64-Channel
IPTV Remultiplexer
Controller

SW-4956

Device controller software for the
64-Channel IPTV Remultiplexer

Instruction manual

V 1.02

Contents

1. The structure and installation of the SW-4956 software

The SW-4956 64-Channel IPTV Remultiplexer Controller is the configuring and controlling software for the CW-4956 type 64-Channel IPTV Remultiplexer. For the sake of the users two versions are available:

- **Light version** - for those who are going to reach the operational conditions quickly without having high level knowledge in this field of digital television technology. In this version many parameters are preset automatically according to the factory considerations.
- **Full version** - here the service parameters can be modified in details according to the user's demand. This mode is recommended for skilled users creating professional services.

On installing the software both versions are installed and each of them can be selected in the View menu item any time. The facilities are as follows:

- **Light version:** setting the main data of the 64 IPTV output signals, saving the data into file and loading data from file, and loading the operational program into device in one step.
- **Full version:** besides the facilities of the Light version, there are possibilities for detailed viewing and modifying the parameters of the tables and descriptors, setting possibilities of the device parameters (IP Address, MAC Address, gateway, netmask, timings, filters, enable/disable, etc.), changing the parts of the operating program, checking the operation by the diagnostics module.

The settings of the 64 channels are stored in a common data base. The software of the configured data base can change on clicking the **Compile …** button, so the user can change between the Light and the Full version any time.

We recommend using the Light version for beginners after setting the IP address and the TS Port Interval. In the Instruction Manual the important pieces of information are printed in normal size letters, the special information is printed in small letters.

The CW-4956 device is equipped with two Gigabit Ethernet Controller connector. The device is controlled via RJ 45 or optical connector with inscription 'Input'. On delivery condition the RJ45 connectors of the device are active, and can be connected to the network with CAT5 or CAT6 type cables. On inserting the optical module the device changes to the optical input automatically if it can establish connection there, and disconnects the RJ45 connector. First we recommend connecting the device to the PC with straight UTP cable via switch.

All products of CableWorld Ltd are of own development and constitute a uniform system. A number of descriptions can be found about using the Gigabit CW-Net system on the www.cableworld.hu web site. In the CableWorld system the software and the descriptions are available for free downloading and using. Answers to the Frequently Asked Questions can be found on the web site. The use of the software is supported by video help available for downloading.

The structure of the SW-4956 software

The structure of the SW-4956   64-Channel IPTV Remultiplexer device controller software is simple, anyone can learn using it by selecting the automatic services. For skilled users, the software support realising the unique conceptions with manual setting possibilities. The software comprise all the platforms required for setting the device; auxiliary software is not required. The SW-4956 software consist of the following parts:

- **Device Programmer** – user interface for loading the device controller programs. .
- **IPTV Remultiplexer Program Editor** – editor for making the device controller programs. Typically the program editing is made by entering and modifying data in text files.
- **Diagnostics** – diagnostics module, allows monitoring the operation of the internal units in the device, viewing the parameters in operation. (In the Full version only.)
- **System Configuration** − user interface for setting the general parameters of the device (IP Address, TS Port Interval, MAC Address, Lock, etc.) (In the Full version only.)

The block diagram of the software is shown in Figure 1.1. This can be seen on the screen on starting the software.
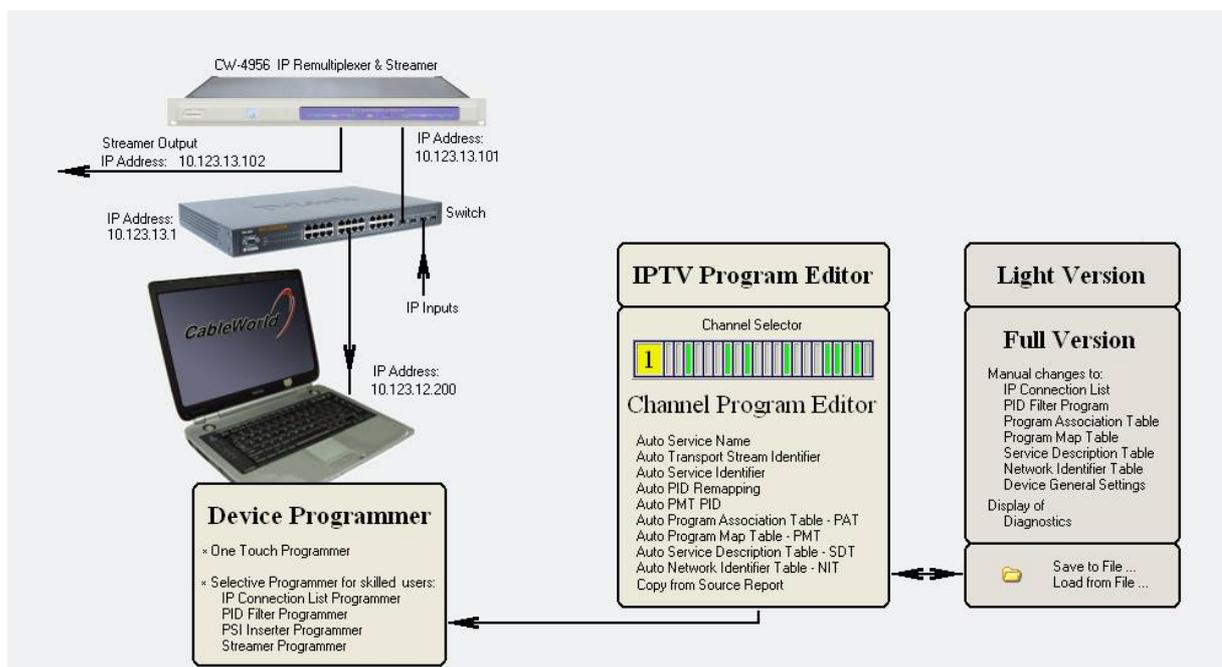

Figure 1.1
Structure of the SW-4956 software

Installing the SW-4956 software

The SW-4956 software installer can be downloaded from the www.cableworld.hu web site. On running the installer exe file the software installs in the C:\Program Files\CableWorld\SW_4956 directory. When operating more than one device or large systems, the whole content of the SW_4956 software directory should be copied to the directories of the systems and should be started from there to avoid mixing the settings of the several systems. The user should put the starting icons for the SW_4956 copies on the desktop. These icons should be subtitled according to the system characteristics.

The menu system of the software helps performing the following tasks:

File/

- **Load Settings –** SW4956a.ini, Connect.ini, IPTVpgm.spi
- **Save Settings –** SW4956a.ini, Connect.ini, IPTVpgm.spi
- **Save Settings and Exit** – saves the current settings and data and then exits. The software will start with these settings and data at the next running.
- **Exit** – exit without saving

View/   - (displaying contents and lists)

- **Channel Program from Memory** – displays the content of the Channel Program in the memory. It is practical, when the former database is spoiled. The effect is the same as if a new channel is selected for editing.
- **IP Connection List** –
- **PAT – Program Association Table**
- **PMT – Program Map Table**
- **SDT – Service Description Table**
- **NIT – Network Information Table**
- **Source Report from file** – allows viewing the source report (source.srp file) of the transport streams made by the SW-4952 software and allows taking data from it.
- **PID Filter Programs**
- **PSI Inserter Programs**
- **Output Stream Table**
- **List of 64 channels to Switch On or Switch Off** – The list is independent from Channel Programs (editable manually).
- **One Touch Programmer** – for reprogramming the device
- **Selective Programmer for skilled users** – separated programmer for modifying the parts of the program
- **SW-4956 Software Light version**
- **SW-4956 Software Full version**

Load from … / (loading file or from file)

- **Load IP Connection List from …** - file
- **Load IPTV Remultiplexer Program from …** - loads a *.spi file comprising 64 programs.

- **Load Channel Program from …** -
- **Load PAT Section from …** - to manual editor
- **Load PMT Section from …** - to manual editor
- **Load SDT Section from …** - to manual editor
- **Load NIT Section from …** - to manual editor
- **Load my TS Report from …** - allows loading TS Report (one TS) or Source Report (several TSs).

Save as … /   (saving contents to file)

- **Save IP Connection List as …**
- **Save 64 Channel IPTV Remultiplexer Program as …** - saves data base
- **Save Channel Program as …**
- **Save PAT Section as …**
- **Save PMT Section as …**
- **Save SDT Section as …**
- **Save NIT Section as …**
- **Save Output Stream Table as ...**

Edit/   (erasing, replacing or inserting)

- **Erase selected Channel Program** – restores basic values
- **Erase All Channel Program** – 64 programs
- **Replace Channel Programs** –
- **Insert Auto PAT to user defined PAT** – to manual editor
- **Insert Auto PMT to user defined PMT** – to manual editor
- **Insert Auto SDT to user defined SDT** – to manual editor
- **Insert Auto NIT to user defined NIT** – to manual editor
- **Apply Read back IP Connection List** – IP Connection List=Read back List

Read back .../

- **IP Connection List** – (from device)
- **PID Filter Program –** (from device)
- **PSI Inserter Ch/1...3 Program from Selected Channel** – (from device)
- **Program of Continuity Counter Automat** – (from device)
- **Output Stream Table** – (from device)
- **PSI Inserter Ch/4 Program from Selected Channel** – (from device)

Tools/   (starting the software if installed)

- **SW-4841 Ethernet Board Controller**
- **SW-4901 Gigabit Ethernet Controller**
- **SW-4811B TS Analyzer**
- **Wireshark –** (Ethernet analyser)
- **VLC Media Player**
- **TS Reader Lite**

2.   IPTV fundamentals

In digital television technology the components of the radio and television programs (e.g. video, audio, teletext, EPG, etc.) are transmitted in separated data streams. In the satellite and terrestrial signal distribution it is practical if the input signal to the modulator comprises components of several programs. In these systems the combined data stream of 6 to 8 or more programs is transmitted in a given channel of the frequency band simultaneously. The data stream transmitting the complete programs is called transport stream. If the transport stream carries only one program, it is SPTS type (Single Program Transport Stream), if it carries several programs, it is MPTS (Multi Program Transport Stream).

In case of the IPTV services the data transmission capacity is limited, so the transmission of unnecessary data streams should be avoided. That is, the IPTV service requires creating such data streams, which comprise only the most necessary components, (i.e. SPTS type).

In the case when the user produces the data streams of a program, the SPTS type is simple, needs no special procedure. The complex tasks will appear, when the user wants to receive programs from satellite, cable or terrestrial transmission. In this case the available MPTS data stream must be separated into several SPTS data streams. The creation of the SPTS data stream consists of two steps as follows:

● Separating the video-, audio, etc. data streams, assembling the elementary streams for a given program of the IPTV service.
● Creating new tables (min. PAT, PMT, SDT) according to the demand of the IPTV service.

Usually the IPTV services allows reception of several programs. Every program in the service requires a separate device or unit for supplying SPTS streams.

The streamer of the IPTV service encapsulates the SPTS data steams in UDP data streams with separate IP addresses and Port numbers. Usually 7 TS packets of 188 bytes each are inserted in every UDP/IP packet. The streamer's task is the temporary storing of the TS packets until the data amount required for sending out the UDP packet (usually 7 packets) is collected.

The CW-4956 IPTV Streamer can process almost every data stream format arriving at its ASI and IP input. It stores the packets temporarily in DDR2RAM. The 64 output streamers produce 64 SPTS or MPTS data streams according to the user's configuration.

Note: There are systems different from the above described. The IPTV service can be realised with MPTS data stream, as well. But realising this application requires comprehensive professional knowledge. For detailed professional instruction ask for cableworld@cableworld.hu.

3.   The structure of the CW-4956   64-Channel IPTV Remultiplexer

The CW-4956 64-Channel IPTV Remultiplexer can manage 60 IP and 4 ASI inputs, the maximum of the input streams can be 64. The IP inputs are identified with their IP Address and Port Number, so one of the parameters can be the same at several input streams, if the second can distinguish them. The contents of the UDP packets arriving with the same Destination IP Address and Destination Port Number will be summed. This feature sometimes can be used for increasing the number of inputs but it can cause the mixing of the packets, too.

Within the software the ASI inputs are identified with the Port Numbers 1 to 4 (the ASI Input-1 is the Port Number = 1 etc.). The device inputs are configured by the IP Connection List. The relationship of the 64 inputs with the IP Connection List is shown in Figure 3.1.
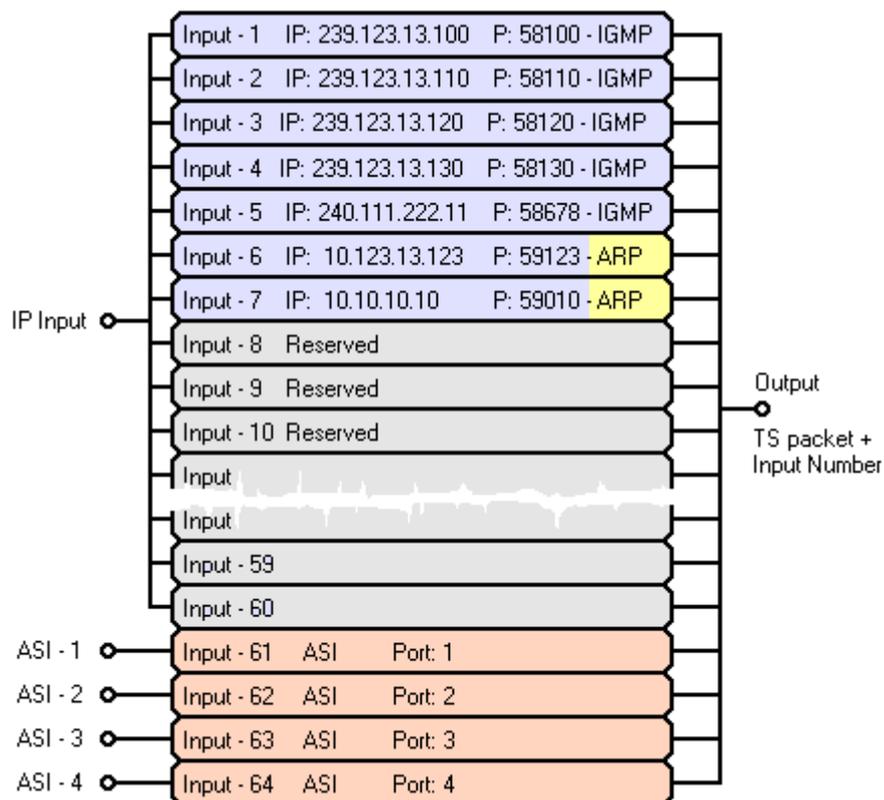
Figure 3.1
Relationship of the IP Connection List with the 64 inputs

The input filter module controls the enable/disable of the input data stream. As the ASI input can not be filtered, all the TS packets can pass to the PID Filter.

The input filters affix an information byte to the transferred transport stream packet. The affixed byte indicates the input number where it was transferred. Later the PID Filter will form the packet according to the PID value and the input number.

The IP inputs can be configured by loading the IP Connection List. The IP Connection List determines, which IP addresses and Port numbers (i.e. data streams) are enabled by one or another member of the 60 IP inputs. Besides the IP Address and Port Number the IP inputs must be assigned with one marking from the following three groups:

● Multicast connection, marking: IGMP
● Unicast connection, marking: ARP
● Reserve (not used) input, marking: Res

The input unit manages the inputs marked with IGMP code, according to the IGMPv2 protocol, and sends messages to the network requesting the data stream. In case of ARP marking the device will not initiate sending messages, it answers the arriving ARP messages only. In case of the marking 'Res', the input module transfers no packets, it takes the written IP address and Port data as preliminary reservation.

Important note: The IP Connection List configuring the inputs is in close relationship with the PID filters. If the IP Connection List is modified, and it affects the operation of the PID Filters (e.g. transferring the data stream from one input to another), then the reconfiguring of the PID Filter is necessary.

The IP addresses and Port numbers can be used extensively, but remember the following restrictions:
● The Port Number values 1 to 4 identify the four ASI inputs, TS must not arrive here.
● The transport stream can be transmitted at the Port Number values within the TS Port Interval range. The value of the TS Port Interval must be set by programming. The factory settings are: TS Port Lower Limit: 57000,   TS Port Upper Limit: 59999.
● The communication Port must always be outside the TS Port Interval range. The SW-4956 software communicates with the device at Port Number 56946. The value of the communication port can be modified in the SW4956a.ini file.

After the input filter, the PID Filter determines the input number and PID value of the packets, which can pass by to the 1 gigabit SDRAM operating as FIFO. The fast FPGA circuits give great freedom in creating the output streams. Remember, that every TS packet can be built only in one of the 64 output streams. The device has no packet copying unit, so data streams must be built in the output streams as many times as required. The block diagram of the device is shown in Figure 3.2.

The output stage of the device operates in continuous streamer mode. As for communication it answers only the ARP and Ping messages, even this can be disabled. The output can completely be configured through the input IP connector. So the output stage is completely protected from external effects; in IPTV services firewall is not required.
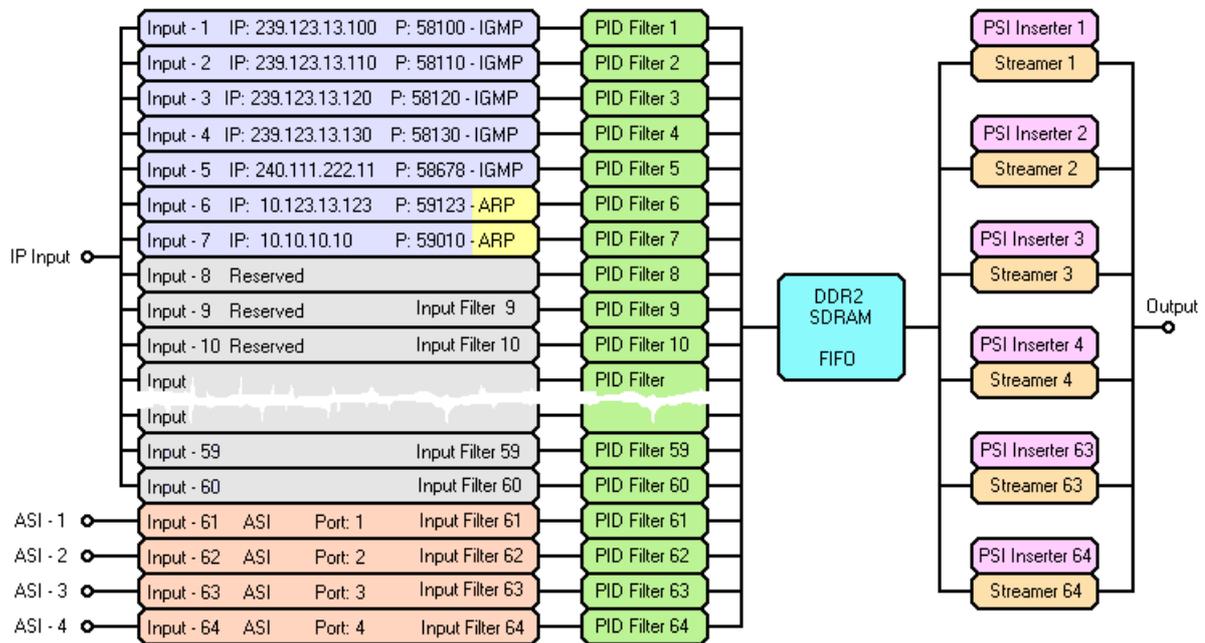
Figure 3.2
Block diagram of the 64-Channel IPTV Remultiplexer

Important note: **the TS packets arriving at the device input, can be used only once. Every packet can be built in one output stream only. For using at several places, the packet must be fed in several inputs.**

The device stores the programs in EEPROMs and Flash memories. The loading of the general settings (IP Address, TS Port Interval, IP Connection List etc.) is very fast; it takes a few seconds only. The size of the Flash memory of the PID Filter and the PSI Inserter is 0.5 Gbit each. The complete deleting time of the Flash depends on the type, the ageing and the temperature (4 to 16 minutes), but the two Flash memories can be deleted simultaneously. The writing process in the Flash memories is fast, it takes a few minutes only. The complete reprogramming of the device typically takes 10 to 20 minutes. Little modifications can be loaded in a few seconds.

4.   Creating the IPTV Remultiplexer program

The CW-4956 64-Channel IPTV Remultiplexer comprises 64 transport stream remultiplexers. The operation of every one of the 64 remultiplexers must be defined separately by making a unique operating program for each of them. The SW-4956 software can create the 64 programs automatically, if the user defines

● the IP address of the input data streams and
● the components (programs), what the output data stream should comprise.

The device is capable of producing 64 IPTV data streams, so making the 64 remultiplexer programs takes one or two days, even if defining the parameters of each data stream takes 10 minutes only. At the beginning, creating one channel program may take one hour or more. So configuring the 64 channels may take a week or more.

SW-4956 Software Light version   On choosing the View\SW-4956 Software Light version menu, a simplified user interface appears on the screen, where the most important parameters must be defined only. Most of the parameters are set by software automatically. In this mode a number of display surfaces and setting possibilities are not visible, so the user knows the way about the parameters easily. This mode is recommended for beginners.

SW-4956 Software Full version   In the View\SW-4956 Software Full version menu, the full range of the setting possibilities becomes visible. This mode is recommended for the skilled users of the digital television techniques.

The SW-4956 software stores the total program of the 64 remultiplexers in the IPTVpgm.spi file. This file can be found in the C:\Program Files\CableWorld\SW_4956\ IPTV_PGM directory. When the exit from the software happens with saving, the software saves the data in this file. On starting the software the data of this file will be loaded in. The total program can be saved and loaded independently.

The separate programs of the remultiplexers are called 'Channel Program'. The IPTVpgm.spi file comprises 64 Channel Programs. The Channel Programs can be saved and loaded independently and can replace each other. So the total program of the 64 remultiplexers can be rearranged easily.

Channel Program   The independent program of each remultiplexer is called Channel Program. The Channel Program comprises the data of one remultiplexer unit. The Channel Program consists of the following parts:

● **Data of the output stream** – are used for making the program of the output streamer.
● **Data of the input streams** – are used for making the IP Connection List and the PID Filter Program, that enables the PID transit and PID Remapping.
● **Data of the Output stream' tables** – are used for making the PSI Inserter program, that generates the PAT, PMT, SDT and NIT tables.

The Channel Program becomes visible on clicking the **IPTV Remultiplexer Program Editor** tab. On clicking the LED-like indicator on the left or moving the scrollbar, the Channel Program to be displayed can be selected by setting a number 1 to 64. After this selection, the total user interface will display the data of this channel. A part of the user interface is shown in Figure 4.1.
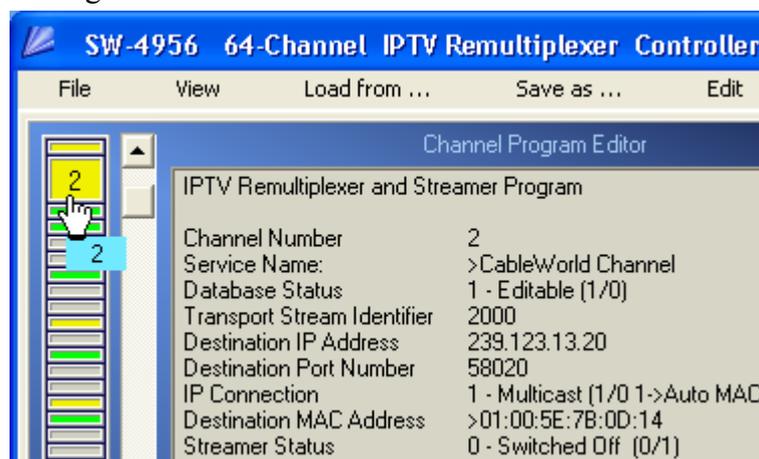

Figure 4.1
Channel Program selection components, coloured LED-like indicator and scrollbar

The Channel Program Editor displays the data as text. The data can be modified by modifying the text. The software receives and processes the data on clicking the **Compile ...** button.

The suggested editing mode   Start modifying the data on top of the text database and click the Compile ... button as often as possible. On erroneous data entry the software corrects the data immediately or suggests modification. First it is practical to ask for processing after each data modification. After some practice, multiple data entries are allowed. Important note: in the text database inserting or deleting new lines by copying or typing is not allowed! Within the lines the data can be modified by copying, typing or deleting. In the lines where the mark '<' can be seen, there are such data (e.g. hexadecimal numbers), which must be separated from the text. The '>' mark shows the beginning of the data line. In the data where each character has an important role, the data is built in between the characters '>' '<'. The software waits for the data in the same format, as it uses for displaying. If the data entry is missed, choose the repeated displaying by the View/Channel Program from Memory menu. Doing steps back and forth with the channel selector has the same effect.

Undo   On clicking the Compile button, the software first saves the current database, and then starts entering the new data. The position before the processing, can be restored with the Undo button.

Save   The user can save the current database into the protected section of the RAM.

Recall   The database last saved in the RAM, will be recalled. The Save and Recall buttons can be used for copying the data, as well.

Channel Number The identifier of the channel (the internal remultiplexer), (cannot be modified).

Service Name The name of the channel service. It is built in the SDT table by the software automatically.

Database Status On starting, the software sets the selected database status to '1 – Editable' mode. By setting the status to '0 – Read Only', the user can protect the perfect program from random interventions. Protect the definitive data by setting this variable to '0'.

The first set of the database comprises the parameters of the output stream (name, IP address, Port Number, etc.), these will be modified only, if the user wants to change the basic settings. The first data set appears as follows:

IPTV Remultiplexer and Streamer Program

Channel Number	37
Service Name:	>IPTV Pgm - 37
Database Status	1 - Editable (1/0)
Transport Stream Identifier	37000
Destination IP Address	239.123.14.114
Destination Port Number	58370
IP Connection	1 - Multicast (1/0 1->Auto MAC)
Destination MAC Address	>01:00:5E:7B:0E:72
Streamer Status	0 - Switched Off (0/1)

Streamer Status The output streamer of the configured remultiplexer can be switched on/off, irrespectively of the program inside. The colour of the LED on the left display belonging to the remultiplexer:
- grey, if the program is not prepared,
- yellow, if the program has been compiled, but the unit is switched off,
- green, if the switched on status is written in the database.

Remember, switching on the output streamer is an important step of making the Channel Program!

The second set of the database comprises the data of the input stream. The basic setting assumes, that the output stream is created from one transport stream (1-Common Source). After the IP Address and the Port Number are given, the device sends IGMP messages, if the connection type is set to multicast mode (basic setting).

Number of Elementary Streams	2
Source of Elementary Streams	1 - Common Source (1/0)
Source IP Address	239.123.13.1
Source Port Number	58000
Type of IP Connection	1 - Multicast (1/0)

Important note: Due to the device construction every one input data stream (input PID or packet) can be used only once in creating the output streams! If the same data stream (e.g. teletext) is to be built in two output streams, it must be fed into two input ports. The device is unable for copying, multiplying the packets.

Number of Elementary Streams   Important characteristic of the output stream, the number of the component data streams (video, audio, TXT, etc.). When one or more tables (PMT, SDT, TDT, TOT, etc.) are transferred from the input transport stream, then this parameter must be increased with the number of these tables. When the number of the components appearing on the screen is not as many as your demand, enter the desired number, click the Compile button and the software does the modification. The software compiles the PID Filter & Remapper program from the data of the components.

In the data set of the elementary streams the value of the input PID and the stream type must always be defined accurately!

```
> Elementary Stream  #1
Output PID (new PID)            3710   h0E7E
Input PID (source PID)          8190   h1FFE
Stream Type                     1  Video

> Elementary Stream  #2
Output PID (new PID)            3720   h0E88
Input PID (source PID)          8190   h1FFE
Stream Type                     3  Audio
```

The data set of the PAT, PMT, SDT and NIT tables is the last in the database. The software creates the tables automatically, the user's intervention is required only for changing the basic settings.

PAT Section   The PAT table is created by the software and comprises one service. The starting database of the PAT can be seen in the editor as follows:

```
Program Association Table       PAT
Source of PAT                   0 - PSI Inserter (0-1-2)
PAT - PMT Inserter Program      0 - Create Automatically (0-1-2)
Version Number                  1   h01
Service Identifier              37000   h9088
PMT PID                         3700   h0E74
PAT - PMT Repetition Time       200 ms
```

PMT Section   The PMT table is made automatically, too. The user's intervention is required only for changing the basic settings. The data set of the PMT:

```
Program Map Table               PMT
Source of PMT                   0 - PSI Inserter (0-1-2)
Version Number                  1   h01
PCR PID                         3710   h0E7E
Number of Elementary Streams    2
```

The number of elementary streams built into the table by the software is defined in the PMT data set. When some tables are taken from the input, the number given at the PID Filter must be diminished with the number of tables! Always the data streams at the end of the list will be omitted.

SDT Section   The SDT comprises the data of one service. The software automatically writes in the table the Provider Name given in the \Settings\4956a.ini file and the service name (IPTV Pgm – 37) derived from the basic data given in the file.

Service Description Table	SDT
Source of SDT	0 - PSI Inserter (0-1-2)
SDT Inserter Program	0 - Create Automatically (0-1-2)
Version Number	1 h01
Original Network Id	0 h0000
SDT Repetition Time	1000 ms

NIT Section   The NIT table is made automatically from the basic data, the data set appears as follows:

Network Information Table	NIT
Source of NIT	0 - PSI Inserter (0-1-2)
NIT Inserter Program	0 - Create Automatically (0-1-2)
Version Number	1 h01
NIT Repetition Time	4000 ms

The four tables above can be switched off in the Source of Table line by typing the digit '2'. When the PMT table will be taken from the input, write '1' into the Source of Table line.

Making program quickly with copying

The 64-Channel IPTV Remultiplexer has no input transport stream analyser, but it can receive the Source Report (of the input transport streams) made by the SW-4952 TS Remultiplexer through file (Source.srp). On selecting the **Load my TS Report from …** menu, files comprising one or more TS data can be loaded in. The software saves the loaded file in the \Sources\Source.srp file for use afterwards.

On selecting the View\Source Report from file … menu, on the right of the editor the transport streams appear in tree structure. On clicking some service within the transport stream, the text of the button with inscription '**Insert ...**' tells, what services can be inserted. On clicking the **Insert …** button the software creates the channel program as follows:
- Every elementary stream is taken over.
- The PMT table from the input is transferred.
- PAT, SDT and NIT tables are generated automatically by the PSI Inserter.

The quick program making with duplication is a good preparation for the services to be modified, so its use is recommended for those, who are able to make the Source Report with the SW-4952 software. Working with multicast input streams no device is required for using the SW-4952 software. Making and loading in the Source Report helps making the Channel Program even if it is used only for viewing the TS data.

5.   Programming the 64-Channel IPTV Remultiplexer

The SW-4956 software comprises all the modules needed for programming the device, supplementary software is not needed. In the course of programming the 64 Channel IPTV Remultiplexer & Streamer, the 64 transport streams have a common IP input. The SW-4956 software offers the two possibilities as follows:

One Touch Programmer   On selecting the View\One Touch Programmer menu, click the button and wait until the software configures all the 64 remultiplexers according to the current settings. The programming usually takes a multiple of ten minutes, depending on the content of the program and the deviation of the physical parameters of the built in memories. The One Touch Programmer does the tasks as follows:
- Reprogramming the IP Connection List
- Reprogramming the 64 input PID Filters
- Reprogramming the 64 channels' PSI Inserter (the PAT-PMT, SDT and NIT Inserter and switching off the fourth Inserter)
- Reprogramming the Output StreamTable

Selective Programmer for skilled users   On selecting the View\Selective Programmer for skilled users menu the remultiplexer programs can be loaded in separately. Simple modifications or corrections can be accomplished in this mode quickly. But this mode is recommended for those who are fully aware of the operation of every part of the device. Of course the One Touch Programmer is available in this mode, as well.

Setting the general parameters   At installing the device, the setting of the required parameters (IP Address, MAC address, TS Port Interval etc.) can be performed on the page **'System Configuration'** of the SW-4956 software Full version, contrary to the former products of CableWorld.

5.1. Setting the general parameters

The general parameters must usually be set only in the first period of the installation. The parameters can be set on entering the System Configuration page. At building the systems, when operating several devices in a system, the correct setting of the IP Address is the most important. The factory setting is 10.123.13.101 IP address. The the IP address can be modified with the **Replace IP Address** function.

The other important parameters to be set are the TS Port Interval and the Communication Port. For setting the important and other parameters detailed guide can be found in chapter System Configuration (8).

Note: The CW-4955, CW-4956 and CW-4957 type devices are the third generation products of CableWorld. The instruction set is with 16 bit organization, so the parameters cannot be set with the former software. The new types support the former systems only, that they answer the Query question of the Gigabit system (e.g. SW-4901), but content of the answer cannot be interpreted for the former software.

5.2. Programming the IP Connection List

The task of the IP Connection List is assigning the input streams and the inputs, managing the multicast network. The IP Connection List can be programmed and read back independently. Remember, the transfer of the input streams requires modifying the program of the input PID Filters.

5.3. Programming the PID Filters

Important, that the PID Filters are assigned to the inputs and not to the output channels. The program of the PID Filters can be loaded and read back separately. The software allows programming one group of the PID Filters, too. The number of PID Filters to be programmed are asked by the software at the beginning of programming.

5.4. Programming the PSI Inserters

The most important part of the 64-output channel program is the PSI Inserter program of the channel. As programming the built in $64 \times 4 = 256$ PSI Inserters simultaneously is a great task, the software allows programming the selected ones on demand. The modules to be programmed must be selected with the Channel Selector controls.

The software informs about the state of programming continually. Interrupting the programming is undesirable (but it is enabled).

5.5. Programming the Output Stream Table

The programming of the Output Stream Table defining the parameters of the output streams can be program in one step mode. The program consist of 64 channel programs.

The device stores the time of the last programming. The stored time can be seen on the System Configuration page after the Query.

6. SW-4956 software services for qualified operators

The basic settings of the CW-4956 software have been developed for the beginner user to do the required settings quickly and simply. In the course of development we think about the skilled users, who want to realize their own ideas. In this chapter we show how the customized ideas can be realized in manual mode. At manual modifications the **Auto Identifier** and the **Auto PID** limit the setting possibilities, so they must be switched off in this case.

6.1. IP Connection List

The SW-4956 software compiles the 64 output data streams from 4 ASI and 60 IP input data streams. The 60 IP inputs of the device can receive data streams of any IP address and Port number. For every IP data stream the IP Connection List defines the ordinal number of the input, where it is to arrive. On processing any channel program (on clicking the Compile … button), the software makes a new IP Connection List program. The program puts on the list only the input streams of those channels, which are switched on (Streamer Status = Switched On). In this list the sequence of the inputs is the same as the sequence in the list of demands made beginning from the Channel Program 1. Every paired IP Address and Port Number is put on the list only once.

In the software (Full version) the user can use an individual IP Connection List, i.e. the program will not modify this list depending on the instantaneous status. The IP Connection List can be edited manually in the ini file or in the IP Connection List Editor. The list can be saved in file and can be loaded from file. In professional applications using the manual list or closing the automatically edited list by switching to manual mode are favourable.

Important note: The PID Filters identify the data streams according to the ordinal number of the input. So after modifying the IP Connection List, reprogramming the PID Filters of the channels concerned is necessary, if any IP data stream is shifted to another input.

The device ask for the multicast data streams from the network according to the IP Connection List. In multicast transmission the network management and entering the data streams happen automatically according to the list. In unicast transmission the data streams must be sent by the user. The data can be put on the list in arbitrary sequence, the temporarily unused data streams can be switched off with the 'Disabled' signal. A 8-character identifier can be assigned to the data of the IP inputs, it has no effect on the operation, but useful in documentation of the settings. The identifier made automatically by the software (e.g. Stream28) shows the channel program, where this data stream was used first. The unique identifier featuring the data stream (e.g. Astra_HD) can be typed in, after changing to manual mode and switching off the 'Read only' mode. The data modification must be validated with the **Compile IP Connection List** button.

The IP Connection List can be read back from the device, the read back database will be saved automatically by the software in the \IPconPGM\ReadConn.ini file.

Supplementary information:

At creating the MPTS and some SPTS data streams the output stream must be compiled from several input streams. In these cases set the source of the input data streams to multiple sources by typing '0' as follows (0 – Separated Source (0/1)):

Number of Elementary Streams   6
Source of Elementary Streams   0 - Separated Sources (0/1)

In this setting the sources of the input streams must be given separately, and the software puts the source of the components on the IP Connection List. The SW-4956 software allows inserting up to 128 Elementary streams into the output stream, but the total number of the sources must not be more than 60+4. These special possibilities can be used only in the full version of the software.
(The device hardware does not limit the number of the elementary streams to be built into the output stream.)

6.2. PID Filter

All the 64 inputs of the device have a 8192 piece PID Filter, the value of the PIDs can be modified on demand. The bit enabling or disabling the transit, the value of the output PID and the number of the output, where this packet with this PID value is to be sent, are carried by a 4-byte data. The 4-byte data is stored in Flash memory. In the PID Filter Flash memory the data of the inputs are stored in separate blocks, so that the data of the inputs can be deleted or modified separately. The data of Input-1 are in Block 0, the further data are located next to it. The data of the deleted Block disable the operation of the assigned PID Filter modules. The PID Filter Blocks can be deleted directly in the System Configuration page.

The program of the 64 PID Filters will be made again with each compilation by the software, and in the course of making, the data of all the 64 channels will be processed. In many cases (e.g. when only four input streams are used), rewriting all the 64 PID Filter programs is not necessary, so the Full version of the software allows programming the PID Filters in limited range (e.g. from PID Filter 1 to PID Filter 4).

6.3. PSI Inserter

The capacity of the PSI Inserter storage device is 64 Mbytes, which is divided into equal parts for the 64 channels. The 64 Mbyte Flash memory comprises 512 blocks, so the data can be stored in 8 blocks for each channel. Each block can be deleted independently, too. The block can store 512 TS packets. The 4 PSI Inserters in every channel have the following storage capacity.

1. PAT-PMT Inserter   max. 512 TS packets   1 block
2. SDT Inserter   max. 256 TS packets   1/2 block
3. NIT Inserter   max. 256 TS packets   1/2 block
4. User defined Inserter   max.3072 TS packets   6 blocks

Supplementary information:

The PSI Inserter stores each TS packet in the 256-byte section of the Flash memory. In the course of programming the PSI Inserter, the packets must be entered one by one, together with the waiting time preceding the packet insertion and with the bit requesting the generating of the automatic Continuity Counter. The raster of the waiting time is 10 ms, the shortest waiting time is 10 ms, the variable of the waiting time is of 2 bytes.

The PSI Inserters in each channel comprise 16 counters, so they can generate the data of the Continuity Counter for 16 different PID values. The 16 PID values must be set by programming.

The PAT-PMT-SDT-NIT Inserters can be programmed with the SW-4956 software, the programmer disables the operation of the 4th PSI Inserter. The 4th PSI Inserter allows the user generating special data streams (e.g. for refreshing set-top box software). The data of the 4th PSI Inserter can be loaded into device with the programmer module on the System Configuration page.

The user is allowed to load self made packets into any of the four PSI Inserters. The SW-4956 software can process and load in the 188 byte TS packets and the *.doi file formats made in the SW-4952 TS Remultiplexer and the SW-4956 software. (Note: The SW-4952 software generates the timing data in 1 ms raster, the SW-4956 software generates in 10 ms raster. The SW-4956 software detects and converts these automatically to 10 ms raster.)

In programming the PSI Inserter, the packets to be loaded will be saved automatically into file of *.doi and *.ts format by the software. The saving happens in the IPTV_PGM\PSI_PGM directory. In saving 32 null packets are inserted to the packets, so they can be analysed easily with the TS analyzer software. The programs having been loaded into device can be read back, and then can be found in the Readback directory in *.doi and *.ts format.

6.4. Program Association Table – PAT

The SW-4956 software creates the PAT table automatically for the IPTV data stream compiled by the user. This table comprises only one service (SPTS), the user's job is only the programming. The current data of the PAT table can be seen in the PAT Editor on clicking the **View/PAT** menu item.

Supplementary information:

The software always creates a PAT table comprising one Service, indicating the NIT transmitted in PID 16.

The manual PAT editor will be available, if the PAT-PMT Inserter Program data is modified to 1 and the Compile ... button has been pushed in the Channel Program. As the data of the PAT and PMT tables are in close relation, the editor of the two tables can be set to auto or manual mode simultaneously. The data of the PAT table in the Channel Program are as follows:

Program Association Table	PAT
Source of PAT	0 - PSI Inserter (0-1-2)
PAT - PMT Inserter Program	1 - Create Manually (0-1-2)
Version Number	1 h01
Service Identifier	28000 h6D60
PMT PID	2800 h0AF0
PAT - PMT Repetition Time	200 ms

In manual editing mode the table data can be seen on the display of the PAT Editor as follows:

Program Association Table - PAT

PAT Number	28
Type of PAT:	Created Manually
PAT Editor Status:	Read Only
PAT Packet Header	>47 40 00 10
PAT Pointer	>00
PAT Section	>00 B0 11 6D 60 C3 00 00
NIT Service	>00 00 00 10
Service - 2	>6D 60 0A F0
CRC (Read Only)	>6F 95 00 95
Number of Services	2 (with NIT)

In the basic setting the Table Editor can be read only, disabling the protection is the user's task. The whole table can be seen under the table data after scrolling down the scrollbar as follows:

Program Association Table - PAT (Read Only)
47 40 00 10 00 00 B0 11 6D 60 C3 00 00 00 00 00
10 6D 60 0A F0 6F 95 00 95

When the PAT table is to be made for MPTS, set the number of services first, and after clicking the Compile button type the PAT data.

The automatic settings of the PAT editor:

In the **Auto Identifier** mode the software generates a discrete **Service Identifier** value from the initial and raster values given in the SW4952a.ini file (see Auto Mode) and the channel number. On unchecking the Auto Identifier checkbox the Service Identifier can be set on demand.

The **PMT PID** is calculated in Auto PID mode from the initial and raster values given in the SW4952a.ini file. On unchecking the Auto PID checkbox the PMT PID can be set on demand.

For the value of the **PAT - PMT Repetition Time** the software sets 200 ms. The user can freely modify this value between 1 and 10000 ms. The software distinguishes the copying from the Source Report by setting a repetition time of 210 ms (variable).

Other methods of the manual PAT editing:

The manual editing mode can be started in the Channel Program Editor by selecting the mode '1-Manually' (+ Compile …), and then the View/PAT menu and unchecking the 'Read Only' checkbox. Then start modifying the data in small steps and check by clicking the Compile PAT button, what the editor has accepted, what data are allowed to modify. The PAT Section with CRC at the end can be saved in file and can be loaded from file (SW_4956\Tables*.dat). The data storages of the manual and the automatic editor are independent from each other. The 'Number of Service' variable must be set manually in file operations, too. In the course of the Compile PAT operation always a new CRC will be made.

6.5. PMT – Program Map Table

The SW-4956 software makes the PMT table automatically for the IPTV data stream compiled by the user. In Auto mode only the PSI Inserter must be programmed.

Supplementary information:

The SW-4956 software displays the data of the PMT table in the Channel Program Editor box as follows:

Program Map Table	PMT
Source of PMT	0 - PSI Inserter (0-1-2)
Version Number	1 h01
PCR PID	2810 h0AFA
Number of Elementary Streams	2

The virtually missing data (e.g. PMT PID or PAT – PMT Inserter Program Create Automatically/Manually) are common with the data of the PAT table, so they are not displayed again. The user can avoid the automatic services and can modify the parameters on demand as follows:

On selecting '0' (basic value) in the **Source of PMT** line, the PSI Inserter will create the PMT table. On selecting '1', the PSI Inserter will not create PMT table, the user can transfer one PMT table from the input streams. On selecting '2', the Switched Off inscription will appear, indicating that the user needs no PMT table.

Very often the user wants to transfer the PMT table from the input. Then select setting '1' (PMT transfer from the input), and in the train of the elementary streams after the video, audio, etc., data streams type the transfer of the PMT PID to the PMT table, as well. But at creating the PMT table do not add the PMT data stream to the **Number of Elementary Streams**. E.g.
- The transferred ES data streams: video1, audio1, audio2, PMT, EPG, TDT, TOT (Number of Elementary Streams=7)
- At creating the PMT, the number of data streams getting into the PMT is less than above (Number of Elementary Streams = 3).

On setting '0' in the **PAT - PMT Inserter Program** line the PSI Inserter program will be created automatically, on selecting '1' the software makes the PSI Inserter program from the table edited by the user manually. In the case of code '2', on loading the program the software requires giving the complete program of the PSI Inserter in file.

The value of the **Number of Elementary Streames** is used for giving the number of elementary streams to be inserted in the PMT table.

For viewing the current PMT table click the **View / PMT – Program Map Table** menu item. The PMT Editor shows the automatically or manually edited PMT table depending on the setting. The manual editing of the PMT table happens here, if the PAT-PMT Inserter Program Create Manually mode has been set and compiled previously into the Channel Program. End the Read Only mode before starting the editing. During entering the data click the **Compile PMT** button frequently, to see the partial results, too. The editor allows editing only one PMT. PMTs for MPTS transmission can be loaded only from file in the first version of the software.

At manual editing we recommend using the Edit menu for loading the automatically edited PMT in the manual editor, and then modifying it. The manual PMT editor is prepared mostly for modifying the descriptors. It is always practical to create the frame of the PMT by the software. The PMT Section can be saved in file and can be load from file. The data storages of the manual and the automatic editor are independent from each other.

For inserting the descriptors the variable 'Status of Descriptors' must be set to zero, then the compiler arriving at this item will open the Descriptor Editor. The upper table of the Descriptor Editor shows the current descriptors, the lower table shows the components of a directory which can be loaded from ini file. For compiling the descriptor sequence, copy the descriptors from the directory to the upper table in the desired order. The descriptors can be modified manually in both tables. Use the Compile button frequently. After finishing the descriptor editing, insert them in the table.

For skilled users we recommend using their own descriptor directory file, either loading it occasionally or modifying or replacing the \Settings\Descript.ini file.

At using the Source Report the software makes a program, which transfers the PMT table from the input data stream. The software copies the PMT table from the Source Report to the manual editor of the PMT Editor too, so it can be viewed in the PMT Editor and can be created by the PSI Inserter locally.

6.6.   SDT – Service Description Table

The SW-4956 software generates the SDT table automatically for the IPTV data streams compiled by the user. In Auto mode only the PSI Inserter must be programmed. The Provider Name must be given in the Settings\SW4956a.ini file and it is the same in all the 64 channels. The Service Name is taken from the 4th line of the Channel Program, the name is freely variable.

Supplementary information:

The SW-4956 software displays the data of the SDT table in the Channel Program Editor box as follows:

```
Service Description Table     SDT
Source of SDT                 0 - PSI Inserter (0-1-2)
SDT Inserter Program          0 - Create Automatically (0-1-2)
Version Number                1   h01
Original Network Id           0   h0000
SDT Repetition Time           1000 ms
```

On selecting '0' (basic value) in the **Source of SDT** line the PSI Inserter will create the SDT table. On selecting '1' the PSI Inserter will not create SDT table, the user can transfer the SDT table from the input streams. On selecting the '2' the Switched Off inscription appears, indicating that the user needs no SDT table.

On setting '0' in the **SDT Inserter Program** line the PSI Inserter program will be created automatically, on selecting '1' the software makes the PSI Inserter program from the table edited by the user manually. In the case of code '2', on loading the program the software requires giving the complete program of the PSI Inserter in file.

For viewing the current SDT table click the **View / SDT – Service Description Table** menu item. The manual editing of the SDT table also happens here, if the Create Manually mode has been set previously. The SDT table comprises many descriptors, the use and editing possibilities of the Descriptor Editor is reviewed at the PMT table. New services can be inserted to MPTS by setting the Insert New Service data to '1'. The Provider Name and the Service Name must be given at requesting the insertion. The Service Id etc. can be modified any time after the insertion, but then the two names can be modified only with the Descriptor Editor.

6.7.   NIT – Network Information Table

The SW-4956 software makes the NIT table automatically for the IPTV data streams compiled by the user. In Auto mode only the PSI Inserter must be programmed.

Supplementary information:

The manual editing of the NIT table happens as described at the PMT and SDT table. The descriptors can be modified only with the Descriptor Editor. On setting the Status of Descriptors variable to '0' and clicking the Compile NIT button the Descriptor Editor appears automatically. At the manual editing of the NIT, creating a new table from the table edited by the software or loaded from file is also recommended.

6.8.   Output Stream Table

The Output Stream Table comprises the output data of the 64 output streamers (IP Address, Port Number, MAC Address, Stream Identifier, Stream Name) and the switched on or off state. In general case the Output Stream Table is made from the total program of the 64 channels. The Output Stream Table can be loaded to device and read back from there alone, too.

Supplementary information:

The data of the Output Stream Table are very important at configuring systems, because irrespectively of the content these data define the characteristics of the output streams. The data set read from the channel programs can be saved in file and can be loaded from there, too. In order to edit these important parameters independently, the data will be stored in ini file. The speciality of the loading from file is, that the loading can be requested with or without the name of the channels appearing in the SDT table later.

We recommend the builders of large systems, starting with defining the output data of the 64 channel program, and save in file the data of the well structured system. The prepared Stream Table, the loading of the data from file significantly accelerate the configuring process in case of building several systems.

The program can be made as follows, too:
- deleting the entire program,
- loading in the data of the output streams from the prepared file together with the name,
- entering the contents of the streams

On selecting the View/Selective Programmer for skilled users menu the Output Stream Table can be loaded to device independently, then it can be read back from there, and the list read back can be saved in the TEXTfiles\Streams.txt file in text format. The Text format is useful for documentation, it can simply be completed with notes, but cannot be loaded back.

6.9.   Storing the programs, special services for special applications

Supplementary information:

The SW-4956 software stores the data required for programming the 64 remultiplexers in the IPTVpgm.spi file. Always the Channel Program with the number selected by clicking the LED indicator or the scrollbar appears on the IPTV Remultiplexer Program Editor page. The LED and the number of the selected remultiplexer are always magnified. The programs prepared after the compilation have no effect on the operation of the device. For activating the programs they must be load to device one by one, in group or all in one step.

The data of the Channel Program Editor are divided into three groups. The data of the simplest group cannot be modified or cause minor changes, so it is not worth dealing with. The second group has been introduced for the beginner users. The setting of these is very important. The data of the third group provide special opportunities for the trained personnel, we deal with them next.

The name on the top of the database is used for identifying the channel, this will get in the SDT, too.
The output streamer does the streaming in every case unconditionally. Setting the IP Connection type to multicast mode, releases the programmer only from calculating the Destination MAC Address.

By changing the Source of Elementary Streams setting, the programmer can compile output stream from different data streams. At using different sources, the source data must be given at every elementary stream. The creating of the MPTS data stream is fully supported by the device. The support is limited by the SW-4956 software, a number of possibilities are limited in order to simplify the usage.

In the first line of the four tables the source of the table can be set. On changing the basic setting (0-PSI Inserter) the table can be transferred from one of the inputs. The setting switches the PSI Inserter off. On selecting the code '2', indicates for the software, that the user does not want to use this table.

In the next line of the table data, the user can take over the table editing job from the software. On selecting the manual editing, we recommend creating the table first by the software, then on setting the manual mode, load the table edited by the software to the table editor in the subpoint of the Edit menu. Modifying and editing the table made by the software automatically is much easier than creating a new table.

The data content of the tables (Section) can be saved in file and can be loaded from file. E.g. one edited NIT table can be inserted in several places. The Section comprises the data of the table from the h47 sync byte together with the 4-byte CRC. In the editor the Section is not divided into packets yet. The use of the Table Editor is described in points 6.4. to 6.7.

The instruction set of the device is published, the manufacturer supports the work of those users, who are going to write their own device controlling software for customised solutions. The latest instruction set can be downloaded from the www.bytestudio.hu home page.

6.10.   Reading back the programs from the device

The Full version of the SW-4956 software allows reading back the programs loaded to the device. Some of the read back programs have such format, that they can be loaded to another device, others can be used only for viewing and studying.

Supplementary information:

After reading back, the **IP Connection List** will be saved in the ...\IpconPGM\ReadConn.ini file, too. The structure of the file is the same as the Connect.ini file, so it can be loaded to other devices, too.
The IP Connection List displayed in text on the Read back … from Device page, can be saved in the ...\TXTfiles\ReadConn.txt file with the button under the display. The text file can be used for making reports, for documenting the system settings. The software allows fixing up the user's personal notes, as well. After the inscription 'My Comment:' it is practical typing the place and the conditions of the measurement. At creating the txt file the software always saves the current content of the textbox.

Before reading back the **PID Filter Program** the software requests the number of the input where the program will be read back. The read back program can be supplemented with notes, can be saved in file, but cannot be loaded to other devices. The PID Filter Program is compiled automatically from the data of the Channel Programs by the software. Reversing this process gives no obvious solution.

The reading back of the **PSI Inserter Program** is divided into two parts. The reading back happens always from the channel set in the Channel Program editor. The **Read back PSI Inserter Ch/1...3 Program** menu item reads back the program of the first three inserters (PAT-PMT, SDT, NIT) of the selected channel. The read back programs can be found in the ReadBack\PSI_pgm directory in *.doi and *.ts formats, the saving happens automatically. These file formats are suitable for loading and displaying on TS analyser, as well. The text displaying the division of the PSI Inserter Flash memory can be saved in txt file.

The size of the fourth PSI Inserter is extremely large, it is rarely used, the reading back of its content happens in separate menu item.

The reading back of the program of the 64 Continuity Counter Automat happens in the **Read back Program of Continuity Counter Automat** menu item. The read back program can be saved in txt file, this cannot be loaded to device.

The read back **Output Stream Table** can be saved in ini and txt format, only the ini format can be used for programming.

6.11. Advices and tips for using the software

The frequent changing between the Light and Full versions is not recommended, because the software of the Light version can rewrite the data entered previously.

The traffic lights in the GUI continuously indicate the changing, unprocessed data (yellow colour) and the errors (red colour). The green colour indicates, that the software has processed and interpreted the data. At the end of the user's interventions always the green colour will light.

Sometimes happen at great data changes, that on clicking the **Compile …** button no green signal appears. Then the data processing has not been completed, click the **Compile …** button again.

The displayed database (e.g. Channel Program, PAT Section etc.,) is correct and obvious, if on clicking the Compile … button many times in succession, the data remain constant. Also for checking the data, the repeated clicking of the **Compile …** button is practical.

Instruction manual

6.12.   The structure of the SW-4956   IPTV Remultiplexer Controller directory

C:\Program Files**SW_4956**

        Settings

                SW4956a.ini   storage of the settings

                Descript.ini   descriptor directory

                IPTV_1.ico

        IPconPGM

                Connect.ini   IP Connection List

                ReadConn.ini   the read back list

        IPTV_PGM

          PIDf_PGM

                PIDfilt.dap   program of the 64 PID filters

          PSI_PGM

                PSI1PAT.doi   table programs in doi format

                PSI1PAT.ts   table programs in ts format

          Streams

                StrTable.ini   parameters of output streams

          IPTVpgm.spi   joint program of 64 channels

          Ch_pgm.sci   program of one channel

        Sources

                Source.srp   report of the TSs loaded last

        Readback

          PSI_pgm

            PSI1_3.doi,   read back PSI Inserter Pgm

            PSI1_3.ts   read back PSI Inserter Pgm

        UserPGMs

                UserDef.doi   PSI Inserter program

                UserDef.ts   TS packets saved in file

        Tables

                PAT_1.dat   PAT Section

        TXTfiles

                Connect.txt   data in text format

                ReadCon.txt   data in text format

        Help

                4956Help_a.pdf   help in English

                4956Help_m.pdf   help in Hungarian

      Streamer.exe

7.   Diagnostics

On the diagnostics page the static and dynamic parameters can be displayed. On clicking the **Diagnosis** button the software queries the current parameters of the device and then displays them in text format. The displayed data can be saved in txt file.

In the course of measuring the dynamic parameters the software queries the parameters in every second and displays the changing in different charts (e.g. the internal supply voltages, the PCB temperature of the Streamer, the data rate of the internal modules and the grade of filling in the SDRAM.

In the facilities of the data rate measurements the IP network measurement is very important. On selecting the IP Network test the amount of data arriving at the device input can be seen. At measuring the IP Input the device displays the amount of data after the input IP Filter. At the correct operation of the IP network, these two amounts of data are equal, i.e. no redundant data streams arrive at the device input. When the two data rates are not equal, then disturbing data streams arrive at the device input because of the incorrect operation of the IP network.

Given by the construction, on displaying the data amount of the PID Filter the total data amount of the PID Filter and the PSI Inserter can be seen, as these get into the SDRAM together. The data rate of the PSI Inserter can be seen separately, too. So it can be seen by comparing it with the PID Filter data rate, whether data come from the input. On displaying the data rate of the ASI inputs the data rate from the joint data amount of the four ASI inputs can be seen.

The data amount of the SDRAM is displayed by channel. The chart shows the number of packets in the SDRAM. Usually only a few packets can be found in the SDRAM, as on arriving the 7th packet the UDP packet maker unit of the output streamer starts working and puts the 7 packets on the IP network. The SDRAM can store up to 4096 TS packets ($4096 \times 188 \times 8 = 6{,}16$ Mbits). Above this the SDRAM overflows, that is shown both on the software display and on the front panel of the device. The charts can be enlarged and shifted with the mouse and can be reset with the Clear button.

Important note: The internal circuits of the device use 3.3 V supply voltage. Without the Gigabit connection the current drain is between 2.5A and 3A. The two gigabit connection increases the current with 350 mA each. The device supplies 300mA for both optical modules from the 3.3 V power supply. The maximum load current is 3.8 to 4.3 A, so the internal dissipation is 12 to 15 W without the loss of the power supply. As this power develops in a small volume, a small internal ventilator provides for the ventilation of the device frame and the spreading of the heat. The inlet of the ventilator is at the bottom of the device, so it must not be put directly on the table in operation. When the temperature of the internal PCB reaches 60 degrees Celsius, the microcontroller stops the operation of the high-speed circuits and switch them on again if the temperature of the PCB goes down to 45 degrees Celsius. The switched off state is indicated by the blinking of the front panel LEDs.

8. System Configuration

The systems in the IP network require the setting a number of parameters. Small systems operate well with basic settings, in large systems the required number of settings grow in proportion to the size of the system. This chapter reviews the possibilities, the user can choose according to his application. The controls can be seen on the System Configuration page. On clicking the Query button the data boxes show the data having been read from the device.

Important note: The parameters of the IP input and the IP output can be set through the IP Input connector only. The commands must be sent to the IP Input by the software.

8.1. Replace IP Address

The the device has two IP connections so both of them must be set. Input data streams and the device programming are fed in through the IP Input connector, the output streams appear at the IP Output connector. The IP addresses assigned to the IP input and the IP output must be different. At setting both the input and output IP addresses type the new IP address in the box, and then click the **Replace IP Address** button. Before executing the command the software asks for verification.

Be careful at defining the IP address of the IP Input, because the PC and the device supplying the transport stream can communicate only with the devices of the same network.

At defining the IP address of the IP Output the user can decide freely, because this IP address practically has no influence on the device operation. The IP Output answers the ARP and Ping commands only, and allows querying the device operating status through the output for the user. At defining the IP address only the the user's demand for query is to be considered.

8.2. Replace MAC Address

In the basic setting the the IP input and the IP output are configured to the CableWorld Auto MAC mode. CableWorld Auto MAC = h42:h57:IP1:IP2:IP3:IP4. The user can change this setting freely, but the two MAC address must be different, if they are physically in the same network.

8.3. TS Port Interval

The IP input and the IP output receive the communication messages and the high speed transport stream data at the same connector. Following the device IP connector the built in Port Filter separates the two different data streams.

The most important step of the configuration process is, programming the correct value of the TS Port Interval!

All Ethernet packets arriving in the range of the TS Port Interval will be transmitted automatically to the high speed transport stream processor, so communication is impossible with the device inside this range. The packets arriving outside the range of the TS Port Interval will be processed by the IP Manager. Because of its high complexity the speed of the IP Manager is much lower, its operation can be disturbed, if transport stream arrives at the device input outside the range of the TS Port Interval. The disturbing effect of the TS outside the range is, that some commands are executed and others are not, i.e. as if it is partly wrong. The Port Filter operation is shown in Figure 8.1.
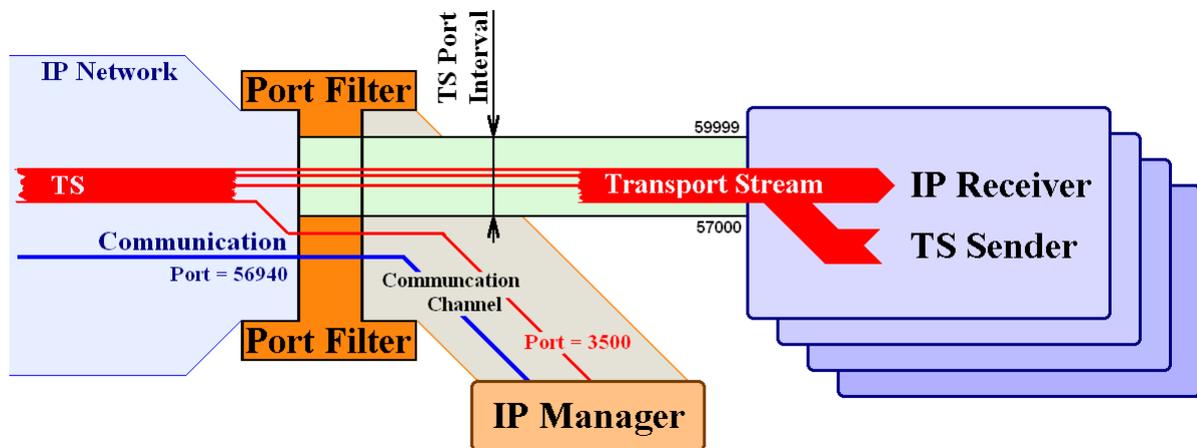
Figure 8.1
Illustrating the Port Filter operation
(If TS arrives at the device input with value Port = 3500 , it will disturb the operation of the IP Manager at the current settings.)

The value of the TS Port Interval can be assigned inside the range 256 to 65535. The operation can be simplified if the input and output TS Port Interval is assigned to the same range. Read out the values of the transport stream ports from the system plan and consider some reserve for determining the value of the TS Port Interval. Set the value of the TS Port interval in the device. If the current value of the communication Port is inside the range of the TS Port Interval, choose a value outside the range and write in the \Settings\SW4956a.ini file.

Important note:

The above conditions must exist during the course of reprogramming (the communication port must not be inside the range of the TS Port Interval).
After modifying the ini file the software must be started again, because the settings are read in at the beginning of running. The current value of the communication port can be found on the Device Programmer page.
In case of faulty programming the factory settings can be reset with the Reset button on the back of the device.
The Lower Limit of the TS Port Interval must always be lower than the Upper Limit.

8.4. Default Gateway and Netmask
Setting these values has significance only in systems of high complexity. If these are needed, ask for help at the cableworld@cableworld.hu address.

8.5. Device Controller Lock – Input Lock
After programming, the device input can be locked against external interventions. An important part of the lock is the 16-character keyword; the lock cannot be lifted without it. The lock can be lifted with the Reset switch on the rear panel of the device, but in this case the device will lose the user's former settings.
In case of input lock, the device answers only the Query, ARP and Ping commands.

8.6.   Output Streamer Lock – Output Lock

The output lock can be set through the input. In case of output lock the device sends no answers to the Query, ARP and Ping commands. The Reset switch can open the output lock, too.

As mentioned earlier, the device cannot be programmed through the output connector. In the 'Unlocked Output' mode the output answers the Query command for establishing the remote control in large systems from this direction, too. This service is very useful at building the system and at troubleshooting in the network, as professionals working on the network can get information about the operation of the remote head-end unit.

8.7.   The reserve connection of the output and the input

The device tries to establish a connection at the IP output and at the IP input first through the optical line. If it fails, then tries to establish the connection through the UTP cable. The automatic change-over allows establishing the reserve connection. If both connection modes are established, then in case of the tear/break or other fault of the optical line the device automatically changes to the copper wire connection.

8.8.   The date of the last programming

The device stores the date of the last programming. The date can be seen on the System Configuration page following the Query. The default identifier of the programming person is 0. Insider system designers can set their own identifier here, in order to see if anyone overwrites their settings.

8.9.   PSI Inserter Ch/4 Programmer

As programming the fourth PSI Inserter of the channels will be rarely necessary, the programmer of the unit has got a place on the System Configuration page. The programmer always programs the 4th inserter of the channel selected in the Channel Program Editor. In case of packets without timing, the software uses the packet delay of (n×10 ms), shown in the data box.

9.   Frequently Asked Questions

1.   How to modify the IP address of the IPTV Remultiplexer? How to check the kind of devices in my network?

The IP address of the device and the similar basic parameters can be set on the **System Configuration** page on clicking the **View\SW-4956 Software Full Version** menu. The settings are detailed in Chapter 8 of the Help. The value of the communication port used by the software (default value 56946) can be modified in the ...\Settings\SW4956a.ini file (the modification will be activated on restarting the software).

The communication system of the IPTV Remultiplexer differs from the system of the former generation, but the device answers the Query question of the SW-4901 Gigabit Ethernet Controller software, so the devices in the IP network can be found with the Search function of the SW-4901 software.

2.   How to check whether the device receives the input signal via the IP network?

For calling the multicast data streams the IP Connection List table must be programmed into the device, for unicast data streams the settings must be made at the sender device. The ASI signals must be connected only. The checks can be done on the Diagnostics page by clicking the menu item of the **View\ ...Full** version. The check starts on clicking the **Run** button. On checking the data amount of the IP Network, the data amount arriving at the device input connector is shown. On checking the data amount of the ASI Input the joint data amount of the four inputs is shown.

3.   What to do, if yellow or red signal appears when compiling the Channel Program?

The yellow signal indicates, that the data have not been processed yet, the red signal indicates that the data are not in accordance with each other (even formally wrong). In every case click the **Compile ...** button once or several times and the software corrects the errors automatically. The software indicates with the green light, that the errors are corrected and the data are in order. The Compile ... button can be clicked several times. The data are correct, if on clicking the button the data would not change any longer; every error has been corrected.

4.   How to check, which of the 64 channels deliver output signal?

The 64 output streamers receive the data from the SDRAM. When the output is enabled and the IP network can receive the UDP packets, the chart displaying the content of the SDRAM shows values between 0 to 7 TS packets, and the heights of the bars appearing in the graph are jumping up and down. The channels with invisible bar have no output signal, the displayed value is zero. When the IP network can not receive the UDP packets (e.g. the network with the 100 Base-T connection fills up) the heights of the bars increase. The SDRAM can store up to 4096 TS packets for every channel, above this limit the Overflow LED starts lighting on the front panel of the device and on the display of the software, too.

5.   How to erase the old programs and to start reprogramming the device?

Erase with the **Edit/Erase All Channel Programs** menu in the Channel Program Editor and load in with the **One Touch Programmer**.

6.   How to switch off the output signal of one or another channel without reprogramming the device?

On selecting the **View/Full ...** version and clicking the **View/List of 64 channels to Switch On or Switch Off** menu, the service switch on/off unit appears. Channels can be selected for switching on by clicking the display on the left and switching off by double-click. On loading this prepared Switched On/Off pattern into the device the required status will be set.

7.   What is the fastest way to produce only one SPTS (one IPTV stream) for checking the operability?

Assuming that every program is erased with the method described in point 5, so the device can be taken empty. For producing the output signal perform the steps as follows:
● Select the first channel in the Channel Program Editor, then type "Streamer Status =1 (On)" and click the Compile … button. This step is the switching on.
● Modify the values of the "Source IP Address: 239.123.16.100" and the "Source Port Number: 58100", if you want to use another input signal. Specify the video PID at the Elementary Stream #1/Input PID value, then the audio PID at the Elementary Stream #2/Input PID value and click the Compile … button. Check the correctness of the entered data.
● Select the Selective Programmer and load in the IP Connection List table. So the device asks for the multicast stream and let it in to input 1.
● Load in the program of the PID Filter 1. So the device transfers the packets arriving with the value of the video and audio PID.
● Load in the program of the Ch-1 PSI Inserter. So the device completes the video and audio data stream with PAT, PMT, SDT and NIT tables.
● Load in the program of the Streamer. So the device starts sending the stream out. Check the correctness of the output signal with the SW-4811B, VLC Media Player, TS Reader or similar software.

8.   What are the most common mistakes in the course of installation?

● The user does not complete the data entry by clicking the Compile … button.
● When typing the data the programmer forgets switching on the channel (Status=1).
● After making the Channel Program(s) the data are not loaded or loaded only in parts to the device.
● The user confuses the numbers of the input units (Input Channel, PID Filter) with the numbers of the output units (PSI Inserter, Output Streamer)..
● The user forgets saving the channel programs have been compiled in file.
● The switch used in the IP network is not able to manage the multicast messages.
● The input or the output IP connection is not able to transfer the amount of data required.

9.   What is the maximum data rate of the ASI inputs?

The four ASI inputs can receive altogether 640 Mbit/s amount of data. Among the four input TSs some can be of very high speed or of very low speed. In the course of manufacturing the tests happen with signal speeds of 40 to 80 Mbit/s. Higher values are not tested.

10.   What are the most important rules of programming and program making?

On programming the device consider, that the hardware consists of two parts as shown in Figure 9.1.
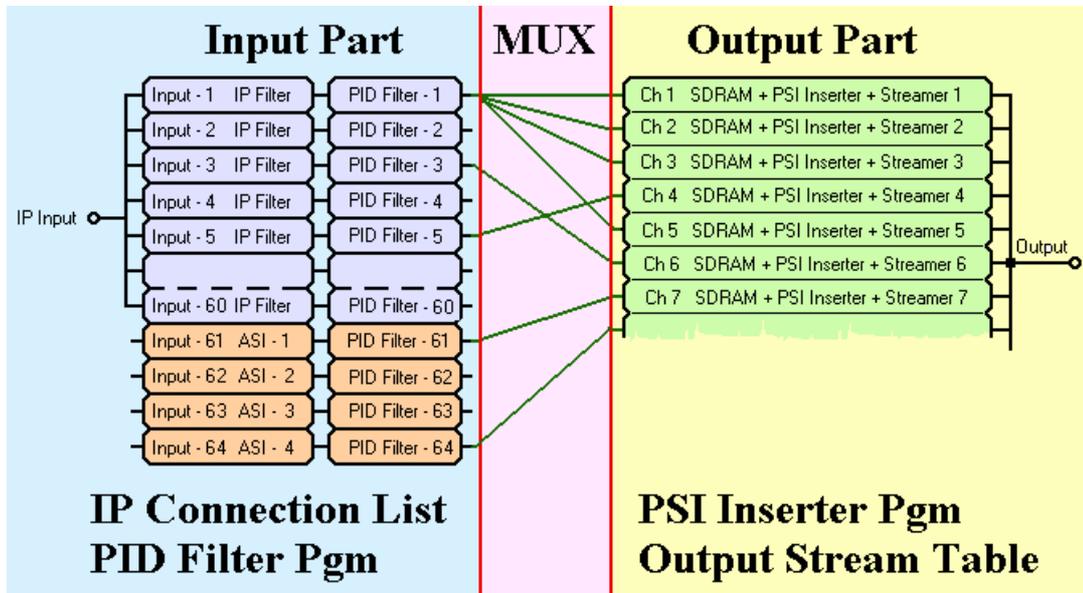

Figure 9.1
IPTV Remultiplexer from programming aspect

The Input Part enables the transit of the TS packets and stamps them. The data of the IP Connection List define for each of the 60 IP input signals, what is the ordinal number of the input where it is to arrive. The PID Filter stamps the input number on the transfered packet, enter the value of the new PID and send the packet towards the required output. Very important, that a given TS packet can be sent from any input to any output. The programming of the input part happens by programming the IP Connection List and the PID Filter.

The Output Part consists of 64 units of the same structure. The TS packet arriving at the channel input, will get into the SDRAM, what is capable of storing the 4096 TS packets. The packets of the PSI Inserter will be sent here, too. When the number of the stored packets gets to seven, the output unit makes an UDP/IP packet and send out the 7 packets toon the IP network. For operating the output part the PSI Inserter and the Output Streamer must be programmed.

It is very important, that the numbering of the inputs and the numbering of the output channels are independent from each other, they must be managed separately. Usually every input sends TS packets for several outputs, so changing the input data can affect several output channels. Loading the programs can be correctly programmed with the selective programmer by considering the signal routes. The One Touch Programmer loads in every program without checking the necessity, so the programming time is relatively long (10 to15 minutes).

The main rule of making the program is, that **every input TS packet can be used for producing the signal of one output only.** At viewing the PID Filter program the (red) error signal is because of the multiple use of the packet. This is an especially common mistake on receipt of programs from the TS Report, if an elementary stream of the input TS has been used in several television and radio programs.

10. Remarks, comments, further information

We are pleased to receive at cableworld@cableworld.hu comments and remarks related to our devices and software, which we may take into consideration at further developments. Further information on the application of our products can be requested at the same address.

CableWorld Team