Digital Video Interfacing Products

AT88IP

TS-over-IP
Receiver/Converter/Recorder
DVB-T2/T/C to DVB-ASI & IP Converter

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

Standard Features

DVB-T2/T/C to IP & DVB-ASI Receiver, Recorder Converter.
- Receives DVB-T2/T/C TS & converts into ASI & IP in real time.
- Records TS using Free application DVSStationIP.
- **Web based Software** as well as **DVSStationIP.**
- **DVSStationIP** runs on **Windows XP, Vista, Windows 7**.
- Remote Web-based configuration management.
- Remote firmware upgrade.
- Saved configuration settings.
- No re-configuration needed after system reboot.
- An alternative to dedicated satellite links.
- Connects digital video equipment to computer networks.
- Encapsulation of the TS data for Ethernet uses IP and the **UDP)**, with **RTP** encapsulation and Pro-MPEG **COP3 FEC** as an option.
- Dedicated hardware performs the encapsulation, which maximizes the throughput and minimizes latency.

Application

Targeted for Digital Video Professionals, Sophisticated End Users and OEMs the AT88IP is an ideal solution for a number of applications such as:
- Development Tools.
- **DVB to IP Gateway.**
- **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.
- Providing an ASI input for decoders, Multiplexers, Modulators.

IP
- 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.

DVB-T2/T/C Input
- **RF Tuner Connector:** 75 Ohms IEC female Type.
- **Loop Through Connector:** 75 Ohms IEC male Type.

Input Frequency Range:
  - **High Band:** 434.0 MHz to 858.0 MHz.
  - **Mid Band:** 149.5 MHz to 426.0 MHz.
  - **Low Band:** 50.5 MHz to 142.5 MHz.
- **Channel Bandwidth:** 6, 7 & 8 MHz.
- **RF Sensitivity:** -80dBm
- **COFDM Spectrum (DVB-T2/T):**

2k and 8k carriers non-hierarchical and hierarchical.
- **Modulation Modes:** DVB-T/T2: QPSK, 16QAM, 64QAM
- **Modulation Modes:** DVB-C: 64QAM, 128QAM, **256QAM**
- **Guard Interval Modes**: 1/4, 1/8, 1/16, 1/32.

Specifications

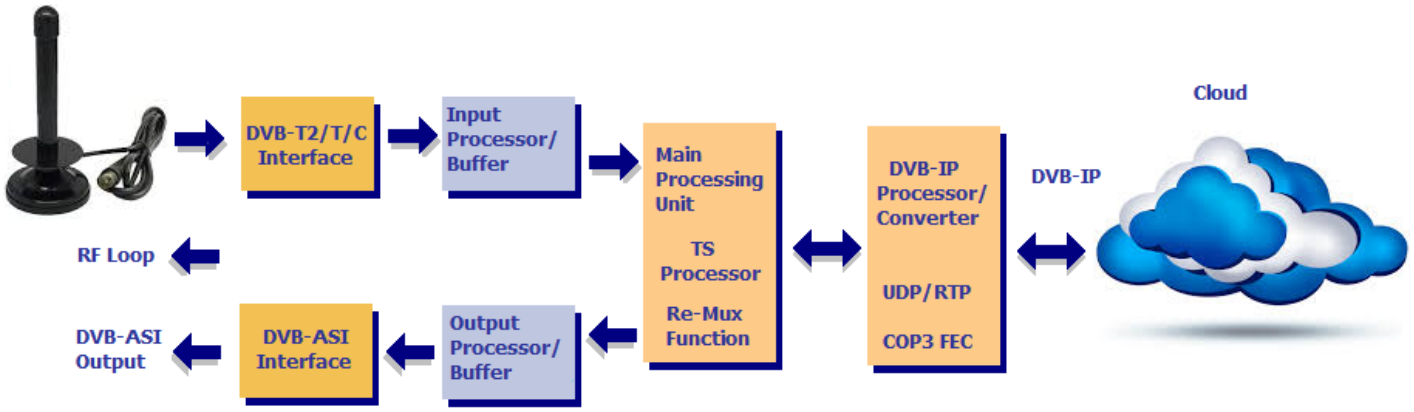
DVB-IP
- **Ethernet encapsulation:** IEEE 802.2 SNAP, Eth.
- **Encapsulation:** UDP or RTP
- **IP support:** IPv4
- **IP-address assignment:** DHCP link local or static
- **Multicast support:** IGMPv2
- **Date Rate:** 100/1000
- **GigE port Physical layer:** IEEE 802.3a
- **GigE port Connector:** RJ-45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

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

DVB-T2/T/C
- **Standards:** DVB-T2/T/C.

1 BLOCK DIAGRAM

The block diagram of the AT88IP device.



2 EXTERNAL INTERFACES

The external interfaces for the AT88IP are shown. There are two F-Type RF connectors, a Mini BNC connector for the DVB-ASI output, 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 AT88IP 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

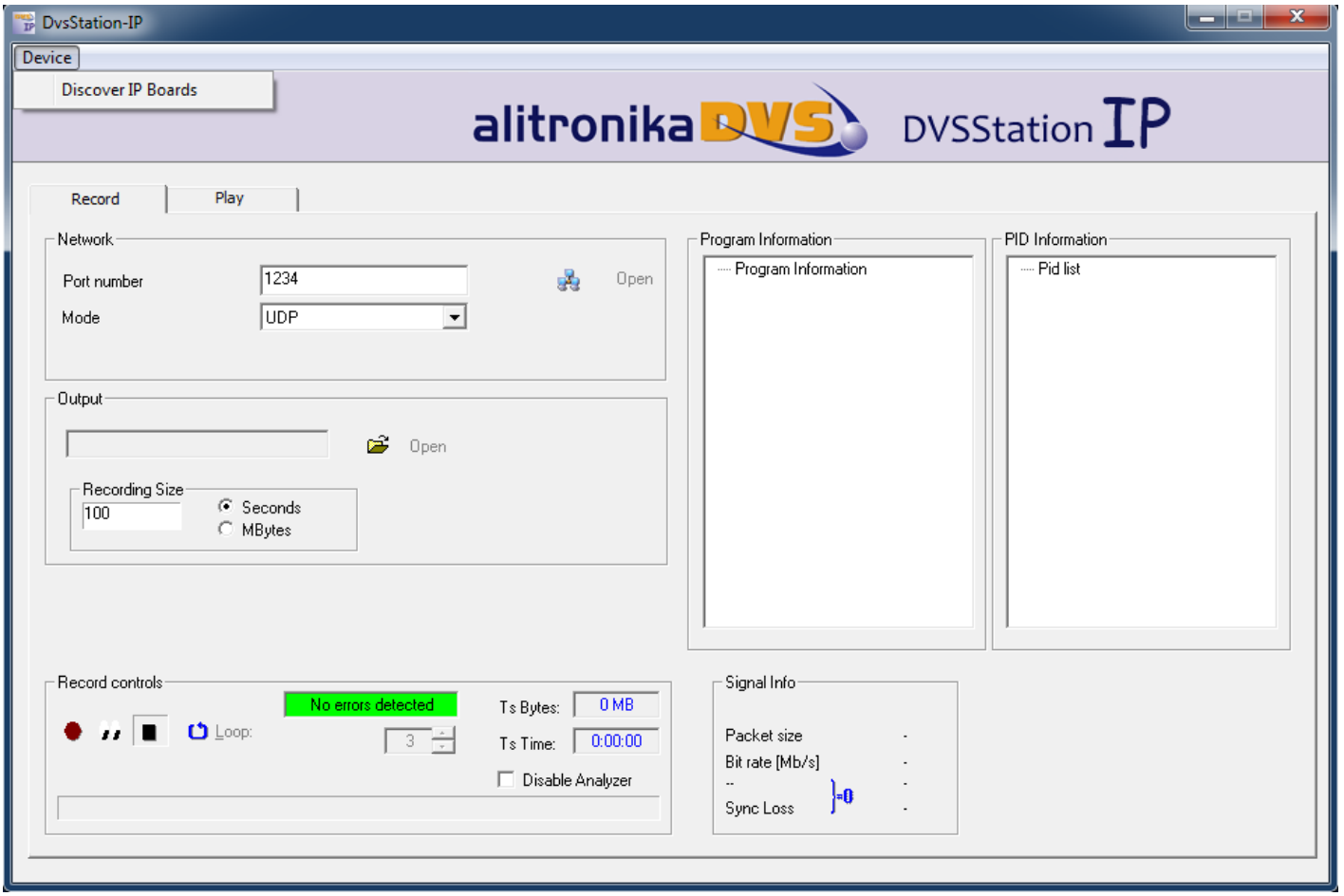
Download the application software, DVSStationIP, from our website.
Link : www.alitronika.com/downloads.htm
Unzip it & install it on a PC/Laptop.

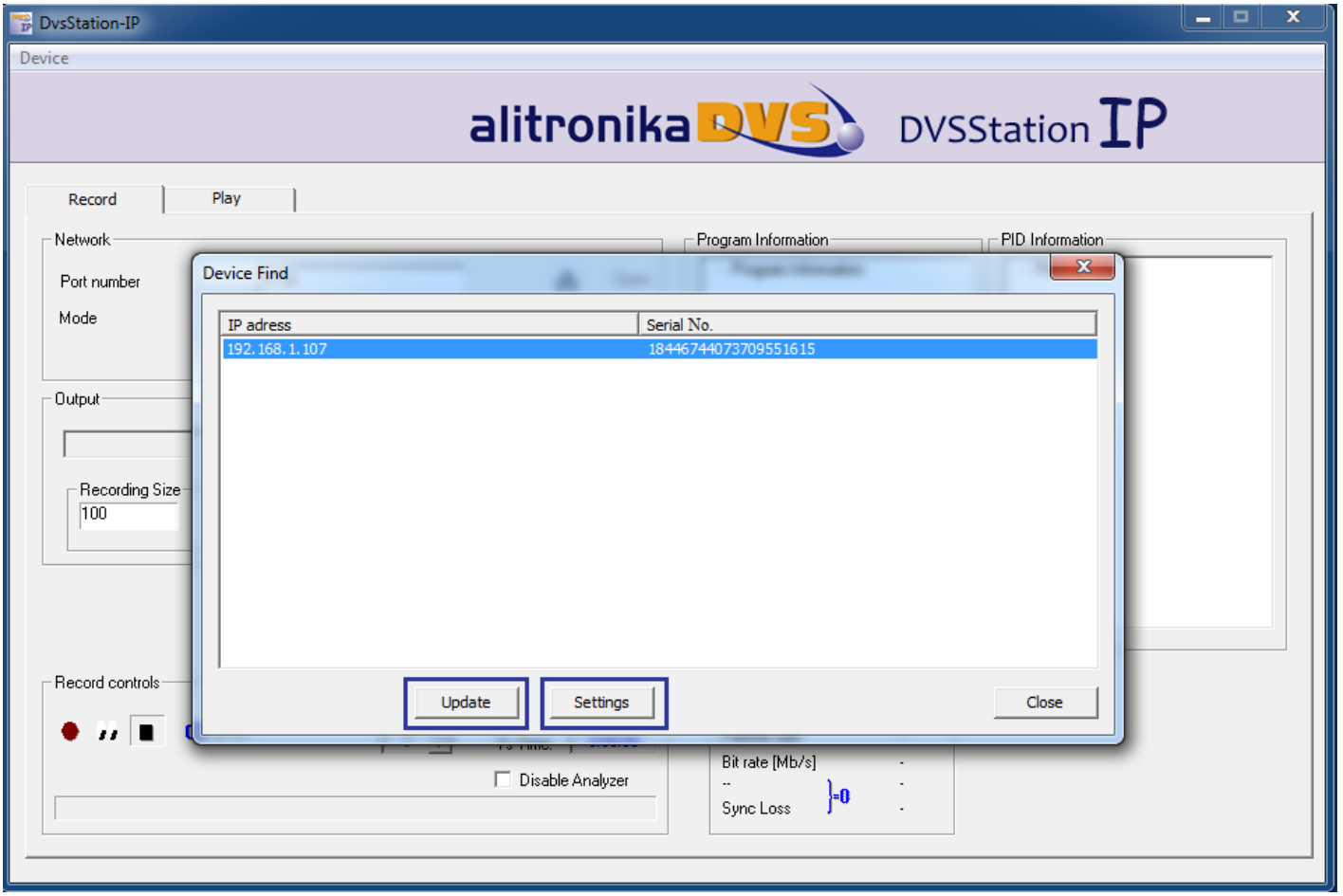
Step 2: Starting for the first Time

Connect the AT88IP & the PC/laptop to your network **DHCP** server.

Connect the power adaptor & Power up the AT88IP using the switch on the rear of the unit.
You should see the Power LED is ON and the 2nd LED, Status1, is BLINKING.

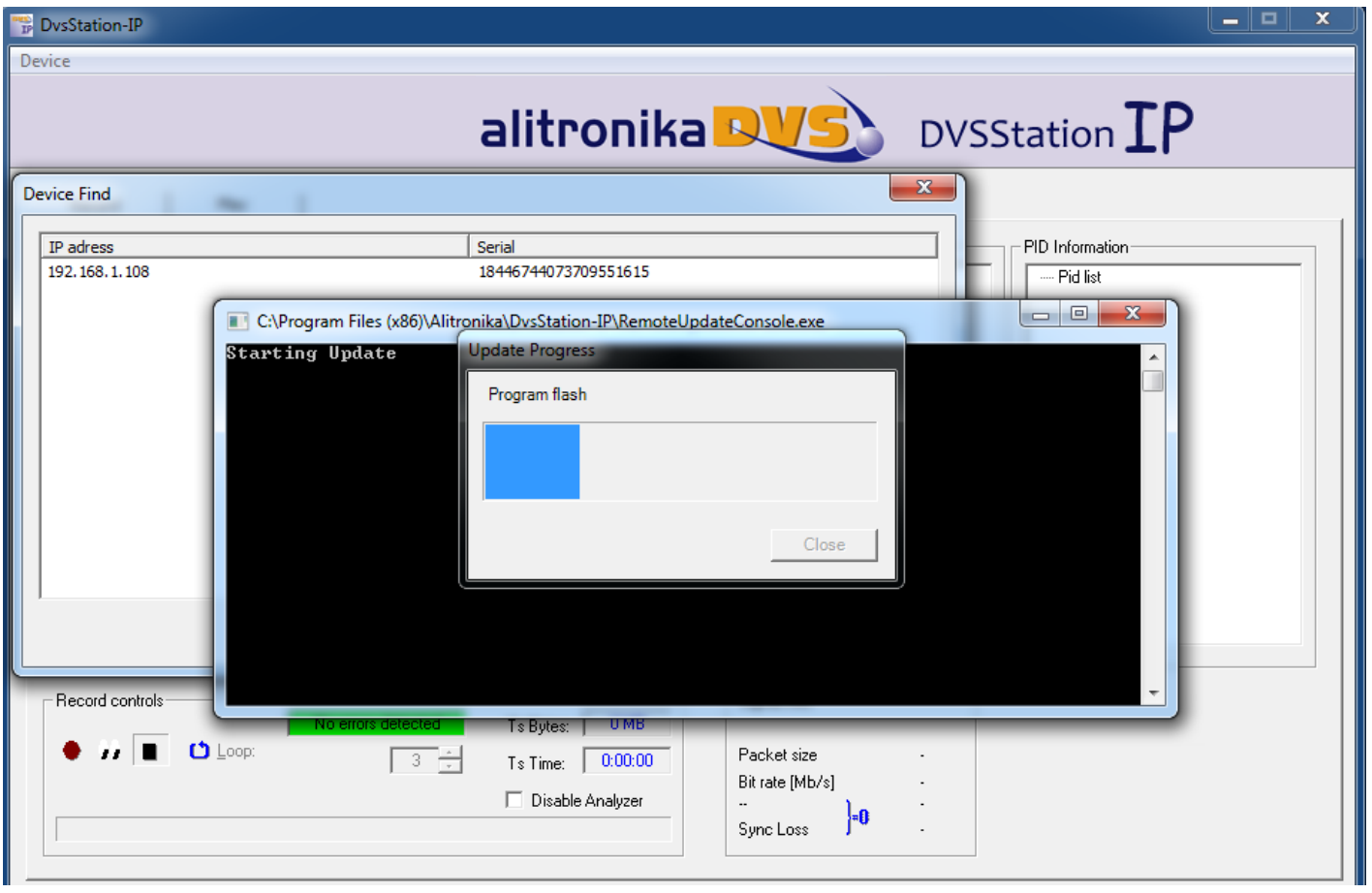
Start DVSStationIP.
From the top bar, **Device**, use "**Discover**" in order to find the IP address of AT60IP.





Step 3: Updating the Firmware if needed

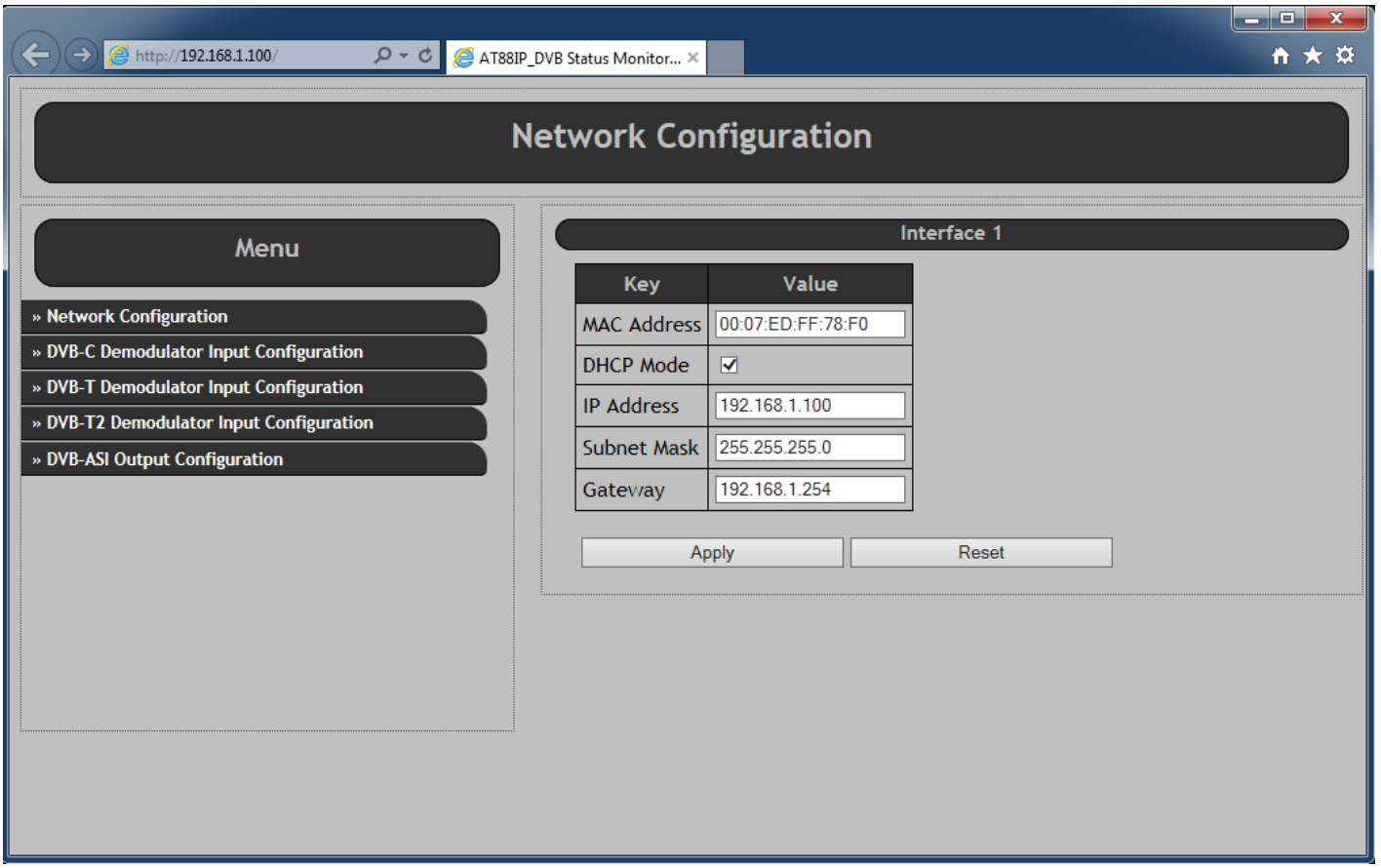
As shown on the screen shots, you should be able to see the IP address of the device as well as the serial number.
Update - Clicking on this would update the firmware of the AT88IP device.
You need not doing this unless you really need an update. If your system is working OK just leave it.
If you do 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.



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-T2/T/C De-modulator parameters.

As it can bee seen from the screen shot below, in order for correct operation of the DVB-T2/T/C Receiver/Demodulator section, a few parameters must be set by the user.

Notice the DVB-T2/T/C input port must first be ENABLED.

Selecting De-modulation mode: The AT88IP has 3 modes, DVB-T2, DVB-T and DVB-C. The user can select any of these from the top level of Web-based configuration management application.

Once a mode (T2, T or C) is selected the following settings can be selected by the user.

1- **Demodulator Settings** - Here only two parameters need setting, the FREQUENCY & the BANDWIDTH for DVB-T and only the FREQUENCY settings for DVB-C.

2- **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.

3- **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.

4- IP Settings – The DVB-T2/T/C 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.

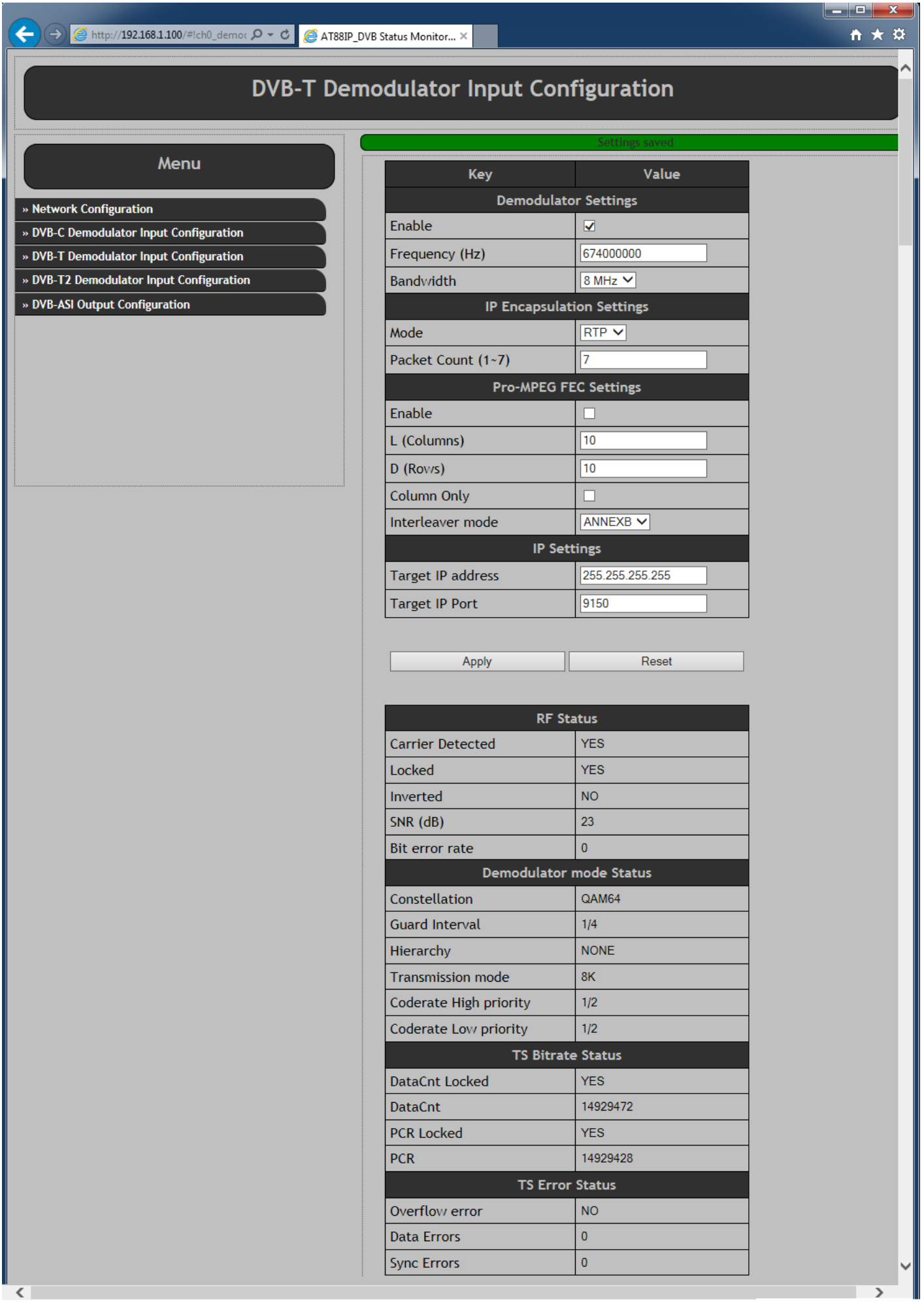
5.1- **Target IP Address** – Select an IP address for Unicast or select 255.255.255.255 for Multicast.

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.

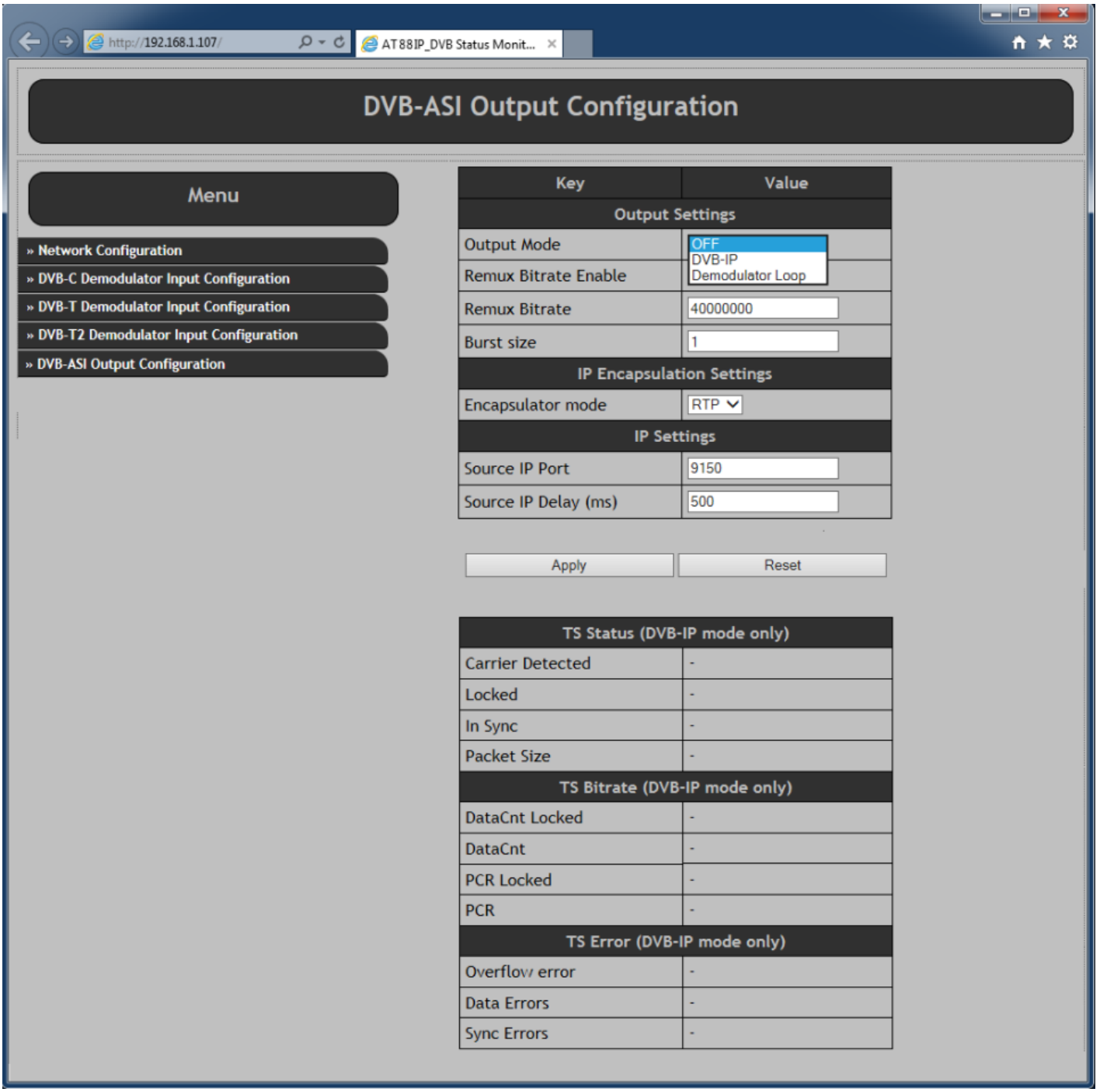
- All modulation parameters related to DVB-T2/T/C RF input and the incoming transport streams are detected automatically by the integrated TS Analyser. No user inputs are required.


http://192.168.1.100/#!ch0_demod
AT88IP_DVB Status Monitor...
DVB-T Demodulator Input Configuration
Menu
» Network Configuration
» DVB-C Demodulator Input Configuration
» DVB-T Demodulator Input Configuration
» DVB-T2 Demodulator Input Configuration
» DVB-ASI Output Configuration
Settings saved
Key
Value
Demodulator Settings
Enable
Frequency (Hz)
674000000
Bandwidth
8 MHz
IP Encapsulation Settings
Mode
RTP
Packet Count (1~7)
7
Pro-MPEG FEC Settings
Enable
L (Columns)
10
D (Rows)
10
Column Only
Interleaver mode
ANNEXB
IP Settings
Target IP address
255.255.255.255
Target IP Port
9150
Apply
Reset
RF Status
Carrier Detected
YES
Locked
YES
Inverted
NO
SNR (dB)
23
Bit error rate
0
Demodulator mode Status
Constellation
QAM64
Guard Interval
1/4
Hierarchy
NONE
Transmission mode
8K
Coderate High priority
1/2
Coderate Low priority
1/2
TS Bitrate Status
DataCnt Locked
YES
DataCnt
14929472
PCR Locked
YES
PCR
14929428
TS Error Status
Overflow error
NO
Data Errors
0
Sync Errors
0

Step 6: Setting the DVB-ASI output parameters.

The DVB-ASI output of AT88IP is completely independent of the DVB-T2/T/C input.
This port is a device on its own.
It could be configured as follows :

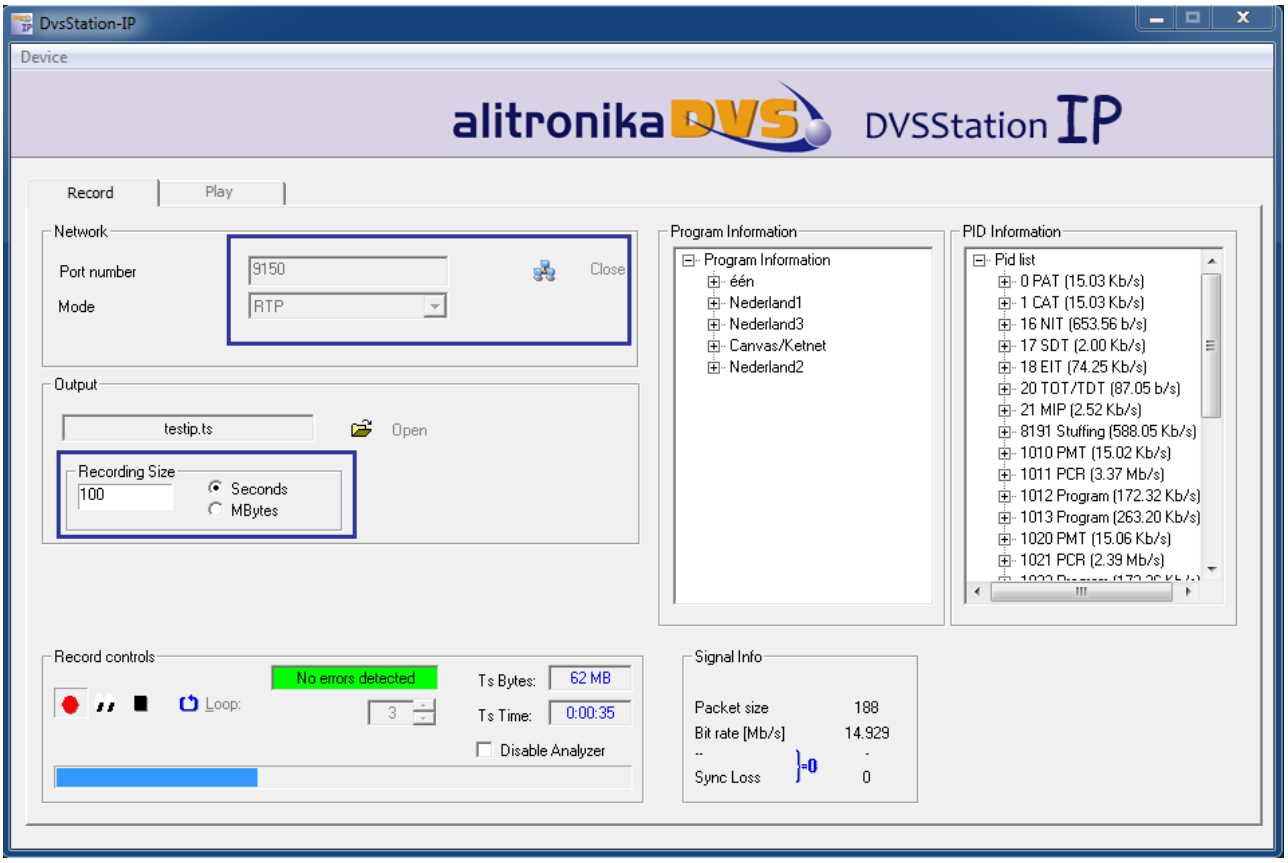
1- It could be **turned off** altogether.
2- It can be **used as DVB-T2/T/C to DVB-ASI converter** to convert the incoming transport stream to be used for example as input of a decoder or a modulator. It could be used to monitor the incoming transport stream or any other function.
3- It could also be used as **an independent DVB-ASI output** of TS over IP converter.
A completely different transport stream could be ported out of this output.
Another use for it could for example be to port the input DVB-T2/T/C transport stream after some processing such as Multiplexing, Re-Multiplexing, PID filtering, Trans-coding, Logo inserting.
In such a case the TS enters the system via the IP network, processing is carried out on it & is send out as a new transport stream via IP network to be used elsewhere is the system.

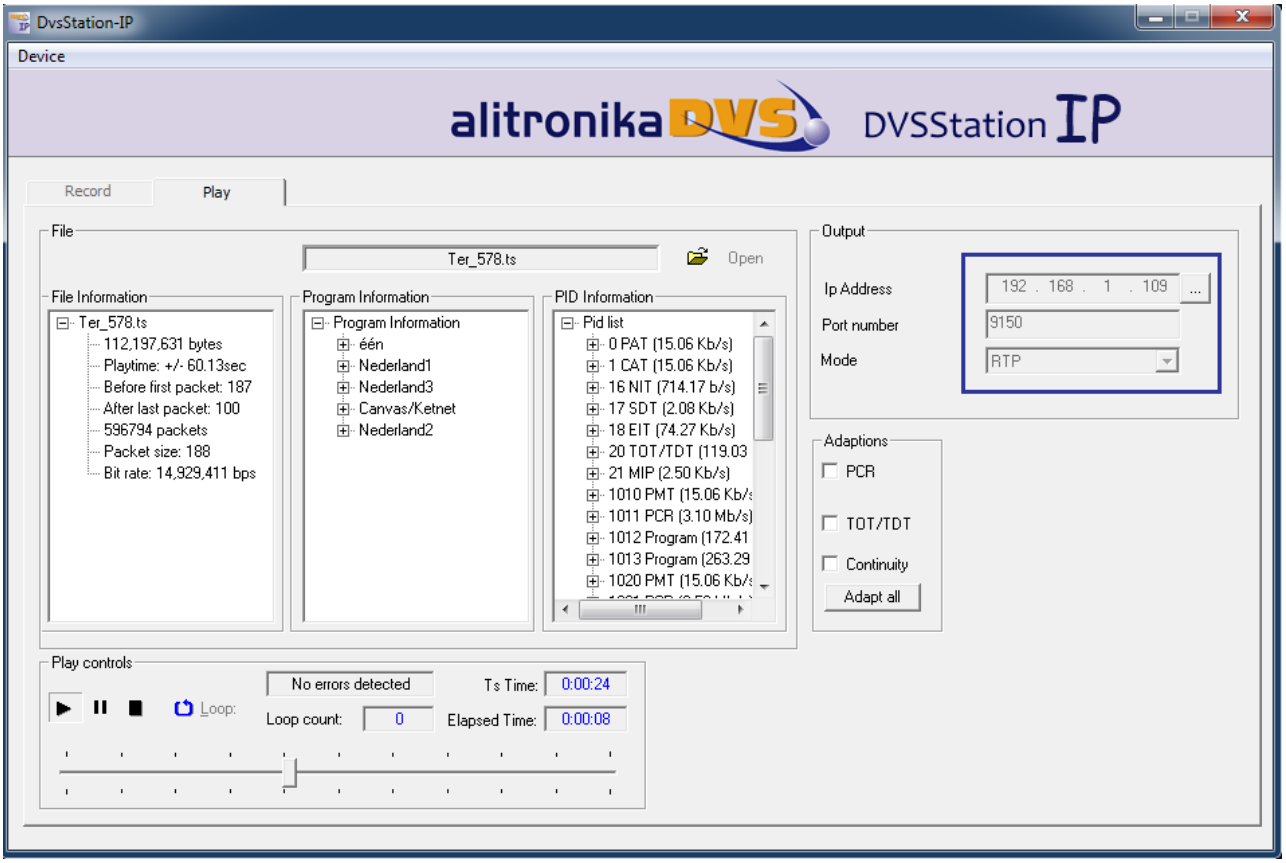


4 APPLICATION SOFTWARE

AT88IP 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

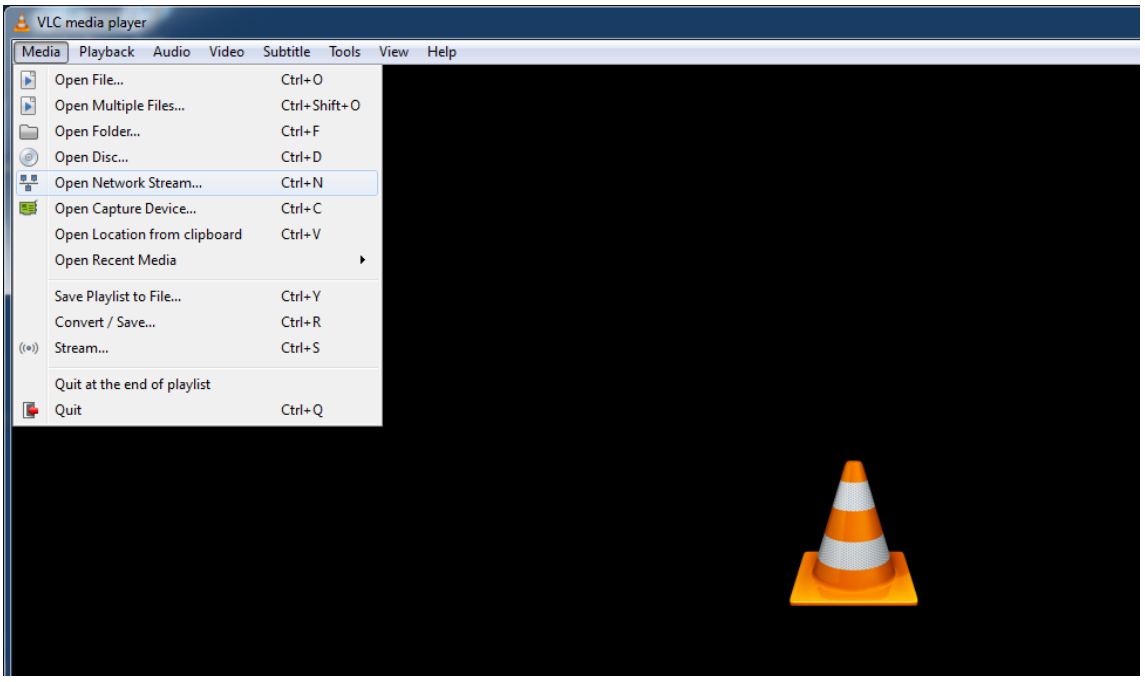


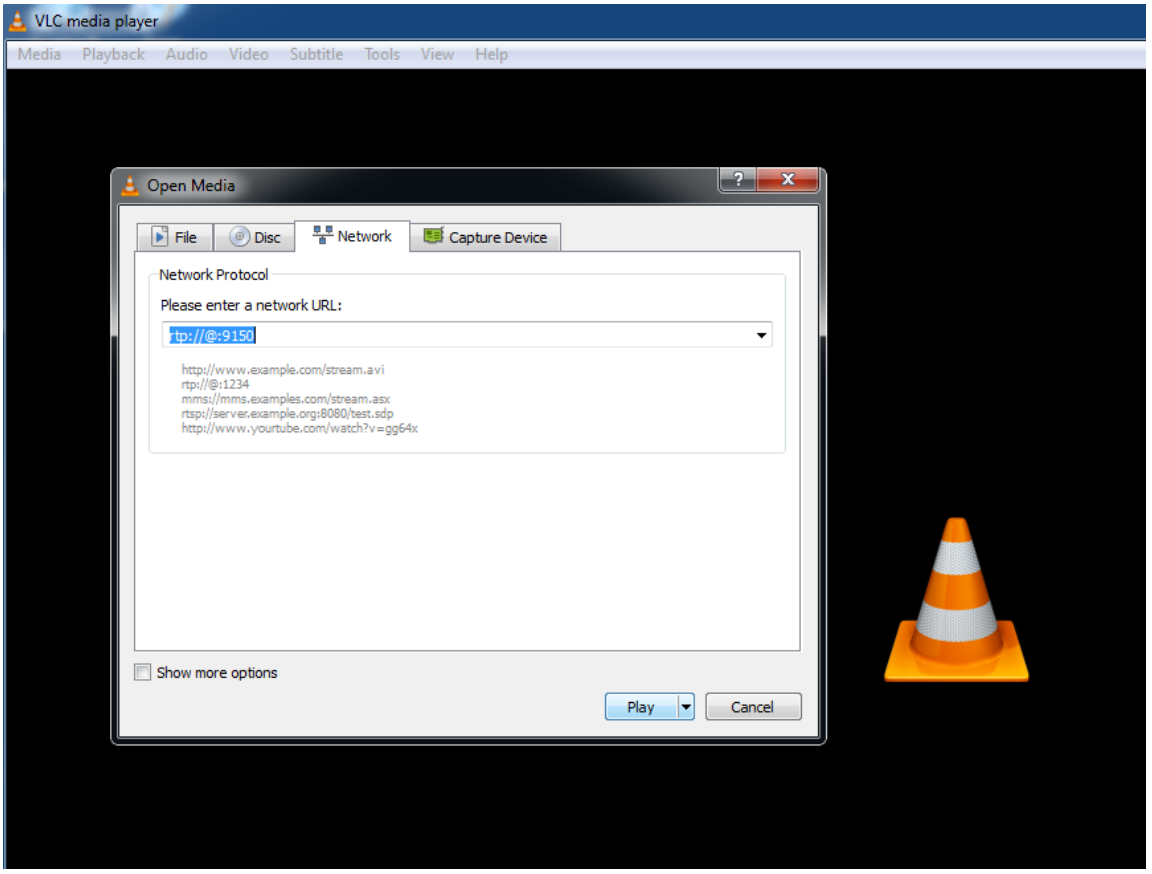


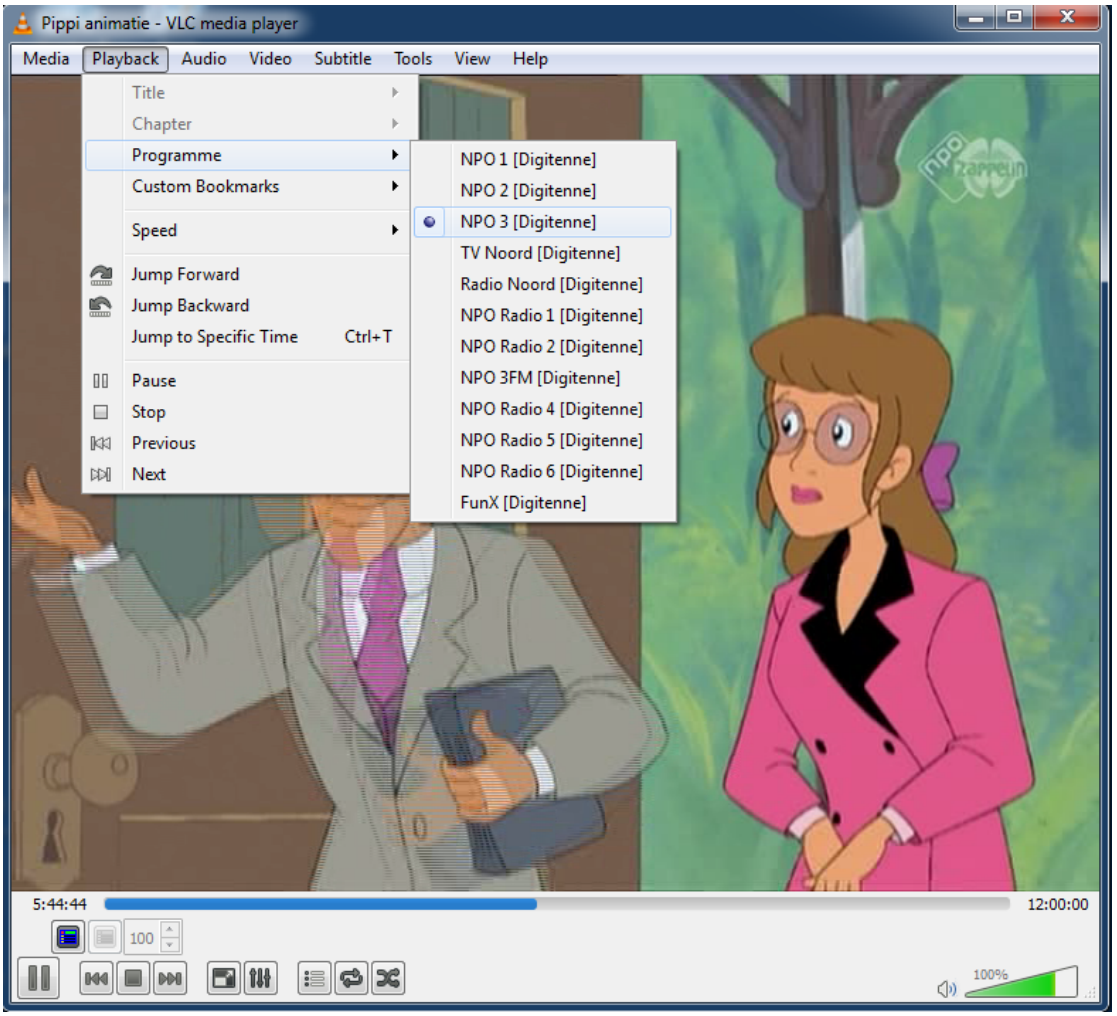
5 SOFTWARE DECODERS

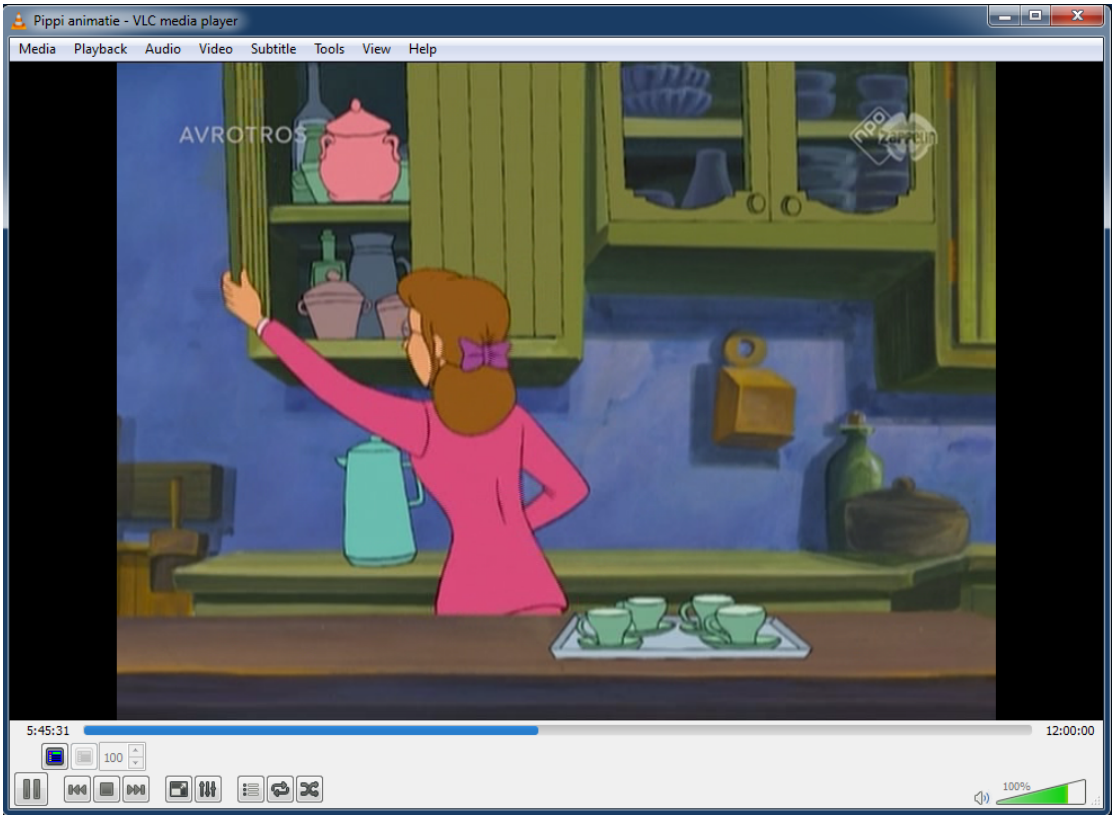
In order to view the programs any software decoder could be used.
Most of them could be downloaded from the Internet FREE of charge.
One such software is the VideoLan. Use this like to download http://www.videolan.org/.
Once install on your system.

- **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.**



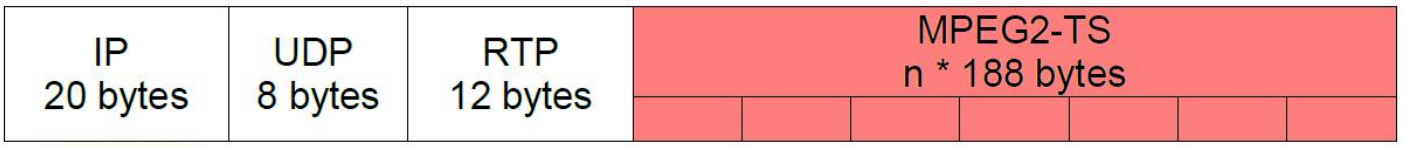



Pippi animatie - VLC media player
Media
Playback
Audio
Video
Subtitle
Tools
View
Help
Title
Chapter
Programme
Custom Bookmarks
Speed
Jump Forward
Jump Backward
Jump to Specific Time
Ctrl+T
Pause
Stop
Previous
Next
NPO 1 [Digitenne]
NPO 2 [Digitenne]
NPO 3 [Digitenne]
TV Noord [Digitenne]
Radio Noord [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]
5:44:44
12:00:00
100
100%


Pippi animatie - VLC media player
Media
Playback
Audio
Video
Subtitle
Tools
View
Help
AVROTROS
5:45:31
12:00:00
100
100%

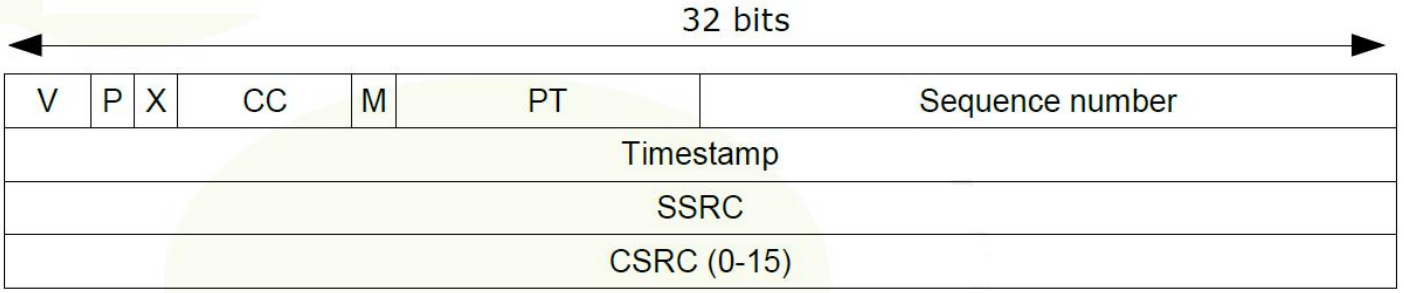
Appendix1 - FEC

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



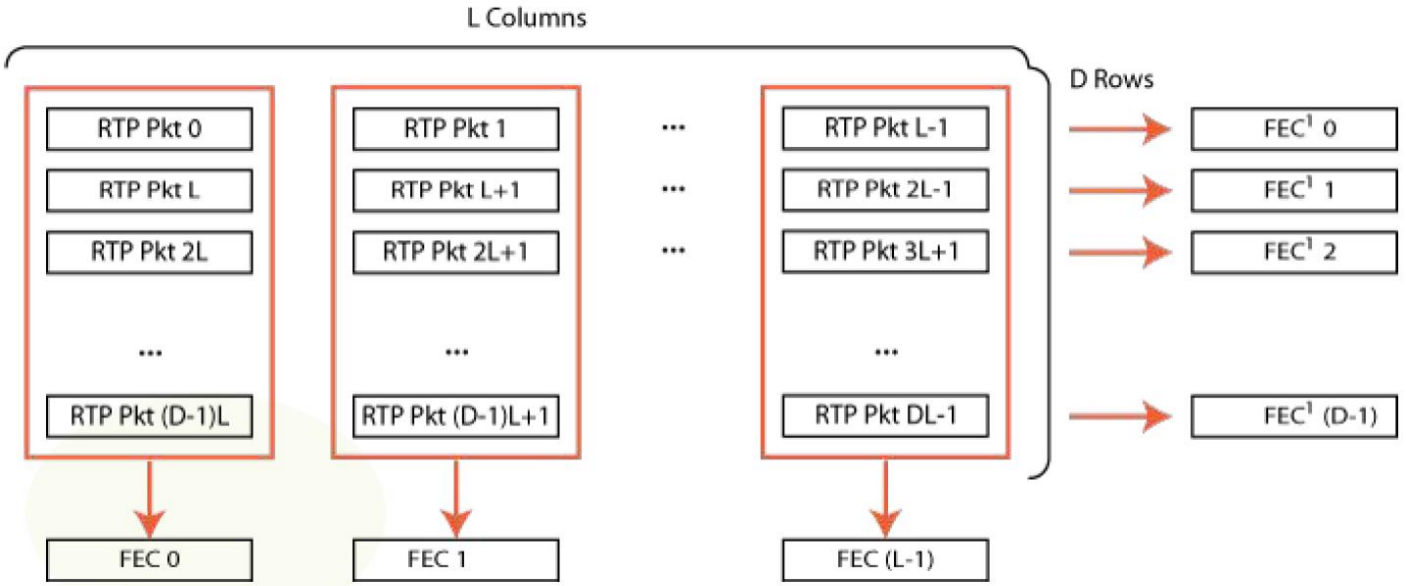
- V - Version, 2 bits. This field identifies the version of RTP.
- P - Padding, 1 bit. If the padding bit is set, the packet contains one or more additional padding bytes.
- X - Extension, 1 bit. If set, the fixed header is followed by exactly one header extension.
- CC - CSRC count. The CSRC count contains 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...).

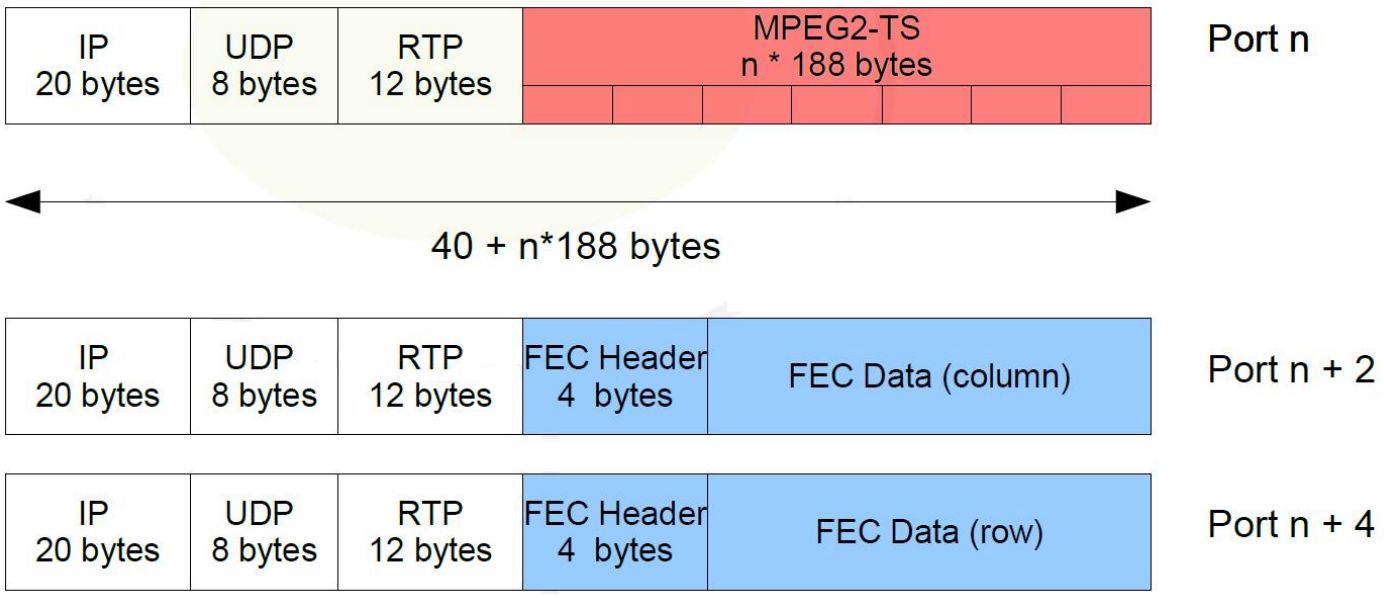
Forward Error Correction

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

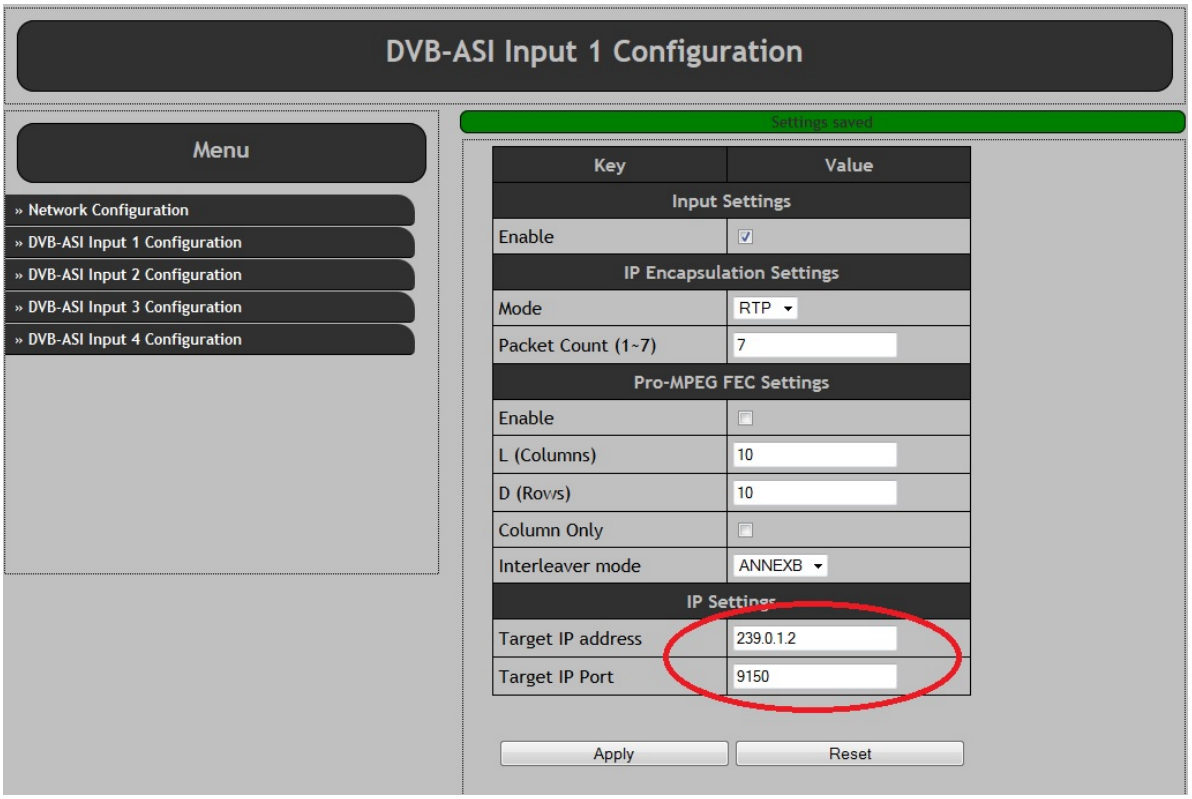
All Alitronika IP devices have the capability to transmit or receive a transport stream by **unicast, multicast** or **broadcast**. This appendix describes the multicast settings.

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.

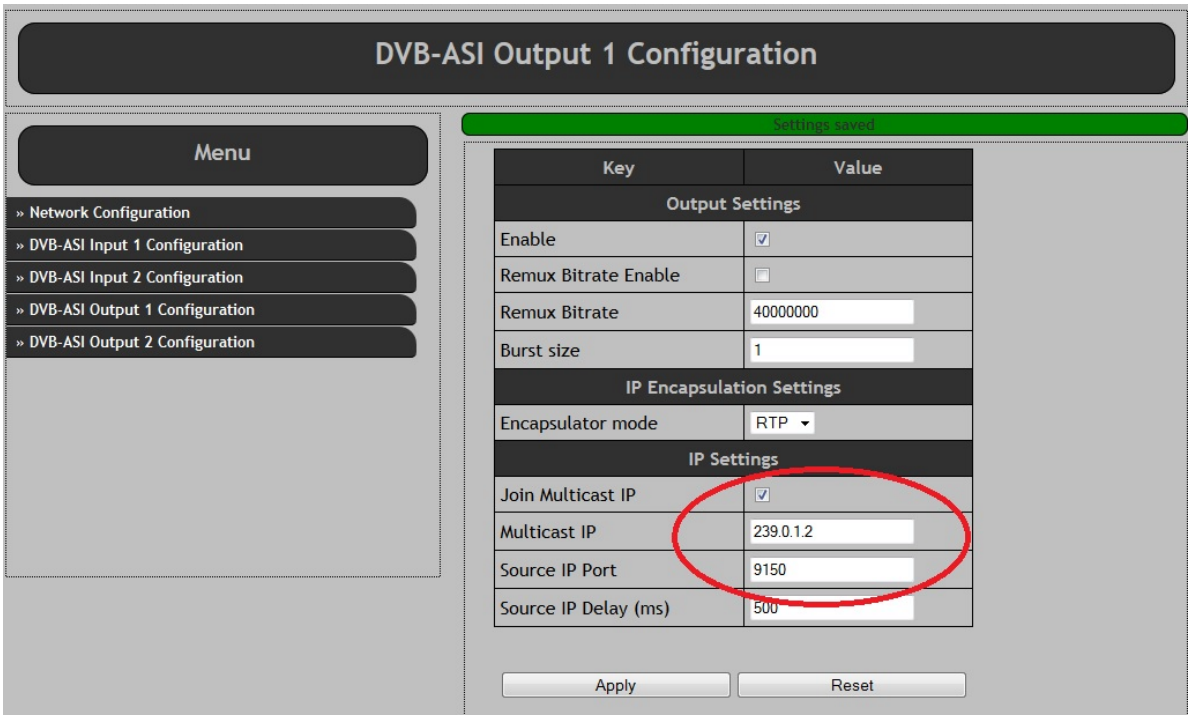
This needs to be the same as the as the multicast transmitter **port number**.

- 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

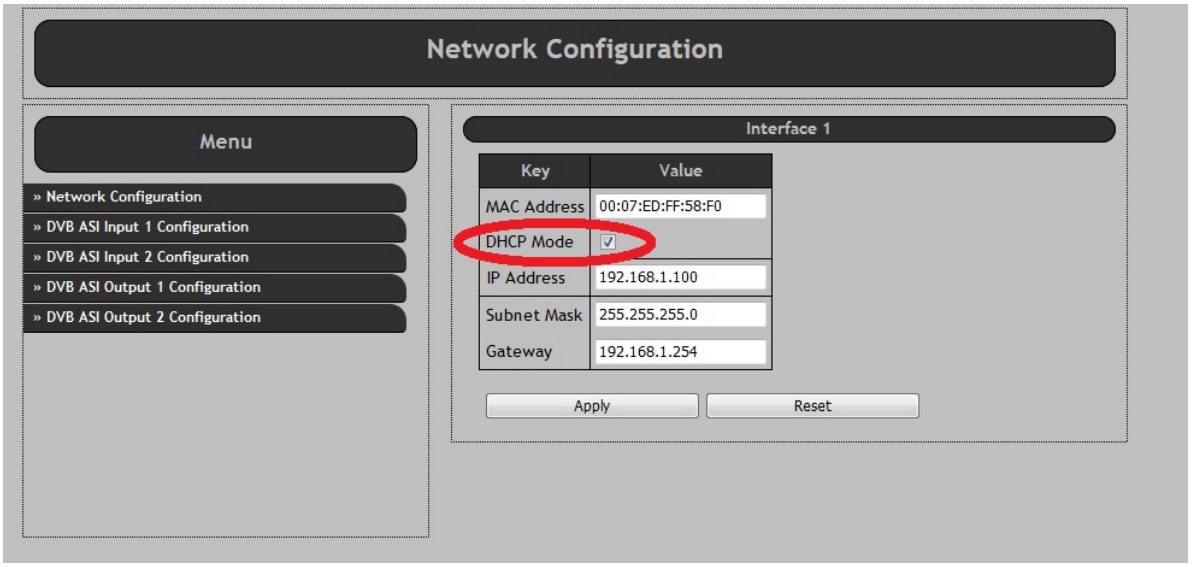
All Alitronika IP devices have the option to obtain the IP address by a DHCP server or to set a static IP address.

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.

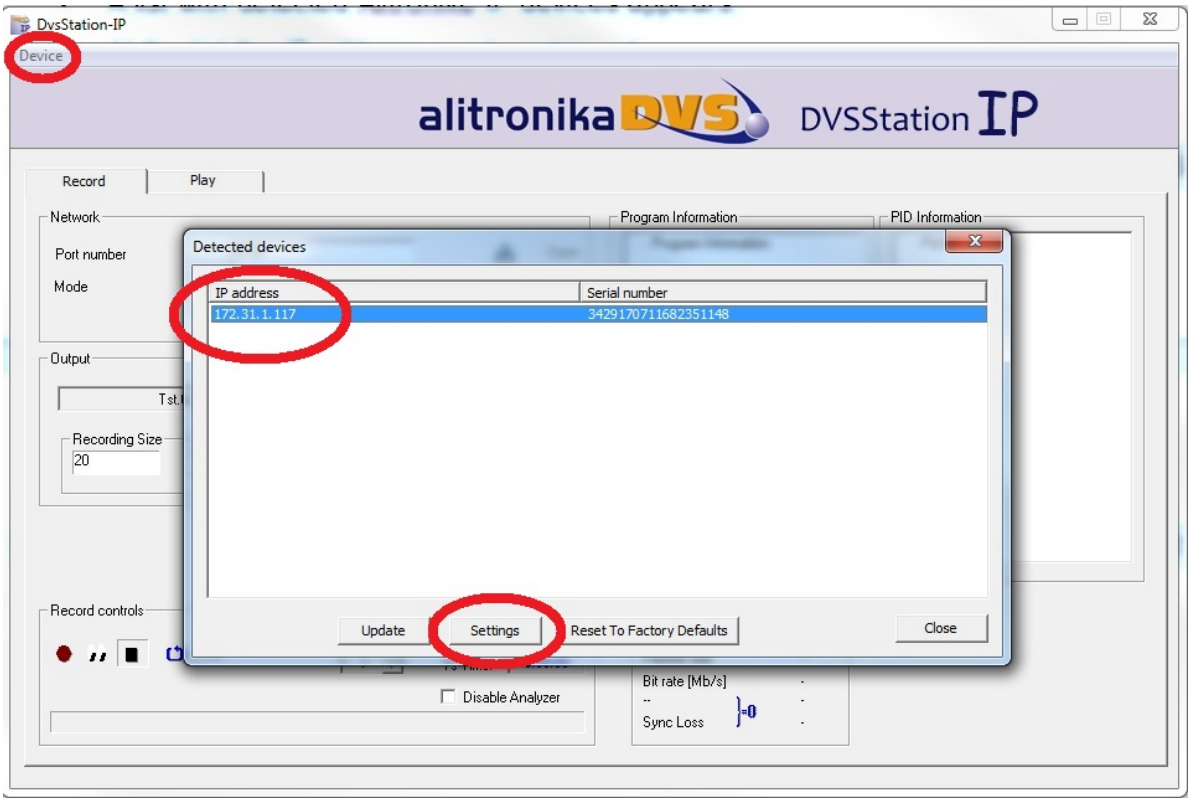


2.3.2 Discover device

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.



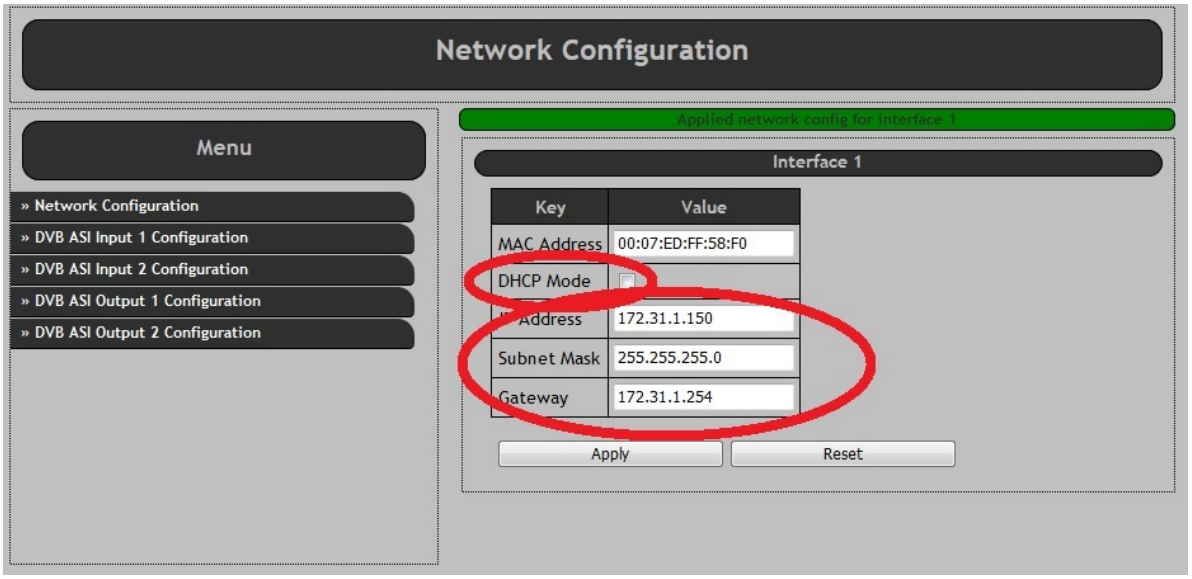
2.3.3 Static IP address

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.

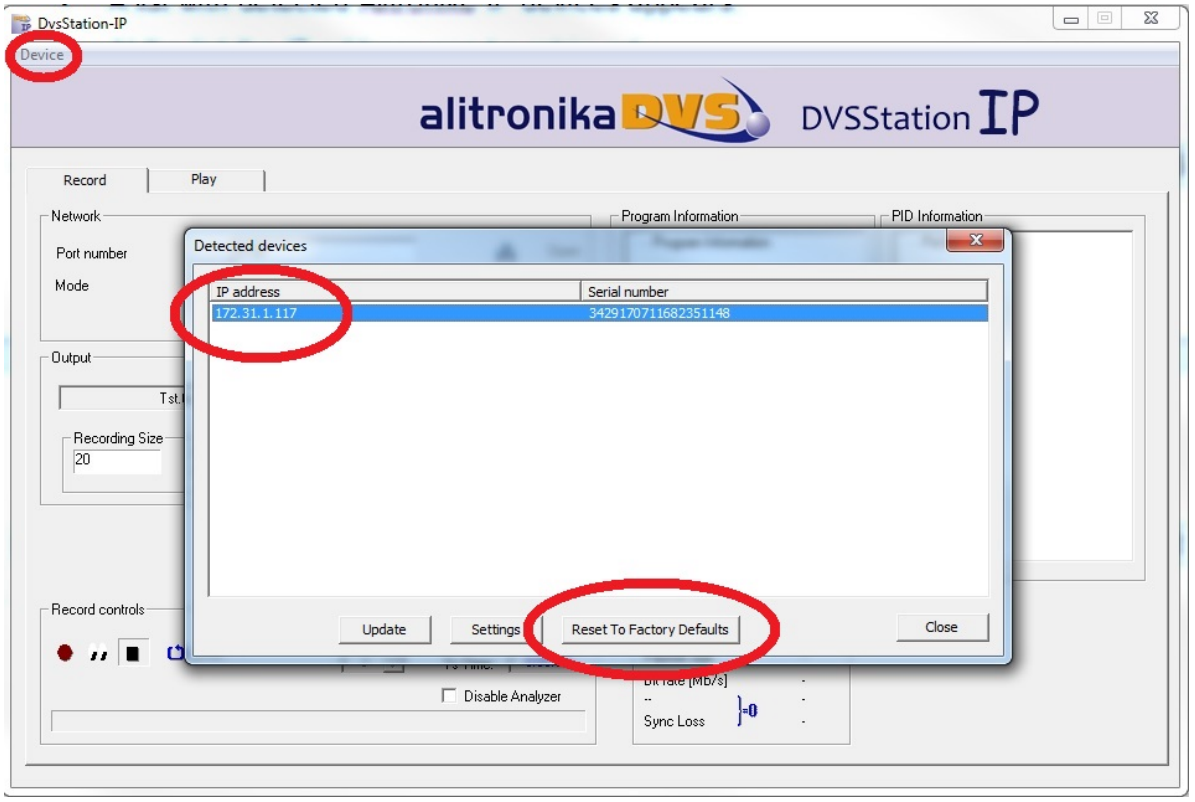


2.4 Recovering from a faulty Static IP address

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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