SW-4884 MPEG-2 Decoder Quad Controller 1.02

MPEG-2 decoder device controller software

The SW-4884 MPEG-2 Decoder Quad Controller software has been designed for setting and controlling the devices as follows:

- CW-4882   MPEG-2 Decoder Duo   two MPEG-2 decoders with ASI inputs
- CW-4883   MPEG-2 Decoder Duo   two MPEG-2 decoders with two CI slots and ASI inputs
- CW-4884   MPEG-2 Decoder Quad   four MPEG-2 decoders with ASI inputs
- CW-4885   MPEG-2 Decoder Quad   four MPEG-2 decoders with four CI slots and ASI inputs
- CW-4982   MPEG-2 Decoder Duo   two MPEG-2 decoders with IP inputs
- CW-4983   MPEG-2 Decoder Duo   two MPEG-2 decoders with two CI slots and IP inputs
- CW-4984   MPEG-2 Decoder Quad   four MPEG-2 decoders with IP inputs
- CW-4985   MPEG-2 Decoder Quad   four MPEG-2 decoders with four CI slots and IP inputs

The devices above are made using the SW-4901 Gigabit Ethernet Controller module of CableWorld Ltd. The parameters can be set by the SW-4884 software and the SW-4901 software. The information for configuring the input units of the IP-input versions can be found in the publication 'Transport Stream Managing over IP' and is available for downloading from the www.cableworld.eu web site.

Instruction manual

1.   Task of the software

Like the former software and product features of CableWorld Ltd, the SW-4884 software besides configuring the built in MPEG-2 decoders has a number of features to help the user's job. The integrated transport stream analyser function as well as the picture and sound monitoring (visual tester) are useful aids for composing the program of the MPEG-2 decoder. The set of parameters read back from the decoder make a lot of information hidden deeply in the transport stream accessible for the user. This feature significantly extends the use of the TS analyser.

Configuring the ASI-input versions is much simpler as the input transport stream is definite for each input. At the IP-input versions there is no output signal without correct configuring of the IP receiver. Configuring the IP receiver needs at least basic learning in operating unicast and multicast systems. The SW-4884 software sets the MPEG-2 decoder and the IP receiver mode as well. Users who want to differ from our IP receiver configuration can do it by using the SW-4901 software.

Before using the SW-4884 software we suggest to new partners to study the descriptions CW-Net.pdf and Using CW-Net.pdf which are available for downloading from the www.cableworld.hu web site. The first step always is to establish connection with the device. Read out the device parameters by the 'Query' button (name, type number, etc.) and start setting the device afterwards.

The software was designed for the Windows system, the development and test happen in Windows XP Professional environment and we suggest our customers to use this version. Detailed technical descriptions, publications and user's guides can be found in our web site.

The detailed description of the Gigabit Ethernet Controller module and the instruction set are free accessible in the 4901k_m.pdf file. For those customers who undertake writing own software for operating our products, we assure extra technical support.

2.   Establishing the CW-Net and the Gigabit CW-Net

The CW-Net can be built of the components of the widely used 100 MBit/s Ethernet networks. The simplest system can be established by connecting the computer's Ethernet socket with that of one of the CableWorld devices' through a category 5 cross-wired cable.

Connecting more than one device can be made through a switch or some other component of similar function, but in this case all devices must have different IP addresses. CableWorld Ltd. delivers its products with the 10.123.13.101 IP address, which must be changed to different addresses each at putting them in operation. For doing this, first connect the computer with a straight (not cross-wired) cable to the switch, and then connect the first device with a straight cable. Set the IP address of the device, and then continue this procedure with all devices.

In the CW-Net network the computer has to be set to a fix IP address (e.g.: 10.123.13.201) and to 100 MBit/s full duplex operation mode. In Windows XP environment, for setting the computer's IP address, select following options: My Computer – Control Panel – Network Connections – Local Area Connection – (mouse right click) Properties – Internet Protocol (TCP/IP). The offered (255.0.0.0) Subnet mask should be accepted. Here, on the upper side of the General page also the setting of the network handling device is offered (Configure > Advanced). After clicking the "Settings" button, click the "Link Speed/Duplex Mode" line in the "Special" page and then in the roll down menu select the "100Mbps/Full Duplex" mode. In most cases auto mode is applicable, too.

When selecting the switch type, consider that for transmitting simple instructions e.g. setting IP addresses any switch type may work, but the fast transport stream can only transmitted by industrial versions.

Most of the switches store the data of the device connected to their port for a few minutes. Therefore in case of changing the IP address (or removing the cable to another port) the device looks inaccessible, as using CableWorld's Auto-MAC setting the MAC address changes as well. This effect ceases when the switch refreshes its MAC table.

In 100Base-T networks the straight and crossover cables are used as mentioned above. In 1000Base-T networks straight cables are used always and all the 8 wires of the UTP cable are applied. Short parts in the Gigabit networks can operate with CAT5 cables but in professional systems and long distance transmissions CAT6 cables must be used. The No.34 issue of the 'CableWorld hírek' technical magazine gives detailed description on the technical solutions used in Ethernet networks.

When connecting to Gigabit networks the setting of the computer should be modified as well. For long time connection at the gigabit output of a switch choose '1000Base-T/Full Duplex Mode'. When the connection changes frequently, on experimentation and development use 'Auto' mode.

In multicast mode choosing the switch and setting-up the network requires special considerations, since many devices are not suitable for the perfect managing of multicast transmission.

3.   Installing the software

The SW-4884 software is free available for our customers, anyone can download it from our web site. Installing is made in the usual way, with running setup.exe. After installing, the software is started with clicking the icon on the desktop.

The Help of this software can be downloaded from our web site in pdf format as well. It is practical in the learning phase if the Help is available in printed form, too.

4. General information

The software stores the general settings in the SW4884a.ini file and always runs with the latest settings. When operating more than one device or large systems the original software can be copied to subdirectories too, and can be started from there. It is practical if the name of the subdirectory and the adherent icon refer to the application so it is easy to link the icon and the device.

The MPEG-2 decoders can be programmed expansively. The user should set 10…15 parameters together for the correct operation. To help configuring 16 prepared decoder settings are deposed in the Settings.ini file. On starting the software these settings in the Settings.ini will be loaded automatically. First it is practical if the user modifies these settings to his tasks. When these 16 settings are not enough, the software permits making and loading ini files comprising new settings under arbitrary names.

Operating the integrated Visual Tester of the SW-4884 software requires the correct giving of the video and audio PIDs. The user's most frequently used 16 PID value-pairs will also be loaded from the Settings.ini file on starting the software. The list of the PID values can be edited and extended the same as the memory of the settings.

Establishing the connection with the device

Connect the device to the computer and set the IP address in the module on the lower right corner of the GUI (Graphic User Interface). Click 'Query' for the device parameters (name, type number, etc.).

IP Address

The software always communicates with the device whose IP address is seen after the inscription 'IP Address:'. The fourth byte of the IP Address is adjustable in steps.

Use CW-Net (10.123.13. xxx)

In the learning phase not really skilled users should remain within the 10.123.13 .xxx range of the CW-Net system. When 'Use CW-Net' box is checked the IP address always starts with 10.123.13. Skilled users can work in any IP address range.

Communication Port Number

In the Gigabit System where transmitting the transport stream and device control use the same IP network the device control instructions should be located outside the port-range reserved for transmitting the transport stream. The SW-4884 software uses the port No. 56926 for communication. The port number can be set by the SW4884a.ini file.

Query

On clicking 'Query' the device parameters at the preset IP address will be queried. The most important data from the device answer will be displayed. The 'Query' message will be given out in the new format of the Gigabit Ethernet Controller so the former devices of the CW-Net system will not reply!

Reset - General device Reset over IP network.

On pushing this button all the circuits in the device get an electronic Reset signal. The Reset time is 5 sec. During Reset the network connection breaks, too. This break cannot be seen through a switch by PC.

The functions of the SW-4884 MPEG-2 Decoder Controller can be grouped around the three tasks as follows and the additional control units will be reviewed according to these:

- Analysing the input transport stream
- Programming the working parameters of the MPEG-2 decoder
- Reading out the MPEG-2 decoder data stored in the device

5.   Analysing the input transport stream

When analysing the input transport stream the first step is selecting the source, that is, making the transport stream to be analysed accessible for the PC. At the ASI-input devices, the device itself sends the transport stream to the PC so the setting is simple. After setting the IP address and establishing the communication, the software can ask the device for the transport stream to be analysed. At the ASI-input devices one of the transport streams of the four ASI inputs gets into the PC through a selector. The software always sets the selector position according to tabs 'MPEG Decoder 1…4' in the lower part of the GUI (Graphic User Interface).

At the IP-input versions in multicast mode the transport stream will be analysed independently of the device. The software logs in the multicast group and asks for the transport stream according to the settings.

In unicast mode the PC cannot access to the transport stream theoretically either so cannot analyse it. In unicast mode the MPEG-2 Decoder can analyse the transport stream only on by-pass road e.g. with the SW-4811B software. Remember, choosing any way you violate the rules of the protocol referring to unicast connection so your interference will not pass without consequences!

Input Selector: ASI Inputs (CW-488x) / IP Input (CW-498x)

The MPEG-2 Decoders are made in ASI-input and IP-input versions. The correct setting of the Input selector buttons informs the software which version it should send out the commands for. The answer to 'Query' automatically sets this switch according to the version. The TS Sampling and TS Replay always start according to this selector setting.

Get Sample and Analyze

The transport stream is a data flow with continuously changing content during the time. So the analysis always refers to a given interval. On pushing the 'Get Sample and Analyze' button the software gets a 1 to 20 Mbyte sample from the stream according to the setting. During sampling the indicator lights green. At the end of sampling it goes yellow and the software starts analysing the sample. At the end of analysing the most important basic data (format, data rate, etc.) and the parameters of the PAT, PMT, SDT tables can be read in the text box. The measured results can be highlighted and copied to the clipboard (Ctrl-C), and saved as a measuring report (Ctrl-V). The size of the sample should be determined so that it could comprise all the tables to be analysed. Increasing the size of the sample it probably comprises the desired table but the time of analysing increases proportionally.

When besides the basic data detailed information is needed in the analysing process, the use of the SW-4811B software is suggested.

Note:

At programming the ASI-input devices the sampling happens at the ASI input of the selected MPEG-2 decoder (1...4). The software automatically controls the ASI selector of the device.

At programming the IP-input devices in Multicast mode the PC gets the sample from the IP network. In this case the device is not required. In Unicast mode the PC has no possibility to test the transport stream.

At the visual test of the transport stream the obtaining process of the stream is the same as the sampling process.

Using the Visual Tester

The SW-4884 MPEG-2 Decoder Controller offers two pieces of video player software for visual testing any television program in the transport stream. On pushing the 'CW Player' button (default) the picture is made by the MPEG-2 decoder software of CableWorld. With the 'Win Player' button the user-installed Windows default media player will be used. When the user wants to use a media player, which is not installed in his PC, the software running will stop.

The user can set the visual tester aspect ratio to 16:9 and 4:3 always manually as none of the software modules control this setting. The selected input, that is the source of the transport stream can be checked on the buttons under the display. The indicator of the active input lights green.

The video and audio PIDs are the most important data for displaying the picture and sound. At faulty audio PID the picture can appear but at faulty video PID neither picture nor sound can. The simplest way to give the two PIDs is to type the V-PID and the A-PID in the box. At the start of typing the box goes yellow, the data processing starts on pushing the 'Enter' button.

To help operating the media player the software offers a list of 16 PID-pairs. Beside these value-pairs the names of the programs can be given as well. When choosing from the list the selected line will be assigned to the given decoder. When changing the decoders always the latest setting (name and PID data) can be seen in the box. These four decoders use the same PID-list.

The audio and video PID-list is loaded from the Settings.ini file. The content of the ini file can simply be adjusted to the user's task by a text editor. On clicking a line in the list then typing a PID value in the box the new values get into the list, which is temporarily stored in the memory. The list can be saved under optional name by the 'Save Settings List as...' button. For modifying the channel-name delete the whole text in the box of the pull-down list, then type the new name and push 'Enter'.

Remember, the settings of the MPEG-2 decoder and the modifications of the video and audio PID-list will be written only in the memory. For saving these settings into file push the 'Save Settings List as …' button. On start the software always loads in the Settings.ini file. While running the software an optional list can be loaded in by the 'Load Settings List from …' button.

A special feature of the software is that on getting sample the analyser automatically writes in the list the PID values found in the sample, (starting backward from the end of the list).

6.   Programming the working parameters of the MPEG-2 decoder

In the course of programming the two modules to be set are as follows:
- IP Receiver module
- MPEG-2 Decoder module

Setting the IP Receiver

At the ASI-input versions the MPEG-2 decoder gets the input signal directly from the ASI interface. The IP receiver is not used still it should be set. Using the SW-4884, the IP receiver will be switched off in the ASI-versions in the course of loading. At manual setting pay attention when the IP Receiver is left configured for multicast or unicast mode. The automatically sent messages and requested streams (e.g. at multicast reception) must not disturb the operation of the system. The setting of the IP Receiver is detailed in our publication 'Transport Stream managing over IP'.

In the SW-4884 software the IP Receiver mode can be set by clicking the pull-down list of the IP Receiver Programmer. In the pull-down list when choosing the last line after the unicast and multicast mode, the IP Receiver will not be configured. In this mode the IP Receiver can be freely configured by the SW-4901 software, the SW-4884 will not change it. The programming can be switched off by giving the value of Multicast Mode=2 in the ini file.

The SW-4884 software helps setting the IP Receiver by automatic setting the majority of parameters. The user should type in the box only the Multicast IP Address, Port number and NCO frequency.
Let us examine what the task of the NCO is!

The transport stream sent through the IP network is transmitted asynchronously at the data rate of 1000 Mbit/s so it cannot be directly received and processed by the MPEG-2 Decoder. The main cause of the problem is that the clock frequency of the IP Interface is 1000/8=125 MHz, but the input clock of the MPEG-2 decoder must not exceed 7 MHz. To solve the problem the IP Receiver stores the incoming UDP packet and then reads it out at the rate of the NCO frequency.

To maintain the continuous data flow the IP Receiver sends 204-byte null packets at the rate of the NCO frequency to the input of the MPEG-2 decoder. The useful/effective packets arriving unpredictably from the IP network will be inserted in these packets. The NCO frequency measured in Hz, corresponds the same value data rate measured in byte/s. To help the setting of the NCO, on typing '0' in the box the software switches to 'Auto mode' and sets the possible max. NCO frequency. The use of 'Auto mode' is suggested.

The default settings of the IP Receiver:

Expected UDP packet format:	7 × 188 bytes / packet, synchronised in IP TV format
In UDP packet, null packets	removed (Remover – On)
In UDP packet, TSP flag	off (TSP flag – Off)
NCO frequency (auto):	6 944 440 Hz
Packet format	204
Null Packet Remover	Off
Null Packet Inserter	On
TS Clk	Continuous

Notes:
- The applied MPEG-2 chip can accept max. NCO = 7 MHz clock signal.
- To make the application of the Common Interface possible the IP Receiver sends continuous, 204-byte format TS to the decoder.
- The user must select whether or not the given equipment contains Common Interface units. ("FTA/Common Int" button).
- The IP Receiver has a memory large enough for storing two UDP/ IP packets.
- In the Gigabit Ethernet Controller module the NCO settings are optimised for the programmed value by the integrated microcontroller. Running the optimising routine can take a few seconds at some frequencies. So the software can exceed the time set to waiting for the reply but this does not influence the programming process. The right execution of the setting can be checked by reading back after a little waiting. The value of 6944440 Hz set in 'Auto mode' provides low jitter and fast response.

Setting the MPEG-2 decoder

The MPEG-2 decoder processes the SI/PSI tables of the transport stream connected to its input and reads out the parameters that are complicated or not really important for the user. On setting the first task is to give the Service Identifier. The decoder reads out the PID-values for the components of the service (picture, sound, teletext, etc.) from the TS. The user's next task is (when several sound tracks are available) to give the PID-value of the audio stream to be decoded. These two important data should be typed in the proper boxes.

The additional data belonging to the Service Identifier and the Audio PID set the parameters of the analogue output signal. The SW-4884 software makes possible to choose the required decoder parameter list from a (formerly prepared and stored) composition of 16 lines. The individual setting-assortments can be easily identified by the name typed in the Program Name box. The decoder settings will be loaded from the Settings.ini file at the beginning of running the software. The modifications of the parameters in the selected line are written only to the memory and the user should save them in file. While running the software the prepared lists can be loaded in any time like the settings of the Visual Tester.

Service Identifier - Selecting the program (service) to be decoded

The programs carried by the transport stream are identified by the service identifier (program number) located in the PMT table of the relevant program. Since the packet identifiers (PID) of the elementary streams belonging to the program can change, so a service identifier should be given for selecting the program to be decoded. The proper identifier can be chosen from the report list of the integrated TS analyser.

After this, the decoder unit always decodes the components belonging to the preset identifier, and tracks the incidental changes of PID as well. PID exchange like this is used by ORF for transmitting regional programs in a given period of time. (This procedure is called Dynamic Content Switching).

Audio PID - Selecting the sound track to be decoded

In case of multiple sound tracks (e.g. multilingual programs) the sound to be decoded can be set by typing the proper PID in this box. This data is provided by the TS Analyser. If the user types '0' (zero) here, the decoder sets the audio PID situated in the first place in the PMT table. (So in case of a single sound track, the user should not deal with this PID.)

Volume R / L

The 'Volume' buttons are used to set the required volumes of the analogue outputs in channels separately. The range is 0…255, the medium volume is approx. 150…200. The scale is non-linear, the volume hardly increases over 200.

Audio Muting

In this box both sound channels can be switched on or off simultaneously.

Output Color Format

The video encoder of the MPEG-2 decoder supports setting many standardized colour systems (PAL, SECAM, NTSC and miscellaneous variants of these). Be careful at choosing, some of them use 50 Hz, others 60 Hz picture format.

Aspect Ratio

In this box the user can set the width to height ratio of the output video signal to the 4:3 or 16:9 screen format (TV, monitor). The input aspect ratio can be 4:3, 16:9 and 20:9. The reproduction of the selected aspect ratio uses various conversion procedures. Some of them cause loss of information others result in black belts on the screen. For the most common conversion (from 16:9 to 4:3) the 'Letterbox' setting is suggested. When all the conversions are omitted, the input and output formats will be identical.

Wide Screen Signalling (VSS) (– Signalling the current Aspect Ratio for the receiver

The current aspect ratio and other information for receivers of 16:9 formats are sent inserted in the 23rd line of the composite video signal by the decoder (according to ETSI EN 300 294). This service operates only in the 625 line PAL and SECAM systems. In this box the inserter can be switched on or off on demand.

Video Programming System (VPS) - Transmitting the Audio Mode and other parameters to receivers

The decoder inserts the VPS data into the 16th line of the composite video signal. So the modulator driven by the decoder output video signal can be controlled according to the current Audio Mode (mono, stereo, dual, etc.). The 16th line is often used for teletext transmission. To avoid disturbing teletext this inserter can be switched off here.

Video Freeze

When the input signal cannot be decoded (program change, noisy or ceased signal, scrambled signal) the user can set the decoder to hold the last perfect decoded picture or provide a blank screen.

ITU-R 656 Mode

Switch off this mode as the CW-488x and the CW-498x types have no digital video outputs.

Loading the program to the MPEG-2 Decoder

The course of programming the MPEG-2 Decoder units is as follows:

- Establish communication with the device and push the 'Query' button. (The reply to Query sets the 'IP Input/ASI Inputs' switch. When the software is used in unique application, the first step is to set the selector to the right position.)
- Choose one from the first 16 lines of the Settings List to store your program.
- Set all parameters of the MPEG-2 decoder.
- At the IP-input version set the multicast IP address and the port number. Set the NCO to Auto mode by deleting the text in the box.
- Use the 'Load Settings' to load the device.
- Read back the settings after a few seconds. At correct setting after reading the Video and Audio indicators go green for a few seconds to show that the reception is in order.
- After successful settings it is useful to save by the 'Save Settings as … ' button to the ini file.

After switching on the device, a logo appears at the output for a few seconds. (The logo can be changed on individual demand.) When the decoder detects input signal the logo disappears. In the TS the software starts searching for the parameters of the program loaded and stored by the 'Load Settings' button last time. (Thus the 'Load Settings' button does the storing simultaneously, separate storing is unnecessary.) If the search is successful the decoding of the program will start. The search can take up to 5…10 seconds depending on the number of the programs in the TS.

In case of unsuccessful setting go back to the selected line of the 'Settings List' and modify the faulty parameter then load the new program to the device. The reproduction of picture and sound by the Visual Tester module is independent from the settings sent to the decoder. The programs of the transport stream can be reproduced on PC independently from the decoder by clicking the pull down list of the Visual Tester or typing the required PID values in the box.

Practiced users can quicken the setting procedure by preparing their settings in the ini file. The name used at the settings and stored in the device helps identifying the settings.

7. Reading out the data from the MPEG-2 decoder

The user can get detailed information about the operation of the decoder and the program under decoding by the 'Read Settings' button any time. The information appears in the 'Report box1.

In the first group of information the user's settings can be checked by reading back directly from the decoder. The version number of the decoder controller software can be found here as well.

In the second group the user can find detailed information about the program under decoding and the elementary streams of the program. The information is mostly obtained by reading and processing the data from the headers of the transport streams. Their interpretation requires a deeper knowledge of the MPEG-2 encoding.

The main parameters are:

> ➢ The original width of the display in pixel.
> ➢ The original height of the display in the number of lines.
> ➢ The size of the video buffer. The minimum size of the buffer required for the given maximum bit-rate, to avoid overflow and underflow. (This is not suitable for measuring the instantaneous bit-rate.)
> ➢ Whether the video sequence contains a B picture.
> ➢ Video Level and Profile data.
> ➢ Aspect ratio, frame rate, input format information
> ➢ Sound encoding data.
> ➢ Sound bit-rate and sampling frequency

The specification contains the current PID values as well as the current operational status of the picture, sound and teletext decoder circuitry. At the end of the list the type of the decoder chip, the size of the RAM used for decoding and the date of the last programming can be seen.

The details for explaining the parameters are available in the following standards:

ISO / IEC 13818-1 -2 -3
ISO / IEC 11172-3

8. Comments, further information

We are pleased to receive (at cableworld@cableworld.hu) comments and remarks pertaining to our products and software and we take the included suggestions and ideas into consideration at further developments. At the same address we are ready to provide further information about the application of the products.