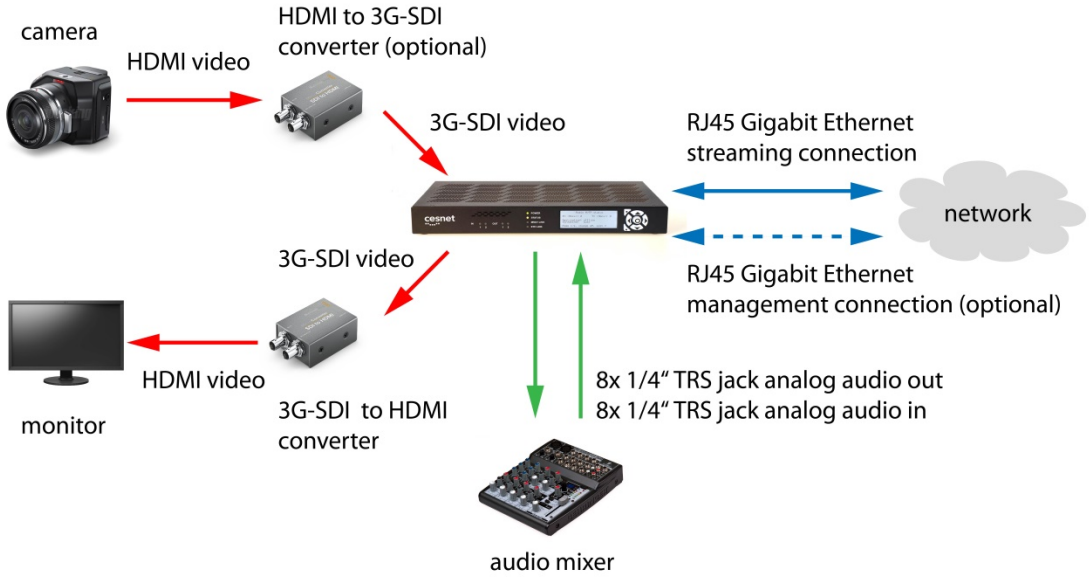
MVTP-Audio

Quick Start Guide

August 2021

1. Turn the MVTP-Audio device on.
2. Connect inputs and outputs as shown in the following diagram. Use HDMI / 3G-SDI adapters where appropriate for video inputs and outputs.
3. Check that the LED for the connected input is on when the input video signal is on.
4. Use the UP and DOWN buttons to move to the Streaming IP Configuration page. Use the CENTER button to enter the editing mode. Set the IP address, netmask and gateway. Confirm settings and exit the menu.
5. Use the UP and DOWN buttons to move to the Status page. Set the remote IP of the peer device. Check that Streaming is auto or yes, Destination is online and TX and RX bitrates are as expected.
6. Use the UP and DOWN buttons to move to the Input and Output Video Formats page. Check that video formats on inputs and outputs are as expected.



Troubleshooting:

- LED for video input is off – check the video signal source
- Destination is offline – use the ping command to check the reachability of the peer device
- RX bitrate is zero – check configuration of the peer device and check firewall settings
- RX bitrate is lower than TX bitrate of the peer device – check that enough network bandwidth is available
- No received video is displayed – check that the video signal uses one of the supported formats
- Received video is flickering – check and possibly increase the receiver buffer size. If increased buffering does not stop flickering, there is probably too high packet jitter or packet loss in the network. You can try decreasing the bitrate by using a video source with fewer frames per second (fps).

MVTP-Audio

User guide

August 2021

Contents

1. Introduction

The MVTP-Audio device transmits video and audio signals over a computer network with minimal added latency. The device is a true real-time system implemented in FPGA hardware and does not require a PC or any external hardware, such as a sound card or a video grabber card. The device can transmit bidirectionally a video signal in up to 1080p60 format, eight audio signals on analog interfaces, four digital audio signals embedded in 3G-SDI interfaces and two digital audio signals on S/PDIF interfaces. A typical setup is illustrated in Figure 1.

Fig. 1: Recommended connections of the MVTP-Audio device

Video input and output signals are connected through 3G-SDI interfaces. A camera with a 3G-SDI output can be connected directly to the 3G-SDI input on the device. A monitor with a 3G-SDI input can be connected directly to the 3G-SDI output on the device. A camera with an HDMI output can be connected using an HDMI to 3G-SDI adapter. A monitor with an HDMI input can be connected using a 3G-SDI to HDMI adapter. For instance, Blackmagic Design Micro Converters work fine.

The minimum configuration that needs to be performed is just setting the device streaming IP configuration and the remote IP address (see sections 7.1 and 7.2).

2. Specification

The main device characteristics are the following:

- 2x 3G-SDI inputs for up to 2x 1080p60 video signals[1]
- 2x 3G-SDI outputs for up to 2x 1080p60 video signals[1]
- 8x balanced or unbalanced TRS jack analog line-level audio inputs
- 8x balanced or unbalanced TRS jack analog line-level audio outputs
- 4-channel 3G-SDI embedded audio transmission

[1] Only the first SDI input and output are currently supported

- S/PDIF digital audio input and output
- Low-latency TICO compression for video
- Added latency of transmitter + receiver from approximately 1 ms, higher buffering may need to be set to compensate for network packet jitter
- 1x Gigabit Ethernet connection through the RJ45 interface for network streaming
- 1x Gigabit Ethernet connection through the RJ45 interface for management access (optional)
- Management and configuration using the front panel display with buttons, the built-in web interface or the command-line interface (using USB and SSH connectivity)

Supported video formats:

- 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94, 1080p60 (progressive video)
- 1080i50, 1080i59.94, 1080i60 (interlaced video)

All video formats support 4:2:2 10-bit color encoding.

Note that lower-resolution video formats, such as 720p, are currently not supported.

3. Connecting inputs and outputs

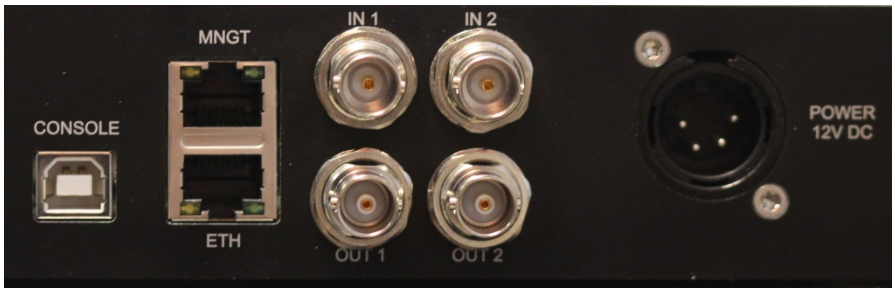
Network

The device includes two RJ45 Gigabit Ethernet interfaces:

- Streaming network interface – bottom RJ45 connector (must be connected)
- Management network interface – upper RJ45 connector (optional, needed for firmware update)

Video

The device includes two 3G-SDI video inputs and two 3G-SDI video outputs. Only the first input (IN1) and the first output (OUT1) are currently supported. The interfaces automatically switch between HD-SDI (for signals up to 1080p30) and 3G-SDI (for signals over 1080p30).



Audio

The device includes TRS (tip-ring-sleeve) 1/4'' jack interfaces for audio inputs and outputs:

- 8x input interfaces in the upper row
- 8x output interfaces in the lower row

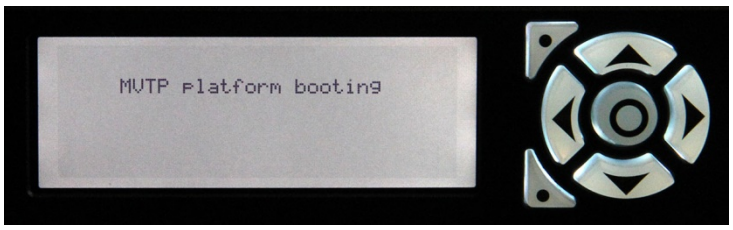
You can connect either symmetrical (balanced) or asymmetrical (unbalanced) 1/4'' plugs. The device expects line-level signals with +3 VU (+7 dBu or 5V peak-to-peak) as FS (full scale). The analog signals are converted by 24-bit/48 kHz ADC/DAC circuits.

USB

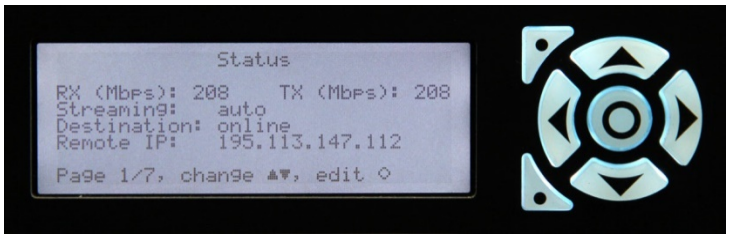
A USB connector can be used for device management through a command-line interface for advanced use.

4. Booting

Once the power is turned on, the device displays a booting message similar to this:

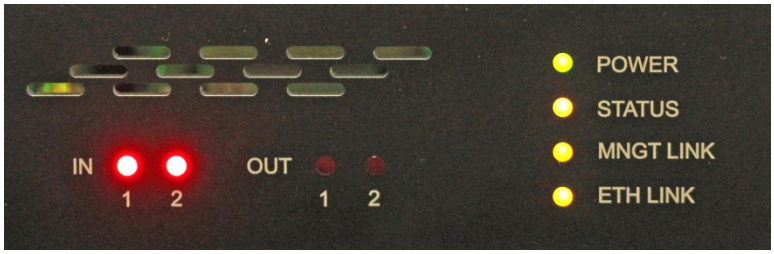


After booting successfully, configuration page 1 is shown:



5. Status LEDs

The front panel includes several status LEDs:



- IN 1 2 – indicates whether a video signal was detected on each 3G-SDI input
- OUT 1 2 – indicates whether a video signal is present on each 3G-SDI output
- POWER – green when the device is powered on

- STATUS – yellow when the device has successfully booted up
- MNGT LINK – yellow when a link has been detected on the management network interface
- ETH LINK – yellow when a link has been detected on the streaming network interface

6. Network bandwidth and firewall settings

The approximate network bandwidth used by the MVTP-Audio device for different video formats with the video compression rate set to 3 bpp including the eight audio channels is shown in Table 1. Additionally, in order to maintain very low added latency, the MVTP-Audio device needs a clean end-to-end network connection with minimal network packet jitter and no packet loss.

Video format	Network bandwidth
1080p25	180 Mbps
1080p30	210 Mbps
1080p50	350 Mbps
1080p60	410 Mbps

Table 1: Network bandwidth

The MVTP-Audio uses the following TCP/UDP ports for incoming packets that need to be enabled on the firewall:

- UDP, src port 30000, dst port 30000 – for video streaming
- UDP, src port 30001, dst port 30001 – for audio streaming
- TCP, dst port 80, src port any – access to a built-in web interface
- TCP, dst port 21, src port any – access to a command-line interface by SSH (optional)

The video and audio streaming packets must be enabled for the streaming network interface.

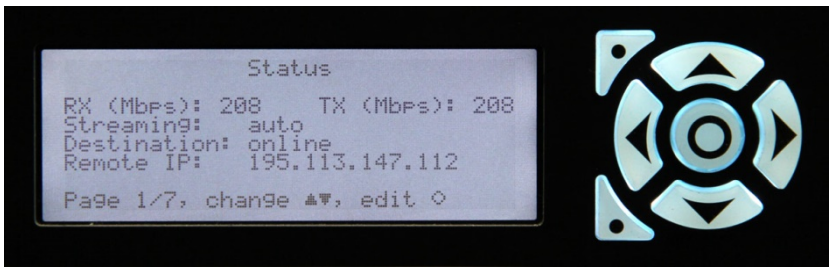
Packets for the web and SSH access can be enabled for the streaming network interface or for the management network interface. However, the firmware update through the built-in web interface can only be done through the management network interface.

7. Configuration through the front panel display

The front panel display shows the status and configuration information on several pages. The UP and DOWN buttons can be used to browse through all pages. During the initial setup, you need to configure at least the IP configuration on the Streaming IP Configuration page and the remote device IP address on the Status page. It is recommended to browse through all pages and configure all settings as needed. When you confirm the new settings on each page, the settings are stored to the FLASH memory and are persistent across device reboots. On each page, the CENTER button can be used to enter the editing mode.

7.1. Status

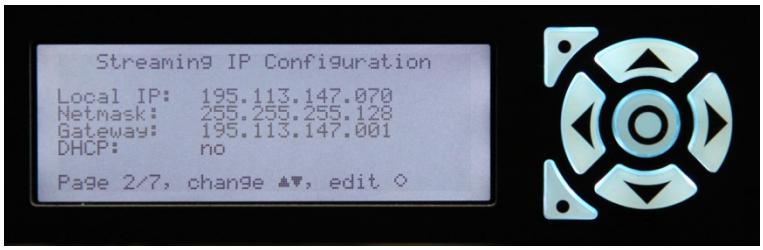
Page 1 shows the status information about network streaming and allows you to start and stop streaming and configure the remote device IP address.



- RX (Mbps) – shows the current incoming network bitrate
- TX (Mbps) – shows the current outgoing network bitrate
- Streaming
  - – set to auto (default), to enable streaming when the remote device is reachable
  - – set to yes, to force streaming
  - – set to no, to disable streaming
- Destination
  - – shows online when the peer device is reachable
  - – shows offline when the peer device is unreachable
- Remote IP – set to the remote device IP address

7.2. Streaming IP configuration

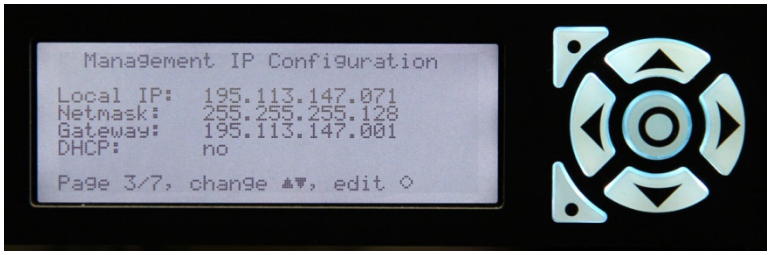
Page 2 allows you to set the IP configuration of the streaming network interface.



- Local IP – set to IP address of the streaming network interface
- Netmask – set to netmask of the streaming network interface
- Gateway – set to IP address of the default gateway
- DHCP
  – set to yes to use DHCP to obtain the IP configuration of the streaming network interface
  – set to no to manually configure the IP configuration of the streaming network interface

7.3. Management IP configuration

Page 3 allows you to set the IP configuration of the management network interface.



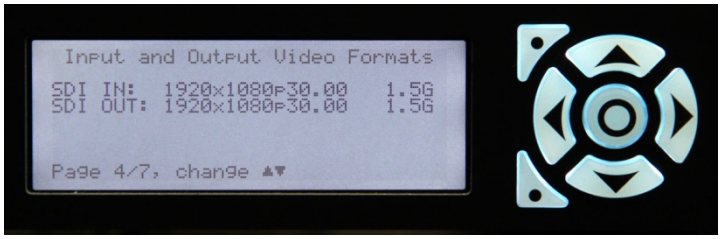
Configure the following items:

- Local IP – set to IP address of the management network interface
- Netmask – set to netmask of the management network interface
- Gateway – set to IP address of the default gateway
- DHCP

  – set to yes to use DHCP to obtain the IP configuration of the management network interface
  – set to no to manually configure the IP configuration of the management network interface

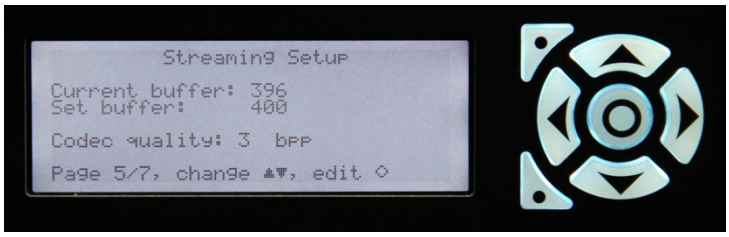
7.4. Input and output video formats

Page 4 shows detected video formats on inputs and outputs. There are no configurable items on this page.



7.5. Receiver buffer and latency

Page 5 shows the current receiver buffer size and allows you to set to desired average receiver buffer size and the video compression rate.



Current buffer – shows the number of packets with video data currently stored in the receiver buffer

Set buffer – set to the desired average number of packets with video data to be stored in the receiver buffer. Higher values increase resiliency to network packet jitter, but also increase the added latency. The default value is 100. Values lower than 100 packets require a highly stable network with minimal packet jitter.

Codec quality – set to the desired average number of bits per pixel (bpp) in the compressed video stream. Default and recommended value is 3. Possible values are from 2 to 5.

Latency

The added latency by a pair of MVTP-Audio devices (transmitter and receiver) for **video and SDI embedded audio** is shown in Table 2. Latency depends on the receiver buffer size and the video format. The same number of packets in the receiver buffer can represent a different time period for different video formats. The values in Table 2 have been measured for the firmware version 4.1.16 and the embedded software version 0.4.0.

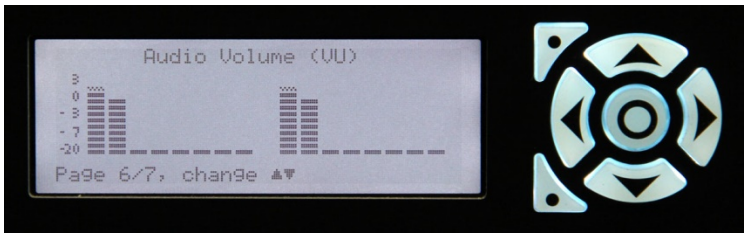
The added latency for **audio using analog inputs and outputs** is independent of the receiver buffer size and it is approximately 3.8 ms.

Receiver buffer size in packets	1080p60 video	1080p30 video
20	0.9 ms	2 ms
40	1.5 ms	3 ms
60	2.1 ms	4 ms
80	2.6 ms	5 ms
100	3 ms	5.9 ms
200	5.6 ms	11 ms
400	10.5 ms	21 ms
800	21.5 ms	42 ms

Table 2: Added latency for video and for embedded audio

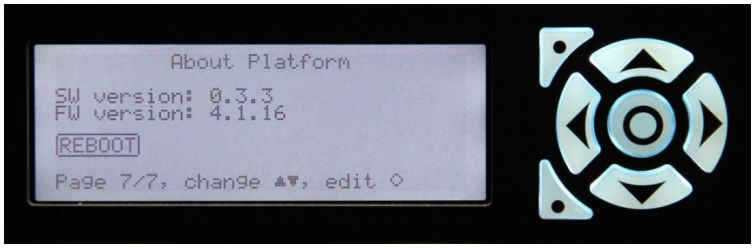
7.6. Audio volume

Page 6 shows the current volume on eight analog audio inputs and outputs as a VU meter. 0 VU is equal to +4 dBu. The maximum input level acceptable before saturation is +3 VU. There are no configurable items on this page.



7.7. Code version and reboot

Page 7 shows the current firmware version in the device and it allows you to reboot the device.



- Reboot – enter the editing mode and confirm or cancel the reboot request

8. Configuration through the built-in web interface

The status information and settings are also available through the built-in web interface. Use a web browser to connect to the IP address of the management network interface or the streaming network interface. Firmware updates are only possible through the management network interface.

The default password is "mvtpadmin".

8.1. Network tab

The network tab is shown in Fig. 2. The tab is divided into several sections:

- In the upper section, you can check the current incoming and outgoing network bandwidth and the number of received and transmitted packets
- In the **Streaming IP configuration section**, you can set the IP configuration of the streaming network interface using DHCP or manually
- In the **Management IP configuration section**, you can set the IP configuration of the management network interface using DHCP or manually

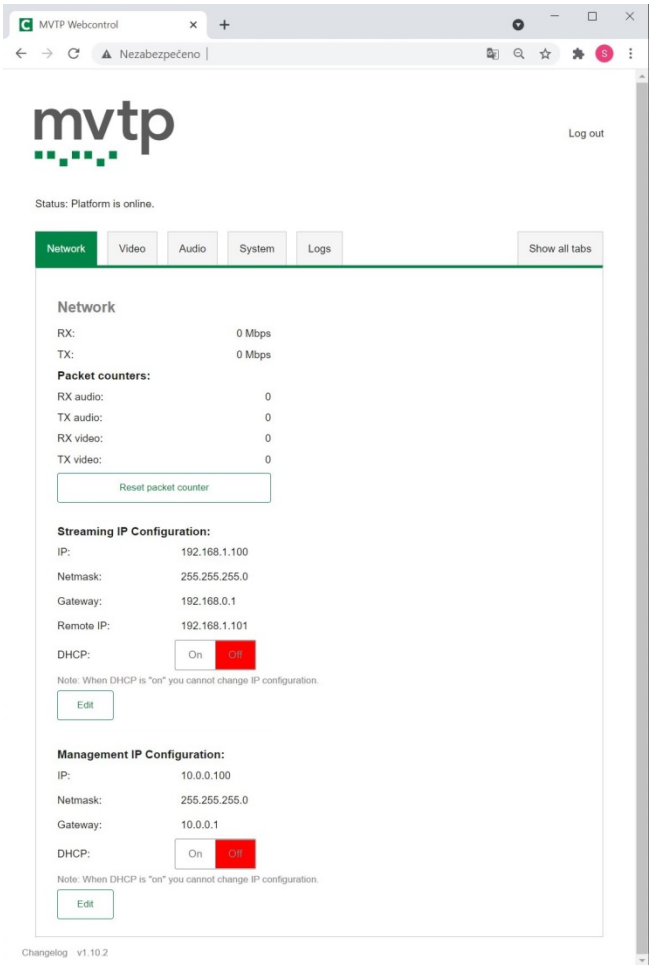


Fig. 2: Network tab of the built-in web interface

8.2. Video tab

The video tab is shown in Fig. 3. The tab is divided into several sections:

- In the **Streaming** section, you can check the reachability status of the remote device (online or offline) and set the streaming mode to on, auto or off. The default mode is auto, when the device streams video and audio when the remote device status is online. In the on mode, the device always streams video and audio, regardless of the reachability status of the remote device. In the off mode, the device does not stream video and audio.
- In the **Receiver buffer** section, you can check the current receiver buffer size and you can set the desired average receiver buffer size. See section 7.5 for more information.
- In the **Input format** and **Output format** sections, you can check the current detected video formats on video input and output interfaces.
- In the **Codec quality** section, you can set the desired average number of bits per pixel (bpp) in the compressed video stream. Default and recommended value is 3. Possible values are from 2 to 5.
- In the **Oscillator frequencies** section, you can check the current frequencies of device oscillators.

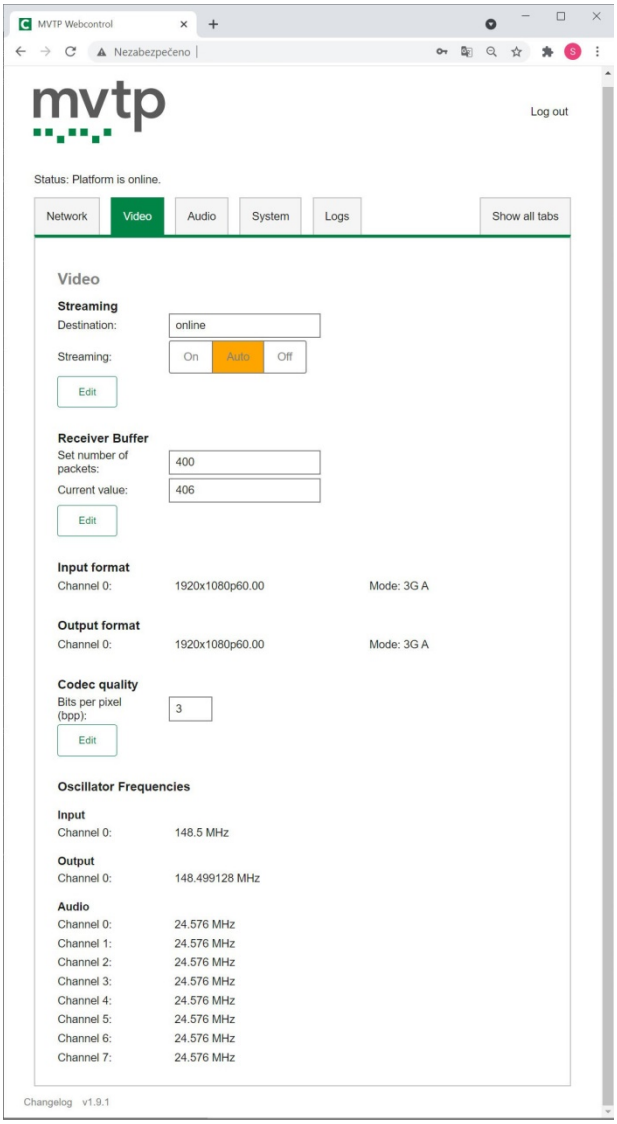


Fig. 3: Video tab of the built-in web interface

8.3. Audio tab

The audio tab is shown in Fig. 4. The tab is divided into several sections:

- In the **Volume (VU)** section, you can check the current volume on eight analog audio inputs and outputs as a VU meter. 0 VU is equal to +4 dBu. The maximum input level acceptable before saturation is +3 VU.
- When you click on the **Show text data button**, the numerical values of the current input and output volume are shown.

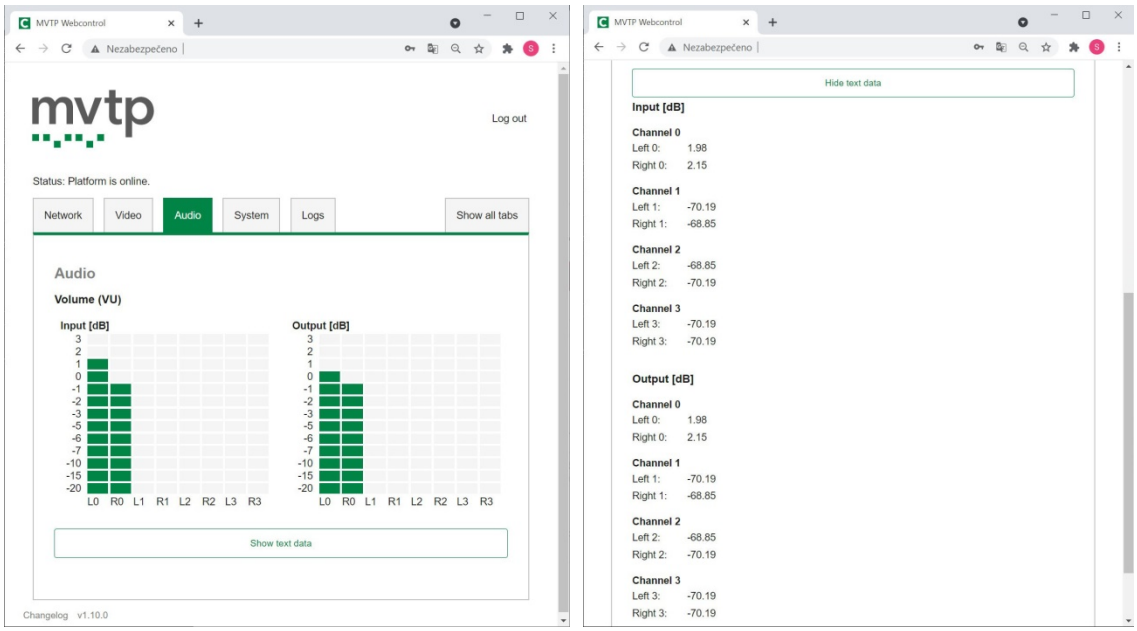


Fig. 4: Audio tab of the built-in web interface

8.4. System tab

The System tab is shown in Fig. 5. The tab is divided into several sections:

- In the **Versions** section, you can check the current versions of software (for the built-in ARM CPU) and hardware (for the FPGA circuit)
- In the **Temperature** section, you can check the current FPGA circuit temperature
- In the **Update software** section, you can open a window to browse your PC's filesystem, find the firmware file to be updated in the device and click on the Update button. The device firmware will be updated and the device will reboot.
- In the **Change Password** section, you can set the new password to access the built-in web interface

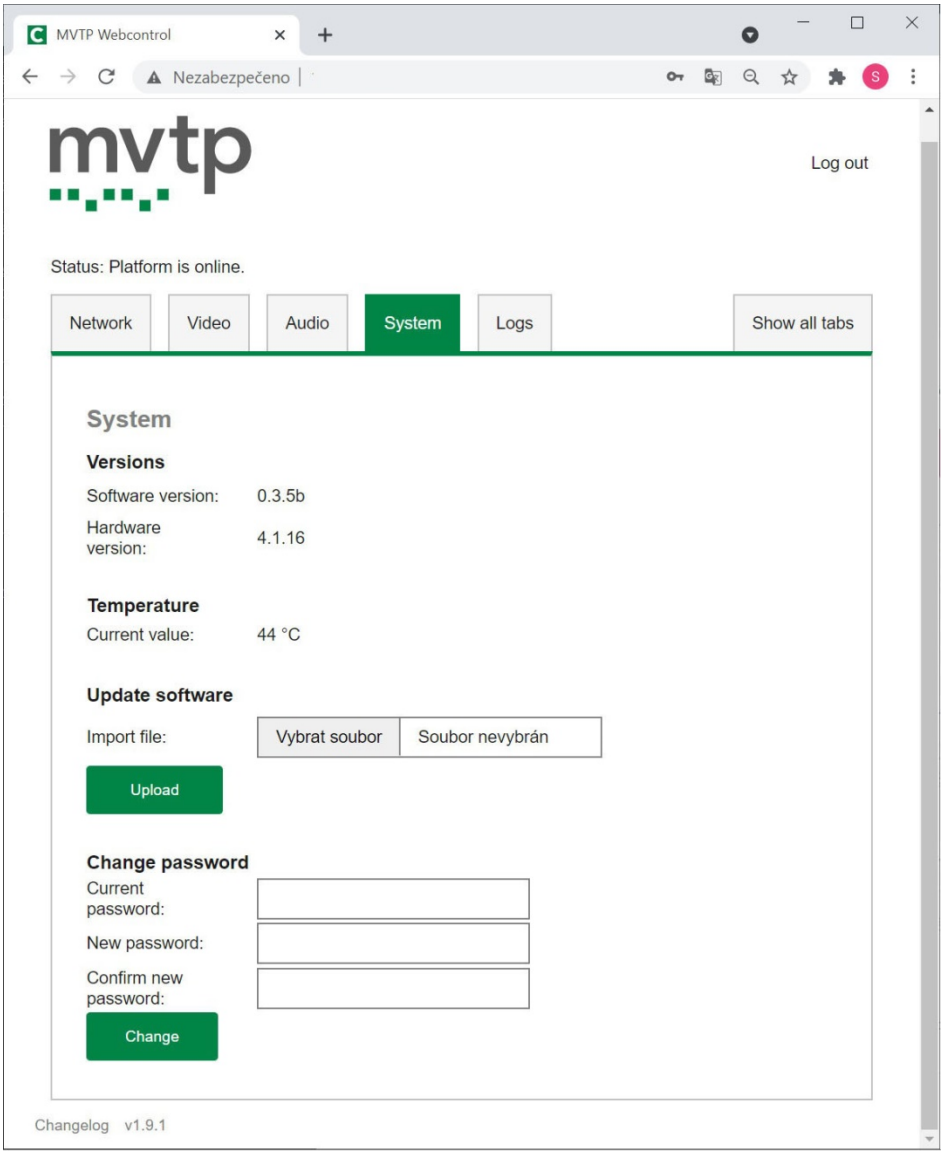


Fig. 5: System tab of the built-in web interface

8.5. Logs tab

The Logs tab is shown in Fig. 6. When you click on the **Start recording** button, the device starts recording certain internal variables and presents their development in time in a diagram. Currently, two internal variables can be monitored – the frequency of the video receiver oscillator and the number of video packets in the receiver buffer.

You can drag a mouse to zoom in on the area inside the diagram or reset the zoom by clicking on the Reset zoom button. You can stop recording by clicking on a Stop recording button. You can save the diagram into a file on your PC by a right-click on the diagram or by clicking the Download graph as a png button after recording stopped.

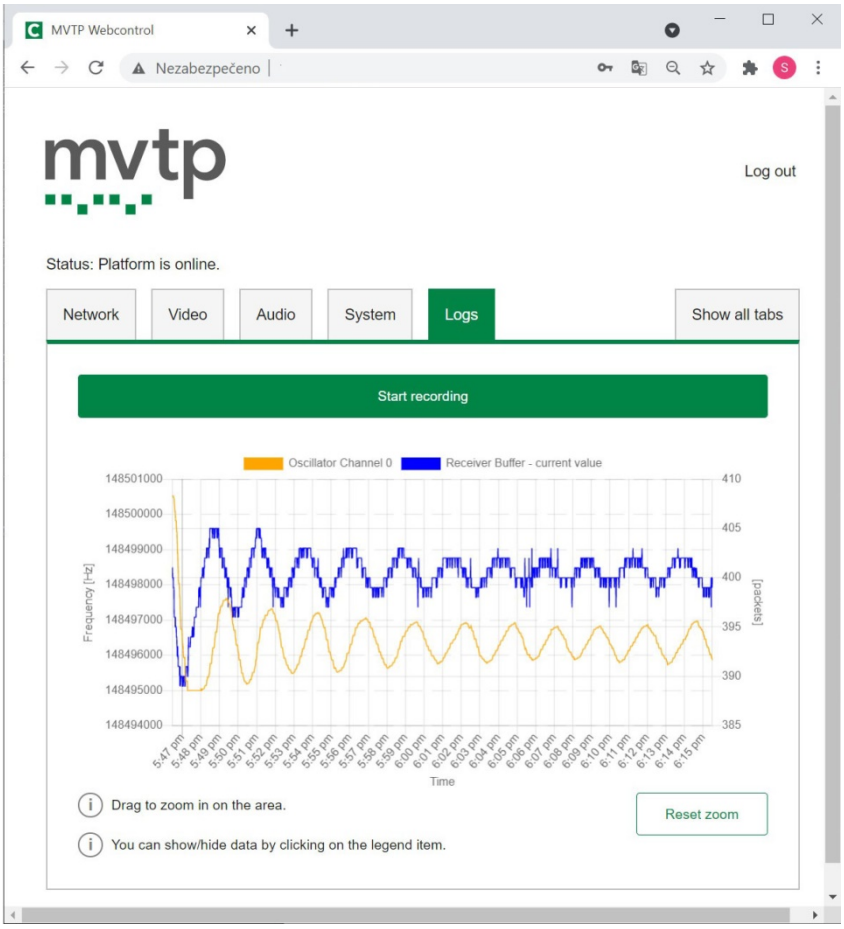


Fig. 6: Logs tab of the built-in web interface

9. Contact

CESNET, z.s.p.o.
Zikova 4
160 00 Prague 6
Czech Republic

E-mail: mvtp@cesnet.cz
WWW: http://mvtp.cesnet.cz