name menu.

6. Continue to add all IRDs to the conditional access list.

7. When you have finished adding IRDs to the conditional access list, press Exit to return to the PGCA menu.

C.7.1.3 Delete an IRD from the Conditional Access List, if Required

8. From the PGCAcfg menu, select DEL IRD. The IRD Delete menu displays.

9. Use the Up and Down buttons to scroll through the list and select the required IRD.

10. Press Enter. The LCD will display Delete <IRD name> Yes [No]

11. Ensure that the correct IRD name is displayed and select Yes.

12. Press Enter. When the information is processed, the system returns to the PGCA menu.

C.7.1.4 View the IRD Conditional Access List

13. View the IRD conditional access list to ensure that all IRDs are listed and that all IRD information was correctly entered.

14. From the PGCAcfg menu, select LST IRD. The IRD List menu displays.

    For each IRD, the following information is displayed: name of the IRD, it's MAC address, and if it is enabled (on) or disabled (off).

C.7.1.5 Enable and Disable Individual IRDs

15. From the PGCAcfg menu, select LST IRD. The IRD List menu displays.

16. Use the Up and Down buttons to scroll through the list and select the required IRD.

17. Enable or disable the selected IRD. Use the minus sign (-) on the alpha-numeric keypad to toggle between On and Off for the selected IRD.

18. Continue selecting IRDs and enabling/disabling each as required.

19. Press Enter. When the information is processed, the system returns to the PGCAcfg menu.

C.7.2 Enable PGCA at the System Level

C.7.2.1 Enable PGCA

20. From the main menu, select Config>CA>Setup>Service>Scramble>PGCA.

C.7.2.2 Enter the Scramble Key

21. Select PGCA KEY. Type in the key using the alpha-numeric keypad and press Enter. SE4000 is Now Processing Data Using the Current PGCA Configuration

22. PGCA is now enabled and will continue to use the current PGCA configuration until PGCA is disabled or the PGCA configuration is changed.

C.7.3 To Disable PGCA at the System Level

To disable PGCA at the system level, select Config>CA>Setup>Service> Scramble>None.

C.8 Configuring PGCA from a Remote Unit

Before you begin configuring the encoder for PGCA, you must have the following:

- A remote unit with a communications program installed, such as ProComm.
- The TMA addresses for each of the decoders in your system.

C.8.1 Connect to a Remote Unit

1. Ensure that the remote unit has a communications program installed, such as ProComm.

2. Connect an RS-232 cable from the PC COM port 1 to the SE4000 RS-232 port.

3. Start the ProComm software. Configure ProComm to communicate via COM port 1 at a baud rate of 38400 bps.

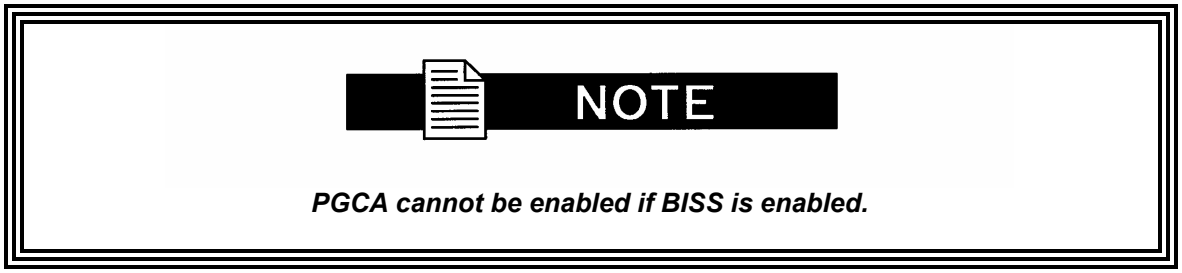
4. Power on the encoder.

5. Wait for the main menu to display on the encoder's front panel.

6. ProComm should display various messages and then end with the prompt >.
   If the > prompt does not display, flip the DCE/DTE switch on the back of the SE4000 to the other position. Press the Enter key on the keyboard several times. The > prompt should display .

C.8.2 Enable PGCA at the System Level

1. Type `tca enable` on and press Enter.



C.8.2.1 Enter the PGCA Scramble Key

2. Type tca mask <value> and press Enter.

C.8.3 Manage the IRD List

C.8.3.1 View the IRD Conditional Access List

3. Type tca list and press Enter.

C.8.3.2 Add IRDs to the Conditional Access List

4. Type tca add <decoder name>@<decoder TMA Address> and press Enter.
   Decoder names are limited to 15 characters in length or less. Decoders are automatically authorized when they are added to the list.

5. Repeat for all required decoders.

C.8.3.3 Delete IRDs from the Conditional Access List

6. Type tca delete <decoder name> and press Enter.

C.8.3.4 Enable Individual IRDs

An enabled, or authorized, decoder will be able to unscramble the incoming transmission from the encoder.

8. Type tca auth <decoder name> and press Enter.

9. Repeat for all required decoders.

C.8.3.5 Disable Individual IRDs

A disabled, or deauthorized, encoder will not be able to unscramble the incoming transmission from the encoder.

10. Type `tca deauth` <decoder name> and press Enter.

11. Repeat for all required decoders.

C.8.3.6 SE4000 is Now Processing Using the Current PGCA Configuration

12. PGCA is now enabled and will continue to use the current PGCA configuration until PGCA is disabled (tuned off) or the PGCA configuration is changed.

C.8.4 Save the Current PGCA Configuration

13. Save the current PGCA configuration to either:

    - Flash memory using the CM Save command.
    - A user-defined configuration set, using the cm create and cm save_cfg commands..

    Any parameter changes, including conditional access changes, that are made using a remote unit are not automatically stored in flash memory. When the SE4000 configuration is changed using a remote unit, an operational test should be performed to verify that the system is operating correctly. Then the new configuration should be saved by issuing the CM SAVE command.

    If the SE4000 is reset, or looses power prior to issuing the CM SAVE command, any changes made using the remote unit will not be restored. Instead, the SE4000 restores the last changes saved to flash memory. Once the configuration is saved using the CM SAVE command, the SE4000 automatically restores the saved settings when the unit is reset or powered up.

C.8.4.1 To Disable PGCA at the System Level

14. Type tca enable off and press Enter.

C.9 Configuring PGCA from a Remote Unit

The following example shows how to add, delete, enable (authorize) and disable (de-authorize) decoders using a remote unit connected to a SE4000. At the end of the example, the PGCA configuration is saved to flash memory.

In this example, the following assumptions apply:

1. Two decoders already exist in the database; both are enabled for PGCA. The existing decoders are:
   - decoder1@11.22.33.44.55.66.77.88
   - decoder2@22.33.44.55.66.77.88.99

2. Decoder1 will be disabled

3. Decoder2 will be deleted from the database

4. Three new decoders will be added to the database and remain authorized.

C.9.1 Enable PGCA

```
tca enable on
```

C.9.2 Enter the PGCA Scramble Key

```
tca mask <value>
```

C.9.3 Deauthorize decoder – decoder1 is disabled, or deauthorized

```
tca deauth decoder1
```

C.9.4 Remove decoder – decoder2 is deleted from the PGCA database

```
tca delete decoder2
```

C.9.5 Add decoders – three decoders are added to the PGCA database

```
tca add decoder3@33.44.55.66.77.88.99.00
tca add decoder4@44.55.66.77.88.99.00.11
tca add decoder5@55.66.77.88.99.00.11.22
```

When decoders are added to the database, they are automatically authorized, or enabled; therefore, these three new decoders do not have to be authorized using the tca auth command.

C.9.6 Review the IRD conditional access list to ensure it is correct

```
tca list
```

The SE4000 displays the following:
Decoder 0x586bd0
ID: 11.22.33.44.55.66.77.88
Auth: Deauthorized
Name: decoder1

Decoder 0x586dd0
ID: 33.44.55.66.77.88.99.00
Auth: Authorized
Name: decoder3

Decoder 0x586ad0
ID: 44.55.66.77.88.99.00.11
Auth: Authorized
Name: decoder4

Decoder 0x586cd0
ID: 55.66.77.88.99.00.11.22
Auth: Authorized
Name: decoder5

C.9.7 The list is correct, save the PGCA configuration changes to flash

```
cm save
```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SE4000 Default Settings

D

Video Encoder Default Settings		
Parameter	**DVB and ATSC Defaults**	**Exceptions**
Data Rate Calc	Auto	-
Enable	On	-
Format Mode	Auto	-
Optimize	Quality	-
PID	33 decimal	-
Resolution	720	-
Data Rate	7.46630 Mbps	-
Chroma	4:2:0	-
Timebase	Video Input	-
Source	Analog	-
PGCA	Off	-

Audio Encoder Default Settings		
Parameter	**DVB and ATSC Defaults**	**Exceptions**
Audio Channel A		
Enable	Off (digital audio) On (analog audio)	-
Compression	MPEG	-
Data Rate	256 Kbps	-
Format	Stereo	-
PID	36 decimal	-
Sample Rate	48 Ksps	-
Source	Analog	-
Lip Sync	0 msec	-
Audio Channel B		
Enable	Off (digital audio) On (analog audio)	-

Compression	MPEG	-
Data Rate	256 Kbps	-
Format	Stereo	-
PID	37 decimal	-
Sample Rate	48 Ksps	-
Source	Analog	-
Lip Sync	0 msec	-

Aux Data Channels Default Settings		
Parameter	**DVB and ATSC Defaults**	Exceptions
Aux Data Async Channel		
Enable	Off	-
Communication Mode	Asynchronous	-
Interface	RS-232	
Baud	38400 bps	
Data Bits	8	
Parity	None	
Stop Bits	1	
PID	42 decimal	
Aux Data Sync Channel		
Enable	Off	-
Interface	RS-422	-
Data Rate	102400 bps	-
Clock Source	Internal	-
PID	43 decimal	-

PSI/SI Tables Default Settings		
Parameter	**DVB and ATSC Defaults**	**Exceptions**
Event Information Table (EIT)		
Enable	On	-
PID	18	-
Transmission Interval	15 dsec	-
Network Information Table (NIT)		
Enable	On	-
FEC Convolution Code Rate	5/6	-
Network ID	0	-
Network Name	MPEG-2 Encoder	-
PID	16	-
Satellite Frequency	011.75725 GHz	-
Satellite Modulation Scheme	QPSK	-
Satellite Orbital Position	019.2° West	-
Sial Polarization	Vertical	-
Symbol Rate	005.5002 Msps	-
Transmission Interval	15 dsec	-
Program Association Table (PAT)		
Enable	On	-
PID	0	-
Program Number	-	1 (DVB) 2 (ATSC)
Transmission Interval	1 dsec	-
Transport Stream ID	1	-
Program Map Table (PMT)	-	-
Enable	On	-
PID	32 decimal	-
Transmission Interval	1 dsec	-
Service Description Table (SDT)		
Enable	On	-
PID	17 decimal	-

Service Name	-	Service 1 (DVB) Ch2 (ATSC)
Service Provider	Unnamed	-
Transmission Interval	15 dsec	-
Enable	Off	-
PID	20 decimal	-
Transmission Interval	100 dsec	-

Remote Control Port Default Settings		
Parameter	**DVB and ATSC Defaults**	**Exceptions**
Baud Rate	38400 bps	-
Data Bits	8	-
Stop Bits	1	-
Parity	None	-
Flow Control	Software XON/XOFF	-
Communication Method	Full-Duplex	-

Network Default Settings		
Parameter	**DVB and ATSC Defaults**	**Exceptions**
IP Address	0.0.0.0	-
IP Mask	225.225.0.0	-
IP Router	0.0.0.0	-

Table Top/Rack Mount Installation Instructions

E

This appendix presents step-by step instructions for the installation of Tiernan 1U, 2U, and 4U products. Instructions are presented for installing products:

NOTE

Instructions are for installation of 1U, 2U and 4U products. A 2U product is shown for illustrative purposes.

- On a table top
- Using front rack mount brackets
- Using rear rack mount brackets

E.0 Table Top Installation

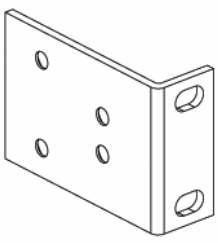
To install a Tiernan unit on a tabletop or other flat surface, place the unit on a rubber mat or other material that will prevent the unit from sliding and protect the table top surface.

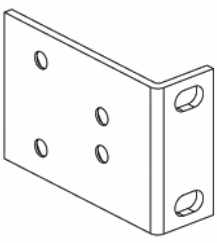
Ensure that the unit is placed on a stable surface of sufficient size and strength where it will not be jarred or pushed off its surface. Ensure that all cables and cords are out of the way and that they will not be tripped over, as this may cause personal injury or serious damage to the unit.

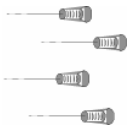
E.1 Rack Mount Installation

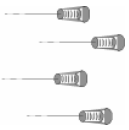
To install a Tiernan unit in a standard 19- inch equipment rack using front mounting brackets, perform these steps:

1. Ensure that there are two brackets and four screws in the front bracket kit. One side of each bracket has small holes while the other side has large holes. The small holes are counter-sunk on one side. The side which is not counter-sunk is placed against the unit.









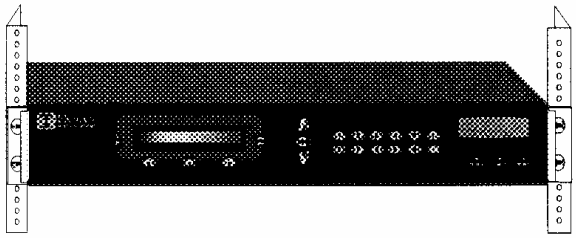
NOTE

The 1U unit contains 8 screws in the shipping kit. One side of each bracket has four small holes while the other side has two large holes.

2. Attach the brackets to both sides of the unit:

   a. Line up the small holes on the bracket with the unit's mounting holes, which are located towards the front of each side panel.
   b. Thread all of the screws through the bracket's small holes and into the Tiernan unit. The screws should be flush with the bracket when tightened.

3. Mount the unit in the rack by attaching the front brackets to the rack using your own washers and bolts.



4. Ensure that the installation provides the minimum required air flow clearances at the sides and rear of the unit.

E.4 Safety Precautions

If rack-mounted units are installed in a closed or multi-unit rack, consider the following items; further evaluation by a Certifying Agency may be required.

E.4.1 Ambient Temperature

The ambient temperature within the rack may be greater than the room's ambient temperature. When installing the unit, ensure that the required air flow for safe operation is provided. Never restrict air flow through the unit's fans or vents.

E.4.2 Rack Stability

During installation, consider weight distribution on the rack; hazardous stability conditions may arise if units are loaded into the rack unevenly.

E.4.3 Input Supply

Overloading of supply circuits could impact over-current protection and supply wiring. To ensure that supply circuits are not overloaded review the nameplate ratings. Connect the unit only to a properly rated supply circuit.

E.4.4 Grounding

Reliable grounding of this equipment must be maintained. Pay particular attention to supply connections when connecting to power strips, rather than direct connections to the branch circuit.

E.4.5 Radiation Performance

This unit complies with FDA radiation performance standards, 21CFR, Sub-chapter J.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Glossary

GL

A	
A	Ampere
AAL1	ATM Adaptation Layer 1.
AAL5	ATM Adaptation Layer 5.
AC	Alternating Current
AC Switching Power Supply	A pulse-width modulation, AC to DC converter.
ADC	Analog to Digital Converter
ADM	Add/Drop Multiplexer. A device that provides an interface between SONET and other network signals, converting DSn signals into or from an OC-*n* signal.
AGC	Automatic Gain Control
AIS	Alarm Indication System. A signal comprised of all binary 1s.
AMSL	Above Mean Sea Level
Amp or Ampere	The standard unit of measure for electrical strength defined as the amount of current that would be produced by an electromotive force of one volt acting through a resistance of one ohm.
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ASI	Asynchronous serial interface, also referred to as DVB ASI.
ASIC	Application Specific Integrated Circuit
ATE	Automatic Test Equipment
ATM	Asynchronous Transfer Mode. A connection-oriented multiplexing and switching method with high-speed transmission capability for data, voice and video.
Auto-Detecting	The capability of a unit to automatically sense and set its configuration to match the operational parameters of an incoming signal.
Auto-Ranging	The capability of a power supply unit to accept variable voltage rates.
Auto-Sensing	The capability of a power supply unit to detect variable voltage rates.

B	
Baseband Multimedia	The non-modulated transmission of audio and video signals.
Baud Rate	A measure of transmission speed over a transmission medium.
BER	Bit Error Rate
BERT	Bit Error Rate Test
Bit/BIT	Binary Digit or Built-In Test
Bit Rate	Refers to the number of bits of data transmitted over a given time period. See also bps.
BITE	Built-In Test Equipment
BNC	Bayonet Neill-Concelman. A type of connector featuring a locking pin on the female end and a cut-out groove for the pin on the male end.
bps	A ratio of the number of bits of data transmitted to the number of seconds elapsed, expressed as bits per second.
BPSK	Binary Phase Shift Keying
Buffer	In data transmission, a buffer is a temporary storage location for information being sent or received. A buffer is usually located between two different devices that have different abilities or speeds for handling the data.
Buffer Overflow	Within a data buffering system, the condition occurring whenever the number of data bits entering the buffer exceeds the data capacity of the buffer.
Buffer Underflow	Within a data buffering system, the condition occurring whenever the number of data bits entering the buffer is not sufficient to maintain the buffer minimum output rate.
Built-In-Self-Test	Evaluative procedures residing in the microcontroller which are used to provide diagnostic information regarding its operational state.
Byte	8 Binary Digits
C	
C	Celsius
C-Band	A portion of the electromagnetic spectrum used heavily for satellite transmissions. The uplink frequency is at 6 GHz, and the downlink is at 4 GHz. Traditional applications include voice communications, video conferencing, and broadcast TV and radio.
Cable Loss	Loss of signal quality within cable, typically due to impedance as a result of excessive cable length or material construction.
Carrier Offset	The frequency difference in Hertz measured between the programmed receive frequency and the actual frequency received.
CATS	Computer Aided Test Software
CA/xxxx	Cable Assembly
CD-ROM	Compact Disk – Read Only Memory
Channel	A single path for transmitting electric or electromagnetic signals.

CLK	Clock
cm	Centimeter
COM	Common
CPS	Cells per second
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check. A system of error checking performed at the transmitting and receiving stations.
CSA	Canadian Standards Association — The Canadian counterpart of the U.S. Underwriters Laboratories.
CW	Continuous Wave
C/N	Carrier to Noise Ratio
D	
DAC	Digital to Analog Converter
Data	Typically refers to the information content of a signal including video, audio, graphic, or character-based information.
Data Bits	Within a data packet, the bits which represent the information content of a packet. See also Data.
dB	Decibel. A unit of measure of signal strength, usually the relation between a transmitted signal and a standard signal source. An increase of 3 dB results in a doubling of the signal strength. An increase of 6 dB results in a quadrupling of the signal strength. Conversely, a decrease of 3 dB and 6 dB results in a reduction in signal strength by one half and three quarters, respectively.
dBc	Decibels Referred to Carrier
dBm	Decibels Referred to 1.0 milliwatt
DC	Direct Current
Decode	To convert a coded signal into its original form.
Demod	Demodulation. See Demodulate.
Demodulate	To retrieve an electrical signal from a carrier signal or wave.
DPLL	Digital Phase Locked Loop
DS3	A commercial leased line format that has the capacity to handle up to 44.763 Mbps of digital information; North American standard digital interface.
dsec	Deci-seconds. A measurement of time that is equal to 0.1 seconds. For example, 15 dsec is equal to 1.5 seconds.
DTE	Data Termination Equipment. A generic name for any device that generates information to be transmitted to another device or over a transmission system. For example, visual display units, computers, and office workstations.
DVB	Digital Video Broadcast. A set of standards providing the specifications for transmission and reception of digitally processed broadcasting signals.
D&I	Drop and Insert

E	
E_b/N_0	E_b = Energy per information bit; N_o = Noise energy per Hertz. Signal energy with respect to noise, expressed in energy per bit/noise in 1 Hz bandwidth.
EEPROM	Electrically Erasable Programmable Read Only Memory
EIA	Electronic Industries Association
EMI	Electromagnetic Interference
ESC	Engineering Service Circuits
ES-ES	Earth Station to Earth Station Communication
ET	Earth Terminal
E-3	European standard 34.368 Mbps digital interface.
F	
F	Fahrenheit
FAS	Frame Acquisition Sync. A repeating series bits, which allow acquisition of a frame.
Fault	A disturbance that impairs or disrupts normal operations.
FCC	Federal Communications Commission
FEC	Forward Error Correction
FIFO	First In, First Out. A type of data buffer.
FPGA	Field Programmable Gate Array. A chip that can be reprogrammed for various uses.
FW	Firmware
G	
g	Force of Gravity
GHz	Gigahertz
GND	Ground
G.703	ITU-T Recommendation G.703, “Physical/Electrical Characteristics of Hierarchical Digital Interfaces.” An interface protocol used for terrestrial transmissions that operates at multiples of 64 Kbps PCM.
H	
HPA	High power amplifier. A device which provides the high power necessary to transmit radio signals from an earth terminal to a satellite.
HSSI	High Speed Serial Interface
HW	Hardware
Hz	Hertz (Unit of Frequency)

I	
IBS	Intelsat Business Services
IDR	Intermediate Data Rate
I/O	Input/Output
IEC	International Electrotechnical Commission. A Geneva-based organization that sets international electrical and electronics standards and includes national committees from over 40 countries.
IEEE	International Electrical and Electronic Engineers
IESS	INTELSAT Earth Station Standards
IF	Intermediate Frequency. 1. A frequency to which a signal wave is shifted locally as an intermediate step in transmission or reception. 2. The fixed frequency resulting from heterodyning the incoming signal with a signal from a local oscillator.
IFL	Interfacility link. Typically refers to an interfacility link cable used to connect a low-noise block (LNB) to an IRD. Often this IFL carries power from the IRD to the LNB.
IF Looptest	A diagnostic, troubleshooting, or operational test procedure designed to test operate satellite equipment by passing video and audio test signals through an encoder and satellite modulator, looping the output of the modulator to the input of the IRD, and monitoring the video and audio output of the IRD.
Impedance	The total opposition of a device offers to the flow of alternating current. Measured in Ohms and varies at different frequencies.
Integrated Receiver/ Decoder	Within a satellite downlink system, a piece of equipment used to demodulate and decode a transport stream.
INTELSAT	International Telecommunication Satellite Organization
IRD	See Integrated Receiver/Decoder.
ISO	International Standards Organization
I&Q	Analog In-Phase (I) and Quadrature Signals (Q)
J	
J	Joule

K	
kbps	Kilobits per second. A ratio of 1000 bits transmitted per second. For example, 10 kbps is equal to 10,000 bits transmitted per second.
Kbps	Kilobytes per second. A ratio of 1000 bytes transmitted per second. For example, 10 Kbps is equal to 10,000 bytes transmitted per second.
kg	Kilogram
kHz	Kilohertz
Ksps	Kilosample or kilosymbol per second. A ratio of 1000 samples or symbols transmitted per second. For example, 10 Ksps is equal to 10,000 samples or symbols transmitted per second.
Ku-Band	A portion of the electromagnetic spectrum in the 12 GHz to 14 GHz range. Used for satellites, employing 14 GHz on the uplink and 11 GHz on the downlink in support of such applications as broadcast TV for man-on-the street interviews and other situations requiring a small, portable dish. Ku is also used in Direct Broadcast Satellite (DBS) systems, or Direct Satellite System (DSS).
L	
LCD	Liquid crystal display. A display technology that uses liquid crystals to form displayed characters.
LED	Light emitting diode. A display technology that uses a light emitting diode to form displayed characters.
Line Resolution	The degree of sharpness of a displayed video image.
LNB	Low Noise Block. A combination low noise amplifier and local oscillator used in some satellite downconverters.
LO	Local Oscillator. A device within a frequency converter that is used to reduce or increase the frequency of the signal passed from the device input to output.
L-Band	1. Portion of the electromagnetic spectrum commonly used in satellite applications, with frequencies in the 390 MHz to 1550 MHz range. 2. For an IRD, the frequency received from the LNB, existing in a range of 950 MHz to 2050 MHz.

M	
mA	Milliampere
Mbps	Megabits per second. A ratio of 1,000,000 bits transmitted per second. For example, 15 Mbps is equal to 15,000,000 bits transmitted per second.
MCPC	See multi-channel-per-carrier.
MFAS	Multi-Frame Acquisition Sync. See FAS.
MHz	Megahertz
MIB	Management Information Base
Mod	Modulator or Modulated
Mono Channel	Referring to one audio output not contained in a stereo mix.
MPEG	Moving Picture Experts Group. 1. A joint committee of the International Standards Organization (ISO) and the International Electrotechnical Commission (IEC). 2. A series of hardware and software standards designed to reduce the storage requirements of digital video. 3. A compression scheme for full motion video.
MPEG-1	Refers to ISO/IEC standards developed in 1991 by the ISO/IEC JTC1/SC29 WG11, Moving Picture Experts Group.
MPEG-2	Refers to ISO/IEC standards 13818-1 (Systems), 13818-2 (Video), 13818-3 (Audio), 13818-4 (Compliance).
ms or msec	Millisecond
MTBF	Mean time between failures. The length of time a user may reasonably expect a device or system to work before an incapacitating fault occurs.
Multi-Channel-Per-Carrier	Two or more video programs transmitted per digital transport stream.
M&C	Monitor and Control
N	
NC	Normally Closed
Network Management System	A system designed to keep a network operating near maximum efficiency and to provide operator interface to the managed system for configuring, isolating and correcting faults, and monitoring operational performance.
NO	Normally Open
Non-Volatile, Field-Programmable Memory	A type of Flash ROM used to store configuration parameters. The ROM memory is configurable by the user but will not clear if the unit loses power.
ns	Nanoseconds
NSAP	Network Service Access Point. 20 octets ATM address per ISO8348 and ITU-T X.213.

NTSC	1. National Television Standards Committee of the Electronic Industries Association (EIA). A committee which determines the video standards for broadcast in the U.S. 2. The U.S. standard for video broadcast which uses a 3.57945 MHz subcarrier whose phase varies with the instantaneous hue of the televised color, and whose amplitude varies with the instantaneous saturation of the color. A single frame (picture) in the standard consists of 525 horizontal scanning lines. Frames are scanned at the rate of 29.97 frames per second. 3. Used to describe the standard method of television transmission in the U. S., Canada, Japan, Central America, and parts of South America.
NVRAM	Non-Volatile Random Access Memory
N/C	No Connection or Not Connected
O	
OC-3	Optical Carrier Level 3 (155.52 Mbps); refer to STM-1.
Ohm	A unit of measure for resistance symbolized by the Greek letter omega W. Defined as the electrical resistance between two points of a conductor when a constant difference of potential of 1 volt, applied between these points produces in this conductor a current of 1 ampere, the conductor not being the source of any electromotive force.
OQPSK	Offset Quadrature Phase Shift Keying
Overhead	A number of data bits used for error-checking, control, timing, and other communications functions that are inserted in the data stream as an additional to the individual data rates of the transport stream components. Overhead must be included when calculating the aggregate transport stream output data rate.
P	
PAL	Phase Alteration Line. 1. A broadcast television standard that uses a subcarrier which is alternated 90 degrees in phase from one line to the next to minimize hue errors in color transmission. 2. The color television transmission standard used in Europe and many other parts of the world.
PAL-I	A European color television transmission standard that uses a 4.43361875 MHz subcarrier. A single frame in this standard consists of 625 scanning line, and frames are scanned at a rate of 25 frames per second.
PC	Personal Computer
PD Buffer	Plesiochronous/Doppler Buffer
PGCA	A proprietary conditional access method used by Tiernan equipment that provides basic signal protection and the ability to authorize individual IRDs.
PID	Packet Identifier. Within a data packet, the bits used for its identification.

Pixel	Picture Element. 1. The smallest unit of area of a video screen image that can be turned on or off, or varied in intensity. 2. The smallest division that makes up the raster scan line for a video display.
PLCP	Physical Layer Convergence Protocol. In DS3 transmission, the part of the physical layer that adapts the transmission facility to perform the distributed queue dual bus (DQDB) access as defined in IEEE 802.6-1990.
PLL	Phase Locked Loop
ppb	Parts per Billion
ppm	Parts per Million
PSI	Program Specific Information.
PVC	Permanent Virtual Circuit. A logical dedicated circuit between two user ports in a point-to-point configuration.
P/N	Part Number
Q	
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying. The transmission of 2 bits per symbol, with each symbol being a phase range of the sine wave. In this fashion, a 2:1 compression ratio is achieved, resulting in a doubling of the efficiency with which a circuit is employed.
R	
RAM	Random Access Memory
RCD	Remote Control Device. A computer terminal used to configure and monitor an encoder or an IRD without using the unit's control front panel.
RF	Radio Frequency
RF Input	The L-Band, C-Band, or Ku-Band input to an IRD.
ROM	Read Only Memory
rms	Root Mean Square
RU	Rack Unit. 1 RU = 1.75"/4.45 cm
Rx	Receive (Receiver)
RxD	Receive Data
R-S	Reed-Solomon Coding. Reed-Solomon codes are block-based error correcting codes with a wide range of applications in digital communications and storage.

S	
Sample Rate	The number of times per second that an analog signal is measured and converted to a binary number in order to convert the analog signal to a digital signal.
Satellite Downlink Frequency	Within a satellite system, the frequency, either C-Band or Ku-Band, of the signal transmitted to the receiving dish.
SEQ	Sequential
SCPC	Single-Channel-Per-Carrier. One video program transmitted per digital transport stream.
SNMP	Simple Network Management Protocol. A widely used network monitoring and control protocol. Data is passed from SNMP agents, which are hardware and/or software processes reporting activity in each network device (hub, router, bridge, etc.) to the workstation console used to oversee the network. The agents return information contained in a Management Information Base, which is a data structure that defines what is obtainable from the device and what can be controlled.
sps	Samples per second. 1. A ratio of the number of times that an analog signal is measured and converted to a binary number to seconds elapsed, expressed as samples per second. 2. Symbols per second — A ratio of symbols transmitted to seconds elapsed expressed as symbols per second. Commonly used to express the speed at which QPSK symbols are transmitted.
Stereo Pair	Two audio signals consisting of sound reproduction of the same audio source.
STS-3c	Concatenated SONET Synchronous Transport Signal Level 3.
SVC	Switched Virtual Circuit. A circuit between two user points in a point-to-point configuration that is established by ATM signaling stack rather than being a dedicated circuit.
Symbol	In digital transmission, a recognizable electrical state that is associated with a signal element, which is an electrical signal within a defined period of time.
SYNC	Synchronize
T	
TBD	To Be Designed or To Be Determined
TM	Technical Manual
TPC	Turbo Product Codes
TRE	Trellis
Tx	Transmit (Transmitter)
TxD	Transmit Data

U	
UART	Universal Asynchronous Receiver/Transmitter
UL	Underwriters Laboratories.
UUT	Unit Under Test
V	
V	Volts
VAC	Volts, Alternating Current
VCO	Voltage Controlled Oscillator
VDC	Volts, Direct Current
VDE	Verband Deutscher Elektrotechniker. The German counterpart of the U.S. Underwriters Laboratories.
VIT	Viterbi Decoding. See Viterbi Code Rate
Viterbi Code Rate	Forward error-correction scheme.
Vpp or Vp-p	Volts peak-to-peak.
W X Y Z	
W	Watt
Misc.	
µs	Microsecond
Ω	Ohms
16QAM	16 Quadrature Amplitude Modulation
8PSK	8 Phase Shift Keying


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