



SMD 989

DVB-S2 Satellite Modulator

User Manual



Copyright

© 2011 Sencore, Inc. All rights reserved.
3200 Sencore Drive, Sioux Falls, SD USA
www.sencore.com

This publication contains confidential, proprietary, and trade secret information. No part of this document may be copied, photocopied, reproduced, translated, or reduced to any machine-readable or electronic format without prior written permission from Sencore. Information in this document is subject to change without notice and Sencore Inc. assumes no responsibility or liability for any errors or inaccuracies. Sencore, Sencore Inc, and the Sencore logo are trademarks or registered trademarks in the United States and other countries. All other products or services mentioned in this document are identified by the trademarks, service marks, or product names as designated by the companies who market those products. Inquiries should be made directly to those companies. This document may also have links to third-party web pages that are beyond the control of Sencore. The presence of such links does not imply that Sencore endorses or recommends the content on those pages. Sencore acknowledges the use of third-party open source software and licenses in some Sencore products. This freely available source code can be obtained by contacting Sencore Inc.

About Sencore

Sencore is an engineering leader in the development of high-quality signal transmission solutions for the broadcast, cable, satellite, IPTV, telecommunications, and professional audio/video markets. The company's world-class portfolio includes video delivery products, system monitoring and analysis solutions, and test and measurement equipment, all designed to support system interoperability and backed by best-in-class customer support. Sencore meets the rapidly changing needs of modern media by ensuring the efficient delivery of high-quality video from the source to the home. For more information, visit www.sencore.com.

Revision History

Date	Version	Description	Author
08/09/2010	0.1	Initial Draft	RJH
11/12/2010	1.0	Product Release	RJH
11/24/2010	1.1	Minor Editing	JD
1/5/2011	1.2	Small Additions	RJH
5/2/2011	2.0	Updated for 2.0 Release	RJH
10/28/2011	2.1	Updates for 2.1 Release	RJH
01/17/2012	2.2	Update for 2.2.0 Release	GJL
05/01/2012	2.3	Update for 2.3.0 Release	GJL
01/16/2013	2.4	Update for 2.4.0 Release	GJL
06/07/2013	2.5	Update for 2.5.0 Release	GJL
12/20/2013	2.6	Update for 2.6.0 Release	GAK
7/1/2014	3.0	Update for 3.0.0 Release	GAK
5/20/2015	3.1	Update for 3.1.0 Release	GAK
1/21/2016	3.2	Update for 3.2.0 Release	GAK
1/08/2018	3.2.2	Edit for 3.2.2 Release	GAK

Safety Instructions

- Read these instructions
- Keep these instructions
- Heed all warnings
- Follow all instructions
- Do not use this apparatus near water
- Clean only with dry cloth
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- Do not expose this apparatus to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the apparatus.
- To completely disconnect this apparatus from the AC Mains, disconnect the power supply cord plug from the AC receptacle.
- The mains plug of the power supply cord shall remain readily operable.
- **Damage Requiring Service:** Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - When the power-supply cord or plug is damaged.
 - If liquid has been spilled, or objects have fallen into the product.
 - If the product has been exposed to rain or water.
 - 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 the controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
- If the product has been dropped or damaged in any way.
- The product exhibits a distinct change in performance.
- **Replacement Parts:** When replacement parts are required, be sure the service technician uses replacement parts specified by Sencore, or parts having the same operating characteristics as the original parts. Unauthorized part substitutions made may result in fire, electric shock or other hazards.

SAFETY PRECAUTIONS

There is always a danger present when using electronic equipment.

Unexpected high voltages can be present at unusual locations in defective equipment and signal distribution systems. Become familiar with the equipment that you are working with and observe the following safety precautions.

- Every precaution has been taken in the design of your Satellite Modulator to insure that it is as safe as possible. However, safe operation depends on you the operator.
- Always be sure your equipment is in good working order. Ensure that all points of connection are secure to the chassis, and that protective covers are in place and secured with fasteners.
- Never work alone when working in hazardous conditions. Always have another person close by in case of an accident.
- Always refer to the manual for safe operation. If you have a question about the application or operation call Sencore for assistance.
- **WARNING** – To reduce the risk of fire or electrical shock never allow your equipment to be exposed to water, rain or high moisture environments. If exposed to a liquid, remove power safely (at the breaker) and send your equipment to be serviced by a qualified technician.
- To reduce the risk of shock the SMD 989 must be connected to a mains socket outlet with a protective earthing connection.
- For the SMD 989 the mains plug is the main disconnect and should remain readily accessible and operable at all times.
- The SMD 989 is equipped with an internal system battery. The SMD must be sent if to Sencore service for replacement

CAUTION – Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type.

FCC Class A Information

The SMD 989 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 instructions, 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 or her own expense.

Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

⚠ Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Content

Table of Figures	9
Introduction	11
Abbreviations.....	12
Hardware Overview	13
SMD 989 Chassis and Controller.....	13
Alarm Contact Closure.....	13
10 MHz Reference Input.....	14
10 MHz Reference Output.....	14
Control Ethernet Connection.....	14
SMD 910 Option (Single or Multistream/IF Output).....	15
SMD 912(A) Option (Single Stream/IF Output).....	15
SMD 920 Option (L-Band Output).....	16
SMD 940 Option (10MHz Reference on L-Band).....	17
SMD 942 Option (24VDC BUC Power & 10MHz on L-Band).....	17
SMD 944 Option (48VDC BUC Power & 10MHz on L-Band).....	17
SMD 952 Option (Dual Redundant AC Power Supply).....	18
SMD 954 Option (Dual Redundant DC Power Supply).....	18
Software Licensing Overview	19
SMD 961 DVB-S Modulation.....	19
SMD 962 Option (DVB-S2-S2X, QPSK & 8PSK Modulation).....	19
SMD 964 Option (DVB-S2-S2X, 16, 32, 64APSK Modulation).....	19
SMD 965 Option (30 Msps).....	20
SMD 966 Option (45 Msps).....	20
SMD 970 Option (TS Analysis).....	20
SMD 971 Option (BISS Scrambling).....	20
SMD 968 Option (TurboPSK Advanced Modulation).....	20
Installation	21
General Considerations.....	21
Rack size.....	21
Ventilation.....	21
Power Connection.....	21
AC Power Connection.....	21
AC Dual Redundant Power Connection (optional).....	21
DC Dual Redundant Power Connection (optional).....	21
Rack Installation.....	22
Controlling the SMD 989 Using the Web GUI	23
ASI Inputs.....	24
IP Inputs (SMD 910).....	26
IP Inputs SMD 912(A)(A).....	29
Modulator Settings.....	33
Configure Modulator – Modulation.....	34
Configure Modulator – Inputs.....	35
Configure Modulator – Modulation Parameters.....	36
Configure Modulator – Carrier ID.....	39
Configure Modulator – TS Analysis.....	41
Configure Modulator – S2 Multistream.....	42
Configure Modulator - PRBS.....	43

Configure Modulator - BISS.....	44
Configure Modulator – TurboPSK.....	45
Configure Modulator – DVB-S2X.....	48
Output Settings.....	52
IF Output	53
RF Output.....	53
Admin Tab.....	55
User Profiles	56
Setting Login Password	56
Downloading SNMP MIBs.....	56
Diagnostics	57
Unit Software Updating.....	57
Unit Software Rollback.....	58
Unit License Update.....	59
10 MHz Reference Clock.....	59
SNMP Communities.....	62
SNMP Trap Managers	63
Alarms/Log Tab.....	64
Alarms/Logs Configure	65
SNMP Trap Configurations.....	68
About Tab.....	70
Controlling the SMD 989 Using the Front Panel.....	71
Front Panel Quick Actions Menu.....	71
Front Panel Modulator Settings.....	72
Modulator Input Configuration	72
Modulator Configuration – Modulation Mode/Configuration	73
Modulator Configuration – Modulator Parameters (Inputs)	74
Modulator Configuration – Modulator Parameters.....	76
Modulator Configuration- BISS Configuration.....	78
Modulator Configuration- PRBS Configuration.....	79
Modulator Configuration- Carrier ID Configuration	79
TS Analysis Configuration.....	81
Output Configuration.....	83
Front Panel Admin Settings	85
Network Settings.....	85
Unit Time.....	87
Temperature	87
Front Panel Lock.....	87
10 MHz Reference	87
Front Panel Alarms/Logs.....	88
Alarms	88
Conditions	90

Events	92
SNMP Trap Configurations	93
Front Panel About	93
About Software	93
About Hardware	93
Licenses	94
Appendix	95
Specifications	95
Open Source Software	102
Warranty	103
Support and Contact Information	104

Table of Figures

Figure 1: Basic SMD 989 platform	13
Figure 2: Contact closure alarm output connector	13
Figure 3: Contact closure pin connection	14
Figure 4: SMD 910 single TS input with IF output	15
Figure 5: SMD 912(A) single TS input with monitor and IF output	15
Figure 6: SMD 920 L-Band output - shown with SMD 910	16
Figure 7: SMD 920 L-Band output - shown with SMD 912(A)	16
Figure 8: SMD 940	17
Figure 9: SMD 942 and SMD 944	17
Figure 10: SMD 952 Dual Redundant AC Power Supply	18
Figure 11: SMD 954 Dual Redundant DC Power Supply	18
Figure 12: SMD 963 option multistream TS input with IF output	19
Figure 13: Rack mounting	22
Figure 14: Logon screen	23
Figure 15: Bay 1 home screen	23
Figure 16: Single ASI input	24
Figure 17 Input List - Shows Disabled inputs with Multistream License	24
Figure 18: ASI configuration	25
Figure 19 Inputs on SMD 910 Modulator	26
Figure 20: Expanded IP status	27
Figure 21 Configure IP Receive Menu	27
Figure 22 IP inputs on SMD912	29
Figure 23 IP Input Settings on SMD 912(A) modulator	30
Figure 24 IP Input Details List with SMD 912(A)	32
Figure 25 Single stream status	33
Figure 26 Multistream status	33
Figure 27 Configuration Modulator settings menu example	34
Figure 28 Modulation Mode selection - SMD910 (Left) and SMD912 (Right)	34
Figure 29 Primary & backup input selection, failover selections	35
Figure 30: Single stream DVB-S2 Configuration shown	36
Figure 31: Supported modulations & code rates for DVB-S/DSNG and DVB-S2	37
Figure 32: Carrier ID – Global Unique ID	39
Figure 33: Carrier ID Configuration	39
Figure 34 Configure TS Analysis	41
Figure 35 SMD 963 multi-stream configuration	42
Figure 36: PRBS Pseudo Random Binary Sequence	43
Figure 37 BISS Scrambling configuration	44
Figure 38 TurboPSK (Single) modulation selection	45
Figure 39 Advanced Modulation Turbo PSK modes and code rates	46
Figure 40: Reduced Latency Selections	47
Figure 41: Configure DVB-SX2 Modulation/FEC	48
Figure 42: Modulation/FEC code rates DVB-SX2	49
Figure 43: Outputs section	52
Figure 44: IF settings	53
Figure 45: RF settings	54
Figure 46: RF settings with 10MHz option	54
Figure 47: Admin tab	55
Figure 48: Password/Unit update location	55
Figure 49: Profile Manager	56
Figure 50: Setting password	56
Figure 51: MIBs	57
Figure 52: Updating software	57
Figure 53: Uploading file	57
Figure 54: Upload successful	58

Figure 55: Update confirmation 58
Figure 56: Updating unit 58
Figure 57: Unit restarting 58
Figure 58: Software rollback 59
Figure 59: Update License 59
Figure 60: Reference clock 59
Figure 61: Network configuration 60
Figure 62: IP settings 60
Figure 63: Configure Clone Settings 61
Figure 64: Bay License Configuration 61
Figure 65: Configure Bay Assignment 62
Figure 66: Date/Time configuration 62
Figure 67: SNMP communities 62
Figure 68: SNMP Managers 63
Figure 69: Alarms reporting view 64
Figure 70: Logs reporting view 64
Figure 71: Logs Severity/Transition Indicators 64
Figure 72: Alarms View - Configure 65
Figure 73: Alarm Configuration 65
Figure 74: Alarm Error Configuration 65
Figure 75: Alarm descriptions 66
Figure 76: Event Configuration 67
Figure 77: Event descriptions 67
Figure 78: SNMP trap view 68
Figure 79: SNMP manager configuration 68
Figure 80: SNMP trap descriptions 69
Figure 81: About page 70
Figure 82: Alarm descriptions 89
Figure 83: Relay event descriptions 91
Figure 84: Event descriptions 92

Introduction

The SMD-989 is a versatile DVB-S/S2/S2X/TurboPSK modulator platform capable of one or two channels of modulation per rack unit. The SMD-989 comes standard with IP and ASI inputs to offer flexibility for future changes in network architecture or sourcing content from two different interfaces. The SMD also supports advanced DVB-S2 features such as 16APSK and 32APSK modulation as well as the carriage of multiple streams on a single RF carrier. It further supports the advanced modulator coding scheme turbo PSK and S2X.

This manual describes how to install, configure, and operate the SMD 989 DVB-S/S2/S2X/TurboPSK Modulator. It is written for professional operators of video distribution systems and assumes a prerequisite level of technical knowledge.

The SMD 989 is controllable through the front panel interface, a supported web browser and/or via SNMP which also provide alarms and traps that may be configured to alert users when errors occur through automation systems.

Through the SMD 989 web interface, front panel, or SNMP the user can perform tasks such as configuration, monitoring, and troubleshooting.

Supported WEB interface browsers include:

- Internet Explorer 7 & above
- Mozilla Firefox 3.5 & above
- Google Chrome

Please check to be sure your web browser is supported as above.

Abbreviations

16 APSK	–	16 Amplitude and Phase Shift Keying
32 APSK	–	32 Amplitude and Phase Shift Keying
64 APSK	--	64 Amplitude and Phase Shift Keying
ASI	–	Asynchronous Serial Interface
BCH	-	Bose and Ray Chaudhuri code
BISS	–	Basic Interoperable Scrambling System
BNC	–	British Naval Connector
BPS	–	Bits per second
CAM	–	Conditional Access Module
CAT	–	Conditional Access Table
CI	–	Common Interface
CID	–	Carrier Identification
DHCP	–	Dynamic Host Configuration Protocol
DVB	–	Digital Video Broadcasting
FCC	–	Federal Communications Commission
HD	–	High Definition
IF	–	Intermediate Frequency
I/O	–	Input/Output
IP	–	Internet Protocol
ISI	–	Intersymbol Interference
LED	–	Light Emitting Diode
MAC	–	Media Access Control
Mbps	–	1,000,000 bits per second
MER	–	Modulation Error Ratio
MPEG	–	Refers to standards developed by the ISO/IEC JTC1/SC29
WG11 MPEG-2 (Video),	–	Refers to ISO/IEC standards 13818-1 (Systems), 13818-2 13818-3 (Audio), 13818-4 (Conformance)
MPTS	–	Multiple Program Transport Stream
NTP	–	Network Time Protocol
PAT	–	Program Association Table
PCR	–	Program Clock Reference
PID	–	Packet Identifier
PMT	–	Program Map Table
QAM	–	Quadrature Amplitude Modulation
QPSK	–	Quadrature Phase Shift Keying
RF	–	Radio Frequency
RU	–	Rack Unit
RW	–	Read/Write
SD	–	Standard Definition
SI	–	Service Information
SNMP	–	Simple Network Management Protocol
SPTS	–	Single Program Transport Stream
TS	–	Transport Stream
Turbo PSK	-	Advanced Modulation Coding Phase Shift Keying

Hardware Overview

The SMD 989 consists of a chassis with two bays which can house individually configured modulators. There are two different modulator options including the SMD 910 or SMD912(A). These options are described in the next section of this manual. Each modulator option can be configured to support either IF or L-band outputs. The modulators support all DVB-S/S2 modulation types from QPSK to 64 APSK. The SMD 910 modulator can be upgraded to support multistream outputs with streams input to one of the four ASI ports or IP interface. The SMD912 modulator can be upgraded to support Turbo PSK advanced modulation. This section of the manual describes the chassis and hardware options available.

SMD 989 Chassis and Controller

The Sencore SMD 989 satellite modulator platform can be configured in multiple hardware configurations. The two bays with the controller located in the middle of the chassis as shown in Figure 1.

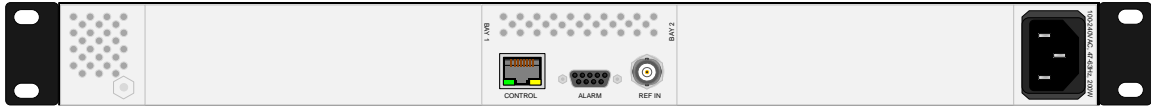


Figure 1: Basic SMD 989 platform

The controller module hosts the graphical user interface along with the relays and 10 MHz input reference. Looking at the rear of the chassis, the left slot is bay 1 and the right slot is bay 2. Each bay is independently controlled and operated. Therefore each bay needs to be configured separately in order to ensure the expected operation.

The SMD 989 platform offers eight modulation options. The modulation module is the SMD 910 which includes an MPEGoIP input via RJ45, four ASI inputs via BNC connectors, and an IF output via a BNC connector. The SMD 910 option can be configured with an optional L-band output module, the SMD 920 which includes and L-band output via an SMA connector. The other licenses available are software licenses enabling features for bitrates, DVB-S2, and multistream.

Alarm Contact Closure

The **Alarm** contact closure output connector allows a user to configure two separate contacts that can be used to drive external alarm indicators (sirens, flashlight etc.) or can be used to connect to a redundancy switching system. The pinout in Figure 3 shows the relays in a de-energized state. When the SMD 989 is on the relays energize. This allows the possibility to monitor the state of the relays if the unit losses power the relays de-energize and a redundant unit can be activated.

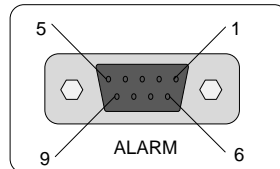


Figure 2: Contact closure alarm output connector

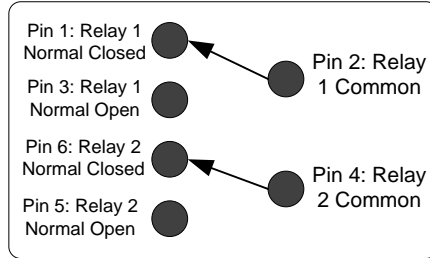


Figure 3: Contact closure pin connection

10 MHz Reference Input

The clock input (CLK IN) is used when a reference with enhanced stability is needed or when several modulators need to be synchronized to the same clock source. The level should be 0 dBm nominally or within a range of -3 to +7 dbm.. The unit automatically senses and switches between the internal or external reference based on presence detection. By default, the internal clock reference is used. When an external clock input is sensed, the unit automatically locks to the incoming reference.

10 MHz Reference Output

The clock output (CLK Out), not shown in figure 1, is used to provide a sample of the internal reference clock when it is desired to synchronize other equipment to the modulator's reference clock or output. The output level is approximately 0 dbm. This output is subsequently and automatically locked to a 10 MHz reference input when an input is applied to the 10 MHz Reference Input.

Control Ethernet Connection

A standard RJ-45 connector provides connection to the SNMP and Web Interface of the SMD 989 platform. The connection is a 10/100 BaseT connection. A user can view the IP address of the unit from the front panel or once known can access the web interface through any supported web browser by typing the IP address of the unit. The control port is capable of both DHCP and static IP addressing. By default the IP address of the SMD 989 is statically set to 10.0.0.60.

Supported Web Browsers include:

- Internet Explorer 7 & above
- Firefox 3.5 & above
- Google Chrome

SMD 910 Option (Single or Multistream/IF Output)

The SMD 910 Module option offers single stream or S2 multistream modulation. A single stream input is selected with one of the ASI and IP inputs to the modulator. There is one IP input port and four ASI ports available by default and come standard. The user is allowed to select the desired input in the front panel, web interface, and/or SNMP. Multistream permits multiple input selections up to 6 streams via the ASI or IP inputs. The IF Out port provides the modulated IF output which is 70 MHz by default but user selectable between 70 and 140 MHz.

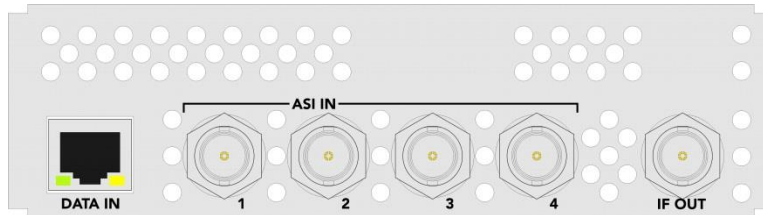


Figure 4: SMD 910 single TS input with IF output

The SMD 910 option has three different types of I/O as shown in Figure 4.

- Data input (RJ45 10/100/1000 auto detect speed & status)
- ASI inputs (75 ohm BNC connectors x4)
- IF output (75 ohm BNC connector)

SMD 912(A) Option (Single Stream/IF Output)

The SMD 912 or SMD 912A Module option offers a single TS stream modulation. A single stream input to the modulator is selected through either the ASI or IP inputs. There are two IP input ports and two ASI input ports available by default and come standard. The user is allowed to select the desired input in the front panel, web interface, and/or SNMP. The IF Out port provides the modulated IF output which is user selectable between 70 and 140 MHz. The MON OUT (monitor output) provides a fixed L-band test output at a frequency of 1100 MHz. The monitor output simultaneously provides a second IF output which mirrors the selected IF output frequency with a level that is – 20 dB in respect to the IF Out port level. The SMD 912 provides an IF output level range from -30 to -5 dBm while the SMD 912A output range is -20 to +5 dBm.

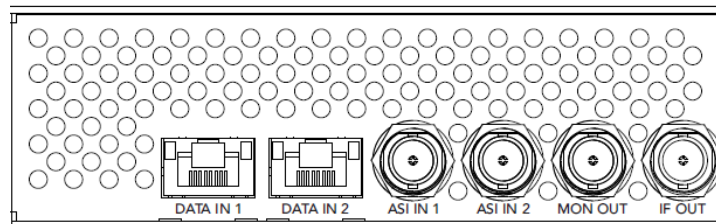


Figure 5: SMD 912(A) single TS input with monitor and IF output

The SDM 912(A) option has four different types of I/O as shown in Figure 5.

- Data inputs (RJ45 10/100/1000 auto detect speed & status x2)
- ASI inputs (75 ohm BNC connector x2)
- Monitor output (75 ohm BNC connector)
- IF output (75 ohm BNC connector)

SMD 920 Option (L-Band Output)

The SMD 920 module provides an L-Band output to either the SMD910 or SMD 912(A) modulator boards. The SMD 920 must accompany either an SMD 910 or SMD 912(A) modulator board in the SMD 989 platform. Inputs to the SMD 910 or SMD 912(A) are described on the previous page of this manual. The SMD 920 module receives an IF input from the SMD 910 or SMD 912(A) and upconverts it to an L-Band frequency output. A short jumper cable from the IF OUT to the IF IN jacks is needed. The IF Input to the SMD 920 L-Band upconverter board is auto detected and must be either a 70MHz or 140 MHz carrier. Therefore, the SMD 910 or SMD 912(A) must be set to output either 70 or 140 MHz for use with the SMD 920. The L-band Output frequency is user settable from 950 to 2150 MHz.

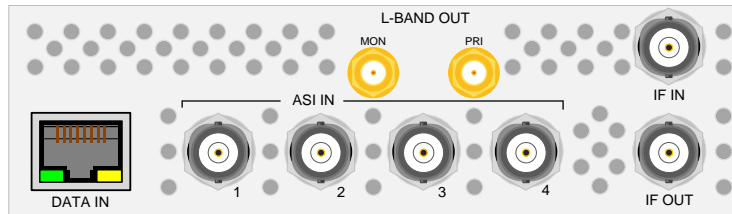


Figure 6: SMD 920 L-Band output - shown with SMD 910

The SMD 920 in combination with the SMD 910 modulator option has six different types of I/O as shown in Figure 6.

- Data input (RJ45 10/100/1000 auto detect speed & status)
- ASI inputs (75 ohm BNC connector x4)
- IF output (75 ohm BNC connector)
- Upconverter IF input (75 ohm BNC Connector)
- L-band primary output (50 ohm SMA connector)
- L-band monitor output (50 ohm SMA connector -20 dBc from primary)

The SMD 920 in combination with the SMD 912(A) modulator option as 7 I/Os (Figure 7).

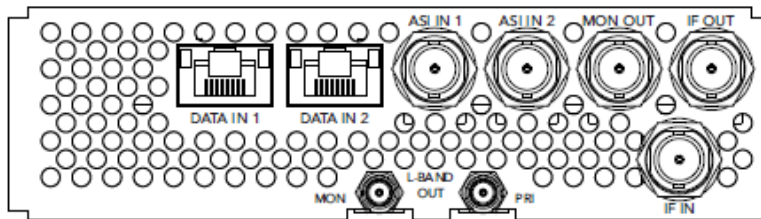


Figure 7: SMD 920 L-Band output - shown with SMD 912(A)

- Data input (RJ45 10/100/1000 auto detect speed & status)
- ASI inputs (75 ohm BNC connector x2)
- Monitor output 1100MHz, -50 dBm (75 ohm BNC connector)
- IF output (75 ohm BNC connector)
- Upconverter IF input (75 ohm BNC Connector)

L-band primary output (50 ohm SMA connector)

L-band monitor output (50 ohm SMA connector -20 dBc from primary)

SMD 940 Option (10MHz Reference on L-Band)

The SMD 940 Option, when used with options SMD 920, adds the capability to combine the L-Band output with an internal 10MHz oven-controlled crystal oscillator or with an external 10MHz reference. SMD 940 eliminates the need for an external diplexer. Option 940 is also adds the capability to combine an external DC to the L-Band output when not used with options SMD 942 and SMD 944 described below. The L-BAND Pri output on the SMD 920 is connected to the LOOP IN. The L-BAND RF, 10MHz and DC are combined at the PRI OUT w/ 10MHz + DC connector.

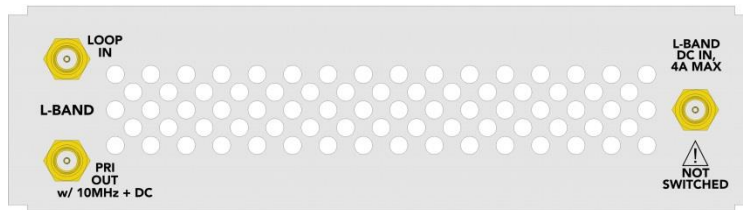


Figure 8: SMD 940

SMD 942 Option (24VDC BUC Power & 10MHz on L-Band)

The SMD 942 Option includes option SMD 940 with the additional capability to provide 24VDC power along with 10MHz and L-Band modulated signal on the same connector. SMD 942 eliminates the need for an external DC supply and external diplexer. The L-BAND Pri output is connected to the LOOP IN. The L-Band RF, 10MHz and DC are combined at the PRI OUT w/ 10MHz + DC connector.

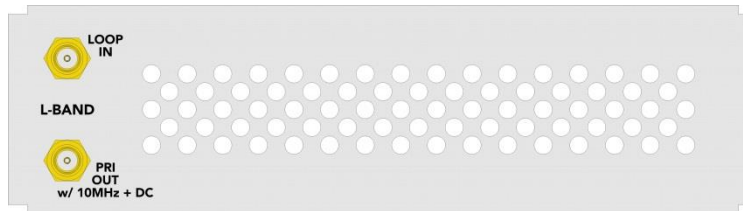


Figure 9: SMD 942 and SMD 944

SMD 944 Option (48VDC BUC Power & 10MHz on L-Band)

The SMD 944 Option includes option SMD 940 with the additional capability to provide 48VDC power along with 10MHz and L-Band modulated signal on the same connector. SMD 944 eliminates the need for an external DC supply and external diplexer. The L-BAND Pri output is connected to the LOOP IN. The L-Band RF, 10MHz and DC are combined at the PRI OUT w/ 10MHz + DC connector.

SMD 952 Option (Dual Redundant AC Power Supply)

The SMD 952 Option Dual Redundant AC Power Supply provides a redundant hot swappable power supply for the unit. If either power supply fails the backup supply will be automatically activated. A power supply failure event will result in an audible alarm notification along with Front Panel and GUI Error notification. The audible alarm can be reset on by pressing the red button on power supply module. The faulty supply can then be removed and replaced without the need to power down the unit or remove the unit from the rack.

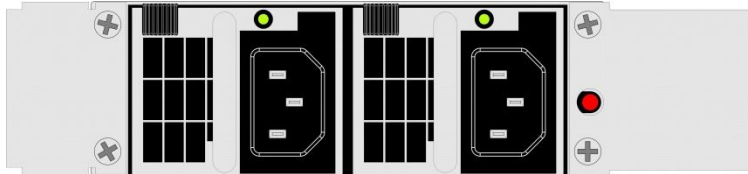


Figure 10: SMD 952 Dual Redundant AC Power Supply

SMD 954 Option (Dual Redundant DC Power Supply)

The SMD 954 Option Dual Redundant DC Power Supply provides a redundant hot swappable power supply for the unit. If either power supply fails the backup supply will be automatically activated. A power supply failure event will result in an audible alarm notification along with Front Panel and GUI Error notification. The audible alarm can be reset on by pressing the red button on power supply module. The faulty supply can then be removed and replaced without the need to power down the unit or remove the unit from the rack.

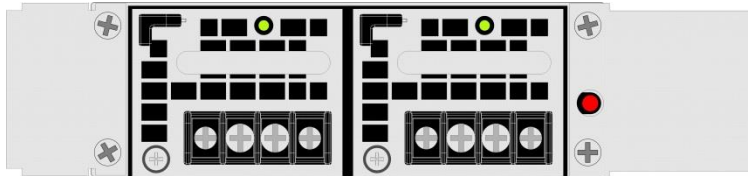


Figure 11: SMD 954 Dual Redundant DC Power Supply

Software Licensing Overview

SMD 961 DVB-S Modulation

The SMD 961 option is a software license allowing the modulator board to modulate DVB-S/DSNG using QPSK, 8PSK, or 16QAM. This option is enabled on all SMD 910 or SMD 912(A)(A) modules by default.

SMD 962 Option (DVB-S2-S2X, QPSK & 8PSK Modulation)

The SMD 962 option is a software license allowing the modulator SMD 910 or SMD 912(A) board to modulate DVB-S and DVB-S2. This option includes the SMD 961 license which allows for DVB-S/DSNG. The SMD 962 option includes QPSK and 8PSK for DVB-S2 and DVB-S2X to 15 Msps. This option can be licensed on the unit at any time without sending it back to the factory.

SMD 963 Option (DVB-S2 Multistream)

The SMD 963 option is a software license which enables multistream for CCM and VCM support for the SMD 910 when used with DVB-S2. This option is not available when using the SMD 912(A)(A) modulator board. The 963 option supports up to a total of 6 TS streams sourced from any of the ASI or IP inputs. The user is allowed to select the desired amount of inputs and type from the front panel, web interface, and/or SNMP. This option can be licensed on an SMD989 unit with an SMD910 modulator at any time without sending it back to the factory. The SMD 970 TS Analysis option is not applicable with DVB-S2 Multistream signals.

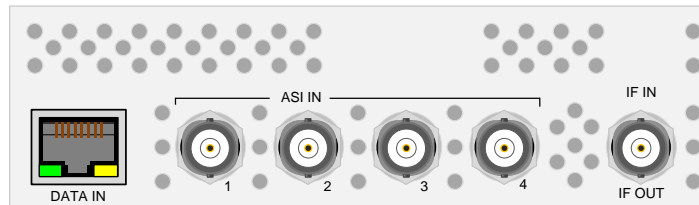


Figure 12: SMD 963 option multistream TS input with IF output

The SMD 963 option has three different types of I/O as shown with SMD 910 board in Figure 12.

- Data input (RJ45 10/100/1000 auto detect speed & status)
- ASI inputs (75 ohm BNC connector)
- IF output (75 ohm BNC connector)

SMD 964 Option (DVB-S2-S2X, 16, 32, 64APSK Modulation)

The SMD 964 option is a software license allowing the modulator SMD 910 or SMD 912(A) to modulate DVB-S, DVB-S2 and DVB-S2X to 15 Msps. This option includes the SMD 961 and SMD 962 licensed capabilities which allows for DVB-S, DVB-S2 and DVB-S2X at QPSK and 8PSK. The SMD 964 option further includes 16 APSK, 32 APSK, and,64APSK modulations for DVB-S2 and DVB-S2X. This option can be licensed on the unit at any time without sending it back to the factory.

SMD 965 Option (30 Msps)

The SMD 965 option is a software license allowing the modulator SMD 910 board or SMD 912(A)(A) board to modulate at a symbol rate up to 30 Msps. The default symbol rate is 0.5 to 15 Msps and the SMD 965 option allows the modulator to extend the rate up to 30 Msps. This option can be licensed on the unit at any time without sending it back to the factory.

SMD 966 Option (45 Msps)

The SMD 966 option is a software license allowing the modulator SMD 910 or SMD 912(A) board to modulate at a symbol rate up to 45 Msps. The default symbol rate is 0.5 to 15 Msps and the SMD 966 option allows the modulator to extend the rate up to 45 Msps. Since the SMD 966 allows up to 45 Msps it includes the SMD 965 license. This option can be licensed on the unit at any time without sending it back to the factory.

SMD 970 Option (TS Analysis)

The SMD 970 option is a software license which adds TS analysis to the primary and secondary (backup) inputs of the SMD 910 or SMD 912(A)(A) modulator. This option extends the input error detection, of the primary and backup inputs following the TS 101 290 [4] guidelines. The TS errors can be configured as a switch to backup trigger and as alarm indicators. This option can be licensed on the unit at any time without sending it back to the factory.

SMD 971 Option (BISS Scrambling)

The SMD 971 option is a software license which enables support of Biss Scrambling in the SMD 910 or SMD 912(A) Modulator Module. BISS is a “Basic Interoperable Scrambling System” for use on DVB signals which encrypts the entire transport stream using fixed session keys. SMD-971 Supports Biss Mode 1 and BISS Mode E. BISS-E introduce encrypted session words and allow centrally-managed conditional access. This option can be licensed on the unit at any time without sending it back to the factory.

SMD 968 Option (TurboPSK Advanced Modulation)

The SMD 968 option is a software license which enables support of an advanced modulation and coding technology in the SMD 912(A) modulator option. This option is not available on the SMD 910 modulator. This option enables the SMD 912(A) modulator to generate and an advanced modulation and coding transmission developed by Broadcom. The transmission is commonly referred to as 8PSK turbo code or simply “Turbo PSK.” This option when combined with SMD 965 increases the turbo output symbol rates from a limit of 15 Msps to 30 Msps. This option can be licensed on a unit with SMD 912(A) modulator or dual modulators at any time without sending it back to the factory.

Installation

General Considerations

This section describes the installation procedure for the SMD 989.

Rack size

The chassis is designed to be installed in a standard 19-inch rack. The SMD 989 occupies 1RU of rack space. All of the cable connections are located on the rear of the unit.

Ventilation

The SMD 989 is cooled via forced induction through the front of the unit and exhausted through the vents in the rear. The SMD 989 is equipped with a temperature monitors to ensure operating temperature is maintained.

Power Connection

Using the proper power connections is vital to the safe operation of the SMD 989. Only use the supplied 3-prong power connector or one with equal specifications.

AC Power Connection

The SMD 989 is capable of either operating on 120V or 240V systems. The power supply will automatically detect the system it is connected to. To hook up the power use the following steps:

1. Locate the AC power cord included with the SMD 989.
2. Plug the female end of the power cord (end with no prongs) into the back of the unit.
3. Locate a protected outlet (usually inside of the rack) to plug the male end of the power cable into.

AC Dual Redundant Power Connection (optional)

The Dual Redundant option allows the SMD 989 to be powered by two separate AC supplies either operating on 120V or 240V systems. The power supply will automatically detect the system it is connected to. To hook up the power use the following steps:

1. Locate the AC power cords included with the SMD 989.
2. Plug the female end of the power cords (end with no prongs) into the back of the unit.
3. Locate a protected outlet (usually inside of the rack) to plug the male end of the power cord into.

DC Dual Redundant Power Connection (optional)

The Dual Redundant option allows the SMD 989 to be powered by two separate DC supplies operating on a -48VDC system. To hook up the power use the following steps:

1. Connect the negative 48VDC to the terminal labeled -48V.
2. Connect ground to the terminal labeled 0V

Rack Installation

To install the SMD 989 into a rack use the following steps:

1. Determine the desired position in the rack for the SMD making sure that the air intake on the front of the unit and the exhausts on the rear of the unit will not be obstructed.
2. Insert the rack mount clips into place over the mounting holes in the rack.
3. Slide the SMD into position in the rack.
4. Secure the SMD to the rack by installing the four screws through the front mounting holes and tightening.

WARNING: To prevent injury, the apparatus must be securely attached to the floor/wall in accordance with the installation instructions.

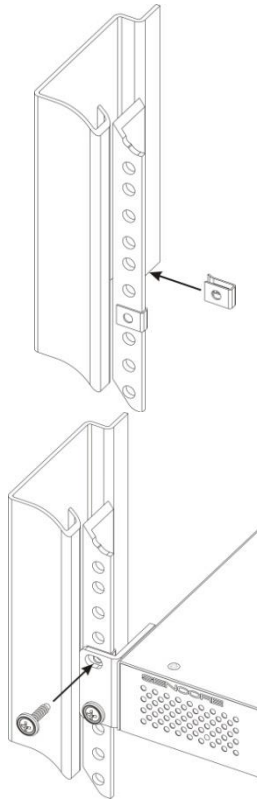


Figure 13: Rack mounting

Controlling the SMD 989 Using the Web GUI

From any supported web browser (IE 7 or above, Firefox 3.5, Google Chrome) that is connected to the same network as the SMD 989, type the IP address of the unit to access the web interface. By default the IP address of the unit is set to static at 10.0.0.60. The SMD 989 is also capable of DHCP addressing and accessing via host name. Refer to Controlling the SMD 989 Using the Front Panel for initial IP settings.

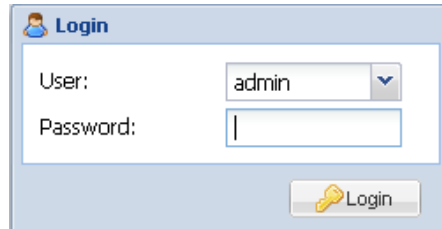


Figure 14: Logon screen

Upon correctly connecting to the unit, a dialog box similar to Figure 14 appears asking the user to login. By default the password is left blank. Once logged on, the password can be set in the “Admin” tab.

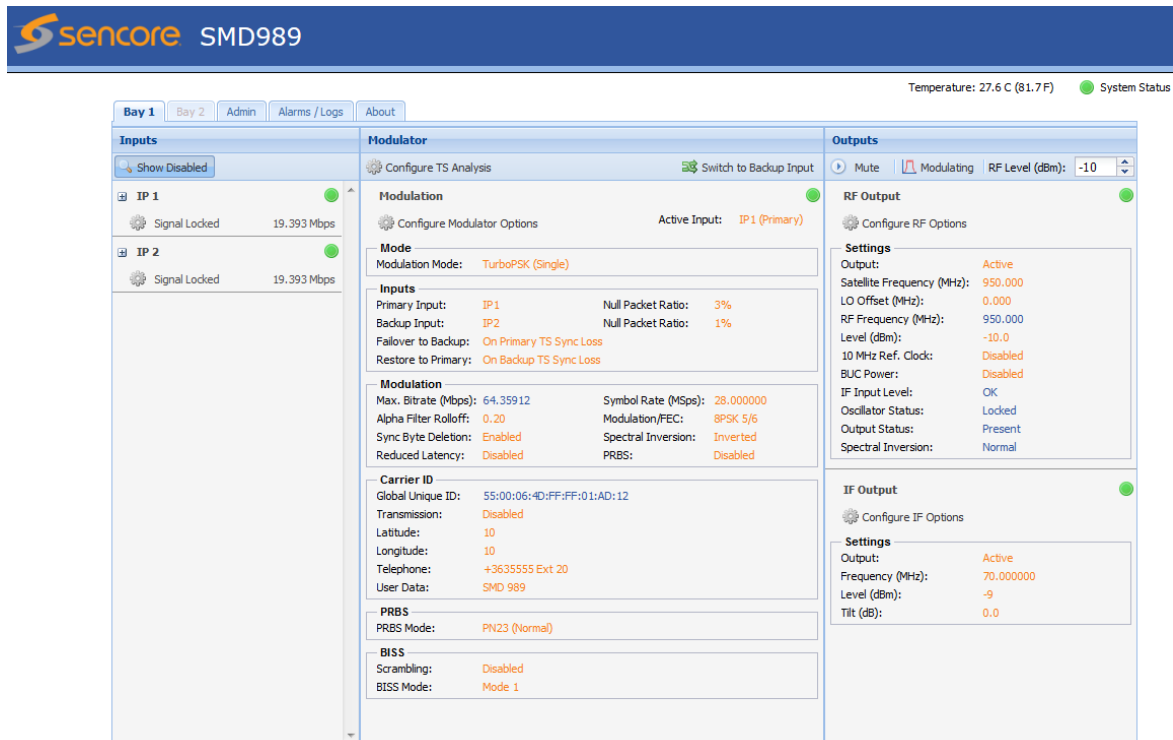



Figure 15: Bay 1 home screen

When logged in a page similar to that shown in Figure 15 appears. Depending on the options of modules/features installed, page variations will be seen and are normal.

The main screen for each bay is displayed in a left-to-right fashion. Inputs are shown on the left, processing in the middle section and outputs are shown on the right. The user is capable of configuring all parameters of the modulator from this page by clicking on the (cog)  icon which represents a settings configuration.

ASI Inputs

The ASI inputs to the modulator are shown on the left column of the home screen for each bay. The available inputs are listed in sections or rows. Each input has either an enabled or disabled status. To see all the possible inputs, click on the Show Disabled tab. To see only the enabled inputs, click on the Hide Disabled tab. Depending on the unit licensing the inputs that are enabled by default and listed may be different.



The inputs available on the SMD 910 modulator include (4) ASI inputs and (6) IP inputs. These will be shown when the Show Disabled icon is selected. The inputs available on the SMD 912(A) modulator includes (2) ASI inputs and 6 IP inputs in both IP port 1 and IP port 2.

Clicking on the “+” sign by each ASI port allows the advanced details to be shown for the port. ASI details include only a packet size indication.

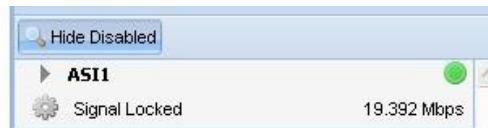


Figure 16: Single ASI input

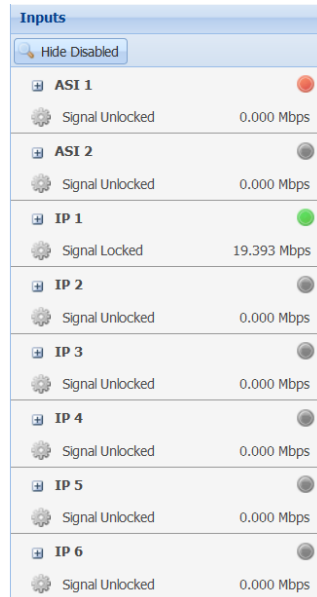



Figure 17 Input List - Shows Disabled inputs with Multistream License

By default ASI input port 1 is enabled, but by clicking on the settings tab for each ASI input the port may be enabled. To configure an ASI port, click on the  icon. In the Configuration ASI Port menu, as shown in Figure 18, the input can be enabled or disabled. Each input port allows the user to set a local Alias for each port. This is a friendly name that can be used to name the input for easy reference in the future.

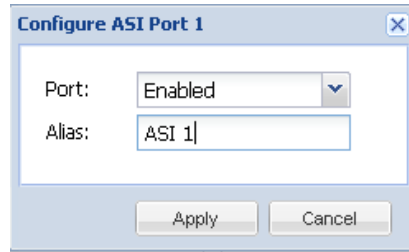


Figure 18: ASI configuration

Each input port listing or section contains an active input bitrate indication on the right side of the section. When the input is enabled and an active transport stream is present on that input, the bitrate counter indicates the incoming bitrate in Mbps.

Each input port listing contains a status indicator light near the right side of the listing. If the port is enabled and no sync is detected, an error will be indicated by a red light. Errors can be user enabled/disabled if desired. Please see the Alarm/Logs Section for details. The chart below describes the status indicator lights.

Green LED	Status is good. No errors are present and function is operating normally.
Red LED	Status indicates input is active but with active error(s). View errors in the Alarms/Logs menu
Grey LED	Input is inactive and/or alarms are inactive

IP Inputs (SMD 910)

The IP inputs to the SMD 910 modulator are shown on the left column of the home screen for each bay. The available IP inputs are listed in rows under the ASI inputs. Each IP input has either an enabled or disabled status. To see all the possible IP inputs, click on the Show Disabled tab. To see only the enabled inputs, click on the Hide Disabled tab. Depending on the unit licensing the IP inputs that are enabled by default and listed may be different.



The IP inputs available on the SMD 910 modulator include (6) IP inputs via IP port 1. These inputs are shown when the Show Disabled icon is selected as shown in Figure 19.

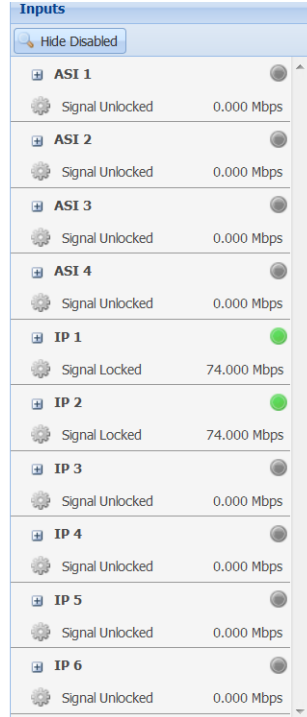


Figure 19 Inputs on SMD 910 Modulator

Each IP input port listing or section contains an active input bitrate indication on the right side of the section. When the input is enabled and an active transport stream is present on that input, the bitrate counter indicates the incoming bitrate in Mbps.

Each IP input port listing contains a status indicator light near the right side of the listing. If the port is enabled and no sync is detected, an error will be indicated by a red light. Errors can be user enabled/disabled if desired. Please see the Alarm/Logs Section for details. The chart below describes the status indicator lights.

Green LED

Status is good. No errors are present and function is operating normally.

Red LED

Status indicates input is active but with active error(s). View errors in the Alarms/Logs menu

Grey LED

Input is inactive and/or alarms are inactive

Each input has a listing of advanced details providing information regarding the settings and status of the input. Clicking on the “+” sign by each IP port allows the advanced details to be shown as presented in Figure 20. Click on the down arrow to close the advanced details list menu. The advanced details list includes routing, port, input buffer, protocol, packet, and IGMP filter information which reflects the current settings of the IP input port.

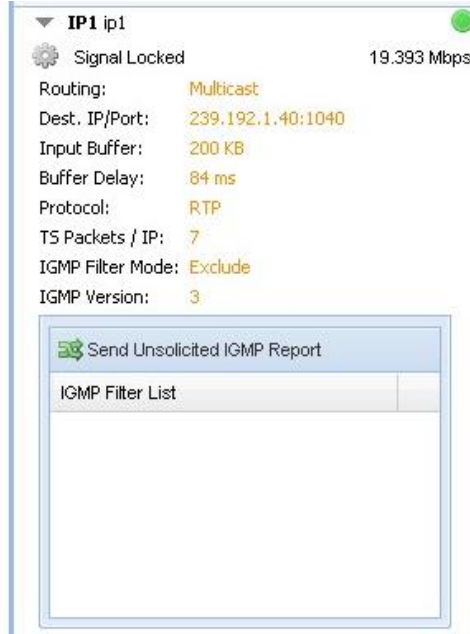


Figure 20: Expanded IP status

Each input can be configured within a configuration menu. Figure 21 represents the IP settings (SMD 910) for an individual IP source, by default all IP inputs Input ports are enabled by clicking on the settings tab for each IP input and enabling the port, moving the port into the Enabled List. This allows for customizing the view for quick reference. The input can be returned to the disabled section or list by disabling the port in the settings tab.

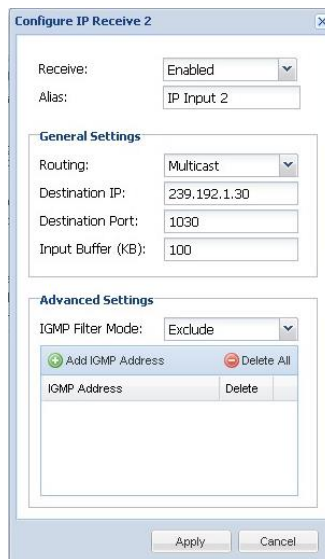


Figure 21 Configure IP Receive Menu

The following chart provides a list of the selections in the IP input configuration menu and a description of setting.

Receive	Enabled Disabled	This setting allows the user to enable or disable the IP input stream for primary or backup use or input to the modulator
Alias		Permits entry of friendly name or description
Routing Mode	Multicast Unicast	<i>Multicast</i> setting allows the unit to receive multicast streams. Multicast streams originate from the IP range 224.0.0.0 – 239.255.255.255. <i>Unicast</i> allows the unit to receive unicast streams. Unicast streams originate directly from a source device.
Destination IP	224.0.0.0 – 239.255.255.255	This setting is only available when receiving a multicast stream. This address is the IP address the source device is sending to.
Destination Port	0 – 65535	This is the UDP port the source device is sending to. This is the only setting required to receive a unicast stream.
Input Buffer Size (KB)	10 – 600 KB	This setting determines how much data is received before the SMD 989 starts decoding. Increasing this value will allow the SMD 989 to receive streams on networks with high network jitter. Increasing this value also increases the latency of the SMD 989.
IGMP Filter Mode	Exclude Include	Used on networks supporting IGMPv3. If this setting is set to <i>Exclude</i> any streams originating from the user defined IP addresses will be rejected. If this setting is set to <i>Include</i> any streams originating from the user defined IP addresses will be received.

Note: IGMPv2 is used to join/leave multicast streams by default if no IGMP Filter addresses are entered. If IGMP Filter Mode addresses are specified then IGMPv3 is used.

IP Inputs SMD 912(A)

The SMD 912(A) or SMD 912(A) provides two physical IP input ports compared to one port on the SMD 910. It further provides RTP/FEC receive capabilities along with configuration of the input buffer by delay time. The IP inputs are also monitored for FEC status information and errors. This section provides details of IP input settings and monitoring details when using the SMD 912(A) modulator.

The IP inputs to the SMD 912(A) modulator are shown on the left column of the home screen for each bay. The available IP inputs are listed in rows under the ASI inputs. Each IP input has either an enabled or disabled status. To see all the possible IP inputs, click on the Show Disabled tab. To see only the enabled inputs, click on the Hide Disabled tab. Depending on the unit licensing the IP inputs that are enabled by default and listed may be different.



The IP inputs available on the SMD 912(A) modulator include (6) IP inputs. These six inputs may be sourced from either IP port 1 or IP port 2. These six possible inputs are shown when the Show Disabled icon is selected as shown in figure 22.

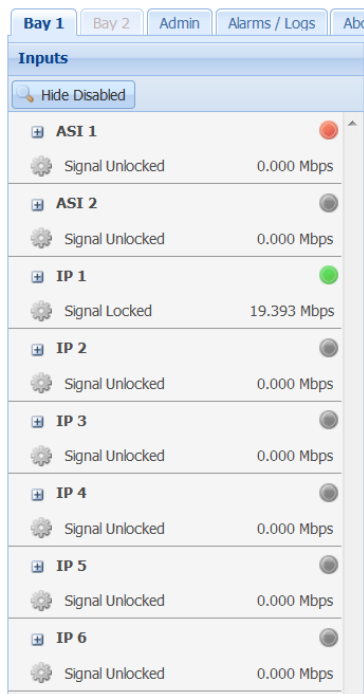


Figure 22 IP inputs on SMD912

The modulator setup provides a user selection of a primary and backup input routed to the modulator. This is explained in the next section of this manual. The primary and backup inputs are selected from the list of inputs on the left side of the home menu. For normal operation the primary and backup inputs must be selected from listed inputs that are enabled and actively receiving an input transport stream. The DVB-S/DSNG single-stream, DVB-S2 CCM single-stream, DVB S2X single-stream or TurboPSK modulation modes default the primary input to ASI 1.

Each IP input port listing or section contains an active input bitrate indication on the right side of the section. When the input is enabled and an active transport stream is present on that input, the bitrate counter indicates the incoming bitrate in Mbps.

Each IP input port listing contains a status indicator light near the right side of the listing. If the port is enabled and no sync is detected, an error will be indicated by a red light. Errors can be user enabled/disabled if desired. Please see the Alarm/Logs Section for details. The chart below describes the status indicator lights.

Green LED	Status is good. No errors are present and function is operating normally.
Red LED	Status indicates input is active but with active error(s). View errors in the Alarms/Logs menu
Grey LED	Input is inactive and/or alarms are inactive

Each input can be configured within its own configuration menu. . Figure 23 represents the IP settings (SMD 912(A)) for an individual IP source. This section provides a description of the settings in the input’s Configure IP Receive menu.

The Receive Enable/Disable field is used to make the input active or inactive. When enabled or active the SMD 989 begins to monitor the input status with the alarms and logging. By default most input ports are disabled, but by clicking on the settings tab for an IP input and selecting enable the port is moved into the Enabled list. This allows for customizing the view of the inputs in the home menu. The input can be returned to the disabled status by disabling the input.

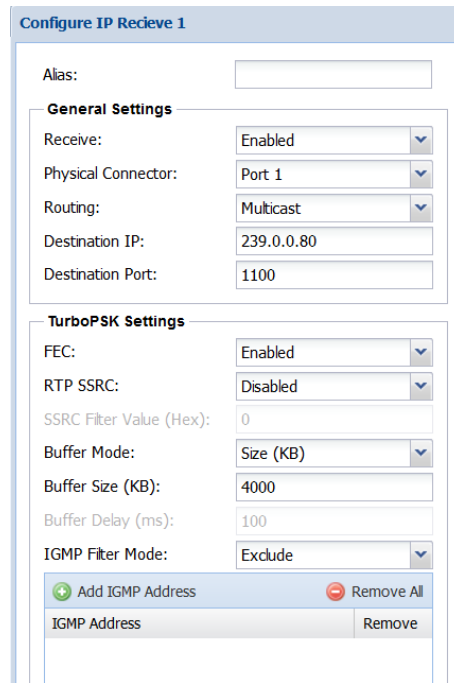


Figure 23 IP Input Settings on SMD 912(A) modulator

The Configure IP Receive menu permits user definition of the receive characteristics of that input. The following chart provides a list of the selections along with a description of the settings for each field.

Each input allows the user to set a local alias or friendly name for easy reference. The general IP settings section allows a user to enter the unicast/multicast address along with destination port.

Alias		Permits entry of friendly name or description
Receive	Enabled Disabled	This setting allows the user to enable or disable these input stream settings.
Physical Connector	Port 1 Port 2	The physical connector on the MPEG/IP card that will be used to receive the input.
Routing Mode	Multicast Unicast	<i>Multicast</i> setting allows the unit to receive multicast streams. Multicast streams originate from the IP range 224.0.0.0 – 239.255.255.255. <i>Unicast</i> allows the unit to receive unicast streams. Unicast streams originate directly from a source device.
Destination IP	224.0.0.0 – 239.255.255.255	This setting is only available when receiving a multicast stream. This address is the IP address the source device is sending to.
Destination Port	0 – 65535	This is the UDP port the source device is sending to. This is the only setting required to receive a unicast stream.
FEC	Enabled Disabled	Enabling FEC (Forward Error Correction) tells the SMD 989 to look at Destination Port +2 and Destination Port +4 for a SMPTE 2022 FEC Matrix.
RTP SSRC	Enabled Disabled	Enabling RTP SSRC allows the SMD989 to filter the input by the user defined value. Only streams containing the user defined value will be received by the SMD989.
SSRC Filter Value	0 – 4294967295	The Filter Value the SMD 989 checks for before receiving a stream with RTP SSRC.
Buffer Mode	Size (KB) Delay (ms)	Allows option to set buffer mode to Size in KB or Delay ms
Buffer Size (KB)	10 – 4000 KB	This setting determines how much data is received before the SMD 989 starts decoding. Increasing this value will allow the SDM 989 is receive streams on networks with high network jitter. Increasing this value also increases the latency of the SMD 989.
Buffer Delay (ms)	1 – 4000 ms	The buffer delay setting allows the buffer size to be set by delay time. The Buffer delay time will be determined by the input data rate.
IGMP Filter Mode	Exclude Include	Used on networks supporting IGMPv3. If this setting is set to <i>Exclude</i> any streams originating from the user defined IP addresses will be rejected. If this setting is set to <i>Include</i> any streams originating from the user defined IP addresses will be received.

With the SMD 912(A) the input buffer size is settable at a range from 1 to 4,000 KB. The larger the buffer size, the more latency will be created in the system. The tradeoff is a potential for IP jitter and dropped packets. It further permits setting an input buffer delay of 1 to 4000 mS.

The advanced settings allow source specific multicasting using IGMP v3 joins. The filter can be set to exclude or include. IGMP addresses can be added and removed by clicking the

appropriate heading in the table. There can be up to 64 addresses entered with the highest address taking priority over the addresses below it. IGMPv2 is used to join/leave multicast streams by default if no IGMP Filter addresses are entered. If IGMP Filter Mode addresses are specified then IGMPv3 is used.

Each input has a listing of advanced details providing information regarding the settings and status of the input. Clicking on the “⊕” sign by each IP port allows the advanced details to be shown as presented in Figure 24. Click on the down arrow to close the advanced details list menu.

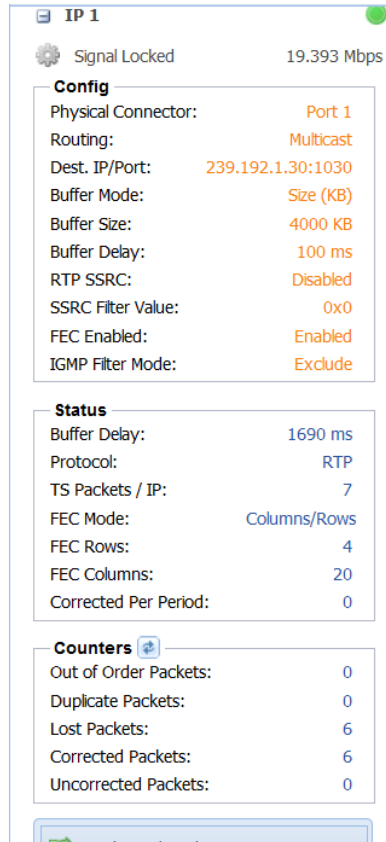


Figure 24 IP Input Details List with SMD 912(A)

The advanced details list includes configuration, status, and counter section. The Config section provides physical port, routing, input buffer, RTP SSRC information, FEC status, and the IGMP filter mode. The Status section provides buffer setting, protocol, and FEC data. The Counter section provides active packet error detection and counts.

Modulator Settings

The section overviews the processing or modulator as shown in the middle of the individual bay home screen. Depending on the enabled licenses, the status might look slightly different as shown in Figure 25 and Figure 26.

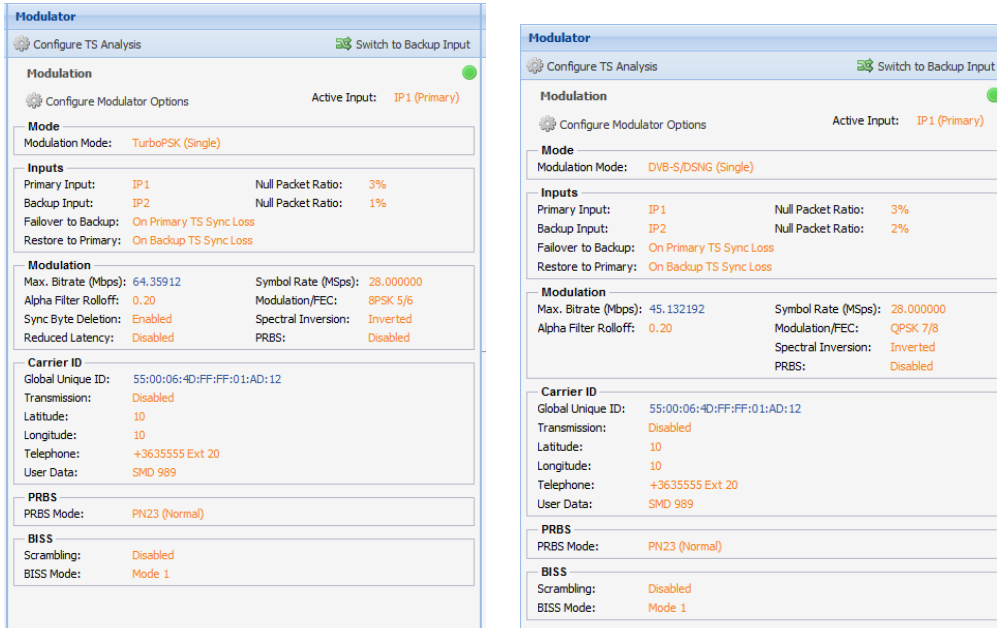


Figure 25 Single stream status

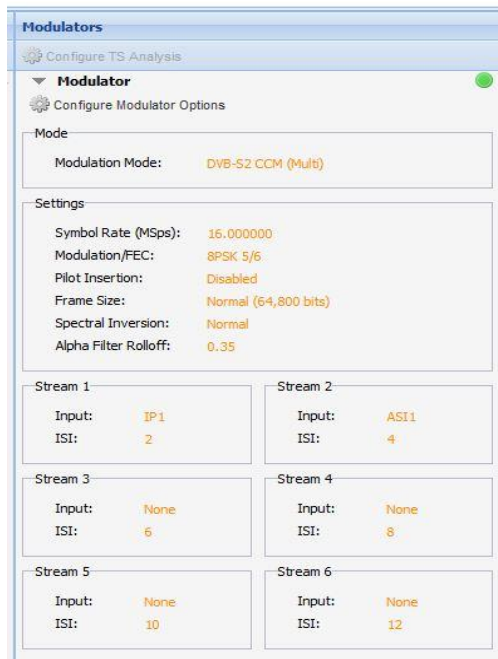


Figure 26 Multistream status

Configure Modulator – Modulation

To configure the modulator click on the “**Configure Modulator Options**” icon  located at the top of the middle “Modulators” section.

Figure 27 is a representation of the menu with settings for single stream (single DVB-S2 CCM mode) modulation. Within the Configure Modulation Options menus five tabs may be shown at the top of the menu. These may be selected to configure settings for the modulator.

Inputs: Provide configuration of the Primary and Backup input feed to the modulator

Modulation: Provides configuration of the modulator transmission

BISS: Provides configuration of the BISS encryption to the modulator transmission

PRBS: Provides Psuedo Random Binary Sequence bit error rate test signal

Carrier ID: Provides configuration of the Carrier ID of the modulator transmission

The following manual sections provide details of the modulator configuration settings available for single stream, multistream and turboPSK modulation.

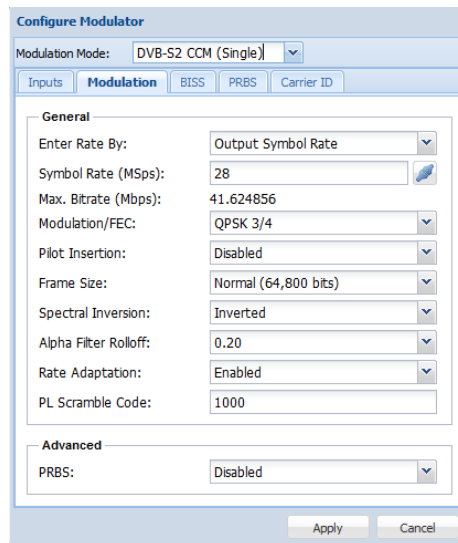


Figure 27 Configuration Modulator settings menu example

The Modulation Mode field at the top of the Configure Modulator menu provides an important selection of the type of output transmission the modulator will generate. Click on the dropdown arrow to produce a list of available modulation modes. The modes listed will vary depending on the system modulator and licensing. Click on a listing to select.

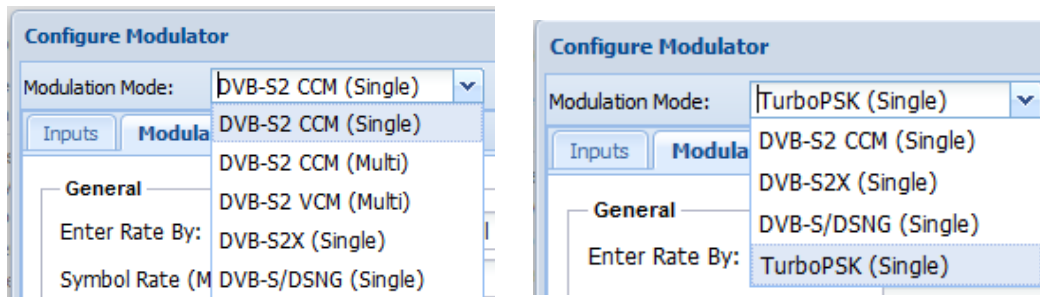



Figure 28 Modulation Mode selection - SMD910 (Left) and SMD912(A) (Right)

Configure Modulator – Inputs

The **Input** tab provides selection of the Primary Input and the option to enable a Backup Input to the modulator. A backup input may be selected in the event of a primary input fault. The selected Primary or the Backup Input is routed to the main modulator input. The selected Primary and Backup Inputs must be enabled and active inputs. (See the previous section of this manual)

Switching Manually from Primary Input To Backup Input:

You can switch manually between the Primary Input and Backup input with the icon located at the top of the middle modulator section. Click on the  **Switch to Backup Input** icon. This icon changes to a Switch to Primary Input icon when the Backup Input is active.

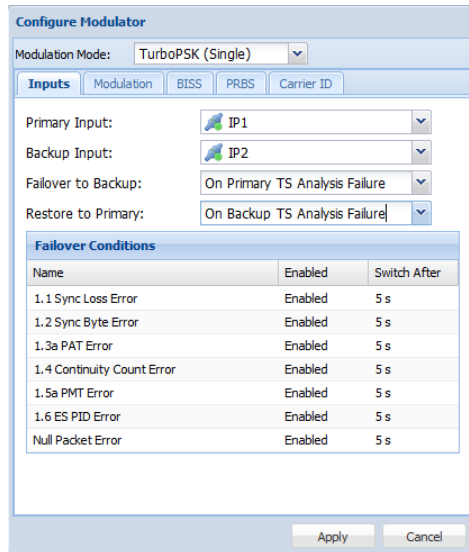
There are several options for defining failover conditions in which the input to the modulator switches from the Primary Input to the Backup input. There are also options for defining conditions in which the input returns from the Backup Input to the Primary Input.

- **Failover to Backup** can be set to On Primary TS Sync Loss, On Primary TS Analysis Failure or Manual Only. TS Sync Loss mode allows the SMD 989 to switch to backup if the primary input transport sync is lost. In TS Analysis mode failover is based on transport stream errors or sync loss. This allows the SMD 989 to switch to a backup source when there are errors in the transport stream even if it does not lose sync. (TS Analysis Failover/Restore switching requires SMD 970 TS Analysis Option)

If **TS Sync Loss Failover** is selected. Restore to Primary can be set to Manual Only, On Primary TS Sync Restored, or On Backup TS Sync Loss. The switchover Interval(s) can be set from 1 to 20 seconds.

If **TS Analysis Failover (option)** is selected, Restore to Primary options are Manual Only on Primary TS Analysis Restored or On Backup TS Analysis Failure. Failover conditions can be enabled/disabled and Switch After interval can be set from 1 to 30 seconds.

IMPORTANT NOTE: When selecting TS Analysis Failover for Primary or Backup inputs, the TS Analysis feature must be enabled or active for the respective primary and/or backup. See section Configure Modulator – TS Analysis on page 41.



Name	Enabled	Switch After
1.1 Sync Loss Error	Enabled	5 s
1.2 Sync Byte Error	Enabled	5 s
1.3a PAT Error	Enabled	5 s
1.4 Continuity Count Error	Enabled	5 s
1.5a PMT Error	Enabled	5 s
1.6 ES PID Error	Enabled	5 s
Null Packet Error	Enabled	5 s

Figure 29 Primary & Backup Input, Failover and Restore

Configure Modulator – Modulation Parameters

The **Modulation** tab provides setup settings of the modulation parameters. First, choose the Modulation/FEC code to use and then select how you wish to set the output symbol rate. You may enter the desired output symbol rate or input bit rate or have the internal calculator recommend a setting. The following section describes entry of these parameters.

The **Enter Rate By** field provides the user a choice of how to setup the output Symbol Rate or Max Bitrate entry fields. The values in these fields are mathematically related depending on the modulation mode, modulation type, and FEC settings. The SMD 989 contains an internal symbol rate or max. input bitrate calculator to assist.

Enter Rate By

- **Output Symbol Rate**
- **Input Bitrate**


Description: Output Symbol Rate mode allows the entry of the desired output symbol rate. The SMD 989 calculates the maximum input bit rate and lists it in the Max. Bitrate field.

Description: Input Bit Rate mode allows the entry of a known input bit rate. The SMD 989 then calculates the needed symbol rate and lists it in the Symbol Rate field.

With output Symbol Rate you enter the desired output symbol rate. It must be mathematically proper based upon the input bit rate measured by the system. When a higher than needed symbol rate is entered, the modulator inserts null packets to achieve the rate. When entering a lower than needed symbol rate the SMD 989 removes nulls, if they exist, from the stream.

With Input Bitrate, the SMD 989 uses the entered bitrate along with the modulation settings to calculate the needed symbol rate. If it is known that the input transport stream contains a significant amount of null packets it is possible to enter a bitrate that is lower than the actual input transport stream bitrate. In this case the SMD 989 will remove existing nulls.

Important Note: *When entering a bitrate lower than the input bitrate or a symbol rate below the minimum, there must be enough nulls in the input transport stream to be removed to allow the lower bitrate or symbol rate or errors in the transmission transport stream result.*

The SMD 989 contains a symbol rate or input bit rate calculator to assist with these selections. By clicking the  icon, the recommended symbol rate will be inserted into the Symbol Rate field or maximum input bitrate inserted in the Bitrate field.

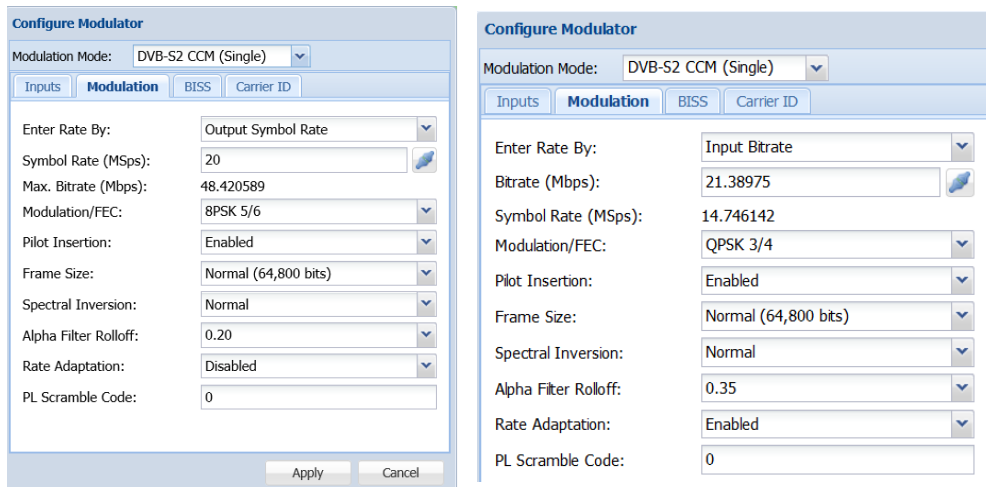


Figure 30: Single stream DVB-S2 Configuration

Modulation/FEC: The modulations and supported code rates are shown in Figure 31. The supported modes are selectable in the drop down list in the Modulation/FEC field. The listings will depend on unit licensing and the selected mode in the Modulation Mode field at the top of the menu.

Code R12ate	DVB-S/DSNG			DVB-S2			
	QPSK	8PSK	16QAM	QPSK	8PSK	16APSK	32APSK
¼				√			
1/3				√			
2/5				√			
½	√			√			
3/5				√	√		
2/3	√	√		√	√	√	
¾	√		√	√	√	√	√
4/5				√		√	√
5/6	√	√		√	√	√	√
7/8	√		√				
8/9		√		√	√	√	√
9/10				√	√	√	√

Figure 31: Supported modulations & code rates for DVB-S/DSNG and DVB-S2

The remaining settings include (Bold indicates default):

Pilot Insertion (Only available in DVB-S2 Modes)

- **Enable**
- Disable

Description: When enabled, every 16 slots of 90 symbols the modulator will insert 36 non-modulated symbols to aid in receiver synchronization. The use of a pilot allows the receiver to maintain carrier recovery, even when the user data payload cannot be decoded.

Frame Size (Only available in DVB-S2 Modes)

- **Normal (64,800 bits)**
- Short (16,200 bits)

Description: Short frames introduce more overhead but give a shorter encapsulation delay. Short frames are 4 time shorter than normal frames.

Spectral Inversion

- **Normal**
- Inverted

Description: Determines whether the spectrum is inverted or normal.

Note: When the SMD 920 L-Band option is installed, the default spectral inversion is inverted as the upconverter will invert. Setting the output to Inverted will give a normal output from the upconverter. This is shown in the RF Output status for Spectral Inversion.

Alpha Filter Rolloff

- **0.35**
- 0.25
- 0.20
- 0.15
- 0.10
- 0.05

Description: The filter rolloff is known as the Alpha coefficient (α). The smaller the α , the less bandwidth will be required on the satellite.

Rate Adaptation (Only available in DVB-S2 single mode)

- **Disable**
- Enable

Description: When set to enable a rate adaption is applied to the DVB-S2.mode. When disabled the rate adaptation is not active. Rate adaptation forces the modulator to add or remove null packets and re-stamp PCRs in order to match TS bitrate to the modulation payload rate. Disabling rate adaptation is desirable where the input TS must be preserved through the transmission chain. In such use cases, it is expected that the input TS bitrate is fairly consistent and the payload mismatch can be resolved by occasionally inserting a dummy frame instead.

PL Scramble Code (Physical Layer Scrambling is only available in DVB-S2 or DVB-S2X single modes)

Description: This is used to specify a randomized scrambling sequence applied to each PL frame and initiated at the end of each PL header. Scrambling randomizes band energy dispersion and allows for a “signature” when may provide association to a satellite operator or satellite. The complex code relates to an “n” value defined by an entry of 0 to 262 141.

PRBS Enable/Disable A pseudo random binary sequence test signal is available for testing. When Enabled the PRBS replaces the normal input modulation feeding the modulator. Select Disabled for normal output applications. See the PRBS section of this manual for added information.

PRBS: (Only available in DVB-S2 Modes)

- Enable
- **Disable**

Configure Modulator – Carrier ID

Carrier ID – DVB CID Global Unique ID: The SDM 989 can optionally provide a carrier added to the transmission that contains a unique identifier value (DVB CID Global Unique ID). The identifier value may be used to trace and quickly resolve a satellite interference event to a transmitting source. The Global Unique Identifier is a fixed value for the equipment manufacturer and is not editable by the user. It may be derived from a 48 bit MAC address or a 48 bit Space Data Association modulator identifier.

Modulation	
Max. Bitrate (Mbps):	27.623792
Alpha Filter Rolloff:	0.20
Symbol Rate (MSps):	20.000000
Modulation/FEC:	QPSK 3/4
Spectral Inversion:	Normal

Carrier ID	
Global Unique ID:	2E:00:06:4D:FF:FF:00:1F:67
Transmission:	Enabled
Latitude:	45.3339
Longitude:	-179.999
Telephone:	+6598843344 Ext 112
User Data:	uplink kccc 1 sd

Figure 32: Carrier ID – Global Unique ID

Configure Carrier ID provides a CID control field and an information field. The CID control provides a means to enable or disable the CID transmission. Optionally an Informational Field may be populated with latitude, longitude, phone and message data.

Transmission: Provides an enable or disable selection for the CID transmission.

- Enabled
- **Disabled**

Description: When enabled, a CID transmission is generated and added to the output. When disable no CID output including the Global Unique ID and Information fields are output.

Configure Modulator

Modulation Mode: DVB-S/DSNG (Single)

Inputs | Modulation | BISS | **Carrier ID**

Transmission: Enabled

Latitude: 45.3339 Enabled

Longitude: -179.999 Enabled

Telephone: 6598843344 Ext: 112 Enabled

User Data: uplink kccc 1 sd Enabled

Apply Cancel

Figure 33: Carrier ID Configuration

Latitude: Provide entry of a latitude pure decimal value to the CID information field.

- Value Entry
- Enabled/**Disabled**

Description: When enabled, the entered latitude value is added to the Information Field of the CID transmission. Enter values 0 to 90 with up to 3 decimal places. Enter positive values for northern hemisphere and negative values for the southern hemisphere. When disabled, the latitude value is not transmitted in the CID.

Longitude: Provides entry of a longitude decimal value to the CID information field.

- Value Entry
- Enabled/**Disabled**

Description: When enabled, the entered longitude value is added to the Information Field of the CID. Enter values 0 to 180 with up to 4 decimal places. Enter positive values for eastern hemisphere and negative values for the western hemisphere. When disabled, the longitude value is not transmitted in the CID.

Telephone: Provides an entry of a contact phone number with an extension number to the CID Information Field.

- Value Entry
- Enabled/**Disabled**

Description: When enabled, the entered phone number is added to the Information Field of the CID. You may enter up to 18 digits or a total of 17 digits if an extension number is entered in the ext. field. When disabled, the telephone number is not transmitted in the CID.

User Data: Provides an entry of up to 24 characters for including a message in the CID Information Field.

- Text Entry Field:
- Enabled/**Disabled**

Description: When enabled, the user data or entered characters are added into the CID Information Field. Up to 24 characters may be entered and transmitted as user data. When disabled, the user data is not transmitted in the CID.

Note: When a CID carrier is enabled and added to the transmission it is known to slightly degrade the MER performance of the satellite IF/RF transmission. Details of this are explained in the ETSI TS 103129 Annex B.2. standard.

Configure Modulator – TS Analysis

Configure TS Analysis (SMD 970 option) The Configure TS Analysis allows the setup of TS Analysis. TS Analysis errors are as defined by TR 101 290 [4]. The TS Analysis may be used for failover input switching, error logging, alarms, SNMP traps, and/or relay switching.

TS Analysis

- Enabled
- **Disabled**

Errors – Threshold

- **Sync Loss:** an error will be indicated when sync has been lost for at least 1 second.
- **Sync Byte:** Corruption: an error will be indicated when the number of errors/second entered has been exceeded. Can be set from 1 to 999 errors/second.
- **PAT Error:** an error will be indicated when the PAT is not present for a period exceeding the time entered (in ms) Can be set from 100ms to 10000ms. Default is 500ms.
- **Continuity Count Error:** an error will be indicated when the number of detected Continuity Count Error per second exceeds the value entered. Can be set from 1 to 999 errors per second. Default is 1 error per second.
- **PMT Error:** an error will be indicated when the PMT is not present for a period exceeding the time entered (in ms). Can be set from 100ms to 10000ms. Default is 500ms.
- **ES PID Error:** an error will be indicated when an Elementary Stream (ES) is not present for a period exceeding the time entered (in ms). Can be set from 100ms to 10000ms. Default is 500ms. The modulator will automatically detect up to 400 elementary stream PIDs on both the primary and backup transport streams.
- **Null Packet Ratio:** an error is indicated when the ratio of the number of null packets in comparison to the normal video packets every second exceeds the maximum or minimum ratio entered.

Exclude PID Entering a PID value here will remove the PID entered from all TS Analysis functions. This eliminates logging or errors associated with the PIDs listed.

No.	Error	Threshold
1.1	Sync Loss	
1.2	Sync Byte Corruption	1 err./s
1.3a	PAT Error	500 ms
1.4	Continuity Count Error	1 err./s
1.5a	PMT Error	500 ms
1.6	ES PID Error	500 ms
-	Null Packet Ratio	20 %

PID	Remove
220	<input type="button" value="Remove"/>
224	<input type="button" value="Remove"/>

Figure 34 Configure TS Analysis

Configure Modulator – S2 Multistream

Configuration for DVB-S2 Multistream Modulation is similar to single stream settings with the ability to add 6 streams to the modulation as shown in Figure 35 below.

The screenshot shows the 'Configure Modulator' dialog box. It is divided into two main sections: 'Global Settings' and 'Individual Settings'.

Global Settings:

- Modulation Mode: DVB-S2 VCM (Multi)
- Symbol Rate (MSps): 34.037539
- Min. Symbol Rate (MSps): 46.364419
- Frame Size: Normal (64,800 bits)
- Spectral Inversion: Inverted
- Alpha Filter Rolloff: 0.35
- Carrier Wave: Disabled

Individual Settings:

Stream	Input	ISI	Modulation/FEC	Pilot
Stream 1	IP1	2	8PSK 9/10	Disabled
Stream 2	IP1	4	QPSK 3/4	Disabled
Stream 3	ASI1	6	QPSK 3/4	Disabled
Stream 4	ASI1	8	QPSK 3/4	Disabled
Stream 5	OFF	10	QPSK 3/4	Disabled
Stream 6	OFF	12	QPSK 3/4	Disabled

Buttons: Apply, Cancel

Figure 35 SMD 963 multi-stream configuration

Multi-stream is supported in DVB-S2 CCM and VCM modes using the SMD910 modulator. Multi-stream DVB-S2 CCM limits the modulation type and FEC to the same for all the streams. Multi-stream DVB-S2 VCM as shown in Figure 35 allows a modulation type and FEC to be set for each stream in the modulation.

Each input can be set to the desired incoming stream. If the input set to “OFF” the stream is not configured to be used in the modulation. If the Input is set to something other than OFF and no stream is present, an error indicating that input is missing is generated.

For each stream an Input Stream Identifier (ISI) is needed. This value is used by receivers to select the appropriate stream out of the multi-stream modulation.

Note: When in the Multi-stream Modulation mode, the input backup and TS Analysis features are not available.

Configure Modulator - PRBS

The PRBS tab provides selection of the available PRBS (Pseudo Random Binary Sequence) test signal available for use with either the SMD 910 or SMD 912(A) modulators.

PRBS (Pseudo Random Binary Sequence): The PRBS feature provides a digital test signal with known properties used for BERT (bit error rate testing) of satellite equipment or transmission paths. Test signals used are a binary PN (Pseudo-Noise) signal known as a PN-23 or Inverted PN-23.

PN23 Normal: A normal version of the Pseudo-Noise PN-23 test signal

PN 23 Inverted: An inverted version of the Pseudo-Noise PN-23 test signal

For BERT tests, the PRBS setting may be set to Enabled. When Enabled, the normal input signal to the modulator is removed and replaced with the selected PN-23 or Inv PN-23 signal.

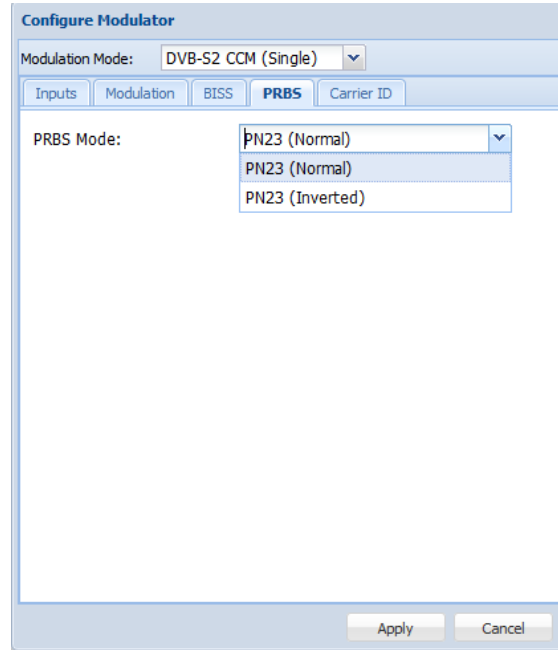


Figure 36: PRBS Pseudo Random Binary Sequence

IMPORTANT: For normal or non-testing applications in which the input is to be used to modulate the satellite IF or L-Band carrier output, the PRBS test signal must be set to **DISABLED**.

Configure Modulator - BISS

Configure BISS Scrambling (SMD 971 Option) The BISS Scrambling is configured by selecting the BISS tab in the Configuration Modulator window. When BISS Scrambling is enabled the entire transport stream will be scrambled. A CA_descriptor will be added to the PMT and CAT table will be created if one does not exist. If a CAT table does exist it will be altered.

Scrambling:

Enabled/Disabled: When set to Enabled the BISS encryption feature becomes active and is ready for the entry of either the Mode 1 or Mode E session word/ID. When Disabled no BISS encryption is added to the stream.

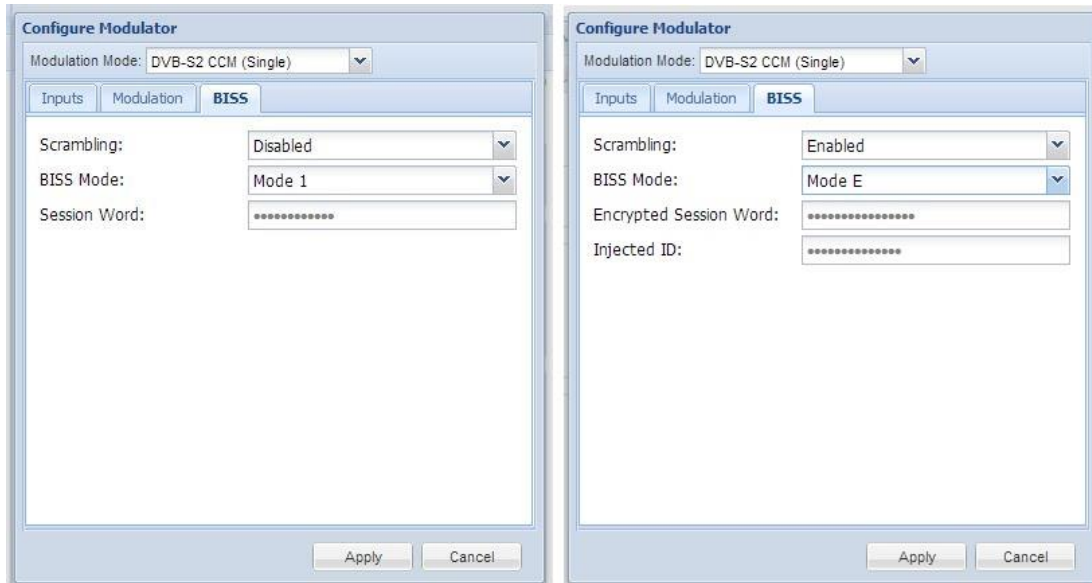


Figure 37 BISS Scrambling configuration

BISS Mode 1: Permits entry of an encrypted twelve (12) character hex session word.

BISS Mode E: Permits entry of an encrypted sixteen (16) character hex session word along with a 14 character hex Injected ID. In BISS Mode E the session word is encrypted and cannot be viewed from the front panel or any remote interface.

Configure Modulator – TurboPSK

Configure TurboPSK modulation (SMD 968 Option) The SMD 912(A) modulator is capable of outputting an advanced modulation scheme known as Turbo PSK. This output is only available when the SMD 968 option is added to a modulator platform which includes an SMD 912(A) modulator board(s).

To configure the modulator click on the “**Configure Modulator Options**” button located at the top of the middle section. The Configure Modulator menu provides selection of the Modulation Mode. Click the dropdown arrow and select **TurboPSK (Single)**.

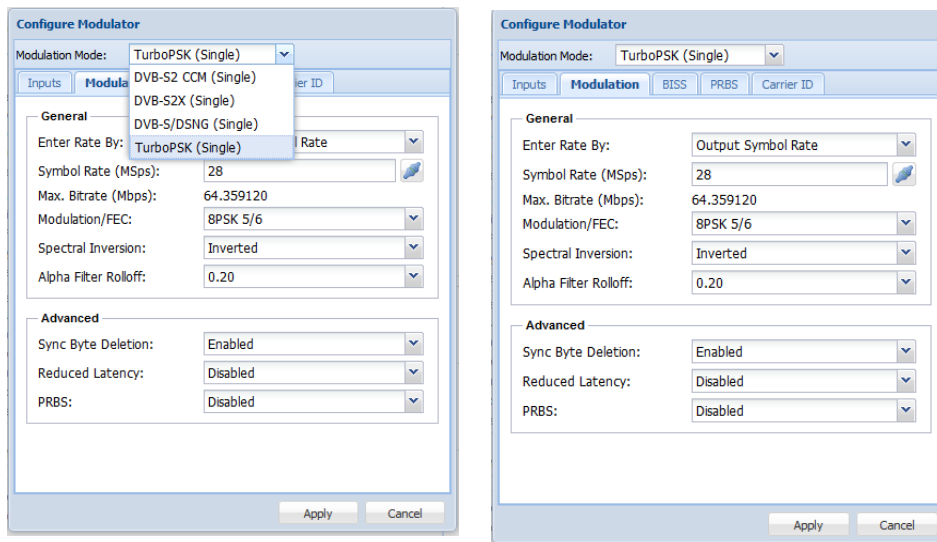
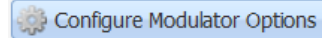


Figure 38 TurboPSK (Single) modulation selection

The **Modulation** tab provides setup settings of the modulation parameters. First, choose the Modulation/FEC code to use and then enter the desired output symbol rate or input bit rate. The following section describe the Turbo PSK parameters.


The **Enter Rate By** field provides the user a choice of how to setup the output Symbol Rate entry fields. The values in these fields are mathematically related. The SDM 989 contains an internal symbol rate calculator to assist.

Enter Rate By

- **Output Symbol Rate**
- **Input Bitrate**

Description: Output Symbol Rate mode allows the entry of the actual output symbol rate desired. With Input Bitrate by entering the bitrate of the input transport stream the SMD 989 uses this bitrate along with the Modulation/FEC settings to calculate the modulation symbol rate. If it is known that the input transport stream contains a significant amount of null packets it is possible to enter a bitrate that is lower than the actual input transport stream bitrate. In this case the SMD 989 will remove the nulls.

Note: When entering a bitrate lower than the input bitrate there must be enough nulls in the input transport stream to be removed to allow the lower bitrate. Entering a bitrate that is too low will result in transport stream errors.

By clicking the  icon, the recommended symbol rate will be inserted into the symbol rate.

Turbo PSK modulation includes many modulation types and FEC code combinations. Figure 39 shows code rates available for the Turbo PSK modulation mode and a representation of the settings for TurboPSK single mode modulation in the dropdown menu.

<u>Code Rate</u>	<u>QPSK</u>	<u>8PSK</u>	<u>16 QAM</u>
1/2	X		
2/3	X	X	
3/4	X	X	X
3/4 (2.05)		X	
3/4 2.10 4/5		X	
5/6	X	X	
7/8	X		
8/9		X	

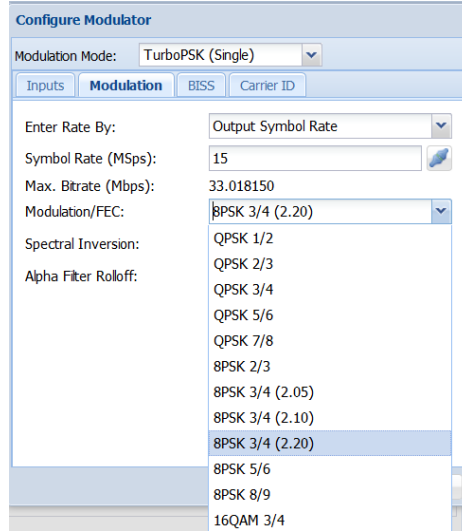


Figure 39 Advanced Modulation Turbo PSK modes and code rates

The remaining settings include (Bold indicates default):

Spectral Inversion

- **Normal**
- Inverted

Description: Determines whether the spectrum is inverted or normal.

Note: When the SMD 920 L-Band option is installed, the default spectral inversion is inverted as the upconverter will invert. Setting the output to Inverted will give a normal output from the upconverter. This is shown in the RF Output status for Spectral Inversion.

Alpha Filter Rolloff

- **0.35**
- 0.25
- 0.20
- 0.15
- 0.10
- 0.05

Description: The filter rolloff is known as the Alpha coefficient (α). The smaller the α , the less bandwidth will be required on the satellite.

Advanced Turbo Modulation Settings

The TurboPSK modulation mode provides several advanced features which may be enabled or selected for use. The Advanced section provides settings for Sync Byte Deletion, Reduced Latency, and PRBS.

Sync Byte Deletion: The Sync Byte Deletion advanced feature permits removal of the incoming MPEG stream sync bytes from reaching the modulator, so as to not output symbols containing the sync byte information. This enables a savings in bandwidth of 1 byte every 188 bytes as modulator output symbols containing sync byte data are removed.

The Sync Byte Deletion setting can be disabled or enabled. When set to Enabled, the modulator blocks the incoming Sync Byte. When Enabled the receive demodulator must reinsert it. When Disabled the modulator receives the full transport stream including the Sync Bytes.

Reduced Latency:

The advanced section contains several reduced latency modes which may be applied to the TurboPSK modulation. The reduced latency modes of the TurboPSK modulation provides several levels of latency that can be applied. The reduced latency modes are only applicable to special low symbol rate data satellite applications using the TurboPSK modulation.

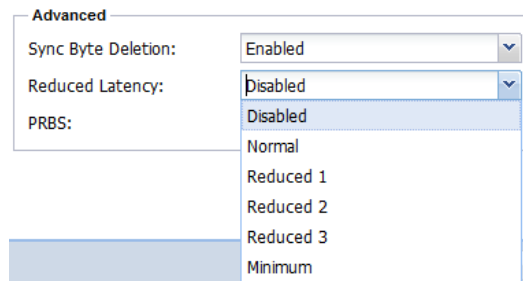


Figure 40: Reduced Latency Selections

Reduced Latency Selections

- Disabled: (Default) No latency reduction - with additional input buffering
- Normal: Introduces slight latency without additional input buffering
- Reduced 1: Adds latency reduction to the Normal mode
- Reduced 2: Adds latency reduction to the Reduced 1 mode
- Reduced 3: Adds latency reduction to the Reduced 2 mode
- Minimum: Adds latency reduction to the Reduced 3 mode

PRBS (Pseudo Random Binary Sequence): The PRBS feature provides a digital test signal with known properties used for BERT (bit error rate testing) of satellite equipment or transmission paths. Test signals used are a binary PN (Pseudo-Noise) signal known as a PN-23 or Inverted PN-23. The test signal is selected within the PRBS tab/menu.

For BERT tests, the PRBS setting may be set to Enabled. When Enabled, the normal input signal to the modulator is removed and replaced with the PN-23 or Inv PN-23 signal.

IMPORTANT: For normal or non-testing applications in which the input is to be used to modulate the satellite IF or L-Band carrier output, the PRBS test signal must be set to DISABLED.

Configure Modulator – DVB-S2X

Configure DVB-S2X modulation. The SMD 912(A) and SMD 910 modulators are capable of outputting an extended modulation scheme for DVB-S2 known as DVB-S2X. This output is active and follows licensing as described earlier in this manual.

To configure the modulator click on the “**Configure Modulator Options**” button located at the top of the middle section. The Configure Modulator menu provides selection of the Modulation Mode. Click the dropdown arrow and select **DVB-S2X(Single)**.

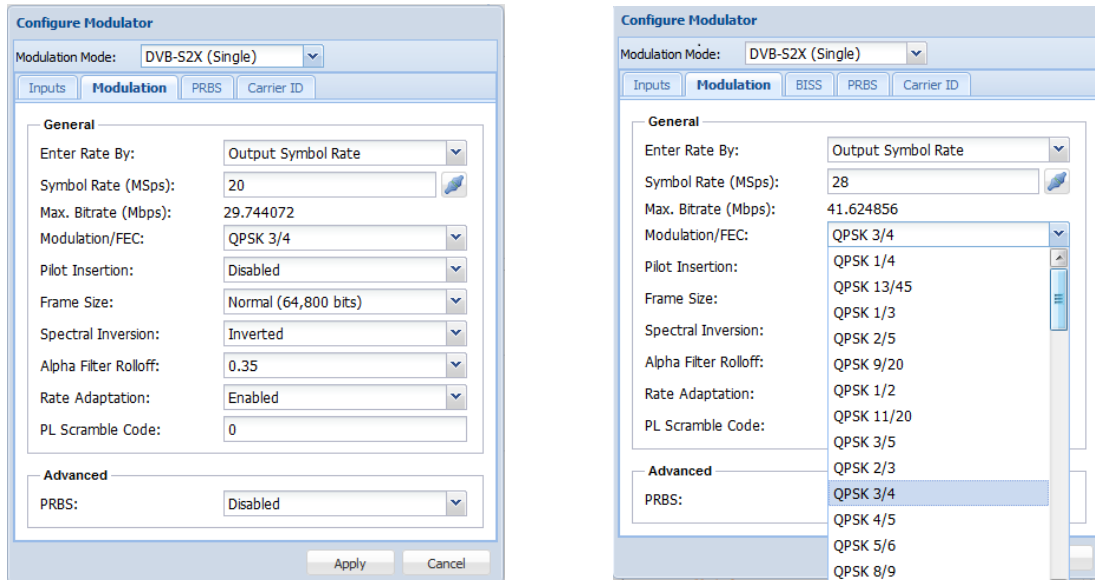
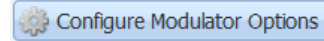


Figure 41: Configure DVB-SX2 Modulation/FEC

The **Modulation** tab provides setup settings of the modulation parameters. First, choose the Modulation/FEC code to use and then select how you wish to set the output symbol rate. You may enter the desired output symbol rate or input bit rate or have the internal calculator recommend a setting. The following section describes entry of these parameters.

The **Enter Rate By** field provides the user a choice of how to setup the output Symbol Rate or Max Bitrate entry fields. The values in these fields are mathematically related depending on the modulation mode, modulation type, and FEC settings. The SDM 989 contains an internal symbol rate or max. input bitrate calculator to assist.

Enter Rate By

- **Output Symbol Rate**
- **Input Bitrate**


Description: Output Symbol Rate mode allows the entry of the desired output symbol rate. The SMD 989 calculates the maximum input bit rate and lists it in the Max. Bitrate field.

Description: Input Bit Rate mode allows the entry of a known input bit rate. The SMD 989 then calculates the needed symbol rate and lists it in the Symbol Rate field.

With output Symbol Rate you enter the desired output symbol rate. It must be mathematically proper based upon the input bit rate measured by the system. When a higher than needed symbol rate is entered, the modulator inserts null packets to achieve the rate. When entering a lower than needed symbol rate the SMD 989 removes nulls, if they exist, from the stream.

With Input Bitrate, the SMD 989 uses the entered bitrate along with the modulation settings to calculate the needed symbol rate. If it is known that the input transport stream contains a significant amount of null packets it is possible to enter a bitrate that is lower than the actual input transport stream bitrate. In this case the SMD 989 will remove existing nulls.

Important Note: When entering a bitrate lower than the input bitrate or a symbol rate below the minimum, there must be enough nulls in the input transport stream to be removed to allow the lower bitrate or symbol rate or errors in the transmission transport stream result.

The SMD 989 contains a symbol rate or input bit rate calculator to assist with these selections. By clicking the  icon, the recommended symbol rate will be inserted into the Symbol Rate field or maximum input bitrate inserted in the Bitrate field.

DVB-S2X					
Code Rate	QPSK	8PSK	16APSK	32APSK	64APSK
1/4	√		√		
3/5		√	√		
2/3		√	√		
3/4	√	√	√	√	
4/5	√		√	√	√
5/6	√	√	√	√	√
7/8					
7/9			√	√	√
8/9	√	√	√	√	
9/10	√	√	√	√	
11/15				√	√
13/18		√			
23/36		√	√		
25/36		√			
26/45			√		
28/45			√		
32/45				√	
77/90			√		
1/2-L			√		
2/3-L			√	√	
3/5-L			√		
5/9-L		√	√		
8/15-L			√		
32/45-L					√
26/45-L		√			

Figure 42: Modulation/FEC code rates DVB-S2X

Modulation/FEC: The modulations and supported code rates are shown in Figure 42. The supported modes are selectable in the drop down list in the Modulation/FEC field.

The remaining settings include (Bold indicates default):

Pilot Insertion (Only available in DVB-S2 and DVB-S2X Modes)

- **Enable**
- Disable

Description: When enabled, every 16 slots of 90 symbols the modulator will insert 36 non-modulated symbols to aid in receiver synchronization. The use of a pilot allows the receiver to maintain carrier recovery, even when the user data payload cannot be decoded.

Frame Size (Only available in DVB-S2 and DVB-S2X Modes)

- **Normal (64,800 bits)**
- Short (16,200 bits)

Description: Short frames introduce more overhead but give a shorter encapsulation delay. Short frames are 4 time shorter than normal frames.

Spectral Inversion

- **Normal**
- Inverted

Description: Determines whether the spectrum is inverted or normal.

Note: When the SMD 920 L-Band option is installed, the default spectral inversion is inverted as the upconverter will invert. Setting the output to Inverted will give a normal output from the upconverter. This is shown in the RF Output status for Spectral Inversion.

Alpha Filter Rolloff

- **0.35**
- 0.25
- 0.20
- 0.15
- 0.10
- 0.05

Description: The filter rolloff is known as the Alpha coefficient (α). The smaller the α , the less bandwidth will be required on the satellite.

Rate Adaptation (Only available in DVB-S2 and DVB-S2X single modes)

- **Disable**
- Enable

Description: When set to enable a rate adaption is applied to the DVB-S2X.mode. When disabled the rate adaptation is not active. Rate adaptation forces the modulator to add or remove null packets and re-stamp PCRs in order to match TS bitrate to the modulation payload rate. Disabling rate adaptation is desirable where the input TS must be preserved through the transmission chain. In such use cases, it is expected that the input TS bitrate is fairly consistent and the payload mismatch can be resolved by occasionally inserting a dummy frame instead.

PL Scramble Code (Physical Layer Scrambling is available in DVB-S2X single mode)

Description: This is used to specify a randomized scrambling sequence applied to each PL frame and initiated at the end of each PL header. Scrambling randomizes band energy dispersion and allows for a “signature” when may provide association to a satellite operator or satellite. The complex code relates to an “n” value defined by an entry of 0 to 262 141.

PRBS Enable/Disable A pseudo random binary sequence test signal is available for testing. When Enabled the PRBS replaces the normal input modulation feeding the modulator. Select Disabled for normal output applications.

The PRBS feature provides a digital test signal with known properties used for BERT (bit error rate testing) of satellite equipment or transmission paths. Test signals used are a binary PN (Pseudo-Noise) signal known as a PN-23 or Inverted PN-23. The test signal is selected in the PRBS tab.

IMPORTANT: For normal or non-testing applications in which the input is to be used to modulate the satellite IF or L-Band carrier output, the PRBS test signal must be set to DISABLED.

Output Settings

This section focuses around the IF and optional RF (SMD 920 option) settings found on the right column of the individual bay home screen.

All SMD 989 modulations will have an IF output area indicating an active or muted output, frequency range from 57 up to 145 MHz, output level and tilt level. If the SMD 920 L-Band option is available it will indicate the RF settings for the module as shown in Figure 43.



Figure 43: Outputs section

There are three quick access buttons at the top of the Outputs section. These buttons provide easy access to common functions or functions that may need to be accessed quickly.

- **Mute:** By clicking the mute button the IF/RF outputs will be muted. When the output is muted the icon will change to “Unmute”
- **Modulating:** Clicking the Modulating quick access icon will stop modulated output and go to a carrier wave (CW). When in CW mode the Modulating icon will change to a CW image and read “CW Only”
- **RF Level (dBm):** This allows the RF output level to be adjusted by either entering the value, from -30dBm to 5dBm, or by using the up and down arrows.

IF Output

Clicking on “**Configure IF Options**” will produce a dialog box as shown in Figure 44.

The output can be set as active or mute.

The IF output frequency is selectable between 57 & 140 MHz in 1 Hz increments. When used with the option SMD 920 RF Upconverter set the IF frequency to 70MHz or 140MHz and the level to -10dBm.

The level for the IF Output is adjustable between -30 to -5 dBm for the SMD 910 and SMD 912. The SMD 912A output level is from -20 to +5dBm. When feeding the SMD 920 option upconverter the IF output level is optimal at -10 dBm for any of the modulator models.

The tilt adjustment allows a user to adjust the overall slope of the output spectrum. The range is selectable from -3 to +3 dB.

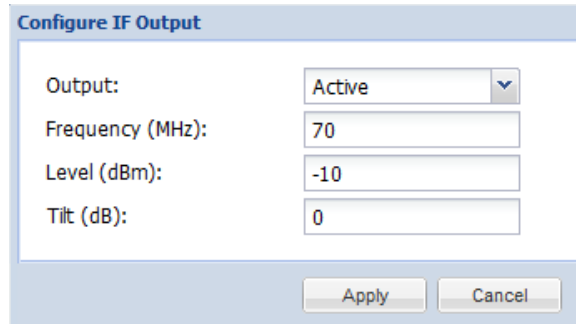


Figure 44: IF settings

RF Output

If the RF L-Band SMD 920 option is installed in the SMD 989 bay, an RF Output section is shown. The header selections provide quick selection for Mute, Modulating, and RF Level. Click on the field to activate. When mute is active no output satellite carrier is output. When the Modulating field is clicked the output modulation is removed and a carrier only is transmitted. By clicking the up or down arrows the output RF level can be increased or decreased incrementally.

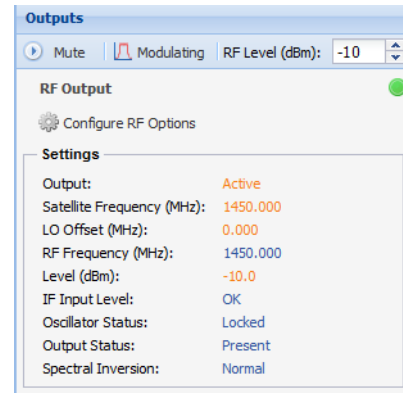
By clicking on the “**Configure RF Options**,” cog a dialog box appears showing RF output selections as shown in Figure 45.

The output can be set as active or mute. This may also be toggled by clicking on the Mute field in the Outputs header. When mute is active no output satellite carrier is output.

The output frequency is settable at a range of 950 to 2150 MHz, When LO Offset is 0MHz.

The LO Offset (MHz) can be entered to allow the desired Satellite Frequency (MHz) to be entered. The SMD 989 will output the proper frequency to achieve the correct satellite frequency when combined with the external Upconverter LO (Local Oscillator). This eliminates the need to determine what the output frequency of the SMD 989 should be to achieve the desired satellite frequency. In the example settings below the output of the SMD 989 will be the same.

The output level is settable at a range of -30 to 5 dBm. This level may also be incremented to a higher or lower level using the up/down arrows in the RF Level (dBm) header section.



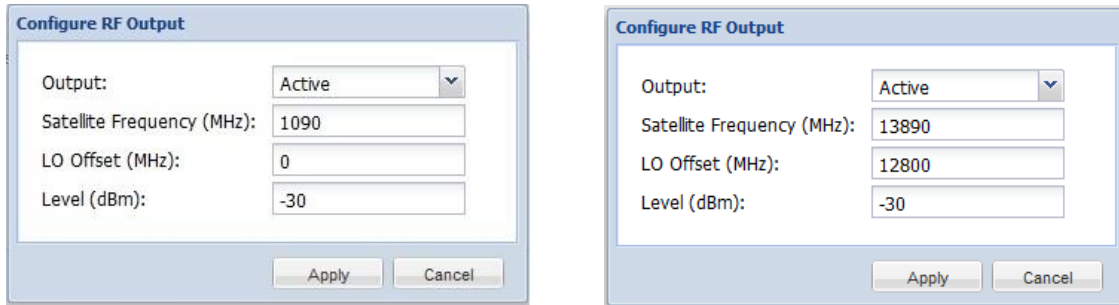


Figure 45: RF settings

If the RF L-Band SMD 920 option is installed along with 10 MHz BUC Power SMD 94X option the ability to configure the RF output as well as the ability to enable or disable the 10MHz Ref. Clock and the BUC Power is also shown. By clicking on the “**Configure RF Options**,” a dialog box will appear as shown in Figure 46. Enabling the 10 MHz Ref. Clock or BUC Power will diplex them with the L-Band PRI RF output looped to the optional SMD 94X LOOP IN.

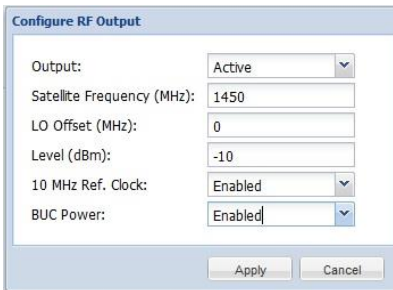


Figure 46: RF settings with 10MHz option

The parameters shown in blue in the RF Output section indicate the status of that parameter and cannot be edited in the RF Output configuration window. These statuses are:

- **RF Frequency:** This is determined by the calculation of the Satellite Frequency and the L.O. Offset frequency.
- **IF Input Level:** This indicates OK if the IF input is at the proper level. The Level indication can be “Low”, “OK” or “High.” If this does not show OK as the status, check that the IF output is set to -10dBm. If the level indicates LOW or HIGH you may increase or decrease the IF Level slightly to return the IF Input Level to OK status. This provides the optimum spectral output performance of the RF upconverter.
- **Oscillator Status:** Indicates if the 10MHz reference is locked to the incoming IF.
- **Output Status:** Indicates Present when the output is active, or Missing if the output is muted.
- **Spectral Inversion:** This reflects what the RF output will be after the RF upconverter. This indication changes depending on the Spectral Inversion setting in the Configure Modulation Options. If the Spectral Inversion is set to Normal in the modulation configuration, the RF Output will be inverted. If the Spectral Inversion is set to Inverted in the modulation configuration, the RF Output will be normal.

Admin Tab

The Admin tab located after the two bays in the web interface allow system specific settings to be set or modified.

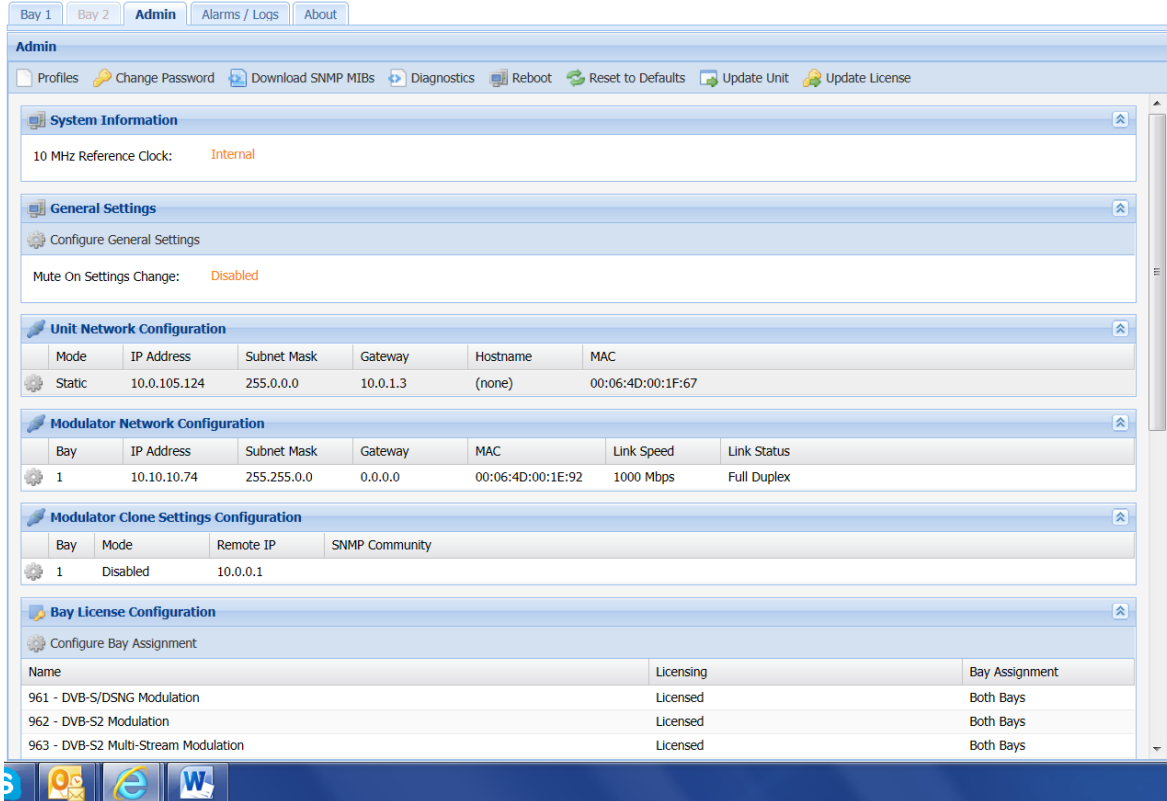


Figure 47: Admin tab

Located directly under the admin control panel are the options for saving/loading profiles, changing the password, downloading the SNMP MIBs, downloading the diagnostic file, unit software updating, and license changes.

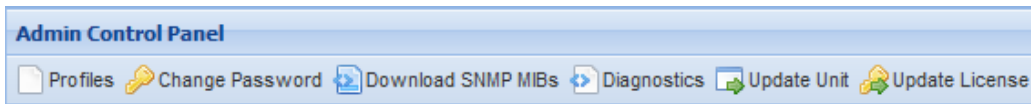


Figure 48: Password/Unit update location

User Profiles

The “Profiles” button opens a dialog box as shown in Figure 49. The user can create a new profile based on the configuration of the complete system. The profile can be saved locally and downloaded to a remote location for backup. The profile can also be uploaded and restored for systems that have the same configuration.

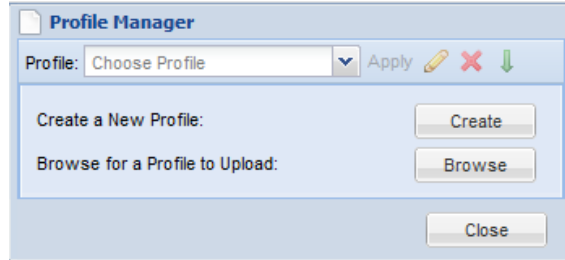


Figure 49: Profile Manager

Note: The configuration of the unit must be the same from system to system to allow the profile to load. If a profile is loaded onto a different channel platform, the profile will not load.

Setting Login Password

Once a user has clicked on the “**Change Password**” button located at the top of the admin tab a dialog box will appear as shown in Figure 50.

The user will need to type the new password and confirm the password to change it from the previous password.

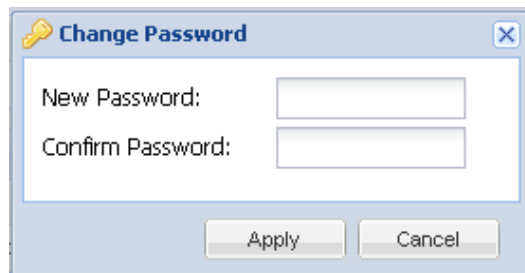


Figure 50: Setting password

Downloading SNMP MIBs

Clicking on the “Download SNMP MIBs” button located at the top of the Admin Tab will open a dialog box as shown in Figure 51.

A new window will appear with the ability to download each MIB.

Index of /mibs/

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
SENCORE-CSP-MIB.MIB	2011-Oct-24 17:46:19	48.4K	application/octet-stream
SENCORE-GLOBAL-REG.MIB	2011-Oct-24 17:46:19	2.3K	application/octet-stream
SENCORE-SMD989-MIB.mib	2011-Oct-24 18:33:14	40.9K	application/octet-stream
SNMP-COMMUNITY-MIB.MIB	2011-Oct-24 17:52:15	15.1K	application/octet-stream
SNMP-FRAMEWORK-MIB.MIB	2011-Oct-24 17:52:15	21.8K	application/octet-stream
SNMP-MPD-MIB.MIB	2011-Oct-24 17:52:15	5.3K	application/octet-stream
SNMP-TARGET-MIB.MIB	2011-Oct-24 17:52:14	22.2K	application/octet-stream
SNMP-USER-BASED-SM-MIB.MIB	2011-Oct-24 17:52:15	38.2K	application/octet-stream
SNMP-VIEW-BASED-ACM-MIB.MIB	2011-Oct-24 17:52:15	33.3K	application/octet-stream
SNMPV2-MIB.MIB	2011-Oct-24 17:52:15	28.6K	application/octet-stream
SNMPV2-SMI.MIB	2011-Oct-24 17:52:14	8.7K	application/octet-stream
SNMPV2-TC.MIB	2011-Oct-24 17:52:14	37.1K	application/octet-stream

To Download: Right-Click, Save Link As or Save Target As

Figure 51: MIBs

Diagnostics

The “Diagnostics” button will generate a text file for troubleshooting by Sencore support. This file included the configuration of the system, a log history, and current licensing of the SMD 989 to provide a complete understanding of the system. The file will be saved to the computer browsing to the SMD 989.

Unit Software Updating

To update the unit’s software click on the “**Update Unit**” button located at the top of the admin tab. This will open a dialog box as shown in Figure 52. .

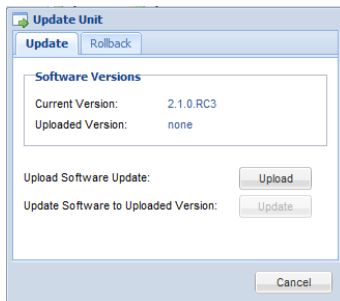


Figure 52: Updating software

The first step is to select the update file to update by clicking on the Upload button and browsing to the location of the file. Locate the file and click open, the file will automatically upload. Once upload is complete a dialog box will confirm successful upload or indicate an error while verifying the file’s contents.

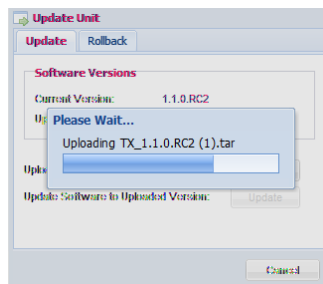


Figure 53: Uploading file

Once uploaded successfully, the uploaded version will appear on the Update Unit dialog screen.

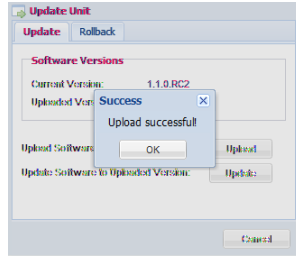


Figure 54: Upload successful

To complete update click on the update button and the unit will commence with the update process indicating when update is complete.

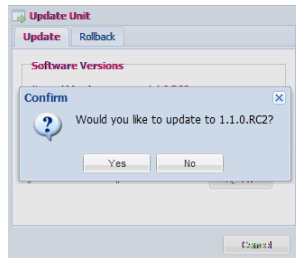


Figure 55: Update confirmation

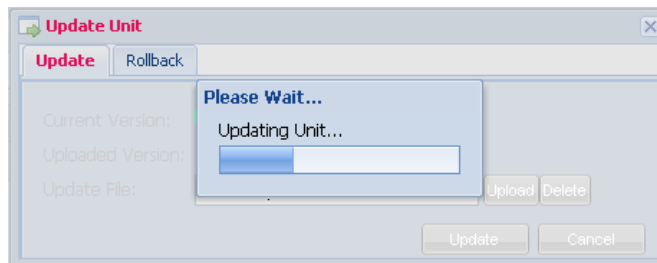


Figure 56: Updating unit

Once update is complete the system will be restarted. The user will be prompted to log back into the web interface once the unit is updated and operational.

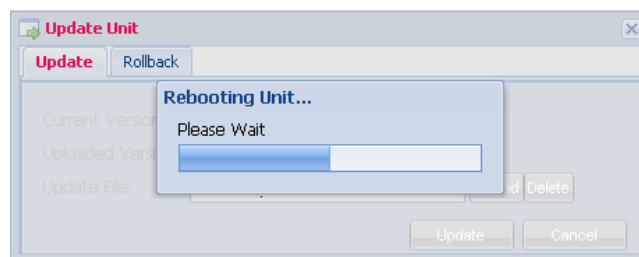


Figure 57: Unit restarting

Unit Software Rollback

The SMD 989 offers the ability to roll back to the previous version of software that was installed on the unit. The roll back feature will restore the unit back to the previous state before the latest update was performed.

The rollback option is located in the “**Update Unit**” dialog box under the rollback tab as shown in Figure 58.

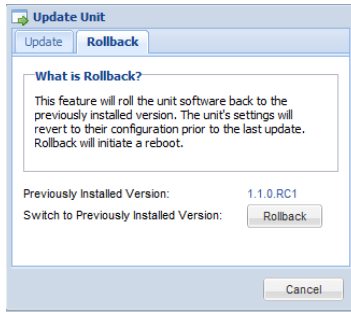


Figure 58: Software rollback

Unit License Update

The SMD 989 offers the ability to license certain features for the individual options installed into the chassis. The Update License button allows these licenses to be installed.

Upon receiving the new license code from Sencore, copy and paste the new license code into the box that appears when clicking on the “Update License” button.

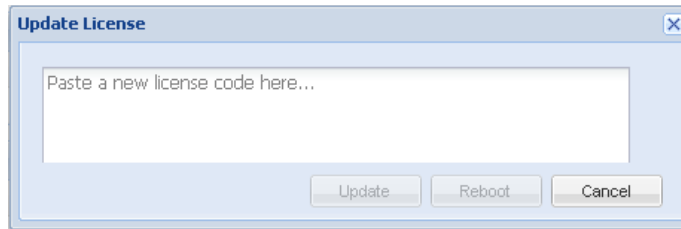


Figure 59: Update License

10 MHz Reference Clock

In the admin tab under system information, the 10 MHz reference is shown. This can either be internal or external. The reference location is autosensing meaning if an external reference is detected it will automatically switch. If no external clock is sensed, the controller will use the internal 10 MHz clock for the modulation reference.

An error can be enabled to alert the user if the external reference is lost. To enable this error monitoring please refer to the **Reporting** tab section, the error is disabled/turned-off by default.

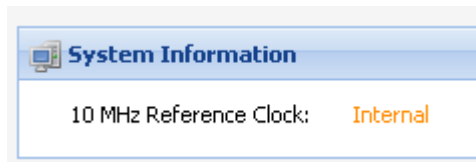



Figure 60: Reference clock

Network Configuration

In the middle of the admin tab is the IP address configuration for the physical ports. The “**Unit Network Configuration**” shows the management port’s settings. The current status is shown, but can be modified by clicking on the cog located on the left of the status.

Unit Network Configuration						
Mode	IP Address	Subnet Mask	Gateway	Hostname	MAC	
 DHCP	10.0.15.55	255.255.0.0	10.0.1.3	(none)	00:06:4D:00:1F:54	



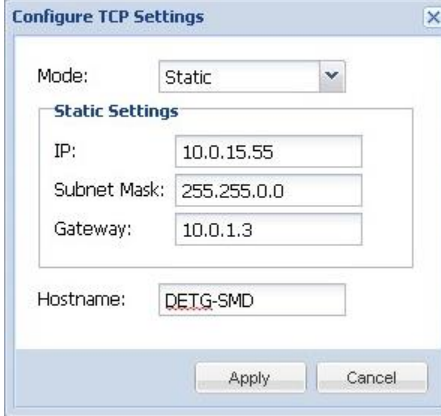
Modulator Network Configuration							
Bay	IP Address	Subnet Mask	Gateway	MAC	Link Speed	Link Status	
 1	10.0.0.61	255.255.255.0	0.0.0.0	00:06:4D:00:1F:7F	1000 Mbps	Full Duplex	
 2	10.0.0.61	255.255.255.0	0.0.0.0	00:06:4D:00:1E:8C	1000 Mbps	Full Duplex	

Figure 61: Network configuration

Clicking on the configure cog a dialog box will appear similar to Figure 62. For the modulator configuration, only IP, subnet, and gateway are allowed to be set. The management port supports DHCP and static IP addressing.

If set to DHCP the user can enter a hostname to easily access the SMD 989 by the name rather than the IP address given by DHCP. When the mode is set to static, the user has to set the IP, subnet, and gateway addresses.



The dialog box titled "Configure TCP Settings" contains the following fields and controls:

- Mode:** A dropdown menu currently set to "Static".
- Static Settings:** A group box containing three text input fields:
 - IP:** 10.0.15.55
 - Subnet Mask:** 255.255.0.0
 - Gateway:** 10.0.1.3
- Hostname:** A text input field containing "DEIG-SMD".
- Buttons:** "Apply" and "Cancel" buttons at the bottom right.

Figure 62: IP settings

Modulator Clone Settings Configuration:

The Modulator Clone function allows the modulation settings on this SMD 989 to be configured the same as another SMD 989 connected on the same network. When enabled entering the IP address of the remote unit to be cloned and the Public SNMP Community name the modulation settings will be configured the same as the remote SMD 989 modulator. The settings that will apply are listed.

Figure 63: Configure Clone Settings

- Modulation Mode
- Symbol Rate
- Modulation FEC Setting
- Pilot Insertion
- Frame Size
- Spectral Inversion
- Alpha Filter Rolloff
- Clean Carrier CW
- IF Output Frequency
- IF Output Level
- IF Output Tilt
- RF Output Frequency
- L.O. Offset
- RF Output Level

License Configuration

The user has the ability to view and change licensing to any of the options available within the SMD989 platform. A list of possible and enabled licenses are shown.

Name	Licensing	Bay Assignment
961 - DVB-S/DSSNG Modulation	Unlocked	Bay 1
962 - DVB-S2 Modulation	Unlocked	Bay 1
963 - DVB-S2 Multi-Stream Modulation	Unlocked	Bay 1
964 - DVB-S2 16 and 32 APSK	Unlocked	Bay 1
965 - 30 MSps Max Symbol Rate	Unlocked	Bay 1
966 - 45 MSps Max Symbol Rate	Unlocked	Bay 1

Figure 64: Bay License Configuration

If one license is enabled and both SMD 989 bays have hardware present, the license can be transferred between the bays by clicking on the “Configure Bay Assignment” button. A dialog box will appear allowing the license to be enabled on a certain bay. If both bays are license the dialog box will simply display both bays.

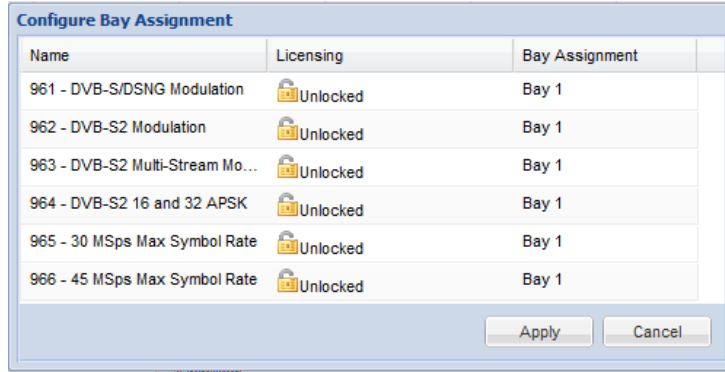


Figure 65: Configure Bay Assignment

Date/Time

The user has the ability to set the local time for the SMD 989 platform. The time can be configured using an NTP server by entering the address to synchronize the time and date or it can be entered manually as shown in Figure 66.

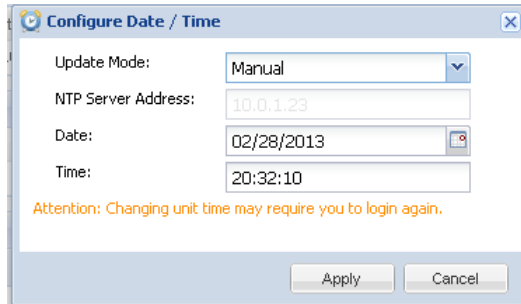


Figure 66: Date/Time configuration

SNMP Communities

The communities for the SNMP management can be changed from the default of “public” for read-only communities and “private” for read-write communities.



Figure 67: SNMP communities

SNMP Trap Managers

The managers for the SNMP management can be entered or removed by clicking on “Configure SNMP Managers”

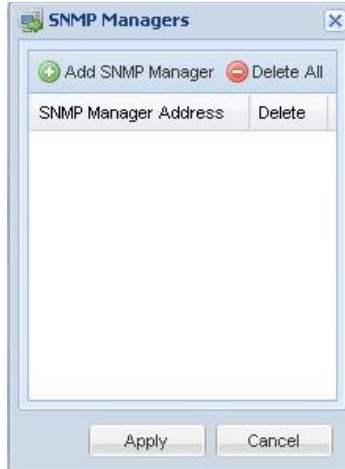


Figure 68: SNMP Managers

Alarms/Log Tab

The Alarms/Log tab holds all of the status and alarm indications for the SMD 989 platform. The Alarms/Log tab has two views Alarms and Logs.

The **Alarms view** shows the current active alarms.

State	Name	Location	Last Changed
ⓘ	ASI TS Sync Error	Bay 1, Port 1	05/10/2012 16:48:48
ⓘ	Input Failover Error	Bay 1, Stream 1	05/10/2012 16:50:49

Figure 69: Alarms reporting view

The **Logs View** shows a history of Alarms and Events. Clicking Refresh will update the log listings in the browser. Clicking Clear in the top menu bar will remove all logged alarms and events. To download and save a history of the Logs click Download and a TSV file will be downloaded from the SMD 989. The TSV file can be imported to a spreadsheet or text document.

Severity	Timestamp	Transition	Location	Message
ⓘ	12/19/2013 14:07:30	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 2941
ⓘ	12/19/2013 14:07:30	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3041 Cleared
ⓘ	12/19/2013 14:07:29	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3842
ⓘ	12/19/2013 14:07:29	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3241 Cleared
ⓘ	12/19/2013 14:07:29	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3041
ⓘ	12/19/2013 14:07:28	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 2941 Cleared
ⓘ	12/19/2013 14:07:28	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3041 Cleared
ⓘ	12/19/2013 14:07:28	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3241
ⓘ	12/19/2013 14:07:27	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 2941
ⓘ	12/19/2013 14:07:27	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3241 Cleared

Figure 70: Logs reporting view

The Logs Severity/Transition Indicators at the bottom of the Alarms/Logs menu provides a reference to the severity icons listed by each log entry. It further provides a transition event or error condition change indicators. Error logs are either informative (Info) or are unit or signal error conditions. Transition entries indicate changes between error conditions and indicate if the log entry went to good or went bad.

Severity	Timestamp	Transition	Location	Message
ⓘ	12/19/2013 18:34:45	⊖	Bay 1, Primary TS Analyzer	TS ES Error for Pid 3841 Cleared

Figure 71: Logs Severity/Transition Indicators

Alarms/Logs Configure

The “Configure” button opens a configuration screen as shown in Figure 73.

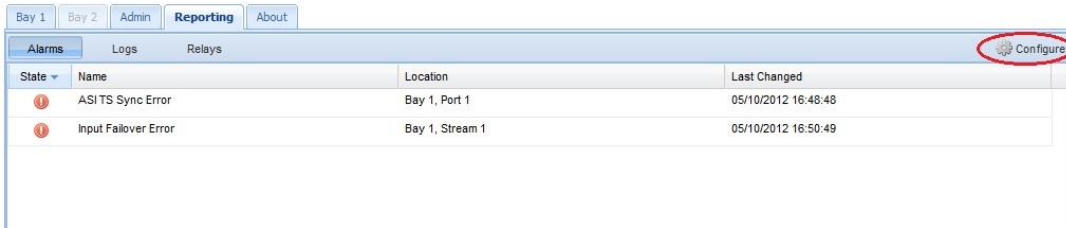


Figure 72: Alarms View - Configure

The Configure Report Information window will open. In the Conditions tab, click the + icon to expand the alarm configuration options in the Conditions tab. The Selection Options popup menu allows easier configuration of the selected alarm error condition.

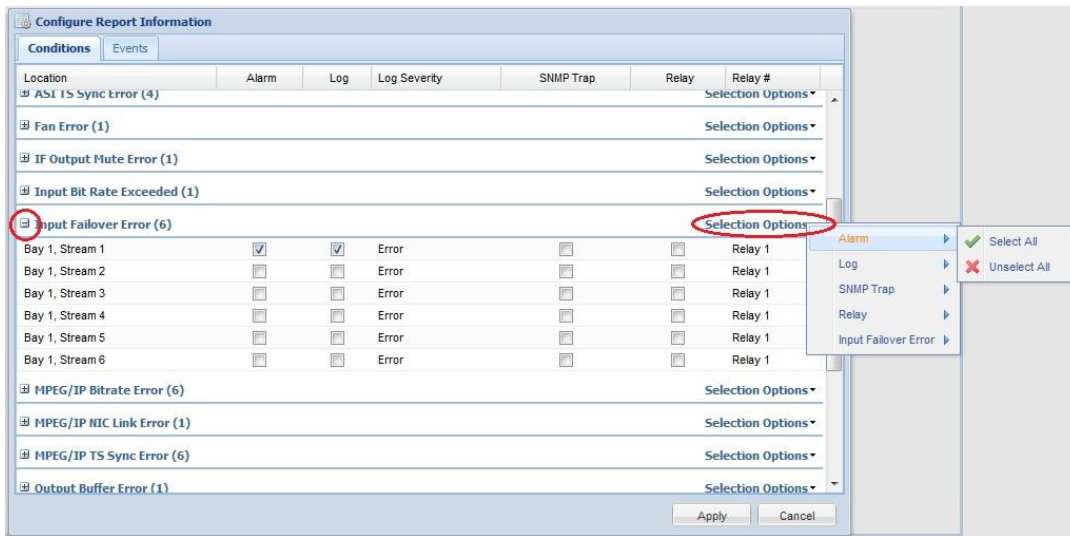


Figure 73: Alarm Configuration

The Error drop down menu is shown in Figure 74. Each condition can be configured as an error or information situation under log severity. The Alarm Relay can also be assigned and set for Relay 1 or Relay 2. When the Relay is enabled the error will trip the respective Relay at the Alarm Contact Closure connector. *Note: To see or select relay 1 and relay 2 click on the relay field to enable a dropdown arrow.*

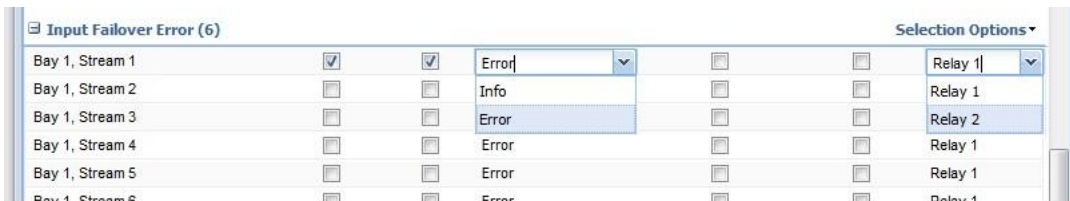


Figure 74: Alarm Error Configuration

Name	Description of Trap
10MHz Ext. Ref Clock Error	Indicates the unit's external reference source has changed between either internal or external.
12V Supply Error	Unable to detect 12V from Power Supply
3V Supply Error	Unable to detect 3V from Power Supply
5V Supply Error	Unable to detect 5V from Power Supply
ASI TS Sync Error	No ASI Sync with TS Input
ASI Bitrate Error	ASI Input Bit Rate Error
Backup Input Active	Unit switched to backup Input
Fan Speed Below Lower Limit	A fan failure has been detected
FEC Reception Error	Error in FEC detected
IF Output Mute Error	Indicates the IF output is muted
IP Loss Error	Indicates MPEG/IP Data loss
MPEG/IP Bitrate Error	Indicates IP Bit Rate Error
MPEG/IP NIC Link Error	Indicates the MPEG/IP Data Link is broken
MPEG/IP TS Sync Error	Indicates MPEG/IP Data interface cannot sync with the TS
RTP Reception Error	RTP reception errors indicated
Output Buffer Error	Data underflow/overflow in buffer, rate adaption issue where TS packets are discarded
TS Continuity Count Error	TS Analysis – CC Error indicated in TS Header
TS ES PID Error	TS Analysis – PID error in ES
TS PAT Error	TS Analysis – PAT CC error
TS PMT Error	TS Analysis – PMT CC error
TS Sync Byte Error	TS Analysis – TS sync byte
TS Sync Loss Error	TS Analysis – Sync Loss
Temperature Error	Internal temp. is outside range of 0 to 45 Celsius
Upconverter IF Input Freq. Error	Not within auto-lock range of 70 or 140 MHz
Upconverter IF Input Level Error	Indicates IF input is not within the acceptable level range for the upconverter
Upconverter Mute Error	Indicates the RF upconverter is muted
Upconverter Oscillator Error	Indicates a loss of oscillator or communication
Upconverter Output Error	Indicates loss of RF upconverter output or system communications

Figure 75: Alarm descriptions

Error handling voltage and temp limits that will trigger an alarm if exceeded:

3 Volt Controller Supply

sensor3VMinLimit.0 - 3.10 VDC
 sensor3VMaxLimit.0 - 3.50 VDC

5 Volt Controller Supply
 sensor5VMinLimit.0 - 4.70 VDC
 sensor5VMaxLimit.0 - 5.30 VDC

12 Volt Controller Supply
 sensor12VMinLimit.0 - 11.28 VDC
 sensor12VMaxLimit.0 - 12.72 VDC

Unit Temperature
 sensorTempMinLimit.0 - 0 C
 sensorTempMaxLimit.0 - 45.00 C

The Events tab allows the setup of Events reporting and actions. Events are notable status changes in the SMD 989. Click the + icon to expand the event configuration options. The Selection Options popup menu allows easier configuration of the selected event. Refer to Figure 77. Event Descriptions.

Location	Log <input checked="" type="checkbox"/>	SNMP Trap <input type="checkbox"/>	Relay <input type="checkbox"/>	Relay #	Relay Duration
+ 10 MHz Reference Source Changed (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms
+ Date/Time Changed (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms
+ NTP Updated (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms
+ Software Update Failed (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms
+ Software Update Succeeded (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms
+ Unit Booted (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms
+ Unit Shutdown (1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relay 1	200 ms

Figure 76: Event Configuration

Name	Description of Event
10MHz Ext. Ref Clock Change	Indicates the external reference clock was not present
Date/Time Change	The unit's date/time has been changed
NTP Update	The unit's date/time was updated by the NTP server
Software Update Failed	The software update did NOT complete successfully
Software Update Succeeded	The software update completed successfully
Unit Booted	The unit has been started
Unit Shutdown	The unit was shutdown

Figure 77: Event descriptions

SNMP Trap Configurations

The SNMP trap configurations can be viewed under the reporting tab by clicking the “**Configurations**” at the top-left of the report control panel. All conditions can be enabled/disabled from sending SNMP Traps. The current status is shown under configuration. To enable/disable the SNMP events click on the “**Configure**” button located on the right side of the screen.

The SNMP trap manager IP addresses can be added under the admin tab and the events that trigger traps to be sent are enabled/disabled under configure settings.

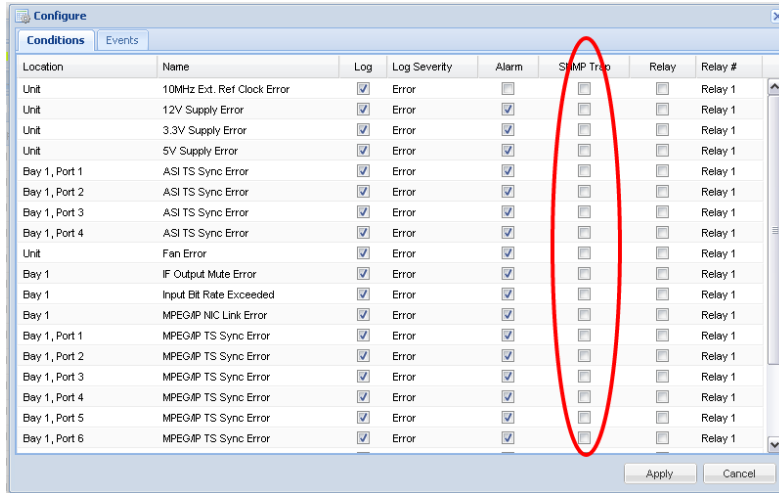


Figure 78: SNMP trap view

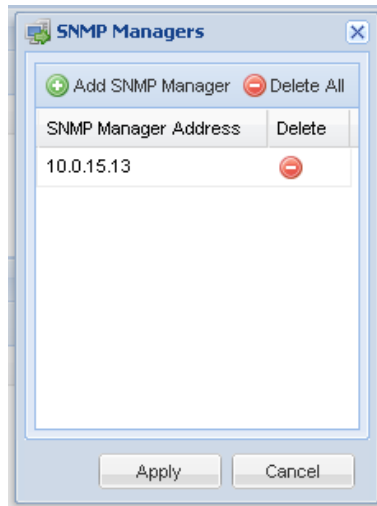


Figure 79: SNMP manager configuration

Name	Description of Trap
10MHz Ext. Ref Clock Error	Indicates the unit's external reference source has changed between either internal or external.
12V Supply Error	Unable to detect 12V from Power Supply
3V Supply Error	Unable to detect 3V from Power Supply
5V Supply Error	Unable to detect 5V from Power Supply
ASI TS Sync Error	No ASI Sync with TS Input
ASI Bitrate Error	ASI Input Bit Rate Error
Backup Input Active	Unit switched to backup Input
Fan Speed Below Lower Limit	A fan failure has been detected
FEC Reception Error	Error in FEC detected
IF Output Mute Error	Indicates the IF output is muted
Input Bit Rate Exceeded	The incoming bitrate exceeds the symbol rate and modulation configuration.
IP Loss Error	Indicates MPEG/IP Data loss
MPEG/IP Bitrate Error	Indicates IP Bit Rate Error
MPEG/IP NIC Link Error	Indicates the MPEG/IP Data Link is broken
MPEG/IP TS Sync Error	Indicates MPEG/IP Data interface cannot sync with the TS
RTP Reception Error	RTP reception errors indicated
Output Buffer Error	Data underflow/overflow in buffer, rate adaption issue where TS packets are discarded
TS Continuity Count Error	TS Analysis – CC Error indicated in TS Header
TS ES PID Error	TS Analysis – PID error in ES
TS PAT Error	TS Analysis – PAT CC error
TS PMT Error	TS Analysis – PMT CC error
TS Sync Byte Error	TS Analysis – TS sync byte
TS Sync Loss Error	TS Analysis – Sync Loss
Temperature Error	Internal temp. is outside range of 0 to 45 Celsius
Upconverter IF Input Freq. Error	Not within auto-lock range of 70 or 140 MHz
Upconverter IF Input Level Error	Indicates IF input is not within the acceptable level range for the upconverter
Upconverter Mute Error	Indicates the RF upconverter is muted
Upconverter Oscillator Error	Indicates a loss of oscillator or communication
Upconverter Output Error	Indicates loss of RF upconverter output or system communications

Figure 80: SNMP trap descriptions

About Tab

The about tab provides the software and hardware details and versions for the equipment found within the SMD 989 platform. It further provides licensing information although added information on licensing may be found in the ADMIN tab. This information will be referenced when talking to technical support. The contact information is also provided for reaching technical support.

The screenshot shows the 'About' tab selected in a navigation menu. The main content area is titled 'About Control Panel' and contains three sections:

- System Information:** Displays 'Software Version: 2.1.0.RC3' and 'Serial Number: 6912676 R10'.
- Hardware Information:** A table listing hardware components across different locations.
- Unit Licenses:** A table listing various licenses, their amounts, support status, and bay assignments.

Location	Type	Model	Assembly	Name	Pi	Revision	Run	Serial
Bay 1	DVB-S/S2 Modulator	SMD 910	2	1140	001	F	12	0009 R10
Bay 1: Option	L-Band Upconverter	SMD 920	2	1143	0	D	10	0030
Center	System Controller	SMD 989	2	1142	001	D	12	0000003

Name	Licensing	Amount	Supported	Bay Assignment
961 - DVB-S/DSNG Modulation	Unlocked	1	Supported	Bay 1
962 - DVB-S2 Modulation	Unlocked	1	Supported	Bay 1
963 - DVB-S2 Multi-Stream Modulation	Unlocked	1	Supported	Bay 1
964 - DVB-S2 16 and 32 APSK	Unlocked	1	Supported	Bay 1
965 - 30 MSps Max Symbol Rate	Unlocked	1	Supported	Bay 1
966 - 45 MSps Max Symbol Rate	Unlocked	1	Supported	Bay 1

Figure 81: About page

Controlling the SMD 989 Using the Front Panel

This section of the user manual covers the menus and operation of the SMD 989 platform using the front panel for control. All functionality of the front panel is also capable through the Web User Interface.

Once the SMD 989 is finished loading, depending on the number of bays populated, a screen similar to the ones on the right will appear. An SMD 989 with two modulators is indicated by Bay 1 and Bay 2.

```
Bay1:Modulator Bay2:Modulat ↔↓↵
40.000 MSps    20.000 MSps
4Streams S2CCM 4Streams S2VCM
RF:1450.00 MHZ RF:2150.00 MHZ
                4 Errors
```

Press the Up or Down arrow key and, the main menu will be displayed as shown to the right.

The user can select from the following:

- Modulator settings for the particular bay
- Administrator settings for network, time, and lockout settings
- Alarm/Logs for alarms, logs, and SNMP trap information
- About for system software/firmware versions

```
                                MAIN MENU    ↓↵
>BAY 1: MODULATOR CONFIG
ADMIN
ALARM/LOGS
ABOUT
```

Front Panel Quick Actions Menu

From the first or opening menu, press the Left or Right arrow key and, the Quick Actions menu (Left arrow = Bay 1, Right arrow = Bay 2) will be displayed as shown to the right. The Quick Actions menu allows quick access to the following settings:

- Mute: mutes the RF & IF outputs
- Clear Carrier Only: in Disabled mode the output is modulated. Enabled the output is in Clean Carrier mode. (CW only)
- RF Level allows setting the output from -30.0 to +5.0 dBm.
- *(Levels change immediately on output upon incrementing the level values in the respective digits via the front panel display)*

```
                                BAY 1: QUICK ACTIONS  ↓↵
>MUTE ALL
CLEAN CARRIER ONLY: DISABLED
RF LEVEL: -20.0 dBm
```

Front Panel Modulator Settings

Select the modulator settings from the main menu, the user will be able to set input, modulation, and output parameters for the given bay the modulator is installed.

```

BAY 1: MODULATOR CONFIG  ↓↵
>INPUT CONFIGURATION
MODULATION CONFIGURATION
TS ANALYSIS CONFIGURATION
OUTPUT CONFIGURATION
    
```

Modulator Input Configuration

Once input configuration is selected, all available inputs ASI and IP will be shown.

```

BAY 1: INPUT CONFIGURATION ↓↵
>ASI 1: ALIAS NAME
ASI 2: TEST
ASI 3: NOT USED
IP 1: LIVE INPUT
IP 2: BACKUP INPUT
    
```

Selecting any of the specific ASI or IP ports, the individual settings can be modified.

ASI Settings and status include:

- Enabling/Disabling the port
- Entering an alias that can be used to name the input for easy reference in the future
- Synchronization status
- Packet size
- Bitrate (Mbps)

```

INPUT STATUS: BAY 1: ASI 1  ↓↵
>PORT: ENABLED
ALIAS: ALIAS NAME
SYNC: SYNCHRONIZED
PACKET SIZE: 188-BYTE
BITRATE: 19.392 MBPS
    
```

IP Settings and status include:

- Enabling/Disable the port
- Entering an alias that can be used to name the input for easy reference in the future
- Routing: Destination IP address
- Destination port
- TS Packets per IP packet
- Synchronization status
- Bitrate (Mbps)
- IP input buffer (100 KB – 4 MB)
- IP IGMP versioning
- Transport Protocol
- Packet Counters (SMD 912(A))
- FEC Row/Column Info (SMD 912(A))

```

INPUT STATUS: BAY 1: IP 1  ↓↵
>RECEIVE: ENABLED
ALIAS: LIVE INPUT
ROUTING: MULTICAST
ADDRESS: 237.0.0.10
DESTINATION PORT: 1234
    
```

```

INPUT STATUS: BAY 1: IP 1  ↓↵
>TS PACKETS / IP PACKETS: 7
SYNC: SYNCHRONIZED
BIT RATE: 10.486 MBPS
BUFFER: 1000 KB
DISPLAY DELAY: 84 MS
    
```


Modulator Configuration – Modulation Mode/Configuration

The Modulator Configuration menus are found under the Bay 1 and Bay 2 listings in the Main Menu. The Modulator Configuration menu has several menus which configure the modulator. The menus vary with hardware and licensing options. The modulation mode is selected in the Modulation Mode field. Depending on the options installed, the modulation mode might be limited to only CCM (single). The modulation parameters change depending on the type of modulation mode selected.

Modulation Mode

- DVB-S/DSNG
- S2 Multi –CCM (SMD 910)
- S2 Multi-VCM (SMD 910)
- S2 Single –CCM
- S2X Single-CCM
- TurboPSK

When in a CCM/VCM multistream mode a new menu is presented to the user under modulation parameters. This new menu allows the user to set global and individual stream settings.

Note: If multistream DVB-S2 VCM is selected, Modulation, FEC, and Pilot Insertion will be set for each individual stream. If multistream DVB-S2 CCM is selected, the modulation and FEC will be located under the modulator parameters.

```

BAY 1: MODULATOR CONFIG ↓↵
INPUT CONFIGURATION
>MODULATION CONFIGURATON
TS ANALYSIS CONFIGURATION
OUTPUT CONFIGURATION
    
```

```

BAY 1: MODULATION MODE ↓↵
MODULATION PARAMETERS
>MODULATION MODE: S2 MULTI-CCM
BISS CONFIGURATION
PRBS CONFIGURATION
CARRIER ID CONFIGURATION
    
```

```

BAY 1: MODULATOR PARAMETER ↓↵
>GLOBAL SETTINGS
STREAM 1: ASI1 ALIAS NAME
STREAM 2: ASI2 TEST
STREAM 3: IP1 LIVE
STREAM 4: IP2 BACKUP
    
```

```

GLOBAL SETTINGS ↓↵
>SYMBOL RATE: 20.014553 MSPS
MINIMUM: 16.45536 MSPS
FRAME SIZE: NORMAL
SPECTRAL INVERSION: NORMAL
    
```

This screen is the global settings when in DVB-S2 multistream (VCM) mode.

```

GLOBAL SETTINGS ↓↵
FRAME SIZE: NORMAL
SPECTRAL INVERSION: NORMAL
ALPHA FILTER ROLLOFF: 0.35
>CARRIER WAVE: DISABLED
    
```

This screen is the multistream (VCM) individual stream settings

```

MODULATION: BAY 1: STREAM 1 ↓↵
>INPUT: ASI1 UNIT ALIAS
MODULATOIN/FEC: 8PSK 2/3
PILOT INSERTION: ENABLED
ISI: 002
    
```

Modulator Configuration – Modulator Parameters (Inputs)

The Modulation Parameters menu provides configuration of the parameters of the modulator. It includes the following line listings in the front panel menus. Listings differ depending on the modulation mode selected.

Modulation Parameters

- Primary Input
- Backup Input
- Active Input
- Switch to Primary/Secondary Input
- Configure Failover
- Enter Rate By
- Symbol Rate
- Max Bitate
- Modulation/FEC
- Pilot Insertion
- Frame Size
- Spectral Inversion
- Alpha Filter rolloff
- Clean Carrier Only
- Rate Adaption
- PL Scrambling Code
- PRBS

Primary Input: Selects the input signal that is routed to the modulator. User may select from any input available on the SMD910 or SMD912.

Backup Input: Selects an input to serve as a backup input should the primary input meet failover conditions or a user desires to switch manually to a backup input. User may select from any input available on the SMD910 or SMD912.

Note: When selecting inputs to the modulator be sure that the inputs selected are enabled in the Input Configuration Menu and properly configured.

Active Input: This field indicates the currently active or selected input.

Primary Input; Indicates the Primary Input is active and being routed to the modulator.

Backup Input: Indicates the Backup Input is active and being routed to the modulator

Switch to Backup/Primary Input: This field permits manual switching to the primary or backup input from the currently active input.

```
BAY 1: MODULATOR CONFIG ↓↵
INPUT CONFIGURATION
>MODULATION CONFIGURATION
TS ANALYSIS CONFIGURATION
OUTPUT CONFIGURATION
```

```
BAY 1: MODULATION MODE ↓↵
>MODULATION PARAMETERS
MODULATION MODE: S2 MULTI-CCM
BISS CONFIGURATION
PRBS CONFIGURATION
CARRIER ID CONFIGURATION
```

```
BAY 1: MODULATION CONFIG ↓↵
>PRIMARY INPUT: ASI1
BACKUP INPUT: IP1
ACTIVE INPUT: ASI1 (PRIMARY)
SWITCH TO BACKUP INPUT
```

```
BAY 1: MODULATOR MODULATION ↓↵
>CONFIGURE FAILOVER
ENTER RATE BY: SYMBOL RATE
SYMBOL RATE: 38.000000 MSPS
MAX BITRATE: 49.4564248 Mbps
```

```
BAY 1: MODULATOR MODULATION ↓↵
>MODULATION FEC: 8PSK 5/6
PILOT INSERTION: DISABLED
FRAME SIZE: NORMAL
SPECTRAL INVERSION: INVERTED
```

```
BAY 1: MODULATOR MODULATION ↓↵
>ALPHA FILTER ROLLOFF: 0.35
CLEAN CARRIER ONLY: DISABLED
RATE ADAPTATION: ENABLED
PL SCRAMBLING CODE: 000000
PRBS: DISABLED
```

Modulator Configuration – Modulator Parameters (Failover)

Failover: This field provides options to enable a Backup Input in the event of a Primary Input fault. Failover and Restore selection must to applied, after changes select the Apply Changes field and press the ENTER front panel key.

Failover to backup options include:

- Primary Sync Loss
- Primary TS Error
- Manual Only

```
BAY 1: MODULATOR MODULATION
SWITCH TO BACKUP INPUT
>CONFIGURE FAILOVER
ENTER RATE BY: SYMBOL RATE
SYMBOL RATE: 38.000000 MSPS
MAX BITRATE: 49.4564248 Mbps
```

TS Sync Loss mode allows the SMD 989 to switch to backup if the primary input transport sync is lost. In the TS Analysis mode failover is based on transport stream errors or sync loss. This allows the SMD 989 to switch to a backup source when there are errors in the transport stream even if it does not lose sync.

```
BAY 1: FAILOVER CONFIG ↓↵
FAILOVER: PRIMAY TS ERROR
RESTORE: BACKUP TS ERROR
>APPLY CHANGES
>FAILOVER CONDITIONS
```

Restore: This field defines the conditions which direct the modulator to return or switch back to the primary input.

Restore to primary options include:

- Primary TS Sync Restored
- Backup TS Sync Loss
- Primary TS Error
- Manual Only
- Primary TS Analysis Restored
- Backup TS Analysis Failure

```
BAY 1: FAILOVER CONDITIONS ↓↵
+1.1 SYNC LOSS ERROR
05 SEC
>+1.2 SYNC BYTE ERROR
05 SEC
```

```
BAY 1: FAILOVER CONFIG ↓↵
+1.3A PAT ERROR
05 SEC
+1.4 CONTINUITY COUNT ERROR
05 SEC
```

The restore to primary options depend on the Failover setting. If failover to backu is TS Sync Loss, restore can be set to Primary TS Sync Restored, or On Backup TS Sync Loss. The switchover Interval(s) can be set from 1 to 20 seconds. If switch to Backup is set to Manual, Restore to Primary can only be set to Manual.

```
BAY 1: FAILOVER CONFIG ↓↵
+1.5A PMT ERROR
05 SEC
+1.6 ES PID ERROR
05 SEC
+NULL PACKET ERROR
05 SEC
```

If **TS Analysis Failure (option)** is selected, Restore options are Manual Only on Primary TS Analysis Restored or On Backup TS Analysis Failure.

Failover conditions can be enabled/disabled and Switch After interval can be set from 1 to 30 seconds. The switch after intervals for each of the TS analysis categories defines a wait time or delay before the modulator switches to the backup or switches from backup to primary when TS analysis errors are detected. If the TS Errors are corrected within this time the switch is not implemented and the TS analysis resumes.

IMPORTANT NOTES: 1. When selecting *TS Analysis Failover for Primary or Backup inputs*, the *TS Analysis* feature must be enabled or active for the respective primary and/or backup. See the *TS Analysis Configuration* menu.

3. You cannot use the *TS Analysis* for failover when you are setup to output *VCM* or *CCM Multistream* with the *SMD910* modulator.

Modulator Configuration – Modulator Parameters

The **Enter Rate** field provides the user a choice of how to setup the modulator's output Symbol Rate or Max Bitrate entry fields. The values in these fields are mathematically related depending on the modulation mode, modulation type, and FEC settings. The SMD 989 contains an internal symbol rate or max. input bitrate calculator to assist. It is recommended that you first select the modulation/FEC code you wish to use.

```
BAY 1: MODULATOR MODULATION ↑↓
CONFIGURE FAILOVER
>ENTER RATE BY: SYMBOL RATE
SYMBOL RATE: 38.000000 MSPS
MAX BITRATE: 49.4564248 Mbps
```

Enter Rate By

- **Output Symbol Rate**
- **Input Bitrate**

Description: Output Symbol Rate mode allows the entry of the desired output symbol rate. The SMD 989 calculates the maximum input bit rate and lists it in the Max. Bitrate field.

Description: Input Bit Rate mode allows the entry of a known input bit rate. The SMD 989 then calculates the needed symbol rate and lists it in the Symbol Rate field.

With output Symbol Rate you enter the desired output symbol rate. It must be mathematically proper based upon the input bit rate measured by the system. When a higher than needed symbol rate is entered, the modulator inserts null packets to achieve the rate. When entering a lower than needed symbol rate the SMD 989 removes nulls, if they exist, from the stream.

With Input Bitrate, the SMD 989 uses the entered bitrate along with the modulation settings to calculate the needed symbol rate. If it is known that the input transport stream contains a significant amount of null packets it is possible to enter a bitrate that is lower than the actual input transport stream bitrate. In this case the SMD 989 will remove existing nulls. **Note: There must be enough nulls in the input transport stream to be removed to allow the lower bitrate or symbol rate or errors in the transmission transport stream result.**

Modulation/FEC: This field selects the modulator's output modulation type and FEC code for the selected modulation mode on page 73.

Pilot Insertion (Enabled/Disabled) (Available in DVB-S2, DVB-S2X Modes)

Description: When enabled, every 16 slots of 90 symbols the modulator will insert 36 non-modulated symbols to aid in receiver synchronization.

```
BAY 1: MODULATOR MODULATION ↑↓
>MODULATION FEC: 8PSK 5/6
PILOT INSERTION: DISABLED
FRAME SIZE: NORMAL
SPECTRAL INVERSION: INVERTED
```

Frame Size (Available in DVB-S2 and DVB-S2X Modes)

- **Normal (64,800 bits)**
- Short (16,200 bits)

Description: Short frames introduce more overhead but give a shorter encapsulation delay. Short frames are 4 time shorter than normal frames.

Spectral Inversion: This field sets the spectrum to inverted or normal.

- **Normal**
- Inverted

Note: When the SMD 920 L-Band option is installed, the default spectral inversion is inverted as the upconverter is set to invert. Setting the output to Inverted will give a normal output from the upconverter. This is shown in the RF Output status for Spectral Inversion.

Alpha Filter Rolloff

- 0.35
- 0.25
- 0.20
- 0.15
- 0.10
- 0.05

```

BAY 1: MODULATOR MODULATION ↓↵
>ALPHA FILTER ROLLOFF: 0.35
CLEAN CARRIER ONLY: DISABLED
RATE ADAPTATION: ENABLED
PL SCRAMBLING CODE: 000000
PRBS: DISABLED

```

Description: The filter rolloff is known as the Alpha coefficient (α). The smaller the α , the less bandwidth will be required on the satellite. Rolloff in DVB-S limited to 0.35, 0.25 and 0.20.

Clean Carrier Only (Disabled/Enabled)

Description: When set to Enabled the modulator outputs only a cw carrier for testing purposes.

Rate Adaptation (Disabled/Enabled) Only available in DVB-S2 or DVB-S2X single mode)

Description: When enabled a rate adaption is applied. When disabled the rate adaptatiois not active. Rate adaptation adds or removes null packets and re-stamps PCRs in order to match TS bitrate to the modulation payload rate.

PL Scrambling Code (6 digit value entry)

Description: This is used to specify a randomized scrambling sequence applied to each PL frame and initiated at the end of each PL header. Scrambling randomizes band energy dispersion and allows for a “signature” when may provide association to a satellite operator or satellite. The complex code relates to an “n” value defined by an entry of 0 to 262 141.

PRBS (Enabled/Disabled)

Description: When Enabled the PRBS replaces the normal input modulation feeding the modulator with a PN23 normal or inverted BERT test signal. Select Disabled for normal output applications.

IMPORTANT: For normal or non-testing applications in which the input is to be used to modulate the satellite IF or L-Band carrier output, the PRBS test signal must be set to DISABLED.

Sync Byte Deletion: (Enabled/Disabled)

Description: This selection permits removal of the incoming MPEG stream sync bytes from reaching the modulator. This saves a bandwidth of 1 byte every 188 bytes. When set to Enabled, the modulator blocks the incoming Sync Byte. When Enabled the receive demodulator must reinsert it. When Disabled the modulator receives the full transport stream including the Sync Bytes.

Reduced Latency: (Only in Turbo PSK mode)

Reduced Latency Selections

- **Disabled:** (Default) No latency reduction - with additional input buffering
- Normal: Introduces slight latency without additional input buffering
- Reduced 1: Adds latency reduction to the Normal mode
- Reduced 2: Adds latency reduction to the Reduced 1 mode
- Reduced 3: Adds latency reduction to the Reduced 2 mode
- Minimum: Adds latency reduction to the Reduced 3 mode

```

BAY 1: MODULATOR MODULATION ↓↵
SPECTRAL INVERSION
>ALPHA FILTER ROLLOFF: 0.3
SYNC BYTE DELETION: ENABLED
REDUCED LATENCY: DISABLED
    
```

Description: The reduced latency modes of the TurboPSK modulation provides several levels of latency that can be applied. The reduced latency modes are only applicable to special low symbol rate data satellite applications using the TurboPSK modulation.

Modulator Configuration- BISS Configuration

Configure BISS Scrambling (SMD 971 Option) The BISS Scrambling is configured by selecting the BISS tab in the Configuration Modulator window. When BISS Scrambling is enabled the entire transport stream will be scrambled. A CA_descriptor will be added to the PMT and CAT table if one does not exist. If a CAT table does exist it will be altered.

```

BAY 1: MODULATOR CONFIGURAT ↓↵
MODULATION PARAMETERS
MODULATION MODE: S2 SINGLE-CCM
>BISS CONGIGURATION
PRBS CONFIGURATION
CARRIER ID CONFIGURATION
    
```

Scrambling: Set to Enable to scramble the Transport Stream. When disabled the transport stream is not encrypted and therefore does not require a BISS key at the receiver.

Enable/Disabled (Disabled is Default)

BISS Mode 1: Allows the entry of an unencrypted twelve (12) character hex session word.

BISS Mode E: Allows the entry of an encrypted sixteen (16) character hex session word along with a 14 character hex and cannot be viewed from the front panel or any remote interface.

```

BISS CONFIGURATION ↓↵
SCRAMBLING: ENABLED
>BISS MODE: MODE 1
SESSION WORD: *****
    
```

Session Word: Provides the entry field to specify the BISS mode 1 or mode e encryption key.

Modulator Configuration- PRBS Configuration

Configure PRBS (PRBS Pseudo Random Binary Sequence) Configuration menu. This menu provides selection of the available PRBS test signal available for use with either the SMD910 or SMD912 modulators. The PRBS feature provides a digital test signal with known properties used for BERT (bit error rate testing) of satellite equipment or transmission paths. Test signals used are a binary PN (Pseudo-Noise) signal known as a PN-23 or Inverted PN-23.

PN23 Normal: A normal version of the Pseudo-Noise PN-23 test signal

PN 23 Inverted: An inverted version of the Pseudo-Noise PN-23 test signal

When Enabled, the normal input signal to the modulator is removed and replaced with the selected PN-23 or Inv PN-23 signal. The PRBS signal is enabled in the Modulation Configuration menu.

```
BAY 1: MODULATOR CONFIGURAT ↓↵
MODULATION PARAMETERS
MODULATION MODE: S2 SINGLE-CCM
>BISS CONGIGURATION
PRBS CONFIGURATION
CARRIER ID CONFIGURATION
```

```
BAY 1: PRBS CONFIGURAT ↓↵
PRBS MODE: PN23 (NORMAL)
```

Modulator Configuration- Carrier ID Configuration

The Carrier ID Configuration settings permit viewing of the Global Unique ID and permit entry and enabling of the latitude, longitude, telephone and user data to the CID information fields. Select the CARRIER ID CONFIGURATION in the MODULATOR CONFIGURATION menu.

Global Unique ID:

A CID carrier may be added to the modulaotor transmission that contains a unique identifier value. The Global Unique Identifier is a fixed value for the equipment manufacturer and is not editable by the user. It may be derived from a 48 bit MAC address or a 48 bit Space Data Association modulator identifier.

Transmission: Provides an enable or disable selection for the CID transmission.

- Enabled
- **Disabled**

Description: When enabled, a CID transmission is generated and added to the output. When disable no CID output including the Global Unique ID and Information fields are output

```
BAY 1: MODULATOR CONFIGURAT ↓↵
MODULATION PARAMETERS
MODULATION MODE: S2 MULTI-CCM
BISS CONFIGURATION
PRBS CONFIGURATION
>CARRIER ID CONFIGURATION
```

```
CARRIER ID CONFIGURATION ↓↵
GLOBAL UNIQUE ID
2E:00:06:4D:FF:FF:00:1F:67
TRANSMISSION: ENBABLED
TRANSMISSION LATITUDE: ENABLED
```

Latitude: Provide entry of a latitude pure decimal value to the CID information field.

- Enable/**Disabled**

- Entered Value

Description: When enabled, the entered latitude value is added to the Information Field of the CID transmission. Enter values 0 to 90 with up to 3 decimal places. Enter positive values for northern hemisphere and negative values for the southern hemisphere. When disabled, the latitude value is not transmitted in the CID.

Longitude: Provides entry of a longitude decimal value to the CID information field.

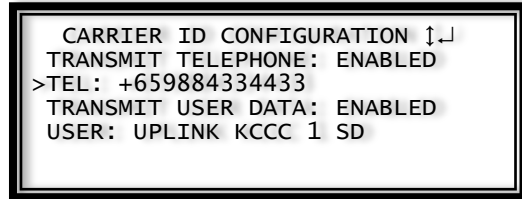
- Enable/**Disable**
- Entered Value



Description: When enabled, the entered longitude value is added to the Information Field of the CID. Enter values 0 to 180 with up to 4 decimal places. Enter positive values for eastern hemisphere and negative values for the western hemisphere. When disabled, the longitude value is not transmitted in the CID.

Telephone: Provides an entry of a contact phone number with an extension number to the CID Information Field.

- Enable/**Disable**
- Entered Value



Description: When enabled, the entered phone number is added to the Information Field of the CID. You may enter up to 18 digits or a total of 17 digits if an extension number is entered in the ext. field. When disabled, the telephone number is not transmitted in the CID.

User Data: Provides an entry of up to 24 characters for including a message in the CID Information Field.

- Enable/**Disabled**
- Text Entry Field

Description: When enabled, the user data or entered characters are added into the CID Information Field. Up to 24 characters may be entered and transmitted as user data. When disabled, the user data is not transmitted in the CID.

Note: When a CID carrier is enabled and added to the transmission or modulated RF output of the SMD 989 it slightly degrades the MER performance of the RF transmission.

Entering CID Values: The latitude, longitude, telephone and user data Carrier ID Configuration fields are all fields which permit user data selection/entry. Press the UP or DOWN arrow front panel pushbutton to position the arrow in front of the selection row in the menu. Press the front panel ENTER button to enter. A field is highlighted as the selected digit or character. Press the UP or DOWN front panel buttons to increment through available values or characters in that field. Press the LEFT or RIGHT arrow buttons to move to the next field and repeat until the desired value is entered.

TS Analysis Configuration

Configure TS Analysis (SMD 970 option) The Configure TS Analysis allows the setup of TS Analysis. TS Analysis errors are as defined by TR 101 290 [4].

TS Analysis

- Enabled
- Disabled

```
BAY 1: MODULATOR CONFIG
INPUT CONFIGURATION
MODULATION CONFIGURATION
>TS ANALYSIS CONFIGURATION
OUTPUT CONFIGURATION
```

When set to Enabled the TS Analysis feature becomes active and analyzes the incoming primary and/or secondary stream. Errors are detected based upon the threshold criteria defined in the TS Error Configuration menu. Detected errors may be used as alarms, logged errors, SNMP traps, or triggers to switch inputs or an external relay.

```
BAY 1: TS ANALYSIS CONFIGURAT
>TS ANALYSIS ON PRIMARY
TS ANALYSIS ON SECONDARY
```

PID Filter

The Pid Filter provides selection of individual Pids within the incoming transport stream in which you do not want the TS Analysis to actively analyze. This eliminates unwanted TS Analysis error logs or alarms on Pids known to contain conditions not compliant with TR 101 290 criteria.

- Add
- Remove

```
BAY 1: TS ANALYSIS ON PRIMARY
PRIMARY TS ANALYSIS: ENABLED
>TS ERROR CONFIGURATION
PID FILTER
<< NO TS ERRORS >>
```

Description: To add a Pid select the Add or Remove row and press ENTER. Use Up and Down arrows to increment each digit to the desire Pid value. Use the Left and Right arrow keys to move to different digit fields. Press the ENTER key to accept the value. To remove select the Remove row and press Enter. Use Up and Down arrow keys to place the marker in front of Pid value to be deleted. Press the Enter key to delete.

```
BAY 1: PID FILTER
> ADD Pid
REMOVE Pid
1200
900
```

TS Analysis Errors/Thresholds

Errors – Threshold

- **Sync Loss (1.1):** an error will be indicated when sync has been lost for at least 1 second.
- **Sync Byte (1.2):** Corruption: an error will be indicated when the number of errors/second entered has been exceeded. Can be set from 1 to 999 errors/second.
- **PAT Error (1.3):** an error will be indicated when the PAT is not present for a period exceeding the time entered (in ms) Can be set from 100ms to 10000ms. Default is 500ms.
- **Continuity Count Error (1.4):** an error will be indicated when the number of detected Continuity Count Error per second exceeds

```
BAY 1: TS ERRORS
1.1) SYNC LOSS
1.2) SYNC BYTE CORRUPTION
> THRESHOLD: .001 ERRORS/SEC
1.3a) PAT ERROR
```

the value entered. Can be set from 1 to 999 errors per second. Default is 1 error per second.

- **PMT Error (1.5a):** an error will be indicated when the PMT is not present for a period exceeding the time entered (in ms). Can be set from 100ms to 10000ms. Default is 500ms.

```
BAY 1: TS ERRORS
1.4) CONTINUITY COUNT ERROR
THRESHOLD: .001 ERRORS/SEC
1.5a) PMT ERROR
THRESHOLD: 00500 ms
```

- **ES PID Error (1.6):** an error will be indicated when an Elementary Stream (ES) is not present for a period exceeding the time entered (in ms). Can be set from 100ms to 10000ms. Default is 500ms. The modulator elementary stream PIDs on both the primary and backup transport streams.

will automatically detect up to 400

```
BAY 1: TS ERRORS
1.6) ES PID ERROR
THRESHOLD: 00500 ms
NULL PACKET ERROR
THRESHOLD: 20%
```

- **Null Packet Ratio:** an error is indicated when the ratio of the number of null packets in comparison to the normal video packets every second exceeds the value entered.

Output Configuration

The Modulator Configuration menu contains an output configuration selection. When selected it leads to settings for the IF output and RF output. This section overviews the IF Output and RF Output menus.

```
BAY 1: MODULATOR CONFIG
INPUT CONFIGURATION
MODULATION CONFIGURATION
TS ANALYSIS CONFIGURATION
> OUTPUT CONFIGURATION
```

```
+ BAY 1: OUTPUT CONFIGURATION
↑↓
>IF OUTPUT
RF OUTPUT
```

The IF output settings include:

The output can be set as active or mute.
When muted there is no modulator output.
 The output frequency is selectable between 57 & 145 MHz (SMD910). Set to 70 MHz to feed the SMD 920 L-Band upconverter.
 The level for the IF output is adjustable between -30 to -5 dBm. The SMD 920's optimum input level default is -10 dBm.
 The tilt adjustment allows a user to adjust the overall slope of the output spectrum. The range is selectable from -3 to +3 dB

```
BAY 1: IF OUTPUT ↑↓
>OUTPUT: ACTIVE
FREQUENCY: 70 MHZ
LEVEL: -10 DBM
TILT: +0.0 DB
```

If the RF L-Band SMD 920 option is installed in the SMD 989 bay, the ability to configure the RF output is shown.

The output can be set to active or mute.
When muted there is no modulator output.
 The output frequency is settable at an L-band frequency of 950 to 2150 MHz if the LO Offset is set to 0 MHz.
 To enter a satellite frequency, first enter the Satellite Frequency followed by the entry of the block upconverter frequency – press Enter. If the difference is not in the L-band

```
BAY 1: OUTPUT STATUS: RF
>OUTPUT: ACTIVE
SAT FREQUENCY: 00950.000 MHZ
LO OFFSET: 00000.000 MHZ
RF FREQUENCY: 00950.000 MHZ
10 MHZ REF. CLOCK : ENABLED
BUC POWER : ENABLED
```

range an error is indicated.
The output RF level is settable at a range of -30 to +5 dBm.
The input status from the IF output is given in high, medium or low depending on the level of input detected. The ideal input is -10 dbm.
Output status is an indication that a signal level is present on the output for confidence monitoring. An alarm can be enabled to alert you if output status is lost.
The oscillator status is an indication the oscillator is locked for confidence monitoring. An alarm can be enabled to alert if the oscillator status becomes unlocked.

If duplexing options are installed a menu selection to enable/disable the 10 MHz clock and/or enable/disable the BUC power is shown.

```
BAY 1: RF OUTPUT      ↕↔
>LEVEL: -10.0 DBM
IF INPUT STATUS: OK
OUTPUT STATUS: PRESENT
OSCILLATOR STATUS: LOCKED
SPECTRUM INVERTED: NORMAL
```

- **Spectral Inversion:** Normal/Inverted. This reflects what the RF output will be after the RF upconverter. This will change depending on the Spectral Inversion setting in the Configure Modulation Options. If the Spectral Inversion is set to Normal in the modulation configuration, the RF Output will be inverted. If the Spectral Inversion is set to Inverted in the modulation configuration, the RF Output will be shown as normal.

Front Panel Admin Settings

The admin settings allow system specific settings to be set, viewed, and modified.

Networking: Provides information and entry of network connections for management and MPEG-IP ports on the SMD 910 SMD 912(A) cards.

Time: Provide a menu to set and manage the unit date and time.

Temperature: Indicates the units internal temperature.

Profiles: Provides creation or recall of stored unit profiles to unit memory.

Settings Clone: Enable/Disable cloning of settings between bays of the modulator.

Reference Clock: Internal or External, Indicates if 10MHz reference clock is generated internally or locked automatically to an input 10 MHz ref.

General Settings: Enable/Disable setting which mutes the modulator when configurations changes are made. Default is disabled.

Lock Front Panel: Provides password management of front panel keys

```

ADMIN SETTINGS  ↕↵
>NETWORKING
  TIME
  TEMPERATURE
  PROFILES
  
```

```

ADMIN SETTINGS  ↕↵
>SETTINGS CLONE
  GENERAL SETTINGS
  REFERENCE CLOCK
  LOCK FRONT PANEL
  
```

Network Settings

To view or edit the networking settings select either the control unit network or the correct bay for IP data network settings.

The unit network menu provides status for current IP address. If DHCP is enabled, the current IP address is shown. If static is enabled, press enter to manually change the IP address, subnet mask, and gateway.

The hostname allows a user to remotely connect to the SMD 989 platform with a web browser by simply typing the hostname and not the IP address into the address bar. This is helpful when used on DHCP networks.

```

NETWORKING SELECT  ↕↵
>UNIT NETWORK
  MPEG/IP BAY 1 PORT 1
  MPEG/IP BAY 1 PORT 2
  CONFIGURE MPEG/IP BAY 1
  MPEG/IP BAY 2 PORT 1
  
```

```

UNIT NETWORK STATUS  ↕↵
>IP ADDRESS: 10.0.15.6
  SUBNET MASK: 255.255.0.0
  GATEWAY: 10.0.1.3
  HOSTNAME: DETG_SMD
  MAC: 00.00.00.00.00.00
  
```

The each modulator comes standard with an IP input for data reception. The physical settings are settable by selecting the bay the modulator is located.

```
BAY 1: MODULATOR NETWORKING  ↓↵
>IP ADDRESS: 10.0.0.61
SUBNET MASK: 255.255.255.0
GATEWAY: 10.0.0.1
MAC: 00.00.00.00.00.00
LINK STATUS: HALF DUPLEX
```

Unit Time

The time and date for the unit can be set manually or synchronized with an NTP server. The date and time are used for storing the correct time for alarms and logs for accurate representation of when the occurrence took place.

```
TIME                               ↕↵
>TIME: 2010/8/12 03:27:48
SOURCE: NTP SERVER
ADDRESS: 10.0.1.23
```

```
TIME                               ↕↵
TIME: 2010/8/12 03:27:48
SOURCE: MANUAL
>SET DATE: 2010/8/12
SET TIME: 03:27:48
```

Temperature

The current temperature for the unit can be viewed in both Centigrade and Fahrenheit.

```
TEMPERATURE                       ↕↵
UNIT TEMP: 26.39C → 79.50F
```

Front Panel Lock

The front panel can be locked to prevent any accidental changes from being made. A password is prompted before the front panel can be locked. Once locked, the same password is needed to unlock the front panel.

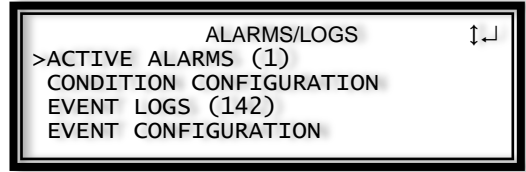
```
FRONT PANEL LOCK                  ↕↵
>PASSWORD: - - - - -
```

10 MHz Reference

The 10 MHz reference clock is automatic presence sensing. If an external clock is present and the system is capable of locking, it will automatically use the external reference. If no external presence is detected, the internal clock is used. Disabled by default, the external reference clock alarm can alert a user if the external reference is lost.

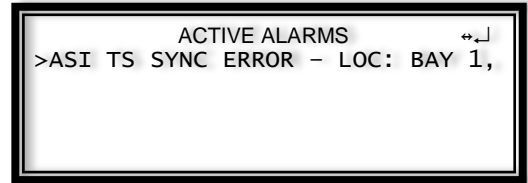
Front Panel Alarms/Logs

The Alarms/Logs section of the front panel holds all of status and alarm indications for the SMD 989 platform. The alarms, logs, SNMP, and relays are separated by individual menus and configurable to the exact settings a user desires to monitor.



Alarms

To view active alarms, select and press enter to view the alarms that are currently generated for the enabled alarms in the SMD 989. Use the right/left errors to view complete error details.



Name	Description of Trap
10MHz Ext. Ref Clock Error	Indicates the unit's external reference source has changed between either internal or external.
12V Supply Error	Unable to detect 12V from Power Supply
3V Supply Error	Unable to detect 3V from Power Supply
5V Supply Error	Unable to detect 5V from Power Supply
ASI TS Sync Error	No ASI Sync with TS Input
ASI Bitrate Error	ASI Input Bit Rate Error
Backup Input Active	Unit switched to backup Input
Fan Speed Below Lower Limit	A fan failure has been detected
FEC Reception Error	Error in FEC detected
IF Output Mute Error	Indicates the IF output is muted
IP Loss Error	Indicates MPEG/IP Data loss
MPEG/IP Bitrate Error	Indicates IP Bit Rate Error
MPEG/IP NIC Link Error	Indicates the MPEG/IP Data Link is broken
MPEG/IP TS Sync Error	Indicates MPEG/IP Data interface cannot sync with the TS
RTP Reception Error	RTP reception errors indicated
Output Buffer Error	Data underflow/overflow in buffer, rate adaption issue where TS packets are discarded
TS Continuity Count Error	TS Analysis – CC Error indicated in TS Header
TS ES PID Error	TS Analysis – PID error in ES
TS PAT Error	TS Analysis – PAT CC error
TS PMT Error	TS Analysis – PMT CC error
TS Sync Byte Error	TS Analysis – TS sync byte
TS Sync Loss Error	TS Analysis – Sync Loss
Temperature Error	Internal temp. is outside range of 0 to 45 Celsius
Upconverter IF Input Freq. Error	Not within auto-lock range of 70 or 140 MHz
Upconverter IF Input Level Error	Indicates IF input is not within the acceptable level range for the upconverter
Upconverter Mute Error	Indicates the RF upconverter is muted
Upconverter Oscillator Error	Indicates a loss of oscillator or communication
Upconverter Output Error	Indicates loss of RF upconverter output or system communications

Figure 82: Alarm descriptions

Error handling voltage and temp limits that will trigger an alarm if exceeded:

3 Volt Controller Supply

sensor3VMinLimit.0 - 3.10 VDC
sensor3VMaxLimit.0 - 3.50 VDC

5 Volt Controller Supply
sensor5VMinLimit.0 - 4.70 VDC
sensor5VMaxLimit.0 - 5.30 VDC

12 Volt Controller Supply
sensor12VMinLimit.0 - 11.28 VDC
sensor12VMaxLimit.0 - 12.72 VDC

Unit Temperature
sensorTempMinLimit.0 - 0 C
sensorTempMaxLimit.0 - 45.00 C

Conditions

Each condition can be user configurable to be an error, logged, SNMP trap, and alarm relay triggered event.

```
CONDITION SELECT      ↕↔
>FAN ERROR - UNIT
 3V SUPPLY ERROR - UNIT
 5V SUPPLY ERROR - UNIT
12V SUPPLY ERROR - UNIT
ASI TS SYNC ERROR - BAY 1
```

```
FAN ERROR            ↕↔
>LOGGING: ENABLED
SNMP TRAP: DISABLED
RELAY: RELAY 1
RELAY ACTIVATION: DISABLED
ALARM NOTIFICATION: ENABLED
```

Name	Description of Trap
10MHz Ext. Ref Clock Error	Indicates the unit's external reference source has changed between either internal or external.
12V Supply Error	Unable to detect 12V from Power Supply
3V Supply Error	Unable to detect 3V from Power Supply
5V Supply Error	Unable to detect 5V from Power Supply
ASI TS Sync Error	No ASI Sync with TS Input
ASI Bitrate Error	ASI Input Bit Rate Error
Backup Input Active	Unit switched to backup Input
Fan Speed Below Lower Limit	A fan failure has been detected
FEC Reception Error	Error in FEC detected
IF Output Mute Error	Indicates the IF output is muted
IP Loss Error	Indicates MPEG/IP Data loss
MPEG/IP Bitrate Error	Indicates IP Bit Rate Error
MPEG/IP NIC Link Error	Indicates the MPEG/IP Data Link is broken
MPEG/IP TS Sync Error	Indicates MPEG/IP Data interface cannot sync with the TS
RTP Reception Error	RTP reception errors indicated
Output Buffer Error	Data underflow/overflow in buffer, rate adaption issue where TS packets are discarded
TS Continuity Count Error	TS Analysis – CC Error indicated in TS Header
TS ES PID Error	TS Analysis – PID error in ES
TS PAT Error	TS Analysis – PAT CC error
TS PMT Error	TS Analysis – PMT CC error
TS Sync Byte Error	TS Analysis – TS sync byte
TS Sync Loss Error	TS Analysis – Sync Loss
Temperature Error	Internal temp. is outside range of 0 to 45 Celsius
Upconverter IF Input Freq. Error	Not within auto-lock range of 70 or 140 MHz
Upconverter IF Input Level Error	Indicates IF input is not within the acceptable level range for the upconverter
Upconverter Mute Error	Indicates the RF upconverter is muted
Upconverter Oscillator Error	Indicates a loss of oscillator or communication
Upconverter Output Error	Indicates loss of RF upconverter output or system communications

Figure 83: Relay event descriptions

Events

Each possible event is configurable to be enabled or disabled if the user does not want it to be logged. An alarm can be disabled and a SNMP trap can still be enabled to be generated for an event.

```

EVENT SELECT
>DATE/TIME CHANGE - UNIT
UNIT BOTUP - UNIT
UNIT SHUTDOWN - UNIT
10 MHZ REFERENCE CHANGE - UNIT
NTP UPDATE - UNIT
    
```

```

DATE/TIME CHANGE
>LOGGING: ENABLED
SNMP TRAP: DISABLED
RELAY: RELAY 1
RELAY ACTIVATION: DISABLED
REALY DURATION: 0100 MS
    
```

```

EVENT LOGS
>130 2010/08/25 UNIT BOOTED
129 2010/08/25 IF OUTPUT: NOTM
128 2010/08/25 IF OUTPUT: MUTED
127 2010/08/25 ASI TS: ABSENT
    
```

Name	Description of Event
10MHz Ext. Ref Clock Change	Indicates the external reference clock was not present
Date/Time Change	The unit's date/time has been changed
NTP Update	The unit's date/time was updated by the NTP server
Software update failed	The unit failed to update the software
Software update succeeded	The unit successfully completed a software update
Unit Bootup	The unit has been loaded
Unit Shutdown	The unit was shutdown
ASI TS Sync Error	No ASI Sync with TS Input has been detected

Figure 84: Event descriptions

SNMP Trap Configurations

The system’s SNMP communities can be configured by selecting SNMP Trap Menu from the reporting options. In the SNMP trap communities, IP addresses can be added and the events that trigger traps to be sent are enabled/disabled under the conditions configuration.

```
SNMP COMMUNITIES      ↕↵
>RO COMMUNITY: PUBLIC_-----
RW COMMUNITY: PRIVATE_-----
```

```
SNMP TRAP MANAGER     ↕↵
>ADD IP
REMOVE IP
10.0.2.45
192.168.1.45
```

Front Panel About

The “**About screen**” provides information for software, hardware and licensing installed in the SMD 989 platform. This information is needed when talking to technical support.

```
ABOUT                ↕↵
>SOFTWARE
HARDWARE
LICENSES
UNIT SERIAL: 1234567
```

About Software

Sample Software Versions

```
SOFTWARE VERSIONS     ↕↵
PRODUCT: SMD 989
VERSION: 3.1.0
```

About Hardware

Sample About Hardware

```
HARDWARE SELECT       ↕↵
>SYSTEM CONTROLLER
L-BAND UPCONVERTER
DVB-S2 MODULATOR
L-BAND UPCONVERTER
DVB-S/S2 MODULATOR
MODULATOR WITH DUAL GIG
```

Sample About Modulator

```
DVB-S2 MODULATOR      ↕↵
LOCATION: BAY 1
MODEL: SMD 910
ASSEMBLY: 2
PI: 1 REV: D
REVISION: F
```

Sample About Upconverter

```
L-BAND UPCONVERTER    ↕↵
LOCATION: BAY 1
MODEL: SMD 920
ASSEMBLY: 2
NAME: 1143
PI: 0
```

Licenses

Sample License

```
LICENSE SELECT        ↕↵
>961 - DVB-S/DSNG MODULATION
962 - DVB-S2 MODULATION
963 - DVB-S2 MULTI-STREAM MODUL
964 - DVB-S2 16 AND 32 APSK
965 - 30 MBPS MAX SYMBOL RATE
```

Appendix



Specifications

SMD 989 Base Unit Includes:

Display, keypad, embedded controller,
Chassis/case, Power Supply/line cord

System –

Display Type:	Organic LED
Display Configuration:	256 pixels by 64 pixels
Keypad:	Snap-dome Membrane
Front Panel Lockout:	Password control, up to 10 alpha-numeric characters (no punctuations or spaces allowed)
Configurations Allowed:	Single Bay Dual Bays
Rear panel:	2 independent bays

Remote Operation/Update Interface –

Type:	Ethernet, 10/100
Rear panel indicators:	Link (Green LED), Activity (Amber LED)
Connector:	RJ45

Front Panel Indicators –

Input LED:	Green indicates valid input on selected input, Off indicates no valid signal on the selected input
Error LED:	Red indicates error is occurring OFF indicates no errors detected

10 MHz Reference Input –

Connector:	(1) BNC, female
Impedance:	50 ohms
Min Level:	-3 dBm
Max Level:	7 dBm
Detection:	Autosensing
Return Loss:	>15 dB

Monitor and Control Interfaces –

Web server GUI	HTTP via web browser for Control & Monitoring
Front Panel	Yes Control & Monitoring
SNMP	Yes Control & Monitoring

Contact Closure Interface –

Type:	(2) Electrical contact closure alarm contacts
Connector:	Connector 9-pin sub-D Female
Alarms supported:	User configurable to any alarm in system

Specifications are subject to change without notice.

AC Power –

Operating Voltage: 95-135 VAC or 180-265 VAC
 Current Draw/Power: 200 Watts
 Frequency: 47-63Hz
 Line Cord: Detachable, 3-prong

General –

RoHS Compliant: Yes
 Operating Temperature: 0 to 45 degrees C
 Operating Humidity: <95% Non-Condensing
 Cooling: Forced air, front intake, rear exhaust
 Temperature monitor: Fan failure, internal temperature sensor
 Size: Height = 1RU (13/4”), Width = 19”, Depth = 19”
 19 in. rack mountable, removable ears
 Rack clips and screws included
 Weight: ~9.5 lbs. (base unit)
 ~12.75 lbs. (Fully Loaded)
 Pollution Degree: 2
 Installation Category: II
 Grounding Post: On chassis
 Grounding Thread Size: 8/32”

SMD 952 Dual Redundant AC Power Supply – Option

Operating Voltage: 95-135 VAC or 180-265 VAC
 Current Draw: 275 Watts
 Frequency: 47-63Hz
 Line Cord: Detachable, 3-prong
 Redundancy: Dual Hot Swappable Load Sharing

SMD 954 Dual Redundant DC Power Supply – Option

Operating Voltage: -40 to -72VDC, Normal -48VDC
 Current Draw: 250 Watts
 Frequency: 0Hz
 Connection: Screw Terminal, -48VDC and 0VDC
 Redundancy: Dual Hot Swappable Load Sharing

SMD 910 Single Stream Modulator

General –

RoHS Compliant: Yes

ASI Serial TS Input –

Connector: (4) BNC, female
 Impedance: 75 ohms
 Standard: ETSI EN 50083-9 DVB ASI
 Data Bit Rate: 270 Mbps
 Packet Size: 188 or 204 byte support
 Transmission Mode: Burst and packet mode support
 Min TS Rate Supported: 0.5 Mbps
 Max TS Rate Supported: 160 Mbps

Specifications are subject to change without notice.

IP TS Input –

Connector:	(1) – 10/100/1000 Auto-negotiating Base-T RJ-45 Ethernet Port
Input format:	UDP, RTP, and RTP with extension headers Multicast and Unicast
Bitrate Range:	0.5 – 160 Mbps
Packets/IP Frame	1-7 MPEG Packets/IP Frame
IGMP Compatibility:	Version 2 and 3
Min TS Rate Supported:	0.5 Mbps
Max TS Rate Supported:	160 Mbps
Network Jitter Buffer:	100 KB to 4MB

IF-band Output –

Connector:	(1) BNC, female
Impedance:	75 ohms
Min Level:	-30 dBm
Max Level:	-5 dBm
Level Adjustability:	1 dB increments
Frequency:	70 MHz Default (Selectable 57-145 MHz)
Frequency Stability:	+/-5x10 ⁻⁸ over operational temp range
Return Loss:	>20 dB
Tilt Adjustment:	+/- 3.0 dB in 0.1 dB steps

SMD 912 or SMD912A Single Stream Modulators

General –

RoHS Compliant:	Yes
-----------------	-----

ASI Serial TS Input –

Connector:	(2) BNC, female
Impedance:	75 ohms
Standard:	ETSI EN 50083-9 DVB ASI
Data Bit Rate:	270 Mbps
Packet Size:	188 or 204 byte support
Transmission Mode:	Burst and packet mode support
Min TS Rate Supported:	.5 Mbps
Max TS Rate Supported:	213 Mbps

IP TS Input –

Connector:	(2) – 10/100/1000 Auto-negotiating Base-T RJ-45 Ethernet Ports
Input format:	UDP, RTP, and RTP with extension headers Multicast and Unicast
Bitrate Range:	0.5 – 213 Mbps
Packets/IP Frame	1-7 MPEG Packets/IP Frame
IGMP Compatibility:	Version 2 and 3
Min TS Rate Supported:	0.5 Mbps
Max TS Rate Supported:	213 Mbps per stream
Network Jitter Buffer:	1 KB to 4MB
Buffer Size:	1-4000 KB, or 1-4000ms delay, user configured
Analysis:	Duplicate, Lost, Corrected, Un-corrected, Out-of-order packet counters
FEC Status:	Row/Column Mode, Rows, Columns

Specifications are subject to change without notice.

IF-band Output –

Connector:	(1) BNC, female
Impedance:	75 ohms
Min Level:	SMD 912: -30 dBm, SMD 912A: -20 dBm
Max Level:	SMD 912: -5 dBm, SDM912A: +5 dBm
Level Adjustability:	1 dB increments
Frequency:	70 MHz Default (Selectable 60-140 MHz)
Frequency Accuracy:	+/-0.6 ppm + +/-0.25 ppm/yr.
Return Loss:	>20 dB (37MHz – 180 MHz)
Tilt Adjustment:	+/- 3.0 dB in 0.1 dB steps
Spurious Outputs:	-58 dBc or greater @ -10dBm

RF Monitor Test Output

Connector:	(1) BNC, female
Impedance:	75 ohms
Outputs RF/IF:	1100 MHz RF & Secondary IF
RF Frequency:	1100 MHz
RF Level:	-50 dBm +/- 5 db
Secondary IF Frequency:	Same as Primary IF Freq.
Secondary IF Level:	-20 dB of Primary IF Output

SMD 961 DVB-S/DSNG Modulation

Supported modulation schemes and FEC:

DVB-S+*	
QPSK	1/2, 2/3, 3/4, 5/6, 7/8
8PSK	2/3, 5/6, 8/9
16QAM	3/4, 7/8
Min Symbol Rate:	0.5 MSps
Max Symbol Rate:	Up to 45 MSps with SMD 966 License
Roll-off Factor:	20%, 25%, 35%
Spurious Performance	-50 dBc @ -10 dBm
PRBS	PN23, Inverted PN23

SMD 962 DVB-S2/DVB-S2X Modulation

Supported modulation schemes and FEC (SMD910, SMD912 or SMD912A):

DVB-S2	
QPSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
8PSK	3/5, 2/3, 3/4, 5/6, 8/9, 9/10 (9/10 is Normal FECFRAME only)
DVB-S2X	
QPSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9,
QPSK	9/10, 13/45, 9/20, 11/20 (Normal FECFRAME only)
QPSK	4/15, 7/15, 8/15, 11/45 14/45, 32/45 (Short FECFRAME)
8PSK	3/5, 2/3, 3/4, 5/6, 8/9,
8PSK	9/10, 23/56, 25/36, 13/18 (Normal FECFRAME only)
8PSK	7/15, 8/15, 26/45, 32/45 (Short FECFRAME only)
8PSK-L	5/9, 26/45 (Normal FECFRAME only)
Min Symbol Rate:	0.5 MSps
Max Symbol Rate:	Up to 45 MSps with SMD 966 License
Frame length:	Short (16,200 bits) or Normal (64,800 bits)
Roll-off Factor:	05%, 10%, 15%, 20%, 25%, 35%
Spurious Performance	-50 dBc @ -10 dBm

SMD 963 Multistream DVB-S2 Option

In Addition to SMD 910 Specifications

ASI Serial TS Input –

Connector:	(4 Total) BNC, female
Impedance:	75 ohms
Standard:	ETSI EN 50083-9 DVB ASI
Data Bit Rate:	270 Mbps
Packet Size:	188 or 204 byte support
Transmission Mode:	Burst and packet mode support
Min TS Rate Supported:	0.5 Mbps
Max TS Rate Supported:	160 Mbps

IP Serial TS Input –

Connector:	(1) – 10/100/1000 Auto-negotiating Base-T RJ-45 Ethernet Port
Input format:	UDP, RTP, and RTP with extension headers Multicast and Unicast
Number of Streams:	Up to 6 streams for multistream
Bitrate Range:	0.5 – 160 Mbps
Packets/IP Frame	1-7 MPEG Packets/IP Frame
IGMP Compatibility:	Version 2 and 3
Min TS Rate Supported:	0.5 Mbps
Max TS Rate Supported:	160 Mbps
Network Jitter Buffer:	100 KB to 4MB

Multistream –

Modes:	DVB-S2 Single Stream CCM DVB-S2 Multistream CCM DVB-S2 Multistream VCM
TS Supported:	Up to 6 any combination of ASI and IP

SMD 964 DVB-S2/DVB-S2X Modulation

Supported modulation schemes and FEC (SMD 910 or SMD 912(A))

DVB-S2

QPSK	Includes all formats of SMD 962
8PSK	Includes all formats of SMD 962
16APSK	2/3, 3/4, 4/5, 5/6, 8/9, 9/10
32APSK	3/4, 4/5, 5/6, 8/9, 9/10
	*9/10 is not supported in Short Frame Mode

DVB-S2X

QPSK	Includes all formats of SMD 962
8PSK	Includes all formats of SDM 962
16APSK	2/3, 3/4, 4/5, 5/6, 8/9, 9/10, 26/45, 3/5,
32APSK	3/4, 4/5, 5/6, 8/9, 32/45, (2/3 Short FECFRAME)
32APSK	9/10, 11/15, 7/9, (Normal FECFRAME only)
32 APSK-L	32/45 Normal FECFRAME only
64 APSK	11/15, 7/9, 4/5, 5/6, (Normal FECFRAME only)
64APSK-L	32/45 (Normal FECFRAME only)
Min Symbol Rate:	0.5 MSps
Max Symbol Rate:	Up to 45 MSps with SMD 966 License
Frame length:	Short (16,200 bits) or Normal (64,800 bits)
Roll-off Factor:	20%, 25%, 35%



Spurious Performance

-50 dBc @ -10 dBm

SMD 968 TurboPSK Modulation (SMD 912(A) Only)

Supported modulation schemes and FEC:

QPSK	1/2, 2/3, 3/4, 5/6, 7/8
8PSK	2/3, 3/4, 4/5, 5/6, 8/9
16QAM	3/4
Note: Turbo PSK mode $\frac{3}{4}$ 2.05 = "3/4", $\frac{3}{4}$ 2.10 = "4/5"	
Min Symbol Rate:	0.5 MSps
Max Symbol Rate:	Up to 30 MSps with SMD 966 License
Frame length:	Short (16,200 bits) or Long (64,800 bits)
Alpha Filter Roll-off Factor:	05%, 10%, 15%, 20%, 25%, 35%
Spurious Performance	-58 dBc @ -10 dB
Modulator Latency:	Normal, Reduced 1, 2 or 3, Minimum
Sync Byte Delete	Removes input sync byte

SMD 970 TS Analysis and Null Packet Error Detection (SMD 910 or SMD 912(A))

TS Analysis	TR101290 P1 Error Detect/Adjustable Thresholds
TS Analysis Inputs	Dual Analysis – Primary and Backup Inputs
TS Analysis Thresholds	User definable thresholds
Null Packet Ratio	Null Packets/Total packets avg. over 1 sec (Expressed as percentage)
Null Packet Error Threshold Range	User Entry 1-99% (Default 20%)
Null Packet Error	Null Packet Ratio exceeds threshold
Accuracy	1%

SMD 971 BISS Scrambling Option (SMD 910 or SMD 912(A))

Scrambling	Entire Transport Stream. A CA_descriptor is added the PMT of each scrambled service a CAT is created or edited.
Mode 1	12 character unencrypted hex Session word
Mode E	16 Character encrypted hex Session word and 14 character injected Identifier (ID)

PRBS (Pseudo Random Binary Sequence)

Signal Types:	PN23, Inverted PN23
---------------	---------------------

SMD 920 L-Band Output Option

In Addition to the SMD 910 or 912 Specifications when installed

Primary L-Band Output –

Connector:	(1) SMA, female
Impedance:	50 ohms
Min Level:	-30 dBm
Max Level:	+5 dBm
Level Adjustability:	0.1 dB increments
Min Frequency:	950 MHz
Max Frequency:	2,150 MHz
Frequency Adjustability:	1 kHz steps
Frequency Stability:	+/-5x10 ⁻⁸ over operational temp range
Frequency Accuracy:	+/-3.5 kHz (IESS-308 Compliance)
Power Stability:	+/-0.5 dB over 24 hrs.
Power Accuracy:	+/-2 dB
Return Loss:	>15 dB
Spurious Performance	-50 dBc @ -10 dBm (SMD 910)
Spurious Performance	-58 dBc @ -10 dBm (SMD 912(A))

Monitoring L-Band Output –

Secondary Output Connector:	(1) SMA, female
Level:	-20 dBc
Return Loss:	>15 dB

IF Input –

Input Connector:	(1) BNC female
Input Impedance:	75 ohms
Input Frequency:	Auto detect @ 70 or 140 MHz
Return Loss:	>20 dB

SMD 940 10MHz on L-Band Output Option

In Addition to the SMD 920 Specifications

Frequency Accuracy	+/- 0.6ppm with +/- 0.25ppm per year
Level	5dBm
Level accuracy	+/-2 dB

SMD 942 24VDC BUC Power with 10MHz on L-Band Output Option

In Addition to the SMD 940 Specifications

24VDC Accuracy	+/-5%
----------------	-------

SMD 944 48VDC BUC Power with 10MHz on L-Band Output Option

In Addition to the SMD 940 Specifications

48VDC Accuracy	+/-5%
----------------	-------

Specifications are subject to change without notice.

Open Source Software

The SMD 989 includes:

Package	Version	License	Copyright
AT32 UC3B Software Framework	1.4.0	BSD	2008, Atmel Corporation
BaseX4JIT	4.0	GPL Version 3, 29 June 2007	2007-2009, Active Group, Inc
BusyBox	1.15.2	GPL Version 2, June 1991	?
Cgicc	3.2.9	LGPL Version 29, June 2007	Stephen F. Booth
dfu-programmer	0.5.2	GPL Version 2, June 1991	Weston Schmidt
Dropbear	0.52	MIT-like	2002-2008 Matt Johnston, et. Al (see license)
E2fsprogs	1.41.9	GPL Version 2, June 1991	Theodore Ts'o
ethtool	2.6.34	GPL Version 2, June 1991	David Miller, et. al.
FamFamFam Silk Icons	013	Creative Commons Attribution 2.5	Mark James
FastDB	3.59	MIT-like	Konstantin Knizhnik
FCGI	2.4.0	FastCGI	Open Market, Inc
Iproute2	2.6.29	GPL Version 2, June 1991	Stephen Hemminger, Alexey Kuznetsov
Libusb	0.1.12	GPL Version 2.1, Feb 1999	Johannes Erdfelt, Thomas Sailer, Brad Hards
Lighttpd	1.4.23	BSD	2004, Jan Kneschke
Linux	2.6.30	GPL Version 2, June 1991	Linus Torvalds, et. Al.
Log4cpp	1.0	GPL Version 2.1 Feb 1999	Bastiann Bakker
Monit	5.1.1	GPL Version 3, 29 June 07	2010 Tildeslash Ltd.
Net-SNMP	5.5	BSD	1989, 1991, 1992 by Carnegie Mellon Univsty.
NTP	4.2.4p7	NTP License	1992-2009 David L. Mills
OpenSSL	0.9.8m	BSD-Like	1998-2008 The OpenSSL Project, 1995-1998
OProfile	0.9.6	GPL Version 2, June 1991	John Levon, Philippe Elie, et. Al
PCRE	8.00	BSD	1997-2009 University of Cambridge, 2007-2008
POPT	1.14	MIT	1998 Red Hat Software
Socket-CAN	1171	BSD-like, GPL Version 2, June 1991	2002-2007 Volkswagen Group Electronic Research
Spawn-FCGI	1.6.3	BSD	Jan Kneschke, Stefan Bahler
TCLAP	1.2.0	MIT	2003 Michael E Smoot
U-Boot	2009.11.1	GPL Version 2, June 1991	Wolfgane Denk, et. al.
USB-Utills	0.86	GPL Version 2, June 1991	Thomas Sailer, Johannes Erdfelt, David Brownell,
Zlib	1.2.3	Zlib/libpng License	1995-2005 Jean-loup Gailly and Mark Adler

Warranty

Sencore One-Year Warranty

Sencore warrants this instrument against defects from any cause, except acts of God and abusive use, for a period of 1 (one) year from date of purchase. During this warranty period, Sencore will correct any covered defects without charge for parts, labor, or recalibration.

Support and Contact Information

Returning products for service or calibration

The SMD 989 is a complex piece of equipment and needs to be serviced and repaired by Sencore. Periodically it is necessary to return a product for repair or calibration. In order to expedite this process please carefully read the instructions below.

RMA Number

Before any product can be returned for service or calibration, an RMA number must be obtained. In order to obtain a RMA number, use the following steps:

1. Contact the Sencore service department by going online to www.sencore.com and select Support.
2. Select Service and Repair from the options given.
3. Fill in the following required information:
 - a. First & Last Name
 - b. Company
 - c. Email
 - d. Phone Number
 - e. Ship and Bill to Address
 - f. Unit Model and Serial Numbers
4. A RMA number will be emailed you shortly after completing the form with return instructions.

Shipping the Product

Once an RMA number has been issued, the unit needs to be packaged and shipped back to Sencore. It's best to use the original box and packaging for the product but if this not available, check with the customer service representative for the proper packaging instructions.

Note: DO NOT return any power cables or accessories unless instructed to do so by the customer service representative.

