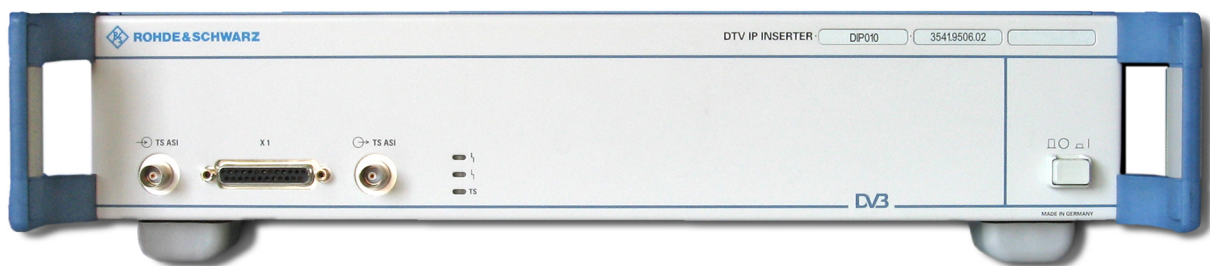


Operating Manual

R&S® DTV DATA INSERTER R&S® DIP010 Incl. Software Option DVB-H

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1. Characteristics

1.1 General

The chapter "Characteristics" contains information about the application and structure of the DTV Data Inserter DIP010 and its technical parameters. In addition, the function of the device and its components are described. A short introduction into the DVB system is given, too.

1.2 Introduction to R&S DIP010 with DVB-H Option

The Digital TV Data Inserter (R&S DIP010) is a device used for generation and transport of additional data in digital TV channel. It generates or inserts data available as any type of IP frames. Among other IP based services, it supports System Software Update (SSU), Multimedia Home Platform (MHP) and services for the distribution of internet content.

The new option of the R&S DIP010 is DVB-H extension, which is implemented in compliance to ETSI EN 302 304 and ETSI EN 301 192. The DVB-H option includes besides of lots of software extensions also a hardware upgrade, which increases the number of services handled by the R&S DIP010 device. DVB-H mode is fully compatible to the existing modes on the R&S DIP010 platform.

Fully automatic time slicing

The R&S DIP010 with DVB-H option supports fully automatic time slicing. It is the only device on market that calculates the bursts automatically with high accuracy, based on a set of undisclosed mathematic formulas. Time accuracy of 1 ms and the data rate resolution of 1 Bit/s allows flexible scenarios.

Hardware Reed Solomon Encoder

With its Hardware Reed Solomon Encoder there are no performance limits while sending 30 or more IP services (Video, Audio or something else), each of them as a single burst with its own FEC (Forward Error Correction).

Logical subchannels

The generated or incoming MPEG-2 transport stream can be divided into subchannels with different time slicing properties. Each subchannel is processed separately by the software. Subchanneling allows grouping of services with similar properties.

Constant code rate on runtime

Each Burst can have a different MPE-FEC code rate (code rate means the ratio between application data and failure error correction data). The code rate is kept constantly using automatic puncturing for each burst on runtime.

Constant rate services

In DVB-H mode it is possible to setup constant rate services that are not time sliced. These services can contain i.e. additional signaling like Electronic Service Guide (ESG) or a preview video channel.

Software Slice Viewer

To have a good overview of the prepared time slicing configuration, an additional software called "Slice Viewer" shows the calculated time slicing configuration as colored diagram. At

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runtime the main gui of the DataInserter software gives information about every processing detail of each service.

1.3 Overview Datacasting System

Datacasting is the **combination of digital audio and video broadcasting with data services**. The broadcast infrastructure like transmitters, satellite links or coax cable networks are used in order to deliver data packets and streams to TV and audio broadcast users. The data content can be based on Internet technologies like static web sites, dynamic Internet streams (IP) as well as all other digital types of multimedia information, e.g. based on the "Multimedia Home Platform" (MHP). Datacasting enriches the existing audio and TV broadcasting world. New applications and services are possible and supported and the convergence of the Internet with Digital TV (DTV) and audio broadcasting is the result.

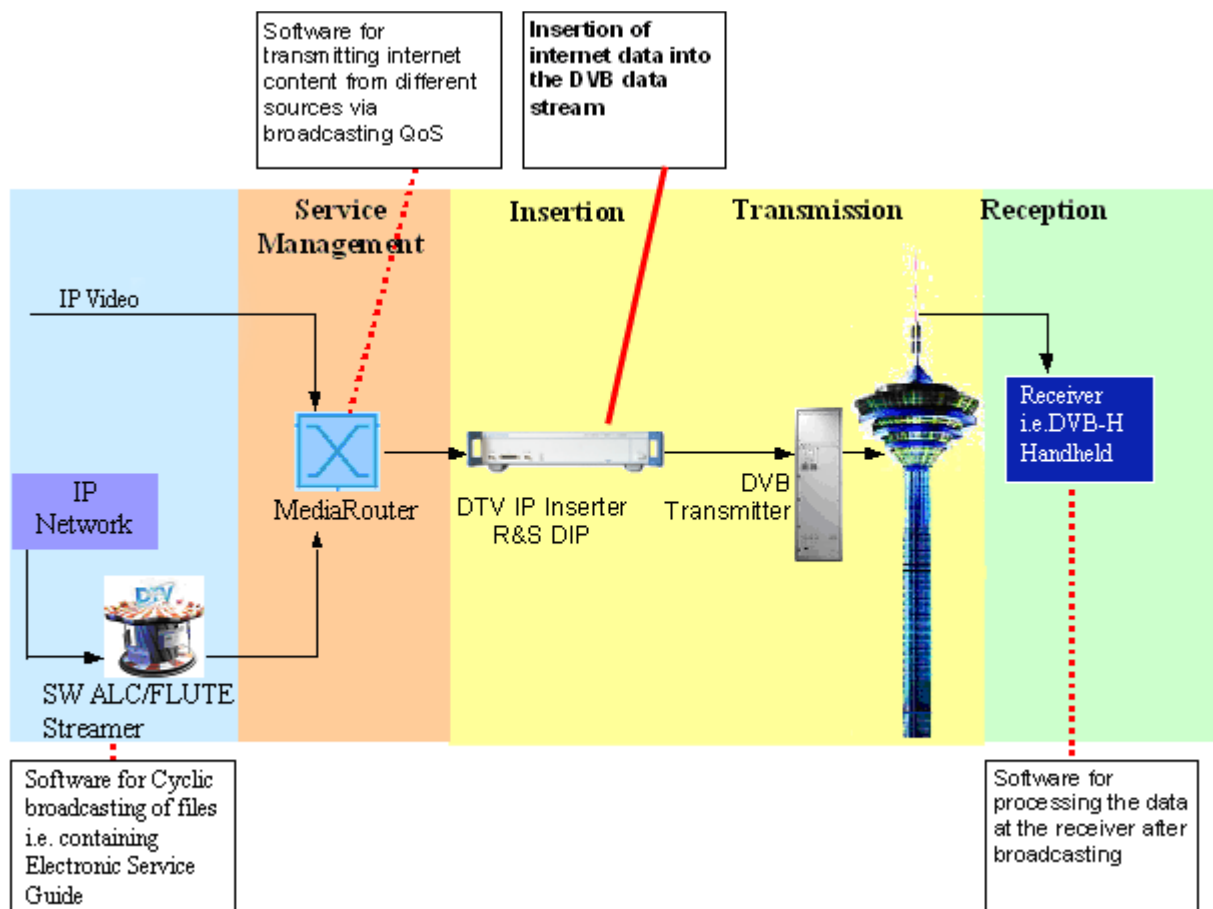


Figure 1.1: Datacasting System

The datacasting is not a simple product, it is a solution. A solution means it is part of an integrated system to create new applications, services and business models. Rohde&Schwarz offers necessary and useful components for such a "data service broadcasting system" but not a fully complete end-to-end system. The following model given as a value chain is useful to illustrate the positioning of Rohde&Schwarz.

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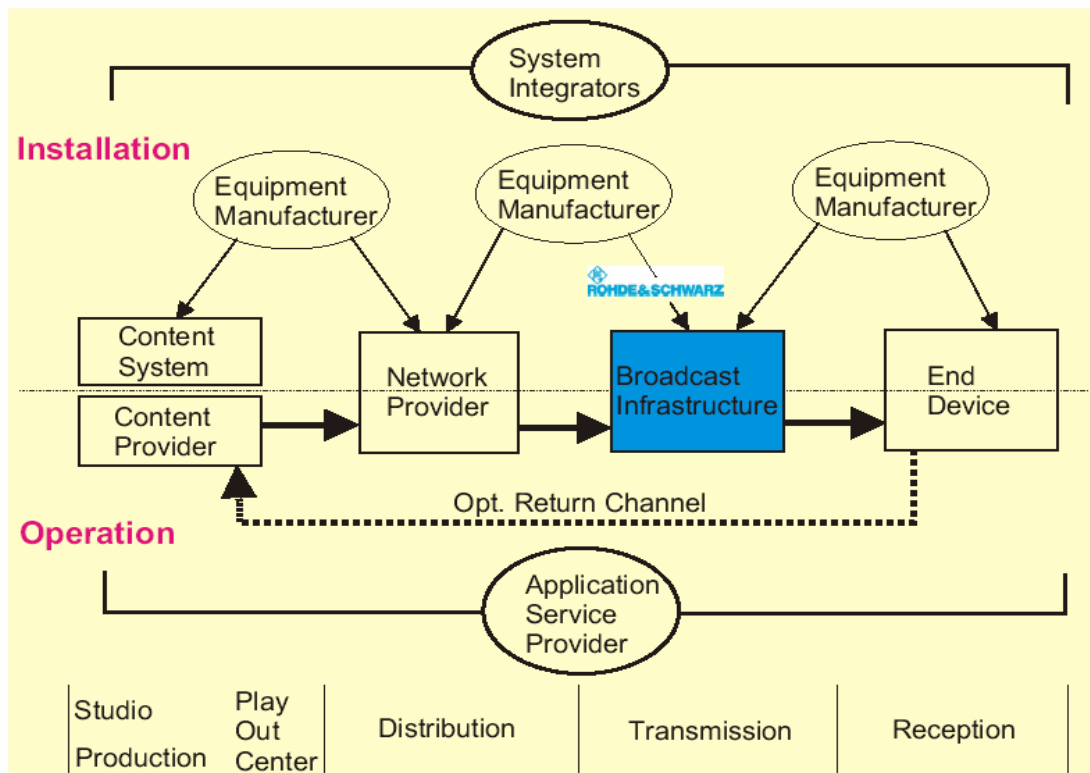


Figure 1.2: Broadcast Infrastructure

Content System:

Server, databases and tools to create and store content (setup of studios)

Content Provider:

Partners to use the system, production and editing of data services (e.g. broadcasters, Internet portal providers, studio users)

Network Provider:

Telecommunication oriented partners to deliver distribution infrastructures (e.g. ATM networks)

Broadcast Infrastructure:

The system to transmit video, audio and data services to end users (transmitters, satellite, cable headends)

End Device:

The end user and his receiver like PCs, Settop Boxes, TV-Sets and all needed tools to enjoy a new service and application

1.4 Overview DVB-H

1.4.1 Time Slicing Mechanism

To benefit most from DVB-H and the possibility to broadcast 30 or more services via one DVB-T channel, a fundamental understanding of time slicing mechanism is essential.

This section gives a brief introduction into time slicing and some special features the R&S DIP010 data inserter with DVB-H option is equipped with, to optimize data rate usage within the channel.

The example to be examined in the following assumes that there are three IP services with different IP data rate entering the R&S DIP010 via the ethernet interface. Service 1 (i.e. audio service) is with 100 kbit/s quite slow, whereas Service 2 (video stream) with 500 kbit/s is remarkable fast.

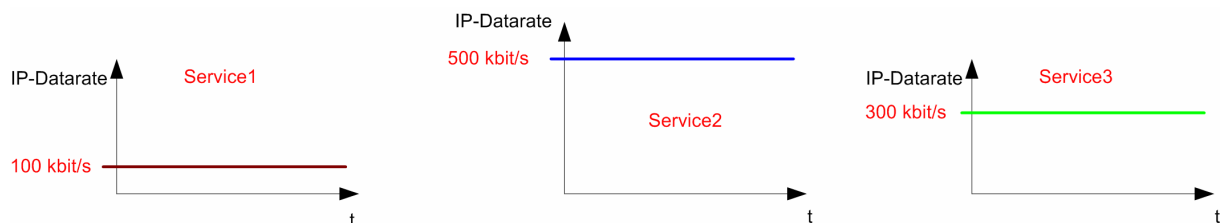


Figure 1.3: IP services with different data rate

The basic idea

The basic idea of time slicing is to cut incoming information sequentially into slices. These time slices are encapsulated one by one into bursts, that are sent in constant time intervals (ΔT) and with higher data rate over the MPEG-2 transport stream. Because burst duration and time interval are signalled within the bursts, a handheld terminal for mobile TV is able to reduce the power-on time of its receiver according to the time of burst reception. The power-off time of 2 to 5 seconds between two successive bursts provokes a valuable saving of power consumption (up to 90%).

Relationship between data rate and ΔT

At the mobile device the bursts are unwrapped and data are re-assembled to streaming media. To avoid signal interrupts the next burst in sequence must be present when all data of the previous one have been processed. As data within a time slice are consumed more quickly the faster the service is, the interval ΔT of a fast service must be shorter than that of a slow service. This causes bursts of services with different properties to overlap, and may result in a summarized data rate that exceeds the channel data rate.

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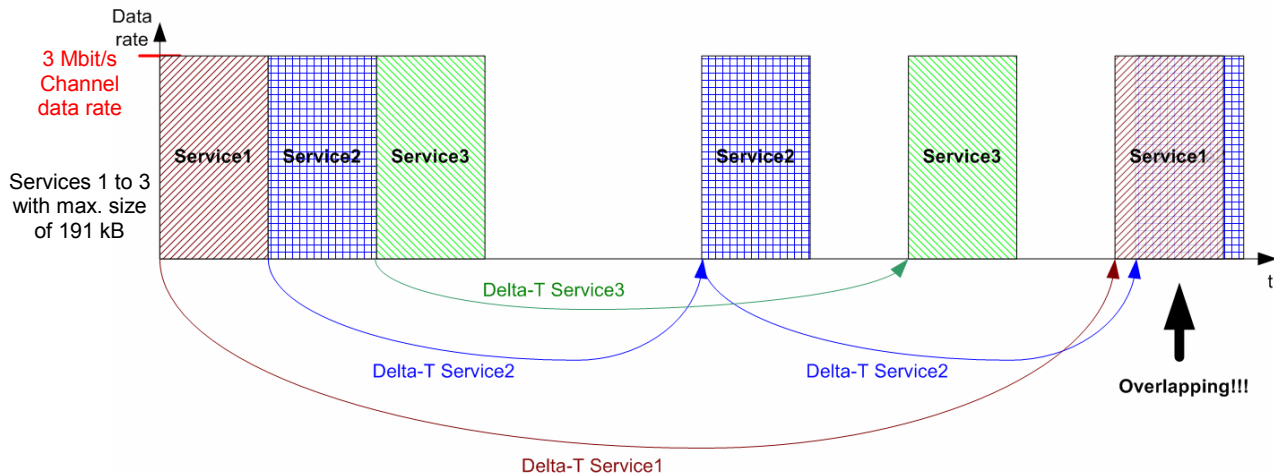


Figure 1.4: Services as bursts with different Delta-T

To prevent overlapping while maximizing the time between slices (Delta-T) the DTV Data Inserter software utilizes some sophisticated techniques to calculate the time slicing structure. The main objective is to synchronize all Delta-T to the smallest.

Reducing duration of data burst

Synchronization of Delta-T can be done by resizing the bursts of all slower services (service 1 and 3). Reducing burst size is one approach resulting in slices with less information and a faster consumption at the mobile device.

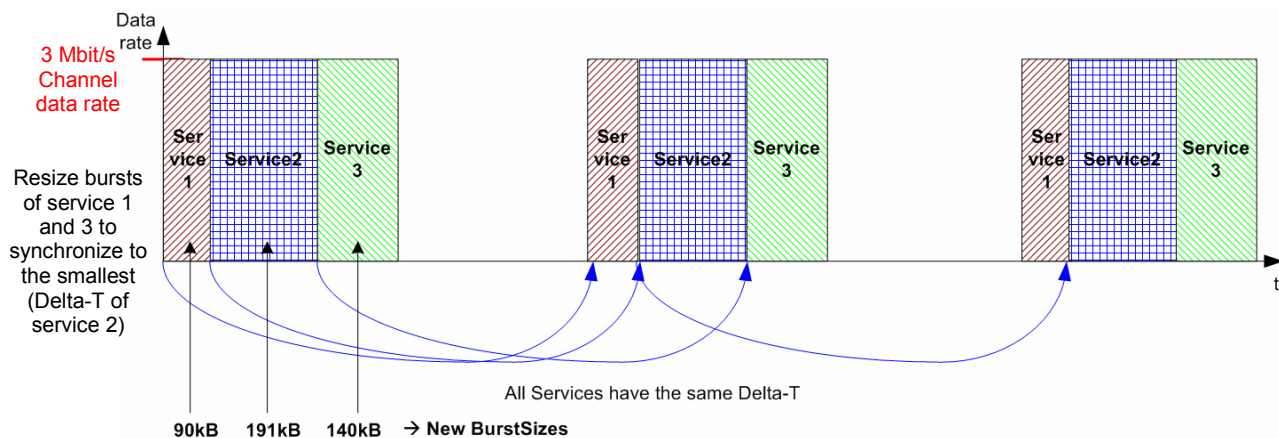


Figure 1.5: Services with different burst durations but same Delta-T

Changing services to minimum burst duration

Reducing burst duration is limited by some physical conditions. A known problem of mobile reception are signal interceptions that rise with increasing velocity. If the burst duration is too short the data loss within a burst could take a value (i.e. 1/5 of total data) that error correction can no longer restore.

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The DTV Data Inserter software therefore offers a feature that limits the minimum burst duration. While forcing the burst duration to an adequate minimum (that can be set manually), the software decreases the data rate of bursts thus providing a constant Delta-T.

Note:

The setting of a minimum burst duration for each service is opposed to short receiver uptimes. Therefore the user has to balance power consumption and the strength of error correction when setting a minimum burst duration.

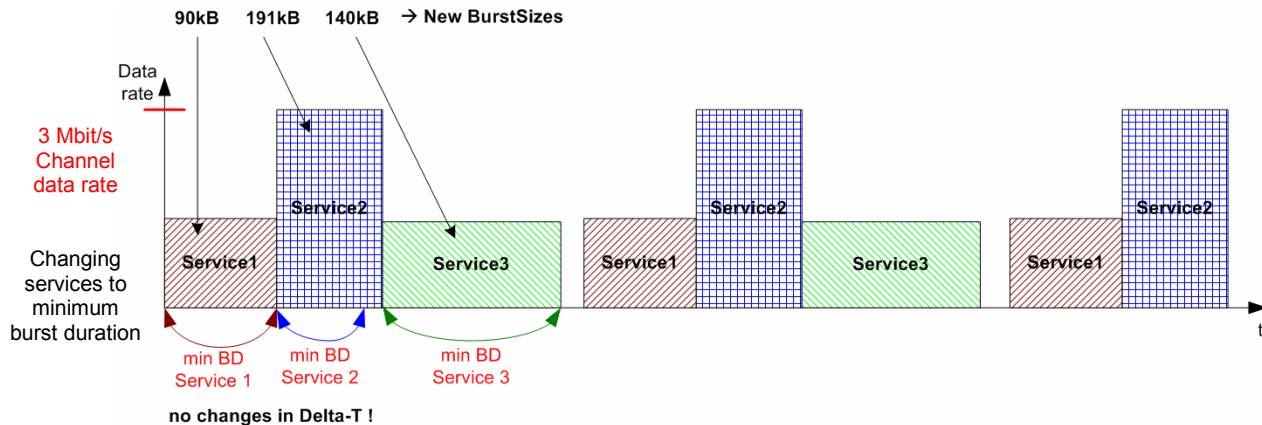


Figure 1.6: Bursts with different data rate but no changes in Delta-T

Line count minimisation in MPE-FEC frame

For processing forward error correction (FEC) the application data of each burst are wrapped into MPE-FEC frames. A MPE-FEC frame, which is normally spanned by 1024 lines and 255 columns, features two sections of dedicated size: an application data section for IP datagrams with 191 columns and a section for Reed Solomon data (MPE-FEC) with 64 columns.

Due to the fixed number of lines the columns allocated by the application data vary with respect to the burst size. As a result the code rate (the ratio between forward error correction data and application data) is a direct function of the burst size.

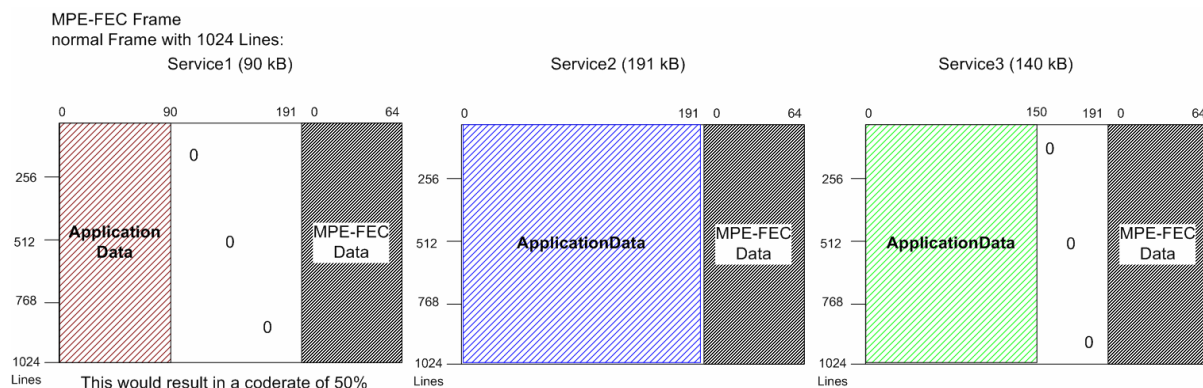


Figure 1.7: Code rate as a direct function of the burst size

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To introduce user specified code rates that fit the actual service requirements the DTV Data Inserter software features a mechanism called line count minimisation. This feature reduces the line count according to burst size and code rate. Smaller bursts result in minor line counts, whereas 256, 512, 768, and 1024 lines are supported.

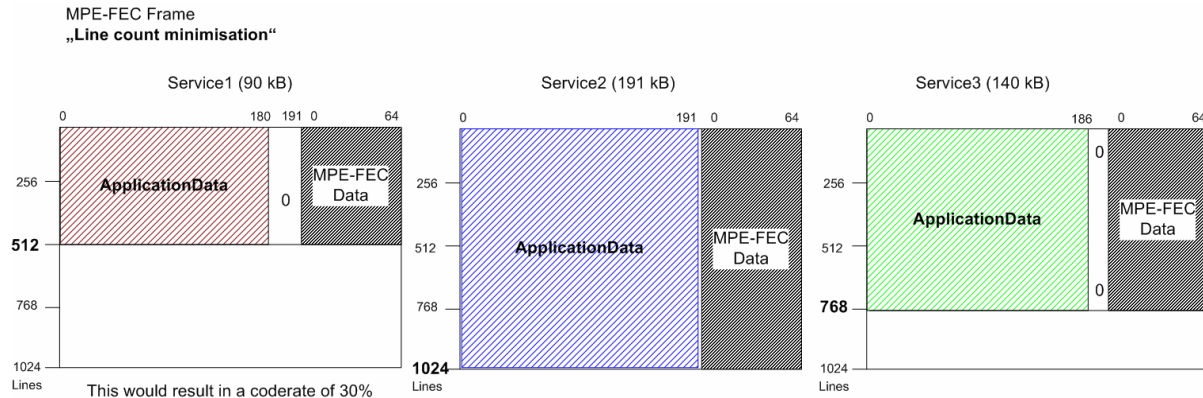


Figure 1.8: Example for line count minimization with average code rate of 30%

Note:

Line count minimisation will also be done, if the given code rate is in range.

It is also possible to set up the line count manually.

Automatic puncturing in MPE-FEC frame

If the IP data rate varies, the calculated MPE-FEC frame size does not fit the amount of application data during runtime.

In the example below the service was calculated for 140 kB under the prerequisite of 25% code rate given by the user. But due to a temporarily reduced IP data rate the frame size allocated by the application data decreases to 50 KB, which boosts the code rate to approximately 50%.

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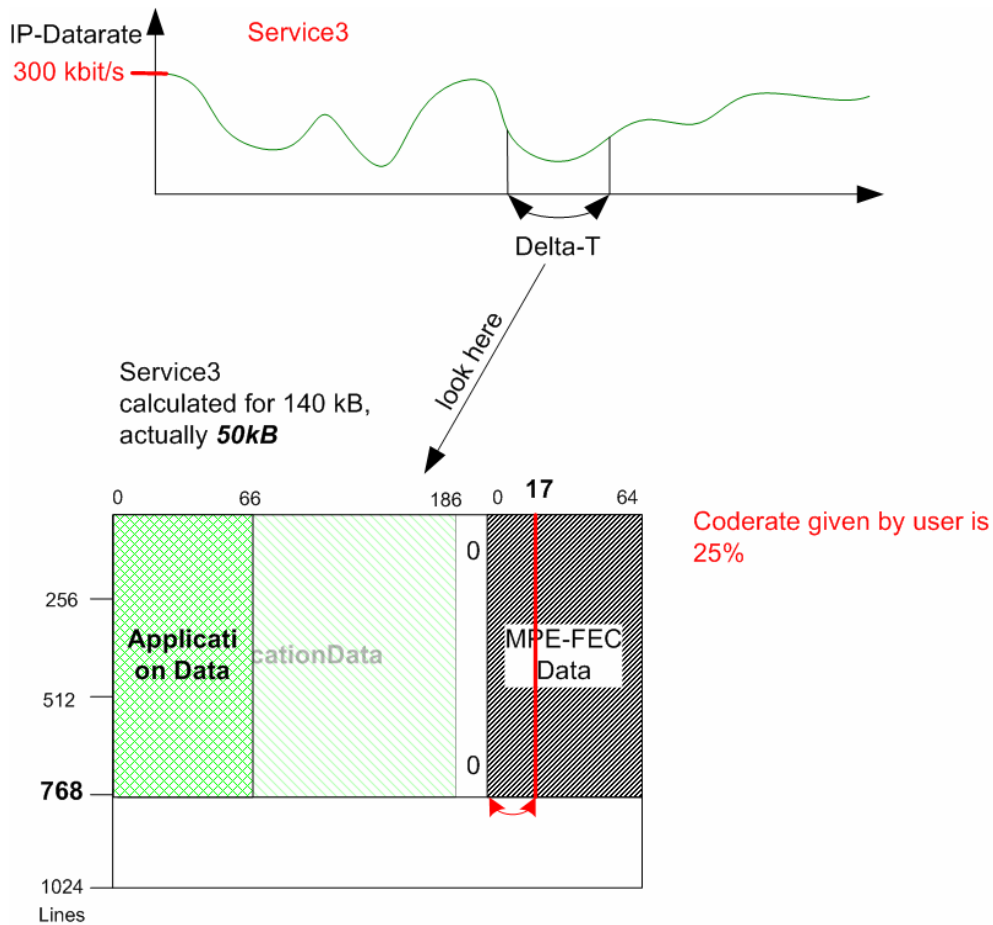


Figure 1.9: Boost of code rate as a result of variable IP data rate

To prevent a varying code rate the automatic puncturing can remove the necessary number of columns (here: 47) from the MPE-FEC section. As shown in the following figure only 17 columns containing Reed Solomon data are sent instead of formerly 64.

To have 25% Coderate (MPE-FEC Overhead) automatic puncturing will remove 47 Columns of ReedSolomon Data.

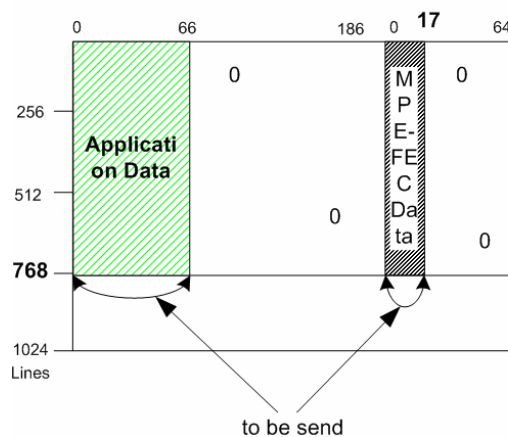


Figure 1.10: Constant code rate as a result of automatic puncturing

Real bursts on runtime

Line count minimisation and automatic puncturing are applicable to provide and maintain a user given code rate. Unlike burst data rate, which varies with the service data rate, burst duration and Delta-T keep unchanged.

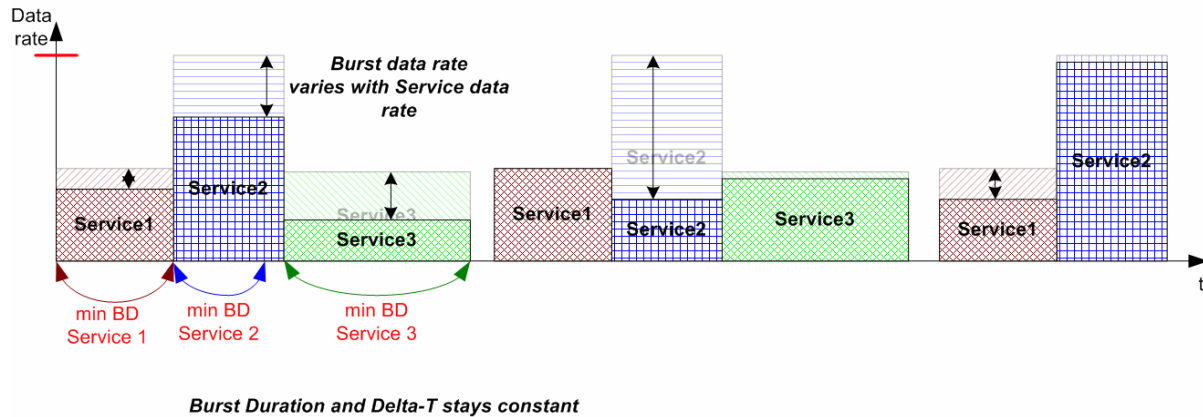


Figure 1.11: The effect of line count minimisation and automatic puncturing

1.4.2 Vertical Time Slice Structure

As the DVB-T channel data rate cannot be fully used limited by user requirements and technical parameters, more than one time slice structure is necessary to fill the channel (i.e. 14 Mbit/s) with an optimum number of services.

This is done using a vertical time slice structure which comprises

- several subchannels, each of them accommodating a collection of bursts (or services) with same Delta-T
- one or more groups of subchannels; each group features a fixed (user given) maximum data rate, that must not exceed the channel data rate, as well as the sum of all group data rates must not
- the possibility to broadcast 30 streams or more over one DVB-T channel (DVB-T Mux)

Example for vertical time slice structure

An example for vertical time slice structure is given Figure 1.12.

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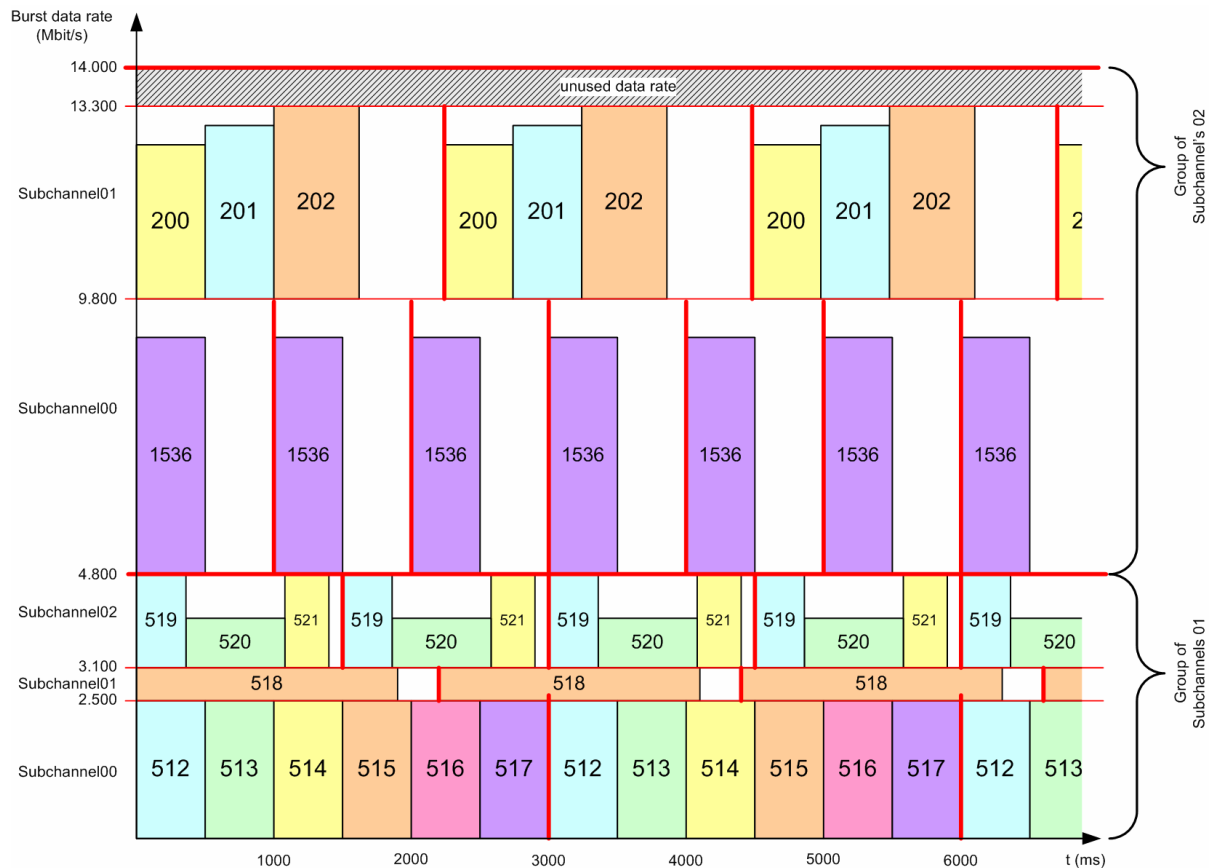


Figure 1.12: Vertical time slice structure

The total channel data rate of 14 Mbit/s is distributed to two Groups Of Subchannels with maximum data rate of 4.8 and 9.2 Mbit/s. Each group represents two or more subchannels, that characterizes a consistent Delta-T for all services within each subchannel.

Group 1 i.e. comprises three subchannels, containing a different amount of services. Subchannel 0 has a Delta-T of 3 seconds and a burst duration for each service of 0.5 seconds. This consistency with respect of Delta-T and burst duration within the whole subchannel is not a must, as seen with subchannel 1 of Group 2, where burst duration varies for each service from 0.5 to 0.7 seconds. Otherwise it is worth mentioning that a subchannel of widely similar services may result in an optimized usage of data rate.

Hardware configuration for setting up a vertical time slice structure

Physically the vertical time slice structure can be set up by a number of R&S DIP010 devices with DVB-H option, whereas each Group Of Subchannels is triggered by just one R&S DIP010. This partitioning enables the roll-out center to run services of different providers on different devices.

The involved R&S DIP010 devices are arranged in series with the first R&S DIP010 functioning as a generator for the MPEG-2 Transport stream. Consecutively all R&S DIP010 inserters including the generator insert the dedicated services in terms of burst into the MPEG-2 Transport stream. This is done by means of the DTV Data Inserter application on board of each R&S DIP010.

1.4.3 Overheads in DVB-H

At DVB-H mode the data broadcasting profile called “Multiprotocol encapsulation” (MPE) is used to transport the IP datagrams over DVB. MPE is defined in ETSI EN 301 192.

The incoming IP datagrams are encapsulated into datagram_sections which are compliant to the DSMCC_section format for private data (see ISO/IEC 13818-6 [5]). The mapping of the section into MPEG-2 Transport Stream packets is defined in MPEG-2 Systems ISO/IEC 13818-1 [1].

Each incoming IP datagram contains a header and a payload part. The IP header has always a fixed size whereas the payload part is not fixed (46 to 1500 Bytes). That is why the percentage of overhead of an IP packet can vary.

According to ETSI EN 301 192 each IP packet will be encapsulated into exactly one MPE section. Each MPE section also contains a header, forming an additional overhead. At DVB-H mode each time slice gets an extra overhead of Forward Error Correction (FEC) sections. These packets will be generated to each burst having a maximum size of 191kByte (IP datagram's).

Finally each MPE and MPE-FEC section will be mapped into MPEG-2 Transport Stream packets, each containing 4 or 5 Bytes overhead. Each MPEG-2 TS packet has a constant size of 188 Bytes.

If you want to calculate the exact relation between overhead and payload of the IP stream you have to consider all Overheads:

- 4 or 5 Bytes of MPEG-2 TS packet (depending on MPE section start),
- MPE-overhead,
- Addition MPE-FEC sections,
- IP overhead.

This relation is directly dependent from the average IP packet size, the IP stream contains. If the average IP packet size is smaller, the percentage of overhead is bigger. Whereas the percentage of overhead is smaller the bigger the IP packets are.

At DVB-H mode it is necessary to calculate the resulting MPEG-2 TS data rate of each incoming IP stream. Having this value, it is possible to estimate the area each time sliced service needs within the available Channel TS data rate. Having included very accurate mathematic formulas for this calculation, it is possible to easily configure many services with the R&S DIP010.

The following figure gives an overview over the DVB-H data mapping and its overheads.



1) more than one section possible

1.5 Further Datacasting Applications

Receive the Internet without Internet access

Digital broadcasting networks as a secondary distributor for Internet content

Digital broadcasting networks offer channels for distributing Internet content. In this way viewers can be reached who are not connected to the Internet. According to an online study by public broadcasters in Germany, these are as many as 70 % of the TV audience.

Broadcasting of streaming media (according to the DVB-H standard)

Internet video and audio programs can be broadcast and received even mobile in addition to static content. In this way Internet radio and TV stations can be received by radio and TV sets. Localized advertising and information can be enriched by short video clips added as Internet streaming.

Enrich the broadcast programs by additional information

Broadcasting Web-based program information

TV broadcasters could broadcast Web-based information together with their programs, e. g. electronic TV journals. An electronic guide for the programs of several broadcasters could also be transmitted. Broadcasters can add their own Web sites to their communication offering.

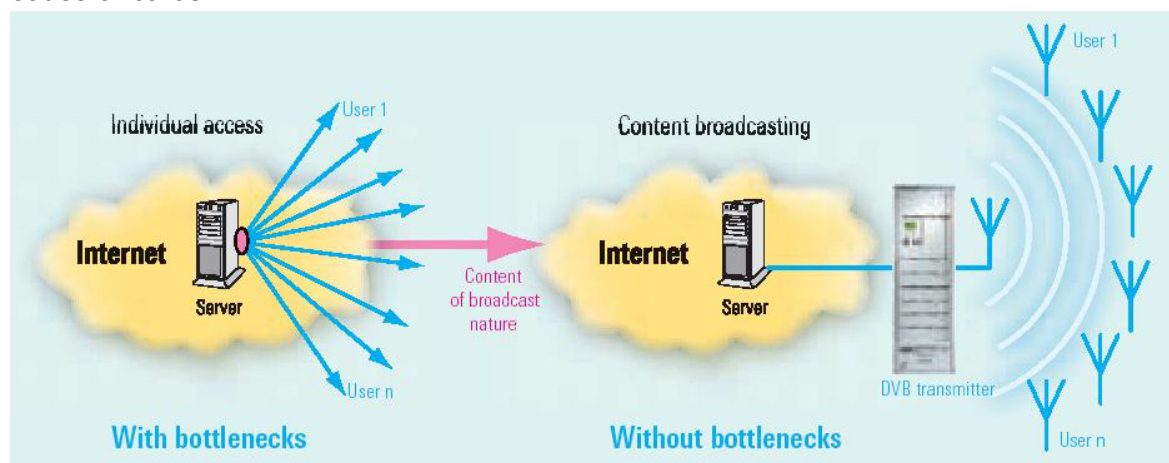
Combination of t-commerce and e-commerce

Extra information may be sent in parallel with topical programs or commercial spots. Interested viewers can call this information by a keystroke without long loading times. Access to the Internet is only required for online orders. The user may navigate through the selected information through what is called local interactivity.

Development of new distribution channels

Distribution of video and computer games

Games for consoles and computers enjoy increasing popularity. These games may also be sent via DTV. Distribution channels can be optimized in combination with chargeable access codes or cards.



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Figure 1.14: Content Broadcasting

Broadcast local information

Localized information

Traffic reports, breaking news, local information, etc can be inserted into overregional broadcasting. Seeing that terrestrial digital television (DVB-T) and digital radio broadcasting (DAB) are also suitable for mobile applications, the services and information can also be accessed from vehicles and public transportation.

Localized advertising

The possibility of inserting data services between the play-out center and the transmitter system also allows implementation of local and regional advertising. Advertising can be adapted to customers and local factors. Local data service studios dynamically produce current information and content.

Corporate networks

Corporations with many subsidiaries and offices in a region or city can use digital broadcast networks to supply information and updates (catalogs, price lists, etc) to their various sites. Broadcasters themselves can use their infrastructure to distribute inhouse information and communicate with all their sites. The components of digital broadcasting systems can thus also be controlled and monitored like in a local network.

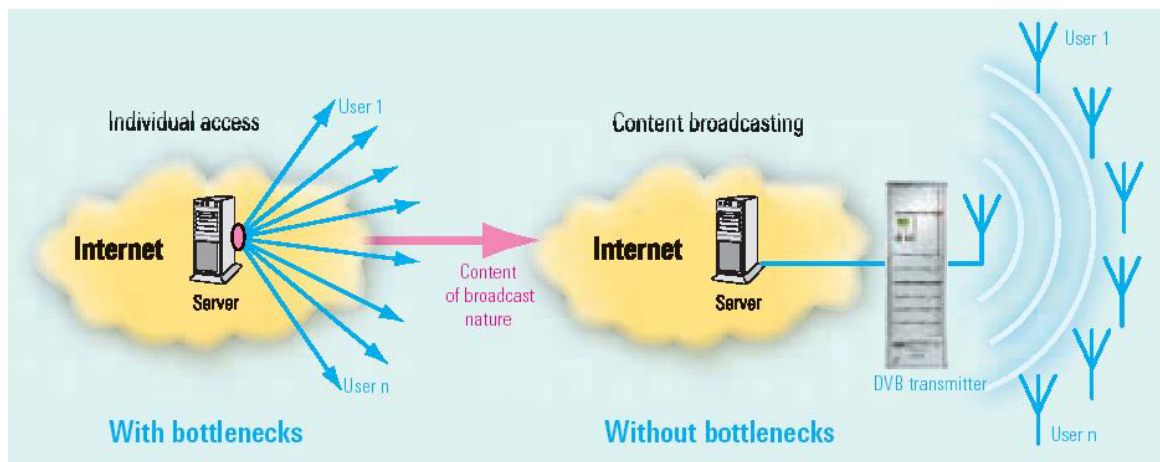


Figure 1.15: Broadcast Local Information

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1.6 Basic Configuration

The transfer of data to R&S DIP010 can be started from any computer within the Internet or Intranet. The data is applied as a unidirectional data stream, typically as IP data stream. An NDIS driver transfers all IP packets to the inserter software. The standard Internet and network layer protocols are used. The NDIS driver takes the IP frames which will be inserted into the MPEG-2 transport stream using a specific built-in hardware. The inserter software uses the applied data to generate new transport stream sections in the outgoing MPEG-2 signal according to the DSMCC mechanism method defined in ISO/IEC138181-6, typically multiprotocol encapsulation in case of IP data.

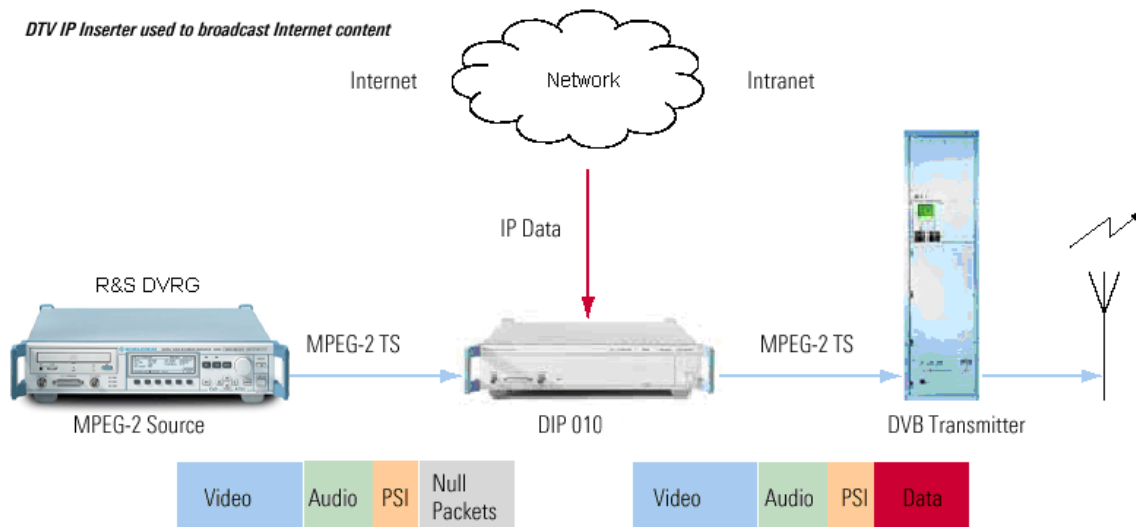


Figure 1.16: Basic Configuration

DTV Data Inserter supports an MPEG-2/IP generator mode. It generates a MPEG-2 transport stream containing only data at the output port. This signal can feed a program multiplexer in order to add video and audio if a mixed service is needed. This device is used to generate MPEG-2 transport streams containing data for pure data services and applications.

At Figure 1.17 on the left side the principal of the inserter mode and on the right side the generator mode is shown.

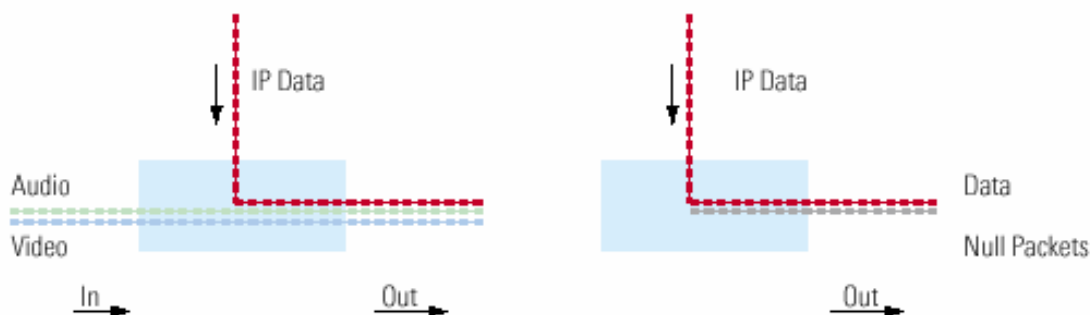


Figure 1.17: MPEG-2 Insertion / Generation

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1.7 Design

The components of the DTV Data Inserter DIP010 fit into a 19" cabinet. On both sides, a front handle is installed. On the front panel, there are the power switch, three LED's and the plugs of the data in and output.

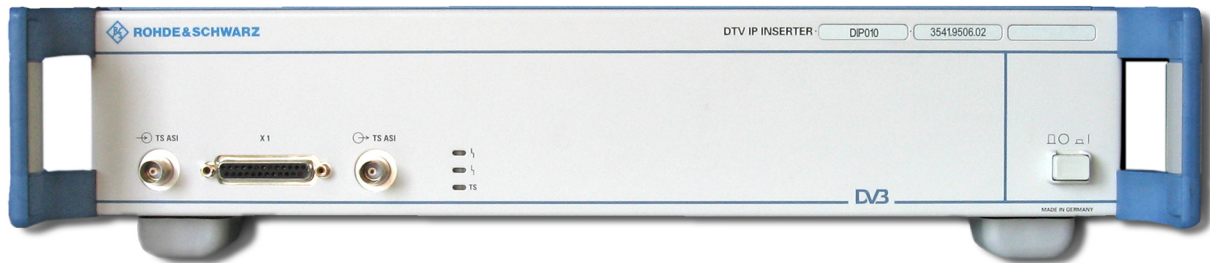


Figure 1.18: DTV Data Inserter R&S DIP010, Front View

On the rear panel, the connectors for the external devices and the mains connection are arranged. On the left side, there are two fan openings for ventilation. In the frame corners there are four rear wall feet mounted.



Figure 1.19: DTV Data Inserter R&S DIP010, Rear View

DTV DATA INSERTER • DIP010 + DVB-H Option

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1.8 Function

1.8.1 DTV Data Inserter R&S DIP010, Component Overview

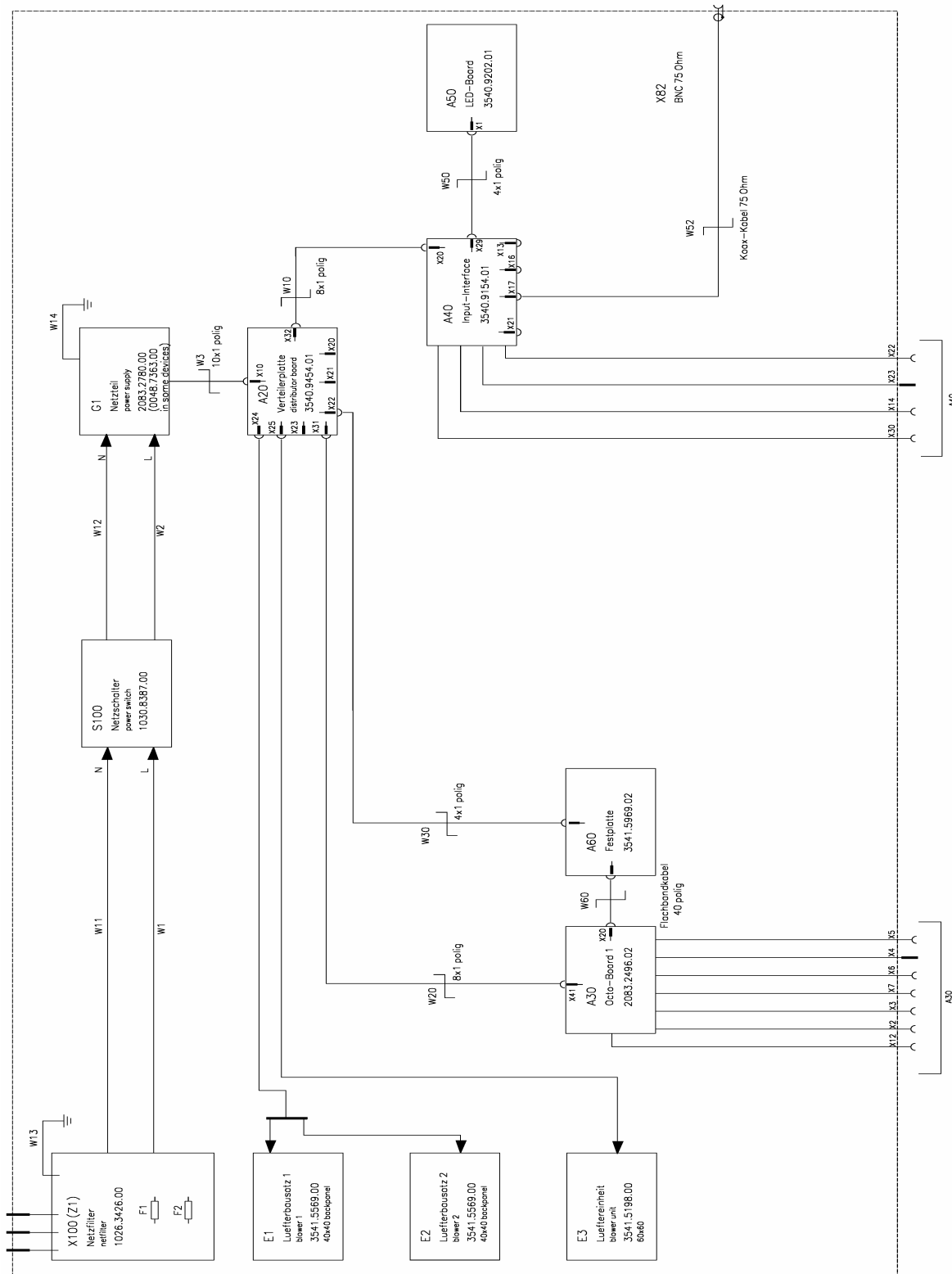


Figure 1.20: Component Overview

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This drawing gives an overview about the different components in the R&S DIP010 and the connections among them. The components are configured in the factory as required by the software and hardware of the Inserter instrument. This configuration must not be changed.

Opening the device and replacing / repairing components should only be done by Rohde & Schwarz Service personnel!

1.8.2 PII-MMC Mainboard (A30)

This component provides the necessary computing power for the calculation of MPEG-2 TS packets with encapsulated data and for additional software components, like Media Router or Web Carousel. It carries the CPU (Pentium II Mobile Module, 700 MHz) and a memory module (256 MB SDRAM, PC100). All jumper positions must not be changed.

1.8.3 Input Interface (A40)

This component receives MPEG-2 TS packets from the processing unit in PII-MMC motherboard and inserts the packets in a MPEG-2 TS. The MPEG-2 TS Signal can be bypassed through the Input Interface board or it can be generated by the Input Interface board.

All jumper positions must not be changed.

1.8.4 Distribution Board (A20)

This component is used for protecting the different low voltages in the inserter. In the case of a short-circuit or overload in the inserter, the destroyed fuses may not be changed by the user. The presence of the different voltages (5 VDC, 12 VDC, 3.3 VDC, -12 VDC; all double) is signalled by 8 LEDs.

1.8.5 LED Board (A50)

This component is used for indicating the current state of the DTV Data Inserter hardware, it carries 3 LEDs for "Error" (red), "Warning" (yellow) and "OK" (green).

The red and green LED is directly controlled by the hardware. The yellow LED is only controlled by the DataInserter software.

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1.9 Technical Data

1.9.1 Output signal

Output signal	transport stream according to ISO/IEC 13818-1, up to 54Mbit/s
Length of MPEG-2 packets	188 byte
Useful data rate for inserted data	up to 54Mbit/s (data, continuous insertion)

1.9.2 Signal input/output

MPEG-2 Signal input/output	MPEG-2 data stream synchronous parallel front (SPI) 25-pin, LVDS
MPEG-2 Signal input/output	MPEG-2 transport stream asynchronous serial front and rear panel (ASI), BNC, 270 Mbit/s , 800 mV (V pp), 75 Ω

1.9.3 Data input signal

Interface on integrated PC.....	10/100 BaseT
Connector.....	RJ45

1.9.4 DVB-H Output

DVB-H Output	according to ETSI EN 302 304 V1.1.1 (2004-11) and ETSI EN 301 192 V1.4.1 (2004-11)
Number of subchannels.....	up to 15
Number of TimeSlicing Bursts (different PIDs)	up to 120
Resolution of time parameters.....	1 ms
Resolution of data rate	1 Bit/s

1.9.5 Electrical characteristics

Power supply AC	110 V to 240 V, 50 Hz or 60 Hz
Power supply limits AC.....	90 V~ to 264V~
Power consumption	max. 100 VA
CE-Declaration.....	meets Low Voltage Directive 73/23EC and its updates EMC Directive 2004/108/EC
Electrical safety	meets EN 60950, IEC 60950, UL60950 CSA C22.2 No. 60950
Electromagnetic compatibility	Emission meets EN 55022 class B, Immunity meets EN 55024

1.9.6 Climatic Characteristics

Environmental class	3.1 (ETS 300 019-1-3)
Operating temperature range	+5°C to +40°C (specs guaranteed)
Permissible temperature range.....	0°C to +50°C
Storage temperature range	-40°C to +70°C
Climatic resistance	max. rel. humidity: 95 % at 25°C

DTV DATA INSERTER • DIP010 + DVB-H Option

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1.9.7 General Data

Operating system Embedded WindowsNT
Hard disk at least 100 GByte

1.9.8 Mechanical Data

Dimensions (W x H x D)465 mm x 90 mm x 500 mm
(19" cabinet, 2 HU)
Weight.....approx. 6 kg

1.9.9 Miscellaneous

MTBF 14.892 h (1.7a)
Colour Grey (RAL 7004)

1.9.10 Ordering Information

DTV Data Inserter DIP010	3540.9254.20
DVB-H Option	3542.0060.00
DVB SSU Carousel	3540.9890.00
19" Adapter 2 HU, 19" Rack Mounting Kit 2HU.....	1096.3260.00

DTV DATA INSERTER • DIP010 + DVB-H Option

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1.10 Key features DTV Data Inserter platform

1.10.1 General

- two MPEG-2 modes supported: **Inserter** or **Generator** (see below)
- works with MPEG-2 transport streams in the range 1 to 54 Mbit/s
- opportunistic utilization of **up to 54 Mbit/s** MPEG-2 TS resources with data or as guaranteed data service
- usage of all free MPEG-2 resources, till last TS packet
- MPEG-2 packets length: 188 bytes
- MPEG-2 transport modes: continuous or burst
- filtering and re-insertion of any kind of MPEG-2/DVB PSI/SI tables
- universal data insertion interface: MPEG-2 TS packets, PIDs in range: 0x0 to 0x1FFF
- use of any MPEG-2 TS packets for data insertion, specified by base PID and range specified by a binary mask
- very short hardware delay: duration of three transport stream packets (depends on MPEG-2 TS rate)
- physical bypass (ASI-to-ASI) of MPEG-2 input (inserter mode)
- **DVB-H fully supported according to ETSI EN 302 304, ETSI EN 301 192 and EN 300 468**

➤ **Generator Mode**

- MPEG-2-TS data rate, adjustable, granularity 1 kbit/s, range: 0,1 to 54 Mbit/s
- opportunistic use of MPEG-2 resources: use of all dedicated resources (stuffing packets) for data insertion, up to 54 Mbit/s
- MPEG-2/DVB PSI/SI tables generation
- program clock reference generation, granularity 10 ms, range 10 to 200 ms
- output: MPEG-2 transport stream, packet length 188 bytes
- output: MPEG-2 transport stream, mode: always continuous
- output: MPEG-2 transport stream, connectors: ASI and SPI

➤ **Inserter Mode**

- bypassing original MPEG-2 transport stream (with 3 level security), keeping original MPEG-2 TS time stamps consistency etc.,
- opportunistic use of MPEG-2 resources: use of all dedicated resources (stuffing packets) for data insertion, up to 54 Mbit/s
- MPEG-2 transport streams, packet length 188 bytes,
- input: MPEG-2 transport streams, connectors: ASI or SPI, adjustable,
- output: MPEG-2 transport stream, connectors: ASI or SPI, adjustable,
- input: MPEG-2 transport streams, mode: continuous or packet (burst), adjustable,
- output: MPEG-2 transport streams, mode: always continuous,
- use of ranges of packet ID's (even number of PIDs: 2, 4, 8, ..., 4096) for data insertion defined by two parameters: BasePID and PIDMask

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- guaranteed use of MPEG-2 resources: maximum for data transfer rate of all useful data within MPEG-2 transport stream up to 54.0 Mbit/s,
- MPEG-2/DVB PSI/SI tables generation

1.10.2 DVB-H Support

➤ **Generator/Inserter Mode**

- The generator mode of R&S DIP010 allows the generation of an empty MPEG-2 TS with a specified data rate and DVB-H Services inside.
- In inserter mode of R&S DIP010 packets with a specified PID of an incoming MPEG-2 TS (normally Null-packets with PID 0x1FFF) will be replaced by the DVB-H services.

➤ **Support of IPv4 and IPv6 formatted IP Services**

- The R&S DIP010 is able to transmit IPv4 and IPv6 formatted IP services in parallel.

➤ **Forward Error Correction with Reed Solomon Hardware Encoder**

- The Reed Solomon Hardware Encoder realizes the FEC without limitations in time behaviour.
- The adjustable code rate (ratio between application data and failure error correction data) is kept constantly on runtime using automatic puncturing.
- The lines of the MPE-FEC frame are variable as defined in ETSI EN 301 192.

➤ **Subchanneling**

- The generated or incoming transport stream can be divided into logical subchannels with different time slicing properties.
- Each subchannel is processed separately by the software so there are no dependencies between them.
- Subchanneling allows summarizing of services with similar properties.

➤ **Time Slicing**

- Fully automatic time slicing with full control over the most important settings
The fully automatic time slicing calculates the settings for every service to realize fully optimized time slicing. It uses a set of undisclosed mathematic formulas having a proven accuracy. Possible settings are:
 - Maximum data rate of each service on IP level
 - Minimum Burst Duration (to improve reception)

DTV DATA INSERTER • DIP010 + DVB-H Option

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- FEC On/Off
 - Code rate of FEC
 - Maximum Delta-T of the subchannel
 - Data rate of the subchannel
 - MPE-FEC Frame Lines (is not a must)
 - Manual time slicing
- For each service the time slicing values can be set up manually. Necessary values are:
- Burst duration
 - Delta-T
 - Maximum burst size
 - Maximum data rate
 - Position within the subchannel
 - MPE-FEC frame lines

➤ **PSI/SI Signalling**

The R&S DIP010 with DVB-H option can automatically create a complete set of DVB-H PSI/SI signaling (in compliance to ETSI EN 300 468 and ETSI EN 301 192). The following tables are included:

- Program Associated Table (PAT)
- Program Map Table (PMT)
- IP/MAC Notification Table (INT)
- Network Information Table (NIT)
- Service Description Table (SDT)

The use of all signalling tables can be customized. All defined descriptors can be set up in the tables using the DVB-H wizard software. It is also possible to edit these tables using the Extensible Markup Language (XML).

The “Time Slice and FEC Identifier Descriptor” of the INT table will be generated automatically depending on the service settings.

Working in inserter mode only the DVB-H specific signalling can be generated (single PSI/SI tables can be switched off).

➤ **Constant Rate Services**

It is possible to setup constant rate services that are not time sliced. These services can contain i.e. additional signalling like Electronic Service Guide (ESG) or a preview video channel.

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➤ ***Slice Viewer***

Additional graphical software shows the complete time slicing configuration as a diagram. Each service is displayed with a different color containing the most important information.

➤ ***ALC/FLUTE Streamer***

With ALC/FLUTE a new carousel type is available supporting the proprietary IP-data cast protocol ALC/FLUTE. Add mechanism: FTP access, carousel synchronization.

➤ ***DVB-H Wizard***

Graphical wizard for easy step-by-step configuration of DVB-H services on the R&S DIP010 platform. The DVB-H wizard configures the internal platform applications: DTV Data Inserter, Media Router and PSI Generator and stores the configuration in XML format for re-use.

2. Getting Started

2.1 Safety Precautions

In setting up premises for the operation of electrical installations and in setting up and operating the installations themselves, the relevant national or international safety rules and regulations must be observed.



First of all check the following points:

- The chosen mains voltage of the device must be in accordance with the mains voltage in your country

The plug of the device must fit the mains socket in your location

- All your mains lines, interfaces and antennas must be lightning-protected before connecting

Premises for the operation of electrical installations:



CAUTION:

The mains voltage can be up to 265 VAC. This voltage is extremely dangerous. Therefore, highest caution is necessary here.



CAUTION:

The device includes sensible mains voltage components. Please use this device only with mains voltage lines, secured by max. 16A fuses.



CAUTION:

Operating the device with voltages outside the specified ranges may cause damage to it.

2.2 EMC Safety Precautions

In order to avoid electromagnetic interference, the unit should be covered while in use.



CAUTION:

Only suitably shielded signal and control cables must be used. Particularly the network cable (Cat. 5) has to be sufficiently shielded and provided with metallic connectors. The use of unshielded cables is not permitted.

2.3 Unpacking and Checking

After having received the device, carry out the following steps:

- Unpack the device.
- Check all delivered items (device and accessories) according to the delivery notes.
- Check the device and accessories for visible damage signs which may have occurred during transport.
- Contact the transport agent immediately if any damage is discovered.
- Keep the packaging for later use, e.g. if the device is to be sent to the nearest R&S representative or to R&S Germany for repair (see address list following the title page of the manual on CD-ROM).

2.4 Rules for Handling during Operation

- Use the device in temperature-regulated rooms only; do not use it outside.
- Only use with lightning-protected interfaces, antennas and mains lines.
- Do not operate the device without casing.
- Pull out the mains plug when the device is not in use or opened or being repaired.
- Please note, the casing is necessary for safety, also if the device is switched off.
- Replace fuses only with the same type and the same technical values.
- Keep the device steady earthed by the protective contact of the power cord; check the function of the earth connection once a year.
- Only use your country specific power plug and power cord.
- Do not operate the device outside of germany with the german power cord if it is supplied with the standard accessories. Contact our representatives in that case.
- Do only use shielded data cables. Make sure that the shield is connected to the plugs.
- Avoid bumps, shocks or steady vibrations, e.g. by ventilators, cooling /freezing units or other machines.
- Keep the device dry and clean.
- Do not put paper clips, needles or pins into the plugs, sockets, ventilation gaps or chinks.
- Do not spill liquids over the device.

3. Installation

The DTV Data Inserter can be used as tabletop unit or as plug-in unit in a 19" rack.

When using the device as tabletop unit, correct ventilation of the vitiated air must be assured. Therefore, sufficient space behind the device is necessary. By demounting the clamps on the bottom of the device, the device can be brought into an upright (vertical) position.

For the installation into a 19" rack, a special adapter (ZZA-211; 1096.3260.00) is needed, which can be obtained from your Rohde & Schwarz sales point. Fix the adapter to the device in accordance with the supplied assembly instructions. Afterwards, the device can be put in the 19" rack and screwed up.

If you have also ordered the DVB-H Option (3542.0060.00) a hardlock will be delivered with the accessories. Please connect it to the parallel interface on the rear of the DIP010 (refer to chapter 3.1.2, connector X5).

The DVB-H hardlock is necessary to run the DVB-H software packet.

Attention: In case of loss of the hardlock, Rohde & Schwarz will not replace it! In case of damage of the hardlock, replacing can only be done by sending the defective hardlock back to Rohde & Schwarz. In that case please contact your local Rohde & Schwarz representative.

3.1 Cabling

The DTV Data Inserter R&S DIP010 can work in MPEG-2 generator mode or in MPEG-2 inserter mode, bypassing the MPEG-2 transport stream from the input to the output connector. Dependent on the functionality there are MPEG-2 input and output connectors or only MPEG-2 TS output connectors.

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3.1.1 External Connectors, Front Panel

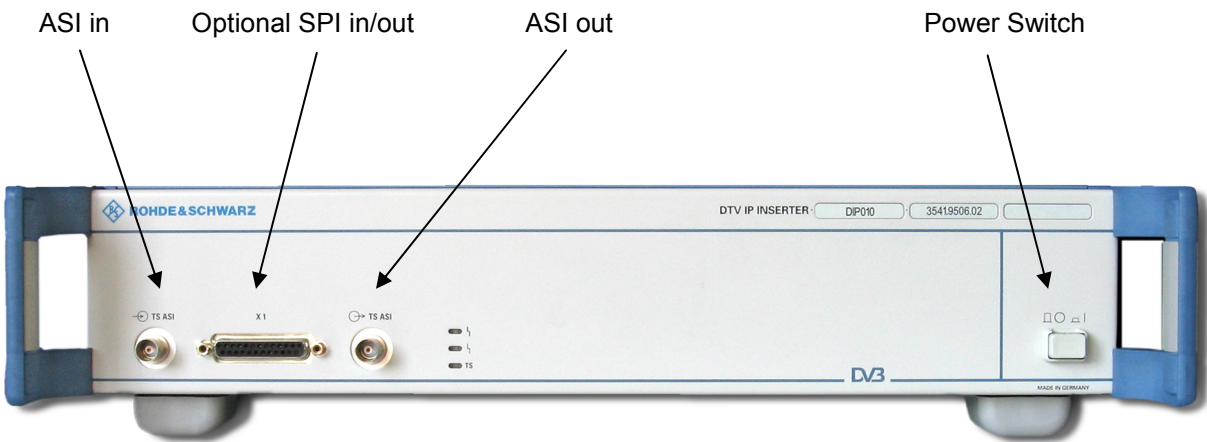




Figure 3.1: Basic Cabling, Front View

connector label: **TS ASI** 

connector type: **INPUT**


physical type: asynchronous, serial transport stream interface

ASI interface	
frequency range	<850 MHz
bit rate	270 Mbit/s
connector system	BNC
input impedance	75 Ω

connector label: **X1**


connector type: **INPUT/OUTPUT** (configuration via DTV Data Inserter control software, default: output)


physical type: synchronous, parallel transport stream interface (DVB-SPI)

	
connector system	sub-D connector, female, 25-contact,
pin assignment	see table below
Inputs	LVDS level

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connector label: **TS ASI** 
connector type: **OUTPUT**
physical type: asynchronous, serial transport stream interface

ASI interface	
frequency range	<850 MHz
bit rate	270 Mbit/s
connector system	BNC
input impedance	75 Ω

3.1.2 External Connectors, Rear Panel

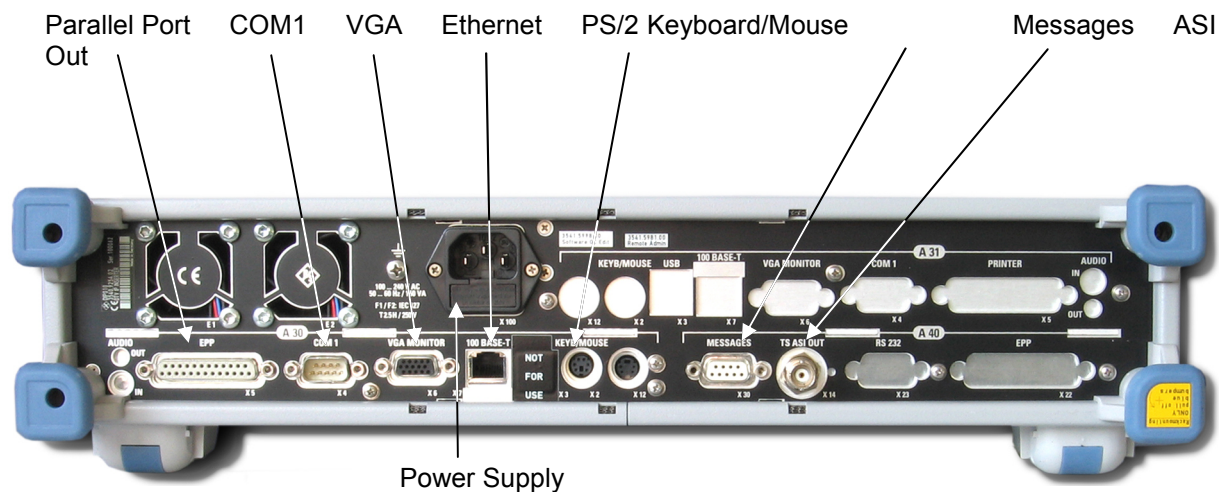









Figure 3.2: Basic Cabling, Rear View

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No.	Connector	Description
X2		KEYB/MOUSE Mini-DIN connector, female Use enclosed “Y-cable” (2083.1960.00) to connect keyboard and mouse (see Figure 3.3)
X4		COM 1: Serial Port sub-D connector, male, 9-pins transmission method: asynchr., without handshake transmission rate: 9600 / 19 200 baud level: RS-232
X5		EPP: Parallel Port sub-D connector, female, 25-pins level: TTL <i>DVB-H and SSU Option: Please connect the hardlock to this connector</i>
X6		VGA MONITOR sub-D HD connector, female, 15-pins
X7		100 BASE-T RJ 45 connector, female use a standard Cat. 5 (or Cat. 6) Ethernet cable for connection to local area network (LAN)
X14		TS ASI OUT Used in parallel to ASI out connector on the front panel. Can be used i.e. for monitoring.
X30		MESSAGES sub-D connector, female, 9-pins transmission method: relay contacts level: floating (refer to Figure 3.4)
X100		Connector “Power Supply” 100 ... 240 V AC 50 ... 60 Hz / 150 VA

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3.1.3 Cabling with external devices

To avoid damages, the controller cable connections should only be made with the controller being switched off. The data feed cables (ASI and SPI) can be connected in any order.

Keyboard/Mouse Cable:

For connecting mouse and keyboard there is only one PS/2 connector (X2) at the rear available. This can be splitted using the enclosed “Y-cable” to connect mouse and keyboard.

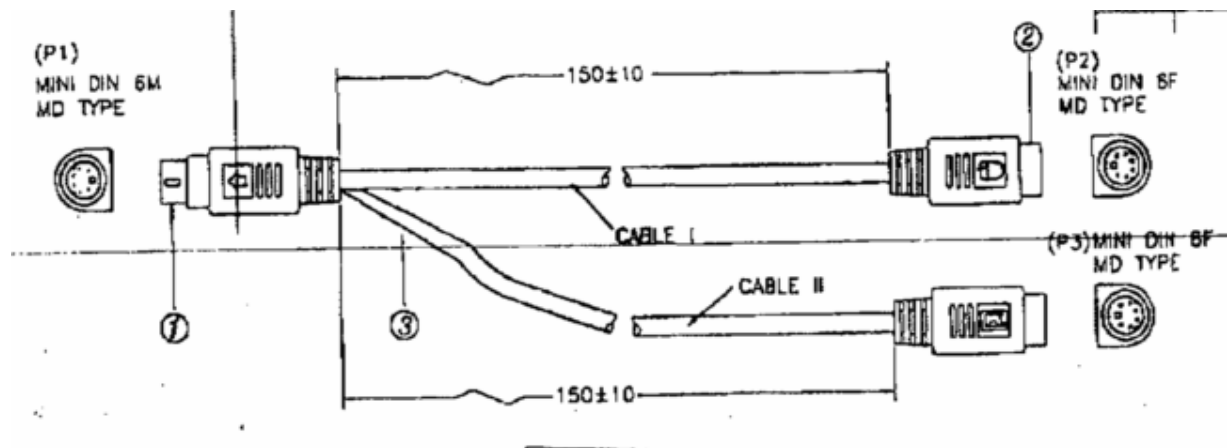


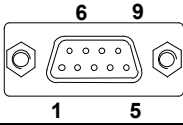
Figure 3.3: keyboard/mouse cable (Y-cable)

Message Connector (X30)

The message connector gives the possibility to get signals shown by the LEDs on the front panel. The following three signals are possible.

TS OK	valid TS present at input
Warning	- software bypass - no data from controller for at least 500 ms
Fault	no communication between controller/insertter hardware, ASI Out 1 connected to ASI input

The signal is checked by measuring the passageway between the appropriate contacts. This can be done with any standard multi-meter. Example: to get the information when the TS OK LED is on, measure the passageway between contacts 1 and 3.

	
transmission method	relay contacts
connector	sub-D connector, female, 9-pin
level	floating

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Pin	Abbreviation	Signal
1	TS OK	"TS OK" NC (normally closed) contact
2	TS OK	"TS OK" NO (normally open) contact
3	TS OK	"TS OK" common contact
4	warning	"Warning" NC contact
5	warning	"Warning" NO contact
6	warning	"Warning" common contact
7	fault	"Fault" NC contact
8	fault	"Fault" NO contact
9	fault	"Fault" common contact

Figure 3.4: sub-D messages

4. System Requirements

4.1 Processing Power

The table below lists the requirements for the integrated processor of the DTV Data Inserter R&S DIP010:

Components	Requirements
Mainboard	Octo
Memory	512 Mbyte SDRAM (PC100)
Processor	Intel Mobile Module (Pentium II)
Hard disk	at least 100 Gbytes, EIDE
Graphics card	S3 VIRGE/Mxi chip set; VGA, SVGA, XGA and SXGA TFT; 4 Mbyte graphics memory, 66 MHz AGP port, direct LCD support
Network controller	LAN controller Intel SB82559, 10/100 Mbit/s
Control unit	external keyboard/mouse, external VGA monitor
<u>Software</u> Operating system	Windows NT 4.0 / Service Pack 6

4.2 Controller Configuration of DTV Data Inserter

The controller of the DTV Data Inserter is supplied with correct BIOS settings, integrated Windows NT Embedded operating system and installed DTV Data Inserter software.

4.2.1 BIOS Settings

The BIOS settings of the inserter should not be changed. However, if changes should become necessary, the original settings should be restored if possible. The original BIOS settings are listed in the appendix. They can be verified by the user.

4.2.2 Controller Name in the Instrument

A special instruction ensures that the controller name in the DTV Data Inserter DIP010 is unambiguous. If it becomes necessary to change the name, it can be directly done under control panel → network below the top tab.

After having pressed the "change" button in the dialog, enter a name up to eight characters in length which is unambiguous in the network. During factoring process, the name set is derived from the serial number of the device.

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4.2.3 Network Address of the DTV Data Inserter

For remote control and routing of the IP data streams of the services, the DTV Data Inserter must be configured with an address accessible from the local network. Ask your network administrator for an available IP network address and the corresponding network mask. If the controller needs access to the Internet (e.g. for downloading service data), a default gateway must be configured in addition.

These settings can be made under:

Control panel → Network → Protocols → TCP/IP protocol → Properties.

Note:

Please change only the TCP/IP address of the primary network adapter (Intel, IPTap), not the address of the virtual NDIS network card (R&S IP Gate) - the local data services are configured to the fixed address on the NDIS network card.

4.2.4 Full Utilisation of the Hard Disk

The DTV Data Inserter instruments are supplied by a hard disk capacity of at least 20 GBytes. This capacity is used by the drives C: and D:, which are installed during production. If the hard disk has a capacity of more than 40 GByte, the remaining capacity can be activated.

In this case proceed as follows:

1. Select the disk administrator program under Start → Programs → Administrative tools. The occupied memory partitions are shown, and any free space is marked in grey.
2. If there is any free space left, click with the right mouse key on the free (grey) area and select "Create...".
3. After creating the partition, click the area again with the right mouse key and select "Assign drive letter..." to assign a letter to the drive.
4. To activate the changes click the grey area again with the right mouse key and select "Commit changes now...".
5. Finally, click the area again with the right mouse key and select "Format...". A dialog window is displayed. Select the NTFS type and the quick format method in this window. After quick-formatting, the new partition is available without requiring a restart.

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4.2.5 Windows NT Embedded

The Windows NT Embedded operating system was selected for the DTV Data Inserter because

- it is suitable for the use in embedded systems and
- of the binary compatibility with MS Windows NT.

The following features make Windows NTE particularly suitable for embedded systems:

- Null VGA support
- Null keyboard/mouse support
- Minimum OS
- Standard Windows communication services/protocols
- Standard management interfaces (remote management) etc.

The binary compatibility allows the use of standard Windows software components and provides the familiar look-and-feel interface for the user.

For further information on the operating system, please refer to the Microsoft web site www.microsoft.com (select the Windows NT Embedded 4.0 operating system in the catalogue).

4.2.6 Pre-installed Software

The standard installation on the controller board includes:

- the DTV Data Inserter application with required dynamic libraries (*.dll) and NT drivers
- the pre-configured configuration file "inserter.ini"
- the hardware test applications

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4.2.7 File System Structure

The roughly structure of the file system on drive “c:\” on the DIP010 is indicated below:

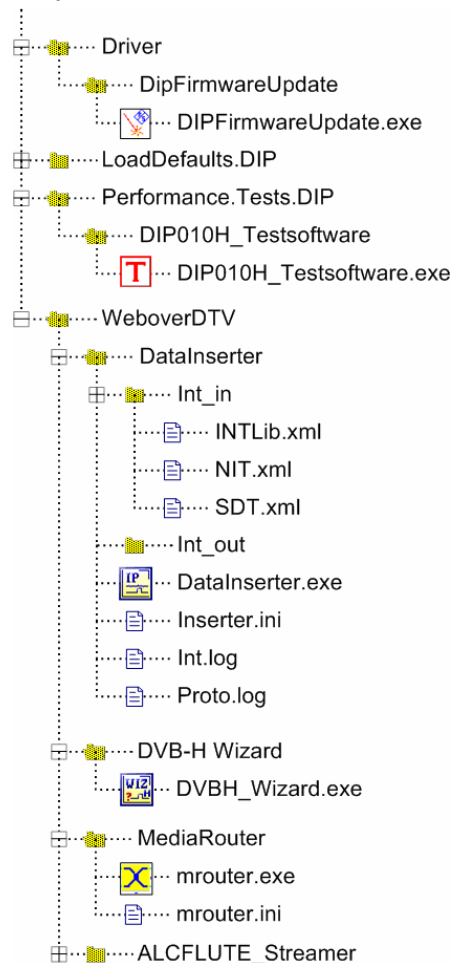


Figure 4.1: File System structure

A brief explanation of the directories:

- Driver: installed driver versions
 - DipFirmwareUpdate contains the Firmware Update software
- LoadDefaults.DIP contains the default settings for MediaRouter and DataInserter
- Performance.Tests.DIP contains the Performance Test software
 - DIP010H_Testsoftware contains the DIP010 Testsoftware
- WeboverDTV contains all important software by Rohde & Schwarz
 - DataInserter contains the DataInserter software
 - INT_IN contains the xml files for signalling (and some examples)
 - INT_OUT contains the generated TS files for signalling
 - DVB-H Wizard contains the DVB-H Wizard software and its configuration files
 - MediaRouter contains the MediaRouter software
 - ALCFLUTE_Streamer contains the ALCFLUTE_Streamer software

A brief explanation of the files:

- DipFirmwareUpdate.exe software to update the hardware with new firmware
- DIP010H_Testsoftware.exe software to test the hardware of the DIP010 (refer to 5.1)

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- INTLib.xml xml-configuration file for configuring INT table in DVB-H mode
- NIT.xml xml-configuration file for configuring NIT table in DVB-H mode
- SDT.xml xml-configuration file for configuring SDT table in DVB-H mode
- DataInserter.exe DTV Data Inserter software for inserting IP data into MPEG-2 TS
- Inserter.ini configuration file of DTV Data Inserter software
- Int.log log file containing errors after generation of PSI/SI signalling tables
- Proto.log log file of DTV Data Inserter application
- DVBH_Wizard.exe DVB-H Wizard application to setup a simple DVB-H configuration
- Mrouter.exe Media Router application to fetch the IP packets from network and prepare them for the DTV Data Inserter application
- Mrouter.ini configuration file of Media Router application.

5. Performance Test

5.1 Subject

The DTV Data Inserter DIP010 is a device used in the field of digital TV. It works with MPEG-2 transport streams (i.e. generated with R&S device DVRG 2083.1302.02) and with packets in Internet format delivered via the network. This device exchanges MPEG-2 packets for other MPEG-2 packets, i.e. for data packets with the Internet content.

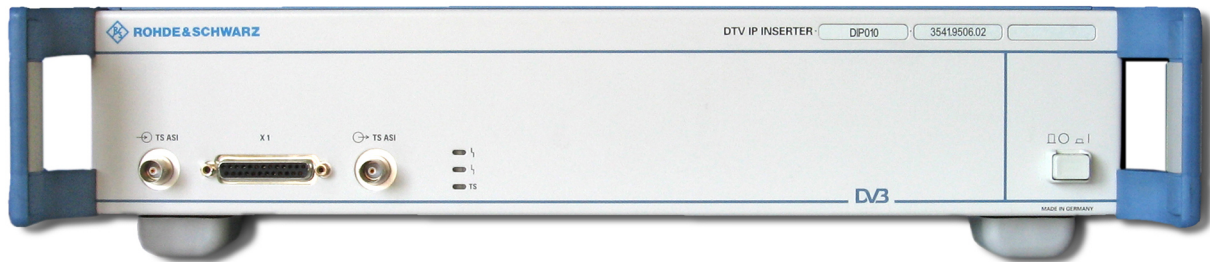


Figure 5.1: DTV Data Inserter DIP010-H

The performance test of the DTV Data Inserter devices should be directly done in base band MPEG-2 signal. The recommended measurement device for this purpose is the R&S device DVM400 (2085.1800.02). It analyses the correctness of the produced MPEG-2 signal.

5.2 Equipment and Accessories

Devices:

- monitor, keyboard, mouse for the R&S DIP010 device, PS/2 Y-cable (R&S 2083.1960.00),
- MPEG-2 Generator R&S DVRG (R&S 2083.1302.02),
- MPEG-2 Measurement Decoder DVM400 (R&S 2085.1800.02),
- cables

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5.3 Test Setup

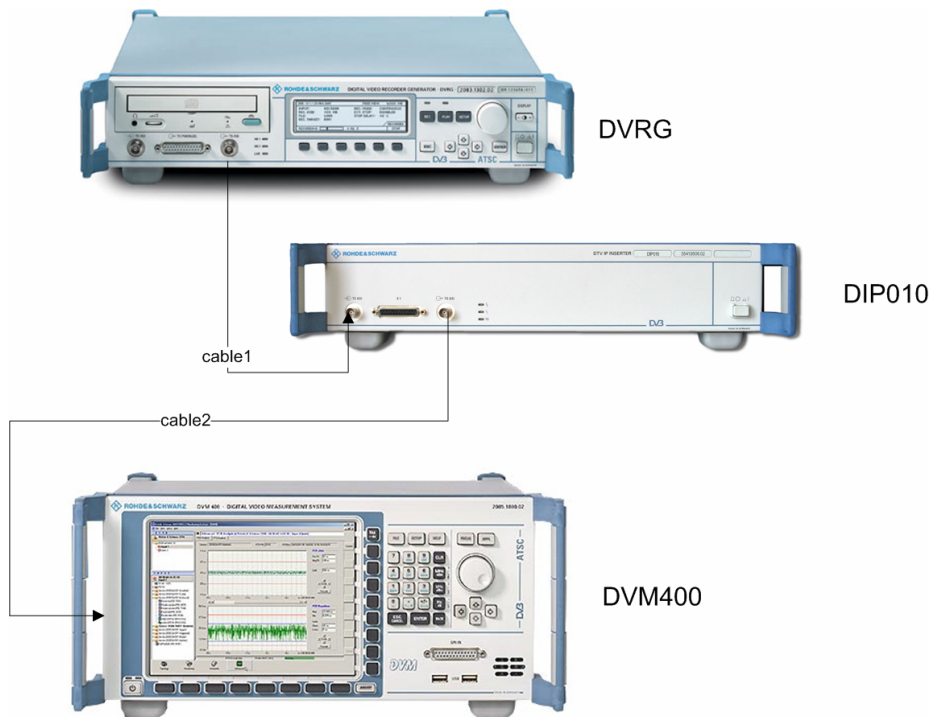


Figure 5.2: Performance Test Setup

The following cables are needed:

- cable 1: standard BNC 75 Ohm
- cable 2: standard BNC 75 Ohm

Use R&S DVRG MPEG-2 transport stream without built-in errors.
Adjust the R&S DVM software to monitoring mode.

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5.4 Unit Tests

The following tests check all HW units inside the *DTV IP Inserter* devices. Repair steps are listed in the next chapter.

Part	Operations	Check	Possible error source
power supply unit	switch on the device	red LED (sum fault) is on	<ul style="list-style-type: none">- fuse in the power supply- fuse on fuse board- power supply unit- LEDs on LED board
“Octo” PC main board	switch on device, connect monitor, keyboard and mouse	PC boots automatically and known Windows NT desktop appears on monitor	<ul style="list-style-type: none">- power supply- fuses unit- hard disc (hardware)- hard disc (Win NT image)
input interface unit	switch off device, connect R&S DVRG on input (TS IN), connect R&S DVM on output (Front TS Out)	MPEG2 sequence is bypassed, R&S DVM shows correct MPEG2 TS	<ul style="list-style-type: none">- bypass relays on the input interface unit is damaged
	switch on device, connect R&S DVRG on input (TS IN), connect R&S DVM on output (Front TS Out)	MPEG2 sequence is bypassed, R&S DVM shows correct MPEG2 TS; red LED is on	<ul style="list-style-type: none">- power supply- fuse unit- firmware
	switch on device, connect R&S DVRG on input, connect R&S DVM on output, R&S DIP010 device is booted and switched to “insert” mode	MPEG2 sequence is in working chain, only (!) green LED is on, R&S DVM shows correct MPEG2 TS,	<ul style="list-style-type: none">- see above case- Octo PC main board- hard disc (hardware)- hard disc (Win NT image)

If an error appears, be sure that you tried it after a reboot of the R&S DIP010, too.

5.5 Advanced Tests for the R&S DIP010

Besides of the both Transport Stream (TS) connectors TS ASI IN and TS ASI Out Front that where tested above, there are two other connectors working with MPEG-2 TS: TS ASI Out Rear and SPI In/Out. All those connectors can also be tested with the "DIP010H_Testsoftware".

For advanced tests, the R&S DIP010 device has to be in full working state - PC must be booted, monitor, keyboard and mouse have to be connected.

Before starting the test software please be sure that the DataInserter software is closed!

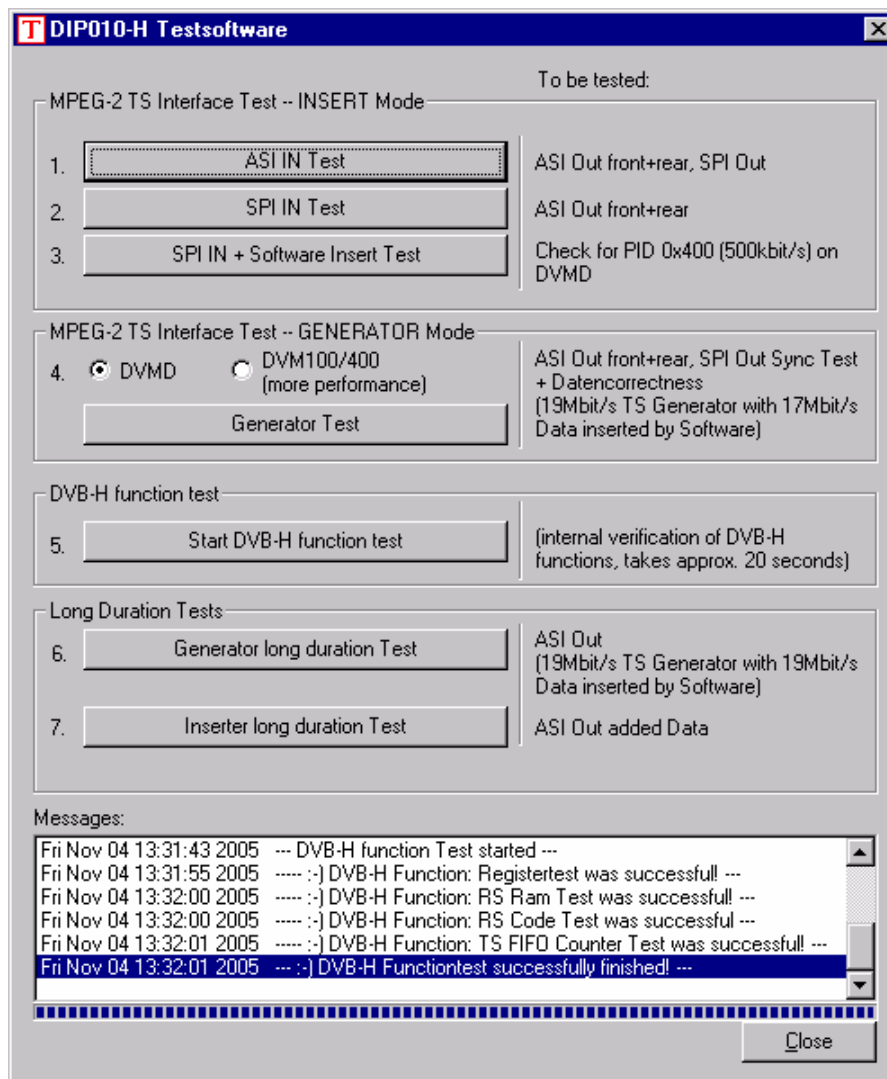


Figure 5.3: DIP010H_Testsoftware

Please start the test software from the directory "C:\Performance.Tests.Dip\DIP010H_Testsoftware". With this software all necessary tests can be done to verify the correct working of the DIP010.

It is possible that the software starts with the error message "Initialisation was not successful. Program closed!". This can be caused due to problems with loading the Input Interface

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driver. Please be sure that the DataInserter software is closed. Restart the DIP010 and try it again. If this does not work, please check whether the driver is correctly installed at "C:\winnt\system32\drivers\dippcidrv.sys". The screenshot in Figure 5.3 shows the structure of the test software.

The DIP010H test software consists of multiple tests that are started by pressing the corresponding button. Each test is documented in the message window and in the logging file "Logfile.txt" in the program directory. This file should stay on the R&S DIP010. A copy for service purposes can be made via RemoteAdministrator.

For testing only the TS In/Outputs only the buttons/tests 1-4 are needed. After pressing one of those buttons a message window with a short description appears. **The test will not start until you confirm the message with OK.** The following tests should work properly (there are some advices to set up the DVM stream explorer software for correct measurement):

1. "ASI IN Test" (Button 1) – with the set up as described in 5.3 (DVRG has to be connected to ASI IN port). Differently from the basic set up, also the ASI Out Rear and SPI Out connectors have to be connected to the DVM (one after the other as single tests). The test has to result an errorless signal at all output ports. This have to be checked with the stream explorer software on the DVM.
2. "SPI IN Test" (Button 2) – Differently from the basic set up the MPEG-2 TS from the DVRG has to be connected via SPI cable to the SPI input interface (Please disconnect the ASI IN cable for correct testing). The test has to result an errorless signal at all output ports. This have to be checked with the stream explorer software on the DVM.
3. "SPI IN + Software Insert Test" (Button 3) – With the same set up as in test 2 the DIP010 will add an additional service to the incoming MPEG-2 TS with the Packet Identifier (PID) 0x400 respectively 1024 decimal. This stream is not referenced by any signalling tables, so the DVM stream explorer has to notify an "unreferenced PID 0x400". If no other error messages appear, the test was successful. To have no error messages in the DVM monitoring software you can switch off the message "unreferenced PID" in the monitoring configuration (menu/setup/monitoring configuration):

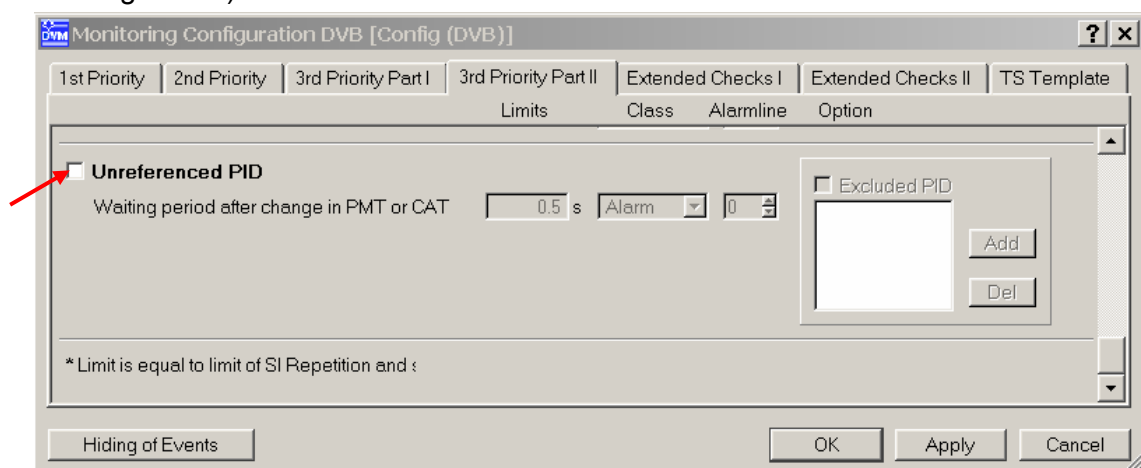


Figure 5.4: DVM settings - SPI IN test

4. "Generator Test" (Button 4) – for this test no input MPEG-2 TS signal has to be connected to the DIP010. Differently from the basic set up, also the ASI Out Rear and SPI Out connectors have to be connected to the DVM (one after the other as single

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tests). Executing this test requires the choice of the correct measurement device. (DVMD or DVM100/400). The background is that the (older) DVMD is not able to measure the highest data rate that can be generated by the DIP010. That is why it is recommended to take a DVM100 or 400 or a corresponding device that can analyse 54Mbit/s MPEG-2 TS.

The test has to result a errorless signal at ASI Out Front + Rear and at SPI out. The following error messages can appear. They are not interesting for this test and do not mean an error!

a) Missing PID 0x401 resp. 1025 decimal

b) Missing AIT, EIT, ... (Only PAT and PMT are generated by the DIP010, so other signalling tables are missing!)

To suppress these error messages in the DVM monitoring software below the tab “1st Priority” all messages except “PID Distance” should be enabled.

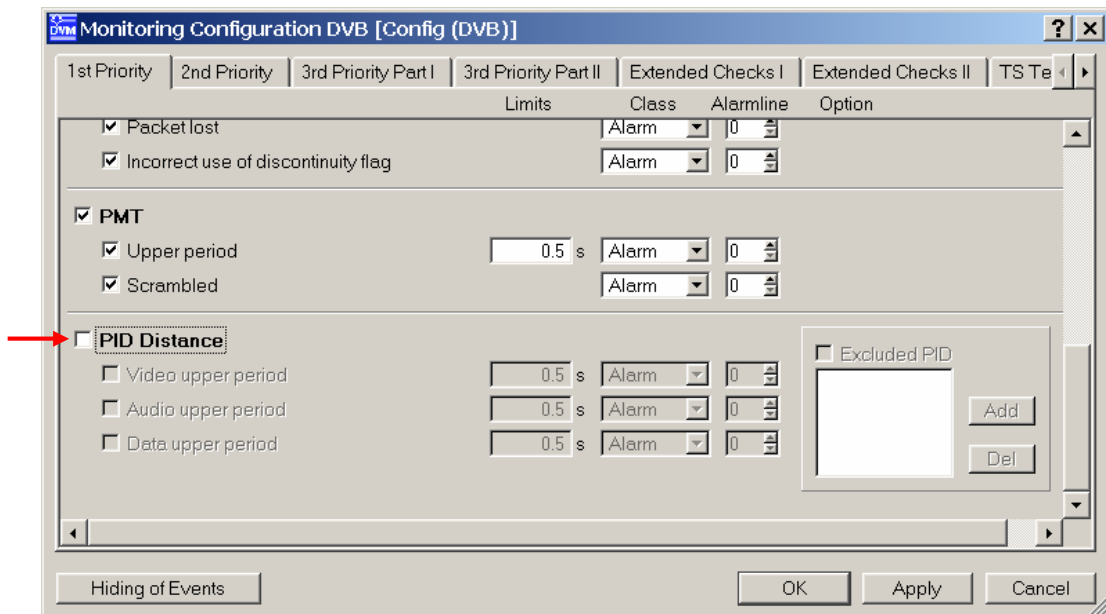


Figure 5.5: DVM settings – Generator test, 1st priority

At the “2nd priority” tab everything should be enabled.

At the “3rd priority” tab only the PAT and PMT repetition should be enabled.

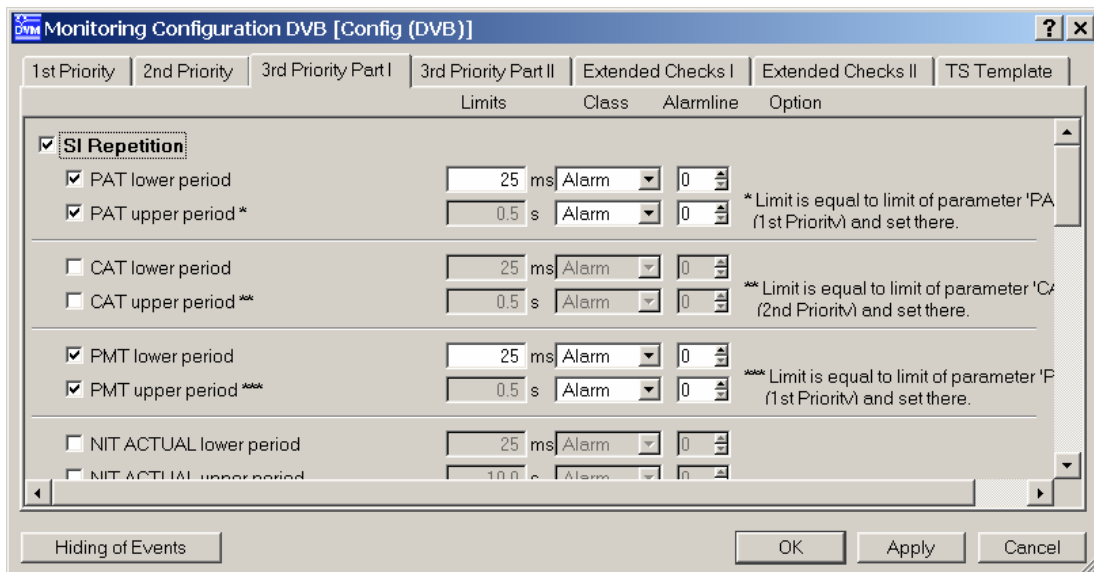


Figure 5.6: DVM settings - Generator test, 2nd priority

At the panel “3rd priority part II” only “unreferenced PID” should be enabled (in contrast to the SPI IN test).

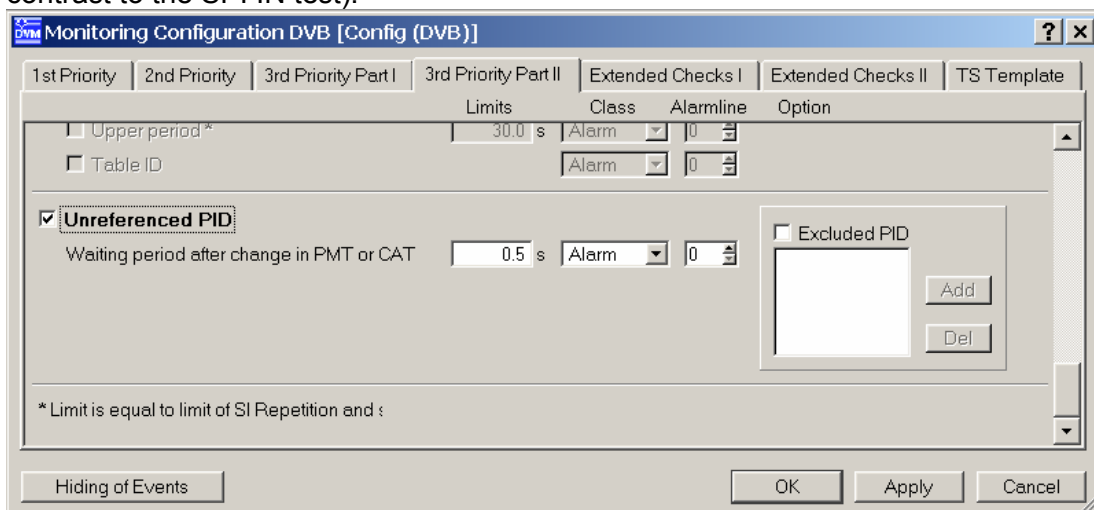


Figure 5.7: DVM settings - Generator test, 3rd priority part II

On the panels “Extended Checks I”, “Extended Checks II” and “TS Template” all settings should be disabled.

5. “*Start DVB-H function test*” (Button 5) – This test does not test any MPEG-2 TS port so not device has to be connected. This test runs alone for approximately 20 seconds. It tests the DVB-H functionality of the PCI input platine. You can also check the LEDs with it. All of them should blink some times. If it is not successful the PCI input platine may be defect!
6. “*Generator long duration test*” (Button 6) – This test is similar to the Generator Test (Button 4). Please use the same set up and notice the description of this test. At this test the maximum possible data rate will be tested. There should be no error messages up to the ones described at test 4.
7. “*Inserter long duration test*” (Button 7) – Please set up the basic set up with ASI IN connected to the DVRG and ASI Out connected to the DVM. At this test the complete free data rate of the incoming TS will be used to fill it with an additional service on

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PID 0x400 respectively 1024 decimal. There should be no NULL-packets left in the TS. At the stream explorer of the DVM only the error message "Unreferenced PID 0x400" should appear.

The following test results should be checked:

Test	Operations	Check	Possible error source
Start Testsoftware	Close the DataInserter application! Start "DIP010H_Testsoftware"	Software starts	Software does not start: - DataInserter software is already running, - restart the DIP010 and try again (driver may not correctly loaded), - driver is not installed, check for existing c:\winnt\system32\drivers\dippcidrv.sys
1. ASI IN test	connect R&S DVRG on DIP010 port <i>TS ASI in</i> , connect R&S DVM on DIP010 port <i>TS ASI out</i>	only green LED is on, R&S DVM shows correct MPEG2 TS, Check also ASI Out Rear and SPI Out Front with R&S DVM!	- ASI ports are not correctly connected, - input interface is damaged (hardware or firmware)
2. SPI IN test	connect R&S DVRG on DIP010 port <i>SPI IN</i> , connect R&S DVM on DIP010 port <i>TS ASI out</i> , remove any cable from ASI IN	only green LED is on, R&S DVM shows correct MPEG2 TS, Check also ASI Out Read with R&S DVM!	- ASI/SPI ports are not correctly connected, - input interface is damaged (hardware or firmware)
3. SPI IN + Software Insert Test	connect R&S DVRG on DIP010 port <i>SPI IN</i> , connect R&S DVM on DIP010 port <i>TS ASI out</i> , remove any cable from ASI IN	only green LED is on, R&S DVM shows correct MPEG2 TS but one error message of unreferenced PID 0x400. No other errors should appear.	- ASI ports are not correctly connected, - input interface is damaged (hardware or firmware)
4. Generator Test	R&S DVRG should be disconnected!, connect R&S DVM on DIP010 port <i>TS ASI out</i>	only green LED is on, R&S DVM shows only the following errors: - Missing PID 0x401 (1025dec) - There is only PAT and PMT table → all others will be missing	- ASI ports are not correctly connected, - input interface is damaged (hardware or firmware)
5. Start DVB-H	in/output port does not need to be	Wait for the result of the test.	- On error restart the DIP010 and try again

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function test	connected,		- input interface is damaged (hardware or firmware)
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6. DTV “DataInserter” Software Overview

The DTV “DataInserter” is a software module responsible for the insertion of several kinds of data packets into the MPEG-2 TS. It communicates with and manipulates the data inserting hardware (→ the Input Interface) directly. The following types of data are currently supported:

- IP packets including DVB-H,
- Object Carousel / Data Carousel DSMCC sections (transparent),
- MPEG-2 TS packets (transparent),
- PSI/SI tables.

For processing as Data or Object Carousel the DTV Data Inserter is a relatively simple application with focus on reliability and robust operation. Most of the data processing is done in modules before the DTV Data Inserter, which prepares the data for insertion into physical channel (i.e. SSU Streamer application).

At DVB-H Mode the DataInserter processes the complex time slicing mechanism and generates all necessary PSI/SI signalisation.

It is required that data packets for the DTV DataInserter application are prepared by the MediaRouter software.

Features of the DTV DataInserter software:

- receives prepared data in form of packets of the MediaRouter (see User Manual MediaRouter Ident.no. 3531.1848.42)
- accepts prepared data: IP packets, packets after Object Carousel / Data Carousel any kind of MPEG-2 TS packets
- data reception only on a standard specified UDP/IP port
- resends the received data within the MPEG-2 transport stream
- no limitation of possible data services
- no limitation of used PIDs
- data processing with up to 54 Mbit/s
- automatic recognition of type and working mode of underlying DTV Data Inserter hardware, auto-adjust
- well structured main GUI displaying global statistics on packet level in visual (status LEDs) and textual form (counters)
- well structured settings GUI for users with different system skills: basic, expert, DVB-H, PSI/SI and internal settings
- predictable usage of MPEG-2 resources:
 - o specification of MPEG-2 resources used for data insertion - two parameters: base PID and mask describing a range of PIDs
 - o guaranteed data insertion with up to 54 Mbit/s

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- MPEG-2 /DVB conform data service signalling
 - o dynamic generation of PSI signalling for all kinds of data services: IP, MHP, Data Carousel; dynamic exchange of signalling during operation (current/next logic); insertion of different PSI/SI tables possible
- enhanced buffering of packets controlled by several parameters: size of UDP socket buffer, size of RingBuffer for internal buffering
- remote console interface for easy remote communication (i.e. via EDS SOAP/XML interface) with DTV Data Inserter application

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6.1 Operation – Data Insertion

The DTV Data Inserter DIP010-H is a robust software application acting on the interface between IP network and MPEG-2 transport stream. Its main focus is always-on operation. Its interfaces are optimised for data packet insertion.

The DTV Data Inserter application accepts data on one dedicated interface, the UDP/IP port. Only data in a special format, prepared by the MediaRouter (see User Manual MediaRouter Ident.no. 3531.1848.42), is accepted. This format includes the data itself and all necessary channel specific information for its insertion into DVB/DAB channels.

The necessary preparation of data is done in the MediaRouter software. *MediaRouter* is a free option on the DTV Data Inserter devices. More information on this module is provided in the following section.

The basic software required for the insertion of data with the DTV Data Inserter consists of two components: DTV Data Inserter and MediaRouter. Both components start automatically when booting the DTV Data Inserter.

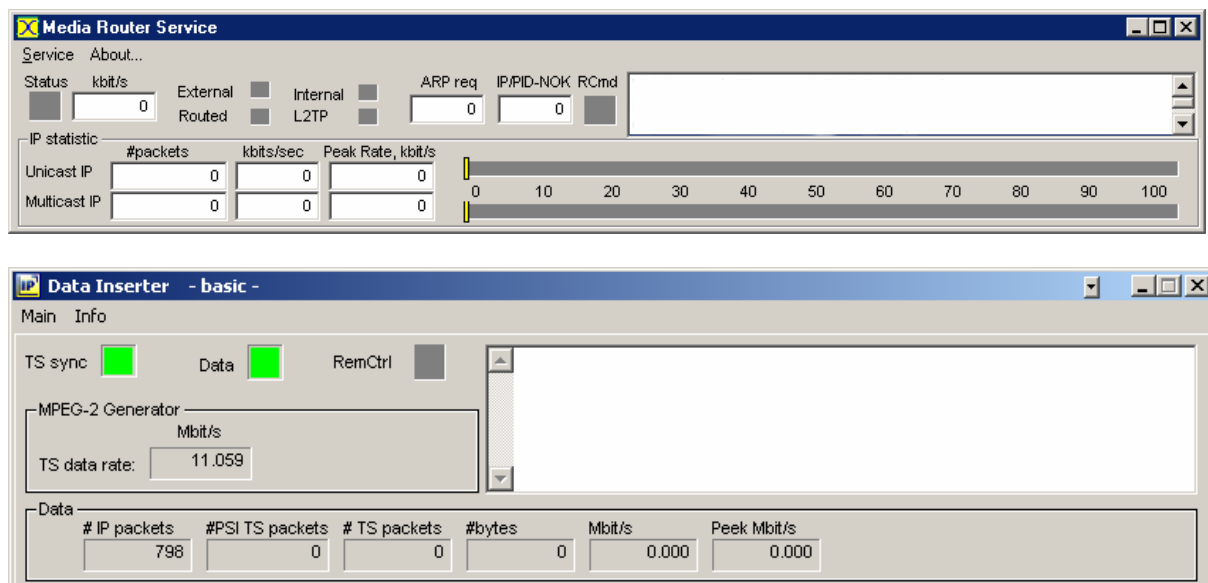


Figure 6.1: Basic Software Configuration

The DTV Data Inserter works in the following processing steps:

- data reception
- decision about the received kind of data
- calculation of Multiprotocol Encapsulation (in case of IP data)
- buffering of prepared MPEG-2 TS data packets
- insertion

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The DTV Data Inserter expects data packets prepared by the MediaRouter on a standard UDP/IP socket interface. After the reception of a packet, the DTV Data Inserter looks into it and, depending on the packet header, recognises one of the following data types:

- MPEG-2 TS packets for transparent insertion without data processing. This type is recognised if the payload starts with the byte 0x47 and its length is exactly 188 bytes.
- DataCarousel / ObjectCarousel sections for transparent insertion.
- IP packets for processing, preparation and insertion. (i.e. for DVB-H)

If a received packet has a recognised format, the Data LED on the DTV Data Inserter GUI flashes green.



Figure 6.2: DTV Data Inserter LED's

In case the received data has a wrong format – especially if it has not been prepared by the MediaRouter software, the data LED on the DTV Data Inserter GUI flashes yellow, indicating a warning due to the data format. Data packets are received and dropped immediately. The counter of data packets increases, but the counter of TS packets does not increase.

This warning can occur if the user is sending data directly to the receiving socket of the DTV Data Inserter and not to the MediaRouter. Data packets are not prepared properly in this case.

When frames have been correctly received from the MediaRouter, the DTV Data Inserter performs a multiprotocol encapsulation (ETSI EN 301 192 / ISO 13818-6) calculation of IP packets inside the frames. Added information like PID and MAC are extracted from the header of the MediaRouter and used for the calculation of MPE sections.

Prepared MPE sections are split into MPEG-2 TS packets and buffered into an internal buffer, the “Ring Buffer” (only if not DVB-H mode), optimised for quick data processing. With the internal buffering also higher bit rates of incoming IP packets can be processed in short peaks. Depending on the adjustable size of DTV Data Inserter internal buffer, also very big peaks can be buffered.

Example: with a buffer size of 64 Kbyte, an added peak traffic with an average data rate of 512 kbit/s can be buffered up to one second.

At Inserter mode the DTV Data Inserter hardware is looking into the incoming MPEG-2 Transport Stream and if free resources are found, the prepared MPEG-2 TS packets will be inserted instead of pre-defined MPEG-2 resources (in general NULL packets with Packet ID 0x1FFF). The insertion process is performed by a high speed buffer triggered by advanced hardware interrupt mechanisms allowing a MPEG-2 TS data rate of up to 54 Mbit/s.

6.2 Operation – PSI/SI Processing

The DTV Data Inserter has the capability of generating appropriate PSI/SI signalling for signalisation of data services in DVB signal.

The DTV Data Inserter generates and manages all the PSI signalling on its own.

The following table types can be generated with the DTV Data Inserter:

- PAT
- PMT
- NIT
- INT
- SDT

The generation of this type of tables can be configured by the user.

The software keeps the signalisation consistent, i.e. if one service was deleted, one PMT would not be generated anymore, but also the references in PAT, SDT, INT (DVB-H mode) would be deleted. New CRC for all tables will be computed.

Goal of the default PSI/SI generation is a minimal signalisation, but it is also possible to set all known descriptors in the software (manually).

For more details on the PSI generation, please refer to section 7.4.4. and 7.5.

7. DTV Data Inserter Operation

The DTV Data Inserter is a service-like application running permanently. It is started during booting up and keeps on running thereafter.

The DTV Data Inserter is the software module establishing a communication to the hardware. This communication is processed by a robust and optimized hardware driver.

There are two versions of the DataInserter software, a basic version and a full version supporting DVB-H mode. The basic version is always installed on the DIP010 and is free for running. The full version of the DTV Data Inserter software fully supports DVB-H. It is only available with the DVB-H option, running only with the Rohde & Schwarz DVB-H Hardlock connected to the parallel port at the rear of the DIP010.

The main graphical user interface of the DTV Data Inserter includes exclusively elements which show information about the status of the data within the application in textual and graphical manner, so it is read-only.

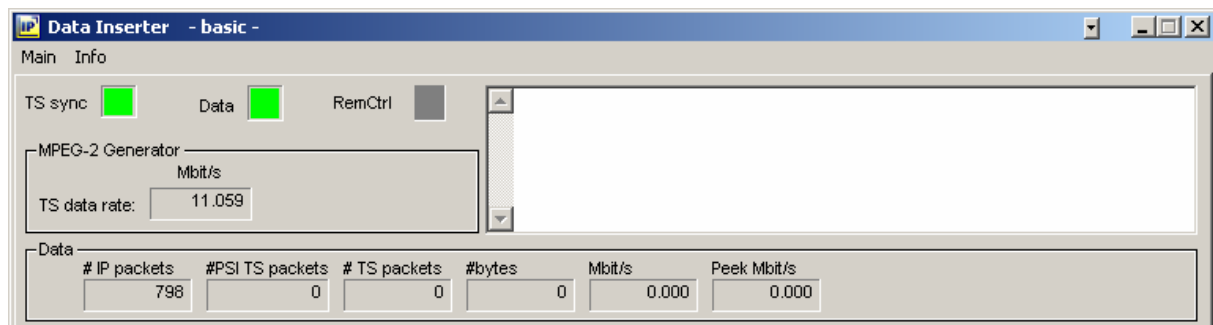


Figure 7.1: DTV Data Inserter (- basic -) Main GUI

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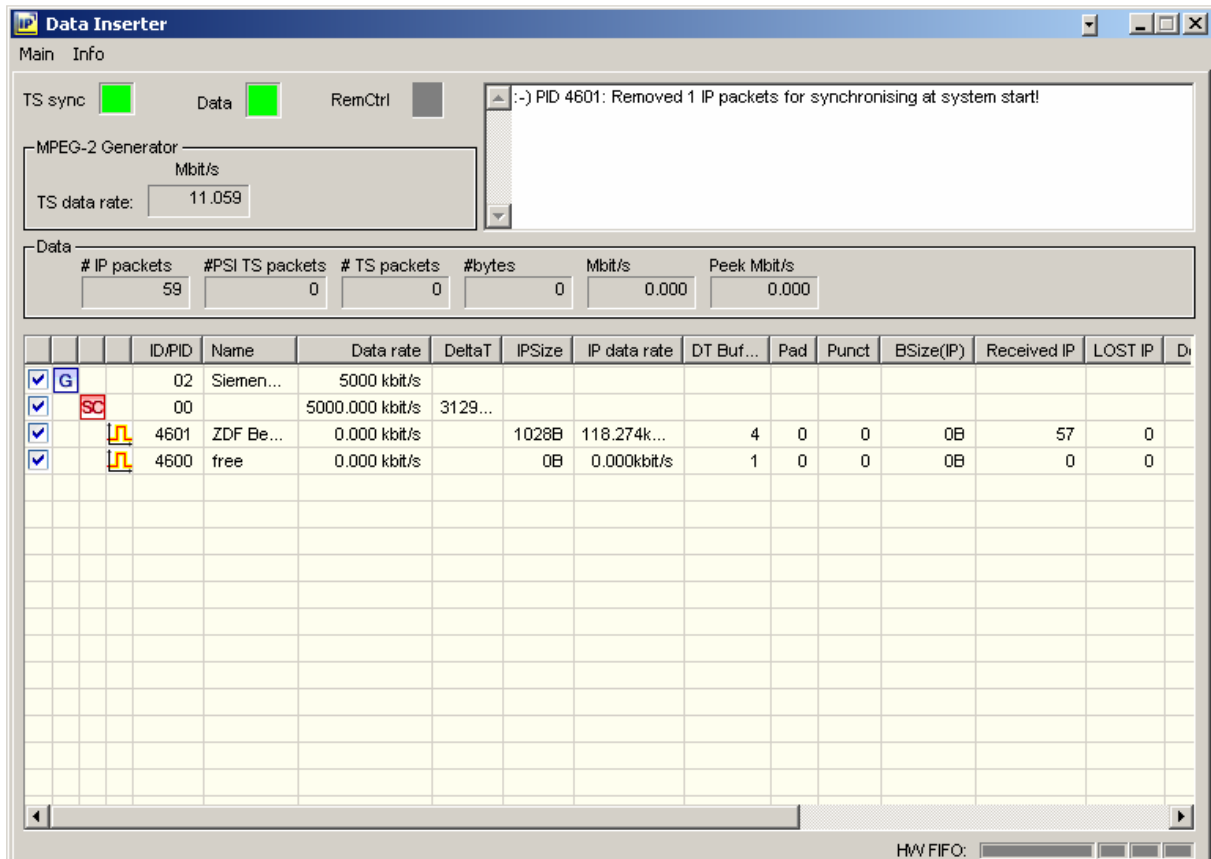


Figure 7.2: DTV Data Inserter (Full version) Main GUI, DVB-H Mode enabled

The window is divided into four logical areas:

- Upper left: here the summarised information about the status of the DTV Data Inserter is shown. One look at this area, and you see whether the DTV Data Inserter is working properly or not.
- Upper right: the log window is placed here. The user can see information given by the DTV Data Inserter. Three different levels of information can be adjusted: only errors, errors and warnings or all information, including errors, warnings and information.
- Middle area: here more specialised information is shown. There are a lot of counters describing the situation in the incoming IP and MPEG-2 streams and outgoing MPEG-2 data stream. Reading left to right these items are: number of received IP packets, number of generated MPEG-2 TS packets, sent bytes, current data rate, and peek data rate.
- Lower area: This is only available with the DVB-H option. It is described in the next chapter (7.1).

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7.1 DVB-H Statistics (only DVB-H Option)

If DVB-H is switched on (see chapter 7.4.1), the Main GUI expands as follows:

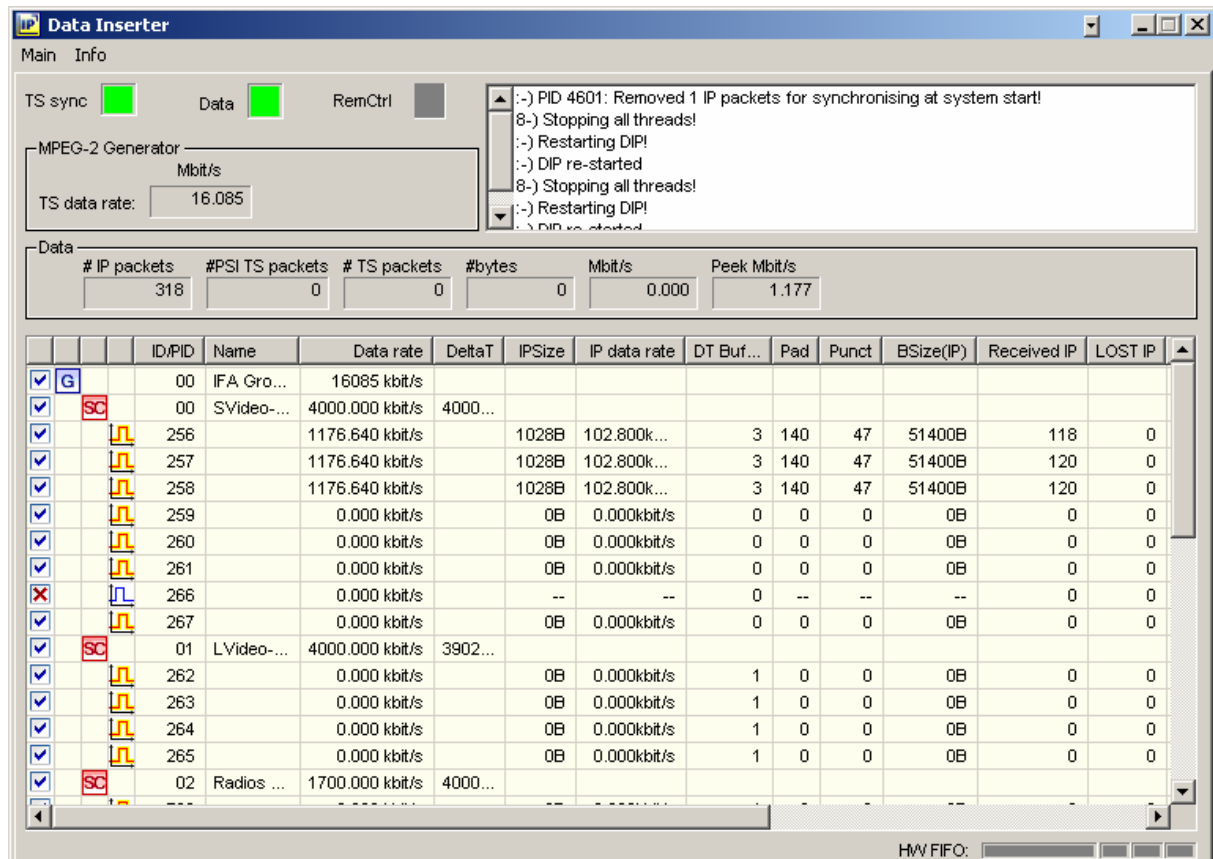







Figure 7.3: Expanded Main GUI for DVB-H

The additional table provides a statistical overview of the group of subchannels that has been set for the associated DIP010 with DVB-H option within the DVB-H Settings panel (see chapter 7.4.3).

According to the vertical time slice structure there are informations concerning either the total group (first line with symbol ) , a single subchannel within the group (lines with symbol ) , or an individual service within a subchannel (lines with symbol .

The check boxes   in the first column indicate which services, subchannels or groups are activated or not. Note: Even though it is possible to pre-configure several group configurations for one DIP010-H, only the currently active group of subchannels is shown in the table.

The other columns provide informations that are explained in the following:

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Group related informations

- ID/PID: Each group characterizes an unique identifier (ID), that is automatically incremented.
- Name: Group name set by user
- Data rate: Data rate that has been reserved for the group

Subchannel related informations

- ID/PID: Each subchannel characterizes an unique identifier (ID), that is automatically incremented. The count starts with 00.
- Name: Subchannel name set by user
- Data rate: Data rate that has been reserved for the subchannel.
- DeltaT: Delta-T of the subchannel that is automatically calculated.

Service/burst related informations

- ID/PID: Packet IDs (PID) in decimal notation that characterizes each burst or service in the MPEG-2 TS. The numbers originate from the MediaRouter software (see User Manual MediaRouter Ident.no. 3531.1848.42) where each selected IP stream has been assigned to a unique PID.
- Data rate: Data rate of the actual sent burst. The value varies depending on the incoming IP data rate (Burst Duration and Delta-T is fixed. Fluctuations in data rate are compensated by adopting the burst datarate).
- IPSize: Measured average size of incoming IP packets (in bytes), including IP overhead.
- IP data rate: Measured incoming IP data rate of the service.
- DT Buffer: Number of buffered bursts
- Padding: Padding in the actual burst (number of unused application data columns within the MPE-FEC frame, see chapter 1.4.1)
- Puncturing: Puncturing in the actual burst (number of columns removed from the MPE-FEC section, see chapter 1.4.1)
- BSize(IP): Size of the application data (IP packets) sent with the actual burst (in bytes).
- Received IP: Number of received IP packets.
- LOST IP: Number of IP packets that cannot be sent due to a FIFO overflow. *Note: Possible reasons are: IP data rate is higher than specified in the settings, Average IP packet size is smaller than specified in the settings (smaller packets increase the percentage of overhead produced for each packet) (see chapter 7.4.3).*
- Delayed IP: Number of IP packets that have exceeded the size of the actual burst. Therefore these packets were buffered to be sent *delayed* with the next burst. The occurrence of delayed IP packets indicates either acceptable peaks in the IP data rate (small numbers and sporadical appearance) or a mismatch between the configured and the actual IP data rate (increasing delayed IP number, often followed by lost IP packets).

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Note: To avoid interceptions the number of delayed IP packets for streaming media should be zero.

- IP FIFO: IP packet FIFO, that may overflow (= 100%) if the actual IP data rate is faster than configured in the DVBH settings panel (see chapter 7.4.3). Note: The value for IP FIFO always should be less than 100%.
- Created TS: Number of created MPEG-2 Transport Stream packets.
- LOST TS: Lost TS packets
- TS FIFO: This is an internal FIFO collecting the generated TS packets for sending to hardware. It should not reach 100%.
- Real BD: Real generated burst duration. The burst duration should stay constant at the calculated value. This is for checking the correct working of the DataInserter application.
- Sent TS: Sent TS packets.

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7.2 Version Information

Information about the working mode of the DTV Data Inserter, the software and firmware version can be found when clicking the menu option “Info”.

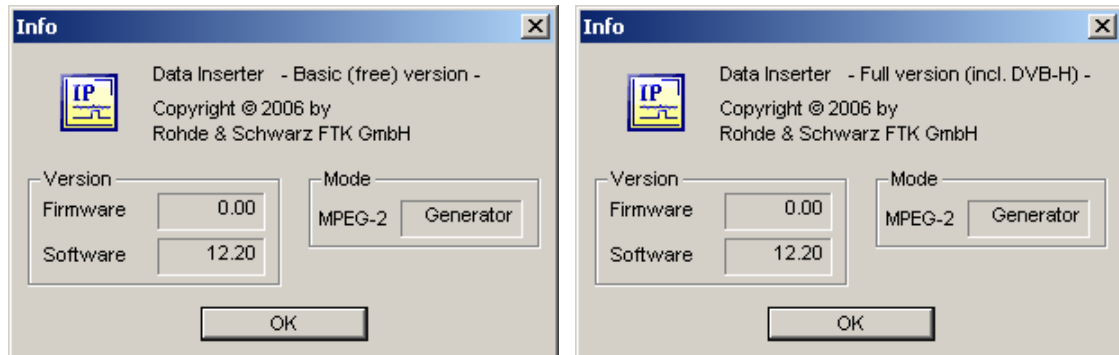


Figure 7.4: Version and Mode Information

In the displayed window, two kinds of information are shown:

- Version of the firmware (should be at least version 1.09) and the software.
- Actual MPEG-2 working mode of the device, MPEG-2 inserter or MPEG-2 generator.

It is easy to differentiate the free basic DTV Data Inserter version from the full version. The information about the year of release is displayed as well.

7.3 Main Menu

When clicking the main menu option, the following menu points are available:

- Settings: Basic, Expert, DVBH, PSI/SI and Internal
- Reset Counters : resets all counters displayed on main GUI
- Clear Log Window: clears the log window on the upper right part of the main GUI
- Start: Starts the Inserter processing
- Stop: Stops the Inserter processing
- Restart: restarts the DTV Data Inserter, re-initialises all values
- Exit: Closes the DTV Data Inserter application.

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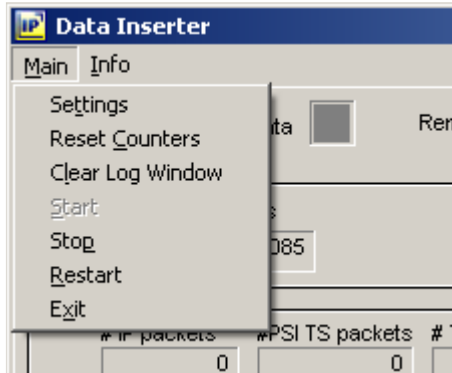


Figure 7.5: DTV Data Inserter, Main Menu

The setting options are described in detail in the following sections.

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7.4 User Settings Interface

☞ The settings of the DTV Data Inserter have to be done only once, they are physical level settings and do not change during the operation of the inserter.

☞ Entering the settings interface does not interrupt the work of the DTV Data Inserter. The user can change values and will be asked upon closing the dialog whether these values should be activated. The activation requires a restart of the application and a short interrupt in processing.

The settings interface of the DTV Data Inserter consists of five panels: Basic, Expert, DVBH, PSI/SI and Internal. The property sheets include settings according to user skills and required adjustments, e.g. on the basic settings sheet, there are adjustments for inexperienced users.

7.4.1 Basic Settings

On the basic settings sheet, inexperienced users can configure the basic adjustments necessary for the operation of the DTV Data Inserter.

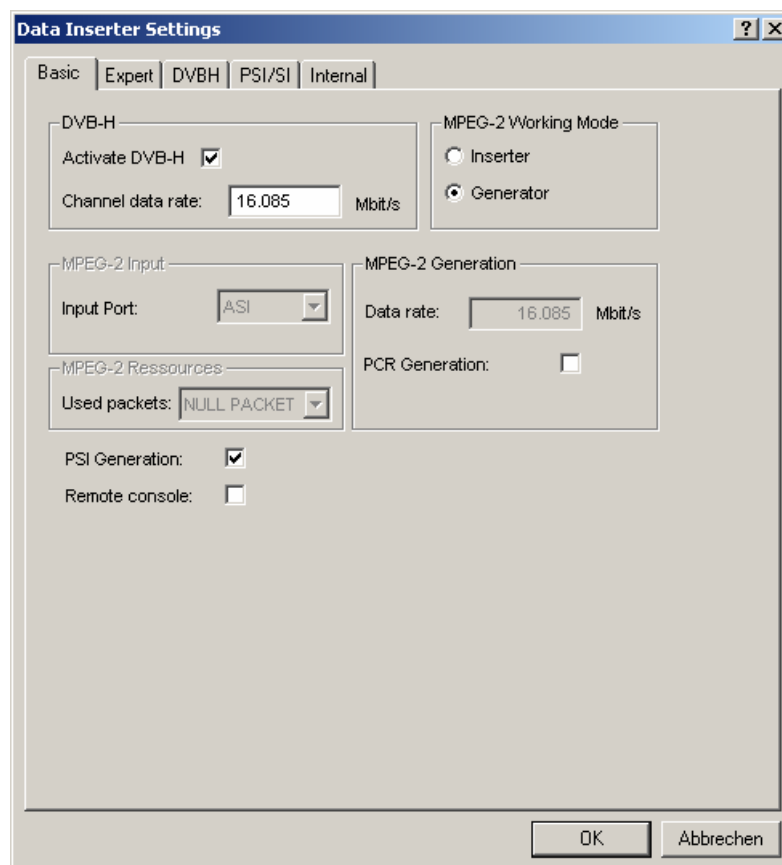


Figure 7.6: DTV Data Inserter, Basic Settings Panel

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The top part of the window is separated into the sections DVB-H and MPEG-2 Working Mode.

DVB-H

- Activate DVB-H: Checking this box will enable the DVB-H mode of the DTV Data Inserter DIP010-H and activate the time slicing mechanism. If unchecked, DVB-H and PSI/SI settings cannot be used. This field is only available at full version of the DTV Data Inserter.
- Channel data rate: Specifies the total channel data rate, that can be distributed to one or more Groups of Subchannels. The value has to be set in generator mode as well as in inserter mode. The channel data rate will be equal to the generator data rate in generator mode. Its range is 1.000 to 54.000 Mbit/s.

MPEG-2 working mode

It can be set to:

- Inserter: configure the DTV Data Inserter DIP010-H device to work as MPEG-2 TS bypassing device, using the free resources of the incoming MPEG-2 TS for opportunistic data insertion,
- Generator: configure the DTV Data Inserter DIP010-H device to work as MPEG-2 TS generating device and inserting the data into the generated MPEG-2 TS.

The rest of the basic settings panel is divided into two different blocks:

- Left half describing the MPEG-2 adjustments in the inserter mode
- Right half describing the MPEG-2 adjustments in the generator mode

Depending on the selected operating mode, the inserter or generator mode settings are available.

Basic settings in the inserter mode

- Input Port: Describes the connector at the front panel of the Inserter with MPEG-2 TS input. The DTV Data Inserter is capable of these types of input interfaces: ASI and SPI (see also 3.1.1 "External Connectors, Front Panel")
- Used packets: Describes the kind of MPEG-2 resources in the incoming MPEG-2 TS which will be used for the insertion of data packets: The user can choose here: Null packets (default option) or packets described by a base PID and a binary mask, which are set in Expert settings.

Basic settings in the generator mode

- Data rate: Specifies the sum rate of the MPEG-2 TS in Mbit/s generated by the DTV Data Inserter device, the granularity is 1 kbit/s. Range: 1.000 to 54.000 Mbit/s. This is only available if DVB-H mode is not activated, because it is the same as the channel data rate.

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- PCR Generation: Checking this box will enable the generation of the add Program Clock Recovery (PCR) information transported in the PES sections. PCR details will be set in the Expert settings.

PSI generation: To enable the generation of added PSI/SI tables in accordance to the settings on panel PSI/SI, this box has to be checked. Note: *In DVB-H mode this box must be checked. Details can be set up in PSI/SI panel.*

If the DIP010 is operating in inserter mode only the offset tables for the data service should be configured on sheet PSI/SI, i.e. in case of MHP service only one PMT and one AIT should be inserted additionally.

Detailed PSI/SI generation parameters can be set under Expert settings if this box is checked.

Checking the **Remote console** box starts the remote console capability for contacting the DTV Data Inserter application on a TCP/IP port. Execution of several API functions of the DTV Data Inserter is possible via remote console. For more details, please refer to the remote console section.

Changing the parameters requires a re-start of the application.

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7.4.2 Expert Settings

On the Expert settings sheet, advanced users can change all default adjustments of the DTV Data Inserter. These settings should not be changed. They can be changed in order to optimise the whole system configuration.

👉 There is no security for getting into this sheet, do not use it if you are not an expert.

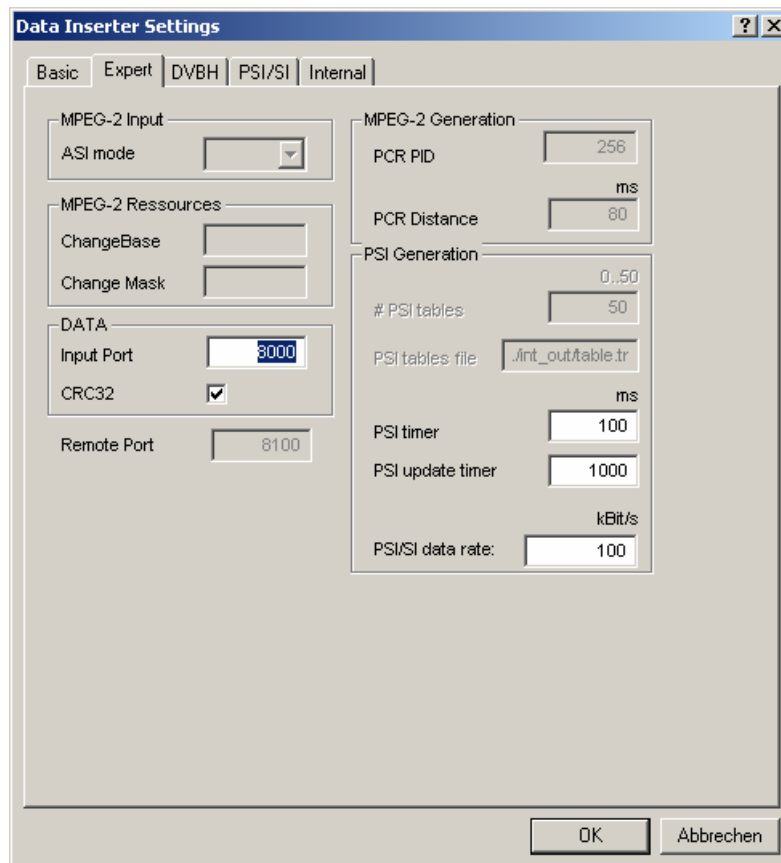


Figure 7.7: DTV Data Inserter, Expert Settings Panel

The expert settings panel is divided into three blocks:

- left part describing the MPEG-2 adjustments in the inserter mode
- top right part describing the MPEG-2 adjustments in the generator mode
- bottom right part describing the PSI/SI generation settings
- left lower part describing the settings related to the fetched data

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Expert settings in the inserter mode

- **ASI mode:** MPEG-2 packets can be distributed inside the transport stream in two different modes: continuous mode (same slot number between each packet) and burst mode (no slots or very long slots between the TS packets). In case of burst mode, MPEG-2 TS has to be cached in the hardware on input,
- **Change Base/Change Mask:** these parameters can be manipulated if the user has selected the "PID+Mask" option under "Used resources" in Basic settings. With the help of these two parameters, a range of PIDs can be used for data insertion.

Logic:

The PID of an incoming TS packet is binary AND'ed to the ChangeMask value. If the result equals the ChangePID, the respective TS packet is replaced by a packet containing IP data.

Example:

The PIDs 0x3C, 0x3D, 0x3E, 0x3F should be blanked.

The following parameters must be set:

ChangePID = 0x3C, ChangeMask = 0x1FFC so the PIDs: 0x3C - 0x3F are blanked.

Expert settings in generator mode

- **PCR PID / PCR Distance:** the generation of MPEG-2 TS requires the generation of PCR packets (for clock recovery on receiver side). This PID is signalled in the PMT table. Default values for the generation are: PID=0x100 and Timer=100 ms. Please do not change them if not necessary.

Expert settings for PSI generation

- **# PSI tables:** maximum number of MPEG-2 PSI/SI sections read from the tables file can be specified here. Each PSI Section can consist of several TS packets. Note: For DVB-H mode the recommended number of PSI tables is 50.
- **PSI tables file:** position and name with the file including the prepared PSI/SI sections can be specified here. If no valid file path will be specified here, default PAT and PMT will be generated in generator mode. Default for DVB-H is the file "C:/weboverdtv/DataInserter/int_out/table.trp".
- **PSI timer:** each table will be inserted with a specified timer. Default value is 100 ms, granularity is also 100 ms.
- **PSI update timer:** DTV Data Inserter works with two sets of PSI/SI tables – current and next one. While one set is inserted, the second one can be processed and be manipulated. As soon as new set of PSI/SI tables is stored a token signalling will be generated. DTV Data Inserter searches for the update token with the timer specified here, default each 1000 ms.
- **PSI/SI data rate:** In case of inserting many signalling tables this value reduces the speed of inserting them. So i.e. the DVB-H processing will not be impaired.

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Expert settings for DATA

- **Input Port:** describes the only UDP/IP port on which data prepared by the MediaRouter (see User Manual MediaRouter Ident.no. 3531.1848.42) is received by the DTV Data Inserter. There is no other data interface in the DTV Data Inserter. The default value is port: 8000, which is also set in the MediaRouter as default position of the DTV Data Inserter.
- **CRC32:** checking this box activates the generation of the CRC32 instead of default checksum in each DSMCC Multiprotocol Encapsulation section (in case of IP packets).

Remote Port

- TCP/IP port describing where the remote control console is running.

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7.4.3 DVBH Settings (only DVB-H option)

On the DVBH settings sheet, users can pre-configure one or more group configurations and set one configuration active to be used in the time slicing calculation.

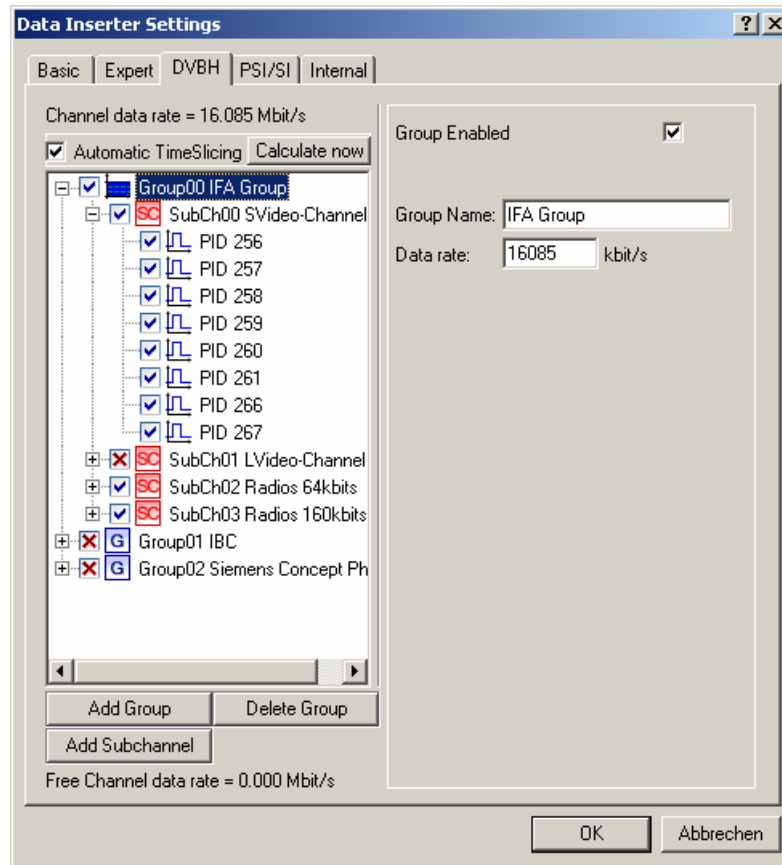


Figure 7.8: DTV Data Inserter, DVBH Settings Panel (group selected)

The window is divided into a left and a right part.

The left part features a tree structure for building up and arranging the time slicing structure. Group configurations and subchannels within the tree can be expanded to access their respective child elements.

Activating elements



Elements can be checked (activated) in the tree to participate in the time slicing calculation or unchecked (deactivated) to be temporarily excluded. **Note:** If the settings of an element do not fit the calculation process, the element is automatically deactivated.

Selecting elements

Elements selected in the tree (marked) can be configured in the right half of the window, which therefore varies with the type of element (group, subchannel, or service = PID).

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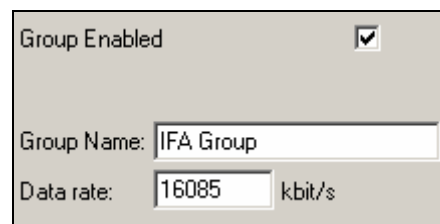
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Main controls

- **Automatic TimeSlicing:** Checking this box will enable the automatic calculation of bursts and simplify the group configuration considerably. It is therefore the recommended setting for most of the users (also for experts).
- **Calculate now:** This button works only, if the DTV Data Inserter processing is stopped. Pressing it will take over all changes you have made in this panel and starts a recalculation of the automatic TimeSlicing parameters.
- **Channel data rate:** Display of the total channel data rate, that has been set on the generator's Basic settings panel. Together with the **Free xxx data rate** displayed in the lower part of the window the information is helpful to plan the spreading of the available data rate.

Group related controls

If a group is selected in the tree, group related settings can be done on the right side, that take effect after confirming with OK.



The screenshot shows a dialog box titled "Group Enabled" with a checked checkbox. Below it, there is a "Group Name:" label followed by a text input field containing "IFA Group". At the bottom, there is a "Data rate:" label followed by a text input field containing "16085" and a unit label "kbit/s".

Figure 7.9: DTV Data Inserter, group related controls

The controls in the right half of the window are:

- **Group Enabled:** Checking this box will activate the selected group (and deactivate all other group configurations in return). It has the same effect as the checkboxes in the tree view on the left side.
- **Group Name:** For differentiation purposes a group name *can* be assigned.
- **Data rate:** Setting of the data rate that can be allocated by the selected group on MPEG-2 TS level.

The controls in the bottom left half of the window are:

- **Add Group:** Pressing this button will add a new group, that can be configured autonomous with subchannels and services.
- **Delete Group:** Pressing this button will delete the actually selected group.
- **Add Subchannel:** Pressing this button will add a new subchannel to the selected group.
- **Free Channel Data rate:** Display of the free data rate that is not yet allocated by the active group(s) of the involved DIP010 devices (generator and inserters).

Subchannel related controls

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If a subchannel is selected in the tree, subchannel related settings can be done.

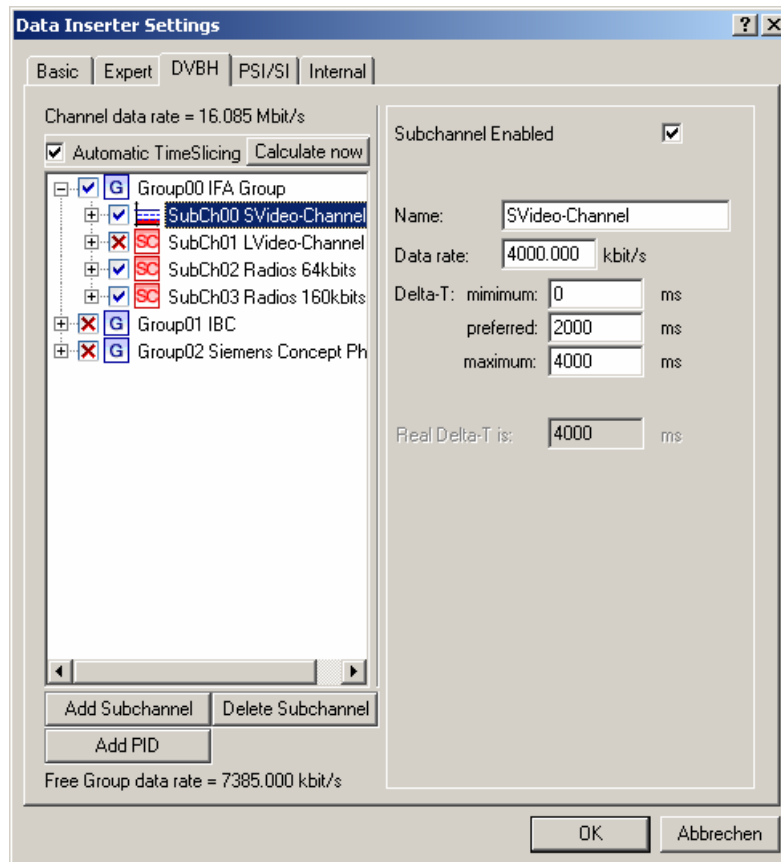


Figure 7.10: DTV Data Inserter, DVBH Settings Panel (subchannel selected)

The controls in the right half of the window are:

- **Subchannel Enabled:** Checking this box will activate the selected subchannel. It has the same effect as the checkboxes in the tree view on the left side.
- **Name:** For differentiation purposes a subchannel name *can* be assigned.
- **Data rate:** Setting of the data rate that can be allocated by the selected subchannel on MPEG-2 TS level. The data rate sum of all subchannels within one group must not exceed the group data rate!
- **Delta-T (minimum/maximum):** In case of automatic time slicing the calculation of Delta-T is done in two steps: Step 1 is the synchronisation of all Delta-T to the smallest (compare to chapter 1.4.1), whereas step 2 ensures that the user constraints Delta-T maximum and Delta-T minimum are fulfilled. **Delta-T: maximum** enables the provider to reduce the Delta-T (calculated in step 1), which can help to minimize the switching time, that might take long time when customers are switching between services. **Delta-T: minimum** on the other side provides the possibility to set a lower limit, that restricts the power consumption of the mobile device to a reasonable value. Note: Both limits must be set, if Automatic TimeSlicing is checked. If a service of the subchannel cannot fit a constraint, it will be automatically deactivated!

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- **Delta-T: preferred:** If Delta-T: maximum is maintained for all services of the subchannel, a subsequent calculation is initiated to accomplish the preferred value (if possible without loss of services). *Note: In most cases it may be sufficient to set Delta-T: preferred to Delta-T: maximum.*
- **Real Delta-T is:** If Automatic TimeSlicing is activated this field shows the calculated Delta-T value. If Automatic TimeSlicing is disabled this value has to be set manually. The other Delta-T values will be deactivated.

The controls in the left half of the window are:

- **Add Subchannel:** Pressing this button will add a new subchannel, that can be configured autonomous with services.
- **Delete Subchannel:** Pressing this button will delete the actually selected subchannel.
- **Add PID:** Pressing this button will add a new service to the selected subchannel. The procedure is explained in detail in the next section "Service related controls".
- **Free Group Data rate:** Display of the free data rate that is not yet allocated by the selected subchannel.

Service related controls

If a service (PID) is selected in the tree, service related settings can be done.

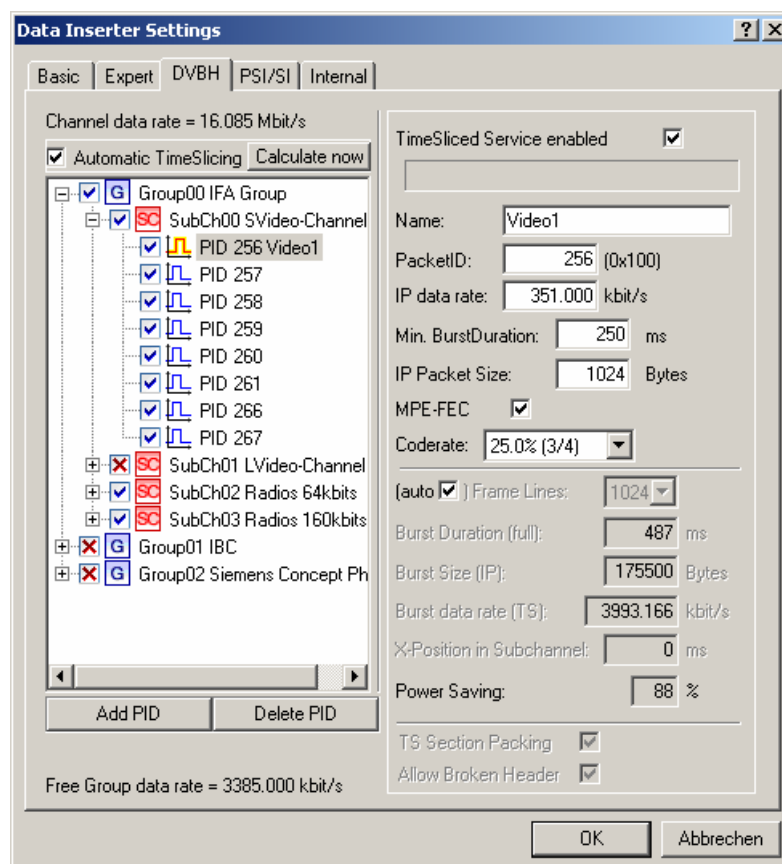


Figure 7.11: DTV Data Inserter, DVBH Settings Panel (service selected)

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The controls in the right half of the window that must be set if automatic time slicing is switched on, are:

- **TimeSliced Service enabled:** Checking this box will activate the selected service. It has the same effect as the checkboxes in the tree view on the left side.
- **Name:** For differentiation purposes a service name *can* be assigned.
- **PacketID:** To select a specific service the PacketID must comply with the respective PID assigned in the MediaRouter. The Number can be set as decimal or hex-value (with "0x" as prefix), either when adding a new Service (Add PID) or later per input field.
- **IP data rate:** Setting of the maximum IP data rate of the service. An applicable value can be found by means of the MediaRouter display.
- **Min BurstDuration:** Setting of a minimum burst duration to reduce the risk of data loss in consequence of signal interceptions (see chapter 1.4.1).
- **IP Packet Size:** This parameter describes the average size of incoming IP packets and is needed to calculate an adequate overhead. If the value is set to large, an increased number of lost IP packets is the consequence. Vice versa this criterion can be used to find an applicable value: Starting i.e. at 800 Bytes (recommended value) the IP packet size can be enlarged step by step until reaching a limit, that is found at the occurrence of delayed or lost IP packets. Note: If the number of services to be wrapped in the subchannel is not critical, it is a good idea to choose a smaller value (i.e. 500 Bytes), that establishes a big overhead in the calculations, thus the lost of IP packets can certainly be prevented. Please also have a look at main GUI service statistic at the values "IPSize" and even at "Delayed IP".
- **MPE-FEC:** Unchecking this box will disable the processing of FEC data.
- **Coderate:** To specify the strength of forward error correction (if MPE-FEC is switched on) a code rate can be selected. Coderate is the proportion application data to Reed Solomon data. The coderate will be kept while the system is running by automatic puncturing (refer to 1.4.1).

$$Coderate = \frac{100 \cdot BurstSize_{IP}}{BurstSize_{IP} + BurstSize_{FEC}} \%$$

- **auto** – Checkbox for **Frame Lines:** The DTV Data Inserter software normally calculates the Line count of the MPE-FEC frame automatically to the slowest values depending on the result of the Burst Size (IP) and the configured code rate. If you are an experienced user and want to set the number of frame lines manual, uncheck the auto checkbox and set the Frame Lines manually.



The lower part of the right window section comprises parameters that are calculated if automatic time slicing is switched on, but have to be set manually, if the automatic is switched off. These controls are:

- **Frame Lines:** calculated optimum of lines within the MPE-FEC frame
- **Burst Duration (full):** Exact burst duration of complete burst (including MPE-FEC)

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- **Burst Size (IP):** Maximum burst size of the Application Data Table of the MPE-FEC Frame (IP data) (refer to 1.4.1)
- **Burst data rate (TS):** Maximum Transport stream data rate of the burst; the value can vary at runtime (can be smaller), depending on incoming IP data rate
- **X-Position in Subchannel:** Relative time position within the subchannel in ms. i.e. if a service forms always the 2nd burst and the first burst has a burst duration of 250 ms the x-position in subchannel for the 2nd burst will be 250ms. This is the start time of the burst.
- **Power Saving:** resulted receiver power saving in contrast to the non time-sliced inserting (approx. value; does not include shut down and power on time of the receiver)

The controls in the left half of the window are:

- **Add PID:** Pressing this button will add a new service to the subchannel, that has to be specified by means of the packet ID (decimal or hex-value).
- **Delete PID:** Pressing this button will delete the actually selected service from the subchannel.

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7.4.4 PSI/SI Settings (only DVB-H option)

The DataInserter is able to generate a complete set of Program Specific Information / Service Information (PSI/SI) containing the following Signalling tables:

- Program Associated Table (PAT)
- Program Map Table (PMT)
- IP/MAC Notification Table (INT)
- Network Information Table (NIT)
- Service Description Table (SDT)

The PSI/SI settings sheet can be logically divided into three main sections.

Upper section

The upper section comprises four buttons to choose the PSI/SI Signalling Mode. These buttons are:

- **OFF:** the signalling is totally switched off
- **Small:** initializes a small signalling with a reduced set of tables containing only PMT and INT tables.
- **Custom:** enables the choice of a customized set of tables
- **Full:** initializes the full signalling with all possible tables enabled

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The screenshot shows the 'Data Inserter Settings' dialog box with the 'PSI/SI' tab selected. The 'Basic' tab is also visible. The 'PSI/SI Signalling Mode' is set to 'Full'. The 'PAT' checkbox is checked, with 'Version number' set to 1 and 'Transport Stream ID' set to 18 (0x12). The 'PMT's' checkbox is checked, with 'PMT PID Range' set from 65 to 69. The 'INT (use: ./INT_IN/INTLib.xml)' checkbox is checked, with 'AUTOMATIC Mode' unchecked. The 'PMT (signalling INT)' checkbox is checked, with 'Version number' set to 3. The 'INT PID' is set to 1872 (0x750) and the 'ServiceID INT-PMT' is set to 65500 (0xffdc). The 'IP/MAC_stream_location_descriptor (standard values)' section shows 'NetworkID' as 0x69, 'Original NetworkID' as 0x98c, and 'Transport Stream ID' as 0x5. The 'NIT (use: ./INT_IN/NIT.xml)' and 'SDT (use: ./INT_IN/SDT.xml)' checkboxes are both checked. A 'Create PSI immediately' button is at the bottom right. The 'OK' and 'Abbrechen' buttons are at the bottom.

Figure 7.12: DTV Data Inserter, PSI/SI Settings Panel

Middle section

Starting from a full signalling with activated full automatic Mode (check box) only a few settings are to be done in the middle section.

- **Version number:** a number that characterizes the version of the actual PAT
- **Transport Stream ID:** a provider specific descriptor (in case of doubt we recommend to retain the default setting)
- **PMT PID range:** the range must be set in such a way, that it does not conflict with the PID range used for the services; it is recommended to reserve at least 5 PIDs (according to 5 PMT)
- **AUTOMATIC Mode:** This function creates a simple INT configuration automatically for each configured service.
At automatic mode only the basic information of the platform will be taken over from the INTLib.xml file (see **7.5 Expert Signalling settings (only DVB-H option)**)
- . The N1_loop's will be ignored. All services that are configured in the DataInserter software will get an automatically generated IP/MAC_Stream_location descriptor with

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an automatically generated ServiceID. The DataInserter software will put as much services as possible into one PMT (using the same ServiceID). If the PMT reaches the maximum size of 1024 bytes a new PMT with incremented ServiceID will be generated.

Unfortunately the automatic INT table does not contain any IP address descriptors. If they are needed the automatic mode should not be used. Please refer to chapter **7.5 Expert Signalling settings (only DVB-H option)**

-


Attention Experts:

-  **If AUTOMATIC mode is switched on, the N1-loops in INTLib.xml will not be analysed!**
-  **In AUTOMATIC mode, the IP addresses of the services will NOT be signalled!**

- **ServiceID INT-PMT:** changing the default setting is only recommended for experienced users. The Service ID must not be already defined for any service. The DataInserter will generate a single PMT only for describing the INT. It is not possible to include the service references to this PMT.
- **INT PID:** the setting for INT PID must not conflict with other PIDs already used (Neither Service PID's nor PMT PID's)
- **Version number:** the version number of INT should be incremented if a new table is generated
- **NetworkID:** This value can only be set in fully automatic mode. It is needed for automatic generation of the IPMAC_Stream_Location_Descriptor (tag 0x13).
- **Original NetworkID:** This value can only be set in fully automatic mode. It is needed for automatic generation of the IPMAC_Stream_Location_Descriptor (tag 0x13).
- **Transport_Stream_ID:** This value can only be set in fully automatic mode. It is needed for automatic generation of the IPMAC_Stream_Location_Descriptor (tag 0x13).

Lower section

Pressing the button **Create PSI immediately** in the right corner triggers the immediate creation of the PSI/SI signalling in compliance to ETSI EN 300 468. It is not necessary to restart the DataInserter processing after changing the signaling.

-  **If the message “There were errors with PSI/SI Generation.” appears in DataInserter log window, there were problems with PSI/SI creation. Please have a look into the file “C:\WeboverDTV\DataInserter\int.log” for a detailed error description!**

7.4.5 Internal Settings

On the Internal settings sheet, users can change some internal application parameters, which can influence the data processing in the Inserter (!). These settings are not required to be changed, they can be changed in order to optimise the whole system configuration.

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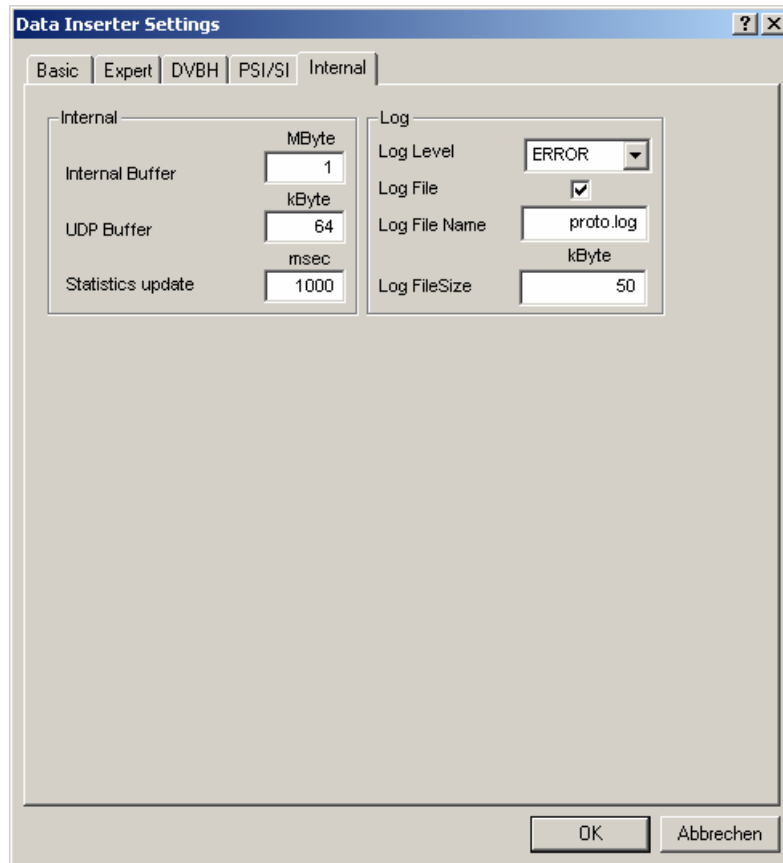


Figure 7.13: DTV Data Inserter, Internal Settings Panel

Two logical sections are provided within the internal settings:

- Internal: all internal application control values
- Log: level of the log information written to the log window on main GUI and to the log file

Internal settings

- **Internal Buffer:** size of the internal buffer of the DTV Data Inserter for intermediate buffering of data packets. Depending on the size, data rate peaks can be buffered here. The size of the buffer influences the delay of the data packets. Default 1 MByte. In DVB-H mode the internal buffer is irrelevant.
- **UDP Buffer:** size of UDP sockets receiving buffer for keeping incoming UDP packets before they will be collected by the DTV Data Inserter. High values are advantageous for a burst network behaviour. Default value (=max) is 64 kByte.
- **Statistics update:** interval between the refreshing of values on the GUI. Default value = 1000 milliseconds (1 second), min= 100 ms. Please do not use a too small value here. A too small value can influence the performance of the system and may also influence the accuracy of the time slicing processing.

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Log

In this section, a user can specify the amount of the log messages from the DTV Data Inserter:

- **INFO:** all log messages will be shown and saved (recommended for test purposes only, maximum performance is required!). **Attention: Info log level will influence the performance of the DTV Data Inserter! The accuracy of the time slicing may be negatively influenced!**
- **WARNING:** only warnings and errors will be shown and saved (recommended for test purposes only, increased performance is required)
- **ERROR:** only error messages will be shown and saved (**recommended setting**).

Checking the box “Log file” will enable the saving of the debug information into a text file. Each log information is saved together with a time stamp and the level type of the message.

- **Log File Name:** name of the log file. The file will be saved to the DTV Data Inserter working directory: C:\weboverdtv.actual\dtvipinserter\,
- **Log File Size:** size of the log file in kbytes, the messages will be written wrap-around. Default size is: 50 kByte.

7.5 Expert Signalling settings (only DVB-H option)

This chapter is very important for experts that want to use the full signalling functionality of the DIP010.

The DataInserter software uses the following *.xml files for generating PSI/SI signalling:

- C:\WeboverDTV\DataInserter\INT_IN\IntLib.xml
- C:\WeboverDTV\DataInserter\INT_IN\INIT.xml
- C:\WeboverDTV\DataInserter\INT_IN\SDT.xml

These files can only be edited by hand or by the DVBHWizard software.
In the following the editing by hand will be described in detail:

7.5.1 INT Table configuration with INTLib.xml

The configuration file INTLib.xml is the base for generating the IP/MAC Notification Table (INT) and the corresponding PMT tables. It contains all static settings with information about the platforms and IP/MAC streams. The xml-structure is nearly the same as the structure of the INT table (see ETSI EN 301 192). It can be seen in the following figure.

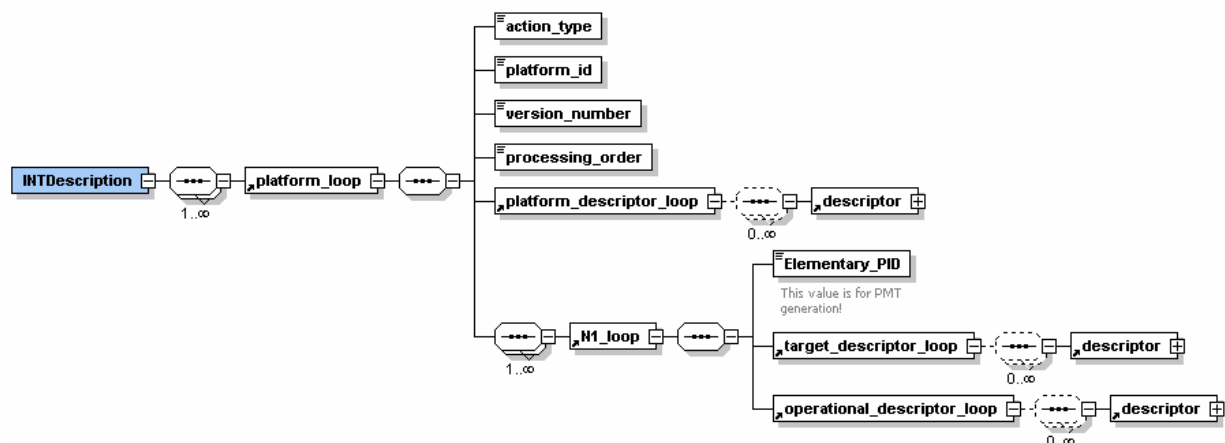


Figure 7.14: Structure of INTLib.xml

As defined in ETSI EN 301 192 the 1st loop (platform_descriptor_loop) is used to describe the IP/MAC platform (related to the platform_id). The 2nd loop (N1_loop) associates an operational_descriptor_loop with a target_descriptor_loop. Each N1_loop describes exactly one elementary stream.

Differently from the INT table structure the INTLib.xml contains a field called Elementary_PID. This information is necessary for the DataInserter software to assign the N1_loop settings to a PMT table.

👉 **The INTLib.xml structure complies to the xml standard and is also described in the file "Input_int.xml.xsd".**

The INTLib.xml has to contain at least the following values:

- action_type
- platform_id (The platform_id_hash will be generated automatically by the DataInserter software)
- version_number

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- processing_order
- at least one N1_loop
- each N1_loop has to contain at least one Elementary_PID

The following table shows an overview over the possible descriptors:

Descriptor	Tag Value	Allowed in Loop		
		Platform	Target	Operational
reserved	0x00			
target smartcard descriptor	0x06		*	
target MAC address descriptor	0x07		*	
target serial number descriptor	0x08		*	
target IP address descriptor	0x09		*	
target IPv6 address descriptor	0x0A		*	
IP/MAC platform name descriptor	0x0C	*		
IP/MAC platform provider name descriptor	0x0D	*		
target MAC address range descriptor	0x0E		*	
target IP slash descriptor	0x0F		*	
target IP source slash descriptor	0x10		*	
target IPv6 slash descriptor	0x11		*	
target IPv6 source slash descriptor	0x12		*	
IP/MAC stream location descriptor	0x13	* ¹⁾		*
ISP access mode descriptor	0x14	*		*
telephone descriptor	0x57	*		*
private data specifier descriptor	0x5F	*	*	*
user private	0x80 to 0xFE			
reserved	0xFF			

¹⁾ The IP/MAC_stream_location_descriptor should not be used in the Platform Descriptor loop. But the software has no problems creating it.

The following figure shows a simple INTLib.xml for one service:

```
<?xml version="1.0" encoding="UTF-8"?>
<INTDescription>
  <platform_loop>
    <action_type>0x01</action_type>
    <platform_id>0xffff02</platform_id>
    <version_number>12</version_number>
    <processing_order>0</processing_order>
    <platform_descriptor_loop>
    </platform_descriptor_loop>
    <N1_loop>
      <Elementary_PID>0x64</Elementary_PID>
      <target_descriptor_loop>
      </target_descriptor_loop>
      <operational_descriptor_loop>
        <descriptor tag="0x13">
          <network_id>0x1234</network_id>
          <original_network_id>0x1234</original_network_id>
          <transport_stream_id>0x1234</transport_stream_id>
          <service_id>0x0032</service_id>
          <component_tag>0x60</component_tag>
        </descriptor>
      </operational_descriptor_loop>
    </N1_loop>
  </platform_loop>
</INTDescription>
```

Figure 7.15: Simple example for an INTLib.xml

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The structure of the INTLib.xml file is defined as follows:

Each INTLib.xml file has to begin with the start tag <INTDescription> closed with the end tag </INTDescription> at the end of the document. This tag must not be twice in the file.

An INT table can describe multiple platforms. Therefore the tag "<platform_loop>" is defined. To describe multiple platforms simple repeat the platform_loop as like as to be seen in the example on the right.

```
<INTDescription>
  <platform_loop>
    ...
  </platform_loop>
  <platform_loop>
    ...
  </platform_loop>
</INTDescription>
```

The INT table is defined in ETSI EN 301 192 as to be seen in Figure 7.16.

Name	Number of bits	Identifier	Remarks
IP/MAC_notification_section() {			
table_id	8	uimsbf	0x4C
section_syntax_indicator	1	bslbf	1b
reserved_for_future_use	1	bslbf	1b
reserved	2	bslbf	11b
section_length	12	uimsbf	
action_type	8	uimsbf	see table 14
platform_id_hash	8	uimsbf	
reserved	2	bslbf	11b
version_number	5	uimsbf	
current_next_indicator	1	bslbf	1b
section_number	8	uimsbf	
last_section_number	8	uimsbf	
platform_id	24	uimsbf	
processing_order	8	uimsbf	0x00
platform_descriptor_loop()			
for (i=0, i<N1, i++) {			
target_descriptor_loop()			
operational_descriptor_loop()			
}			
CRC_32	32	rpchbf	
}			

Figure 7.16: Syntax of INT table (EN 301 192)

The DTV Data Inserter software needs only the most important values to be set in the xml file. The following values of the INT table must **not** be set:

- table_id → will be automatically set to 0x4C
- section_syntax_indicator → will be always set to 1
- section_length → will be calculated automatically
- platform_id_hash → will be automatically generated from the platform_id
- current_next_indicator → will be set automatically
- section_number → will be set automatically
- last_section_number → will be set automatically
- all "reserved" values → will be automatically set to "1"

All length fields will set automatically.

The "platform_descriptor_loop", the "N1_loop", the "target_descriptor_loop" and the "operational_descriptor_loop" can be handled the same way as the platform loop. They can be repeated. Differently from the INT table definition the INTLib.xml needs also the value "Elementary_PID".

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Each descriptor loop can contain at least one descriptor. The descriptor coding is shown in the following example:

```
<descriptor tag="0x13">
  <network_id>0x1412</network_id>
  <original_network_id>0x1555</original_network_id>
  <transport_stream_id>0x1124</transport_stream_id>
  <service_id>0x3334</service_id>
  <component_tag>0x23</component_tag>
</descriptor>
```

Figure 7.17: descriptor coding example

Each descriptor has to begin with the start tag <descriptor tag="0x..."> and end with the end tag </descriptor> (do not forget this). The start tag contains the hexadecimal value for the descriptor tag (here: 0x13). This unique tag value identifies the descriptor.

Most descriptors can be repeated within one loop. If there is a descriptor that must not be repeated the software will not check for this!

Please be sure that the descriptors you configure are also defined for the actual descriptor loop. Have a look at ETSI EN 301 192 (for INT table) and ETSI EN 300 468.

Name	Number of bits
IP/MAC_stream_location_descriptor () {	
descriptor_tag	8
descriptor_length	8
network_id	16
original_network_id	16
transport_stream_id	16
service_id	16
component_tag	8
}	

Figure 7.18: ETSI definition for descriptor "0x13"

The descriptor coding for the xml file is always nearly the same as defined in the ETSI documents. The table in Figure 7.18 shows the ETSI descriptor coding of the descriptor with tag 0x13 according to the example in Figure 7.17. The descriptor_length will be calculated automatically by the DTV Data Inserter software so the value must not be written into the xml file. Please also think always on correct spelling. All other descriptors work in the same way.

To guarantee a correct DVB-H signalling the IP/MAC_stream_location descriptor (descriptor tag 0x13) should be contained in every operational descriptor loop of each N1_loop. The DataInserter software needs its service_id to create an appropriate PMT.

The service_id within the IP/MAC_stream_location descriptor (located in operational_descriptor_loop) will be used as program number for PAT and PMT generation. With the example from Figure 7.15 the DTV Data Inserter software will create a PMT with the program number 0x32 referencing to the stream with elementary PID 0x64 in its stream_loop. The PAT will reference to the PMT with program_number 0x32.

You can use the same service_id for multiple services (N1_loop's). The DataInserter software will put the services with the same service_id into the same PMT's.

☞ **The maximum size of one PMT table is 1024 bytes. If this size is reached the DataInserter will not put any more services into this PMT. The DataInserter will save the following message into the "int.log" file: "Too many programs in one PMT**

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(max.1024Bytes): ServiceID=0x%x, PID 0x%x removed!" Put the service into another PMT by using a different service_id.

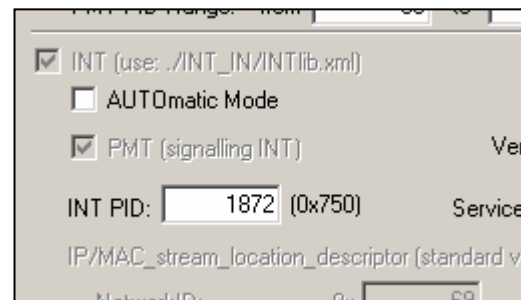
The IP/MAC_stream_location descriptor located in the platform_descriptor_loop (not recommended) will not be used for PAT or PMT generation. It will only appear in the generated INT table.

If one service does not contain an IP/MAC_stream_location descriptor it will not be referenced by any PMT!

☞ The Time Slice and FEC identifier descriptor (time_slice_fec_identifier_descriptor) with descriptor tag 0x77 will be created automatically from the settings made in the DataInserter. It must not be included in the INTLib.xml file!

☞ Take care with Elementary PID's. They must not be used twice. Compare to the settings you have made in DataInserter, too!

☞ The PSI/SI settings in DataInserter software allow the setting of an "AUTOMATIC Mode" (see picture on the right side). This Mode has to be switched off when editing the INTLib.xml! If it is activated the DataInserter will not analyse the N1_loop's. It will generate a simple INT table for easy signalling.

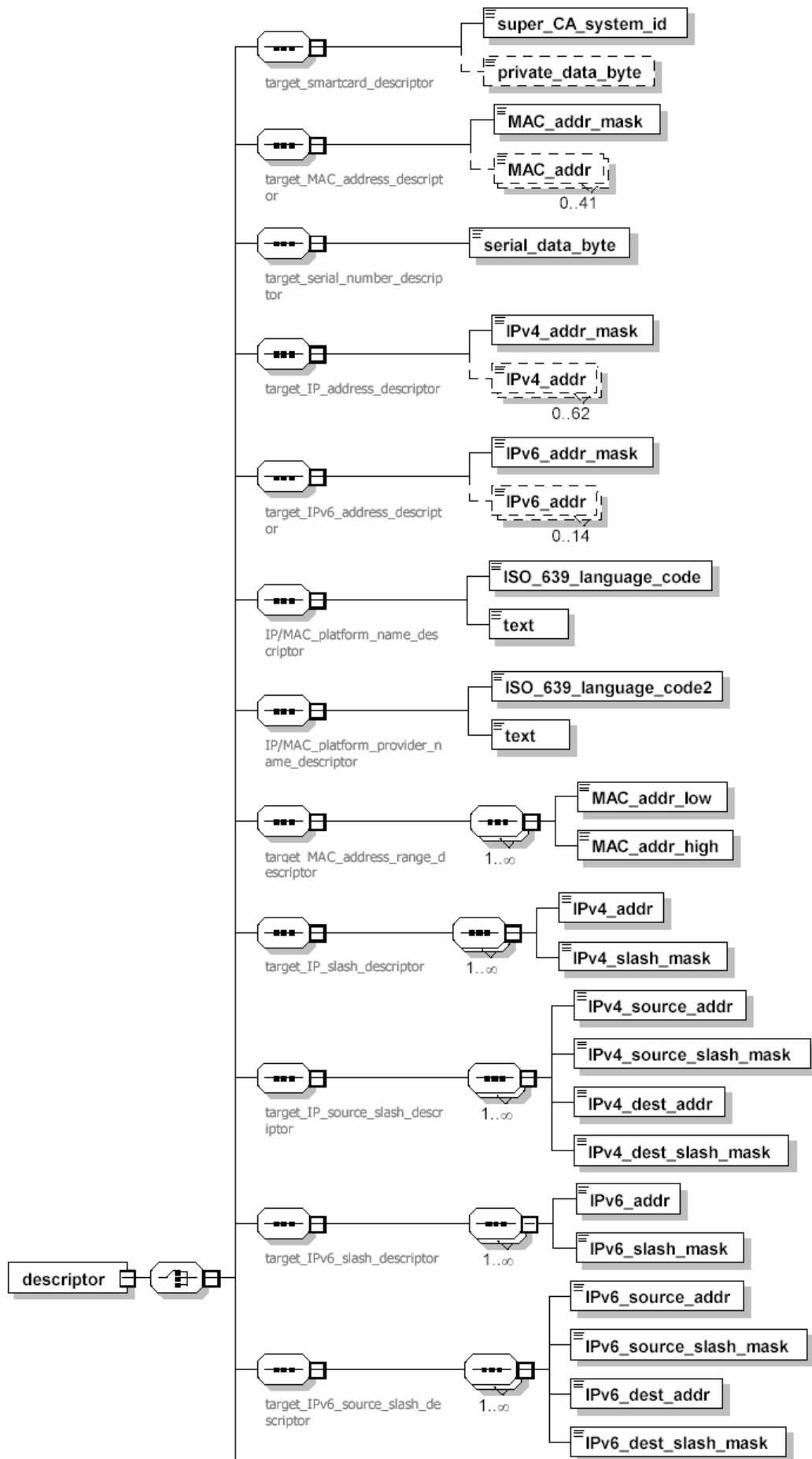


☞ If the message "There were errors with PSI/SI Generation." appears in DataInserter log window, there were problems with PSI/SI creation. Please have a look into the file "C:\WeboverDTV\DataInserter\int.log" for a detailed error description!

The following figure shows the input format of all possible descriptors. An example for all descriptors is also included on the DIP010 in the INT_IN directory. It is called INTLib_complex.xml.

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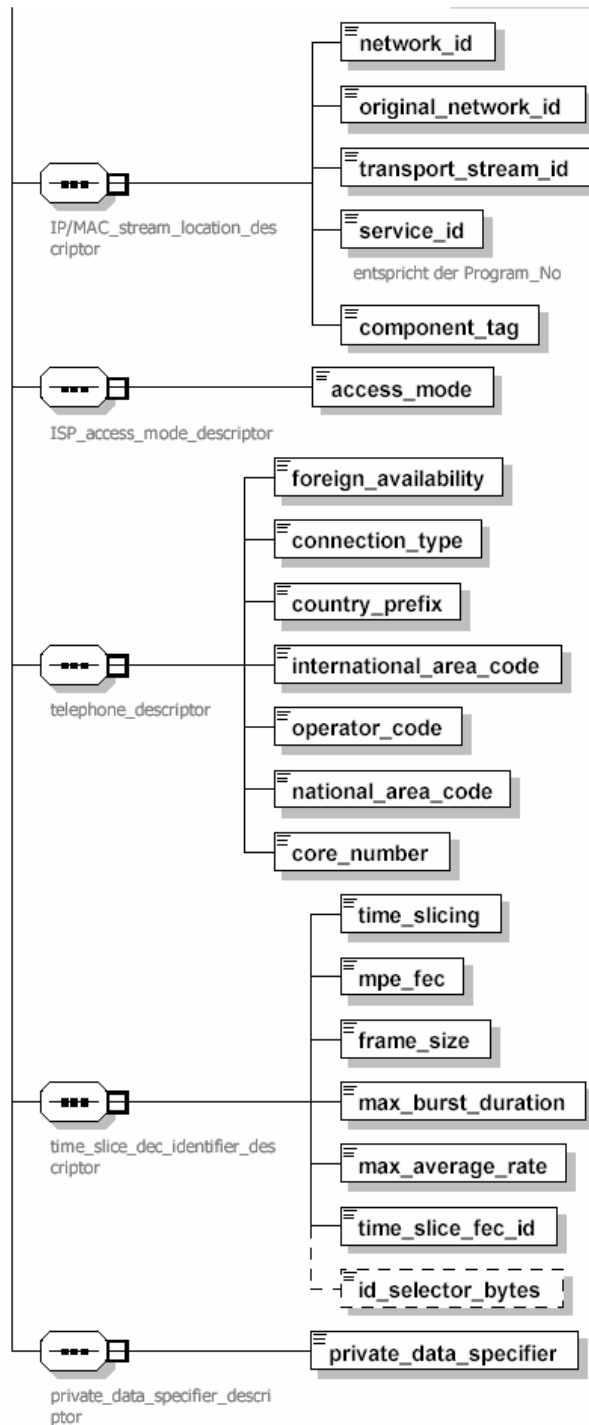


Figure 7.19: Descriptor input format for INTLib.xml

The following figure shows an example for the complete signalling configuration. Here you can see the relations between the most important settings.

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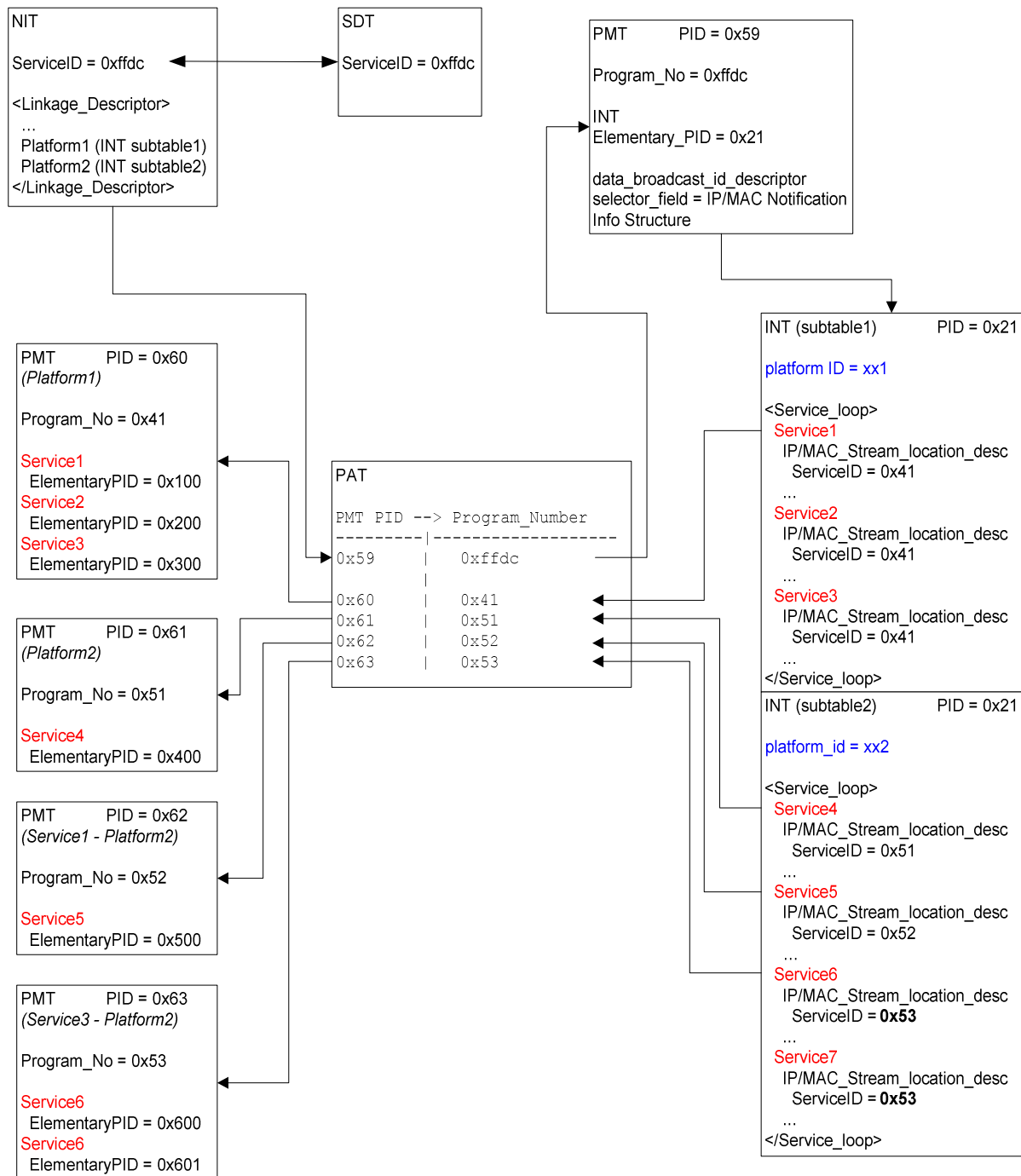


Figure 7.20: Example configuration and its relations to PAT and PMT

7.5.2 NIT Table configuration with NIT.xml

The configuration file NIT.xml is the base for generating the Network Information Table(NIT). It contains all static settings with information about the network. The xml-structure is nearly the same as the structure of the NIT table (see ETSI EN 300 468). It can be seen in the following figure.

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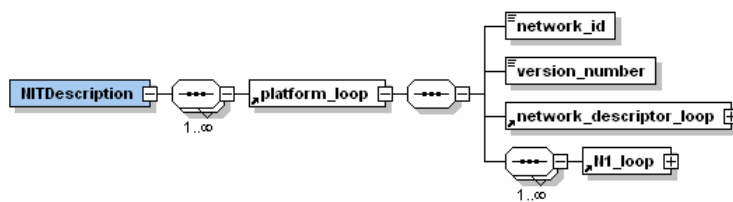


Figure 7.21: Structure of NIT.xml

You can find an example for the NIT.xml in the directory
“C:\WeboverDTV\DataInserter\Int_in\nit.xml”.

7.5.3 SDT Table configuration with SDT.xml

The configuration file SDT.xml is the base for generating the Service Description Table (SDT). It contains all static settings with information about the network. The xml-structure is nearly the same as the structure of the SDT table (see ETSI EN 300 468).

An example can be found in the directory “C:\WeboverDTV\DataInserter\Int_in\sdt.xml”.

8. Setting up a DVB/IP Transmission System

Each DIP010 with DVB-H option will have a preconfigured DVB-H session installed, starting at system start-up.

The required steps for setting-up a simple IP data transmission system are:

1. Start DTV Data Inserter application
2. Start MediaRouter service (see User Manual MediaRouter Ident.no. 3531.1848.42)
3. Configure Networks/IP addresses for transport

Steps 1 and 2 will be executed automatically on each delivered DTV Data Inserter. Only step 3 has to be done.

If some adjustments are necessary in the DTV Data Inserter, e.g. the MPEG-2 input port is not ASI but SPI, please finish all and restart the application. All values will be saved. The DTV Data Inserter is running and there is no necessity to interrupt its operation.

If you want to change the basic parameters of the MediaRouter, e.g. port numbers or interface selection, you will have to restart the service afterwards. All values will be saved. The MediaRouter is running and there is no necessity to interrupt its operation.

You can configure the networks anytime without interrupting the operation of the MPEG-2 chain. Please add the MediaRouter a network and specify single IP addresses within this network.

Compare with the example configuration in the MediaRouter chapter. Now you can test the work of the whole system.

Assuming you have configured the IP=192.168.1.2, please open an operating system command box (Start->Run , type "cmd"). Please write here:

```
ping 192.168.1.2
```

Now you should see the green light on the MediaRouter and the green data light on the DTV Data Inserter. Your system has been configured successfully for this IP address ☺

An example for a DVB-H transmission system can be seen in Figure 8.1. This should contain at least one video ip source, here: video camera connected to a H264 video encoder, being connected to the DIP010 via Ethernet interface. For a first test of the transmitting system you might send the video to the same IP address as tested above with the ping. Secondly you should use a multicast IP address for transmitting the DVB-H video.

The MPEG-2 Transportstream generated by the DIP010 will be send by a transmitter, here: the broadcast test system and transmitter R&S SFU to the antenna.

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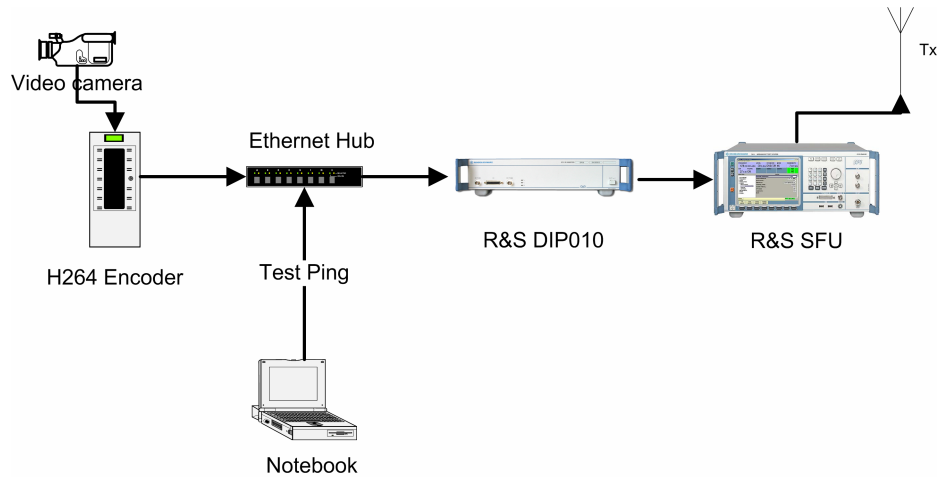


Figure 8.1: DVB-H Transmission System

9. Remote Control Interface

The remote control interface is a capability included in each application of DTV Data Inserter systems. It is simply a TCP/IP server socket waiting for client connections and understanding a set of predefined commands with fixed syntax.

The remote control interface is used for configuration, monitoring and maintenance purposes.

The remote control interface is used for:

- monitoring the running status of the DTV Data Inserter
- starting/killing the DTV Data Inserter application

The following commands are currently supported:

SET COMMANDS:

- SET KILL:** forces DTV Data Inserter to exit and unload from memory (use it only in emergency cases)
- SET DEBUG:** switch to FULL answer mode, so called “human” mode,
- SET NODEBUG:** switch to normal, brief answer mode.

GET COMMANDS:

- GET RUN:** returns state of the DTV Data Inserter (started/stopped).
- GET TSSYNC:** returns the info whether there is a valid MPEG-2 TS on the input connector of the DTV Data Inserter,
- GET TSRATE:** returns the data rate value of the whole MPEG-2 TS and of null packets on input,
- GET DATARATE:** returns the current and peak value of the data rate of inserted data packets,
- GET PACKETS:** returns the number of inserted data: IP packets, TS packets and bytes,
- GET IDENT:** returns the identification of the DTV Data Inserter.

HELP Commands:

- QUIT:** quits the remote console session,
- EXIT:** quits the remote console session,
- HELP:** displays the list of all available commands.

Note: New commands and even a SNMP interface are actually in development (20.01.2006).

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9.1 Using the Remote Control Interface

In order to test the remote control interface, simply call the “telnet” application at the command line. Example: if the DTV Data Inserter has the IP network address 131.0.55.71 and the command port of the DTV Data Inserter is set to: 8100 (default), write at command line:

```
telnet 131.0.55.71 8100
```

After the connection has been established, please write the command: **SET DEBUG** and switch on the echo mode. Now you can write **HELP** to see the command list from above, etc.

Using “telnet “ is only for test purposes and for specialists. The remote control interface is dedicated to be integrated in a management system, which will provide the remote configuration in an easier way. **EXIT** or **QUIT** ends the remote console session.

9.2 Remote Control Session

The remote control module supports two answer modes: silent and full (echoed “human”) mode. Silent mode means :

- no terminal echo
- no command prompt
- no responses to SET commands
- minimum output to GET commands

Full answer mode means:

- terminal echo used
- “DataInsRC>” command prompt used
- reports about all commands (SET and GET groups) have been sent

The remote control session starts always in silent mode. If necessary, use the commands SET DEBUG and SET NODEBUG to switch to full mode and back to silent mode. The silent mode is used for easily parsing answers of the DTV Data Inserter by management programs. There are only two rules for the silent mode:

- SET commands never have responses,
- GET commands always return one string terminated by a CR/LF pair. There is only one exception: the GET IPMACN <Net#> command returns zero, one or more rows of text, each row is terminated by a CR/LF pair, and the whole list of rows is terminated by an empty row with CR/LF symbols only. If there are no records in the IP/MAC table for appropriate <Net#> parameter – only two bytes – CR/LF – have returned.

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For example, the command GET RUN returns in human mode:

*** DataInserter *** - State: Running.

DataInsRC>

In silent mode, it returns:

1

Some GET commands and possible responses in both modes:

Commands	Answer in Full Mode	Silent Mode
GET RUN	*** Data Inserter *** - State: Running.	1
GET TSSYNC	*** Data Inserter *** - TS Sync found *** Data Inserter *** - TS Sync not found	1 0
GET TSRATE	*** Data Inserter *** - TS Rate: 23.000 PID rate: 1.000	23.00 2.100
GET DATARATE	*** Data Inserter *** - Data Rate: 1.345 Peak data rate: 2.012	1.345 2.012
GET PACKETS	*** Data Inserter *** - IP packets: 1036 TS packets: 6265 Bytes: 11256	1036 6265 11256
GET IDENT	*** Data Inserter *** - Identification: DIP010 SerNr: 100006	8 100006

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10. Remote Control of the DTV Data Inserter

The *Remote Administrator*, a standard help-desk tool for the remote-control of instruments linked to a TCP/IP network, is installed on the hard disk of the DTV Data Inserter. It can be found under Programs → Remote Administrator in the Windows startup menu.

The *Remote Administrator* program is made up of two components: viewer and server. Viewer should be activated on the PC that remotely controls the DTV Data Inserter. On the DTV Data Inserter controller, only the server needs to be active. The server is installed as a system service and starts automatically when the controller is booted. The two units must be linked by a network cable (e.g. both may be connected to the local network or linked via the Internet).

Remote control is performed via the Internet protocol TCP/IP, which must be installed on the two controllers. The tool is officially registered. This is shown by the message displayed in the Viewer window directly after the application has been started.

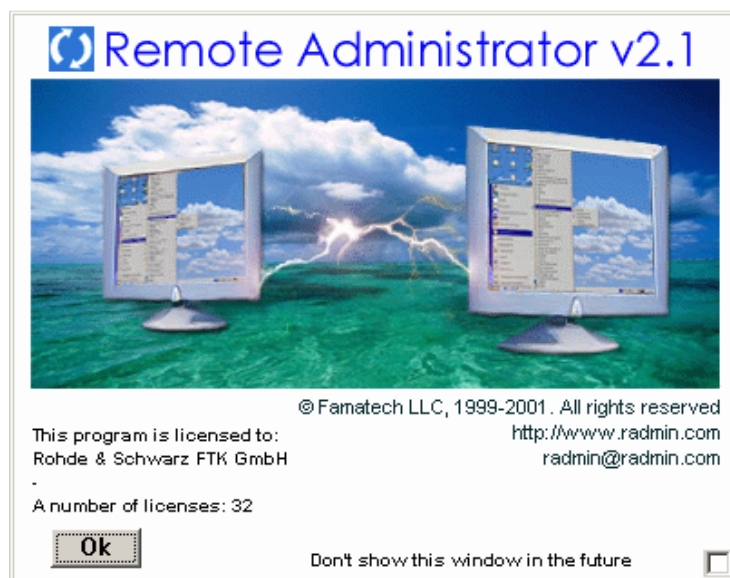


Figure 10.1: Remote Administrator, Starting Window with License Information

After the license information has been confirmed, a link can be established to the DTV Data Inserter. To do so, select New in the startup menu. A name for the instrument (as desired) and the TCP/IP address of its individual physical network card are entered in the dialog window. The TCP/IP address is marked on the adhesive label at the lower side of the DTV Data Inserter. If the IP address has been adapted to the network, always use the modified IP address.

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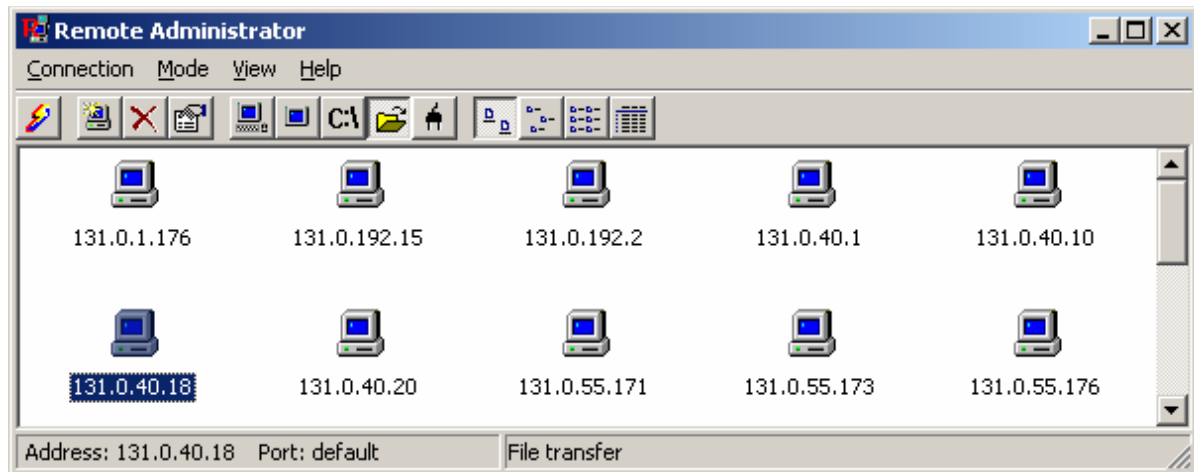


Figure 10.2: Remote Administrator, Main Window

The following options can be selected in the menu bar of the viewer window (menu in the center).

- Remote screen controlled via mouse and keyboard
- Viewing the remote screen
- Telnet
- File transfer
- Shutdown of remote computer

When one of the first two options is selected, the screen of the remote DTV Data Inserter can be displayed on the local terminal, with full operating capabilities or “write-protected” for information only. The third option opens a Telnet console (normally not required). Option four is used for file transfer and therefore also for software updates or similar actions. When the fifth option is selected, the remote DTV Data Inserter can be shut down. Normally this is done with the Windows Start button (first option).

When the first option is selected, a double-click on the symbol of the DTV Data Inserter to be controlled opens the following or a similar window. Any action can be performed on the remote controller with the local keyboard and mouse.

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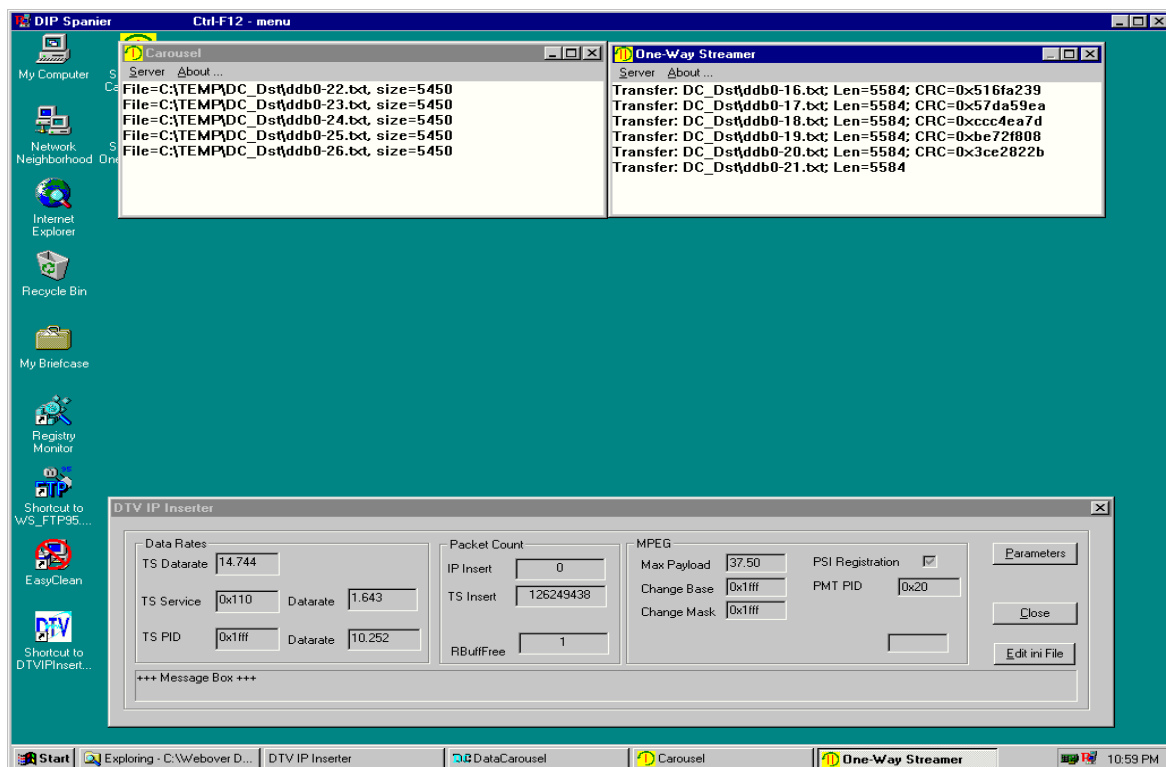


Figure 10.3: Remote Administrator, Full Control Window

Important: The remote controller can only be controlled via keyboard and mouse if a mouse and a keyboard are connected at the remote controller site. Otherwise Windows NT will not load the necessary drivers.

The DTV Data Inserter devices are supplied without password protection to ensure that an initial connection can be established. It is essential, however, that the access to the DTV Data Inserter is protected by a password.

To accomplish this, select the “Settings for Remote Administrator Server” program in the remote administrator folder on the DTV Data Inserter controller and configure at least one user with full privileges and another with limited access rights.

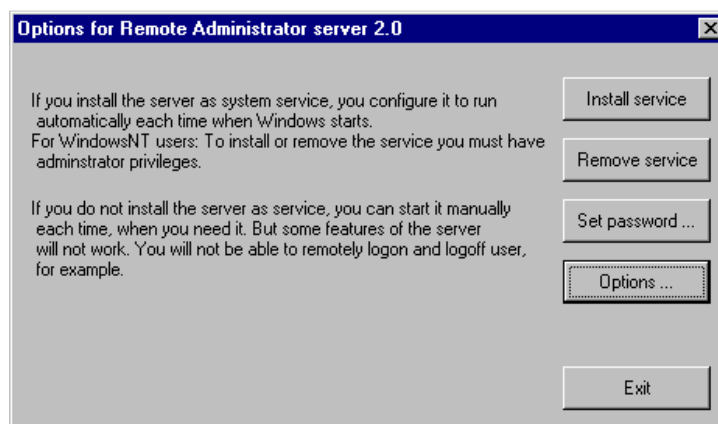


Figure 10.4: Remote Administrator, Server Options

More information about Remote Administrator, can be obtained in Internet: www.radmin.com.

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Software Updates

DTV Data Inserter software is static and doesn't require any additional installation routine. It will be simply copied to the hard disc of the inserter device and started by mouse double-click.

The software on the DTV Data Inserter device can be updated in two ways:

1. With the aid of the Remote Administrator tool and the file transfer option.
Select the file transfer option and double click on the DTV Data Inserter symbol in the Viewer. A file transfer window opens where files can be copied. The file transfer window is horizontally divided into two sections where all local and remote drives are shown. The files are copied by way of drag and drop – select an item with the mouse and drag it to the other window.

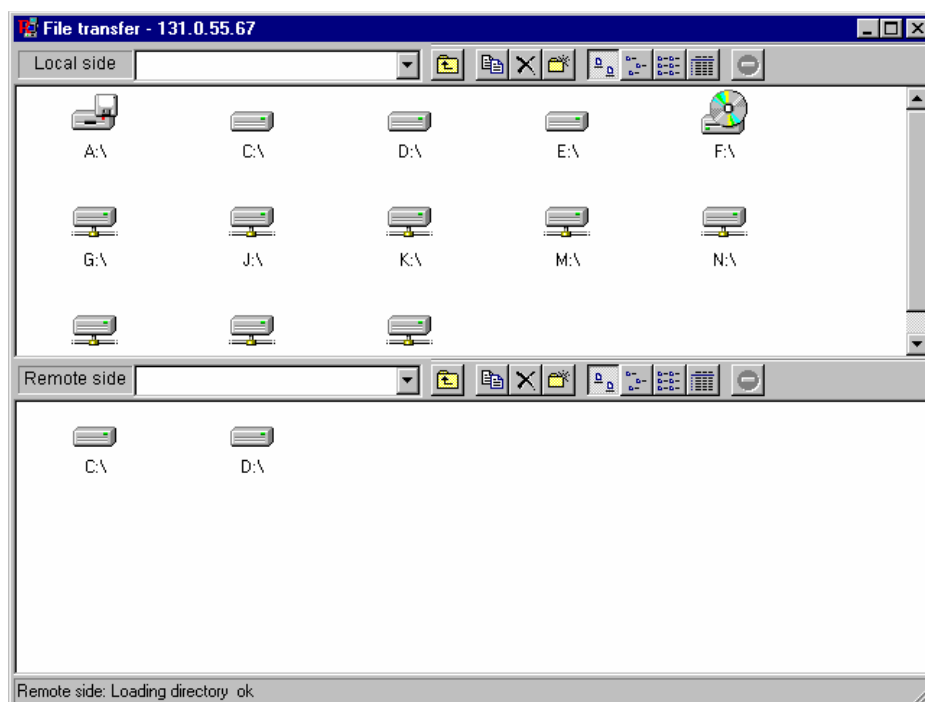


Figure 10.5: Remote Administrator, File Transfer Window

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2. With the Microsoft Browser mechanism installed as standard in NT networks. With the aid of this mechanism, the DTV Data Inserter can be reached in the Explorer window of a controller, which is connected to the same network segment as the DTV Data Inserter, via the network environment¹.

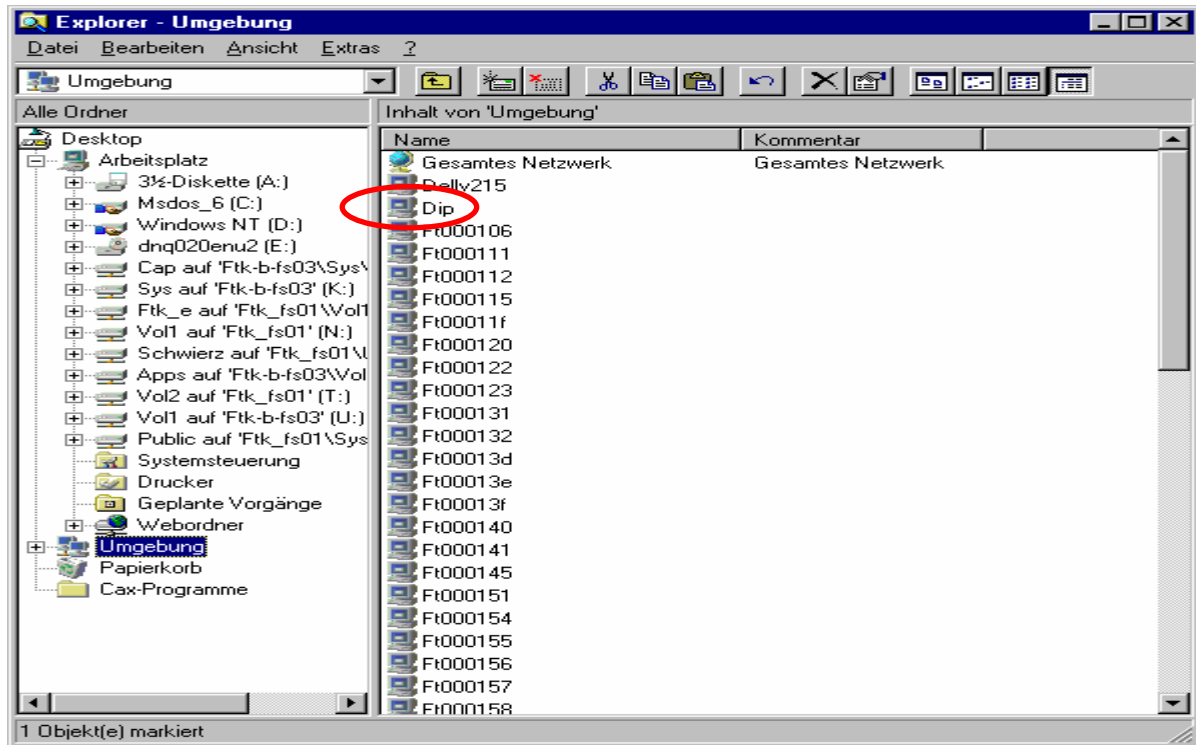


Figure 10.6: Explorer Window

For the update, the controller with the new software, for instance, (e.g. a laptop) can be connected to the network interface of the DTV Data Inserter by means of a network patch cable.

Firmware Update:

It might be that a new firmware for the DIP010 is offered to you. In that case copy the firmware file into the folder C:\driver\DIPFirmwareUpdate\ and follow the instructions in chapter 11.

¹ The controllers can be viewed with the aid of the NetBIOS protocol. The following services must be installed and tested on the controller: Microsoft Client (if the other controllers are to be seen from this controller) and Microsoft Server (if this controller is to be seen from the other controllers) for networks.

11. Firmware Update

The DIP010 input interface has two areas containing the same firmware. The first area can be updated by everyone. The second area is for security reasons and can be updated only by the service personnel. It will be loaded if the first firmware image is damaged.

For updating the Firmware via Software it is necessary that at least one Firmware Image was success-fully loaded by the input interface at start-up. Otherwise the Firmware Update software will not work (it will be started with an exception). If the firmware cannot be loaded correctly by the input interface, it has to be done by the R&S service.

Firmware Update via Software:

Please copy the actual firmware version with the following article code into the directory "C:\Driver\DIPFirmwareUpdate\":

Article Code	Filename	Description
3561.7473.02	x2cv2000_image1_xxx.bin	First firmware image

The firmware update software is located in the directory "C:\Driver\DIPFirmwareUpdate\DIPFirmwareUpdate.exe".

Before starting the software it is mandatory to close all other application especially the DataInserter software!

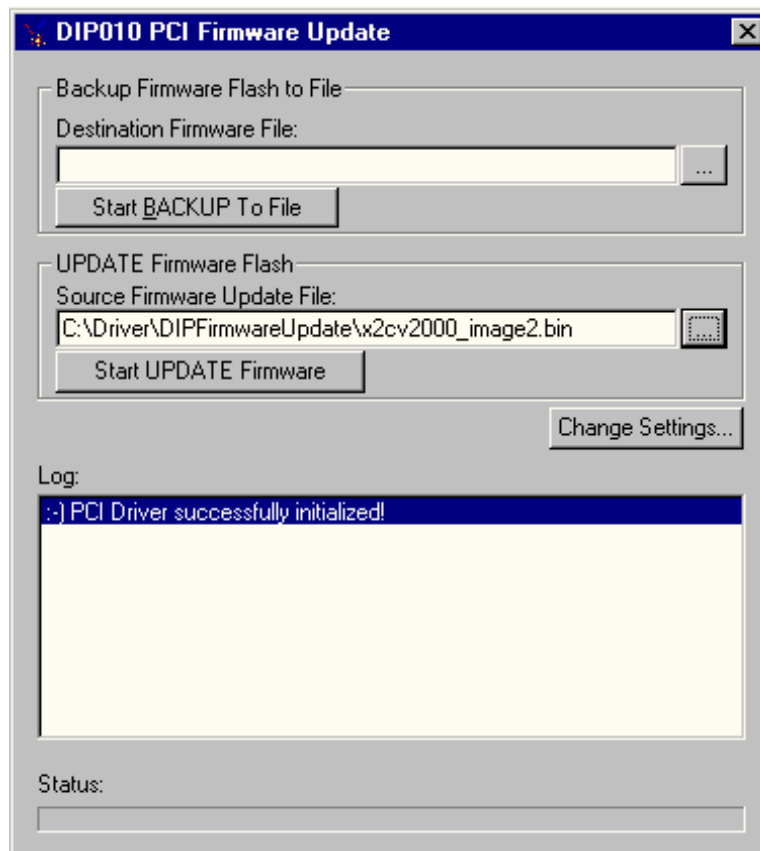


Figure 11.1: Firmware Update software

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Start the Firmware Update Software. If it starts with an error message please check, whether the DataInserter is already opened or try it again after a **restart** of the DIP010.

Open the image file (x2cv2000_image1_xxx.bin) at the point "Source Firmware Update File". Now press the "Start Update Firmware" button and wait until the firmware update is complete. **Interrupting the firmware update will cause damage in the firmware! Do not interrupt the process!**

If it ends with the message "Firmware successfully updated – READY!" the first Image was successfully written.

To activate the new firmware it is necessary to shutdown the DIP010 and **switch it off**. After switching it on again the new firmware version will be ready to use.

12. Maintenance and Troubleshooting

12.1 General

For maintenance and troubleshooting, observe the currently valid safety precautions and accident prevention regulations, see chapter 2.1 for more information.

12.2 Maintenance

DTV Data Inserter DIP010 uses modules that cannot be repaired using conventional techniques because of their high complexity and component density. R&S uses automatic test stations and computers for repairs and fault diagnosis. Normally, a user does not have resources of this kind. Repairs on the user's premises are, therefore, not envisaged.

We therefore advise that fully functioning spare units be kept ready as backups.

The instrument does not require regular maintenance. Maintenance mainly consists of cleaning the unit and, if required, replacing the battery. Make sure that the inlet and outlet vents are not dirty by cleaning them regularly.

A battery-backed RAM is provided in the instrument for storing internal instrument data. The RAM and the system clock are powered from a lithium battery with a lifetime of approx. 5 years. When the battery is empty, the stored data is lost. Changing the battery is described under Repairs in the Service Manual. Please contact your local Rohde & Schwarz representative for exchanging it.



Caution:

Handle batteries carefully. Do not disassemble, crush, puncture, short external contacts, dispose of in fire or water, or expose batteries to temperatures higher than 60 degrees Celsius (140 degrees Fahrenheit). Battery cells may explode. Do not attempt to open or service batteries; replace batteries only with batteries designated for the product.

Do not dispose of your device's battery with normal household waste. Discard a used battery according to the manufacturer's instructions or contact your local waste disposal agency for disposal instructions. Dispose of a spent or damaged battery promptly. Do not recharge the battery!

12.2.1 Cables

- Check the Power Cord (earth connection).
- Check the Data Cables (shielding).

12.2.2 Fan

DTV Data Inserter DIP010 is equipped with a fan that dissipates heat from the power supply and the modules.

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CAUTION:

Make sure that the fan is not obstructed to avoid overheating.

Do not operate the unit with defective fan. Have it repaired immediately.

12.2.3 Cleaning

The outside of the instrument is best cleaned with a soft, lint-free cloth or a brush. If the contamination is difficult to remove, use meths or a mild detergent.



CAUTION:

Do not use any solvents like nitro-cellulose lacquer thinner, acetone, etc, to avoid damage to front-panel labels or plastic parts.

Furthermore, any dust inside the instrument should be removed at regular intervals to ensure proper cooling (approx. every 1 to 2 years depending on the daily operating time of the equipment and the amount of dust in the operating environment).

12.2.4 Storage

The storage temperature range is:

40 °C to +85 °C

When stored for an extended period of time, the instrument should be protected against dust and high humidity.

12.2.5 Fuses

The DIP010 contains fuses for the Power supply.

To exchange them please refer to Figure 12.1 and Figure 12.2

Steps:

- demount the fuse bracket on the rear of the DIP device,
- check the fuses with the multi-meter instrument,
- remove the blasted fuses,
- put new fuses into the bracket,
- mount the bracket back on the rear side.



Caution: *Using fuses with higher Ampere value is hazardous and results in damaging the POWER SUPPLY or other boards inside the DIP. Please use only fuses with appropriate parameters.*

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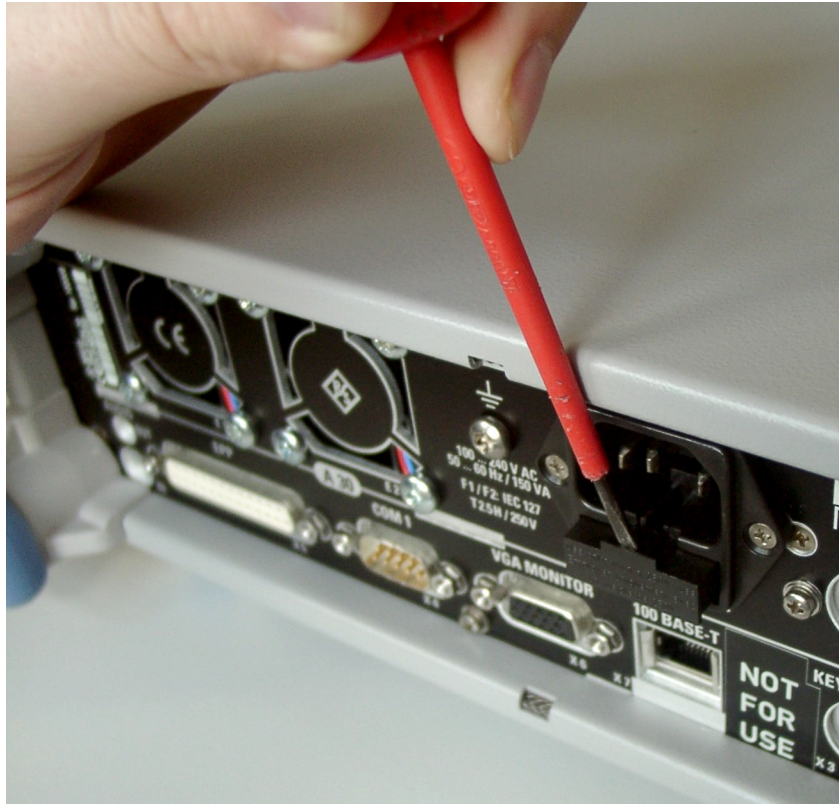


Figure 12.1: Exchanging Power Supply Fuses (1)



Figure 12.2: Exchanging Power Supply Fuses (2)

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12.3 Troubleshooting



During the operation of the Inserter, there might be warning and / or error messages due to faulty function. These messages are displayed over LED's and / or the external screen.

12.3.1 Visual Inspection

Before commencing the trouble shooting, please carry out a visual inspection of the switched off Inserter. Follow these steps:

- Carefully examine the plug connector and the counter plug whether there are any damaged, corroded or dirty contact pins or sockets.
- Replace the respective plug connectors if necessary, and replace the counter plug connector (for example for heat damages).

12.3.2 LED Messages

LED	Normal Operation	Fault	Cause
LED "Error" 	LED off: Faultless operation	No communication between mainboard and MPEG-2 processing hardware	<ul style="list-style-type: none">- Control cable faulty- Control cable not fit- Device driver not loaded Further checking with displayed messages
LED "Warning" 	LED off: Device is operational	Data loss IP Data IP in wrong format	<ul style="list-style-type: none">- Control cable faulty- Control cable not fit- Device driver not loaded- Buffer size too small- Wrong configuration- IP data rate too high Further checking with displayed messages

12.3.3 Typical Problems

DTV Data Inserter does not recognise the underlying hardware type

This may be a driver problem. Please restart the DIP010.

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TS LED is not green

This indicates that the transport stream on the input connector cannot be recognised. There are two possible reasons for that:

- a different connector than specified in the DTV Data Inserter software, “Basic settings” is used,
- the MPEG-2 TS ASI mode is burst (not continuous), so please select “burst mode” under “Expert settings”

SPI Out seems not working correctly (Inserter mode, Burst)

If the DIP is in **inserter mode** and the incoming MPEG-2 TS ASI mode is **burst** and you have also **selected “burst mode”** under “Expert settings”, the DIP has to readjust the SPI Output signal. Readjusting will always be done after TS Sync was lost. So if you have no output on SPI Out, please unplug the ASI input for 5 seconds until the Software recognises that the TS sync was lost. After re-plugging it the SPI out should be readjusted and working correctly.

Alternatively you can also press restart in the DataInserter software.

Data LED is yellow

Data is sent directly to the DTV Data Inserter application in a wrong format. Please send the data always to the MediaRouter (see User Manual MediaRouter Ident.no. 3531.1848.42), which is preparing the data and sends it to the DTV Data Inserter in appropriate format.

Stopping the DTV Data Inserter interrupts the MPEG-2 TS

The MPEG-2 TS will be interrupted for about 1 ms and bypassed again. This often results in longer interruptions in the whole DVB chain. It is not necessary to restart the DTV Data Inserter or interrupt its work, please avoid it.

For more questions and answers, please refer to the Technical FAQ for Datacasting systems.

13. Environmental protection

Rohde & Schwarz is an environmentally conscious company with practices that encourage the conservation of natural resources.

RoHS directive

The European Parliament and the Council of the European Union adopted a "Directive on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment," known as the RoHS Directive 2002/95/EC. The RoHS directive will ban placement on the EU market of electrical and electronic equipment containing lead, mercury, cadmium, hexavalent chromium, PBB and PBDE as of July 1st, 2006.

The DIP010 complies to this directive. But it contains partly lead in solders. This complies to Article 4, paragraph 2, where the prevention shall not apply to lead in solders for network infrastructure equipment for signalling, transmission as well as network management for telecommunication.

WEEE directive

The directive on Waste Electrical and Electronic Equipment, known as the WEEE directive 2002/96/EC, was transposed into law by the EU Parliament in 2003. The directive stipulates that as of August 13th, 2005, producers and importers must finance the recycling of electrical products that they sell into the EU market.

The DIP010 contains a battery that must not be disposed with household waste. Before disposing the device the battery has to be removed and disposed correctly. The device contains electronic circuits that must not be disposed with household waste. It has to be disposed by licensed dumping enterprises.

As manufacturer, Rohde & Schwarz takes back the device in the European Union for disposing it correctly. As your qualified supplier Rohde & Schwarz has the necessary know-how and the infrastructure for recycling or disposing of old electrical and electronic equipment. Please contact your local Rohde & Schwarz Representative.

Appendix 1

IP Tutorial: Basic Addressing

IP Tutorial: Basic Addressing

(source : <http://compnetworking.about.com>)

The Internet Protocol (IP) had its origins in UNIX® networking, it was developed in the 1970s. Today, IP has become a standard mechanism for [network operating systems \(NOS\)](#) to communicate with each other. Well-known protocols such as HTTP and TCP have been built on top of the IP foundation.

Bits and bytes

An IP address contains four bytes (32 bits) of data. For readability purposes, people typically work with IP addresses in a decimal notation that uses periods to separate each byte (also known as an [octet](#)). For example, the IP address

00001010 00000000 00000000 00000001

often appears in the equivalent string representation

10.0.0.1

IP addresses can be subdivided into *classes*. The values of the leftmost four (4) bits of an address determine its class. All “Class A” addresses, for example, have the leftmost bit set to zero, but each of the remaining 31 bits may be set independently to either “0” or “1” (as represented by an ‘x’ in these bit positions):

0xxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx

From this rule, it follows that class A addresses include all values in the range “0.0.0.0” to “127.255.255.255”.

Class B addresses must have the leftmost bit set to one, and the next bit set to zero, but all other bits may vary:

10xxxxxx xxxxxxxx xxxxxxxx xxxxxxxx

And so it follows that Class B addresses fall in the range from “128.0.0.0” to “191.255.255.255”. Similarly, Class C, D, and E addresses set the second, third, and fourth bit (respectively) to one. The following table summarizes the overall breakdown of all IP addresses into this class system.

Class	Leftmost Bits	Start Address	Finish Address
A	0xxx	0.0.0.0	127.255.255.255
B	10xx	128.0.0.0	191.255.255.255
C	110x	192.0.0.0	223.255.255.255
D	1110	224.0.0.0	239.255.255.255
E	1111	240.0.0.0	255.255.255.255

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Network numbering

Computer networks consist of individual [segments](#) of network cable. The electrical properties of cabling limit the useful size of any given segment such that even a modestly-sized [local-area network \(LAN\)](#) requires several of them. [Gateway devices](#), like [routers](#) and bridges, connect these segments although not in a perfectly seamless way.

Besides partitioning through the use of cable, subdividing of the network can also be done at a higher level. *Subnets* support “virtual” network segments that split the traffic flowing through the cable rather than the cables themselves. The subnet configuration often matches the segment layout one-to-one, but subnets can also subdivide a given network segment

Network addresses

Even without subnetting, hosts on the Internet (or any other IP network) are uniquely identified on a network by something called the *network number*. (Multi-homed nodes that contain multiple network adapters can belong to multiple networks.) Network numbering allows a group of hosts (peers) to communicate efficiently with each other; these may be computers located in the same facility or all computers used by a workgroup, for example.

Network numbers look very much like IP addresses, but the two should not be confused. In the absence of subnetting, some “default” networks can be derived immediately from host IP addressing and its class structure. Consider the host IP address 10.0.0.1, for example, an address commonly used on private networks. Because it is a class A address, with no subnetting employed, its leftmost byte (eight bits) refer by default to the network address (10), and all other bits remain set at zero (10.0.0.0). Thus, 10.0.0.0 is the network number corresponding to IP address 10.0.0.1.

In this scheme, the part of the IP address that does not refer to the network refers instead to the *host address* (literally, the unique identifier of the host on that network). In this example, the host address becomes “0.0.0.1” or simply “1”. Also note that a network address becomes a reserved address that should not be assigned to any actual host. Hosts like 10.0.0.1 may use the 10.0.0.0 address for special purposes, and having a live host at that location could cause conflicts.

The table below illustrates the numbering scheme for class A, B, and C networks. Although the same scheme can apply to class D and E networks, those address ranges have been reserved for other purposes and should be discussed separately.

Class	Host Address Range	Network Address	Default Mask
A	0.0.0.0 – 127.255.255.255	x.0.0.0	255.0.0.0
B	128.0.0.0 – 191.255.255.255	x.x.0.0	255.255.0.0
C	192.0.0.0 – 223.255.255.255	x.x.x.0	255.255.255.0

In general, a network address uses the leftmost byte of its hosts addressing if the hosts fall within the Class A range, the leftmost two bytes for hosts in Class B, and the leftmost three bytes for hosts in Class C. This algorithm is applied in practice with the use of a *network mask*. The above table shows the decimal representation of the default network masks that

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is commonly used by network operating systems. The decimal value “255” corresponds to one byte that has all bits set to one (11111111).

Conclusion

Network addressing basically organises hosts into groups. This can improve security (by isolating critical nodes) and can reduce network traffic (by preventing transmissions between nodes that do not need to communicate with each other). Generally, network addressing becomes even more powerful when introducing subnetting and/or supernetting.

Subnetting in practice

Subnetting works by applying the concept of **extended network** addresses to individual computer (and other network device) addresses. An extended network address includes both, a **network address** and additional bits that represent the **subnet number**. Together, these two data elements support a two-level addressing scheme recognised by standard implementations of IP. The network address and subnet number therefore support a three-level scheme when combined with the **host address**.

Consider the following real-world example. A small business plans to use the 192.168.1.0 network for its internal ([intranet](#)) hosts. The human resources department wants their computers to be on a restricted part of this network because they store payroll information and other sensitive employee data. But because this is a class C network, the default subnet mask of 255.255.255.0 allows all computers on the network to be peers (to send messages directly to each other) by default.

The first four bits of 192.168.1.0 –

1100

place this network in the class C range and also fix the length of the network address at 24 bits. To subnet this network, more than 24 bits must be set to ‘1’ on the left side of the subnet mask. For instance, the 25-bit mask 255.255.255.128 creates a two-subnet network as follows.

Network Address (24 bits)	Subnet Number (1 bit)	Extended Network	Host Address Range
11000000 10101000 00000001	0	192.168.1.0	192.168.1.1 – 192.168.1.127
11000000 10101000 00000001	1	192.168.1.128	192.168.1.129 – 192.168.1.255

For every additional bit set to ‘1’ in the mask, another bit becomes available in the subnet number to index additional subnets. A two-bit subnet number can support up to four subnets, a three-bit number supports up to eight subnets, and so on.

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Private networks and subnets

The governing bodies that administer the Internet protocol have identified certain networks as reserved for internal use. In general, intranets that use these networks can reduce the difficulty in administering their IP configuration and Internet access. These three networks, along with their default subnet masks, are listed below.

Network Address	Default Mask
10.0.0.0	255.0.0.0
172.16.0.0	255.240.0.0
192.168.0.0	255.255.0.0

Consult [RFC 1918](#) for more details about these special networks.

Subnetting review

Subnetting allows network administrators some flexibility in defining relationships among network hosts. Hosts on different subnets can only “talk” to each other through specialised network [gateways](#), like [routers](#). The ability to filter traffic between subnets can make more data rate available to applications and can limit access in desirable ways.

Multicast reception

Applications: Assembler, Quick Time Player, Windows Media Player

Receiving IP multicast packets requires BINDING THE RECEIVING SOCKET to the network adapter delivering this IP multicast. In case of DVB/DAB data reception with an PC card, binding to the NDIS driver of the DAB/DVB PC receiving card.

Very important in this context is, that this NDIS driver network adapter has to have an DEFINED IP ADDRESS (expert info: no DHCP). Please set the IP address of the NDIS driver to any private IP address, i.e. 192.168.1.1 (mask 255.255.255.0) via the: System control – network –TCP/IP properties panel.

With the Assembler application it is possible to bind the receiving socket to an dedicated network adapter, but not with the standard player like Quick Time or Media Player.

In case of Quick Time Player it is necessary to disable all other network cards besides of the DVB/DAB card's NDIS driver. In this case the Quick Time player always binds its receiving socket to this only network card.

Disabling the cards is done as follow:

- Windows 2000 (you can easy disable /enable network cards) with the help of the properties menu (right mouse key),

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- Windows NT: here you can only uninstall all other network cards (experts info: you can stimulate the NDIS driver with any other Multicast receiving application to give the packets to the stack, i.e. with an “dummy” instance of the Assembler).

Appendix 2

BIOS Configuration

BIOS Configuration

The BIOS settings made in the DTV Data Inserter upon delivery are listed below:

STANDARD CMOS SETUP

Settings	Value
Date	User defined
Time	User defined
Primary Master	Auto
Primary Slave	Auto
Secondary Master	Auto
Secondary Slave	Auto
Drive A	None
Drive B	None
Video	EGA/VGA
Halt On	All, but keyboard

BIOS FEATURES SETUP

Settings	Value
CPU Internal Cache	Enabled
External Cache	Enabled
CPU L2 Cache ECC Checking	Enabled
Processor Number Feature	Enabled
Quick Power On Self Test	Enabled
Boot Sequence	C only
Swap Floppy Drive	Disabled
Boot Up Floppy Seek	Disabled
Boot Up NumLock Status	On
Gate A20 Option	Fast
Typematic Rate Setting	Enabled
Typematic Rate	30
Typematic Delay	250
Security Option	Setup
PCI/VGA Palette Snoop	Disabled
OS Select For DRAM > 64MB	Non-OS2
Report No FDD For WIN 95	No
Video BIOS Shadow	Enabled
C8000-CBFFF Shadow	Enabled
CC000-CFFFF Shadow	Enabled
D0000-D3FFF Shadow	Disabled

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D4000-D7FFF Shadow	Disabled
D8000-DBFFF Shadow	Disabled
DC000-DFFFF Shadow	Disabled

CHIPSET FEATURES SETUP

Settings	Value
Auto Configuration	Enabled
EDO DRAM Speed Selection	60 ns
EDO CASx# MA Wait State	2
EDO RASx# Wait State	2
SDRAM RAS-to-CAS Delay	3
SDRAM RAS Precharge Time	3
SDRAM CAS Latency Time	2
SDRAM Precharge Control	Enabled
DRAM Data Integrity Mode	ECC
System BIOS Cacheable	Enabled
Video BIOS Cacheable	Enabled
Video RAM Cacheable	Enabled
8 Bit I/O Recovery Time	1
16 Bit I/O Recovery Time	1
Memory Hole At 15M-16M	Disabled
Passive Release	Enabled
Delayed Transaction	Disabled
AGP Aperture Size (MB)	64

INTEGRATED PERIPHERALS

Setting	Value
IDE HDD Block Mode	Enabled
PCI DIE 2 nd Channel	Enabled
On-Chip Primary PCI IDE	Enabled
IDE Primary Master PIO	Auto
IDE Primary Slave PIO	Auto
IDE Primary Master UDMA	Auto
IDE Primary Slave UDMA	Auto
On-Chip Secondary PCI IDE	Enabled
IDE Secondary Master PIO	Auto
IDE Secondary Slave PIO	Auto
IDE Secondary Master UDMA	Auto
IDE Secondary Slave UDMA	Auto
Onboard PCI SCSI Chip	Enabled

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Setting	Value
USB Keyboard Support	Disabled
Init Display First	PCI Slot
KBC input clock	8 MHz
Onboard FDC Controller	Enabled
Onboard Serial Port 1	3F8/IRQ4
Onboard Serial Port 2	2F8/IRQ3
UR2 Mode	Standard
Onboard Parallel Port	378/IRQ7
Parallel Port Mode	ECP+EPP
ECP Mode use DMA	3

POWER MANAGEMENT SETUP

Settings	Value
Power Management	User-defined
PM Control by APM	Yes
Video Off Method	Blank Screen
Video Off After	Standby
MODEM Use IRQ	3
Doze Mode	Disable
Standby Mode	Disable
Suspend Mode	Disable
HDD Power Down	Disable
Throttle Duty Cycle	75%
PCI/VGA Act-Monitor	Disabled
Soft-Off by PWR-BTTN	Instant-Off
PowerOn by Ring	Disabled
CPU Fan on Temp High	Disabled
IRQ 8 Break Suspend	Disabled
IRQ[3-7,9-15],NMI	Disabled
Primary IDE 0	Disabled
Primary IDE 1	Disabled
Secondary IDE 0	Disabled
Secondary IDE 1	Disabled
Floppy Disk	Disabled
Serial Port	Disabled
Parallel Port	Disabled

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PNP/PCI CONFIGURATION

Settings	Value
PNP OS Installed	No
Resources Controlled By	Manual
Reset Configuration Data	Disabled
PCI IDE IRQ Map To	PCI-Auto
Primary IDE INT#	A
Secondary IDE INT#	B
Use MEM base addr	N/A
IRQ-X assigned to	PCI/ISA PnP
DMA-X assigned to	PCI/ISA PnP

Appendix 3

Descriptor Coding in INTLib.xml, NIT.xml and SDT.xml

1. INTLib.xml

In the following you can find a complex example of the INTLib.xml file containing all defined descriptors:

```
<?xml version="1.0" encoding="UTF-8"?>
<platform_loop>
  <action_type>0x01</action_type>
  <platform_id>0xffff02</platform_id>
  <version_number>12</version_number>
  <processing_order>0</processing_order>
  <platform_descriptor_loop>
    <descriptor tag= »0x0C »>
      <ISO_639_language_code>deu</ISO_639_language_code>
      <text>String</text>
    </descriptor>
    <descriptor tag="0x0D">
      <ISO_639_language_code>eng</ISO_639_language_code>
      <text>String</text>
    </descriptor>
    <descriptor tag="0x13">
      <network_id>0x1234</network_id>
      <original_network_id>0x1234</original_network_id>
      <transport_stream_id>0x1234</transport_stream_id>
      <service_id>0x0032</service_id>
      <component_tag>0x60</component_tag>
    </descriptor>
    <descriptor tag="0x14">
      <access_mode>0x04</access_mode>
    </descriptor>
    <descriptor tag="0x57">
      <foreign_availability>0</foreign_availability>
      <connection_type>0x12</connection_type>
      <country_prefix>ger</country_prefix>
      <international_area_code>deu</international_area_code>
      <operator_code>asd</operator_code>
      <national_area_code>ger</national_area_code>
      <core_number>1234</core_number>
    </descriptor>
    <descriptor tag="0x5F">
      <private_data_specifier>0x1234</private_data_specifier>
    </descriptor>
  </platform_descriptor_loop>
</N1_loop>
<Elementary_PID>0x300</Elementary_PID>
<target_descriptor_loop>
  <descriptor tag="0x06">
    <super_CA_system_id>0x12345678</super_CA_system_id>
    <private_data_byte>0x12345678</private_data_byte>
  </descriptor>
  <descriptor tag="0x07">
    <MAC_addr_mask>255:255:255:255:255:255</MAC_addr_mask>
    <MAC_addr>123:123:123:123:123:123</MAC_addr>
    <MAC_addr>24:25:26:27:28:29</MAC_addr>
  </descriptor>
  <descriptor tag="0x08">
    <serial_data_byte>0x1234567894</serial_data_byte>
  </descriptor>
  <descriptor tag="0x09">
    <Ipv4_addr_mask>255.255.255.0</Ipv4_addr_mask>
    <Ipv4_addr>127.0.0.1</Ipv4_addr>
    <Ipv4_addr>127.0.0.2</Ipv4_addr>
  </descriptor>
  <descriptor tag="0x0A">
    <Ipv6_addr_mask>ff15:0000:0000:0000:0000:0000:0000:7503</Ipv6_addr_mask>
    <Ipv6_addr>ff15:0000:0000:0000:0000:0000:0000:7503</Ipv6_addr>
    <Ipv6_addr>ff15:0000:0000:0000:0000:AAA0:0000:7503</Ipv6_addr>
  </descriptor>
  <descriptor tag="0x0E">
    <MAC_addr_low>123:123:123:123:123:123</MAC_addr_low>
    <MAC_addr_high>124:214:124:124:124:124</MAC_addr_high>
    <MAC_addr_low>123:123:123:123:113:123</MAC_addr_low>
```

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```
<MAC_addr_high>124:214:124:124:110:123</MAC_addr_high>
</descriptor>
<descriptor tag="0x0F">
  <Ipv4_addr>127.0.0.1</Ipv4_addr>
  <Ipv4_slash_mask>255</Ipv4_slash_mask>
  <Ipv4_addr>127.0.0.2</Ipv4_addr>
  <Ipv4_slash_mask>25</Ipv4_slash_mask>
  <Ipv4_addr>127.0.0.3</Ipv4_addr>
  <Ipv4_slash_mask>12</Ipv4_slash_mask>
</descriptor>
<descriptor tag="0x10">
  <Ipv4_source_addr>127.0.0.1</Ipv4_source_addr>
  <Ipv4_source_slash_mask>21</Ipv4_source_slash_mask>
  <Ipv4_dest_addr>211.215.215.0</Ipv4_dest_addr>
  <Ipv4_dest_slash_mask>28</Ipv4_dest_slash_mask>
  <Ipv4_source_addr>127.0.0.1</Ipv4_source_addr>
  <Ipv4_source_slash_mask>21</Ipv4_source_slash_mask>
  <Ipv4_dest_addr>211.215.215.0</Ipv4_dest_addr>
  <Ipv4_dest_slash_mask>28</Ipv4_dest_slash_mask>
</descriptor>
<descriptor tag="0x11">
  <Ipv6_addr>ff15:0000:0000:0000:0000:0000:7553</Ipv6_addr>
  <Ipv6_slash_mask>24</Ipv6_slash_mask>
  <Ipv6_addr>ff15:0000:0000:0fff:0000:0000:7503</Ipv6_addr>
  <Ipv6_slash_mask>80</Ipv6_slash_mask>
</descriptor>
<descriptor tag="0x12">
  <Ipv6_source_addr>ff15:0000:0000:0000:0000:0000:7603</Ipv6_source_addr>
  <Ipv6_source_slash_mask>81</Ipv6_source_slash_mask>
  <Ipv6_dest_addr>ff15:0000:0000:0000:0000:0000:7603</Ipv6_dest_addr>
  <Ipv6_dest_slash_mask>82</Ipv6_dest_slash_mask>
  <Ipv6_source_addr>ff15:0000:0000:0000:0000:0000:7604</Ipv6_source_addr>
  <Ipv6_source_slash_mask>83</Ipv6_source_slash_mask>
  <Ipv6_dest_addr>ff15:0000:0000:0000:0000:0000:7604</Ipv6_dest_addr>
  <Ipv6_dest_slash_mask>84</Ipv6_dest_slash_mask>
</descriptor>
<descriptor tag="0x5F">
  <private_data_specifier>0x90123456</private_data_specifier>
</descriptor>
</target_descriptor_loop>
<operational_descriptor_loop>
  <descriptor tag="0x13">
    <network_id>0x1412</network_id>
    <original_network_id>0x1555</original_network_id>
    <transport_stream_id>0x1124</transport_stream_id>
    <service_id>0x3334</service_id>
    <component_tag>0x23</component_tag>
  </descriptor>
  <descriptor tag="0x14">
    <access_mode>0x01</access_mode>
  </descriptor>
  <descriptor tag="0x57">
    <foreign_availability>1</foreign_availability>
    <connection_type>0x02</connection_type>
    <country_prefix>gem</country_prefix>
    <international_area_code>eng</international_area_code>
    <operator_code>vvv</operator_code>
    <national_area_code>us</national_area_code>
    <core_number>33</core_number>
  </descriptor>
  <descriptor tag="0x5F">
    <private_data_specifier>0xab123456</private_data_specifier>
  </descriptor>
  <descriptor tag="0x77">
    <time_slicing>0x1</time_slicing>
    <mpe_fec>0x1</mpe_fec>
    <frame_size>0x3</frame_size>
    <max_burst_duration>0x31</max_burst_duration>
    <max_average_rate>0x5</max_average_rate>
    <time_slice_fec_id>0x2</time_slice_fec_id>
    <id_selector_bytes>0x1234567890</id_selector_bytes>
  </descriptor>
</operational_descriptor_loop>
```


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```
</N1_loop>
</platform_loop>
<platform_loop>
  <action_type>0x01</action_type>
  <platform_id>0xffff04</platform_id>
  <version_number>12</version_number>
  <processing_order>0</processing_order>
  <platform_descriptor_loop>
    <descriptor tag="0x13">
      <network_id>0x1234</network_id>
      <original_network_id>0x1234</original_network_id>
      <transport_stream_id>0x1234</transport_stream_id>
      <service_id>0x0050</service_id>
      <component_tag>0x12</component_tag>
    </descriptor>
    <descriptor tag="0x14">
      <access_mode>0x03</access_mode>
    </descriptor>
  </platform_descriptor_loop>
</N1_loop>
<N1_loop>
  <Elementary_PID>0x320</Elementary_PID>
  <target_descriptor_loop>
  </target_descriptor_loop>
  <operational_descriptor_loop>
  </operational_descriptor_loop>
</N1_loop>
<N1_loop>
  <Elementary_PID>0x321</Elementary_PID>
  <target_descriptor_loop>
  </target_descriptor_loop>
  <operational_descriptor_loop>
    <descriptor tag="0x13">
      <network_id>0x1412</network_id>
      <original_network_id>0x1555</original_network_id>
      <transport_stream_id>0x1124</transport_stream_id>
      <service_id>0x0003</service_id>
      <component_tag>0x02</component_tag>
    </descriptor>
  </operational_descriptor_loop>
</N1_loop>
<N1_loop>
  <Elementary_PID>0x322</Elementary_PID>
  <target_descriptor_loop>
  </target_descriptor_loop>
  <operational_descriptor_loop>
  </operational_descriptor_loop>
</N1_loop>
</platform_loop>
</INTDescription>
```

2. NIT.xml

In the following you can find a complex example of the NIT.xml file containing all defined descriptors (Some descriptors were not already realized on printing date. Please ask for a software update if needed):

```
<?xml version="1.0"?>
<NITDescription>
  <platform_loop>
    <network_id>0x69</network_id>
    <version_number>1</version_number>
    <network_descriptor_loop>
      <descriptor tag="0x40">
        <text>ROHDE&SCHWARZ Network</text>
      </descriptor>
      <descriptor tag="0x4A">
        <transport_stream_id>0x5</transport_stream_id>
        <original_network_id>0x98C</original_network_id>
        <service_id>0x45</service_id>
        <linkage_type>0x0B</linkage_type>
        <private_data_byte>0x10FFF0040C656E67084D6F62696C655456</private_data_byte>
      </descriptor>
      <descriptor tag="0x5F">
        <private_data_specifier>0x00001234</private_data_specifier>
      </descriptor>
      <descriptor tag="0x6C">
        <cell_info_loop>
          <cell_id>0x00000065</cell_id>
          <cell_latitude>0x00000E64</cell_latitude>
          <cell_longitude>0x0000075A</cell_longitude>
          <cell_extend_of_latitude>0x0000038E</cell_extend_of_latitude>
          <cell_extend_of_longitude>0x000001C7</cell_extend_of_longitude>
          <subcell_info_loop>
            <cell_id_extension>0x00000085</cell_id_extension>
            <subcell_latitude>0x00004321</subcell_latitude>
            <subcell_longitude>0x00002234</subcell_longitude>
            <subcell_extend_of_latitude>0x0000022A</subcell_extend_of_latitude>
            <subcell_extend_of_longitude>0x0000011B</subcell_extend_of_longitude>
          </subcell_info_loop>
        </cell_info_loop>
      </descriptor>
      <descriptor tag="0x5A">
        <centre_frequency>0x12345678</centre_frequency>
        <bandwidth>5</bandwidth>
        <priority>1</priority>
        <Time_Slicing_indicator>1</Time_Slicing_indicator>
        <MPE-FEC_indicator>1</MPE-FEC_indicator>
        <constellation>2</constellation>
        <hierarchy_information>4</hierarchy_information>
        <code_rate-HP_stream>3</code_rate-HP_stream>
        <code_rate-LP_stream>2</code_rate-LP_stream>
        <guard_interval>1</guard_interval>
        <transmission_mode>1</transmission_mode>
        <other_frequency_flag>0</other_frequency_flag>
      </descriptor>
      <descriptor tag="0x41">
        <service_loop>
          <service_id>0xF000</service_id>
          <service_type>0xa</service_type>
        </service_loop>
        <service_loop>
          <service_id>0xF00</service_id>
          <service_type>0xb</service_type>
        </service_loop>
        <service_loop>
          <service_id>0x0F0</service_id>
          <service_type>0xc</service_type>
        </service_loop>
        <service_loop>
          <service_id>0x000F</service_id>

```

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```
<service_type>0xd</service_type>
</service_loop>
</descriptor>
<descriptor tag="0x43">
  <frequency>0x12345678</frequency>
  <orbital_position>0xFFFF</orbital_position>
  <west_east_flag>1</west_east_flag>
  <polarization>1</polarization>
  <modulation>1</modulation>
  <symbol_rate>0x0FFFFFFF</symbol_rate>
  <FEC_inner>0xF</FEC_inner>
</descriptor>
<descriptor tag="0x44">
  <frequency>0x12345678</frequency>
  <FEC_outer>0xF</FEC_outer>
  <modulation>1</modulation>
  <symbol_rate>0x0FFFFFFF</symbol_rate>
  <FEC_inner>0xF</FEC_inner>
</descriptor>
<descriptor tag="0x42">
  <stuffing_byte>0xABCDEF</stuffing_byte>
</descriptor>
<descriptor tag="0x62">
  <coding_type>1</coding_type>
  <frequency_list_loop>
    <centre_frequency>0xFF000000</centre_frequency>
  </frequency_list_loop>
  <frequency_list_loop>
    <centre_frequency>0x00FF0000</centre_frequency>
  </frequency_list_loop>
  <frequency_list_loop>
    <centre_frequency>0x0000FF00</centre_frequency>
  </frequency_list_loop>
  <frequency_list_loop>
    <centre_frequency>0x000000FF</centre_frequency>
  </frequency_list_loop>
</descriptor>
<descriptor tag="0x6D">
  <cell_info_loop>
    <cell_id>0x3215</cell_id>
    <frequency>0x76543210</frequency>
    <subcell_info_loop>
      <cell_id_extension>0x01</cell_id_extension>
      <transposer_frequency>0x000000F</transposer_frequency>
    </subcell_info_loop>
    <subcell_info_loop>
      <cell_id_extension>0x02</cell_id_extension>
      <transposer_frequency>0x000000F0</transposer_frequency>
    </subcell_info_loop>
    <subcell_info_loop>
      <cell_id_extension>0x03</cell_id_extension>
      <transposer_frequency>0x000000FF</transposer_frequency>
    </subcell_info_loop>
  </cell_info_loop>
  <cell_info_loop>
    <cell_id>0x3215</cell_id>
    <frequency>0x76543210</frequency>
    <subcell_info_loop>
      <cell_id_extension>0x04</cell_id_extension>
      <transposer_frequency>0x000000F0</transposer_frequency>
    </subcell_info_loop>
    <subcell_info_loop>
      <cell_id_extension>0x05</cell_id_extension>
      <transposer_frequency>0x0000F000</transposer_frequency>
    </subcell_info_loop>
    <subcell_info_loop>
      <cell_id_extension>0x06</cell_id_extension>
      <transposer_frequency>0x0000FF00</transposer_frequency>
    </subcell_info_loop>
    <subcell_info_loop>
      <cell_id_extension>0x07</cell_id_extension>
      <transposer_frequency>0x0000FF01</transposer_frequency>
    </subcell_info_loop>
  </cell_info_loop>
</descriptor>
```

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```
</cell_info_loop>
<cell_info_loop>
  <cell_id>0x3215</cell_id>
  <frequency>0x76543210</frequency>
  <subcell_info_loop>
    <cell_id_extension>0x08</cell_id_extension>
    <transposer_frequency>0xFF000000</transposer_frequency>
  </subcell_info_loop>
  <subcell_info_loop>
    <cell_id_extension>0x09</cell_id_extension>
    <transposer_frequency>0xFFFF0000</transposer_frequency>
  </subcell_info_loop>
</cell_info_loop>
</descriptor>
<descriptor tag="0x5B">
  <network_name_loop>
    <ISO_639_language_code>ger</ISO_639_language_code>
    <char>Deutsch</char>
  </network_name_loop>
  <network_name_loop>
    <ISO_639_language_code>eng</ISO_639_language_code>
    <char>Englisch</char>
  </network_name_loop>
</descriptor>
</network_descriptor_loop>
<transport_stream_loop>
  <transport_stream_id>0x5</transport_stream_id>
  <original_network_id>0x98C</original_network_id>
  <transport_descriptor_loop>
    <descriptor tag="0x40">
      <text>ROHDE&SCHWARZ Network</text>
    </descriptor>
  </transport_descriptor_loop>
</transport_stream_loop>
</platform_loop>
</NITDescription>
```

3. SDT.xml

In the following you can find a complex example of the SDT.xml file containing all actually defined descriptors (Some descriptors were not already realized on printing date. Please ask for a software update if needed):

```
<?xml version="1.0" encoding="UTF-8"?>
<SDTDescription>
  <platform_loop>
    <transport_stream_id>0x2213</transport_stream_id>
    <original_network_id>0x4444</original_network_id>
    <service_loop>
      <service_id>0x32</service_id>
      <EIT_schedule_flag>0</EIT_schedule_flag>
      <EIT_present_following_flag>0</EIT_present_following_flag>
      <running_status>0x4</running_status>
      <free_CA_mode>0</free_CA_mode>
      <descriptor_loop>
        <descriptor tag="0x42">
          <stuffing_byte>0x12345678</stuffing_byte>
        </descriptor>
        <descriptor tag="0x48">
          <service_type>0x01</service_type>
          <service_provider_name>Rohde Schwarz Test</service_provider_name>
          <service_name>Testservice</service_name>
        </descriptor>
        <descriptor tag="0x4A">
          <transport_stream_id>0x05</transport_stream_id>
          <original_network_id>0x098c</original_network_id>
          <service_id>0xffdc</service_id>
          <linkage_type>0x0B</linkage_type>
          <private_data_byte>0x10FFF0040C656E67084D6F62696C655456</private_data_byte>
        </descriptor>
        <descriptor tag="0x57">
          <foreign_availability>0</foreign_availability>
          <connection_type>0x12</connection_type>
          <country_prefix>deu</country_prefix>
          <international_area_code>ger</international_area_code>
          <operator_code>r+s</operator_code>
          <national_area_code>ger</national_area_code>
          <core_number>1234</core_number>
        </descriptor>
        <descriptor tag="0x5F">
          <private_data_specifier>0x1234</private_data_specifier>
        </descriptor>
        <descriptor tag="0x64">
          <data_broadcast_id>0x06</data_broadcast_id>
          <component_tag>0x1</component_tag>
          <multiprotocol_encapsulation_info>
            <MAC_address_range>0x4</MAC_address_range>
            <MAC_IP_mapping_flag>0x0</MAC_IP_mapping_flag>
            <alignment_indicator>0x1</alignment_indicator>
            <max_sections_per_datagram>1</max_sections_per_datagram>
          </multiprotocol_encapsulation_info>
          <ISO_639_language_code>ger</ISO_639_language_code>
          <text>Hallo!</text>
        </descriptor>
      </descriptor_loop>
    </service_loop>
  </platform_loop>
</SDTDescription>
```

Appendix 4

List of Abbreviations

List of Abbreviations

Abbreviation	Designation
A	
AIT	Application Information Table
ASI	Asynchronous Serial Transport Stream Interface
ATM	
B	
C	
CRC	Cyclic Redundancy Checksum
D	
DAB	Digital Audio Broadcasting
DSMCC	Digital Storage Media Command and Control
DTV	Digital Television
DVB-T	Digital Video Broadcasting – Terrestrial
E	
EDS SOAP/XML	
EIT	Event Information Table
ETI	Ensemble Transport Interface
EPP	Ensemble Provider Profile
EPP	Equal Error Protection
F	
FEC	Forward Error Correction
G	
GUI	Graphical User Interface
H	
I	
INT	IP/MAC Notification Table
IP	Internet Protocol
J	
K	

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Abbreviation	Designation
L	
M	
MHP	Multimedia Home Platform
MOT	Multimedia Object Transfer
MPE	Multiprotocol Encapsulation
MPEG-2	Moving Pictures Expert Group -2
MPEG-2 TS	Moving Pictures Expert Group-2, Transport Stream
N	
NDIS	Network Driver Interface Specification
NIT	Network Information Table
O	
P	
PAT	Program Association Table
PID	Packet Identifier
PMT	Program Map Table
Q	
R	
RS	Reed Solomon
S	
SDT	Service Description Table
SPI	Synchronous Parallel Transport Stream Interface
STI	Service Transport Interface
T	
TCP/IP	Transfer Control Protocol / Internet Protocol
TS	Transport Stream