

## REFERENCE GUIDE

**SM6610, SM6615, SM6620 and  
SM6625 Satellite Modulators**

**Software Version 4.0 and later**



SM6610, SM6615, SM6620 and SM6625 Satellite Modulators

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## List of Contents

### **Chapter 1: Introduction**

This chapter identifies the equipment versions covered by this manual; describes the purpose of the equipment in a typical system; provides a summary of its main features; identifies the controls, indicators and connectors on the front and rear panels; and lists the available options.

### **Chapter 2: Installing the Equipment**

This chapter provides a guide to the suitability of an installation; gives detailed procedures for the preparation, installation and configuration of the equipment including **important safety information**; provides pin-out details of the external connectors; and details the power-up/-down procedures.

### **Chapter 3: Operating the Equipment Locally**

This chapter provides a guide to using the local (VT100) user interface; describes the menus, screens and options available to the user; and details the setting-up, configuration and operating procedures.

### **Chapter 4: Front Panel Control**

This chapter describes the menus, screens and options available to the user; and details the setting-up, configuration, operating and monitoring procedures.

### **Chapter 5: RS-232 Remote Control Protocol**

Describes the RS-232 Remote Control protocol via the RS-232/485 or Ethernet port.

### **Chapter 6: RS-485 Remote Control Protocol**

Describes the RS-485 Remote Control protocol via the RS-232/485 port.

### **Chapter 7: Equipment Description**

This chapter gives a brief introduction to some of the principles and techniques used in the design of the equipment to aid in understanding its operation and function; and provides a high-level description of the equipment, which identifies the functions of its main constituent parts, cards and modules.

### **Chapter 8: Preventive Maintenance and Fault-finding**

This chapter details routine maintenance tasks to be performed; provides general servicing advice, and information regarding warranty and maintenance; lists the error messages that may occur, and any appropriate Operator action to be taken; provides general fault-finding information for other types of problem which may be encountered; and provides relevant disposal information.

### **Chapter 9: File Transfer Protocol (FTP)**

Provides information on the FTP interface including firmware, software, logs, and configuration.

### **Chapter 10: Licence Keys**

Provides information on how to obtain Licence Keys and how to enter them by FTP.

### **Chapter 11: XPO Web Control Interface**

### **Annex A: Glossary**

### **Annex B: Technical Specification**

## About this Reference Guide

This Reference Guide provides instructions and information for the installation and operation of the SM6610, SM6615, SM6620 and SM6625 Satellite Modulators.

This Reference Guide should be kept in a safe place for reference for the life of the equipment. It is not intended that this Reference Guide will be amended by the issue of individual pages. Any revision will be by a complete reissue. Further copies of this Reference Guide can be ordered from the address shown on page vii. If passing the equipment to a third party, also pass on the relevant documentation.

Issues of this Reference Guide are listed below:

Issue	Date	Software Version	Comments
1	Jun 2004	1.1	Initial Issue
2	Jan 2005	2.0	Updated for software v2.0, which supports transport stream rate adaptation.
3	Mar 2006	3.0	Updated for software v3.0, which supports DVB-S2 modulation.
4	Sept 2006	4.0	Updated for software v4.0 and rebranded.

The following documents are also associated with this equipment:

- ST.US.E10152: User Guide
- ST.TS.SNMP.E10152: SNMP Remote Control
- ST.RE.PREKOR.E10154: Reference Guide for the PREKOR Software Option for SM6620 and SM6625 Satellite Modulators

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E-mail Address:	training@tandbergtv.com
Internet Address	<a href="http://www.tandbergtv.com">http://www.tandbergtv.com</a>

### Customer Services and Technical Training Postal Address

Tandberg Television  
Unit 2  
Strategic Park  
Comines Way  
Hedge End  
Southampton  
Hampshire  
SO30 4DA  
United Kingdom

### Return of Equipment

If you need to return equipment for repair, please contact the Customer Services Helpdesk on +44 (0) 23 8048 4455. A Returns Authorisation Number (RAN) will be issued and full details of the unit will be logged. Please ensure the RAN number is clearly marked on the packaging of the unit. The unit should then be sent to the following address:

Tandberg Television – Customer Services  
Unit 1  
Strategic Park  
Comines Way  
Hedge End  
Southampton  
Hampshire  
SO30 4DA  
United Kingdom

### Technical Publications

If you need to contact TANDBERG Television Technical Publications regarding this publication, e-mail: [techpubs@tandbergtv.com](mailto:techpubs@tandbergtv.com).

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# Chapter 1

## Introduction

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## 1.1 Scope of This Reference Guide

### 1.1.1 What This Reference Guide Describes

This Reference Guide describes the functions and operations of the SM6600 range of Satellite Modulators and is written for its operators/users. It includes information on the installation and day-to-day care and operation of the unit. It does not include any maintenance information that requires the removal of covers. Removing the covers of this equipment may invalidate any warranty.



Figure 1.1: Modulator Front View

### 1.1.2 Software Version

This Reference Guide has been written to cover the functionality of software version **4.0 and later**. This Reference Guide continues to be relevant to subsequent software issues where the functionality of the equipment has not changed. Where a new issue of software changes the functionality, a new issue of this Reference Guide is provided.

The software version can be found:

- On the startup screen
- In the local control mode (see *Chapter 3*):
  - ❖ In the Main menu by selecting option 7, Software Update menu and then, from there, choosing option 3, Display Code Versions
  - ❖ In the Test menu by selecting option 3, Version and Build Information (the appropriate entry is the Controller Card, main software version)
- In the front panel menu by selecting Build Information under the System Menu option.

### 1.1.3 Equipment Models

The SM6600 range of Satellite Modulators encompasses four base unit models and a number of hardware and software options. Each Modulator comprises an enclosure with several cards fitted. This Reference Guide covers the current hardware in which the latest firmware may be installed. The marketing code and part numbers are shown in *Table 1.1*.

Table 1.1: Marketing Code Descriptions of Basic Units

Marketing Code	Part Number	Description
SM6610/BAS	E10152	Satellite Modulator Base Unit with IF Output
SM6615/BAS	E10153	Satellite Modulator Base Unit with L-Band Output
SM6620/BAS	E10154	Satellite Modulator Base Unit with IF Output, DVB-S2 and PREKOR capable
SM6625/BAS	E10155	Satellite Modulator Base Unit with L-Band Output, DVB-S2 and PREKOR capable
SM66XX/HWO/ASI-SPI	S13450	DVB ASI & SPI Input Card
SM66XX/SWO/HOM	N/A	DVB-DSNG Higher Order Modulation (8PSK and 16QAM)
SM66XX/SWO/PREKOR	N/A	PREKOR Licence
SM66XX/SWO/HS	N/A	Extended Symbol Rate (0.2 - 66 Msymbol/s)
SM66XX/SWO/S2	N/A	DVB-S2 Broadcast Mode, including QPSK Modulation
SM66XX/SWO/S2-8PSK	N/A	DVB-S2 8PSK Modulation Supplement

Marketing Code	Part Number	Description
SM66XX/SWO/S2-16APSK	N/A	DVB-S2 8PSK and 16APSK Modulation Supplement
SM66XX/SWO/S2-32APSK	N/A	DVB-S2 8PSK, 16APSK and 32APSK Modulation Supplement

## 1.1.4 Information Labels

### Typical Side Panel Information Label

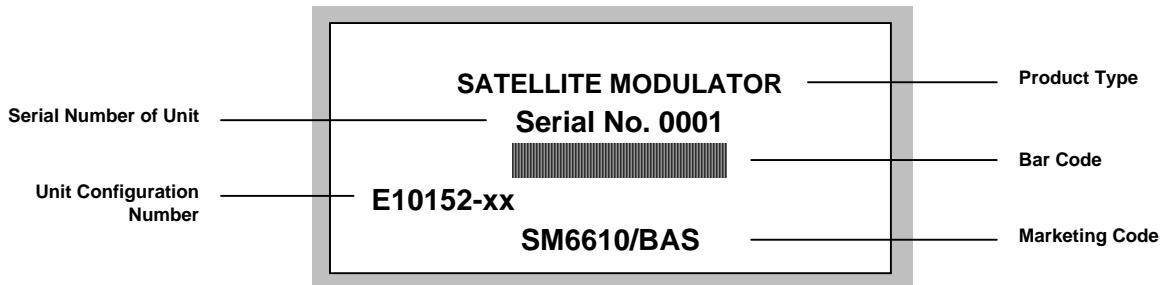


Figure 1.2: Typical Side Panel Information Label

### Label Definitions

Table 1.2 explains the terms carried on the Information label.

Table 1.2: Information Label Description

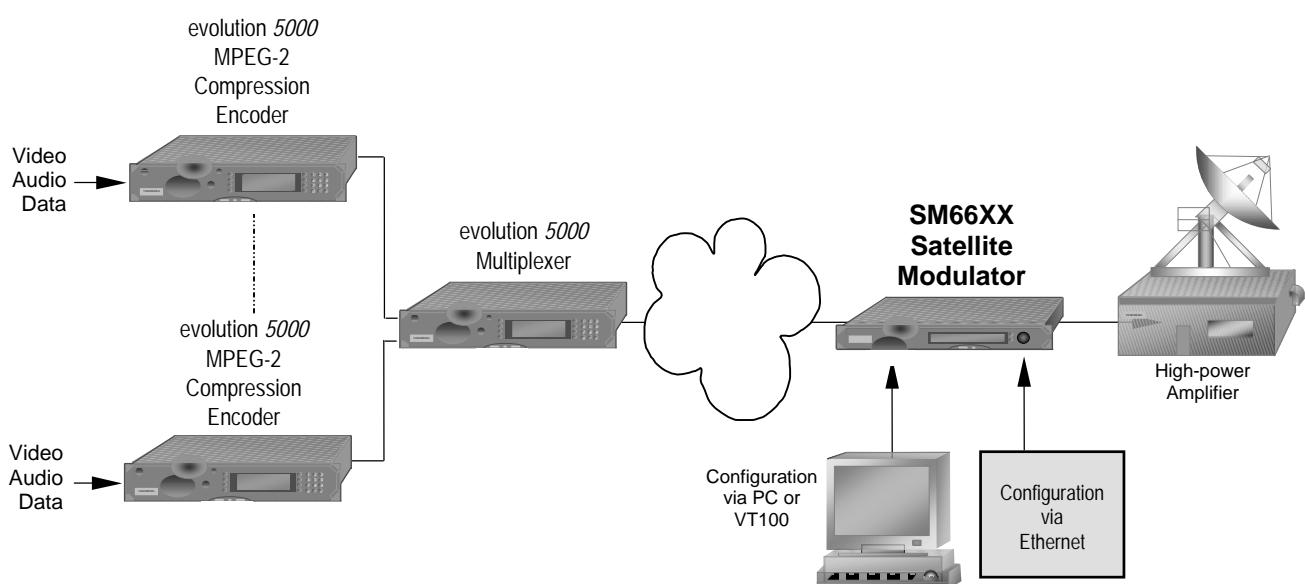
Label Legend	Explanation
Product Type	Describes the unit in plain English.
Serial Number	A unique number given to the unit.
Unit Configuration Number	<p>The unit configuration number is in two parts separated by a dash.</p> <p>The first part is the E number of the base unit before options are added, but includes the basic boards for functionality.</p> <p>The second part is an internally generated string number that varies with configurations.</p> <p>For example: E10152-54</p> <p>E10152: The base unit excluding any option cards.</p> <p>54: An internally generated number.</p>
Marketing Code	A code that identifies the product for marketing purposes.
Bar Code	A code used for unit identification in the manufacturing process.

## 1.2 Role of the Modulator

The Modulator is designed specifically for the broadcasting of digital satellite television signals to ETSI standards EN 300 421 (DVB-S), EN 301 210 (DVB-DSNG) and EN 302 307 (DVB-S2).

The unit is designed for the transmission of MPEG-2 digitally-compressed video, audio and data services provided by the evolution 5000 range of products, although it could be used with other types of equipment providing the specification is compatible (see *Annex B, Technical Specification*). The input data interfaces to the unit conform to the DVB Asynchronous Serial Interface (DVB ASI) standard, and optionally the DVB Synchronous Parallel Interface (DVB SPI) standard if the SM66XX/HWO/ASI-SPI option is fitted.

The Modulator can be configured by its front panel, a VT100 terminal, or a PC running a terminal emulator (see *Figure 1.3*). Alternatively, the Modulator may be controlled remotely, either via its Ethernet ports or RS-232/485 port.



*Figure 1.3: Separated Modulator and Multiplexer Configuration*

## 1.3 Summary of Features

### 1.3.1 MPEG-2 and DVB Compliance

The Modulator normally accepts an MPEG-2 transport stream in either 188-byte or 204-byte packet format. Alternatively, an internally generated Pseudo Random Binary Sequence (PRBS) or Null Packets source may be selected for test purposes. This does not require the presence of a transport stream input.

### 1.3.2 Data Inputs

The Modulator base unit has two DVB ASI electrical inputs. When fitted with the SM66XX/HWO/ASI-SPI option, the Modulator has two additional DVB ASI electrical inputs (making four in total) and one DVB SPI input. The incoming data may be in any of the following four formats:

- 188-byte packets (188 data bytes, contiguous packets)
- 204-byte packets (188 data bytes and 16 RS coding bytes; the coding bytes are ignored)
- 204-byte packets (188 data bytes and 16 dummy bytes)
- Unframed data, i.e. without MPEG-2 sync bytes

### 1.3.3 Transport Stream Rate Adaptation

The modulator is capable of performing transport stream rate adaptation with PCR correction, allowing it to be used at a fixed symbol rate irrespective of the transport stream input data rate. Rate adaptation may be switched on or off under user control. See *Section 7.3.2, Transport Stream Rate Adaptation* for further details of the rate adaptation function.

### 1.3.4 IF Output Models

Modulator models SM6610 and SM6620 have a tuneable 50-180 MHz IF output. Both main and monitor outputs are provided on these models.

### 1.3.5 L-Band Output Models

Modulator models SM6615 and SM6625 have a tuneable 950-1750 MHz L-band output. Both main and monitor outputs, and an L-band carrier combining input are provided on these models. 24 V dc power and a 10 MHz reference frequency output, both switchable, are provided via the main L-band output connector for use by an external frequency up-converter.

### 1.3.6 DVB-S2 and PREKOR™ Capable Models

Modulator models SM6620 and SM6625 are DVB-S2 capable and incorporate TANDBERG Television's proprietary PREKOR™ Dynamic Pre-correction system. The PREKOR™ system corrects non-linear magnitude and phase distortions, and group delay distortion introduced by the uplink HPA and satellite transponder. It is of particular benefit when using higher order modulations such as 16QAM, 16APSK or 32APSK.

#### NOTES...

1. The SM66XX/SWO/S2 software option, and optionally the SM66XX/SWO/S2-8PSK, SM66XX/SWO/S2-16APSK or SM66XX/SWO/S2-32APSK software option, must be installed to enable DVB-S2 modulation.
2. The SM66XX/SWO/PREKOR software option must be installed to enable the PREKOR™ system.

### 1.3.7 Forward Error Correction Coding

Noise and interference can cause some bits to be received in error. Therefore, Forward Error Correction (FEC) is used to add redundancy, i.e. extra bits, to the transmitted signal. This allows a large number of errors at the receiver to be corrected by the FEC decoder. The FEC coding scheme used depends on the modulation standard selected. The DVB-S and DVB-DSNG standards employ a concatenated coding scheme consisting of an outer Reed-Solomon (RS) code, bit interleaving and an inner convolutional code. The DVB-S2 standard employs a concatenated coding scheme consisting of an outer Bose-Chaudhuri-Hocquenghem (BCH) code and an inner Low Density Parity Check (LDPC) code.

Each FEC coding scheme provides for a number of different code rates, permitting a trade-off between bit-rate and ruggedness.

### 1.3.8 Modulation Schemes

DVB-S BPSK and QPSK modulations are available as standard on each base unit model. Additionally, DVB-DSNG 8PSK and 16QAM modulations are available with the SM66XX/SWO/HOM option. DVB-S2 QPSK, 8PSK, 16APSK and 32APSK modulations are available as options on modulator models SM6620 and SM6625.

### 1.3.9 Symbol Rate Range

Each base unit model has a symbol rate range of 1 to 48 Msymbol/s as standard. An extended symbol rate range of 0.2 to 66 Msymbol/s is available with the SM66XX/SWO/HS option.

### 1.3.10 IF Tilt Correction

All base unit models incorporate a digital IF tilt corrector having a linear amplitude versus frequency response with user-controllable slope. This facility is intended for correcting the frequency dependent attenuation that may be introduced by long IF output cables.

## **1.4 Key Features**

### **1.4.1 Standard Features**

- QPSK modulation in accordance with ETSI standard EN 300 421 (DVB-S)
- Variable symbol rate operation: 1 to 48 Msymbol/s
- User selectable spectrum roll-off factor: 20%, 25%, 30% and 35%
- Two DVB ASI electrical inputs
- Transport stream rate adaptation with PCR correction
- IF output frequency: 50 to 180 MHz, tuneable in 1 kHz steps (Models SM6610 and SM6620)
- L-band output frequency: 950 to 1750 MHz, tuneable in 1 kHz steps (Models SM6615 and SM6625)
- IF tilt correction
- Low spurious IF/L-band outputs
- Front panel LCD display and 6-button keypad
- RS-232/485 control, backwards compatible with System 3000 and evolution 5000 SM5600 Satellite Modulators
- Dual-redundant 10BaseT Ethernet control
- Software and firmware easily upgraded by remote Ethernet FTP
- Feature enabling by factory entry of licence keys

### **1.4.2 Optional Features**

- Two additional DVB ASI electrical inputs (i.e. four in total) and one DVB SPI input
- Higher order modulation in accordance with ETSI standard EN 301 210 (DVB-DSNG): 8PSK and 16QAM
- DVB-S2 modulation in accordance with ETSI standard EN 302 307 (available on models SM6620 and SM6625 only): QPSK, 8PSK, 16APSK and 32APSK
- PREKOR™ Dynamic Pre-correction (available on models SM6620 and SM6625 only)
- Extended symbol rate range: 0.2 to 66 Msymbol/s

## **1.5 Applications**

### **1.5.1 DVB Applications**

- Satellite DTH broadcasting
- Satellite distribution
- DSNG systems where a separate Modulator is required
- SCPC and MCPC systems

### **1.5.2 Non-DVB Applications**

- Telecommunications
- Internet backbone

## 1.6 Additional Features for Greater Flexibility

### 1.6.1 Spectrum Sense

The Modulator output spectrum can be reversed if required. This gives greater flexibility when converting the signal to RF (Ku-band or C-band), since the choice of local oscillator frequency for the conversion can itself either lead to a normal or reversed spectrum.

### 1.6.2 Control and Monitoring

#### Local Control

Control and monitoring may be performed locally via a **VT100** terminal or a PC running appropriate software using the RS-232/485 port.

#### Remote Control

In addition to the RS-232/485 port, remote control is possible using either one of the Ethernet ports. The user may also control the Modulator via Telnet (see *Chapter 3, Operating the Equipment Locally*).

#### User Selectable Functions

The control and monitoring functions that may be performed by both types of terminal are similar. The user may set, amongst others:

- Transport stream input source, PRBS or Null Packets selection
- Bit-rate or symbol rate
- Rate adaptation on/off
- Coding and modulation standard: DVB-S/DSNG, DVB-S2 (option)
- Modulation format: BPSK, QPSK, 8PSK (option), 16QAM (option), 16APSK (option), 32APSK (option)
- FEC code rate
- IF frequency or uplink frequency
- IF power
- IF output on/off
- Modulation on/off
- Spectrum sense
- Health/status monitoring
- Self-tests

## 1.7 Guided Tour

### 1.7.1 Construction

The Modulator is constructed using a shielded self-ventilated enclosure. All inputs and outputs are via rear-panel connectors. The unit may be operated freestanding or mounted in a 19-inch rack; 1U rack height is required.

### 1.7.2 Controls and Indicators

#### Operating Controls

The Modulator may be controlled by the LCD display and pushbutton keypad. The front panel offers a choice of two interface levels, either monitoring only or full access control (refer to *Chapter 4, Front Panel Control*).

#### Front Panel Indicators

The Modulator provides two LED indicators. These are located at the left-hand side of the unit (see *Figure 1.4*).

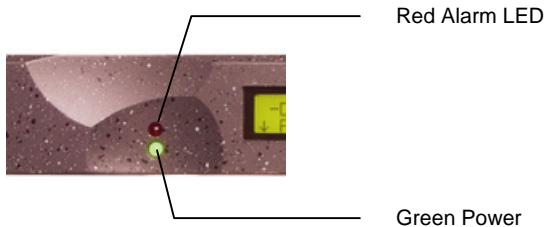


Figure 1.4: Front Panel LEDs

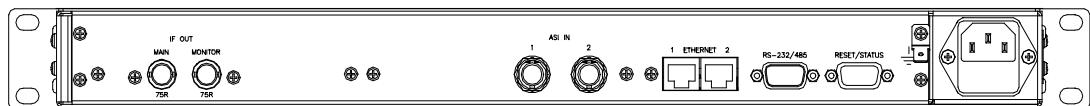
Table 1.3: Modulator LED Indicators

Indicator	Description
Alarm	The red LED indicates when an alarm condition is present.
Power	The green LED is illuminated when ac power is applied.

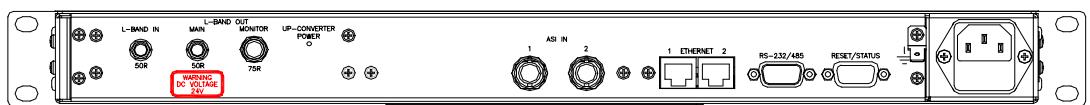
### 1.7.3 Rear Panel Connectors

All input and output connectors are located at the rear panel (see *Figure 1.5* to *Figure 1.8*).

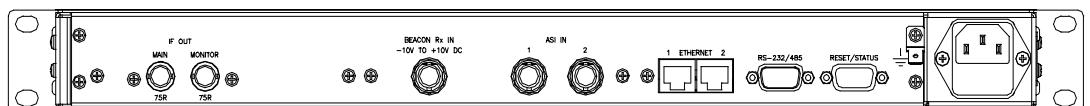
For pin-out information, see *Chapter 2, Installation*. For specifications of the connector interfaces, see *Annex B, Technical Specification*.



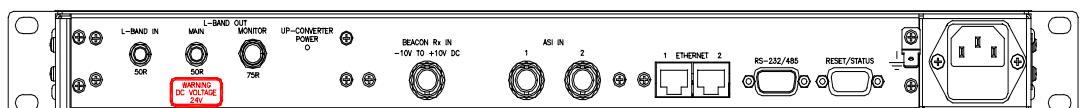
*Figure 1.5: View of the SM6610 Modulator Rear Panel*



*Figure 1.6: View of the SM6615 Modulator Rear Panel*



*Figure 1.7: View of the SM6620 Modulator Rear Panel*



*Figure 1.8: View of the SM6625 Modulator Rear Panel*

## 1.8 Input Option Module

The SM6600 Satellite Modulator chassis design allows the fitting of an input option module, providing the capability for the Modulator to accept input data streams in alternative formats. The following options are currently available:

- DVB ASI & SPI Input Card (S13450)

## 1.9 Getting Started

The following check list provides a guide as to what needs to be done to get the equipment up and running.

1. Switch on the Modulator. With the Modulator correctly installed and connected to the input and output equipment, switch on the unit in accordance with the instructions given in *Chapter 2, Installing the Equipment*. Confirm that it powers up correctly. If it does not, refer to *Chapter 8, Preventive Maintenance and Fault-finding*.
2. Establish local or remote control. Connect the relevant terminal to the RS-232/485 port or the Ethernet Port (1 or 2). Ensure the terminal is switched on and operational (see *Chapter 3, Operating the Equipment Locally* for instructions on how to establish control from the local terminal or from the remote terminal).

**NOTE...**

The rear panel connector is compatible with either RS-232 or RS-485, depending upon the mode selected on the Modulator. (See *Section 3.7 System Menu, Option 4, Serial Port Configuration*.)

3. Select configuration parameters. Set the required configuration parameters (see *Chapter 3, Operating the Equipment Locally* for instructions on how to select parameters from the local terminal).

Implement the configuration. Ensure the required configuration parameters are sent from the terminal to the Modulator and that they are implemented.

## Chapter 2

# Installing the Equipment

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## 2.1 Read This First!

### 2.1.1 Handling

The Modulator must be handled and installed carefully and thoughtfully to prevent safety hazards and damage.

### 2.1.2 Installing the Equipment

Ensure the personnel designated to fit the unit have the appropriate skills and knowledge. If in any doubt, contact TANDBERG Television Customer Services (see *Preliminary Pages* for contact details).

Installation of the product should follow these instructions, and should only use installation accessories recommended by the manufacturers. When rack mounted, this equipment must have shelf supports as well as being fixed at the front panel.

Do not use this product as a support for any other equipment.

### 2.1.3 Lifting

Although this product only weighs approximately 7.2 kg (15.9 lb), in some circumstances it might be awkward to lift. In which case, do not attempt to lift or move it without proper assistance or equipment. If in doubt, get help.

### 2.1.4 Mechanical Inspection

Inspect the equipment for damage-in-transit. If in doubt, please contact TANDBERG Customer Services (see *Preliminary Pages*).

**WARNING...**

REMOVING THE COVERS OF THIS EQUIPMENT MAY INVALIDATE ANY WARRANTIES, CAUSE A SAFETY HAZARD OR/AND AFFECT THE EMC PERFORMANCE. CHECK WITH TANDBERG TELEVISION CUSTOMER SERVICES.

### 2.1.5 Moving the Equipment Safely



Do not place this product on an unstable cart, stand, bracket, or table. The product may fall, causing serious injury and serious damage to the product. Use only with a cart, stand, bracket or table recommended by TANDBERG Television.

An appliance and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the appliance and cart combination to overturn. Do not move or carry the equipment whilst it is still connected to the supply or other leads, is live, or is in operation.

### 2.1.6 Fixing

The Modulator is designed for fixed use only and has been shipped with fixing brackets suitable for a standard 19-inch rack. When installed in a rack, it should be secured using the fixing brackets. In addition, support shelves must be used to reduce the weight on the brackets. Ensure it is firmly and safely located and it has an adequate flow of free-air.

Slide the Modulator onto the chassis supports and affix to the rack by means of an M6 x 18 mm panhead screw in each corner.

## 2.1.7 Ventilation

### Openings in the Covers

Openings in the Modulator enclosure are provided for ventilation. These ensure reliable operation of the product and protect it from overheating. These openings must not be blocked or covered.



Figure 2.1: Air-flow Through the Equipment

### Care in Positioning

#### CAUTIONS...

1. The fans contained within this unit are not fitted with dust/insect filters. Pay attention to the environment in which it is to be used.
2. Do not install units so that the air intakes of one align with the outlets on another. Provide baffles and adequate spacing.

The Modulator should never be placed near or over a radiator or other source of heat. It should not be placed in a built-in installation such as a rack unless proper ventilation is provided and the instructions have been adhered to.

Allow at least 50 mm free air-space at each side of the equipment to ensure adequate cooling. Units in racks can be stacked without the need for ventilation panels between them. Racks containing stacked equipment may need to be forced air-cooled to reduce the ambient temperature within the rack.

### Protection from Moisture

Do not install this equipment in areas of high humidity or where there is a danger of water ingress.

### Environment

The Modulator is intended to operate in ambient air temperature conditions in the range 0°C to +50°C, and relative humidity 0% to 90% (non-condensing). See *Annex B, Technical Specification* for a full specification.

## 2.1.8 Installing Cables - Safety

Power supply cables should be routed so that they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to cables at plugs, convenience receptacles, and the point where they exit from the appliance.

Do not run a.c. power cables in the same duct as signal leads. Do not move or install equipment whilst it is still attached to the mains supply. Ensure safety and ESD precautions are observed whilst inter-connecting equipment.

## 2.1.9 Lightning Protection

**WARNING...**

IF THE MODULATOR HAS BEEN SUBJECT TO A LIGHTNING STRIKE OR POWER SURGE WHICH HAS STOPPED IT WORKING, DISCONNECT THE POWER IMMEDIATELY. DO NOT REAPPLY POWER UNTIL IT HAS BEEN CHECKED FOR SAFETY. IF IN DOUBT, CONTACT TANDBERG TELEVISION CUSTOMER SERVICES.

Where appropriate, ensure this product has an adequate level of lightning protection. Alternatively, during a lightning storm or when it is left unattended and unused for long periods of time, unplug it from the supply outlet and disconnect the antenna or cable system. This will prevent damage to the product due to lightning and power line surges.

## 2.2 EMC Compliance Statements<sup>1</sup>

### 2.2.1 EN 55022

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

### 2.2.2 FCC

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 Reference Guide, 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 his/her own expense.

## 2.3 Mains Operating Voltage, Fusing and Earthing

### 2.3.1 AC Power Supply

The Modulator operates from a wide-ranging mains power supply (100-120 V or 220-240 Vac 50/60 Hz nominal) and is designed for use in ambient air temperature in the range 0°C to +50°C. There are no links etc. to be altered for operation from different supply voltages. The full Technical Specification is given in *Annex B, Technical Specification*.

**WARNING...**

THIS EQUIPMENT SHOULD ONLY BE OPERATED FROM THE TYPE OF POWER SOURCE INDICATED ON THE MARKING LABEL. IF YOU ARE NOT SURE OF THE TYPE TO YOUR BUSINESS, CONSULT YOUR APPLIANCE DEALER OR LOCAL POWER COMPANY. DO NOT OVERLOAD WALL OUTLETS AND EXTENSION CORDS AS THIS CAN RESULT IN A RISK OF FIRE OR ELECTRIC SHOCK.

<sup>1</sup> The EMC information was correct at the time of manufacture. The EMC tests were performed with the Technical Earth attached.

## 2.3.2 Fuse

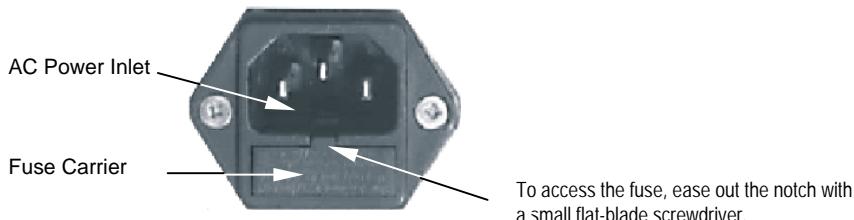


Figure 2.2: AC Power Inlet Assembly

Table 2.1: Fuse Information

Item	Specification
Fuse	Single pole, fitted in live conductor in power input filter at rear of unit.
Fuse type	5 mm x 20 mm anti-surge (T) HBC, IEC/EN 60127-2 Sheet 5
Fuse rating	5 A
Fuse rated voltage	250 Vac
Power lead connector fuse (if appropriate)	5 A minimum

**NOTE...**

See Annex B, *Technical Specification* for more fuse information.

## 2.3.3 Technical Earth

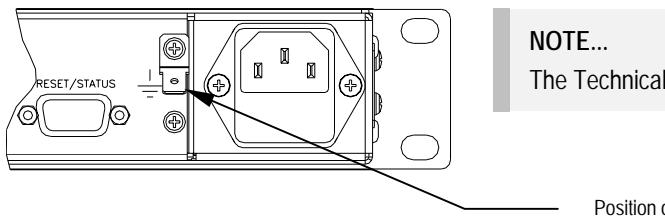


Figure 2.3: Location of the Technical Earth

**NOTE...**

The Technical Earth terminal is the 6 mm tab connector.

The unit has a Technical Earth terminal (marked  $\perp$ ) located at the rear panel (See Figure 2.3). Its use is recommended. This is NOT a Protective Earth for electric shock protection. The terminal is provided to:

1. Ensure all equipment chassis fixed within a rack are at the same technical earth potential. To do this, connect a wire between the Technical Earth terminal and a suitable point on the rack.
2. Eliminate the migration of stray charges when connecting between equipment.

## 2.3.4 Connecting the Equipment to the AC Power Supply

As there is no mains switch fitted to this unit, ensure the local a.c. power supply is switched OFF before connecting the supply cord.

Connect the supply cord to the Modulator and then to the local supply.

## 2.3.5 AC Power Supply Cord

### General

A two-metre mains supply cord is supplied with this product. It is fitted with a moulded plug suitable for either the USA, UK, mainland Europe or Australia/New Zealand as advised at the time of ordering.

**NOTE...**

The Modulator is not fitted with an a.c. power supply ON/OFF switch. Ensure the socket-outlet supplying the Modulator is installed near the unit so that it is easily accessible.

### Wire Colours

The wires in the supply cord are coloured as shown in *Table 2.2*.

*Table 2.2: Supply Cord Wiring Colours*

	UK (BS 1363)	EUROPE (CEE 7/7)	USA (NEMA 5-15P)
Earth:	Green-and-yellow	Green-and-yellow	Green
Neutral:	Blue	Blue	White
Live:	Brown	Brown	Black

If the colours do not correspond with the coloured markings identifying the terminals in a locally supplied plug, proceed as in *Table 2.3*. The inclusion of *Table 2.3* is for reference.

*Table 2.3: Non-standard Supply Cord Wire Colours*

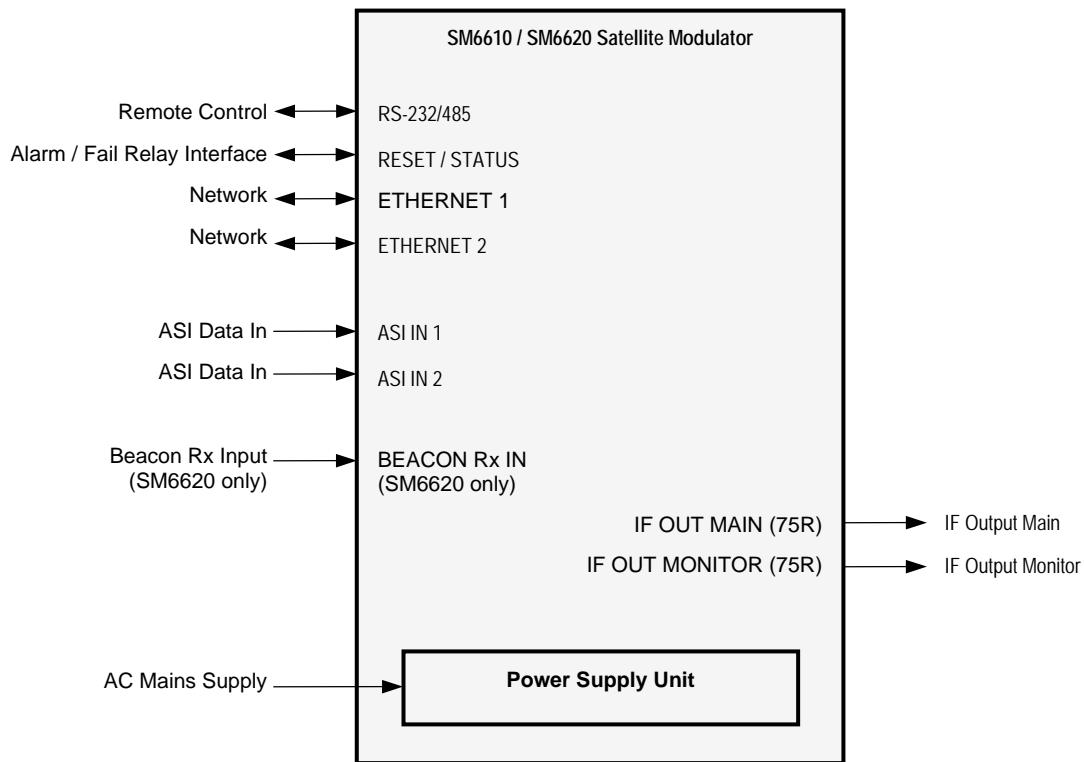
Wire Colour (UK)	Action
Green-and-yellow	...must be connected to the terminal in the plug which is marked with the letter E or the safety earth symbol $\frac{1}{2}$ or coloured green or green-and-yellow.
Blue	...must be connected to the terminal in the plug which is marked with the letter N or coloured black.
Brown	...must be connected to the terminal in the plug which is marked with the letter L or coloured red.

## 2.4 Connecting up the Modulator

### 2.4.1 General

When the Modulator has been installed in its intended operating position it is ready to be connected to the rest of the system equipment (see *Section 2.5 Signal Connections* for pin-out details of the unit connectors).

Unused connectors on this equipment do not need to be terminated.



*Figure 2.4: Equipment Connections – IF Output Models SM6610 and SM6620*

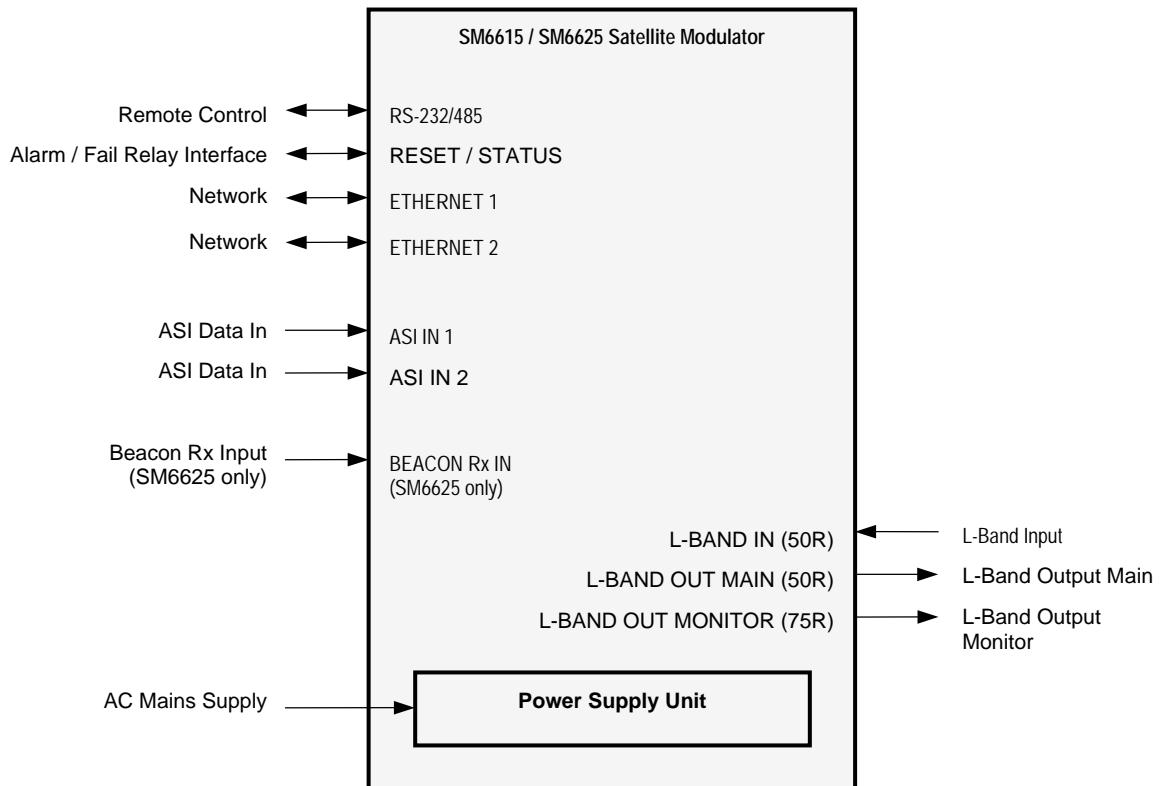


Figure 2.5: Equipment Connections – L-Band Output Models SM6615 and SM6625

## 2.4.2 Transport Stream Input

If no input option module is fitted, connect an MPEG-2 transport stream in ASI format to one of the two ASI IN connectors (see *Annex B, Technical Specification* for details). If the SM66XX/HWO/ASI-SPI option is fitted, connect an MPEG-2 transport stream, either in ASI format to one of the four ASI IN connectors, or in SPI format to the SPI IN connector. More than one transport stream may be fed into the Modulator simultaneously, but only one is selected as the modulator input. This facility may be used for input redundancy purposes but automatic switching is not supported.

## 2.4.3 L-Band Input (Available Only on L-Band Output Models SM6615 and SM6625)

If required, connect the L-BAND IN connector to the output of an auxiliary modulator using good quality coaxial cable with a characteristic impedance of  $50\ \Omega$ . This facility is useful for combining carriers for transmission via the same uplink equipment.

## 2.4.4 Beacon Receiver Input (Available Only on PREKOR™ Models SM6620 and SM6625)

If required, connect the BEACON Rx IN connector to the voltage output of a beacon receiver using good quality coaxial cable with a characteristic impedance of  $75\ \Omega$ . This facility is useful when using PREKOR™ Dynamic Pre-correction with a satellite that does not have on-board AGC.

## 2.4.5 Modulated Output

### IF Output Models SM6610 and SM6620

Connect the IF OUT MAIN connector to the appropriate up-converter or other equipment using good quality coaxial cable with a characteristic impedance of  $75\ \Omega$ .

If required, connect the IF OUT MONITOR connector either to a spectrum analyser or, via a suitable up-converter, to an IRD for local monitoring purposes.

### L-Band Output Models SM6615 and SM6625

#### CAUTION...

A 24 V dc voltage is present at the L-BAND OUT MAIN connector when the up-converter dc power is switched on. Do not connect this output directly to a spectrum analyser or other sensitive equipment.

The use of a dc block is recommended.

Connect the L-BAND OUT MAIN connector to the appropriate up-converter or other equipment using good quality coaxial cable with a characteristic impedance of  $50\ \Omega$ . If required by the up-converter, switch on the up-converter d.c. power and/or the 10 MHz reference frequency output.

If required, connect the L-BAND OUT MONITOR connector either to a spectrum analyser or to an IRD for local monitoring purposes.

## 2.4.6 Local/Remote Control

Select a method for configuring the Modulator. Connect the local control terminal or computer to the RS-232/485 connector.

#### NOTE...

The rear panel connector is compatible with either RS-232 or RS-485, depending upon the mode selected on the Modulator. (See *Section 3.7, System Menu, Option 4, Serial Port Configuration*.)

Alternatively, connect ETHERNET port 1 or 2 into a suitable 10BaseT network connection for network based remote operation. These two Ethernet ports are duplicate Ethernet inputs provided to allow network redundancy. See *Chapter 3, Operating the Equipment Locally* for details of the protocol used and the control and monitoring commands that are available.

## 2.4.7 Power Supply

*Section 2.3, Mains Operating Voltage, Fusing and Earthing* provides details of power supply connection, earthing and safety. Read all the instructions carefully and take note of all warnings and cautions.

## 2.4.8 Reset/Status

If required, connect to an external status monitoring device.

## 2.4.9 Technical Earth

Connect the Technical earth to a suitable point on the equipment.

## 2.5 Signal Connections

### 2.5.1 General

All signal input/output connectors are located at the rear panel of the Modulator. For a detailed interface specification see *Annex B, Technical Specification*.

Always use the specified cables for signal integrity and compliance with EMC requirements.

### 2.5.2 Control and Monitoring

#### Rear Panel View

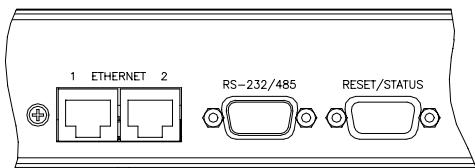


Figure 2.6: Control and Monitoring Connections

#### RS-232/485

A 9-way D-type male sub-miniature connector provides a control interface which is user configurable as either RS-232 or RS-485, and as either a local (terminal) control or remote control port.

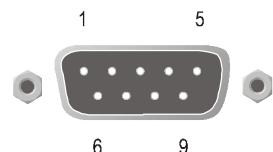


Table 2.4: RS-232/485 Connector Pin-outs

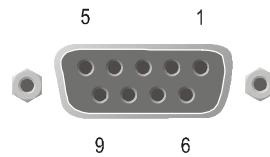
Item	Specification	
Connector type	9-way D-type, Male	
Connector designation	RS-232/485	
Pin-outs	RS-232 Connections	RS-485 Connections
	Pin 1 — Data Carrier Detect (DCD) Pin 2 — Receive Data (RxD) Pin 3 — Transmit Data (TxD) Pin 4 — Data Terminal Ready (DTR) Pin 5 — Ground Pin 6 — Data Set Ready (DSR) Pin 7 — Request to Send (RTS) Pin 8 — Clear to Send (CTS) Pin 9 — Ring Indicator (RI)	Pin 1 — Transmit Data – (TxD–) Pin 2 — Transmit Data + (TxD+) Pin 3 — Request to Send – (RTS–) Pin 4 — Request to Send + (RTS+) Pin 5 — Ground Pin 6 — Receive Data – (RxD–) Pin 7 — Receive Data + (RxD+) Pin 8 — Clear to Send – (CTS–) Pin 9 — Clear to Send + (CTS+)

#### NOTE...

The rear panel connector is compatible with either RS-232 or RS-485, depending upon the mode selected on the Modulator. (See *Section 3.7, System Menu, Option 4, Serial Port Configuration*.)

## Reset/Status

A 9-way D-type female sub-miniature connector provides an alarm relay interface, which can be used to remotely signal equipment or input signal failure. The **fail relay** is driven by an equipment failure and the **alarm relay** is driven by an equipment alarm (see *Chapter 8, Preventive Maintenance and Fault-finding*).

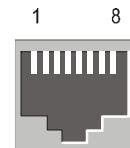


*Table 2.5: Reset/Status Connector Pin-outs*

Item	Specification
Connector type	9-way D-type, Female
Connector designation	RESET / STATUS
Pin-outs	Pin 1 — Protective Ground - Cable Shield Pin 2 — FAIL (common) Pin 3 — ALARM (make to pin 8 when OK) Pin 4 — ALARM (make to pin 8 when not OK) Pin 5 — Reset (line 2) (connect to pin 9 for remote reset) Pin 6 — FAIL (make to pin 2 when OK) Pin 7 — FAIL (make to pin 2 when not OK) Pin 8 — ALARM (common) Pin 9 — Reset (line 1) (connect to pin 5 for remote reset)

## Ethernet 1, Ethernet 2

The Ethernet ports are used to provide network connections for the Modulator. Both Ethernet ports may be connected simultaneously for network redundancy purposes. The input to ETHERNET 2 is ignored if an input to ETHERNET 1 is detected.

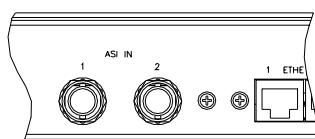


*Table 2.6: Ethernet Pin-outs (2 off)*

Item	Specification
Connector type	RJ-45
Connector designations	ETHERNET 1 ETHERNET 2
Pin-outs (Unused pins not connected)	Pin 1 — Tx Out (+) Pin 2 — Tx Out (-) Pin 3 — Rx In (+) Pin 6 — Rx In (-)

### 2.5.3 DVB ASI Electrical Inputs – Base Unit

#### Rear Panel View



*Figure 2.7: DVB ASI Input Connections*

## DVB ASI Electrical Inputs

Two BNC, female  $75\ \Omega$  connectors provide DVB-compliant ASI electrical connections at a fixed line transmission rate of 270 Mbit/s.

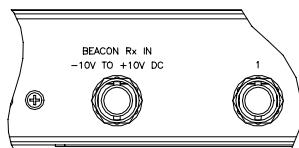


*Table 2.7: DVB ASI Electrical Connectors (2 off)*

Item	Specification	
Connector type	BNC $75\ \Omega$ Female	
Connector designations	ASI IN 1 ASI IN 2	When SM66XX/HWO/ASI-SPI option not fitted
	ASI IN 3 ASI IN 4	When SM66XX/HWO/ASI-SPI option fitted
Pin-outs	Centre Shield	Signal Ground/Chassis

## 2.5.4 Beacon Receiver Input – Models SM6620 and SM6625

### Rear Panel View



*Figure 2.8: Beacon Receiver Input Connections*

### Beacon Receiver Input

$75\ \Omega$  BNC socket provides a beacon receiver input.

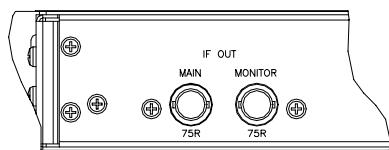


*Table 2.8: Beacon Receiver Input Connector*

Item	Specification	
Connector type	BNC $75\ \Omega$ Female	
Type	Analogue	
Connector designation	BEACON Rx IN	
Pin-outs	Centre Screen	Signal Ground

## 2.5.5 IF Outputs – Models SM6610 and SM6620

### Rear Panel View



*Figure 2.9: IF Output Connections*

## IF Output (Main)

$75 \Omega$  BNC socket provides an IF output.

Table 2.9: IF Output Connector (Main)



Item	Specification	
Connector type	$75 \Omega$ Female	
Type	Analogue	
Connector designation	IF OUT MAIN	
Pin-outs	Centre	IF Output
	Screen	Ground

## IF Output (Monitor)

$75 \Omega$  BNC socket provides an IF output used for monitoring.

Table 2.10: IF Output Connector (Monitor)



Item	Specification	
Connector type	$75 \Omega$ Female	
Type	Analogue	
Connector designations	IF OUT MONITOR	
Pin-outs	Centre	IF Output
	Screen	Ground

## 2.5.6 L-Band Input and Outputs – Models SM6615 and SM6625

### Rear Panel View

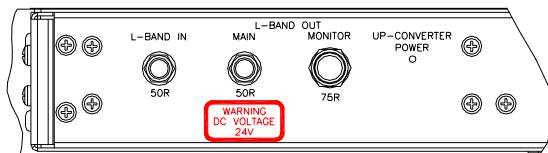


Figure 2.10: L-Band Input and Output Connections

## L-Band Input

$50 \Omega$  SMA socket provides an L-band input.

Table 2.11: L-Band Input Connector



Item	Specification	
Connector type	SMA $50 \Omega$ Female	
Type	Analogue	
Connector designation	L-BAND IN	
Pin-outs	Centre	L-Band Input
	Screen	Ground

## L-Band Output (Main)

50 Ω SMA socket provides an L-band output.



*Table 2.12: L-Band Output Connector (Main)*

Item	Specification	
Connector type	SMA 50 Ω Female	
Type	Analogue	
Connector designation	L-BAND OUT MAIN	
Pin-outs	Centre	L-Band Output
	Screen	Ground

## L-Band Output (Monitor)

75 Ω F-type socket provides an L-band output used for monitoring.

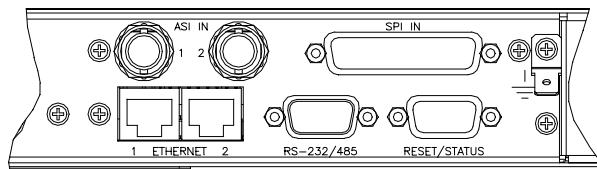


*Table 2.13: L-Band Output Connector (Monitor)*

Item	Specification	
Connector type	F-type 75 Ω Female	
Type	Analogue	
Connector designations	L-BAND OUT MONITOR	
Pin-outs	Centre	L-Band Output
	Screen	Ground

## 2.5.7 S13450 DVB ASI & SPI Input Card (Option)

### Rear Panel View



*Figure 2.11: S13450 DVB ASI & SPI Input Card Connections*

### DVB ASI Electrical Inputs

Two BNC, female 75 Ω connectors provide DVB-compliant ASI electrical connections at a fixed line transmission rate of 270 Mbit/s.



*Table 2.14: DVB ASI Electrical Connectors (2 off)*

Item	Specification	
Connector type	BNC 75 Ω Female	
Connector designations	ASI IN 1 ASI IN 2	
Pin-outs	Centre	Signal
	Shield	Ground/Chassis

## DVB SPI Input

This 25-way, D-type female sub-miniature connector provides a DVB-compliant synchronous parallel interface.



Table 2.15: DVB SPI Connector Pin-outs

Item	Specification	
Connector type	25-way D-type, Female	
Connector designation	SPI IN	
Pin-outs	Pin 1 — Clock (+)	Pin 14 — Clock (-)
	Pin 2 — System Ground	Pin 15 — System Ground
	Pin 3 — Data 7 (+)	Pin 16 — Data 7 (-)
	Pin 4 — Data 6 (+)	Pin 17 — Data 6 (-)
	Pin 5 — Data 5 (+)	Pin 18 — Data 5 (-)
	Pin 6 — Data 4 (+)	Pin 19 — Data 4 (-)
	Pin 7 — Data 3 (+)	Pin 20 — Data 3 (-)
	Pin 8 — Data 2 (+)	Pin 21 — Data 2 (-)
	Pin 9 — Data 1 (+)	Pin 22 — Data 1 (-)
	Pin 10 — Data 0 (+)	Pin 23 — Data 0 (-)
	Pin 11 — DVALID (+)	Pin 24 — DVALID (-)
	Pin 12 — PSYNC (+)	Pin 25 — PSYNC (-)
	Pin 13 — Cable Shield	

## 2.6 Powering Up/Down

### 2.6.1 General

Before powering up the equipment, confirm that the Modulator has been correctly installed by checking the following:

1. The Modulator enclosure has been installed in a suitable location.
2. Power supply range has been checked and the relevant fuse has been set at the rear panel power inlet connector, and a good earth has been provided.
3. The Modulator has been connected to other equipment and the control terminal, as required.

### 2.6.2 Powering Up

With the Modulator correctly installed, power up the unit as follows:

1. Power up the Modulator by turning on the local mains supply. The unit executes a series of power-up initialisation and self-test routines.
2. Ensure that all cooling fans are rotating. If they are not, switch off the equipment immediately.
3. Confirm that the front panel green Power LED is illuminated.
4. A warm-up period of 60 seconds (IF Output models) or 5 minutes (L-Band Output models) is required for the internal 10 MHz reference to meet specification. The Modulator is available for operation after performing self-tests.

### 2.6.3 Powering Down

Power down the Modulator as follows:

1. If required, disable the Modulator output by setting the IF Output state to Off at the relevant control terminal being used to configure the Modulator.
2. If required, remove the power supply connection at the rear of the unit.

BLANK

# Chapter 3

## Operating the Equipment Locally

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## 3.1 Using Terminal Control

### 3.1.1 Introduction

**CAUTION...**

Only one logical control interface on the Modulator, i.e. Front Panel, Terminal, SNMP Remote Control, FTP, etc, should be used at any one time. Using more than one interface simultaneously may cause unexpected behaviour of the Modulator.

A VT100 terminal or a PC running the VT100 terminal emulation program may be used for control and monitoring of the Modulator, or terminal control can be used over a network using Telnet.

### 3.1.2 Setting up the VT100 Terminal Emulation Program

#### General

To use the VT100 terminal emulation program it is necessary to set the parameters first. The instructions below are for the HyperTerminal program supplied as part of the Windows NT 4.0 and Windows XP operating systems.

#### Connecting the Terminal to the Modulator

To configure the parameters for the HyperTerminal program, proceed as follows:

1. Select the **Terminal** program by accessing it through **Start, Program, Accessories, Communications, HyperTerminal**.
2. Choose the icon and name for the terminal connection (see *Figure 3.1*) and click **OK**.

**NOTE...**

The name chosen in the example shown in *Figure 3.1* is SM6600 Terminal.



Figure 3.1: Connection Description Dialog Box

3. Choose the port to connect to (see *Figure 3.2*) and click **OK**.

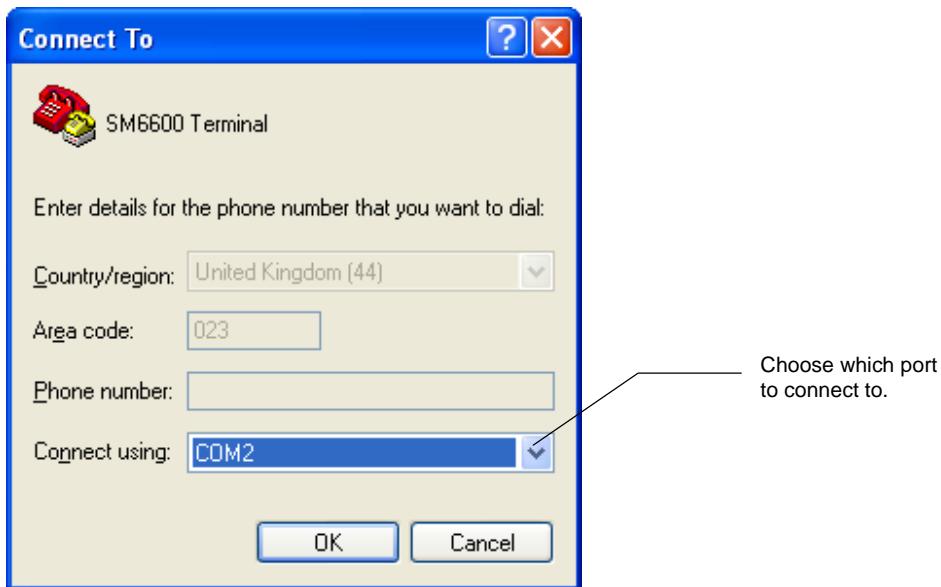


Figure 3.2: Connect To Dialog Box

4. Set the port parameters as specified in *Figure 3.3* and click **OK**.

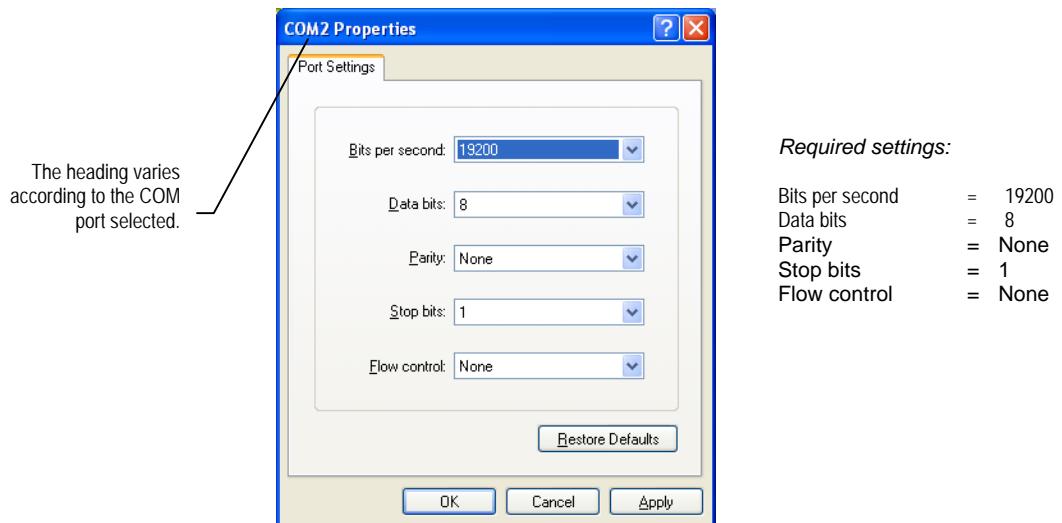
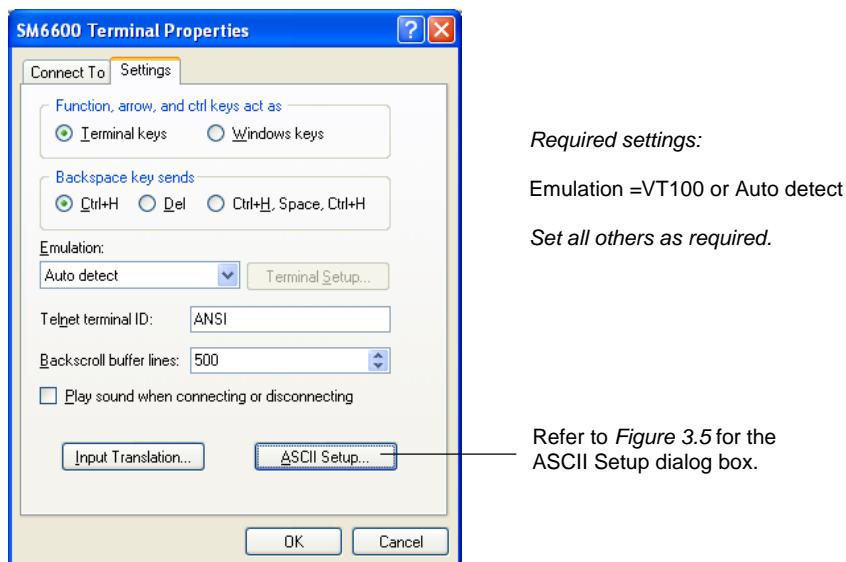


Figure 3.3: Port Properties Dialog Box

At this point, the terminal is connected to the Modulator.

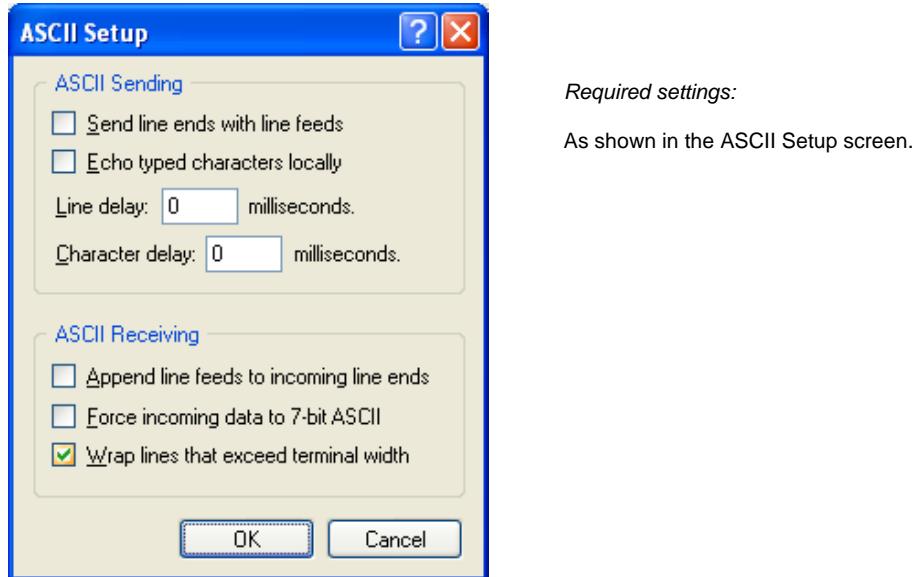
## Change the Terminal Properties

From **File** on the Windows menu bar, choose **Properties** if the terminal properties require changing. This displays the **Properties** dialog box. Select the **Settings** tab to display the dialog box shown in *Figure 3.4*.



*Figure 3.4: SM6600 Terminal Properties Dialog Box*

If the ASCII settings require changing, click the **ASCII Setup** button on the **SM6600 Terminal Properties** dialog box. This displays the dialog box shown in *Figure 3.5*.



*Figure 3.5: ASCII Setup Dialog Box*

The terminal emulation parameters are now set and do not require resetting unless the configuration has not been saved prior to exiting the program.

## Terminal Connection and Protocol

The Terminal control port is configured as a Data Terminal Equipment (DTE) communications port with the following specification:

- 19200 baud
- 8 data bits
- No parity
- 1 stop bit
- No flow control

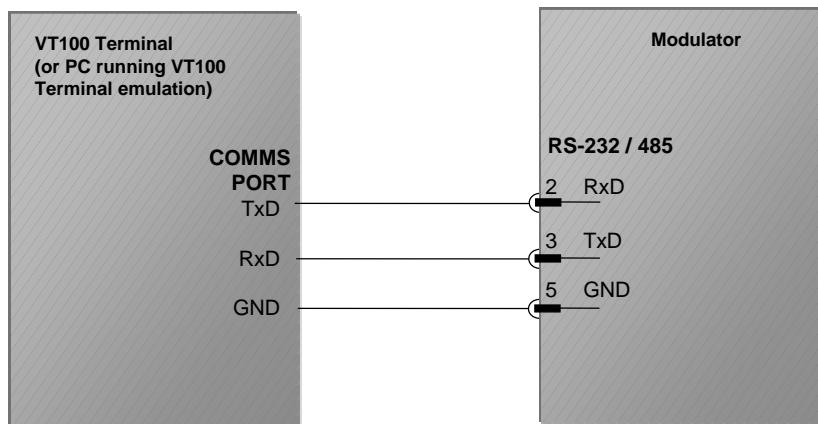


Figure 3.6: Local Terminal Connections

## Establishing Control when the Modulator is in Terminal Mode

Set the Modulator to Terminal Mode via the Front Panel (see [Section 4.2.3](#)) or Telnet (see [Section 3.1.3](#)). To enable Terminal control using a local VT100 terminal, perform the following:

1. **Connect the terminal**

The terminal may be connected either before or after power-up of the Modulator. Connect the local terminal to the RS-232/485 connector located near the right-hand side of the rear panel using a null-modem cable.

2. **Boot**

At switch-on, a boot display appears. The Main Menu is then displayed, signifying that Terminal control has been established.

**NOTE...**

If the terminal is connected after power-up, press ENTER to activate Terminal control.

3. **Configure parameters as required**

Previous configuration parameters are stored in Flash memory and restored on power-up. If a new configuration is required, choose the configuration parameters using either the **Quick Setup** menu or the **Configuration** menu.

### 3.1.3 Setting Up Telnet

#### General

A Telnet program is supplied with Microsoft Windows and may be used to control the Modulator via a network.

To set up Telnet, perform the following:

1. From DOS, type **telnet <domain name server>** or **telnet <IP address>**.
2. Enter **root** for the user name, and **root** for the password.
3. To ensure correct communications, select the **Preferences** option from the **Terminal** menu and select the following parameters:

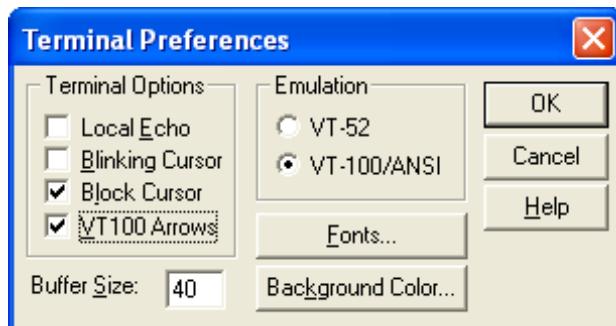


Figure 3.7: Telnet Terminal Preferences Dialog Box

#### Establishing Telnet Control

To connect to the Modulator using the Microsoft Telnet program, from the **Connect** menu, select **Remote System...**

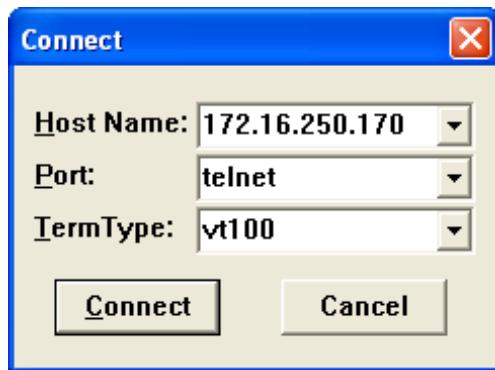


Figure 3.8: Telnet Connect Dialog Box

Enter the IP address of the Modulator and click **Connect**. A user name and password is necessary to gain access to the Modulator. Both the default user name and the default password are **root**.

#### NOTE...

The password for the root user may be changed by users with User Management privileges; see *Section 3.7, System Menu, Manage User Accounts* for details.

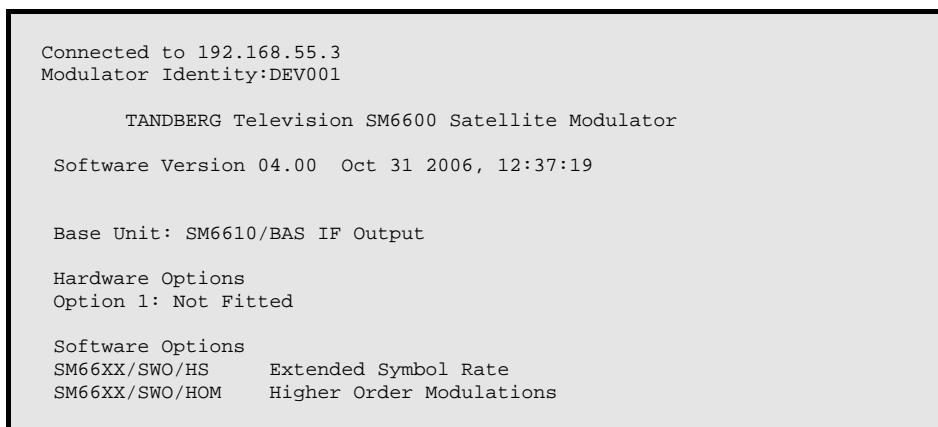
## 3.2 Navigating the Display Screens

### 3.2.1 Booting

At switch-on the Modulator runs through a boot sequence which may optionally include a series of self-tests. During this stage, a boot display similar to that shown in *Figure 3.9* appears for several seconds on the local terminal or Telnet session. This particular example is via Telnet.

If the self-tests are successfully completed, the Main Menu is displayed.

If the tests are not successfully completed, one of various error messages may be displayed. See *Chapter 8, Preventive Maintenance and Fault-finding* for a list of the possible messages along with an explanation and any relevant remedial action.



*Figure 3.9: Example Boot Display*

### 3.2.2 Navigating the Menus

Each of the menu screen choices is accompanied by a number. Press the associated number followed by **Enter** to select the required command or option. The last command in each menu is **Exit** or **Quit**. This causes the display to revert to the previous menu in the hierarchy.

Refer to

*Figure 3.10* which shows the hierarchical structure of the menus and sub-menus.

#### NOTE...

The screens displayed in this Reference Guide are only representations – there may be differences between these and the screens actually displayed, depending upon the specific Modulator model, the hardware options fitted (if any), the software options installed and the setting of certain parameters.

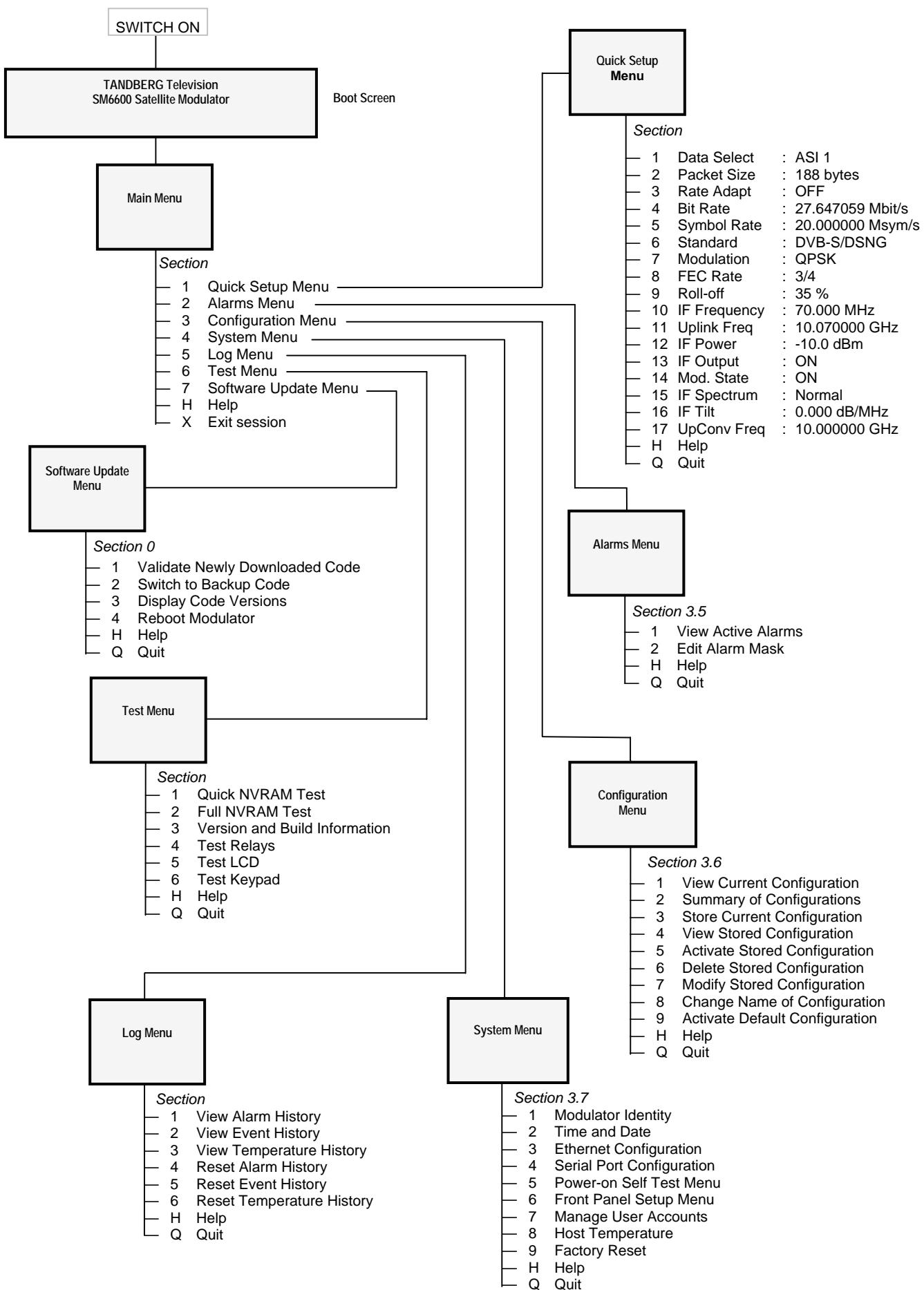
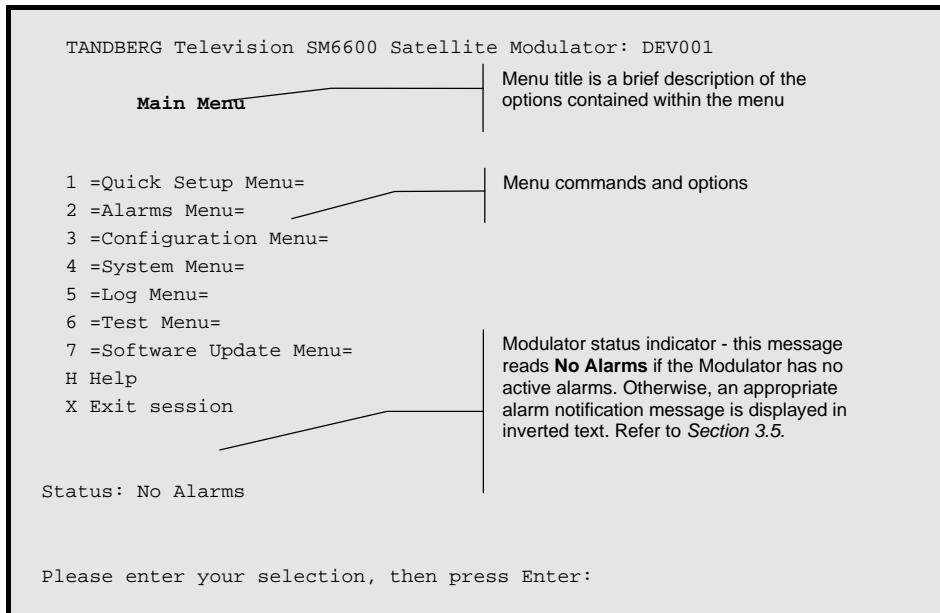


Figure 3.10: Menu Hierarchy

### 3.3 Main Menu

The Main Menu provides options for configuring and testing the Modulator. It also allows a password to be set to prevent access to the menu system. The Main Menu is automatically displayed immediately after the boot display screen. All menus conform to the format shown below.



Each of the options on this top-level menu provides access to further sub-menus (see the following headings).

#### NOTES...

1. Certain functionality of the Modulator is dependent upon the specific Modulator model, the hardware options fitted and the software options installed in it. The options available in some front panel and terminal menus vary, dependent upon the functionality available and the setting of certain parameters.
2. To ensure a valid output, the message **Status: No Alarms** must be present and the Alarm LED must not be lit on the front panel.
3. Menu options with an = sign on either side (e.g. =Test Menu=) indicate there are sub-menus.

## 3.4 Main Menu Option 1: Quick Setup Menu

### 3.4.1 Quick Setup Menu

Type 1 at the prompt to enter the Quick Setup Menu from the Main Menu. The menu for Modulator model SM6610 provides the following options:

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Quick Setup Menu

 1 Data Select   : ASI 1           11 Uplink Freq   : 10.070000 GHz
 2 Packet Size   : 188 bytes       12 IF Power     : -10.0 dBm
 3 Rate Adapt    : OFF             13 IF Output    : ON
 4 Bit Rate      : 27.647059 Mbit/s 14 Mod. State   : ON
 5 Symbol Rate   : 20.000000 Msym/s 15 IF Spectrum : Normal
 6 Standard      : DVB-S/DSNG      16 IF Tilt      : 0.000 dB/MHz
 7 Modulation    : QPSK            17 UpConv Freq  : 10.000000 GHz
 8 FEC Rate      : 3/4             H Help
 9 Roll-off      : 35 %           Q Quit
10 IF Frequency  : 70.000 MHz

Status: No Alarms

Please enter your selection, then press Enter:
```

#### NOTE...

The options available in this menu, their numbering and the ranges of some parameters are dependent upon the specific Modulator model and the software options installed in it.

### 3.4.2 Quick Setup Menu Options

#### NOTE...

For menu options where the option number varies, depending upon the Modulator model, software options installed and the setting of certain parameters, the option numbers are indicated thus: (\*).

#### Quick Setup Menu Option 1: Data Select

**Data Select** enables the user to select one of the available input ports, or one of two internally generated test signals (Null Packets or PRBS), as the input data source to the Modulator.

```
Data Select : Current Value= "ASI 1"
 1      ASI 1
 2      ASI 2
 3      Null Pkts
 4      PRBS
```

#### NOTE...

The options available are dependent upon whether or not an input option card is fitted. The options shown in the above display are for a Modulator with no input option card. If the DVB ASI & SPI Input card is fitted, then three additional options (ASI 3, ASI 4 and SPI) are available.

## Quick Setup Menu Option 2: Packet Size

This parameter indicates to the modulator the expected input packet size, either 204 bytes, 188 bytes or Unframed.

```
Packet Size : Current Value= "188 bytes"
1          204 bytes
2          188 bytes
3          Unframed
```

## Quick Setup Menu Option 3: Rate Adapt

When **Rate Adapt** is set to ON, rate adaptation is enabled; null packets are either inserted into or removed from the transport stream, and PCR correction is performed. When **Rate Adapt** is set to OFF, rate adaptation is disabled and the modulator operates in data-derived clocking mode in which the output symbol rate is locked to the input data rate.

```
Rate Adapt : Current Value= "OFF"
1          OFF
2          ON
```

## Quick Setup Menu Option 4: Bit Rate

**Bit Rate** indicates to the modulator the expected transport stream input bit-rate. Its range is variable, dependent upon the settings of other parameters and options. When a **Bit Rate** value is entered, the corresponding value of **Symbol Rate** is automatically calculated and set, dependent upon the settings of other parameters.

```
Bit Rate     : Current Value= "27.647059" Mbit/s
Enter New Value 0.276471 to 91.235294 in Mbit/s,
or press Enter
```

## Quick Setup Menu Option 5: Symbol Rate

When **Rate Adapt** is set to OFF, **Symbol Rate** sets the nominal symbol rate of the modulator. The actual symbol rate value is locked to the transport stream input data-rate provided that the latter is within the tracking range of the input de-jitter PLL (see *Section 7.3.2, Transport Stream De-jittering*). When **Rate Adapt** is set to ON, **Symbol Rate** sets the actual symbol rate of the modulator. See also *Quick Setup Menu Option 3: Rate Adapt*.

The range of **Symbol Rate** is 1-48 Msymbols/s as standard, or 0.2-66 Msymbols/s with the Extended Symbol Rate option.

```
Symbol Rate : Current Value= "20.000000" Msym/s
Enter New Value 0.200000 to 66.000000 in Msym/s,
or press Enter
```

## Quick Setup Menu Option 6: Standard

This parameter selects the modulation and coding standard to be used by the modulator.

Standard : Current Value= "DVB-S/DSNG"
1 DVB-S/DSNG
2 DVB-S2

### NOTE...

The menu option DVB-S2 is available only on Modulator models SM6620 and SM6625 with the SM66XX/SWO/S2 software option.

## Quick Setup Menu Option 7: Modulation

The **Modulation** options available are dependent upon the software options installed in the Modulator and the setting of **Standard**. The options shown in the following display are for a Modulator with the SM66XX/SWO/HOM option and with **Standard** set to DVB-S/DSNG.

Modulation : Current Value= "QPSK"
1 BPSK
2 QPSK
3 8PSK
4 16QAM

## Quick Setup Menu Option 8: FEC Rate

The **FEC Rate** options available are dependent upon the settings of **Standard** and **Modulation**. The options shown in the following display are with **Standard** set to DVB-S/DSNG and **Modulation** set to QPSK.

FEC Rate : Current Value= "3/4"
1 1/2
2 2/3
3 3/4
4 5/6
5 7/8

## Quick Setup Menu Option 9: Frame Size

The menu option **Frame Size** is available only when **Standard** is set to DVB-S2. It is used to select the LDPC encoded frame size. When set to Normal, the frame size is 64,800 bits. When set to Short, the frame size is 16,200 bits.

Frame Size : Current Value= "Normal"
1 Normal
2 Short

## Quick Setup Menu Option 10: Pilots

The menu option **Pilots** is available only when **Standard** is set to DVB-S2. It is used for switching pilot carrier insertion on or off.

Pilots : Current Value= "OFF"
1 OFF
2 ON

## Quick Setup Menu Option 11: Map Mode

The menu option **Map Mode** is available only when **Standard** is set to DVB-S2. It is used to set the power of the modulated signal constellation relative to that of the pilot carriers. When set to Peak power, the power of the constellation points in the outer circle is equal to the power of the pilot carriers. When set to Mean power, the average power of all the constellation points is equal to the power of the pilot carriers.

```
Map Mode      : Current Value= "Peak power"
 1            Peak power
 2            Mean power
```

## Quick Setup Menu Option 12: Gold Seq N

The menu option **Gold Seq N** is available only when **Standard** is set to DVB-S2. This parameter sets the physical layer scrambling code, or Gold sequence, number. Its range is 0 to 262,141 (integer).

```
Gold Seq N   : Current Value= "0" (0x00)
Enter New Value 0 to 262141 in ,
or press Enter
```

## Quick Setup Menu Option (\*): Roll-off

This parameter is used to select the roll-off factor of the Modulator's square-root raised-cosine spectrum-shaping filters. ETSI standard EN 300 421 (DVB-S) specifies a roll-off factor of 35%. EN 301 210 (DVB-DSNG) specifies a roll-off factor of 35%, and optionally 25% for use with 8PSK and 16QAM modulations. EN 302 307 (DVB-S2) specifies roll-off factors of 20%, 25% and 35%.

```
Roll-off      : Current Value= "35" %
 1            20 %
 2            25 %
 3            30 %
 4            35 %
```

## Quick Setup Menu Option (\*): IF Frequency

This parameter sets the carrier, or centre frequency of the IF output. The allowable range is 50-180 MHz for Modulator models SM6610 and SM6620, and 950-1750 MHz for Modulator models SM6615 and SM6625. The parameters **IF Frequency** and **Uplink Freq** are interrelated; when an **IF Frequency** value is entered, the value of **Uplink Freq** is calculated automatically and displayed for information. See also *Quick Setup Menu Option (\*): Uplink Freq* and *Quick Setup Menu Option (\*): UpConv Freq*.

```
IF Frequency: Current Value= "70.000" MHz
Enter New Value 50.000 to 180.000 in MHz,
or press Enter
```

## Quick Setup Menu Option (\*): Uplink Freq

**Uplink Freq** refers to the frequency of the RF output from an external up-converter that is used in the satellite earth station to frequency up-convert the Modulator's IF output. The parameters **IF Frequency** and **Uplink Freq** are interrelated; when an **Uplink Freq** value is entered, the value of **IF Frequency** is calculated and set automatically.

The allowable range of **Uplink Freq** is dependent upon the Modulator model, the **UpConv Freq** and **IF Spectrum** settings. See also *Quick Setup Menu Option (\*): IF Frequency* and *Quick Setup Menu Option (\*): UpConv Freq*.

```
Uplink Freq : Current Value= "10.070000" GHz  
Enter New Value 10.050000 to 10.180000 in GHz,  
or press Enter
```

#### NOTE...

The parameters Uplink Freq and IF Frequency are interrelated; the user may enter a value for either parameter and the other is calculated automatically using either one or other of the following equations, dependent upon the setting of IF Spectrum:

$$\text{Uplink Freq} = \text{UpConv Freq} + \text{IF Frequency} \quad (\text{IF Spectrum Normal})$$

$$\text{Uplink Freq} = \text{UpConv Freq} - \text{IF Frequency} \quad (\text{IF Spectrum Inverted})$$

## Quick Setup Menu Option (\*): IF Power

This parameter is used to set the IF output power level. Its range is –20 to +5 dBm.

```
IF Power : Current Value= "-10.0" dBm  
Enter New Value -20.0 to 5.0 in dBm,  
or press Enter
```

## Quick Setup Menu Option (\*): IF Output

This is used for switching the IF output on or off.

```
IF Output : Current Value= "ON"  
1 OFF  
2 ON
```

## Quick Setup Menu Option (\*): Mod. State

This is used for switching the modulation state on or off. The modulation OFF state is sometimes known as ‘CW’ or ‘Clean Carrier.’

```
Mod. State : Current Value= "ON"  
1 OFF  
2 ON
```

## Quick Setup Menu Option (\*): IF Spectrum

When **IF Spectrum** is set to Normal, the modulation at the IF Output of the Modulator is in accordance with ETSI standards EN 300 421 (DVB-S), EN 301 210 (DVB-DSNG) or EN 302 307 (DVB-S2), as appropriate. When set to Inverted, the modulation spectrum is inverted (reversed). This is useful when there is a spectrum inversion introduced by the following up-converter.

```
IF Spectrum : Current Value= "Normal"  
1 Normal  
2 Inverted
```

## Quick Setup Menu Option (\*): IF Tilt

This parameter is used to set the IF tilt (slope) introduced by the built-in IF Tilt Corrector. Its range is -0.04 dB/MHz to 0.04 dB/MHz.

```
IF Tilt      : Current Value= "0.000" dB/MHz
Enter New Value -0.040 to 0.040 in dB/MHz,
or press Enter
```

## Quick Setup Menu Option (\*): UpConv Freq

**UpConv Freq** represents the overall translation frequency of the external up-converter. See also *Quick Setup Menu Option (\*): IF Frequency* and *Quick Setup Menu Option (\*): Uplink Freq*.

```
UpConvFreq   : Current Value= "10.000000" GHz
Enter New Value 0.000000 to 100.000000 in GHz,
or press Enter
```

## Quick Setup Menu Option (\*): UpConv Pwr

The menu option **UpConv Pwr** is available only on Modulator models SM6615 and SM6625. It is used for switching on or off the 24 Vdc power supply which may be used to power an external block up-converter (BUC).

```
UpConv Pwr   : Current Value= "OFF"
1          OFF
2          ON
```

## Quick Setup Menu Option (\*): UpConv Ref

The menu option **UpConv Ref** is available only on Modulator models SM6615 and SM6625. It is used for switching on or off the 10 MHz frequency reference which may be used by an external BUC.

```
UpConv Ref   : Current Value= "OFF"
1          OFF
2          ON
```

## Quick Setup Menu Option (\*): =PREKOR Menu=

The PREKOR Menu option is available only on Modulator models SM6620 and SM6625 with the SM66XX/SWO/PREKOR software option installed. For details of this menu option and other aspects of PREKOR™ operation, see ST.RE.PREKOR.E10154: Reference Guide for the PREKOR Software Option for SM6620 and SM6625 Satellite Modulators.

## Quick Setup Menu Option H: Help

Type **H** at the prompt to view information about the options on the Quick Setup Menu.

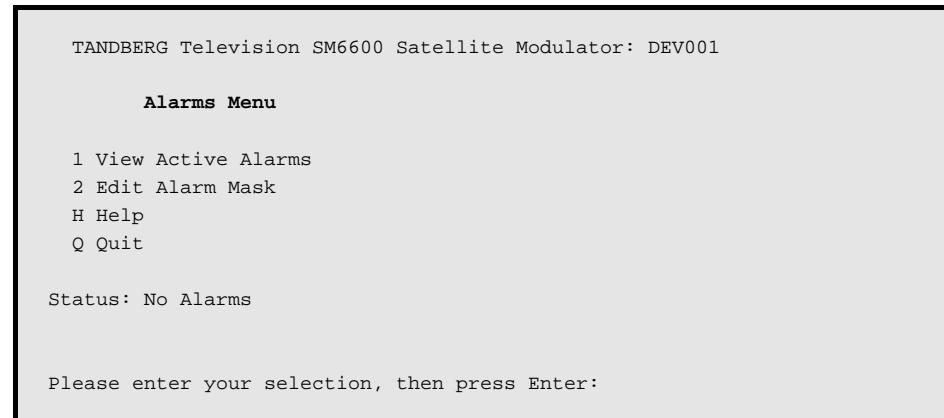
## Quick Setup Menu Option Q: Quit

Type **Q** at the prompt to return to the Main Menu.

## 3.5 Main Menu Option 2: Alarms Menu

### 3.5.1 Alarms Menu

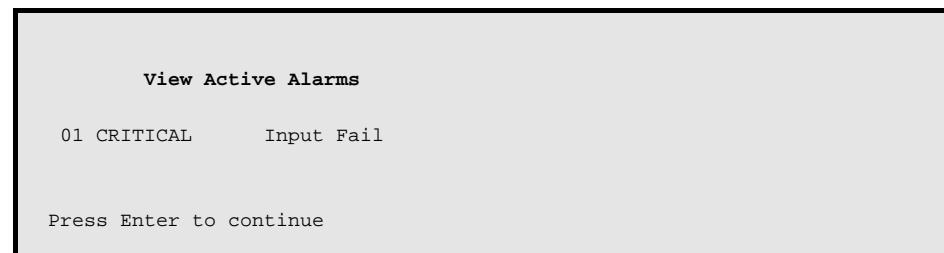
Type **2** at the prompt to enter the Alarms Menu from the Main Menu. This menu provides the following options:



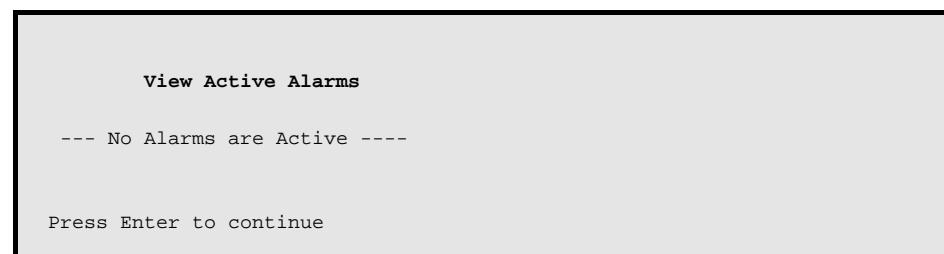
### 3.5.2 Alarms Menu Options

#### Alarms Menu Option 1: View Active Alarms

Type **1** at the prompt to display the View Active Alarms screen from the Alarms Menu. This screen lists all currently Active Alarms in descending order of importance. See *Chapter 8, Section 8.9* for a list of possible Alarm messages.

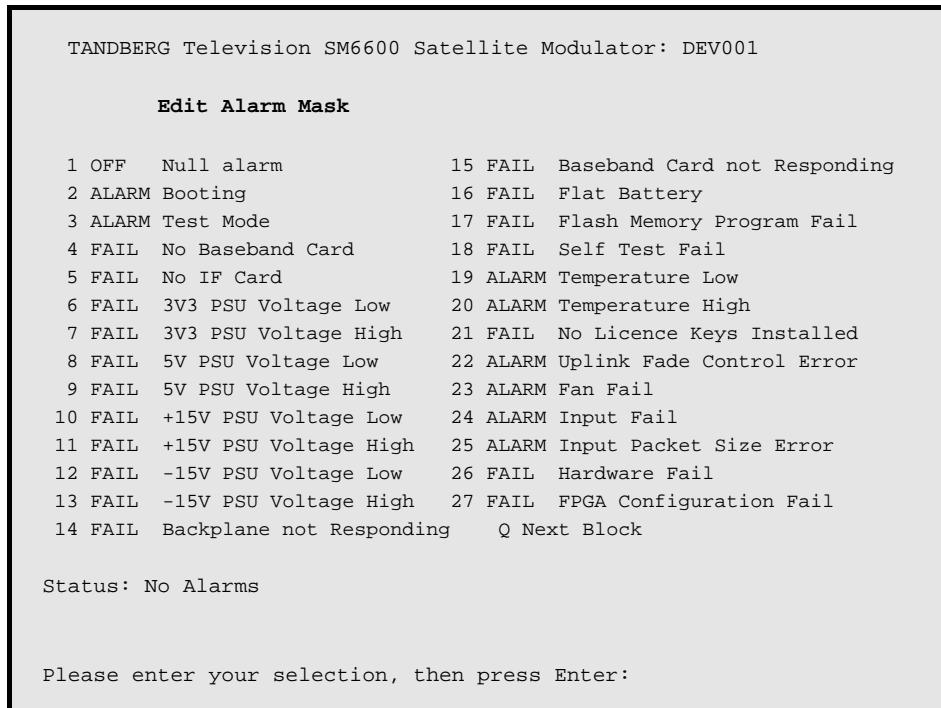


If no active alarms are present, the following screen is displayed.



## Alarms Menu Option 2: Edit Alarm Mask

Type **2** at the prompt to enter the Edit Alarm Mask menu from the Alarms Menu. This menu provides the following options:



Selecting any item displays a menu similar to the following. The display shows the screen after **12 (-15V PSU Voltage Low)** has been selected.

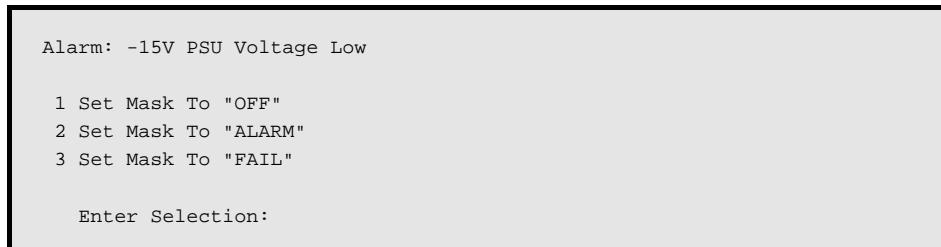


Table 3.1: Alarm Mask Options

Setting	Description
OFF	The selected item is masked. When an item is designated as OFF and is active, it does not actuate the alarm or fail relay, or the front panel Alarm LED. It does not report the alarm via the various interfaces.
ALARM	The selected item is designated as an alarm. When an item is designated as an alarm and is active, it actuates the alarm relay and the front panel Alarm LED. It also reports the alarm via the various interfaces.
FAIL	The selected item is designated as a fail. When an item is designated as a fail and is active, it actuates both the alarm and fail relays, and the front panel Alarm LED. It also reports the alarm via the various interfaces.

## Alarms Menu Option H: Help

Type **H** at the prompt to view information about the options on the Alarms Menu.

## Alarms Menu Option Q: Quit

Type **Q** at the prompt to return to the Main Menu.

## 3.6 Main Menu Option 3: Configuration Menu

### 3.6.1 Configuration Menu

Type **3** at the prompt to enter the Configuration Menu from the Main Menu. This menu provides options for selecting configuration and operating features.

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Configuration Menu

1 View Current Configuration
2 Summary of Configurations
3 Store Current Configuration
4 View Stored Configuration
5 Activate Stored Configuration
6 Delete Stored Configuration
7 =Modify Stored Configuration=
8 Change Name of Configuration
9 Activate Default Configuration
H Help
Q Quit

Status: No Alarms

Please enter your selection, then press Enter:
```

### 3.6.2 Configuration Menu Options

#### Configuration Menu Option 1: View Current Configuration

To select the View Current Configuration option from the Configuration Menu type **1** at the prompt. This option permits the viewing of the current configuration settings. The following illustrates a typical display.

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Config 0="" Main Config Menu <AnyUser> 23 FEB 2006 14:25:34

1 Data Select : ASI 1           12 Gold Seq N   : 0
2 Packet Size : 188 bytes      13 Roll-off     : 35 %
3 Rate Adapt  : OFF            14 IF Frequency : 70.000 MHz
4 Bit Rate    : 27.647059 Mbit/s 15 Uplink Freq  : 10.070000 GHz
5 Symbol Rate : 20.000000 Msym/s 16 IF Power    : -10.0 dBm
6 Standard    : DVB-S/DSNG       17 IF Output   : ON
7 Modulation  : QPSK           18 Mod. State  : ON
8 FEC Rate    : 3/4             19 IF Spectrum : Normal
9 Frame Size  : Normal         20 IF Tilt     : 0.000 dB/MHz
10 Pilots     : OFF             21 UpConv Freq : 10.000000 GHz
11 Map Mode   : Peak power      Q Quit

Status: No Alarms

Please enter your selection, then press Enter:
```

#### NOTE...

The actual display depends upon the Modulator model, the hardware options fitted (if any) and the software options installed.

## Configuration Menu Option 2: Summary of Configurations

To select the Summary of Configurations option from the Configuration Menu type **2** at the prompt. This displays the previously stored configurations.

```
Summary of Configurations

Config_0  Name="Current  ", Author="AnyUser   ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system    ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system    ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system    ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system    ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system    ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system    ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system    ", JUN 01 2004 13:05:47
```

## Configuration Menu Option 3: Store Current Configuration

To select the Store Current Configuration option from the Configuration Menu type **3** at the prompt. This allows the current configuration to be stored in the Flash memory.

Up to eight user configurations can be stored and later recalled without having to individually select the parameters each time. Enter the configuration number 0-8.

### NOTE...

Configuration 0 is the currently active configuration and Configuration 9 is the factory default (read only) configuration.

```
Store Current Configuration

Config_0  Name="Current  ", Author="AnyUser   ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system    ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system    ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system    ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system    ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system    ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system    ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system    ", JUN 01 2004 13:05:47
```

```
Copy Current Configuration as Stored Config
Enter Config Number 0-8 ...
```

## Configuration Menu Option 4: View Stored Configuration

To select the View Stored Configuration option from the Configuration Menu type **4** at the prompt. This allows the viewing of any of the previously stored configurations. Enter configuration number 0-9.

```
View Stored Configuration

Config_0  Name="Current  ", Author="AnyUser  ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system   ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system   ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system   ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system   ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system   ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system   ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system   ", JUN 01 2004 13:05:47

View Stored Config
Enter Config Number 0-9...
```

### Configuration Menu Option 5: Activate Stored Configuration

To select the Activate Stored Configuration option from the Configuration Menu type **5** at the prompt. This allows any of the previously stored configurations to be activated.

```
Activate Stored Configuration

Config_0  Name="Current  ", Author="AnyUser  ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system   ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system   ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system   ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system   ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system   ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system   ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system   ", JUN 01 2004 13:05:47

Select Stored Config to Activate
Enter Config Number 0-9...
```

Select the number of the configuration to be activated (1-9). When this is done the Modulator loads it and configures to the specified parameters.

## Configuration Menu Option 6: Delete Stored Configuration

To select the Delete Stored Configuration option from the Configuration Menu type **6** at the prompt. This allows any of the previously stored configurations to be deleted. Select the number of the configuration to be deleted (1-8).

```
Delete Stored Configuration

Config_0  Name="Current  ", Author="AnyUser  ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system    ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system    ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system    ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system    ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system    ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system    ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system    ", JUN 01 2004 13:05:47

--- To Skip deletion of any Configuration, Press <CR> only ---
Select Stored Config to Delete
Enter Config Number 1-8...
```

## Configuration Menu Option 7: Modify Stored Configuration

To select the Modify Stored Configuration option from the Configuration Menu type **7** at the prompt. This allows any of the previously stored user configurations to be modified. Select the number of the configuration to be modified (1-8).

```
=Modify Stored Configuration=

Config_0  Name="Current  ", Author="AnyUser  ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system    ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system    ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system    ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system    ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system    ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system    ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system    ", JUN 01 2004 13:05:47

Select Stored Config to be Modified
Enter Config Number 1-8...
```

## **Configuration Menu Option 8: Change Name of Configuration**

To select the Change Name of Configuration option from the Configuration Menu type **8** at the prompt. This allows the name of any of the previously stored configurations to be changed. Select the number of the configuration to be changed (1-8).

```
Change Name of Configuration

Config_0  Name="Current  ", Author="AnyUser  ", JUN 01 2004 13:29:52
Config_1  Name="First    ", Author="system   ", JUN 01 2004 13:48:09
Config_2  Name="Second   ", Author="system   ", JUN 01 2004 13:48:09
Config_3  Name="Third    ", Author="system   ", JUN 01 2004 13:48:09
Config_4  Name="Fourth   ", Author="system   ", JUN 01 2004 13:48:09
Config_5  Name="Fifth    ", Author="system   ", JUN 01 2004 13:48:09
Config_6  Name="Sixth    ", Author="system   ", JUN 01 2004 13:48:09
Config_7  is Empty
Config_8  is Empty
Config_9  Name="Default  ", Author="system   ", JUN 01 2004 13:05:47

Select Config requiring "Name" change ...
```

## **Configuration Menu Option 9: Activate Default Configuration**

To select the Activate Default Configuration option from the Configuration Menu type **9** at the prompt. This activates the factory default configuration.

```
Activate Default Configuration

Defaults have been set.
Press <CR> ...
```

## **Configuration Menu Option H: Help**

Type **H** at the prompt to view information about the options on the Configuration Menu.

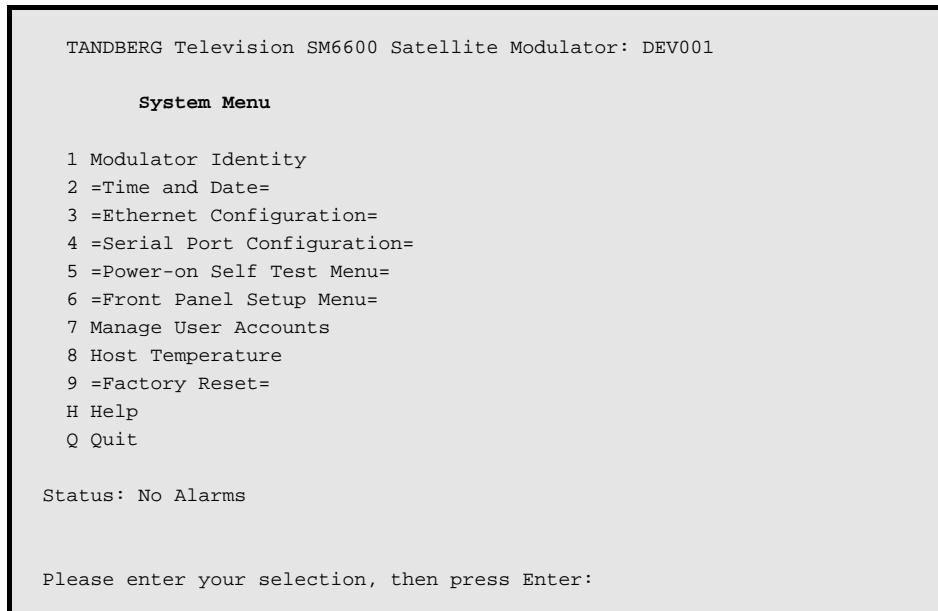
## **Configuration Menu Option Q: Quit**

Type **Q** at the prompt to return to the Main Menu.

## 3.7 Main Menu Option 4: System Menu

### 3.7.1 System Menu

Type **4** at the prompt to enter the System Menu from the Main Menu. This allows system configuration parameters to be set.

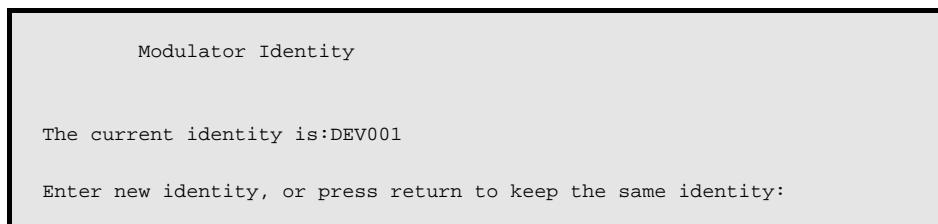


### 3.7.2 System Menu Options

#### System Menu Option 1: Modulator Identity

##### Changing the Modulator Identity

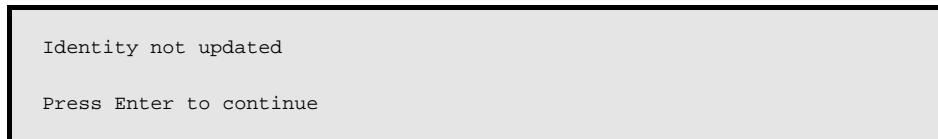
To display or edit the current Modulator identity, type **1** at the prompt.



In this example, the current identity is **DEV001**. To change the identity, type in the new one and press ENTER. It may be up to 49 characters in length. If no change is required, press ENTER.

##### Accepting the Current Modulator Identity

When the ENTER key is pressed without entering a new identity, the following screen is displayed. Press ENTER to return to the System Menu.



## System Menu Option 2: Time and Date

### Overview

To select the Time and Date Menu from the System Menu type **2** at the prompt. This allows the current time and date settings to be viewed or set. It also allows a network time and date source to be specified. The time and date is used by the Modulator in its alarm and event logs.

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Time and Date Menu

1 Display Current Time and Date
2 Set Time and Date
3 Setup Network Time Server
4 Date Format
H Help
Q Quit

Status: No Alarms

Please enter your selection, then press Enter:
```

### Time and Date Option 1: Display Current Time and Date

Type **1** at the prompt to display the Display Current Time and Date screen from the Time and Date Menu.

```
Display Current Time and Date

[Initiated: FEB 26 2004 09:06:40]      [Booted: FEB 23 2006 16:20:58]

The current time is: Thursday February 23 2006 17:07:29

Press Enter to continue
```

### Time and Date Option 2: Set Time and Date

Type **2** at the prompt to select the Set Time and Date option from the Time and Date Menu.

### Time and Date Option 2: Set Time and Date - Setting the Time From the Network

If the time server has been set up and enabled, the time can be downloaded from the network. To select this type **Y** at the Get time from network? (Y/N) option.

```
Set Time and Date

Get time from network?(Y/N)
Got time: 01 JUN 2004 14:39:09 281 ms
Time updated successfully.

- Y Chosen

Press Enter to continue
```

When the time server is not available, the following screen is displayed.

```
Failed to get the time from the network.  
Press Enter to continue
```

Press ENTER to return to the Time and Date Menu.

### Time and Date Option 2: Set Time and Date - Setting the Time Locally

If the time and date is not to be downloaded from the network, it must be entered manually using the following screen. To select this type **N** at the Get time from network?(Y/N) option.

```
Set Time and Date  
  
Get time from network?(Y/N) - N Chosen  
The current time is: Tuesday June 1 2004 14:47:39  
Enter Hours (0 - 23): 14 -  
Enter Minutes (0 - 59): 47 -  
Enter Seconds (0 - 59): 39 -  
Enter Date (1 - 31): 1 -  
Enter Month (1 - 12): 6 -  
Enter Year: 2004 -  
Enter Day (1 - 7, 1 = Sunday): Tuesday -  
Date and time updated  
  
Press Enter to continue
```

### Time and Date Option 3: Setup Network Time Server

Type **3** at the prompt to view the Setup Network Time Server menu from the Time and Date Menu. This menu allows a network time server to be specified.

```
Setup Network Time Server  
  
Current time server IP address = 158.43.128.33  
Do you want to change it (Y/N)?:
```

### Time and Date Option 3: Setup Network Time Server - Changing the IP Address

Type **Y** at the previous screen to display the following. This allows the IP address of the time server to be specified.

```
Enter time server IP address: 158.43.128.33 - New IP address entered  
Time server IP address updated.  
Current time server protocol = SNTP  
Do you want to change it (Y/N)?: Type Y to change the protocol
```

## Time and Date Option 3: Setup Network Time Server - Changing the Time Protocol

The Modulator supports both the **Time** and **SNTP** (Simple Network Time) protocols. Once enabled, the Modulator updates its internal time every 15 minutes.

```
Enter 1 for Time protocol, 2 for SNTP:2          - 2 Chosen
Time server port updated.
Use of the time server (158.43.128.33) is currently ENABLED.
```

## Time and Date Option 4: Date Format

The Modulator supports a number of date formats. Use this option to make a selection.

```
Date Format

Current Date Format = yyyy/mm/dd

1 mm/dd/yyyy
2 dd/mm/yyyy
3 yyyy/mm/dd

Please enter your selection, then press Enter:
```

## System Menu Option 3: Ethernet Configuration

### Overview

Type **3** at the prompt to view the Ethernet Configuration Menu from the System Menu. This menu allows the configuration of the Ethernet interface.

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Ethernet Configuration Menu

1 Display Current Settings
2 Modify IP Address
3 Modify Subnet Mask
4 Modify Gateway IP Address
5 Display Ethernet Port Usage
6 SNMP Setup
H Help
Q Quit

Status: No Alarms

Please enter your selection, then press Enter:
```

### Ethernet Configuration Option 1: Display Current Settings

Type 1 at the prompt to view the Display Current Settings screen from the Ethernet Configuration Menu. It displays the current settings.

```
Display Current Settings

IP Address      : 192.168.55.102
Subnet Mask     : 255.255.240.0
Gateway IP      : 192.168.63.254
Gateway          : Enabled
MAC Address     : 00:20:AA:1F:00:01
Time Server IP  : 158.43.128.33
Time Protocol   : SNTP
Time Server      : Enabled
SNMP Mode       : Monitoring Only

Press Enter to continue
```

### Ethernet Configuration Option 2: Modify IP Address

Type 2 at the prompt to view the Modify IP Address menu from the Ethernet Configuration Menu. It displays the current setting and allows the IP address to be changed:

```
Modify IP Address

Changing the IP address will terminate this network connection.

Current IP Address = 192.168.55.102
Do you want to change it (Y/N)?: - Y Pressed

Enter the new IP address: 192.168.55.102 - New IP address entered
IP address updated

Press Enter to continue
```

### Ethernet Configuration Option 3: Modify Subnet Mask

Type 3 at the prompt to view the Modify Subnet Mask menu from the Ethernet Configuration Menu. It displays the current setting and allows the subnet mask to be changed:

```
Modify Subnet Mask

Changing the Subnet mask may terminate this network connection.

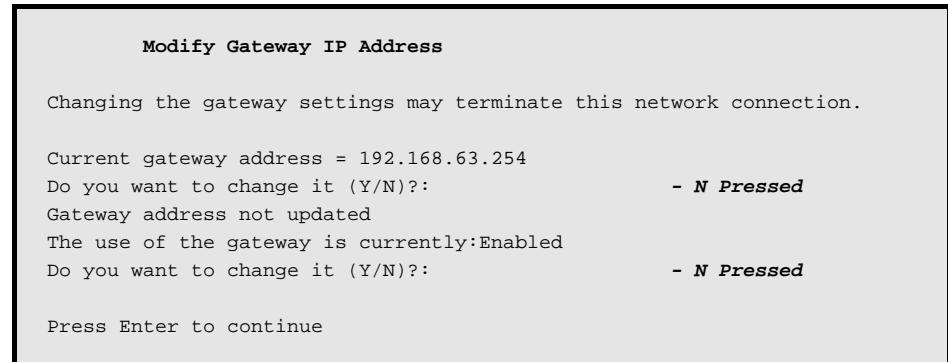
Current subnet mask = 255.255.240.0
Do you want to change it (Y/N)?: - Y Pressed

Enter the new Subnet mask: 255.255.240.0 - New subnet mask entered
Subnet mask updated

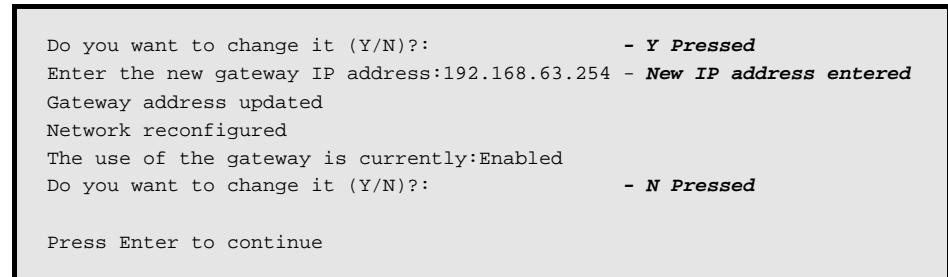
Press Enter to continue
```

## Ethernet Configuration Option 4: Modify Gateway IP Address

Type **4** at the prompt to view the Modify Gateway IP Address menu from the Ethernet Configuration Menu. It displays the current setting and allows the Gateway IP address to be changed:

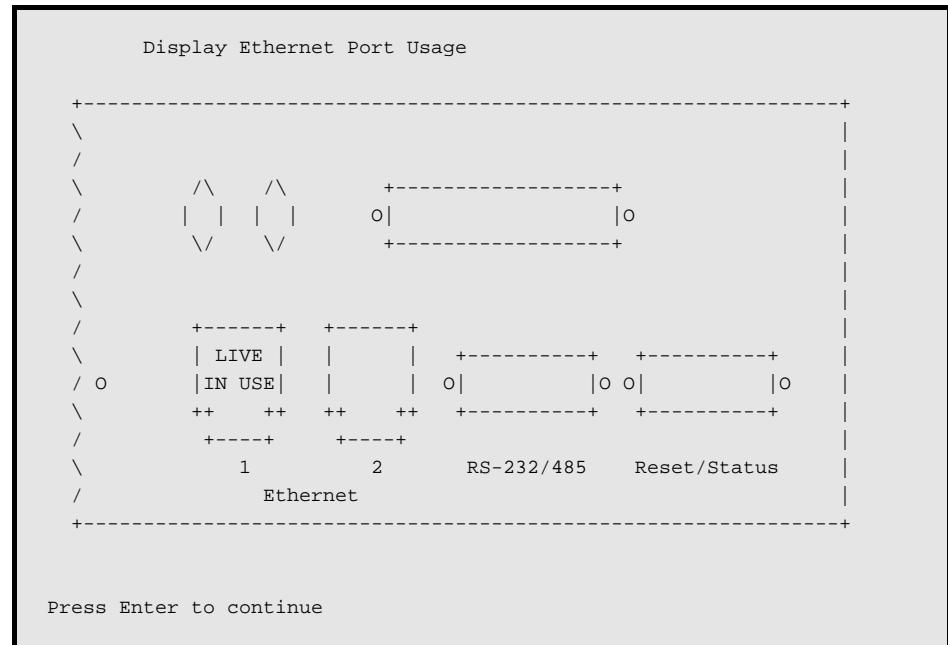


If **Y** is typed as the response to changing the gateway address, the following screen is displayed.



## Ethernet Configuration Option 5: Display Ethernet Port Usage

Type **5** at the prompt to view the Display Ethernet Port Usage screen from the Ethernet Configuration Menu. It displays the status of the two Ethernet connectors on the rear panel.



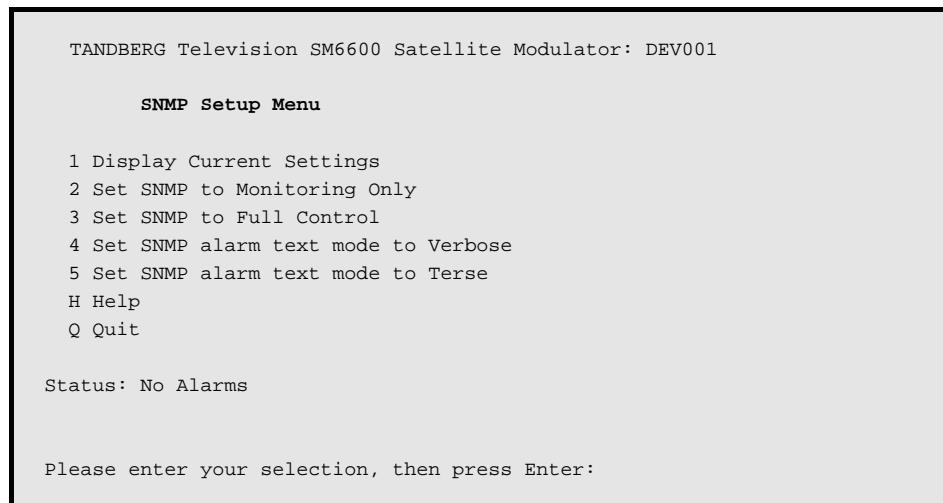
*Table 3.2: Display Ethernet Port Usage Screen Messages*

Message	Description
LIVE	There is a cable plugged in which is connected to a network
IN USE	The Modulator is using data from this connector

It is possible for both links to be **live** but only one will be in use at any one time.

### Ethernet Configuration Option 6: SNMP Setup

Type **6** at the prompt to view the SNMP Setup Menu from the Ethernet Configuration Menu. It displays the current settings and displays the status.

*Table 3.3: SNMP Setup Menu Options*

Command	Messages
1 Display Current Settings	The SNMP mode is set to Monitor Only / Full Control. The SNMP alarm text mode is set to Verbose / Terse.
2 Set SNMP to Monitoring Only	SNMP mode updated. Already set to monitor only mode.
3 Set SNMP to Full Control	SNMP mode updated. Already set to full control mode.
4 Set SNMP alarm text mode toVerbose	SNMP verbose alarm text mode updated. Already set to verbose alarm text mode.
5 Set SNMP alarm text mode toTerse	SNMP terse alarm text mode updated. Already set to terse alarm text mode.

## System Menu Option 4: Serial Port Configuration

### Serial Port Configuration

Type **4** at the prompt to view the Serial Port Configuration Menu from the System Menu. This menu displays the Serial (RS-232/485) port configuration settings and allows the port mode to be set.

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Serial Port Configuration Menu

1 Display Current Settings
2 Set Port Mode
3 Select Interface
4 Select Termination
5 Select Baud Rate
6 Select RS-485 Address
H Help
Q Quit

Status: No Alarms

Please enter your selection, then press Enter:
```

### Serial Port Configuration Option 1: Display Current Settings

Type **1** at the prompt to view the Display Current Settings screen from the Serial Port Configuration Menu. It displays the current settings (the settings cannot be changed).

```
Display Current Settings

Port Mode      : Terminal
Interface     : RS-232
Termination   : Hi-Z
Flow Control   : None
Baud Rate     : 19200

Press Enter to continue
```

### Serial Port Configuration Option 2: Set Port Mode

Type **2** at the prompt to view the Set Port Mode menu from the Serial Port Configuration Menu. This option allows the serial port to be configured for either terminal or remote control.

```
TANDBERG Television SM6600 Satellite Modulator: DEV001

Port Mode

1 Set Mode to Terminal
2 Set Mode to Remote
H Help
Q Quit

Status: No Alarms

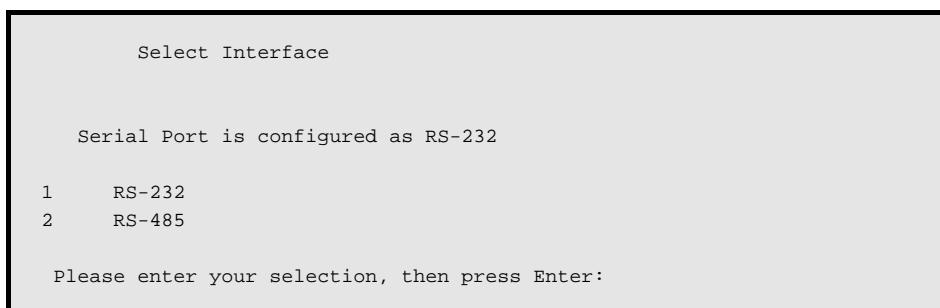
Please enter your selection, then press Enter:
```

Table 3.4: Set Port Mode Options

Command	Messages	Description
1 Set Mode to Terminal	Port mode updated. This change requires the modulator to be rebooted.	Select this option to allow control of the Modulator by means of a VT100 terminal.
2 Set Mode to Remote	Port mode updated. This change requires the modulator to be rebooted.	Select this option to allow remote control of the Modulator via the RS-232/485 port using either the RS-232 or the RS-485 remote control protocol. See <i>Chapter 5, RS-232 Remote Control Protocol</i> and <i>Chapter 6, RS-485 Remote Control Protocol</i> .

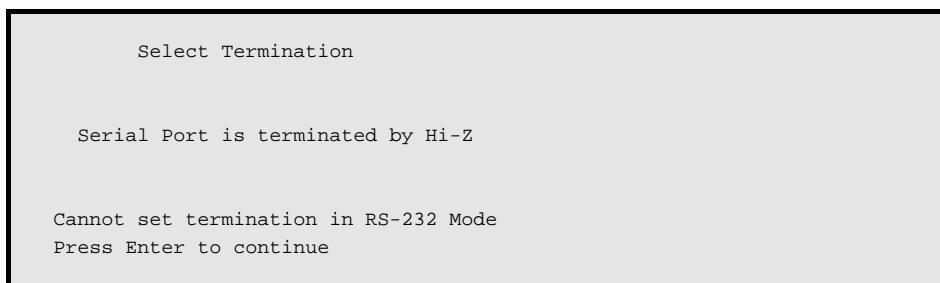
### Serial Port Configuration Option 3: Select Interface

Type 3 at the prompt to view the Select Interface menu from the Serial Port Configuration Menu. This option allows the port to be configured as either an RS-232 or RS-485 port.



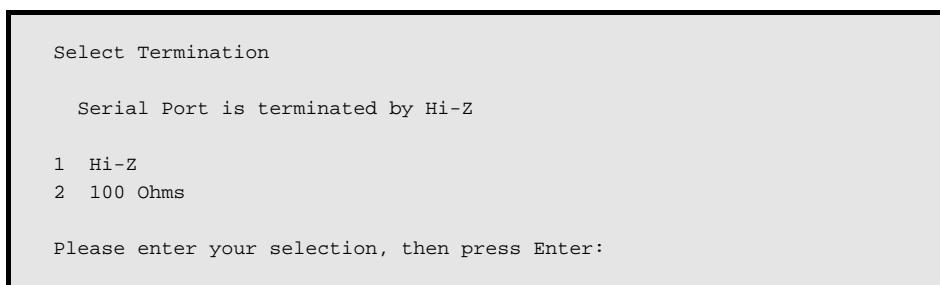
### Serial Port Configuration Option 4: Select Termination – RS-232 Interface

Type 4 at the prompt to view the Select Termination menu from the Serial Port Configuration Menu. When the RS-232 interface is selected, only the high impedance (Hi-Z) option is available.



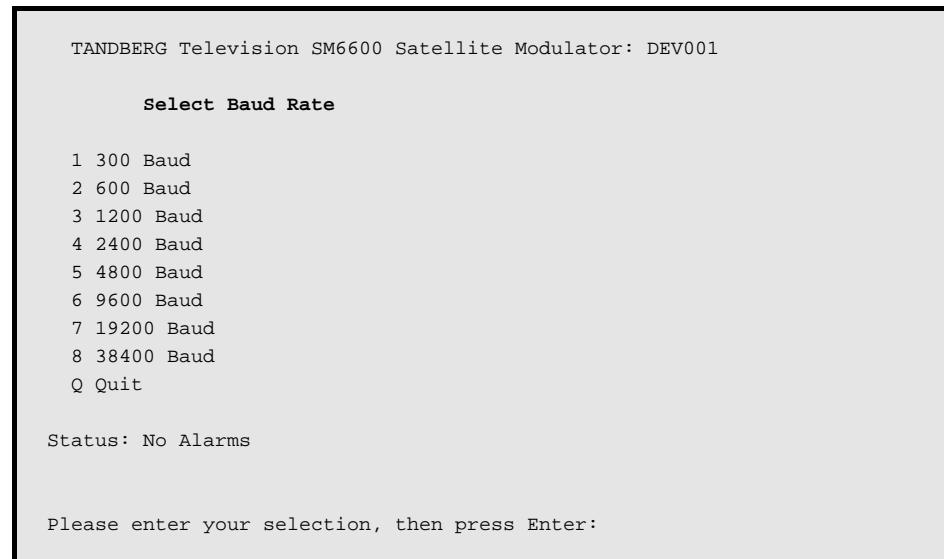
### Serial Port Configuration Option 4: Select Termination – RS-485 Interface

Type 4 at the prompt to view the Select Termination menu from the Serial Port Configuration Menu. Selecting **100 Ohms** switches in 100 Ω line termination resistors at the RS-485 line receiver inputs.



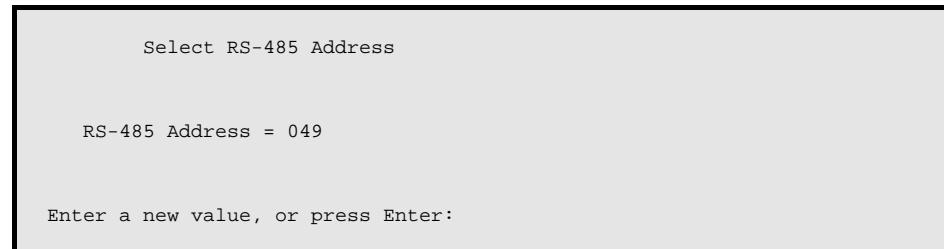
## Serial Port Configuration Option 5: Select Baud Rate

Type **5** at the prompt to view the Select Baud Rate menu from the Serial Port Configuration Menu. This option allows the speed of the RS-232/485 port to be set between 300 and 38400 Baud.



## Serial Port Configuration Option 6: Select RS-485 Address

Type **6** at the prompt to view the Select RS-485 Address menu from the Serial Port Configuration Menu. This option allows the RS-485 address to be configured. The address is used by the RS-485 Remote Control Protocol. See *Chapter 6, RS-485 Remote Control Protocol*.



## System Menu Option 5: Power-on Self Test Menu

### Power-on Self Test Menu

Type **5** at the prompt to view the Power-on Self Test Menu from the System Menu. This menu allows the self-test executed at power-on to be enabled or disabled.

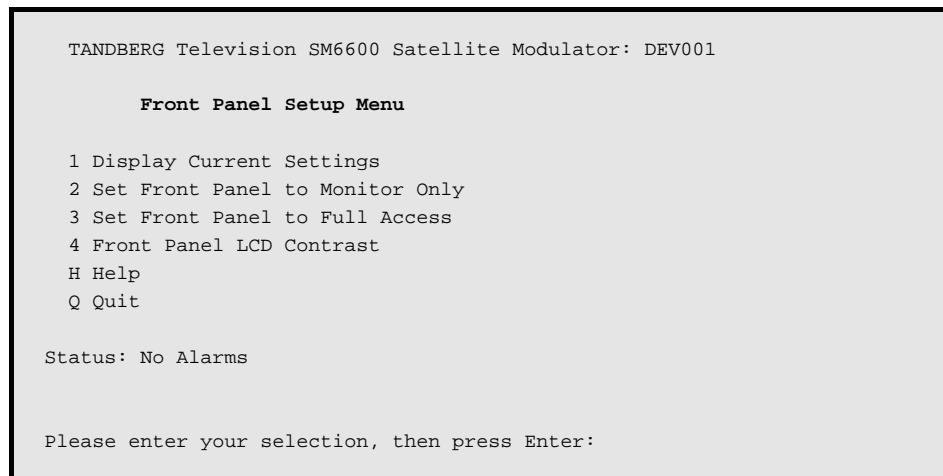


*Table 3.5: Power-on Self Test Menu Options*

Command	Messages	Description
1	Display Current Settings Power-on self test is ENABLED. Power-on self test is DISABLED.	This displays the current settings.
2	Enable / Disable Power on Self Test Do you want to ENABLE the power-on self test?(Y/N) Do you want to DISABLE the power-on self test?(Y/N)	Selecting this option toggles the execution of the power on self-test.

**System Menu Option 6: Front Panel Setup Menu**

Type **6** at the prompt to view the Front Panel Setup Menu from the System Menu. This menu defines the access available from the front panel and permits the LCD display contrast to be adjusted.

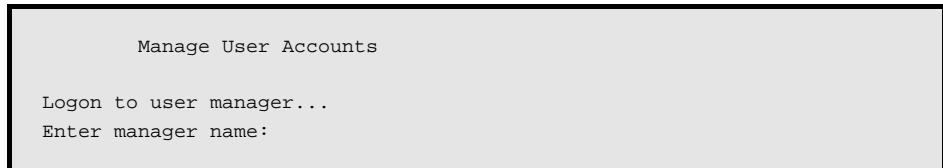
*Table 3.6: Front Panel Setup Menu Options*

Command	Options	Description	
1	Display Current Settings	This screen displays the current settings.	
2	Set Front Panel to Monitor Only	The front panel display is set to view only mode using this menu option. In this mode, all configuration information may be viewed, but no modifications to any settings are allowed.	
3	Set Front Panel to Full Access	The front panel display is set to full access mode using this menu option. In this mode, the Modulator may be fully controlled.	
4	Front Panel LCD Contrast	1	Contrast 1 (Min)
		2	Contrast 2
		3	Contrast 3
		4	Contrast 4
		5	Contrast 5 (Max)

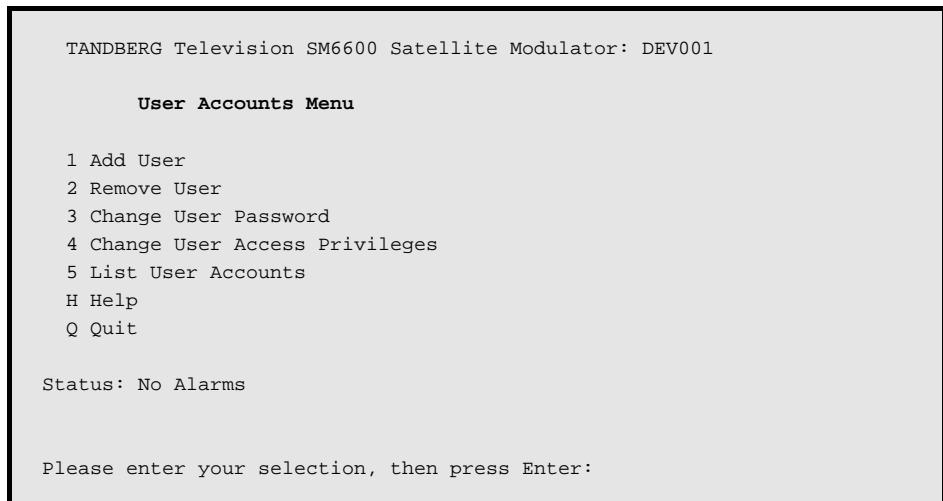
## System Menu Option 7: Manage User Accounts Menu

### Manage User Accounts Menu

To select the Manage User Accounts menu from the System Menu type **7** at the prompt. This menu allows user accounts to be created, modified or deleted. When the Manage User Accounts menu item is selected, the user must log on:



Access to the User Accounts Menu is only available to users with User Management privileges. Once logged on, the following menu is displayed:



*Table 3.7: User Accounts Menu Options*

Command	Options	Description
1 Add User	Enter new user name: Enter new user password: Re-enter password:	This option allows users to be added to the system. There is a maximum of 10 user accounts.
2 Remove User	Enter user name:	This option allows a user account to be removed.
3 Change User Password	Enter existing user name: Enter new password: Re-enter password:	This option allows the password of a user to be changed. Only a user manager can change passwords.
4 Change User Access Privileges		See <i>Figure 3.11</i> and <i>Figure 3.12</i>
5 List User Accounts		See <i>Figure 3.13</i>

### User Accounts Menu Option 4: Change User Access Privileges – New Account

This menu is shown for a new account. All possible privileges are shown as **Add** indicating that the user currently does not have them.

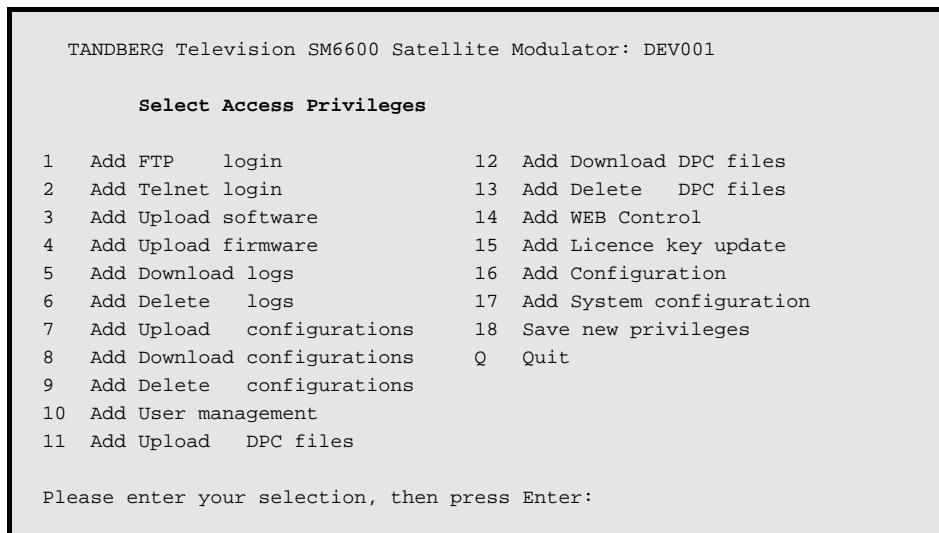


Figure 3.11: User Accounts Menu Option 4: Change User Access Privileges – New Account

### User Accounts Menu Option 4: Change User Access Privileges – Changing User Privileges

To add the right to login via Telnet, type **2**. This displays the screen shown in *Figure 3.12*.

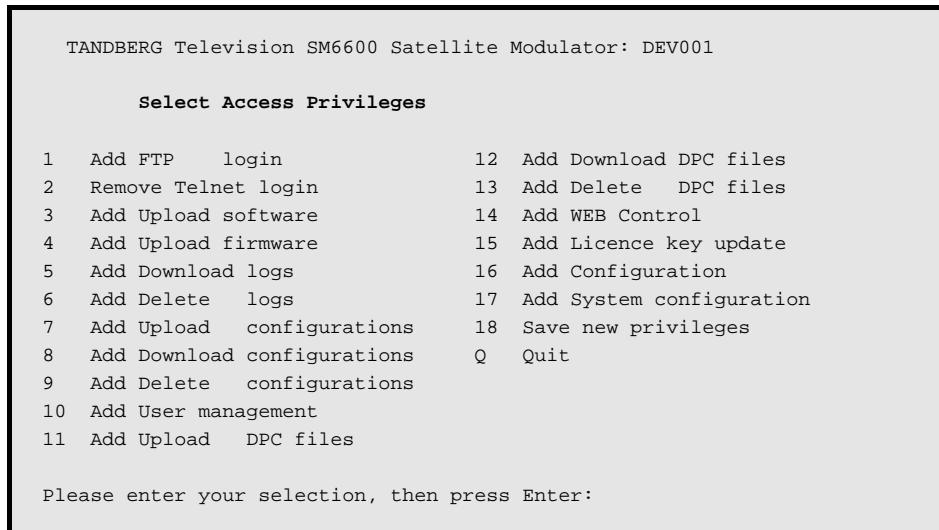


Figure 3.12: User Accounts Menu Option 4: Change User Access Privileges – Changing Privileges

The Telnet login is now listed as **Remove**, indicating that the privilege has been assigned. Repeat until all privileges that are required have been selected, then type **18** to save new privileges and update the account.

### User Accounts Option 5: List User Accounts

To select the List User Accounts screen from the User Accounts Menu, type **5** at the prompt. This screen, shown in *Figure 3.13*, displays the current accounts and their access privileges (described in *Table 3.8*).

```

List User Accounts

User number: 1
User name : root
Privileges :
    FTP      login
    Telnet   login
    Upload   software
    Upload   firmware
    Download logs
    Delete   logs
    Upload   configurations
    Download configurations
    Delete   configurations
    User management
    Upload   DPC files
    Download DPC files
    Delete   DPC files
    WEB Control
    Licence key update
    Configuration
    System configuration

Press Enter to continue

```

Figure 3.13: List User Accounts Display

There is always a **root** account. The root account has all access rights and has a default password of **root**. The password may be changed but the access rights cannot be altered. The root account cannot be deleted; however, if the password has been changed, attempting to delete the account will reset the password to the default.

Table 3.8: User Account Privileges

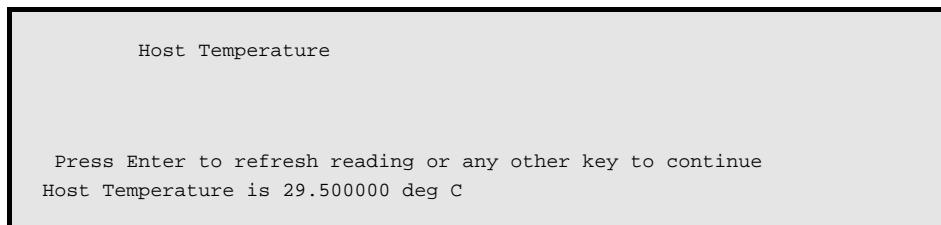
Privilege	Description
FTP login:	User can login via FTP
Telnet login:	User can login via Telnet
Upload software:	User can update the Modulator software (FTP access required)
Upload firmware:	User can update the Modulator firmware (FTP access required)
Download logs:	User can download Modulator log files (FTP access required)
Delete logs:	User can delete Modulator log files (FTP access required)
Upload configurations:	User can upload configuration files (FTP access required)
Download configurations:	User can download configuration files (FTP access required)
Delete configurations:	User can delete configuration files (FTP access required)
User management:	User can perform user management functions
Upload DPC files:	User can upload pre-corrector files (FTP access required)
Download DPC files:	User can download pre-corrector files (FTP access required)
Delete DPC files:	User can delete pre-corrector files (FTP access required)
WEB Control:	User can modify the configuration via the web interface
Licence key update:	User can update licence key files (FTP access required)
Configuration:	
System configuration:	

**NOTE...**

Information on FTP access is given in *Chapter 9, File Transfer Protocol (FTP)*.

## System Menu Option 8: Host Temperature

To select the Host Temperature option from the System Menu type **8** at the prompt. This displays the latest temperature value measured on the Host Controller Card (which takes up to ten seconds).



## System Menu Option 9: Factory Reset

To select the Factory Reset Menu from the System Menu type **9** at the prompt. It allows the user to reset system data.

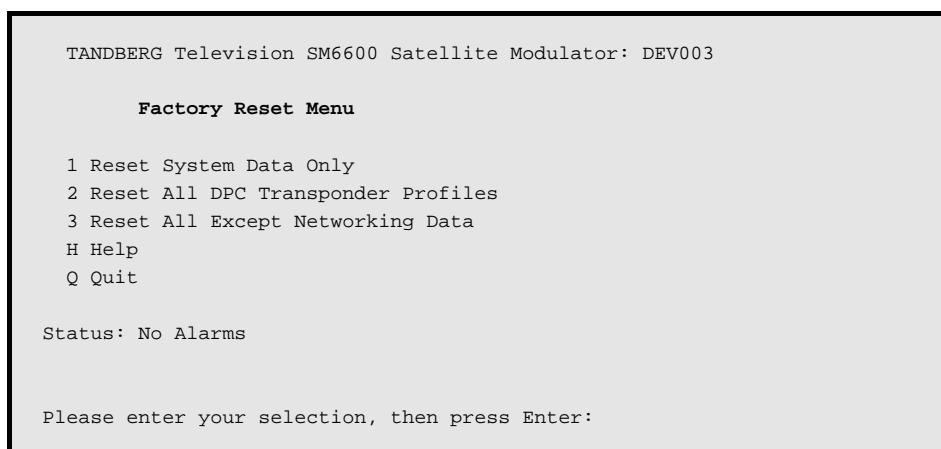


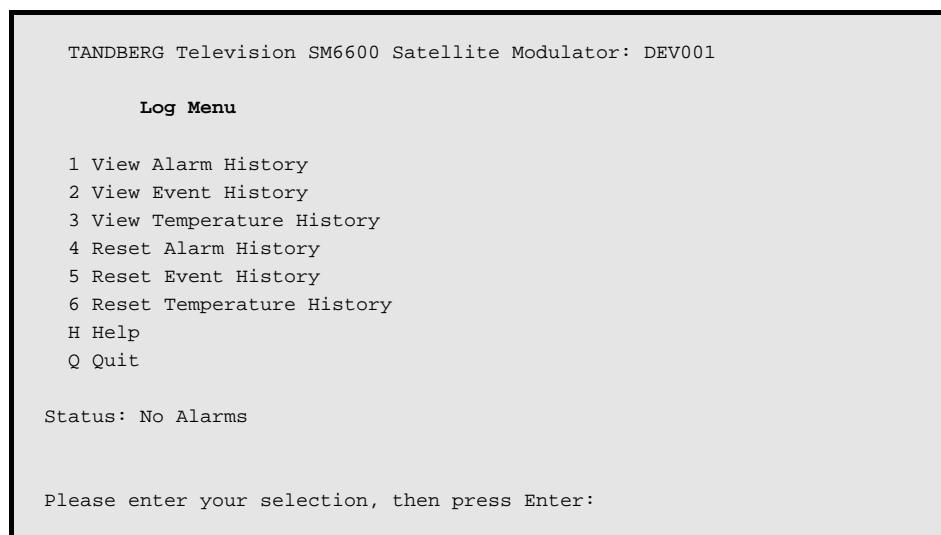
Table 3.9: System Menu Option 9: Factory Reset Menu Options

Command	Description
1    Reset System Data Only	This option restores all system configuration settings to their factory defaults but preserves all network settings and DPC transponder profiles (if applicable).
2    Reset All DPC Transponder Profiles	This option sets all DPC transponder profiles to Null-correction (applicable only to Modulator models SM6620 and SM6625).
3    Reset All Except Networking Data	This option restores all system configuration settings to their factory defaults, deletes all saved configurations and sets all DPC transponder profiles to Null-correction (applicable only to Modulator models SM6620 and SM6625). Network settings are preserved.

## 3.8 Main Menu Option 5: Log Menu

### 3.8.1 Log Menu Overview

Type **5** at the prompt to enter the Log Menu from the Main Menu. This menu allows the various Modulator logs to be viewed and reset.

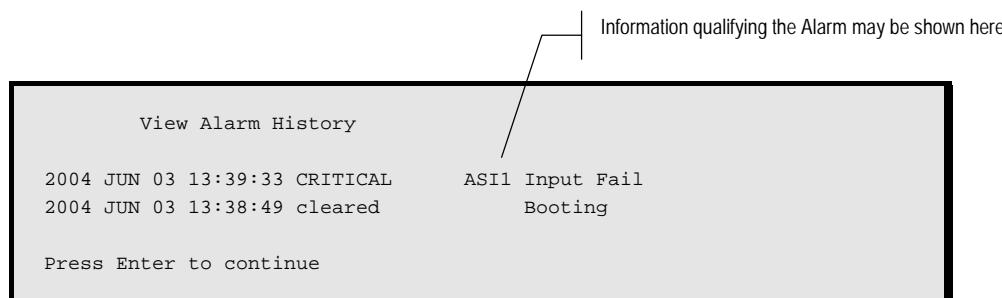


### 3.8.2 Log Menu Options

#### Log Menu Option 1: View Alarm History

The alarms log indicates irregularities in the input signals to the Modulator, or internal conditions of malfunction. It can help in fault diagnosis.

To select the View Alarm History screen from the Log Menu type **1** at the prompt. See *Chapter 8, Section 8.9, Alarm and Failure Reporting* for lists of possible Alarm Log entries.



#### Log Menu Option 2: View Event History

This event log shows a record of normal operating activity in the Modulator which may have a bearing on its current state.

To select the View Event History screen from the Log Menu type **2** at the prompt. See *Chapter 8, Section 8.10, Event Reporting* for a list of possible Event Log entries.

```
View Event History

2004 JUN 03 13:39:32 : New Configuration Saved
2004 JUN 03 13:38:46 : Telnet User Logged In
2004 JUN 03 13:38:37 : Modulator Restarted
2004 JUN 03 13:38:17 : Modulator Stopped
2004 JUN 03 13:38:17 : User Requests A Restart
2004 JUN 03 13:38:05 : Event Log Reset

Press Enter to continue
```

### Log Menu Option 3: View Temperature History

This log shows minimum and maximum recorded temperatures as well as the current temperature within the Modulator casing. It verifies the unit is not being subjected to undue environmental stress.

To select the View Temperature History screen from the Log Menu type 3 at the prompt. Displays the temperature log:

```
View Temperature History

Temperature min/max since 2004 JUN 03 13:38:02

Minimum temperature    29.0 deg C at 2004 JUN 03 13:39:32
Maximum temperature    29.5 deg C at 2004 JUN 03 13:38:02
Current temperature     29.0 deg C

Press Enter to continue
```

### Log Menu Option 4: Reset Alarm History

Resetting historical logs removes obsolete information that might otherwise become confusing. In the absence of explicit resets, the oldest recorded data will be overwritten once the allocated recording capacity has been filled.

To select the Reset Alarm History option from the Log Menu type 4 at the prompt. This clears the alarm log.

```
Reset Alarm History

Alarm history reset

Press Enter to continue
```

### Log Menu Option 5: Reset Event History

To select the Reset Event History option from the Log Menu type 5 at the prompt. This clears the event log.

```
Reset Event History

Event history reset

Press Enter to continue
```

## **Log Menu Option 6: Reset Temperature History**

To select the Reset Temperature History option from the Log Menu type **6** at the prompt. This option sets both recorded temperature extremes to the current temperature.

Reset Temperature History

Temperature log reset.

Press Enter to continue

## **Log Menu Option H: Help**

Type **H** at the prompt to view information about the options on the Log Menu.

## **Log Menu Option Q: Quit**

Type **Q** at the prompt to return to the Main Menu.

## 3.9 Main Menu Option 6: Test Menu

### 3.9.1 Test Menu

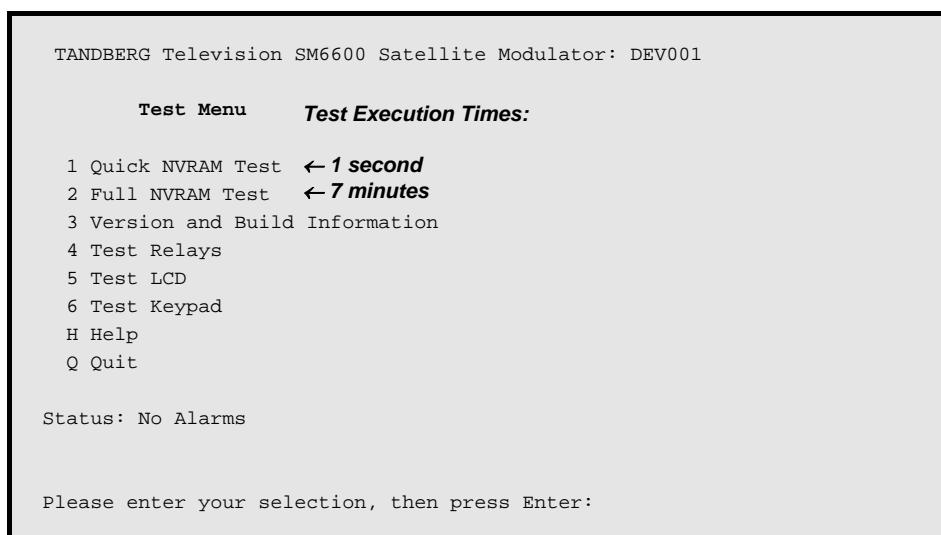
Type **6** at the prompt to enter the Test Menu from the Main Menu. The Test Menu allows access to test functions to verify the correct operation of the Modulator. If working properly it should pass all the tests.

#### CAUTION...

Some of the functions in the Test Menu cause the Modulator to lose its configuration. In this event a warning message is displayed and confirmation must be given to continue with the test.

#### NOTE...

If a test fails contact TANDBERG Television Customer Services for advice and assistance.

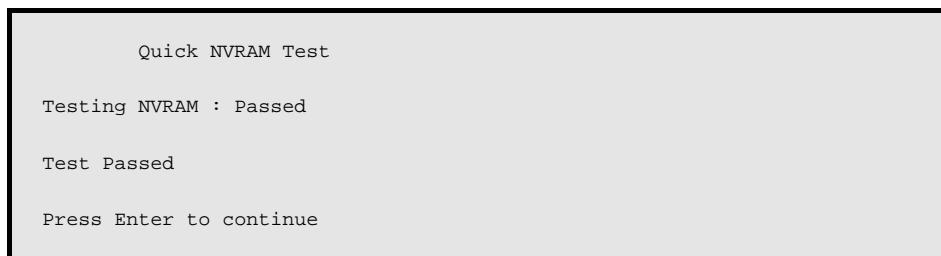


### 3.9.2 Test Menu Options

#### Test Menu Option 1: Quick NVRAM Test

This option subjects the Non-volatile Random Access Memory (NVRAM) to a simple data pattern retention test.

Type **1** at the prompt to select the Quick NVRAM Test option from the Test Menu. This quickly tests correct operation of the NVRAM in the Modulator.



#### Test Menu Option 2: Full NVRAM Test

This option is similar to the Quick NVRAM test but employs more extensive test patterns to detect more subtle address or data bus malfunctions.

Type **2** at the prompt to select the Full NVRAM Test option from the Test Menu. Each test comprises an extensive address bus test followed by a data bus test.

The address bus test performs a write-read action to all locations and cross-checks the contents of non-addressed locations. The data bus test performs a series of write-read actions to check the performance of each bit of every location. If the address bus test fails, the data bus test is not performed.

**NOTE...**

This test typically takes several minutes.

```

Full NVRAM Test

Testing battery backed RAM
Blanking RAM
Performing addressing tests
100% Done

Performing data bus tests
100% Done
Passed

Test Passed

Press Enter to continue

```

### **Test Menu Option 3: Version and Build Information**

Type **3** at the prompt to display the Version and Build Information screen from the Test Menu. This displays the current software and firmware versions as well as hardware revisions and serial numbers.

```

Identifying Name : DEV001
Unit Inventory Serial No. : 1
Unit Initialisation Date : MAY 16 2003 15:09:02
Last Boot Time : FEB 23 2006 16:20:58

Controller Card
PCB Revision : 3
Modification Status : 0
Serial No. : 000800116BD5
Firmware Version : 1.1
Boot Software Version : 01.00
Main Software Version : 04.00
Web Site Version : 01.00

Backplane
PCB Revision : 2
Modification Status : 0
Firmware Version : 1.0

Modulator Baseband Card
Card Type : S13129
PCB Revision : 1
Modification Status : 1
Serial No. : 000000000000
CPLD Firmware Version : 1.0
DSP Firmware Version : 3.1
Software Version : 3.0

Modulator IF Card
Card Type : S10310
PCB Revision : 3
Modification Status : 0
Serial No. : 000800114E24
Firmware Version : 1.1

```

```
SM66XX/SWO/HOM : Enabled  
SM66XX/SWO/HS  : Enabled
```

Press Enter to continue

### Test Menu Option 4: Test Relays

Type 4 at the prompt to select the Test Relays option from the Test Menu. This allows the correct operation of the Alarm and Fail relays to be tested. It also lights the front panel Alarm LED.

Test Relays

Relay test mode will exit automatically after 5 minutes of inactivity.

Both relays now set to OFF

Press Enter to continue

Alarm relay SET, Fail relay CLEAR.

Press Enter to continue

Alarm relay CLEAR, Fail relay SET.

Press Enter to continue

Both relays SET.

Press Enter to continue

Test complete.

Press Enter to continue

### Test Menu Option 5: Test LCD

Type 5 at the prompt to select the Test LCD menu from the Test Menu. This option allows the front panel display operation to be verified.

Test LCD

LCD should now be displaying:

0123456789012345678901234567890123456789  
abcdefghijklmnopqrstuvwxyz{}[]-+=!\$%&^\*(

Press Enter to continue

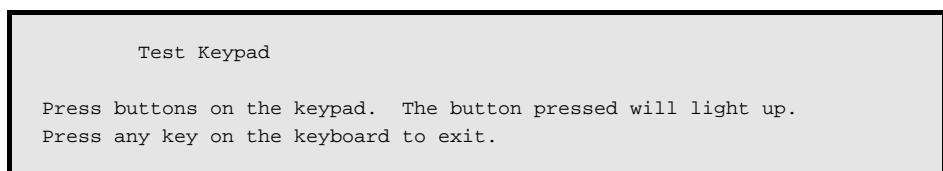
The LCD should now be blank.

Press Enter to continue

## Test Menu Option 6: Test Keypad

Type **6** at the prompt to select the Test Keypad menu from the Test Menu.

This option allows the front panel keypad to be verified. Once selected, the keys pressed on the front panel are displayed on the terminal and the associated key is illuminated.



## Test Menu Option H: Help

Type **H** at the prompt to view information about the options on the Test Menu.

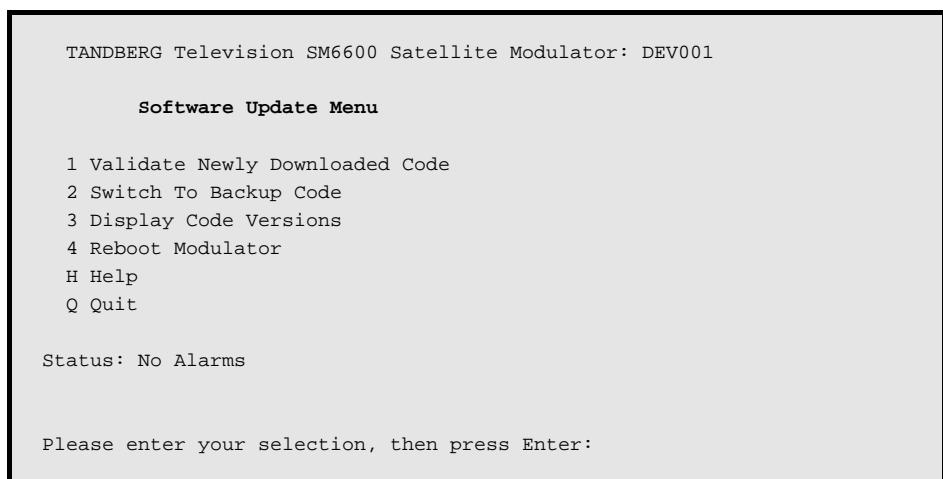
## Test Menu Option Q: Quit

Type **Q** at the prompt to return to the Main Menu.

## 3.10 Main Menu Option 7: Software Update Menu

### 3.10.1 Software Update Menu

Type **7** at the prompt to enter the Software Update Menu from the Main Menu. This menu provides options for the following:



### 3.10.2 Software Update Menu Options

#### Software Update Menu Option 1: Validate Newly Downloaded Code

This option marks the code as being valid. After a software download, the Modulator will pause for five seconds during boot before starting the main application code. This serves as a recovery strategy, allowing the user to prevent the code from running in the situation where invalid code has been downloaded. Selecting **Validate Newly Downloaded Code** will remove this pause.

```
Validate Newly Downloaded Code
```

```
Current version built Oct 31 2006, 12:37:19
```

```
Validating code...
Code validated OK.
```

```
Press Enter to continue
```

## Software Update Menu Option 2: Switch To Backup Code

When the main application software is updated, the previously installed version is retained as a backup copy. This option allows the user to revert to that earlier software version. Selecting this option will display the details of the previous version of code loaded into the Modulator:

```
Switch To Backup Code
```

```
Current Code Version.
Current Version Number : V04.00.00
TimeStamp : Oct 31 2006 12:37:32
```

```
Current Bank is 1
Switching to Bank 2
Backup code details:
Backup Version Number : V03.00.00
TimeStamp : Feb 23 2006 13:46:12
```

```
Are you sure you want to switch to this code?(Y/N):
```

If **Y** is typed, the backup code and the current code are switched over. The Modulator must be rebooted to start running the backup code.

## Software Update Menu Option 3: Display Code Versions

Type **3** at the prompt to display the version numbers and timestamps of the current main application code and backup code.

```
Display Code Versions
```

```
Current = Main App 1 (Active)
Current version built Oct 31 2006, 12:37:19
```

```
Selected Bank is 1
Selected Bank Version number : V04.00.00
TimeStamp : Oct 31 2006 12:37:32
```

```
Backup Bank is 2
Backup Version number : V03.00.00
TimeStamp : Feb 23 2006 13:46:12
```

```
Press Enter to continue
```

## Software Update Menu Option 4: Reboot Modulator

Select option **4** to reboot the Modulator. This is only needed after a code download or after switching to backup code. When selected, a confirmation prompt is displayed. If this operation is via the Telnet interface, an additional warning is displayed.

Reboot Modulator

Rebooting the modulator will terminate this network connection.

Are you sure you want to reboot the modulator?(Y/N):

### **3.11      Main Menu Option H: Help**

Type **H** at the prompt to select the **Help** option from the **Main Menu**.

### **3.12      Main Menu Option X: Exit Session**

Type **X** at the prompt to select the **Exit Session** option from the **Main Menu**. This option disconnects the user from the Modulator if connected via Telnet.

### **3.13      Main Menu Option X: Exit Session**

Type **X** at the prompt to select the **Exit Session** option from the **Main Menu**. This option disconnects the user from the Modulator if connected via Telnet.

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# Chapter 4

## Front Panel Control

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## 4.1 Front Panel Control

### 4.1.1 Introduction

**CAUTION...**

Only one logical control interface on the Modulator, i.e. Front Panel, Terminal, SNMP Remote Control, FTP, etc, should be used at any one time. Using more than one interface simultaneously may cause unexpected behaviour of the Modulator.

Partial control and monitoring of the Modulator is provided via the front panel's LCD screen and pushbuttons.

**NOTE...**

Certain functionality of the Modulator is dependent upon the specific Modulator model, the hardware options fitted and the software options installed in it. The options available in some front panel and terminal menus vary, dependent upon the functionality available and the setting of certain parameters.

### 4.1.2 Booting

**NOTE...**

If necessary, refer to *Chapter 2, Installation* for powering up and down procedures.

At switch-on the Modulator runs through a short boot sequence. The following boot display is shown briefly on the control panel before displaying the **Main Menu** screen.

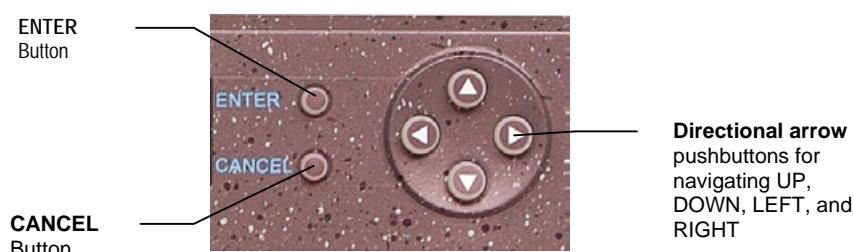
TANDBERG Satellite Modulator SM6600  
Television Software V04.00 Booting...

### 4.1.3 Navigating the Menus

#### Pushbuttons

There are six pushbuttons on the front panel which allow menus to be selected and commands or options chosen. The pushbuttons are shown in

*Figure 4.1. The pushbutton functions are described in Table 4.1.*



*Figure 4.1: Front Panel Pushbuttons*

Table 4.1: Front Panel Pushbutton Functions

Pushbutton	Description
● Enter	Main pushbutton for making selections.
● Cancel	Takes user back one menu; or out of Edit Mode, cancelling any changes made.
◀ ▶ ▲ ▼	Directional arrow pushbuttons for navigating Left, Right, Up and Down.

## Screen Symbols

The front panel display uses a number of symbols and conventions.

Figure 4.2 illustrates the use of arrows on the front panel display.

Table 4.2 describes the symbols and conventions used with the front panel display.

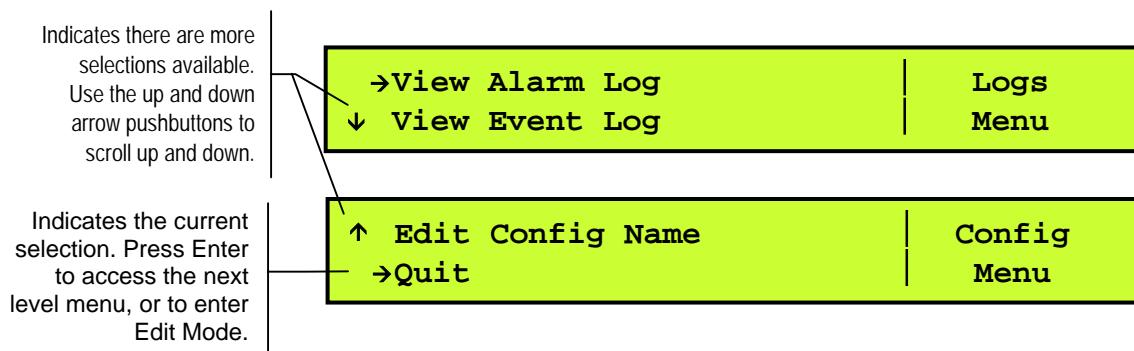


Figure 4.2: Front Panel LCD Symbols

Table 4.2: Front Panel LCD Symbols

Symbol	Description
↑	Indicates there are more menu selections above.
↓	Indicates there are more menu selections below.
→	Indicates current selection that can be edited or viewed. To change the selection, use the arrow pushbuttons to scroll up and down.
—	Dash indicates current selection (viewing only).
[ ]	Data can be edited when enclosed in brackets. Either toggle (e.g. Enabled/Disabled) by pressing any arrow pushbutton, or individually make changes to a character when it is underlined.
[ _ ]	An underlined digit can be edited. Use the up and down arrow pushbuttons to scroll through the characters; use the left and right arrow pushbuttons to move to the next digit.

## 4.2 User Interface Modes

### 4.2.1 Types of Interface Mode

There are two user interface modes as follows:

- Monitor Only mode
- Full Access mode

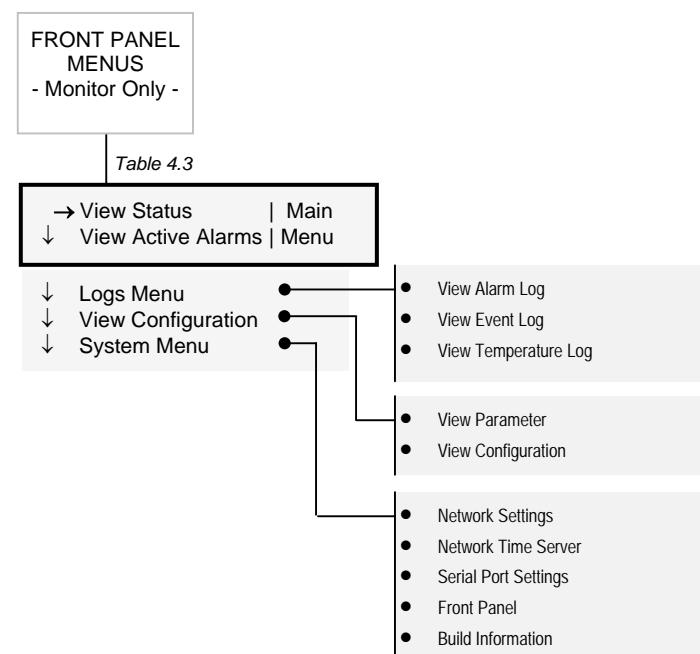
To change the user mode refer to the **Front Panel Setup Menu**. This is found in Section 3.7 as option 6 of the System Menu in *Chapter 3, Operating the Equipment Locally*.

## 4.2.2 Monitor Only Mode

All configuration and log information can be viewed but the user cannot edit or clear logs, and cannot save or load configurations. In **Monitor Only** mode the **Main Menu** is as follows:



Scroll down to access the remainder of the top-level options as shown in *Table 4.3*.



*Figure 4.3: Monitor Only Menus*

*Table 4.3: Monitor Only Menu Options*

Top Level	Sub-level	Description
<b>View Status</b>		Displays the current status and temperature, and current date and time.
<b>View Active Alarms</b>		Gives a snapshot of present alarms when Enter is pressed.
<b>Logs Menu</b>	View Alarm Log	History of alarms, e.g.: Input stream errors.
	View Event Log	History of events, e.g.: When Modulator was restarted, When new configuration was saved.
	View Temperature Log	History of temperatures, e.g.: Minimum, maximum, current.
<b>View Configuration</b>	View Parameter	Allows viewing of the current parameters individually.
	View Configuration	Allows viewing of the configuration settings for configurations 0 – 9.

Top Level	Sub-level	Description
System Menu	Network Settings	Allows viewing of the IP Address, Gateway IP Address, Subnet Mask, Gateway Enable State and SNMP Mode.
	Network Time Server	Allows viewing of the IP Address, Time Protocol and enable state of the Network Time Server.
	Serial Port Settings	Allows viewing of the Port Mode, Interface, Flow Control and Baud Rate.
	Front Panel	Allows viewing of the Keypad Beep Setting (ON/OFF), Date Format and LCD Contrast.
	Build Information	Displays information relating to the unit. This includes card, revision and modification details. The main software version is also displayed under this option.

### 4.2.3 Full Access Mode

In this mode the Modulator can be fully controlled giving the user full access with editing and viewing capabilities for all accessible menus. In **Full Access** mode the **Main Menu** is as shown in *Figure 4.4*.

**NOTE...**

In Full Access mode, the Change Parameter and Change Configuration options may be accessed via the front panel even if the unit is in remote control. Confirmation of the action is required before a change can be made.

Information on using the front panel to change parameters and configurations is given in Sections 4.2.4 to 4.2.7.

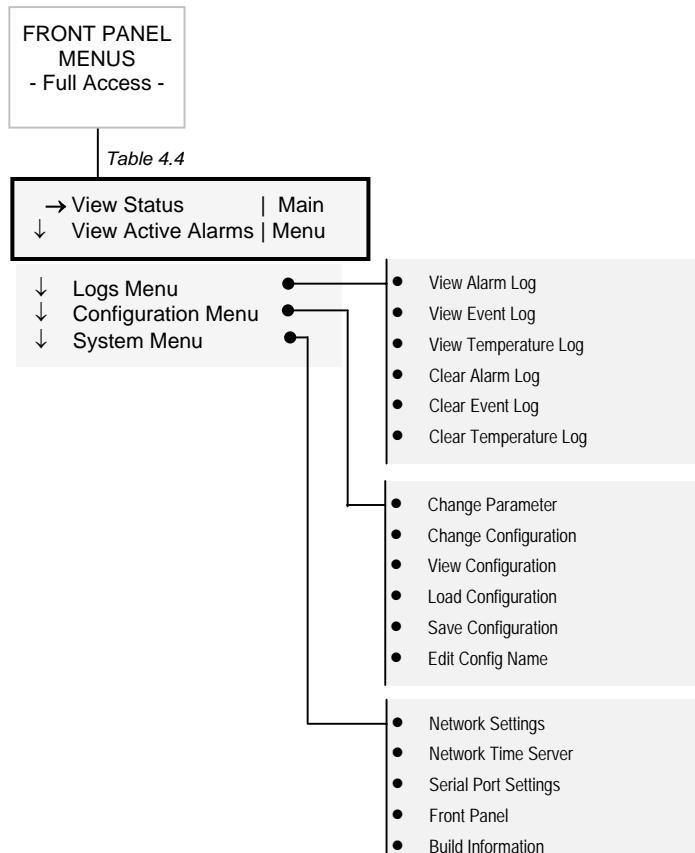


Figure 4.4: Full Access Menus

Table 4.4: Full Access Menu Options

Top Level	Sub-level	Description
<b>View Status</b>		Displays the current status and temperature, and current date and time.
<b>View Active Alarms</b>		Gives a snapshot of present alarms when Enter is pressed.
<b>Logs Menu</b>	View Alarm Log	History of alarms, e.g.: Input stream errors.
	View Event Log	History of events, e.g.: When Modulator was restarted, When new configuration was saved.
	View Temperature Log	History of temperatures, e.g.: Minimum, maximum, current.
	Clear Alarm Log	}
	Clear Event Log	} Clears respective log history.
	Clear Temperature Log	}
<b>Configuration Menu</b>	Change Parameter	Allows changes to the current parameters individually:  Data Select: ASI1, ASI2, Null Pkts, PRBS (+ ASI3, ASI4, SPI with DVB ASI & SPI Input Card option)  Packet Size: Unframed, 188 bytes, 204 bytes  Rate Adapt: OFF, ON  Bit Rate: 1 – 84 Mbit/s (variable limits, dependent upon selected Packet Size, Modulation, FEC Rate and other parameters)  Symbol Rate: 1 – 48 Msymbol/s (0.2 – 66 Msymbol/s with Extended Symbol Rate option)  Standard: DVB-S/DSNG (+ DVB-S2 with S2 software option)  Modulation: BPSK, QPSK, 8PSK, 16QAM, 16APSK, 32APSK (available values dependent upon software options installed and selected Standard)  FEC Rate: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 7/8, 8/9, 9/10 (available values dependent upon selected Standard, Modulation and Frame Size)  Frame Size: Normal, Short (available only when Standard is set to DVB-S2)  Pilots: OFF, ON (available only when Standard is set to DVB-S2)  Map Mode: Peak power, Mean power (available only when Standard is set to DVB-S2)  Gold Seq N: 0 – 262141 (available only when Standard is set to DVB-S2)  Roll-off: 20%, 25%, 30%, 35%  IF Frequency: 50 – 180 MHz for models SM6610 and SM6620; 950 – 1750 MHz for models SM6615 and SM6625  Uplink Freq: 10.070000 GHz (value related to IF Frequency, dependent upon UpConv Freq and IF Spectrum – see note below)  IF Power: -20 to 5 dBm  IF Output: OFF, ON  Mod. State: OFF, ON  IF Spectrum: Normal, Inverted  IF Tilt: -0.04 dB/MHz to 0.04 dB/MHz  UpConv Freq: 0.000000 – 100.000000 GHz  UpConv Pwr: OFF, ON (available only on models SM6615 and SM6625)

Top Level	Sub-level	Description
	UpConv Ref: OFF, ON (available only on models SM6615 and SM6625) =PREKOR Menu= (available only on models SM6620 and SM6625 with the PREKOR software option)	
Change Configuration	Allows changes to the current configuration settings as a block of changes:  Data Select: ASI1, ASI2, Null Pkts, PRBS (+ ASI3, ASI4, SPI with DVB ASI & SPI Input Card option)  Packet Size: Unframed, 188 bytes, 204 bytes  Rate Adapt: OFF, ON  Bit Rate: 1 – 84 Mbit/s (variable limits, dependent upon selected Packet Size, Modulation, FEC Rate and other parameters)  Symbol Rate: 1 – 48 Msymbol/s (0.2 – 66 Msymbol/s with Extended Symbol Rate option)  Standard: DVB-S/DSNG (+ DVB-S2 with S2 software option)  Modulation: BPSK, QPSK, 8PSK, 16QAM, 16APSK, 32APSK (available values dependent upon software options installed and selected Standard)  FEC Rate: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 7/8, 8/9, 9/10 (available values dependent upon selected Standard, Modulation and Frame Size)  Frame Size: Normal, Short (available only when Standard is set to DVB-S2)  Pilots: OFF, ON (available only when Standard is set to DVB-S2)  Map Mode: Peak power, Mean power (available only when Standard is set to DVB-S2)  Gold Seq N: 0 – 262141 (available only when Standard is set to DVB-S2)  Roll-off: 20%, 25%, 30%, 35%  IF Frequency: 50 – 180 MHz for models SM6610 and SM6620; 950 – 1750 MHz for models SM6615 and SM6625  Uplink Freq: 10.070000 GHz (value related to IF Frequency, dependent upon UpConv Freq and IF Spectrum – see note below)  IF Power: –20 to 5 dBm  IF Output: OFF, ON  Mod. State: OFF, ON  IF Spectrum: Normal, Inverted  IF Tilt: –0.04 dB/MHz to 0.04 dB/MHz  UpConv Freq: 0.000000 – 100.000000 GHz  UpConv Pwr: OFF, ON (available only on models SM6615 and SM6625)  UpConv Ref: OFF, ON (available only on models SM6615 and SM6625)  DPC State: OFF, ON (available only on models SM6620 and SM6625 with the PREKOR software option)  UFC Mode: Manual, Automatic (available only on models SM6620 and SM6625 with the PREKOR software option)	
View Configuration	Allows viewing of the configuration settings for configurations 0 - 9.	
Load Configuration	Allows the loading of any previously stored configurations.	
Save Configuration	Allows current configurations to be stored in Flash memory.	
Edit Config Name	Allows the configuration names to be edited.	

Top Level	Sub-level	Description
System Menu	Network Settings	Allows configuration of the IP Address, Gateway IP Address, Subnet Mask, Gateway Enable State and SNMP Mode.
	Network Time Server	Allows configuration of the IP Address, Time Protocol and enable state of the Network Time Server.
	Serial Port Settings	Allows setting of the Port Mode, Interface, Flow Control and Baud Rate.
	Front Panel	Allows setting of the Keypad Beep (ON/OFF), Date Format and LCD Contrast.
	Build Information	Displays information relating to the unit. This includes card, revision and modification details. The main software version is also displayed under this option.

**NOTE...**

The user may enter a value for either IF Frequency or Uplink Freq. The two parameters are interrelated by either one or other of the following equations, dependent upon the setting of IF Spectrum:

$$\text{Uplink Freq} = \text{UpConv Freq} + \text{IF Frequency} \quad (\text{IF Spectrum Normal})$$

$$\text{Uplink Freq} = \text{UpConv Freq} - \text{IF Frequency} \quad (\text{IF Spectrum Inverted})$$

#### 4.2.4 Edit Mode

Press **Enter** to expand a selected submenu and to permit a value to be changed. Press **Cancel** to deselect the edited parameter or close the current submenu.

In edit mode, data can be edited when enclosed in brackets. Either toggle to make a change (e.g. Enabled/Disabled or On/Off) by pressing any arrow pushbutton; or individually make changes to a character when it is underlined.

Use the up and down arrow pushbuttons to scroll through the characters; use the left and right arrow pushbuttons to move to the next digit  
(for example: **[70 . 000] MHz**).

Press **Enter** to save changes.

#### 4.2.5 Change Parameter

The Change Parameter menu permits each parameter change to be executed independently and immediately in the current configuration.

#### 4.2.6 Change Configuration

To change the configuration, a pending configuration is created by selectively modifying various parameters as required.

When all changes have been made, select **Quit**. The following will be displayed:

<b>→No      Reconfigure the</b> <b>Yes      modulator now?</b>	
---	--

Select **Yes** to make the pending configuration become the current configuration.

Select **No** to discard all changes.

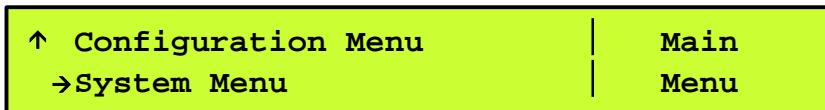
All of the parameter changes in the configuration are executed together. A final display will show the configuration has been copied and the values have been changed.

#### 4.2.7 Example: Setting the IP Address from the Front Panel

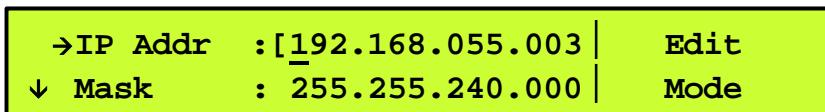
To set the IP address (and other networking parameters) from the front panel, perform the following:

1. Select the **System Menu** from the **Main Menu**.

If the Main Menu is not the current display, press the **Cancel** button until **Main Menu** is displayed on the right of the screen. The system menu is the fifth item in the main menu; press the down arrow until it is selected:



2. Enter the **System Menu** by pressing **Enter**.
3. Select the **Network Settings** menu which is the first item in the system menu. Press **Enter** to enter the menu.
4. The IP Address, Subnet Mask, Gateway IP Address and Gateway Enable State can now be edited. To change an item, select it using the up and down keys, then press **Enter** on the item you wish to change. The current digit being edited is underlined in the following IP Address:



5. Press the up and down arrow keys to cycle through the characters. Use the left and right keys to navigate along the address. When finished, press **Enter** to confirm the change. To cancel the change, press **Cancel**.

**NOTE...**

Erroneous address settings cannot be saved.

## 4.3 Configuration Options

*Table 4.5* lists the options available.

*Table 4.5: Configuration Options*

Configuration Setting	Options
Data Select	ASI 1, ASI 2, Null Pkts, PRBS (+ ASI 3, ASI 4, SPI with DVB ASI & SPI Input Card option)
Packet Size	Unframed, 188 bytes, 204 bytes
Rate Adapt	OFF, ON
Bit Rate	xxx.xxxxxx Mbit/s
Symbol Rate	xx.xxxxxx Msym/s
Standard	DVB-S/DSNG, DVB-S2
Modulation	BPSK, QPSK, 8PSK, 16QAM, 16APSK, 32APSK
FEC Rate	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 7/8, 8/9, 9/10
Frame Size	Normal, Short
Pilots	OFF, ON
Map Mode	Peak power, Mean power
Gold Seq N	xxxxxx
Roll-off	20%, 25%, 30%, 35%
IF Frequency	xxxx.xxx MHz
Uplink Freq	xxx.xxxxxx GHz
IF Power	xx.x dBm
IF Output	OFF, ON
Mod. State	OFF, ON
IF Spectrum	Normal, Inverted
IF Tilt	x.xxx dB/MHz
UpConv Freq	xxx.xxxxxx GHz
UpConv Pwr	OFF, ON (available only on models SM6615 and SM6625)
UpConv Ref	OFF, ON (available only on models SM6615 and SM6625)
DPC State	OFF, ON (available only on models SM6620 and SM6625 with the PREKOR software option)
UFC Mode	Manual, Automatic (available only on models SM6620 and SM6625 with the PREKOR software option)

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# Chapter 5

## RS-232 Remote Control Protocol

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## 5.1 Introduction

### 5.1.1 Read This First!

This chapter covers the RS-232 Remote Control Protocol only. For RS-485, see *Chapter 6*.

**NOTE...**

The rear panel RS-232/485 connector is compatible with either RS-232 or RS-485, depending upon the mode selected on the Modulator. (See *Section 3.7 System Menu, Option 4, Serial Port Configuration*.)

### 5.1.2 Interface Requirements

#### General

**CAUTION...**

Only one logical control interface on the Modulator, i.e. Front Panel, Terminal, SNMP Remote Control, FTP, etc, should be used at any one time. Using more than one interface simultaneously may cause unexpected behaviour of the Modulator.

**NOTE...**

This chapter covers Version 4 of the Remote Control Protocol.

The Modulator is able to accept the remote control messages defined in this Chapter either via RS-232 or Ethernet.

#### RS-232

The rear panel connector is designated **RS-232/485**. This is configured to run between 300 and 38400 baud (see *Section 3.7 System Menu, Option 4, Serial Port Configuration*).

Before the Modulator will accept commands via the RS-232/485 port using the RS-232 remote control protocol, the **Port Mode** must first be set to **Remote** and the **Interface** must be set to **RS-232**. See *Chapter 3, Section 3.7.2* for details of how to perform this.

#### Ethernet

The Modulator listens on port 999 for remote control messages. Only one connection of this type is allowable at any one time. The Modulator also supports SNMP remote control via the Ethernet ports. See ST.TS.SNMP.E10152 for details.

### 5.1.3 Communications Protocol

#### Type - Length - Value (TLV) system

The protocol is based on the type - length - value (TLV) system. This TLV is wrapped with a start identifier, a total length and a checksum. This system does allow for multiple TLV sections to be included within one message, but this is not supported by the Modulator; only one TLV may be present in one message.

#### Message Definition

The Modulator replies to every message received. In all cases except for an error, the type of the reply message is the same as the received message.

*Table 5.1: Message Syntax*

<b>Start</b>	** for messages to the Modulator, \$\$ for message from the Modulator
<b>message length</b>	The total length of the message starting from the type up to and including the checksum
<b>type</b>	The type of the message - detailed in the following sections
<b>length</b>	The length of the value
<b>value</b>	The data
<b>checksum</b>	The checksum. Calculated by adding the bytes from type to the end of value, ignoring carry, expressed as 8-bits.

## Example Message

*Table 5.2* shows an example of a Message sent to the Modulator.

*Table 5.2: Example Message*

Byte	Value	Description
1	0x2A	**
2	0x2A	**
3	0x05	The total length of the TLV section + checksum
4	0x01	The type of the message
5	0x02	The size of the value section
6	0xFE	First byte of value
7	0x12	Second byte of value
8	0x13	The checksum

The example shown in *Table 5.2* sends a message to the Modulator of type 1 containing two bytes 254 and 18.

## Byte Ordering

Where multiple byte values are sent, they must be ordered with the most significant byte first.

## Message Extensions

To allow for enhancements, the receiver of the message from the Modulator must not assume the location of the checksum, but should calculate its location from the message length field. Doing this will allow for the message to grow in size and still be received. If additional data is added to a message it will be added at the end, thus allowing software written for an earlier version of the message to still function.

## Resetting the Link

Once the start sequence has been received by the Modulator it will continue to receive data until it has a complete message. To ensure that the Modulator is ready to receive a new message, sending a series of 255 space characters (0x20) will reset the internal buffers. This, however, should not be required unless there has been some previous communications problem. In doing this, the Modulator may send an error indicating that the message is too long.

## 5.2 Messages to the Modulator

### 5.2.1 Functionality Constraints

Certain functionality of the Modulator is dependent upon the specific Modulator model, the hardware options fitted and the software options installed in it. The validity of some parameter values in configuration messages to the Modulator is dependent upon the functionality available. Parameter values are validated by the Modulator and accepted or rejected as appropriate. For example, 16QAM modulation is only available if the Higher Order Modulation (HOM) software option is installed.

### 5.2.2 Activate Configuration

Sending this message activates a stored configuration in the Modulator. Configurations 1-8 are user-stored configurations, but Configuration 9 is the configuration of default values for Modulator parameters. These default values are built into the application code.

*Table 5.3: Activate Configuration Parameters*

Type	0x71		
Length	1	Size	
Value	Configuration Number 1 - 9		1

### 5.2.3 Upload Configuration

Sending this message retrieves the specified configuration from the Modulator. Configuration 0 is the current configuration.

*Table 5.4: Upload Configuration*

Type	0x73		
Length	1	Size	
Value	Configuration Number 0 - 9		1

### 5.2.4 Upload Current Configuration

Sending this message retrieves the current configuration from the Modulator.

*Table 5.5: Upload Current Configuration*

Type	0x74		
Length	0		

### 5.2.5 Download Configuration

This message downloads and activates (so becoming the current configuration) a configuration to the Modulator. The configuration structure can be upgraded by defining a new protocol version number and adding the extra fields required at the end of the message.

Table 5.6: Download Configuration

Type	0x70	
Length	Depends on protocol version	Size
Value	Protocol Version  (See <i>Section 5.8 Protocol Version</i> )	1
Input Select	0x00 - SPI 0x01 - ASI 1 0x02 - Reserved 0x03 - ASI 2 0x04 - ASI 3 0x05 - ASI 4 0x10 - Test packets (Null) 0x11 - Test packets (PRBS)	1
Reserved	Set to 0x00	1
Packet Size	0x00 - 204 byte 0x01 - 188 byte 0x02 - Unframed	1
Reserved	Set to 0x00	1
Bit-rate	Byte 1: Bit-rate bits (31..24) Byte 2: Bit-rate bits (23..16) Byte 3: Bit-rate bits (15..8) Byte 4: Bit-rate bits (7..0) e.g. 155 Mbit/s = 0x093D1CC0	4
Symbol rate	Byte 1: Symbol rate bits (31..24) Byte 2: Symbol rate bits (23..16) Byte 3: Symbol rate bits (15..8) Byte 4: Symbol rate bits (7..0) e.g. 30 Msymbol/s = 0x01C9C380	4
FEC rate	0x00 - Reserved 0x01 - Reserved 0x02 - Reserved 0x03 - 1/2 0x04 - 2/3 0x05 - 3/4 0x06 - 5/6 0x07 - 7/8 0x08 - 8/9 0x09 - 9/10 0x0A - 1/4 0x0B - 1/3 0x0C - 2/5 0x0D - 3/5 0x0E - 4/5	1
Standard	0x00 - Reserved 0x01 - DVB-S/DSNG 0x02 - DVB-S2	1

Modulation format	0x00 - QPSK 0x01 - BPSK 0x02 - 8PSK 0x03 - 16QAM 0x04 - 16APSK 0x05 - 32APSK	1
Spectrum sense	0x00 - Normal 0x01 - Inverted	1
Spectrum roll-off factor (Alpha)	0x00 - Reserved 0x01 - Reserved 0x02 - 20% 0x03 - 25% 0x04 - 30% 0x05 - 35%	1
Modulation On/Off	0x00 - Off 0x01 - On	1
Reserved	Set to 0x0000	2
Reserved	Set to 0x00	1
IF Power	Byte 1: IF Power bits (15..8) Set IF power in 0.1 dB steps	2
	Byte 2: IF Power bits (7..0) Value as signed 16-bit integer. e.g.: 0x000A = 1.0 dBm, 0xFFFF = -0.1 dBm	
IF Frequency	Byte 1: Frequency bits (23..16) Set IF frequency in 1 kHz units	3
	Byte 2: Frequency bits (15..8)	
	Byte 3: Frequency bits (7..0)	
	e.g.: 70 MHz = 0x11170	
General Control	Bit      0      1      1	
S/W reset initiates a Modulator reset	0 - S/W reset      Normal      Enabled	
	1..7 - Reserved      Set to 0	
Reserved	Set to 0x09C4	2
Reserved	Set to 0x02	1
Reserved	Set to 0x00	1
IF Carrier Control	0x01 - IF Carrier Off 0x02 - IF Carrier On	1
Rate Adaptation Control	0x00 - Off 0x01 - On	1
Frame Size	0x00 - Normal	1
Applicable to DVB-S2 only	0x01 - Short	
Pilot Insertion	0x00 - Off	1
Applicable to DVB-S2 only	0x01 - On	
Map Mode	0x00 - Peak power	1
Applicable to DVB-S2 only	0x01 - Mean power	

Scrambling Code (Gold Sequence) Number Applicable to DVB-S2 only	Byte 1: Scrambling Code bits (23..16) Byte 2: Scrambling Code bits (15..8) Byte 3: Scrambling Code bits (7..0) Value as unsigned integer, range 0-262,141.	3
IF Tilt	IF tilt (slope) in units of 0.001 dB/MHz. Value as 8-bit signed integer, range -40 to 40.	1

## 5.2.6 Save Configuration

This message downloads a configuration to the Modulator to one of the save locations 1 - 8. The configuration structure can be upgraded by defining a new protocol version number and adding the extra fields required at the end of the message. The format of the configuration items of this message however should match those of the Download Configuration message.

Table 5.7: Save Configuration

Type	0x81	
Length	Depends on protocol version	Size
Value	Configuration Number Configuration name Protocol Version	1 Max 20 characters 0x00 - 0xFF (See <i>Section 5.8 Protocol Version</i> )
Input Select	0x00 - SPI 0x01 - ASI 1 0x02 - Reserved 0x03 - ASI 2 0x04 - ASI 3 0x05 - ASI 4 0x10 - Test packets (Null) 0x11 - Test packets (PRBS)	1
Reserved	Set to 0x00	1
Packet Size	0x00 - 204 byte 0x01 - 188 byte 0x02 - Unframed	1
Reserved	Set to 0x00	1
Bit-rate	Byte 1: Bit-rate bits (31..24) Set interface bit-rate, 1 bit/s increments. This value is only used if Symbol rate is set to 0xFFFFFFFF. Byte 2: Bit-rate bits (23..16) Byte 3: Bit-rate bits (15..8) Byte 4: Bit-rate bits (7..0) e.g. 155 Mbit/s = 0x093D1CC0	4
Symbol rate	Byte 1: Symbol rate bits (31..24) Set symbol rate, 1 symbol/s increments. This value is used by default unless set to 0xFFFFFFFF in which case bit-rate will be used. Byte 2: Symbol rate bits (23..16) Byte 3: Symbol rate bits (15..8) Byte 4: Symbol rate bits (7..0) e.g. 30 Msymbol/s = 0x01C9C380	4

FEC rate	0x00 - Reserved 0x01 - Reserved 0x02 - Reserved 0x03 - 1/2 0x04 - 2/3 0x05 - 3/4 0x06 - 5/6 0x07 - 7/8 0x08 - 8/9 0x09 - 9/10 0x0A - 1/4 0x0B - 1/3 0x0C - 2/5 0x0D - 3/5 0x0E - 4/5	1
Standard	0x00 - Reserved 0x01 - DVB-S/DSNG 0x02 - DVB-S2	1
Modulation format	0x00 - QPSK 0x01 - BPSK 0x02 - 8PSK 0x03 - 16QAM 0x04 - 16APSK 0x05 - 32APSK	1
Spectrum sense	0x00 - Normal 0x01 - Inverted	1
Spectrum roll-off factor (Alpha)	0x00 - Reserved 0x01 - Reserved 0x02 - 20% 0x03 - 25% 0x04 - 30% 0x05 - 35%	1
Modulation On/Off	0x00 - Off 0x01 - On	1
Reserved	Set to 0x0000	2
Reserved	Set to 0x00	1
IF Power	Byte 1: IF Power bits (15..8) Byte 2: IF Power bits (7..0) Value as signed 16-bit integer. e.g.: 0x000A = 1.0 dBm, 0xFFFF = -0.1 dBm	2
IF Frequency	Byte 1: Frequency bits (23..16) Byte 2: Frequency bits (15..8) Byte 3: Frequency bits (7..0) e.g.: 70 MHz = 0x11170	3
Set IF frequency in units of 1 kHz		

General Control	Bit	0	1	1
S/W reset initiates a Modulator reset	0 - S/W reset	Normal	Enabled	
	1..7 - Reserved	Set to 0		
Reserved	Set to 0x09C4			2
Reserved	Set to 0x02			1
Reserved	Set to 0x00			1
IF Carrier Control	0x01 - IF Carrier Off			1
	0x02 - IF Carrier On			
Rate Adaptation Control	0x00 - Off			1
	0x01 - On			
Frame Size	0x00 - Normal			1
Applicable to DVB-S2 only	0x01 - Short			
Pilot Insertion	0x00 - Off			1
Applicable to DVB-S2 only	0x01 - On			
Map Mode	0x00 - Peak power			1
Applicable to DVB-S2 only	0x01 - Mean power			
Scrambling Code (Gold Sequence) Number	Byte 1: Scrambling Code bits (23..16)			3
Applicable to DVB-S2 only	Byte 2: Scrambling Code bits (15..8)			
	Byte 3: Scrambling Code bits (7..0)			
	Value as unsigned integer, range 0-262,141.			
IF Tilt	IF tilt (slope) in units of 0.001 dB/MHz. Value as 8-bit signed integer, range -40 to 40.			1

## 5.2.7 Get Version Information

This message retrieves all the version information available from the Modulator.

Table 5.8: Get Version Information

Type	0x76
Length	0

## 5.2.8 Get Status

This message prompts the Modulator to return the current status.

Table 5.9: Get Status

Type	0x77
Length	0

## 5.2.9 Save Current Configuration

Saves the current configuration to a specified configuration slot.

*Table 5.10: Save Current Configuration*

Type	0x80	
Length	21	Size
Value	Configuration number to save to. 1 - 8	1
	Configuration name Max 20 characters	20

## 5.2.10 Get Health

*Table 5.11: Get Health*

Type	0x79
Length	0

## 5.3 Messages from the Modulator

### 5.3.1 Activate Configuration

*Table 5.12: Activate Configuration*

Type	0x71	
Length	1	Size
Value	Operation Success 0x00 - Error	1
	Invalid Parameter returned if selected config empty or not in the range 1 - 9 0x01 - OK 0x0F - Invalid Parameter	

### 5.3.2 Upload Configuration

If an error occurred when the Modulator processed the outgoing message, the following response will occur:

*Table 5.13: Upload Configuration (Error Condition)*

Type	0x73	
Length	1	Size
Value	Operation Success 0x00 - Error 0x0F - Invalid Parameter	1

Otherwise, the Modulator configuration is returned:

Table 5.14: Upload Configuration (Normal Condition)

Type	0x73		
Length	Depends on protocol version	Size	
Value	Protocol Version  (See Section 5.8 Protocol Version)	1	
	Input Select  Returns current input interface or test packet source	0x00 - SPI 0x01 - ASI 1 0x03 - ASI 2 0x04 - ASI 3 0x05 - ASI 4 0x10 - Test packets (Null) 0x11 - Test packets (PRBS)	1
Reserved		Ignore value	1
Packet Size		0x00 - 204 byte 0x01 - 188 byte 0x02 - Unframed	1
Reserved		Ignore value	1
Bit-rate	Bit-rate converted from the current symbol rate in bit/s	Byte 1: Bit-rate bits (31..24) Byte 2: Bit-rate bits (23..16) Byte 3: Bit-rate bits (15..8) Byte 4: Bit-rate bits (7..0) e.g. 0x093D1CC0 = 155 Mbit/s	4
Symbol rate	Returns current symbol rate in units of 1 symbol/s	Byte 1: Symbol rate bits (31..24) Byte 2: Symbol rate bits (23..16) Byte 3: Symbol rate bits (15..8) Byte 4: Symbol rate bits (7..0) e.g. 0x01C9C380 = 30 Msymbol/s	4
FEC rate		0x03 - 1/2 0x04 - 2/3 0x05 - 3/4 0x06 - 5/6 0x07 - 7/8 0x08 - 8/9 0x09 - 9/10 0x0A - 1/4 0x0B - 1/3 0x0C - 2/5 0x0D - 3/5 0x0E - 4/5	1
Standard		0x01 - DVB-S/DSNG 0x02 - DVB-S2	1
Modulation format		0x00 - QPSK 0x01 - BPSK 0x02 - 8PSK 0x03 - 16QAM 0x04 - 16APSK 0x05 - 32APSK	1

Spectrum sense	0x00 - Normal 0x01 - Inverted	1												
Spectrum roll-off factor (Alpha)	0x02 - 20% 0x03 - 25% 0x04 - 30% 0x05 - 35%	1												
Modulation On/Off	0x00 - Off 0x01 - On	1												
Reserved	Ignore value	2												
Reserved	Ignore value	1												
IF Power	Byte 1: IF Power bits (15..8) Byte 2: IF Power bits (7..0) Value as signed 16-bit integer. e.g.: 0x000A = 1.0 dBm, 0xFFFF = -0.1 dBm	2												
IF Frequency	Byte 1: Frequency bits (23..16) Byte 2: Frequency bits (15..8) Byte 3: Frequency bits (7..0) e.g.: 0x11170 = 70 MHz	3												
General Control	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Bit</th> <th>0</th> <th>1</th> <th></th> </tr> </thead> <tbody> <tr> <td>0 - SW reset</td> <td>Normal</td> <td>Enabled</td> <td>1</td> </tr> <tr> <td>1..7 - Reserved</td> <td>Ignore value</td> <td></td> <td></td> </tr> </tbody> </table>	Bit	0	1		0 - SW reset	Normal	Enabled	1	1..7 - Reserved	Ignore value			
Bit	0	1												
0 - SW reset	Normal	Enabled	1											
1..7 - Reserved	Ignore value													
Reserved	Ignore value	2												
Reserved	Ignore value	1												
Reserved	Ignore value	1												
IF Carrier Control	0x01 - IF Carrier Off 0x02 - IF Carrier On	1												
Rate Adaptation Control	0x00 - Off 0x01 - On	1												
Frame Size	0x00 - Normal	1												
Applicable to DVB-S2 only	0x01 - Short													
Pilot Insertion	0x00 - Off	1												
Applicable to DVB-S2 only	0x01 - On													
Map Mode	0x00 - Peak power	1												
Applicable to DVB-S2 only	0x01 - Mean power													
Scrambling Code (Gold Sequence) Number	Byte 1: Scrambling Code bits (23..16) Byte 2: Scrambling Code bits (15..8) Byte 3: Scrambling Code bits (7..0) Value as unsigned integer, range 0-262,141.	3												
IF Tilt	IF tilt (slope) in units of 0.001 dB/MHz. Value as 8-bit signed integer, range -40 to 40.	1												

### 5.3.3 Upload Current Configuration

If an error occurred when the Modulator processed the outgoing message, the following response will occur, otherwise the current configuration is returned as with Upload Configuration.

*Table 5.15: Upload Current Configuration*

Type	0x74		
Length	1		Size
Value	Operation Success 0x00 - Error 0x0F - Invalid Parameter		1

### 5.3.4 Download Configuration

*Table 5.16: Download Configuration*

Type	0x70		
Length	1		Size
Value	Operation Success 0x00 - Error 0x01 - OK 0x0F - Invalid Parameter		1

### 5.3.5 Save Configuration

*Table 5.17: Save Configuration*

Type	0x81		
Length	1		Size
Value	Operation Success 0x00 - Error 0x01 - OK 0x0F - Invalid Parameter		1

### 5.3.6 Get Version Information

#### General

This message returns all the hardware, software, and firmware version information for all fitted cards in the Modulator. This message encapsulates individual TLVs for each card found in the Modulator. The TLVs and types are defined below. TLVs can be sent in any order.

*Table 5.18: Get Version Information*

Type	0x76		
Length	Dependent on cards fitted		Size
Value	Protocol Version 0x00 - 0xFF (See <i>Section 5.8 Protocol Version</i> )		1
	Card Type		1
	Length of card version information		1
	Value - version information		Variable
	TLVs are inserted for all fitted cards		

## Host Controller Card (S11340)

Table 5.19: Host Controller Card (S11340)

Type	0x01	
Length	36	Size
Value	App. Major Version Number	Text string, e.g. ASCII "01"
	App. Minor Version Number	Text string, e.g. ASCII "01"
	Reserved	Text string, e.g. ASCII "01"
	Reserved	Text string, e.g. ASCII "01"
	Reserved	Text string, e.g. ASCII "01"
	Reserved	Text string, e.g. ASCII "01"
	Monitor Major Version Number	Text string, e.g. ASCII "01"
	Monitor Minor Version Number	Text string, e.g. ASCII "01"
	Web Site Version Number	Text string with zero terminator, e.g. ASCII "01.01", "01.02" etc
	Host Controller Card CPLD Firmware Version	Upper nibble - major version number Lower nibble - minor version number
	Host Controller Card PCB Revision and Modification Status	Upper nibble - PCB revision Lower nibble - Mod status
	Backplane CPLD Firmware Version	Upper nibble - major version number Lower nibble - minor version number
	Backplane PCB Revision and Modification Status	Upper nibble - PCB revision Lower nibble - Mod status
	Unit Inventory Serial Number	32-bit binary, MSB first
	Host Controller Card Serial Number	48-bit number, MSB first

## Modulator Baseband Card (S13129 / S13133)

Table 5.20: Modulator Baseband Card (S13129 / S13133)

Type	0x02	Size
Length	43	
Value	Baseband Card Type	Text string, e.g. ASCII "13129"
	Baseband Card PCB Revision and Modification Status	Upper nibble - PCB revision Lower nibble - Mod status
	Reserved	Ignore value
	Baseband Card CPLD Firmware Version	Upper nibble - major version number Lower nibble - minor version number
	Baseband Card FPGA Firmware Version	Upper nibble - major version number Lower nibble - minor version number
	Reserved	Ignore value
	Baseband Card Control Software Version	Upper nibble - major version number Lower nibble - minor version number
	IF Card Type	Text string, e.g. ASCII 10310, 11291 etc.
	IF Card PCB Revision and Modification Status	Upper nibble - PCB revision Lower nibble - Mod status
	IF Card Serial Number	48-bit number, MSB first
	IF Card CPLD Firmware Version	Upper nibble - major version number Lower nibble - minor version number
	Reserved	Ignore value

## DVB ASI & SPI Input Card (S11341)

Table 5.21: DVB ASI &amp; SPI Input Card (S11341)

Type	0x03	Size
Length	8	
Value	DVB ASI & SPI Input Card Firmware Version	Upper nibble - major version number Lower nibble - minor version number
	DVB ASI & SPI Input Card PCB Revision and Modification Status	Upper nibble - PCB revision Lower nibble - Mod status
	DVB ASI & SPI Input Card Serial Number	48-bit number, MSB first

## 5.4 Get Status

The return below is for protocol version 4. Future expansion or changes can be made by incrementing the protocol version number.

*Table 5.22: Get Status*

Type	0x77			
Length	7			
Value	Protocol Version	0 - 0xFF (See <i>Section 5.8 Protocol Version</i> )		
	Modulator Status	Bit	0	1
		0.5 - Reserved	Default 0	
		6 - Modulation	Off	On
		7 - Carrier on/off	Off	On
	Symbol clock offset (ppm)	Signed integer value, MSB first		
	Temperature (°C)	Signed byte		
	Alarm Status	Bit	0	1
		0 - Reserved	Default 0	
		1 - Alarm 1	OK	Set
		2 - Alarm 2	OK	Set
		3 - Alarm 3	OK	Set
		4 - Alarm 4	OK	Set
		5 - Fail	OK	Set
		6..7 Reserved	Default 0	
	Operation Status	0x00 - Configuring 0x01 - Stand-by 0x02 - Active, Carrier On		

## 5.5 Save Current Configuration

*Table 5.23: Save Current Configuration*

Type	0x80		
Length	1		
Value	Operation Success	0x00 - Error	1
		0x01 - OK	
		0x0F - Invalid Parameter	

## 5.6 Get Health

*Table 5.24: Get Health*

Type	0x79					
Length	1					Size
Value	Health word Assume 0x00 for normal operation	Bit	0	1	1	
		0..5 - Reserved	Default 0			
		6 - Critical Fail	OK	Fail		
		7 - Reserved	Default 0			

## 5.7 Bad Message

This message is sent in reply to a message that could not be processed.

*Table 5.25: Bad Message*

Type	0x75			
Length	1			Size
Value	Error Code	0x00 - Bad checksum	1	
		0x01 - Message too long		
		0x02 - Unknown message		

## 5.8 Protocol Version

The Protocol Version field should be set to 0x04.

# Chapter 6

## RS-485 Remote Control Protocol

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## 6.1 Introduction

### 6.1.1 Read This First!

This chapter covers the RS-485 Remote Control Protocol only. For RS-232, see *Chapter 5*.

**NOTE...**

The rear panel RS-232/485 connector is compatible with either RS-232 or RS-485, depending upon the mode selected on the Modulator. (See *Section 3.7 System Menu, Option 4, Serial Port Configuration*.)

### 6.1.2 Interface Requirements

#### General

**CAUTION...**

Only one logical control interface on the Modulator, i.e. Front Panel, Terminal, SNMP Remote Control, FTP, etc, should be used at any one time. Using more than one interface simultaneously may cause unexpected behaviour of the Modulator.

**NOTE...**

This chapter covers Version 4 of the Remote Control Protocol.

The rear panel connector is compatible with either RS-232 or RS-485, depending upon the mode selected on the Modulator. The RS-485 mode can be configured to use one of several baud rates. Other settings are 8 data bits, no parity and no flow control.

#### RS-485

The rear panel connector is designated **RS-232/485**. This is configured to run between 300 and 38400 baud (see *Section 3.7 System Menu, Option 4, Serial Port Configuration*).

Before the Modulator will accept commands via the RS-232/485 port using the RS-485 remote control protocol, the **Port Mode** must first be set to **Remote** and the **Interface** must be set to **RS-485**. See *Chapter 3, Section 3.7.2* for details of how to perform this.

### 6.1.3 Communications Protocol

#### Type - Length - Value (TLV) system

The protocol is based on the type - length - value (TLV) system. This TLV is wrapped with a start identifier, a total length and a checksum. This system does allow for multiple TLV sections to be included within one message, but this is not supported by the Modulator; only one TLV may be present in one message.

#### Message Format

The protocol is based on a stream of data bytes that represent a number of fields to form a message. All the bytes are ASCII encoded except for the address field and checksum field. The subscripts of number indicate their numeric base. The fields **<>** in a complete message are as follows:

**<start> <address> <type><value><end><checksum>**

*Table 6.1: Message Syntax*

<b>Start</b>	Indicates the start of a message. For messages to the Modulator this field is the 'STX' (ASCII 2 <sub>10</sub> ) character. For messages from the Modulator that indicate a message error this field is the 'NAK' (ASCII 21 <sub>10</sub> ) character. For other messages from the Modulator this field is the 'ACK' (ASCII 6 <sub>10</sub> ) character.
<b>address</b>	Indicates the identifying address of the destination or source device of the message. Device address value can be from 1 <sub>10</sub> to 127 <sub>10</sub> inclusive. This field is 1 byte in length.
<b>type</b>	Specifies the type of command/response message. This field is numeric and 2 bytes in length, with valid values.
<b>value</b>	Is the command/response message data. It comprises a number of sub fields. The sub fields can be numeric or TEXT values.
<b>End</b>	Indicates the end of a message. This field is the 'ETX' (ASCII 3 <sub>10</sub> ) character.
<b>checksum</b>	Calculated by XOR-ing all bytes from the start field to the end field, inclusive. This field is 1 byte in length.

## Example Message

*Table 6.2 shows an example of a Message sent to the Modulator.*

*Table 6.2: Example Message*

Byte	Type	ASCII Char	Value		Description
			Hex (0x)	Dec	
1	Start	STX	2	2	Start character
2	Address	A	41	65	The device address is 65
3	Type	2	24	36	The type of message
4	Type	4			
5	Value	F	FE	254	Numeric value
6	Value	E			
7	Value	6	6B7	1719	Numeric value
8	Value	B			
9	Value	7			
10	Value	N		Name 4	TEXT value
11	Value	a			
12	Value	m			
13	Value	e			
14	Value	space			
15	Value	4			
16	End	ETX	3	3	End character
17	Checksum		35	53	Checksum

The example shown in *Table 6.2* sends a message to the Modulator of type 0x24.

## Byte Ordering

Where a field consists of more than one byte, it must be ordered with the most significant byte first.

## Message Extensions

To allow for future enhancements, the receiver of messages from the Modulator must not assume the location of the checksum based on the message type. Doing this will allow for the message to grow in size and still be received. If additional data is added to a message it will be added at the end of the value field, thus allowing software written for an earlier version of the message to still function.

## Numeric Fields

A numeric field consists of 1 or more bytes. The bytes represent an ASCII encoded hexadecimal value. The following ASCII characters are allowed in a numeric field:

- Numeric characters '0' – '9'
- Upper case letters 'A' – 'F'

## TEXT Fields

TEXT fields consist of 1 or more contiguous bytes. The field will normally be a fixed number of bytes. Unused bytes should be set to 'NUL' (ASCII 0). The following ASCII characters are allowed in a TEXT field:

- Numeric characters '0' – '9'
- Upper case letters 'A' – 'Z'
- Lower case letters 'a' – 'z'
- Space character (ASCII 32<sub>10</sub>)

## 6.2 SM66XX Remote Control

### 6.2.1 Outline

The SM66XX message protocol works on a configuration concept. This is outlined in the diagram below. Instead of downloading individual parameter values an entire configuration is handled.

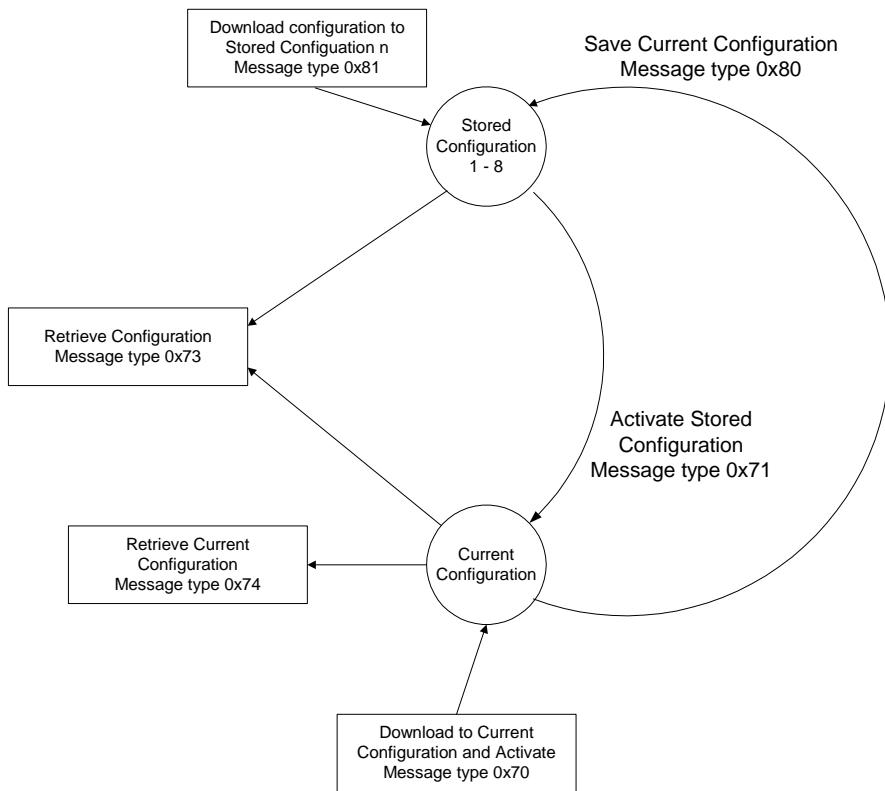


Figure 6.1: SM66XX Remote Control

Configurations can be stored in any of the 8 slots provided or activated immediately by downloading to the current configuration.

### 6.2.2 Functionality Constraints

Certain functionality of the Modulator is dependent upon the specific Modulator model, the hardware options fitted and the software options installed in it. The validity of some parameter values in configuration messages to the Modulator is dependent upon the functionality available. Parameter values are validated by the Modulator and accepted or rejected as appropriate. For example, 16QAM modulation is only available if the Higher Order Modulation (HOM) software option is installed.

## 6.3 Messages to the Modulator

### 6.3.1 Activate Configuration

Sending this message activates a stored configuration in the Modulator. Configurations 1-8 are user-stored configurations, but Configuration 9 is the Modulator's built-in default configuration.

*Table 6.3: Activate Configuration Parameters*

		Size
Type	0x71	2
Value	Configuration Number	0x01 - 0x09

### 6.3.2 Upload Configuration

Sending this message retrieves the specified configuration from the Modulator. Configuration 0 is the current configuration.

*Table 6.4: Upload Configuration*

		Size
Type	0x73	2
Value	Configuration Number	0x00 - 0x09

### 6.3.3 Upload Current Configuration

Sending this message retrieves the current configuration from the Modulator.

*Table 6.5: Upload Current Configuration*

		Size
Type	0x74	2

## 6.3.4 Download Configuration

This message downloads and activates (so becoming the current configuration) a configuration to the Modulator.

*Table 6.6: Download Configuration*

Type	Value	Size
Protocol Version	0x00 - 0xFF (See Section 6.8 Protocol Version)	2
Input Select	0x00 - SPI 0x01 - ASI 1 0x02 - Reserved 0x03 - ASI 2 0x04 - ASI 3 0x05 - ASI 4 0x10 - Test packets (Null) 0x11 - Test packets (PRBS)	2
Reserved	Set to 0x00	2
Packet Size	0x00 - 204 byte 0x01 - 188 byte 0x02 - Unframed	2
Reserved	Set to 0x00	2
Bit-rate	e.g. 155 Mbit/s = 0x093D1CC0  Set interface bit-rate in 1 bit/s increments. This value is only used if Symbol rate is set to 0xFFFFFFFF.	8
Symbol rate	e.g. 30 Msymbol/s = 0x01C9C380  Set symbol rate in 1 symbol/s increments. This value is used by default unless set to 0xFFFFFFFF in which case bit-rate will be used.	8
FEC rate	0x00 - Reserved 0x01 - Reserved 0x02 - Reserved 0x03 - 1/2 0x04 - 2/3 0x05 - 3/4 0x06 - 5/6 0x07 - 7/8 0x08 - 8/9 0x09 - 9/10 0x0A - 1/4 0x0B - 1/3 0x0C - 2/5 0x0D - 3/5 0x0E - 4/5	2
Standard	0x00 - Reserved 0x01 - DVB-S/DSNG 0x02 - DVB-S2	2

Modulation format	0x00 - QPSK 0x01 - BPSK 0x02 - 8PSK 0x03 - 16QAM 0x04 - 16APSK 0x05 - 32APSK	2
Spectrum sense	0x00 - Normal 0x01 - Inverted	2
Spectrum roll-off factor (Alpha)	0x00 - Reserved 0x01 - Reserved 0x02 - 20% 0x03 - 25% 0x04 - 30% 0x05 - 35%	2
Modulation On/Off	0x00 - Off 0x01 - On	2
Reserved	Set to 0x0000	4
Reserved	Set to 0x00	2
IF Power	Value as 16-bit signed integer Set IF power in 0.1 dB steps e.g. 0x000A = 1.0 dBm, 0xFFFF = -0.1 dBm	4
IF Frequency	e.g. 70 MHz = 0x011170 Set IF frequency in units of 1 kHz	6
General Control	Bit            0            1            2	
S/W reset initiates a Modulator reset	0 - S/W reset      Normal      Enabled 1..7 - Reserved    Set to 0	
Reserved	Set to 0x0000	4
Reserved	Set 0x02	2
Reserved	Set 0x00	2
IF Carrier Control	0x01 - IF Carrier Off 0x02 - IF Carrier On	2
Rate Adaptation Control	0x00 - Off 0x01 - On	2
Frame Size	0x00 - Normal	2
Applicable to DVB-S2 only	0x01 - Short	
Pilot Insertion	0x00 - Off	2
Applicable to DVB-S2 only	0x01 - On	
Map Mode	0x00 - Peak power	2
Applicable to DVB-S2 only	0x01 - Mean power	
Scrambling Code (Gold Sequence) Number	Byte 1: Scrambling Code bits (23..16) Byte 2: Scrambling Code bits (15..8) Byte 3: Scrambling Code bits (7..0) Value as unsigned integer, range 0-262,141.	6
Applicable to DVB-S2 only		
IF Tilt	IF tilt (slope) in units of 0.001 dB/MHz. Value as 8-bit signed integer, range -40 to 40.	2

## 6.3.5 Save Configuration

This message downloads a configuration to the Modulator to one of the save locations 1 - 8.

*Table 6.7: Save Configuration*

Type	Value	Size
Type	0x81	2
Value	Configuration Number	0x01 - 0x08
	Configuration Name (TEXT)	Unused bytes set to NUL (ASCII 0)
	Protocol Version	0x00 - 0xFF (See <i>Section 6.8 Protocol Version</i> )
	Input Select	0x00 - SPI 0x01 - ASI 1 0x02 - Reserved 0x03 - ASI 2 0x04 - ASI 3 0x05 - ASI 4 0x10 - Test packets (Null) 0x11 - Test packets (PRBS)
	Reserved	Set to 0x00
	Packet Size	0x00 - 204 byte 0x01 - 188 byte 0x02 - Unframed
	Reserved	Set to 0x00
	Bit-rate	e.g. 155 Mbit/s = 0x093D1CC0
	Symbol rate	e.g. 30 Msymbol/s = 0x01C9C380
	Set interface bit-rate in 1 bit/s increments. This value is only used if Symbol rate is set to 0xFFFFFFFF.	
	FEC rate	0x00 - Reserved 0x01 - Reserved 0x02 - Reserved 0x03 - 1/2 0x04 - 2/3 0x05 - 3/4 0x06 - 5/6 0x07 - 7/8 0x08 - 8/9 0x09 - 9/10 0x0A - 1/4 0x0B - 1/3 0x0C - 2/5 0x0D - 3/5 0x0E - 4/5

Standard	0x00 - Reserved 0x01 - DVB-S/DSNG 0x02 - DVB-S2	2												
Modulation format	0x00 - QPSK 0x01 - BPSK 0x02 - 8PSK 0x03 - 16QAM 0x04 - 16APSK 0x05 - 32APSK	2												
Spectrum sense	0x00 - Normal 0x01 - Inverted	2												
Spectrum roll-off factor (Alpha)	0x00 - Reserved 0x01 - Reserved 0x02 - 20% 0x03 - 25% 0x04 - 30% 0x05 - 35%	2												
Modulation On/Off	0x00 - Off 0x01 - On	2												
Reserved	Set to 0x0000	4												
Reserved	Set to 0x00	2												
IF Power	Value as 16-bit signed integer Set IF power in 0.1 dB steps e.g. 0x000A = 1.0 dBm, 0xFFFF = -0.1 dBm	4												
IF Frequency	e.g. 70 MHz = 0x011170 Set IF frequency in units of 1 kHz	6												
General Control	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Bit</th> <th>0</th> <th>1</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>0 - S/W reset</td> <td>Normal</td> <td>Enabled</td> <td></td> </tr> <tr> <td>1..7 - Reserved</td> <td>Set to 0</td> <td></td> <td></td> </tr> </tbody> </table>	Bit	0	1	2	0 - S/W reset	Normal	Enabled		1..7 - Reserved	Set to 0			
Bit	0	1	2											
0 - S/W reset	Normal	Enabled												
1..7 - Reserved	Set to 0													
Reserved	Set to 0x0000	4												
Reserved	Set to 0x02	2												
Reserved	Set to 0x00	2												
IF Carrier Control	0x01 - IF Carrier Off 0x02 - IF Carrier On	2												
Rate Adaptation Control	0x00 - Off 0x01 - On	2												
Frame Size	0x00 - Normal	2												
Applicable to DVB-S2 only	0x01 - Short													
Pilot Insertion	0x00 - Off	2												
Applicable to DVB-S2 only	0x01 - On													
Map Mode	0x00 - Peak power	2												
Applicable to DVB-S2 only	0x01 - Mean power													
Scrambling Code (Gold Sequence) Number	Byte 1: Scrambling Code bits (23..16) Byte 2: Scrambling Code bits (15..8) Byte 3: Scrambling Code bits (7..0) Value as unsigned integer, range 0-262,141.	6												
Applicable to DVB-S2 only														
IF Tilt	IF tilt (slope) in units of 0.001 dB/MHz. Value as 8-bit signed integer, range -40 to 40.	2												

### 6.3.6 Get Status

This message prompts the Modulator to return the current status.

*Table 6.8: Get Status*

		Size
Type	0x77	2

### 6.3.7 Save Current Configuration

Saves the current configuration to a specified configuration slot.

*Table 6.9: Save Current Configuration*

		Size
Type	0x80	2
Value	Configuration Number 0x01 - 0x08	2
	Configuration Name (TEXT) Unused bytes set to NUL (ASCII 0)	20

### 6.3.8 Get Health

*Table 6.10: Get Health*

		Size
Type	0x79	2

## 6.4 Messages from the Modulator

### 6.4.1 Activate Configuration

The start field for this message is ACK if OK is indicated, otherwise the start field is NAK.

*Table 6.11: Activate Configuration*

		Size
Type	0x71	2
Value	Operation Success 0x00 - Error Invalid Parameter returned if selected config empty or not in the range 1 - 9	2
	0x01 - OK 0x0F - Invalid Parameter	

## 6.4.2 Upload Configuration

If an error occurred when the Modulator processed the outgoing message, the following response will occur. The start field for this message is NAK.

*Table 6.12: Upload Configuration (Error Condition)*

		Size
Type	0x73	2
Value	Operation Success	0x00 - Error
		0x0F - Invalid Parameter

Otherwise the Modulator configuration is returned. The start field for this message is ACK.

*Table 6.13: Upload Configuration (Normal Condition)*

		Size
Type	0x73	2
Value	Protocol Version  (See <i>Section 6.8 Protocol Version</i> )	2
	Input Select  Returns current input interface or test packet source	2
	0x00 - SPI 0x01 - ASI 1 0x02 - Reserved 0x03 - ASI 2 0x04 - ASI 3 0x05 - ASI 4 0x10 - Test packets (Null) 0x11 - Test packets (PRBS)	
Reserved	Ignore value	2
Packet Size	0x00 - 204 byte 0x01 - 188 byte 0x02 - Unframed	2
Reserved	Ignore value	2
Bit-rate	e.g. 0x093D1CC0 = 155 Mbit/s  Returns the bit-rate in units of 1 bit/s calculated from the current symbol rate	8
Symbol rate	e.g. 0x01C9C380 = 30 Msymbol/s  Returns the current symbol rate in units of 1 symbol/s	8

FEC rate	0x03 - 1/2 0x04 - 2/3 0x05 - 3/4 0x06 - 5/6 0x07 - 7/8 0x08 - 8/9 0x09 - 9/10 0x0A - 1/4 0x0B - 1/3 0x0C - 2/5 0x0D - 3/5 0x0E - 4/5	2												
Standard	0x01 - DVB-S/DSNG 0x02 - DVB-S2	2												
Modulation format	0x00 - QPSK 0x01 - BPSK 0x02 - 8PSK 0x03 - 16QAM 0x04 - 16APSK 0x05 - 32APSK	2												
Spectrum sense	0x00 - Normal 0x01 - Inverted	2												
Spectrum roll-off factor (Alpha)	0x02 - 20% 0x03 - 25% 0x04 - 30% 0x05 - 35%	2												
Modulation On/Off	0x00 - Off 0x01 - On	2												
Reserved	Ignore value	4												
Reserved	Ignore value	2												
IF Power	Value as 16-bit signed integer	4												
IF power in 0.1 dB steps	e.g. 0x000A = 1.0 dBm, 0xFFFF = -0.1 dBm													
IF Frequency	e.g. 0x011170 = 70 MHz	6												
General Control	<table border="1"> <thead> <tr> <th>Bit</th> <th>0</th> <th>1</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>0 - S/W reset</td> <td>Normal</td> <td>Enabled</td> <td></td> </tr> <tr> <td>1..7 - Reserved</td> <td>Ignore value</td> <td></td> <td></td> </tr> </tbody> </table>	Bit	0	1	2	0 - S/W reset	Normal	Enabled		1..7 - Reserved	Ignore value			
Bit	0	1	2											
0 - S/W reset	Normal	Enabled												
1..7 - Reserved	Ignore value													
Reserved	Ignore value	4												
Reserved	Ignore value	2												
Reserved	Ignore value	2												
IF Carrier Control	0x01 - IF Carrier Off 0x02 - IF Carrier On	2												
Rate Adaptation Control	0x00 - Off 0x01 - On	2												
Frame Size	0x00 - Normal 0x01 - Short	2												
Applicable to DVB-S2 only														

Pilot Insertion	0x00 - Off	2
Applicable to DVB-S2 only	0x01 - On	
Map Mode	0x00 - Peak power	2
Applicable to DVB-S2 only	0x01 - Mean power	
Scrambling Code (Gold Sequence) Number	Byte 1: Scrambling Code bits (23..16)	6
Applicable to DVB-S2 only	Byte 2: Scrambling Code bits (15..8)	
	Byte 3: Scrambling Code bits (7..0)	
	Value as unsigned integer, range 0-262,141.	
IF Tilt	IF tilt (slope) in units of 0.001 dB/MHz. Value as 8-bit signed integer, range -40 to 40.	2

### 6.4.3 Upload Current Configuration

If an error occurred when the Modulator processed the outgoing message, the following response will occur, otherwise the current configuration is returned as with Upload Configuration. The start field for this message is NAK.

Table 6.14: Upload Current Configuration

		Size
Type	0x74	2
Value	Operation Success 0x00 - Error 0x0F - Invalid Parameter	2

### 6.4.4 Download Configuration

The start field for this message is ACK if OK is indicated, otherwise the start field is NAK.

Table 6.15: Download Configuration

		Size
Type	0x70	2
Value	Operation Success 0x00 - Error 0x01 - OK 0x0F - Invalid Parameter	2

### 6.4.5 Save Configuration

The start field for this message is ACK if OK is indicated, otherwise the start field is NAK.

Table 6.16: Save Configuration

		Size
Type	0x81	2
Value	Operation Success 0x00 - Error 0x01 - OK 0x0F - Invalid Parameter	2

## 6.5 Get Status

The start field for this message is ACK.

*Table 6.17: Get Status*

Type	0x77	Size		
Value	Protocol Version	0x00 - 0xFF (See Section 6.8 Protocol Version)	2	
	Modulator Status	Bit	0	1
	0..5 - Reserved	Ignore value		
	6 - Modulation	Off	On	
	7 - Carrier On/Off	Off	On	
	Symbol clock offset (ppm)	Signed integer value, MSB first	4	
	Temperature (°C)	Signed byte	2	
	Alarm Status	Bit	0	1
	0 - Reserved	Ignore value		
	1 - Alarm 1	OK	Set	
	2 - Alarm 2	OK	Set	
	3 - Alarm 3	OK	Set	
	4 - Alarm 4	OK	Set	
	5 - Fail	OK	Set	
	6..7 - Reserved	Ignore value		
	Operation Status	0x00 - Configuring 0x01 - Standby 0x02 - Active, carrier On	2	

## 6.6 Save Current Configuration

The start field for this message is ACK if OK is indicated, otherwise the start field is NAK.

*Table 6.18: Save Current Configuration*

Type	0x80	Size	
Value	Operation Success	0x00 - Error 0x01 - OK 0x0F - Invalid Parameter	2

## 6.7 Get Health

The start field for this message is ACK.

Table 6.19: Get Health

Type	0x79				Size
Value	Health word Assume 0x00 for normal operation	Bit	0	1	2
		0..5 - Reserved	Ignore value		
		6 - Critical Fail	OK	FAIL	
		7 - Reserved	Ignore value		

## 6.8 Protocol Version

The protocol version field should be set to 0x04.

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# Chapter 7

## Equipment Description

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## 7.1 Scope of this Chapter

This chapter provides a simplified overview of the SM6600 range of Satellite Modulators.

## 7.2 DVB-S and DVB-DSNG Coding and Modulation Principles

### 7.2.1 DVB-S Modulation

The Modulators support QPSK modulation in accordance with ETSI standard EN 300 421 (DVB-S). Additionally, they support BPSK modulation in accordance with ETSI Technical Report TR 101 198. In the BPSK and QPSK modulation schemes, each symbol represents 1 and 2 bits of data, respectively. BPSK gives the lower bit-rate for a given symbol rate but is the most rugged with respect to noise and interference.

Five convolutional code rates are available with BPSK and QPSK modulations as follows:  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ ,  $\frac{5}{6}$ , and  $\frac{7}{8}$ . These provide different compromises between bit-rate and ruggedness.

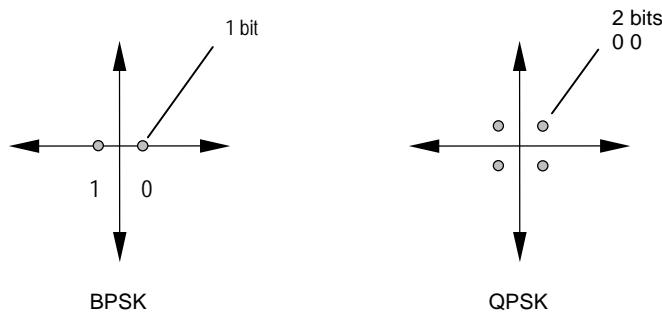


Figure 7.1: BPSK and QPSK Constellations

### 7.2.2 DVB-DSNG Modulation

The Modulators optionally support 8PSK and 16QAM modulations in accordance with ETSI standard EN 301 210 (DVB-DSNG). In the 8PSK and 16QAM modulation schemes, each symbol represents 3 and 4 bits of data, respectively. 16QAM gives twice the bit-rate of QPSK for a given symbol rate but is less rugged with respect to noise and interference.

For these modulations, pragmatic trellis coded modulation (PTCM) is used. PTCM code rates of  $\frac{2}{3}$ ,  $\frac{5}{6}$  and  $\frac{8}{9}$  are available with 8PSK modulation. PTCM code rates of  $\frac{3}{4}$  and  $\frac{7}{8}$  are available with 16QAM modulation.

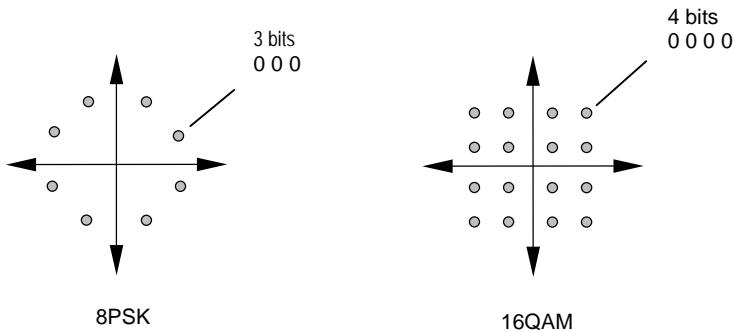


Figure 7.2: 8PSK and 16QAM Constellations

### 7.2.3 Forward Error Correction and Interleaving

Noise and interference can cause some bits to be received in error. To counter such errors, a concatenated forward error correction (FEC) coding scheme is used, comprising an outer Reed-Solomon (204, 188) code, convolutional interleaving and an inner convolutional code. In this scheme, firstly 16 parity check bytes are added to the data in each packet by the RS Encoder. The data are then passed through a convolutional interleaver which shuffles the order of transmission of the data bytes. Finally, the data are passed through a convolutional encoder which adds additional redundant data bits. Different convolutional code rates can be used to provide different levels of ruggedness:  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ ,  $\frac{5}{6}$ ,  $\frac{7}{8}$  and  $\frac{8}{9}$ , the values available being dependent upon the modulation selected.

At the receiver the data are Viterbi decoded, de-interleaved and then RS decoded. The inner convolutional coding together with Viterbi decoding provides powerful error correction capability against errors induced by additive white Gaussian noise (AWGN) in the channel, but any residual errors at the output of the Viterbi Decoder tend to occur predominantly in blocks. The de-interleaving process redistributes the errors so that they occur more randomly as well as restoring the original order of the data bytes, allowing the following RS Decoder to further correct the residual errors to maximum effect.

## 7.3 DVB-S2 Coding and Modulation Principles

The SM6620 and SM6625 Modulators optionally support QPSK, 8PSK, 16APSK and 32APSK modulations in accordance with ETSI standard EN 302 307 (DVB-S2). The DVB-S2 coding and modulation system is quite complex; a detailed description is beyond the scope of this Reference Guide. For further details, the reader is referred to the EN 302 307 standard, available from [ETSI](#).

## 7.4 Modulator Functional Description

### 7.4.1 Introduction

Each of the SM6600 Satellite Modulator Base Unit models contains three main cards: a Baseband card, an Output card and a Host Controller card (see *Figure 7.3* and *Figure 7.4*). The Baseband card and the Output card together form the core of the Modulator. The Host Controller card is responsible for the communication, configuration and monitoring functions performed by the Modulator. Additionally, an optional Input card (not shown in *Figure 7.3* and *Figure 7.4*) may be fitted.

The function of each card is described in greater detail throughout this section.

## 7.4.2 Baseband Card

The Baseband card accepts transport stream data via one of several interfaces and performs the DVB-S, DVB-DSNG or DVB-S2 encoding function.

There are two variants of the Baseband card, designated S13129 and S13133. The S13129 card, used in Modulator models SM6610 and SM6615, does not have DVB-S2 or PREKOR™ Dynamic Pre-correction capability and has no Beacon Receiver Input. The S13133 card, used in Modulator models SM6620 and SM6625, has DVB-S2 and PREKOR™ Dynamic Pre-correction capability, and has a Beacon Receiver Input. The two cards are otherwise functionally identical.

### Transport Stream Interface

The Baseband card can receive an MPEG-2 transport stream via either of its two DVB-compliant Asynchronous Serial Interfaces (ASI), located on the rear panel of the Modulator. Alternatively, it can receive a transport stream via the Modulator backplane from the optional DVB ASI & SPI Input card, if fitted.

Transport streams may be connected to both ASI inputs for input redundancy purposes. This is useful if two independent distribution systems are available to carry the transport stream from the multiplex source. In case of failure of one distribution system, the other will still carry the data to be transmitted. The Modulator can be made to switch if the input in use suffers a failure, although automatic switching is not currently supported.

The Baseband card can accept input data streams in any of four different data formats:

- 188-byte packets consisting of 188 contiguous data bytes
- 204-byte packets consisting of 188 data bytes and 16 RS coding bytes (the coding bytes are ignored)
- 204-byte packets consisting of 188 data bytes and 16 dummy packets
- Unframed data, i.e. without MPEG-2 sync bytes

### Transport Stream Rate Adaptation

The modulator has a transport stream rate adaptation function, allowing it to be used at a fixed symbol rate irrespective of the transport stream input data rate, subject to the limitations described below. Rate adaptation may be switched on or off under user control.

When rate adaptation is switched on, null packets are either inserted into or removed from the transport stream, and PCR correction is performed. Insertion of null packets (packet stuffing) can be performed without limitation other than that imposed by the maximum symbol rate of the modulator. However, removal of null packets (packet dropping) can only be performed to the extent that there are null packets available in the transport stream to be removed.

When rate adaptation is switched off, the modulator operates in data-derived clocking mode in which the output symbol rate is locked to the transport stream input data rate by means of a digital PLL having a very low loop bandwidth. In this mode, PCR correction is not performed.

### Transport Stream De-jittering

When rate adaptation is switched off, the digital PLL referred to in *Transport Stream Rate Adaptation* operates in conjunction with a FIFO buffer to perform a de-jittering function, substantially removing any jitter present on the incoming transport stream, such as is commonly generated by SDH or PDH telecommunications distribution circuits. This jitter must be removed before the DVB-S modulation process.

## DVB Encoding

After rate adaptation or de-jittering, the transport stream is encoded in accordance with ETSI standard EN 300 421 (DVB-S), EN 301 210 (DVB-DSNG) or EN 302 307 (DVB-S2). The resulting I- and Q-channel signals are converted from digital to analogue form and are then passed to the Output card.

## PREKOR™ Dynamic Pre-correction (S13133 Card Only)

The PREKOR™ Dynamic Pre-correction function is performed after the DVB encoding process and before digital to analogue conversion. This system corrects non-linear magnitude and phase distortions, and group delay distortion introduced by the uplink HPA and satellite transponder. It is of particular benefit when using higher order modulations with non-circular constellations such as 16QAM, 16APSK or 32APSK.

The Beacon Receiver Input can be used for automatically adjusting the level of pre-correction in response to an input voltage derived from an external satellite beacon receiver. This facility is useful for compensating for uplink fades when using PREKOR™ with a satellite that does not have on-board AGC.

### 7.4.3 Output Card

The Output card accepts the analogue I- and Q-channel signals from the Baseband card and performs I & Q modulation of the carrier signal. There are two different Output cards: the S10310 IF Output card and the S11291 L-Band Output card. The particular card fitted is dependent upon the Modulator model. The S10310 card is fitted in the IF output models SM6610 and SM6620. The S11291 card is fitted in the L-Band output models SM6615 and SM6625.

#### S10310 IF Output Card

The S10310 card performs I & Q modulation, followed by frequency down-conversion to the IF output frequency, amplification and output power level control. Its output carrier frequency is tuneable over the range 50-180 MHz. Both main and monitor outputs are provided.

#### S11291 L-Band Output Card

The S11291 card performs direct I & Q modulation at the L-band output frequency, followed by amplification and output power level control. Its output carrier frequency is tuneable over the range 950-1750 MHz. Both main and monitor outputs are provided.

A signal applied to the L-Band Input is combined with the on-board-generated carrier at the input of the final output amplifier. This facility is useful for combining carriers for transmission via the same uplink equipment.

A switchable 24 Vdc power supply and 10 MHz reference frequency are combined with the L-band output for use by an external block up-converter (BUC).

### 7.4.4 S11340 Host Controller Card

The microprocessor on the Host Controller Card is responsible for the communication, configuration and monitoring functions performed by the Modulator. It supports RS-232/485 remote control, Ethernet control, VT100 terminal control and front panel control. Errors and alarms can be reported via any of the aforementioned interfaces and via a simple RESET/STATUS relay interface.

The embedded software in the Modulator also enables the user to upgrade all of the software and firmware in the unit (via FTP) without having to remove the chassis cover. In case of an external error in the data stream or power supply the Modulator will always restore its last working state when all the external errors are cleared. The embedded software controls this recovery. For an explanation of all the control and monitoring features refer to *Chapter 3, Operating the Equipment Locally*.

## 7.4.5 S13450 DVB ASI & SPI Input Card (Option)

### Transport Stream Interface

The S13450 DVB ASI & SPI Input card can receive DVB-compliant MPEG-2 transport streams via either the Synchronous Parallel Interface (SPI) or the two Asynchronous Serial Interfaces (ASI). The user can connect a stream into any of the three interfaces.

It is also possible to connect two inputs; for example, it is possible to connect a stream into both ASI Inputs. This is useful if two distinct distribution systems are available to carry the transport stream from the multiplex source; in case of failure on one distribution system the other will still carry the data to be transmitted. The Modulator can be made to switch if the input in use suffers a failure, although automatic switching is not currently supported.

The S13450 card can accept input data streams in any of four different data formats:

- 188-byte packets consisting of 188 contiguous data bytes
- 204-byte packets consisting of 188 data bytes and 16 RS coding bytes (the coding bytes are ignored)
- 204-byte packets consisting of 188 data bytes and 16 dummy packets
- Unframed data, i.e. without MPEG-2 sync bytes

Transport stream rate adaptation or de-jittering is performed on the Baseband card.

### Additional ASI Information

The encoded line rate of the ASI stream is 270 MBaud  $\pm 100$  ppm. All ASI bytes are 8B/10B encoded as specified by ETSI standard EN 50083-9. Special comma characters, K28.5 code words are used as byte synchronisation patterns. Two consecutive K28.5 code words are transmitted prior to each MPEG-2 packet and subsequent K28.5 code words are inserted to pad the data to achieve the required encoded ASI line rate.

The ASI stream can be accepted in either byte mode or single packet burst mode. In byte mode, the ASI stream consists of MPEG-2 data bytes separated by an approximately constant number of K28.5 code words. In single packet burst mode, the ASI transport stream consists of an entire packet of MPEG-2 data bytes being transmitted and then a series of K28.5 code words until the next packet of data is ready to be transmitted.

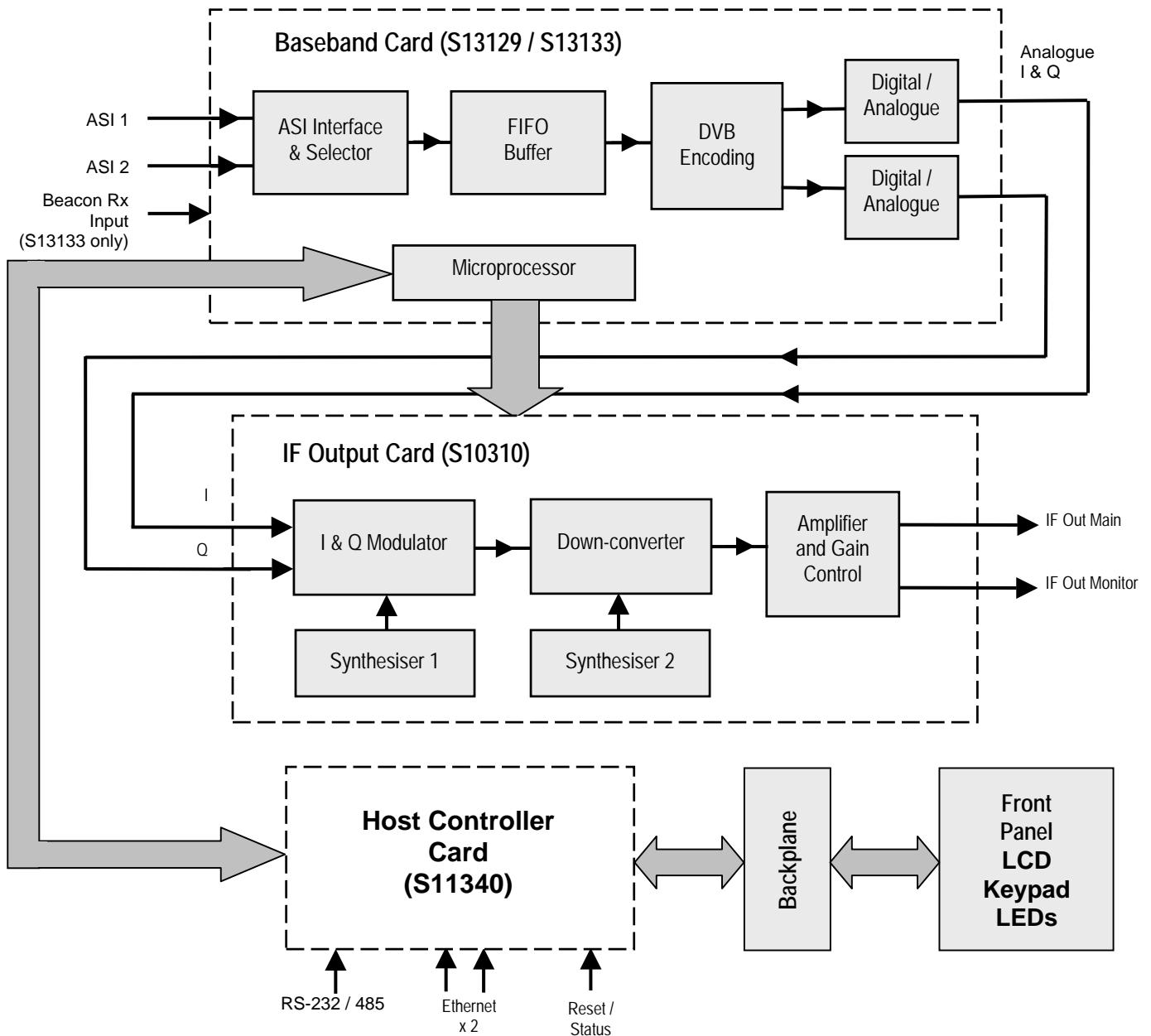


Figure 7.3: Functional Block Diagram – IF Output Models SM6610 and SM6620

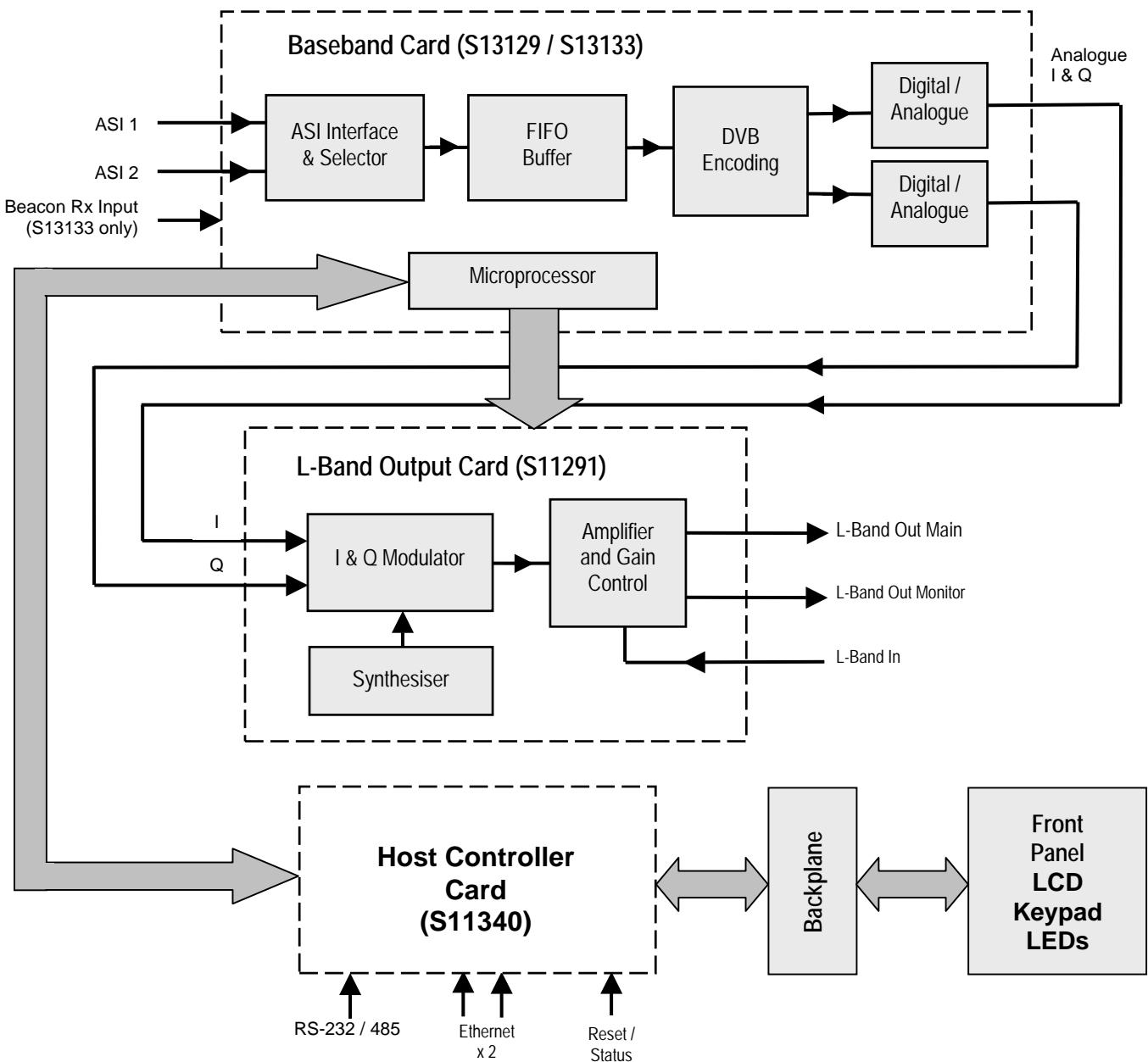


Figure 7.4: Functional Block Diagram – L-Band Output Models SM6615 and SM6625

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# Chapter 8

## Preventive Maintenance and Fault-finding

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## 8.1 Introduction

This chapter provides the schedules and instructions, where applicable, for routine inspection, cleaning and maintenance which should be performed by an operator. There are also some basic fault-finding procedures to follow in the event of a suspected failure of the SM66XX Satellite Modulator.

## 8.2 Routine Checks

### 8.2.1 Cooling Fans

There are no routine checks associated with this equipment other than to ensure that the unit is adequately cooled. This equipment must never be operated unless the cooling fans are working; this should be checked periodically. A fan fail alarm will be enunciated via the control interfaces if any of the fans stop working.

**CAUTION...**

The fans contained within this unit are not fitted with insect/dust filters. Pay particular attention to the environment in which it is going to be used.

### 8.2.2 Cleaning

Unplug the equipment from the supply before cleaning. Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning the exterior of the Modulator.

## 8.3 Servicing

### 8.3.1 Conditions Requiring Servicing

**WARNING...**

**DO NOT ATTEMPT TO SERVICE THIS PRODUCT AS OPENING OR REMOVING COVERS MAY EXPOSE DANGEROUS VOLTAGES OR OTHER HAZARDS. REFER ALL SERVICING TO SERVICE PERSONNEL WHO HAVE BEEN AUTHORISED BY TANDBERG TELEVISION.**

The following is a list of conditions which may indicate the need for servicing:

1. When the power-supply cord or plug is damaged.
2. If liquid has been spilled, or objects have fallen into the product.
3. If the product has been exposed to rain or water.
4. If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions, as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
5. If the product has been dropped or the case has been damaged.
6. When the product exhibits a distinct change in performance.
7. If the equipment has been subject to a lightning strike or power surge.

### 8.3.2 Replacement Parts

When replacement parts are required, be sure only parts specified by TANDBERG Television Limited (or having the same characteristics as the original part) have been used. Unauthorised substitutions may result in fire, electric shock or other hazards.

### 8.3.3 Checks on Completion of Servicing

Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in a safe operating condition. Also, performance and EMC checks may be required.

## 8.4 Maintenance and Support Services

### 8.4.1 Introduction

TANDBERG Television is a leader in the design, integration and implementation of digital broadcasting products and systems. It has a large team dedicated to keeping our customers on-air 24 hours a day, 365 days a year.

With regional offices worldwide, and ultra-modern specialist service facilities in the US, UK, Hong Kong and Australia, TANDBERG Television covers the world. There is a customer service centre open round the clock, every day of the year, in your time zone.

TANDBERG's years of design and support experience enable it to offer a range of service options that will meet your needs at a price that makes sense.

It's called the **TANDBERG Advantage**.

### 8.4.2 Warranty

All TANDBERG Products and Systems are designed and built to the highest standards and are covered under a comprehensive 12 month warranty.

### 8.4.3 Levels of Continuing TANDBERG Television Service Support

For stand-alone equipment, then TANDBERG Television **BASIC Advantage** is the value for money choice for you.

BASIC provides you with year-by-year Service long after the warranty has expired.

For systems support you can choose either **Gold** or **Silver Advantage**. These packages are designed to save you costs and protect your income through enlisting the help of TANDBERG Television support specialists.

Call TANDBERG Sales for more details.

### 8.4.4 Maintenance Philosophy

This chapter provides some basic fault-finding procedures to follow in the event of a suspected Modulator failure. It is assumed that other equipment units have been eliminated as the possible cause of the failure (see relevant documentation).

#### WARNING...

HAZARDOUS VOLTAGES ARE PRESENT WITHIN THIS EQUIPMENT AND MAY BE EXPOSED IF THE COVERS ARE REMOVED. ONLY TRAINED AND APPROVED SERVICE ENGINEERS ARE PERMITTED TO SERVICE THIS EQUIPMENT.

It is the objective of this chapter to provide sufficient information to enable the rectification of apparent faults by operator action, or else to identify the suspect module, where possible. In the event that the recommended action fails to clear the abnormal condition, call a Service Engineer or contact TANDBERG Television Customer Services (see *Preliminary Pages*).

**NOTE...**

Unauthorised maintenance or the use of non-approved replacements may invalidate any warranties and/or affect the equipment specification.

## 8.4.5 Fault Diagnosis for an Operator

Always investigate the failure symptoms fully, prior to taking remedial action. Fault diagnosis for the equipment operator is limited to the following tasks, since the operator should **NOT** remove the covers of the equipment:

1. Check the front panel **Power LED**. If this is not lit:
  - a) Replace external equipment, power source and cables by substitution to check their performance.
  - b) Replace the fuse in the power connector at the rear panel.
2. Confirm that the equipment hardware configuration is suitable for the purpose and has been correctly installed and connected up. Reconfigure/reconnect as necessary.
3. Confirm that inappropriate operator action is not causing the problem, and that the equipment software set-up, via the local terminal, is capable of performing the task being asked of it. Change set-up parameters as necessary.
4. Use the test menus and options provided by the local terminal.
5. Switch off the equipment if it becomes unusable, or to protect it from further damage.
6. Check that the fans are unobstructed and working correctly.

Call a trained and approved Service Engineer or contact Customer Services.

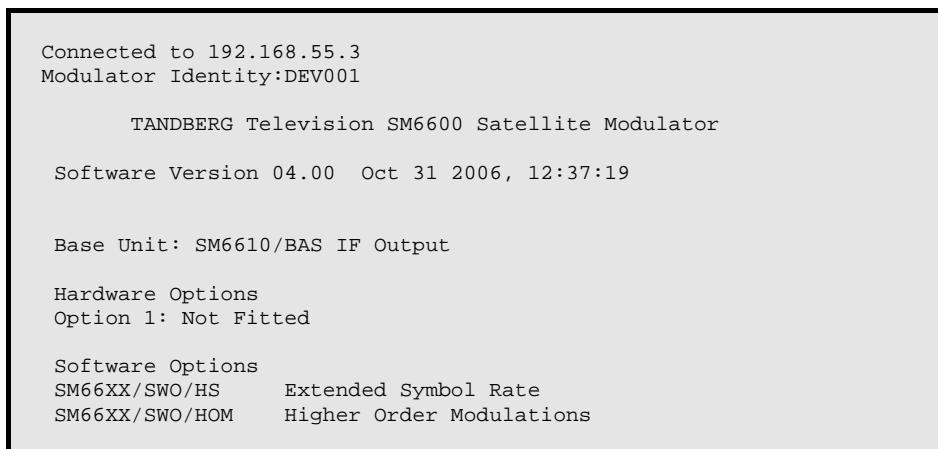
**NOTE...**

A Modulator **must** be connected to an Encoder or Multiplexer (or otherwise fed with a suitable MPEG-2 transport stream) and monitoring IRD in order to carry out tests in isolation. This may entail removing the stand-by Encoder or Multiplexer from service, if one is available, to enable local diagnostics to be carried out.

## 8.5 Boot Errors

### 8.5.1 Boot Display

At switch-on, boot information is displayed on the terminal along with self-test results. Normally, when booting is successful, a display similar to that shown in *Figure 8.1* will appear for several seconds.



*Figure 8.1: Example Boot Display*

#### NOTE...

The boot display indicates the software version number, the Modulator Base Unit model number, which hardware option is fitted (if any) and which software options are installed.

### 8.5.2 Self-test Result Messages

Following the execution of the self-test, one or more of the messages shown in *Table 8.1* may be displayed.

*Table 8.1: Self-test Results Messages*

Message	Meaning	Remedial Action
Test Passed	Test passed successfully.	None required.
Test Failed	Test has failed.	Power down the Modulator and the control terminal, and power up again after leaving the equipment switched off for 15 seconds. If the fault persists, call a Service Engineer.

## 8.6 Poor Error Performance

Use the following techniques to fault-find the Modulator when there are a high number of errors in the received signal (video, audio and data may be poor or absent altogether).

Fault-find the problem as detailed in *Table 8.2*.

*Table 8.2: Poor Error Performance Fault-finding*

Step	Action	If Result of Action is Yes...	If Result of Action is No...
1	<b>Check for Error Messages.</b> Is a fault indicated on the local terminal or computer display?	Fault-find according to the displayed message (see Boot Errors or Alarm and Status Mnemonics as appropriate).	Proceed to next step.
2	<b>Check Modulator and MPEG-2 Data Source Configuration.</b> Are the Modulator and MPEG-2 Data Source Equipment (i.e. Encoder, etc) configured incorrectly?	Configure the Modulator and MPEG-2 data source equipment correctly, paying particular attention to the Input Data Selection (ASI1, etc), Packet Size, Bit-rate, Symbol Rate and FEC Rate settings.	Proceed to next step.
3	<b>Check Modulator Error Correction.</b> Can a lower FEC rate be applied?	Try a more powerful coding rate ( $\frac{5}{6}$ is the most powerful for DVB-S).	If the most powerful coding rate is already being used, proceed to next step.
4	<b>Check Modulation Format.</b> Can a more rugged (lower order) modulation format be applied?	Try a more rugged modulation format (BPSK is the most rugged).	If the most rugged modulation format is already being used, proceed to next step.
5	<b>Check Equipment Cabling.</b> Is input/output cable run to/from the Modulator and the next equipment in close proximity to power cables or RFI sources or very long?	Re-route the cables to avoid the possibility of interference from external sources, or relocate the Modulator, or shorten the cables.	Possible problem with Modulator, call a Service Engineer.

## 8.7 Power Supply Problems/LED Unlit

### 8.7.1 Symptoms

**WARNING...**

IN THE EVENT OF A POWER SUPPLY FAULT, HAZARDOUS ENERGY LEVELS MAY BE PRESENT ON THE INTERFACES. IF SUCH A FAULT HAS OCCURRED, OR IS SUSPECTED, DO NOT TOUCH ANY EXPOSED WIRES, CONNECTORS OR CIRCUITRY.

Use the following techniques to fault-find the Modulator according to the observed symptom(s) when a power supply failure is suspected.

### 8.7.2 Power LED Unlit

When the Modulator Power LED is unlit, fault-find the problem as detailed in *Table 8.3*.

*Table 8.3: Power LED Unlit Fault-finding*

Step	Action	If Result of Action is Yes...	If Result of Action is No...
1	Check Power LED. Is the Modulator still working?	If the Modulator is clearly working normally then the Power LED itself is probably at fault. Call a Service Engineer.	Proceed to next step.
2	Check AC Power Source. Connect a known-working piece of equipment to the power source outlet. Does it work?	The problems lies within the Modulator or power cable. Proceed to next step.	The problem lies with the ac power source. Check building circuit breakers, fuse boxes, etc. If problem persists, contact the electricity supplier.
3	Check Power Cable and Fuse. Unplug the power connector from the Modulator and try it in another piece of equipment. Does it work?	The problems lies within the Modulator. Proceed to next step.	The problem lies either with the cable itself, or with the fuse in the plug. Replace the fuse or try another cable.
4	Check PSU Module and Fuse. Ensure the power connector is unplugged. Remove the fuse from the rear panel connector and inspect it. Has the fuse blown?	Replace the fuse with one of the correct type and rating (see <i>Annex B Technical Specification</i> ). If the PSU still does not work, unplug the power cable and call a Service Engineer.	Possible problem with the PSU module, call a Service Engineer.

### 8.7.3 Fan(s) Not Working / Modulator Overheating

This equipment is forced-air-cooled and must not be operated unless all cooling fans are working. In the event of overheating problems, refer to *Table 8.4*.

*Table 8.4: Fans Not Working / Modulator Overheating*

Step	Action	If Result of Action is Yes...	If Result of Action is No...
1	Check Air Inlets/Outlets. Blocked air inlets/outlets could restrict the flow of air and lead to overheating. Are the air inlets/outlets clear?	Proceed to next step.	Switch the equipment off and unblock the air inlets/outlets.
2	Check Fan Rotation. Inspect the fans located at the sides of the enclosure. Are the fans rotating?	Check that the Modulator has been installed with sufficient space allowed for airflow (see <i>Chapter 2, Installation</i> ). If the ambient air is too hot, additional cooling may be required.	Possible break in the dc supply from the PSU module to the suspect fan(s), or fan failure. Call a Service Engineer.

## 8.8 VT100 Terminal Emulation Program Problems

Ensure that the terminal emulation program is set up correctly. See *Section 3.1.2, Setting up the VT100 Terminal Emulation Program* for the complete procedure.

## 8.9 Alarm and Failure Reporting

### 8.9.1 Introduction

This section describes the alarm and fail conditions which cause the alarm/fail relays to be actuated and which are recorded in the Alarm log. They are dependent on the cards fitted and, in some cases, the mode of operation of the Modulator. The alarms reported are dependent upon the Alarm Mask settings. See *Section 3.5.2* for further details. This section defines the alarm-reporting scheme in the SM6600 range of Satellite Modulators.

### 8.9.2 Alarm Severity Levels

Each alarm is assigned one of six severity levels. These levels provide an indication of how it is perceived that the capability of the Modulator has been affected. Those severity levels which represent service affecting conditions ordered from most severe to least severe are **critical**, **major**, **minor** and **warning**. The six severity levels are defined below.

1. The **cleared** severity level indicates the clearing of one or more previously reported alarms. This alarm clears all alarms for the Modulator that have the same alarm type, probable cause and specific problems (if given).
2. The **indeterminate** severity level indicates that the severity level cannot be determined.
3. The **warning** severity level indicates the detection of a potential or impending service affecting fault, before any significant effects have been felt. Action should be taken to further diagnose (if necessary) and correct the problem in order to prevent it from becoming a more serious service affecting fault.
4. The **minor** severity level indicates the existence of a non-service affecting fault condition and that corrective action should be taken in order to prevent a more serious (for example, service affecting) fault. Such a severity can be reported, for example, when the detected alarm condition is not currently degrading the capacity of the Modulator.
5. The **major** severity level indicates that a service affecting condition has developed and an urgent corrective action is required. Such a severity can be reported, for example, when there is a severe degradation in the capability of the Modulator and its full capability must be restored.
6. The **critical** severity level indicates that a service affecting condition has occurred and an immediate corrective action is required. Such a severity can be reported, for example, when the Modulator becomes totally out of service and its capability must be restored.

### 8.9.3 Alarm Groups

The alarm text and severity levels for all Modulator alarms are defined in this section. Alarms are divided into four groups according to their source:

- Alarms sourced by the Host Controller card (slot number 3)
- Alarms sourced by the Input card (slot number 4)
- Alarms sourced by the Baseband card (slot number 2)
- Alarms sourced by the IF card (slot number 1)

Each alarm is capable of being masked. See *Section 3.5.2* for further details.

## 8.9.4 Host Controller Card (Slot 3) Alarms

The alarms sourced by the Host Controller card are listed in *Table 8.5*. These include general equipment alarms detected by the Host Controller card as well as those originating from the Host Controller card itself.

*Table 8.5: Host Controller Card Alarms*

Terminal Alarm Message	Front Panel Alarm Message	Severity Level
Booting	Booting	Critical
Test Mode	Test Mode	Critical
No Baseband Card	No Baseband Card	Critical
No IF Card	No IF Card	Critical
3V3 PSU Voltage Low	3V3 PSU Voltage Low	Critical
3V3 PSU Voltage High	3V3 PSU Voltage High	Critical
5V PSU Voltage Low	5V PSU Voltage Low	Critical
5V PSU Voltage High	5V PSU Voltage High	Critical
+15V PSU Voltage Low	+15V PSU Voltage Low	Critical
+15V PSU Voltage High	+15V PSU Voltage High	Critical
-15V PSU Voltage Low	-15V PSU Voltage Low	Critical
-15V PSU Voltage High	-15V PSU Voltage High	Critical
Backplane not Responding	Backplane Error	Critical
Baseband Card not Responding	Baseband Card Error	Critical
Flat Battery	Flat Battery	Warning
Flash Memory Program Fail	Host Flash Fail	Critical
Self Test Fail	Self Test Fail	Critical
Temperature Low	Temperature Low	Warning
Temperature High	Temperature High	Warning
No Licence Keys Installed	No Licence Keys	Warning
Uplink Fade Control Error	Uplink Fade Ctl Error	Major
Fan Fail	Fan Fail	Warning

## 8.9.5 Input Card (Slot 4) Alarms

The alarms sourced by the Input card are listed in *Table 8.6*.

*Table 8.6: Input Card Alarms*

Terminal Alarm Message	Front Panel Alarm Message	Severity Level
Input Fail	Input Fail	Critical
Input Packet Size Error	Input Pkt Size Error	Critical

## 8.9.6 Baseband Card (Slot 2) Alarms

The alarms sourced by the Baseband card are listed in *Table 8.7*.

*Table 8.7: Baseband Card Alarms*

Terminal Alarm Message	Front Panel Alarm Message	Severity Level
Hardware Fail	Hardware Fail	Critical
FPGA Configuration Fail	FPGA Config Fail	Critical
FPGA Temperature High	FPGA Temp High	Critical
FPGA Clock Unlocked	FPGA Clock Unlocked	Critical
Calibration Fail	Calibration Fail	Major
Modulator Core Reset	Modulator Core Reset	Critical
Modulation Fail	Modulation Fail	Critical
Clock Fail	Clock Fail	Critical
Sync Fail	Sync Fail	Critical
Input Data Rate Error	Input Data Rate Error	Critical
Host Control Disabled	Host Control Disabled	Indeterminate
Parameter Fault	Parameter Fault	Critical
I <sup>2</sup> C Bus Error	I <sup>2</sup> C Bus Error	Minor
Flash Memory Program Fail	Flash Program Fail	Critical
Download Fail	Download Fail	Critical
Baseband Synth Unlocked	Baseband Synth Unlocked	Critical
Baseband Input Fail	Baseband Input Fail	Critical

## 8.9.7 IF Card (Slot 1) Alarms

The alarms sourced by the IF card are listed in *Table 8.8* and *Table 8.9*.

*Table 8.8: IF Card Alarms – IF Output Models SM6610 and SM6620*

Terminal Alarm Message	Front Panel Alarm Message	Severity Level
IF Carrier Frequency Unlocked	IF Carrier Frequency Unlocked	Critical
IF Power Level Error	IF Power Level Error	Major
IF Output Muted	IF Output Muted	Critical

*Table 8.9: IF Card Alarms – L-Band Output Models SM6615 and SM6625*

Terminal Alarm Message	Front Panel Alarm Message	Severity Level
IF Carrier Frequency Unlocked	IF Carrier Frequency Unlocked	Critical
IF Output Muted	IF Output Muted	Critical
Up-converter Power Shutdown	UpConv Power Shutdown	Major

## 8.9.8 Front Panel Alarm LED

The red front panel Alarm LED is lit when any unmasked alarm condition exists.

**NOTE...**

The front panel display indicates the alarm severity level by using a numeric index. These are described under *Alarm Severity Levels* on page 8-9.

## 8.9.9 Alarm and Fail Relays

The alarm and fail relay contacts (described under *Signal Connections* in *Chapter 2, Installing the Equipment*) are driven by the equipment's alarms and warnings. *Table 8.10* shows the effect of masking on the relays and the Alarm LED.

*Table 8.10: Effect of Masking the Alarm and Fail Conditions*

Mask	Relay	Alarm LED
Off	None	-
Alarm	Alarm	✓
Fail	Alarm + Fail	✓

## 8.10 Event Reporting

*Table 8.11 lists the Event Log entries. See Chapter 3, Section 3.8.2 Log Menu Option 2: View Event History for details.*

*Table 8.11: Event Log Entries*

Log Entry	Description
Alarm Log Reset	The alarm log was reset
Configuration Store Reset	The configuration store has been reset
DPC Profiles Reset	All DPC profiles reset to null correction
Event Log Reset	The event log was cleared
Failed To Boot Correctly	The Modulator failed to boot correctly
File Sent By Modulator	Files were downloaded via FTP from the Modulator
Files Received By Modulator	Files were uploaded via FTP to the Modulator
FTP Connection Closed	An FTP session was closed
FTP Connection Opened	An FTP connection request was received
FTP User Failed To Log In	An FTP user attempted to login, but failed
FTP User Logged In	A user logged in via FTP
Logs Reset-Flat Battery	The logs have been reset due to the battery being flat
Modulator Stopped	
Net Config Changed	The network parameters were changed
New Configuration Saved	A new configuration has been saved
NVRAM Reset – Corruption	The logs have been reset due to corruption
Self Test Failed	The self-test failed
Stored Config Deleted	A stored configuration has been reset
Stored Configs Updated	One of the stored configuration was updated
System Entered A Test Mode	The Modulator started executing a test
System Exited Test Mode	The Modulator finished executing a test
Telnet User Logged In	A user has logged in via Telnet
Telnet User Logged Out	A Telnet user logged out
Telnet User Login Failed	A Telnet user failed to log in
Temperature Log Reset	The temperature log has been reset
User Requests A Restart	
Modulator Restarted	The Modulator rebooted
Time Updated From Network	The real time clock was updated from a network time server
Time Changed By User	A user changed the real time clock
Unknown Log Entry	The log entry is unknown
User Accounts Updated	User accounts have been modified

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# Chapter 9

## File Transfer Protocol (FTP)

### Contents

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## 9.1 File Transfer Protocol (FTP)

### 9.1.1 Introduction

#### CAUTION...

Only one logical control interface on the Modulator, i.e. Front Panel, Terminal, SNMP Remote Control, FTP, etc, should be used at any one time. Using more than one interface simultaneously may cause unexpected behaviour of the Modulator.

The SM66XX Satellite Modulators provide a File Transfer Protocol (FTP) interface, which is primarily used for code and firmware updates. It is also used for retrieving logs and configurations as well as uploading configurations.

Any FTP program may be used to access the Modulator's FTP server. However, it should be noted that the Modulator will only allow one logon at a time and many graphical FTP clients use multiple logons. The FTP client supplied with Microsoft Windows NT 4.0 is recommended. The sample screens shown in this chapter were obtained using this FTP client.

#### NOTE...

The Modulator uses a reduced instruction set of standard FTP commands.

### 9.1.2 FTP Interface

To FTP to the Modulator, FTP Logon privilege is required. A typical logon screen is as follows:

```
C:\>ftp 192.168.55.3
Connected to 192.168.55.3.
220 TANDBERG      Satellite Modulator SM6600
User (192.168.55.3:(none)): root
331 Password required for user root.
Password:
230-Modulator identity:
230-DEV001
230 User logged in.
ftp>
```

When logged on, the Modulator returns its identity, which can be set from the terminal interface described in *Chapter 3, Operating the Equipment Locally*.

The FTP server responds to the normal `dir` and `ls` commands. The top-level directory is as follows:

```
ftp> dir
200 Set port to 172.17.225.20:1143.
150 opening data connection
drw-rw-rw- 1 system      system          0 FEB 26 2004 software
drw-rw-rw- 1 system      system          0 FEB 26 2004 logs
drw-rw-rw- 1 system      system          0 FEB 26 2004 config
drw-rw-rw- 1 system      system          0 FEB 26 2004 dpc
drw-rw-rw- 1 system      system          0 FEB 26 2004 firmware
drw-rw-rw- 1 system      system          0 FEB 26 2004 webserver
drw-rw-rw- 1 system      system          0 FEB 26 2004 keys
226 transfer complete.
ftp: 469 bytes received in 0.02Seconds 29.31Kbytes/sec.
ftp>
```

The format of the **dir** results reflect the FTP specification. The **User** is the name of the user that last changed the file, or **system** for fixed or read-only files and directories.

The **group** is used to indicate the version number of the file, or one of the following for files that have no version:

cfg	-	Configuration file
log	-	Log file

### 9.1.3 The Software Directory

This directory contains the software for the Modulator. To enter the software directory, type **cd /software**.

```

ftp> cd /software
250 software/
ftp> dir
200 Set port to 172.17.225.20:1146.
150 opening data connection
--w---w-- 1 root      V03.00      1154637 FEB 23 16:20 active_app.hex
--w---w-- 1 root      V01.00      68661 MAY 06 2004 monitor.hex
--w---w-- 1 system    system      0 FEB 26 2004 minapp.hex
--w---w-- 1 root      V03.00      1154637 FEB 23 16:18 app.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:00 boot.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:00 ctl.hex
226 transfer complete.
ftp: 423 bytes received in 0.03Seconds 13.65Kbytes/sec.
ftp>

```

The file **active\_app.hex** is the current main application code for the Modulator. **Monitor.hex** is the start-up code for the Host Controller card. **Minapp.hex** is the reduced application code (not currently supported). **App.hex** is the backup application code. **Boot.hex** is the boot code for the Baseband card and **ctl.hex** is the Baseband card control code.

#### NOTE...

The contents of this directory depend on the user's access rights.

It is not possible to retrieve software files from the Modulator.

### 9.1.4 The Firmware Directory

This directory contains the firmware for the Modulator. To enter the firmware directory, type **cd /firmware**. Typical firmware directory contents are as follows:

```

ftp> cd /firmware
250 firmware/
ftp> dir
200 Set port to 172.17.225.20:1147.
150 opening data connection
--w---w-- 1 system    s13129     999999 FEB 23 18:03 dsp.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:03 dsp2.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:03 coeff20.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:03 coeff25.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:03 coeff30.hex
--w---w-- 1 system    s13129     999999 FEB 23 18:03 coeff35.hex
226 transfer complete.
ftp: 356 bytes received in 0.09Seconds 3.79Kbytes/sec.
ftp>

```

The above files are firmware files that are programmed into the FPGA on the Baseband Card. The file **dsp.hex** is the FPGA configuration file for the DVB-S and DVB-DSNG modulation/coding standards. The file **dsp2.hex** is the FPGA configuration file for the DVB-S2 modulation/coding standard. The files **coeff20.hex**, **coeff25.hex**, **coeff30.hex** and **coeff35.hex** are filter coefficient files for the baseband shaping filters, with roll-off factors of 20%, 25%, 30% and 35%, respectively.

## 9.1.5 The Logs Directory

This directory contains the logs kept by the Modulator. These are the same logs as those viewed on the terminal described in *Chapter 3, Operating the Equipment Locally*.

```
ftp> cd /logs
250 logs/
ftp> dir
200 Set port to 172.17.225.20:1148.
150 opening data connection
-rw-rw-rw- 1 system      log          41494 FEB 23 17:57 event.log
-rw-rw-rw- 1 system      log          9587 FEB 23 17:57 alarm.log
-rw-rw-rw- 1 system      log          201 FEB 23 18:04 temp.log
226 transfer complete.
ftp: 209 bytes received in 0.41Seconds 0.51Kbytes/sec.
ftp>
```

The file **event.log** is the Event log, **alarm.log** is the Alarm log and **temp.log** is the Temperature log.

### NOTE...

The data for these logs is held in a compressed format, and when viewing a directory the logs are uncompressed to calculate the file size, which may take a few seconds.

Log files may be retrieved by using the **get** command.

```
ftp> get event.log
200 Set port to 172.17.225.20:1149.
150 opening data connection
226 Transfer complete.
ftp: 41494 bytes received in 0.94Seconds 49.61Kbytes/sec.
ftp>
```

The log files may be reset by using the **del** command.

```
ftp> del event.log
250 File successfully deleted.
ftp>
```

Doing this is exactly the same as doing reset event log from the terminal, as described in *Chapter 3, Operating the Equipment Locally*.

## 9.1.6 The Config Directory

### Contents of the Directory

The **config** directory contains the nine stored configurations as well as the active configuration. It also holds the Ethernet configuration and version information.

The **active.cfg** file holds the currently implemented configuration and cannot be deleted. Files **config01.cfg** to **config08.cfg** hold saved user configurations and can be deleted. The **config09.cfg** file holds the factory default configuration and cannot be deleted. Neither the Ethernet configuration file **ethernet.cfg** nor the version and build information file **version.cfg** can be deleted.

```
ftp> cd /config
250 config/
ftp> dir
200 Set port to 172.17.225.20:1166.
150 opening data connection
-r--r--r-- 1 AnyUser   cfg          545 MAY 20 06:50 active.cfg
-rw-rw-rw- 1 system    cfg          543 MAY 20 07:53 config01.cfg
-rw-rw-rw- 1 unknown   cfg          34 APR 28 15:29 config02.cfg
-rw-rw-rw- 1 unknown   cfg          34 APR 28 15:29 config03.cfg
-rw-rw-rw- 1 unknown   cfg          34 APR 28 15:29 config04.cfg
-rw-rw-rw- 1 system    cfg          543 MAY 20 07:52 config05.cfg
-rw-rw-rw- 1 unknown   cfg          34 APR 28 15:29 config06.cfg
-rw-rw-rw- 1 unknown   cfg          34 APR 28 15:29 config07.cfg
-rw-rw-rw- 1 unknown   cfg          34 APR 28 15:29 config08.cfg
-rw-rw-rw- 1 system    cfg          547 APR 28 15:32 config09.cfg
-r--r--r-- 1 system    cfg          270 MAY 20 07:54 ethernet.cfg
-r--r--r-- 1 system    cfg          1456 MAY 20 07:54 version.cfg
226 transfer complete.
ftp: 873 bytes received in 0.20Seconds 4.30Kbytes/sec.
ftp>
```

## Typical Config Files

### **config09.cfg (or any config file)**

The following illustration shows a typical configuration file.

```
Config 9      Name: Default

Data Select     : ASI 1
Packet Size    : 188 bytes
Rate Adapt     : OFF
Bit Rate       : 27.647059 Mbit/s
Symbol Rate    : 20.000000 Msym/s
Standard        : DVB-S/DSNG
Modulation     : QPSK
FEC Rate       : 3/4
Frame Size     : Normal
Pilots          : OFF
Map Mode        : Peak power
Gold Seq N     : 0
Roll-off        : 35 %
IF Frequency   : 70.000 MHz
IF Power        : -10.0 dBm
IF Output       : ON
Mod. State     : ON
IF Spectrum    : Normal
IF Tilt         : 0.000 dB/MHz
UpConv Freq    : 10.000000 GHz
DPC State      : OFF
UFC Mode        : Manual
```

## **ethernet.cfg**

The following illustration shows a typical Ethernet configuration file.

```

IP Address      : 192.168.55.3
Subnet Mask    : 255.255.240.0
Gateway IP     : 192.168.63.254
Gateway        : Enabled
MAC Address    : 00:20:AA:1F:00:01
Time Server IP : 0.0.0.0
Time Protocol   : SNTP
Time Server     : Disabled
SNMP Mode      : Full Control

```

## **version.cfg**

The following illustration shows a typical version and build information file.

```

Identifying Name          : DEV001
Unit Inventory Serial No. : 1
Unit Initialisation Date : FEB 26 2004 09:06:40
Last Boot Time           : FEB 23 2006 17:57:04

Controller Card
PCB Revision            : 3
Modification Status      : 0
Serial No.               : 0008004E6D5A
Firmware Version         : 1.1
Boot Software Version    : 01.00
Main Software Version    : 04.00
Web Site Version         : 01.00

Backplane
PCB Revision            : 2
Modification Status      : 0
Firmware Version         : 1.0

Modulator Baseband Card
Card Type                : S13129
PCB Revision              : 1
Modification Status        : 1
Serial No.                 : 000000000000
CPLD Firmware Version     : 1.0
DSP Firmware Version       : 3.1
Software Version           : 3.0

Modulator IF Card
Card Type                : S10310
PCB Revision              : 3
Modification Status        : 0
Serial No.                 : 0008003940E2
Firmware Version           : 1.1

Software Options
SM66XX/SWO/HOM          : Enabled
SM66XX/SWO/HS             : Enabled

```

## Downloading Configurations

It is possible to download configurations to the Modulator using FTP. Any of the eight stored user configurations **config01.cfg** to **config08.cfg** may be changed. The currently implemented configuration **active.cfg** and the factory default configuration **config09.cfg** may not be changed in this way.

To download a configuration, a configuration file must be prepared in a specific format for the Modulator to understand. It is recommended that a configuration file be retrieved from the Modulator as a starting point.

The format is as follows:

```
parameter name : value
```

## Exiting FTP Session

To exit the FTP session, type **bye** or **quit** then press **Enter**.

```
ftp> bye  
221 Closing connection ... goodbye.  
C:\>
```

## Chapter 10

# Licence Keys

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## 10.1 Introduction

Certain functionality of the Modulator is dependent upon the specific Modulator model, the hardware options fitted and the software options installed in it. Software options are enabled or disabled by means of licence keys installed in the Modulator. A licence key is a string of numbers which, when downloaded to a Modulator, will enable a specific feature or set of features.

Licence keys may be installed by the user, allowing field upgrading of Modulators to be performed simply.

## 10.2 Obtaining Licence Keys

Licence keys can be purchased from your local TANDBERG Television sales representative. To obtain a key or keys, specify the options required plus the serial numbers of the Modulators. These can be obtained from the Terminal or FTP interfaces. Below is a typical version information screen from the terminal:

```

Identifying Name      : DEV001
Unit Inventory Serial No.   : 1
Unit Initialisation Date    : FEB 26 2004 09:06:40
Last Boot Time          : FEB 23 2006 17:57:04

Controller Card
  PCB Revision        : 3
  Modification Status : 0
  Serial No.          : 0008004E6D5A
  Firmware Version    : 1.1
  Boot Software Version: 01.00
  Main Software Version: 04.00
  Web Site Version    : 01.00

Backplane
  PCB Revision        : 2
  Modification Status : 0
  Firmware Version    : 1.0

Modulator Baseband Card
  Card Type           : S13129
  PCB Revision        : 1
  Modification Status : 1
  Serial No.          : 000000000000
  CPLD Firmware Version: 1.0
  DSP Firmware Version: 3.1
  Software Version    : 3.0

Modulator IF Card
  Card Type           : S10310
  PCB Revision        : 3
  Modification Status : 0
  Serial No.          : 0008003940E2
  Firmware Version    : 1.1

Software Options
  SM66XX/SWO/HOM     : Enabled
  SM66XX/SWO/HS       : Enabled

```

To ensure the correct licence key is generated, this entire file should be supplied. Licence keys will be sent via email.

A single key can enable more than one feature, but will only work on a single Modulator. When keys are ordered for several Modulators a number of keys may be supplied as a single licence key file.

## 10.3 Entering Single Licence Keys

### 10.3.1 Single Key

When a single key is requested, it may be entered via the FTP interface.

### 10.3.2 FTP Entry

Save the emailed key to a file called **licence.dat** and download to the keys directory. An example session is shown as follows:

```
C:\>ftp 192.168.55.3
Connected to 192.168.55.3.
220 TANDBERG      Satellite Modulator SM6600
User (192.168.55.3:(none)): root
331 Password required for user root.
Password:
230-Modulator identity:
230-DEV001
230 User logged in.
ftp> cd keys
250 keys/
ftp> put licence.dat
200 Set port to 172.17.225.20:1356.
150 opening data connection
226-DPC:Disabled
226-8PSK:Enabled
226-16QAM:Enabled
226-High Speed:Enabled
226-Low Speed:Enabled
226 Transfer complete.
ftp: 90 bytes sent in 0.00Seconds 90000.00Kbytes/sec.
ftp> bye
221 Closing connection ... goodbye.
```

## 10.4 Entering Multiple Licence Keys

The process of entering several keys is the same as for a single key. Entering keys intended for several Modulators to a single unit does not cause a problem as keys intended for other Modulators are ignored.

For example, if a system consists of 10 Modulators and they are all to be upgraded to include higher order modulation (HOM), a large licence key file will be supplied. This file can be downloaded to all the Modulators within the system.

# Chapter 11

## XPO Web Control Interface

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## 11.1 Introduction

The XPO interface provides a web-based method for controlling the modulator via Internet Explorer. This interface is in addition to the Telnet, serial and front panel interfaces and is complementary to them.

Parameters are set in the interface, then committed by clicking on the **Apply Changes** button. Parameters may be refreshed by clicking on the **Refresh** button. The results of the action are displayed in the bottom pane of the web page.

## 11.2 Login Screen

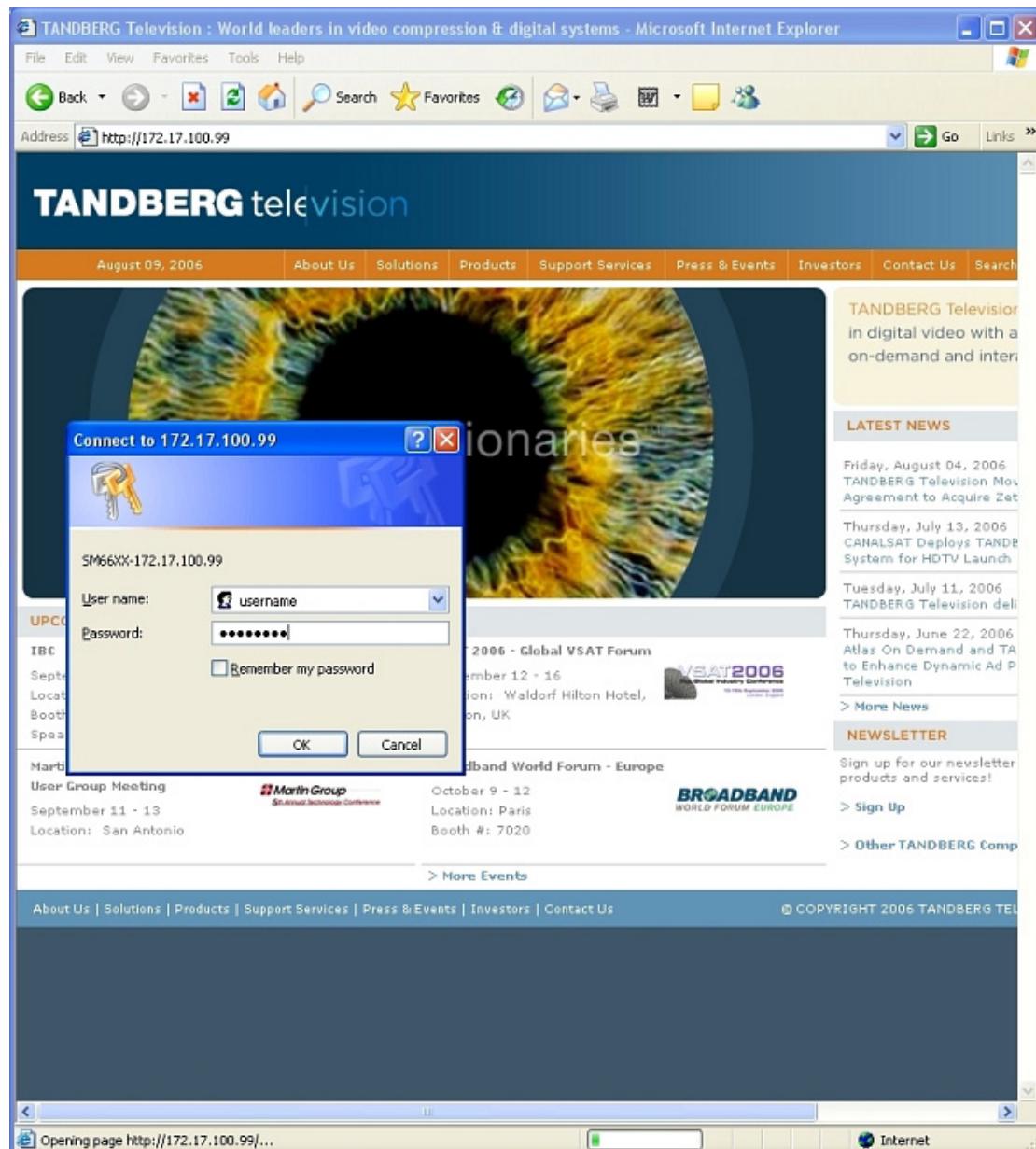


Figure 11.1: Login Screen

Upon opening the modulator home page with the browser, the user will be prompted to provide a username and password. These default to `username` and `password`, but the username may be changed in the telnet interface, whilst the password may also be changed using the XPO interface. If no username and password is supplied, the interface will offer only read-only access.

## 11.3 Status Tab

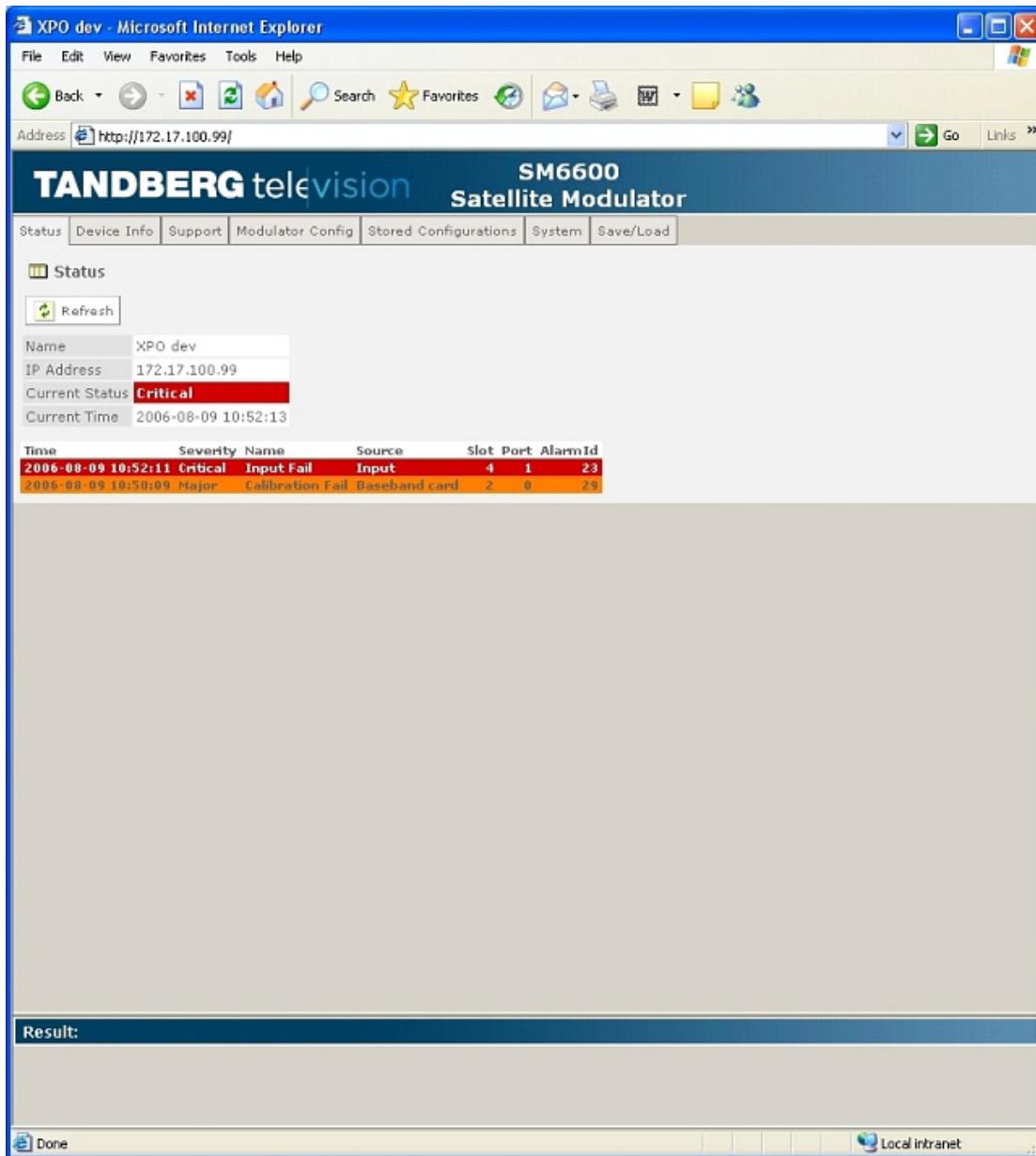


Figure 11.2: Status Tab

The Status Tab shows an overview of the current status of the modulator, including any current alarms.

## 11.4 Device Info Tab

### 11.4.1 Main Page

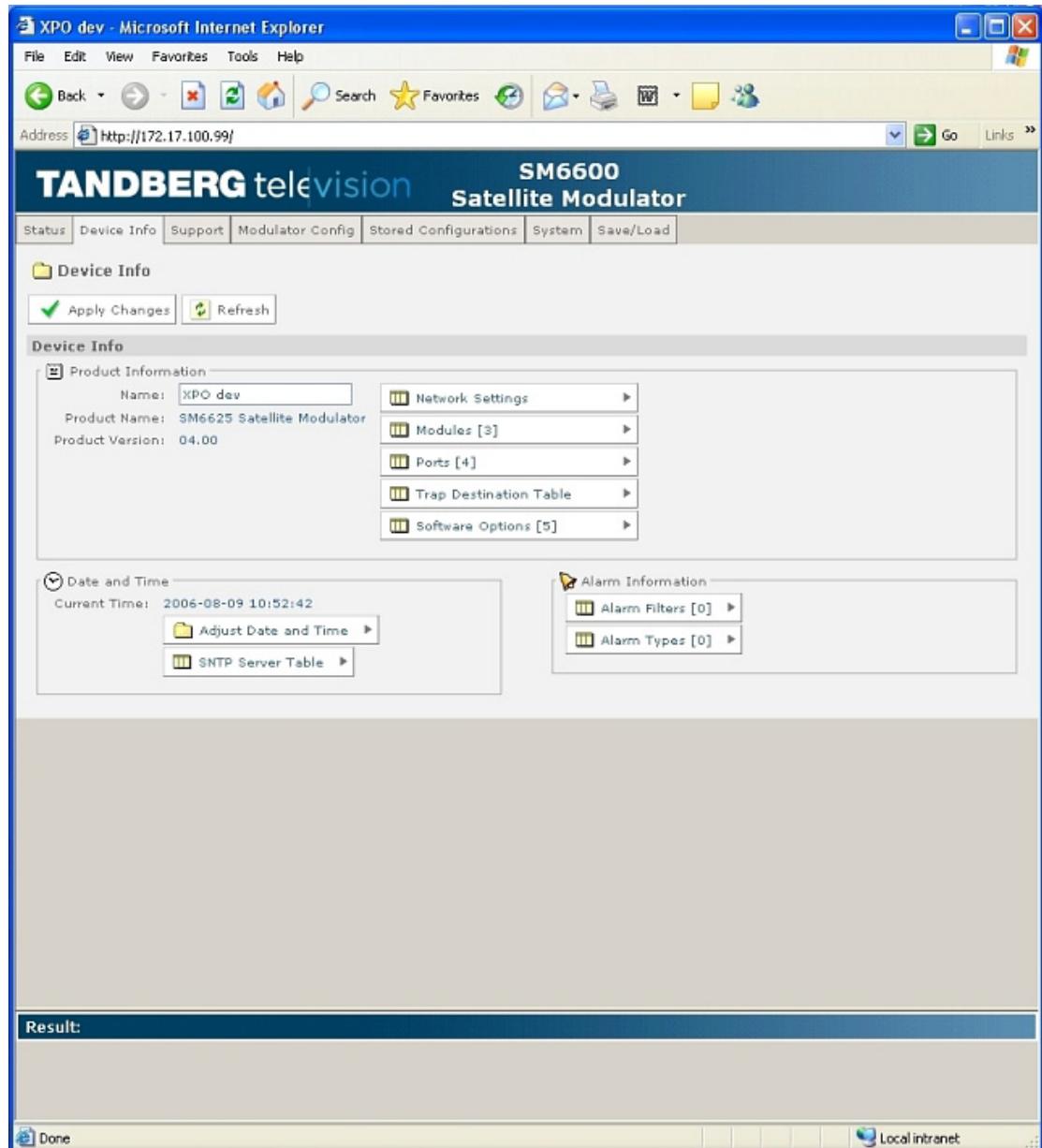


Figure 11.3: Device Info Tab

The Device Info tab contains details of the modulator's current settings, including versions, installed options and network settings.

## 11.4.2 Device Info – Network Table

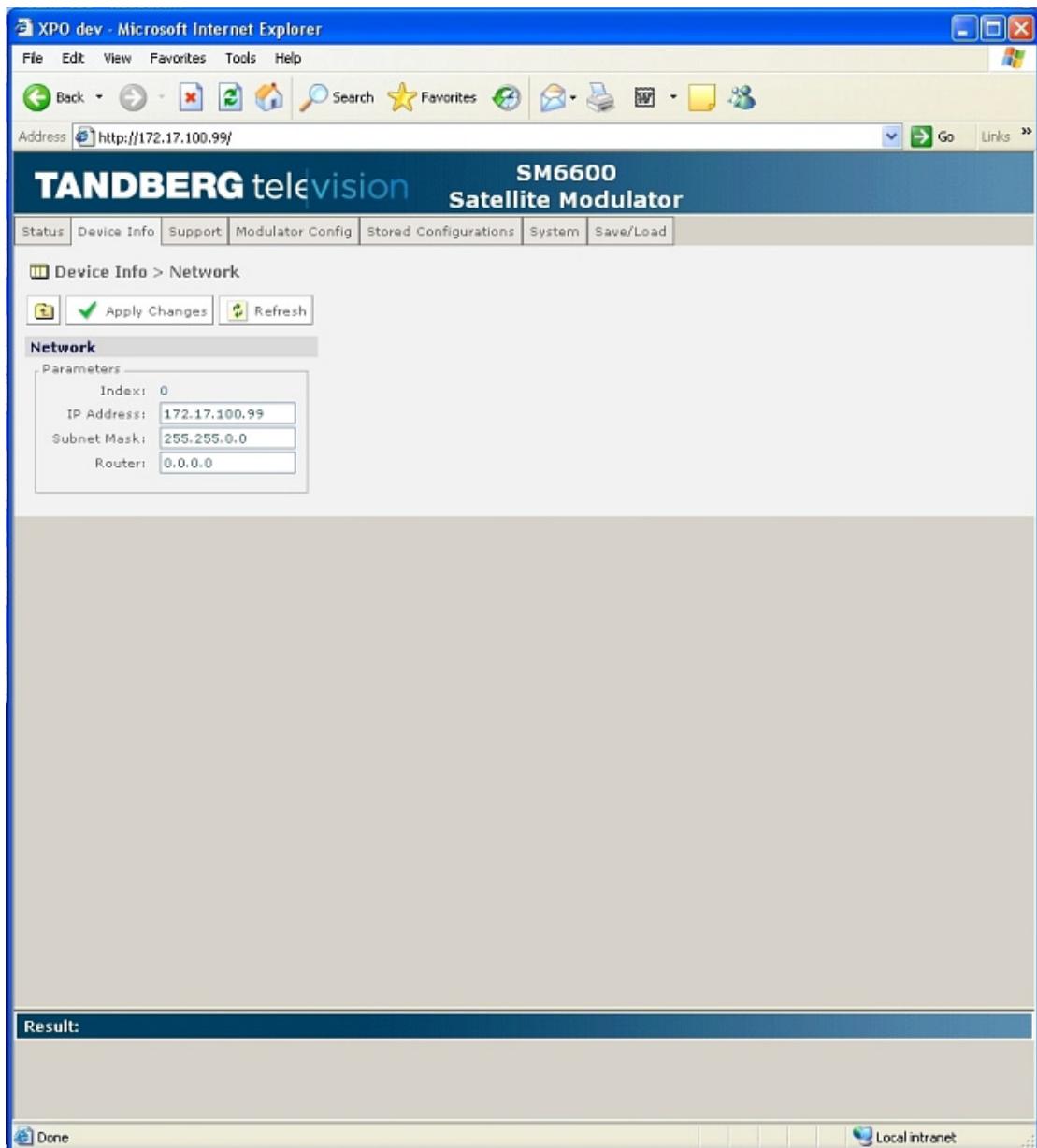


Figure 11.4: Device Info – Network Table

Here the user may alter the network settings for the modulator.

**NOTE...**

The settings do not take effect until the modulator is rebooted.

A setting of 0.0.0.0 for the router indicates that there is no gateway in effect.

See [Section 3.7.2](#).

### 11.4.3 Device Info – Modules Table

The screenshot shows a Microsoft Internet Explorer window displaying the XPO Web Control Interface for a TANDBERG television SM6600 Satellite Modulator. The title bar reads "XPO dev - Microsoft Internet Explorer". The address bar shows "http://172.17.100.99/". The main content area has a header "TANDBERG television" and "SM6600 Satellite Modulator". Below the header is a navigation menu with tabs: Status, Device Info (which is selected), Support, Modulator Config, Stored Configurations, System, and Save/Load. Under the Device Info tab, there is a sub-menu "Device Info > Modules". The main content area displays a table titled "Modules" with the following data:

Slot	ModuleID	Name	HW-ID	Serial Number	SW Version	SW Build Time	FW Version	PLD Version
1	S11291	L-Band Modulator Card	2:0	00080024E759			1.0	
2	S131303	Baseband Card (with PREKOR)	1:1	000000000000	3.0		3.0	1.0
3	S11340	Host Controller Card	3:0	000800116BD5	04.00	Aug 8 2006 16:15:20	1.1	

At the bottom of the page, there is a "Result:" section which is currently empty. The status bar at the bottom right shows "Local intranet".

Figure 11.5: Device Info – Modules Table

This table lists the modules installed in the modulator, including serial numbers and versions where applicable.

## 11.4.4 Device Info – Ports Table

The screenshot shows a Microsoft Internet Explorer window titled "XPO dev - Microsoft Internet Explorer". The address bar contains "http://172.17.100.99/". The main content area displays the "TANDBERG television SM6600 Satellite Modulator" interface. A navigation menu at the top includes "Status", "Device Info" (which is selected), "Support", "Modulator Config", "Stored Configurations", "System", and "Save/Load". Below the menu, a breadcrumb trail shows "Device Info > Ports". There are two buttons: "Refresh" and a button with a gear icon. A table titled "Ports" lists the following data:

Slot	Port	Type	TypeValue	Direction	DirectionValue
1	1	Satellite IF	18	Output	2
1	2	Satellite IF	18	Output	2
2	1	DVB ASI	3	Input	1
2	2	DVB ASI	3	Input	1

A "Result:" section below the table is currently empty. At the bottom of the page are "Done" and "Local intranet" buttons.

Figure 11.6: Device Info – Ports Table

The Ports table lists the inputs and outputs available on the modulator.

## 11.4.5 Device Info – SNMP Trap Destination Table

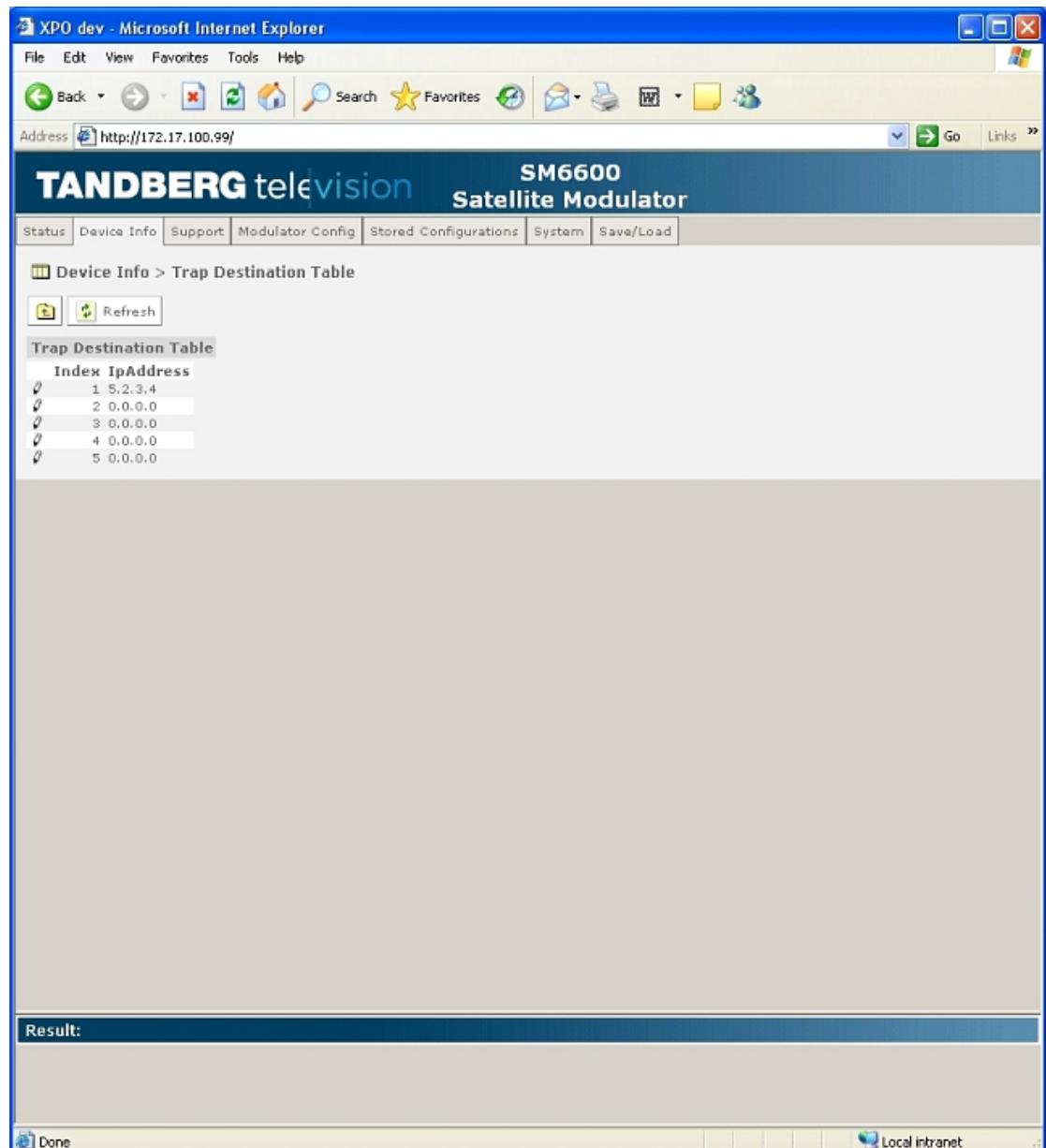


Figure 11.7: Device Info – SNMP Trap Destination Table

The modulator can make use of up to 5 trap destinations for SNMP control. These are set in the trap destination table. An address of 0.0.0.0 indicates that the trap destination is not set.

See Section 3.7.2.

## 11.4.6 Device Info – Software Options Table

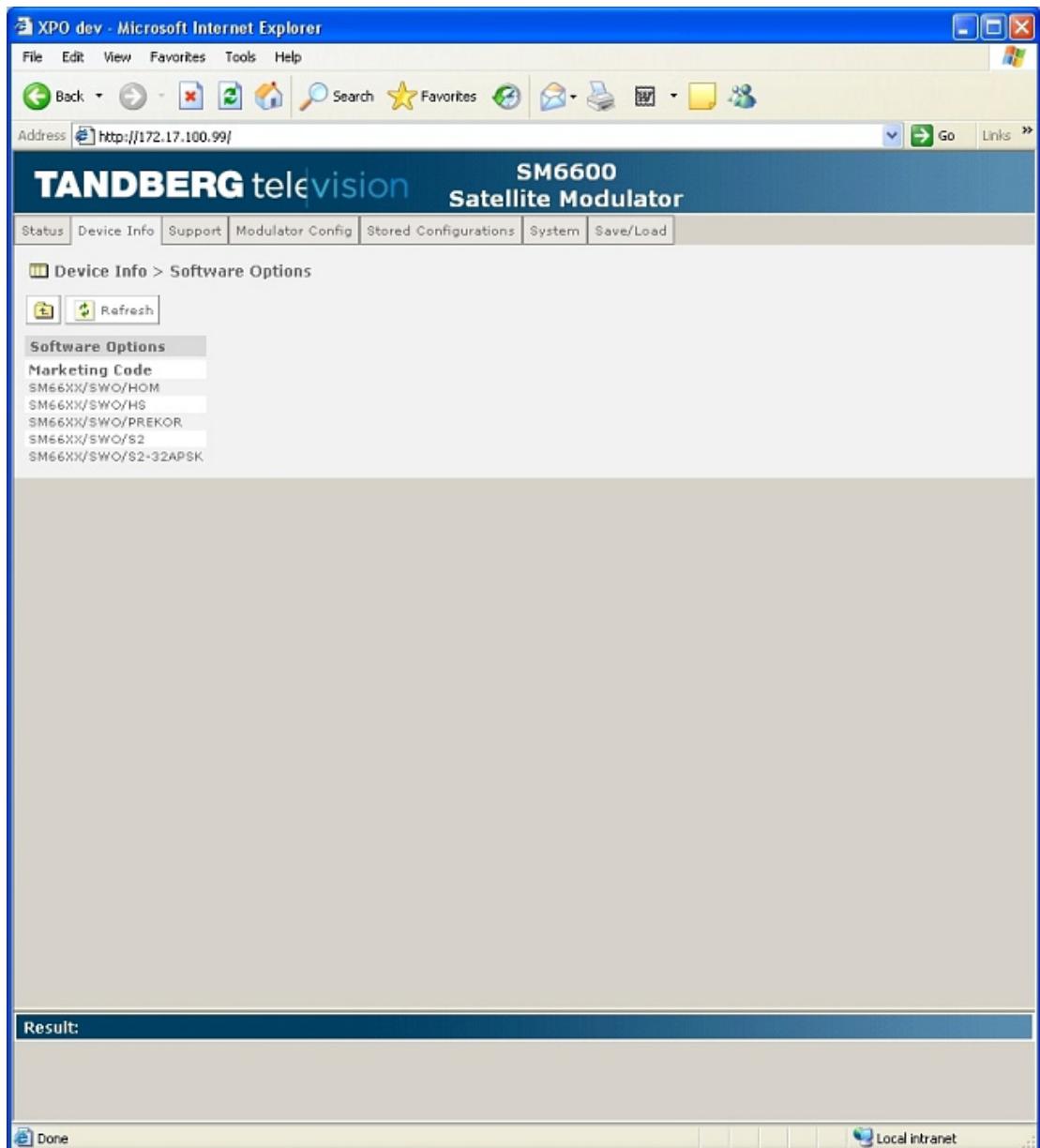


Figure 11.8 Device Info – Software Options Table

This table lists the licensed options installed at boot time.

## 11.4.7 Device Info – Adjust Date and Time

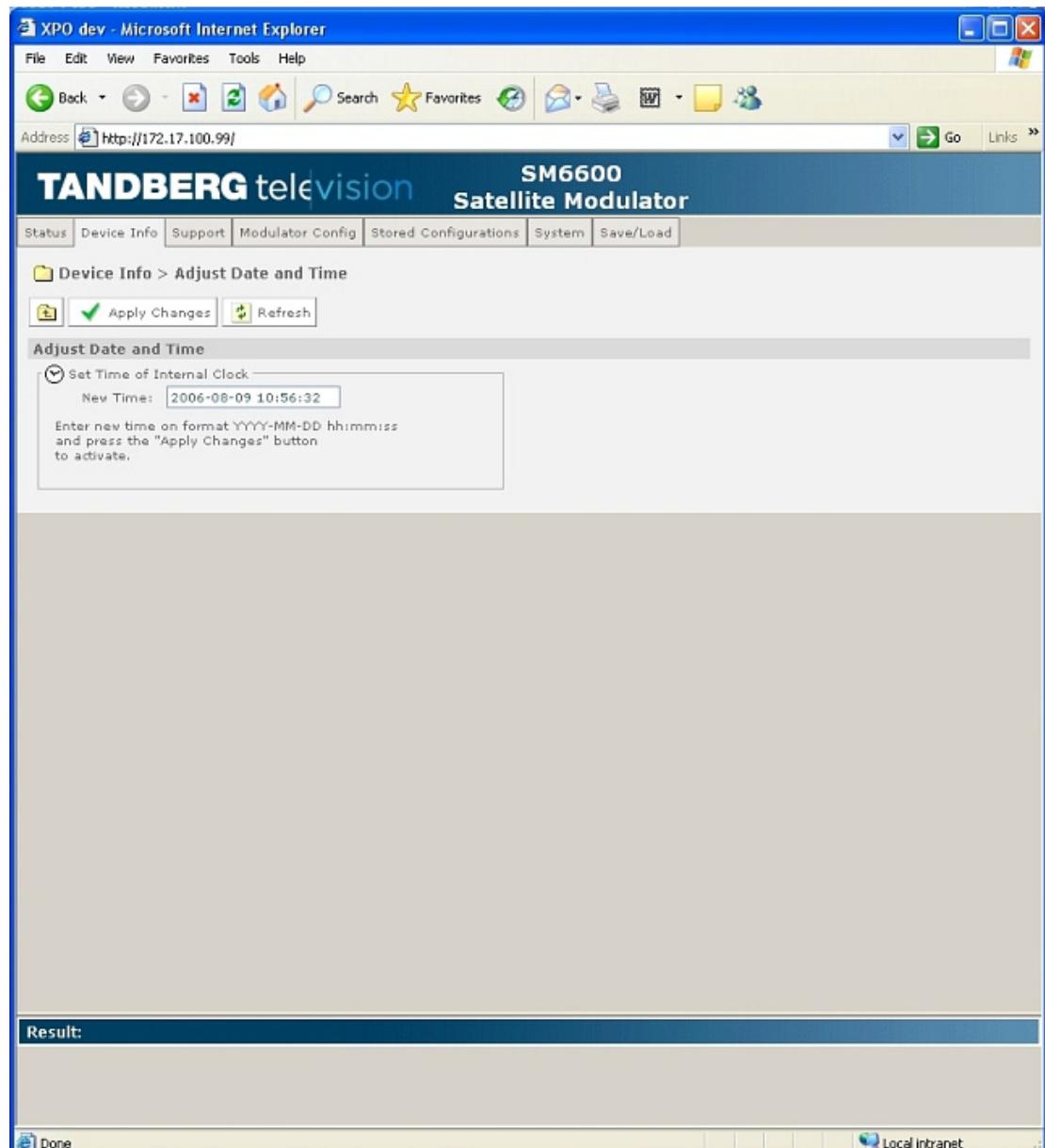


Figure 11.9: Device Info – Adjust Date and Time

This table allows the adjustment of the date and time of the modulator.

See Section 3.7.2.

## 11.4.8 Device Info – SNTP Server Table

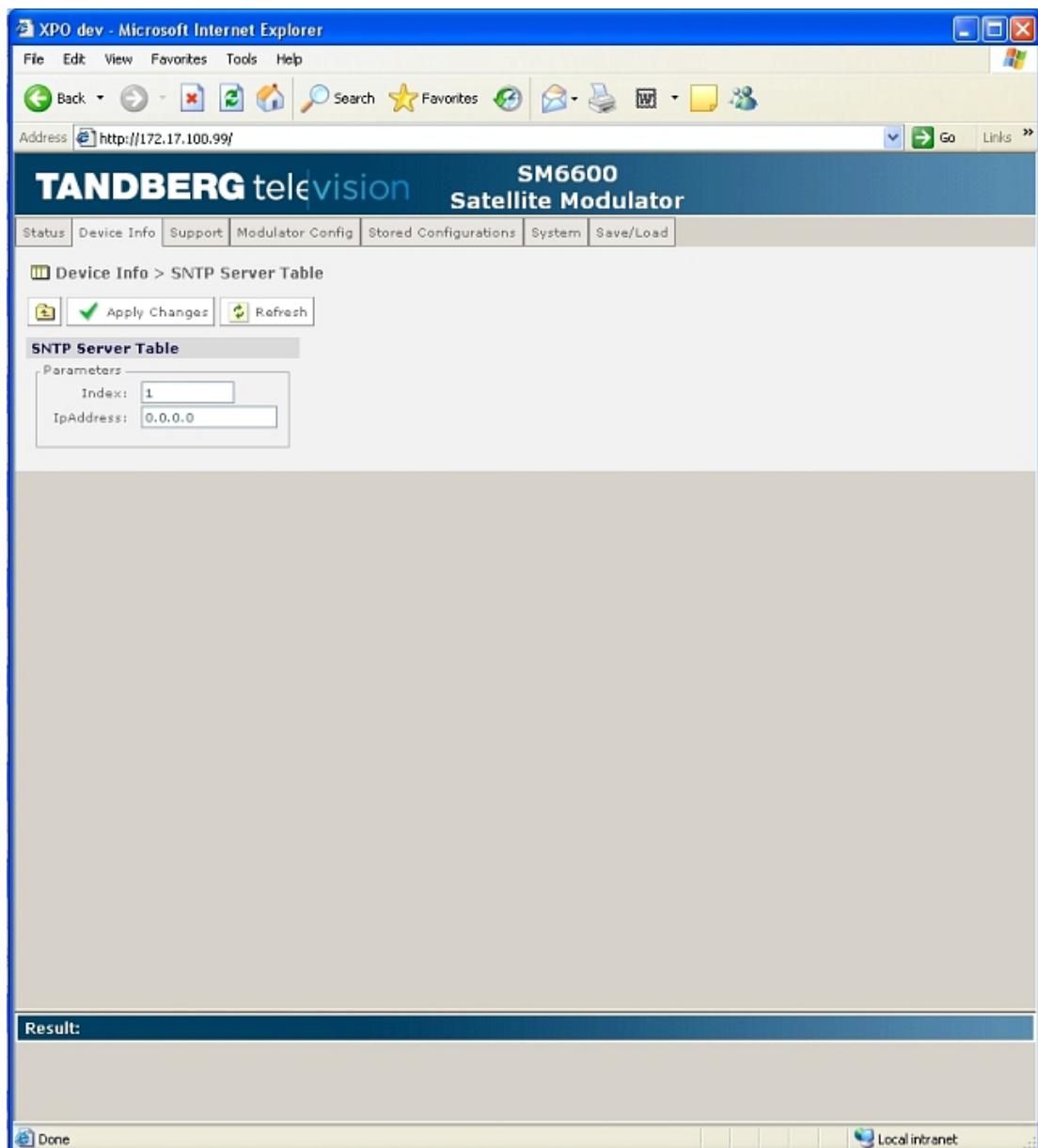


Figure 11.10: Device Info – SNTP Server Table

The modulator can derive its time settings from an SNTP server; an address of 0.0.0.0 indicates that this function is disabled.

See Section 3.7.2.

## 11.4.9 Device Info – Alarm Filters Table

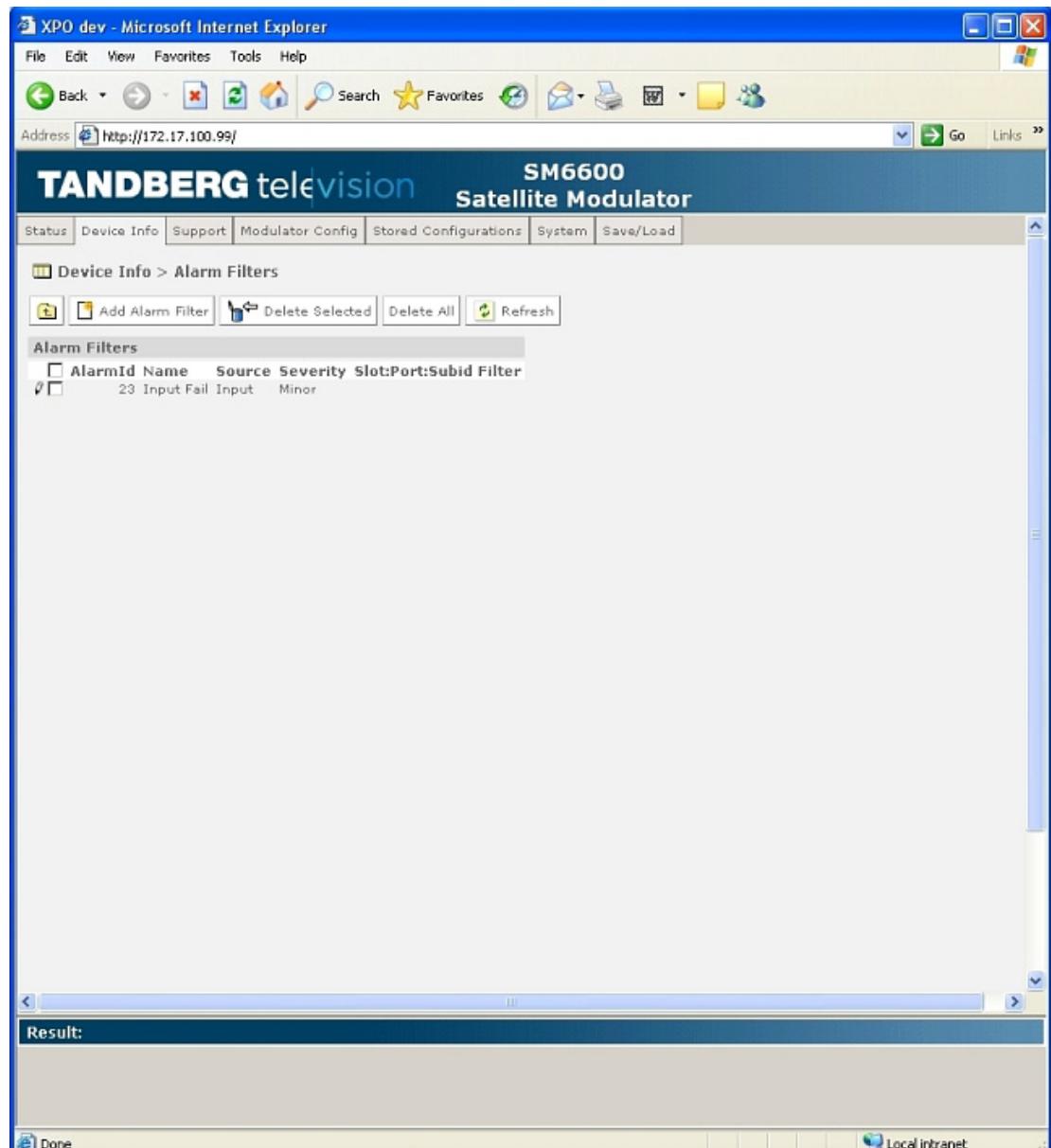


Figure 11.11: Device Info – Alarm Filters Table

The severity of reported alarms may be upgraded or downgraded by adding filters to the Alarm Filters table.

## 11.4.10 Device Info – Alarm Types Table

The screenshot shows a Microsoft Internet Explorer window titled "XPO dev - Microsoft Internet Explorer". The address bar contains "http://172.17.100.99/". The main content area displays the "TANDBERG television SM6600 Satellite Modulator" interface. A navigation menu at the top includes "Status", "Device Info", "Support", "Modulator Config", "Stored Configurations", "System", and "Save/Load". Below the menu, a breadcrumb trail shows "Device Info > Alarm Types". A toolbar with icons for back, forward, search, and refresh is visible. The main content is a table titled "Alarm Types" with 46 items. The columns are "AlarmId", "Name", "Source", and "Severity". The table lists various alarms such as "1 Booting", "2 Test Mode", and "30 Modulator Core Reset", categorized by source (Host card or Baseband card) and severity (Critical, Warning, or Major). A "Result:" section is present below the table, and the status bar at the bottom right shows "Local intranet".

AlarmId	Name	Source	Severity
1	Booting	Host card	Critical
2	Test Mode	Host card	Critical
3	No Baseband Card	Host card	Critical
4	No IF Card	Host card	Critical
5	3V3 PSU Voltage Low	Host card	Critical
6	3V3 PSU Voltage High	Host card	Critical
7	5V PSU Voltage Low	Host card	Critical
8	5V PSU Voltage High	Host card	Critical
9	+15V PSU Voltage Low	Host card	Critical
10	+15V PSU Voltage High	Host card	Critical
11	-15V PSU Voltage Low	Host card	Critical
12	-15V PSU Voltage High	Host card	Critical
13	Backplane not Responding	Host card	Critical
14	Baseband Card not Responding	Host card	Critical
15	Flat Battery	Host card	Warning
16	Flash Memory Program Fail	Host card	Critical
17	Self Test Fail	Host card	Critical
18	Temperature Low	Host card	Warning
19	Temperature High	Host card	Warning
20	No Licence Keys Installed	Host card	Warning
21	Uplink Fade Control Error	Host card	Major
22	Fan Fail	Host card	Warning
23	Input Fail	Input	Critical
24	Input Packet Size Error	Input	Critical
25	Hardware Fail	Baseband card	Critical
26	FPGA Configuration Fail	Baseband card	Critical
27	FPGA Temperature High	Baseband card	Critical
28	FPGA Clock Unlocked	Baseband card	Critical
29	Calibration Fail	Baseband card	Major
30	Modulator Core Reset	Baseband card	Critical

Figure 11.12: Device Info – Alarm Types Table

This table lists the possible alarms, their IDs, sources and severity.

## 11.5 Support Tab

### 11.5.1 Main Page

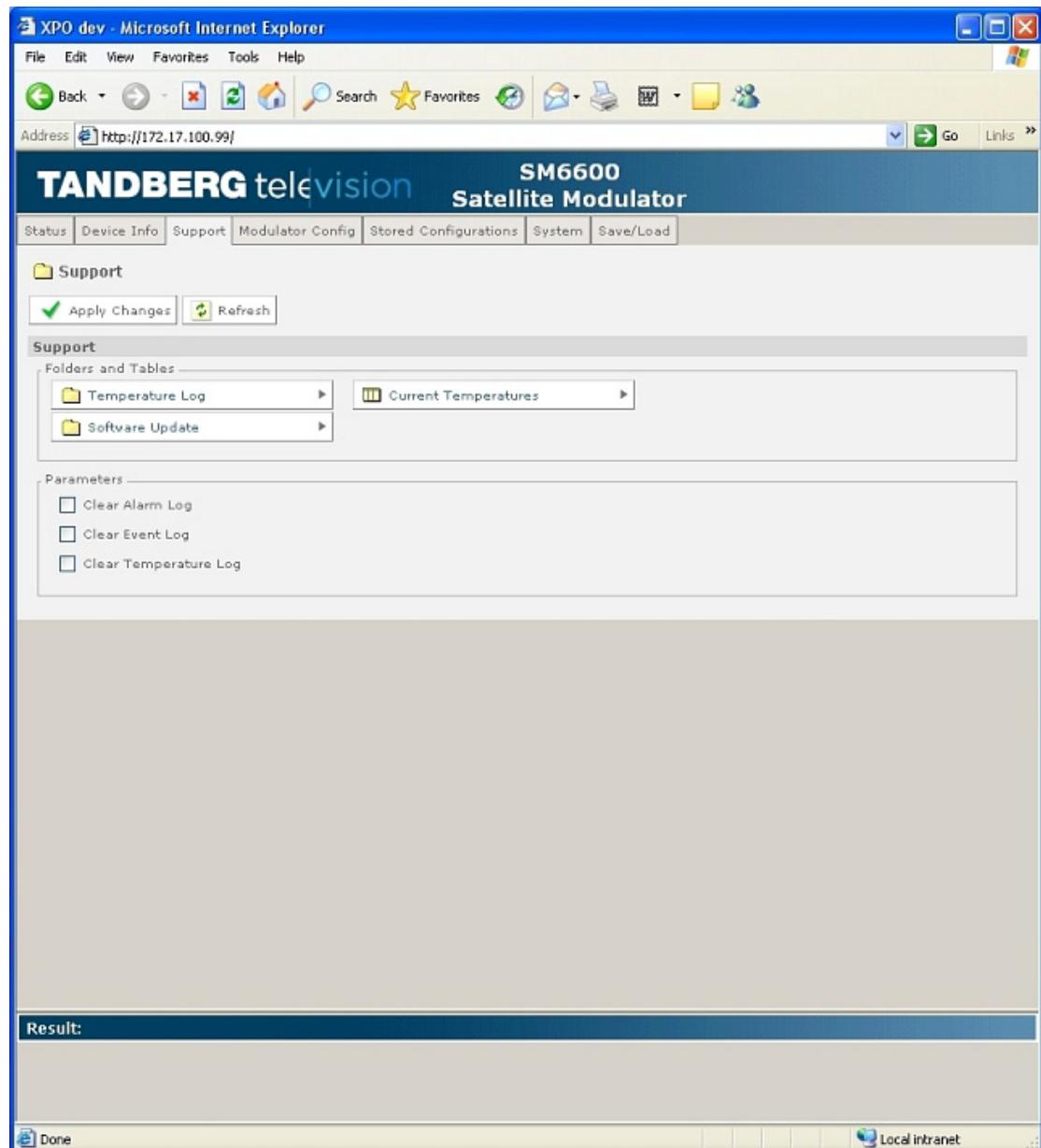


Figure 11.13: Support Tab

The Support tab contains the log folders and the facility to clear the logs.

See Section 3.8.2.

## 11.5.2 Support – Temperature Log

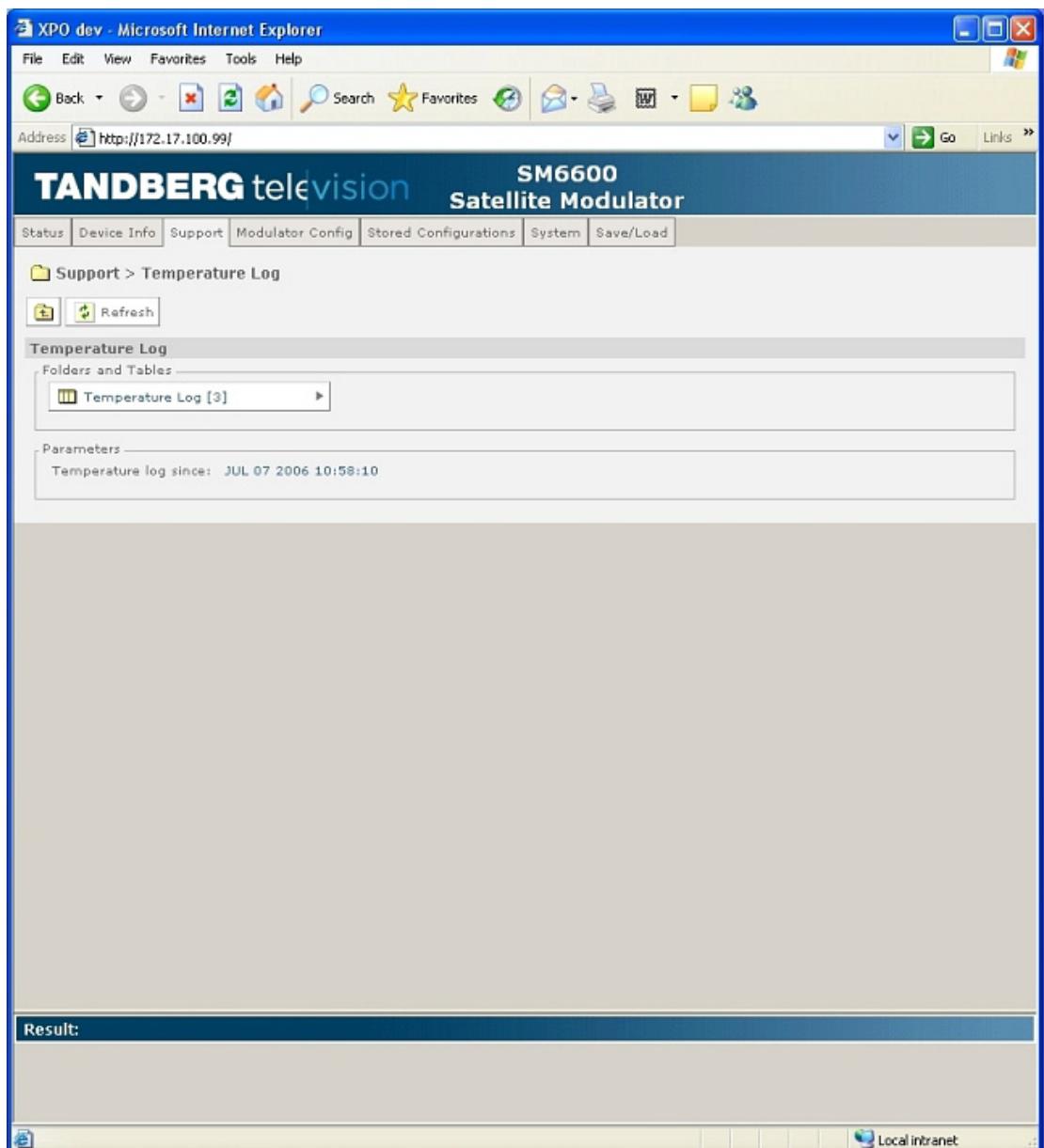


Figure 11.14: Support – Temperature Log

This folder contains the Temperature Log table itself, along with the date that the log was last reset.

See Section 3.8.2.

### 11.5.3 Support – Temperature Log Table

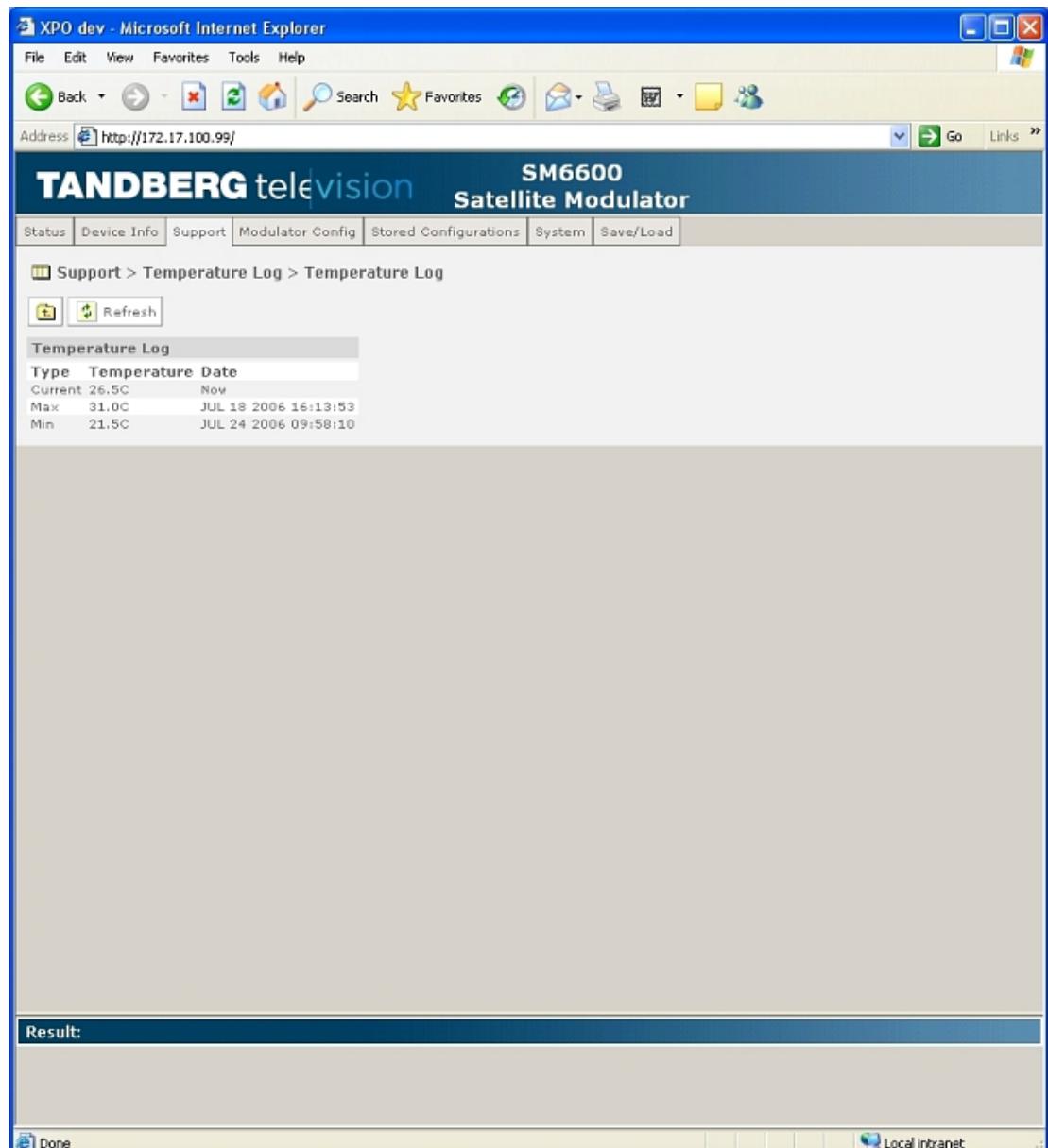


Figure 11.15: Support – Temperature Log Table

The temperature log table lists the current, maximum and minimum temperatures recorded for the host card.

See Section 3.8.2.

## 11.5.4 Support – Software Update

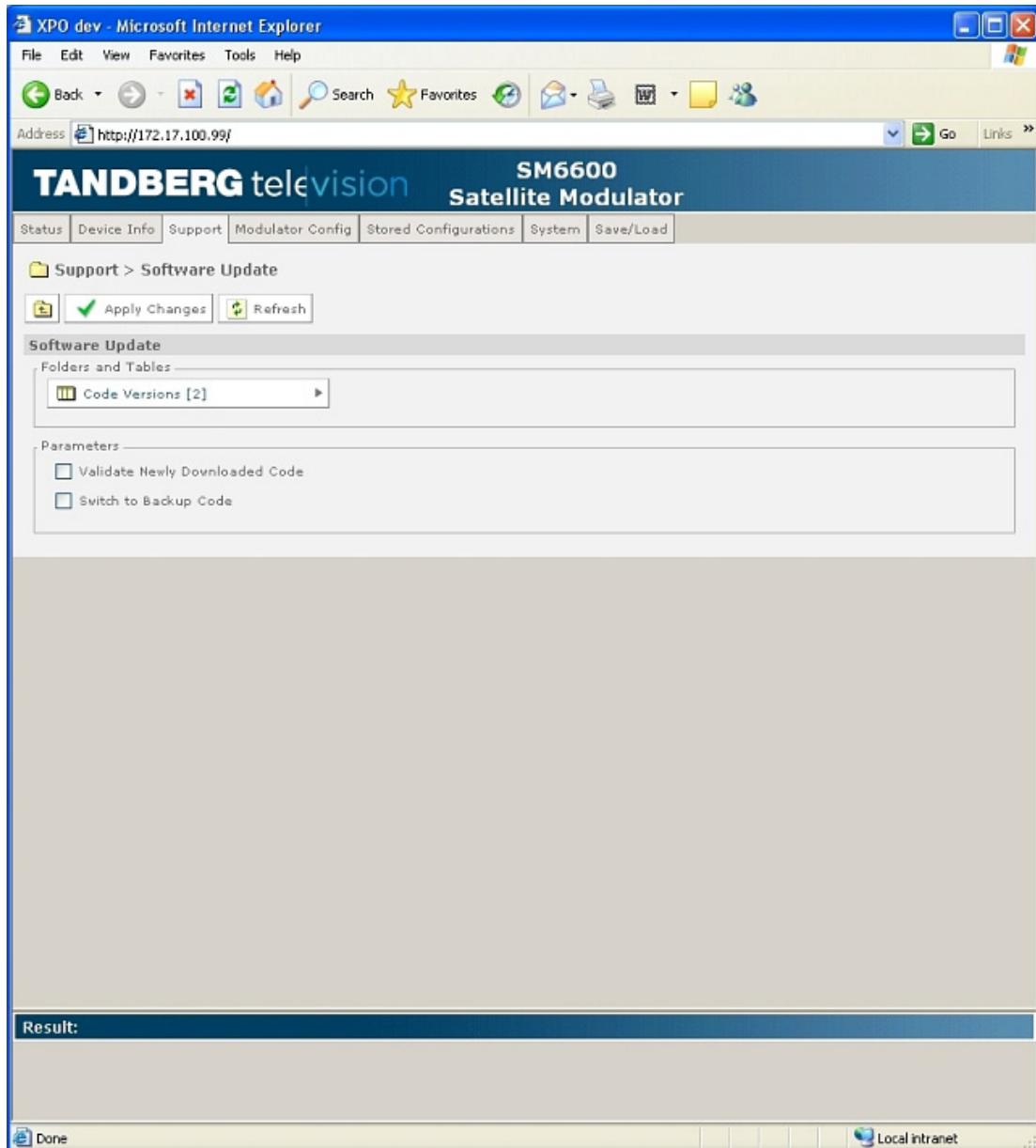


Figure 11.16: Support – Software Update

This folder allows the user to validate new code, switch to the backup code and view the table of currently installed software.

See Section 3.10.2.

## 11.5.5 Support – Code Versions Table

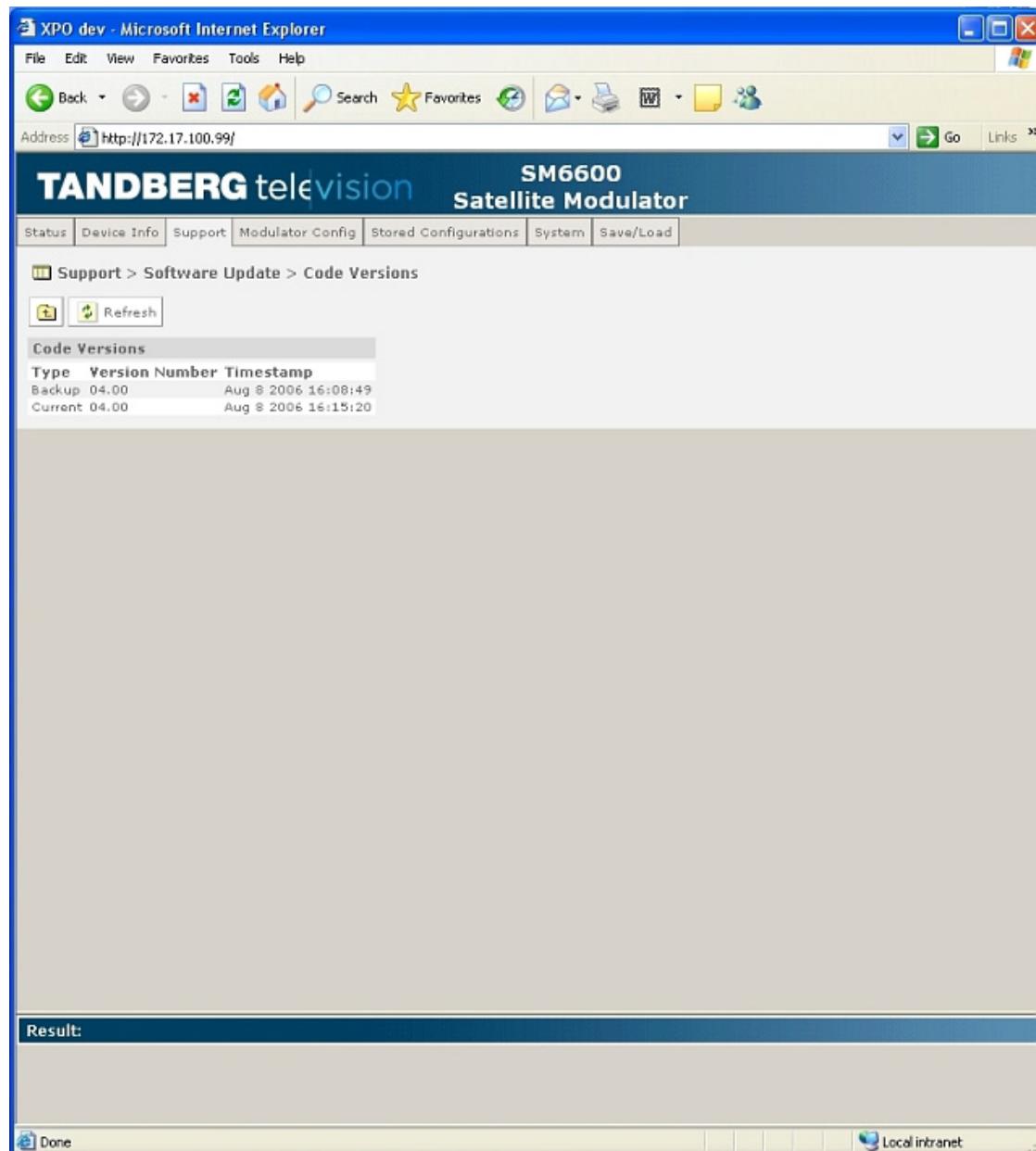


Figure 11.17: Support – Code Versions Table

The Code Versions table lists the version numbers and timestamps for the currently installed software images.

See Section 3.10.2.

## 11.5.6 Support – Current Temperatures Table

The screenshot shows a Microsoft Internet Explorer window titled "XPO dev - Microsoft Internet Explorer". The address bar displays "http://172.17.100.99/". The main content area is titled "TANDBERG television" and "SM6600 Satellite Modulator". A navigation menu at the top includes "Status", "Device Info", "Support", "Modulator Config", "Stored Configurations", "System", and "Save/Load". Below the menu, a breadcrumb trail shows "Support > Current Temperatures". There are "Print" and "Refresh" buttons. A table titled "Current Temperatures" lists component locations and their temperatures:

Location	Temperature
Baseband Card FPGA	27.0C
Host Controller Card	26.5C
IF Card	32.0C

A "Result:" section is present below the table, and the status bar at the bottom shows "Done" and "Local intranet".

Figure 11.18: Support – Current Temperatures Table

This folder lists the current temperatures within the modulator components.

## 11.6 Modulator Config Tab

### 11.6.1 Main Page

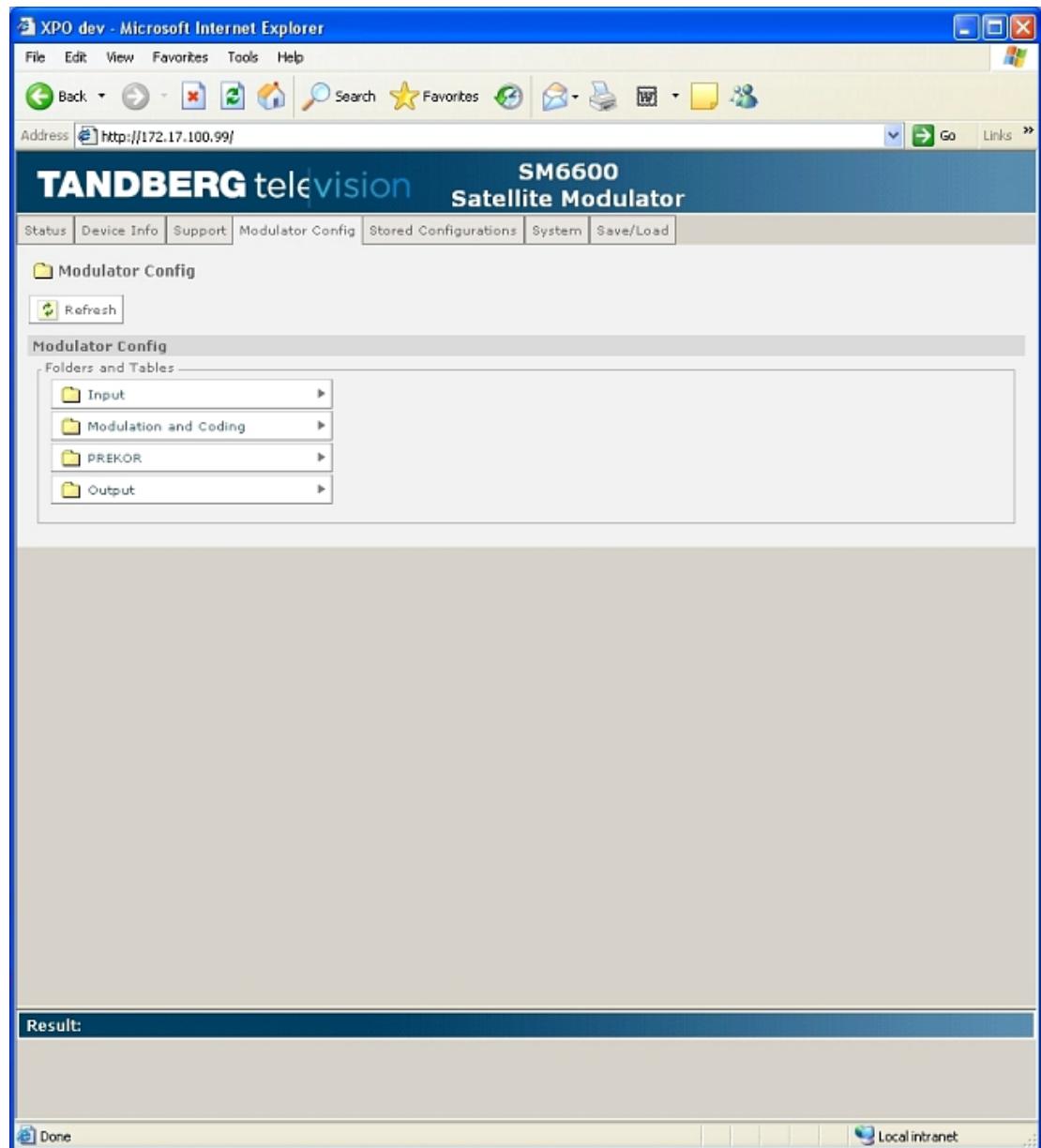


Figure 11.19: Modulator Config Tab

The Modulator Config tab contains the folders used for core control of the modulator functions.

## 11.6.2 Modulator Config – Input Settings

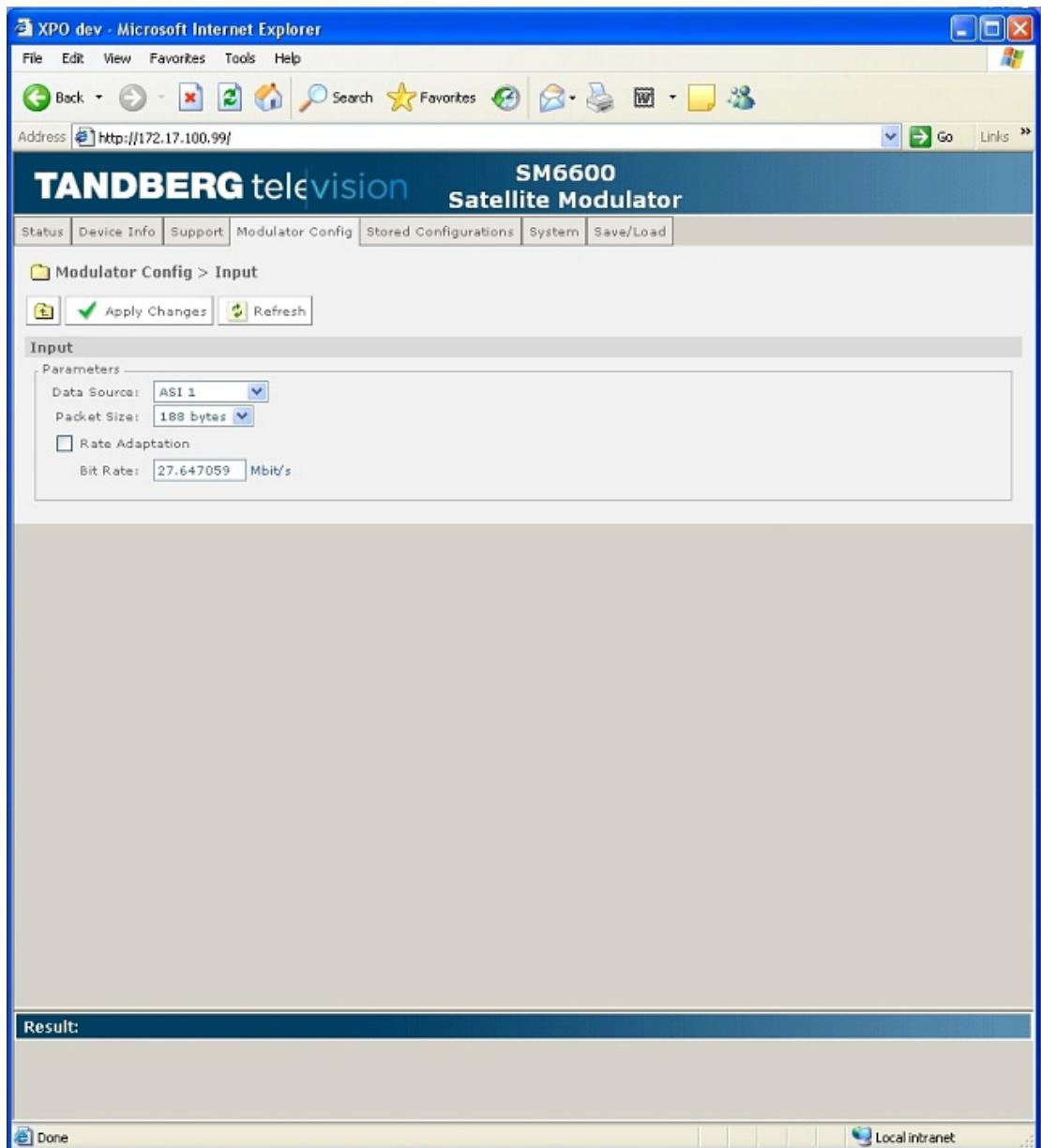


Figure 11.20: Modulator Config – Input Settings

The Input folder allows control of input selection and associated parameters.

See Section 3.4.2.

## 11.6.3 Modulator Config – Modulation and Coding Settings

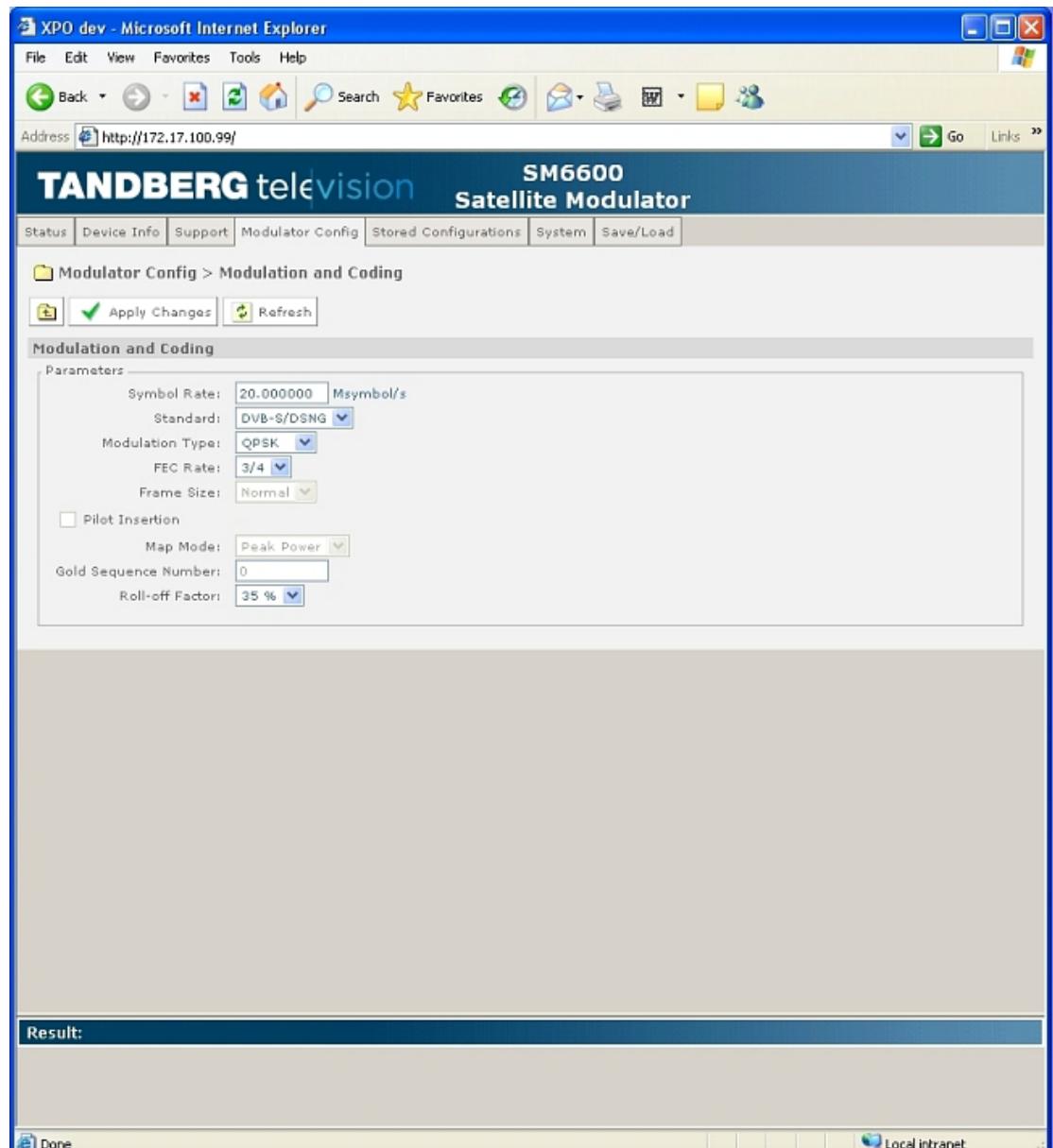


Figure 11.21: Modulator Config – Modulation and Coding Settings

The Modulation and Coding folder contains the settings relevant to modulation schemes.

See Section 3.4.2.

## 11.6.4 Modulator Config – PREKOR Settings (if fitted)

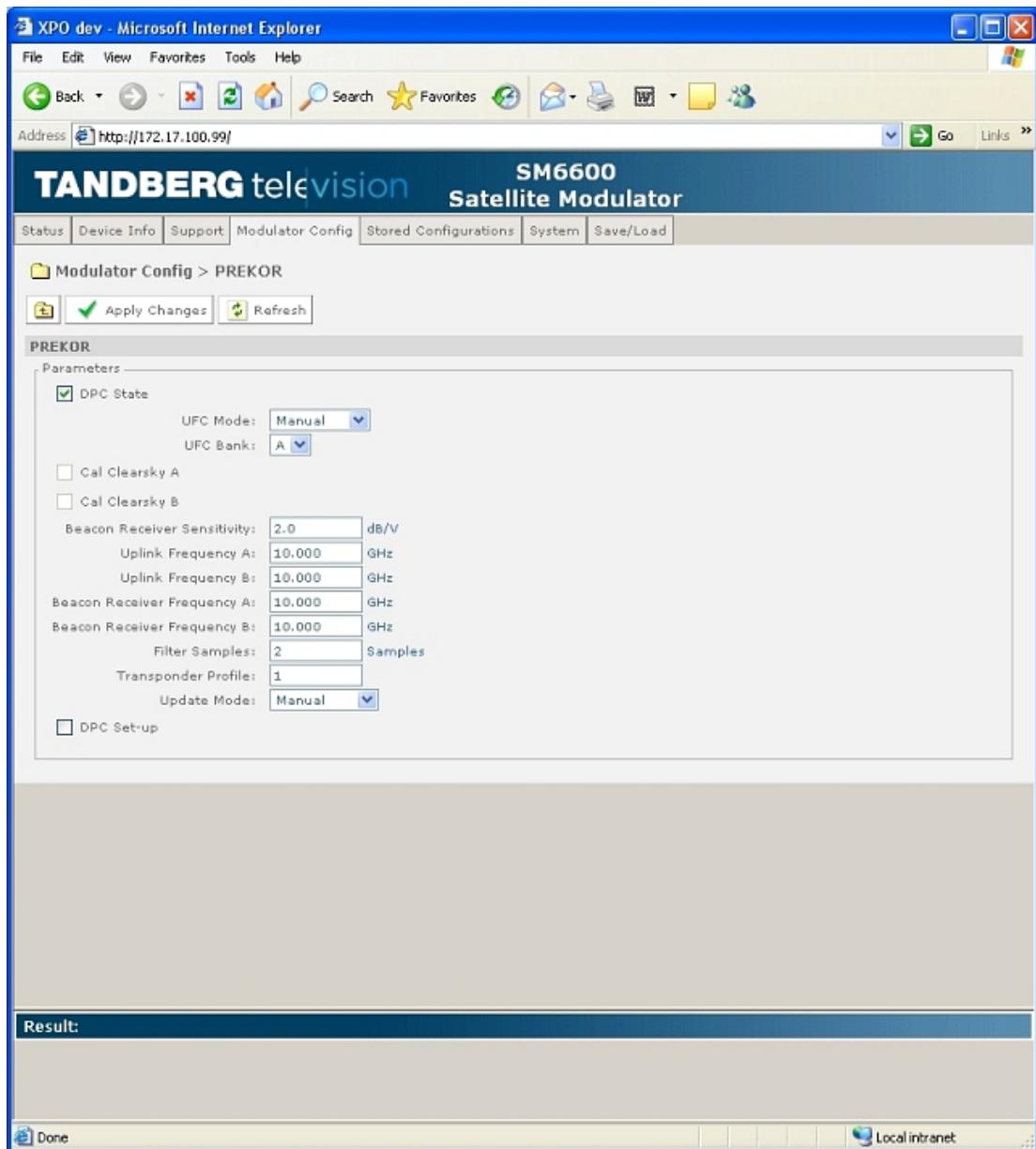


Figure 11.22: Modulator Config – PREKOR Settings (if fitted)

This folder is only visible on PREKOR-enabled modulators. This allows the control of the precorrection settings for the modulator.

See Section 3.4.2.

## 11.6.5 Modulator Config – Output Settings

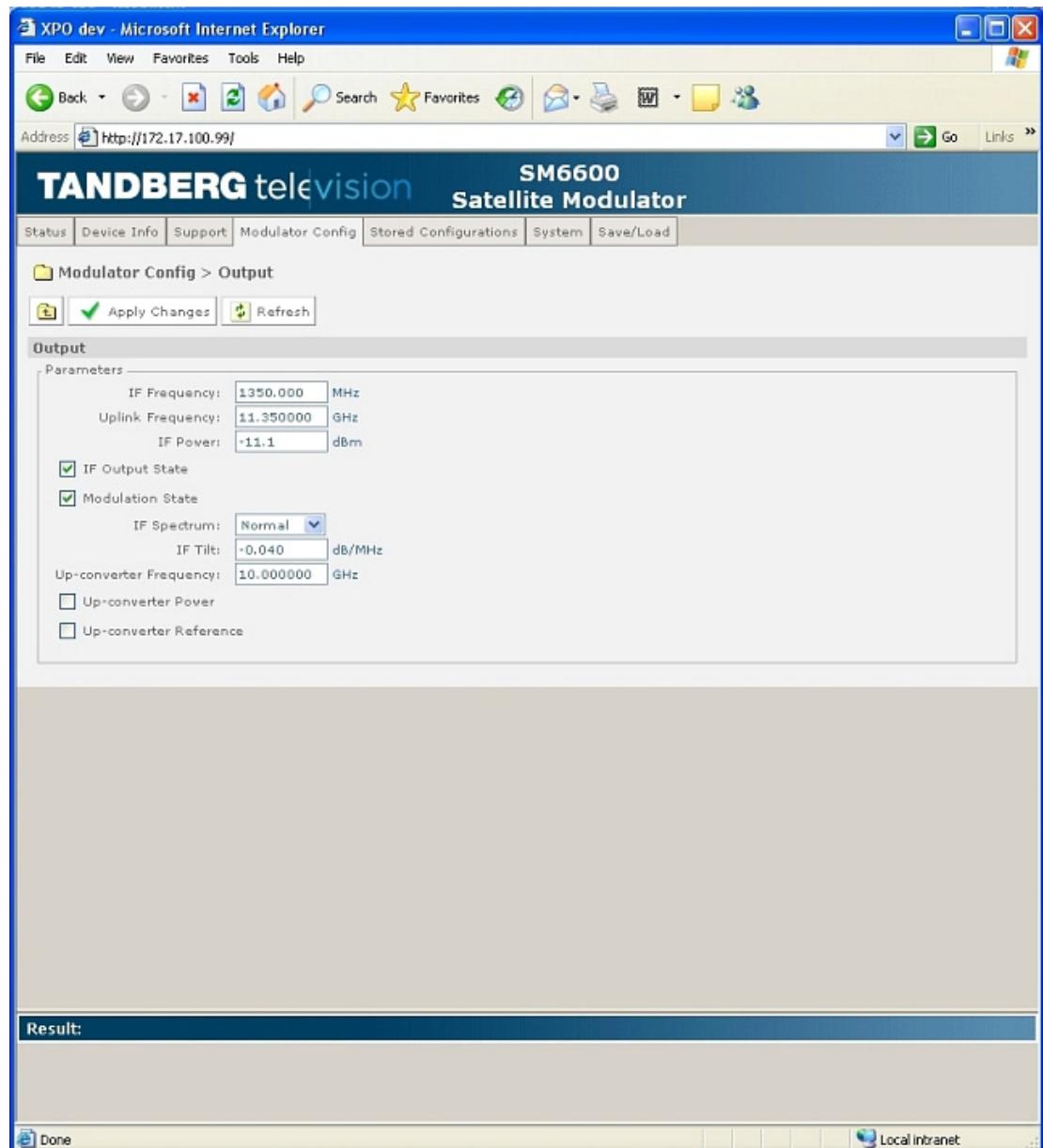


Figure 11.23: Modulator Config – Output Settings

The Output folder contains the settings for the output section of the modulator.

See Section 3.4.2.

## 11.7 Stored Configurations Tab

### 11.7.1 Main Page

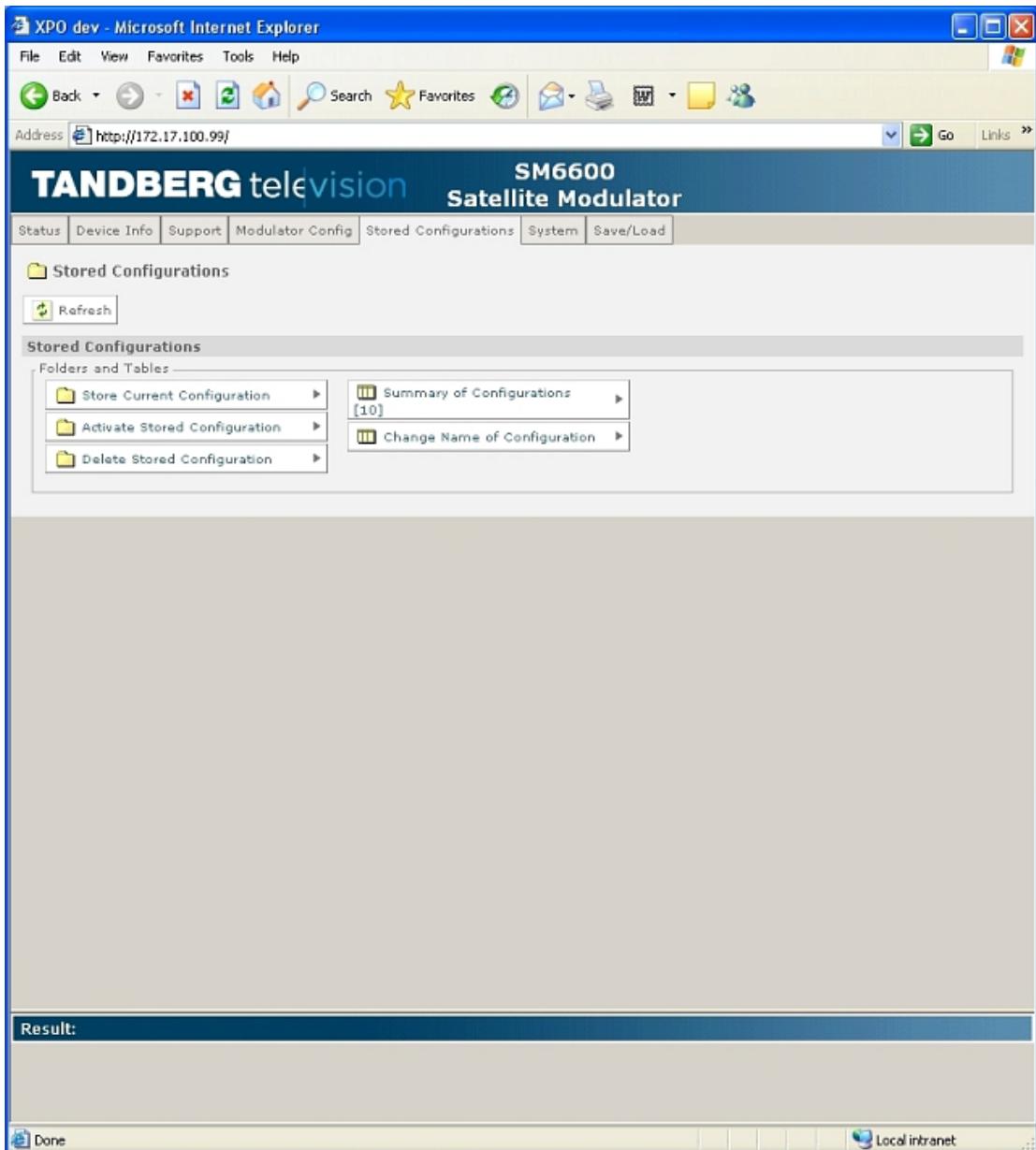


Figure 11.24: Stored Configurations Tab

This tab contains the stored configuration handling folders.

## 11.7.2 Stored Configurations – Store Current Configuration

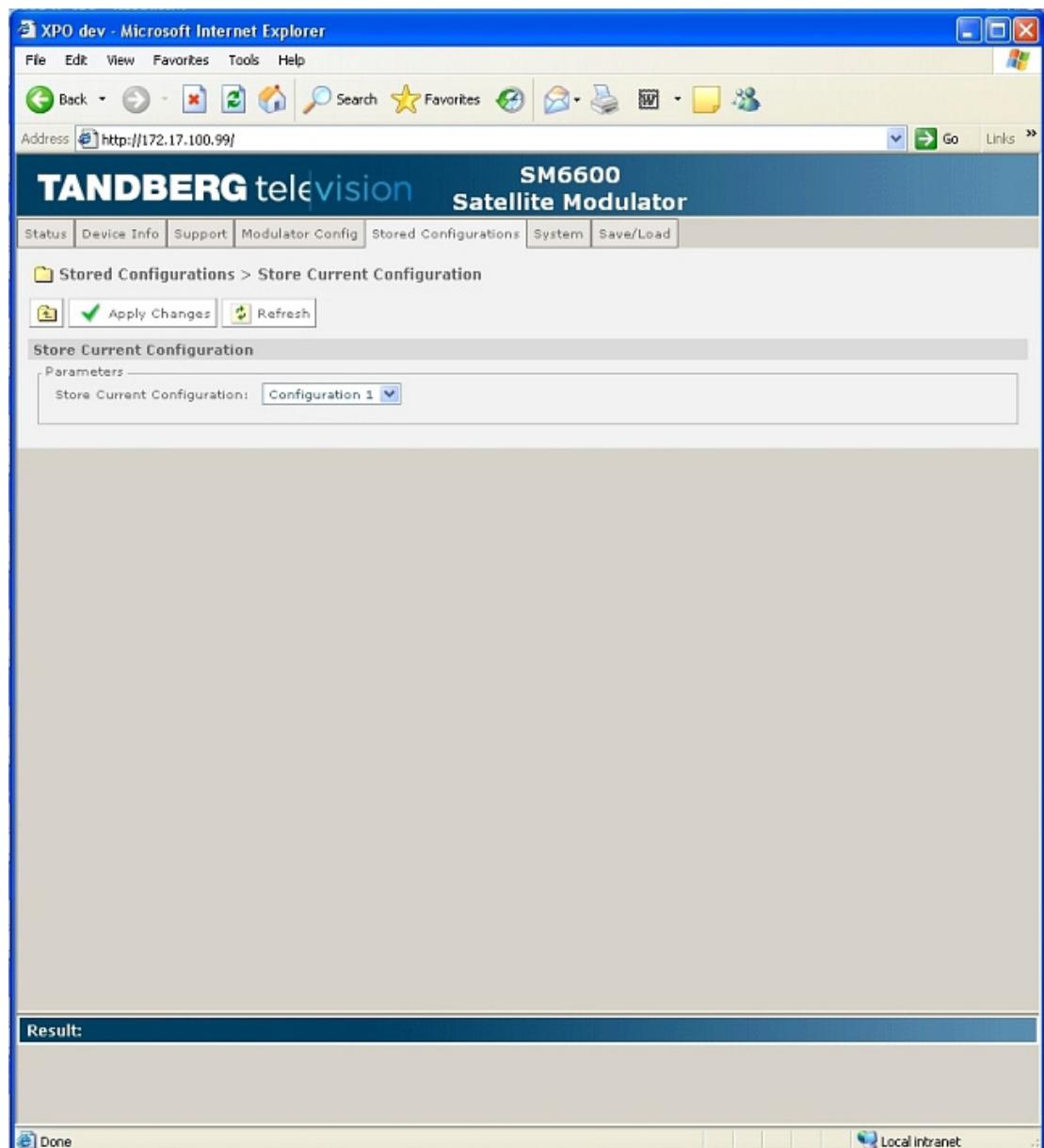


Figure 11.25: Stored Configurations – Store Current Configuration

This folder allows the storing of the current configuration in one of the available slots. Existing stored configurations shall be overwritten with no warning.

See Section 3.6.2.

## 11.7.3 Stored Configurations – Activate Stored Configuration

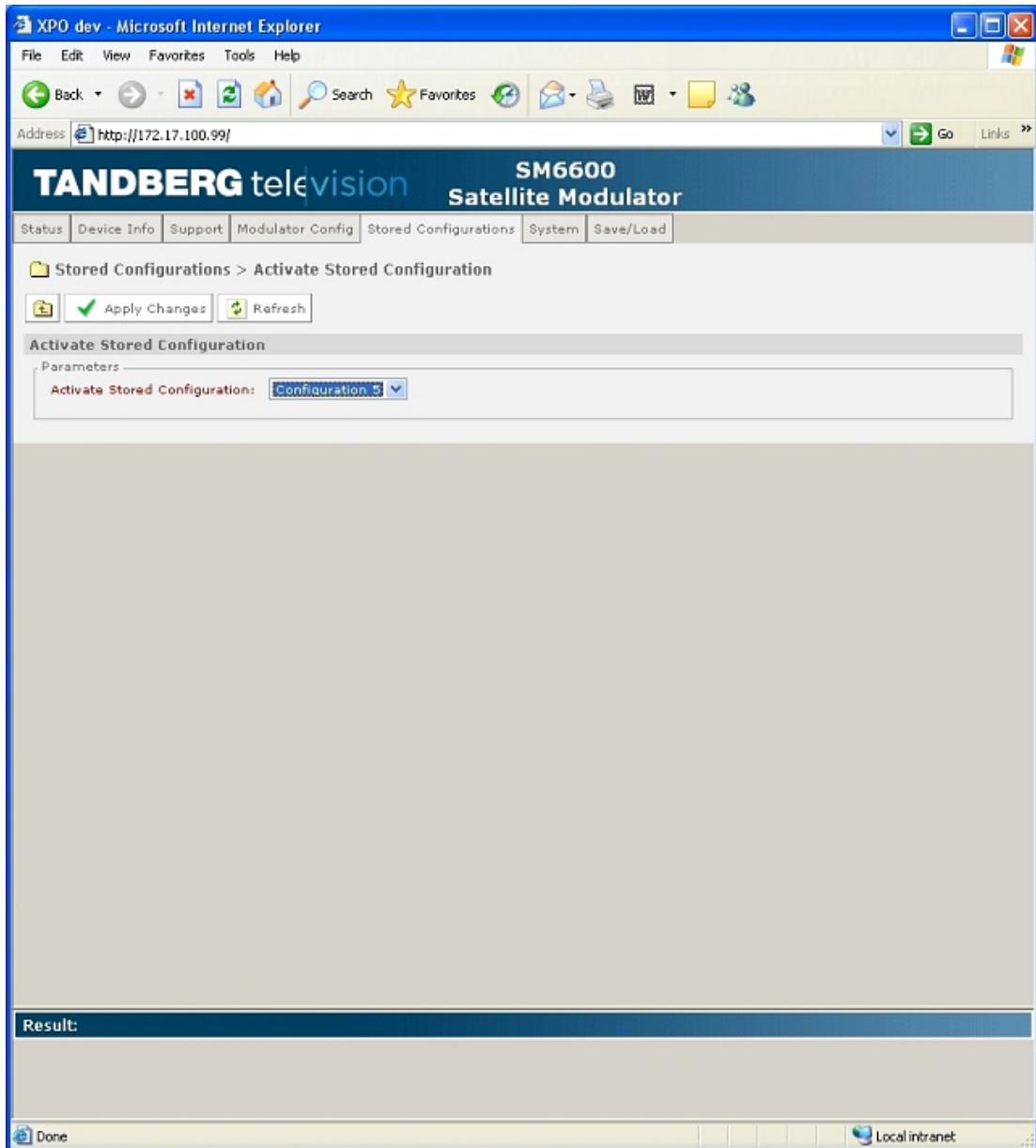


Figure 11.26: Stored Configurations – Activate Stored Configuration

This folder enables the activation of an existing stored configuration.

**NOTE...**

Attempts to activate empty configurations shall be ignored.

See Section 3.6.2.

## 11.7.4 Stored Configurations – Delete Stored Configuration

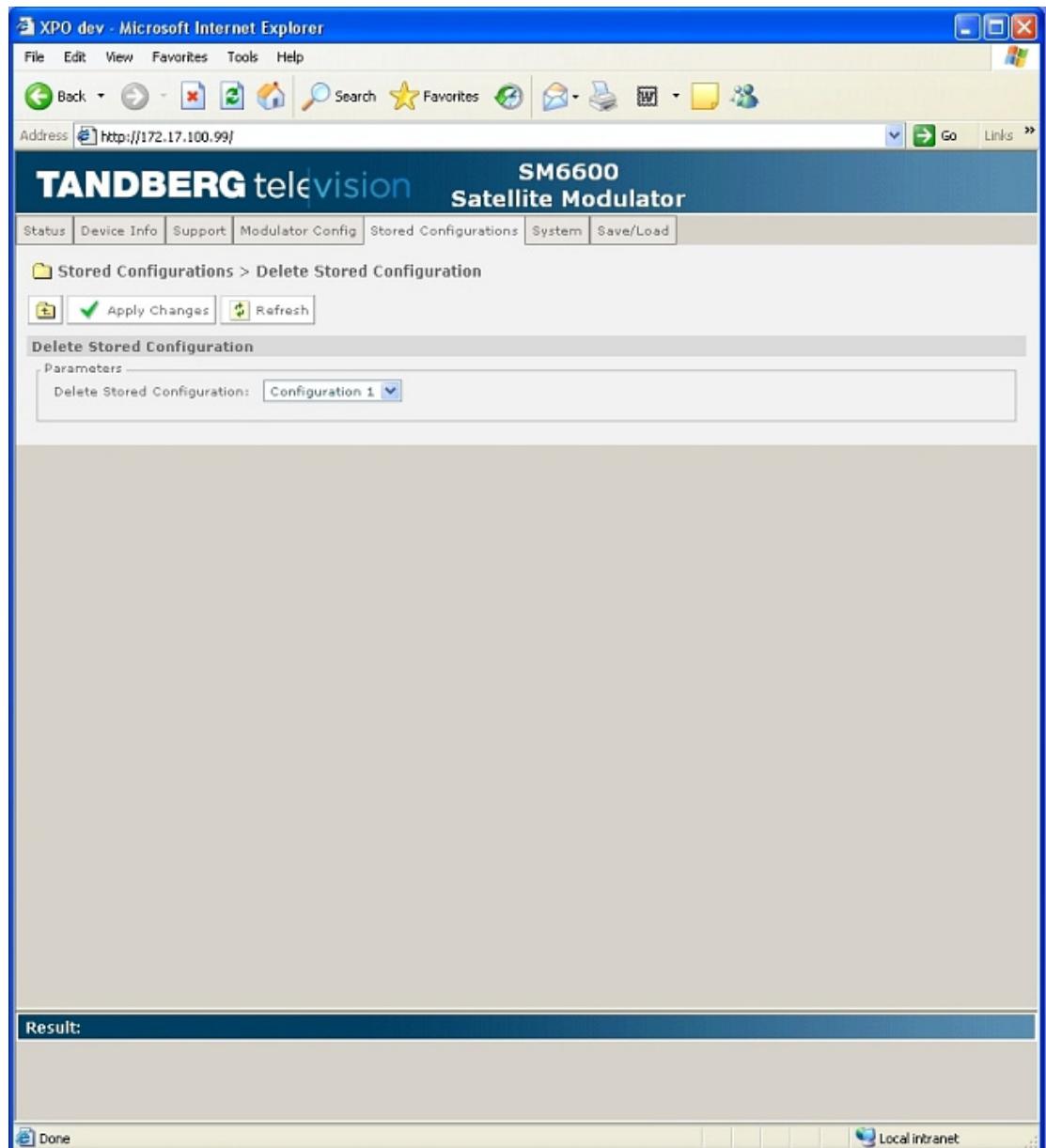


Figure 11.27: Stored Configurations – Delete Stored Configuration

Delete Stored Configuration allows a stored configuration to be deleted.

**NOTE...**

Attempts to delete non-existent configurations shall be ignored.

See Section 3.6.2.

## 11.7.5 Stored Configurations – Summary of Configurations

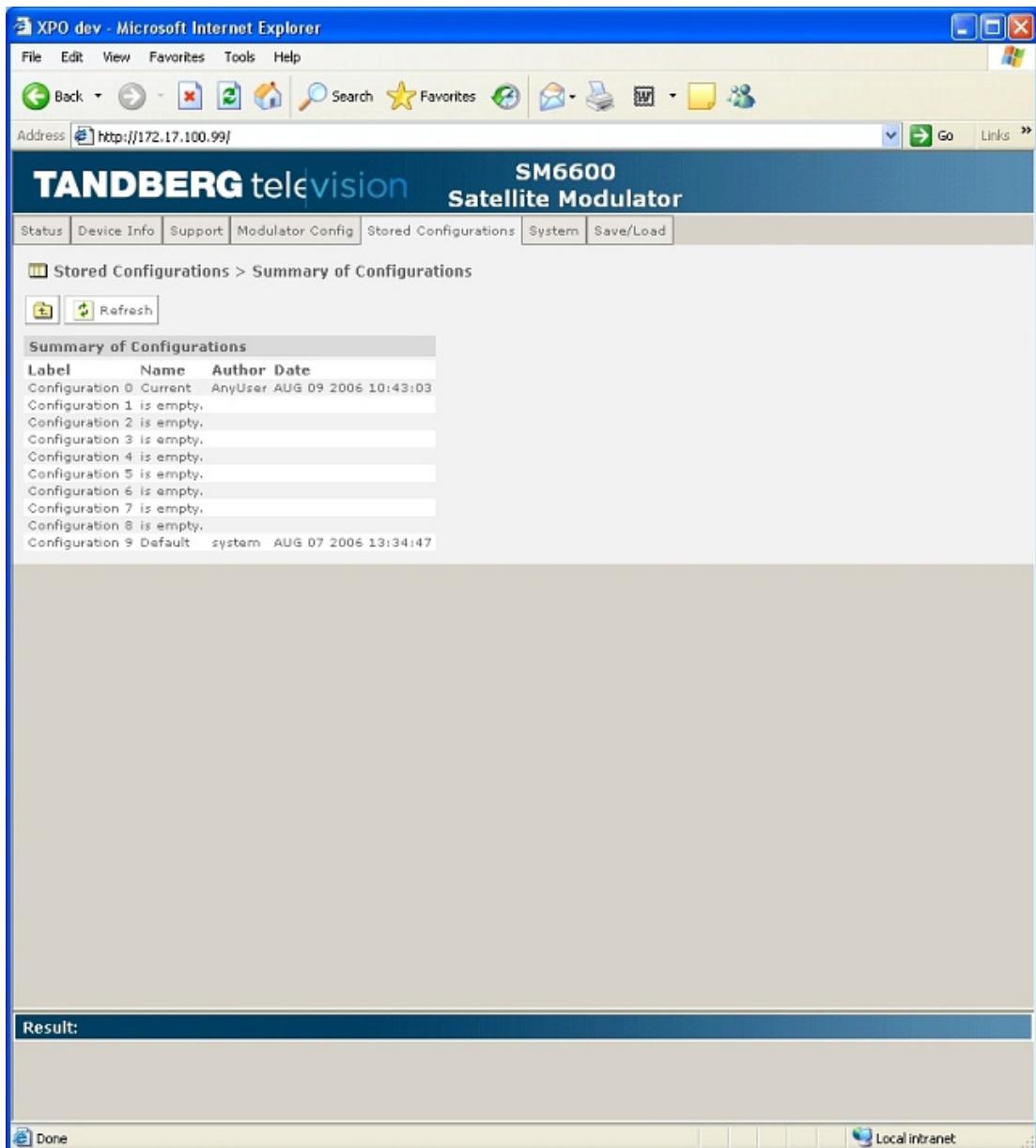


Figure 11.28: Stored Configurations – Summary of Configurations

Summary of Configurations displays the names, dates and usernames of the currently stored configurations.

See Section 3.6.2.

## 11.7.6 Stored Configurations – Change Name of Configuration

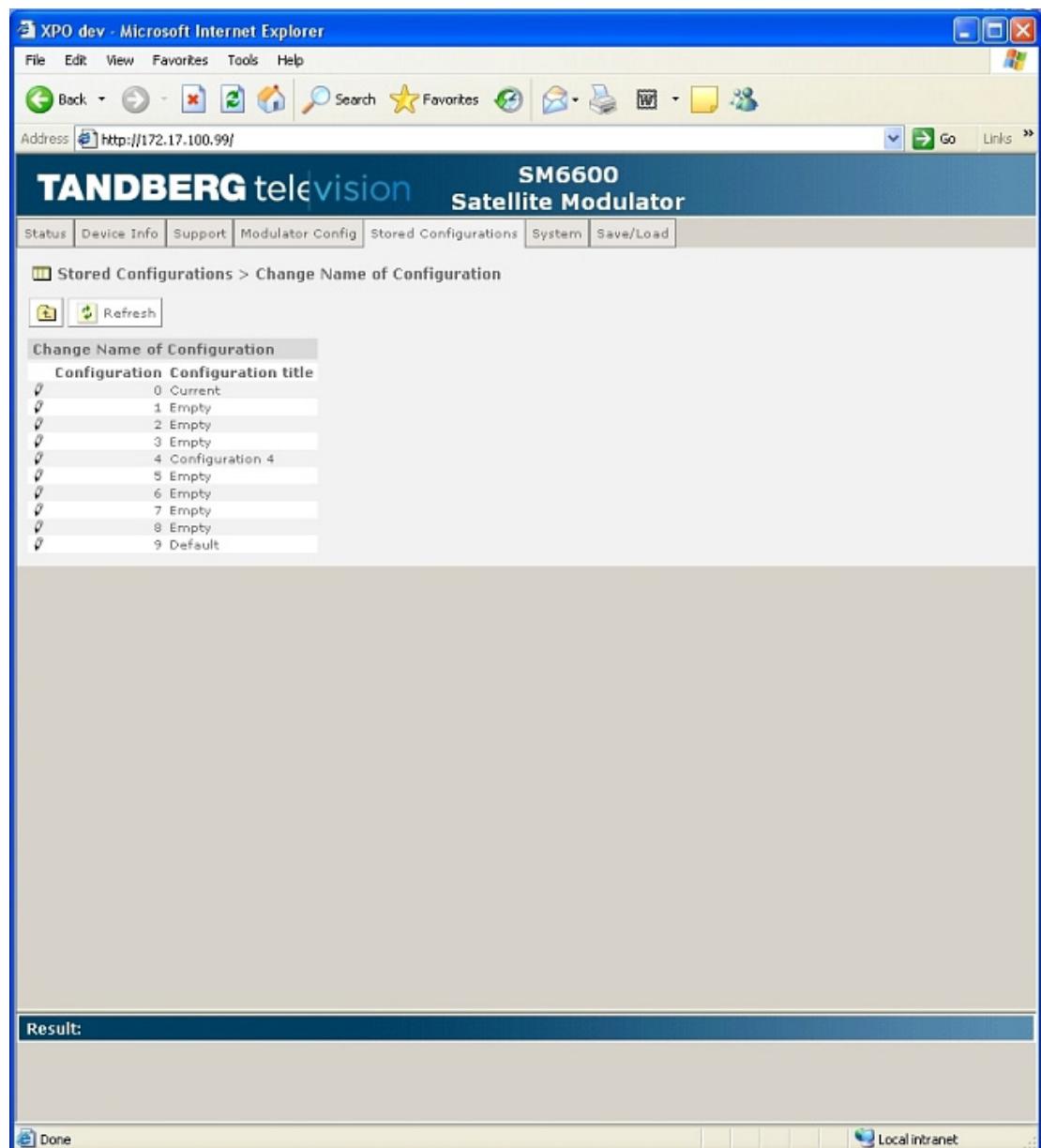


Figure 11.29: Stored Configurations – Change Name of Configuration

This folder enables the changing of the stored names of configurations within the modulator.

See Section 3.6.2.

## 11.8 System Tab

### 11.8.1 Main Page

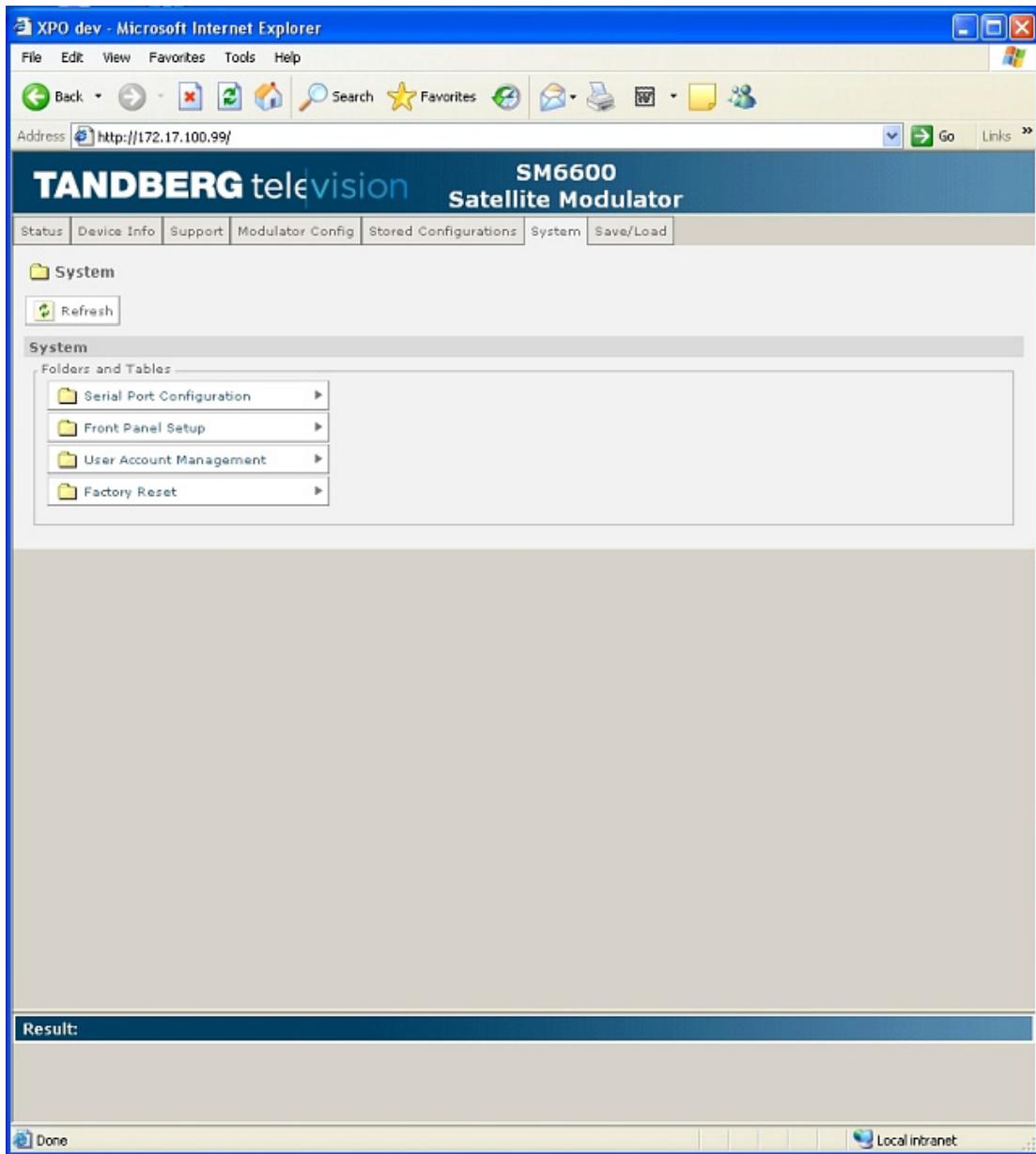


Figure 11.30: System Tab

The System tab contains the folders pertaining to the general housekeeping functions of the modulator not covered under the Device Info tab.

## 11.8.2 System – Serial Port Configuration

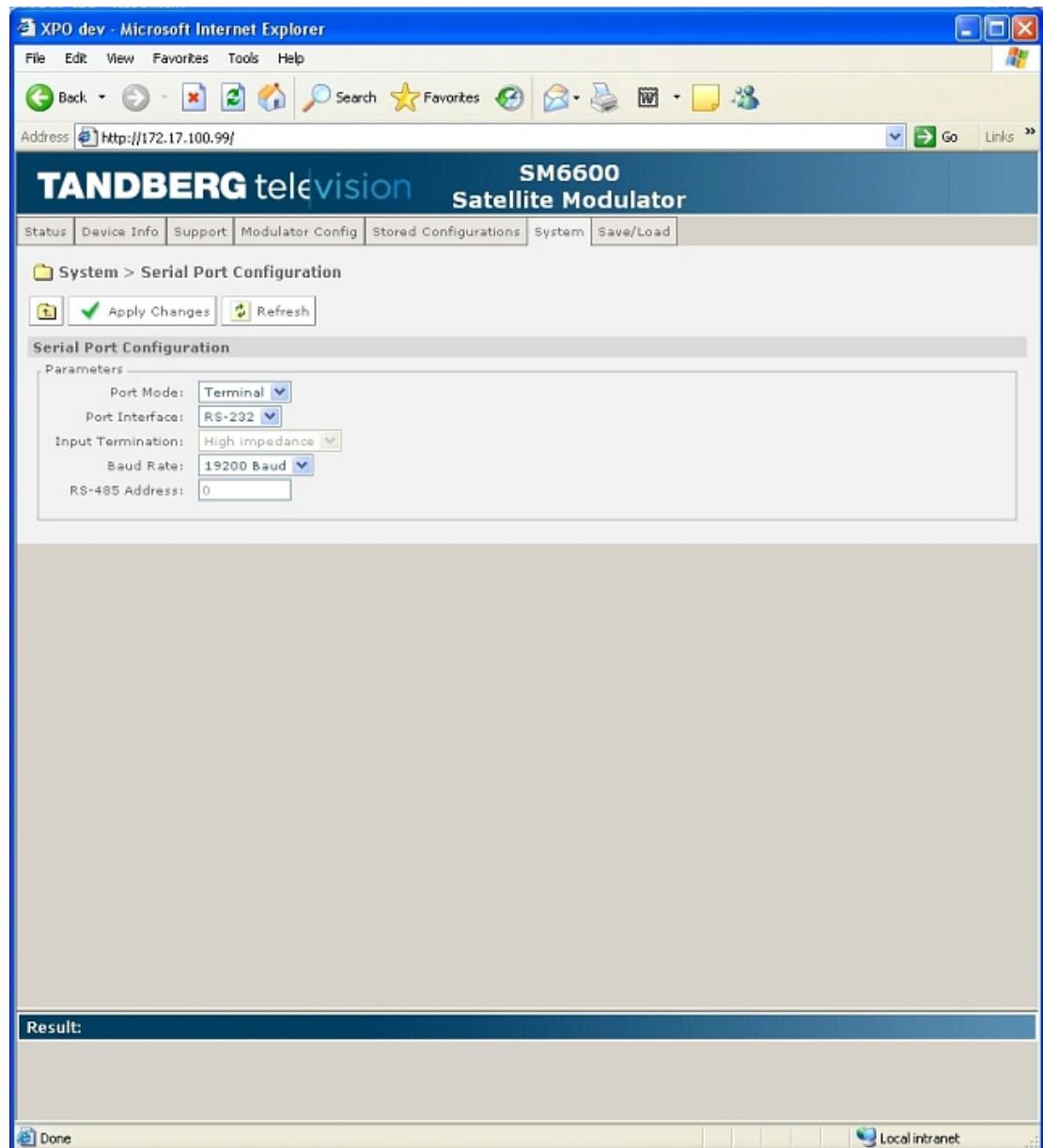


Figure 11.31: System – Serial Port Configuration

Serial Port Configuration allows the user to view and alter the settings for the serial port.

**NOTE...**

These settings do not become active until the unit is rebooted.

See Section 3.7.2.

## 11.8.3 System – Front Panel Setup

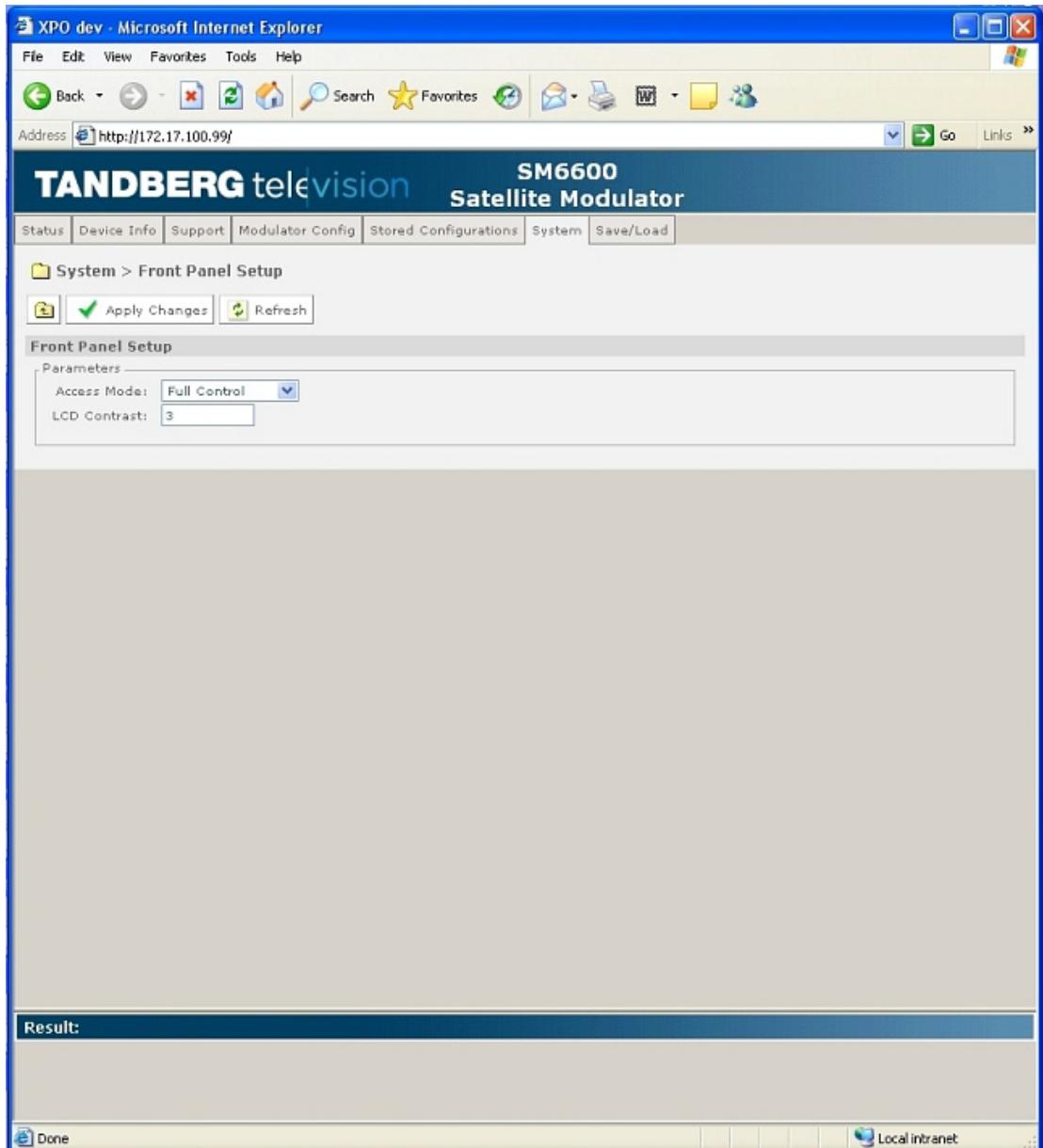


Figure 11.32: System – Front Panel Setup

Front Panel Setup allows control of the access mode for the front panel and LCD contrast.

See Section 3.7.2.

## 11.8.4 System – User Account Management

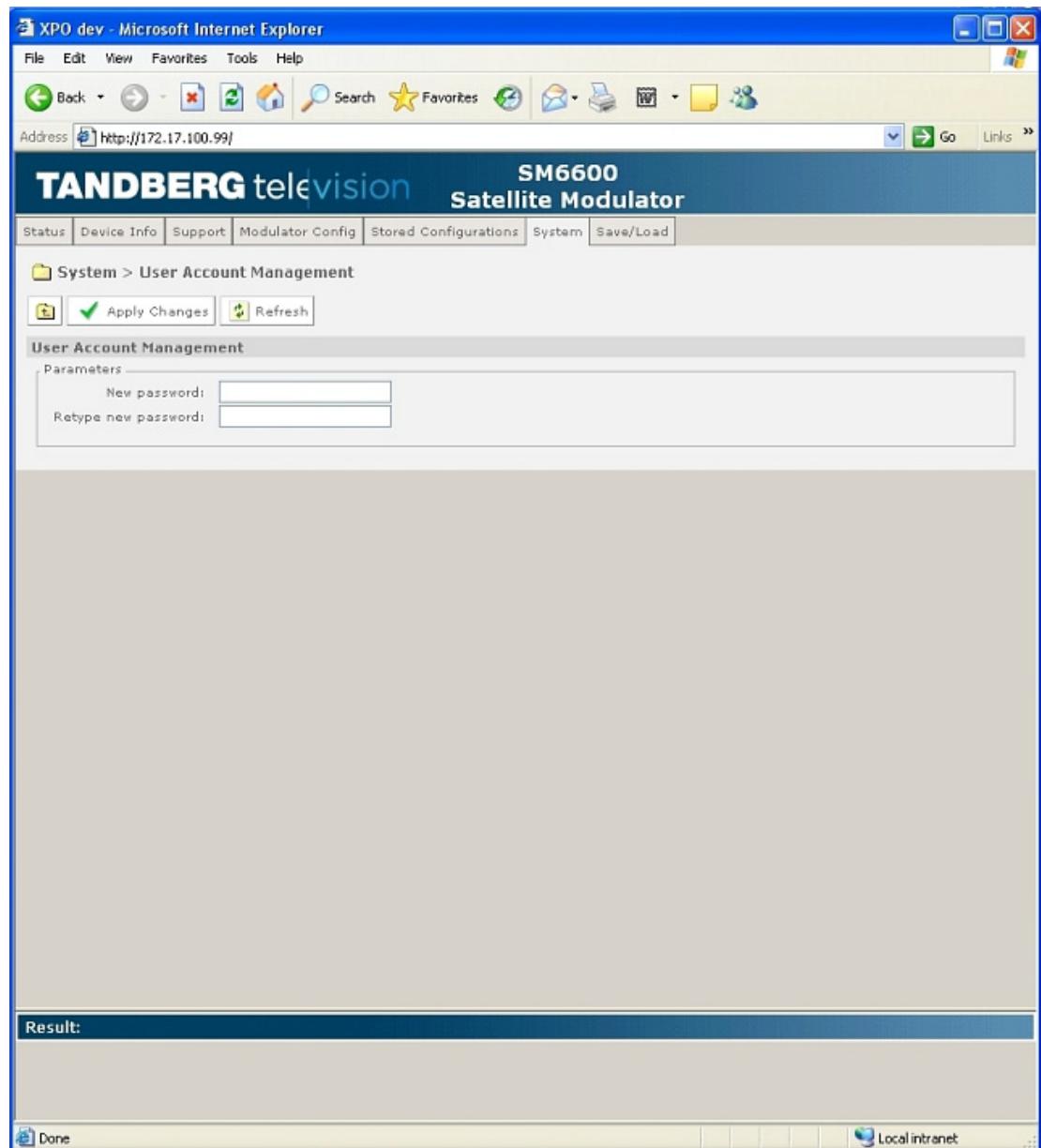


Figure 11.33: System – User Account Management

User Account Management allows the changing of the password for the current user.

## 11.8.5 System – Factory Reset

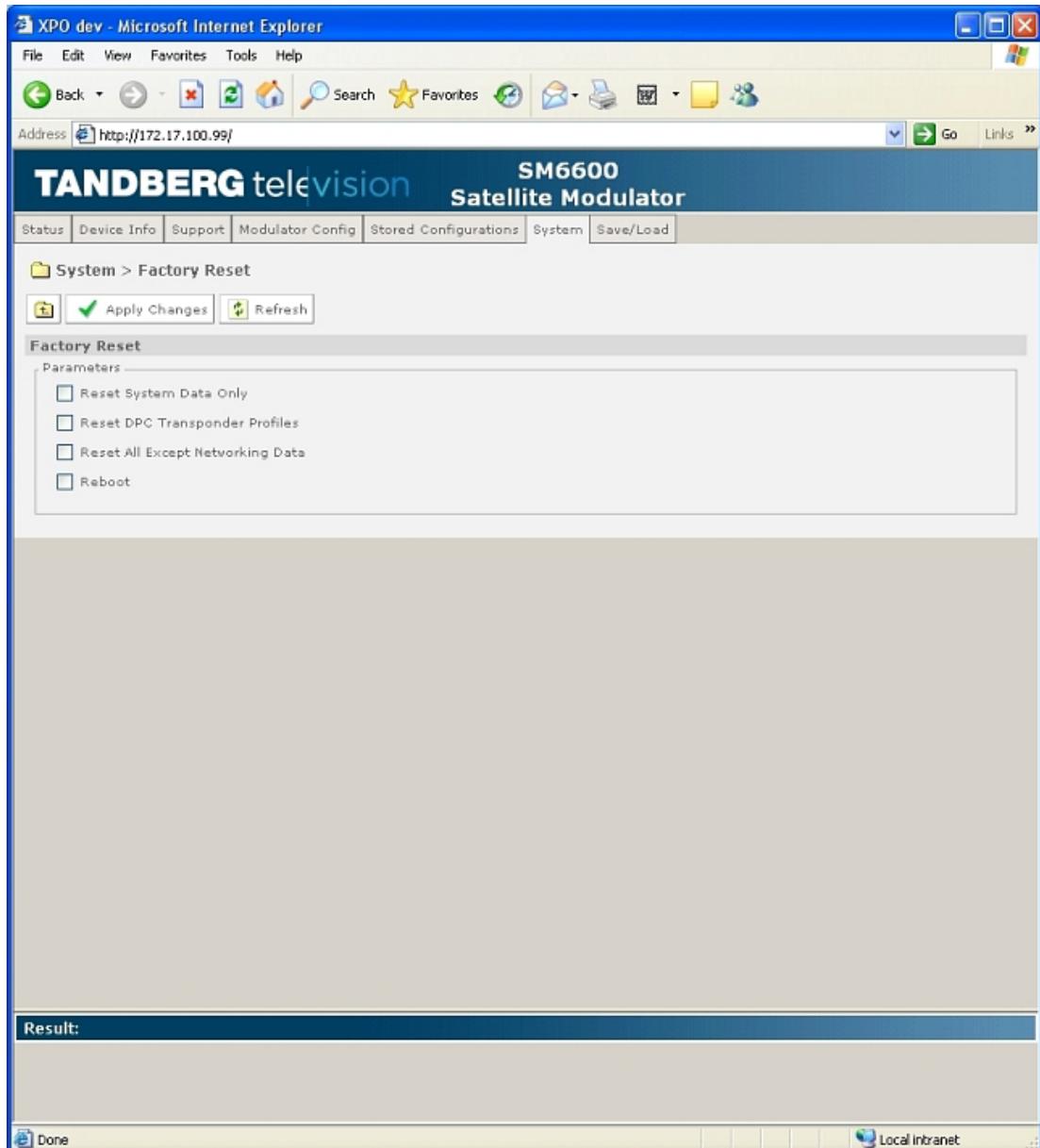


Figure 11.34: System – Factory Reset

This menu item allows the resetting of various attributes of the system, up to and including rebooting the modulator.

See Section 3.10.2.

## 11.9 Save/Load Tab

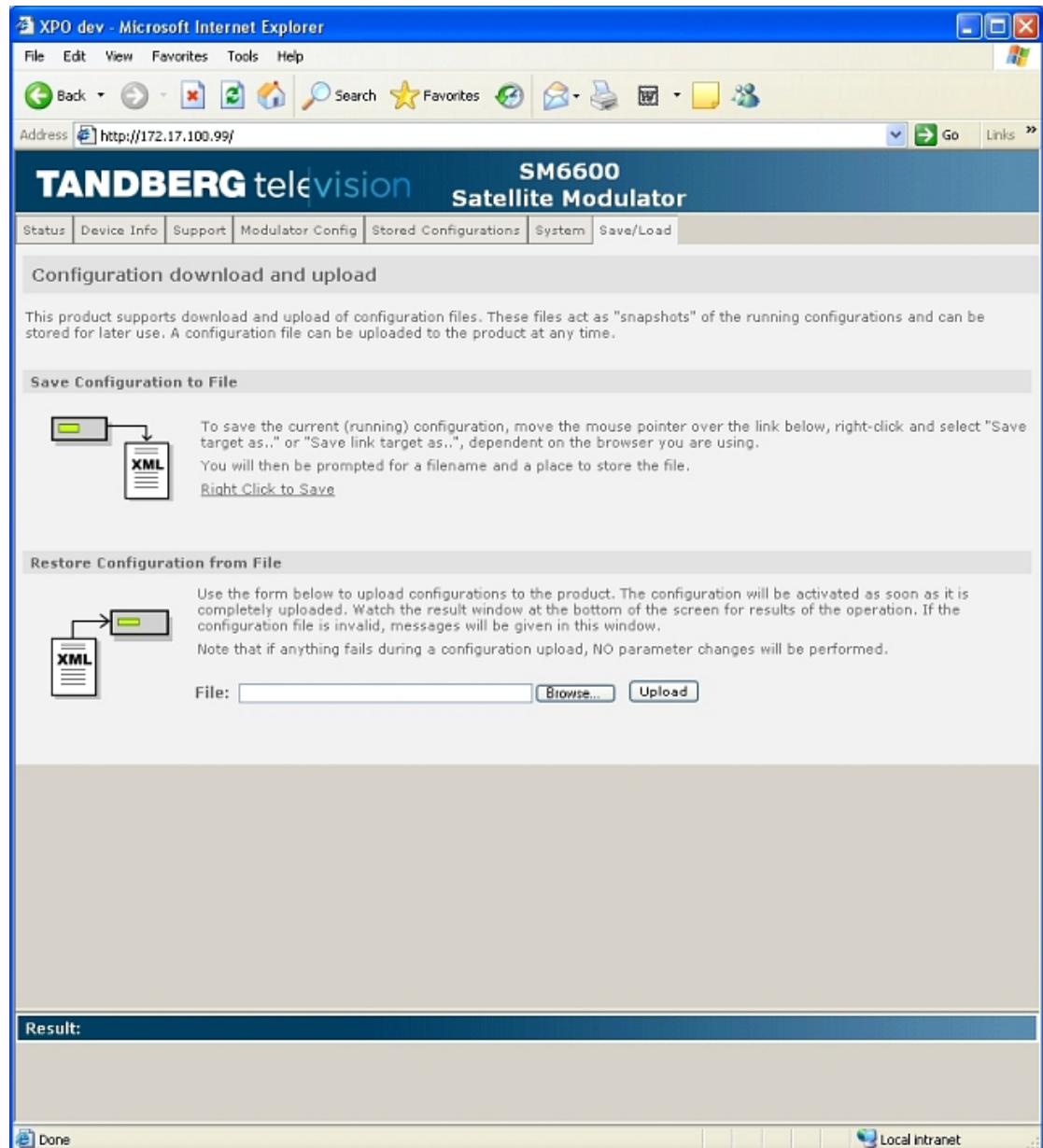


Figure 11.35: Save/Load Tab

The configuration of the modulator may be stored as an XML file; similarly, if read/write access is available to the user, a configuration may be uploaded to the modulator. This allows configurations to be set up in advance and then enabled.

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## Annex A

# Glossary

The following list covers most of the abbreviations, acronyms and terms as used in TANDBERG Television Limited Manuals, User and Reference Guides. All terms may not be included in this Reference Guide.

<b>µm</b>	<b>Micrometre</b> (former name - micron): a unit of length equal to one millionth ( $10^{-6}$ ) of a metre.
<b>3:2 pulldown</b>	A technique used when converting film material (which operates at 24 pictures per second) to 525-line video (operating at 30 pictures per second).
<b>4:2:0</b>	Digital video coding method in which the colour difference signals are sampled on alternate lines at half the luminance rate.
<b>4:2:2</b>	Digital video coding method in which the colour difference signals are sampled on all lines at half the luminance rate.
<b>422P@ML</b>	<b>422 Profile at Main Level:</b> A subset of the MPEG-2 standard, which supports digital video storage (DVD etc.) and transmissions up to 50 Mbit/s over various mediums. Used for Contribution and Distribution applications.
<b>5B6B</b>	<b>5 Binary Bits Encoded to 6 Binary Bits:</b> Block code.
<b>ADPCM</b>	<b>Adaptive Differential Pulse Code Modulation:</b> An advanced PCM technique that converts analogue sound into digital data and vice versa. Instead of coding an absolute measurement at each sample point, it codes the difference between samples and can dynamically switch the coding scale to compensate for variations in amplitude and frequency.
<b>ACC</b>	<b>Authorisation Control Computer.</b>
<b>ADT</b>	<b>Audio, Data And Teletext.</b>
<b>AFC</b>	<b>Automatic Frequency Control.</b>
<b>AFS</b>	<b>Automation File Server.</b>
<b>AGC</b>	<b>Automatic Gain Control.</b>
<b>AMOL I and II</b>	<b>Automatic Measure of Line-ups I and II:</b> Used by automated equipment to measure programme-viewing ratings.
<b>ASI</b>	<b>Asynchronous Serial Interface.</b>
<b>ASIC</b>	<b>Application-Specific Integrated Circuit:</b> A customised chip designed to perform a specific function.
<b>Async</b>	<b>Asynchronous.</b>

<b>ATM</b>	<b>Asynchronous Transfer Mode:</b> A connection orientated, cell based, data transport technology designed for Broadband ISDN (B-ISDN). It provides a circuit-switched bandwidth-on-demand carrier system, with the flexibility of packet switching. It offers low end-to-end delays and (negotiable on call set-up) Quality of Service guarantees. Asynchronous refers to the sporadic nature of the data being transmitted. Cells are transmitted only when data is to be sent, therefore the time interval between cells varies according to the availability of data.
<b>ATSC</b>	<b>Advanced Television Standards Committee:</b> An organisation founded in 1983 to research and develop a digital TV standard for the U.S.A. In late 1996, the FCC adopted the ATSC standard, the digital counterpart of the NTSC standard.
<b>B3ZS</b>	<b>Bipolar with Three Zero Substitution:</b> A method of eliminating long zero strings in a transmission. It is used to ensure a sufficient number of transitions to maintain system synchronisation when the user data stream contains an insufficient number of 1s to do so. B3ZS is the North American equivalent of the European HDB3.
<b>Backward Compatibility</b>	Refers to hardware or software that is compatible with earlier versions.
<b>BAT</b>	<b>Bouquet Association Table:</b> Part of the service information data. The BAT provides information about bouquets. It gives the name of the bouquet and a list of associated services.
<b>baud rate</b>	The rate of transfer of digital data when the data comprises information symbols that may consist of a number of possible states. Equivalent to bit-rate when the symbols only have two states (1 and 0). Measured in Baud.
<b>BER</b>	<b>Bit Error Rate:</b> A measure of transmission quality. The rate at which errors occur in the transmission of data bits over a link. It is generally shown as a negative exponent, (e.g., $10^{-7}$ means that 1 in 10,000,000 bits are in error).
<b>BISS</b>	<b>Basic Interoperable Scrambling System:</b> Non-proprietary encryption from EBU (Tech3290).
<b>Bit-rate</b>	The rate of transfer of digital data when the data comprises two logic states, 1 and 0. Measured in bit/s.
<b>Block; Pixel Block</b>	An 8-row by 8-column matrix of luminance sample values, or 64 DCT coefficients (source, quantised, or dequantised).
<b>Bouquet</b>	A collection of services (TV, radio, and data, or any combination of the three) grouped and sold together, and identified in the SI as a group. A single service may be in several bouquets.
<b>B-Picture; B-Frame</b>	<b>Bi-directionally Predictive Coded Picture/Frame:</b> A picture that is coded using motion-compensated prediction from previous I or P frames (forward prediction) and/or future I or P frames (backward prediction). B frames are not used in any prediction.
<b>BPSK</b>	<b>Binary Phase Shift Keying:</b> A data modulation technique.
<b>Buffer</b>	A memory store used to provide a consistent rate of data flow.
<b>BW</b>	<b>Bandwidth:</b> The transmission capacity of an electronic line such as (among others) a communications network, computer bus, or broadcast link. It is expressed in bits per second, bytes per second or in Hertz (cycles per second). When expressed in Hertz, the frequency may be a greater number than the actual bits per second, because the bandwidth is the difference between the lowest and highest frequencies transmitted. High bandwidth allows fast transmission or high-volume transmission.
<b>Byte-mode</b>	Each byte is delivered separately in the ASI Transport Stream, with stuffing data added between the Bytes to increase the data rate to 270 Mbit/s. See DVB Document A010 rev. 1, Section B3.3, (ASI) Layer-2 Transport Protocol.
<b>CA</b>	<b>Conditional Access:</b> The technology used to control the access to viewing services to authorised subscribers through the transmission of encrypted signals and the programmable regulation of their decryption by a system such as viewing cards.
<b>CAT</b>	<b>Conditional Access Table:</b> Part of the MPEG-2 Program Specific Information (PSI) data. Mandatory for MPEG-2 compliance if CA is in use.

<b>C-Band</b>	The portion of the electromagnetic spectrum, which spans the frequency range of approximately 4 GHz to 6 GHz. Used by communications satellites. Preferred in tropical climates because it is not susceptible to fading.
<b>CCIR</b>	See: ITU-R.
<b>CCITT</b>	See: ITU-T.
<b>Channel</b>	A narrow range of frequencies, part of a frequency band, for the transmission of radio and television signals without interference from other channels. In the case of OFDM, a large number of carriers spaced apart at precise frequencies are allocated to a channel.
<b>Channel Coding</b>	A way of encoding data in a communications channel that adds patterns of redundancy into the transmission path in order to improve the error rate. Such methods are widely used in wireless communications.
<b>Chrominance</b>	The colour part of a TV picture signal, relating to the hue and saturation but not to the luminance (brightness) of the signal. In a <b>composite-coded</b> colour system, the colour information (chrominance, often referred to as chroma) is modulated onto a high frequency carrier and added to the monochrome-format video signal carrying the luminance (Y). In a <b>component-coded</b> colour system, the two colour-difference signals (R-Y)(B-Y) usually referred to as $C_{RC_B}$ (digital) or $P_{RP_B}$ (analogue), are used to convey colour information. When $C_{RC_B}$ ( $P_{RP_B}$ ) is added to the luminance (Y), the complete picture information is conveyed as $YC_{RC_B}$ ( $YP_{RP_B}$ ).
<b>Closed Captioning</b>	A TV picture subtitling system used with 525-line analogue transmissions.
<b>CODE</b>	Create Once Distribute Everywhere.
<b>Codec</b>	The combination of an <b>Encoder</b> and a complementary <b>Decoder</b> located respectively at the input and output of a transmission path.
<b>COFDM</b>	<b>Coded OFDM:</b> COFDM adds forward error correction to the OFDM transmission consisting of Reed-Solomon (RS) coding followed by convolutional coding to add extra bits to the transmitted signal. This allows a large number of errors at the receive end to be corrected by convolutional (Viterbi) decoding followed by RS decoding.
<b>Composite</b>	CVBS Video Signal, 1 V pk-pk
<b>Compression</b>	Reduction in the number of bits used to represent the same information. For the purposes of a broadcast system, it is the process of reducing digital picture information by discarding redundant portions of information that are not required when reconstituting the picture to produce viewing clarity. Compression allows a higher bite-rate to be transmitted through a given bandwidth.
<b>Compression System</b>	Responsible for compressing and multiplexing the video / audio / data bit-streams, together with the authorisation stream. The multiplexed data stream is then ready for transmission.
<b><math>C_{RC_B}</math></b>	Digital Colour difference signals. These signals, in combination with the luminance signal (Y), define the colour and brightness of each picture element (pixel) on a TV line. See: <b>Chrominance</b>
<b>CRC</b>	<b>Cyclic Redundancy Check:</b> A mathematical algorithm that computes a numerical value based on the bits in a block of data. This number is transmitted with the data and the receiver uses this information and the same algorithm to ensure the accurate delivery of data by comparing the results of algorithm and the number received. If a mismatch occurs, an error in transmission is presumed.
<b>CVBS</b>	<b>Colour Video Black Sync Signal</b>
<b>dB</b>	<b>Decibels:</b> A ratio of one quantity to another using logarithmic scales to give results related to human aural or visual perception. dB is a ratio whereas dBm, for example, is an absolute value, quoted as a ratio to a fixed point of 0 dBm. 0 dBm is 1 mW at 1 kHz terminated in 600 . 0 dBmV is 1 mV terminated in 75 .

<b>DCE</b>	<b>Data Communications Equipment:</b> Typically a modem. It establishes, maintains and terminates a session on a network but in itself is not the source (originator) or destination (end receiving unit) of signals (e.g. a computer, see DTE). A DCE device may also convert signals to comply with the transmission path (network) format.
<b>DCT</b>	<b>Discrete Cosine Transform:</b> A technique for expressing a waveform as a weighted sum of cosines. Raw video data is not readily compressible. DCT is not in itself a compression technique but is used to process the video data so that it is compressible by an encoder. DCT processes the picture on an 8x8-pixel block basis, converting the data from an uncompressible X Y form (as displayed by an oscilloscope) to a compressible frequency domain form (as displayed by a spectrum analyser). Can be forward DCT or inverse DCT.
<b>DDS</b>	<b>Direct Digital Synthesiser.</b>
<b>Decoder</b>	The unit containing the electronic circuitry necessary to decode encrypted signals. Some Decoders are separate from the receiver but in satellite TV broadcasting, the term is often used interchangeably as a name for an Integrated Receiver Decoder (IRD). The term IRD, or IRD / Decoder, is usually associated with satellite TV broadcasting while Cable systems are based on Converters or on Set-Top Boxes / Converters.
<b>Decoding Time-stamp</b>	A field that may be present in a PES packet header that indicates the time that an access unit is to be decoded in the system target Decoder.
<b>DENG</b>	<b>Digital Electronic News Gathering</b>
<b>DID</b>	<b>Data Identifier.</b>
<b>Differential Coding</b>	Method of coding using the difference between the value of a sample and a predicted value.
<b>DIL</b>	<b>Dual In Line:</b> The most common type of package for small and medium scale integrated circuitS. The pins hang vertically from the two long sides of the rectangular package, spaced at intervals of 0.1 inch.
<b>DIN</b>	<b>Deutsches Institut für Normung:</b> German Standards Institute.
<b>Downlink</b>	The part of the satellite communications circuit that extends from the satellite to an Earth station.
<b>Downconvert</b>	The process by which the frequency of a broadcast transport stream is shifted to a lower frequency range.
<b>DPCM</b>	<b>Differential Pulse Code Modulation:</b> An audio digitisation technique that codes the difference between samples rather than coding an absolute measurement at each sample point.
<b>DSNG</b>	<b>Digital Satellite News-Gathering.</b>
<b>DSP</b>	<b>Digital Signal Processor.</b>
<b>DTE</b>	<b>Data circuit Terminating Equipment:</b> A communications device that originates (is the source) or is the end receiving unit (destination) of signals on a network. It is typically a terminal or computer.
<b>DTH</b>	<b>Direct To Home.</b> The term used to describe uninterrupted transmission from the satellite directly to the subscriber, that is, no intermediary cable or terrestrial network utilised.
<b>DTMF</b>	<b>Dual-Tone MultiFrequency</b>
<b>DVB</b>	<b>Digital Video Broadcasting:</b> A European project which has defined transmission standards for digital broadcasting systems using satellite (DVB-S), cable (DVB-C) and terrestrial (DVB-T) medium, created by the EP-DVB group and approved by the ITU. Specifies modulation, error correction, etc. (see EN 300 421 for satellite, EN 300 429 for cable and EN 300 744 for terrestrial).
<b>DVB SI</b>	<b>Digital Video Broadcasting Service Information.</b>
<b>DVB-PI</b>	<b>DVB-Professional Interfaces:</b> TTV Lan search shows – DVB Physical Interfaces

<b>Earth</b>	<b>Technical Earth:</b> Ensures that all equipment chassis within a rack are at the same potential, usually by connecting a wire between the Technical earth terminal and a suitable point on the rack. This is sometimes known as a Functional earth.  <b>Protective Earth:</b> Used for electric shock protection. This is sometimes known as a safety earth.
<b>EBU</b>	<b>European Broadcast Union.</b>
<b>ECM</b>	<b>Entitlement Control Message.</b>
<b>EDI</b>	Ethernet Data Input
<b>EIA</b>	<b>Electronics Industries Association (USA).</b>
<b>EIT</b>	<b>Event Information Table:</b> Equipment: A component of the DVB-Service Information (SI) stream generated within an Encoder, containing information about events or programmes such as event name, start time, duration, etc.  System: EIT (Present/Following) contains the name of the current and next event. It may include an optional descriptor (synopsis) giving brief details of content. EIT (Schedule) is used to produce a full EPG. The EIT is the only DVB-SI table, which can be encrypted.
<b>Elementary Stream</b>	A generic term for a coded bit-stream, be it video, audio or other.
<b>EMC</b>	<b>Electromagnetic Compatibility.</b>
<b>EMM</b>	<b>Entitlement Management Message.</b>
<b>Encryption</b>	Encoding of a transmission to prevent access without the appropriate decryption equipment and authorisation.
<b>EPG</b>	<b>Electronic Programme Guide:</b> On-screen programme listing using thumbnail pictures and/or text.
<b>Ethernet</b>	The most widely used local area network (LAN) defined by the IEEE as the 802.3 standard. Transmission speeds vary according to the configuration. Ethernet uses copper or fibre-optic cables.
<b>ETS</b>	<b>European Telecommunications Standard.</b>
<b>ETSI</b>	<b>European Telecommunications Standards Institute.</b>
<b>FBAS</b>	German for CVBS
<b>FCC</b>	<b>Federal Communications Commission.</b>
<b>FDM</b>	<b>Frequency Division Multiplex:</b> A common communication channel for a number of signals, each with its own allotted frequency.
<b>FEC</b>	<b>Forward Error Correction:</b> A method of catching errors in a transmission. The data is processed through an algorithm that adds extra bits and sends these with the transmitted data. The extra bits are then used at the receiving end to check the accuracy of the transmission and correct any errors.
<b>FFT</b>	<b>Fast Fourier Transformation:</b> A fast algorithm for performing a discrete Fourier transform.
<b>FIFO</b>	First In, First Out: A data structure or hardware buffer from which items are taken out in the same order they were put in. Also known as a shelf from the analogy with pushing items onto one end of a shelf so that they fall off the other. A FIFO is useful for buffering a stream of data between a sender and receiver that are not synchronised - i.e. they not sending and receiving at exactly the same rate.
<b>FM</b>	<b>Frequency Modulation:</b> Analogue modulation procedure
<b>Footprint</b>	The area of the Earth's surface covered by a satellite's downlink transmission. Also (generally) the area from which the satellite can receive uplink transmissions.
<b>FTP</b>	<b>File Transfer Protocol:</b> A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a Web site on a local machine, they are typically uploaded to the Web server, using FTP. Unlike e-mail programs in which graphics and program files have to be attached, FTP is designed to handle binary files directly and does not add the overhead of encoding and decoding the data.

<b>G.703</b>	The ITU-T standard which defines the physical and electrical characteristics of hierarchical digital interfaces.
<b>GOP</b>	<b>Group of Pictures:</b> MPEG video compression works more effectively by processing a number of video frames as a block. The TANDBERG Television Encoder normally uses a 12 frame GOP; every twelfth frame is an I frame.
<b>GUI</b>	<b>Graphical User Interface:</b> The use of pictures rather than just words to represent the input and output of a program. A program with a GUI runs under a windowing system and has a screen interface capable of displaying graphics in the form of icons, drop-down menus and a movable pointer. The on-screen information is usually controlled / manipulated by a mouse or keyboard.
<b>HDTV</b>	<b>High Definition Television.</b>
<b>HPA</b>	<b>High Power Amplifier:</b> Used in the signal path to amplify the modulated and up-converted broadcast signal for feeding to the uplink antenna.
<b>HSYNC</b>	<b>Horizontal (line) SYNCs.</b>
<b>HU</b>	Height Unit
<b>Hub</b>	A device in a multipoint network at which branch nodes interconnect.
<b>ICAM</b>	<b>Integrated Conditional Access Module:</b> Embedded in the IRD and responsible for descrambling, plus packet filtering and reception. It also contains the physical interface to the subscriber's viewing card.
<b>IDU</b>	<b>Indoorunit</b>
<b>IEC</b>	<b>International Electrotechnical Committee.</b>
<b>IF</b>	<b>Intermediate Frequency:</b> Usually refers to the 70 MHz or 140 MHz output of the Modulator in cable, satellite and terrestrial transmission applications.
<b>Interframe Coding</b>	Compression coding involving consecutive frames. When consecutive frames are compared, temporal redundancy is used to remove common elements (information) and arrive at difference information. MPEG-2 uses B and P frames, but since they are individually incomplete and relate to other adjacent frames, they cannot be edited independently.
<b>Intraframe Coding</b>	Compression coding involving a single frame. Redundant information is removed on a per frame basis. All other frames are ignored. Coding of a macroblock or picture that uses information only from that macroblock or picture. Exploits spatial redundancy by using DCT to produce I frames; these are independent frames and can be edited.
<b>IP</b>	<b>Internet Protocol:</b> The IP part of TCP/IP. IP implements the network layer (layer 3) of the protocol, which contains a network address and is used to route a message to a different network or sub-network. IP accepts packets from the layer 4 transport protocol (TCP or UDP), adds its own header to it and delivers a datagram to the layer 2 data link protocol. It may also break the packet into fragments to support the Maximum Transmission / Transfer Unit (MTU) of the network.
<b>I-picture; I-frame</b>	<b>Intracoded Picture/Frame:</b> A picture / frame, which is coded using purely intracoding with reference to no other field or frame information. The I frame is used as a reference for other compression methods.
<b>IPPV</b>	<b>Impulse Pay Per View:</b> One-time events, purchased at home (on impulse) using a prearranged SMS credit line.
<b>IRD</b>	<b>Integrated Receiver Decoder:</b> The Receiver with an internal MPEG Decoder, which is connected to the subscriber's TV. The IRD is responsible for receiving and de-multiplexing all signals. The unit receives the incoming signal and if CA is active, decodes the signal when provided with a control word by the viewing card. Domestic IRDs are also known as Set-Top Units or Set-Top Boxes.
<b>IRE</b>	<b>Institute of Radio Engineers:</b> No longer in existence but the name lives on as a unit of video amplitude measurement. This unit is 1% of the range between blanking a peak white for a standard amplitude signal.

<b>ISDN</b>	<p><b>Integrated Services Digital Network:</b> The basic ISDN service is BRI (Basic Rate Interface), which is made up of two 64 kbit/s B channels and one 16 kbit/s D channel (2B+D). If both channels are combined into one, called <b>bonding</b>, the total data rate becomes 128 kbit/s and is four and a half times the bandwidth of a V.34 modem (28.8 kbit/s).</p> <p>The ISDN high-speed service is PRI (Primary Rate Interface). It provides 23 B channels and one 64 kbit/s D channel (23B+D), which is equivalent to the 24 channels of a T1 line. When several channels are bonded together, high data rates can be achieved. For example, it is common to bond six channels for quality videoconferencing at 384 kbit/s. In Europe, PRI includes 30 B channels and one D channel, equivalent to an E1 line.</p>
<b>ISO</b>	<b>International Standards Organisation.</b>
<b>ISOG</b>	<b>Inter-union Satellite Operations Group.</b>
<b>ITS</b>	<b>Insertion Test Signal:</b> A suite of analogue test signals placed on lines in the VBI. Also known as VITS.
<b>ITT</b>	<b>Invitation To Tender.</b>
<b>ITU-R</b>	<b>International Telecommunications Union - Radiocommunications Study Groups</b> (was CCIR).
<b>ITU-T</b>	<b>International Telecommunications Union - Telecommunications Standardisation Sector</b> (was CCITT).
<b>JPEG</b>	<b>Joint Photographic Experts Group:</b> ISO/ITU standard for compressing still images. It has a high compression capability. Using discrete cosine transform, it provides user specified compression ratios up to around 100:1 (there is a trade-off between image quality and file size).
<b>kbit/s</b>	1000 bits per second.
<b>Kbit</b>	1024 bits, usually refers to memory capacity or allocation.
<b>Ku-band</b>	The portion of the electromagnetic spectrum, which spans the frequency range of approximately 12 GHz to 14 GHz. Used by communications satellites. Preferred for DTH applications because this range of frequency is less susceptible to interference.
<b>LAN</b>	<b>Local Area Network:</b> A network, which provides facilities for communications within a defined building or group of buildings in close proximity.
<b>L-band</b>	The frequency band from 950 MHz to 2150 MHz, which is the normal input-frequency-range of a domestic IRD. The incoming signal from the satellite is down-converted to L-band by the LNB.
<b>LED</b>	<b>Light Emitting Diode.</b>
<b>LNB</b>	<b>Low Noise Block Down-Converter:</b> The component of a subscriber satellite transmission receiving dish which amplifies the incoming signal and down-converts it to a suitable frequency to input to the IRD (typically 950 MHz - 1600 MHz).
<b>LO</b>	<b>Local Oscillator.</b>
<b>lsb</b>	<b>Least significant bit.</b>
<b>Luminance</b>	The television signal representing brightness, or the amount of light at any point in a picture. The Y in $Y\text{C}_\text{R}\text{C}_\text{B}$ .
<b>LVDS</b>	<b>Low Voltage Differential Signal:</b> LVDS is a generic multi-purpose Interface standard for high speed / low power data transmission. It was standardised in ANSI/TIA/EIA-644-1995 Standard (aka RS-644).
<b>Macroblock</b>	A 16x16-pixel area of the TV picture. Most processing within the MPEG domain takes place with macro blocks. These are converted to four 8x8 blocks using either frame DCT or field DCT. Four 8 x 8 blocks of luminance data and two (4:2:0 chrominance format), four (4:2:2) or eight (4:4:4) corresponding 8 x 8 blocks of chrominance data coming from a 16 x 16 section of the luminance component of the picture. Macroblock can be used to refer to the sample data and to the coded representation of the sample values and other data elements.

<b>Mbit/s</b>	<b>Million bits per second.</b>
<b>MCC</b>	<b>Multiplex Control Computer:</b> A component of a System 3000 compression system. The MCC sets up the configuration for the System 3000 Multiplexers under its control. The MCC controls both the main and backup Multiplexer for each transport stream.
<b>MCPC</b>	<b>Multiple Channels Per Carrier.</b>
<b>MEM</b>	<b>Multiplex Element Manager:</b> A GUI based control system, part of the range of TANDBERG Television compression system control element products. The evolution 5000 MEM holds a model of the system hardware. Using this model, it controls the individual system elements to configure the output multiplexes from the incoming elementary streams. The MEM monitors the equipment status and controls any redundancy switching.
<b>MMDS</b>	<b>Multichannel Microwave Distribution System:</b> A terrestrial microwave direct-to-home broadcast transmission system.
<b>Motion Compensation</b>	The use of motion vectors to improve the efficiency of the prediction of sample values. The prediction uses motion vectors to provide offsets into the past and/or future reference frames or fields containing previously decoded sample values that are used to form the prediction error signal.
<b>Motion Estimation</b>	The process of estimating motion vectors in the encoding process.
<b>Motion Vector</b>	A two-dimensional vector used for motion compensation that provides an offset from the co-ordinate position in the current picture or field to the co-ordinates in a reference frame or field.
<b>MP@ML</b>	<b>Main Profile at Main Level:</b> A subset of the MPEG-2 standard, which supports digital video storage (DVD etc.) and transmissions up to 15 Mbit/s over various mediums.
<b>MP@HL</b>	<b>Main Profile at High Level:</b> A subset of the MPEG-2 standard, which supports digital video storage (DVD etc.) and transmissions up to 80 Mbit/s over various mediums.
<b>MPEG</b>	<b>Moving Pictures Experts Group:</b> The name of the ISO/IEC working group which sets up the international standards for digital television source coding.
<b>MPEG-2</b>	Industry standard for video and audio source coding using compression and multiplexing techniques to minimise video signal bit-rate in preparation for broadcasting. Specified in ISO/IEC 13818. The standard is split into layers and profiles defining bit-rates and picture resolutions.
<b>msb</b>	<b>Most significant bit.</b>
<b>Msymbol/s</b>	(Msym/s) <b>Mega (million) Symbols per second</b> ( $10^6$ Symbols per second).
<b>Multiplex</b>	A number of discrete data streams (typically 8 to 12), from encoders, that are compressed together in a single DVB compliant transport stream for delivery to a Modulator.
<b>MUSICAM</b>	<b>Masking pattern adapted Universal Sub-band Integrated Coding And Multiplexing:</b> An audio bit-rate reduction system relying on sub-band coding and psychoacoustic masking.
<b>Mux</b>	<b>Multiplexer:</b> Transmission Multiplexer: receives EMMs from the ACC, ECMs from the BCC, video/audio data from the encoders, and the SI stream from the SIC. It then multiplexes them all into a single DVB-compliant transport stream, and delivers the signal to the uplink after modulation.  The Multiplexer also contains the cypher card, which scrambles the services according to the control words supplied by the BCC.
<b>Network</b>	In the context of broadcasting: a collection of MPEG-2 transport stream multiplexes transmitted on a single delivery system, for example, all digital channels on a specific cable system.
<b>NICAM</b>	<b>Near Instantaneously Companded Audio Multiplex:</b> Official name is NICAM 728. Used for digital stereo sound broadcasting in the UK employing compression techniques to deliver very near CD quality audio. 728 refers to the bit-rate in kbit/s.

<b>NIT</b>	<b>Network Information Table:</b> Part of the service information data. The NIT provides information about the physical organisation of each transport stream multiplex, and the characteristics of the network itself (such as the actual frequencies and modulation being used).
<b>nm</b>	<b>Nanometre:</b> a unit of length equal to one thousand millionth ( $10^{-9}$ ) of a metre.
<b>NTSC</b>	<b>National Television Systems Committee:</b> The group, which developed analogue standards used in television broadcast systems in the United States. Also adopted in other countries (e.g. Mexico, Canada, Japan). This system uses 525 picture lines and a 59.97 Hz field frequency.
<b>NVOD</b>	<b>Near Video On Demand:</b> Method of offering multiple showings of movies or events. The showings are timed to start at set intervals, determined by the broadcaster. Each showing of a movie or event can be sold to subscribers separately.
<b>NVRAM</b>	<b>Non-volatile Random Access Memory:</b> Memory devices (permitting random read / write access) that do not lose their information when power is removed. Stores the default configuration parameters set by the user.
<b>ODU</b>	<b>Outdoor Unit</b>
<b>OFDM</b>	<b>Orthogonal Frequency Division Multiplex:</b> A modulation technique used for digital TV transmission in Europe, Japan and Australia; more spectrally efficient than FDM. In OFDM, data is distributed over a large number of carriers spaced apart at precise frequencies. The carriers are arranged with overlapping sidebands in such a way that the signals can be received without adjacent channel interference.
<b>OPPV</b>	<b>Order ahead Pay Per View:</b> An advance purchase of encrypted one-time events with an expiry date.
<b>OSD</b>	<b>On-screen display:</b> Messages and graphics, typically originating from the SMS, and displayed on the subscriber's TV screen by the IRD, to inform the subscriber of problems or instruct the subscriber to contact the SMS.
<b>Packet</b>	A unit of data transmitted over a packet-switching network. A packet consists of a header followed by a number of contiguous bytes from an elementary data stream.
<b>PAL</b>	<b>Phase Alternating Line:</b> A colour TV broadcasting system where the phase of the R-Y colour-difference signal is inverted on every alternate line to average out errors providing consistent colour reproduction.
<b>PAT</b>	<b>Program Association Table:</b> Part of the MPEG-2 Program Specific Information (PSI) data and is mandatory for MPEG-2 compliance. The PAT points (maps) to the PMT.
<b>PCM</b>	<b>Pulse Code Modulation:</b> A process in which a signal is sampled, each sample is quantised independently of other samples, and the resulting succession of quantised values is encoded into a digital signal.
<b>PCR</b>	<b>Program Clock Reference:</b> A time-stamp in the transport stream from which the Decoder timing is derived.
<b>PDC</b>	<b>Program Delivery Control:</b> A Teletext service allowing simple programming (i.e. VideoPlus) of VCR recording times. If the desired program is rescheduled, PDC updates the programming information in the VCR.
<b>Pel</b>	<b>Picture Element:</b> Also known as a pixel. The smallest resolvable rectangular area of an image either on a screen or stored in memory. On screen, pixels are made up of one or more dots of colour. Monochrome and grey-scale systems use one dot per pixel. For grey-scale, the pixel is energised with different intensities, creating a range from dark to light (a scale of 0-255 for an eight-bit pixel). Colour systems use a red, green and blue dot per pixel, each of which is energised to different intensities, creating a range of colours perceived as the mixture of these dots. If all three dots are dark, the result is black. If all three dots are bright, the result is white.

<b>PES</b>	<b>Packetised Elementary Stream:</b> A sequential stream of data bytes that has been converted from original elementary streams of audio and video access units and transported as packets. Each PES packet consists of a header and a payload of variable length and subject to a maximum of 64 kbytes. A time-stamp is provided by the MPEG-2 systems layer to ensure correct synchronisation between related elementary streams at the Decoder.
<b>PID</b>	<b>Packet Identifier:</b> The header on a packet in an elementary data stream, which identifies that data stream. An MPEG-2 / DVB standard.
<b>PIN</b>	<b>Personal Identification Number:</b> A password used to control access to programming and to set purchase limits. Each subscriber household can activate several PINs and may use them to set individual parental rating or spending limits for each family member.
<b>Pixel</b>	<b>PIX (picture) Element:</b> The digital representation of the smallest area of a television picture capable of being delineated by the bit-stream. See <b>Pel</b> for more information.
<b>pk-pk</b>	<b>peak to peak:</b> Measurement of a signal or waveform from its most negative point to its most positive point.
<b>PLL</b>	<b>Phase-Locked Loop.</b> A phase-locked loop is a control system which controls the rotation of an object by comparing its rotational position (phase) with another rotating object as in the case of a sine wave or other repeating signal. This type of control system can synchronise not only the speed, but also the angular position of two waveforms that are not derived from the same source.
<b>PMT</b>	<b>Program Map Table:</b> Part of the MPEG-2 Program Specific Information (PSI) data and is mandatory for MPEG-2 compliance. Each service has a PMT, which lists the component parts (elementary streams of video, audio, etc.) for the various services being transmitted.
<b>P-picture/P-frame</b>	A picture / frame produced using forward prediction. It contains predictions from either previous I frames or previous P frames. The P frame is used as a reference for future P or B frames.
<b>ppm</b>	<b>Parts per million.</b>
<b>PPV</b>	<b>Pay Per View:</b> A system of payment for viewing services based on a usage / event basis rather than on on-going subscription. Subscribers must purchase viewing rights for each PPV event that they wish to view. PPV events may be purchased as IPPV or OPPV.
<b>Program</b>	PC - A sequence of instructions for a computer. TV - A concept having a precise definition within ISO 13818-1 (MPEG-2). For a transport stream, the timebase is defined by the PCR. The use of the PCR for timing information creates a virtual channel within the stream.
<b>Programme</b>	A linking of one or more events under the control of a broadcaster. For example, football match, news, film show. In the MPEG-2 concept, the collection of elementary streams comprising the programme, have a common start and end time. A series of programmes are referred to as events.
<b>P<sub>R</sub>P<sub>B</sub></b>	Analogue Colour difference signals. Refer to C <sub>RCB</sub> for an explanation.
<b>PROM</b>	<b>Programmable Read-Only Memory:</b> A device, which may be written once with data for permanent storage, and then read whenever required. Special types of PROM permit the erasure of all data by Ultraviolet light (EPROM) or by application of an electronic signal (EEPROM).
<b>PS</b>	<b>Program Stream:</b> A combination of one or more PESs with a common timebase.
<b>PSI</b>	<b>Program Specific Information:</b> Consists of normative data, which is necessary for the demultiplexing of transport streams and the successful regeneration of programs. (See also: SI).
<b>PSIP</b>	<b>Program System Information Protocol:</b> The ATSC equivalent of SI for DVB.
<b>PSK</b>	<b>Phase Shift Keying:</b> A method of modulating digital signals particularly suited to satellite transmission.
<b>PSR</b>	<b>Professional Satellite Receiver:</b> See also: IRD.
<b>PSU</b>	<b>Power Supply Unit.</b>

<b>QAM</b>	<b>Quadrature Amplitude Modulation:</b> A method of modulating digital signals, which uses combined techniques of phase modulation and amplitude modulation. It is particularly suited to cable networks.
<b>QPSK</b>	<b>Quadrature Phase Shift Keying:</b> A form of phase shift keying modulation using four states.
<b>QSIF</b>	<b>Quarter Screen Image Format.</b>
<b>Quantise</b>	A process of converting analogue waveforms to digital information. 8-bit quantisation as set out in ITU-R Rec. 601. uses 256 levels in the range 0 – 255 to determine the analogue waveform value at any given point. The value is then converted to a digital number for processing in the digital domain.
<b>RAM</b>	<b>Random Access Memory:</b> A volatile storage device for digital data. Data may be written to, or read from, the device as often as required. When power is removed, the data it contains is lost.
<b>RAS</b>	<b>Remote Authorization System:</b> A TANDBERG TV proprietary public-key encryption system used to prevent unauthorized viewing of a TV programme or programmes.
<b>RF</b>	<b>Radio Frequency.</b>
<b>RGB</b>	<b>Red, Green, Blue:</b> The Chroma information in a video signal.
<b>ROM</b>	<b>Read Only Memory:</b> A non-volatile storage device for digital data. Data has been stored permanently in this device. No further information may be stored (written) there and the data it holds cannot be erased. Data may be read as often as required.
<b>RS</b>	<b>Reed-Solomon coding:</b> An error detection and correction, coding system. 16 bytes of Reed-Solomon Forward Error Correction code are appended to the packet before transmission bringing the packet length to 204 bytes. The 16 bytes are used at the receiving end to correct any errors. Up to eight corrupted bytes can be corrected.
<b>RLC</b>	<b>Run Length Coding:</b> Minimisation of the length of a bit-stream by replacing repeated characters with an instruction of the form ‘repeat character x y times’.
<b>SCPC</b>	<b>Single Channel Per Carrier.</b>
<b>Spectral Scrambling</b>	A process (in digital transmission) used to combine a digital signal with a pseudo-random sequence, producing a randomised digital signal that conveys the original information in a form optimised for a broadcast channel.
<b>Scrambling</b>	Alteration of the characteristics of a television signal in order to prevent unauthorised reception of the information in clear form.
<b>SDI</b>	<b>Serial Digital Interface.</b>
<b>SDT</b>	<b>Service Description Table:</b> Provides information in the SI stream about the services in the system; for example, the name of the service, the service provider, etc.
<b>SELV</b>	<b>Safety Extra Low Voltage (EN 60950).</b>
<b>STB</b>	<b>Set-Top Box:</b> A box that sits on top of a television set and is the interface between the home television and the cable TV company. New technologies evolving for set-top boxes are video-on-demand, video games, educational services, database searches, and home shopping. The cable equivalent of the IRD.
<b>SFN</b>	<b>Single Frequency Network:</b> The SFN technique allows large geographic areas to be served with a common transmission multiplex. All transmitters in the network are synchronously modulated with the same signal and they all radiate on the same frequency. Due to the multi-path capability of the multi-carrier transmission system (COFDM), signals from several transmitters arriving at a receiving antenna may contribute constructively to the total wanted signal. The SFN technique is not only frequency efficient but also power efficient because fades in the field strength of one transmitter may be filled by another transmitter.
<b>SI</b>	<b>Service Information:</b> Digital information describing the delivery system, content and scheduling (timing) of broadcast data streams. DVB-SI data provides information to enable the IRD to automatically demultiplex and decode the various streams of programmes within the multiplex. Specified in ISO/IEC 13818[1]. (DVB)

<b>Single Packet Burst Mode</b>	A burst of ASI bytes (either 188 or 204, depending on packet length) is contiguously grouped into an MPEG-2 Transport Stream packet. Stuffing data is added between the packets to increase the data rate to 270 Mbit/s. See DVB Document A010 rev. 1, Section B3.3, (ASI) Layer-2 Transport Protocol.
<b>Smart Card</b>	A plastic card with a built-in microprocessor and memory used for identification, financial transactions or other authorising data transfer. When inserted into a reader, data is transferred to and from the host machine or a central computer. It is more secure than a magnetic stripe card and it can be disabled if the wrong password is entered too many times. As a financial transaction card, it can be loaded with digital money and used in the same way as cash until the balance reaches zero. The file protocol is specific to its intended application.
<b>SMATV</b>	<b>Satellite Mast Antenna Television:</b> A distribution system, which provides sound and television signals to the households of a building or group of buildings, typically used to refer to an apartment block.
<b>SMPTE</b>	<b>Society of Motion Picture and Television Engineers.</b>
<b>SMS</b>	<b>Subscriber Management System:</b> A system which handles the maintenance, billing, control and general supervision of subscribers to conditional access technology viewing services provided through cable and satellite broadcasting. An SMS can be an automatic (e.g. Syntellect) system where subscribers order entitlements by entering information via a telephone. Alternatively, an SMS can be a manual system, which requires subscribers to speak with an operator who then manually enters their entitlement requests. Some systems support multiple SMSs.
<b>SNG</b>	<b>Satellite News-Gathering.</b>
<b>SNMP</b>	<b>Simple Network Management Protocol.</b>
<b>Spatial Redundancy</b>	Information repetition due to areas of similar luminance and/or chrominance characteristics within a single frame. Removed using DCT and Quantisation (Intra-Frame Coding).
<b>SPI</b>	<b>Synchronous Parallel Interface.</b>
<b>Statistical Redundancy</b>	Data tables are used to assign fewer bits to the most commonly occurring events, thereby reducing the overall bit-rate. Removed using Run Length Coding and Variable Length Coding.
<b>TAXI</b>	<b>Transparent Asynchronous Tx / Rx Interface:</b> A proprietary high-speed data interface.
<b>TCP / IP</b>	<b>Transmission Control Protocol/Internet Protocol:</b> A set of communications protocols that may be used to connect different types of computers over networks.
<b>TDM</b>	<b>Time Division Multiplex:</b> One common, communications channel carrying a number of signals, each with its own allotted time slot.
<b>TDT</b>	<b>Time and Date Table:</b> Part of the DVB Service Information. The TDT gives information relating to the present time and date.
<b>Temporal Redundancy</b>	Information repetition due to areas of little or no movement between successive frames. Removed using motion estimation and compensation (Inter-Frame Coding).
<b>Time-stamp</b>	A term that indicates the time of a specific action such as the arrival of a byte or the presentation of a presentation unit.
<b>TOT</b>	<b>Time Offset Table:</b> This optional SI table supports the use of local offsets as well as the UTC time/date combination. The purpose of the table is to list by country the current offset from UTC and the next expected change to that offset (to track when daylight saving occurs). The offset resolution is to within 1 minute over a range of ±12 hours from UTC.
<b>Transport Stream</b>	A set of packetised elementary data streams and SI streams, which may comprise more than one programme, but with common synchronisation and error protection. The data structure is defined in ISO/IEC 13818-1 [1] and is the basis of the ETSI Digital Video Broadcasting standards.
<b>Transport Stream Packet Header</b>	A data structure used to convey information about the transport stream payload.
<b>TS</b>	<b>Transport Stream.</b>

<b>TSDT</b>	<b>Transport Stream Descriptor Table:</b> A component of the MPEG-2 PSI data. This table describes which type of Transport stream it is in (i.e. DVB, ATSC etc.). It may also contain other descriptors.
<b>TSP</b>	<b>Transport Stream Processor.</b>
<b>U</b>	44.45 mm (rack height standard).
<b>UART</b>	<b>Universal Asynchronous Receiver Transmitter:</b> A device providing a serial interface for transmitting and receiving data.
<b>Upconvert</b>	The process by which the frequency of a broadcast transport stream is shifted to a higher frequency range.
<b>Uplink</b>	The part of the communications satellite circuit that extends from the Earth to the satellite.
<b>UPS</b>	<b>Uninterruptable Power Supply:</b> A method of supplying backup power when the electrical power fails or drops to an unacceptable voltage level. Small UPS systems provide battery power for a few minutes; enough to power down the computer in an orderly manner. This is particularly important where <b>write back cache</b> is used.  Write back cache is where modified data intended for the disk is temporarily stored in RAM and can be lost in the event of a power failure. Sophisticated systems are tied to electrical generators that can provide power for days. UPS systems typically provide surge suppression and may provide voltage regulation.
<b>UTC</b>	<b>Universal Time Co-ordinate:</b> An internationally agreed basis for timekeeping introduced in 1972 and based on international atomic time (corresponds to Greenwich Mean Time or GMT).
<b>VITC</b>	Vertical Interval Time Code.
<b>VITS</b>	<b>Vertical Interval Test Signal:</b> See: ITS.
<b>VPS</b>	<b>Video Programming System:</b> A German precursor to PDC
<b>WSS</b>	<b>Wide Screen Switching:</b> Data used in wide-screen analogue services, which enables a receiver to select the appropriate picture display mode.
<b>WST</b>	<b>World System Teletext:</b> System B Teletext. Used in 625 line / 50 Hz television systems (ITU-R 653).
<b>XILINX</b>	A type of programmable Integrated Circuit.
<b>XLR</b>	Audio connector featuring three leads, two for signal and one for GND.
<b>Y (Luminance)</b>	Defines the brightness of a particular point on a TV line. The only signal required for black and white pictures.
<b>Y/C</b>	Broadcast video with separate colour, Y (luminance) and C (Chroma) (sometimes called S-Video).
<b>YUV</b>	Y: Luminance component (Brightness), U and V: Chrominance (Colour difference)

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## Annex B

# Technical Specification

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## B.1 Control and Monitoring – All Base Unit Models

### B.1.1 RS-232/RS-485 Remote Control

This connector provides an RS-232/RS-485 control port that may be configured either as a local (terminal menu) or remote control port.

*Table B.1: RS-232/RS-485 Control Specification*

Item	Specification
Safety status:	SELV
Type:	ITU-T V.24/V.28 (RS-232D) asynchronous serial data
Connector designation:	RS-232/485
Connector type:	9-way D-type male
Termination:	High impedance / 100 Ω (RS-485 inputs only)
Supported Baud rates:	300, 600, 1200, 2400, 4800, 9600, 19200 (default), 38400 Baud
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None
Control modes:	Terminal / remote
Local control:	VT100 compatible terminal menus
Remote control protocol:	See <i>Chapter 5, RS-232 Remote Control Protocol</i> and <i>Chapter 6, RS-485 Remote Control Protocol</i>

### B.1.2 Ethernet Remote Control

*Table B.2: Ethernet Remote Control Specification*

Item	Specification
Safety status:	SELV
Connector designation:	ETHERNET 1 and ETHERNET 2
Connector type:	8-way RJ-45 socket, 10BaseT (ISO 882/3)
Control modes:	Remote control SNMP Remote Control Telnet FTP (Used for software/firmware download)
Remote control protocol:	See <i>Chapter 5, RS-232 Remote Control Protocol</i> and <i>ST.TS.SNMP.E10152</i>

### B.1.3 Reset/Status Port

This connector provides volt-free relay contacts for alarm and fail, and remote reset input.

*Table B.3: Reset / Status Port Specification*

Item	Specification
Safety status:	SELV
Connector designation:	RESET/STATUS
Connector type:	9-way D-type female
Alarm Contacts:	Change-over contacts (5 Ω in common)
Fail contacts:	Change-over contacts (5 Ω in common)
Reset contacts:	Short pins 9 and 5

## B.2 DVB ASI Electrical Inputs (DVB ASI IN) – All Base Unit Models

Two DVB ASI electrical inputs are provided as standard on each Modulator Base Unit model. One of the two inputs is selected under user control as the input to the Modulator.

*Table B.4: DVB ASI IN Specification*

Item	Specification
Safety status:	SELV
Connector type:	BNC 75 Ω
Connector designation:	ASI IN 1 and 2 (SM66XX/HWO/ASI-SPI option not fitted) ASI IN 3 and 4 (SM66XX/HWO/ASI-SPI option fitted)
Compliance:	EN 50083-9, June 1998: Section 4.4
Input bit-rate range:	Defined by symbol rate range, modulation and coding standard, modulation format, FEC code rate, input packet size and other parameters, subject to a maximum limit of 213 Mbit/s.  For the DVB-S and DVB-DSNG standards, see <i>Table B.5: Input Bit-rate Ranges for DVB-S and DVB-DSNG (Standard)</i> and <i>Table B.6: Input Bit-rate Ranges for DVB-S and DVB-DSNG (Extended Symbol Rate Option)</i> .  For the DVB-S2 standard, use the <a href="#">SM66xx Input Bit-rate Ranges</a> spreadsheet utility to calculate the input bit-rate ranges.
Byte stuffing modes:	Byte and Single Packet Burst modes

Table B.5: Input Bit-rate Ranges for DVB-S and DVB-DSNG (Standard)

Modulation Format	FEC Code Rate	Bit-rate $R_{188}$		Bit-rate $R_{204}$	
		Min	Max	Min	Max
BPSK	1/2	0.460784	22.117647	0.500000	24.000000
	2/3	0.614379	29.490196	0.666667	32.000000
	3/4	0.691176	33.176471	0.750000	36.000000
	5/6	0.767974	36.862745	0.833333	40.000000
	7/8	0.806373	38.705882	0.875000	42.000000
QPSK	1/2	0.921569	44.235294	1.000000	48.000000
	2/3	1.228758	58.980392	1.333333	64.000000
	3/4	1.382353	66.352941	1.500000	72.000000
	5/6	1.535948	73.725490	1.666667	80.000000
	7/8	1.612745	77.411765	1.750000	84.000000
8PSK	2/3	1.843137	88.470588	2.000000	96.000000
	5/6	2.303922	110.588235	2.500000	120.000000
	8/9	2.457516	117.960784	2.666667	128.000000
16QAM	3/4	2.764706	132.705882	3.000000	144.000000
	7/8	3.225490	154.823529	3.500000	168.000000

Table B.6: Input Bit-rate Ranges for DVB-S and DVB-DSNG (Extended Symbol Rate Option)

Modulation Format	FEC Code Rate	Bit-rate $R_{188}$		Bit-rate $R_{204}$	
		Min	Max	Min	Max
BPSK	1/2	0.092157	30.411765	0.100000	33.000000
	2/3	0.122876	40.549020	0.133333	44.000000
	3/4	0.138235	45.617647	0.150000	49.500000
	5/6	0.153595	50.686275	0.166667	55.000000
	7/8	0.161275	53.220588	0.175000	57.750000
QPSK	1/2	0.184314	60.823529	0.200000	66.000000
	2/3	0.245752	81.098039	0.266667	88.000000
	3/4	0.276471	91.235294	0.300000	99.000000
	5/6	0.307190	101.372549	0.333333	110.000000
	7/8	0.322549	106.441176	0.350000	115.500000
8PSK	2/3	0.368627	121.647059	0.400000	132.000000
	5/6	0.460784	152.058824	0.500000	165.000000
	8/9	0.491503	162.196078	0.533333	176.000000
16QAM	3/4	0.552941	182.470588	0.600000	198.000000
	7/8	0.645098	212.882353	0.700000	213.000000

## B.3 Modulation and Coding

Table B.7: Modulation and Coding Specification

Item	Specification	Notes
Standards supported:	EN 300 421 (DVB-S) EN 301 210 (DVB-DSNG) EN 302 307 (DVB-S2) – Broadcast Mode only	Available as standard Requires HOM software option Available only on models SM6620 and SM6625 with S2 software option
Modulation format:	BPSK QPSK 8PSK, 16QAM QPSK, 8PSK, 16APSK, 32APSK	As per ETSI TR 101 198 As per EN 300 421 As per EN 301 210 (Option) As per EN 302 307 (Options)
Outer coding:	Reed-Solomon (204, 188, T = 8) Bose-Chaudhuri-Hocquenghem (BCH)	DVB-S and DVB-DSNG DVB-S2
Inner coding:	Convolutional (Viterbi), K = 7 Low density parity check code (LDPC)	DVB-S and DVB-DSNG DVB-S2
Encoded frame size:	Normal (64800 bits), short (16200 bits)	Applicable to DVB-S2 only
FEC code rate:	1/2, 2/3, 3/4, 5/6, 7/8 2/3, 5/6, 8/9 3/4, 7/8 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10* 3/5, 2/3, 3/4, 5/6, 8/9, 9/10* 2/3, 3/4, 4/5, 5/6, 8/9, 9/10* 3/4, 4/5, 5/6, 8/9, 9/10*	With QPSK (DVB-S) With 8PSK (DVB-DSNG) With 16QAM (DVB-DSNG) With QPSK (DVB-S2) With 8PSK (DVB-S2) With 16APSK (DVB-S2) With 32APSK (DVB-S2)
		* FEC code rate 9/10 is not available with short frame size
Pilot carrier insertion:	OFF, ON	Applicable to DVB-S2 only
Physical layer scrambling code (Gold sequence) number:	0 to 262141	Applicable to DVB-S2 only
Symbol rate range:	1 to 48 Msymbol/s 0.2 to 66 Msymbol/s	Available as standard With extended symbol rate option For certain combinations of modulation format, FEC code rate, input packet size and other parameters, the maximum symbol rate may be limited to lower values than those indicated due to an input bit-rate limitation of 213 Mbit/s imposed by the ASI input interface.
Symbol rate step size:	1 symbol/s	
Symbol rate tracking range:	±122 ppm	Rate adaptation OFF Not applicable with rate adaptation ON
Symbol rate error:	Determined by input data rate accuracy within tracking range < ±20 ppm	Rate adaptation OFF Rate adaptation ON
Spectrum roll-off factor:	20%, 25%, 30%, 35%	
Spectrum sense:	Normal, inverted	

## B.4 Beacon Receiver Input – Models SM6620 and SM6625

**NOTE...**

This input is available only on models SM6620 and SM6625.

*Table B.8: BEACON Rx IN Specification*

Item	Specification
Safety status:	SELV
Connector type:	BNC 75 Ω
Connector designation:	BEACON Rx IN
Input impedance:	10 kΩ nominal
Input voltage range:	–10 V to +10 V
Input sensitivity:	0.5 to 4 dB/V in 0.1 dB/V steps

## B.5 IF Outputs – Models SM6610 and SM6620

**NOTE...**

These outputs are available only on models SM6610 and SM6620.

*Table B.9: IF OUT MAIN Specification*

Item	Specification
Safety status:	SELV
Connector type:	BNC female 75 Ω
Connector designation:	IF OUT MAIN
Output impedance:	75 Ω
Output power:	–20 dBm to +5 dBm in 0.1 dB steps
Power level stability:	±0.5 dB
Return loss:	>20 dB, 50-180 MHz
IF tilt correction range:	–0.04 to 0.04 dB/MHz
Transmission modes:	Modulation on/off Carrier on/off
Carrier frequency:	50-180 MHz, tuneable in 1 kHz steps
Carrier frequency temperature stability:	< ±0.1 ppm (±7 Hz at 70 MHz)
Carrier frequency ageing, short term:	< ±0.005 ppm/day
Carrier frequency ageing, long term:	< ±1.5 ppm first year
Carrier ON/OFF ratio:	>60 dB
Carrier suppression:	>40 dB

Item	Specification
Phase noise (continuous):	< -66 dBc/Hz at 100 Hz offset < -76 dBc/Hz at 1 kHz offset < -86 dBc/Hz at 10 kHz offset < -96 dBc/Hz at 100 kHz offset < -120 dBc/Hz at 1 MHz offset and above
Phase noise (discrete sidebands):	< -70 dBc
Spurious outputs (modulated carrier):	< -60 dBc/4 kHz over the frequency range 0 to 500 MHz but excluding the frequency range of the wanted output signal (equal to $\pm 1.06 \times$ Symbol Rate about the carrier frequency, as defined by the spectrum mask <i>Figure A.1</i> in EN 300 421)
Spurious outputs (unmodulated carrier):	< -55 dBc, each component
Noise floor (N <sub>0</sub> /C):	< -120 dBc/Hz
Main / monitor output isolation (both directions):	>30 dB, 50-180 MHz

*Table B.10: IF OUT MONITOR Specification*

Item	Specification
Safety status:	SELV
Connector type:	BNC female 75 Ω
Connector designation:	IF OUT MONITOR
Output impedance:	75 Ω
Output power:	-20 dB ±2 dB relative to main IF output power
Return loss:	>20 dB, 50-180 MHz

## B.6 L-Band Input and Outputs – Models SM6615 and SM6625

**NOTE...**

These inputs and outputs are available only on models SM6615 and SM6625.

### B.6.1 L-Band Input

This input provides a carrier combining facility for summing an externally generated carrier into the L-band output.

*Table B.11: L-BAND IN Specification*

Item	Specification
Safety status:	SELV
Connector type:	SMA female 50 Ω
Connector designation:	L-BAND IN
Input impedance:	50 Ω
Gain to L-BAND OUT MAIN output:	0 dB ±2 dB
Input power:	+5 dBm max
Return loss:	>14 dB, 950-1750 MHz

### B.6.2 L-Band Outputs

*Table B.12: L-BAND OUT MAIN Specification*

Item	Specification
Safety status:	SELV
Connector type:	SMA female 50 Ω
Connector designation:	L-BAND OUT MAIN
Output impedance:	50 Ω
Output power:	-20 dBm to +5 dBm in 0.1 dB steps
Output power ramp rate:	9 dB/s over operational power level range
Power level stability:	±0.5 dB
Return loss:	>14 dB, 950-1750 MHz
Transmission modes:	Modulation on/off Carrier on/off
Carrier frequency:	950-1750 MHz, tuneable in 1 kHz steps
Carrier frequency temperature stability:	< ±0.02 ppm (±35 Hz at 1750 MHz)
Carrier frequency ageing, short term:	< ±0.0005 ppm/day
Carrier frequency ageing, long term:	< ±0.1 ppm first year < ±0.05 ppm/year after first year
Carrier ON/OFF ratio:	>60 dB
Carrier suppression:	>35 dB

Item	Specification
Phase noise (continuous):	< -46 dBc/Hz at 10 Hz offset < -66 dBc/Hz at 100 Hz offset < -76 dBc/Hz at 1 kHz offset < -86 dBc/Hz at 10 kHz offset < -96 dBc/Hz at 100 kHz offset < -120 dBc/Hz at 1 MHz offset and above
Phase noise (discrete sidebands):	< -70 dBc
Spurious outputs (modulated carrier):	< -60 dBc/4 kHz over the frequency range 500 MHz to 2500 MHz but excluding the frequency range of the wanted output signal (equal to $\pm 1.06 \times$ Symbol Rate about the carrier frequency, as defined by the spectrum mask <i>Figure A.1</i> in EN 300 421)
Noise floor ( $N_0/C$ ):	< -120 dBc/Hz
Main / monitor output isolation (both directions):	> 30 dB, 950-1750 MHz

*Table B.13: L-BAND OUT MONITOR Specification*

Item	Specification
Safety status:	SELV
Connector type:	F-type female 75 Ω
Connector designation:	L-BAND OUT MONITOR
Output impedance:	75 Ω
Output power:	-30 dB nominal relative to main L-band output power
Return loss:	> 10 dB, 950-1750 MHz

### B.6.3 Reference Frequency Output

A reference frequency output is provided via the L-BAND OUT MAIN connector, intended for use by an external frequency up-converter.

*Table B.14: Reference Frequency Output Specification*

Item	Specification
Output power:	0 dBm $\pm 3$ dB sine-wave into 50 Ω load Switchable on/off
Frequency:	10 MHz
Frequency temperature stability:	< $\pm 0.02$ ppm ( $\pm 0.2$ Hz)
Frequency ageing, short term:	< $\pm 0.0005$ ppm/day
Frequency ageing, long term:	< $\pm 0.1$ ppm ( $\pm 1$ Hz) first year < $\pm 0.05$ ppm/year ( $\pm 0.5$ Hz/year) after first year
Phase noise:	-110 dBc/Hz at 10 Hz offset -135 dBc/Hz at 100 Hz offset -155 dBc/Hz at 1 kHz offset -160 dBc/Hz at 10 kHz offset

## B.6.4 DC Power Output

A d.c. power output is provided via the L-BAND OUT MAIN connector, intended for powering an external frequency up-converter.

*Table B.15: DC Power Output Specification*

Item	Specification
Voltage (open circuit):	+24 V nominal, switchable on/off
Output resistance:	1 Ω nominal
Ripple:	<100 mV pk-pk
Rated current:	500 mA max, short-circuit protected
Short-circuit current:	<1 A
Short-circuit duration:	Indefinite (automatic shutdown after approx. 2s)

## B.7

## S13450 DVB ASI & SPI Input Card (Option 1)

Two DVB ASI inputs and one DVB SPI input are provided on the DVB ASI & SPI Input card. One of these three inputs, or one of the two ASI inputs provided as standard on the base unit, is selected under user control as the input to the Modulator.

### NOTE...

These inputs are available only if the DVB ASI & SPI Input Card option SM66XX/HWO/ASI-SPI is fitted.

## B.7.1

## DVB ASI IN

*Table B.16: DVB ASI IN Specification*

Item	Specification
Safety status:	SELV
Connector type:	BNC 75 Ω
Connector designation:	ASI IN 1 and 2
Compliance:	EN 50083-9, June 1998: Section 4.4
Input bit-rate range:	Defined by symbol rate range, modulation and coding standard, modulation format, FEC code rate, input packet size and other parameters, subject to a maximum limit of 213 Mbit/s.  For the DVB-S and DVB-DSNG standards, see <i>Table B.5: Input Bit-rate Ranges for DVB-S and DVB-DSNG (Standard)</i> and <i>Table B.6: Input Bit-rate Ranges for DVB-S and DVB-DSNG (Extended Symbol Rate Option)</i> .  For the DVB-S2 standard, use the <a href="#">SM66xx Input Bit-rate Ranges</a> spreadsheet utility to calculate the input bit-rate ranges.
Byte stuffing modes:	Byte and Single Packet Burst modes

## B.7.2 DVB SPI IN

*Table B.17: DVB SPI IN Specification*

Item	Specification
Safety status:	SELV
Connector type:	25-way D-type female
Connector designation:	SPI IN
Compliance:	EN 50083-9, June 1998: Section 4.2
Input bit-rate range:	As per DVB ASI IN inputs. See <i>Table B.16: DVB ASI IN Specification</i> .

## B.8 Maintenance / Upgrade

Software on the S11340 Host Controller Card, and software and firmware on the S13129/S13133 Modulator Baseband Card may be updated by FTP via the Ethernet ports.

## B.9 Power Supply

This equipment is fitted with a wide-ranging power supply. It is suitable for supply voltages of 100-120 Vac –10% +6% or 220-240 Vac –10% +6% at 50/60 Hz nominal.

*Table B.18: Power Supply Specification*

Item	Specification
Power distribution system:	Type TN ONLY (EN 60950 para 1.2.12.1): Power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to that point by protective earth conductors. This equipment must NOT be used with single-phase three-wire and PE, TT or IT Type Power distribution systems.
Connection to supply:	Pluggable Equipment Type A (EN 60950 para 1.2.5): Equipment which is intended for connection to the building power supply wiring via a non-industrial plug and socket-outlet or a non-industrial appliance coupler or both. Correct mains polarity must always be observed. Do not use reversible plugs with this equipment.
Class of equipment:	Class I Equipment (EN 60950 para 1.2.4): electric shock protection by basic insulation and protective earth.
Rated voltage:	100-120 / 220-240 Vac (single phase)
Rated frequency:	50/60 Hz
Voltage selection:	Wide-ranging
Rated current:	2 A (100 - 120 V range) 1 A (220 - 240 V range)
Input connector:	CEE 22/IEC 320 3-pin male receptacle
Fuse:	Fuse in live conductor in power input filter at rear of unit. Do not use reversible plugs with this equipment.
Fuse type:	Bussmann S505 series Littelfuse 215 series 5x20 mm time delay (T) 1500 A breaking capacity (HBC) IEC/EN 60127-2 Sheet 5
Fuse current rating:	5 A (T) for 100 – 120 V operation 5 A (T) for 220 – 240 V operation
Consumption:	60 W nominal

## B.10 Physical Details

Table B.19: Physical Details

Item	Specification
Height:	44 mm, 1U chassis
Width:	444 mm excluding fixing brackets
Overall width:	482 mm including fixing brackets
Depth:	512 mm excluding rear connector clearance
Overall depth:	531 mm including rear connector clearance
Approximate mass:	7.2 kg (15.9 lb)
Rack mounting case:	19 inch width, 1U height

## B.11 Environmental Conditions

Table B.20: Environmental Specification

Item	Specification
<b>Operational</b>	
Temperature:	0°C to +50°C (32°F to 122°F) ambient with free air-flow
Relative humidity:	0% to 90% (non-condensing)
Cooling requirements:	Forced air cooling
Handling/movement:	Designed for fixed use when in operation
Ventilation:	Air intakes are located on the left-hand side of the unit and air outlets on the right-hand side, as viewed from the front.
Waterproofing:	Front panel is splash-proof
<b>Storage/Transportation</b>	
Temperature:	-20°C to +70°C (-4°F to 158°F)
Relative humidity:	0% to 90% (non-condensing)

## B.12 Compliance<sup>1</sup>

### B.12.1 Safety

This equipment has been designed and tested to meet the requirements of the following:

EN 60950-1	European	Information technology equipment - Safety.
IEC 60950-1	International	Information technology equipment - Safety.

In addition, the equipment has been designed to meet the following:

UL 60950-1	USA	Information Technology Equipment - Safety.
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<sup>1</sup> The version of the standards shown is that applicable at the time of manufacture.

## B.12.2 EMC<sup>2</sup>

This equipment has been designed and tested to meet the following:

EN 55022 and CISPR22	European International	Emission Standard Limits and methods of measurement of radio frequency interference characteristics of information technology equipment - Class A.
EN 61000-3-2 <sup>3</sup>	European	Electromagnetic Compatibility (EMC), Part 3 Limits; Section 2. Limits for harmonic current emissions (equipment input current $\leq 16$ A per phase).
EN 61000-3-3 <sup>3</sup>	European	Electromagnetic Compatibility (EMC), Part 3. Limits; Section 3. Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated current $\leq 16$ A.
EN 55024	European	Information technology equipment - Immunity characteristics - Limits and methods of measurement.
FCC	USA	Conducted and radiated emission limits for a Class A digital device, pursuant to the Code of Federal Regulations (CFR) Title 47-Telecommunications, Part 15: Radio frequency devices, subpart B - Unintentional Radiators.

## B.12.3 CE Marking



The CE mark is affixed to indicate compliance with the following directives:

89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

73/23/EEC of 19 February 1973 on the harmonisation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.

1999/5/EC of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity. (If fitted with telecom type interface modules).

### NOTE...

The CE mark was first affixed to this product in 2004.

## B.12.4 C-Tick Mark



The C-Tick mark is affixed to denote compliance with the Australian Radiocommunications (Compliance and Labelling – Incidental Emissions) Notice made under s.182 of Radiocommunications Act 1992.

### NOTE...

The C-Tick mark was first affixed to this product in 2004.

<sup>2</sup> The EMC tests were performed with the Technical earth attached, and configured using recommended cables.

<sup>3</sup> Applies only to models of the Product using ac power sources.

## B.13 Cable Types

The signal cable types (or similar) in *Table B.21* are those recommended by TANDBERG Television in order to maintain product EMC compliance.

*Table B.21: Suitable Signal Cable Types*

Signal Type	Connector	Cable
RS-232	9-way D-type Male	Belden 8162 CM 2PR24 shielded E108998 (typical)
Ethernet	RJ-45	Alcatel Data Cable FTP 7 x 0.16
ASI Inputs	BNC	Canford Audio BBC 1/3 PSF (type 2 video cable)
IF (75 Ω)	BNC	Belden 1694A
L-Band (75 Ω)	F	Belden 1694A
L-Band (50 Ω)	SMA	RG-223/U double shielded RF cable

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