Universal Transport Stream Remultiplexer Controller

SW-4953

Device controller software for the Transport Stream Remultiplexers

Instruction manual

V1.09

Contents

1. Introducing the SW-4953 software

In the past years CableWorld developed transport stream remultiplexers with different structures and services. The SW-4953 Universal Transport Stream Remultiplexer Controller has been designed on the basis of development experience and user feedback for being used in any CableWorld product.
The software is the improved and extended version of the former SW-4952 and can be divided into the following two main units:

- Transport stream analyser and editor
- Device programmer

The SW-4953 Universal Transport Stream Remultiplexer Controller software version V1.06 can be used to program the following devices:

- **CW-4851, -52, -54, -58 Transport Stream Remultiplexer**
  (remultiplexers with 2, 4 and 8 ASI inputs and ASI (+IP) output)
- **CW-4855 Transport Stream Remultiplexer**
  (improved version of the CW-4854 with 4 ASI inputs)
- **CW-4856 Multiformat Transport Stream Remultiplexer**
  (remultiplexer with 3 ASI and 3 IP inputs and ASI (+IP) output)
- **CW-4951 IP Remultiplexer Quad & Streamer**
  (remultiplexer with 256 IP inputs and 4 IP outputs)
- **CW-4952 IP Remultiplexer Quad**
  (remultiplexer with 256 IP inputs and 4 ASI outputs)
- **CW-4956 64-Channel IPTV Remultiplexer**
  (remultiplexer with 60 IP and 4 ASI inputs and 64 IP outputs)
- **CW-4958 16-Channel Edge Remultiplexer**
  (remultiplexer with 60 IP and 4 ASI inputs and 16 (64) IP outputs and PCR corrector)

Besides the GUI of the new types the SW-4953 software comprises the following features:

- *Additional automatic functions to accelerate and simplify the programming process*
- *Expanding the capacity of the SDT and NIT editor to 16 sections*
- *LCN descriptor editor*
- *Integrating the (so far separate) software necessary to set up the general features and the characteristics of the streamer.*
- *One Touch programmer for programming all the features of the device in one step; simple loading ready-made configuration to several devices.*

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.

The devices and software of CableWorld can be classified into the following groups:

- **First generation products**
  The CW-48xx series products generally have ASI inputs and outputs, and can be connected to the IP Network by the internal Ethernet Controller 100Base-T of the device. The instruction set of the device can be can be downloaded from the www.cableworld.eu web site in the CW-Net.pdf file. The system is generally 8 bit organized.(in 8 bits). The units of the CW-485x series must be connected to the PC directly with crossover cable or via switch with straight cable.
- **Second generation products**
  The CW-49xx series products typically use the transport stream transmission over IP, with the Ethernet Controller gigabit version 1000Base-T connection. The devices are controlled with an extended instruction set, it is compatible with the first generation. The devices are controlled by the CW-4901 Gigabit Ethernet Controller. The units in the gigabit family work in slave mode, so they must be connected to the PC with straight CAT6 cable via switch.

- **Third generation products**
  The third generation products are markedly different from their ancestors, besides the UTP cable (1000Base-T), the optical cable can be connected, as well. The instruction set is of 16-bit, the compatibility is ensured only to the extent that the device sends a response to the simplest question of the second generation (Send ACK), but the answer is no longer applicable. We recommend interconnecting the units with optical cable via switch, but use of the straight CAT-6 cables is permitted, as well. The latest version of the instruction set of the second and third generation products can be downloaded from the www.bytestudio.hu web site.

The structure and installation of the SW-4953 software

Remultiplexing the transport stream is a complex task but simple steps can be taken with little skills, only special tasks need high-level expertise. In the SW-4953 software a number of automatic functions help and simplify performing the tasks. However there are manual setting possibilities in every procedure, so the job of skilled users is not limited. The SW-4953 software consists of four parts as follows:

- **Transport Stream Analyzer** – allows the deep learning of the input signals in order to get detailed information about the input data streams for creating a new stream. The summarized information taken from the input data streams are stored in the 'Source Report' (the set of TS Reports).
- **Transport Stream Constructor** – It is a desktop where the user can compose the desired output data stream with the support of the automatic functions.
- **Device Programmer** – It automatically delivers the programs to the output stream composed by the user, which will be loaded to device to generate the transport stream desired by the user.
- **Diagnostics** – This module allows monitoring the working parameters and the operation of the internal units of the device (in operation). The schematic diagram of the software is shown in Figure 1.1. Also this is shown on the (monitor) software control panel on starting the software.

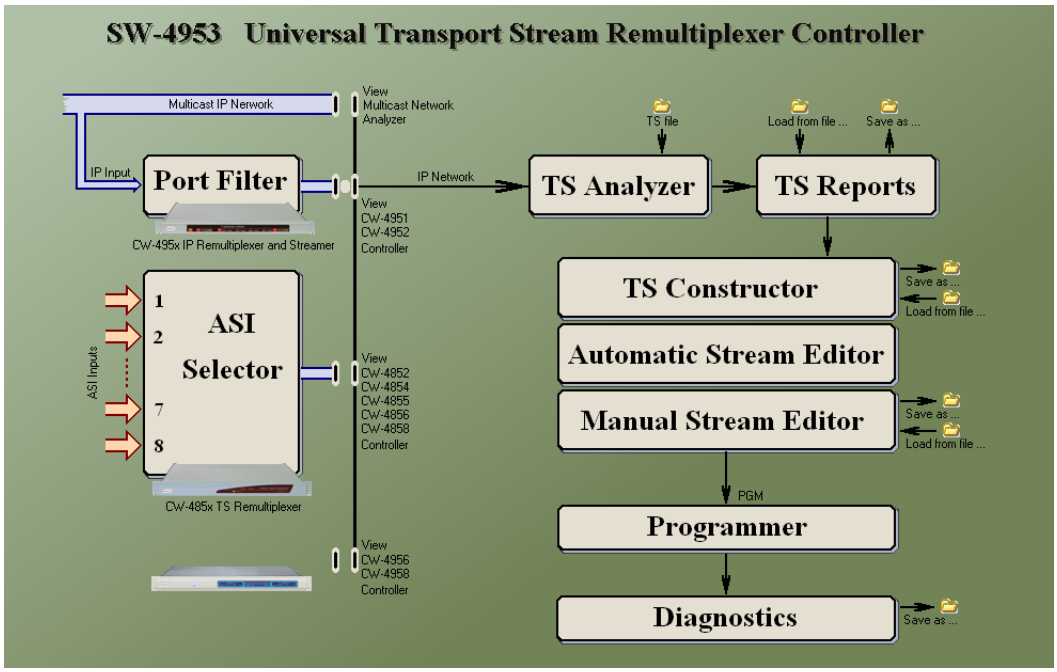


Figure 1.1
Structure of the SW-4953 software

The SW-4953 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_4953 directory. When operating more than one device or large systems the whole content of the SW_4953 software directory should be copied to subdirectories 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_4953 copies on the desktop. These icons should be subtitled according to the system characteristics.

NEW!

In Windows Vista or later operating systems, the permission to write file by the operator is highly restricted. So the software should be installed in a directory where we have the right to write files storing the settings and our task without entering as an administrator.

Designing the transport stream step by step

When using the SW-4953 software the transport stream design, the device programming happens by the following steps:

- Analysing the input transport streams, making the report comprising the transport streams (i.e. the Source Report).
- Making the frame of the transport stream with the desired number of services (programs) using the functions 'New TS' and 'New Service'.
- Filling the empty TS frame with content; copying the services of the Source Report to the empty places of the output TS with mouse using the 'Add to TS ...' function.
- Making the tables required for operating the set-top box (PAT, PMT, SDT, NIT) and the programs to be loaded to the remultiplexer – by clicking the 'Create PAT-PMT-SDT-NIT and the Device Programs' buttons using always the automatic mode.
- Programming the device by loading the
  IP Connection List, the
  PID Filter Program and the
  PSI Inserter Program.
- Programming the output streamer in the IP-output versions.
- Checking the device's operation by using the Diagnostics module.

The use of the software; the steps of programming are shown in figure 1.2. In case of special demands (e.g. changing the name of the service, diminishing the components of the service, etc.) in the first step it is practical to use the automatic functions to do everything and in the second step to modify this starting material in manual mode.

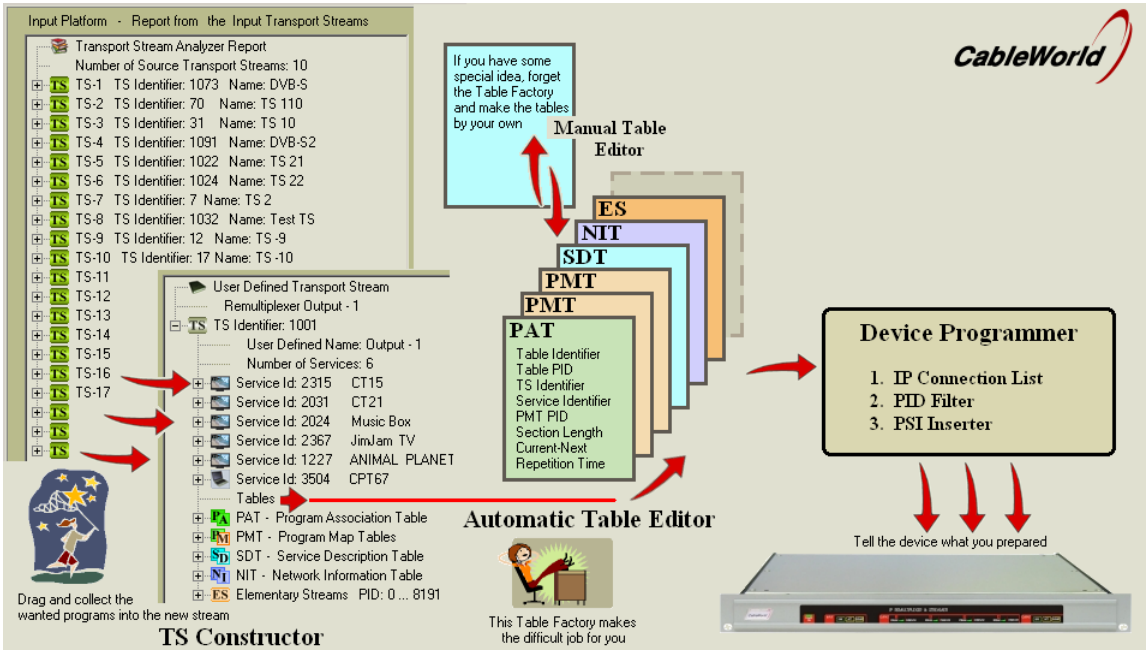


Figure 1.2
Transport stream design

2. IP Remultiplexer fundamentals

The main difference between the ASI-input and the IP-input TS remultiplexers is, that the ASI versions have visible, separate inputs but in the IP remultiplexer all input signals arrive at the device together via one RJ45 type connector so the input signals are not visible and cannot be separated. The transport streams from the IP network are forwarded to the connector of the assigned device according to the IP address. The Port number determines whether the TS passes through the connector or will be discarded.

The value of the Port number is optional between 0 and 65535 (h0000 to hFFFF). In the CableWorld's system design the first step is to determine the Port number range where the transport streams will be sent and the device control commands should be located outside this range. The suggested lower and upper limits for the TS Port range are 57000 and 59999 respectively. The communication ports of the devices should be located in the range 56000 to 56999. At default settings our system software automatically fulfil these conditions. The detailed description of these questions is available in our publication 'Transport Stream Managing over IP' (TSMoIP-m.pdf).

The IP remultiplexer can process the streams only within a (binary) range of 2048 ports in the reserved transport stream range (57000+2048=59048). At system design the user should pay attention to this terms.

In the case of the IP remultiplexer the lower limit of the Port range to be processed should be given by the Port Offset value and the port numbers of the transport streams to be processed should be set in the range between 'Port Offset' and 'Port Offset+2047'. The explanation of the Port Offset is shown in Figure 2.1.

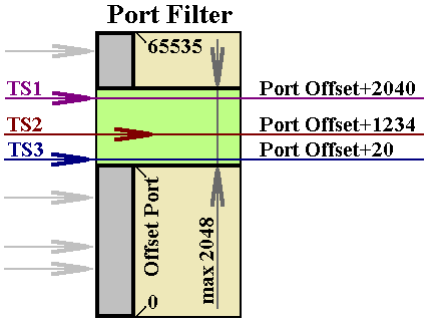


Figure 2.1

Structure of the Port Filter and explanation of the Offset Port

Supplementary information:

At the gigabit input of the IP Remultiplexer a few ns are available to decide if the incoming UDP/IP packet is allowed to transfer. The Port Filter compares 2048 (Port Offset to Port Offset+2047) Port values with the port number of the incoming UDP/IP packet and decides within 100 ns if the packet is allowed to pass through. The transferred packets get to the PID Filter input and the rest will be discarded. The four remultiplexers in the device use a common Port Filter. The four PID Filters should be set with a common Port Offset value. The momentary sum of the data streams transferred by the Port Filter is shown in the first diagram of the diagnostic module.

Important to know: The Port Filter can transfer the data streams, which effectively arrive at the input connector of the device. The data streams can reach the input connector only in unicast or multicast connection and incidentally in the unfrequented broadcast system.

At unicast connection the sender device should provide sending the data stream. The IP Remultiplexer automatically replies the ARP messages arriving incidentally.

For establishing the multicast connection the network used should be able to manage the IGMP (Internet Group Management Protocol) messages. In the second step in order to call in the data stream the IP Remultiplexer should send IGMP messages to the network, (but it should be configured first). The IP Remultiplexer sends IGMP messages to the network according to the content of the programmed IP Connection List, i.e. calls in the multicast data streams whose parameters are in the list.

The data streams sent out in the broadcast system will reach the input connector of the device automatically; there is nothing to do in this mode. The disadvantage of the broadcast is that loads the network to a great extent, so it is used rarely.

NEW!

The user feedback has shown that in many cases, the user can not change the port number of the TS to be processed when arriving at the device input, so the following amendments have been made:

The value of the TS Port Interval can be changed in the device with programming, the value of the communication port can be changed in the SW4953a.ini file. The communication port must be out of the TS Port Interval in every phase of programming. For setting in one step and in the correct order a new configuring module has been built in the SW-4953 software on the Device Settings page. When changing CableWorld basic settings (TS Port Interval 57000 to 59999, communication port 56945), first we recommend using the following: TS Port Interval 1990 to 55999, communication Port 64945. The required changes will be executed with one touch by the software. Where this setting is not suitable, in the next step it can be modified with the SW-4953.

- The SW-4953 software automatically defines the value of the Port offset. The size of the TS Port Interval can be set to greater than 2048, but the following condition must be satisfied: the difference of any two TS Port numbers to be processed, must not be 2048 or its integer multiple. The software automatically detects this condition and issues an alert in case of failure.
- In the CW-4956 and CW-4958 types the input filter watches the value of the IP Address and the TS Port Interval simultaneously, so these can process signals of any sources, but the number of the communication port must be out of the TS Port Interval range. The disturbing effect of the wrong port number from the TS (Port number=3500) is shown in Figure 2.2.

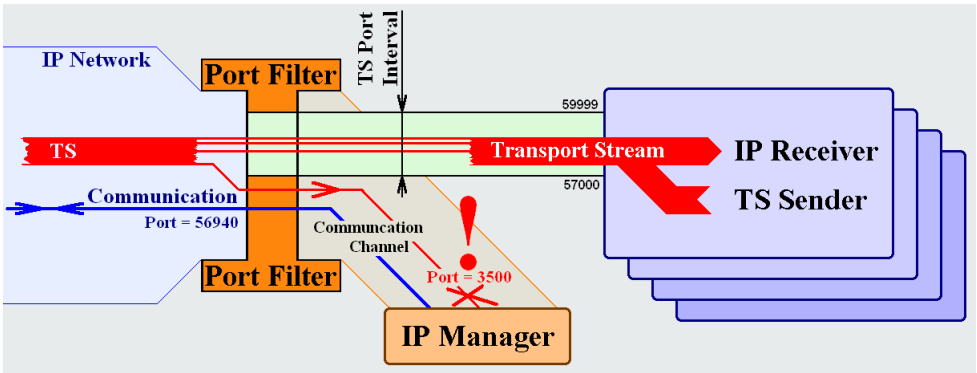


Figure 2.2
Disturbing effect of the TS from outside the TS Port Interval

3. Using the transport stream analyzer

Start the software by clicking the icon on the desktop. The appearing graphic user interface (GUI) is set according to the content of the SW4953a.ini file. The settings of the GUI will be saved on closing the software if the user asks for saving. The ... Settings\SW4953a.ini file comprises all the settings required for running the software.

Supplementary information:

The settings besides the SW4953a.ini file can be saved with the '... \Save Settings as ...' command under optional name, and can be loaded in with the '... \Load Settings (*.ini) from ...' command at any time. The settings saved by the user differ from the content of the SW4953a.ini file, as they do not comprise the relations between device names and type numbers. Saving the settings in separate files and loading them is needed only in large systems at programming many devices or at beginners (e.g. the user wants to go back to the basic setting or needs remote support by sending the *.ini file).

One of the most important modules is the Input IP Address List, which comprises the 256 input IP addresses and port numbers. The device uses only the IP data streams listed there. This list can be saved irrespectively of the settings with the '... \Save Input IP Address List as ...' command and can be load with the '... \Load Input IP Address List (*.ini) from ...' command. Designing the Input IP Address List is a labour-intensive job. The data entry can be done by filling in the cells of the table or modifying the ini file with a text editor. Remember, the software receives the data of the table only on clicking the Enter button!

In the 'View' menu item select the type of device, which is to supply the transport stream for the analysis and the type of device to be programmed later.

Supplementary information:

The Transport Stream Analyzer module of the SW-4953 software can analyse the steams from the sources as follows:

- **Source: IP Network** The software can analyse the multicast data streams of the IP network even without a device and the unicast data streams arriving at the IP address of the PC. For analysing the network signals select the 'View Multicast Network Analyzer' setting.
- **Source: CW-485x TS Remultiplexer** The CW-485x series devices have ASI inputs. On selecting the 'View CW-485x TS Remultiplexer Controller' menu item, the device will send the ASI data streams of the inputs to be analysed to the PC via the IP network.
- **Source: CW-4951, -52 IP Remultiplexer and Streamer** The CW-4951, -52 devices are equipped with a universal receiver module which can receive the multicast and unicast data streams of the IP network one by one and forward them to the PC. On checking the 'View CW-4951 or -52 IP Remultiplexer and Streamer Controller' menu item the data streams to be analysed will be transmitted to the PC through the device. Select this menu item at installing the CW-4951 and CW-4952 IP Remultiplexer and Streamer.
- **Source: CW-4956, -58** types have no internal receiver, the transport stream must be analysed with the IP Network analysis.

The picture on the left shows the route of the streams according to the mode selected. Be careful, this setting will determine the other modes of the software.

Select the inputs you want to analyse. Be careful when selecting the IP inputs, analysing too many streams (more than 10) takes a long time.

Supplementary information:

The signal of IP input will be processed on clicking the IP address or the Port number in the Input IP Address List table. The line of the enabled address is marked green. Click the name to disable the input. The IP address enabled last time (marked yellow) will get to the list of the manual analyser.

The enabling and disabling of the ASI inputs can be set in the checkbox of the ASI input. Only the signals of the checked inputs will be processed. At the manual analyser the ASI input to be analysed is to be checked in the pull-down list.

The transport stream analyser of the SW-4953 software offers auto and manual mode. For analysing the input signals the auto mode should be used, the manual mode is useful only at troubleshooting and solving special tasks. The first step is to check in Auto – Fast mode if the analysis can run according to the user's conception. When the user can detect an incoming signal from every input, then they should select the Auto – Normal mode for analysing the input signals. The run-time of the Auto – Deep mode is very long, can take a few minutes, and so use it carefully.

Supplementary information:

In the Auto – Fast mode the analyser gets samples of 5 MByte and max. 1 sec long from the signal, so often occurs that some tables (e.g. NIT, BAT, etc.) are not found in the sample. In the Auto – Normal mode the size of the sample is 20 MByte and max. 5 sec, so the result of the analysis is usually suitable for remultiplexing. The Auto – Deep mode gets samples of 40 MByte and max. 20 sec, so the analysis takes long time.

The analyser software analyses the samples in the same way in all the three modes, the difference is caused by the content of the small and large samples.

It is important to know about the unicast and the a multicast reception, that

- in correct network operation only the unicast data stream sent to the device IP address will appear at the device connector.
- those multicast data streams will get to the device input, which are ordered there by the IGMP messages of the device.

The input stage of the CW-4951, -52 IP Remultiplexer does not monitor the IP and the MAC addresses; it is not its job. Its only job at unicast reception is to answer the incidental ARP messages, and so does it. At Multicast reception at the beginning of the reception it sends an IGMP Membership Report message towards the network, at the end of reception it sends an IGMP Leave Group message and besides these answers the IGMP Membership Query messages incoming from the network. The communication steps mentioned above and the correct network design together ensure that the data streams required can appear at the input connector of the device. The input stage of the device, the 'Port Filter' let the Ethernet packets pass by their Port number.

When filling the IP Address List at the multicast data streams, the Multicast IP address and the Port number are very important, enter them correctly. At the unicast data stream the unicast IP address is the IP address of the device, so any unicast address can be entered in the IP address cell, the software and the device will neglect it. It is very useful to enter the sender IP address in the cell as a reminder. The Port number is very important at the unicast reception, enter it correctly.

In case of unicast and multicast reception irrespectively of the device and the software (SW-4953) the user or the operator should ensure that the data streams are sent continuously (streaming) by the sources in the required mode.

Analysing the signals of the sources result in line of reports about transport streams. This set of reports is called Source Report. The SW-4953 software can record signals of transport streams resulting from up to 256 sources in a common report. On the Source Analyzer page the user can briefly inspect this report, to see the main data (TS Identifier, tables, components, etc.), but there is nothing to do with it. The sample should be large enough to ensure that the properly deep mass of data is available from every transport stream to be used, and the tables and elementary streams to be used are there in the sample so that the software could enter them into the report.

At the end of the analysing process it is strongly suggested to save the Source Report in file (...\Sources*.srp), to avoid the need for repeating this procedure. The design of the transport stream starts from this Source Report, the output streams and the device controller programs will be designed from this. On exit with saving the software saves the Source Report and on start this will be loaded in.

Supplementary information:

The SW-4953 software can analyse a transport stream stored in file, and *.srp format report can be made from this as well. The reports from several sources can be united and combined with the 'Add TS Report file to TS Report' command. These procedures can be necessary in the midst of a great task/work turns out that some analysis has not been done, was forgotten or some descriptors, tables, etc., should be inserted into the output stream what can be taken out only from samples saved in files. It is very important, that the active parts of the IP Address List in the joined reports suit to each other (IP address and Port number conflicts are not allowed).

4. Using the TS Constructor

The transport stream is a set of several data steams. The tree structure shows well the relation of the data streams. As the use of the tree structure for illustrating the components of the transport stream is widespread, so the SW-4953 software also offers this form for building a new stream. On entering the TS Constructor page the results of the analysis of the transport stream sources are shown on the left, and on the right the software wait for us to assemble the output stream on demand. In the Quad version use the 'View' menu item to select the output whose signal you want to compose, that is, which one of the four remultiplexers you are going to use.

TS Constructor Mode The TS Constructor offers three modes. In the 'Do not change TS' mode the software do not change the output stream, the 'Add to TS ...' mode is for building, the 'Remove from TS ...' mode is for disassembling the output stream. For assembling a new stream use the 'Add to TS ...' mode.

Create new TS In the first step create an empty transport stream (null packets) by clicking the 'New TS' button. First the software asks for typing the Transport Stream Identifier. This number between 0 and 65535 will identify the transport stream to be assembled. The second step is typing the name of the TS. This name will not be built in the stream but helps the user in identification later. When the user gives no data and clicks the OK button, the software will generate the missing data automatically. The software prepares one each empty PAT, PMT, SDT and NIT tables for the design. This time they are still empty and grey coloured.

The 'Create new TS' button is the clear button of the right side editor at the same time, as it clears every former design. The same effect can be realized in the 'Remove from TS' mode when the TS is assigned and dragged in the trash.

New Service The transport stream is a set of services (radio and television programs). On user request in the new version the New Service button causes the software to build the required number of new services into the transport stream. The Service Identifier and the Service Type is provided automatically, these can be modified only later in manual mode.

In the second step in the construction of the TS, insert as many services in the TS with the New Service button, as many programs are to be incorporated. The number of services can be increased and decreased later.

New ... Table The transport stream controls the receivers with the inherent tables. When the user wants to build special tables in the transport stream, he/she can make place for these tables by clicking the 'New ... Table' button. The software asks for typing the table PID value and the Table Identifier. The 'New ... Table' function must be used only when solving special tasks.

New ES The transport stream is a set of elementary streams. When the user wants to take a data stream from one of the input transport streams that does not belong to any services, then he can make place for it by clicking the 'New ES' button. The software asks for typing the PID and the source (Port number or ASI input number). In the initial period of the TS design this operation is not necessary. In this operation the software cannot consider the rate of the stream. In the following step of the transport stream design the prepared empty places must be filled with content, real data. On the left side a number building blocks are available. In the 'Add to TS ...' mode clicking any element copies it to the clipboard. The main features of the element on the clipboard are shown in the 'Selected Item' box. On clicking any element on the left, the TS Constructor will not change the left side. The user can get rid of the marked element by clicking the trash.

Copying the complete TS Sometimes the user wants to transpose one whole input transport stream to the output, since only little modifications will be needed. For this operation click the selected stream on the left and then on the right insert the selected stream by clicking the header of the TS. On approving the content of the clipboard will be inserted except the TS Identifier and the TS Name. The copied transport stream can be modified later the same, as if it were assembled from its elements; e.g. services, elementary streams, etc. can be removed.

Copying services one by one Click the selected service on the left and then insert it in its place on the right. The software allows the inserting to empty places only; overwriting the former services is not possible. The PAT and PMT tables will be made automatically, in case of PID conflict the PID Remapper will work automatically. The software prefers and uses the Service Identifier given by the user, but it uses the source identifier if data are not found.

Copying the tables It is necessary when the user want to take a table from the source side for using it directly or with little modifications. Definitely avoid copying the PAT and the PMT tables because it totally confuses the stream. Copying the NIT tables often helps the design, copying the CAT, BAT, TDT, TOT tables will be an important design step in many cases.

Copying Elementary Stream The Elementary Stream inserted by copying differs from the stream inserted by the 'New ES' operation, because the software knows their data from the TS analysis, e.g. the data rate, so it can take account of them when building the stream. Use the copying when the Source Report comprises the data of the Elementary Stream, if not, use the 'New ES' operation, but be careful.

Remove from TS ... Almost any time any thing can be removed from the structured output stream. But be careful, because removing a few important data can confuse the stream and reversing the operation is not possible. After setting the mode, click the element to be removed, verify the operation if it suits your intention. The 'remove Service' and the 'remove ES' are the most frequently used operations. The design of the PAT and PMT tables is performed automatically.

Note: At removing the elementary streams the software is not monitoring if another service is using it. E.g. at removing the service, every elementary stream of it is removed, but this and the similar mistakes will be corrected later by the automatic functions.

Remapping function At inserting the elementary streams the automatic Remapping function is always switched on. At inserting the service the components are inserted by the automatic functions. For the new PID value always the next free PID value is selected. At inserting the elementary streams one by one the offered value can be changed.

Note: The PID values changed by the PID Remapper automata can be modified later in the manual editor. The 'Full Remapping' function clears these initial modifications (PID Remapping) and redesigns everything.

5. PSI Editor

In the course of programming the Transport Stream Constructor helps the user to describe for the software the transport stream he wants to create. The SW-4953 automatically processes the assembled transport stream (Output TS – 1…64); designs the tables required for controlling the set top box and makes the programs to be loaded into the device, when instructed. When the user wants to differ from the solutions of the automatic functions, he can change to the manual mode. We suggest for the professional users to use the automatic function first, and then to take over the control and accomplish the modifications on demand.

It is important to note, that the report of the transport stream (Constructed TS 1...64) assembled by the user can be saved into file and can be loaded as a start-up position any time. The software also takes the data from this report for design. The first step for making the tables and programs is clearing the content of the PSI Editor and setting the auto mode everywhere. This can be done by clicking the 'Clear PSI Editor and set Full Auto Mode' button. The design of the tables and the programs to be loaded to the device can be done by clicking by the 'Create PAT – PMT – SDT – NIT and Device Programs' button.

To sum it up: In the simplest case for designing the tables and the programs to be loaded to the device click the '**Clear PSI Editor and set Full Auto Mode'** button and then the '**Create PAT – PMT – SDT – NIT and Device Programs'** button. These two buttons can be found in the PAT – PMT Editor and the SDT – NIT … Editor page as well. The buttons with the same inscription are completely equivalent; any of them can be clicked.

5.1. PAT – PMT Editor

Using the PAT – PMT Editor is necessary only when the user wants to modify the tables and programs made in the automatic mode.

Supplementary information:

The SW-4953 software uses the following databases:

- Source Report - The set of data describing the input transport streams
- Constructed TS-1...64 - The set of data describing the transport stream assembled by the user
- Table Report-1...64 - The set of tables and programs designed by the software
- Programs - The operating programs to be loaded to device

The relationships of the databases are shown in figure 5.1.

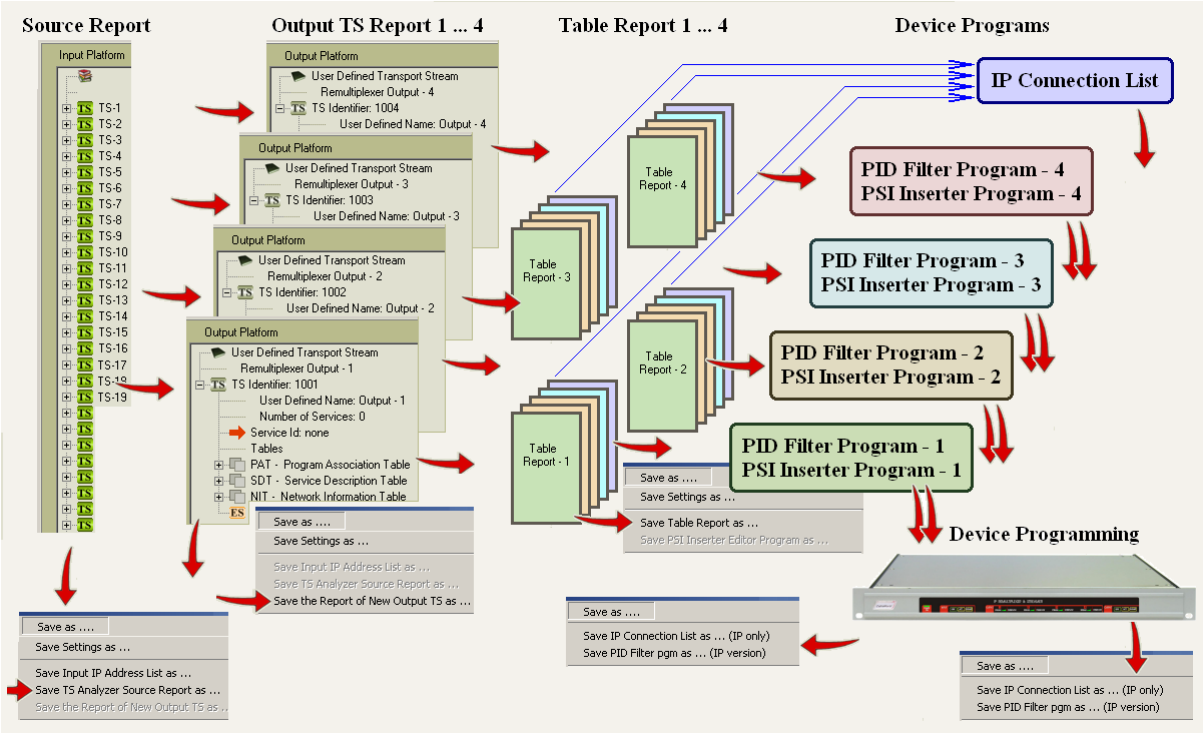


Figure 5.1

Databases of the SW-4953 software

The PSI Editor processes the database of the transport stream assembled by the user and writes the processed data in the Table Report database, then makes the device controller programs from this. The clicking of the 'Clear PSI Editor' button clears all the data of the Table Report and set the editors to automatic mode. The table and program design starts with processing the main data of the transport stream. The starting data can be seen in the Transport Stream Parameter Editor table. The initial values are loaded from the Settings.ini file. In order to change these data finally, modify the ini file.

A simple way for modification: Set the editor to manual mode and modify the wanted data in the table then click the 'Create PAT – PMT …' button. In manual mode the software reads the data directly from the table then after the processing it writes back the data in the table to verify their interpretation. All units of the PSI Editor work in this way, i.e. the operation of the editors can be summarized as follows:

- The Editor works in automatic mode with the internal data and displays the result on the screen.
- In manual mode it processes the data on the screen so the user's modifications will get into the database.
- Clicking the 'Create PAT – PMT …' button runs the complete editing process from the beginning in every case (except clear), and if it finds manual mode anywhere, it will do the editing with considering it.
- In the course of the editing after every modification, i.e. often and bravely, click the 'Create PAT – PMT …' button in order to process and store your data.

In the course of editing (among the tables) the Program Association Table (PAT) will be edited first. At automatic editing the PAT Editor shows the series composed from the Service Id and the PMT PID values. Setting the PAT Editor to manual mode (User Defined PAT) the software assembles the PAT table from the (editing) table of the PAT Editor, so it can be edited freely.

The data will be read out on clicking the 'Create ...' button, and after processing the software writes them back to the table. During editing use often the 'Create ...' button, to ensure the interpretation and acceptation of your data.

The software writes a '0' value in place of the cleared data, the rows with 0,0 values will not get into the PAT table. The software makes a PMT table for those rows of the PAT Editor, where one of the two data is not zero. The current number of PMT tables belonging to the PAT table can be seen after the inscription 'Number of PMTs:'.

Attention! The automatic Service Identifier, the automatic PMT PID and the Full Remapping functions react to the PAT table. As a special service the PAT Editor permits passing PAT table from one input without alteration, or preventing PAT table from passing into the output stream. These two services are made for special applications and are considered at making the program of the output PSI Inserter.

The PMT Editor uses the PAT Editor data. In automatic mode the software makes all the PMT tables in one step, but cannot show them simultaneously. Clicking the rows of the PAT Editor one by one, always the PMT table belonging to the selected row will be displayed. In the PMT Editor always the displayed table becomes editable, and the others remain unvaried.

In the PMT Editor the user can switch on/off the automatic Service Identifier, the automatic PMT PID and the Full Remapping functions. In default setting the software works with automatic Service Identifier allocation and full PID Remapping function. The Full Remapping function overwrites the automatic PMT PID function.

The automatic editor produces the PMT tables with using the PAT – PMT Inserter. The descriptors of the PMT table can be seen in the Descriptor Editor when clicking the row of the Elementary Stream Information.

The PMT Editor also allows of the manual editing, when the 'Modify PMTs Manually' mode is selected. In this mode the Editor works only with the actually displayed PMT table, and leaves the others unvaried. In manual mode the PMT table will be redesigned with using the data of the PMT Editor table. Also at the PMT table the user can pass from the input stream in place of the PSI Inserter or prevent passing the PMT. Check this demand in the PAT Editor table (by clicking the PSI, Port, Off fields), but after checking remember to write it into the data with the 'Create PAT – PMT ...' button. In case of several PMTs click the 'Create PAT – PMT ...' button for each PMT separately. The data has been stored, if changing the PMT tables the setting does not disappear when displaying the table again.

At assembling the tables the most difficult task is the editing of the descriptors. The SW-4952 software provides an extra Descriptor Editor. In case of the PMT the descriptors get into the upper table of the editor by clicking the descriptors of the ES Info, where they can be seen separately. In the lower table of the editor the descriptor samples stored in the \RemuxDOC\Descriptors\Descript.ini file can be seen. The user can load the data of his own file to this store with the 'File\Load my Descriptor File (*.ini) from ...' command, but he can extend the content of the Descript.ini file, too. Remember to raise the number of the stored descriptors, too, when extending the ini file!

The selected descriptor of the descriptor storage can be inserted to the selected row of the editor by the 'Copy the selected Descriptor ...' button. The software copies back the whole content of the Descriptor Editor to the Elementary stream by the 'Copy Descriptors to ES ...' button. Any editing task can be solved with the two commands and the Copy-Paste (Ctrl+C, Ctrl+V) operations. The software always sets the length (cuts or completes) of the descriptor info to the 'Length' data. Remember, the modification of the PMT descriptors will be stored only by clicking the 'Create ...' button. During editing, do not skip among the software modules before clicking the 'Create ...' button, because some modifications can be lost.

Useful advice: When the user assembles one or more descriptors manually or copies from other sources, after the editing he should send them for checking to the Descriptor Editor, where the interpretation can be seen. It can be modified there, too, if necessary. As the second check put the descriptors from the Descriptor Editor to the table. Here the software recompiles the descriptors and corrects the remaining errors. The descriptors can be taken correct, if converting them several times to and from the same result is found.

5.2. SDT – NIT ... Editor

In the editor of the SDT, NIT, etc. tables always only the editor of the selected table is displayed by the 'View SDT Editor', 'View NIT Editor', etc. buttons. The first version of the SW-4953 software supports only the editing of the SDT and NIT tables and the Elementary Streams, the editors of the other tables will be built in during further development.

Before editing the SDT table the editing of the PAT and PMT tables must be accomplished. The software can automatically built in the SDT table those data, which can be found in the 'Constructed TS' set of data assembled by the user. Changing the names of the programs is possible in manual mode only.

The NIT table is independent from the PAT, PMT and SDT tables. It can be made any time. The NIT Editor can merely copy the input NIT table, and then it can be developed

manually. The desired NIT table always must be created manually.

In the editor of the Elementary Streams always the state after editing the tables is displayed. The manual editing of the Elementary Streams is needed only when the user wants to realize a special solution (e.g. to build in a data stream from outside the PAT and PMT), or does not agree with the solution of the automatic function somewhere (e.g. to clear some audio data streams).

Supplementary information:

The SDT, NIT, etc. tables can be assembled manually as well, but we suggest doing it automatically first, and then modifying the data of the editor manually. Remember, the changes in manual mode will be processed only on clicking the 'Create ...' button. These tables also can be taken from the input as elementary streams, or the use of the table can be switched off. These selections also must be validated by clicking the 'Create ...' button.

In manual mode the SDT Editor permits of adding or removing services in the table. In manual mode all the data of the rows will be cleared from the table where the user clears the value of the Service Identifier. Giving the Service Identifier can open new row of data. The Descriptor Editor always shows the Descriptors of the selected row in the SDT Editor. See the use of the Descriptor Editor at the editing of the PMT table. The modified descriptors can be copied to the selected row of the SDT Editor with the 'Copy the Descriptors to the Table' button.

The software specially supports the editing of the Service Descriptor comprising the name of the service. The Service Descriptor marked h48 will be displayed in the SDT Editor table by characters as well. The appearing service names here can be modified directly from the PC keyboard. After modifying the name, on clicking the 'Insert selected Service Name to Descriptor' button, the descriptor of the selected name changes automatically. When modifying several names, click the button after every modification. Special characters can be inserted with the Descriptor Editor. Remember to modify the 'Length' field, when changing the length of the name. When modifying the name, for simpler editing insert temporary characters in the place of the special characters and then modify them in the Descriptor Editor. The copy and paste (Ctrl+C, Ctrl+V) can be used well in editing the SDT.

Suggestion: The work for modifying the name of the service and the service provider several times, can be simplified as follows: Write the frame of the Service Descriptor marked with the number h48 (72) with the company name and a few characters of the service name into the Descript.ini file and recall from there during editing. After the insertion only the name of the service is to be confirmed. As a muster, the descriptor frame of 'CableWorld' (as a service provider) is saved in the Descript.ini file. Who makes tables for several companies, can make his personal descriptor file from these descriptor frames. The self made descriptor file can be recalled with the 'File/Load my Descriptor File (*.ini) from ...' command.

The NIT table comprises the data of the distribution network (independent from the PAT, PMT and SDT tables), so it cannot be edited automatically. The automatic editor can display a NIT table only if the user put a NIT table in the Constructed TS previously. The NIT table can be edited manually or can be transferred from an input but its creation can be disabled. The large NIT tables are complicated, comprises many descriptors. The editing can be accelerated if the user can create his table by modifying a similar NIT. The NIT editing without starting data needs practice and expertise. The NIT Editor considers filling the Length field as a base and processes the characters according to these. Clearing the Length field will clear the related data as well.

The Elementary Stream Editor shows what Elementary Streams were transferred during editing. The content of the editor is largely similar to the content of the PID Filter Programmer. In the ES Editor the user can remove and insert streams in the same way as in the PID Filter Programmer. The special service of the ES Editor is permitting the transfer of all components from a selected port. E.g., this mode is required when a slow rate DVB-T transmission is to be extended with other programs.

On clicking the 'View Computed TS' button the user can see in detail the stream assembled as a result of the automatic and manual editing. On clicking the 'View Error List' button the user can see the errors found in the editing by the software (under development).

5.3. Clear PSI Editor and set Full Auto Mode

On clicking the 'Clear PSI Editor' button the data of all tables and program editors will be cleared, the mode selectors change to automatic mode, the table editing and program designing process starts from the beginning.

Important note: After the clear the PSI Editor contains no data. On clicking the 'Create ...' button storing the data starts. On changing to manual mode more and more data will be stored. These data can be cleared safely only with the 'Clear PSI Editor' operation. During editing the tables, when the user modifies the assembled transport stream (e.g. removes and inserts a service), the PSI Editor must always be cleared, because the software cannot follow, where the former entries belong to, which data are permitted or not permitted to change.

5.4. Editing the LCN descriptors

The LCN (Logical Channel Number) descriptor placed in the NIT table allows the set-top box to display the programs in the order determined by the user after the automatic channel search. The NIT table comprises the parameters required by the user, so the automatic editor can build in little information in the NIT table without the user's data. For easier editing of the NIT table, the SW-4953 software offers new possibilities.

On selecting the automatic NIT editing the program builds only one Network Name Descriptor (h40) in the NIT table, and reads its name from the SW4953a.ini file. By clicking the LCN Descriptor Editor button on page SDT-NIT Editor, we get new opportunities. On checking the Insert LCN ... check-box, the program compiles the NIT as follows:

- First it examines if the LCN_x.ini file assigned to the given channel program can be found in the ...\RemucDOC\Desctiptors directory, where "x" is the channel number. This solution allows making different NIT for every channel.
- When the file assigned to the channel is not found, the software searches and processes the LCNdesc.ini file. Working with this file every channel will have the same NIT.

On clicking the **Load LCNdesc.ini and Create NIT button** we can keep track of the automatic editing work, when the NIT will be replaced. On the PSI Editor page the packets of the new NIT can be viewed and saved into file.

Editing the data of the LCNdesc.ini file:

The structures of the LCN_1.ini, ... LCN_64.ini and LCNdesc.ini files are quite identical the data can be modified with text editor. On opening the file the following can be seen:

```
[Project]
Project Name=My first LCN
Network Name=CableWorld Network
Date=2010.01.14.
LCN Descriptor type 83/87=83
Number of TS=2
```

The name of the network, the type of the LCN descriptor (83 or 87) and the number of transport streams to be placed in the NIT must be given in the header. The project name and the date can be freely used to identify the file. Using the header data, first the software builds a Network Name Descriptor in the NIT table, then place the descriptors of the transport streams in the required number. First, a Cable Delivery System Descriptor (h44) is made from the data given in the header of the transport stream, then it is followed by the LCN descriptors; in the required number. The LCN descriptors also consist of header and data, the data must be started with the descriptor number (1, 2, ...). The second number inside the descriptor is the ordinal number of the service. Some data in the header are used only in the h87 type descriptors.

```
[TS-1]
TS Identifier=1000
Original Netw Id=1
Frequency (Hz)=100000000
FEC_outer=2
Modulation=3
Symbol Rate (S/s)=6875000
FEC inner=0
Number of list=1

1_Channel List Id=1
1_Channel List Name=CableWorld test
1_Country Code=HUN
1_Number of Services=2

1_1_Service Id=1000
1_1_Visible Flag=1
1_1_Logical Channel Number=1

1_2_Service Id=2000
1_2_Visible Flag=1
1_2_Logical Channel Number=2
```

At making larger data sets use the copy function then modify the data. The data must not contain any character error. Check the correctness of the file data by the load button of the LCN Descriptor Editor.

5.5. Editing the descriptors

Improving quality of service increasingly requires the integration, modification or removal of different descriptors. The descriptor editing requires a higher level of expertise, so new users are rarely undertake such change. In auto mode the software can copy only the descriptors in the analysed samples. The descriptors for user services to meet individual needs should be drawn up by the users on the basis of their expertise. In manual mode the software allows placing these in the tables.

In the PMT tables the descriptors can be placed on the service level (Program Info) and on the level of the elementary streams (ES Info), too. The SDT and NIT tables typically contain a large number of descriptors.

The SW-4953 software allows editing descriptors by the Descriptor Editor. The first step in editing is analysing the Descriptors, separating the current descriptor data line into individual descriptors. In this example the PMT table descriptors are decomposed. As shown in Figure 5.2, the Program Info section contains no descriptors, on clicking a descriptor series of an elementary stream (1) the Descriptor Editor shows the descriptors decomposed and interpreted.

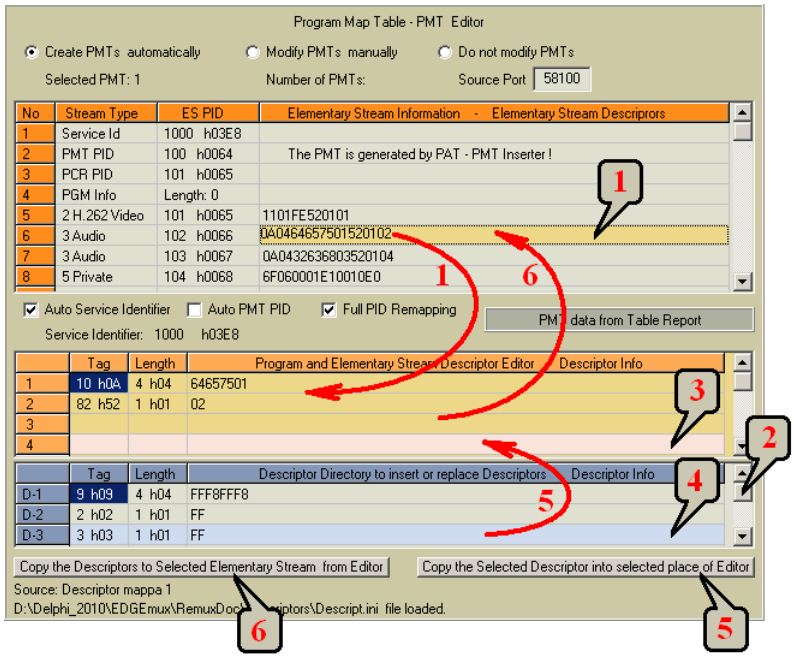


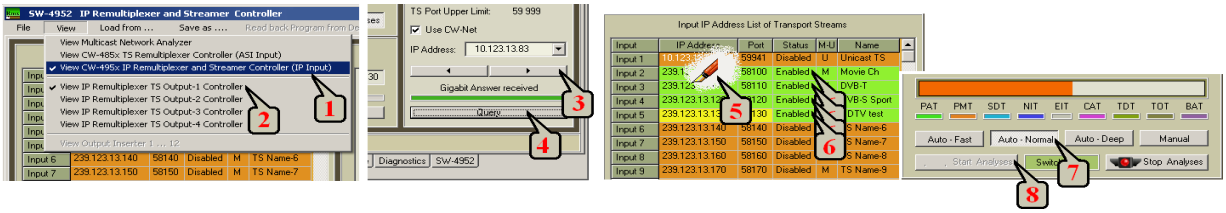
Figure 5.2
Using the Descriptor Editor

As compiling the descriptors is a difficult task the software loads more than 100 descriptors from the Descript.ini file to the descriptor directory. The most common descriptors should be written into this file. Click the desired line (3) where the new descriptor is being inserted. In the directory select the (4) descriptor, you want to insert here. On clicking the **Copy the Selected ...** button (5) the software do the copying. In the Descriptor Editor the data can still be modified. When the descriptors are in the editor in the desired order and content, on clicking the **Copy the Descriptors ...** button (6) the new series gets back to the starting position. The software checks the formal correctness of the descriptors, but the content control is the user's task.

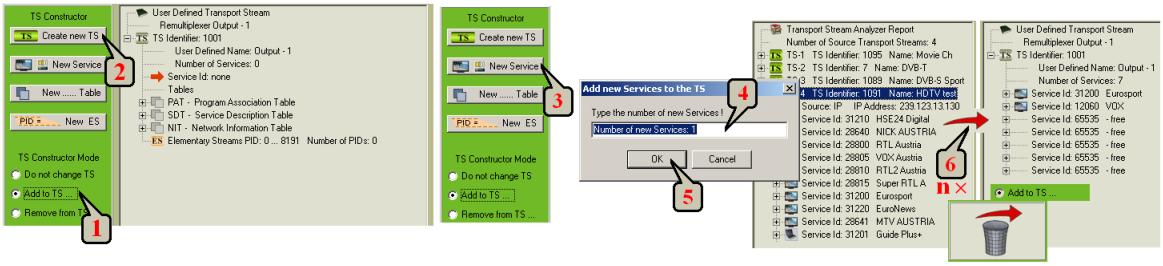
The editor on page SDT – NIT Editor operates as mentioned above. The edited descriptors will be finally installed and stored always only after clicking the **Create ...** button.

6. The remultiplexing process in pictures

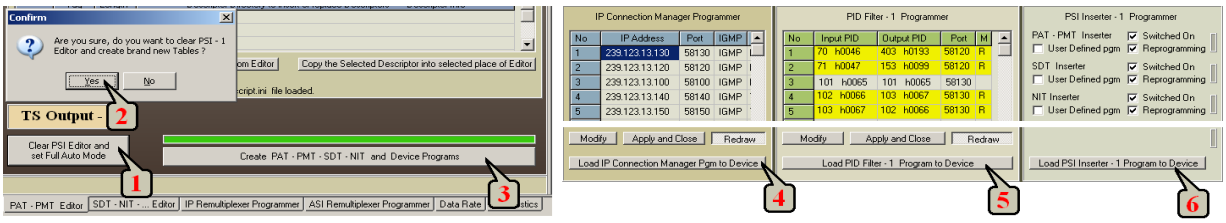
1. Analyse the input transport streams, before composing the output TS!



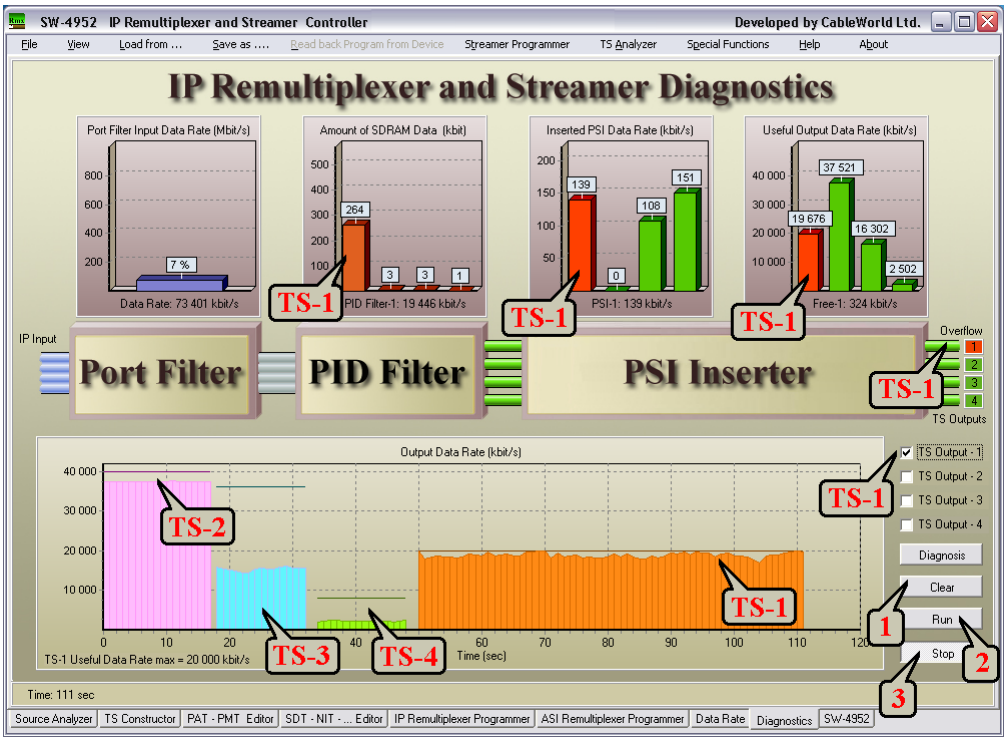
2. Compose the output transport stream!



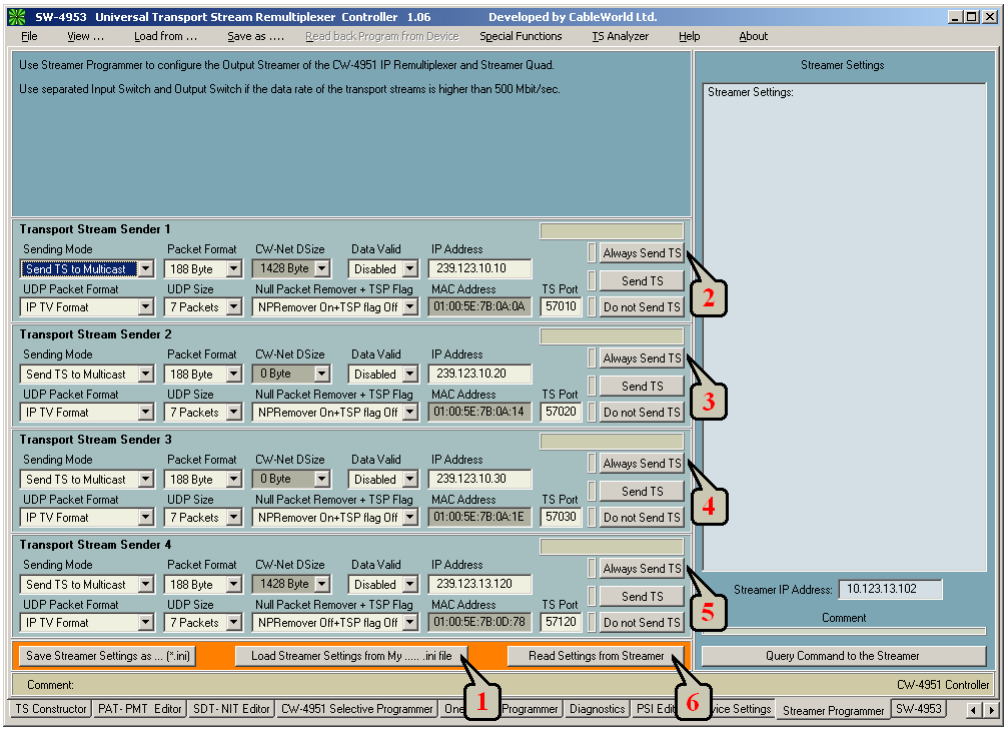
3. Create the tables and the device operating programs, and then load the programs to the device!



4. Check the operation of the device!



5. For IP-output device (CW-4951) configure the output streamer!



7. Programming the CW-485x TS Remultiplexer

The CW-4852, CW-4854, CW-4858 are the first generation TS Remultiplexers of CableWorld of which thousands were sold. So CableWorld feels obliged to make the latest version of software suitable for programming these types. The programming interface of the devices will become available, when the View CW-485x TS Remultiplexer Controller mode is set in the View ... menu. The lower left part of the Analyzer page also shows in picture the relationship between the software and the device and the paths of the data streams. The ASI Remultiplexer programmer comprises the following three modules:

- PID Filter Programmer
- PSI Inserter Programmer
- General Settings

The program of the PID Filter Programmer and the PSI Inserter Programmer can come from the TS Constructor module, can be loaded from file or can be read back from the device. Before loading the software automatically saves the PID Filter program to the PIDfilt.dpf file and the PSI Inserter program to the PSIpgm.da file.

The novelty of the SW-4953 software is, that the Replace IP Address and the Set ARP Repetition Time functions are on the Device Settings page, and no special software required for setting them.

The detailed description of the CW-485x remultiplexers can be found in the Help of the SW-4851 software.

Supplementary information:

The PID Filter Programmer demonstrates the current program in a table but does not allow modifying the data. When saving into file the program of the table will be saved, the program read from the file and the program read back from the device get into the table automatically. For storing the programs the software offers the …\ASI_PGM subdirectory in the source directory, the automatically saved programs also can be found here.

The PSI Inserter Programmer can load in the PSIinfo.dat and the PSIpgm.da type files as well. The identification of the PSIinfo.dat file happens with the word 'CableWorld' which can be found in the header. The PSIinfo.dat type files will be automatically converted into PSIpgm.da type files and then the software will work only with this and the read back program also will be saved in this version. (Note: At the PSIinfo to PSIpgm conversion the automatic function tries to set the greatest PAT-PMT:SDT:NIT ratio (32:4:1), so the size of the program to be made is usually greater than which is made by the SW-4851B software at manual setting.)

In the General Settings module the querying of the settings/preset values is performed with the program of the Diagnostics module, since a number of other parameters will be queried, so the querying time is 5 to 8 sec. Remember, that the setting of the NCO determining the output data rate and the packet format will be started only by clicking the 'Set NCO and Format' button. The successful entry will be acknowledged. The command for switching out and in the PCR corrector will be started by the buttons immediately.

In case of the ASI Remultiplexers the diagram shows the transferred data stream of the PID Filters situated after the 2, 4 or 8 ASI inputs. The bar diagram helps monitoring the operation of the ASI lines and the PID Filters. In case of Overflow the colour of the bar goes red. The 8-input remultiplexer comprises an internal remultiplexer too. The lower left part of the diagnostic page informs of the state of the Internal Multiplexer. The block diagram in the middle helps interpreting the displayed data. The lower right display informs of the operation of the Output Multiplexer and the PCR corrector. The display shows, how many from the 64 automatic PCR correctors have found a PCR data stream, in how many cases was the PCR correction unnecessary. Here you can see the number of the corrected and incorrigible values, as well. The Diagnostics Report shows more details of the data, there also can be seen which units from the 64 PCR correctors are operating in the moment of the examination. The complete query of the 8-input remultiplexers happens in 7 phases, for the smaller ones in 5 phases. The progress bar in the lower left corner illustrates the phase of the query.

8. Programming the CW-4855 TS Remultiplexer

The 6-input Remultiplexer panel has been developed using the development and application experience of the CW-485x-type TS remultiplexers, and is used in the following equipment:

- **CW-4855 TS Remultiplexer** - which is an improved version of the CW-4854 Type with 4 ASI inputs and output, and after the programming with IP output, too. This type is fully able to replace his predecessor, the substitute type.
- CW-4856 Multiformat TS Remultiplexer - has 3 ASI and 3 IP inputs, the output is ASI and after programming can be IP, as well. This type was made for applications where the processing of both ASI and IP input signals is required.

The service of the two new types of Remultiplexer, far surpasses the previous versions, while the price is not increased. In these versions all the PID values can be filtered and changed (remapping). Large SDRAM helps to manage the VBR streams, the PSI Inserter's capacity is much higher. The PCR corrector can correct the PCR value with an error of less than 500 ns at all the PID values.

The programming of the two products differ only in that one of them has four inputs and the other has six inputs. In the Multiformat type after configuring the three IP input, the input signals can be treated in the same way as the ASI input signals. The Remultiplexer board structure, the circuit design of the two devices are similar to the IP remultiplexers. Details of the PSI Inserter design and programming can be found in the description of the CW-4951 IP Remultiplexer. The block diagram of the Remultiplexer board is shown in Figure 8.1.

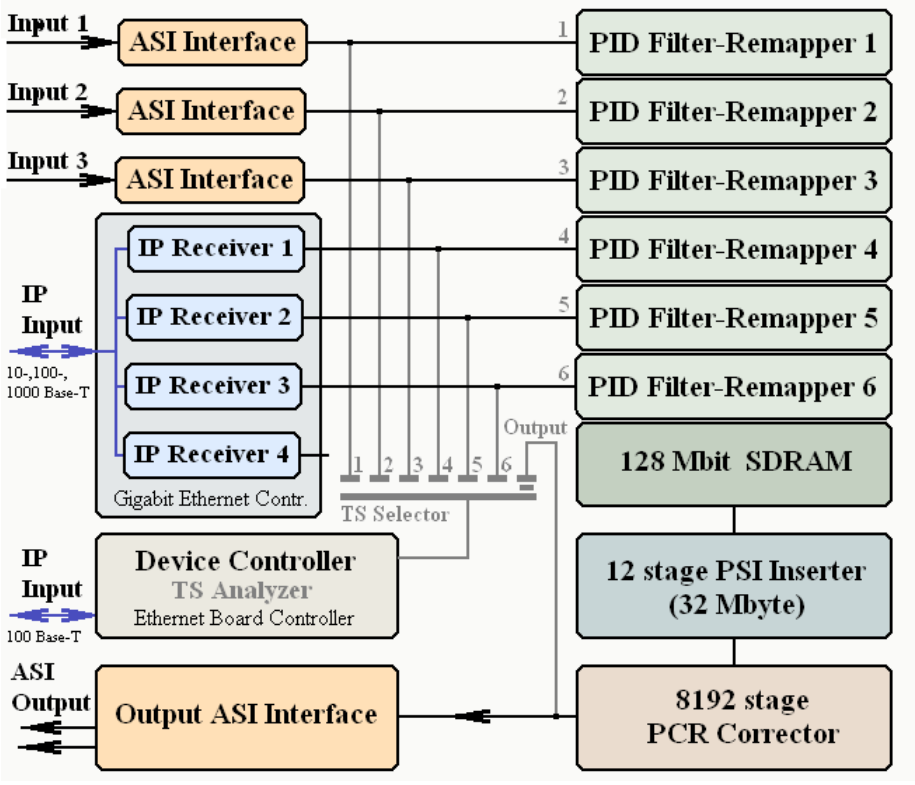


Figure 8.1
Block diagram of the remultiplexer board in the CW-4855 and CW-4856 types

In the type CW-4855 the Ethernet cabling, the IP address setting, the input and output signal sampling, etc., are perfectly identical to the previous CW-4854 type. New features: programmable filters at the inputs which can disable the inputs, filter out the null packets and remove the defective packets marked by the Transport Error bit. Remember these settings or modify, if necessary. The device is capable of receiving MPTS, SPTS, elementary stream level, burst format, continuous, etc., that is any packetized input signal.

New feature: Beyond the NCO any input signal can be used as output clock signal and programmable PLL can be used when very low jitter is required. The external clock feeding option is not available in these types.

The PSI Inserter priority can be set when compiling the output signal. In applications where the PSI Inserter produces tables (PAT, PMT, NIT, SDT), always check the **High PSI Inserter Priority** check box, or the PSI Inserter will not issue the packets to be inserted, as long as the contents of the SDRAM is not empty. When the Priority function is turned on, the PSI data insertion takes precedence over the other data in the transport stream. That is, the tables will be sent out full, while the picture, audio and other data streams are waiting in the SDRAM as needed. In general applications enabling the PSI Priority function is recommended.

The Device Control input can be operated in 10Base-T or 100 Base-T mode, the remultiplexer will be set and configured from here. The factory setting of this input IP address is 10.123.13.101.

The compilation process of the transport stream does not differ from those described previously, so this issue is not dealt with in this chapter. The interface required for programming the device is available in the View CW-4855 TS Remultiplexer Controller menu.

The PID Filter operation and programming is the same as described in the IP remultiplexer. The PID Filter program can be edited manually, too. The program loading will start after the confirmation request.

The PSI Inserter programming is the same as described in the IP Remultiplexer. In the CW-4855, the employed bus speed is lower, so larger amounts of data (e.g. 1 to 2 Mbyte set-top box software update) takes considerably longer to load than the load through a gigabit line.

Setting the data rate, selecting the transport stream clock source, setting the input filter (Filter General) and turning on/off the PCR corrector are done with the buttons on the programming page. The software always asks the amendment request. The reading back of the settings happens by the Query button of the GUI.

On the diagnostic page, we get information about the current operational status of the remultiplexer. On requesting diagnostic text report, the results can be saved in text file. Using dynamic query, we can receive continuous information about the extent of the input and output data streams, the possible errors and overflows.

9. Programming the CW-4856 Multiformat TS Remultiplexer

The CW-4856 TS Multiformat Remultiplexer structure, the circuit design is the same as of the type CW-4855, so first study those described in the previous chapter.

The CW-4856 TS Multiformat Remultiplexer differs from that it has only three ASI interfaces, the inputs 4, 5, 6 of the 6-input Remultiplexer board are connected to the outputs 1, 2, 3 of the Gigabit Ethernet Controller IP Receiver. The device can process three ASI and three IP data streams.

The Multiformat TS Remultiplexer management and programming differs from the CW-4855 type only, that first the three receivers of the IP inputs must be set with the SW-4901 software to the reception of the desired IP streams. After programming the three IP Receivers the device will treat the IP and ASI signals in the same way, the 6 input signals will be distinguished by the input number (1 to 6).

It is important to note that the device has two IP inputs. The Device Control input can be operated in 10Base-T or 100 Base-T mode and the Remultiplexer can be set and programmed through this. The factory setting of this input IP address is 10.123.13.101. The transport stream is fed via the other IP input which can be operated in 10Base-T, 100Base-T and 1000Base-T mode, too. On delivery its IP address is 10.123.13.102.

The course of analysing the input streams is the same as described at the previous four-input (CW-4854, CW-4955) and eight-input (CW-4858) remultiplexers, only important to ensure that the IP receivers (IP Receiver-1 to IP Receiver-3) be configured with the SW-4901 Gigabit Ethernet Controller software in advance. The software allows both unicast and multicast connections. The Remultiplexer unit can receive signals of 188 and the 204 bytes/packet format. The input signal can be both burst format (gated) and continuous stream. The configuring of the IP receivers is described in the IP-4901 SW handling instructions. The transport stream transmission over IP network is described in publication 'Managing Transport Stream over IP' and is available from software, too.

Important note: The Gigabit Ethernet Controller directs the UDP/IP packets to the different signal processing units by the Port number. The most common error in configuring the IP receivers is, that the user does not configure the Port Number range of the TS Interval in the first step, and the transport stream is sent to the device outside this port number range. In this case, the transport stream sent to the communication channel will overload the communication channel microcontroller and the device behaves as if it was defective (responds to commands rarely and difficult). To avoid this error, first decide the Port Number range where the transport streams will be forwarded, and program this limits into the device. Port number of the communication in any case should fall outside this range. The communications port number value (set value 56941) can be changed in the ini file.

The GUI required to program the device is available by selecting the View CW-4856 TS Multiformat Remultiplexer Controller menu.

10. Programming the CW-4951 and CW-4952 IP Remultiplex

The IP-input remultiplexer comprises four remultiplexers. The four remultiplexers can be programmed separately. The programming steps are as follows:

- Programming the input IP Connection Manager (with the common data of the four remultiplexers)
- Programming the PID Filter (the four remultiplexers separately)
- Programming the A PSI Inserter (the four remultiplexers separately)
- Programming the Special functions (generally needs no programming)

Supplementary information:

The IP Connection Manager calls for the multicast data streams from the IP network, so its correct programming is essential for the multicast reception. In unicast connection the device replies to the ARP messages automatically, the IP Connection Manager needs no data from the unicast connections. In other words: The data of the IP Connection Manager do not participate directly in creating the output TS. The program of the IP Connection Manager decides the IGMP messages the device should send to the multicast network, in order to make the network direct the required data streams here.

The PID Filter decides, which PIDs of data streams from which input transport streams and at which PID value will be transferred to the output data stream. Therefore the programming has to be made very carefully. The PID Filter modules can be reprogrammed separately. It is important to emphasize, that at the IP remultiplexer every input data stream (video, audio, tables, etc.) is identified with two values, the PID and the Port number together.

The PSI Inserter inserts the new tables in the transport stream. For the correct operation of the set-top box the content of the tables must be assembled carefully. The PSI Inserter modules also can be programmed separately.

The IP Remultiplexer & Streamer is able to provide a number of additional services (e.g. set top box software update). Programming these services is not necessary for the correct operation, but remember switching them off when they are not used.

Programming the IP Connection Manager

The 256-input IP Remultiplexer receives all the 256 input signals through the same RJ45 type connector. The transport streams required for the remultiplexing are called in by the IP Connection Manager from the IP network. For establishing the multicast connections the device sends IGMP messages to the network, and at the unicast connections it replies to the incidental ARP messages.

The IP Connection Manager handles only the connections, which are programmed in it according to the IP Connection List.

Important note: The four remultiplexers in the device use one common input, so the program to be loaded to the IP Connection Manager module must comprise the aggregated demands of the four remultiplexers. In line with the programming of the PID Filter modules, the IP Connection Manager module is to be reprogrammed as well, if the user has changed the input streams. The programming of the IP Connection Manager is fast, the number of permitted reprogramming is 1 000 000.

Very important note: The IP Remultiplexer filters the input streams only by the Port Number. The IP Connection List must not include any port number values, where the distance from each other is n × 2048 (where, n = 1, 2, 3, ...). The data streams in n × 2048 distance will be merged.

Supplementary information:

The IP Connection List comprises the list of the input IP streams to be processed. The software edits the list automatically, but the list can be edited manually too, it can be saved into file and can be loaded from file. The list will always be saved automatically in the '\IP_PGM\IPconPGM\Connect.ini' file before loading in. The manual editing can be performed in the table of the screen and in the 'ini' file as well.

Editing in the table of the screen, the software accepts only the rows, where the columns of the IP address and the Port number are filled in. The IP address '0.0.0.0' and the Port number '0' cannot be used! Before the editing, switch off the Read Only mode. The software processes the data only when you press the Compile button.

The third column of the list decides, how the software handles the given IP address. In case of IGMP inscription, it takes it a multicast data stream irrespectively of the IP address value and sends an 'IGMP Membership Report' message to the network. At manual editing it is enough to enter an 'i' character in the cell. The ARP and the empty field are important only for the user. The device will reply to the ARP question effectively if the device's IP address is the same as the IP address here. At the unicast connections the right method is to enter the device's IP address in the IP Address field and next, the Port number of the unicast stream to be received, and to sign the unicast connection with an 'ARP' inscription. The empty field can be used to sign the IP address and Port data temporarily not used and allocated for later development and the multicast data, where sending the 'IGMP Membership Report' message is not required.

Note: The PID filter of the device uses the Port numbers only, and has no information about the IP addresses assigned to the Port numbers, so at reading back the program of the PID Filter, it is impossible to find out the relationship between the Port numbers and the IP addresses. The task of the IP Connection List is determining the multicast addresses where the 'IGMP Membership Report' message is to be sent, and storing the assignments of the Port numbers and the IP addresses. In the 'Comment' column of the table a 12-character long identifier can be assigned to the IP address and Port data, which will be stored in the device as well.

On clicking 'Query', the number of data stored in the device and within that the number of IP addresses signed for sending 'IGMP Membership Report' messages can be seen under the IP Connection List table. The IGMP Membership messages are sent out successively in every 10 ms, the frequency of the repeating is determined by the value of the IGMP Report Time.

Note: The four remultiplexers have a common input, so the program of the IP Connection Manager must comprise the aggregated demands of the four remultiplexers. Never call for a multicast stream unnecessarily, and do not set too frequent sending for the IGMP Membership Report messages. The repetition time of 60 s is usually suitable, but with the knowledge of the multicast network settings, the largest possible value should be set.

The software automatically edits the program of the IP Connection Manager by processing the data of the four remultiplexers. The manual editor on the 'SDT – NIT - ... Editor' page permits of making a short 'IP Connection List' from the program of the remultiplexers signed by the user. The command of the Special Functions menu item permits of adding new items from file to the existing IP Connection Manager program.

Special programming information: The 'ClearStreamTable' command clears the program of the IP Connection Manager, it takes a few ms. The programming uses the 'AddStream' commands. First always the data of the StreamType=1 multicast streams are to be programmed, the other data will be only stored but not processed by the remultiplexer. The programming must be closed with the 'StoreStreamTablePointers' command.

Programming the PID Filter

The software makes the program of the PID Filter automatically. In every case the PID Filter of the selected output (Output - 1 ... 4) will be programmed. As the first step of programming the software clears the 256 Mbit Flash memory in the device. On starting the Flash memory clears itself automatically; the clearing cannot be stopped. The clearing time is very different, typically 2 minutes, but it can take up to 5 minutes. The software controls the course of clearing continually and indicates the end of the clearing. After the clearing the load of the PID Filter program starts. The software indicates the end of the programming.

Do not interrupt the course of programming! During a programming process programming of other modules cannot be started!

Supplementary information:

The device can handle 2048 port numbers and has 8192 PID Filter modules for each port. When the Flash memory operating the PID Filter is cleared, every PID Filter module is switched off. For switching on one PID Filter module, 6 bytes are to be programmed in the device. The first two bytes of the 6-byte data comprise the port number starting with the MSB byte. The second two bytes comprise the input PID value also starting with the MSB byte. The third two bytes give the value of the output PID (Remap PID), but here the MSB b5 bit has a special role. Setting the b5 bit to '0' is used for switching on the PID Filter module and enabling its operation.

Important note: The 2048 port values must be side by side. The name of the initial value is 'Offset Port', its value can be modified on the 'Special Settings' panel. The Query command always set the Offset Port to the value stored in the device. The suggested Offset Port value is 57000. The programming instruction of the PID Filter sets the value of the Offset Port, even if the user does not provide it. At the four remultiplexers the value of the Offset Port must be the same. If the user configures a few PID Filters then changes the Offset Port and configures the others, it causes improper operation. In this case only the latter filters will operate correctly. Reading back the PID Filter program can check the correctness of the setting. At changing the value of the Offset Port, the PID Filter modules programmed formerly, must be reprogrammed. The value of the Offset Port can be found in the 'ACK' reply and the read back data of the PID Filter program, as well. The software always saves automatically the program loaded to the PID filter in the 'IP_PGM\PIDf_PGM\PIDfilt1...4.dpi' file. The user can save the program under another name, and can load in programs saved formerly.

In systems built from products of different manufacturers can not always be ensured that the TS Port Number values be within a 2048 wide range. This domain may be left, if any two Port Number values differ from each other with not n×2048 (n = 1, 2, 3, ...). The Port Offset value in such cases can remain 57000, but the transport stream still must not arrive at the device connector outside the TS Port Interval range. The SW-4953 software indicates that error.

It is important to note that the device can communicate via Port just outside the range of the TS Port Interval. TS Port Interval value can be set freely by programming, but the communication port even in the amendment process should be out of the TS Port Interval value. The value of the communication port can be set in the SW4953a.ini file. Following the amendment, the software must be restarted to open the new port to communicate.

The structure of the *.dpi file: The first 256 bytes is the header, which is made automatically at saving, at loading the software accepts any kinds of headers. The header is followed by the 6-byte PID Filter data, but in the file the order of data differs from the order used at programming. The first two bytes comprise the value of the input PID starting with the LSB according to Windows, this is followed by the value of the output PID and the two bytes of the port, also starting with LSB. .

The SW-4953 software permits viewing and modifying the PID Filter program when necessary. In the table of the PID Filter Programmer the representation can be required in the order the input PID, the output PID or the Port number. For direct modification click the 'Compile' button. On clearing one data from any row the whole row will be cleared. For entering the new data 10 empty rows are available underneath. For data processing click the 'Compile' button.

Important note: The automatic PID Filter editor is preferred to the manual editing. Always save into file the manually edited PID Filter program and call it back again just before loading. The manually edited programs in the software can be overwritten accidentally.

In the firs step of programming the SW-4953 starts clearing the Flash and querying the state of the Flash in every second. During clearing click the 'Load PID Filter ...' button and then do not ask for loading, the device will stop clearing the Flash memory, but nothing will be written in any more. During writing the SW-4953 software signs the unused ports, in order to speed up the read back of the program. The read back time of the cleared but not written Flash memory is about 63 times longer than of the cleared and then written Flash.

Special programming information: The content of the PID Filter can be erased by the 'ErasePIDFilter' command. The value of the offset port is to be set with the 'SetOffsetPort' command always before programming the PID filter. The PID Filter is programmed with 'WritePIDFilter' commands. At the writing and reading (ReadPIDFilter) the absolute Port number is to be used, but only the relative port value is stored. When changing the Offset port value after the writing, not the written values will come back at reading! The input General Filter can be set with the 'SetGeneralFilter' command.

From the Port Filter unit of the IP input the packets get to the input of the four PID Filter units through a common General Filter unit. The General Filter allows prompt removing the null packets and the packets marked faulty by the Transport Error Indicator bit. In the course of programming we suggest switching on the removing of the null packets and transferring the packets marked faulty by the Transport Error Indicator. Who is fully aware of the effects of these operations can use any setting; the device is suitable for special functions, as well.

Programming the PSI Inserter

The PSI Inserter comprises 12 equivalent inserter modules. The SW-4953 software labels the first four Output Inserter modules as follows:

1. PAT-PMT Inserter
2. SDT Inserter
3. NIT Inserter
4. TDT-TOT Inserter

The Output Inserter modules can be programmed separately, their operation can be switched on/off, the loaded programs can be read back. The size and operation of the Output Inserter modules can be programmed comprehensively, but changing the configuration is required only in special applications.

Programming the PSI Inserter: The automatic editor sets the modes of the PSI Inserter too, on clicking the '**Create PAT – PMT –** ...' button. There is nothing else to do, but loading the program by clicking the '**Load PSI Inserter ...**' button.

Supplementary information:

Each of the four remultiplexers in the CW-495x IP Remultiplexer Quad types comprises 12 Output Inserter modules. The 12 Output Inserter modules get the user-programmed data from a common 32-Mbyte background storage. The storage is divided into 256 blocks of 128 kbytes each, the blocks can be cleared and a programmed separately. The 256-byte units of these blocks store the data of the packets to be sent. So one block can store the data of 512 packets; that is the Flash memory can store 512*256=131072 packets. The PSI Inserter module of the SW-4952 software assigns the 32- Mbyte background storage to the 12 Output Inserter modules in the partition as follows:

1.	Output Inserter 1 PAT-PMT Inserter	2 blocks (0, 1)	256 kbytes	Auto Continuity Counter
2.	Output Inserter 2 SDT-BAT Inserter	2 blocks (2, 3)	256 kbytes	Auto Continuity Counter
3.	Output Inserter 3 NIT Inserter	2 blocks (4, 5)	256 kbytes	Auto Continuity Counter
4.	Output Inserter 4 CAT... Inserter	2 blocks (6, 7)	256 kbytes	Auto Continuity Counter
5.	Output Inserter 5 Free	2 blocks	256 kbytes	
6.	Output Inserter 6 Free	2 blocks	256 kbytes	

7.	Output Inserter 7 Free (TS Generator)	12 blocks	1.5 Mbytes	
8.	Output Inserter 8 Free (TS Generator)	16 blocks	2 Mbytes	
9.	Output Inserter 9 Free (TS Generator)	24 blocks	3 Mbytes	
10.	Output Inserter 10	Free (TS Generator)	32 blocks	4 Mbytes
11.	Output Inserter 11	Free (TS Generator)	32 blocks	4 Mbytes
12.	Output Inserter 12	Free (TS Generator)	128 blocks (128...255)	16 Mbytes

The partition is defined in the SW4953a.ini file. In general use the modification is not necessary, but when the user wants to modify the partition, he can do it in the SW4953a.ini file. Important note: On changing the partition generally the whole storage is to be reprogrammed. At designing the new partition it is practical to consider the block sizes and to assign the integral multiples of the block to the Inserter modules.

The 1.0 version of the SW-4953 software uses only a few percent of the possibilities offered by the 12 Output Inserters, the reserve is built in for supplying the demands of the following years. The structure and operation of the PSI Inserter, and the current partition of the background storage are shown in Figure 10.1.

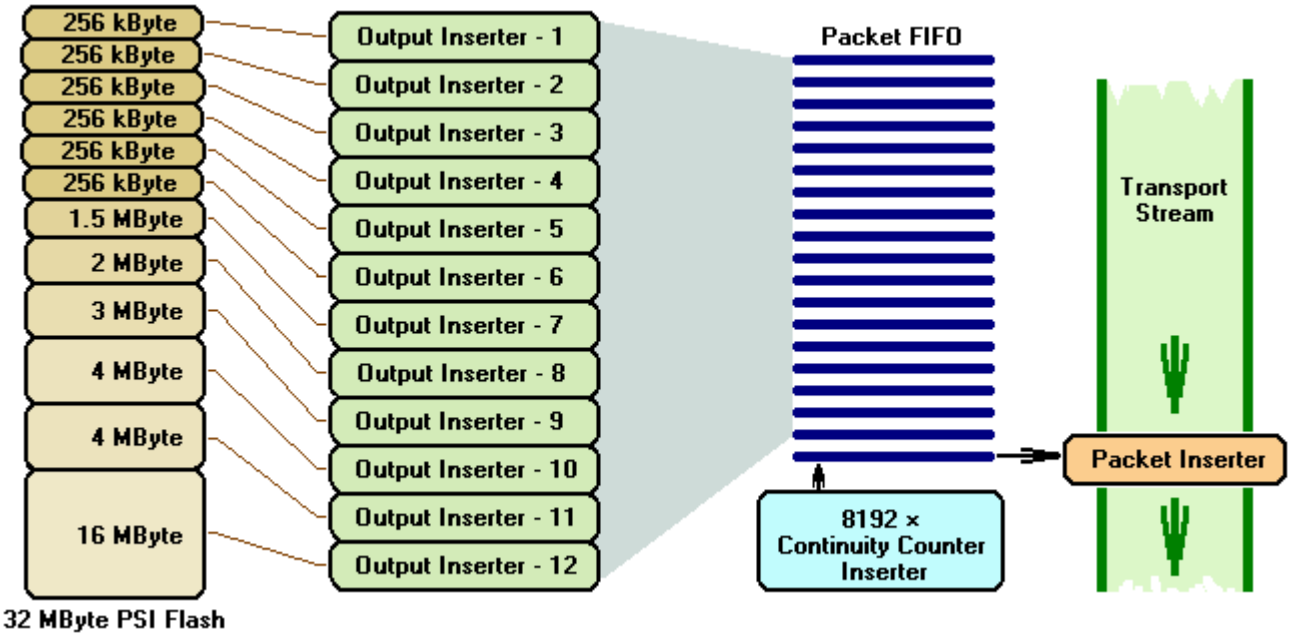


Figure 10.1

Structure of the PSI Inserter

At creating the tables the packets to be sent must be loaded in the 256-byte sections of the block. 3-byte timing data must be assigned to every packet. The packet delay before the insertion can be set to 0, 1, 2, ... 16777215 msec (279 sec) values. For the packets to be inserted an automatic Continuity Counter can be inserted for every PID value. The 12 Output Inserters use the 8192 Continuity Counter (CC) inserters jointly, that is the 12 Inserters put the packets to be sent in a common FIFO and the Continuity Counter Inserter processes the combined data stream.

At using the memory partition above, the PAT-PMT inserter can insert 1024 different packets, i.e. in case of maximal sized tables many hundreds of PMT tables can be created. The size of the SDT and the NIT Inserter is the same; they are suitable for creating practically any table series. The SW-4953 uses the automatic Continuity Counter insertion.

The programs of the 12 Output Inserter modules can be loaded and cleared separately. The programming and clearing can be performed during operation as well. The operation of every module can be switched on/off. Practical information: Switching on/off the operation of the Output Inserter modules permits switching on/off the prepared tables (e.g. PAT-PMT combination) with one command and performing other difficult tasks. Important note: The 12 Output Inserters have the same structure; any of them can be used for creating any tables. At the overflow of the the output stream, the order of inserting the packets does not change, and the overflow transitionally stops the delay clock of the inserting. The jam at inserting the packets is indicated by the diagnostics module and the front panel LED of the device as 'Overflow'.

The background storage of the PSI Inserter can be cleared at once, completely or by blocks. The full clear is performed by clicking the 'Erase PSI Editors …' and is ordered for the storage of the four remultiplexers at the same time. The overall clear is practical at overall reprogramming and at erroneous operation caused by incorrect programming. (The background storage or some part of it must be cleared before programming; the software automatically performs it. The data of the flash memory cannot be modified.) The SW-4953 assigns the storage to the Output Inserters by blocks. At loading in the programs, the software clears only the blocks concerned, and so modifying the tables or the set-top box refreshing software will not change the operation of the other Output Inserter modules.

The Output Inserter modules can perform TS Generator functions as well, so the data of the set-top box refreshing software, data streams of pictures and movies, etc., can be programmed in the storage as well. The SW-4953 software use only the 1 ... 3 modules of the Output Inserter for creating the PAT, PMT, SDT and NIT tables, and switch off the others; they are available for the user. In the basic state the software shows only the controls of these three modules, the other modules can be recalled from the View menu. The software automatically creates the programs belonging to the tables, but the check boxes of the 'User Defined Pgm' allow at the 12 modules, for the user loading the program of his own. The program of the Output Inserter modules consists of 256-Byte packets. Before loading, the software saves the program to be loaded in 256-Byte and 188-byte formats as well. The 256-byte format will be saved in 'Oins105.doi' (**O**utput **Ins**erter-**1**/**05**. module) form, the name of the 188-byte format is the same, but its extension is 'ts'. The first 256 bytes of the 256-byte format is the header and then the packets can be found as shown in Figure 10.2.

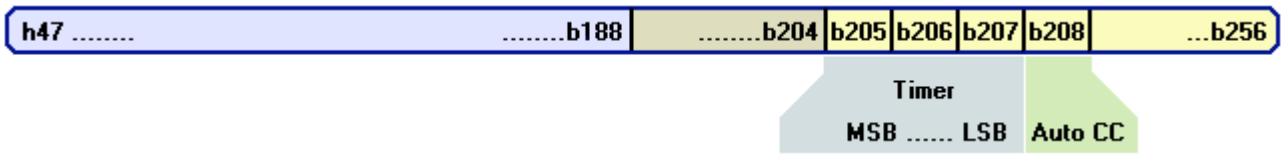


Figure 10.2

Structure of packet and timing data in the file with extension '*.doi' and the PSI Inserter Program editor

The content of the file corresponds with the data to be loaded, and can be loaded in any Output Inserter modules. The content of the file can be viewed with the SW-4811B Transport Stream Analyzer program after calling it in with the 'Load from file' operation. For viewing the data content the mode of the Data Analyzer is to be set to auto or 256 bytes/packet value. (In the 256-byte packet an optional comment can be placed from the b210 byte to the b252 byte. The last four bytes are reserved.) The 188-byte format file with extension 'ts', comprises no header and timing data, so it can be displayed with the software of other manufacturers. This format cannot be used for programming. At creating the files with extensions 'ts' and 'doi' the software insert 32 null packets at the end of the file, but this is not part of the program.

Programming the PSI Inserter:

1. First the software examines how many Output Inserter modules are to be reprogrammed and then sets their indicator to blue colour and asks for confirming the reprogramming. Here the user still can cancel the reprogramming.
2. On starting the programming the 12 modules will be programmed one by one. When the user does not asks for the reprogramming, the software will enable or disable the operation of the Inserter and sets the module indicator to green.
3. At reprogramming the software examines what programs are to be loaded. Generally it asks the program from the TS Constructor module. When the user asks for loading his program, the 'Open Dialog' box will be displayed, where a prepared (*.doi) file of PSI Inserter format is to be given. When the software does not get a suitable program for loading (e.g. Cancel, 0 sized file, inadequate file format, etc.), it loads a null packet to the 'Inserter' and switches off its operation (Switched Off). In case of small size, lack of the file and wrong file format, it sets the module indicator to yellow, and sets to red when the file is greater than the free space.

4. The software saves the program to be loaded into '*.doi' and ' *.ts' files before loading.
5. The software clears the blocks to be reprogrammed according to the size of the program to be loaded.
6. The software writes the packets in the flash memory and displays the number of the packet at the same time.
7. After finishing the writing the software goes on disabling or enabling the operation of the Output Inserter module and saves the settings. .
8. The software passes on to programming the next module.

The PSI program loaded to device can be read back. At reading back the program of any Output Inserter module, first the partition of the Flash memory, the Flash Memory Sector Table (Start Address and Stop Address) will be read back. The read back data are displayed in the Diagnostics module, from where the data can be saved into text file. Then the program stored between the Start Address and Stop Address will be read back. The software automatically saves the read back program in the '... IP_PGM\PSI_PGM-qRbackPGM' directory and loads it to the PSI Inserter Program Editor on the Data Rate page.

Using the PSI Inserter Program Editor:

Generally the PSI Inserter Program Editor module is not used, but it helps solving special tasks and speeds up troubleshooting. The PSI Inserter Program Editor is a table, which allows creating, viewing and modifying the PSI Inserter program. The PSI Inserter Editor can be loaded up from external source with the 'Load PSI Inserter program to Editor menu' command. At the PSI Inserter programs saved under name '*.doi', the header and the additional 32 null packets will be cut off and only the effective data part can be seen. At loading traditional 188-byte transport stream, every packet will be loaded.

The loaded program can be edited freely. In the 256-byte rows the timing and control data are shown as in Figure 6.2. After the modifications the data processing starts on clicking the 'Compile' button. At the end of the program the Compiler clears the whole row. If the user clears the initial h47, then the erroneous data will be replaced with hFF.

The created or modified program can be saved with the 'Save PSI Inserter Editor program as ...' command. The saving is done in the two formats mentioned above.

The SW-4953 software saves the read back PSI Inserter program into file and loads to the Editor simultaneously, so it can be viewed simply.

The PSI Inserter Program Editor can be used well to programs comprising up to a few hundred packets, but the operation slows down with increasing the number of packets. It can be used with many thousands of packets, but at such times filling in the tables or processing the data takes a few seconds. Wait until the process will be completed! For creating very large sized (many Mbytes) programs it is practical using another software.

Programming the output streamer

The CW-4951 IP Remultiplexer and Streamer delivers the four created transport streams at physically and logically separated IP outputs. The factory setting for the device's input IP address is 10.123.13.101, for the output IP address is 10.123.13.102. These two IP addresses must not be the same in a common network!

The IP address of the input and the output modules can be modified with the programmer of the Device Settings page or the SW-4901 Gigabit Ethernet Controller software.

The programming of the output streamer is fully independent from the programming of the IP remultiplexer, so it can be done any time. The programming can be carried out with the controls of the Streamer Programmer page or the SW-4901 software. Detailed guidance can be found in the SW-4901 Help. This help is available for downloading in pdf format too, on our www.cableworld.eu web site.

Special Settings / Functions

The user need not care for the special settings, the software and the default settings of the devices result in correct operation.

Supplementary information:

TS Port Offset

The IP Remultiplexer filters the input streams on the basis of the difference between the TS Port Number- TS-Port Offset and watches only the difference range of 0 to 2047. The SW-4953 software reads the TS Port Offset value from the TS 4953a.ini file and use it for programming the device at the PID Filter programming. The default TS port offset = 57000, we recommend using this .

Remove Input Null Packets

The null packets arriving at the input are usually not necessary; it is practical to discard them immediately. At the default settings of the device and the SW-49534 software the input null packet removing is always switched on. With checked check box this function of the Input Filter input is switched on. The Query command sets state of the Check box according to state of the device. The device setting can be modified with the 'Set Input Filter' button. By removing the input null packets, the load of the circuitry and the SD RAM decreases.

Use Transport Error Indicator

On the high frequency transfer routes the Reed-Solomon error correcting circuitry provides for correcting the errors. When all of the errors in the packet cannot be corrected, the corrector sets the Transport Error bit to '1'. By checking the 'Use Transport error Indicator' check box the user can ask for prompt discarding the packets marked faulty. As discarding the whole packet causes greater failure in the video and audio streams than the real error inside, so discarding the faulty packets is not suggested. In general, do not check this box, do not use removing, but remember that this function may be useful in special applications.

The grey field by the button indicates an unknown value determined by the software, the green field indicates a value read back from the device. The red field indicates an unsuccessful setting.

Reading back the loaded programs

Reading back the loaded programs is required only in special applications; this function is not required for installing the device.

Reading back the program of the IP Connection Manager

For reading back the IP Connection Program select the 'Read back Program from Device' menu item and then the 'Read back IP Connection List' command. The reading back process is fast the read back list can be seen in the editor. Save the read back list into file, if you want to use it another time besides viewing.

Reading back the PID Filter program

Important note: The reading back process of the PID Filter Flash memory is very slow, if it was not programmed after clear. This is the situation when the user erases every data with the 'Erase PID Filter 1 ... 4' button. In this state, reading back the data of the 8192 PID filters of each port number takes 2-3 seconds. The total reading back time is 2048 × 2 ... 3 sec, i.e. more than one hour. In this case stop the reading back with the 'Stop Read back ...' command.

The reading back of the PID Filter program is much more faster, if it is done from the programmed PID Filter. At programming the Flash the PID Filter Programmer sets a marking code at the PID=0 value of the sub-store of the Port number, if no PID filters are used in that store. When the software finds such a code, it omits reading the sub-store. In this case at reading back, the port numbers run quickly on the display, and they stop for 2-3 seconds while reading back the 8192 PID values only at the used ports.

Reading back the PSI Inserter program

The device comprises 12 Output Inserters for each remultiplexer, their programs can be read back separately. For starting the reading back, check in the pull-down list the one you want to read back. The read back program can be viewed in the table of the PSI Inserter Program Editor. Save it in file, if you want to use it later. The setting data of the Output Inserter are shown on the Diagnostics page.

11. Programming the CW-4956 type 64-Channel IPTV Remultiplexer

The CW-4956 type 64-Channel IPTV Remultiplexer and the CW-4958 type 16-Channel Edge Remultiplexer belong to the newest remultiplexer generation using serial data processing. The difference between the former parallel-based models (e.g. CW-4951, -52) and the new serial-based models (CW-4956, -58) is shown in Figure 11.1.

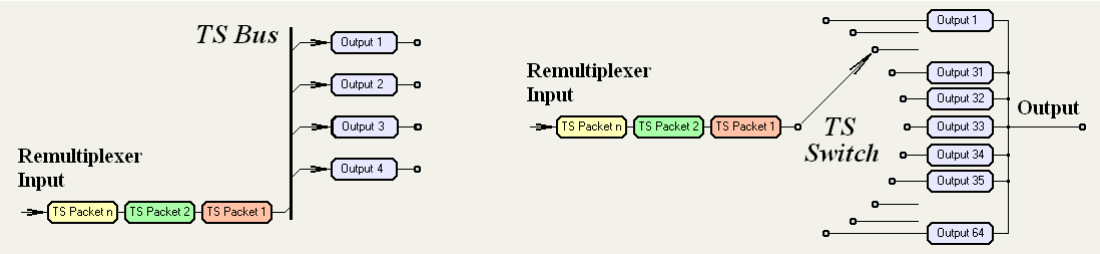


Figure 11.1
Structures of the parallel-based (left) and the serial-based remultiplexers

In the parallel-based system the remultiplexers receive the input TS packets from bus, so the TS packets can be forwarded to any output. In the serial version the packets are distributed by switch so the packet arriving at the input can be forwarded to one output only. The serial solution has the advantage that much more remultiplexers can be realised (e.g. 64 units), the data rate can be much greater. The only downside is that the incoming TS packet can be incorporated into only one output signal. In the serial system when a packet is to be built in more than one output signal then it is to be fed in more inputs.

The novelty of the CW-4956 and the CW-4958 types is that they have both ASI and IP inputs. The total amount of data in four ASI inputs can be accepted up to 640 Mbit/s by the serial system. In the 60 IP inputs the packets are filtered according to the IP address and the Port number. 100% of the IP input capacity can be utilised (e.g. at Gigabit speeds it is nearly 1000 Mbit/s).

The CW-4956 64-Channel IPTV Remultiplexer and the CW-4958 16-Channel Edge Remultiplexer have a similar internal structure but produce widely differing output signals. The difference is as follows:

- CW-4956 type 64-Channel IPTV Remultiplexer produces no output signal at the absence of input signal, only the PSI Inserter packets appear at the output. There is no internal clock generator and PCR corrector in the device, it can produce both SPTS and MPTS data streams. The CW-4956 type is made for different IPTV systems.
- CW-4958 type 64-Channel Edge Remultiplexer output produces null packets according to the preset data rate. After arriving the input signal the useful packets will be built in place of these null packets. The device contains an internal clock generator, the PCR corrector adjusts the time stamps to this. The device is suitable for the production of SPTS and MPTS streams. This version is made mainly for producing the input signal of the high-frequency modulators.

The main application of the CW-4956 type 64-Channel IPTV Remultiplexer is; producing the SPTS signals of IPTV systems. In this area of applications we recommend using the SW-4956 IPTV Remultiplexer Controller software. The use of the SW-4953 software will be justified in production of MPTS signals. The programming details are described in the next chapter together with the programming of the CW-4958 type.

12. Programming the CW-4958 type 16-Channel Edge TS Remultiplexer

This chapter describes together the programming of the CW-4956 type 64-Channel IPTV Remultiplexer and the CW-4958 type 16-Channel Edge Remultiplexer. For getting to know the difference between the two devices is proposed reading through the previous chapter.

During programming these two types, the following unit operations are to be set, and the following are taken into account during programming:

- When the ASI input is used, there is no other business, such as connecting the ASI cable to the BNC input socket. When using the IP input, the optical fiber or UTP cable connection only creates the opportunity to receive input with the device, and there are many things to do. Unicast or multicast connection should be used to send input signal to the IP input. In unicast transmission, the sending side should be set so that the signal reaches the desired input. In multicast transmission, our input should be set to request the input signal. The configuration of the IP input happens by preparing and loading the IP Connection list.
- The device is a total of 60 +4 = 64 inputs. The IP Connection List will determine which input controls which input streams. After configuring the inputs, the PID Filter determines whether the 1, 2, 3, ... 64 input from the TS packet to be transferred in or if it has been transferred in what PID value to proceed. It is very important to see that in the parallel system remultiplexers the PID Filter is connected to one channel (remultiplexer) function and will be compiled from its data, but the in the serial-based devices, the PID Filter is connected to the input and its data will be compiled from the data of 64 channels. The most common error for beginner users is the incorrect interpretation of the serial operation of PID Filter systems.
- The task of the PSI Inserter is to insert tables (PAT, PMT, SDT, etc..) among the packets arriving from the input. The PSI Inserters are assigned to the channels, their operations are in accordance with the user interpretation.
- At IP outputs, the output characteristics should be configured. The output characteristics of the data streams are included in the Output Stream Table. At the CW-4958 type, the output data rate should be set here and the PCR corrector also can be turned on or off through the data in this table.

Since the programming of the 64 Remultiplexers takes long and and little amendments do not need reprogramming all the data, the SW-4953 software allows the reprogramming some of their programs on the **Selective Programmer** page. The partial programming is very fast and efficient, but will only be successful if the programmer sees, when and which unit needs reprogramming.

12.1. The IP Connection List compilation and programming

The IP Connection list specifies the IP addresses and port numbers that the 60 IP inputs will receive from the data streams. The device sends IGMP messages to the network on the basis of the data in the list. The software automatically compiles the list from the programs of the 64 channels. In the list only the data of the switched channels will be processed.

It is very important to know that the IP Connection List and the data PID Filter data are linked. The PID Filter is assigned to the input number and always filters the packets which arrive at this input (e.g. input 4). For example, the IP Connection List determines which data stream is to arrive at input 4.

The IP Connection list can be saved in file, can be loaded from file and can be manually edited and modified, too. When making the programs it is practical if the software create the list automatically. At the subsequent amendments of which only small corrections to be made, it is advisable to switch to manual mode and use the previously constructed list. The need to use manual mode is illustrated in the following example: working with 20 input streams and temporarily off the output signal of the channel using data of the 8th input. In this case, the software will automatically

edit the IP Connection List to 19 line, so the list and the PID filters from the 8th have to be reprogrammed, too. In such a case, switch to manual mode and keep the list previously used, so there is no need for reprogramming. The data are stored in ini file format, so the file can be edited easily.

When making the programs, first the software makes the IP Connection List, then using this the PID Filter programs will be made. If the **User Defined IP Connection List** box is checked, the software will not produce a list and will adapt the additional programs to the list shown on the **Selective Programmer** page. When making the PID Filter program a data stream is found, which is not on the list, an error message will be sent.

The IP Connection list appears in read-only version on the screen. To edit the list manually turn off the Read Only mode, type the information and press the **Compile ...** button. After processing the data, you can see the list read and corrected by the software. At the stream type it is sufficient to enter the first letter, the software investigates only the first character.

The IP Connection List can be programmed into the device and can be read back from it independently of the other programs. The read back list can be activated by selecting the Special Functions\ Apply IP Connection List from Device menu.

12.2. PID Filter program compilation and programming

It can not be stressed enough that in the serial system remultiplexer the PID Filters are assigned to the inputs. The PID Filter program defines the following processes

- Enabling the transfer of the TS packet arriving at a given input.
- Setting the PID value of the transferred packets (PID Remapping).
- Forwarding the packet to one of the outputs.

The software automatically makes the program of the PID Filters. In the program only the data of the switched-on channels are processed. The device and the program store only the number of the input, the IP address and Port number is not part of the program. The Selective Programmer display page tries to help the programmer's job, so beside the input number it shows also the IP address read from the current IP Connection List. The PID Filters assigned to the inputs can be programmed separately. When loading the program, the software asks to specify the range where the input PID Filters should be reprogrammed. Only one PID Filter data can be read back at a time, the input number should be given at starting the reading back.

The program of the PID Filters can be saved to a file and can be loaded from file. The program always includes the total program of the 64 PID Filters. The PID Filter program can be manually edited after turning off the Read Only mode. For any changing or deleting data scroll the selected data to the top line of the list. The content of the top row is shown in the table below the display, the data can be modified here. The data will be processed on pushing the **Insert or Modify** or **Delete** button. The values of the Input Number and the Input PID decide whether the data line will be added to the list as new data or modified data.

As the packet arriving at the input can be diverted always only to one output, the software sends an error message if in the course of program making one packet should have been inserted in more than one output signal. The error signal can be read at the end of the PID Filter program. The first half of the error signal shows the number of packets has been used many times. The second half of the display will appear when the software find a data stream, which could not be connected to any one of the inputs, the one whose IP address and port number is not found in the IP Connection list. If an error occurs, the display changes colour. The PID Filter program can be used in case of error, but some elementary streams will be missing from the output streams.

The device and the software can handle 64 input signals. The first 60 inputs are designed for receiving IP data streams, the ASI Interface is connected to the last four inputs as follows:

BNC connector	PID Filter List	Port number assigned
● ASI Input 1	Input 61	Port Number = 1
● ASI Input 2	Input 62	Port Number = 2
● ASI Input 3	Input 63	Port Number = 3
● ASI Input 4	Input 64	Port Number = 4

12.3. PSI Inserters program compilation and programming

The CW-4956 and CW-4958 types comprise 64 TS Remultiplexers and each remultiplexer has four PSI Inserter modules. The device programmer should provide programming the 64 x 4 = 256 PSI Inserters.

The program of the PSI Inserters is made separately when making the 64 remultiplexer programs. On pressing the **Create-PMT-PAT, SDT, NIT ...** button, always the selected channel program is being made, the other channel programs remain unchanged.

The **PSI Inserter Programmer** on the Selective Programmer page controls the process of programming and operating the 256 PSI Inserter modules and has no effect on the program of the PSI Inserters (data content of the tables to be inserted). The **PSI Inserter Control Program** determines whether the four PSI Inserters in every channel

- will be turned on or off,
- the Inserter Flash memory will be reprogrammed,
- on reprogramming the program made by the software or the user will be loaded in.

On pushing the **Clear PSI Editor and set Full Auto Mode** button, the software reset the PSI Inserter programmer. By default, all the PSI Inserters are off. If you then switch, it will be automatically programmed.

On pushing the **Create-PMT-PAT, SDT, NIT ...** button, the software examine the on-channel data and adjust the program of the PSI Inserters. When you want the software not to modify the programming process of the PSI Inserters, check the **User Defined PGM** box.

The PSI Inserter Control Program can be saved in a file by selecting the **Save PSI Inserter Control Program** menu, or may be loaded from a file by the **Load PSI Inserter Control Program** menu. When browsing the data the use of the up/down button is practical, so the data of one channel will be displayed at a time. In manual editing the data will be processed only on pressing the Compile button. In manual editing insert or delete of rows is not allowed. In data modification the software monitors only the numeric code in the given line, the text is automatically filled. The useful numerical values of the line are indicated by the software at the end of the line. The data are stored in ini file format, so they can be edited there.

The PSI Inserter Programmer Module contains two buttons for program loading. On pressing the **Load PSI Inserter On-Off PGM** button, the software reads the 64 × 4 Inserter modules' status data from the PSI Inserter Control Program and accordingly turns on or off them.

On pressing the **Load the PSI Inserter Programs** button the software asks, which modules you want to program, and after confirmation it does the programming according to the Control program.

In the CW-4956 and CW-4958 types the PSI Inserter reads the packets of the tables to be inserted and other data streams from a Flash memory. Since the PSI Inserters of the 64 remultiplexers use a common Flash memory, the packet inserting capacity is limited. Over 5000 packet / sec insert rate, the packets may be inserted with minor or major delays.

The packets will not be lost, the inserted packets will not be deficient, but the table repetition time can increase depending on the degree of overload. The overload may be reduced, if for example we set 200 or 300 ms repetition time instead of 100 ms at the PAT and PMT tables.

In the unused remultiplexers besides disabling the outputs, always switch off the PSI Inserter function, since otherwise the PSI Inserter reduces the packet issuing capacity depending on the stored program inside.

The TS packet storage capacity of the four PSI Inserters in each channel:

PAT-PMT Inserter	512 TS Packets (1 Block)
SDT Inserter	256 TS Packets (1/2 Block)
NIT Inserter	256 TS Packets (1/2 Block)
User Defined Inserter	3072 TS Packets (6 Blocks)

12. 4. Output Streamer program compilation and programming

Both the CW-4956 and CW-4958 types have 64 output units and can produce 64 different output streams. Both types are programmable for producing UDP packets containing 1 to 7 TS packets, but not in the same way. The differences are as follows:

- The CW-4956 type collects the TS packets in an internal RAM and provides output signal only when the UDP packet is full.
- The CW-4958 type collects the TS packets in an internal RAM similarly, but an internal clock generator controls the sending of the UDP packet. When the sufficient number of TS packet is not received, null packets will be inserted in the empty places. The output data rate can be programmed in UDP packet / sec units. In the UDP packets containing 7 TS packets the raster of the output data rate is 7 × 188 × 8 = 10528 bits / s. The output PCR corrector corrects the PCR values according to the output data rate. The number of PCR corrector modules is 8192, so all the PCRs transmitted in any PID value will be corrected.

The program of the output streamers can be edited manually after the Read only mode is turned off. For entering the output characteristics of the channel, the following information is necessary to provide:

Output 1	>IP Out 1
Status	0 - Switched Off
IP Address	239.123.13.100
Port Number	58100
MAC Address	>01:00:5E:7B:0D:64
TS Packet Format	188
UDP Format	7 TS packet - Mcast
PCR Corrector	1 - Switched On
Data Rate	38016608 bit/s

The name in first row helps the user to identify the channel. The output signal is turned on and off by entering a value of 0 or 1. After the data processing you can see the 64-channel condition on the color display. When entering the IP address, Port number and MAC address the specimen format is to be followed. The Multicast MAC calculation is done by the software automatically, if you write an "M" letter after the number of packets at the format of the UDP. The TS packet format can be set to 188 or 204 bytes per packet. The number of TS packets built in the UDP packet can be set between 1 and 7. The PCR corrector is turned off by entering a value of 0. The software adjust the output data rate to the integer UDP / sec values.

The output data will be processed only on pressing the **Compile Streamer Program** button. When browsing data the up/down button should be used. The program of the output streamers can be saved in file, loaded from file. The data are stored in ini file format, so the file can be edited.

The program of the 64 output streamers program is loaded by pressing the **Load Output Streamer Program** button. The output streamers can not be programmed separately. Streamer program can be read back and can be activated by selecting the Special Functions / Apply Output Streamer Program from Device menu.

12.5. General Settings

The user interface for the general characteristics of the CW-4956 and CW-4958 models can be found on the Device Settings page. The setting procedures are described in a separate chapter. The items needed very rarely are left on this page, if you need one, we recommend the use of SW-4956 software.

13. One Touch Programmer

The remultiplexer typically comprises several main unit (IP receiver, PID Filter, PSI Inserter, Output Streamer) and some auxiliary circuits (NCO, PLL, PCR Corrector etc.). For the proper operation all units should be adjusted by programming so in installing a device several programming processes should be implemented.

At the request of customers CableWorld integrates in its software solutions the One Touch Programmer function, which will run consecutively the required programming processes instead of the user. The process of programming starts with pressing the **One Touch Programmer** button and the confirmation of the request. A text display provides constant flow of information about the current state of the programming process and the programmed features. The programming process can be stopped between the programming cycles by pressing the **Break** button, but it can not be continued.

The One Touch Programmer is appropriate, if

- the programming process is long and you do not want to monitor every step of the process, or if
- several devices are to be loaded with the same program.

Using the One Touch Programmer, note that the software is designed as follows:

- The software will start with the last saved settings
- The settings can be saved in a file and loaded from a file
- After the Query button is pressed the software reads the main features of the machine, the software shows them, they are considered the basic parameters.

In the event when more than one device are to be loaded with the same parameters, start the software, set the parameters if it is necessary and then using the One Touch Programmer begin to configure the device without first press the Query button.

When the Query button is pressed, the following is proposed to proceed: On pressing the Query button the characteristics (Data Rate, Packet Format, etc.) preset by the software will be rewritten to the values read from the device. If they are not appropriate for you, the Load Settings menu can be used to load the stored attributes and then the One Touch Programmer can be started.

The complex programs of the larger modules (PID Filter, PSI Inserter etc.) will not be changed by the Query button.

14. Diagnostics - using the diagnostic module

The SW-4953 software, allows you to look into the functioning of this complex device. After selecting the device type, the diagnostic page assigned to the device's hardware appears automatically.

The continuous operation of the diagnostic module can be started and stopped with the Run button and the Stop button respectively. In this mode, the software periodically queries and displays the characteristics of the device. The contents of the charts and displays can be deleted with the Clear button. The test stops automatically when you exit the diagnostic module.

Diagnostics Report can be made in text about the settings and operational conditions by pressing the Diagnostics button. The user can add his comments to the report and the report can be saved in a text file.

For checking the operation, external software can be run through the TS Analyzer menu. The run of these software will be successful if they are pre-installed in their default directories.

Supplementary information:

In case of the ASI Remultiplexers the diagram shows the transferred data stream of the PID Filters situated after the 2, 4 or 8 ASI inputs. The bar diagram helps monitoring the operation of the ASI lines and the PID Filters. In case of Overflow the colour of the bar goes red. The 8-input remultiplexer comprises an internal remultiplexer too. The lower left part of the diagnostic page informs of the state of the Internal Multiplexer. The block diagram in the middle helps interpreting the displayed data. The lower right display informs of the operation of the Output Multiplexer and the PCR corrector. The display shows, how many from the 64 automatic PCR correctors have found a PCR data stream, in how many cases was the PCR correction unnecessary. Here you can see the number of the corrected and incorrigible values, as well. The Diagnostics Report shows more details of the data, there also can be seen which units from the 64 PCR correctors are operating in the moment of the examination. The complete query of the 8-input remultiplexers happens in 7 phases, for the smaller ones in 5 phases. The progress bar in the lower left corner illustrates the phase of the query.

On the diagnostics page of the CW-4855, -56 remultiplexers the input data streams, the content of the SDRAM, the inserted data quantity of the PSI Inserter and the output data quantity can be seen on the different charts.

On the CW-4951, -52 IP Remultiplexer & Streamer Diagnostics page four bar diagrams are shown above the block diagram. On clicking the RUN button the data of the diagram will be refreshed every second. The first diagram illustrates the amount of data arriving from the IP network and transferred by the Port Filter. The hardware counts the TS packets carried by the UDP packets, the display shows the data rate, as the product of the packet number and 188*8. The diagram can show, whether the setting of the network and the IP Manager can ensure the required amount of data for the device.

The second diagram shows the amount of data of the four SDRAM placed after the four PID Filter. The four SDRAM operates in FIFO mode, at correct operation the SDRAMs store only a few packets (e.g. 1 … 2 ×188×8 = 1504 or 3008 bits). In case of VBR stream, if the amount of data grows quickly, transitionally more packets are stored in the SDRAM. When the data do not fit in the output stream, the content of the SDRAM rises continuously and the output overflows. The output overflow is indicated by the ‘Overflow’ LED on the screen and on the front panel of the device. The inscription under the diagram shows the present input data rate of the selected SDRAM.

The third diagram shows the total amount of data inserted by the PSI Inserter.The fourth diagram shows the useful output data rate. The displayed value is the sum of the amount taken from the SDRAM and the amount inserted by the PSI Inserter. Under the diagram the size of the present free space is shown.

The diagram under the block diagram shows the useful output data rate as a function of time. The thin line in the diagram shows the possible maximum. According to the checkboxes the diagnostic module decides, which one from the four remultiplexers will be preferred at displaying the data. We suggest checking only one box at a time. The timing diagram can be shifted with the right button of the mouse, and can be scaled up or down by the rectangle drawn with the left button (from left to right or from right to left).

Clicking the ‘Diagnostics’ button, a very detailed diagnostic process starts. The results are shown with

text in the comment box, as well. The user can comment the results and can save them in a text file. At evaluating the displayed data, consider that the device measures the data in packet/sec units. The data rates are calculated with the size of 188 byte/packet, so the lower digits may deviate from the expected value.

On the CW-4956, -58 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 × 188 × 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 CW-4956, 58 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.

15. General Settings

In the CW-4000 modular digital television system of CableWorld the programming software are assigned to modules or module groups. It follows that to program the device a number of software may be required. The novelty of the SW-4953 software is, that includes most of the software modules, which the user may need.

15.1. Replace IP Address

The IP address of CableWorld products is set to 10.123.13.101 when delivered. The first step in installation, the device must be set to an IP address, which is not used by any other. The product's IP address can be changed arbitrarily with the **Replace IP Address** command, but after the command the device is available only in the new IP address.

15.2. The instruction set of the remultiplexers

The CW-4852, CW-4854, CW-4855, CW-4858 type devices and the control input of the CW-4856 operate with the 100-Mbit CW-Net system, the parameters can be set with the SW-4800 software. The unknown devices can be restored with the Replace IP Address instruction issued by broadcasting.

The CW-4951, CW-4952, the IP input of the CW-4856 are the units of the CW-4901 Gigabit system, the characteristics can be programmed with the SW-4901 software. If the device is programmed incorrectly it can be reset to the factry defaults with the steps as follows: switch off - internal Reset Jumper - power on - off - remove Reset Jumper.

The CW-4956 CW-4958 models are the products of the most advanced generation. The parameters can be set with the SW-4953, SW-4956 (SW-4955) software. If the device is programmed incorrectly, it can be set back to the factory defaults with the Reset switch on the back panel.

When building the IP network, the SW-4901 software queries the network so that all of the above device sends a response to the query.

15.3. Setting the TS Port Interval in the (Gigabit system) CW-4951, CW-4952, CW-4956, CW-4958 type devices and the CW-4856 IP Input

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 15.1.

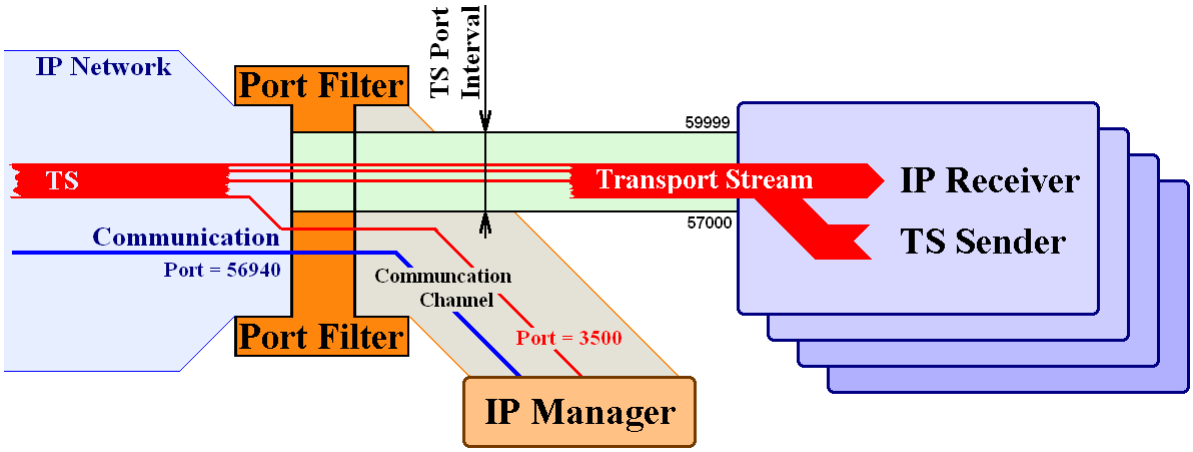


Figure 15.1
Illustrating the Port Filter operation
(If TS arrives at the device input with value Port = 3500 , it will disturb the operation of the IP Manager at the current settings.)

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.

15.4. ARP Repetition Time

In the IP network the switch stores a few minutes the data; which device on which gate appeared, and then deletes the data. In Unicast connection, the receiver does not send data to the network, so its address will be rapidly cleared. As a result, the switch starts to forward with broadcast the data sent for the receiver, so the network load increases. To avoid this, each device can be configured to send ARP messages to update the switch MAC table, i.e. address will not be deleted. The repetition time should be set somewhat lower than the cancellation period preset in the switch. The proposed value is a few minutes.

15.5. IGMP Repetition Time

The collection of the multicast streams is the task of the IP receiver. In the case of disrupting the IP network the traditional communications may stop. To avoid this CableWorld products issue messages to request Multicast streams on a regular basis. For repeating IGMP messages, a few minutes of time setting is proposed.

15.6. MAC Address, Router IP Address

These characteristics are generally not required. All CableWorld products allow the use of manual MAC Address. If you need more information, contact cableworld@cableworld.hu .

15.7. Device Controller Lock – Input Lock

The IP input of the CW-4951, -52 types can be locked with the IP SW-4901 software. Remember, that the lock can be lifted only with the 8-byte key used at locking.

After programming, the device input of CW-4956, CW-4958 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.

15.8. Output Streamer Lock – Output Lock at CW-4956 and CW-4958

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.

15.9. Data Rate Computer

The Data Rate Computer helps calculating the data rate required for the high frequency modulators. After setting the modulation characteristics, the data rate value to be set is shown in the ‘Computed Data Rate’ box. On clicking the ‘Apply’ button by the box, the software sets the parameters to be programmed. On clicking the ‘Apply’ button by the ‘User Defined Data Rate’ box, the software computes the value of the NCO and the PLL frequency to the data rate has been typed in the box; it is the 1/8 part of the data rate value.

15.10. Using NCO and PLL

The CW-495x IP Remultiplexer & Streamer offers two ways for generating the output clock signal. At using the NCO (Numerically Controlled Oscillator), the clock signal can be adjusted in a wide range (120 Hz – 25 MHz) and in very fine steps (1 Hz), but the NCO jitter is 8 ns. In most cases and with IP output this way is suggested. The integrated PLL circuit operates with a small jitter, but its frequency range is smaller (787401 Hz – 25 MHz) and the raster depends on the frequency. The software shows the available values. We suggest using the PLL for generating the modulating signal of the jitter-sensitive high frequency modulators.

At the start of executing and after executing the 'Load Settings from ...' command the SW-4953 software shows the settings of the NCO Frequency, PLL Frequency, Packet Format and TS Clock Source stored in the ini file. On clicking the Query button these data will be changed to the data read back from the device. The Query button on the Data Rate Platform is fully identical with the Query buttons of the other platforms.

Programming the prepared data starts by clicking the 'Load Data Rate Pgm' button, but the software asks for verification. During verification the new data rates are displayed in details.

Supplementary information:

The IP Remultiplexer comprises oscillators of two kinds for creating the output transport stream. The oscillator named NCO, generates the clock signal from the signal of a 125 MHz crystal oscillator. The advantage of the NCO, that its frequency can be adjusted between 120 Hz and 62,5 MHz (the 62,5 MHz value is limited to 25 MHz by the SW-4952 software) in 1 Hz steps. But the period of the adjacent clock signals may differ with 8 ns, i.e. the typical jitter is 8 ns. Generally the use of the NCO is suggested.

The oscillator named PLL operates with a low jitter integrated circuit (CDCE 949 Texas). The disadvantage is, that its frequency range is much narrower, the frequency raster is non-linear and depends on the generated frequency value. At using the PLL, type the required value and check, if the value after processing the data is suitable for us. At IP output it is no good using the PLL. The advantage of the small jitter can be exploited at ASI and parallel outputs.

The NCO and the PLL circuits can be found both in the CW-4855 and the CW-4856 types. The reference signal of the NCO is the 81 MHz internal oscillator with 50 ppm, so the jitter is somewhat larger. You can set 1 Hz to 40.5 MHz frequency range at the NCO and 97,753 Hz to 40.5 MHz frequency range at the PLL but they can only be used in a narrower range because of the ASI Interface (7x8 = 56 Mbit/s).

The CW-4956 type does not have an internal oscillator, the rate of the output data stream is determined by data rate of the TS components.

The CW-4958 type produces the output signal in UDP packet/sec units. The accuracy of the oscillator timing the output signal is better than 50 ppm. Whereas the output signal of 64 independently programmable remultiplexers appear at a common IP output, depending on the set values, small and large UDP packet slips occur. The nature of slips of the UDP packets is similar to slip in the switch.

15.11. PCR Corrector design, switching on and off

The CW-4951, -52, -58 type remultiplexer comprises a statistical PCR corrector for eliminating the heavy PCR errors from the IP network. The number of the integrated PCR correctors is 8192, that is the hardware can handle every data stream comprising a PCR, separately.

The mass of data belonging to the PCRs is stored in a SDRAM, the new PCR values are computed by a fast FPGA module. The off/on switch circuit of the PCR Corrector is the PCR Corrector Reset circuit in one piece; that is the complete correction procedure can restart with off/on switching. When the PCR Corrector is switched on, it completely rewrites the PCR data and tries to diminish the PCR error to under ± 500 ns. Generally we suggest keeping the PCR corrector switched on.

Supplementary information:

The correction of the PCR error becomes critical, if the SDRAM stores a great amount of data streams and the actual PCR error reaches the order of magnitude of a second. The PCR Corrector restarts itself automatically, if the distance between the two PCR data exceeds the 728 ms value, or the detected PCR error is greater than 46 sec. In case of little errors, the correction of the internal 27 MHz reference oscillators stops transitionally, if the content of the SDRAM exceeds the size of 1024 packets.

The PCR corrector of the CW-4855 and the CW-4856 types has the same structure and services as of the IP remultiplexers. The first-generation CW-4852, -54, -58 types have only 64 PCR correctors and can reduce the PCR errors only to ± 2 to 3 microseconds.

16. Additional information for those interested in deeper details

CableWorld Ltd cordially supports the users who are ready to integrate these hardware and software in their systems and complete them with their own solution. The next chapter was written for them and provides special information in their applications.

The content and format of the files used:

1. The structure of the 'ini' files corresponds with the structure of the initializing files used widespread. The content of the file can be completed and modified with any text editor. The 'ini' type files used for storing the data are as follows:

- Settings (SW4953a.ini) – The SW4953a.ini file comprises the default settings of the software, the assignment of the type number and the device name, and the Input IP Address List used last time. The software always automatically saves the settings to the SW4953a.ini file, so this name is reserved. The user can save the settings under other names and then load from there.
- Input IP Address List (*.ini) – The software allows saving the list comprising the 256 IP addresses in separate file or loading from there. It is practical storing the user's savings in the 'Settings\AddrList' directory.
- IP Connection List (Connect.ini) – This file stores the program of the IP Connection Manager. The 'Connect.ini' is a reserved name. Before loading it in the device the software saves the program loaded last time in the \IP_PGM\IPconPGM\Connect.ini file.
- The programs of the CW-4956, -58 types can be found in the 64Ch_PGM directory. The IP Connection List (IpcoList.ini), the PSI Inserter Control Program (PSIcontr.ini) and the Output Streamer program (StrTable.ini) can be found in ini type files.

2. Before loading the PID Filter programs are saved automatically in the in the PIDfilt1.dpi ... PIDfilt4.dpi files. The *.dpi file starts with a 256-byte header, comprising the parts as follows:

- Starting with the byte '0': CableWorld identifier: CABLEWORLD LTD. PID Filter PGM-1 (max. 32 bytes)
- Byte 32: The length of the project name (0 to 144)
- Starting with byte 33: Project name (max. 144 bytes)
- Starting with byte 192: The date of creating the file (8-byte long, in Windows format)
- Starting with byte 256: 6-byte PID Filter data (Input PID (2 bytes) – Output PID (2bytes) – Port Number (2 bytes)). Important note: The data in the file starts with the LSB according to the Windows, i.e. the file structure differs from the data structure used at programming the device!

At loading in the file the software determines the amount of data by the size of the file, so the size is of great significance.

The PID Filter program of the 64-channel devices is connected to the inputs. The PIDfil64.dpa file comprises the data of the 1 to 64 inputs in 4-byte data in the order of the PIDs.

3. Before loading the program of the PSI Inserter is saved in separate files assigned to the 12 Output Inserters. The automatic saving comes to the Oins101.doi ... Oins412.doi files. The content of the file consist of 256-byte units. At this format also the first 256 bytes comprises the header data, and then the 256-byte units of the loaded program follow. The 256-byte units of the loaded program comprise the packets of 188-byte or 204-byte to be sent out, and the timing data and the CC controller as shown in Figure 6.2. The header identifier: 'CABLEWORLD LTD. PSI Program-1, followed by the identifier of the module performing saving.

The program of the Output Inserter is saved with extension 'ts' without header and control data in 188-byte version as well. This version allows examining the data stream with software of other manufacturers, too.

At creating the files with extension 'ts and 'doi' the software put 32 null packets at the end of the file but this is not the part of the program any more. At loading in the files the software determines the amount of data by the size of the file; the size is of great significance. The 32 added packets always would be cut off.

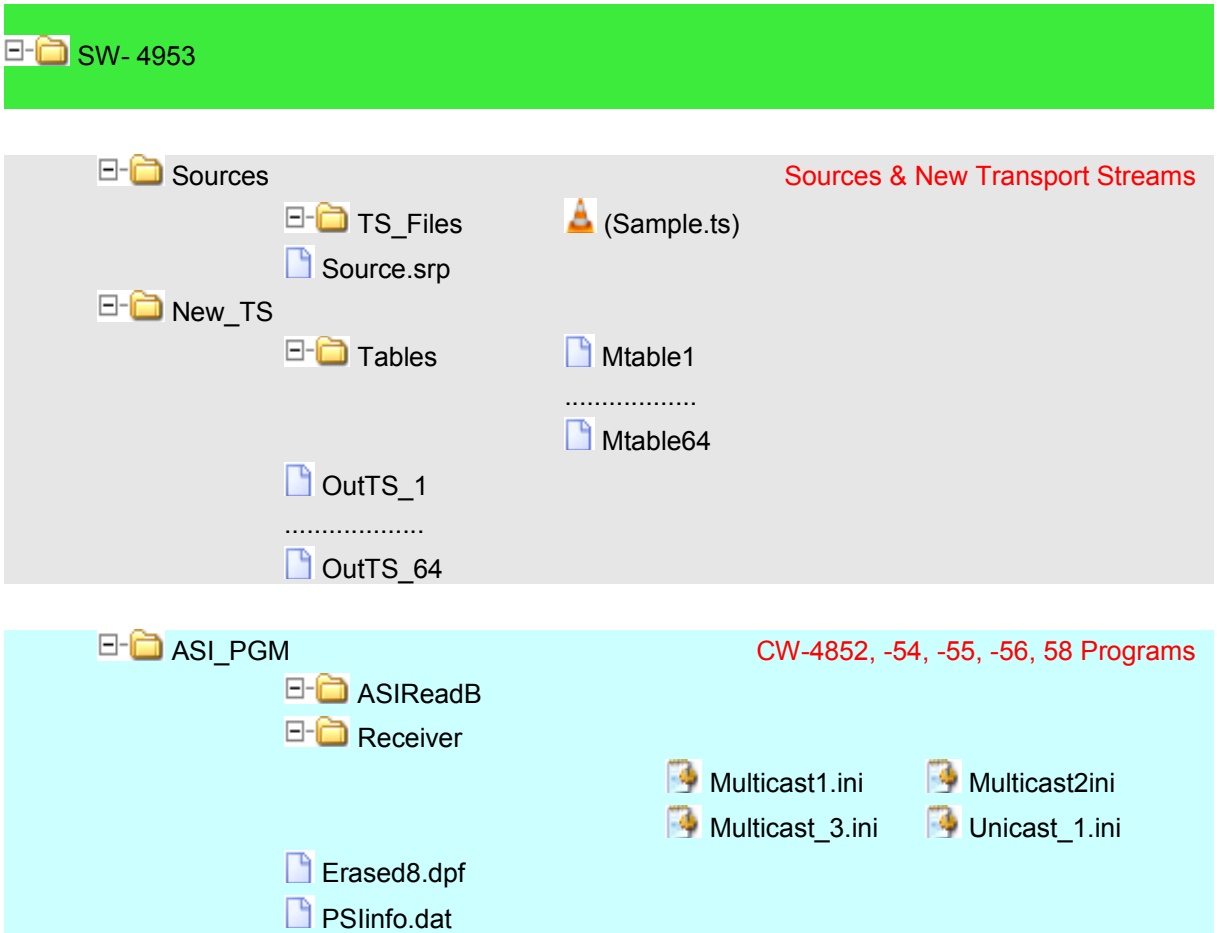
At reading back the Output Inserter program, on the command 'ReadPSI' the device sends back the 256 bytes stored in the memory without modification. In the device memory the first 3 bytes form the timing data followed by the CC byte, then the 204 bytes of the packet and a 256-4-204=48 byte long empty section follow. The SW-4953 software rearranges the data of the device's reply according to the format used in the Editor and the file.

In the CW-4956 and the CW-4958 types the file format is the same, the programs are saved as PATPMT55.doi, PATPMT.ts, SDTpgm.doi, NITpgm.doi etc.

The CW-4955 and the CW-4956 types use the 1st channel of the IP Remultiplexer when making and storing programs.

4. The file formats of the ASI-input remultiplexer PID filter (*.dpf) and PSI Inserter (PSIinfo.dat, PSIpgm.da) files are the same as described in the former SW_4851 software. The first 8×1024 bytes of the '*.dpf' file correspond with the loaded program. The PSIinfo.dat file consists of the 204-byte TS packets, comprising the master packets for the packets to be generated. The PSIpgm.da comprises the loaded program.

5. The report of the input transport streams is saved in the Source.srp file. The file comprises a 4096-byte header and then the data of the transport streams in flexible (n × 1024) sized units. The structure of the transport stream report (OutpTS_1.srp) edited by the user is the same, but comprises only the data of one transport stream following the 4096-byte header. The structure of the Table Report made by the software is the same, but some parts of the data arrangement are unlike. The structure of these three files is complicated, so it is not published, and it is not necessary for creating the user' individual software. The arrangement of the directories and data storages of the SW-4953 software is shown in Figure 16.1.



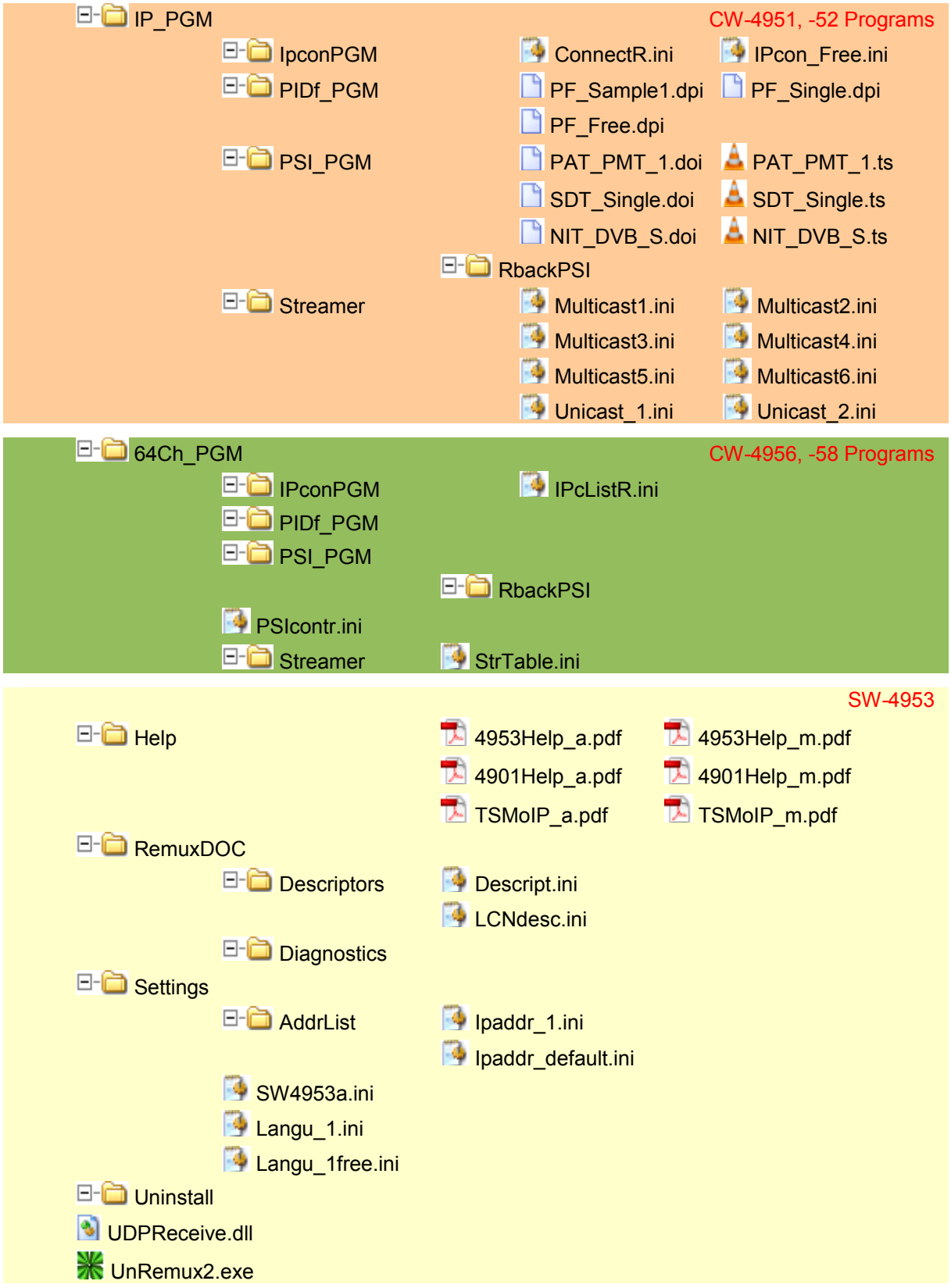


Figure 16.1
Structure of the SW-4953 software

The detailed instruction manual of the IP Remultiplexer and Stream Master board can be downloaded from www.bytestudio.hu.

17. User's Guide for creating the lingual versions of the SW-4953

The SW-4953 software beginning with the 1.06 version, allows the user to determine the text appearing on the screen, i.e. to create an optional language version. The steps for translating the texts are as follows:

- During running the installer exe asks the language version the user wants to install. Then the Langu_1.ini file will be installed in the \Settings directory.
- If the software finds no the Langu_1.ini file, or the file is empty (e.g. at the English version), then the software displays the original English texts.
- The files comprising the Hungarian, Italian, etc., translations can be made continually. The perfect files are built in the installer exe by CableWorld. Anyone can try his own translation by replacing the Langu_1.ini file.
- Until the translation of the given language is not ready, the software installs a file where "?" appears instead of texts. In the file the translated texts must be written in the place of the question marks.

Creating the Langu_1.ini file:

Open the file with a simple text editor (e.g. Word Pad). The variables completed with letter "e" show the original text in English. The translated text must be written under this text, in the place of the question mark. Any other modifications in the data of the file, inserting notes, etc., are not allowed.

The text to be translated before the translation is as follows:

s200e=Save as ...
s200=?

After translating it to Hungarian:

s200e=Save as ...
s200=Mentés, mint ...

The content of the Langu_1.ini file is loaded in at the beginning of running the software. On copying the Langu_1.ini file to the C:\Program Files\CableWorld\SW_4953\Settings directory and starting the software, the translation can be tested immediately.

18. Making and editing the TS Report

In the CW-4852, -54, -55, -56, -58 type devices the built in TS Selector and Ethernet Controller help to transmit the input and output streams via the IP network to the computer, where the user can analyse them.

The CW-4951 and the CW-4952-type devices have IP receiver units, which can transform the unicast and multicast streams and transmit them to the computer to be analyzed there.

The CW-4956 and the CW-4958 types have 60 IP and 4 ASI inputs, however, they have no receiver unit for analyzing the streams.

For remultiplexing the transport stream the user must know what components the input streams contain. The SW-4953 software is able to record any number of transport stream data written to a file (Source.srp), and then offer the user the possibility to use the transport stream data to edit the new TS. The name of the database containing the data of the transport streams is: TS Report. To create a TS Report the SW-4953 software can:

- take samples from the multicast data streams of the IP network,
- take samples of data transmitted from the devices to the computer,
- analyze the transport stream recorded in file

Analyzing and using the TS transmitted from the device to the computer is simple, because the input parameters are also available. When the remultiplexer is not able to sample the input signal or the TS is not available, an additional solution e.g. samples stored in files should be used.

At programming the CW-4956 and the CW-4958 models assume that the majority of the data streams are multicast streams, thus can be sampled directly, or the patterns of the ASI data streams are available in some way (e.g. analyzed by another device). In order to facilitate the remultiplexing process the SW-4953 software can:

- aggregate two or more TS Reports
  (**File \ Add Source files to the Report Source Report** menu)
- use different TS Reports separately, and
- modify subsequently the source data (IP Address, Port Number, ASI Input Number) in the TS Report.

The options listed above usually allow compiling a TS report, which is well adapted to the task and makes the editing of the output TSs simple even up to 64 output signals.

In case of types containing several remultiplexers the SW-4953 software supports the user's work with the manual editing of the PID Filters' program and the summary option of the separately edited PID Filter programs (**Add PID Filter Program to the PID Filter Program** menu).

19. Frequently Asked Questions

1. How to start setting the remultiplexer?

   First set an output data rate (e.g. 40 Mbit/s) and do not want more than build in one TV program in this data stream. Who has some practice in remultiplexing can try performing the task with the help of the pictures, but reading the big letter parts of the 'HELP' is suggested.

2. What is the most common mistake in using the software?

   The software can be used for programming devices of different types but can be used without a device, too. The most common mistake is, that the user does not select the right mode in the first step. After installation the software is set to programming the CW-495x IP Remultiplexer & Streamer. If you want to work with a multicast network or program the former ASI-input TS Remultiplexers, switch over the mode in the 'View ...' menu.

3. What to do, if no transport stream appears during the TS analysis?

   Probably, the mode selector in the View ... menu (View Multicast Network Analyzer – View CW-485x ... – View CW-495x ...) is not set properly. In the second step, check the right setting of the IP address with the 'Query' button. In the third step, make sure that there is signal in the IP network or in the ASI cables indeed. Who has no device or network nearby, can try operating the software by loading in the sample 'Source.srp' (Load Source Report (*.srp) from ...).

4. What can be wrong if at working with a multicast network the system does not work or works partially only?

   In multicast systems it is not enough if the streams are of multicast type, it is also important that the switches applied can handle the IGMP messages. Probably, at the IP-input remultiplexers the use of improper switches will cause the problem.

5. What to do, if the menu items mentioned in the description are not accessible and appear dimmed in the pull down list?

   The software allows calling only the commands that are applied in the given GUI. Change to another GUI, where the given command can be executed. The 'View ...' menu item affects the usefulness of the commands, as well. E.g. when selecting the GUI of the IP remultiplexer, the programming instructions of the ASI devices are not accessible.

6. How to make the Input IP Address List show always my network data?

   Rewrite the data of the SW4953a.ini file with an optional text editor or type the data in the rows of the table (pushing the Enter button after every piece of data) and then save settings and exit. The software always starts with the data saved last.

7. What to do, if the data will not be built in the output TS at creating the TS?

   Select the 'Add to TS ...' mode for creating the TS. The adding is successful only, if an equivalent element is inserted in an equivalent place. You have clicked the right place, if the software asks for confirming the insertion. Create empty places with the operation 'Add New Service' for building in the services (programs) and put the selected service in here. Use the 'Remove from TS ...' function for removing the empty places or unnecessary services. Important note: The 'Remove Service' function removes the elementary streams permanently and takes no notice if it is used by another service. In case of complex TS, instead of 'Remove Service', rebuild the stream!

8. What are the steps of the simple remultiplexing?

   Analyse the input signals
   Assemble the desired TS with the TS Constructor
   Have the tables and the programs created automatically by clicking the 'Create PAT – PMT …' button

   Load the following programs to device:
   IP Connection List
   PID Filter Program
   PSI Inserter Program

9. When should the IP Connection List program be modified?

   The device calls the data streams from the IP network according to the IP Connection List. The list is to comprise the total data of the four remultiplexers. The IP Connection List program is to be loaded to the device again, if you want to take data from such a multicast data stream, which is not on the list. If any of the data steams are on the list redundantly, it causes error only at the overload of the gigabit line.

10. Can the tables be switched off and on simply, without programming?

    Yes, the device comprises 4×12 PSI Inserters. Each of them can be switched off and on with one command without changing the program inside. In case of the SW-4953 software the switching off and on comes with the 'Load PSI Inserter Pgm' command and the software programs all the 12 switches according to the current setting. The SW-4953 software uses only the first three inserters, the automatic function keeps the others always switched off. When you want to program only the switching off and on, all the Reprogramming checkboxes must be unchecked.

11. How to set the output data rate and format?

    The device offers an NCO and a PLL circuit for generating the clock signal. In case of IP output it is not important which one you will select. At ASI output the PLL jitter is much less, but the frequency range of the NCO is much greater. The data in the device can be read out with the 'Query' command on the Data Rate page. The new data can be written in by clicking the 'Set Data Rate Pgm' button. The Data Rate Computer helps setting the data rate in the different modulation modes.

12. What to do, if the created tables and programs look defective?

    The most common case, when the user assembles a transport stream, and then starts creating the tables and programs but in the meantime goes back to the TS Constructor and modifies the TS. After modifying the Constructed TS, clear the PSI Editor and start creating the tables again. Omitting the clear can cause errors. The error depends on what is modified. In every case when the programs or the tables are defective, clear the PSI Editor and start the creation again with the 'Create ...' button.

13. How to create an IP TV data stream?

    Set the output data rate to 8 to 16 Mbit/s (f=1 to 2 MHz) by the NCO. Put in one TV program and configure the remultiplexert. Configure the output streamer for sending multicast data stream and removing the null packets. Remember: The output streamer is at another IP address, it differs from that of the input. In large systems it is practical to use a password for locking the programmability of the streamer (See the Help file of the SW-4901).

14. How to configure large systems?

    In large systems, when 5, 10 or more remultiplexers must be configured, configure them separately. For this, connect the PC to a device via switch, and then connect the switch to the large network with a cable, that can be easily disconnected. In this arrangement configure the devices one by one, and build them in the large system only when you checked their correct operation separately. In large networks among many data packets it is difficult finding, checking the IGMP messages and other data packets, and troubleshooting the incidental errors.

15. After successful programming, how can the files be saved simply, in order to carry on the work and modify the data later, without restarting the remultiplexing?

    The simplest and safest solution is copying the complete 'Programfiles\CableWorld\SW_4953' directory to the storage area used for saving, and starting the 'exe' file from here later. The content of the directory can be copied as many times as required. At programming several remultiplexers, assign separate directory to every remultiplexer. The files and the programs can be saved and recalled separately. So the programs can be exchanged among the four remultiplexers, but it requires the knowledge described in the user's guide.

16. How to convert the multicast data streams to ASI signals, if they are received at port numbers 1027 and 1138 from the communication network?

    First set the communication system of the IP Remultiplexer & Streamer according to the port number of the incoming signals. The factory setting for the device 'TS Port Interval' is 57000 to 59999. For example set the 'TS Port Interval' on the Source Analyzer page to the 1000 to 2000 range; this comprises both incoming values. The communication port can remain at 56941. In the second step set the value of the 'TS Port Offset' to this range, too. Set the 'TS Port Offset' to 1000. The following steps of the remultiplexing are the same as described earlier.

Notes:
The allocation of the Port Number is described in the pdf file named 'Transport Stream Managing over IP', which can be opened from the Help menu, as well.
In the case of the IP Remultiplexer & Streamer, the port number interval of the transport streams to be processed must not be greater than 2048, as the PID filter can process only this range. Of course for protecting the communication, the TS Port Interval can be set to a greater value. For example 1000 to 56000 can be set instead of 1000 to 2000.
The communication port always must be outside the TS Port Interval. Outside the TS Port Interval, high-speed data streams arriving at the device input can even totally disable the communication with the device, so avoid this situation!

17. In the first channel of the CW-4958 16-Channel Edge TS Remultiplexer the output data rate is programmed to 180 Mbit/s. What is the reason that the diagnostic page does not show it when selecting the IP output (Run – OK)?

    At this type the output data rate depends on the output connection, too. If the output is not connected to cable, the UDP packets can not leave the device, so the display can not show a value greater than 0. For example, at 100 Base-T connection only a part of the UDP packets can be launched, so the reading will be less than 180 Mbit/s. The diagnostics page shows the actual value and not the programmed value.

18. I compiled a service containing 150 programs with the SW-4953 software. From this the software automatically produced a 8-section SDT. How can I view and modify these tables?

    The tables can be viewed with the View SDT Editor button. The sections can be selected with the section scroll button. The complete packet series can be seen in the PSI Editor.

    The manual data editing process is as follows:

    - Clear PSI Editor …
    - Create PAT, PMT, SDT, NIT ... -automatically
    - Set Modify SDT Manually mode, then set the mode with the Create PAT-PMT-SDT-NIT button in the Table Report
    - Now you can navigate between the sections
    - Modify the data within the Section, then Create PAT-PMT-SDT-NIT ...
    - When modifying the Service Name and the Provider Name the descriptors of the names should be done individually by pressing the Insert selected Service Name ... button.
    - The adjustment possibilities are limited, the software is only capable of implementing changes within the section. It is unable to rearrange the sections or open a new section.

    At the auto-editing of the section the software provides an empty space given in the variable **Section free place** of the SW4953a.ini file for the manual changes at the end of the section. The value can be given between 0 and 512, the default is 100 bytes in size.

19. How to feed the IP-input CW-4268 QAM Modulator from the CW-4958 Edge remultiplexer?

    The two devices fit well together, but one should pay attention when setting the data rate. Calculate (for example, using the SW-4953 Data Rate Computer), the data rate required for the selected QAM mode. The remultiplexer output data rate should be set to a value lower than that. The best choice is, when the difference is a few times 10^{-4} (0.01%) in size.

20. How does the automatic Continuity Counter operate in the CW-4856 and -58 types?

    These types comprise 128 automatic CCs in channels 1 to 16 and 16 of them in every channel above channel 16. Programming can determine the PID values where the automatic functions operate. The SW-4953 software does it automatically. The correct programming can be checked by reading back the program.

21. Who is responsible for setting up the program of the PSI Inserter Controller?

    The SW-4953 software creates this program automatically, however, uses the PSI Inserters sparingly. The software configures and turns on only those channels' PSI Inserters, which are in use. On checking the Auto Switch On / Off check box, the Clear PSI button turns off, the Create PAT-PMT .... button turns on the output signal of the channel being edited. The user-defined PSI Inserter Control program will not be modified by the software.

22. How to move the TS Port Interval domain easily?

    In the Special Functions menu the SW-4953 software offers the conversion of the software and the device to a new TS Port Interval and a new Communication Port value. The top picture of Figure 19.1 shows the default settings used by CableWorld. The bottom of the image shows an example how to configure settings in the SW4953a.ini file. The user's desired settings can be made by modifying these two versions or by giving new data via the ini file. When using the menu, the software and device settings change at the same time. In the menu the default values can be restored as well. The computer port will take the new value only after restarting the SW-4953 program.

    It is important to note that the device is not programmable within the range of the TS Port Interval, the control unit will not receive commands sent with port numbers within the range. Outside the range any port can be used for communication with the device. The TS Port Interval can not be set to values less than 256. The TS Port Interval is adjustable down to a very small range. If the device receives a transport stream outside the range of the TS Port Interval, the communication becomes very uncertain and erratic, such a TS is highly disturbing to the operation of the device. The TS Port Interval can be set by programming the device. The value of the communication Port is determined by the value specified in the SW-4953a.ini file.

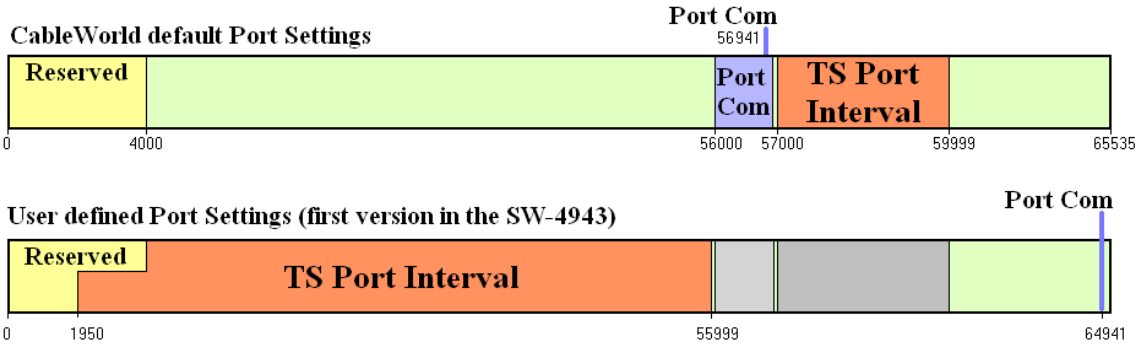


Figure 19.1
Illustrating the location of the TS Port Interval and the communication port

20. 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

To the request of our users, we made the following modifications and upgrades in the SW-4953 software's V1.07 version:

1. To be able to fully use the capabilities of the latest 64 channel system, we added the IP Address to the PID and the Port Number, when identifying elementary streams. Using the V1.07 version, devices of the 64 channel system (CW-495x), will be correctly programmed even if certain streams have the same PID and Port Numbers and only differ in the IP Address.

2. Since our users create more and more complicated streams, it was necessary to upgrade the table editors. For the users of the new version, we suggest the followings:

PAT: Most of the time, only the PSI Inserter-generated table will work. In special situations, manual modifications will be necessary.

PMT: When the content of the PMT changes dynamically in the input stream (e.g.: local programs are added to the stream at times) allowing through the input PMT, provides a simple solution. We need to check in the PAT table, at which program we want to take the PMT from a port, the software will change the program of the PID Filter, automatically. Remember, it is not allowed to change the PIDs of the streams of a service.

SDT: Most of the time, only the PSI Inserter-generated table will work. The SDT can be copied from the Source Report with the “Add to TS...” function, but this is recommended only, if minor manual modifications need to be performed on a table. The SDT still can be let through from any input.

NIT: The NIT contains the special needs of the user, therefore it can only be done manually. Since the role of the NIT is more and more important, the V1.07 version offers several new editing options.

If we have a NIT in our system, which we would like to use in several TSs, make a TS Report of it. With the “File/Load TS file...” menu we can make TS Reports of NIT packets stored in files. This report, which may only contain the analysis of the NIT, will be added to the TS Report, with the “File/Add TS Report to TS Report...” function. From the TS Report, the NIT can be copied in the TS Constructor, as the TV-programs. True, that this function only works with one-section NITs, but in small- and medium systems, it makes the editing of the NIT significantly easier.

In the new version, the NIT Editor, which inserts the LCN descriptors, is also expanded and the NIT data are given in ini file. It is believed, that this method for preparing multi-section NITs will be the favourite in the coming years. The NIT still can be allowed through from any input.

CAT: The CAT can not be edited automatically. The new software let through the incoming CAT automatically, if in the TS Constructor we copy it from an input stream to the output stream.

TDT: The local creation of the TDT requires the exact time from the internet or GPS receiver, therefore it is simpler to take it from one of the streams. The new software lets through the incoming TDT automatically, if we copy it in the TS Constructor.

TOT: The TOT is transmitted via the same PID as the TDT, therefore it can not be edited separately.

EIT: The EIT is a constantly changing data stream, so the common remultiplexers working with PID filtering, are not capable of editing the EIT. This editing can be done with the CW-4955 type 64-channel Remultiplexer, offered by CableWorld. Either an earlier or an edited data stream can be added to the output stream in the TS Constructor with the "Add to TS..." function. The new software uses the PID program to let through the EIT data stream.

Elementary Streams: When editing coded broadcasts, local programs etc., any elementary stream can be transferred to the output stream (Add to TS...), like TV-programs. In manual mode the Elementary Stream Editor allows even the entire transport stream through without change.

3. Based on feedbacks from users, a number of small errors of version V1.07 were corrected (masking error at the Version Number, external NIT program loading error in the SW-495x, etc.).

To the request of our users, we made the following modifications and upgrades in the SW-4953 software's V1.08 version:

In version 1.08 of the software minor bugs have been corrected. The values of some of the "Reserved" bits in some tables were changed, and an error in the loading module of the language versions was removed.

To the request of our users, we made the following modifications and upgrades in the SW-4953 software's V1.09 version:

1. We made a new version of the CW-4958 type 16-Channel Edge TS Remultiplexer, which has a separate control port. The type of the new version is **CW-4958 SM** (**S**eparated **M**anagement Port).

The hardware is the same, the control program of the FPGA has been modified. The previous version has one IP Input and one IP Output (RJ45 or Fiber) connector and receives the control instructions via the TS Input connector. At the IP Input the packets carrying the TS packets and the control packets are distinguished by the Port Number. The new version receives the UDP packets carrying the TS at the output side in full duplex mode. The modified name of the IP Input connector is **Management Port**, the new name of the IP Output connector is **TS Input/Output Port**.

Figure 20.1
Rear panel of the CW-4958 SM

2. In the SM version the value of Manufacturer Code has been changed from 0x0000 to 0x0001, this helps the software to recognize the version. From the reply sent to the **Query** question, the SW-4953 software determines, which version is connected and modifies the inscriptions on the display.

3. It is assumed that the separate Management Port input of the device will not receive UDP packets containing TS, so the default value of the TS Port Interval has been changed to 0 to 255. This means that the device can communicate in the 256 to 65535 port interval.

In order that the TS Input/Output Port in default setting could receive the TS packets from as many ports as possible, at this input the default value of the TS Port Interval has been changed to 256 to 65535. In this setting only the TSs arriving with port numbers less than 256 can not be received.

Both settings can be changed with programming.

Note: The application of the separate Management Port also has advantages and disadvantages as the previous version, so CableWorld produces both versions and the users are free to use any of them.

We greatly appreciate your comments and feedback.