Digital Video Interfacing Products

AT240IP

TS-over-IP
MPEG2 TS Player, Recorder & Converter
4 independent DVB-ASI Inputs / Outputs
DVB-IP Transmitter & Receiver
Tunnelling of ASI signals over LAN, WAN or the Internet

Pro-MPEG Code Of Practice #3(COP3) FEC

Standard Features

Full Duplex **DVB-ASI Player/Recorder & DVB-ASI to IP & IP to DVB-ASI Converter.**
- Two Versions :
Version 1 :
2x DVB-ASI inputs, 2x DVB-ASI outputs & GigE IP input/output.
Version 2 :
4x DVB-ASI inputs & One GigE IP input/output.
- Converts HD and SD MPEG-2 or H.264/MPEG-4 AVC transport streams from DVB-ASI to IP in real time.
- Receives HD and SD MPEG-2 or H.264/ MPEG-4 AVC transport streams over Ethernet-based Internet Protocol (IP) networks and converts them to DVB-ASI.
- **Web based Software** as well as **DVSStationIP.**
- **DVSStationIP** runs on **Windows XP, Vista, Windows 7**.
- Supports DVB According to Standard **EN50083-9.**
- Supports 188 & 204 byte or Arbitrary Packet Sizes.
- Remote Web-based configuration management and remote firmware upgrade.
- Saved configuration setting. No re-configuration needed after system reboot.
- An alternative to dedicated satellite links – connects digital video equipment to computer networks.

IP
- On the transmit side, encapsulation of the TS data for Ethernet uses IP and the **User Datagram Protocol (UDP)**, with **Real-time Transport Protocol (RTP)** encapsulation and Pro-MPEG **Code Of Practice #3(COP3) forward error correction (FEC)** as an option. Dedicated hardware performs the encapsulation, which maximizes the throughput and minimizes latency.
- On the receive side, the device can accept traffic from Ethernet network and recover TS data. For RTP encapsulated data, the device includes a receive buffer to absorb network jitter and correct for packet reordering and packet duplication. COP3 FEC-based lost packet recovery is available.
- For multiple TS interfaces, the AT240IP individually maps each one to a specific UDP/IP socket (a combination of IP address and UDP port). All other encapsulation parameters can also be individually configured per TS.

Application

Targeted for Digital Video Professionals, Sophisticated End Users and OEMs the AT240IP is an ideal solution for a number of applications such as:
- Development Tools.
- **DVB to IP Gateway.**
- Universal Interface for Digital Video or MPEG-II Transport Stream Recording, Playing and Processing.
- **Video on Demand Server.**
- Transport Stream Test Generator.
- **Studio to Transmitter Links.**
- ENG (Electronic News Gathering) Stream content to and from remote locations.
- ASI input to Cable System.
- **Distance education/Corporate training.**
- Converting ASI out from encoders to IP, or from an IP source to devices such as decoders, Multiplexers, Modulators.

- IP Maximum rate of up to 214 Mbps per ASI channel.
- Network jitter correction.
- Supports constant bit rate ASI output.
- IP address assignment from DHCP server & static IP.
- IP address also configurable through the web interface.
- Configuration for Time To Live (TTL) for Multicast.

Input

- Automatic Cable Equalization of up to 350m.
- Supports True or Inverted ASI signals.
- Carrier and Lock Detection.
- Sync, Error & Code Violation Detection.
- Supports both multi-program TS (MPTS) & single-program TS (SPTS) data.

Output

- Programmable Output Bit Rate.
- Can play Higher Bitrate then the TS file.
- Null packet insertion by Hardware.
- PCR, continuity counter correction.
- Packet time and date correction.

Specifications

DVB-IP

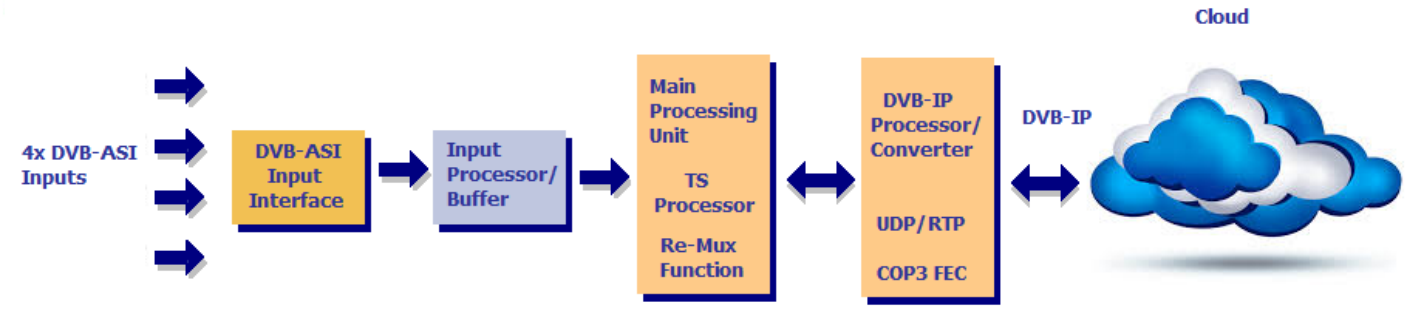
- **Ethernet encapsulation:** IEEE 802.2 SNAP, Eth.
- **Encapsulation:** UDP or RTP
- **IP support:** IPv4
- **IP-address assignment:** DHCP,link local or static
- **Multicast support:** IGMPv2
- **Date Rate:** 100/1000
- **GigE port Physical layer:** IEEE 802.3a
- **GigE port Connector:** RJ-45 with LEDs
- **FEC:** Pro-MPEG Code Of Practice #3(COP3)
- **TSoIP to ASI latency:** Less than 1ms
- **Jitter tolerance range:** 1 .. 500ms

DVB-ASI

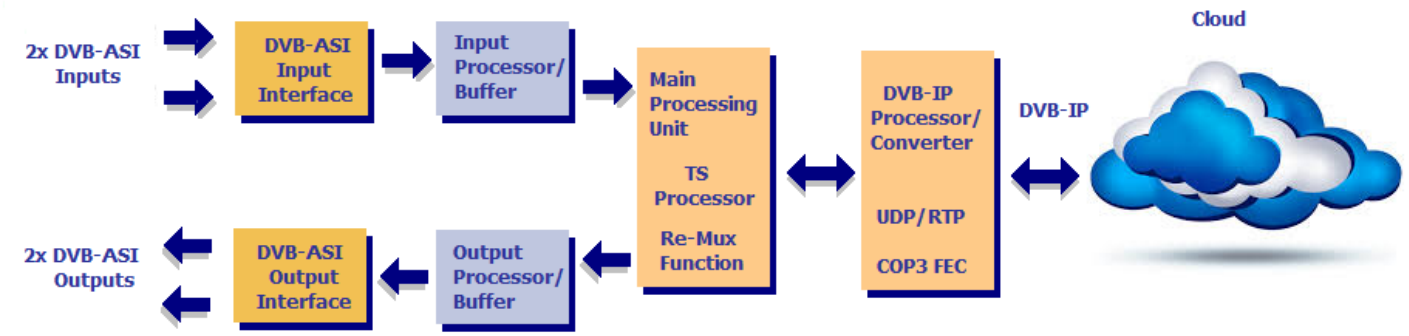
- **DVB-ASI port Physical layer:** EN50083-9
- **DVB-ASI Connector:** 75 Ohms Mini BNC
- **Input Return Loss:** >15 dB.
- **Input Signal level:** 800 mV +/- 10%
- **Output Signal level:** 1.0Vp-p nominal.
- **DVB-ASI Input/Output Bit Rate:** 0 to 214 Mbit/s.
- **DVB-ASI Output Clock:** 270 MHz.

1 BLOCK DIAGRAM

The block diagram of the AT240IP device.



AT240IP – Version 1- 4x ASI inputs



AT240IP – Version 2- 2x ASI inputs & 2x ASI outputs

2 EXTERNAL INTERFACES

The external interfaces for the AT240IP are shown. There are four Mini BNC connectors for the DVB-ASI inputs/outputs, a RJ45 connector with two LEDs, a Power Supply Inlet and a Power Switch.

Only the power adaptor supplied by Alitronika with this device should be used. These power supplies are carefully selected for output voltage, current & power ratings as well as noise level. Using any other power supplies will affect the performance of the device for sure and may damage the device's internal components permanently which is not covered by the warranty.

The three LEDs in front of the unit function as follows:

Top LED - Power
ON = Power is on
OFF = Power is off, No power
Middle LED - **Status1**
OFF = After power up this LED should be Blinking, if not something is wrong!
ON = When the device has connected correctly with the IP Network.
Bottom LED – **Status2**
OFF = This LED is off after power up
ON = When the device has SYNC to any incoming and/or out going TS.

3 INSTALLATION

The AT240IP device operates in a stand-alone mode. RF input & IP parameters are set using the Remote Web-based configuration management application. As such there are no need for any other application software. However DVSStationIP, the IP version of Alitronika's DVSStation3/4/IP application software is provided FREE of charge with these devices. Please follow these steps for problem free operation of the device.

Step 1: Application Software

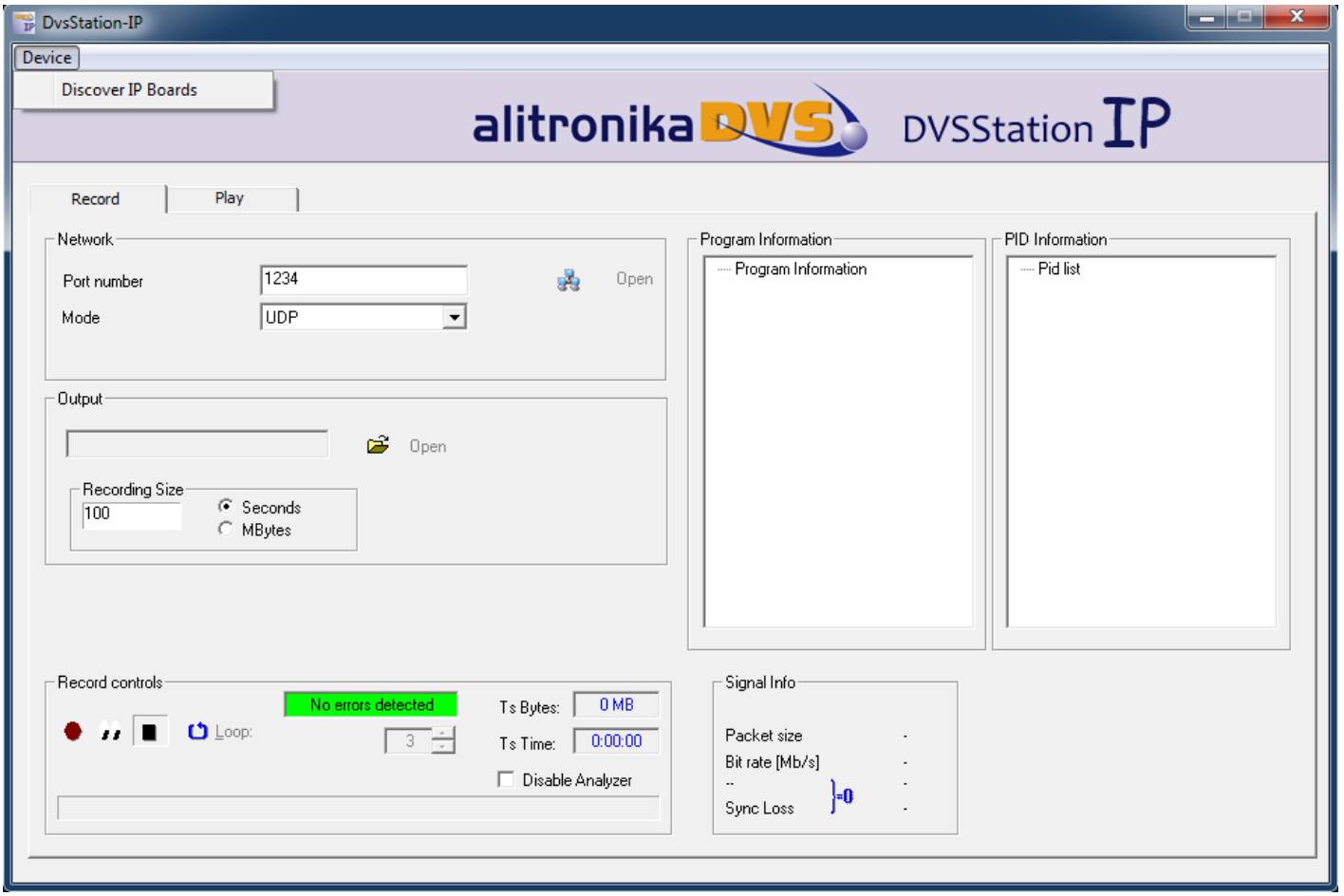
Download the application software, DVSStationIP, from our website.
Link : www.alitronika.com/downloads.htm
Unzip it & install it on a PC/Laptop.

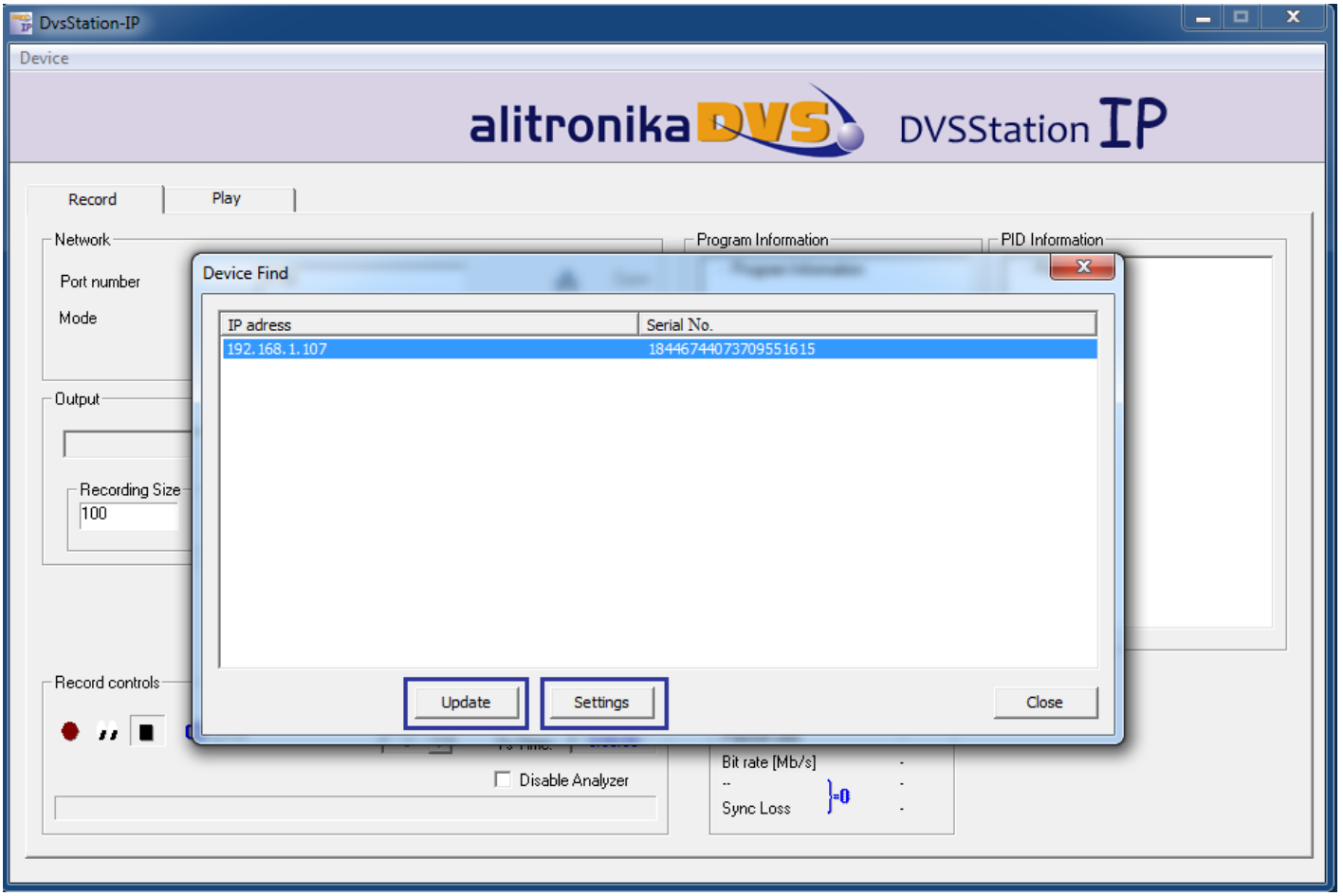
Step 2: Starting for the first Time

Connect the AT240IP & the PC/laptop to your network **DHCP** server.

Connect the power adaptor & Power up the AT240IP using the switch on the rear of the unit.
You should see the Power LED is ON and the 2nd LED, Status1, is BLINKING.

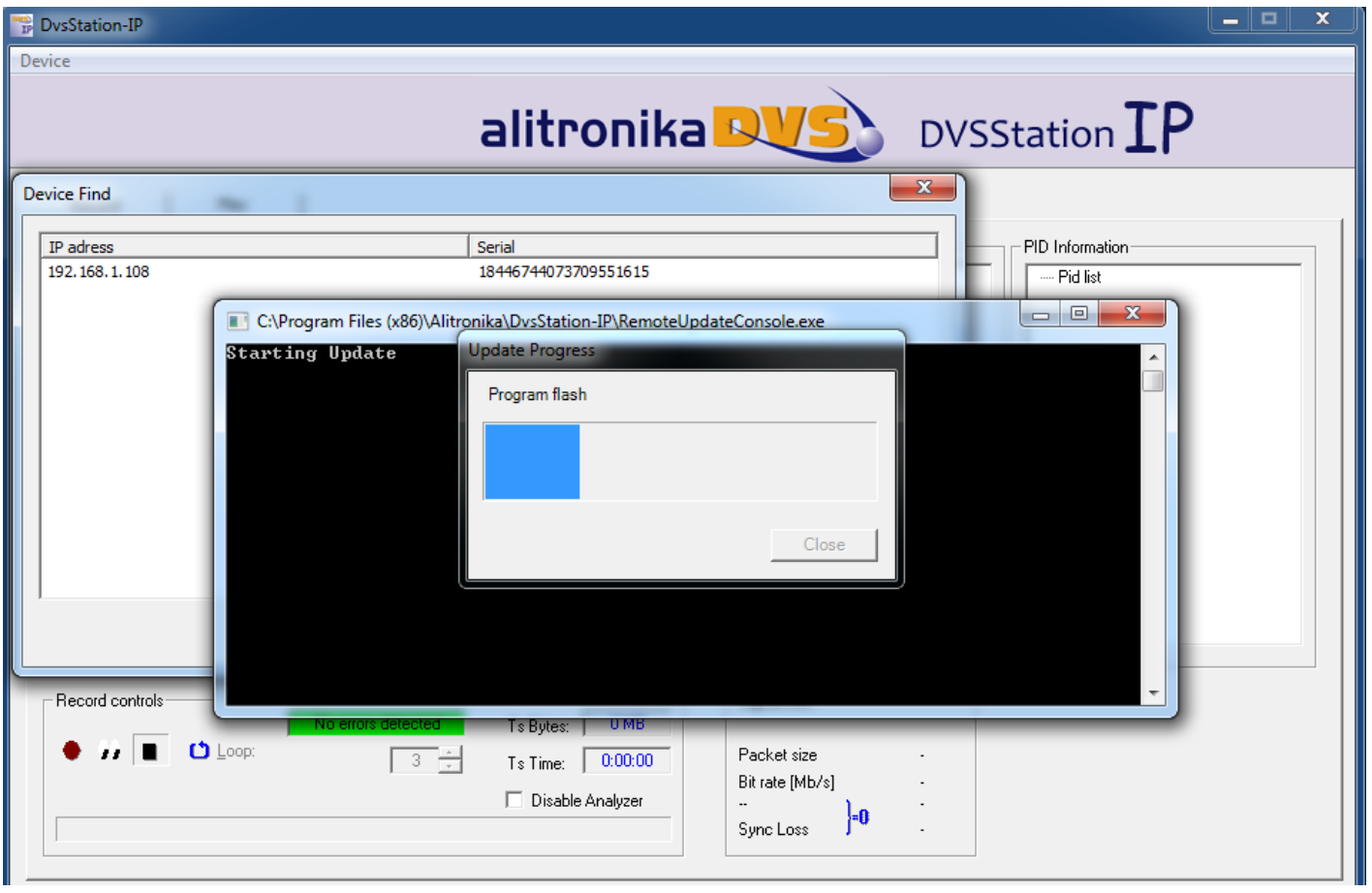
Start DVSStationIP.
From the top bar, **Device**, use "**Discover**" in order to find the IP address of AT60IP.





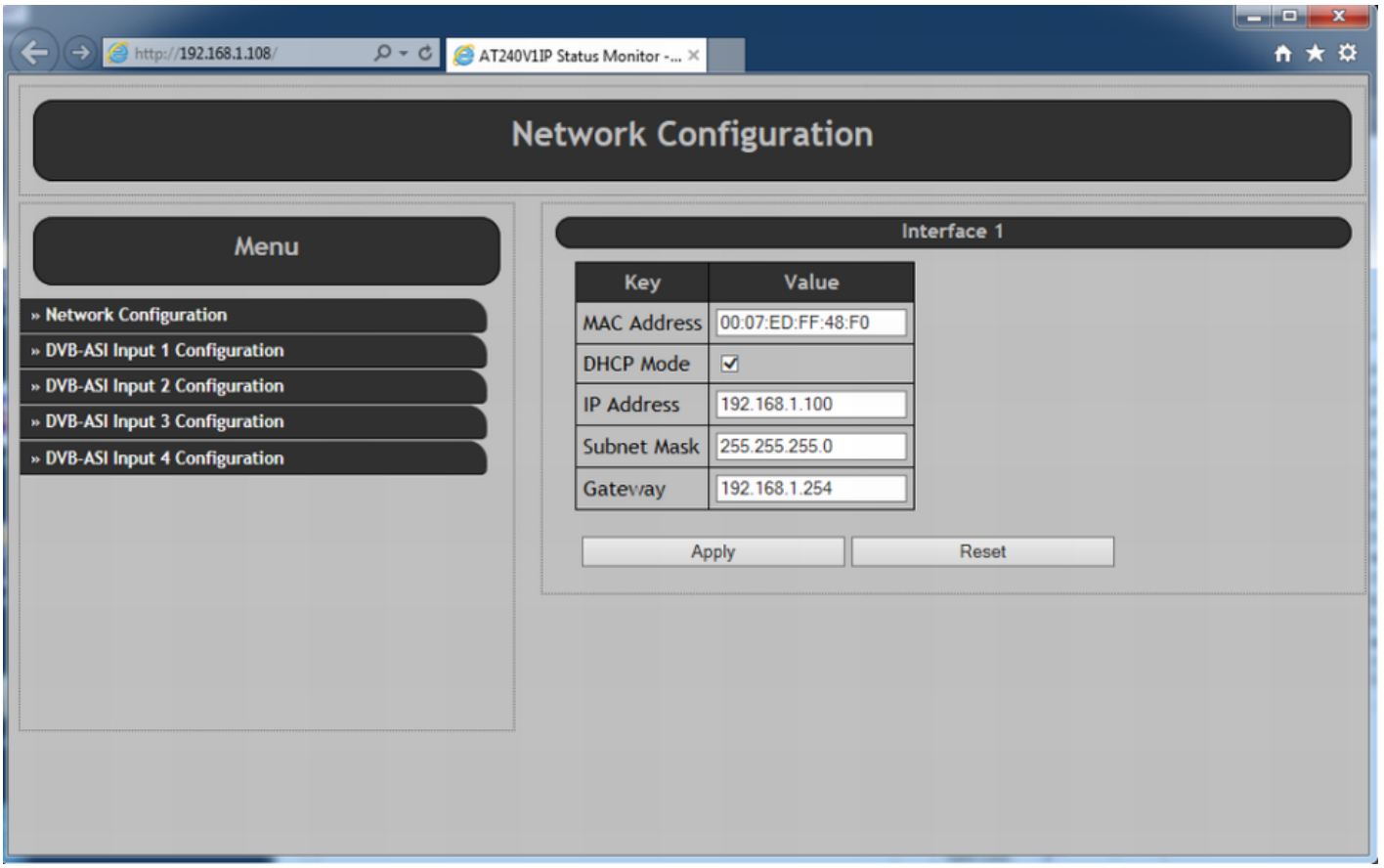
Step 3: Updating the Firmware if needed

As shown on the screen shots, you should be able to see the IP address of the device as well as the serial number.
Update - Clicking on this would update the firmware of the AT240IP device.
You need not doing this unless you really need an update. If your system is working OK just leave it.
If you do update the firmware you must wait for the **process to complete without any interruptions** for example, disconnecting the device from the network, powering it down. If the updating is interrupted the device will no longer have a valid firmware & no longer operates.

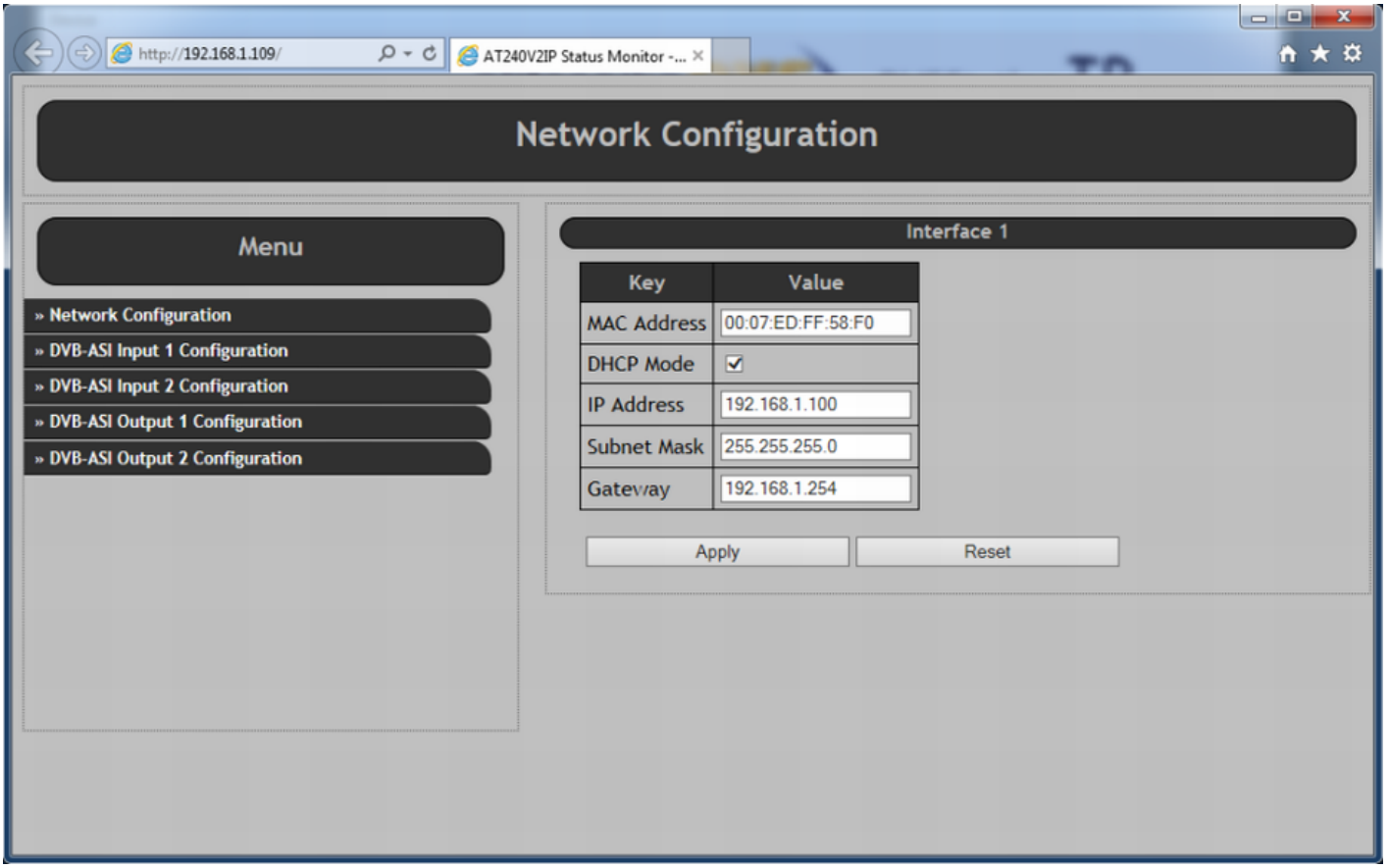


Settings - Clicking on this would start the Remote Web-based configuration management application on your web browser. Notice you could do this manually if you know the IP address by just typing this line on your web browser.

Step 4: Remote Web-based configuration management application
Once the configuration management starts this screen can be seen.



AT240IP – Version 1- 4x ASI inputs



AT240IP – Version 2- 2x ASI inputs & 2x ASI outputs

The “Network Configuration” screen is opened by default.
The MAC Address, IP Address, Subnet Mask & the Gateway address can bee seen.
The user can change any of these & then clicking on “APPLY”.
It is assumed the user is familiar with IP terms.
The DHCP Mode could be selected/De-selected.

Step 5: Setting the DVB-ASI input parameters.

As it can bee seen from the screen shot below, in order for correct operation of the AT240IP, a few parameters must be set by the user.

Notice any DVB-ASI input port must first be ENABLED.

1- **IP Encapsulation Settings**

3.1- **Mode** – RTP or UDP

3.2- **Packet Number** – Transport Packets are converted & send via IP in bursts.
The number of packets per burst could be selected from 1 to 7.
Refer to DVB over IP documents if you wish to know more about this. Also see Appendix1.

2- **Pro-MPEG FEC Settings**

Again it is assumed the user knows about DVB-over-IP.
It is clear when sending Transport Streams over IP (or anything over IP), data could get lost or corrupted.
Forward Error Schemes such as Pro-MPEG Code Of Practice #3(COP3) FEC are used to recover the data.
The user has control over the FEC.
FEC adds additional overhead to the data transfer over IP network.

4.1- **Enabling the FEC** – User is able to Enable or Disable the FEC function.
It is matter of trade-off between the speed & quality.
We assume the user knows what is the best here.

4.2- **Number of Columns & Rows (L & C)** – Refer to DVB over IP for this. Also see Appendix1.

4.3- **Interleaver Mode** - Refer to DVB over IP for this. Also see Appendix1.

3- IP Settings – The DVB-S2/S Transport Streams are Received, De-modulated & after being processed according to all of the user selected settings above, it send to IP address. The user has also control over where the streams are going.

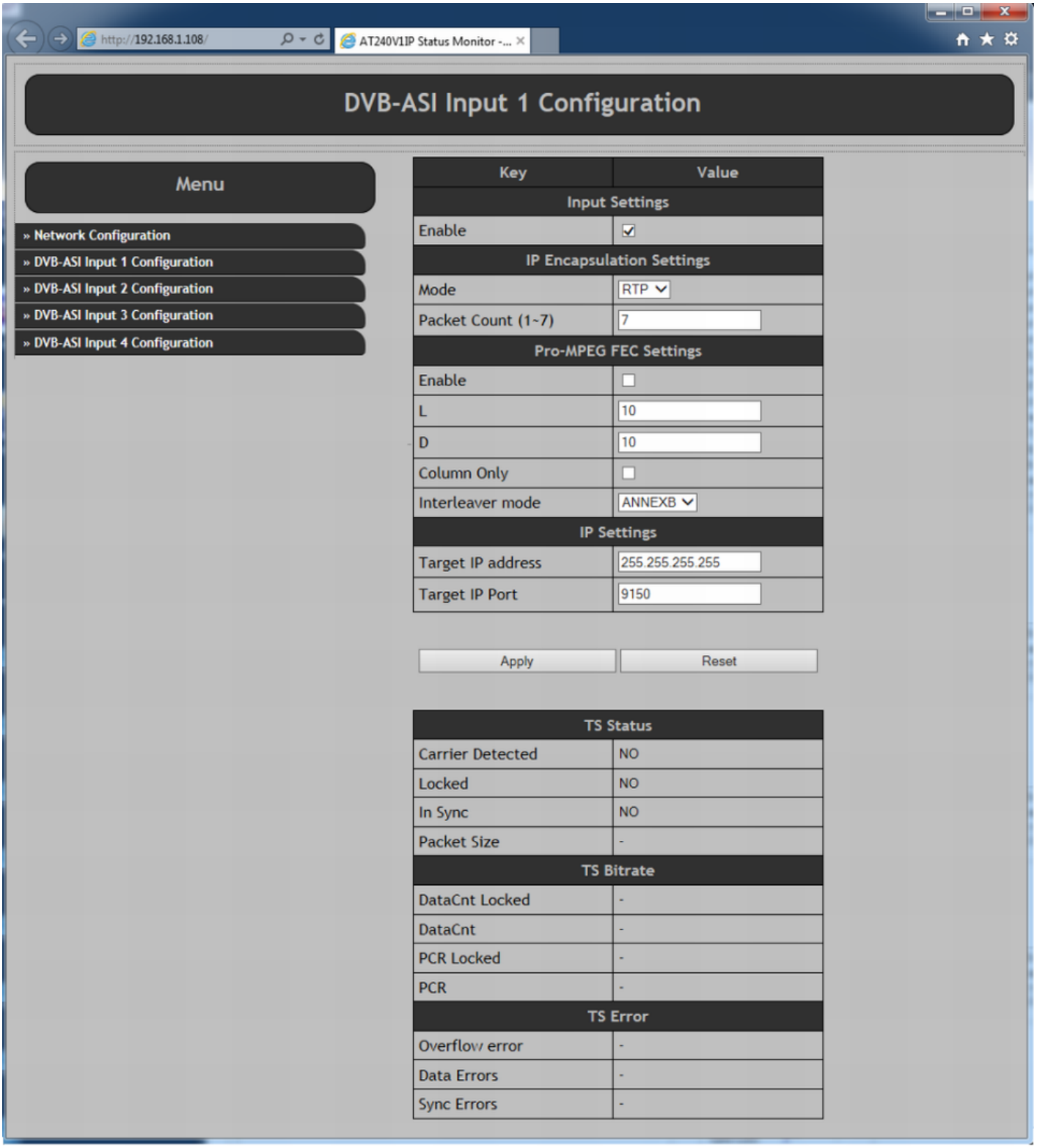
5.1- **Target IP Address** – Select an IP address for unicast or select 255.255.255.255 for Multicast.

5.2- **Target Port** – User can also select the port number.

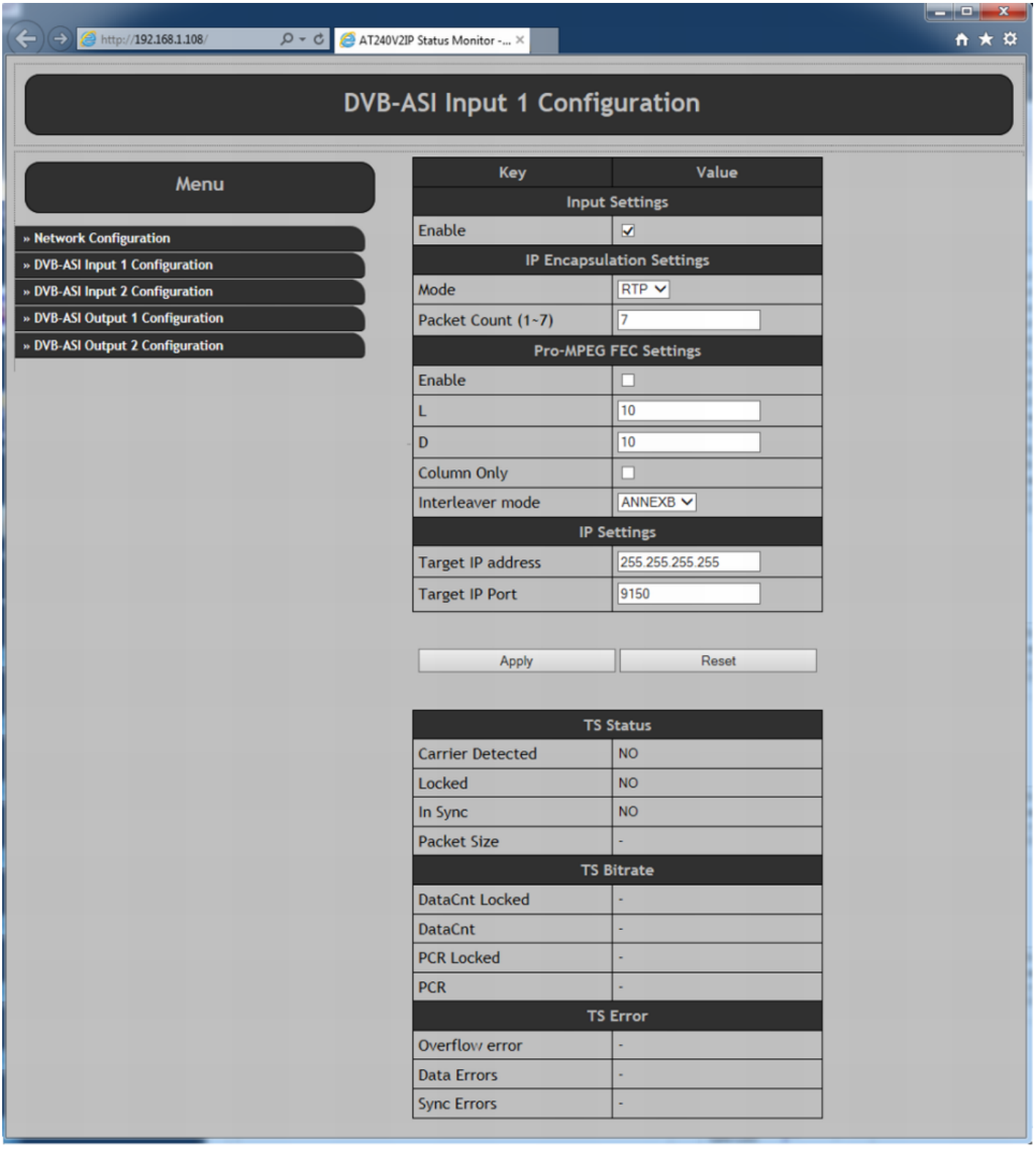
Notes :

- Click on **Apply** to save the selected settings on the **non-volatile mem**ory of the AT60IP device.
The device will operate with these parameters until the user changes them.
No re-configuration needed after system reboot.

- All modulation parameters related to DVB-S2/S RF input and the incoming transport streams are detected automatically by the integrated TS Analyser. No user inputs are required.



AT240IP – Version 1- 4x ASI inputs



AT240IP – Version 2- 2x ASI inputs & 2x ASI outputs

Step 6: Setting the DVB-ASI output parameters.

Output Enable - Any DVB-ASI input port must first be ENABLED.

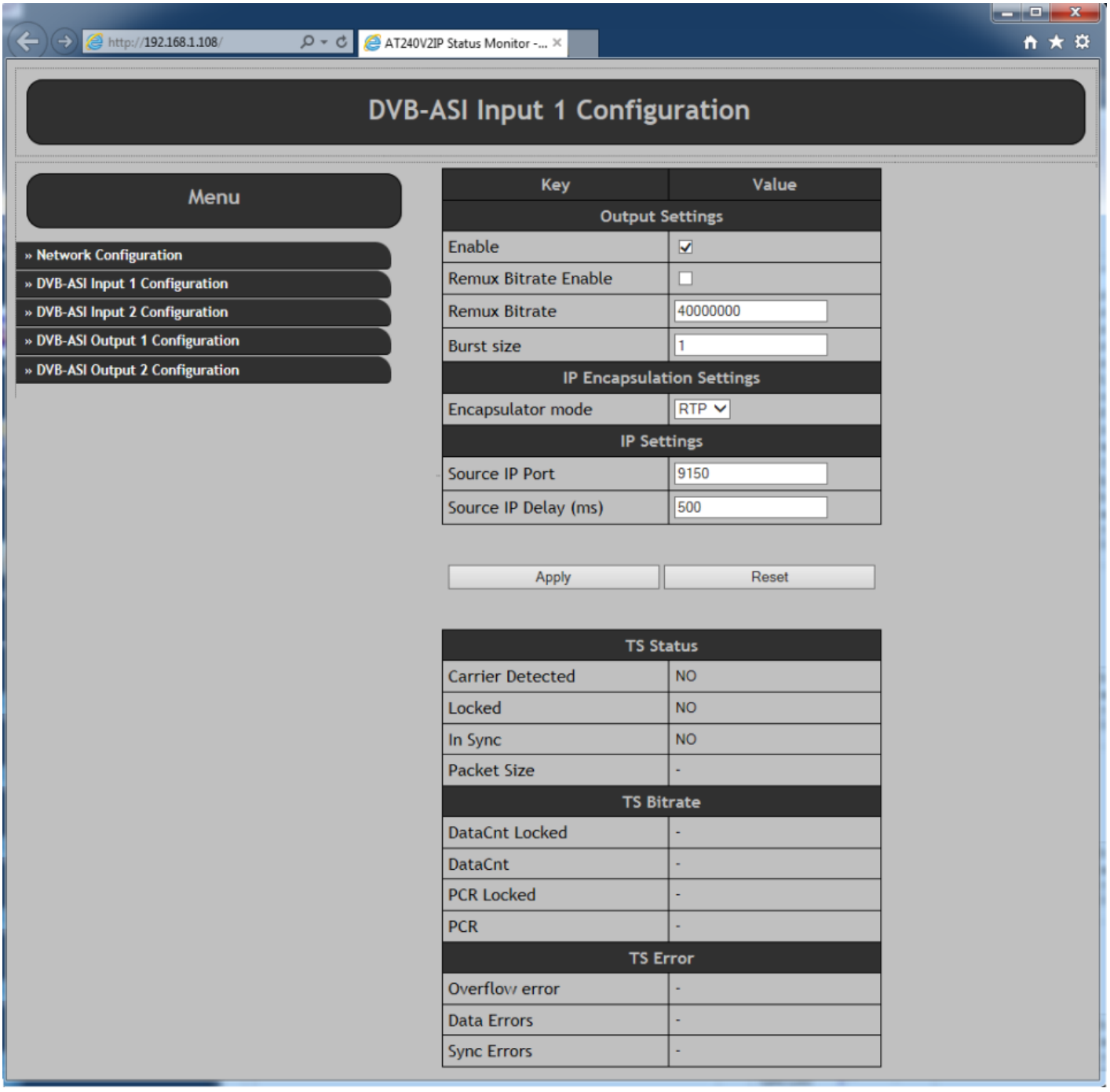
Remux function - The Remux function which allows changing the bitrate to a higher bitrate than that of the TS files could also be Enabled by the user. The desired bitrate is entered by the user, the Remux function of the AT240IP would than add the necessary null packets to increase the bitrate.

Burst size – Packets are send as bursts. User can select the number of packets in a burst.

Encapsulation Mode – RTP or UDP.

Source IP port – User can select the port number for the ASI output.

IP delay – The desired delay value is set by the user.

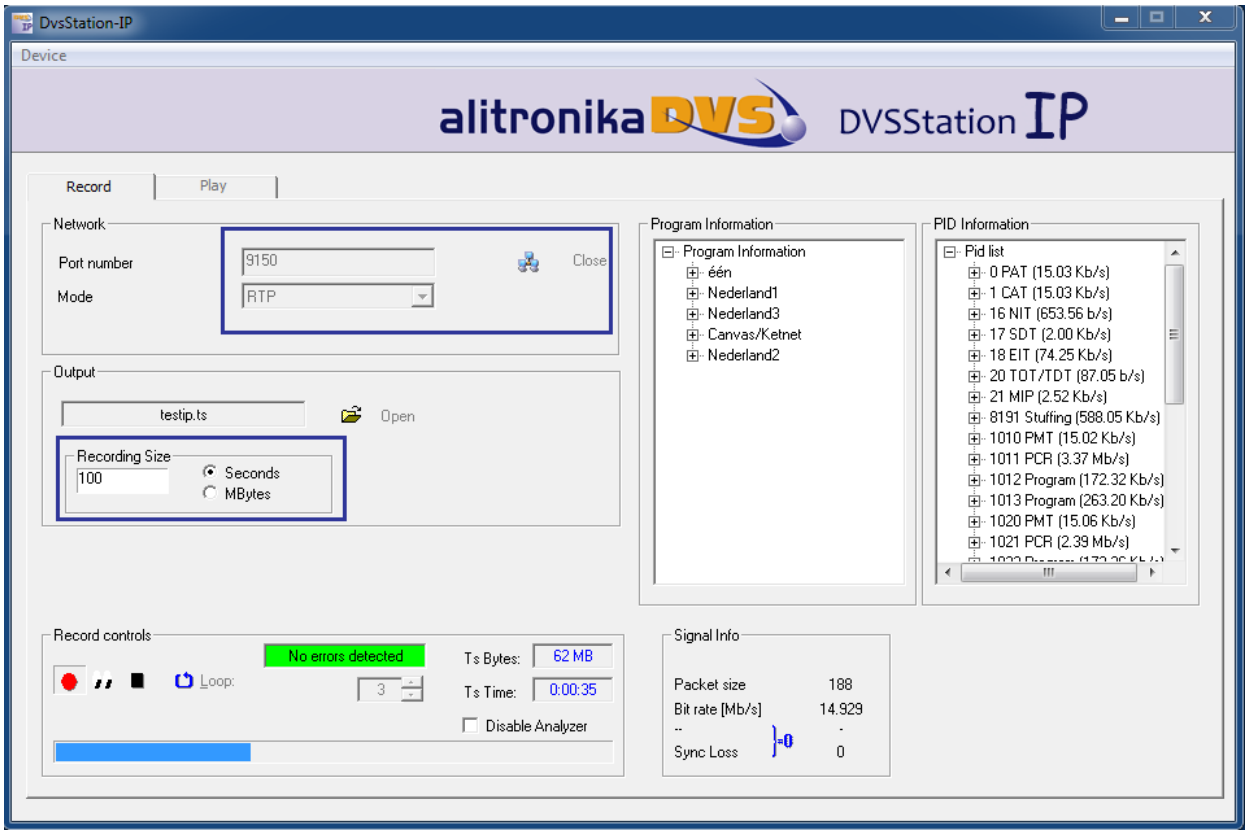


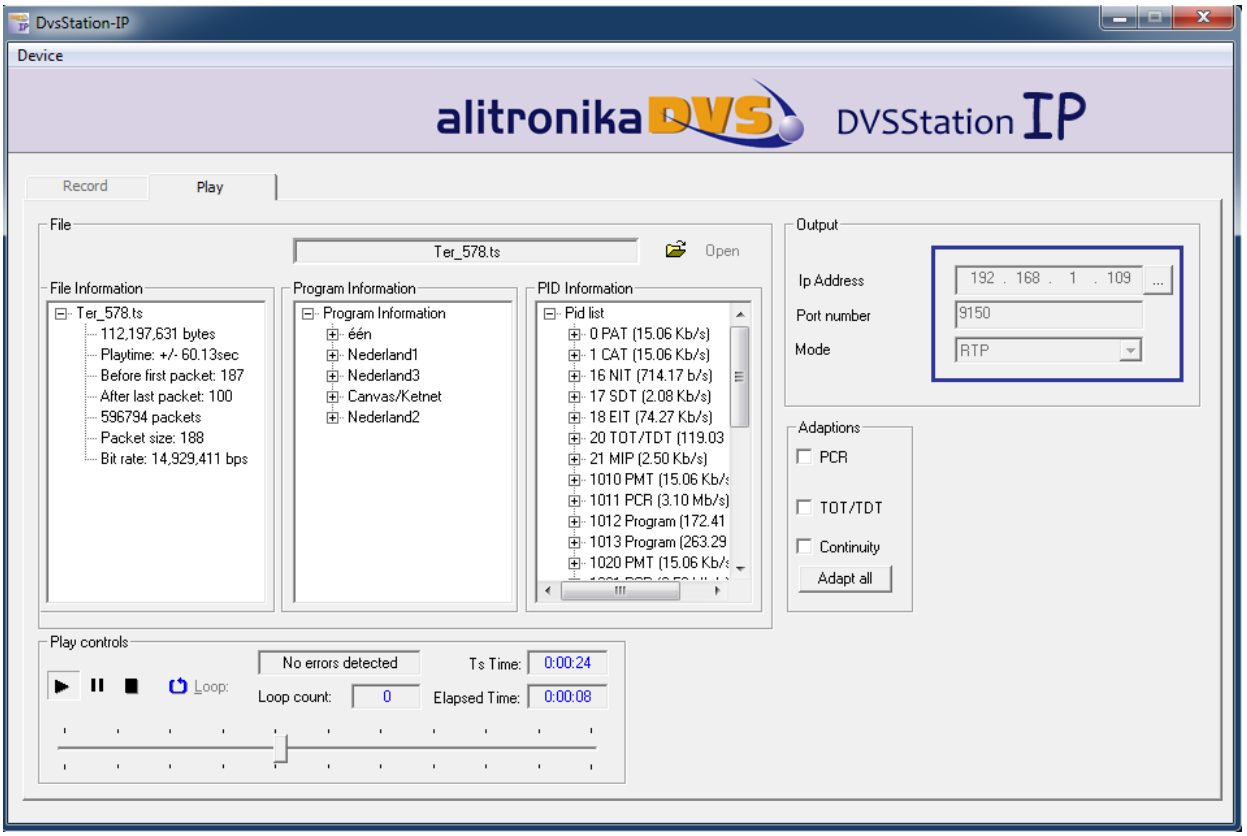
AT240IP – Version 2- 2x ASI inputs & 2x ASI outputs

4 APPLICATION SOFTWARE

AT240IP operates as a stand-alone device. DVSStationIP could be used to add even more functions & features to it.

1- Up-dating the firmware
2- Finding the device's IP address with "Discover" function when not used with a fixed IP address.
3- Recording & monitoring the incoming transport stream.
4- Play back any transport streams

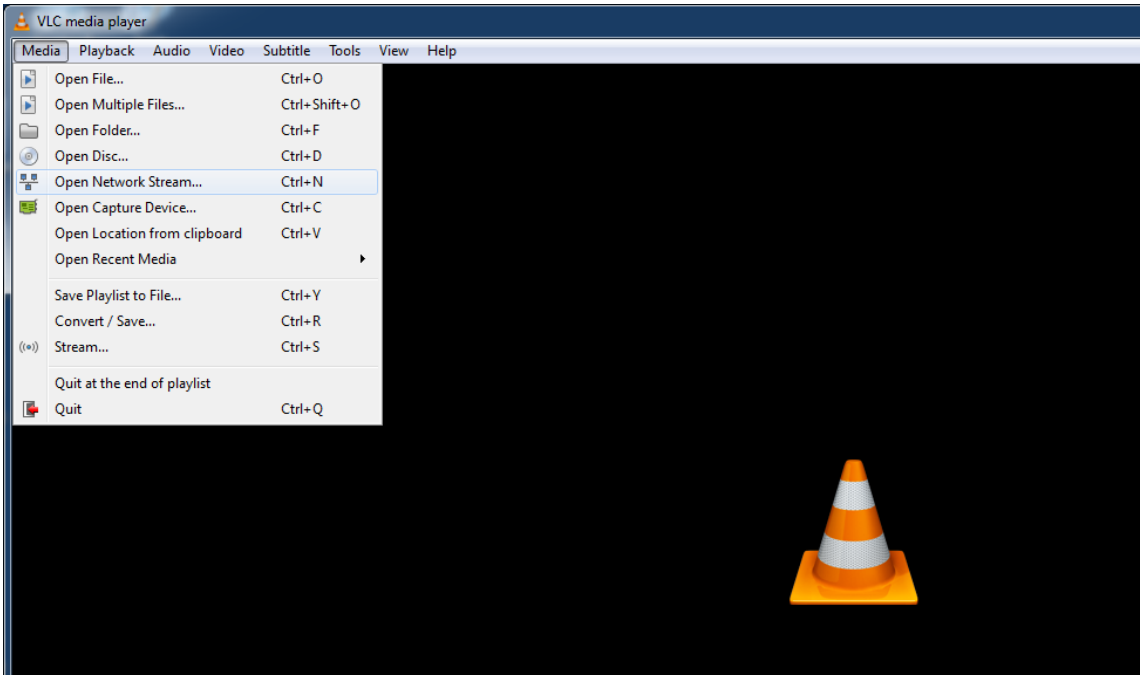


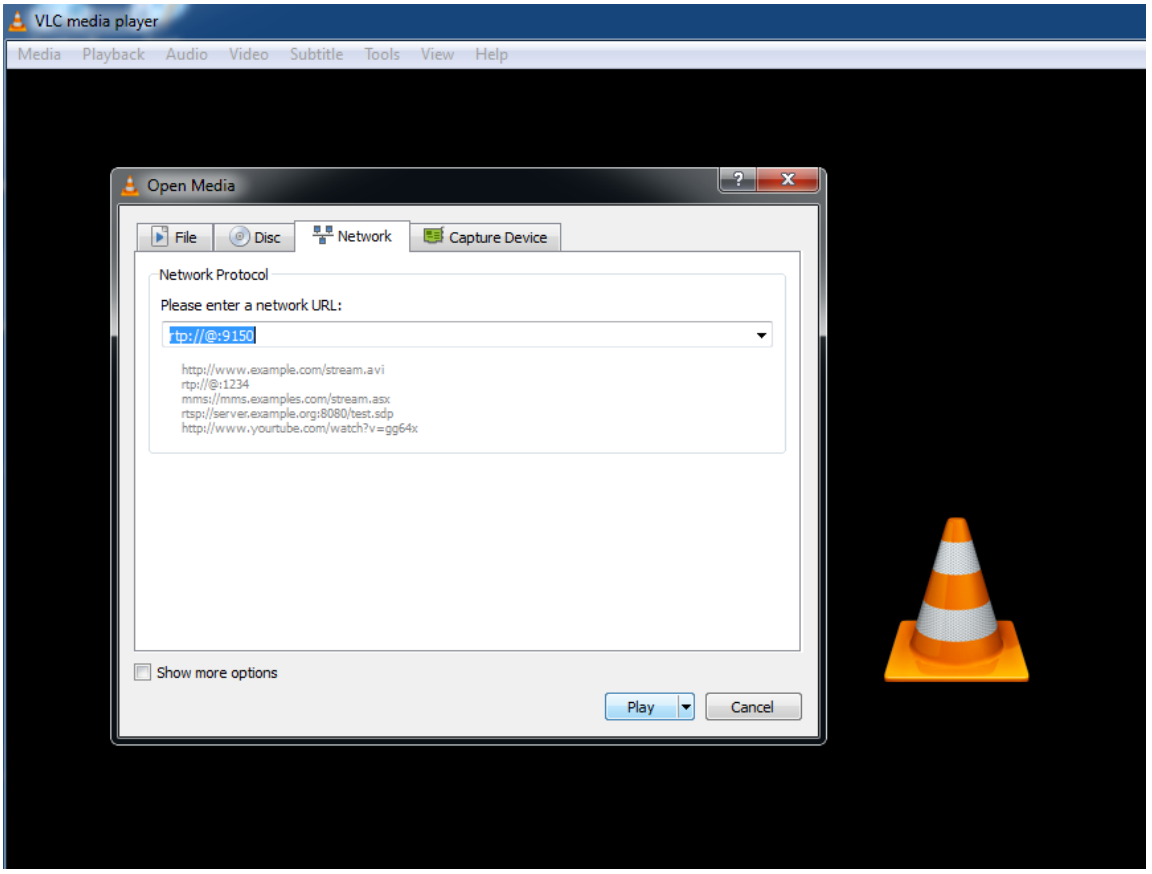


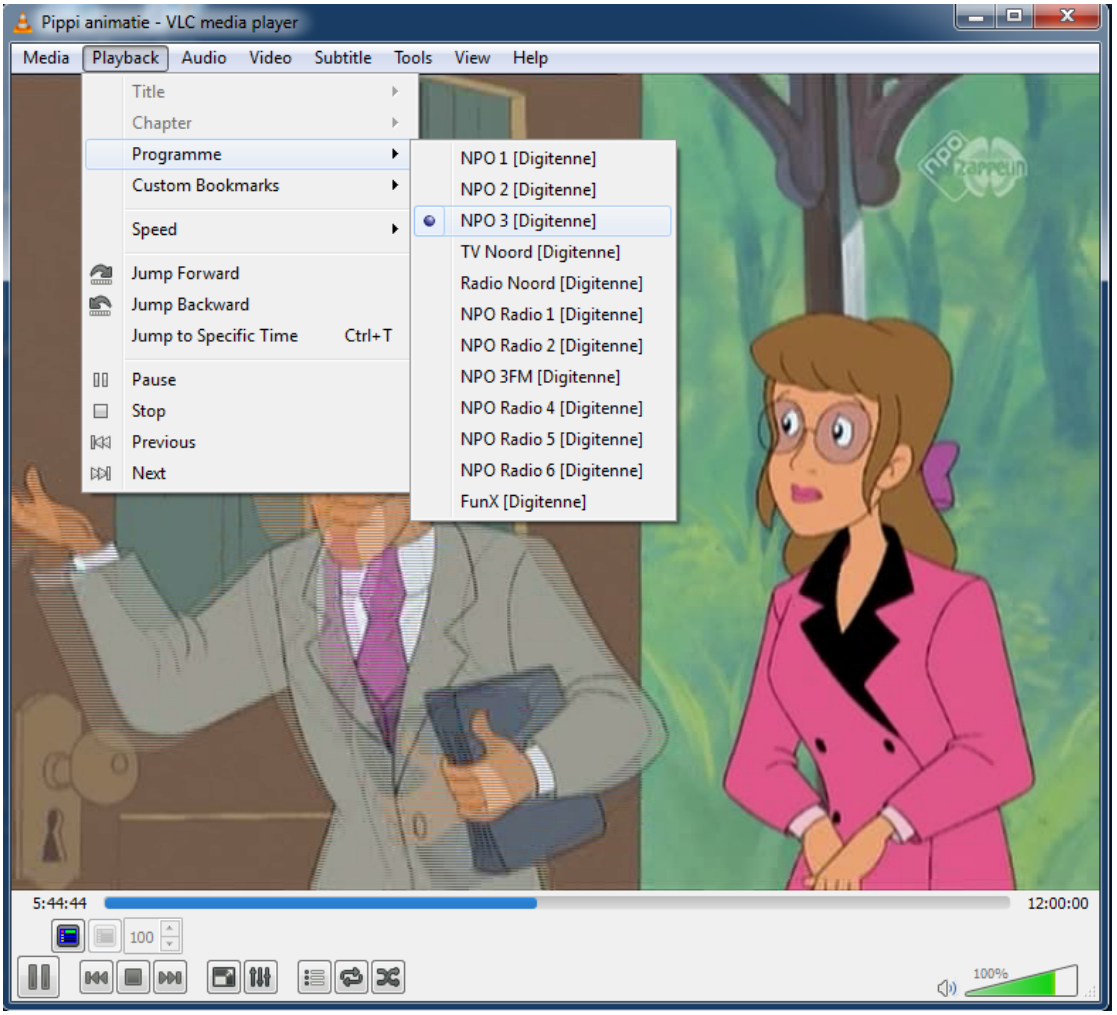
5 SOFTWARE DECODERS

In order to view the programs any software decoder could be used.
Most of them could be downloaded from the Internet FREE of charge.
One such software is the VideoLan. Use this like to download http://www.videolan.org/.
Once install on your system.

- **From "Media" => Open Network Stream**
- **Type in "rtp://@:9150" for example (if you are using RTP mode & the Port is 9150)**
- **From "Playback"=> Click on "Programs" and select the desired program for the list to view.**






Pippi animatie - VLC media player
Media
Playback
Audio
Video
Subtitle
Tools
View
Help
Title
Chapter
Programme
Custom Bookmarks
Speed
Jump Forward
Jump Backward
Jump to Specific Time
Ctrl+T
Pause
Stop
Previous
Next
NPO 1 [Digitenne]
NPO 2 [Digitenne]
NPO 3 [Digitenne]
TV Noord [Digitenne]
Radio Noord [Digitenne]
NPO Radio 1 [Digitenne]
NPO Radio 2 [Digitenne]
NPO 3FM [Digitenne]
NPO Radio 4 [Digitenne]
NPO Radio 5 [Digitenne]
NPO Radio 6 [Digitenne]
FunX [Digitenne]
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Pippi animatie - VLC media player
Media
Playback
Audio
Video
Subtitle
Tools
View
Help
AVROTROS
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12:00:00
100
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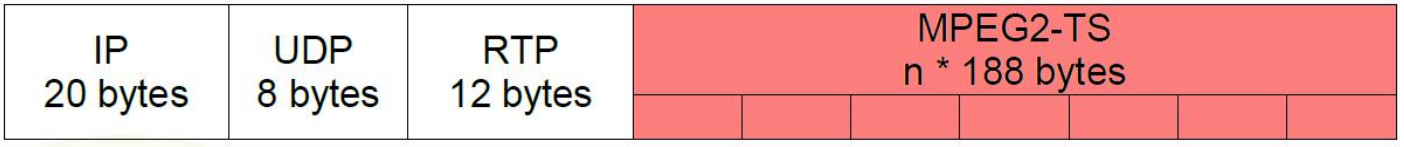
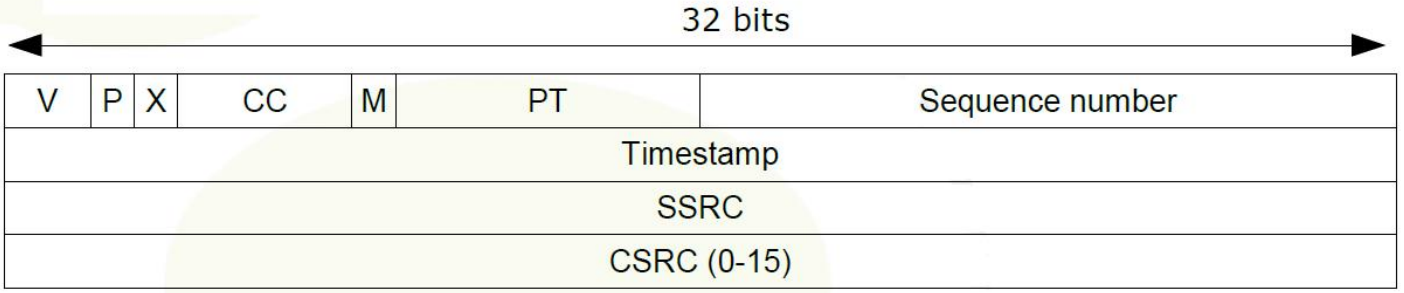
Appendix1 – FEC

DVB-IPI (ETSI TS 102 034) specifies protocols at the IP networking layer (IP Infrastructure) that must be supported on key system interfaces to deliver DVB services over IP networks.
Below are presented the main points on MPEG2 TS over IP Encapsulation set by DVB-IPI.
All MPEG-2 transport streams shall be encapsulated in RTP (Real-time Transport Protocol) according to RFC 1889 in conjunction with RFC 2250. Transport service is provided jointly by UDP (checksum and multiplexing) and RTP (sequencing and time stamping / jitter removing).
RTP always uses an even UDP port number.



40 bytes + n * 188 bytes

Figure 1 : RTP packet structure



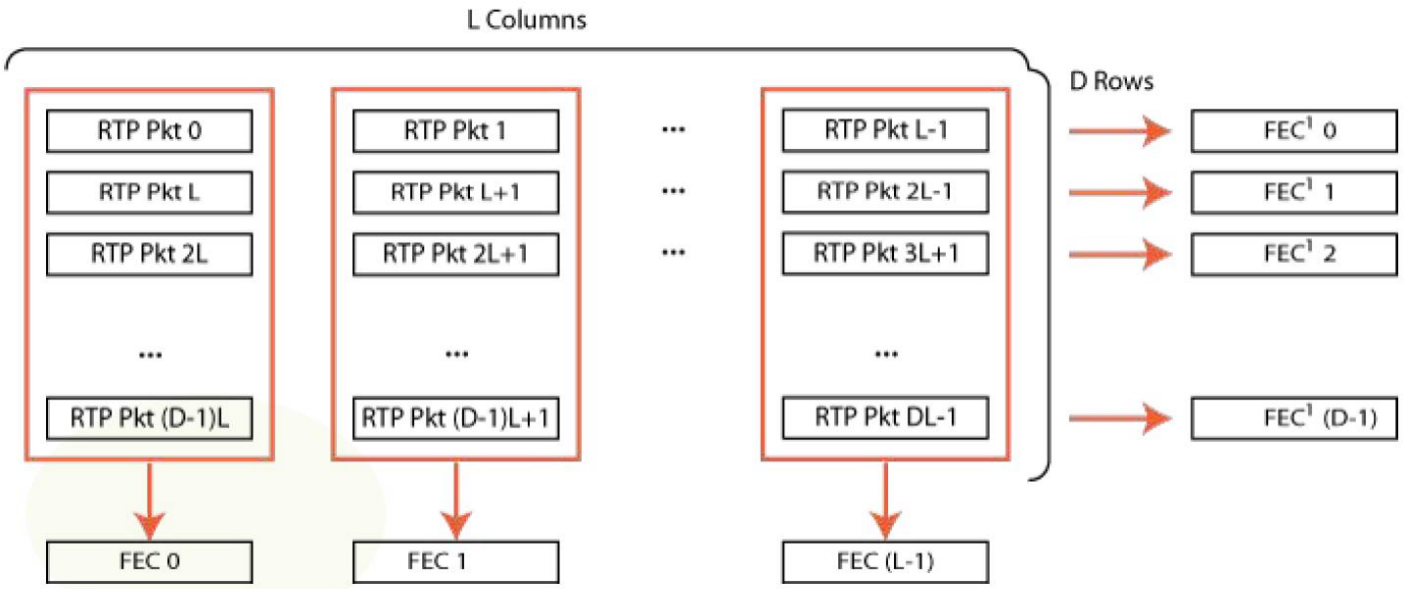
- V - Version, 2 bits. This field identifies the version of RTP.
- P - Padding, 1 bit. If the padding bit is set, the packet contains one or more additional padding bytes.
- X - Extension, 1 bit. If set, the fixed header is followed by exactly one header extension.
- CC - CSRC count. The CSRC count contains the number of CSRC identifiers that follow the fixed header.
- M - Marker, 1 bit. The interpretation of the marker is defined by a profile.
- PT - Payload type, 7 bits. Identifies the format of the RTP payload and determines its interpretation by the application.
- Sequence number Sequence number, 16 bits. The sequence number increments by one for each RTP data packet sent and may be used by the receiver to detect packet loss and to restore packet sequence.
- Timestamp Timestamp, 32 bits. The timestamps reflects the sampling instant of the first byte in the RTP data packet.
- SSRC Synchronization source, 32 bits. Identifies the synchronization source.
- CSRC Contributing source, 0 to 15 items, 32 bits each. An array of 0 to 15
- CSRC elements identifying the contributing sources for the payload contained in this packet.

For most streams, the RTP/UDP/IP overhead of 40 bytes per RTP packet is relatively low (for example 3% with a 1 316 byte payload).
IP packets can carry from 1 to 7 TS packets, knowing that:
– overall size of RTP payload must not exceed the MTU (Maximum Transfer Unit) in order to prevent RTP packets fragmentation around the network,
– short packets cause a high overhead.
There is no requirement for every RTP packet in a stream to contain the same number of transport stream packets. The receiver should use the length field in the UDP header to determine the number of transport stream packets contained in each RTP packet. The time stamp field in RTP header is based on the PCR values from MPEG-2 with a resolution of 90 Khz.
Streams must include PAT (Program Association Table) & PMT (Program Map Table) – other tables are optional. SI (Service Information) is intended to be delivered via separate IP streams, in e.g. XML format. RTCP (Real-time Transport Control Protocol) can be included to periodically inform the sending side about network quality (e.g. lost packets, delay, jitter, etc.).
The fact is that, at the output of the IP network, delivered Transport Stream must be fully ISO/IEC 13818-1 compliant (40ms maximum jitter, 1 artifact every hour...).

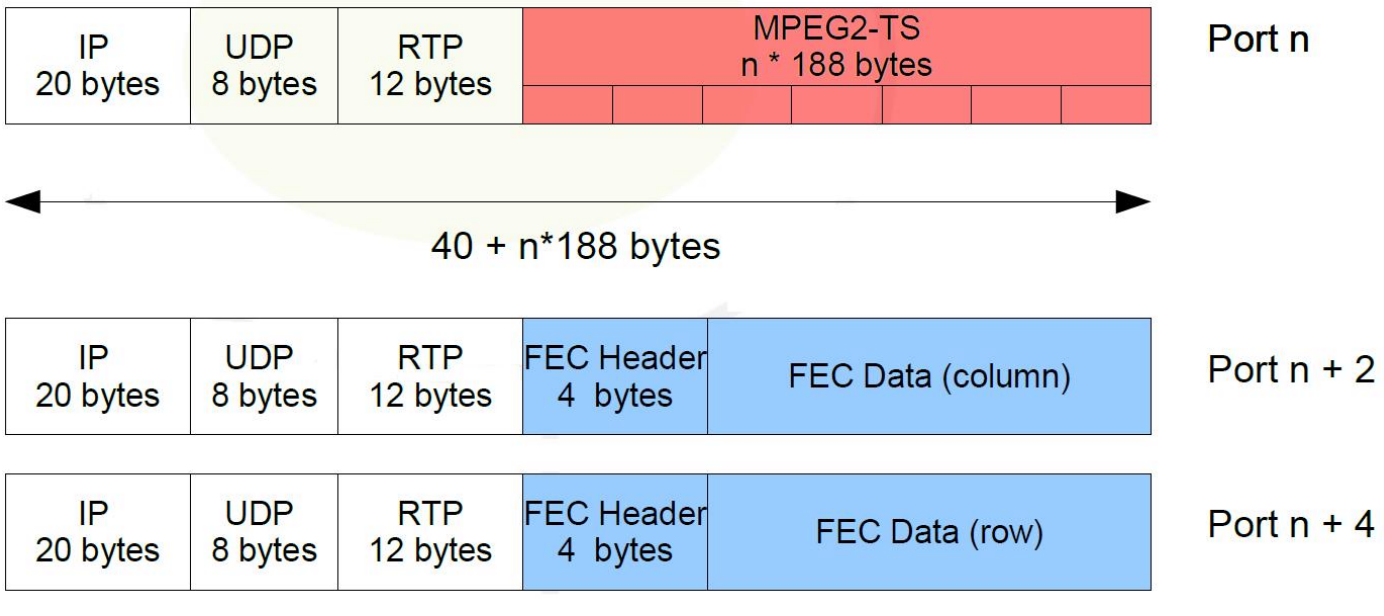
Forward Error Correction

The Pro-MPEG Forum (association of broadcasters, program-makers, and vendors) approved an open standard to improve QoS in professional video over IP networks, while keeping interoperability between equipment manufacturers.
Standard is provided as a set of guidelines and recommendations (Codes of Practice).

Code of Practice #3 describes a Forward Error Correction (FEC) method for protection against errors in delivering professional MPEG-2 TS data over IP networks. This method implemented in IP adapters, packet errors, out of order packets, network jitter and delay can be compensated. Such process is done in real-time along with TS over IP encapsulation.
FEC protection data is calculated and embedded in regular RTP packets with a specific payload type, and relies on simple XOR arithmetic's (if F=A?B?C, then if only A,B,F are present, C can be recovered with C=A?B?F). A FEC matrix is generated (cf figure 3) and transmitted on two separate UDP ports, FEC columns on UDP port + 2 and FEC rows on UDP port + 4.



The dual FEC mode structure



FEC packets transmission

Appendix2 - Multicast

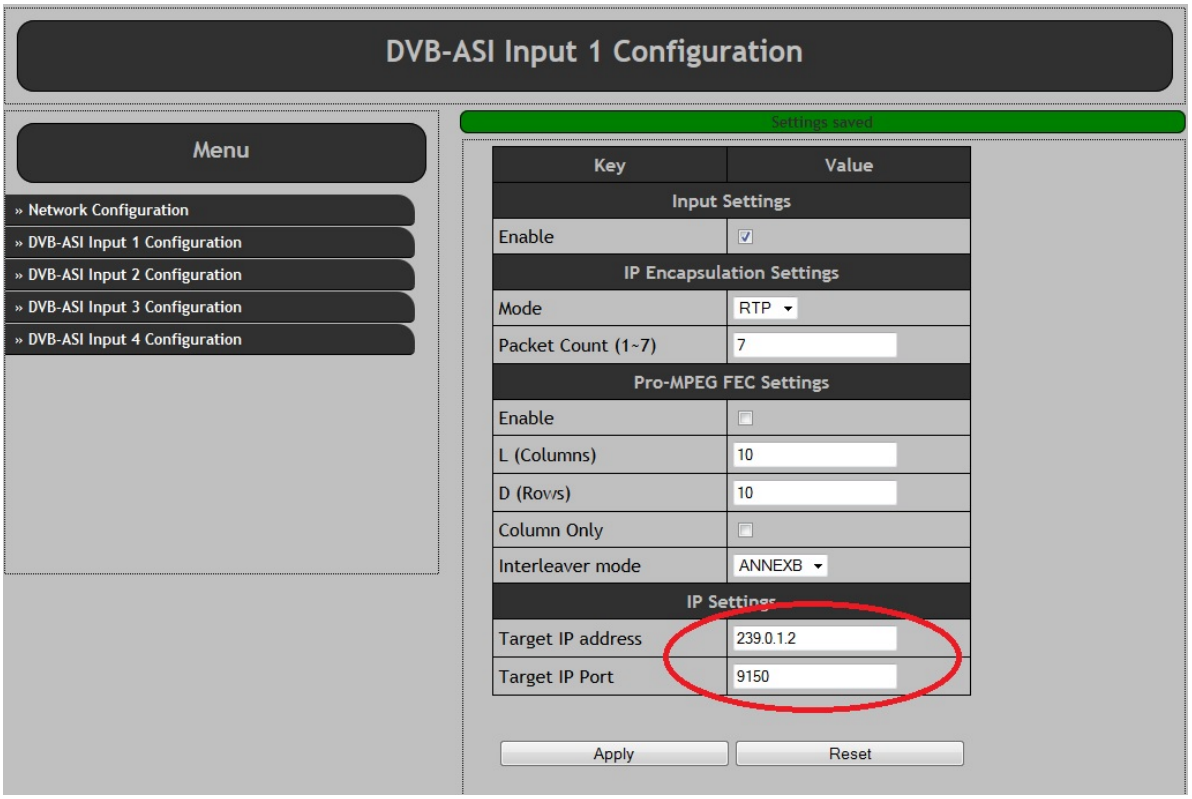
All Alitronika IP devices have the capability to transmit or receive a transport stream by **unicast, multicast** or **broadcast**. This appendix describes the multicast settings.

2.1 Multicast Transmit

In order to enable multicast transmit, the target IP address must be set to a value in the multicast range.

The multicast range is from **224.0.0.0** to **239.255.255.255**.

Also the target IP **port number must be set**.



2.2 Multicast Receive

To receive the multicast stream at another device the device must be set up as follows:

- First the multicast IP address must be set.

This needs to be the same as the multicast transmitter **IP address**.

- Second the port number must be set.

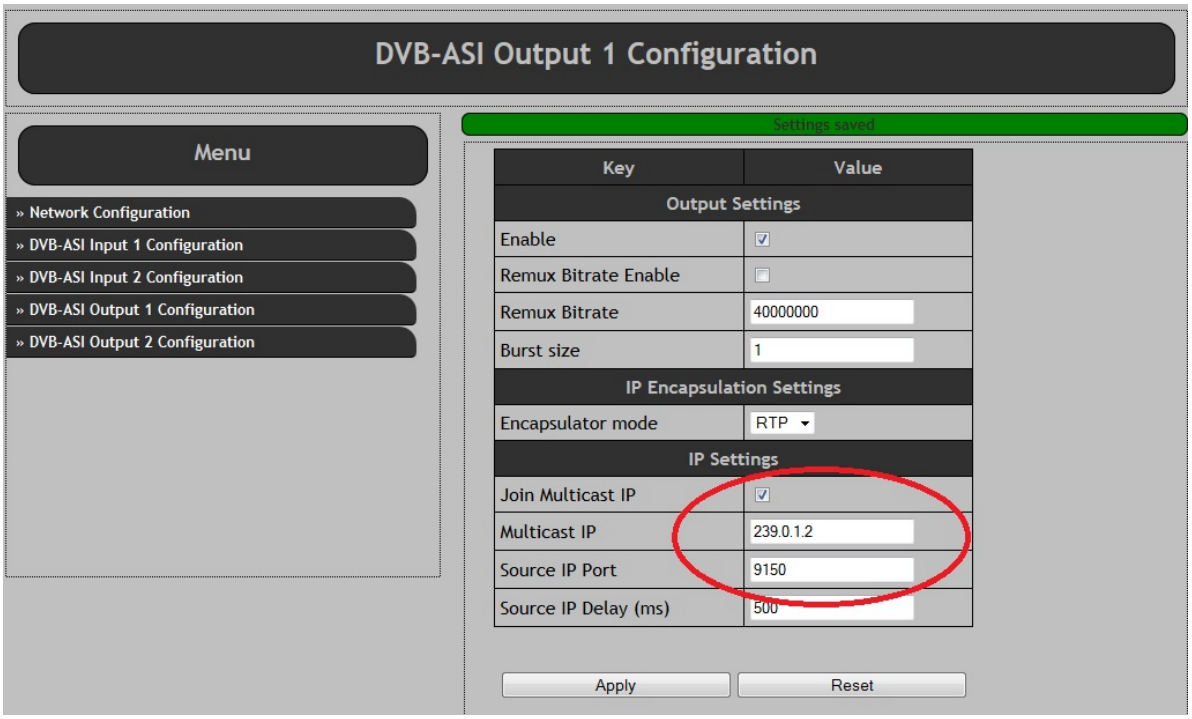
This needs to be the same as the as the multicast transmitter **port number**.

- Finally the "**Join multicast IP**" check box must be enabled.

When enabled, the device sends a multicast join group message to the Ethernet network switch. The switch then enables sending the transport stream to the device.

When the "**Join multicast IP**" check box is disabled, the device sends a leave multicast group message to the switch. The switch then disables sending the transport stream to that device.

When the "**Join multicast IP**" check box is disabled, the "**Multicast IP**" address is ignored.



2.3 RIGMP Querier

The **join and leave** multicast group messages belongs to the IGMP protocol. Most switches have a timeout at the multicast group table. The timeout can be named "**Host timeout**" or "**Aging timeout**".

At the timeout the multicast group is cleared and multicasting stops.

To avoid this the following can be done:

- Increase "Host timeout"/"Aging timeout" value.
- Configure the multicasting manually at the switch.
- Install an IGMP Querier in the network.
- Use the internal IGMP Querier of the switch (if the switch supports this).

2.3 DHCP or Static IP address

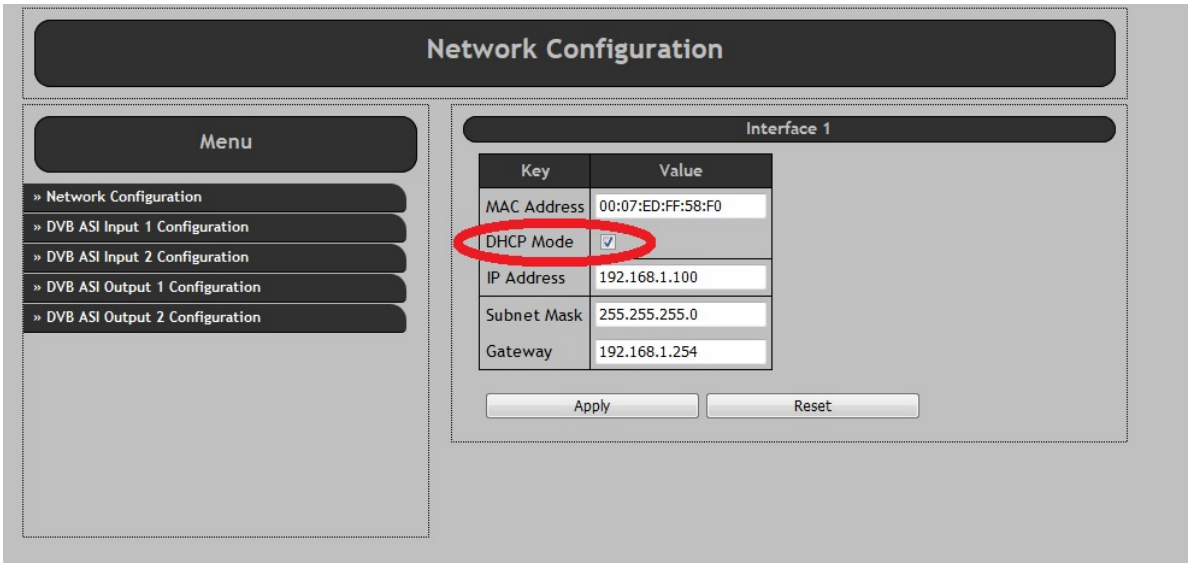
All Alitronika IP devices have the option to obtain the IP address by a DHCP server or to set a static IP address.

2.3.1 DHCP

To obtain the IP address by a DHCP server the device must be set as followings:

- Switch on the device.
- Open the devices settings web interface.
- Select the "Network Configuration" page.
- Select the "DHCP Mode" checkbox.
- Press Apply.
- Restart the device.

In DHCP mode the IP address, Subnet Mask and Gateway settings are ignored.

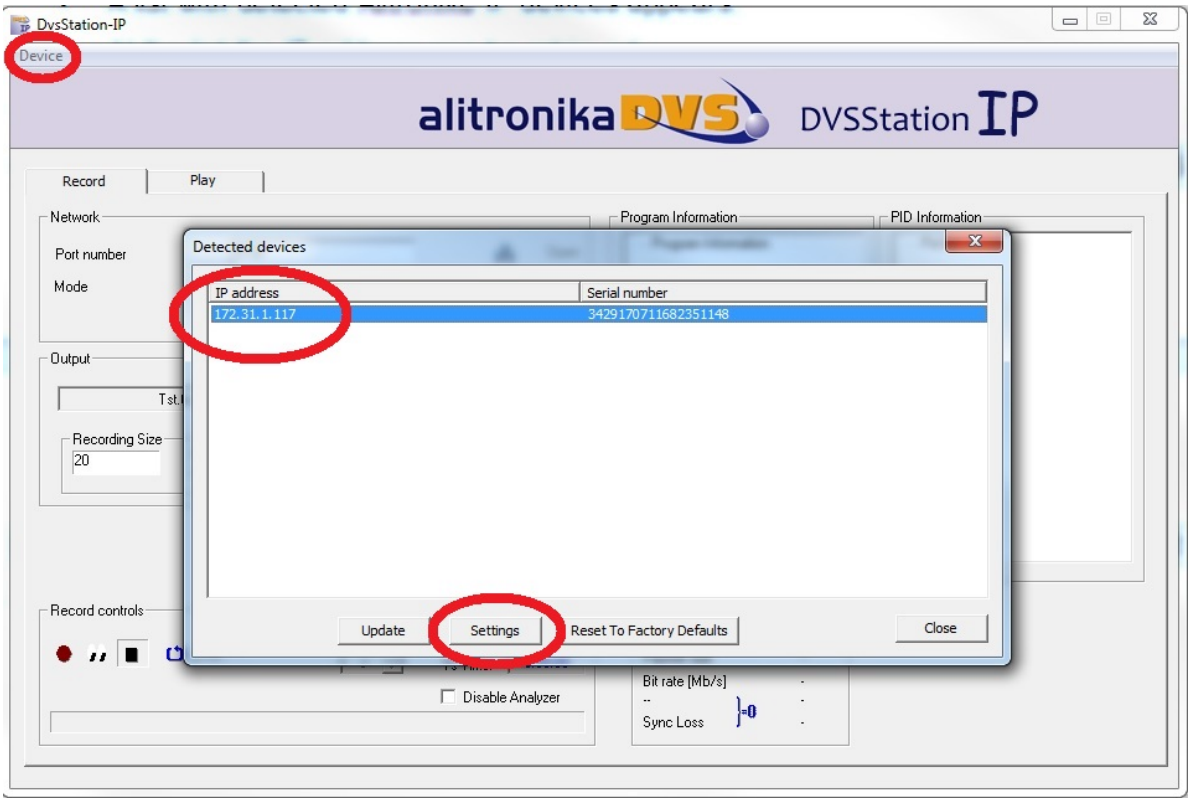


2.3.2 Discover device

If the device uses DHCP mode, the IP address is unknown. To discover the device, DVSStation-IP must be used.

Use the following procedure to discover the device:

- Switch on the device.
- Open DVSStation-IP.
- At DVSStation-IP click on the “Device” menu item and select the “Discover IP Devices”.
- A list with detected Alitronika IP devices appears.
- At the list the IP address can be retrieved.
- Select the device and press the “Settings” button to open the web interface.



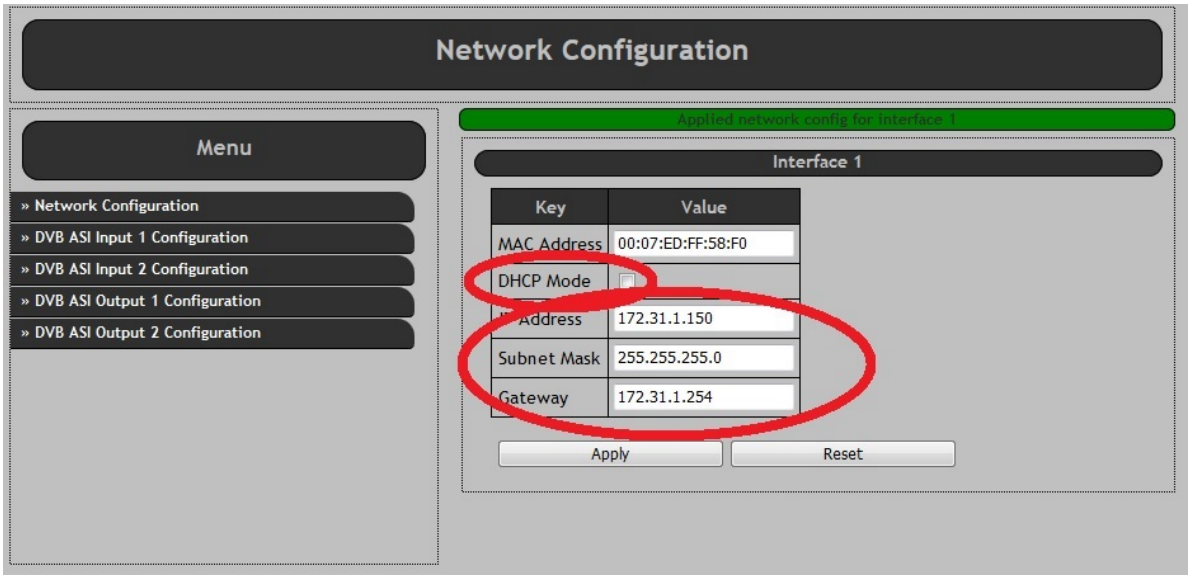
2.3.3 Static IP address

With a static IP address the device always starts with the same IP address.

To use the static IP address the device must be set as following:

- Switch on the device.
- Open the devices settings web interface.
- Select the “Network Configuration” page.
- Deselect the “DHCP Mode” checkbox.
- Enter a valid address at the “IP Address” field. **Please note that the IP address must be in the same IP range of the local network, else the device could be unreachable.**
- Enter a valid address at the “**Submask**” field.
- Enter a valid address at the “**Gateway**” field. (Normally the IP address of the modem).
- Press Apply.
- Restart the device.

After restart the device uses the static IP address.

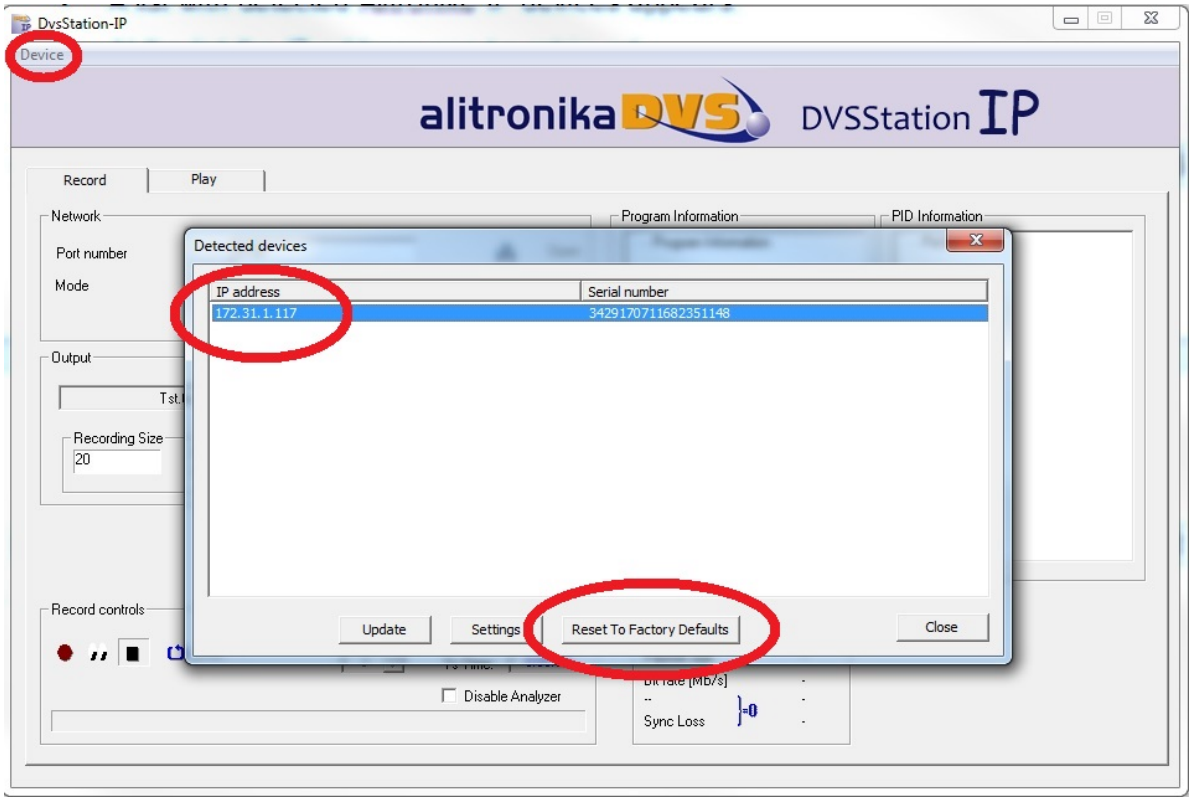


2.4 Recovering from a faulty Static IP address

If a faulty static IP address is set, the device could be unreachable. To recover from this situation, DVSStation-IP must be used.

Use the following procedure to recover the device:

- Switch on the device.
- Open DVSStation-IP.
- Once DVSStation-IP is active click on the “Device” menu item and select the “Discover IP Devices”.
- A list with detected Alitronika IP devices appears.
- Select the device with the faulty IP address and select the “Restore to Factory Defaults” button.
- The device now restores the default settings with DHCP mode enabled.
- The device restarts automatically.
- Wait until the device re-appears in the device list with a new and correct IP address.



2.5 References (ordered from 'user understandable' to protocol description):

http://www.juniper.net/documentation/en_US/junos12.1/topics/concept/igmp-snooping-multicast-forwarding.html
https://en.wikipedia.org/wiki/Internet_Group_Management_Protocol
http://wiki.mikrotik.com/wiki/Manual:Multicast_detailed_example
https://tools.ietf.org/html/rfc2236
https://tools.ietf.org/html/rfc3376

2.5 Video Tutorial:

https://www.youtube.com/watch?v=GGqcwdDW1a8 (Cisco Multicast IGMPv2)

2.6 Dumb tool, which can act as IGMP Querier application:

https://code.google.com/p/igmpquery/

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