MPX-1c
User Manual



FM-MPX over IP Codec

MPX-1c User Manual V2.3

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Your audio. Our solution.

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2 About this Manual

You can download the latest version of this user manual here:

http://download.2wcom.com/products/MPX1c_HDBA/

2.1 References and Hyperlinks in this PDF File

If you are reading this manual as a non-print version, please note that this PDF file contains bookmarks. You can navigate through the document via the content overview in your PDF viewing software if you enable bookmarks view.

All references to pages, sections, figures, and tables in the text identify a location within this PDF file. Click on the reference to jump to the referred passage in the text.

2.2 Tags and Their Meanings

The following signal words and signs warn you about risks and dangers:

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Describes precautions necessary to protect the equipment.
	Contains useful information for the user.


Warning of general danger situation


Warning of electric shock


Warning of hot surface


Warning of fire hazard

3 For Your Safety

The device conforms to the relevant European directives and is safely constructed. Nevertheless, some residual dangers remain. 2wcom Systems GmbH accepts no liability for any damage caused by non-observance of the safety instructions.

- Read through this user manual carefully before using the device. If you pass on the device, be sure to also include this user manual.
- Any improper use of the device and all actions on the device not described in this user manual are considered as misuse outside the statutory limits for liability of the manufacturer.
- Only operate the device if it is in a technically perfect condition. If the device or a part of it is defective, take the device out of operation. Do not repair the device yourself. In case of any damages, send the device to 2wcom immediately for inspection or dispose of it properly according to the regional disposal regulations.
- Keep the device away from unauthorized persons.



Danger from electric current!

- Plug the device into a grounded power socket only. Never remove the grounding wire/contact.
- Do not open the housing of the device by yourself. Do not touch open electrical parts.
- Dangerously high voltages are present inside the housing. Even after disconnecting the mains supply, dangerously high voltage levels may be present for a certain time.
- Do not touch the device when your hands are wet.
- Never expose the device to liquids. If any liquid gets inside the housing, immediately disconnect the device completely from the power supply. Do not continue operating the device.



Fire hazard due to overheating or electric current!

- Ensure sufficient heat dissipation during operation. Avoid the following when installing the device:
  - Non-ventilated environment, e.g. a narrow shelf or built-in cabinet
  - Extremely warm or cold place
  - Direct exposure to sunlight
  - Too high or too low temperatures
  - Extremely wet or dusty environment
- Do not cover the ventilation openings of the device to avoid heat accumulation.
- Do not operate the device in the presence of flammable gases.
- Do not place objects with open flames, such as burning candles, on the device.
- Do not place any heavy objects on the supply cord. A damaged cord can lead to fire or electric shock hazards.
- When disconnecting the supply cord, always pull on the plug, never on the cable, to avoid cord damage.



Danger from explosive atmosphere!

- Do not use the device in an explosive environment.

Warning of hot surface!

The device may heat up greatly during normal operation despite an active cooling system.

- Do not touch the surfaces of the device during or shortly after operation.

Risk of equipment damage!

- Before each use, check the housing, the front panel, the cable and the power plug for visible damage and defects (e.g. scratches, cracks, wear and tear, damaged insulation, improper plug connections or extension cables).
- If the power cord is damaged, immediately disconnect the power plug. Never use the device with a damaged power cord.
- All damaged components must be replaced immediately.
- Only use a grounded three-wire power supply cord and plug that complies with the national regulations.
- Make sure that the power socket is next to the device and readily accessible to the user.
- External devices which are connected to the device could be damaged by the device or damage the device itself if the output levels exceed the specified limits.
- Do not use corrosive detergents on the device such as benzene, thinner, alcohol or acetone. Clean the surface of the device with a soft, dry cloth only.

4 Product Overview

4.1 About the MPX-1c

The MPX-1c is a point-to-point or point-to-multipoint MPX codec using IP-based network technologies for real-time distribution of complete FM-MPX (FM composite signal) to connect your signal generation in the studio directly to the transmitter site. The MPX-1c offers you high-level technology, reduced to the essential feature set to ease your operation.

Flexible in application: The codec is designed for broadcasters with single stations using this technology, professional requirements to the signal quality, and the flexible usage in their network. The same box can be used as an Encoder or Decoder. The MPX-1c has always analogue and digital interfaces. Optionally, it is possible to reduce the bandwidth via µMPX.

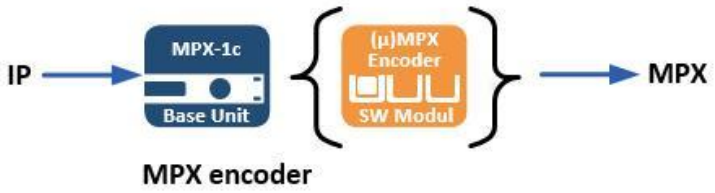
Easy operation: The MPX-1c makes individual sound processing (stereo generation) and RDS generation on each transmitter site obsolete and moves it back into the studio/playout center where the signal is generated. The signal is generated once and can be distributed to various transmitter sites via IP (multichannel). This saves rack space, service, and support on the transmitter site.

Saving bandwidth: To transport a complete FM-MPX signal in the highest quality possible (192 kHz, 24 bit), a bandwidth of up to 5Mbps is required. By enabling the µMPX mode, the MPX-1c is able to reduce the bandwidth even further to 800 kbps down to 320 kbps.

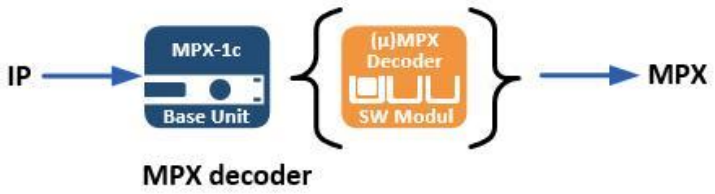
Pay as you grow: All soft- and hardware components are individually combinable.

Transmission robustness: Dual Streaming and Pro-MPEG FEC ensure rock-solid IP transmission, or you go beyond with RIST or SRT (secure reliable transport). The optional two hot-pluggable power supplies guaranteeing fail-safe operation perfect the whole concept.

Smart management: Configuration set-up via an easy-to-use web interface for general settings as well as for backup or fall back. For remote control, the codec offers various possibilities—HTTP, FTP, Telnet, NMS, SNMP. Perfect synchronization can be achieved by PTPv2 and latency control.



MPX encoder



MPX decoder

4.2 Software Rights

Software rights enable additional functions. Some rights may be included in the base version of the product, others are available as an optional purchase. The following table displays an overview of the software rights that are available for the MPX-1c:

Right	Description
Encoder	Number of encoders
Decoder	Number of decoders
µMPX Decoder	Option to use µMPX decoders
µMPX Encoder	Option to use µMPX for encoders
SRT Decoder	SRT and RIST functionalities for decoders
SRT Encoder	Option to use SRT or RIST for encoders
MPE	MPE (Multiprotocol Encapsulation) decoding/encoding
TS Encoder	Option to use transport stream over IP using UDP/RTP, unicast/multicast for encoders
TS Decoder	Transport stream over IP using UDP/RTP, unicast/multicast for decoders
SPN	Option to use SPN (synchronous playout network) for synchronous playout via NTP time server. Accuracy: < 20 ms

4.3 Front Panel



1 **Headphone:** 6.3 mm / 1/4” socket for the connection of headphones

2 **LCD Screen:** Illuminated LCD screen, graphical, 264x64 pixels

3 **[Warning] LED:** LED indicator for alarms. For more information, see 9.1 Status LEDs.

4 **[Input] LED:** LED indicator for signal inputs. For more information, see 9.1 Status LEDs.

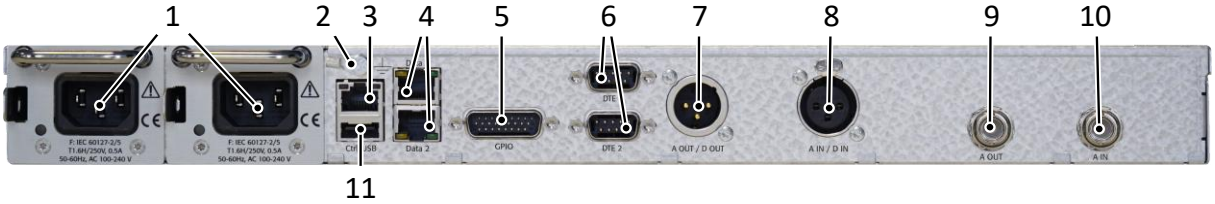
5 **[Output] LED:** LED indicator for signal outputs. For more information, see 9.1 Status LEDs.

6 **[Power] LED:** LED indicator for the dual power supply. For more information, see 9.1 Status LEDs.

7 **Reset pin hole:** Recessed button for resetting the device (warm start and recovery mode)

8 **Jog wheel:** For operating the device via the LCD screen

4.4 Back Panel



1 **Power supply unit:** Mains supply voltage IEC socket.
Optional redundant power supply through a second power supply unit:
- Option 1: standardized IEC hot-swappable power supply connector; 90-260 V, 47-63 Hz; automatic switchover.
- Option 2: power supply 48 V DC.
Combination of power supply 230 V AC and 48 V DC is possible.

2 **Grounding stud:** This stud can be used to connect a grounding system if necessary.

3 **[Ctrl]:** RJ-45 connector, 10/100/1000 Base-T interface for controlling and monitoring the device via Ethernet. The device can communicate with the IP network and can be configured via the integrated web interface using an internet browser.
The LEDs show the link status (green, active if a physical network connection exists) and the activity status (yellow, active if data communication is active).

4 **[Data]:** 2x RJ-45 connector; 10/100/1000 Base-T interface for two redundant outputs for data, audio and GPIO transmission via Ethernet.

5 **[GPIO]:** 26-pole D-Sub male connector; combined connector for inputs (GPI) and outputs (GPO).

6 **[DTE]:** 2x 9-pole D-Sub male connector for serial RS-232C data communication.

7 **[D OUT][A OUT]:** AES/EBU male interface, 110 Ω, for the output of digital audio. Integrated XLR male connector; output of the analog audio signal.

8 **[D IN][A IN]:** AES/EBU female interface, 110 Ω, for the input of digital audio. Integrated XLR female connector; input of the analog audio signal. For the MPX-1c, this is MPX.

9 **[A OUT]:** BNC socket, 50 Ω, output for analog signals.

10 **[A IN]:** BNC socket, 50 Ω, input for analog signals. For the MPX-1c, this is MPX.

11 **[USB]:** USB 2.0 interface for service, configuration and firmware.

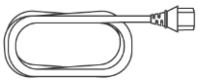
5 First Steps

5.1 Checking the Delivery Contents

Use the following list to check the completeness of delivery. The delivery contents may vary in exceptional cases.



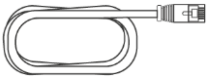
MPX-1c



Power cord



Link to product data



Network patch cable

5.2 Installing the Device

For the device to operate safely, note the following regarding the location:

- Mount the device securely and stable in a 19-inch rack designed for this purpose.
- Avoid direct sunlight, direct proximity to radiators and air conditioners, dust, water and chemicals
- When setting up the device, make sure that it is placed at a suitable viewing angle to the displays and that the device has sufficient heat dissipation.

5.3 Connecting the Signals

Before connecting the device to the power supply, first connect the inputs and outputs of the device to the corresponding connectors:

1. For encoding, connect the signal inputs to [D IN / A IN] and/or BNC [A IN].
2. For decoding, connect the signal outputs to [D OUT / A OUT] and or BNC [A OUT].
3. Connect a network patch cable to [Ctrl] and to your existing network.
4. Connect network patch cables to [Data] and to your existing network.
5. Use the headphone output for monitoring the input/output audio signals.

✓ You have connected the device. Continue with connecting the power supply.

5.4 Connecting the Power Supply

NOTICE **Risk of equipment damage!**

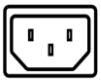
➢ Make sure that the device and the contained cords are compatible to the domestic line voltage and frequency!

Optionally, the device comes with 2 exchangeable plug-in power supply units which can be equipped with different redundant power supply connectors: either IEC sockets or Neutrik powerCON sockets.

If the device is equipped with a primary and a secondary power supply, then the primary power supply is used. If the primary power supply fails, then the device promptly switches to the secondary power supply and the status changes immediately on the **Device** status page. If the secondary power supply fails, then the device does not need to switch the power supply source and it takes at least 1 minute for the status to update on the **Device** status page.

If the device is equipped with hot-pluggable power supplies, both power supply cassettes must be installed and used during operation. Operating the device with only one cassette may result in improper cooling, reduced mechanical integrity, and compromised overall system reliability.

IEC socket



IEC socket: 230 V AC, 90-260 V AC, 47-63 Hz

- Connect the power supply cord fully to the IEC socket at the back panel of the device and to an independent mains power outlet.

✓ You have connected the power supply to the device. The [Power] LED is green if both power supply cords are connected. The [Power] LED flashes green/red if only one power supply cord is connected.

Neutrik powerCON socket

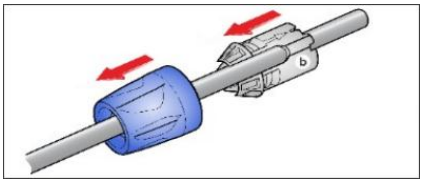


48 V DC Neutrik powerCON socket with aut. switchover (NAC3MPA 1) and Neutrik powerCON connector (NAC3FCA)

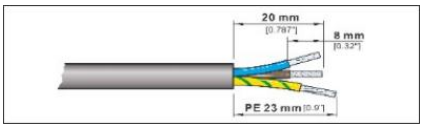
NOTE: The corresponding power cords are not part of the delivery contents!

To prepare and connect the Neutrick powercon connector:

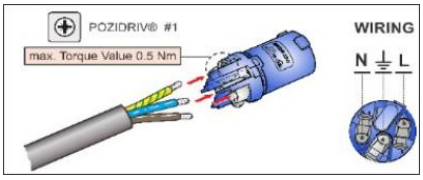
1. Slide the clamping sleeve and collet onto the cable.



2. Remove part of the insulation.

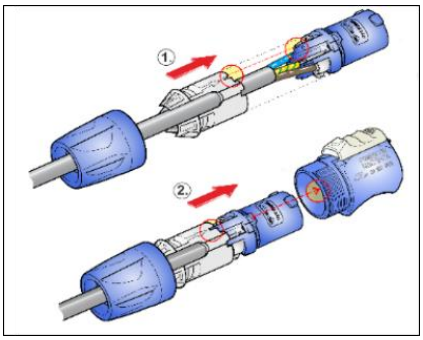


3. Insert the wires into the clamping holes on the inset and fasten them with screw and clamping plate using a screwdriver.



If you use the voltage of +48 V and 0 V, fasten the +48 V wire to **L** in the connector.
If you use the voltage of 0 V and -48 V, fasten the 0 V wire to **L** in the connector.

4. Push the inset and collet into the housing (observe guide ribs and guide slot).



5. Tighten the clamping sleeve with a wrench.
6. Connect the power supply cord fully to the powerCON socket at the back panel of the device and to an independent mains power outlet.

✓ You have connected the power supply to the device. The [Power] LED is green if both power supply cords are connected. The [Power] LED flashes green/red if only one power supply cord is connected.

5.5 Configuring the Network

NOTICE **False connection of the Ethernet interfaces will lead to incorrect operation!**

- Use the [Data] interfaces only for data transfer.
- Use the [Ctrl] interface only for the access to the device via the web interface and for SNMP.
  To change the supported services per interface, see 5.1 Configuring the Interface Services.

To transfer data over IP and access the device via the web interface, you must connect the device to your IP network.

For the [Ctrl] interface, DHCP is enabled by default. When you connect the device to your DHCP-enabled network, it will automatically get the IP configuration for the [Ctrl] interface. To view the obtained IP

address, turn the jog wheel to the left to see the “System Info” display. Here you will find the obtained IP address and further system information.

To connect the device to your IP network and change the IP setup via the LCD menu:

1. Push the jog wheel to enter the configuration menu.
2. Turn the jog wheel to focus the **Network** tab and push the jog wheel.
3. Push the jog wheel to enter the menu for the [Ctrl] interface.
4. Configure the settings for your existing IP network (IP address, netmask, gateway etc.). Consult the responsible network administrator if applicable.
5. Turn the jog wheel until the **Save** menu item is selected and push the jog wheel.
6. In the dialog window, select **Yes** to save the settings and restart the device.

✓ The device is now connected to the IP network.

5.6 Accessing the Web Interface

The device can be fully operated via the integrated web interface using an internet browser. For this purpose, use a computer that is connected to the same IP network that the device is connected to.

Requirement: You have already connected the [Ctrl] interface to the network.

1. Access the web interface by entering the IP address of the device into a web browser.
   ➢ A login screen appears.
2. Enter the username and password.

✓ The main page of the web interface appears.

The default login data (case sensitive) are:

- For read-only access: **user** / **user**
- For full access: **manager** / **manager** or **admin** / **admin**



Change the login data as soon as possible to avoid unauthorized access to the MPX-1c and document the login data in a safe place.

5.7 General Operation

5.7.1 Operation via web interface

The MPX-1c has an integrated web interface. You can make all configurations and operations using a web browser.

Note the following rules when operating the device via web interface:

- If you want to keep any changes made in the configuration of the device, click the corresponding **Save** button.
  The changes in each block must be saved individually. If you changed data in several blocks or tabs, click the **Save** button under each block to save all changed data. Otherwise, any unsaved block will be reset to the previously saved status when leaving the page.
- If you do not want to keep the changes, leave the page without saving or reload the page.
- Use a decimal point as the decimal separator in numbers in the input fields (i.e. “6.5” for “six and a half”).

5.7.2 Operation via LCD menu

Some basic functions of the device can be operated via the LCD menu and jog wheel.

The display has 2 main menus:

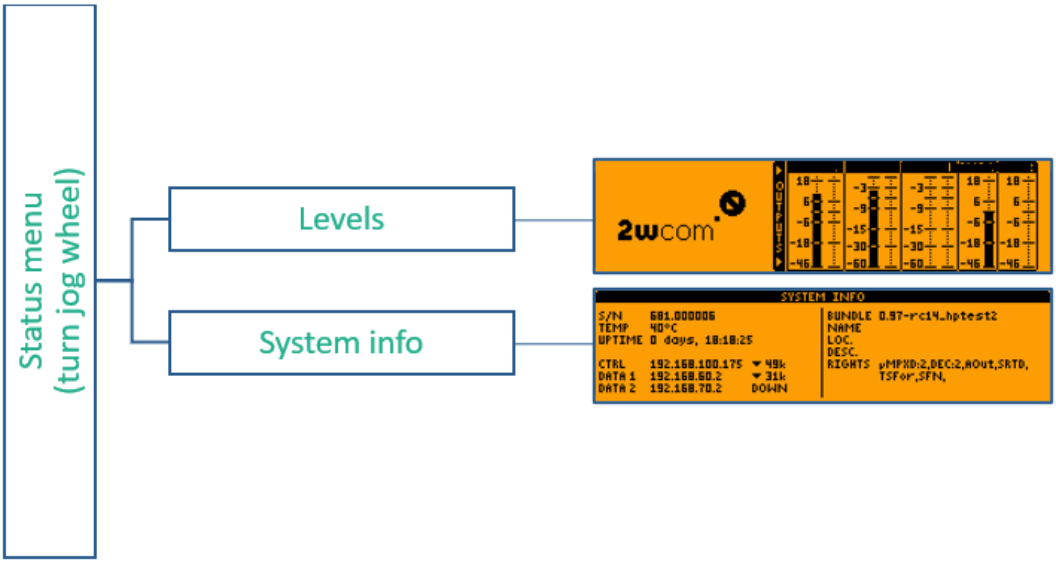
- Status menu (turn jog wheel left or right)
- Configuration menu (push jog wheel)

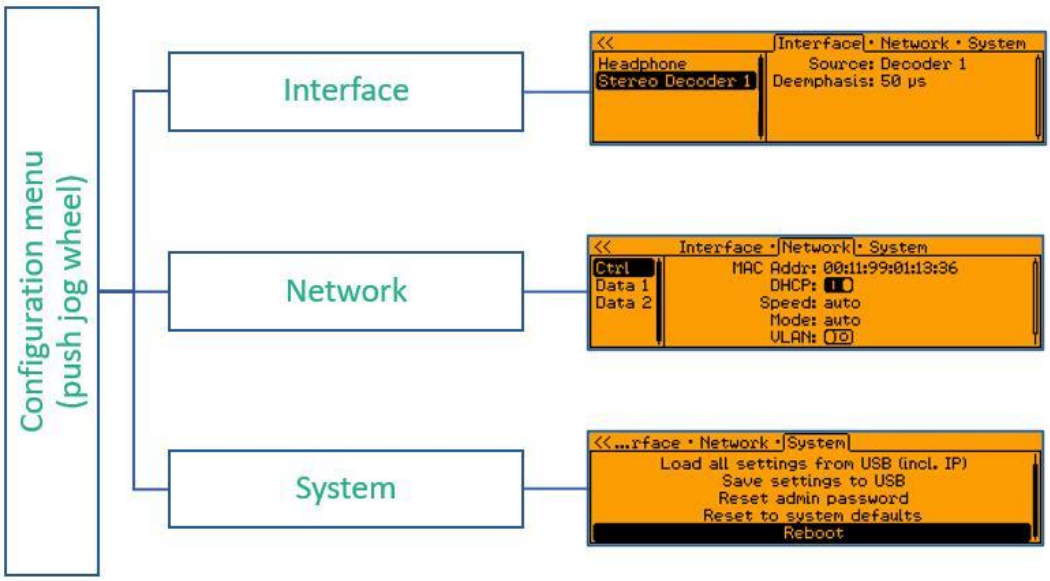
After a warm or cold start of the device, the display shows the default screen of the status menu. When you navigate in the LCD menu, the display returns to the Status Overview after few minutes of inactivity.

Note the following when operating the device via the LCD menu:

- To switch from the status menu to the configuration menu, push jog wheel.
- To move the focus in the menu structure, turn jog wheel.
- To open a menu tab, focus the tab and push jog wheel.
- To select a configurable menu entry, focus the entry and push jog wheel.
- To configure the selected menu entry, turn jog wheel.
- To confirm changes in a menu entry, push jog wheel.
- To return to the previous menu level, select ≪.

Navigation structure

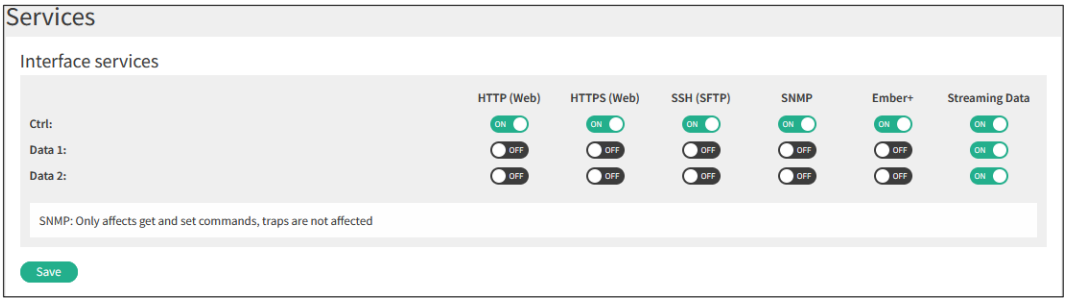



Configuration menu
(push jog wheel)
Interface
Network
System
<< Interface • Network • System
Headphone
Stereo Decoder 1
Source: Decoder 1
Deemphasis: 50 µs
<< Interface • Network • System
Ctrl
Data 1
Data 2
MAC Addr: 00:11:99:01:13:36
DHCP:
Speed: auto
Mode: auto
VLAN:
<<...rface • Network • System
Load all settings from USB (incl. IP)
Save settings to USB
Reset admin password
Reset to system defaults
Reboot

6 Network Settings

6.1 Configuring the Interface Services

For each ethernet interface, you can select the services by which the interface can receive and send data.



To select the supported services.

1. Navigate to the page **Services**.
2. For each individual interface, define which data can be received and sent.
3. Click **Save**.

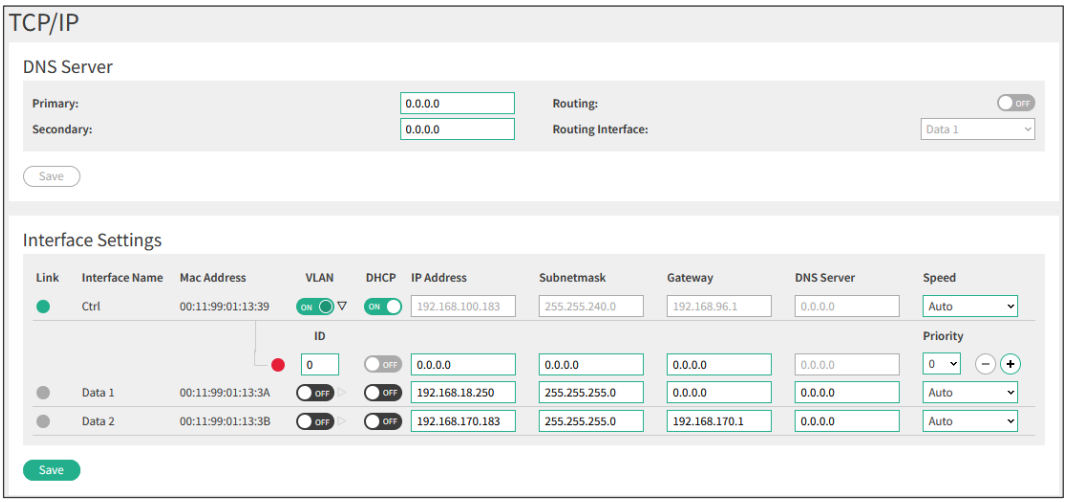
✓ The interfaces now only support the selected services.

6.2 TCP/IP: Configuring the Ethernet Interfaces

The MPX-1c has several Ethernet interfaces: 1 for configuration and the others for data exchange. Configure the interfaces for data transmission.

NOTICE **False connection of the Ethernet interfaces will lead to incorrect operation!**

- ➢ Use the [Data] interfaces only for data transfer.
- ➢ Use the [Ctrl] interface only for the access to the device via the web interface and for SNMP.
  To change the supported services per interface, see 5.1 Configuring the Interface Services.



To configure the ethernet interfaces:

1. Navigate to the page **TCP/IP**.
2. Configure the parameters for the DNS Server, Ctrl and Data interfaces.



The necessary address settings depend on the individual network and should be assigned by the responsible network administrator, if applicable.

3. Click **Save**.

✓ The ethernet interfaces are now configured.

Parameters

Primary	Enter the IP address of the primary domain name server (DNS).
Secondary	Enter the IP address of the secondary domain name server (DNS).
Routing	Enable the Routing, which enables the DNS server to send and answer the requests over different [Data] interfaces.
VLAN	Enable VLAN and enter a VLAN ID (1-4095).
Priority	Assign a priority (1-7) to this stream to add a priority code point (PCP) according to the IEEE 802.1Q specification. Select 0 to disable the priority and use best-effort delivery.
DHCP	Enable dynamic host configuration protocol (DHCP) which enables the device to get an IP address automatically.
IP Address	If DHCP is disabled, then assign an IP address to the interface.
Subnetmask	Enter the subnetmask for the IP address.
Gateway	Enter the address of the local system that is used for the internet access (e.g. the router).
DNS Server	Enter the IP address of the DNS server used.
Speed	Set the network connection speed in Mbps or select **Auto**.

6.3 Using TCP/IP Tools for Network Testing

The MPX-1c features built-in TCP/IP tools for testing and diagnosing network connections. Use the ping tool for quick connectivity checks and basic latency measurements. Use the traceroute tool for a detailed analysis of the network path and to diagnose routing issues.



Using the Ping Tool

The ping tool helps you determine the connectivity status and latency between the MPX-1c and a specified network destination.

1. Navigate to the **TCP/IP** page and select the **Tools** tab.
2. Configure the parameters in the **Ping** block:

Destination	Enter the hostname or IP address of the destination you want to ping.
Interface	Select the network interface to use for the ping request
Count	Specify the number of ping requests to send. The default is 10.
TTL	Set the maximum number of hops (routers) the ping request can pass through. The default is 255.
Data size	Define the size of the ping packet in bytes. Enter 0 to use the default size.

3. Select **Start** to initiate the ping test.
4. Select **Stop** to end the ping test at any time.

✓ The results are displayed in the **Output** block. The ping results show each packet's response time and any packet loss, indicating the connection quality and latency.

Using the Traceroute Tool

The Traceroute tool helps you trace the path that data packets take from the MPX-1c to a specified network destination. This helps identify any delays or issues occurring along the path.

1. Navigate to the **TCP/IP** page and select the **Tools** tab.
2. Configure the parameters in the **Traceroute** block:

Destination	Enter the hostname or IP address of the destination you want to trace.
Interface	Select the network interface to use for the traceroute.
Max. hops	Specify the maximum number of hops (routers) the traceroute should attempt.
Time to wait	Set the maximum time (in seconds) to wait for each hop's response.

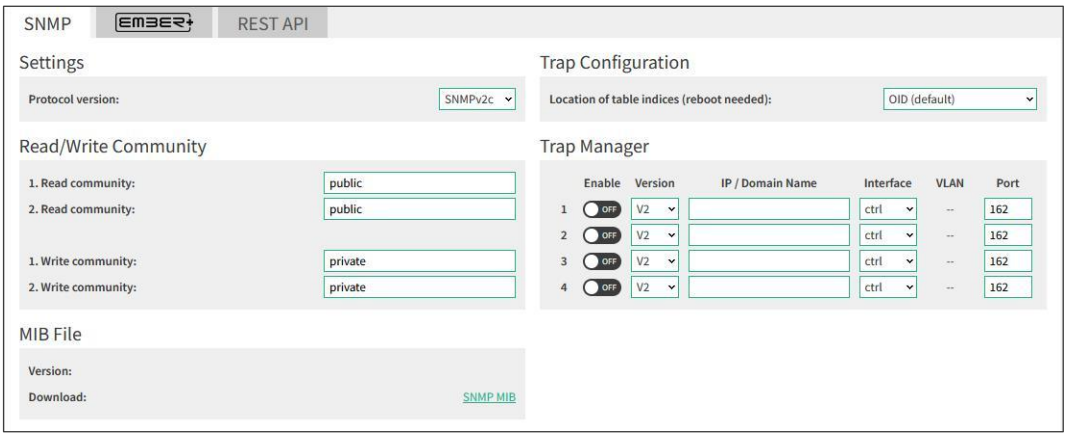
3. Select **Start** to initiate the traceroute test.
4. Select **Stop** to end the traceroute test at any time.

✓ The results are displayed in the **Output** block. The traceroute results list each hop's IP address and response time.

6.4 SNMP: Configuring Access Data for External Requests

You can configure access data (read community/write community) that is necessary for external SNMP requests to the MPX-1c.

SNMP (Simple Network Management Protocol) is a protocol used for managing and monitoring network devices. SNMP requests can be used to retrieve information such as the MPX-1c's current settings and performance metrics. This information can be used to diagnose problems and optimize network performance. SNMP requests can also be used to configure the MPX-1c remotely, allowing administrators to adjust settings.



For the SNMP manager tool to operate correctly, it requires the specific MIB files. These MIB files must be compiled by your SNMP manager tool. You can save the MIB files in the block **MIB File**.

1. Navigate to the page **External APIs**.
2. Click on the tab **SNMP**.
3. Select the protocol version in the block **SNMP Protocol**.
4. Configure the parameters in the block **Read/Write Community** or **SNMP3 / Security**. The parameters differ depending on the selected protocol version.
5. Click **Save**.

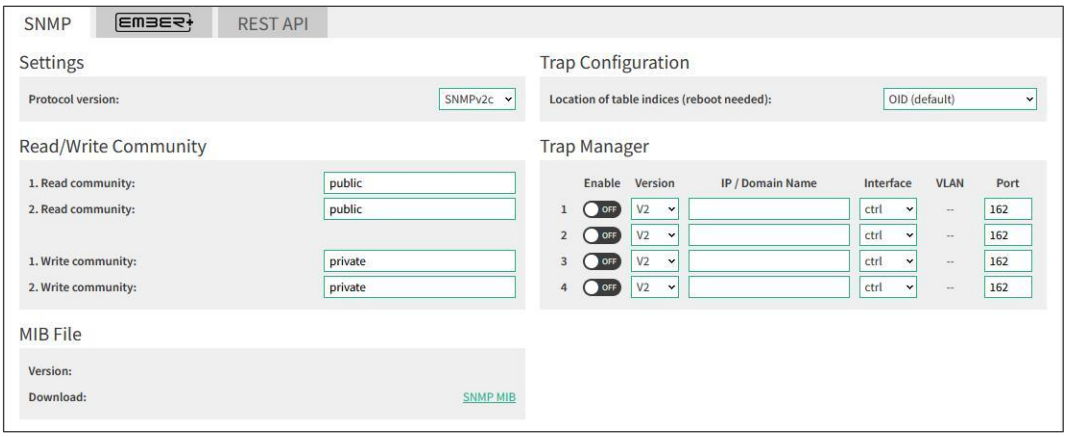
✓ You have configured the access data for external SNMP requests.

Parameters

Read Community	Enter SNMP access data for the external read-only SNMP access to the device.
Write Community	Enter SNMP access data for the external write SNMP access to the device.
Read/Write user	Enter user name and password for the external write SNMP access to the device.
Read/Write user	Enter user name and password for the external read-only SNMP access to the device.
Security protocols	Select an authentication protocol and a privacy protocol.

6.5 SNMP: Configuring Trap Managers

As part of the monitoring function, the device can send SNMP traps to the defined IP addresses of the SNMP managers. SNMP traps are messages that are sent from a network device to a central management system when a specific event or condition occurs. SNMP traps are used as a means of notifying network administrators of important events, such as errors or performance issues, allowing them to take corrective action as needed. You can also readout the settings via SNMP Get.



For the SNMP manager tool to operate correctly, it requires the specific MIB files. These MIB files must be compiled by your SNMP manager tool. You can save the MIB files in the block **MIB File**.

1. Navigate to the page **External APIs**.
2. Click on the tab **SNMP**.
3. Select the protocol version in the block **SNMP Protocol**.
4. Select the location of the table indices in the block **Trap Configuration**: OID or OID plus additional index.
5. Configure the parameters in the block **Trap Manager**.
6. Click **Save**.

✓ You have configured the trap managers. If you changed the location of table indices, the MPX-1c must reboot. Each enabled trap is sent once at startup for initialization.

Parameters

Version	Select the format version of the SNMP traps.
IP or Domain Name	Enter the IP address or domain name of the trap receiver.
Port	Enter the port number.

6.6 Ember+: Configuring Access for Monitoring

As part of the monitoring and remote-control function, the device is capable to be controlled via the Ember+ protocol.



1. Navigate to the page **External APIs**.
2. Click on the tab **Ember+**.
3. Configure the parameters in the block **Settings**.
4. Click **Save**.

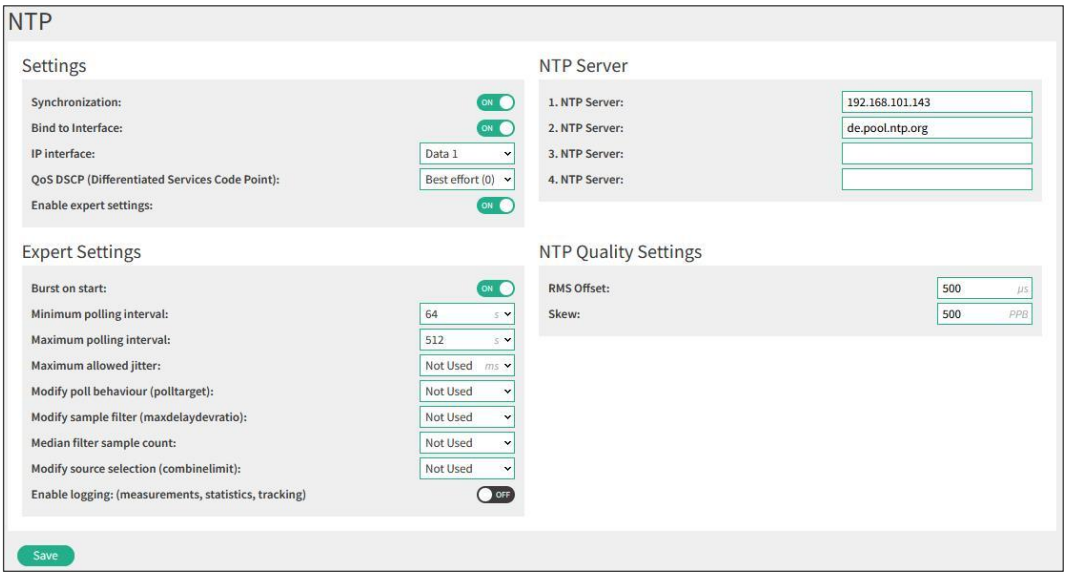
✓ You have configured the Ember+ access.

Parameters

Mode	Select the mode from the dropdown menu.
Timeout	Enter the value for interval in seconds for a timeout.
Port	Enter the port number for the connection.

6.7 NTP: Synchronizing Date and Time

The MPX-1c can automatically synchronize its date and time with an external NTP (Network Time Protocol) server. The configurable parameters on this page may differ depending on the activated rights.



1. Navigate to the page **NTP**.
2. Configure the parameters.
3. Click **Save**.

✓ You have synchronized the date and time with an external NTP server.

Parameters

Synchronization	Start or stop the synchronization with the NTP server.
Bind to interface	To bind the NTP synchronization to a specific IP interface, set the switch to **ON**. Select the [data] interface and VLAN.
QoS DSCP	Select the quality of service (QoS). The selected packet will be prioritized.
NTP Quality Rating	Select the quality of the NTP server. Low: Event logging, device time synchronization. Medium: For NTP servers that are accessed through the Internet and are used as External Clock source. High: For Stratum 1 NTP servers that are connected locally and are used as External Clock source. (SPN) For Medium and High settings, NTP will be rated as valid once the clock discipline algorithm has converged to acceptable RMS offset and skew values. For the Low setting, NTP becomes valid much quicker with reduced accuracy, however it will increase over time.
Enable expert settings	Set the switch to ON to show further parameters.

1. NTP Server	Enter the IP address or network name of the first NTP server to be used.
2.-4. NTP Server	Enter the IP addresses or network names of the 2nd, 3rd and 4th NTP servers to be used.

6.8 Enabling the REST API

A REST API is a standardized method for software applications to communicate over the internet. It operates based on REST principles, using HTTP requests and responses. The REST API enables seamless integration with other applications. It simplifies control through familiar HTTP methods, offers remote management, and facilitates automation, real-time monitoring, scalability, and extensibility. With help of the REST API, you can automate tasks and efficiently manage your audio codec system.

2wcom's REST API is compliant to Open API 3.0. For more information on Open API 3.0, refer to the official documentation: *https://swagger.io/specification/*

To enable the REST API:

1. Navigate to the page **External API**.
2. Select the tab **REST API**.
3. Set the switch **Enabled** to **ON**.
4. Click **Save**.
5. Download the file **openapi.json** from the page.

✓ You have now access to the REST API of the MPX-1c. For detailed information for developers, refer to the API documentation: *https://download.2wcom.com/general/2WCOM_REST_API.pdf*

6.9 Monitoring Audio via Live Listening

Activated MPX decoders can be monitored via Live listening. Live Listening enables you to listen "live" to any of the MPX decoders directly over the MPX-1c web interface. The MPX-1c is equipped with an adjustable bit rate encoder that can encode the input audio signal in five different formats. You can manually set up the parameters for audio encoding depending on the bandwidth available for data distribution.

Prerequisite: You have already configured the input sources and assigned them to the codec.

To set up audio monitoring via Live Listening:

1. Navigate to the page **Live Listening**.
2. Configure the parameters.
3. Set the switch **Activation** to **ON**.
4. Click **Save**.
5. In the banner, select an available audio source from the dropdown menu **Live Source**.



6. To change the playback volume, click the green volume levels.
7. To start streaming, click the play button.

✓ The MPX-1c now plays the audio over the web interface.

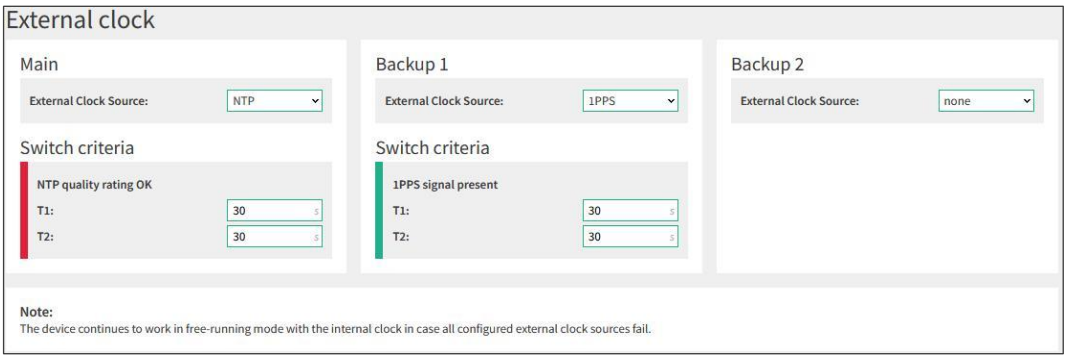
Parameters

Port	Enter the port number for streaming. The URL for Icecast streaming is "`IP address of the device:streaming port`". The standard port for live streaming is 8000. Example: `http://192.168.12.23:8000`.
Encoder Format	Select an audio format for streaming.
Audio Mode	Select a stereo or mono audio mode.
Sampling Rate	Select a sampling rate for streaming.
Bitrate	Select a bit rate for the selected audio format quality.

6.10 Using an External Clock Source

This option is only available if either of the rights *SFN* or *SPN* is enabled or if the device is equipped with a GPS module.

You can synchronize the MPX-1c with an external clock. Precise synchronization of time across devices on a network is critical to avoid audio distortion or loss of quality. By using an external clock source, audio codecs can ensure that they are operating with the same timebase, allowing them to maintain a consistent audio stream. By keeping all devices synchronized to an external clock source, audio codecs can ensure that their output remains high-quality and reliable. You can configure 1 main and up to 2 backup clocks.



To synchronize the MPX-1c with an external clock:

1. Navigate to the page **External Clock**.
2. Select an external clock source for the main and backup clock sources.
3. Configure the parameters for the main and backup clock sources.
4. Configure the switch criteria for the main and backup source. The configurable criteria may vary depending on the selected clock source.
   T1 is the delay time for alarm trigger. **T2** is the delay time for alarm end.
5. Click **Save**.

✓ The MPX-1c is now synchronized with an external clock. You can view the status information of the external clock on the page **Overview**. To use the external clock as the clock source for the audio inputs and/or audio outputs, see 7.1 Configuring input/output settings.

In case all configured external clock sources fail, the device will continue to work in free-running mode using the internal clock.

7 Codec Settings

7.1 Creating Codec Profiles

You can create codec profiles to assign to the different encoders of the MPX-1c.

1. Navigate to the page **Codec**.
2. Click on the tab **Profiles**.
3. To create a new codec profile, click ⊕.
4. To set up the new codec profile, click **Edit**.
   - ➢ A dialog window opens.
5. Configure the parameters.
6. Click **Save**.

✓ You have created and edited a codec profile.

Parameters

Name	Assign a name to the codec profile for better reference.
Encoder format	Select the encoder format. Different settings are configurable depending on the selected encoder format.
Frame size	Select the required frame size.
Audio mode	Select the audio mode in the dropdown menu.
Sampling rate	Set up sampling rate in the dropdown menu. The sampling rate for Livewire can only be configured for 48 kHz. For some 2wcom devices, the sampling rate is set to 192 kHz.
Sampling width	Set up sampling width in the dropdown menu in the range of 16-24 bits depending on the selected encoder format.
Endianness	Select the endianness (order of bytes).
Bitrate	Select the bit rate in the dropdown menu depending on the chosen audio mode. For some encoder formats, this field shows the calculated bitrate depending on the selected settings.
Used codec version	Select the codec version used for µMPX based on compatibility and feature requirements.
Keyframe interval	Set the frequency at which keyframes are inserted into the encoded audio stream.
Encryption mode	Select the encryption mode. Off: Select this if the µMPX signal should not be encrypted. Password: Enter a password to protect the stream. Hash: Enter a hash value to protect the stream.
GPIO Tunneling	Enable GPIO tunneling for GPIO switch between encoder and decoder.

7.2 Input Source Settings

7.2.1 Creating input source configurations for TS/IP

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
DVB IP TS/IP	TS/IP – Transport stream over IP using UDP/RTP, Unicast/Multicast (prerequisite: *TS Decoder* right)	[Data]

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.
7. Create a demux configuration that uses this input source configuration as a source. (See 6.2.3 Creating demux configurations)

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Enter the name of the stream for better reference.
IP type	Select Unicast/Multicast.
Multicast IP	Enter the IP for Multicast, if selected as IP type.
Port	Sender UDP port (the same as set in the encoder settings for output streaming)
IP interface	Select the interface for the input signal.
Protocol	Select the MPEG2 transport stream encapsulation.
Packet reorder/ dejitter delay	The dejitter buffer for IP transforms the variable delay into a fixed delay. It holds the first packet received for a period of time before it sends it out to the decoder. This time period is necessary for reordering the packets as well as to compensate the jitter and optionally to apply FEC correction and/or to combine it with the second, dual streaming input. Enter the value for this holding period in ms. **NOTE:** The delay time of the input source must not exceed 200 ms if the sample rate is 192 kHz.
RIST	Enable RIST to recover lost packets by resending them.
FEC Mode	Configure the FEC mode depending on the sample rate and the acceptable value for delay. For more information about the delay values, see 6.7 Setting Up a Buffer.
FEC column/row port offset	Enter the offset to the main destination port the data should be sent to. For example, if the main port is 5004, the value "2" for FEC column port offset means that the port is then 5006 (5004 + 2). If you do not want to use this offset, enter "0".
Dual streaming	If dual streaming is enabled, configure the IP parameters. You can set up the same or different [Data] sources for the Ethernet input.

7.2.2 Creating input source configurations for TS/SRT

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
TS/SRT	TS/SRT – Transport stream over IP using SRT (prerequisite: *TS Decoder* and *SRT Decoder* rights)	[Data]

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.
7. Create a demux configuration that uses this input source configuration as a source. (See 6.2.3 Creating demux configurations)

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Enter the name of the stream for better reference.
Mode	Select whether you want to use SRT in listener or caller mode.
Port	Specify the port number for SRT connection.
IP interface	Select the interface for the input signal.
Latency	Define the time interval for the latency before the MPX-1c starts to decode the signal distributed via SRT protocol.
Encryption	If the input stream is protected by AES encryption, enable end-to-end encryption.
Maximum reorder tolerance	Enter the maximum number of packets that should be reordered.
Passphrase	Enter the password used to secure the SRT stream.

7.2.3 Creating demux configurations

To use an input source configuration that is TS-based, you must first create a corresponding demux configuration.

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the tab of a TS-based input source.
3. In the block **Demux Configurations**, select the tab **Audio** to use the audio and optionally the ancillary data of a stream. Select the tab **Data** to only use the ancillary data of a stream. For more information, see 6.9 Configuring Ancillary Data.
4. To create a new demux configuration, click ⊕.
5. To configure the demux configuration, click **Edit**.
6. Configure the parameters.
7. Click **Save**.

✓ You have created a demux configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

TS source	Select the source for the demultiplexer configuration profile in the dropdown menu.
Configuration mode	Select the configuration mode. • **Manual/PID:** Enter the specific audio PID and a name for better reference. • **Service from list (fixed PID):** Refresh the service list. Select the service and audio track. • **Service from list (auto PID):** Refresh the service list. Select the service. This mode is used for services that switch to another audio track at times. In that case, the MPX-1c automatically switches to the new audio PID.
Encapsulation mode	Select an encapsulation mode: Multiprotocol Encapsulation or Packetized Elementary Stream.
Audio sync mode	Select the audio sync mode: Buffer level: synchronization with the rate of the incoming data PCR: synchronization with the PCR PID. This is more precise.
Decoder type	Predefine the codec type for the decoder by choosing the audio codec or selecting “Automatic” from the dropdown menu.
Buffer [ms]	Enter a value for the audio buffer.
Gain	Set the source-specific gain. This is useful if the level of this source is either higher or lower than the levels of the other sources in the decoder chain (main - backup).
Buffer size (µMPX)	Enter the buffer size for µMPX.
Decryption mode	Select the decryption mode. • **Off:** Select this if the µMPX signal is not encrypted. • **Password:** Enter the password that is needed for decryption. • **Hash:** Enter the decryption hash value.
Ancillary data decoding	If the input stream of the decoder contains ancillary data, the MPX-1c can forward them to the corresponding outputs. If ancillary data are enabled, private data cannot be enabled.
GPIO tunneling	Enable or disable GPIO tunneling for GPIO switch between encoder and decoder.
Private data	If private data is enabled, enter the data PID and select the configuration mode from the dropdown menu. If private data are enabled, ancillary data cannot be enabled.

7.2.4 Creating input source configurations for Elementary Streams (UDP/RTP)

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
Elementary Streams	RTP Elementary stream over IP using Unicast/Multicast	[Data]

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.

4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Enter the name of the stream for better reference.
IP type	Select Unicast/Multicast.
Multicast IP	Enter the IP for Multicast, if selected as IP type.
Port	Sender UDP port (the same as set in the encoder settings for output streaming)
IP interface	Select the interface for the input signal.
Protocol	Select the MPEG2 transport stream encapsulation: RTP or UDP. **Note:** If RTP is used, make sure to also allow RTP Port+1 in your firewall settings, as this port is used for RTCP.
Packet reorder/ dejitter delay	The dejitter buffer for IP transforms the variable delay into a fixed delay. It holds the first packet received for a period of time before it sends it out to the decoder. This time period is necessary for reordering the packets as well as to compensate the jitter and optionally to apply FEC correction and/or to combine it with the second, dual streaming input. Enter the value for this holding period in ms.
RIST	Enable RIST to recover lost packets by resending them.
Decoder type	Predefine the codec type for the decoder by choosing the audio codec or selecting “Automatic” from the dropdown menu.
Synchronous Playout/SFN	Enable Synchronous Playout using SFN or enter a buffer size [ms].
Buffer [ms]	Enter a value for audio buffer.
Gain	Set the source-specific gain. This is useful if the level of this source is either higher or lower than the levels of the other sources in the decoder chain (main - backup).
Buffer size (µMPX)	Enter the buffer size for µMPX.
Decryption mode	Select the decryption mode. • **Off:** Select this if the µMPX signal is not encrypted. • **Password:** Enter the password that is needed for decryption. • **Hash:** Enter the decryption hash value.
Ancillary data decoding	If the input stream of the decoder contains ancillary data, the MPX-1c can forward them to the [DTE] outputs.
GPIO tunneling	Enable GPIO Tunneling for GPIO switch between encoder and decoder.
FEC Mode	Configure the FEC mode depending on the sample rate and the acceptable value for delay. For more information about the delay values, see 6.7 Setting Up a Buffer.
FEC column/row port offset	Enter the offset to the main destination port the data should be sent to. For example, if the main port is 5004, the value "2" for FEC column port offset means that the port is then 5006 (5004 + 2). If you do not want to use this offset, enter "0".

Dual streaming	If dual streaming is enabled, configure the IP parameters. You can set up the same or different [Data] sources for the Ethernet input.

7.2.5 Creating input source configurations for SRT

This option is only available if the right *SRT Decoder* is enabled.

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
SRT	Elementary stream over IP using SRT (optional: “SRT Decoder” right)	[Data]

This function is not yet available for µMPX.

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Enter the name of the stream for better reference.
Mode	Select whether you want to use SRT in listener or caller mode.
Port	Specify the port number for SRT connection.
IP interface	Select the interface for the input signal.
Latency	Define the time interval for the latency before the MPX-1c starts to decode the signal distributed via SRT protocol.
Maximum reorder tolerance	Enter the maximum number of packets that should be reordered.
Encryption	If the input stream is protected by AES encryption, enable end-to-end encryption.
Passphrase	Enter the password used to secure the SRT stream.
Decoder profile	Select the codec profile from the dropdown menu.
Buffer [ms]	Enter a value for audio buffer.
Gain	Set the source-specific gain. This is useful if the level of this source is either higher or lower than the levels of the other sources in the decoder chain (main - backup).
Ancillary data output	If the input stream of the decoder contains ancillary data, the MPX-1c can forward them to the [DTE] outputs.

7.2.6 Creating input source configurations for internal storage (File)

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
File	Files from internal storage	Internal storage (eMMC, optional SSD)

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Assign a name to the configuration profile for better reference.
File	Select an audio file in the dropdown menu.
Buffer	Enter a value for audio buffer.
Gain	Set the source-specific gain. This is useful if the level of this source is either higher or lower than the levels of the other sources in the decoder chain (main - backup).

7.2.7 Creating input source configurations for XLR

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
XLR	Digital (AES/EBU) or analog audio over XLR connector	[D IN] [A IN]

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Assign a name to the configuration profile for better reference.
Ancillary data source	Select the source for ancillary data in the dropdown menu.

7.2.8 Creating input source configurations for BNC

You can create an input source configuration and use it for encoding and decoding.

Input Source	Description	Source Interface
BNC	BNC inputs	[A IN]

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Name	Assign a name to the configuration profile for better reference.

7.2.9 Creating input source configurations for the Generator

You can generate an MPX signal and use it as an input source for test purposes. The MPX signal is flexibly adjustable by separately enabling the left and right channel as well as the pilot tone and stereo encoder.

To create a new configuration profile for an input source:

1. Navigate to the page **Codec**.
2. In the block **Input Sources**, select the input source for which you want to create a configuration profile.
3. To create a configuration profile, click ⊕.
4. To set up the new configuration profile, click **Edit**.
5. Configure the parameters.
6. Click **Save**.

✓ You have created an input source configuration. Continue with 6.3 Assigning input source and codec profile to an encoder.

Parameters

Frequency	Enter the frequency of the left and right channels.
Level	Enter the level of the left and right channels.
Phase	Select the phase of the left and right channels.
Pilot Tone	Enable the pilot tone. Enter the level of the pilot tone.
Stereo Encoder	Enable the stereo encoder.

7.3 Assigning input source and codec profile to an encoder

The MPX-1c is equipped with parallel encoders that can operate at the same time. One input can be the source for several encoders.

Prerequisite: You have already created configuration profiles for the input sources you want to use.

1. Navigate to the page **Codec**.
2. Click on the tab **Encoder**.
3. In the block **Source/Profile Assignment**, assign an input source configuration to each encoder by selecting it in the dropdown menu **Input source**. Alternatively, drag/drop the input source configuration into this field.
4. Select the source for ancillary data from the dropdown menu **Ancillary Source**. To configure the ancillary data inputs and outputs, see 6.9 Configuring Ancillary Data.
5. Assign a codec profile to each encoder by selecting it from the dropdown menu **Profile**. Alternatively, drag/drop the codec profile into this field.
6. Click **Save**.

✓ You have activated and configured the encoders.

The MPX-1c can also operate as a **transcoder** and change the codec format of an input audio stream. For transcoding, assign the corresponding input stream to the encoder and configure the format of the output stream. This function is currently limited to PCM only.

7.4 Setting up encoder outputs

7.4.1 Setting up an Elementary Stream output

You can activate and configure output streams for each encoder.

To set up a converter output:

1. Navigate to the page **Codec**.
2. In the block **Outputs**, select the tab (if applicable) of the output you want to set up.
3. Click ⊕ to create a new encoder output.
4. To set up the new output, click **Edit**.
5. Edit the parameters of the output settings.
6. Click **Save**.

✓ You have set up an encoder output.

Parameters

Activation	To activate this output, set the switch to **ON**.
Encoder	Select the encoder. The same encoder can be assigned to several outputs.
Name	Enter the name of the stream for better reference.
Domain Name / IP	Define the domain name or IP address of the destination.
Port	Specify the port number of the destination.
QoS DSCP	Select the quality of service (QoS). The selected packet will be prioritized.
Multicast TTL	TTL (Time to Live) for multicast packets.
IP interface	Select the interface for the output.

Mode	Select the mode of the output stream in the dropdown menu: RTP or UDP. **NOTE:** Besides UDP/RTP, RTCP packets are also generated for the encoder output and are sent in intervals of 5 s. UDP/RTP allows reordering packets by means of sequence numbers.
RTCP output	Enable or disable the Real-Time Control Protocol (RTCP) output for monitoring and control of the stream. **Note:** If RTP is used, make sure to also allow RTP Port+1 in your firewall settings, as this port is used for RTCP.
Maximum payload size	Select the size limit for the payload. To set no limit, select **Maximum**.
Send Delay	Set up the send delay, which the encoder should wait in order to send Audio over IP as an offset stream for redundancy
RIST	Enable RIST to recover lost packets by resending them. You can enter a limit for the bandwidth used by the stream including re-sent packets.
Synchronous Playout / SFN	Enable SFN and enter the global delay to ensure synchronous playout.
FEC Mode	Configure the FEC mode depending on the sample rate and the acceptable value for delay. For more information about the delay values, see 6.7 Setting Up a Buffer.
FEC column/row port offset	Enter the offset to the main destination port the data should be sent to. For example, if the main port is 5004, the value "2" for FEC column port offset means that the port is then 5006 (5004 + 2). If you do not want to use this offset, enter "0".
Dual streaming	If dual streaming is enabled, configure the IP parameters. You can set up the same or different [Data] sources for the Ethernet input.

7.4.2 Setting up an SRT output

You can activate and configure output streams for each encoder.

To set up a converter output:

1. Navigate to the page **Codec**.
2. In the block **Outputs**, select the tab (if applicable) of the output you want to set up.
3. Click ⊕ to create a new encoder output.
4. To set up the new output, click **Edit**.
5. Edit the parameters of the output settings.
6. Click **Save**.

✓ You have set up an encoder output.

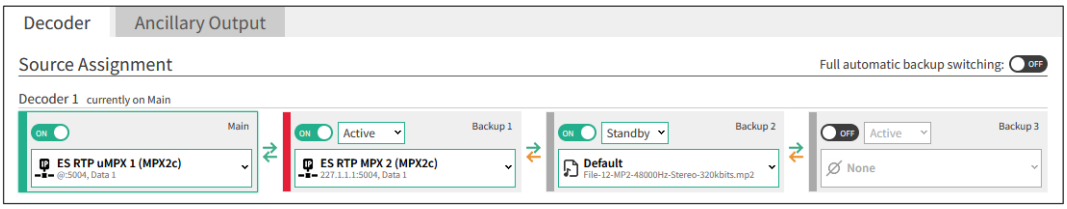
Parameters

Activation	To activate this output, set the switch to **ON**.
Encoder	Select the encoder. The same encoder can be assigned to several outputs.
Name	Enter the name of the stream for better reference.
Mode	Choose between “Caller” and “Listener” mode.
Host	Enter the host domain of the SRT destination.
Auto-configure source port	Activate automatic configuration of the source port.
Source port	If auto-configuration is disabled, enter the source port number manually.

Destination port	Enter the port number of the destination.
IP interface	Select the [data] interface for the output.
Latency	Define the time interval for the latency before the MPX-1c starts to output the SRT stream.
Encryption	The type of AES encryption determines the length of the key (passphrase). AES-182 uses a 16-character passphrase (128 bit), AES-192 uses a 14-character (192 bit) and AES-256 uses a 32-character (256 bit) passphrase.
Passphrase	Define a password used to secure the SRT stream.

7.5 Assigning Source Streams to a Decoder

For each audio output, you can activate up to 4 input streams for decoding and assign one of them to the "Main Source". The remaining streams are alternative backups for decoding. The decoder receives and processes all enabled input sources from the encoder but only outputs the highest-priority audio signal that is error-free. The priorities of the streams are as follows: main source, backup 1, backup 2, backup 3.



Prerequisite: You have already created input source configurations (see 6.2 Input Source Settings).

To assign source streams to a decoder:

1. Navigate to the Codec page.
2. Click on the tab **Decoder** tab.
3. Under **Source Assignment**, activate an input signal in the **Main** column by setting the switch to **ON**.
4. To assign an input source configuration to the main source, select it in the dropdown menu. Alternatively, drag and drop the input source configuration into the field.
5. Assign up to 3 backup sources following the same principle.
6. Choose between **Active** or **Standby** mode for your backup sources. This setting determines how the decoder handles these sources.
   When a backup source is set to Active mode, the decoder continuously processes it. This ensures that the backup source is readily available for immediate use. It offers quick switching to the backup source when required.
   In Standby mode, the decoder still receives the backup source, but it remains in a dormant state, consuming fewer system resources. The decoder will only start processing the standby source when it's needed. While Standby mode conserves resources, it may introduce a slight delay when switching to the standby source due to the initial processing time.
7. Optionally, disable **Full automatic backup switching** to gain more control over the source switching. Click on the arrows between the sources to prevent a backup from automatically switching back to the input of higher priority, even if it improves in quality. This prevents unwanted back-and-forth switching between unstable sources.
8. Click **Save**.

✓ The decoder now processes the main and backup sources. Continue with defining switch criteria for the main and backup sources (see 6.6 Defining Switch Criteria).

You can decode and play files from the internal storage. This option is recommended as an advanced redundancy for backup sources in case of input failure.

You can use XLR audio inputs as a backup source fed from an external device or for a loopback test.

7.6 Defining Switch Criteria

The MPX-1c decoder can automatically switch between alternative sources as a redundancy solution in case of failure. The decoder receives and processes all enabled input sources from the encoder but only outputs the audio signal of the highest priority that is error-free (main source – backup 1/2/3). Additionally to the global switch criteria, you can define switch criteria for individual sources that override the global switch criteria.

You can enable the following switch criteria for input sources. The availability of switch criteria depends on the selected input source.

No input data	The MPX-1c will switch to the next input source if no signal is available in the activated IP input [Data].
Packet jitter	The MPX-1c will switch to the next input source if the packet jitter exceeds the set value.
Packet loss	The MPX-1c will switch to the next input source if packet errors are detected in the input signal over the activated IP input [Data].
No decoder output	The MPX-1c will switch to the next input source if the decoder does not output any data.
Audio silence detection	The input source will be switched to the next backup source if silence in the audio signal of the input stream is detected.
AES/EBU no signal	The input source will be switched to the next backup source if no signal is detected in the active input.

To define global switch criteria for each audio input type:

1. Navigate to the page **Switch Criteria**.
2. Click on the tab of the input source for which you want to define switch criteria.
3. If any of the listed criteria should be monitored, enable the corresponding switch.
4. In the field **Value**, enter the threshold above or below which the input source should be switched.
5. For each enabled criterion, define the delay time **T1** for switching release. After this delay time, the input source switches to the next backup source.
6. For each enabled criterion, define the delay time **T2** for switching end. After this delay time, the input source switches back to the previous source, if its signal is good.
7. Click **Save**.

✓ The MPX-1c now automatically switches to the next good input source. For some switch criteria, you can set an alarm (see 8.1 Setting Up Alarms).

To define individual switch criteria for a specific input source:

1. Navigate to the page Codec.
2. Click **Edit** on the input source for which you want to define individual switch criteria.
3. Select the **Switch criteria** tab.

4. Toggle the switch **Override global switch criteria**.
5. Define the individual switch criteria.
6. Click **Save**.

✓ The switch criteria for this input source now override the global switch criteria.



On the page Codec, the switch criteria scope (SCS) of an input source is indicated with for global and with for individual.

7.7 Setting Up a Buffer

The MPX-1c is equipped with an MPX buffer and a dejitter buffer for IP.

The MPX buffer is a delay buffer for received MPX. The MPX-1c can use this delay buffer, for example, to switch to the backup source or external source. When using µMPX, a dedicated µMPX buffer will be added.

The dejitter buffer for IP stores a configurable number of packets before passing them on to the decoder. This buffer is necessary for possibly reordering packets, as well as to compensate jitter. Optionally it is also used to apply FEC correction and/or to combine one stream with the second, dual streaming input.

When using the MPX-1c, there are different stages where delay is introduced during processing for security (e.g. FEC or dejitter delay). For uninhibited operation, make sure that delay settings are in a save range.

For a basic setup, delay is calculated in the following matter:

Encoder processing delay + transmission delay on IP network + decoder processing delay

Encoder delay is typically < 5 ms. Transmission delay on the IP network can vary by a large degree, depending on the network. Decoder processing delay needs to be broken down into multiple stages:

Dejitter/Reorder or FEC output delay + additional delay + decoder processing delay

If no FEC is used, you can use a dejitter/reorder buffer which will add delay in the length it is set up to. If FEC is used, there is a minimum delay that is required for safe operation (in the length of two full FEC matrices). Any delay on top of that is used for additional dejittering reordering of the input stream, as the FEC also includes this task as well. If the user setting is too small, it is overwritten internally to ensure safe operation. The current active setting to each decoder can always be viewed on the page **Overview** in the block “Details – Decoder”. You can use the additional delay setting to further delay the output up to 1000 ms. The decoder will also have a delay 20 ms for PCM or 100 ms for µMPX.

Recommended default buffer configuration: Packet reorder delay: 100 ms, Audio delay: 100 ms

The minimal needed additional buffer sizes depend on the selected FEC Mode (Row x Col):

FEC Mode (2 x matrix size) Codec (Packets/s)	1x4 (8)	4x4 (32)	5x5 (50)	10x10 (200)
PCM (1000)	0.008	0.032	0.05	0.20
µMPX (95)	0.084	0.337	0.0526	2.105

7.8 Setting Up Dual Streaming

Dual streaming is the simultaneous transmission and reception of 2 identical IP streams that come from the same encoder. This allows a seamless exchange of IP packets in case of errors: If the main stream drops packets, then the decoder immediately replaces them using the packets from the second stream. Ideally, the two streams use different networks, so one stream is still available in case of the other network failing.

Alternatively, it is possible to send both streams over the same network, with one stream being slightly delayed by setting up a send delay for it. Lost packets in the primary stream can be replaced in case of a burst error by using a dejitter buffer. The downside of using one network for both streams is that both streams will be affected in case of the network failing.

To set up dual streaming:

1. Set up dual streaming in the input source settings. For more information, see 6.2 Input Source Settings.
2. To use the input source, select it in the source assignment.

✓ Dual streaming is now enabled in the MPX-1c.

7.9 Configuring Ancillary Data

You can configure ancillary data and add them to the inputs and outputs.



To configure the ancillary data inputs and outputs:

1. Navigate to the page **Ancillary Data**.
2. In the tabs **Inputs** and **Outputs**, enter a name for the DTE input/output and set a baud rate.
3. To add UDP inputs/outputs for ancillary data, click ⊕.
4. Configure the parameters for the UDP inputs/outputs.
5. Click **Save**.
6. Navigate to the page **Codec**.
7. In the tab **Encoder**, add an ancillary source to the input source. Alternatively, select the **Pipe** function to use ancillary data that already exist in the input source.
8. Click **Save**.
9. In the tab **Ancillary Output**, assign sources to the ancillary data outputs. You can either select a specific ancillary data source or one of the decoder audio outputs. If one of the decoder audio outputs is selected, then the MPX-1c outputs the ancillary data of the currently active main or backup source.
10. Click **Save**.

✓ The ancillary data are now added to the stream.

Parameters

Name	Enter a name for the input/output for better reference.
Max. Datarate	Enter the maximum data rate that is allowed for this input.
Multicast	Choose whether to use multicast.
Multicast IP	Enter the multicast IP.
IP	Enter the IP address. This can be a multicast IP.
Port	Specify the port for ancillary data via UDP.
Interface	Select the [Data] interface to be used.
VLAN	If the selected [Data] interface is an interface with VLAN, then select the VLAN to be used.

7.10 Configuring the TS Multiplexer

The MPX-1c can output up to 8 multiplexed streams over IP at the same time. One multiplexed stream can contain up to 16 programs. To each program, you can add up to 16 payload contents. You can use the IP interfaces [Data] redundantly for the same stream content and the same destination or send different stream contents to the same or different destinations.

7.10.1 Setting up a Multiplex with payload content

Prerequisite: You have already configured the input sources.

Prerequisite: You have already assigned input sources and codec profiles to the encoders.

To set up a multiplexed stream with payload:

1. Navigate to the **TS Multiplexer** page.
2. To create a new Multiplex, click **+**.
   - ➢ A new tab with TS settings appears.
3. To add a new service to the TS payload content, click **Add Service**.
4. To add encoder audio to the stream, select an available source from the **Payload** dropdown menu. You can either select encoder audio or an ES stream from an external source.
5. To add another payload to the content, click **Add Payload**.
6. To add private data to the stream, select the input source from the **Payload** dropdown menu. Alternatively, drag/drop the input from the tab **Data**.
7. Specify the service ID, service name, service provider name, PMT PID, PCR PID, and PID for the program.
8. Select between the modes PES (program elementary stream) and MPE (multiprotocol encapsulation). If MPE is selected, enter the destination PID, destination port and the protocol.
9. In the **General** block, configure the parameters.
10. Click **Save**.

✓ You have set up a multiplexed stream. Continue with 6.10.2 Setting up Multiplex outputs.

Parameters

Encoding standard	Select the encoding format: DVB or ATSC.
MPEG TS tables	Select MPEG TS tables as needed for the multiplexing process.
Auto-calculate required TS bit rate	Enable this option to automatically calculate the required Transport stream bit rate based on the selected settings.
Bit rate	If auto-calculated TS bit rate is disabled, enter the bit rate manually.
Audio bitrate priority	Select a priority for the audio bitrate: low latency or low bitrate overhead.
Private data mode	Set the mode for handling private data within the multiplexed stream: Elementary stream (ES) or TS adaption.
Network ID	Enter the network ID to identify the network where the multiplexed data will be transmitted.
Original Network ID	Enter the original network ID to indicates the network in which the TS stream was originally created.
Transport Stream ID	Assign a Transport Stream ID to identify the specific Transport Stream being used.
Network name	Enter the name of the network where the multiplexed data will be transmitted.
Audio PID removal on bad input	Enable or disable the removal of PIDs in case the input is bad.

7.10.2 Setting up Multiplex outputs

For each TS Multiplex, you can create and save up to 32 destination streams.

To set up Multiplex outputs:

1. Navigate to the page **TS Multiplexer**.
2. In the block Multiplexer Outputs, click on the tab of the output you want to set up.
3. To create a new output, click ⊕.
4. To configure the output, click **Edit**.
   - ➢ A dialog window opens.
5. Configure the parameters.
6. Click **Save**.

✓ The MPX-1c now outputs multiplexed streams.

TS/IP output parameters



This option is only available if the *TS Encoder* right is activated.

Activation	Enable this output stream.
Name	Enter the name of the stream for better reference.
Domain name/IP	Enter the IP of the destination.
Port	Specify the port number of the destination.
Multicast TTL	TTL (Time to Live) for multicast packets.
IP interface	Select the [Data] interface for the output.
Mode	Select the mode of the output stream in the dropdown menu: RTP or UDP. **NOTE:** Besides the RTP, the RTCP packets are also generated for the encoder output and are sent in 5 s intervals. RTP allows reordering packets by means of sequence numbers.
RTCP output	Enable or disable Real-Time Control Protocol (RTCP) output, which is used for monitoring and controlling the stream.
Send delay	Enter the send delay, that the encoder should wait in order to send Audio over IP as an offset stream for redundancy (for more information, see 6.7 Setting Up a Buffer).
RIST	Enable RIST to recover lost packets by resending them.
Bandwidth limiting	Specify the total bandwidth for the transport stream, including both the primary stream and RIST retransmissions. For example, if the stream typically uses 500 kbps and the limit is set to 1000 kbps, RIST can use up to 500 kbps for retransmissions. Make sure not to set this parameter to the retransmission overhead alone. A low value can block retransmissions, effectively disabling RIST, while the primary stream remains unaffected.
FEC Mode	Configure the FEC mode depending on the sample rate and the acceptable value for delay (for more information, see 6.7 Setting Up a Buffer). **NOTE:** Enable Pro-MPEG FEC in the corresponding decoder.
FEC column (L)/ FEC row (D) port offset	Enter the offset to the main destination port the data should be sent to. For example, if the main port is 5004, the value “2” for FEC column port offset means that the port is then 2006 (5004 + 2). If you do not want to use this offset, enter “0”.
Dual Streaming	Enable or disable dual streaming. If dual streaming is enabled, the menu will expand. Set up the connection for dual streaming in the expanded menu. For the Ethernet input, you

can select the same or a different source.
NOTE: Enable dual streaming in the corresponding decoder.

TS/SRT output parameters



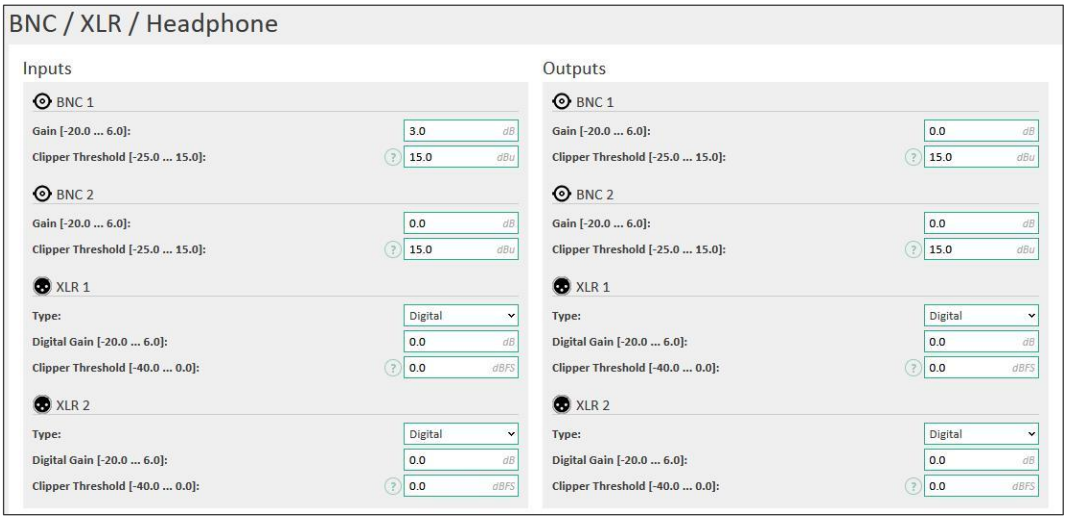
This option is only available if the rights *TS Encoder* and *SRT Encoder* are activated.

Activation	Enable this output stream.
Name	Enter the name of the stream for better reference.
Mode	Select either caller or listener mode.
Host	Enter the host domain of the SRT destination.
Auto-configure source port	Activate automatic configuration of the source port.
Source port	If auto-configuration is disabled, enter the source port number manually (relevant for e.g. firewall)
Destination port	Enter the port number of the destination.
IP interface	Select the [Data] interface for the output
Latency	Define the time interval for the latency before the MPX-1c starts to output the SRT stream.
Encryption	Enable SRT encryption. The type of AES encryption determines the length of the key (passphrase). AES-128 uses a 16-character (128-bit) passphrase, AES-192 uses a 24-character (192-bit) and AES-256 uses a 32-character (256-bit) passphrase.
Passphrase	Define a password used to secure the SRT stream. **NOTE:** The same encryption key should be set for this input TS in the corresponding decoder.

8 Interface Settings

8.1 Configuring input/output settings

For signal input and output, XLR and BNC interfaces are available. You must manually select the type for the signal input in the web interface between analog and digital.



To configure the signal inputs and outputs:

1. Navigate to the page **BNC / XLR / Headphone**.
2. Configure the parameters in the blocks **Inputs** and **Outputs**.
3. Click **Save**.

✓ You have configured the signal inputs and outputs.

Parameters

Type	Select the signal type for XLR inputs/outputs: digital or analog.
Gain	Adjust the gain of the input and output signals. This is useful if the signal's level is too high or too low.
Clipper Threshold	The default threshold for clipping is 15 dBu. To reduce the threshold even further, enter a value below 15 dBu. Values above 15 dBu are invalid. If you do not want to use this function, then keep the default value.

8.2 Setting the Critical Level Marker

The audio level of the inputs and outputs is displayed on the overview page. You can set the critical level marker to specify when the bar should turn orange.



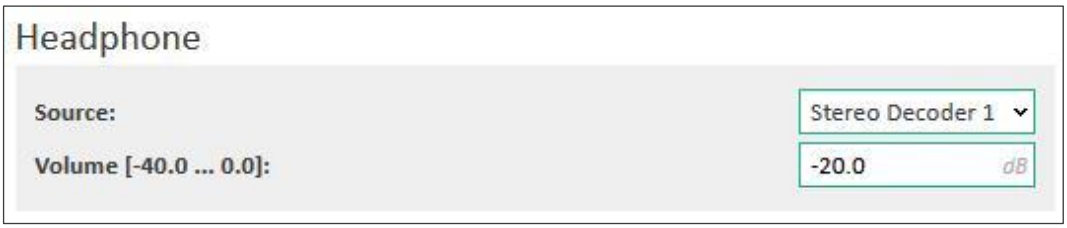
To set the critical level marker:

1. Navigate to the page **BNC / XLR / Headphone**.
2. In the block **Critical Level Marker**, define the threshold above which the bar should turn orange.
3. Click **Save**.

✓ The bar indicating the audio level of the inputs and outputs now turns orange whenever the audio level is above the set value.

8.3 Changing the Headphone Volume

The input signal can be monitored via the headphone interface.



To change the volume of the headphone output:

1. Navigate to the page **BNC / XLR / Headphone**.
2. In the block **Headphone**, select the source for the headphone output.
3. Set the volume for the headphone output in a range from -40.0 to 0.0 dB.

✓ The volume of the headphone output is now adjusted.

8.4 Configuring the DTE interface

The MPX-1c is equipped with two 9-pole D-Sub male connectors for serial RS-232C data communication. To connect the serial interfaces, use a DTE cable.

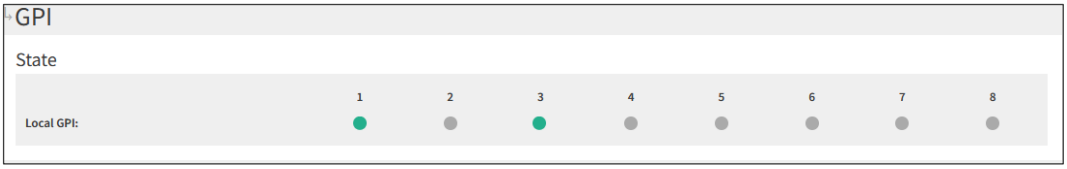
To configure the DTE interface:

1. Navigate to the page **DTE**.
2. Configure the baud rate for each DTE input and output.
3. Click **Save**.

✓ You have configured the DTE interfaces. To view the status of the DTE data, see 9.5 Ancillary Data Status.

8.5 Viewing the GPI Status

The MPX-1c is equipped with 8 GPI contacts housed in the same 26-pole D-sub male connector as the GPOs. The inputs can be used for remote control (in combination with remote control software).



- To actuate a GPI, pull the corresponding control pin electrically to ground (pin 9). The resulting control current is less than 5 mA.
- To view the status of the GPIs, navigate to the page **GPI**.

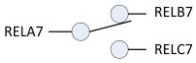
For information on the GPI pin layout, see 11.2 Interface Pin Layouts.

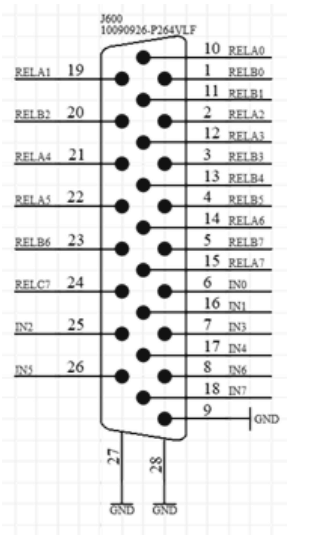
8.6 Configuring GPO Settings

GPO

The MPX-1c features 8 GPOs: 7 SPST relays (form A) and 1 SPDT relay (form C). You can use the relays for alarms of the monitoring function.

The pin layout for GPO is as follows:

GPO No.	Switch contacts	Switch type
1	RELA0, RELB0	SPST, NO
2	RELA1, RELB1	SPST, NO
3	RELA2, RELB2	SPST, NO
4	RELA3, RELB3	SPST, NO
5	RELA4, RELB4	SPST, NO
6	RELA5, RELB5	SPST, NO
7	RELA6, RELB6	SPST, NO
8		SPST



SPST: a simple on/off switch: single pole, single throw
SPDT: single pole, double throw
NO: normally open

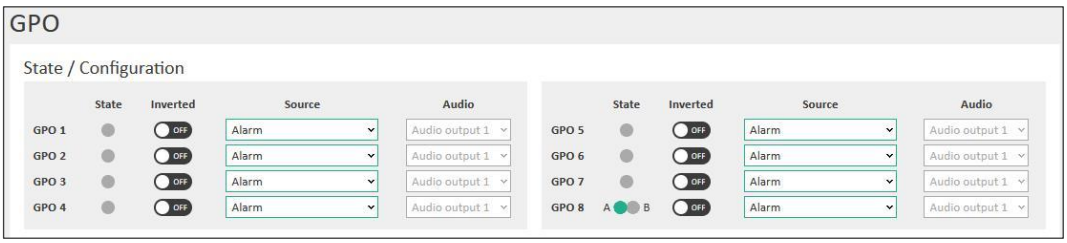
NOTICE **Risk of equipment damage!**

- ➢ The relay contacts have a maximum load of 0.5 A at 30 V DC. Do not exceed these values.

To configure the GPO settings and view the status of the GPOs:

1. Navigate to the page **GPO**.
2. To invert a GPO, enable the corresponding switch.
3. Select the source for the GPO switch in the field **Source**. Only GPOs that are selected for the source **Alarm** can be used to indicate a triggered alarm.
4. If you set GPIO Tunneling as the source, then select the audio to be used for this function.
5. Click **Save**.

✓ You have configured the GPO settings.

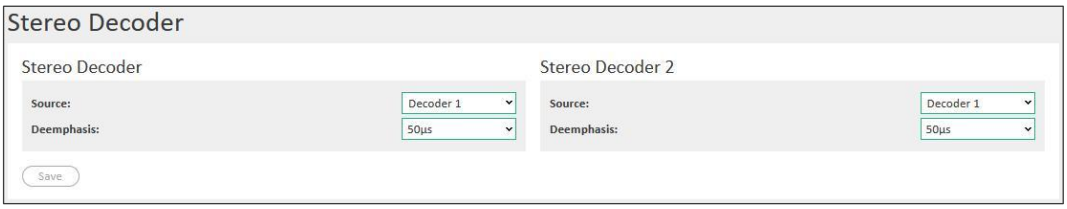


The virtual LED **State** indicates the status of the GPOs (green: ON, grey: OFF). The state of a relay is ON if the alarm which is assigned to this relay is triggered.

For information on the GPO pin layout, see 11.2 Interface Pin Layouts.

8.7 Configuring the stereo decoder

The stereo decoder decodes only the audio from the left and right channel from the MPX signal. You can enable 1 stereo decoder for every MPX decoder covered by your license.



To configure the stereo decoder:

1. Navigate to the page **Stereo Decoder**.
2. Configure the parameters.
3. Click **Save**.

✓ You have configured the stereo decoder.

Parameters

Source	Select the source interface or decoder for the stereo decoder.
Deemphasis	Select the deemphasis for better transmitting.

9 System Settings

9.1 Setting Up Alarms

You can set several alarms that trigger in case of defined events. You can monitor the following:

Temperature	Alarm is triggered if the device temperature exceeds the configured value.
Power failure	Alarm is triggered in case of an error in one of the two power supply units.
LAN Link	Alarm is triggered in case of an error in Ethernet data communication.
1 PPS clock status	Alarm is triggered if 1 PPS signal is not present.
NTP clock status	Alarm is triggered if no NTP server is available.
Silence Detection	Alarm is triggered if the device detects silence in the left and/or right channel of the audio output.
AES/EBU No Signal	Alarm is triggered if no decoded digital audio is available in the audio input.
AES/EBU CRC Error	Alarm is triggered if a cyclic redundancy check error is detected.
No Input Data	Alarm is triggered if no input data is detected.
Encoder input silence detection	Alarm is triggered if silence occours in the encoder input for the set amount of time.
Encoder input low level detection	Alarm is triggered if the encoder input level is below the threshold for the set amount of time.
DTE input timeout	Alarm is triggered if no ancillary data have been received on this DTE interface for a set amount of time.
DTE output timeout	Alarm is triggered if no ancillary data have been sent over this DTE interface for a set amount of time.
SFN Accuracy	Alarm is triggered if SFN accuracy exceeds the set value for a set amount of time.
Buffer Level	Alarm is triggered if there will soon be not enough retained data to play out as buffer.
Audio Error Count	Alarm is triggered if the error counter increases by one. The alarm ends if the error counter stopped increasing for a set period of time.

To set up alarms:

1. Navigate to the page **Alarm**.
2. For each alarm, configure the corresponding parameters.
3. Click **Save**.

✓ Enabled alarms will now be saved in a log entry and signaled over SNMP, LED or GPO if triggered.

Parameters

Enable	Enable or disable an alarm.
Priority	Select the priority of the alarm message.
Values	Enter the value below or above which the alarm triggers.
T1	Set the delay time for alarm trigger.
T2	Set the delay time for alarm end.
SNMP, LED, GPO	Enable the corresponding switch if the alarm should be signaled by SNMP traps, an LED or GPO switch. The corresponding GPO must be activated for the source “Alarm” (see 7.6 Configuring GPO Settings).

9.2 Entering Device Information

For better identification of the MPX-1c, you can enter device-specific data.

1. Navigate to the page **Global**.
2. Configure the parameters in the block **System info**.
3. Click **Save**.

✓ The saved information is now displayed in the banner.

Parameters

Name	Enter the name of the device for better reference.
Location	Enter the location of the device.
Description	Enter further important information on the device.

9.3 Setting Up Session Timeout

Session timeout is a security feature that automatically logs out the user after a period of inactivity. You can define the period of inactivity or disable session timeout.

1. Navigate to the page **Global**.
2. In the field **Session timeout**, enter the value in minutes for the period of inactivity necessary to automatically log out the user. Enter “0” to disable this function.
3. Click **Save**.

✓ You will now be automatically logged out after the set period of inactivity.

9.4 Changing the Title of the Browser Tab

You can change the title of the browser tab to display the information you need for better reference.

1. Navigate to the page **Global**.
2. In the field **Browser Tab Title**, enter the information you want to display. You can use variables for specific information. Variables will update automatically if the corresponding information changes. View the possible variables by hovering over the input filed.
3. Click **Save**.

✓ The title of the browser now displays the configured information.

9.5 Updating the Firmware with a File

You can upload ARM firmware stored locally and activate it via the web interface. Alternatively, you can load a firmware file from a USB stick.

To install a firmware file via the web interface:

1. Navigate to the page **Global**.
2. In the block **Upload / Activate**, click **Browse/Drop** and select the firmware file you want to upload. Alternatively, you can select a firmware file that was previously uploaded to the **Storage** page.
3. Click **Upload** / **Activate** to install the firmware file. This may take a while. Do not interrupt this process.
4. After a successful activation, follow the prompt to restart the device.

✓ After the reboot, the new firmware is active.

To manually install firmware from a USB stick via the LCD menu:

1. Insert a USB stick with the firmware file into the [USB] port.
2. Use the jog wheel to select **Config menu** ➞ **System** ➞ **Global** ➞ **Update firmware from USB**.
3. Select the firmware file you want to upload.
4. Select **Update**. The installation may take a while. Do not interrupt this process.
5. Select **OK** to reboot the device.
6. Remove the USB stick from the device.

✓ After the reboot, the new firmware is active.

To automatically install firmware from a USB stick:

1. Create a folder named "autoupdate" on the USB stick.
2. Place the firmware file in the "autoupdate" folder. Make sure that the folder only contains one firmware file.
3. Insert the USB stick into the [USB] port.
   ➢ The device automatically finds the firmware file on the USB stick. If the firmware version of the file differs from the currently installed one, the device automatically installs the new firmware. The installation may take a while. Do not interrupt this process.
4. Select **OK** to reboot the device.
5. Remove the USB stick from the device.

✓ After the reboot, the new firmware is active.

9.6 Checking for Updates

You can check for updates and install them, if available. You can also view the release notes and details about the available updates. Additionally, it is possible to download the firmware file to install at a later point of time.

To install an available update:

1. In the menu **Support**, click **Check for updates**.
   ➢ The window **Available Firmware Versions** opens.
2. Select the update you want to install.
   ➢ The dialog window **Firmware Update** opens.
3. Click **Yes, update now**. The update may take a while. Do not interrupt this process. Since the device reboots during this process, you will be logged out.

✓ The firmware is now updated.

In the window **Available Firmware Versions**, firmware bundles that are newer than the currently installed one are marked with ★. Important updates are marked with ❗. Click **Open** to view the change notes and details about a bundle version. To download a firmware bundle for later installation, click 💾.

In the window **Available Firmware Versions**, you can enable an **automatic update check** every 24 hours. If a new update is available, it will be indicated by the ★ icon next to the **Check for Updates** menu item. You can also enable a notification dialog that informs you of any new updates.

9.7 Activating rights

Some functions of the MPX-1c are optional and licensed. To use these functions, you must activate additional rights by uploading a rights file. To receive rights files, please contact your 2wcom sales representative. For more information, see 3.2 Software Rights.

1. Navigate to the page **Global**.
2. In the block **Upload / Activate**, click **Browse/Drop**.
3. Select the rights file (*.2wcom_key) that you want to upload.
4. Click **Upload**. The upload may take a while. Do not interrupt this process.
5. After a successful upload, follow the prompt to restart the device.

✓ The new rights will be active after restart. You can view the current rights in the block **System information**.

9.8 Uploading and Activating an SSL Certificate

An SSL certificate is a digital certificate that provides authentication for a website and enables an encrypted connection.

To upload and activate an SSL certificate:

1. Navigate to the page **Global**.
2. In the block **Upload / Activate**, click **Browse/Drop**.
3. Select the SSL certificate file (*.pem) you want to upload.
4. Click **Upload**. The upload may take a while. Do not interrupt this process.

✓ You have uploaded an SSL certificate.

9.9 Generating and Saving a Settings File

You can download the current settings and save them as a file either to your local storage or to the internal storage of the MPX-1c. You can use this file later to restore the settings or upload it to another device to copy the settings.

1. Navigate to the page **Global**.
2. In the block **Settings Download**, enter a file name and click **Generate**.
   - ➢ A file is being created. This may take a few seconds.
   - ➢ The download option with the time and date of file creation appears.
3. Click **Download**.
4. Save the file to a location of your choice.
5. Click **Save**.

✓ You have saved settings to a local file. To upload and activate the settings stored locally, see 8.10 Loading Settings from a File.

9.10 Loading Settings from a File

You can upload a settings file to restore previous settings or copy the settings from another device. You can do this either via the web interface or the LCD menu. You can load the settings either without or including IP settings such as IP addresses and VLANs. This enables you to easily swap out a device. Note that if you load settings including IP via the web interface, you will lose the connection to the device due to the new IP address. For information on how to generate a settings file, see 8.9 Generating and Saving a Settings File.

To load a settings file via the web interface:

1. Navigate to the page **Global**.
2. In the block **Upload / Activate**, click **Browse/Drop** and select the settings file you want to upload. Alternatively, you can select a previously uploaded or saved file from the internal storage of the device.
3. Click **Upload** / **Activate** to install the settings file. The file upload may take a while. Do not interrupt this process.

✓ The new settings are now active. If you chose to also load the IP settings, the device now has a new IP address.

To load a settings file via the LCD menu:

1. Insert a USB stick with the settings file into the [USB] port.
2. Use the jog wheel to select **Config menu** ➞ **System** ➞ **Settings** ➞ **Load from USB** or **Load from USB (incl. IP)**.
3. Select the settings file you want to upload.
4. Select **Upload**. The file upload may take a while. Do not interrupt this process.

✓ The new settings are now active. If you chose to also load the IP settings, the device now has a new IP address.

9.11 Generating and Downloading a Diagnostic Report

In case of any problems or failures, you can generate and download a diagnostic report to send to 2wcom.

To generate and download a diagnostic report:

1. Navigate to the page **Global**.
2. In the block **Diagnostic Report**, select the time period for which the device captures all activities.
3. Click **Generate**. A file is being created. This may take a while. Do not interrupt this process.
   ➢ The download option with the time and date of file creation appears.
4. Click **Download**.
5. Save the file to a location of your choice.

✓ You have generated and downloaded a diagnostic report.

9.12 Uploading a Debug Script

To identify a specific error, you can upload a debug script that you have received from 2wcom. Depending on the expected error, the debug script monitors extra status information and records the incoming data. When the error occurs, the recording stops and a debug.log file is generated which contains all information that 2wcom needs to fix it.

To upload a debug script:

1. Navigate to the page **Global**.
2. In the block **Debug Report**, click **Browse/Drop file**.
3. Select the debug script file (*.upd) you want to upload.
4. Click **Upload**. The upload may take a while. Do not interrupt this process.
5. To start the debugging process, click **Start**. This may take a while. Do not interrupt this process.

➢ When an error occurs, the script is automatically stopped. A download link for the debug.log file appears.

6. To download the debug.log file, click on the link.
7. Send the file to your 2wcom contact person.

✓ 2wcom can now identify the error and determine further action.

9.13 Rebooting the Device

To reboot the device:

1. Navigate to the page **Global**.
2. In the block **Control**, click **Now** in the field **Reboot Device**.

✓ The device restarts. After the restart, you will have to log in again.

9.14 Restoring Factory Settings

Restoring the factory settings will delete all configurations that were made by a user except for the IP address of the CTRL interface. This also applies to the access accounts.

To reset the device to factory settings:

1. Navigate to the page **Global**.
2. In the block **Control**, click **Now** in the field **Load Factory Settings**.

✓ You have restored the factory settings.



9.15 Accessing the recovery mode via reset pin hole

If you cannot access the MPX-1c via the web interface, you can reboot the device using the reset pin hole. You can also use the reset pin hole to access the recovery mode in which you can flash the device or restore factory settings.

- To restart the device, press the reset button for a second.

1. To access the recovery mode, press the reset button for a few seconds until all LEDs on the front panel turn off and only power LED starts flashing quickly.
   ➢ The device starts in recovery mode.
2. Access the recovery web interface by entering the IP address of the device into a web browser.
   In recovery mode, you can upload and activate firmware, reset the system to factory settings or reboot the device.



3. After flashing or resetting the device, reboot the device by clicking **Reboot**.

✓ After a few seconds, the device will be ready for operation.

9.16 Setting the Time and Date

You can set the time, time zone and date of the internal clock.

1. Navigate to the page **Time**.
2. In the block **Local time**, select the present time zone in the dropdown menus.
3. Click **Save**.
4. In the block **Time and date settings**, enter the current date and time.
5. Click **Save**.

✓ You have set the time and date. The current time and date of the internal clock is shown in the field **Present local date and time**.

9.17 Changing Login Data

The default accounts are a read-only access (Guest account), a full access without a permission to manage the user accounts (Manager account), and a full access (Admin account). The user account SFTP service is used only for the access from an external SFTP client for uploading audio files and saving them in the internal storage.

Change the login data after the first login to the web interface.

The default login data for the first login are (case sensitive):

- Guest account: “guest”/ “guest”
- Manager account: “manager”/ “manager”
- Admin account: “admin”/ “admin”
- FTP service: “sftpuser”/ “sftpuser”

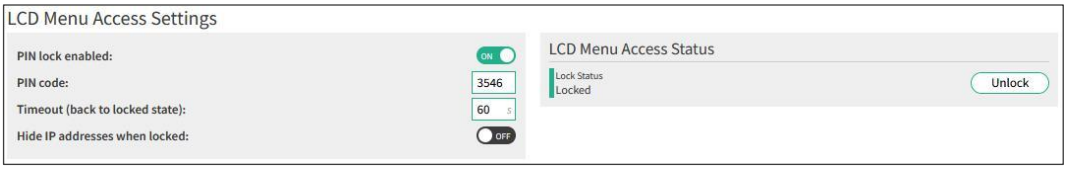
To change the login data:

1. Log in as an admin.
2. Change the login data for an account in the corresponding block and repeat the new password.
3. Click **Save**.

✓ You have changed the login data.

9.18 Setting a PIN Code for the LCD Menu

You can set a PIN code to ensure that only authorized personnel can change any settings through the LCD menu.



To set a PIN code:

1. Navigate to the **User** page.
2. In the **LCD Menu Access Settings** block, enable the **PIN lock enabled** function.
3. Enter a PIN code and the timeout duration after which the LCD menu locks.
4. Determine whether the IP addresses should be hidden or shown when the LCD menu is locked.
5. Select **Save**.

✓ The LCD menu is now secured by a PIN code. The status of the LCD menu is displayed in the block on the right. To unlock or lock the LCD menu through the web interface, select **Unlock/Lock**.

9.19 Adapting the Access for User Accounts

You can configure the access to certain web interface pages for the manager and guest accounts.

Prerequisite: You are logged in as an admin.

To adapt the access for manager and guest accounts each individual MPX-1c menu:

1. Navigate to the page **User**.
2. Click on the tab **Menu Access**.
3. Enable or disable the access to the separate menus by setting the corresponding switch to either **ON** or **OFF**.
4. Click **Save**.

✓ The new access configuration is now active.

10 Status Information

10.1 Status LEDs

The MPX-1c is equipped with 4 status LEDs on the banner of the web interface that display the status of the inputs, outputs, power supply and alarms.



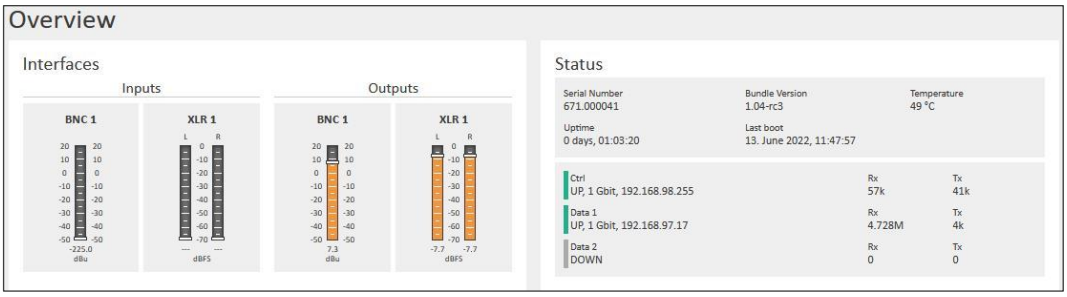
The following table displays the meaning of each LED:

LED	Color	Meaning
Power	●	All supply cords are connected and the power supply is OK.
	●●	Toggles (green/red) if only one power supply is connected or OK.
Warning	●	LED is off if no alarms are triggered.
	●	At least one alarm is triggered.
Input	●	No input monitoring alarms are enabled.
	●	Input monitoring alarms are enabled and all inputs are OK.
	●	One or more inputs are bad, but at least one is good.
	●	All inputs are bad.
Output	●	No decoder output monitoring alarms are enabled.
	●	Output monitoring alarms are enabled and all outputs are OK.
	●	One or more outputs are bad, but at least one is good.
	●	All outputs are bad.

10.2 General Overview

Overview page

The page **Overview** gives you general information on the status of your MPX-1c. The appearance of this page might differ depending on the activated rights, built-in modules and settings.



The audio levels of the inputs and outputs are displayed in the left block. To change the threshold above which the bar turns orange, see 7.2 Setting the Critical Level Marker.

The block **Status** gives general device-specific information as well as information on the ethernet interfaces.

Decoder Status

To get a quick and detailed overview, you can view the current status of the decoder and the incoming data. To view the decoder status, navigate to the page **Overview** and click on the tab **Codec**.

In the block **Decoder**, you can see the status of the currently active decoders:

Green: Enabled
Gray: Disabled
Red: Error

- To view more details on a decoder, click on the corresponding panel.
  - ➢ The **Details** view below the block **Decoder** now displays the status of the decoded audio.
- To reset the counters in the status fields, click **Reset Counters**.

The blocks display the following counters:

IP block	**Missed** indicates packets lost for the corresponding RTP receiver. This is the main error information when neither RIST, FEC, nor dual streaming are active.
FEC block	**Recov.** indicates the number of packets that were recovered by FEC. If dual streaming is active, then the same FEC is used on both IP connections. **Unrecov.** indicates the number of packets that could not be recovered. This is the main error information if FEC is active.
RIST block	**Requested** indicates the number of packets that are lost or late on the receiver side. These packets are requested for retransmission. **Retransmitted** indicates the number of packets that were retransmitted by the sender. **Unrecovered** indicates the number of packets that could not be recovered. This is the main error information if RIST is active.
µMPX block	**Missed** indicates the number of packets that were lost and not received by the decoder. **Restored** indicates the number of packets that were successfully restored using error correction mechanisms. **Underruns** indicates the number of instances where the decoder buffer was insufficient to maintain continuous data delivery.

Dual streaming block	**Unrecovered** indicates the number of packets that could not be recovered. This is the main error information if dual streaming is active.

The following abbreviations may appear in the decoder status overview:

SR	Sampling rate
SW	Sampling width
FEC	Forward error correction
Err	The number of errors in the decoder (e.g. failed samples, no audio, PER)
PER	Packet error rate of the input stream

Encoder Status

To get a quick and detailed overview, you can view the current status of the encoder and the incoming audio data. To view the encoder status, navigate to the page **Overview** and click on the tab **Codec**.

In the block **Encoder**, you can see the status of the currently active encoders.

- To view more details of an encoder, click on the corresponding panel.
  - ➢ The **Details** view below the block **Encoder** now displays the status of the input source, codec profile, and the assigned audio outputs.
- To reset the counters in the status fields, click **Reset Counters**.
- Details of the assigned outputs are displayed in the table. To view the status of an assigned output, select the corresponding tab.
- To change the order of the table columns, drag/drop the column headings.
- To change the column width, hover over the frame line until the cursor changes into a two-headed arrow. Click and move the frame line.

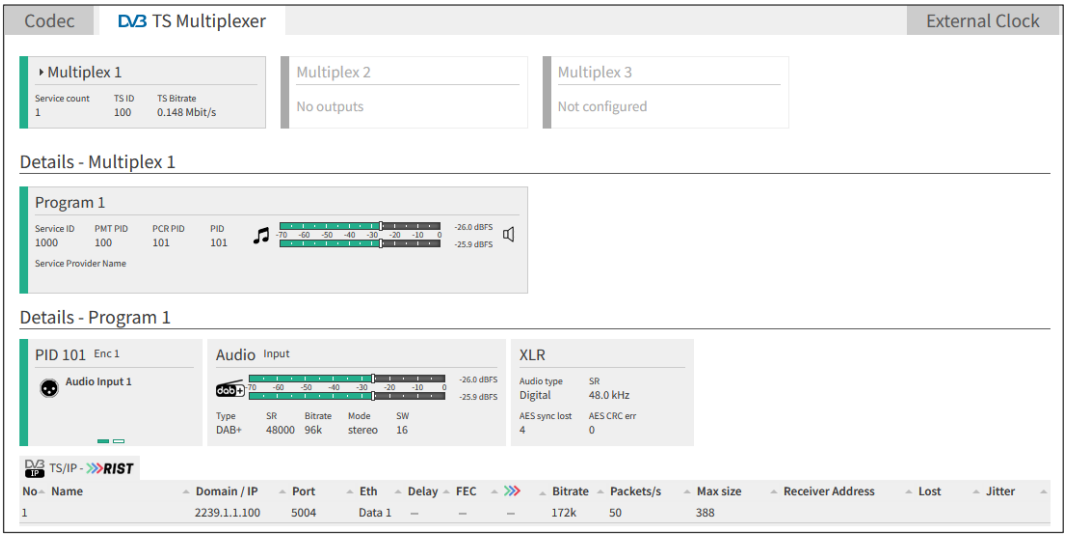
The encoder output displays the following counters:

Lost	Lost indicates the number of lost packets.
RIST/Requested	This indicates the number of packets that the receiver requested for retransmission by the sender.
RIST/Retransmitted	This indicates the number of packets that were retransmitted by the sender. Some requests may not answered due to timing and jitter.

TS Multiplexer status

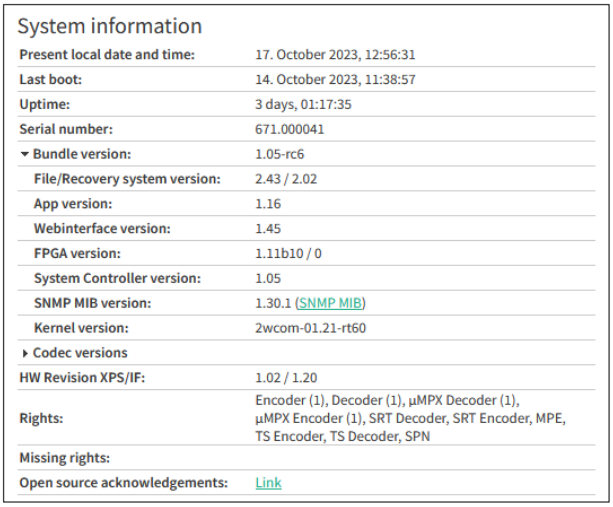
The Tab **TS Multiplexer** on the page **Overview** gives a detailed overview on the status of the enabled multiplex outputs.

- To see more details on the configured programs in one multiplex, click on the corresponding Multiplex.
- To see more details on the payload of a program, click on the corresponding program.



System Information

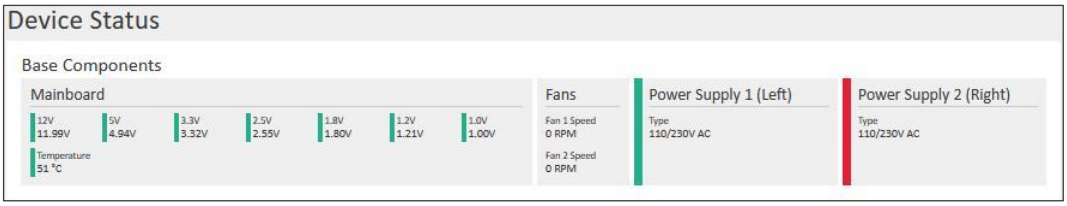
The page **Global** gives specific information on the device, such as the uptime and time of the last boot, serial number, activated rights and software version. The current version of your MPX-1c is the **Bundle Version**.



10.3 Device Status

The **Device** page gives information on the current status of the hardware.

- The block **Mainboard** displays the voltages on the mainboard and the device temperature.
- The block **Fans** displays the speed of the fans.
- The blocks **Power Supply** display the status and type of the left and right power supplies. The colored bar indicates the status: green - ok, red - no power. If only one power supply module is built in, the only one block in displayed on this page.
- The block **Expansion Modules** displays built-in hardware options. If no expansion modules are built in, this block is not shown.

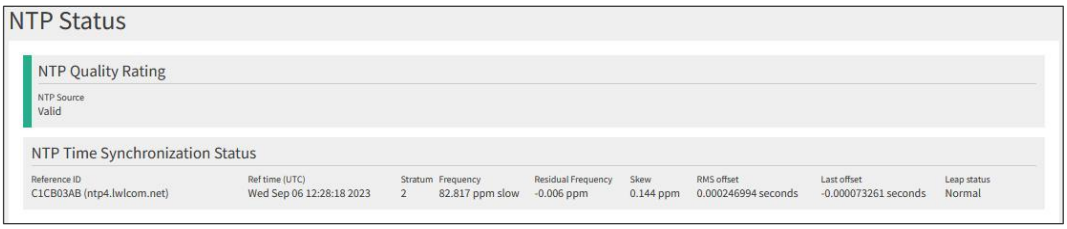


10.4 NTP Status

Navigate to the page **NTP Status** to view the status of the NTP servers used for time synchronization.

The first block gives information on the quality of the current synchronization. The MPX-1c always uses the best available source. The quality status of the current NTP server synchronization is displayed via a color-coded bar:

- green = the quality is good
- red = at least one of the listed data is bad

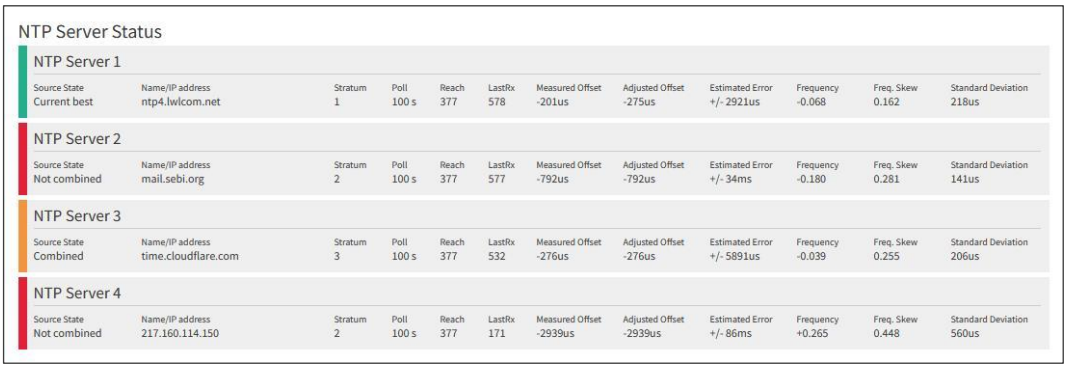


The list below explains the data that is displayed in this block:

NTP Source	States whether an NTP source is available.
Reference ID	The reference ID and IP address of the server to which the computer is currently synchronized.
Ref time (UTC)	The time (UTC) at which the last measurement from the reference source was processed.
Stratum	The stratum value indicates how many levels away the NTP server is from the primary reference source. Lower stratum values indicate a closer and more accurate clock source.
Frequency	The rate by which the clock would be wrong if it were not corrected.
Residual Frequency	Difference between what should be frequency according to the measurements from the reference source and the frequency that is currently used.
Skew	The frequency offset to the clock standard.
RMS Offset	The root-mean-spare offset is a long-term average offset to the currently estimated time.
Last offset	The time (UTC) at which the last measurement from the reference source was processed.
Leap status	Normal: no leap second. Insert second: leap second will be inserted at the end of the month. Delete second: leap second will be deleted at the end of the month. Not synchronized: unknown status (no valid measurement was made).

The block **NTP Server Status** lists all NTP servers and gives detailed information on them. The status of the NTP server source is displayed via a color-coded bar:

- green = current best
- orange = combined
- red = not combined



The list below explains the data that is displayed in this block. For more information, visit *chrony.tuxfamily.org/doc/4.1/chronyc.html*

Source State	Current best: the best source which is currently selected for synchronization Combined: other sources selected for synchronization which are combined with the best source. Not combined: any other source.

Name/IP address	The name or the IP address of the source
Stratum	The stratum value indicates how many levels away the NTP server is from the primary reference source. Lower stratum values indicate a closer and more accurate clock source.
Poll	Polling interval, which is the frequency at which the device queries the NTP server for time updates.
Reach	Indicates the reachability of the NTP server. This is a bitmask value that shows how successfully the device has been able to reach and communicate with the server.
LastRx (Last Receive)	Shows how long ago the last good sample was received from the source.
Measured Offset	The measured time difference between the local clock and the NTP server's clock at the time of synchronization.
Adjusted Offset	This value represents the measured offset after any corrections or adjustments have been applied to align the local clock with the NTP server's time.
Estimated Error	The total worse-case timing error accumulated between the stratum 1 server and the client.
Frequency	This is the estimated residual frequency for the server.
Frequency Skew	The frequency offset to the clock standard.
Standard Deviation	This is the estimated sample standard deviation.

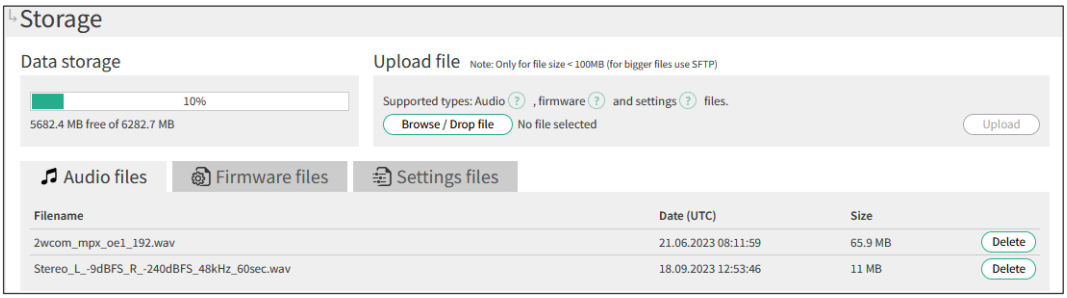
10.5 Ancillary Data Status

The status page **Ancillary Data** gives information on the status of the ancillary data inputs and outputs.

- The different Tabs display information on the DTE inputs and DTE outputs.
- The block **RAW Data** displays the data in the hexadecimal and ASCII code as well as the total bytes.
- The block **RDS/UECP Data** displays the information on the active RDS/UECP data as well as the total frames.
- To pause the data recording, click **Pause**.
- To clear the log, click **Clear**.

10.6 Internal Storage

You can upload audio files to the internal storage to use them e.g. as a backup input source. You can also upload settings files and firmware files to install later. Generated settings files also appear on the **Storage** page.



- Prerequisite: You are logged in as an admin.

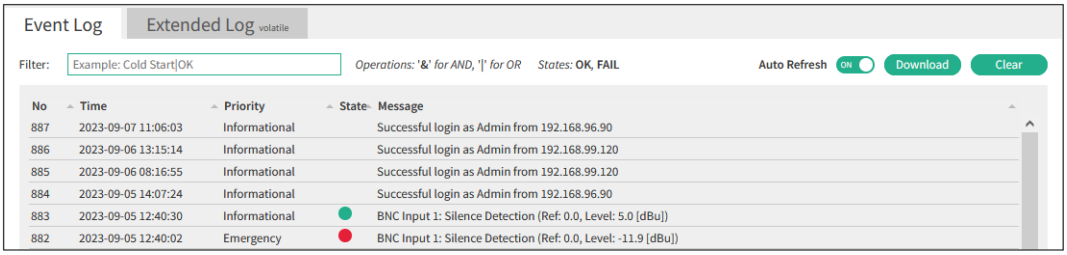
To upload a file to the internal storage:

1. Navigate to the **Storage** page.
2. In the **Upload file** block, select **Browse/Drop file**.
3. Select the audio file, firmware file, or settings file that you want to upload.
4. Click **Upload**. The upload may take a while. Do not interrupt this process.
   - ➢ The uploaded file is now displayed in the corresponding tab.

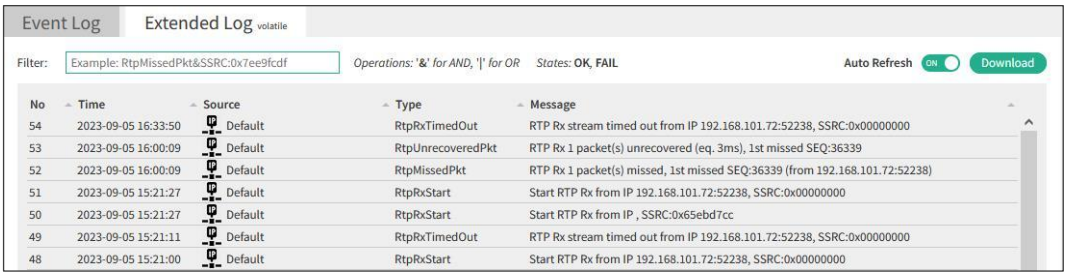
✓ You have uploaded a file to the internal storage. The percentage of used storage is displayed in the block **Data storage**. You can install an uploaded settings file or firmware file on the **Global** page.

10.7 Log

The **event log** is a record of significant system events, such as system restarts and error messages, which are crucial for monitoring the performance of the device. These events have an alarm priority and may require immediate attention or action to resolve issues or ensure proper operation. See also: 8.1 Setting Up Alarms.



The **extended log** contains less critical information compared to the event log, and is primarily intended to provide insights into general events. The log entries in the extended log are informational and do not carry alarm priorities, they are volatile and do not persist over restarts.



- To automatically refresh the page and immediately see new entries, toggle the switch **Auto Refresh**.
- To sort the log entries, click on the column header of the parameter by which you want to sort the entries. To reverse the order, click the same header again.
- To search for a specific entry, enter a term into the search bar.
- To save the list to a log file, click **Download**.
- To delete all log entries, click **Clear**. Confirm your decision in the dialog window.

10.8 Priority of Alarm Messages

Priority	ID/Code	Definition
Emergency	0	System is unusable
Alert	1	Actions must be taken immediately
Critical	2	Critical condition
Error	3	Error condition
Warning	4	Warning condition
Notice	5	Normal but significant condition
Informational	6	Informative message
Debug	7	Debug-level message

In case of an alarm, an error report with the priority of the error will be sent to the Network Operations Center (NOC). The responsible second-level support will decide by means of this information how urgent the alarming case is and what measures are necessary. The event will be recorded in a log entry.

11 Maintenance and Support

11.1 Maintenance and Disposal

No special maintenance is necessary on the device. Do not use corrosive detergents on the device such as benzene, thinner, alcohol or acetone.

Remove dust on the housing of the device with a soft, dry cloth.

Electrical appliances do not belong in domestic waste. Dispose of the device in an environmentally friendly manner via suitable collection systems in accordance to the local regulations.

11.2 Troubleshooting, Support and Warranty

More often than not, it is only a small detail that has been overlooked and leads to a problem. Therefore, read the user manual carefully, as this will help you to understand, prevent and eliminate typical problems. Use the following table to self-check common error sources prior to contacting our support.

Report failures by email to **support@2wcom.com**. For a support request to 2wcom, please have the serial number of the device ready. You can find the serial number of your device on the page **Global** and on the sticker on the rear side of the device: “S/N xxx.xxxxxx”.
For information on the warranty of 2wcom products, visit *https://www.2wcom.com/terms-and-conditions/*.

Problem	Possible Causes	Solution
Device does not turn on	• Power cable is connected improperly • Mains supply failure • Blown fuse	• Check power supply cord. • Make sure that the power plug is fully inserted. • Check mains supply. • Replace fuse by same type.
Device is not accessible via Ethernet	• Network cable is not connected • IP address/TCP port is unknown • A device with the same IP address was connected a few minutes before. Thus, the ARP table thill assigns the old MAC address to the IP address.	• Connect the network cable. • Check IP address obtained from DHCP via LCD menu. • The operation system refreshes the ARP table every few minutes. For an instant access to the device, reset the ARP table of your computer, e.g. by entering `arp-d` in the Windows command prompt.
Device does not respond		• Reboot the device. • Update the software.

11.3 Manufacturer

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12 Technical Details

12.1 Specifications



Technical details (1/3)

Codecs

PCM

Bit depth	12 - 16, 20, 24 bit
FEC	RIST, ProMPEG FEC #3 release 2
Bandwidth	2.4 - 4.6 Mbps (no FEC)

µMPX

Bitrates kbit/s	320, 384, 448, 576, 800
FEC	µMPX FEC, RIST, Pro-MPEG FEC #3 release 2
Bandwidth	320 - 800 kbps (no FEC)

Decoder outputs

Connectors MPX out

Digital	1x XLR (digital), balanced, 110 Ω
Analog	1x BNC, analog,, unbalanced

FM MPX sinal

Signal	FM MPX digital or analog, FM analog L+R Signal
Frequency response	20 Hz – 90 kHz: < 0.05 dB
Stereo separation	> 55 dB
Harmonic distortion	<-90 dB
SNR (CCIR-weighted)	> 75 dB
SNR (A-weighted)	> 90 dB

FM µMPX signal

Signal	Digital and analog
Frequency response	20 Hz – 66 kHz: <0.15 dB
Stereo separation	@500Hz >50 dB
THD	@500 Hz >70 dB
SNR (CCIR-weighted)	> 69 dB

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Technical details (2/3)

Encoder inputs

Connectors MPX in

Digital	1x XLR, balanced, >20 Ω, digital
Analog	1x BNC, 75 Ω, analog, unbalanced

FM MPX signal

Signal	FM MPX digital or analog
Frequency response	20 Hz – 90 kHz: <0.05 dB
Input voltage range	0 ... 14 dBu

Front Panel

Headphone	6.3 mm / 1/4" socket
LEDs	Power, Input, Output, Warning
Operation	Display and Jog Wheel

Back Panel

Gigabit IP

Type	10/100/1000 Base-T
Data	RAW Data via UDP, UDP/RTP, as Unicast or Multicast IGMPv2 Optional: Activation of 2nd data interface
Connectors	3x RJ45 (2x Data & 1x Control)

Contact closure

connector	26 pole sub-D male
Inputs	8 inputs
Outputs	8 floating relays (7x SPST, 1x SPDT) (for DC: max. 30 V, 0.5 A)

Serial

Interface	2x RS-232 Sub D-9
Data transmission format	MPEG ancillary data embedded in audio (IRT) own IP link
Transmission rate	1200 to 115200 baud, asynchronous
Interface	2x RS-232 Sub D-9

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Technical details (3/3)

General Data

Power consumption	< 20W
Case dimensions	19'', 1 RU, depth: 310 mm, width: 424 mm, front panel: 484 mm
Weight	< 5 kg
Material	Steel plate (aluminum-zinc coated)
Operating temp. range	0 – +45°C
Storage temp. range	-40 – +70°C
Languages	English

Power Supply

Standard AC	1 internal IEC power connector voltage range 90 – 260 VAC (nominal 100 – 240 VAC) frequency range 47 – 63 Hz (nominal 50 – 60 Hz)
Dual internal (optional)	Two internal redundant power supplies (AC or DC) automatic switchover and prioritization AC: 90 – 260 VAC (nominal 100 – 240 VAC), 47 – 63 Hz (nominal 50 – 60 Hz)
Dual hot-plug (optional)	Two hot-swappable redundant power supplies (AC or DC) automatic switchover and prioritization AC: 90 – 260 VAC (nominal 100 – 240 VAC), 47 – 63 Hz (nominal 50 – 60 Hz)

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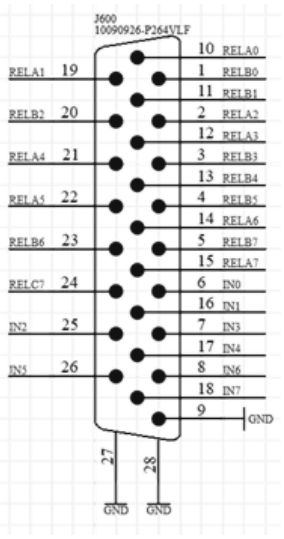
12.2 Interface Pin Layouts

GPI

The device features 8 GPI contacts that are housed in the same 26-pole D-sub male connector as the GPOs. The inputs can be used for remote control (in combination with remote control software).

The pin layout for GPI is as follows:

GPI No.	Control Pin No.
1	IN0
2	IN1
3	IN2
4	IN3
5	IN4
6	IN5
7	IN6
8	IN7



- To actuate a GPI, pull the corresponding control pin electrically to ground (pin 9). The resulting control current is less than 5 mA.

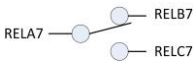
NOTICE **Risk of equipment damage!**

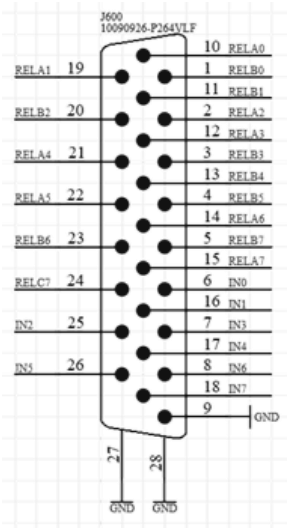
➢ The voltage on GPI contacts must not be negative or exceed +0.7 V.

GPO

The MPX-1c features 8 GPOs: 7 SPST relays (form A) and 1 SPDT relay (form C). You can use the relays for alarms of the monitoring function.

The pin layout for GPO is as follows:

GPO No.	Switch contacts	Switch type
1	RELA0, RELB0	SPST, NO
2	RELA1, RELB1	SPST, NO
3	RELA2, RELB2	SPST, NO
4	RELA3, RELB3	SPST, NO
5	RELA4, RELB4	SPST, NO
6	RELA5, RELB5	SPST, NO
7	RELA6, RELB6	SPST, NO
8		SPST



SPST: a simple on/off switch: single pole, single throw
SPDT: single pole, double throw
NO: normally open

NOTICE **Risk of equipment damage!**

- The relay contacts have a maximum load of 0.5 A at 30 V DC. Do not exceed these values.

12.3 Certificates and Declarations

CE

EC declaration of conformity

The manufacturer

2wcom Systems GmbH
Am Sophienhof 8
24941 Flensburg
Germany

hereby confirms that the product:

MPX-1c

in its conception, construction and form put into circulation is in accordance with all the relevant essential health and safety requirements of the following EC/EU directives as amended and the national laws and regulations adopting these directives:

• Audio/video, information and communication technology equipment - Part 1: Safety requirements	EN IEC 62368-1:2021
• Electromagnetic Compatibility (EMC) Directive	2014/30/EU
• Low Voltage (LVD) Directive	2014/35/EU
• Radio Equipment Directive (RED)	2014/53/EU
• Restriction of Hazardous Substances (RoHS 2) Directive	2011/65/EU

This EC-declaration of conformity is the result of a test, which was accomplished in accordance with the standards EN 301489-1:2020-06, EN 300422-1:2022-05, EN 300422-2:2017-07, EN 55011:2023-10, EN 55035:2022-06, EN 55032:2022-08, EN IEC 61000-3-2:2023-10, EN 61000-3-3:2023-02, EN 61000-4-2:2009-12. EN 61000-4-3:2021-11, EN 61000-4-4:2013-04, EN 61000-4-5:2021-04, EN 61000-4-6:2014-08, EN 61000-4-11:2021-10, EN 61000-4-16:2016-10, EN 63000:2019-05.

This declaration is no longer valid if the machine is modified without our consent.

2wcom Systems GmbH May 19, 2025

