

Novra S300 Receiver **User Manual**

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CAUTION: Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

Novra S300 DVB-S2 Satellite Data Receiver User Manual

Subject to change without notification

Document version: 2.02

Important- Please read this entire manual before installing or operating this product.

Disclaimer

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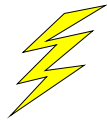
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1 Conventions

1.1 Text Conventions



NOTE: Information in this box will be Informative.



CAUTION: This information will be quite important and should not be ignored.

- Text appearing in `Courier` font indicates characters to be typed in; e.g. type `Shell` indicates that the word “Shell” must be entered exactly as it appears, with the first letter capitalized.
- Text appearing in `Bookman Old Style` font indicates a directory path or filename; e.g. `c:\Program Files`.
- Text appearing in `SMALL CAPS` and `CopperPlateGothic32bc` font in an instruction indicates a button that must be clicked, or a key that must be pressed, or a field that must be entered or a particular screen; e.g. `BUTTON` indicates a button that must be clicked.

1.2 Applicable Models

This manual is applicable to the following Novra Receiver models:

- Novra S300 – Enhanced DVB-S/DVB-S2 satellite data receiver capable of receiving IP data
- Novra S300V – Enhanced DVB-S/DVB-S2 satellite data receiver capable of receiving IP data and MPEG Video data
- Novra S300CA – Same functionality as the S300V, but with a conditional access Common Interface (CI) slot, making it compatible with many commercially available conditional access encryption systems



NOTE: - Your Novra S300 Configuration Application may also be used to configure other Novra receiver families such as the S75 and the S200. This manual does not specifically cover the configuration of these receivers, although the commands are very similar.

1.3 Model Naming Convention

This manual uses the S300 naming convention when referring to any one of the applicable S300 models (see Section 1.2 above).



NOTE: - This manual covers all of the models listed in Section 1.2 above. The S300 Console will automatically detect the receiver model and will gray out console tabs that are not required to configure the receiver.

If the feature you are trying to configure is grayed out in the S300 Console, please contact Novra Support (www.novra.com) to inquire about a firmware or hardware upgrade.

2 Introduction

2.1 Principles of Operation

The S300 is a satellite receiver that enables the reception of IP and Video data carried on a DVB-S2 or DVB-S compliant satellite signal.

Please refer to Figure 1 below for a better understanding of the S300 operation. The desired DVB-S2 satellite signal is received using an appropriately sized satellite dish (not covered in this manual). A Low Noise Block (LNB) downconverter (not covered in this manual) is used to translate the incoming Radio Frequency (RF) signal to an Intermediate Frequency (IF) signal. The S300 receives this I/F signal and extracts the IP content, which is then passed onto the S300 LAN for distribution or viewing via computers connected to the LAN. The received data type may be IP data or may be MPEG video data, depending on the S200 model being employed.

The S300 Management Console resides on a PC connected to the S300 via an Ethernet crossover cable or through an Ethernet hub. The Console is used to perform the following functions:

- Configure IP address network parameters,
- Specify satellite tuning parameters,
- Select DVB information streams by Program IDentification number (PID), and
- Map audio/video Programs and PIDs to multicast address(es).

Once configured, the S300 will retain its settings and continue to forward data transmitted to you by your service provider even after restarting the S300 or your PC.

The S300 Receiver does not require a computer to continue operation. Once the configuration has been set, you should have no need to change them.

3 Getting Started

3.1 Typical S300 Installation

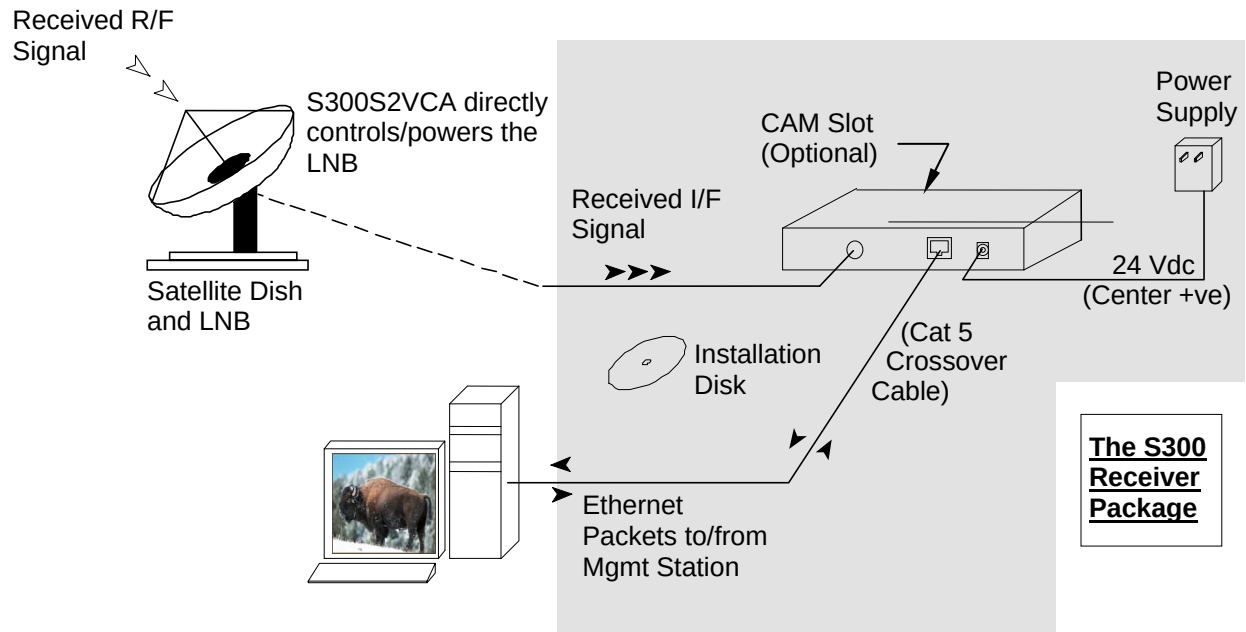


Figure 1: Typical Configuration



NOTE: - This information is needed in order for the receiver to function. It is recommended that all the information be collected before attempting to install the service. Novra Technologies Inc. expects that end users, who wish to control the LNB with the receiver, already have good understanding of satellite technology.



CAUTION: Nothing should be inserted between the S300 and the satellite dish except for a surge suppressor. Cable TV Splitters, TVs, VCRs, and FM receivers are not designed for connection to this portion of the network. It is very likely they will be damaged by the LNB DC voltage generated by the S300

3.2 What Information do I Need – Basic Configuration?

Before using the S300 configuration software to configure your receiver, you need to gather the following information:

- 1) The LO Frequency _____ in MHz of the stream you wish to receive.



NOTE: Local Oscillator Frequency is specific to the LNB Model and is usually stamped on the Unit or can be found in the LNB Manual. Typical Ku Band values include: 9.75, 10.60, 10.75, 11.00, and 11.25 GHz. For the C Band satellite frequencies a typical value is 5.15 GHz.

- 2) The RF Band Frequency _____ in MHz of the stream you wish to receive. Your satellite service provider should be able to provide this information for you.

- 3) Polarization: Horizontal / Left ____ (+15, 18 or 20 Volts DC) **OR** Vertical / Right ____ (+11, +13, or 20 Volts DC). Your satellite service provider should be able to provide this information for you.



NOTE: If the LNB does not have the ability to switch polarizations, choose a value that will provide the most suitable power supply voltage. In most cases this will be Horizontal / Left (+18 Volts).

- 4) Will the receiver be controlling a Single Band LNB (Most Common) or a Universal Band / Dual LNB?



NOTE: The 22 KHz (or 44 KHz) tone is used to switch between the 2 bands of the LNB. The receiver should be configured so that the proper tone is used and the proper band is selected.

- 5) The Symbol Rate in Msps. _____

Examples: 21.096, 5.12600, 1.50, ...etc.

- 6) The IP Address to be assigned to your Novra S300 Receiver

Example: 192.168.170.125

- 7) The IP address of the Default Gateway for the receiver.

- 8) Is the receiver supposed to filter multicast traffic using IGMP?



NOTE: IGMP is an Internet standard that is used to control multicast traffic on the LAN based on the client's interest in the stream. For proper operation, all components of your network should support IGMP

3.3 **SOFTWARE** *Installation on Windows 7*

The S300 Console software is supplied as a single executable. Therefore, it is easy to install on different systems. All you need to do is copy the executable to your working directory.

Please refer to Section 7.2 for information on supported Windows Operating Systems.



NOTE: - You **MUST** be logged onto the system as Administrator.

NOTE: - Your screen resolution **MUST** be at least 800 x 600 and at least "16 bit color" to function properly.

3.4 S300 Startup

- 1- Start the S300 Console software.



NOTE: - You MUST be logged onto the system as Administrator, for the network settings function to work properly.

- 2- The software will attempt to auto-detect all the receivers currently connected to the LAN. After the auto detection is complete, a screen showing all discovered devices will be displayed as shown below:

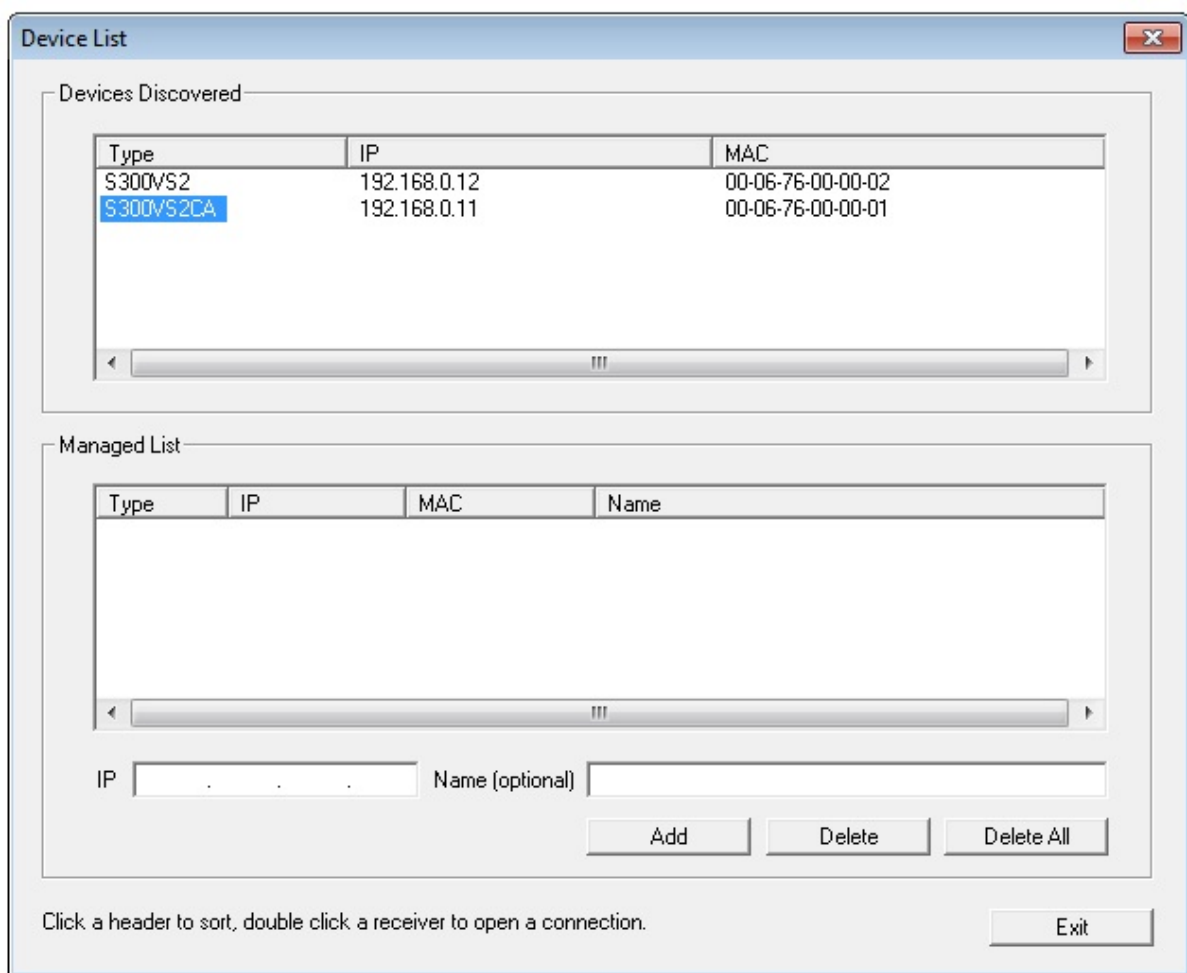


Figure 2 - Discover Devices

You can now select the device you wish to configure by double clicking on the receiver model type in the Devices Discovered listing.

You must also ensure that the network settings of the S300 make it accessible from the Windows management PC. The IP address of the device and the IP address of the management station must reside on the same subnet, or there must be a route that connects both of them through a router. If this is NOT the case, you will be prompted with the Change IP Address Screen as shown below in Figure 3. You will need to change the IP address of your management PC to be on the same subnet as the receiver (in this case, change your PC IP address to: 192.168.0.xxx, where xxx is not equal to 11).

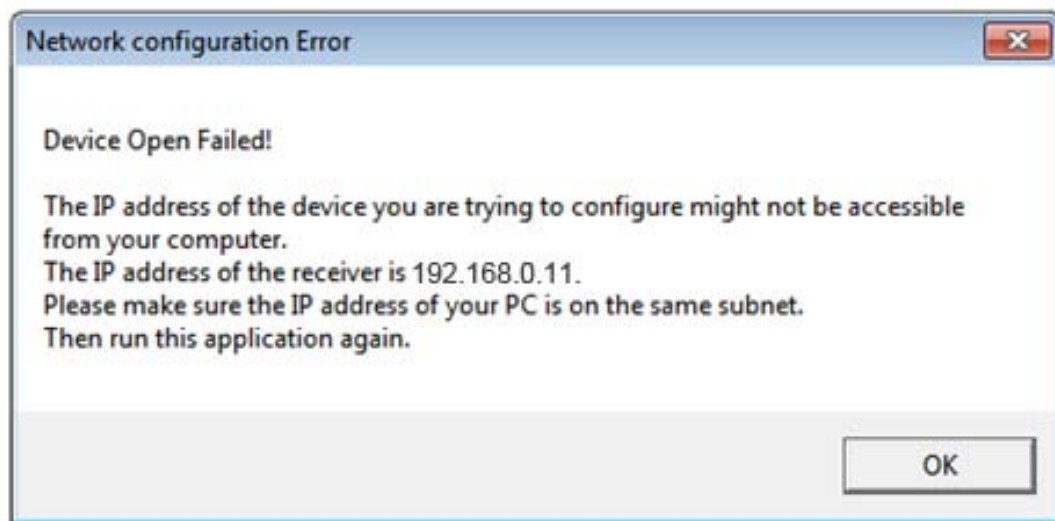


Figure 3 – Change IP Address Screen

- 3- Note: If there is an S300 receiver accessible on your network, but not on your local LAN you can still configure it as if it were on your local LAN. In the Managed List section of the screen above, enter the IPE address of the receiver you wish to configure in the IP field. You can also provide an optional name beside it if you wish. Once the IP address is entered, click ADD to add the IP address to the Managed List. Now double click the IP address you just added to run the Configure Application on the receiver. You can use the ADD, DELETE, and DELETE ALL buttons to add/remove entries in the Managed List.
- 4- Once you have successfully connected to your receiver, you will be prompted to enter a password (see Figure 4 below). The default password that you can use with your new receiver is: Novra-S2 .



Figure 4 – S300 Login Password Screen

- 5- After successfully entering the password, you will be presented with the S300 Console main screen (as shown in Figure 5 below).



NOTE: - Default Password is Novra-S2

3.5 Main Screen

Congratulations, you have logged into the receiver and made it to the main screen.

Your S300 DVB receiver supports both DVB-S and DVB-S2 modes of operation. From a receiver configuration perspective, there are only a few differences between DVB-S mode and DVB-S2 mode. The examples below were taken in DVB-S2 mode.

Figure 5 shows a typical Main Screen setting when the S300 is operating in DVB-S2 mode. The screen provides configuration tabs as well as status information on the S300 operation. At a glance, we can determine a great deal about the status of the S300 operation, including:

- The console is receiving status from the S300 (Status LED is green),
- The receiver is locked (Signal LED is green) to a 30 Msps signal with a C/N of 28.7 dB.
- The LNB DC voltage is turned off (LNB LED is grey),
- The S300 is receiving and processing valid DVB data (Data LED is green)
- The input signal strength is good at -29 dBm
- The S300 is demodulating a DVB-S2 signal with a modulation of 8SK and a coding rate of 3/4
- At the present, the received signal quality is good with a LDPC BER of 0.0E0.
- The receiver has received no uncorrectable packets. If this counter is moving, it is an indication that the satellite link may not be good enough to maintain a solid lock.

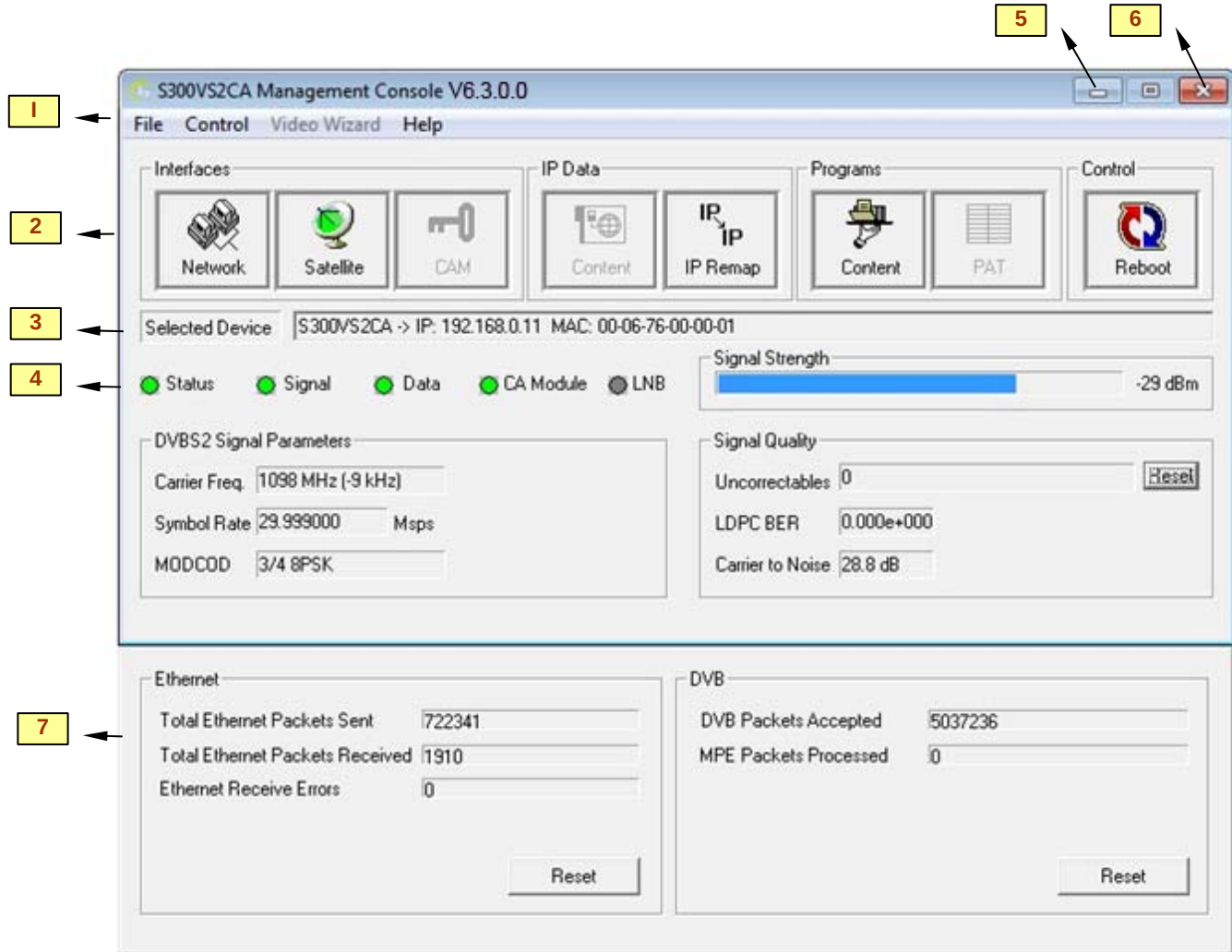


Figure 5 - S300 Console Main Screen for DVB-S2 Operation

The S300 Console can be divided into several basic sections. Each of these sections is described in detail below:

1. At the top of the S300 Console is a drop down menu that provides access to the File menu items, the S300 Configuration menu items, and the Help screen.
2. Below this are the tabbed buttons that also provide access to the various configuration menu items. The tabbed buttons are also grouped based on functionality.
 - i. INTERFACES button group (Network and Satellite) enable configuration of the network and satellite interfaces. The CAM button is used to configure video programs to be descrambled. If the button is grayed out, this feature is not available on the S300 model.

- ii. IP DATA buttons enables the operator to configure the receiver to receive Multi-Protocol Encapsulation (MPE) data and pass/map this data onto the LAN.
- iii. PROGRAMS button group (Content and PAT) provides standard and advanced features enabling the operator to receive MPEG transport stream packets and pass these packets to Multicast IP addresses on the LAN. If the PAT button is grayed out, this feature is not available on the S300 model.
- iv. CONTROL button group provides an additional configuration item that includes Reboot.



NOTE: - Typically the IP Data function is used to configure the S300 to receive and re-distribute IP data, while the Programs function is used to configure the S300 to receive and re-distribute video programs. The Program function may not be available on your receiver model.

- 3. The middle bar of this screen displays the IP address and MAC address for the selected S300 being configured.

- 4. Status information on the operation of the S300 is provided in the lower part of the screen.

This status includes:

- i. **Status** – Turns green when the status packets are being successfully received from the S300 by the S300 console.
- ii. **Signal** – Turns green when the receiver detects an input RF signal at the selected frequency. This matches Signal LED on the front of unit.
- iii. **Data** – Turns green when the S300 has achieved data lock. This means that the receiver is able to recover all the digital timing from the input signal and is receiving a valid DVB transport stream. This does NOT match the blue data LED on the front of the S300.



NOTE: - S300 DATA LED – The blue data LED on the front face plate of the S300 will blink at a ½ second interval if data is being processed and forwarded by the S300.

CA Module – Turns yellow when the S300CA detects a valid CAM in the PCMCIA slot. Turns green when the S300CA detects a valid Program Association Table (PAT) on the incoming stream. If the LED is grayed out, this feature is not available on your receiver model.

- iv. **LNB** – Turns green when the LNB is turned on and is gray when the LNB is turned off. The LNB status LED will also turn red if there is a DC short present on the RF connector input.

- v. **Signal Strength** – Provides a graphic indication of the signal power at the input of the receiver.
- vi. **Carr. Freq.** – Provides the I/F carrier frequency in Mhz and the difference between the desired IF frequency and the tuned value.
- vii. **Sym. Rate** – Provides the receiver symbol rate.
- viii. **ModCod/Coding Rate** : Depending on the mode of operation (DVB-S vs. DVB-S2), this status value will change as follows:
 - 1. **MODCOD** (DVB-S2): Provides the modulation rate and coding rate of the input stream; this number is only valid when the receiver is locked
 - 2. **Coding Rate** (DVB-S): Indicates the Viterbi code rate of the input stream. This number is only valid when the receiver is locked.
- ix. **LDPC BER/BER**: Depending on the mode of operation (DVB-S vs. DVB-S2), this status value will change as follows
 - 1. **LDPC BER** (DVB-S2): Provides a count of the Low Density Parity-Check (LDPC) Bit Error Rate (BER). This number is a measure of the input signal quality
 - 2. **BER** (DVB-S): indicates the receiver Viterbi Bit Error Rate (BER) of the input stream. This number is a measure of the signal quality
- x. **Uncorrectables** – The number of uncorrectable packets that were processed by the demodulator section of the receiver. The counter accumulates and can be reset using the **RESET** button located beside the Uncorrectables field.
- xi. **C/N** – Provides the receive signal Carrier-to-Noise ratio (C/N).
- 5. **Minimize** – To the system Tray
- 6. **Close** – Close the S300 Console
- 7. **Traffic Counters** – The S300 provides a number of traffic counters that are useful in determining the health and operation of the receiver.
 - i. **Total Ethernet Packets Sent**: This counter accumulates the total number of packets being sent from the Ethernet port on the receiver.
 - ii. **Total Ethernet packets received**: The number of Ethernet packets that the S300 received on the Ethernet interface.
 - iii. **Ethernet Receive Errors**: The number of errors that occurred during the reception of Ethernet packets.
 - iv. **DVB Packets Accepted**: The number of DVB packets that the receiver accepted and processed.
 - v. **MPE Packets Processed**: The number MPE data packets processed by the S300.



NOTE: The counters will keep accumulating as long as the window is open. You can use the **RESET** buttons to rest the counters.

4 Configuring the S300

This chapter discusses how to configure the S300. It covers both the drop down menus as well as the configuration buttons.



NOTE: When editing field lists (such as Programs Selects list), you can often edit or delete the list entries by right clicking on them.

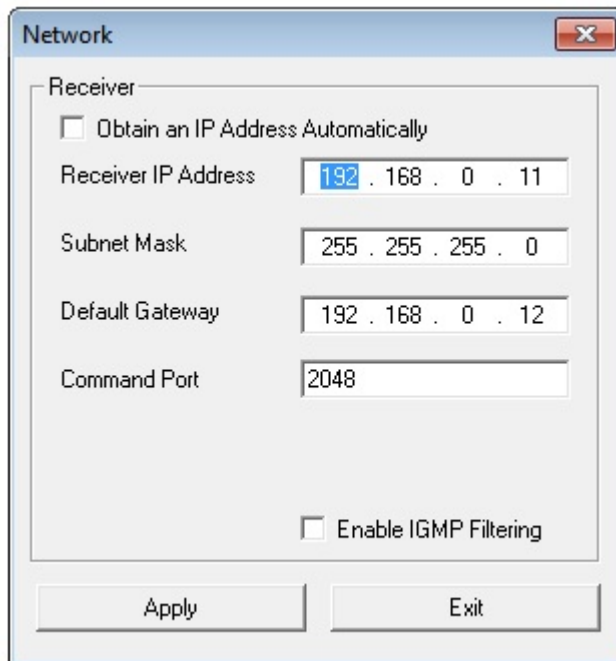
NOTE: Pressing Esc on the keyboard when configuring the S300 has the same effect as selecting Exit.

4.1 Interfaces

The Interfaces group of buttons enables the operator to configure the LAN or Network interface, and the Satellite or L-Band interface (the CAM interface is not required for S300 operation).

4.1.1 Network Button

The network settings of the S300 may be modified by selecting the NETWORK Button and changing the appropriate fields (as shown below).



The image shows a 'Network' configuration dialog box. It has a title bar with a close button (X). The dialog is divided into a 'Receiver' section and a bottom section with 'Apply' and 'Exit' buttons. The 'Receiver' section contains the following fields:

- ☐ Obtain an IP Address Automatically
- Receiver IP Address: 192 . 168 . 0 . 11
- Subnet Mask: 255 . 255 . 255 . 0
- Default Gateway: 192 . 168 . 0 . 12
- Command Port: 2048
- ☐ Enable IGMP Filtering

Figure 6: Network Configuration Dialog Box

1. **Obtain an IP Address Automatically:** This checkbox will force the S300 to use DHCP to automatically obtain its IP address.
2. **Receiver IP:** This is the IP address that is statically assigned to the receiver.
3. **Subnet Mask:** This is the subnet mask that the receiver should use to determine whether an IP address belongs to the same network or not.
4. **Default Gateway:** This is the IP address of the router that the receiver should use whenever it wants to send traffic to a non-local address.
5. **Enable IGMP Filtering:** This check box allows the operator to turn IGMP filtering on or off. IGMP controls which multicast streams will be forwarded on the LAN based on the number of clients listening to that stream.



NOTE: - Proper operation of IGMP protocol requires that all devices used in the network support IGMP protocol.

6. **Command Port:** This is the UDP port that is used by the S300 status messages
7. **Apply:** By pressing this button, the updates are sent to the receiver
8. **Exit:** Exits back to the main screen

4.1.2 Satellite Button

The next step in the configuration is to ensure you have the correct RF settings and that the S300 can successfully lock to your satellite signal. To configure your satellite settings, select the **SATELLITE** configuration button (see 7 below) and input the following fields:

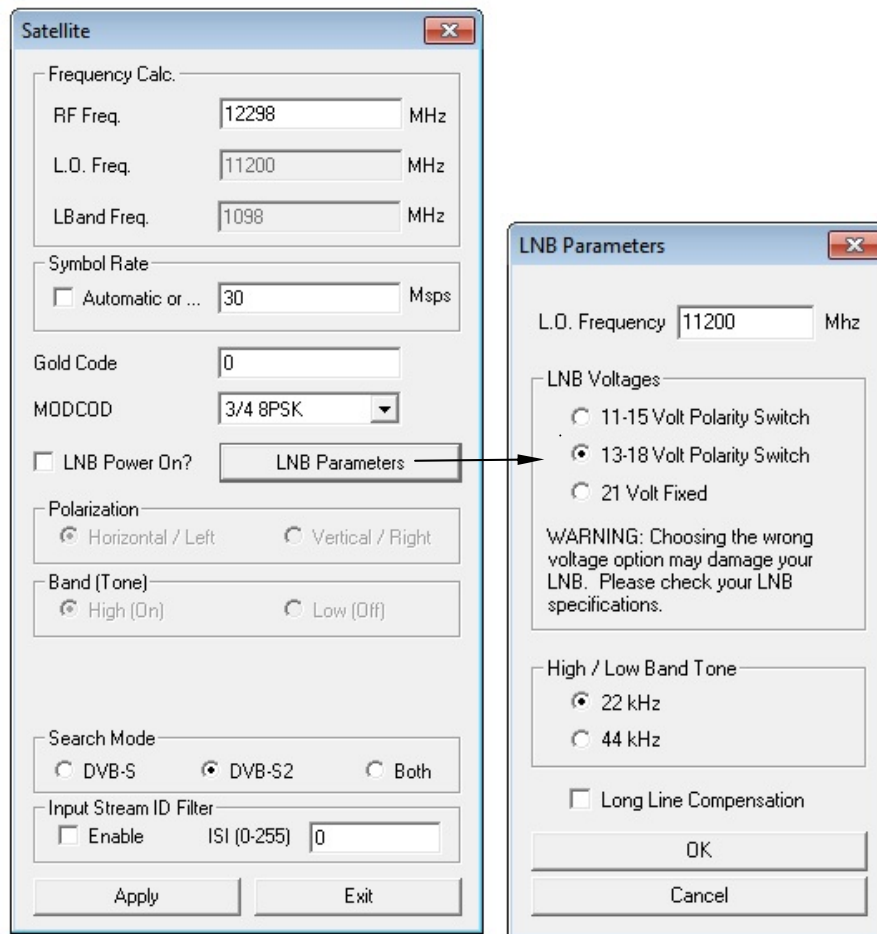


Figure 7: Satellite Configuration and LNB Parameters Dialog

- 1) **RF Frequency:** The RF Frequency of the signal that you are trying to receive.
- 2) **Symbol Rate:** This is the symbol rate of the transponder that you are trying to tune to. The S300 supports automatic detection of the incoming symbol rate (check box) or you can manually specify which symbol rate you wish the receiver to tune to.
- 3) **Gold Code:** Enter the Gold Code setting here. This must match the Gold Code setting in the modulator that is used to generate the DVB-S2 stream. For DVB-S operation, the Gold Code box will be grayed out.



NOTE: - If the Search Mode is set to BOTH and the received stream is DVB-S, then the contents of the Gold Code box will be ignored by the receiver.

- 4) **ModCod:** For multi-stream DVB-S2 operation, the S300 should be configured to receive 1 stream. This is accomplished by entering the ModCod of the signal you wish to receive in the ModCod drop down box. If you enter the wrong ModCod value, you receiver may not be able to lock onto the desires signal.
- For single stream DVB-S2 operation, the Modcod dropdown should be set to ALL.
- For DVB-S operation, the Modcod box will be grayed out.



NOTE: - If the Search Mode is set to BOTH and the received stream is DVB-S, then the contents of the ModCod box will be ignored by the receiver.

- 5) **LNB Power On:** Turns the DC voltage and tone output of the receiver to ON or OFF.
- a. **Polarization:** Switches the DC output of the receiver between Horizontal/Left and Vertical/Right. This setting is only valid if the LNB power is on.



NOTE: - The LNB voltage level may be set by selecting the LNB PARAMETERS button.

- b. **Band (Tone):** Switch the LNB Tone frequency of the receiver On (High) or Off (Low). This is only valid if the LNB power is on.



NOTE: - The LNB tone frequency may be set by selecting the LNB PARAMETERS button.

- 6) **LNB Parameters:** Click this button to bring up the LNB Parameters screen. It is used to set the LO frequency, polarization voltage and LNB tone (see Figure above):
- a. **LO Frequency:** Input the single-band LO frequency in Mhz.
 - b. **Polarity Switching Voltage:** Select either 1 1-15 VOLT POLARITY SWITCH, 13-18 VOLT POLARITY SWITCH or 2 1 VOLT FIXED for the Vertical/Right and Horizontal/Left LNB voltage values.
 - c. **High/Low Band Tone:** Select either 22 KHz or 44 KHz for the LNB switch tone frequency. Typically 22 KHz is used.
 - d. **Long Line compensation:** Checking this box will increase the Polarity Switching voltage by 1 V. This additional voltage may be used to compensate for the voltage drop due to a long I/F cable run between the S300 and the LNB.
 - e. **OK:** By pressing this button, the screen updates will be temporarily stored and the user will be returned to the Satellite screen. By selecting APPLY on the Satellite screen the LNB Parameter settings will be sent to the S300. Selecting EXIT will exit the Satellite screen without setting the LNB Parameter updates.
 - f. **Cancel:** Exits back to the satellite dialog screen



NOTE: - If a dual LNB is being deployed, ensure that the appropriate LO frequency is entered in the LO Frequency box and that the correct band (high or low) is selected in the Satellite screen.

- 7) **SEARCH MODE:** Select either the DVB-S2, DVB-S or BOTH radio button to set your receiver to receive a DVB-S2 or DVB-S compliant satellite signal. If you select Both, the receiver will automatically select the correct mode of operation



NOTE: - The S300 can automatically select between DVB-S2 and DVB-S input streams.

- 8) **Input Stream ID Filter:** The Input Stream Identifier (ISI) Filter may be used by your receiver to filter streams based this value. If the ISI **CHECKBOX** is selected, then the receiver will only demodulate streams that have an ISI value that is the same as the value shown in the ISI box. This command should only be used if the ISI stream value is set on the incoming DVB-S2 stream and if the ISI value is know. You may have to contact your uplink provider for assistance. For DVB-S operation, the ISI input will be grayed out.



NOTE: - If the Search Mode is set to **BOTH** and the received stream is DVB-S, then the contents of the ISI Filter box will be ignored by the receiver.

- 9) **Apply:** By pressing this button, the updates are sent to the receiver.
- 10) **Exit:** Exits back to the main screen

4.2 IP Data

4.2.1 IP Re-Mapping

This section discusses how to configure the IP Re-Mapping feature within the S300.

The IP Remapping feature in the S300 will enable the operator to re-map a multicast IP addresses or multiple multicast IP addresses that have been received by the receiver to a different destination multicast IP address. The IP mapping table will support up to 16 entries and will therefore allow for 16 multicast addresses to be remapped. Some of the features of the IP mapping table include:

- Ability to map single multicast IP address to a destination multicast IP address
- Ability to map multiple multicast IP addresses to a single destination multicast IP address,
- Ability to use a subnet mask to map a range of multicast IP address to a single destination multicast IP,
- Ability to turn the multicast mapping table on or off without losing the table contents,
- Ability to turn a single multicast mapping table entry off (No Rule) without losing the entry from the table,
- Ability to use IGMP filtering to enable (or disable) sending of mapped multicast packets, and
- Ability to forward mapped multicast IP packets regardless IGMP filter setting

The IP mapping table can only be assessed from the main screen by selecting the IP REMAP button. This will bring up the IP re-mapping table as shown below.

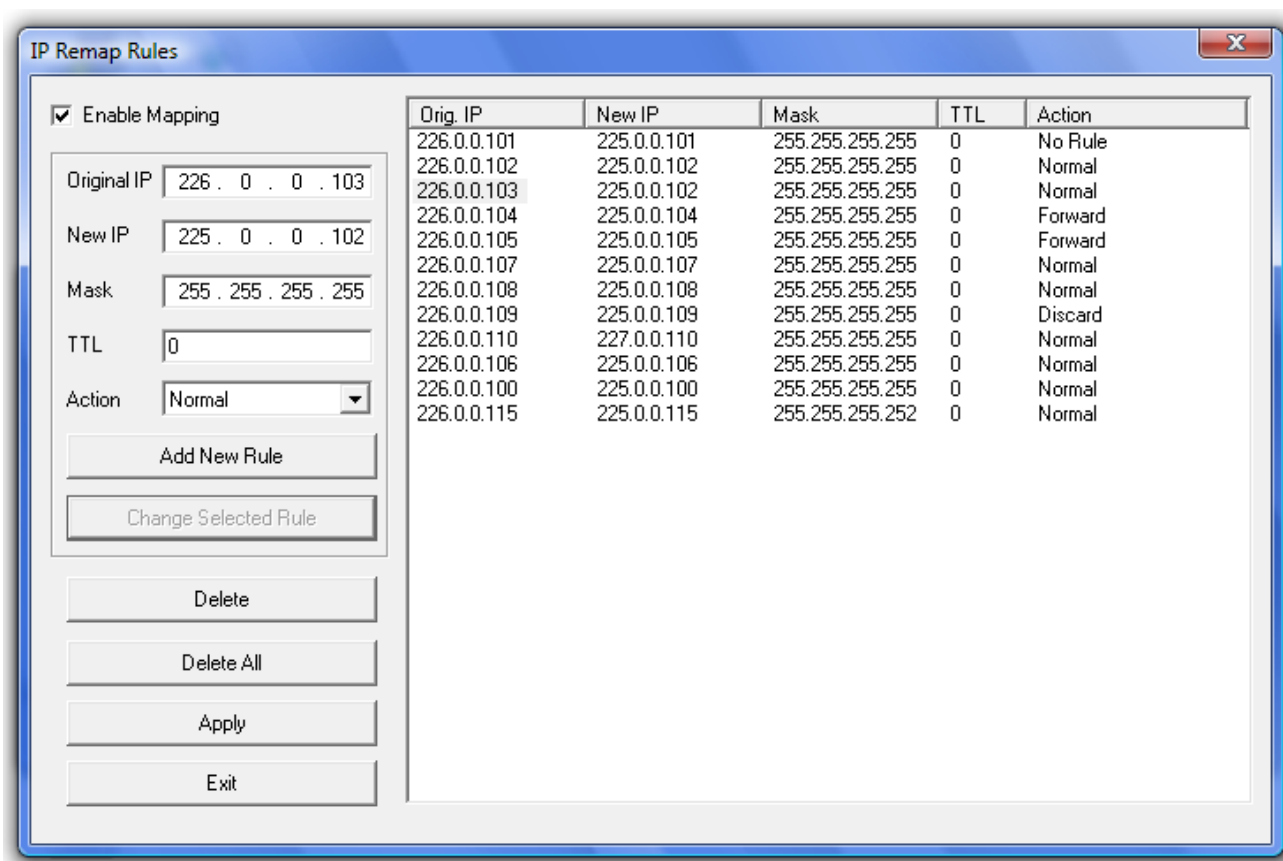
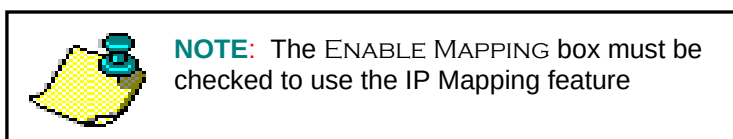


Figure 8 - IP Re-mapping

Referring to the Figure above, the left hand side of the screen enables you to configure the mapping rules and the right hand pane summarizes and displays the configured IP mapping rules. Up to 16 rules are supported.

The following is a description of the above screen entries:

- 1) **Enable Mapping:** Check this box to enable the mapping table. Unchecking this box can also be used to disable the entire mapping table without losing the table contents. The table can then be re-enabled by checking the box.



- 2) **Original IP:** The original multicast IP address that is to be mapped to a new destination IP address.
Note: This IP address must be a multicast IP address.

- 3) **New IP:** The destination multicast IP address that the original multicast IP address is mapped to. It is possible to map multiple Original IP addresses to a single New IP address. Note: this IP address must be a multicast IP address.
- 4) **Mask:** The subnet mask is applied to the Original IP address to create a range of IP addresses that are mapped to the new destination IP address.
- 5) **TTL:** Setting the Time To Live (TTL) value to non-zero causes the TTL field in the IP header to be replaced with this value. The default setting is zero.
- 6) **Action:** The S300 shall perform the following packet forwarding options based on this value. The default setting is no rule.
 - a) NO RULE - rule entry is not applied to the packet
 - b) NORMAL - packet is forwarded based on the IGMP setting
 - c) FORWARD - packet is always forwarded
 - d) DISCARD - packet is always discarded
- 7) **Add Rule:** Adds the rule as defined by the mapping table fields (entries 2-6 above) into the mapping table. Note: The mapping table fields may be populated by double clicking on a selected mapping table entry and may be then edited and added to the mapping table by clicking the Add Rule box.
- 8) **Change Selected Rule:** The operator may load any rule into the mapping table fields (2-6 above) and edit any of the parameters as needed. Clicking the Change Selected Rule button will modify the selected rule with the edited updates.
- 9) **Delete:** Will delete any selected entry in the mapping table
- 10) **Delete All:** Will delete all entries in the mapping table
- 11) **Apply:** Will apply the mapping table to the receiver. This box must be selected for the mapping table changes to take effect
- 12) **Exit:** Will exit back to the S300 Configuration Application main screen

4.3 Programs

This group of buttons enables the operator to receive MPEG audio/video programs and/or MPEG data PIDs and pass this information onto the S300 LAN.

4.3.1 Content Button

The CONTENT Screen (shown in Figure below) enables the operator to perform the following functions:

1. Forward a received audio/video program to a multicast address
2. Forward an MPE data program.
3. Forward an MPE data PID
4. Forward the full transport stream to a single multicast address
5. Forward a raw MPEG PID(s) to a multicast address

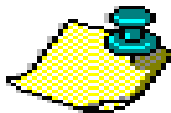
All of these 5 functions may be performed by selecting the Content Button to bring up the Content screen.

This screen (shown below) consists of 4 tabs along the top, one for MPEG programs, one for MPE programs, one for MPE PID's and one for Raw MPEG PID's. Each of these tabs is described in more detail in the sections below.

The Content Configuration Screen uses the same basic layout for all 4 tabs. The screen is broken up into 3 separate panels, including:

1. On the left side of the screen is the panel used to enter the configuration information for each program (or PID),
2. The middle part of the screen (Programs) is used to display the configured programs (or PID's), and

On the right side of the screen is a Program Guide that is used to display a listing of all the programs that are available to be received by the S300. The contents of the Program Guide are parsed by the S300 from the received Transport Stream SI tables. This listing shows the user the list of programs that are available to be selected. The Program Guide provides a color-coded program listing based on information received from the Service Description Table (STD). Red-highlighted streams indicate the program content is encrypted, while green-highlighted streams indicate the program content is in the clear (not encrypted).



NOTE: To properly play out an encrypted (red) program requires an S300CA receiver with an appropriate Conditional Access Module (CAM) and an authorized smart card.



NOTE: For the Program Guide to display the available programs, the S300 must be locked to a Satellite transponder (refer to 4.1.2)

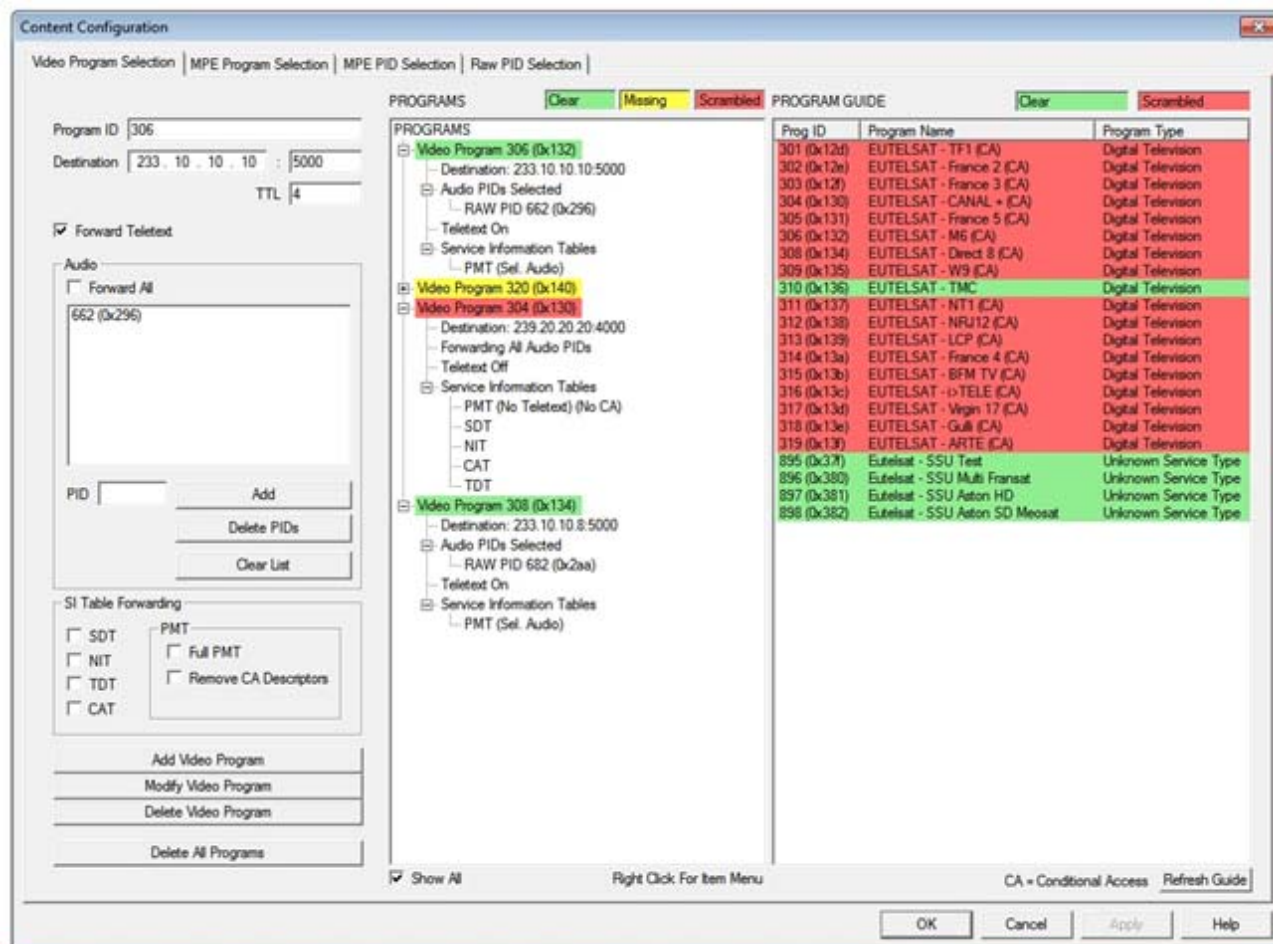


Figure 9 - Content Configuration Screen

4.3.1.1 Video Program Selection

Selecting the VIDEO PROGRAM SELECTION tab will bring up the screen shown above in Figure . The purpose of this screen is to enable the operator to configure the S300 to receive an MPEG Video program and assign it to a multicast IP address so that it can be forwarded onto the receiver LAN. The process to do this is quite simple – enter the program ID and the multicast IP address/port and select APPLY.

The video selection screen is split into three sections. The right-most screen displays the Program Guide which is parsed out from the Transport Stream SI tables by the S300. Occasionally it takes a few seconds for this part of the screen to be updated. The REFRESH button below the Program Guide may be used to manually refresh the Program Guide contents.

The left side of the Content Configuration screen is the working area where the received program details may be entered. The following provides a brief description of each of the configuration items:

1. **Program ID:** Enter the program ID of the program you wish to receive. This field can be auto-populated by double clicking the program in the Program Guide
2. **Destination:** Use this edit box to enter the multicast IP address and port number.
3. **TTL:** Use this edit box to enter the Time to Live (TTL) for the multicast IP packets. The TTL value in the IP header will be replaced with this entry.
4. **Forward Teletext:** Selecting this checkbox will forward any Teletext PID's to the multicast stream.
5. **Audio – Forward All:** Selecting this checkbox will forward all Audio PID's to the multicast stream. If this box is not checked, then the audio PID's must be manually added to the stream. This enables the operator to select which audio stream(s) are forwarded. This feature is particularly useful for situations where multiple audio PID's are included within the stream, but only one is needed to be forwarded with the single program transport stream.
6. **PID - Add:** Use this edit box to manually add Audio PID's to the multicast transport stream.
7. **Delete PID's:** Use this edit box to remove Audio PID's from the multicast transport stream.
8. **Clear List:** Select this button to clear the Audio PID list.
9. **SI Table forwarding:** Use the SI Table forwarding checkboxes to select which SI table PID's are forwarded with the multicast transport stream.
 - a. **SDT:** Use this checkbox to include the Service Description Table (PID 0x0011) in the multicast transport stream.
 - b. **NIT:** Use this checkbox to include the Network Information Table (PID 0x0010) in the multicast transport stream.
 - c. **TDT:** Use this checkbox to include the Time and Date Table (PID 0x0014) in the multicast transport stream.
 - d. **CAT:** Use this checkbox to include the Conditional Access Table (PID 0x0001) in the multicast transport stream.
 - e. **Full PMT:** Use this checkbox to pass the received PMT PID in the multicast transport stream. In this case, the S300 will not regenerate the PMT but will instead pass the full received PMT.
 - f. **Remove CA Descriptors:** Use this checkbox to remove the CA Descriptors from the multicast transport stream.
10. **Add video Program:** After configuring your multicast program, select this button to apply the configuration to the S300.
11. **Modify Video Program:** After making changes to your multicast program, select this button to update the selected button.
12. **Delete Video Program:** Select this button to delete your selected multicast program.

13. Delete All Programs: Select this button to delete all multicast programs.

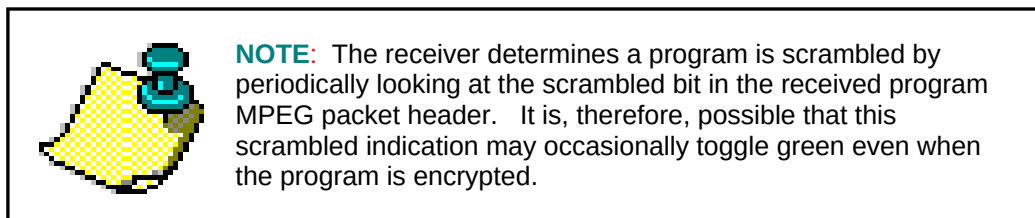
The middle pane of the Content Configuration screen shows a summary of the programs that have been configured. The checkbox at the bottom of the pane allows the user to show just all the configured programs and PID's, or just the ones pertaining to tabbed selection type (in this case, Video Programs).

Again color coding is used to help the operator understand the status of the streams being received by the S300.

A green-highlighted program indicates that the program is received and that it is in the clear (not scrambled). A yellow-highlighted program indicates that the following program information is missing from the program stream:

- There is no Program Information, or
- There is no PMT, or
- There is no Data, PCR, Teletex, Audio or Video PID's

A red-highlighted program indicates that the program is being received by the S300, and that it is scrambled



Finally, if status of the program is unknown, then no highlighting is applied the program listing. For example, when a raw PID or an MPEG PID is added to the Program list, it is displayed with no shading since the receiver does not know if it is part of a program or not. This can be seen in Sections 4.3.1.3 and 4.3.1.4 below.

The program summary for a given program (shown in the Programs Selected pane) may be expanded by clicking on the "+" sign in the program hierarchy. For the example shown above, we can see that program 308 is configured to IP address 233.10.10.8:5000. Only 1 audio PID is forwarded with the stream, that being PID 682. Any associated Teletex PID's are forwarded with the multicast transport stream. The S300 will pass this program to the LAN as a Single Program Transport Stream, and therefore will re-generate the PAT and PMT to reference only this program. All other programs (i.e. the ones not included in the stream) will not be included in the PAT/PMT.

The user may extract detailed information on a particular program after the program has been successfully configured and applied to the S300. By right clicking over the selected program and selecting SHOW PROGRAM INFO (see below):

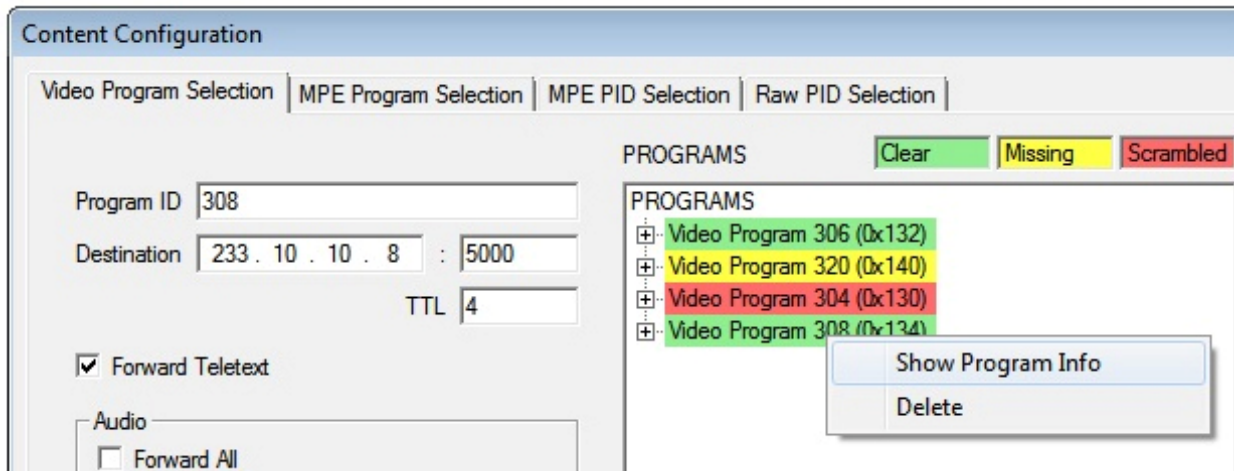


Figure 10 - Show Program Info

The following information status pane is then provided:

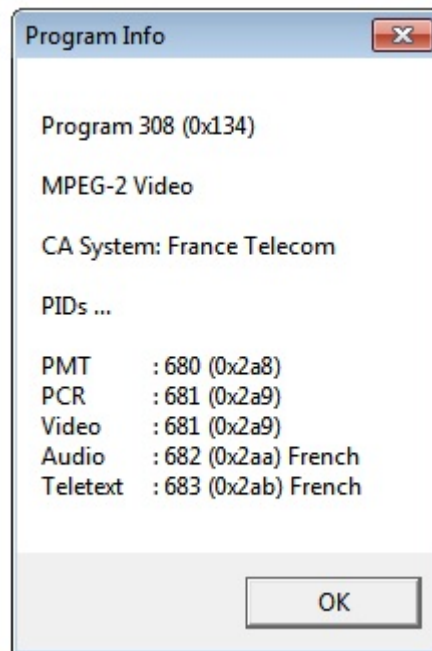


Figure 11 - Program Information Pane

From the Program Info screen above, the following information is provided on the program: Program Number (308), Program Type (MPEG-2 Video), the fact that the program is scrambled and the CA system provider (France Telecom), and the PID's that are being forwarded in the stream.



NOTE: The S300 will automatically detect if the configured program is scrambled and will automatically try to configure the CAM to descramble it. If you are trying to receive an encrypted stream, please ensure you have an authorized CAM and smart card installed in the S300.

4.3.1.2 MPE Program Selection

The MPE Program Selection tab allows the user to configure the S300 to receive MPE programs. To add an MPE program, the user enters the Program ID (or SID) into the PROGRAM ID text box and selects ADD MPE PROGRAM. Similarly, to remove an MPE program, the user selects the program and clicks REMOVE MPE PROGRAM.

The SHOW ALL checkbox at the bottom of the Programs Selected pane can be used to show just the configured MPE Program entries or to show all the configured entries.

As was described in Section 4.3.1.1 above, detailed information on a given program (Program 1010, in this case) may be displayed by right clicking over the Program and selecting SHOW PROGRAM INFO. The Program 1010 information pane is also shown in the figure below.

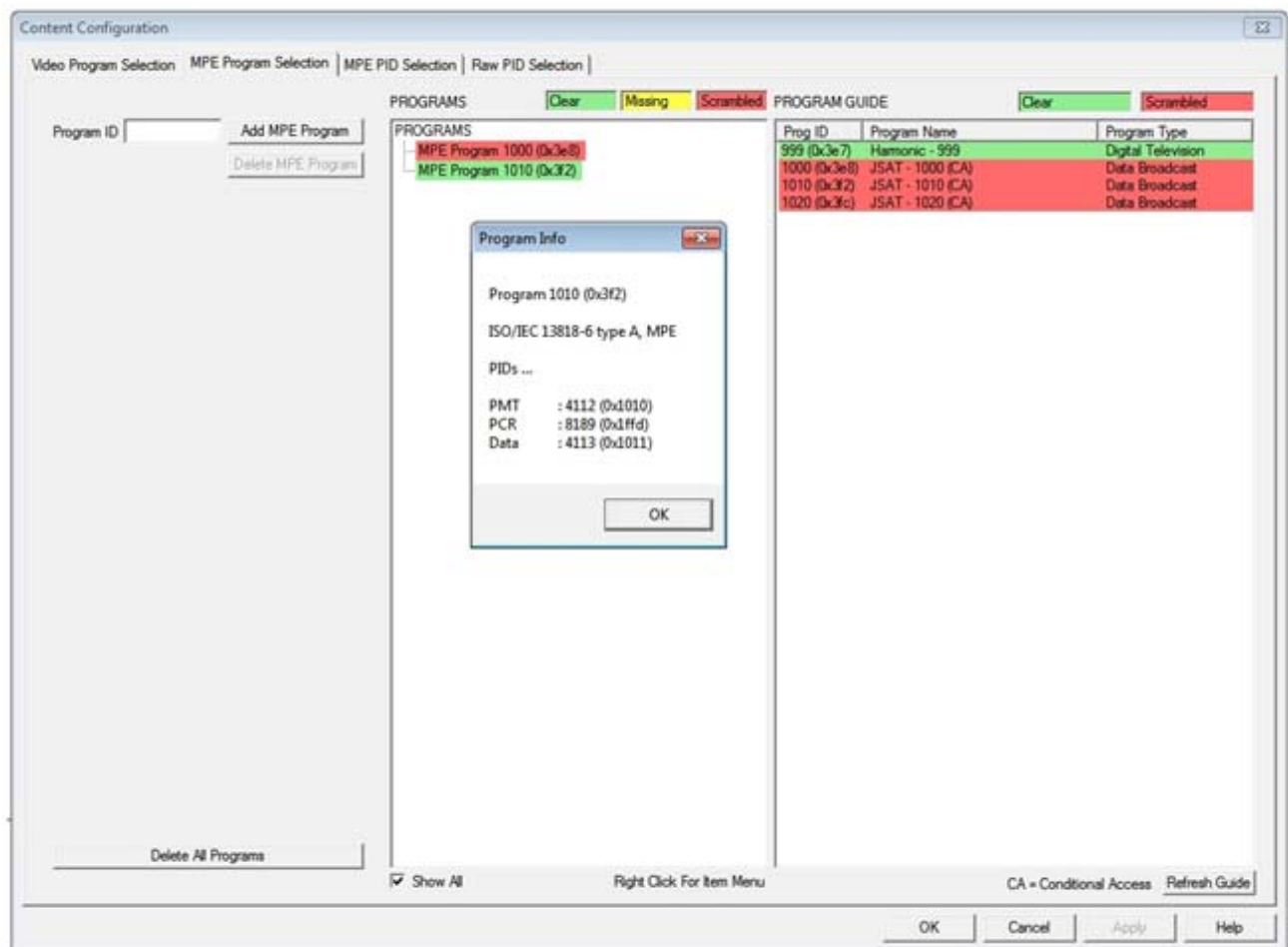


Figure 12 - MPE Program Selection Screen

4.3.1.3 MPE PID Selection

The MPE PID Selection tab allows the user to configure the S300 to receive MPE data PID's. To add an MPE data PID, the user enters the PID into the PID text box and selects ADD PID. Similarly, to remove an MPE PID, the user selects the program and clicks REMOVE PID.

The SHOW ALL. checkbox at the bottom of the Programs Selected pane can be used to show just the configured MPE PID entries or to show all the configured entries.

The entry of these MPE PID's (4133 and 4097) in the Program list does not show any color highlighting because the receiver does not have any information regarding the assignment of these PID's to a program.

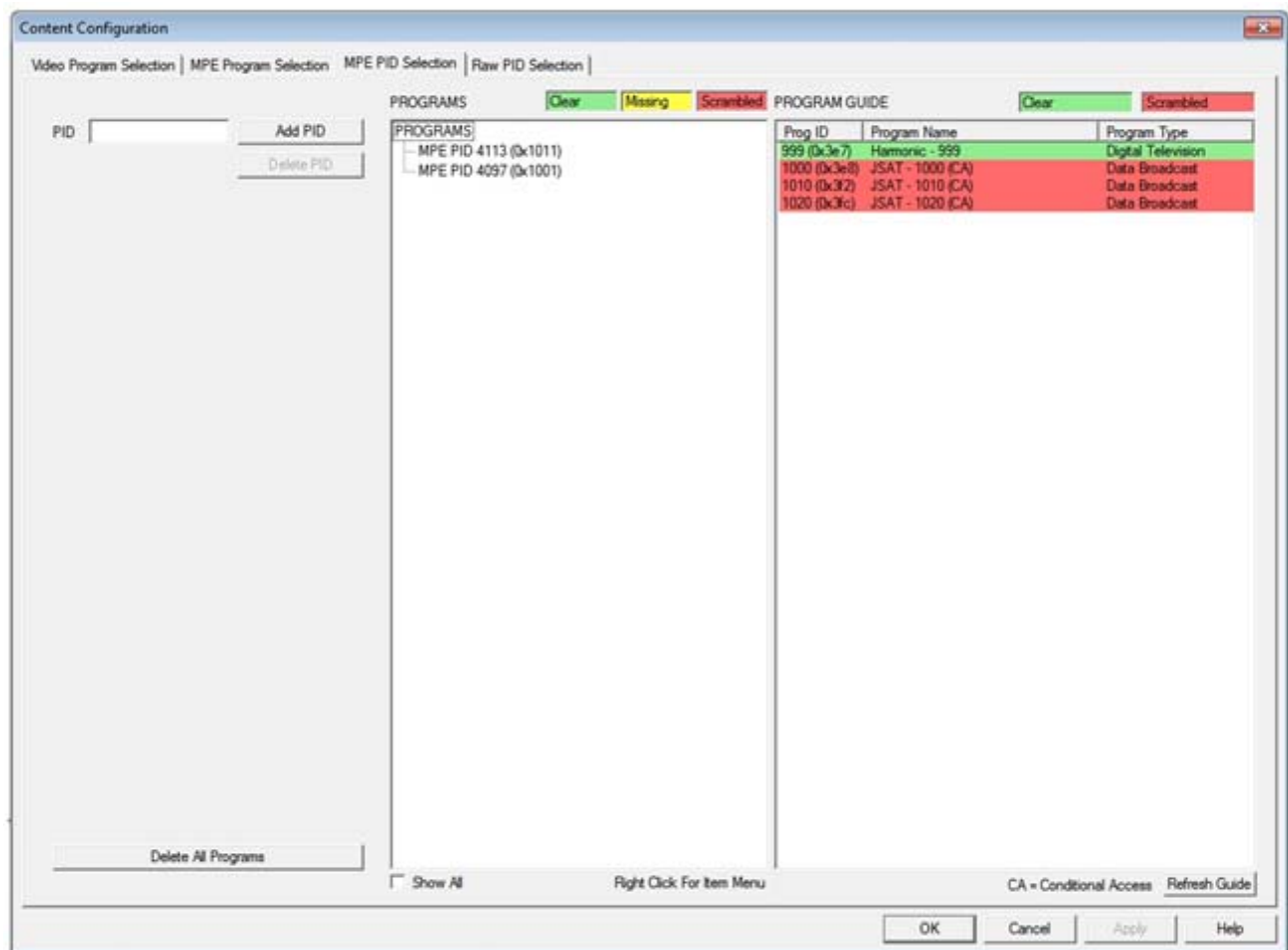


Figure 13 - MPE PID Selection Screen

4.3.1.4 Raw PID Selection

The Raw PID Selection Tab enables the receiver to be configured to pass raw MPEG PID's to a multicast IP address, or to pass the full received Transport Stream to a single multicast IP address.

The following describes the configuration items for this tab:

1. **Destination:** Use this edit box to enter the multicast IP address and port number.
2. **PID - Add:** Use this edit box to manually add Raw PID's to the multicast transport stream.
3. **Delete PID's:** Use this edit box to remove Raw PID's from the multicast transport stream.
4. **Clear List:** Select this button to clear the Raw PID list.
5. **Add Raw Program:** After configuring your Raw PID's, select this button to apply the configuration to the S300.
6. **Modify Raw Program:** After making changes to your Raw PID's, select this button to update the selected PID's.
7. **Delete Raw Program:** Select this button to delete your selected Raw PID's.
8. **Delete All Programs:** Select this button to delete all Raw PID's.

The SHOW ALL. checkbox at the bottom of the Programs Selected pane can be used to show just the configured Raw PID entries or to show all the configured entries.

The entry of these RAW PID's (100, 1000, 1020) in the Program list does not show any color highlighting because the receiver does not have any information regarding the assignment of these PID's to a program.

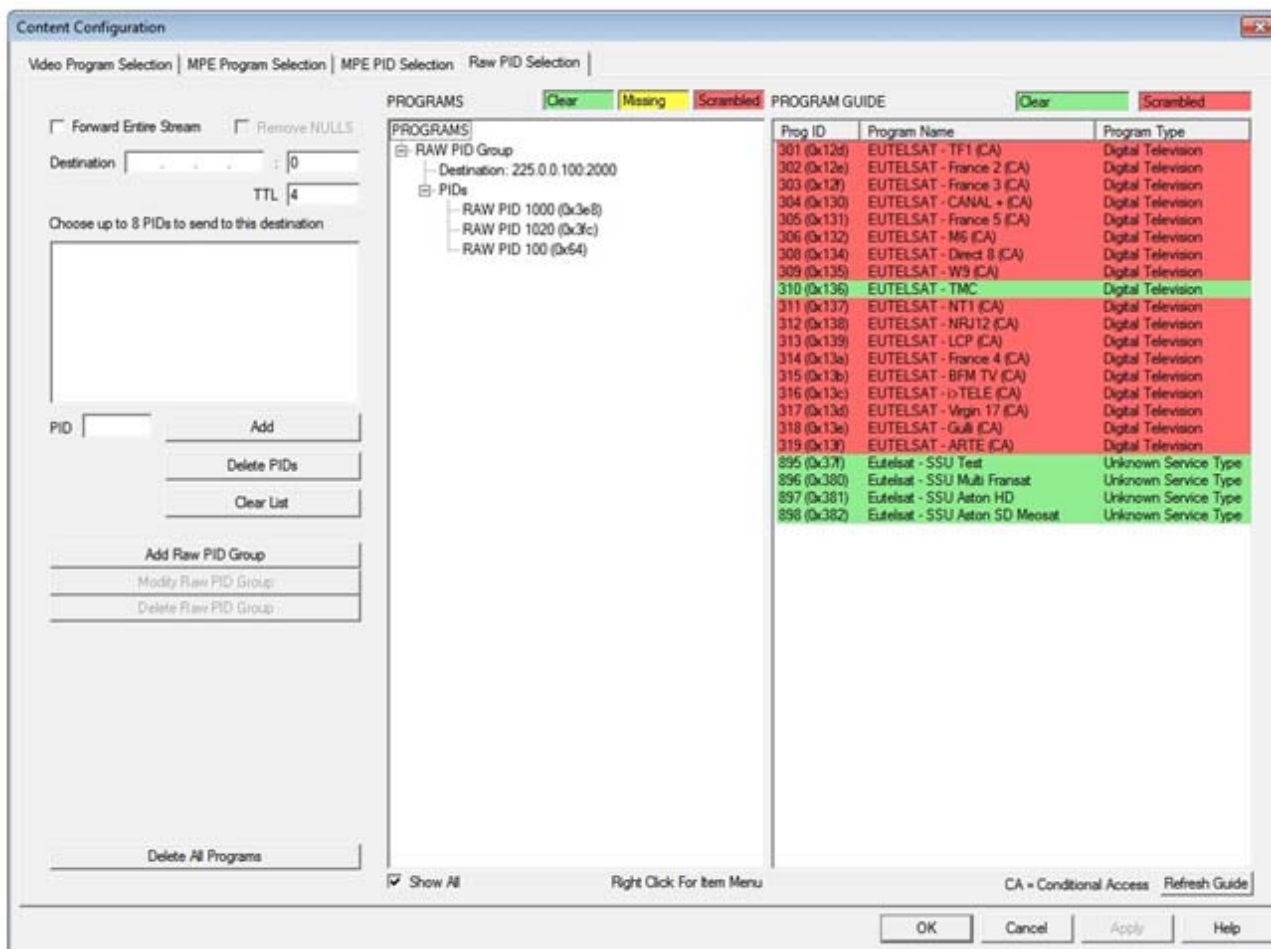


Figure 14 - Raw MPEG PID Selection Screen

4.4 Control

The Control button group provides general configuration and control elements for the receiver.

4.4.1 Reboot Button

Selecting this button will reboot the S300.

4.5 File Drop Down

The file drop down menu (shown below) provides access to the following features

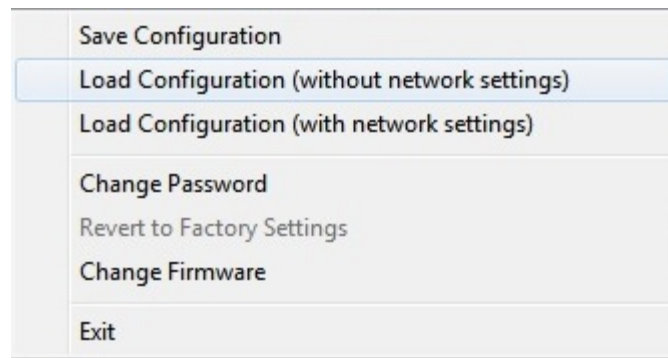


Figure 15 - File Drop-Down Menu

1. **Save Configuration:** Allows the user to save the S300 configuration settings to an XML file
2. **Load Configuration (without network settings):** Allows the user to load the S300 configuration settings from an XML file. The network settings of the receiver will not be updated using this command.
3. **Load Configuration (with network settings):** Allows the user to load the S300 configuration settings from an XML file. Using this command, the S300 network settings (including the IP address) will be updated and applied to the S300.



CAUTION: Setting the IP address of the S300 to a non-routable address or an address not on the same subnet as the S300 Console PC may make the S300 unreachable from the S300 Console PC.

4. **Change Password:** Allows the user to change the S300 Console program password.



Figure 16 - Change Password

5. **Exit:** Exits the S300 Console program
6. **Change Firmware:** Allows the user to download a new firmware load for the S300 receiver.

To change the S300 firmware, please refer to the Figure below:

- a. Select **CODE FILE** and browse to the S300 code update binary file.
 - i. The firmware update function is **ONLY** applicable for S300 DSP firmware files and the S300 CAM controller firmware files.
 - ii. The DSP file will be a binary file (eg: S300VS2_V1R3M18.bin)
 - iii. The CAM controller firmware file will have a ".cam" suffix (eg: CAM_V6R4.cam). The CAM controller firmware upgrade is only applicable to the S300CA receivers
- b. Select **COMMIT**.
- c. On the firmware upload is complete you should get a message stating the **RECEIVER FIRMWARE HAS BEEN REWRITTEN**. The S300 Console program will then shut down and must be restarted to continue configuring the S300.
- d. If you get a **CODE DOWNLOAD FAILED** timeout error, ensure your have changed your IP addresses per the note above.

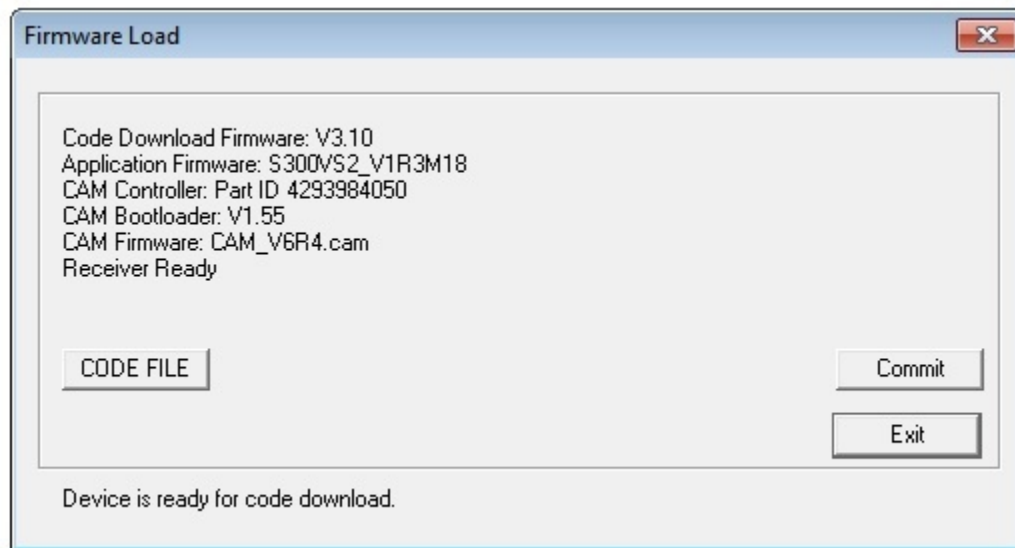


Figure 17 - S300 Firmware Download Screen

4.6 Control Drop Down

The Control drop down menu (shown in the figure below) provides access to the same functions as the buttons on the main application window.

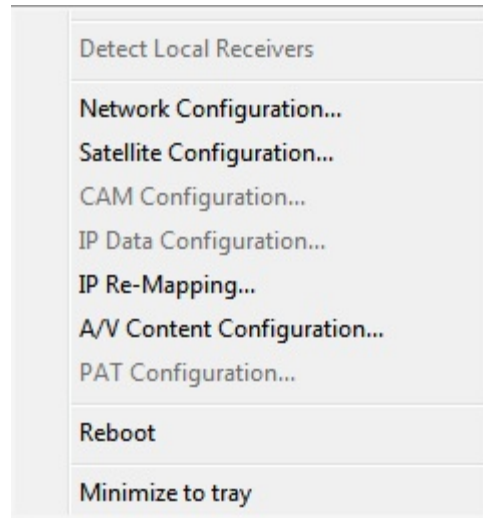


Figure 18: Drop Down Menu (Control)

4.7 Help Drop Down

The Help drop down menu provides access to the Help menu and the About menu.

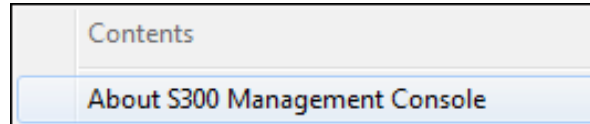


Figure 19 - Help Drop Down Menu

4.7.1 Help

The Help menu is not currently available.

4.7.2 About

An example of the About menu is shown below. It provides Novra contact information and the receiver hardware and software version numbers.

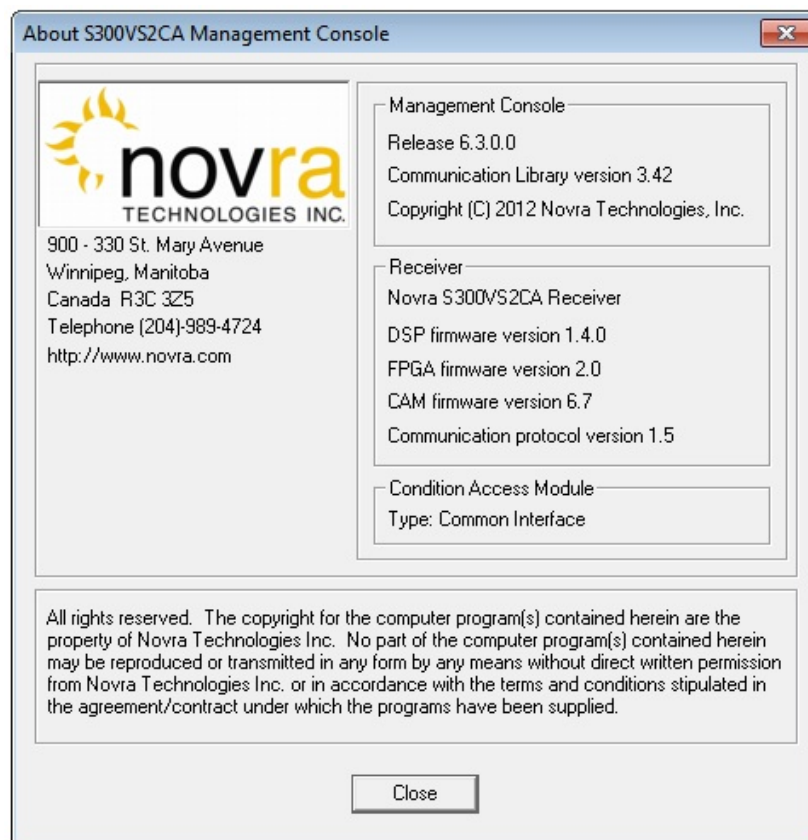


Figure 20 - About Screen

5 How to Configure the S300 for TV Viewing

This Section provides a step-by-step procedure for viewing TV programs using the S300.

Also, it should be pointed out that the S300 provides an Ethernet output (not a video output). It therefore cannot be connected directly to your TV. You can, however, pass the Ethernet signal to an MPEG-over-IP set top box (which would be used to drive video to your TV), or you can view the TV program(s) directly on your PC using a software video player, such as VLC.

To configure the S300-Pro or S300CA for watching TV, please do the following:

1. Configure the Novra software.
 - a. Ensure the host PC is on the same IP address class as the S300. This can be changed back after Novra receiver is configured (Refer to Section 4.1.1).
 - b. Ensure the L-band frequency, symbol rate and LNB settings are correctly set and that the unit is locked to the satellite signal (see Section 4.1.2)
 - c. Select the Content screen and click the VIDEO PROGRAM SELECTION tab. Use the Program Guide to determine which program you wish to receive. Note: it may be necessary to click the REFRESH button on the bottom of the Program Guide to update the guide.
 - i. Enter the Program ID of the program you wish to receive and your multicast IP address/port number.
 - ii. If necessary, configure your Audio PID's, SI tables and Teletex PID (refer to Section 4.3.1.1).
 - iii. Click ADD VIDEO PROGRAM to add your program and select APPLY to configure the S300 with the program. The S300 should now be sending this program via its LAN port to the multicast address specified.



NOTE: To receive scrambled programs, you will need an S300CA with the appropriate Conditional Access Module (CAM) and an authorized smart card.

2. To set up VLC Media player to render the stream, perform the following:
 - a. Select File, Open Network Stream.
 - b. Click on the UDP/RTP radio button and enter the multicast address and port you specified above in the appropriate areas. Select OK.
 - c. VLC will then start playing the television programming.



NOTE: You can make up the IP address based on knowing that no other multicast streams are using that address and port on your network. All multicast streams must be in the 224.X.X.X to 239.X.X.X address space. For example 224.0.0.10, port 3030.

6 Troubleshooting

This section can help you resolve most of the common problems when installing the S300.

1) I connected the receiver and when I start the Console, it says it can't detect any S300 Receivers?

- Make sure the unit is connected to the same LAN that your computer (running S300 Console) is connected to. The best way to rule that out is to use a cross over cable.
- Make sure the unit is powered up and the Ethernet link is established. The green LED on the back of the Ethernet connector should be on solid, and the yellow light should be blinking.
- If you are using a hub, make sure there is only one unit connected.

2) I connected my unit, and it was auto detected. Every time I try to configure the device I get an error Message. What could be wrong?

- Make sure the IP address assigned to the receiver is reachable from your PC, and the receiver is configured correctly to reach your machine (try pinging the receiver from your PC).

3) Why won't the receiver lock to my settings?

- Is the RF cable connected?
- Are you using the correct RF Settings (frequency and symbol rate)?
- Are you using the correct voltage/tone settings for the LNB?

4) The receiver is locked to my signal and there is no Data, why?

- Do you have the right PID selected?
- Are you sure you are on the right transponder?
- If the Ethernet Transmitted packet counter is counting up. Use program such as Wireshark to determine where the traffic is going?
- Is the default gateway on the receiver set correctly?
- Does the DVB MAC address of the traffic match the Mac address of your unit? (UNICAST)
- Are you using IGMP and the network clients are not subscribing? (multicast)
- Is the IGMP hardware filtering checked off (in the Network tab), but no network clients subscribing with IGMP join requests.

5) I have created a mapping rule, but the packets don't seem to be mapped. I only see the original IP packets when I sniff the LAN.

- Make sure you have enabled the Mapping table,
- Make sure your mapping action rule is NORMAL or FORWARD,

6) I have created a mapping rule, but the packets don't seem to be mapped. I don't see either the Original IP packets or the New IP packets when I sniff the LAN.

- Make sure your mapping action rule is NORMAL or FORWARD,
- If your mapping action is NORMAL and you have IGMP filtering enabled, make sure you have an application running that will generate an IGMP join to receive the packets. Otherwise you could try to turn IGMP filtering off, or set your mapping action rule to FORWARD. Note: if you set your mapping action rule to NO RULE, the Original IP packets will not get mapped and the IP traffic on your LAN will be your Original IP packets.

7 Specifications

7.1 Receiver Characteristics

RF Tuner

- Receiving Frequency: 950 to 2150 MHz
- Frequency Acquisition: $\pm 50\%$ Symbol Rate up to ± 10 MHz
- Input Signal Level: -70 dBm to -25 dBm

Multi-standard Demodulation

- DVB-S
 - o QPSK: 300 Ksps to 45 Msps (auto selection)
- DVB-S2
 - o QPSK: 600 Ksps - 45 Msps (auto selection)
 - o 8PSK: 600 Ksps -30 Msps (auto selection)
 - o 16APSK: 600 Ksps -30 Msps (auto Selection)
- Data Rate: 80 Mbps
- Nyquist Root Filter: 0.2, 0.25, 0.35 roll off
- Automatic Code Rate detection and lock

Multi-Standard Decoding FEC (Forward Error Correction)

- DVB-S
 - o Viterbi 1/2, 2/3, 3/4, 5/6, 6/7, 7/8 puncture rates
 - o Reed Soliman 16 bit decoder
- DVB-S2
 - o LDPC 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 rates
 - o BCH (Bose-Chaudhuri-Hocquenghem) decoder

Gold Code Sequencing

- 0-26143 Sequences

LNB Power and Control

- LNB Supply Voltage: Selectable 13/18V, 11/15V, 20 V or off
- LNB Supply with selectable long line compensation
- LNB Control: Selectable 22 KHz, 44 KHz or off
- LNB Supply Current: 400 mA with Short Circuit and Surge Protection

Status Indicators

- Power: Red LED
- Lock: Green LED
- Data: Blue LED (will blink every $\frac{1}{2}$ second if traffic is flowing)
- Ethernet: Link (green) and Transmit (yellow)

Hardware Capabilities

- Multiprotocol Encapsulation (MPE)
- PID Filters: 32
- Internal Hardware Watchdog
- Non-Volatile Configuration Storage
- Field upgradeable operating system for new s/w releases and functional upgrades

Operating Systems

- Once Configured, Receiver Supports all Operating System

Physical Interfaces

- RF Input Connector: F-Type, 75 ohms
- Ethernet 100 Base-T LAN Interface: RJ-45



CAUTION: Nothing should be inserted between the S300 and the satellite dish except for a surge suppressor. Cable TV Splitters, TVs, VCRs, and FM receivers are not designed for connection to this portion of the network. They will not work and if they are connected, even for a brief moment, they will probably never work again because the power on the coax will destroy the input of the misplaced unit.

7.2 Minimum System Requirements

Your computer must operate with any one of the following operating systems to successfully use the Novra Receiver:

- Windows 7 Ultimate
 - Note: To start the application on Windows 7 Home Premium or Windows 7 Professional, you may have to right click on the application and select "Run as Administrator".
- Other Versions of Windows, such as XP, 2000 or Vista will most likely work with Novra Configuration Application, but this has not been verified by Novra.



NOTE: - Performance will be dependant on other applications that your PC is running.

7.3 Supplied Equipment

Please confirm you have received all the equipment listed below.

- Novra S300 Receiver
- Cross-over cable or Ethernet cable
- Power supply (120 Vac to 24 Vdc North America; **OR** 220 Vac to 24 Vdc European)
- S300 Receiver Software CD
- Novra S300 Receiver User Manual (Soft Copy on CD)

APPENDIX

Terms, Definitions, and Other Tidbits of Information

Crossover Cable	A crossover cable is a cable that is used to connect two computers by reversing, or crossing over, the cable pin contacts. This eliminates the need to use a hub when connecting two PCs. It is also referred to as a "Null Modem" cable.
Coax Cable	Looks like this:  The coaxial cable is most commonly used for Cable TV feeds inside a house or apartment. This form of cable allows the high frequencies of TV, and Satellite type signals to move from one place to another with a minimal amount signal loss.
DVB	Digital Video Broadcasting (DVB) is a set of standards that define digital broadcasting using satellite, cable, and terrestrial infrastructures.
FEC	Forward Error Correction (FEC) is a system of error control for data transmission where the receiving device can detect and correct certain errors.
Feed Horn	This is the device that receives the focuses signals from a satellite dish. It collects these signals and submits them to the next piece of equipment in the network, usually a Low Noise Block converter which then changes the signals into a better format for transpiration to the receiver.
Geostationary Orbit	The position where a satellite is 35,786 kilometers (22,241 miles) above the equator. At this distance, the satellite Orbits the earth at the same rate as the earth is turning. This causes the satellite to appear stationary in relation to an observer on the ground.
IP	The Internet Protocol (IP) is a network communication protocol used on Ethernet networks and the Internet.
IP Address	The 32-bit computer address defined by the Internet Protocol. It is usually represented in dotted decimal notation. Example: 192.168.111.112
L-Band	This range of frequencies is from 950 MHz to 2,150 Mhz It is much lower than those used by satellites (About 1/10 to 1/6). Satellite frequencies travel well through space and our atmosphere but do not do well through the cable that comes from the dish on the roof to the receiver. So LNBs convert satellite frequencies to the lower, easier to transport, band of frequencies referred to as the L-Band. It is L-Band frequencies that the S300 receiver tunes to.
LNA	Older systems used a unit called an LNA Low Noise Amplifier. This unit amplifies the RF frequency and then transmits the signals down a special (expensive) cable to the receiver. Note that received signals are not converted to lower frequencies by this unit.
LNB	LNB stands for a Low Noise Block-converter. This unit receives the signals collected from a satellite and converts their very high frequencies (12 Giga Hertz, written 12 GHz, which is actually 12,000,000,000 cycles per second) to a lower and somewhat more usable range. All LNBs have a Local Oscillator (LO). This number is usually stamped on the LNB but not always. It may be necessary to check the original

specifications that came with the LNB or use the model number and brand name to search the Internet.

LNBF	LNBF stands for a Low Noise Block-converter and Feed horn. This is quite a common arrangement where the Feed Horn focal point that collects reflected signals from the satellite dish is combined with the low noise block-converter into one package.
LO	The Local Oscillator (LO) is a circuit that creates a tone of a very specific frequency. These units have many applications in electronics. This important thing to remember is that there is an LO in the LNB (Low Noise Block-converter) and it is part of the circuit that converts the received satellite RF Frequencies to the more user friendly L-Band Frequencies. Typical values include 9.75, 10.60, 10.75, 11.00 and 11.25 GHz for the Ku band and 5.15 GHz for the C Band of satellite frequencies.
MAC Address	The Media Access Control (MAC) address is the unique hardware address for any piece of electronic equipment attached to a network. The MAC Address for your Novra S300 Receiver is displayed on a sticker on the bottom of the receiver.
Mbps	Mega bits per second. (Million bits per second)
MBps	Mega Bytes per second. One "Byte" in computer terms is the same as 8 bits. It is often referred to as a word. 1 Mbps = 8 MBps = 1 million Bytes (Words) per second = 8 million bits per second.
Msp	Mega symbols per second. Suppose you have four symbols, call them A, B, C & D. Let the Symbol A represent two bits of data with the value 00. Let B represent two bits of data with the value 01 Let C represent two bits of data with the value 10 Let D represent two bits of data with the value 11 This means that if the signals we are interested in consist of 1.0 Msp (That's 1 Million symbols per second), and each symbol represents two bits of data, then our signal has a data rate of 2.0 million bits per second (2.0 Mbps). The important point to remember is that satellite systems send and receive symbols which are then converted into data. The S300 takes the resulting data and forwards it to your computer in bursts called "packets."
Packet	A packet is the unit of data that is routed between an origin and a destination. When any file is sent from one place to another (the Internet as an example) it is divided into "chunks" of an efficient size for routing. Each of these packets is separately numbered and includes the Internet address of the destination.
PID	The Packet Identification Code (PID) is used by the receiver to sift through the different packets of the transport stream. The transport stream contains data representing many different signals. The S300 software running on your PC uses the PID number to find only those packets of data that contain the information you have requested. (See RF Frequency.)
Polarization, Circular (Right / Left)	In layman's terms, a circularly polarized signal corkscrews towards the earth. Unlike linear polarization (described below), where the signal is fixed in an up and down fashion or a side to side fashion, Circular Polarization causes the signal to rotate. If it were possible to actually see the incoming signal, it would rotate like the hands on a clock. As with Linear Polarization, this has two modes of operation. It can

either rotate in a clock wise fashion or counter clockwise. Polarization is very useful because it allows the frequency of a Right polarized signal to overlap with the same frequencies of a Left polarized signal.

Polarization, Linear
(Horizontal/Vertical)

In layman's terms, a linearly polarized signal from a satellite approaches the earth as a wave that goes up and down like the waves on the ocean, or from side to side. These two types of waves are classified as being vertically or horizontally polarized. Polarization is very useful because it allows the frequency of a vertically polarized signal to overlap with the same frequencies of a Horizontally polarized signal.

RAM

Random access memory. Used for short term storage of information requiring quick access on a computer. Information stored in RAM can be accessed by the computer much faster than information on the Hard Drive can be accessed.

RF Frequency

Each satellite in orbit has several channels that it can use, each with its own RF Frequency. (Each channel is often referred to as a transponder.) The easiest way to understand them is to think of your FM radio. There are many channels on the FM dial that one can choose from. ("99.9 FM, All Rock, All the Time") When you input the station number to your FM receiver you are actually telling it what RF Frequency it should look at. (99.9 FM means that 99.9 Mega Hz is the desired frequency.) But unlike the FM radio where the channel you tune to only contains one stream of music, a satellite channel contains many individual signals. One channel can contain Internet data **and** video **and** audio **and** specialized data in any number of permutations and combinations. The S300 uses the PID numbers that come with each Internet data, video, audio and specialized data signal to separate them all. (See PID.)

Satellite Signal Hierarchy

1 Satellite has -
|
10 - 24 Transponders (Channels) each with
|
dozens of distinct RF Frequencies each containing
|
up to a theoretical maximum of 8190 packet streams identified by their individual PIDs.

Subnet

A portion of a network, which may be a physically independent network segment, and which shares a network address with other portions of the network.

Symbol Rate

See Msps

Transponder

This is the unit on the satellite that receives a signal transmitted from the earth station, amplifies it, changes its frequency and retransmits it back down to earth. Each radio channel has its own transponder and a number of transponders on the satellite are used to cover the allocated frequency band. A typical satellite will have 24 transponders.

Viterbi

"Convolutional encoding with Viterbi decoding is a Forward Error Correction technique that is particularly suited to a channel in which the transmitted signal is corrupted mainly by additive white Gaussian noise." Further information can be found by searching the Internet or looking at any of these sites.
<http://pw1.netcom.com/~chip.f/Viterbi.html>
<http://hissa.nist.gov/dads/HTML/viterbiAlgorithm.html>