

# **64-Channel EPG Remultiplexer Controller**

## **SW-4955**

Device controller software for the  
64-Channel EPG Remultiplexer

Instruction manual

V 1.02

## Contents

1. The structure and installation of the SW-4955 software.....	3
2. EPG fundamentals.....	7
3. The structure of the CW-4955 64-Channel EPG Remultiplexer.....	9
4. Creating the EPG Remultiplexer program.....	12
5. Programming the 64-Channel EPG Remultiplexer.....	18
6. SW-4955 software services for qualified operators.....	20
7. Diagnostics.....	23
8. System Configuration.....	24
9. Frequently Asked Questions.....	27
10. Remarks, comments, further information.....	30

## 1. The structure and installation of the SW-4955 software

The SW-4955 64-Channel EPG Remultiplexer Controller is the configuring and controlling software for the CW-4955 type 64-Channel EPG 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 EPG 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, 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-4955 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](http://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-4955 software

The structure of the SW-4955 64-Channel EPG 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-4955 software consist of the following parts:

- **Device Programmer** – user interface for loading the device controller programs. .
- **EPG 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 EPG remultiplexing is shown in Figure 1.1. This can be seen on the screen on starting the software.

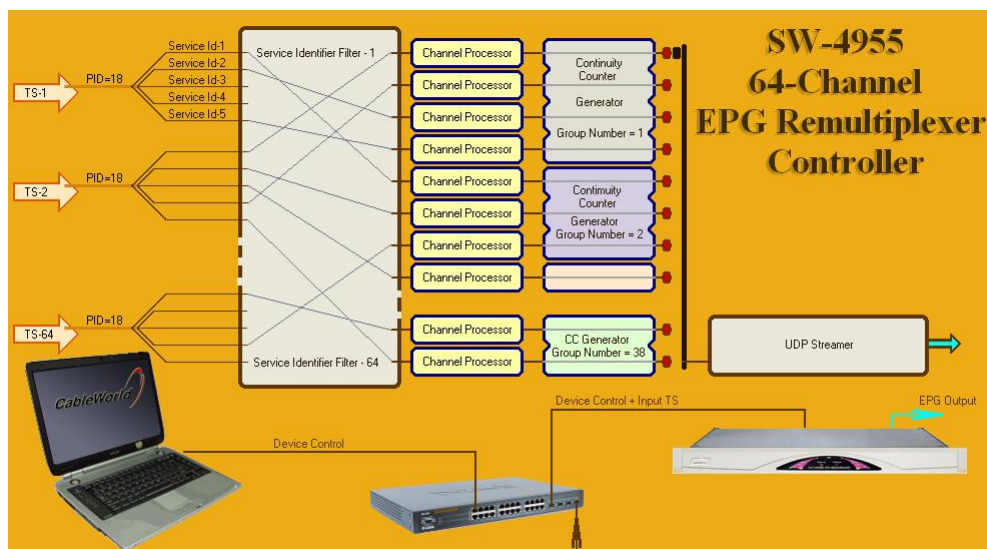


Figure 1.1  
Structure of the EPG remultiplexing

## Installing the SW-4955 software

The SW-4955 software installer can be downloaded from the [www.cableworld.hu](http://www.cableworld.hu) web site. On running the installer exe file the software installs in the C:\Program Files\CableWorld\SW\_4955 directory. When operating more than one device or large systems, the whole content of the SW\_4955 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\_4955 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** – SW4955a.ini, Connect.ini, IPTVpgm.spi
- **Save Settings** – SW4955a.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** –
- **EPG Filter 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-4955 Software Light version**
- **SW-4955 Software Full version**

### Load from ... / (loading file or from file)

- **Load IP Connection List from ...** - file
- **Load EPG Remultiplexer Program from ...** - loads a \*.spi file comprising 64 programs.
- **Load Channel Program from ...** -
- **Load Output Stream Table from ...** -

### Save as ... / (saving contents to file)

- **Save IP Connection List as ...**
- **Save 64 Channel EPG Remultiplexer Program as ...** - saves data base
- **Save Channel Program 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** –
- **Apply Read back IP Connection List** – IP Connection List=Read back List

**Read back .../**

- **IP Connection List** – (from device)
- **EPG Filter Program** – (from device)
- **Output Stream Table** – (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. EPG fundamentals

In the digital television technology, the components of the radio and television programs (e.g. video, sound, teletext, EPG, etc.) are transmitted as separated and independent data streams. Among the components the transmission of the EPG (Electronic Program Guide) is irregular, as the EPG data stream transmitted in PID 18 (h12), is the joint data stream of several programs. So the EPG data stream cannot be remultiplexed with conventional TS Remultiplexer, the TS remultiplexers selecting by the PID value are not suitable for recompiling the EPG. The structure of the EPG is available in the standard describing the tables. The EPG structure is a table like (EIT – Event Information Table) data stream.

The EPG data consist of information blocks, in other words information data sections. Usually the size of these sections is greater than the size of the 188-byte packet, so the section must be disintegrated. The process of sectioning into packets is shown in Figure 2.1.

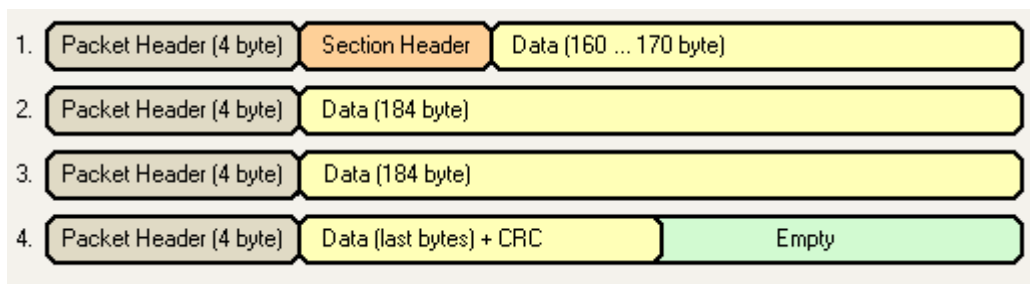


Figure 2.1  
Arranging 600...650 bytes of data in four packets

The information section comprising one or more packets with header is called 'Section'. The Service Identifier placed in the header of the Section defines, which is the program where the packet train following the header belongs to. As every EPG data belonging to the programs of the transport stream is transmitted in PID 18 and the Service Identifier is located only in the first packet of the Section, recompiling the EPG requires special packet processing. At remultiplexing the EPG, all the packets belonging to the section must be collected and transitionally stored. If necessary, the value of the Service Identifier, the TS Identifier and the Table Identifier must be rewritten, and new CRC must be calculated with them. Then the packet train can be used for compiling the new EPG. At adding the transport stream and the EPG together, the order of the packets in the packet train sent by the EPG Remultiplexer must not be permuted. EPG data stream from other source must not be added to the packets.

The EPG Remultiplexer is capable of producing 64 different (belonging to other programs) EPG data streams. The sections of the 64 data streams appear at the output successively with strict timing. The user decides with programming, which section will get into one or another transport stream. The recompiled but not joint data stream is shown in Figure 2.2.

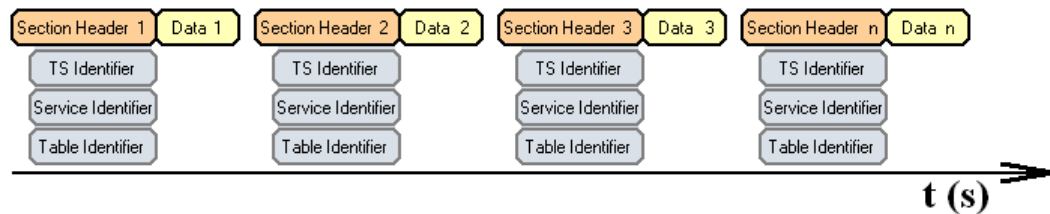


Figure 2.2  
Sectioned new EPG data stream before summing

The identifiers in the headers of the sections shown in the figure are given by the user at making Channel Program. The timing of the sections depends on the timing of the input data streams, the great disorder in time is usual.

### Making EPG for SPTS data stream

In case of SPTS, the EPG data stream of one program must be added to the video and audio data stream. At the CW-4955 the addition is performed by the IP network, the EPG data stream must be sent to the IP address of the video stream.

### Making EPG for MPTS data stream

In case of MPTS, data streams of several programs must be sent to the same IP address, but it is not enough; because these must be linked by the Continuity Counter variable. The CW-4955 EPG Remultiplexer manages together the Continuity Counter variables of those packets, which are put in a common MPTS group in the course of making the Channel program. In the EPG sections of the same transport stream, the TS Identifier, the IP Address and the Port Number have the same value (write the same values in the Channel Program), the Continuity Counter is continuous along the packets.

*Note: Detailed technical instruction can be asked at [cableworld@cableworld.hu](mailto:cableworld@cableworld.hu).*



### 3. The structure of the CW-4955 64-Channel EPG 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.

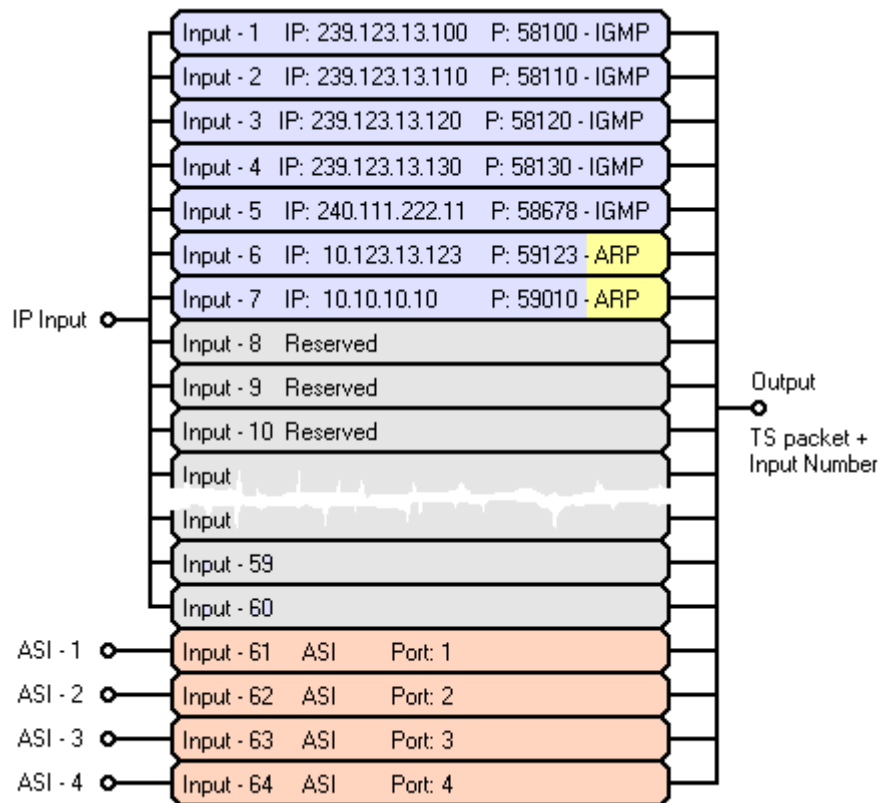


Figure 3.1  
Relationship of the IP Connection List with the 64 inputs

The input filter module controls the enable/disable of the input data stream. In the EPG Remultiplexer the PID Filter following the input filter allows transiting only the packets with PID 18 (h12).

The input filters attach an information byte to the transferred transport stream packet. The attached byte indicates the ordinal number of the input, where the packet was transferred. Afterwards, on the basis of the input number the device can identify the input and the transport stream where the given packet is arrived from.

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 is used for configuring the inputs and identifying the transport stream, so if the IP Connection List is modified then the modification of the Channel Programs may be required.

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-4955 software communicates with the device at Port Number 56945. The value of the communication port can be modified in the SW4955a.ini file.

After the input filter the device compiles the sections of the programmed services for the EPG data stream (i.e. the EIT tables). The built in SDRAM is used for storing the sections. Remember, that every TS packet is allowed to build only in one of the 64 output streams. The device has no copying unit, so if some data stream is to be built into several output streams, then it must be fed into the device several times.

**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 block diagram of the device is shown in Figure 3.2.

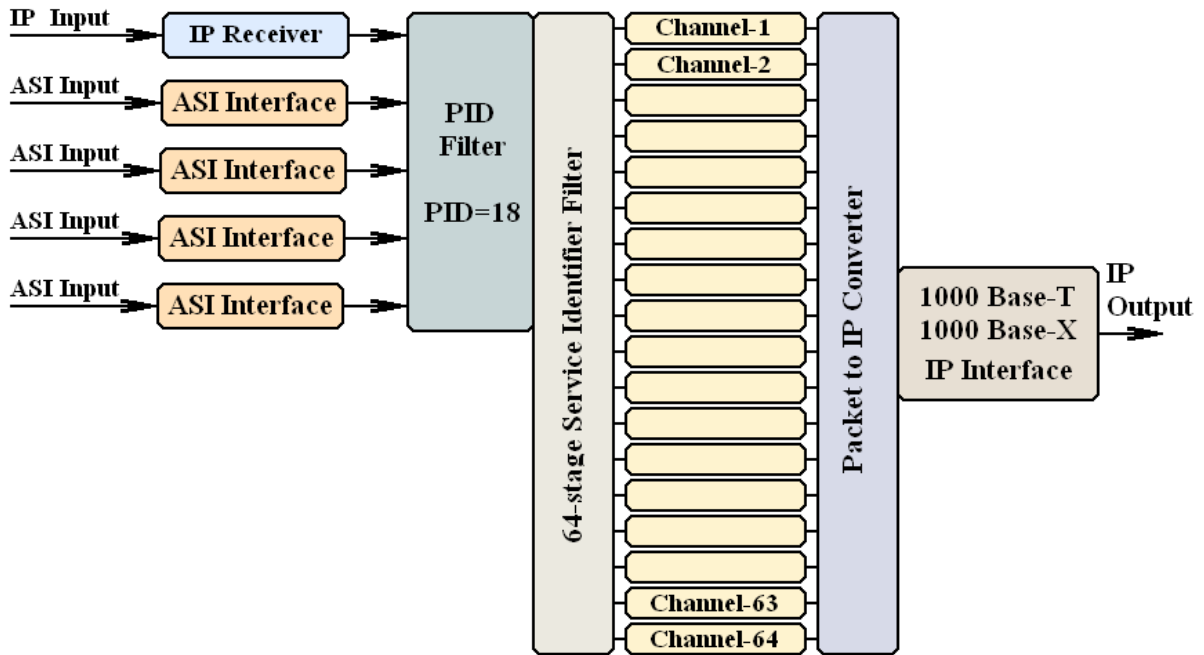


Figure 3.2  
Block diagram of the 64-Channel EPG Remultiplexer

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.

## 4. Creating the EPG Remultiplexer program

The CW-4955 64-Channel EPG Remultiplexer comprises 64 EPG 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-4955 software can create the 64 programs automatically, if the user defines

- the IP address of the input data streams and
- the main parameters of output streams.

The device is capable of producing 64 EPG 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-4955 Software Light version** On choosing the View\SW-4955 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-4955 Software Full version** In the View\SW-4955 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-4955 software stores the total program of the 64 remultiplexers in the EPGpgm.spe file. This file can be found in the C:\Program Files\CableWorld\SW\_4955\EPG\_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 EPGpgm.spe 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 EPG Filter Program
- **Informative data** – not for compiling

The Channel Program becomes visible on clicking the **EPG 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.

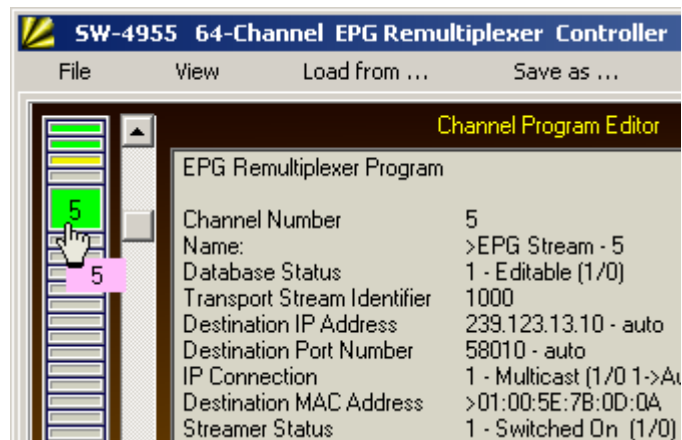


Figure 4.1

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.

## The course of compiling the Channel Program

The first part of the Channel Program comprises the parameters of the output stream as follows:

Channel Number	5
Name:	>EPG Stream - 5
Database Status	1 - Editable (1/0)
Transport Stream Identifier	1000
Destination IP Address	239.123.13.10
Destination Port Number	58010
IP Connection	1 - Multicast (1/0 1->Auto MAC)
Destination MAC Address	>01:00:5E:7B:0D:0A
Streamer Status	1 - Switched On (1/0)

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

**Service Name** The name of the channel service (not used).

**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'.

**Transport Stream Identifier** Important parameter of the output data. The software writes this data into the header of the EIT table. The **Edit/Write MPTS Group Number** menu classifies the channels of the same TS Identifier in one group.

**Destination IP Address** The output streamer will send the UDP packets of the channel to this IP address. The **Edit/Write Output IP/Port automatically** menu writes here the value of the first member in the MPTS Group.

**Destination Port Number** The output streamer will send the UDP packets of the channel to this port. The **Edit/Write Output IP/Port automatically** menu writes here the value of the first member in the MPTS Group.

**IP Connection** Not important parameter. On selecting the 0-Unicast mode the MAC Address can be set freely, in the 1-Multicast mode the software automatically calculates and writes in the MAC address.

**Destination MAC Address** The output streamer will send the UDP packets to this MAC address. . In Multicast mode the value is calculated by the software. In unicast mode it is very important for the user to give this data correctly, as the distribution network delivers the UDP packets on the basis of this.

**Destination TS** The Table Identifier will be modified according to the Actual/Other setting.

**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 part of the Channel Program comprises the parameters of the input stream as follows:

Source IP Address	239.123.13.100
Source Port Number	58100
IP Connection	1 - Multicast (1/0 0->Unicast)
Input Service Identifier	2000 h07D0
Output Service Identifier	2000 h07D0
Original Network Id	1 h0001
MPTS Group Number	2 (1 ... 64) - User Defined

**Source IP Address & Port Number** Set the parameters of the input signal. On setting the IP Connection variable to '1 – Multicast' the device manages the IP network according to the IGMPv2. At the ASI inputs the Port Number isto be set to the same value as the number of the input (1 to 4).

**Input Service Identifier** The value of the Input Service Identifier defines the service and the EPG data stream to be selected from the input data stream. The EPG Filter filters the input EPG data stream with this value.

**Output Service Identifier** In the course of remultiplexing the value of the Service Identifier often changes. At this place, set the value carried by the program in the remultiplexed stream. When the remultiplexing happens with constant Service Identifier value, the same value must be written to these two places.

**Original Network Identifier** The value given here will be built in the tables of the output EPG data stream.

**MPTS Group Number** This variable provides the continuous value of the continuity Counter in the EIT tables inserted in the common transport stream. The value of the variable can be 1 to 64. At EPG made for SPTS data streams, different values are to be given for all the 64 channels. The **Edit/Write SPTS Group Number** menu writes in the ordinal number of the channel to the value of the MPTS Group Number.

The **Edit/Write MPTS Group Number** menu creates groups on the basis of the TS Identifier and writes the same value to the channels of the same group.

**Making EPG for SPTS and MPTS data streams**

With the 64 channels of the EPG Remultiplexer EPG can be made for SPTS and MPTS data streams, too. When the EPG data streams are prepared for SPTS streams, the data streams are different from each other, the values of the output IP Address and the Port Number in the 64 channels must be definitely different. In case of MPTS streams, the single data streams of several channels must be linked and a joint Continuity Counter number must be provided for the output packets. The data of the 64 channels can have a common MPTS Group Number identifier. The value of the variable can be anything from 1 to 64, the device sends out the packets of the channels of the same MPTS Group Number so, that the Continuity Counter be continuous at these packets.

The software offers the automatic making of the SPTS and MPTS Group Number in the **Edit** menu, but allows recalling the formerly stored value given by the user.

In case of MPTS the data stream of the members in the MPTS Group must be sent to the same IP address and Port number. The **Edit/Write Output IP/Port automatically** menu sets the channels belonging to one group to the same output IP Address and Port Number. Then the members of the group get the data of the first element in the group.

The processing of the input TS data, the course of compiling the SPTS and MPTS data streams, the explanation of the MPTS Group are shown in Figure 4.2.

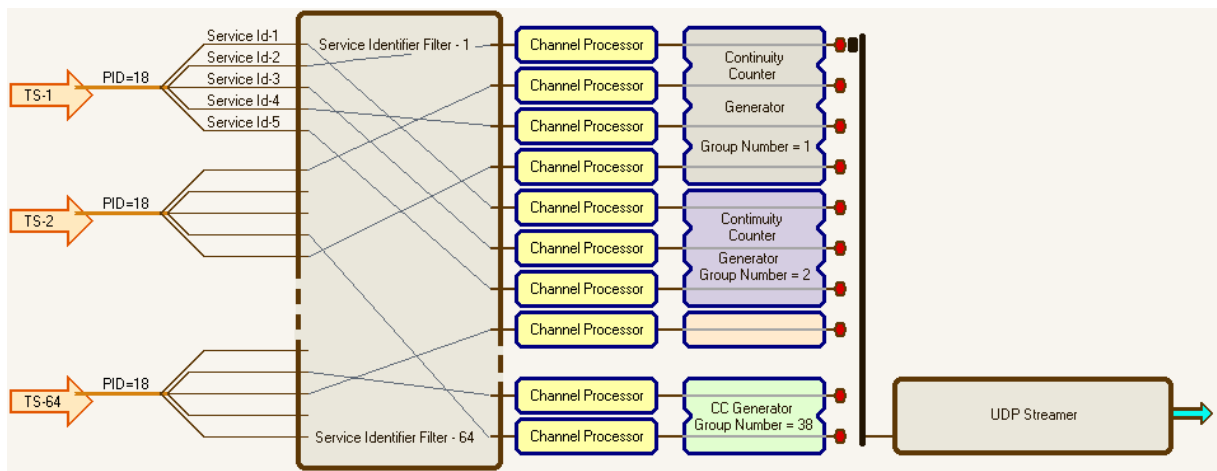


Figure 4.2  
Block diagram of the EPG remultiplexing

The joint data base of the 64 channels can be erased in the Edit menu. After erasing the the data of the SW4955a.ini file get into the Channel Programs.

**Important note:** Due to the device construction every one input data stream (EIT packet belonging to the given Service Identifier) can be used only once in creating the output streams! If the same data stream (EPG of Service) 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.



**Informative data** In the last section of the Channel Program the software gives a summary on the relationships among the programs of the channels. In this section the data cannot be modified, here the written changes are inefficient.

The first part of the information block shows the values of the Service Identifier and TS Identifier of the data streams in the group of the channel under compilation. In the second part the values of the IP Address, Port Number and MAC Address of the members in the group are shown.

## 5. Programming the 64-Channel EPG Remultiplexer

The SW-4955 software comprises all the modules needed for programming the device, supplementary software is not needed. In the course of programming the 64 Channel EPG Remultiplexer, the 64 transport streams have a common IP input. The SW-4955 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 EPG Filters
- 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-4955 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 EPG Filters. The IP Connection List can be saved in file and can be read back from there.

### **5.3. Programming the EPG Filters**

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

### **5.4. Programming the Output Stream Table**

The Output Stream Table defining the parameters of the output streams can be programmed in one step, the program comprises the operating programs of all the 64 channels. The Output Stream Table can be saved in file and can be read back from there.

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-4955 software services for qualified operators

The basic settings of the CW-4955 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.

### 6.1. IP Connection List

The SW-4955 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 EPG Filters identify the data streams according to the ordinal number of the input. So after modifying the IP Connection List, reprogramming the EPG 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.

## 6.2. EPG Filter

Every one of the 64 inputs transfers only the TS packets with PID 18 (h12). The transferred packets get into the input EPG Filter. The EPG Filter finds the beginning of the sections to be built from the transferred packets and reads out the value of the Service Identifier. The EPG Filter transfers only the sections with the given Service Identifier value, and assigns the channel and the output for every transferred packet. The modification of the Service Identifier, TS Identifier, Original Network Identifier and the Table Identifier happens in this process, too.

The EPG Filter and the IP Connection List always change together, i.e. if one of them is modified then the modification or the reprogramming of the other may be required. The selective programming of the EPG Filters can decrease the time of configuring the device, but remember to erase the programs of the unused EPG Filters.

Supplementary information:

The program of the EPG Filters is stored in the upper half of the Flash memory (called EPGPID). The amount of data at every input is of 4 blocks, before programming always four blocks must be erased.

## 6.3. Reading back the programs from the device

The Full version of the SW-4955 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 ...\\pconPGM\\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 text-box.

Before reading back the **EPG 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 EPG Filter Program is compiled automatically from the data of the Channel Programs by the software. Reversing this process gives no obvious solution.

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 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.

### 6.15. The structure of the SW-4955 IPTV Remultiplexer Controller directory

C:\Program Files\SW\_4955\

<b>Settings\</b>		
	SW4955a.ini	storage of the settings
	EPG_1.ico	
<b>IPconPGM\</b>		
	Connect.ini	IP Connection List
	ReadConn.ini	the read back list
<b>EPG_PGM\</b>		
<b>EPGf_PGM\</b>		
	EPGfilt.dap	program of the 64 EPG filters
<b>Streams\</b>		
	StrTable.ini	parameters of output streams
	EPGpgm.spe	joint program of 64 channels
	Ch_pgm.sci	program of one channel
<b>Sources\</b>		
	Source.srp	report of the TSs loaded last
<b>Readback\</b>		
<b>TXTfiles\</b>		
	Connect.txt	data in text format
	ReadCon.txt	data in text format
<b>Help\</b>		
	4956Help_a.pdf	help in English
	4956Help_m.pdf	help in Hungarian
<b>Streamer.exe</b>		

## 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.

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. On displaying the amount of data of the EPG Filter the amount of data filtered by Service Identifier is shown.

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 after completing the Section the packets will be sent out. Given by the slow data rate of the EPG data no jam expected at the output. The SDRAM can store up to 32 TS packets ( $32 \times 188 \times 8 = 48128$  bits). 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.

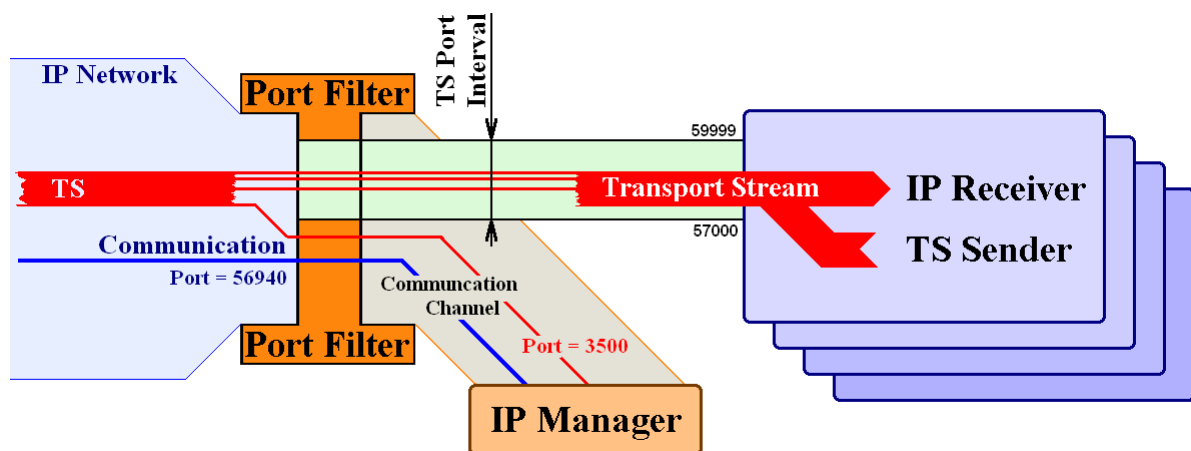
### 8.3. TS Port Interval

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.





8. Figure 8  
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\SW4955a.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](mailto: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. Switching on the PSI Inserter (extending the EIT Elementary Stream to TS)**

For the partners who have no TS remultiplexer for receiving the Elementary Stream, we permit of switching on the built in, but not published PSI Inserter. The PSI Inserter supplying the PAT, PMT, SDT and NIT tables can be programmed with the SW-4956 IPTV Remultiplexer Controller software.

## 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-4955 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 56945) can be modified in the ...\\Settings\\SW4955a.ini file (the modification will be activated on restarting the software).

The communication system of the EPG 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 23 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 32 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 EPG data 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 identifier of the selected program at the value of the Input Service Identifier. Modifying the other identifiers is required only, if the output signal is to be adjusted to an existing system. 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 EPG Filter-1. So the device will transfer the selected EPG packets.
- 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.

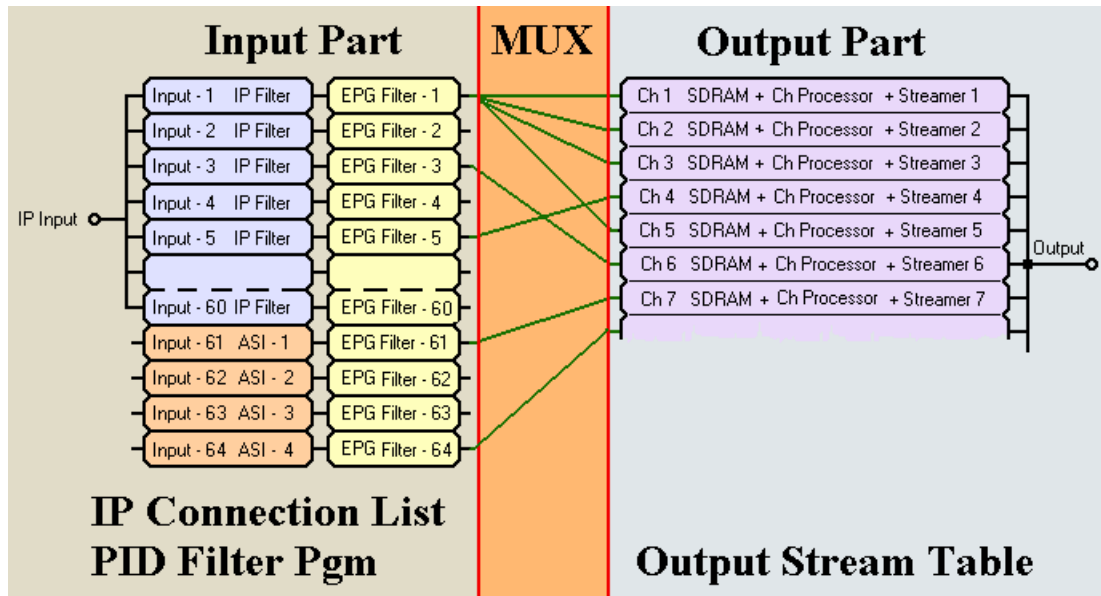


Figure 9.1  
EPG Remultiplexer from programming aspect

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 transferred 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 EPG Filter.

The Output Part consists of 64 units of the same structure. The compiling of the Section begins from the packets arriving at the channel input. When the Section is finished, the output unit makes an UDP/IP packet and sends out to the IP network. For operating the output side 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 to 15 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 EPG Filter program the (red) error signal is because of the multiple use of the packet.

## 10. Remarks, comments, further information

We are pleased to receive at [cableworld@cableworld.hu](mailto: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



Users asked to adapt the EPG Remultiplexer for processing of such EPG data streams, which arrive at PID values different from 18. At their request, in September 2010, in each of the 64 inputs a programmable PID Filter / Remapper circuit was installed. This version filters out the data streams with PID values programmed by the user, then modifies their PID value to 18 and passes them to the remultiplexer circuits.

This feature is available from the V1.04 software version and the 4th Xilinx version. At delivery the device can process the data streams arriving at PID of 18. The user can assign different PID values to the 64 inputs with the v1.02 update of the SW-4955 software. The Input PID Filter / Remapper Programmer will be visible by clicking the **View / Input PID Filter / Remapper Programmer** menu. The programmed values can be read back. The 64-PID values are stored in the SW4955a.ini file.

Suggested uses: Program the device, as if all of the EPG data streams arrived at the PID value of 18. Display both the IP Connection List and the Input PID Filter / Remapper Programmer. At the inputs, where necessary, key in the table the different PID value. Load to device the program modifying the PID values with the Compile ... and then the Load ... button. Check by reading back the PID values, if the programming was correct.

On reprogramming or debugging the device, remember that in the newer version this option is available!