MM01

Audio over IP Codec

Professional multi-format Duplex Audio Coder/Decoder

User Manual MM01 V03.53

Screenshots: MM01 version 1.48, 1.70, 2.02

April 2019

Content

1. Symbols in this manual

1.1. References and Hyperlinks in this PDF File

The original text document of this manual uses bookmarks for reference purposes. If you read this manual as a non-print version, please note that this PDF file also contains all bookmarks! So you can navigate through the document via the content overview in your PDF viewing software if you activate "bookmarks view".

All references to pages, sections, figures and tables as well as hyperlinks in the text identify a location within this PDF file. Just click the reference to find the referred passage in the text!

1.2. Warning signs and their meaning

The following warning signals are used in this user manual:

⚠	Warning of general danger location
⚡	Warning of electric shock
♨	Warning of hot surface
🔥	Warning of fire hazard

1.3. Tags and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers. The tags described here are always used only in connection with the related product documentation and the related product.

⚠ 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.
NOTICE	Describes precautions necessary to protect the equipment.
ⓘ	**NOTE:** Useful information for the user.

2. Introduction

Description The MM01 is a professional Audio over IP Codec. It is equipped with high quality multi-format audio encoder and decoder and is able to distribute audio data using the Internet Protocol (**IP**) via a 10/100/1000-Base-T network interface. The device has two main operation modes:
- transmitting Audio over IP;
- receiving Audio over IP.

> **NOTE**: The MM01 can operate in both modes at the same time: as encoder and decoder (bidirectional and full duplex audio input/output channels).

Thus, the MM01 is used at **both ends** of the transmission chain: in the FM studios where signals are generated, and in the FM stations where signals are received and distributed (see *Figure 1*).

Audio signal can be sent from an input to a different node for the output. The MM01 offers therefore different solutions for audio distribution.

MM01
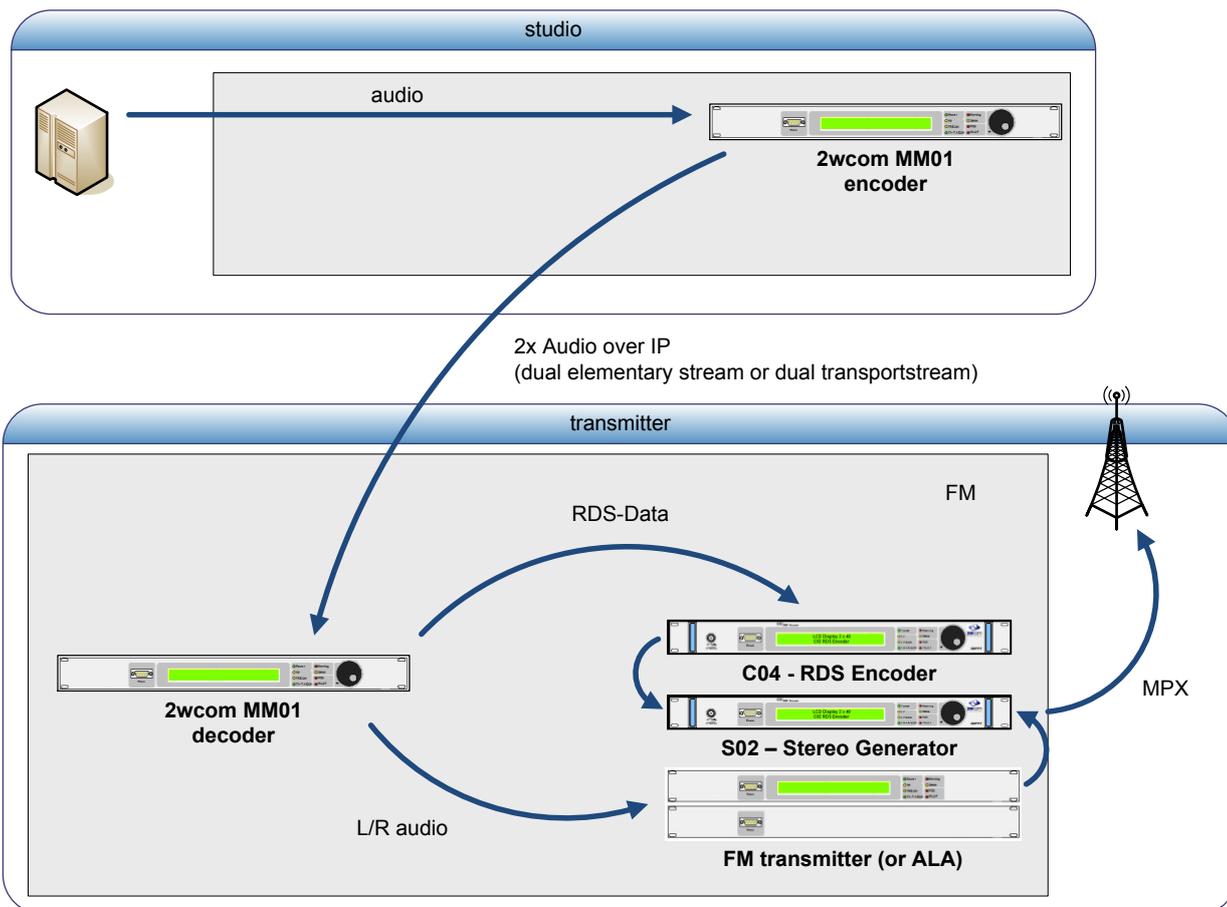
Figure 1: Overview of the possible solution for the MM01

TS protection The MM01 is equipped with a combined mechanism for improving the stability and robustness of the audio data distribution over IP:

- Pro MPEG forward error correction (FEC) scheme to account for bit errors or packet loss (IP).
- Dual streaming for elementary stream and transport stream over IP (RTP/UDP) for redundancy (2x Ethernet LAN 10/100/1000 base-T (RJ45) interface).

Stream4Sure enables continuous audio transmission using sample precise seamless data selection:

- up to 4 source streams with different codecs
- combinable with FEC, Dualstreaming (IP packet based redundancy) and SFN
- must be activated in both devices: encoder as well as decoder
- available only for source type "Elementary stream (RTP/UDP)", "Audio over IP (RTSP/SIP/SAP)".

1 Encoder setup example

Stream4Sure (Main / PCM)
MM01 (Encoder)
Stream4Sure (Backup1 / HE-AACv1)
MM01 (Decoder)

2 Encoder setup example

Stream4Sure (Main / PCM)
MM01 (Encoder)
Stream4Sure (Backup1/ HE-AACv1)
Synchronized
Stream4Sure (Backup2 / HE-AACv1)
MM01 (Decoder)
MM01 (Encoder)
Stream4Sure (Backup3 / HE-AACv1)
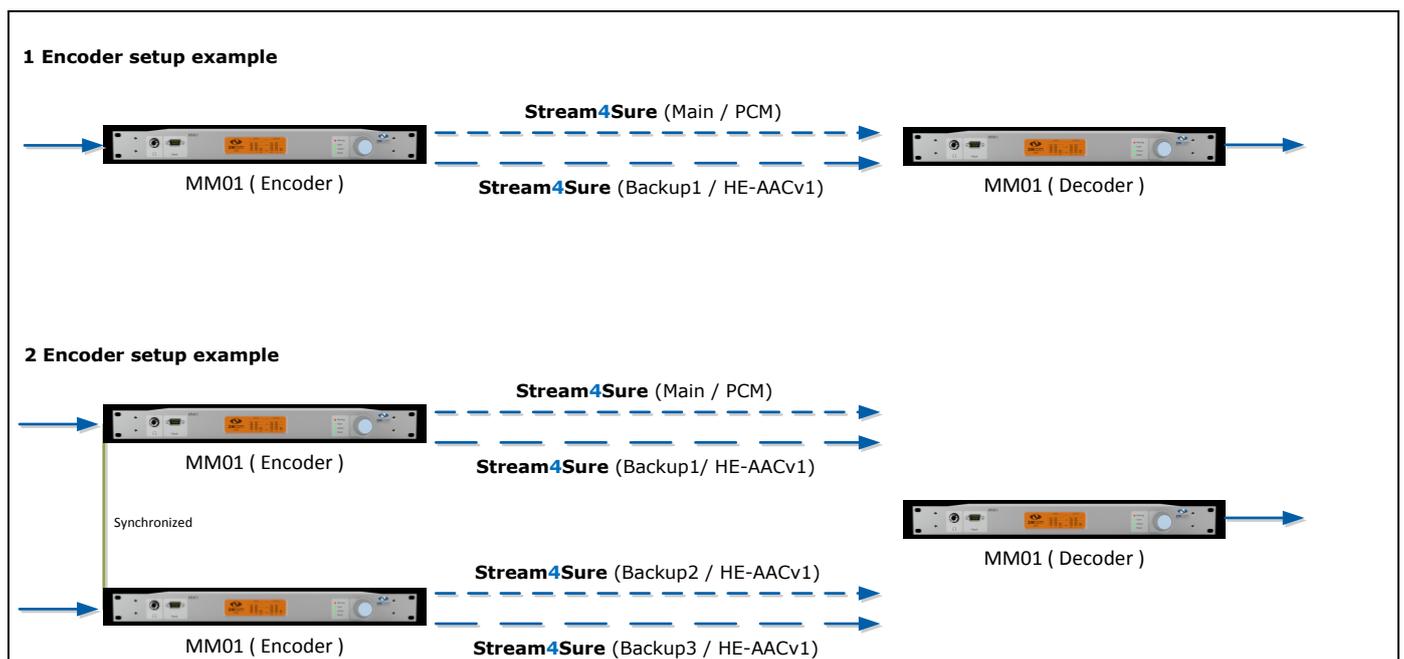
Audio

- FM Tuner Input (optional)
- The MM01 is equipped with a balanced analogue (2xMONO or 1 STEREO IN/OUT) and digital AES/EBU (integrated XLR) interfaces with a configurable level for audio inputs and outputs (over web interface).
- Nominal input/output level is 0 dBu and maximum input level bigger or equal to +18 dBu (optionally: +21 dBu on request).
- A/D and D/A sampling frequency for analog audio is configurable to 24bits/48KHz or larger (see section 13.4 "Set up the coder" on page 43).

Monitoring

- Audio inputs/outputs
- Encoder/Decoder (audio inputs/outputs, silence detection)
- Device functions (power failure, temperature, SFN clock etc.)
- Streaming input (input data, Package Error Rate)

Alarm reporting via

- SNMP traps
- activation of floating relay contacts
- LED, log message

Control **HTTP Web interface**
The unit is controlled via a built-in web user interface.

Home	E-Mail	2wcom			Live: n/a	Logout (admin)	⏻ ❗ ⬇ ⬆

MM01
Name: MM01 Hans
Location: Development
Description:

Overview

Audio Levels

	Input				Output	
AES/EBU	Analog	Encoder	Decoder	Analog	AES/EBU

Status

Device:

Uptime	0 days, 00:58:59
Last reboot	24. October 2017, 08:22:32
Chassis temperature	41°C

LAN:

Ctrl	UP, 100 Mbit, Full Duplex - 192.168.14.127
Data 1	UP, 100 Mbit, Full Duplex - 192.168.14.129
Data 2	DOWN - 192.168.60.170

Decoder   [Reset counters]

	Name	Type	Address	Audio Version	BR	SR	Delay	Error	IP BR	Delay	Miss	Reord	FEC	Recov	Unrec
○ Main	incoming	SIP	@:5004, Data 1	--	--	--	0	0	0k	0	0	0	--	--	--
○ Backup 1															
○ Backup 2															
○ Backup 3															

Encoder

Source:

● Main	Analog
○ Backup 1	None
○ Backup 2	None
○ Backup 3	None

Settings:

	Type	Format	Mode	SR	SW	BR	FEC
Encoder A	RTP	MPEG1 L2	Stereo	48000	16	256k	--
Encoder B	RTP	MPEG1 L2	Stereo	48000	16	256k	--

Stream Destinations:

	Name	Enc	IP	Port	Eth	VLAN	Delay	Stream4Sure	SFN Lat	FEC C	FEC R	BR
○		A	91.195.79.253	20952	Data 1	0	0	--	0	--	--	0k

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Information
« Overview »
Decoder Settings
Decoder
Encoder Settings
Encoder
Interface Settings
Audio / Headphone
DTE
FM Tuner
Relay
Optical Coupler
Network Settings
TCP/IP
SNMP
SNTP (Time)
Icecast Server
AoIP Settings
SIP Contacts
Easy2Connect (SIP)
SIP
SAP
PTP
RTSP
Livewire
System Settings
Global
Time
User
Alarm
Switch Criteria

Settings backup
MM01 is able to store and load all settings in different CODEC interconnection profiles through the Web interface to a SD Card or USB stick.

SNMP, Telnet, NMS
Additional monitoring of the device using SNMP. Rudimentary device control, status information and alarm trap generation is featured. Optional: control via centralized Network Management System (NMS).

LCD and jog wheel
Initial configurations and major status information can be called up via LCD menu and jog wheel.

GPIO
GPIO transmission is possible over 2x Ethernet (Data 1/2) and 2x serial (DTE 1/2) interfaces.

Functions *Table 1* shows the main functions of the MM01:

STANDARD	Encoding Audio digital/analog → Audio over IP	The MM01 can: - reduce the bandwidth of the audio signal for IP - reduce the bit rate to increase the quality of an error correction ("transparent transmission") - digitize/encode the audio signal and output it over IP (MPEG 1/2 Layer 2, 3; Linear PCM, AAC LC/LD, HEv1&v2, Enhanced aptX (E-aptX), G.711, G.722) - protect the output data stream with pro MPEG FEC - output the encoded signal over dual TS or dual elementary stream (RTP/UDP) - stream audio using UDP, RTP, SIP, SAP, PTP and RTSP (standardized by EBU N/ACIP Tech 3326) - additionally use up to 3 backup sources and automatically switch between them as a redundancy (see section 13.7 on page 48 and 14.6 on page 70) - set up max. 28 elementary streams for output - send the channels of 1 CODEC to up to 32 destinations in the same time (several unicast, multicast, broadcast, dual stream) - set up and control audio levels of the input/output
	Decoding Audio over IP → Audio digital/analog	The MM01 can: - receive data stream over IP using UDP, RTP, SIP, SAP, PTP and RTSP - decode audio signal from the IP data stream and output it (MPEG 1/2 Layer 2, 3; Linear PCM, AAC LC/LD, HEv1&v2, Enhanced aptX (E-aptX), G.711, G.722) - set up and control audio levels of the output/input
OPTIONAL		The MM01 can: - use FM Tuner as an Input - use MPEG 2/4 codecs for encoding audio data - synchronize the outputting audio for Single Frequency Networks (SFN) - play files from SD-Card or use alternative streams (Icecast / Shoutcast) - decode RDS data - transmit digital audio and MPX signal in a bit "transparent mode" (see section 15.1 on page 78) - **Stream4Sure**: 2wcom Streaming Technology with different codecs/qualities and seamless switching of up to 4 streams

Table 1: Overview of the main functions of the MM01

SIP   Audio streaming over IP is possible by means of SIP connection. For a quick SIP connection an **Easy2Connect** (SIP) function is available. It uses saved contacts und preconfigured streaming settings to establish the connection by one click.

User   Only experienced technical personal or engineers should operate the MM01. Basic knowledge about FM, audio en-/decoding and IP networks is required.

> **NOTE**: Read this user manual carefully before attempting to operate the unit. Save this user manual for future reference – it contains important safety and operating instructions for the device.

Some features can be combined with each other as separate modules and built in on request. Please contact our sales department.

3.   Safety Instructions

For a secure operation of the device the user should read and hold on all safety instructions mentioned in this manual before the first operation.

⚠ **WARNING**	Non-compliance with the safety instructions can lead to serious injury.

Any changes on the device or operation of the parts not having been proved and released by the manufacturer can lead to unforeseen damage.

Every improper use of the device and all actions on the device not mentioned in this user manual are regarded as a not allowed misuse outside the statutory limits for liability of the manufacturer.

If you sell the device or give it to another person, attach this user manual to the device.

Never operate the device, if it does not function properly. If the device or its part is out of order, put it out of operation. Never repair the device by yourself. If there are any damages in the device, send it immediately to 2wcom Systems for maintenance or dispose it professionally according to the regional disposal regulations.

Keep the device away from unauthorized persons.

⚠ DANGER

⚡	**DANGER of electric shock** Plug the device into a grounded power socket only. Never remove the grounding wire/contact. Never open the housing of the device by yourself. Never 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 with wet hands. Never expose the device to liquids. If any liquid comes inside the housing, immediately disconnect the device completely from the power supply. Do not continue operating the device.

🔥	**FIRE HAZARD of overheating or electric shock**
	
	Ensure sufficient heat dissipation during operation. Avoid following when installing the device:
	
	    – non-ventilated environment, for example a narrow shelve or built-in wardrobe;
	    – extremely warm or cold place;
	    – direct sunlight exposure;
	    – too high or too low temperature;
	    – extremely wet or dusty environment.

| | Do not operate the device in the presence of flammable gases.

Do not cover the ventilation openings of the device to avoid heat accumulation.

Do not put objects with open flames such as burning candles on the device.

Do not put heavy objects on the supply cord. A damaged cord can lead to fire or electric shock hazards.

To disconnect the supply cord, drag always the plug and never the cable to avoid the cord damage. |
|---|---|

⚠ WARNING

| | **WARNING of explosive atmosphere**

Risk of the explosion hazard.

Do **not** use the device in an explosive environment. |
|---|---|
| | **WARNING of hot surface**

The surface of the device can heat up during operation. The device is equipped with a passive cooling system.

Do not touch the surface of the device during operation. |

NOTICE

| | **CAUTION: Risk of equipment damage**

Before the first operation:

Check the housing, the front panel, the supply cord and the plug for visible damage (e.g. scratches, cracks, damaged isolation and abrasion)

In case of damage, unplug immediately the supply cord. Never operate device with a damaged supply cord.

All damaged components must be replaced immediately.

Installation:

Use only a grounded three-wire power supply cord and -plug that complies with the national regulations.

If necessary, another than the supplied supply cord has to be used, in compliance |
|---|---|

	with the regulations of the country where the device is operated.
	Make sure that the AC power outlet is next to the device and readily accessible to the user.
	Installation of other devices:
	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.
	Cleaning:
	Do not use corrosive detergents on the device such as benzine, thinner, alcohol or acetone. Clean the surface of the device only with a soft dry cloth.

4. Supplied Parts

- MM01
- Power supply cord*
- Optional: 1x or 2x 48 VDC terminal blocks; no power supply cord
- PC Software to download: MM01 for Win98, 2000, XP and Vista for configuring and remote operation
- User manual in PDF format to download; on request by paper

*available for different countries

> **NOTE**: The scope of delivery may deviate in special cases.

5. Manufacturer

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6.   Installation

Best setup location

The device should be installed in a 19" rack. Avoid direct sunlight, proximity to radiators and air conditioning, dust, water, and chemicals. Choose a rack location that permits a clear view of the indicators on the device and ensure a sufficient heat dissipation of the device.

Mains supply connection

The device is designed for operation with 100 to 240 VAC, 50 to 60 Hz. Optionally, it can be equipped with a 48 VDC power supply.

Check the corresponding device labeling for compatibility to the domestic line voltage and frequency before connecting the IEC power connector to the mains supply!

No power switch is available; unplug mains supply connector to remove power. Keep the mains supply plug readily accessible to the user.
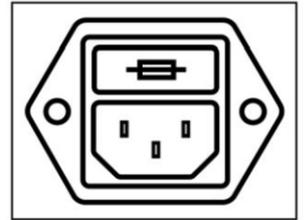
⚠ **WARNING**	
	WARNING Disconnect mains power plug before you open the housing. Repair of the equipment must only be carried out by authorized and qualified personnel. Read also Section „Safety Instructions".

7. Operation

7.1. Device Control via Web Interface

The device has an integrated web interface. All configurations and operations can be made using a web browser.

To control the device via web interface:

Connection: for network configuration and access to the web interface see Section 8.2.

> **(i)** **NOTE:** To maintain security, you are automatically logged out after 15 minutes of no activity.

Navigation: to navigate through the web interface, use only the menu buttons of the web interface and not those of the web browser (i.e. forward and back).

Buttons:

– if you want to save any changes made in the configuration of the device, press the save button;

– if you don't want to save the changes, press the reset button

> **(i)** **NOTE:** Each field has to be saved individually.
> If you change data in several fields, you must click save under each field, in order to save all changed data.
> Otherwise, the unsaved field will be reset to the previously saved status.

Numbers: use a decimal point as the decimal separator in numbers in the input fields (i.e. "6.5" for six and a half).

Input fields: After entering a number or text in an input field, you must click on the corresponding save or ok button to activate the changes. Alternatively you can use the ENTER-key of your computer keyboard.

The next sections explain the separate web interface functions. The operation via jog wheel and LCD on the device is similar to these descriptions.

7.2. Operation via LCD/jog wheel

Some basic functions of the device can also be operated via the LCD/jog wheel at the device.

Via LCD and jog wheel you can:

- configure network settings for the first access to the device over the web user interface
- view the device status and the level of the input/output signal.

If a function of the web interface is applicable for the LCD/ jog wheel, the corresponding **menu path** is shown at the web interface description.

- To change from the default status screen to the main menu screen, push the jog wheel.

- To move the cursor in the menu structure, turn the jog wheel.

- To open a menu entry or to confirm a setting, push the jog wheel.

- To select a configurable menu entry, turn the jog wheel.

- To adjust a menu entry, push and then turn the jog wheel.

- To confirm the adjustment, push the jog wheel.

- To return to a previous menu level, activate the menu entry "<<".

- Some settings need a restart of the device to be activated.

8.   First Steps

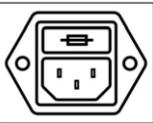The following section contains instructions for quick start.

✓ You have already unpacked and installed the device in an appropriate place

8.1. Power supply

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

The device can be equipped with different redundant power supply connectors:

	230V AC, 90…260 V AC, 47…63 Hz If the device is compatible, connect the power supply cord fully to the IEC power connector at the back panel of the device and an independent mains power outlet.
	- 48V DC Neutrik powerCON socket, aut. switchover (NAC3MPA-1) - Neutrik powerCON connector (NAC3FCA) **NOTE**: No power cords are delivered!

Assembly Instruction for the 48V connector:

To connect your cable to the delivered terminal blocks for [Power IN], insert the wires into the delivered terminals and fasten the screws with a POZIDRIV® screwdriver No 1 to maximal torque of 0.5 Nm.

NOTE the specification for the power supplies and the position of the poles in the connector and in the [Power IN] socket on the back panel of the housing as shown in Figure 2:
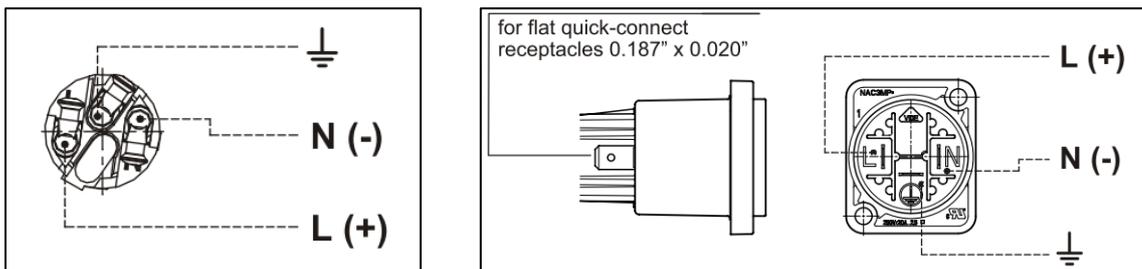

Figure 2: Wiring of the 48V connector (left) and of the 48V socket (right), rear side
  N – "neutral"
  L – phase conductor "line"

NOTICE	
	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.

> **i** **NOTE**: The MM01 Decoder will normally continue playing back the feeding redundant audio signal (Digital, Analog L/R IN/OUT) even in case of no power connection to the device.

⇒ The "Power" LED will turn on green, if both power supply cords are connected.

⇒ The "Power" LED will turn on yellow, if one power supply cord is connected.

8.2. Network configuration

NOTICE

False connection of the Ethernet interfaces will lead to incorrect operation

Use the [Data 1/Data 2] connectors only for the data transfer (input/output).
Use the [Ctrl] connector only for the access to the device via the web interface.

For delivery the device is configured with default settings for the first connection via the IP interface. The default IP address / netmask are `192.168.14.250` / `255.255.255.0`.

You can activate the access to the device or to adjust the default configuration to your own network via LCD screen and jog wheel.

Use jog wheel to configure the IP network:

1. Connect a network patch cable to the 10/100-Base-T connector [Ctrl] on the back panel of the device and your existing IP network.

2. Push the jog wheel to select `"Main Menu"` and select `"Main Menu>Interface>Ctrl IP"`

3. Configure settings for your existing IP network (IP address, netmask, gateway etc.; consult the responsible network administrator if applicable).

4. Save the settings by using the jog wheel and reboot the device selecting `"Main Menu>Reboot"` confirming the reboot question.

   ⇒ Your device is now connected to the IP network.

8.3. Web interface

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

To operate the device via the web interface:

1. Start an internet browser (e.g. Firefox/Mozilla ≥ Version 3.0 or Microsoft Internet Explorer ≥ Version 7.0 (both with Java Script activated)).

2. Enter the configured IP address in the address bar of the browser. If the IP address has not been changed in step 8.2, please enter the default address in the address bar of the browser: `192.168.14.250`.

---

3. A login screen with *Username/Password* appears. Use the default accounts:

  i. for a read-only access use "guest"/"guest"

  ii. for a full access use "manager"/manager" or "admin"/"admin"

⇒ After entering the correct login data (case sensitive), the main MM01 page appears.

NOTE: Change the login data as soon as possible to avoid unauthorized access to the device and document the login data in a safe place.
You can change your login data under **System Settings→User**.

8.4. Connecting the device

For data distribution, connect the device as follows:

1. If the MM01 should operate as an encoder, use the XLR jacks [Analog L/R IN]/[AES/EBU IN] to feed an audio/digital audio signal to the encoder.

2. To output the encoded signal over IP, use the [Data 1/Data 2] RJ-45 connectors for redundant distribution over IP.

3. If the MM01 should operate as a decoder, use the [Data 1/Data 2] RJ-45 connectors to receive the signal over IP for decoding.

4. To output the decoded audio signal, use the XLR jacks [Analog L/R OUT]/[AES/EBU OUT].

5. You can use the analog/digital inputs and outputs for automatic playback in case of power failure.

6. Use the headphone output for monitoring the decoded audio signal. Set up the mode for the headphones output under **Interface Settings→Audio** (possible options: "mute"/"decoder").

8.5. Encoder activation

NOTE: The MM01 can operate in both modes at the same time: as encoder and decoder.

To activate and to configure the unit as an encoder for audio over IP:

1. Select **Encoder Settings→Encoder** in the web interface menu. The page *Encoder* appears.

2. Activate and configure input sources for audio encoding in the field **Source** by clicking the Edit button (main source, backup sources 1-3).

  NOTE: If source "FM Tuner" is available, make settings first under **Interface Settings→FM Tuner**.

3. Define the output stream and configure audio encoder parameters in the field **Encoder Configuration** by clicking the Edit button.

4. Define the destination for the data stream in the field **Stream Destinations** by clicking the Add button. Configure the new destination by clicking the Edit button.

5. Click the save button after each change.

  ⇒ The device is functioning now as an encoder.

8.6. Decoder activation

> **NOTE**: The MM01 can operate in both modes at the same time: as encoder and decoder.

To activate and to configure the unit as a decoder for audio over IP:

1. Select **Decoder Settings→Decoder** in the web interface menu. The window *Decoder* appears.

2. Define the input stream name and choose the source type for decoding in the field **Source Streams** by clicking the [Add] button and then the [Edit] button.

3. If necessary, define more input streams by clicking the [Add] button.

4. Activate the main source (if necessary: backup sources 1-3) in the field **Edit Source Assignment** by clicking the [Edit] button and assign to it an input stream defined in the previous step.

5. Click the [save] button after each change.

   ⇒ The defined stream is being decoded and monitored now. The current state of the source is indicated by the virtual LED in the same field (red/green).

8.7. Switch Criteria

The coder and decoder are able to process several input signals at the same time and switch between the main and backup sources for the input, if one of the signals fails.

To set up switch criteria for encoder and decoder:

1. Select **System Settings→Switch Criteria** in the web interface menu of the MM01. The window *Switch Criteria* appears.

2. Enable and configure each switch criterion separately for Audio Input (Encoder), Decoder and Streaming Input (Decoder).

3. Define for each criterion the delay time *T1* (in milliseconds) for switching release. The delay time from this defined value will be regarded by the system as "bad", so that after the delay time *T1* the device switches the audio source to the configured backup source.

4. Define for each criterion the delay time *T2* (in milliseconds) for switching end, how long a "good" signal for this parameter in the previous source should be available, before the system switches back.

5. Click the [save] button to save the changes.

⇒ The device switches to the next best input source.

8.8. Set up alarm

You can set up monitoring of certain device, input/output, encoder and decoder parameters which should be measured. In case of failure, an alarm can be sent over SNMP, relay switching and/or will be indicated by a warning LED in the front of the device and/or through an entry in the log.

To set up alarm for the available parameters:

1. Select **System Settings→Alarm** in the web interface to open the monitoring setup page.

2. Activate monitoring for each parameter separately by selecting the corresponding checkboxes in the column "Enable".

3. Select for each alarm function the severity level of the alarm in the dropdown menu "Priority" (for more information about alarm priority see Table 2 on page 50)

4. Some alarms need a threshold value. Change or enter the threshold value in the corresponding fields.

5. For each parameter default values are already preset. T1 vs. T2 is the time a parameter has to be "bad" vs. "good" before an alarm will be generated vs. retracted.

6. Activate the way of the alarm distribution (SNMP, Relay, LED) by selecting the corresponding checkboxes.

7. In the same menu you can set up the alarm in case of LAN connection failure or device overheating.

8. Click the ⌷save⌷ button to save the changes.

9. In the same menu you can see status LEDs of each monitoring parameter and under **Status→Log** details about the sent alarms (for more information about log see section 18.16).

8.9. Adjust volume levels

To adjust the volume levels of the available analog/digital inputs and outputs as well as headphone output:

Select **Interface Settings→Audio** to set up the audio volume of headphone, audio analog/digital inputs and outputs.

NOTE: These first steps are only intended for a quick first start and do not cover all device functions. Please read carefully the entire manual to be able to use all functions of the device.

9.   Control Elements and Connectors

9.1. Front Panel
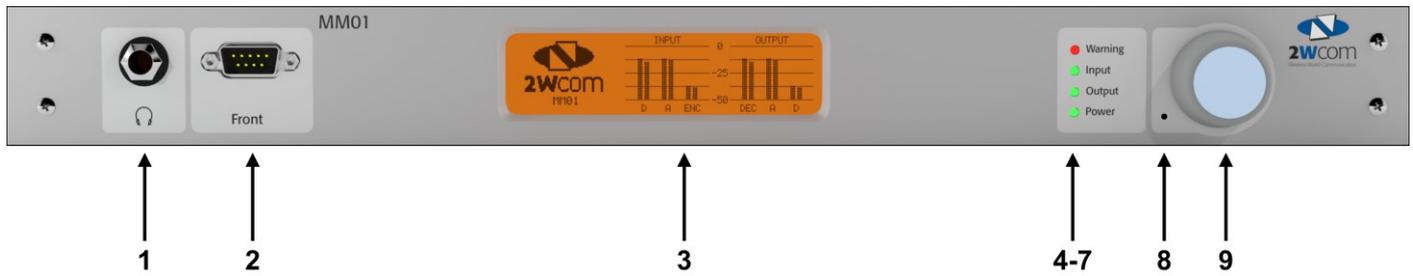
1	Headphones	6.3 mm / 1/4" socket for the connection of headphones.
2	[Front]	9 pole D-Sub male connector; Serial RS-232, only for device servicing purposes.
3	LCD screen	Illuminated, Liquid Crystal Display (LCD), graphical, 264x64 pixel.
4	[Warning] LED	LED indicator (red); lit if alarm is triggered.
5	[Input] LED	Activated (green) if the device is configured for an input source and the audio signal in the input is ok.
6	[Output] LED	Activated (green) if the device is configured for an output, the outgoing signal is available and is ok.
7	[Power] LED	Activated (green) if both power supply cords are connected and the power supply is ok.
		Activated (yellow) if one power supply cord is connected and the power supply is ok.
8	Reset (pin hole)	Recessed button for resetting the device (warmstart).
9	Jog wheel	Jog wheel for the device operation via the LCD screen on the device. Turn the jog wheel to place the cursor on the desired menu entry and push the jog wheel to activate the highlighted menu entry.

9.2. Back Panel
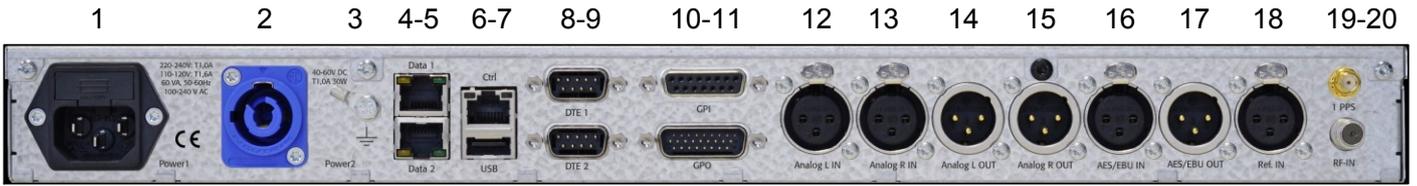
1-2	Power supply ports	2x redundant standardized IEC power supply connector with integrated fuse holder; automatical switchover.
		Fuse ratings depending on mains supply voltage: 90-260 V, 47-63 Hz: T1.6A, time lag type, 5x20 mm, 230 V
		Optional: redundant power supply 48VDC
		Combination of power supply 230 VAC and 48 VDC is possible.
3	[Grounding stud]	The stud can be used to connect a grounding system if necessary.

NOTE:
The required protection earth (PE) is accomplished via the 3-wire mains supply cord.

4-5	[Data 1/2]	2x RJ-45 connectors; 10/100/1000 Base-T interface for two redundant outputs for data, audio and GPIO transmission via gigabit Ethernet;
6	[Ctrl]	RJ-45 connector; 10/100/1000 Base-T interface for control and monitoring the device via Ethernet. The device can communicate with the IP network and can be configured with an internet browser via the integrated web interface. The LED´s at the socket show the link status (green; active if a physical network connection exists) and the activity status (yellow, active if data communication is active).
7	[USB]	USB 2.0 interface for service and firmware.
8-9	[DTE 1/2]	2x 9 pole D-Sub male connector for serial RS-232 data transmission, e.g. output of the MPEG or aptX ancillary data embedded in audio (IRT); own IP link. Transmission rate: 12000 to 115200 baud, asynchronous.
10	[GPI]	15 pole D-Sub female connector; remote control input, GPIO transmission; 7 GPIO inputs; for service.
11	[GPO]	26 pole D-Sub male connector; GPIO transmission; 12 floating relay contacts (12 GPIO outputs); switch contacts of the integrated relays. The relays can be activated by the monitoring function in case of an alarm.
12	[Analog L IN]	Balanced XLR female socket; input of the left channel of the analog audio signal or MONO IN.
13	[Analog R IN]	Balanced XLR female socket; input of the right channel of the analog audio signal or MONO IN.

14	[Analog L OUT]	XLR male socket; output of the left channel of the analog output signal with configurable signal level or MONO OUT.
15	[Analog R OUT]	XLR male socket; output of the right channel of the analog audio signal with configurable signal level or MONO OUT.
16	[AES/EBU] IN	Balanced XLR female socket; AES/EBU interface for the input of the digital audio signal in the "Professional Format". The sample rate of the signal depends on the received signal.
17	[AES/EBU] OUT	Balanced XLR male socket; AES/EBU interface for the output of the digital audio signal in the "Professional Format". The sample rate of the signal depends on the received signal.
18	[Ref. IN]	Balanced XLR female socket; AES/EBU digital reference input for clocking the outputting signal.
19	[1 PPS]	(optional) BNC unbalanced connector for SFN synchronization (GPS input).
20	[RF-IN]	BNC connector for input of FM signal.

10. Network Settings

✓ You have already connected the device to the network [Ctrl] and configured the access to the web user interface (see page 18, section "First Steps").

10.1. TCP/IP: configuration of the Ethernet interfaces

The MM01 has three Gigabit Ethernet RJ45 interfaces: one for configuration and two for data exchange. On requirement the new internet protocol version 6 (IPv6) can be implemented for all interfaces.

NOTICE
False connection of the Ethernet interfaces will lead to incorrect operation Use the [Data 1/Data 2] connectors only for the data transfer (input/output). Use the [Ctrl] connector only for the access to the device via the web interface.

Under **Network Settings→TCP/IP** you can configure the Ethernet interfaces: Control interface to access the web user interface of the device [block Interface **Ctrl**] and both data interfaces [column **Data 1/Data 2**].

NOTE: The MM01 supports ADSL/VDSL connections by assigning static and dynamic IP addresses. To use a dynamic IP, a DynDNS account is needed.

The following parameters can be configured or changed (see Figure 3):

MAC address*:* The current MAC address is shown in the brackets near interface name in the field title.

VLAN ID Enter the VLAN ID for the corresponding interface, if the connected devices should be separate from the main network. Use value "zero", if the VLAN connection should be disabled.

IP address: Individual address that is necessary to identify hardware in an IP network like the internet or intranet.

Netmask: Bit mask, which separates an IP address into a network part and a host part.

Gateway: Address of the local system that is used for the internet access (e.g. the router).

DHCP: Activate or deactivate the Dynamic Host Configuration Protocol which enables the device to get an IP Address automatically.

Primary DNS: IP address of the primary Domain Name Service (DNS) server.

Secondary DNS: IP address of the secondary Domain Name Service (DNS) server.

Routing	Activate or deactivate "Routing" switch, which enables the DNS Server to send and to answer the requests over different Data Interfaces [Data 1] or [Data 2]. Activate "Routing" and select the Data Interface in the drop down menu "Routing Interface".

If "Routing" is deactivated, the requests will be sent to the interface that is connected to the same network as the DNS Server.

Figure 3: TCP/IP settings

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

⇒ Save the changed settings after by clicking the [save] button.

LCD-menu: Interface→TCP/IP

10.2. Monitoring function: configuration of SNMP

As part of the monitoring function, the device is capable to send SNMP traps to the defined IP addresses of the SNMP managers. It is also possible to readout device settings via SNMP Get.

This menu item is available under **Network Settings→SNMP** and is used to setup the IP addresses of the SNMP managers (see Figure 4).

Figure 4: Network Settings – SNMP

Additionally, access data (read community / write community) that is necessary for external SNMP requests to device can be configured here.

You can configure or change in this menu the following parameters for SNMP:

First manager: IP address of the first SNMP manager that receives SNMP traps. The trap sending to this address can also be deactivated by a checking "off" at "Send trap:".

Second manager: IP address of the second SNMP manager that receives SNMP traps. The trap sending to this address can also be deactivated by a checking "off" at "Send trap:".

Read community: SNMP access data for the external read SNMP access to the device.

Write community: SNMP access data for the external write SNMP access to the device.

⇒ Save the settings by clicking the ⬚save button.

ⓘ	**NOTE**: In order for the SNMP manager tool to operate correctly, it requires the specific MIB files. These MIB files need to be compiled by the SNMP manager tool and are provided as download on the Web interface in the "System information" block under **System Settings→Global** (see Figure 66 on page 90) or via email.

ⓘ	**NOTE**: Each activated trap will be sent once at startup for initialization.

You can configure and activate the monitoring functions under **System Settings→Alarm**. More information about alarm settings you can find in section 13.8, 14.7 and 18.3.

10.3. SNTP settings: configuration of date and time

This menu item is available under **Network Settings→SNTP (Time)** and is used to enable the automatic synchronization of the date and time of the device with an external SNTP server (see Figure 5).
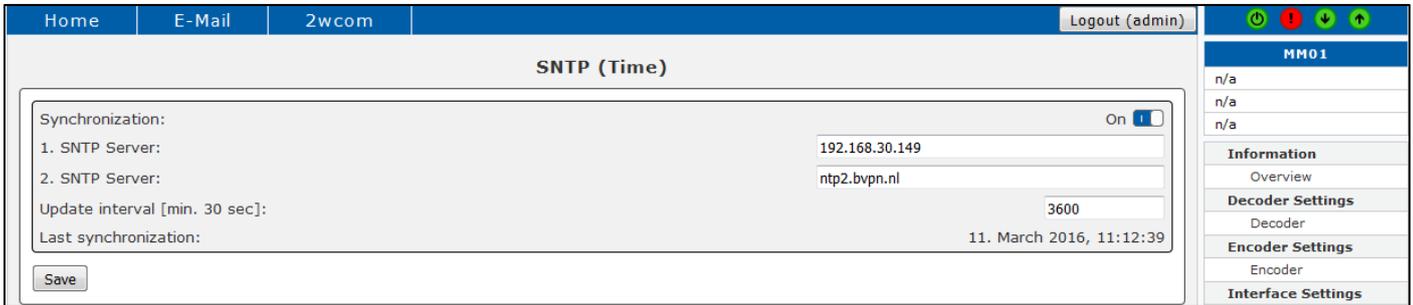
Figure 5: Network settings – SNTP

In this menu you can activate the automatic synchronization of the device clock via SNTP by activating a virtual switch to "ON" and configure or change the following parameters:

1. SNTP Server IP	IP address of the first NTP server to be used.
2. SNTP Server IP	IP address of the second NTP server to be used.
Update interval [min. 30 sec]	Time interval for synchronizing the device clock with the NTP server in seconds.
Last synchronization	Information about the last synchronization.

> **NOTE**: Additionally, you can read out and <u>manually</u> set up the current date and time in the internal clock of the device under **System Settings→Time** (see section 18.12).

10.4. Icecast Server

Icecast Server can be set up as an input source for Encoder and Decoder.

This menu item is available under **Network Settings→Icecast Server** and is used to configure the port for the server, the audio source and audio format for audio monitoring (see Figure 5).
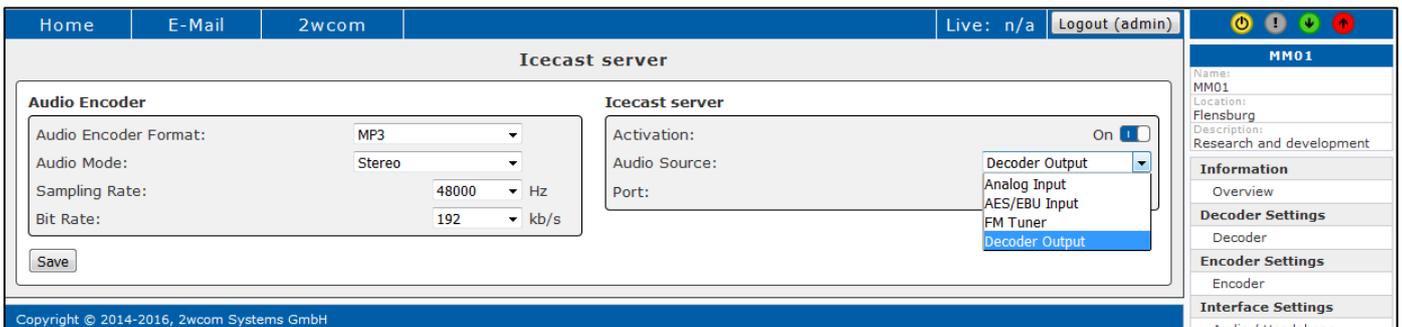
Figure 6: Interface Settings – Icecast Server

11. FM Tuner Settings

The MM01 has an option of FM Tuner. FM Tuner can be configured as an input source for Encoder and for Decoder. The FM Tuner can be used as an input source for Decoder in case of monitoring or backup.

To set up FM Tuner, open the configuration page in the Web interface of the device under **Interface Settings→FM Tuner** (see Figure 7) and make the following settings:
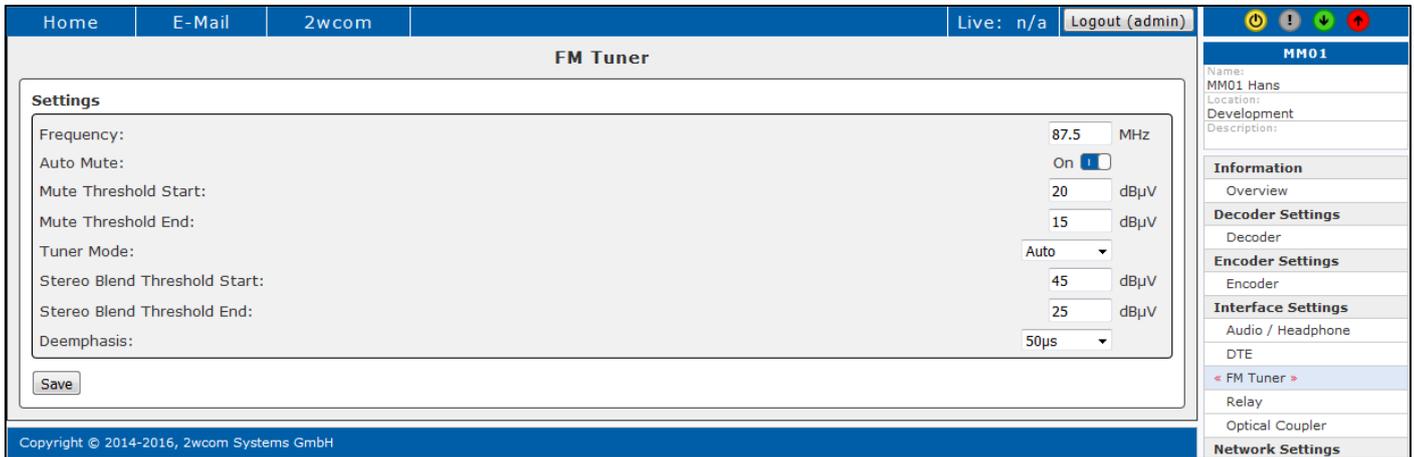
Figure 7: FM Tuner Settings

Frequency:	Frequency of the desired tuned audio program.
Auto Mute:	Activates the mute of the audio signal.
Mute Threshold Start:	RF level threshold limit, from that the mute is activated. The signal power is reduced linear to the indicated value *Mute Attention*. The mute setting can trigger an alarm (settings under **System Settings→Alarm**). The alarm LED on the front site of the device lights red.
Mute Threshold End:	RF level threshold limit, until the mute setting stays activated. The alarm LED on the front site of the device turns off.
Tuner Mode:	Tuner operation mode; settable in drop down menu between *Auto/Mono/Stereo.*
Stereo Blend Threshold Start	RF level threshold limit, from that the stereo blend is turned on. The stereo signal goes linear over to a mono signal. At the stereo blend switching, an alarm can be triggered (settings under **System Settings→Alarm**). The alarm LED on the front site of the device lights red.
Stereo Blend Threshold End	RF level threshold limit, up to that the stereo blend stays activated. The alarm LED on the front site of the device turns off.
Deemphasis	Possible values are 50/75 μs

⇒ Save the settings by clicking the „Save" button at the end the menu bar.
⇒ Check the current settings and the audio level for FM tuner under **Status→FM Tuner** (see Figure 8) or on the integrated LCD monitor in the device.
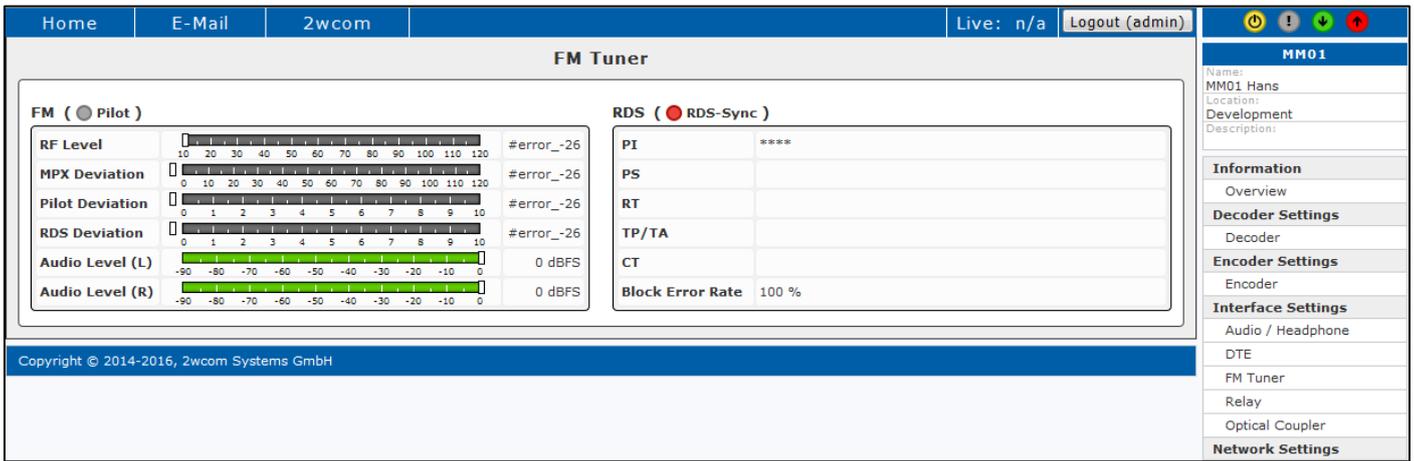
Figure 8: Status of the FM Tuner

12. Audio over IP Settings

12.1. Set up SIP connection

12.1.1. SIP Settings

The MM01 decoder supports Audio IP streaming using SIP (Session Initiation Protocol).

To use the SIP protocol, register with a SIP server and set up the connection to the server under **AoIP Settings→SIP** in the web interface of the MM01 as shown in Figure 9.

Figure 9: Audio over IP Settings – SIP configuration

> **NOTE**: The MM01 is compliant with the mandatory directives N/ACIP EBU Tech 3326.

The following **global** parameters for SIP connection can be configured:

Global configuration

Mode:

Off	– extern calls are rejected;
Receive only	– MM01 can only receive audio streams (up to 4 connections);
Send only	– MM01 sends only audio streams (no decoding);
Send receive	– MM01 sends and receives audio streams (encoding and decoding)

dynamic	– MM01 can change encoder parameters, in order to stream audio with the supported parameters from an extern (decoder) device (up to 2 connections)
fix	– MM01 uses Encoder A. If external decoder devices don't support parameters of Encoder A, a call will be disconnected (up to 16 connections "send only", up to 4 connections "send receive")

Port:	Local SIP port.
Mono mix mode:	*Left, Right, Downmix* (send audio stream).
Accept *INVITES* only via registrar accounts:	ON: Only calls from registered SIP users are accepted; external calls (e.g. over IP) are rejected.
	OFF: all incoming calls are accepted.

NOTE: You can register your device with several SIP servers and receive/send audio streams from/to several external devices (users).

Enter your registration data for several SIP servers in the "Registrar settings" block in both lines:

Registrar settings

Registrar:	Internet domain name of a SIP server.
Username:	Your username for registration with a SIP server.
Password:	Your password for registration with a SIP server.
Phone number:	Your phone number for registration with a SIP server.
Expires	Interval in seconds for the renewal registration.
Active	Activate registration with a SIP server for each account by selecting "ON" in the virtual switch "active".
Interface	For different accounts you can choose different interfaces Data 1/Data 2 or the same interface to set up the connection.

View Configuration

Show *SIP Dial* page instead of *Overview* for user *Manager*:	ON: Easy view with quick configurations **Easy2Connect** for "Manager" account (see Figure 10). For more information see section 12.1.3 "SIP Dial (Easy2Connect)" on page 36.
	OFF: normal view of **Information→Overview** menu
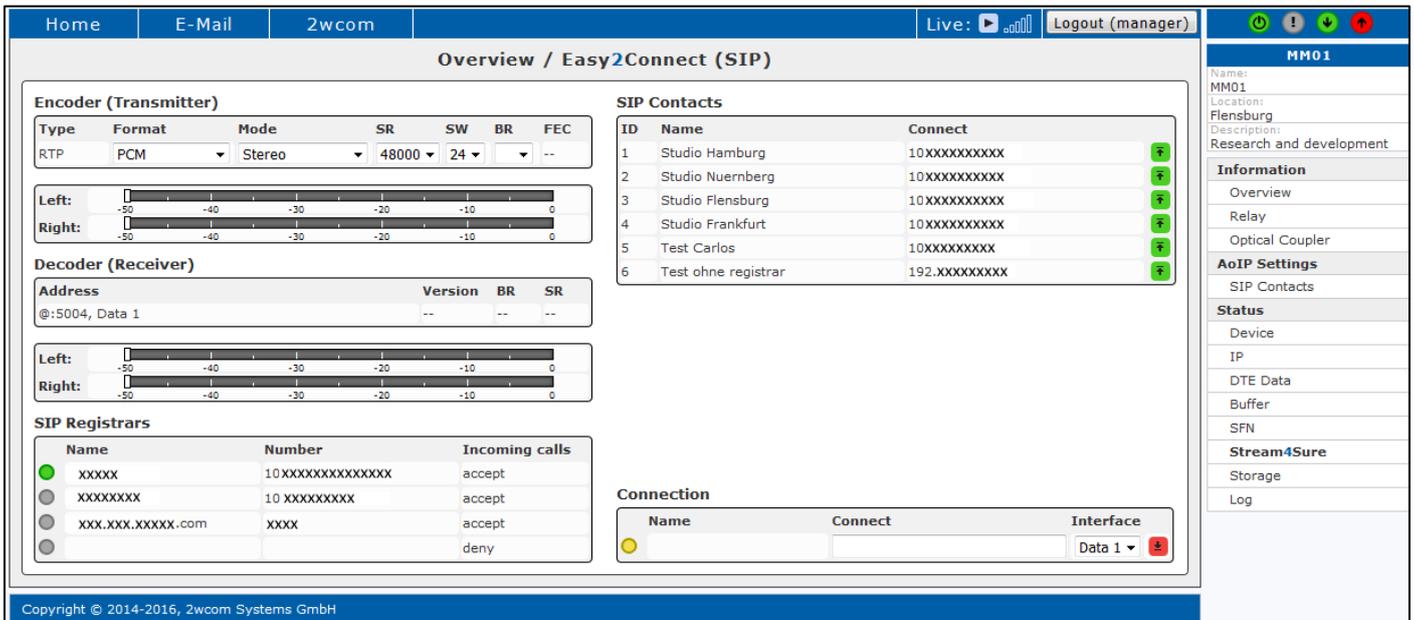
Figure 10: Activated view "Show SIP Dial page instead of Overview for user Manager"

✓ Click the „Save" button to save the changes.
✓ The green LED will turn on, if the connection is active (red – if the connection fails).

12.1.2. Preconfigurations for SIP contacts

For an easier data transmission, you can preconfigure the audio coding formats, which you can later select via mouse click for the data transfer via SIP to the predefined contacts.

NOTE: Coding profiles and SIP contacts can be configured only by the "admin" account.

To set up profiles with different coding formats and to define the SIP contacts:

1. Select **AoIP Settings→SIP Contacts** in the web interface menu. The page *SIP Contacts* appears.
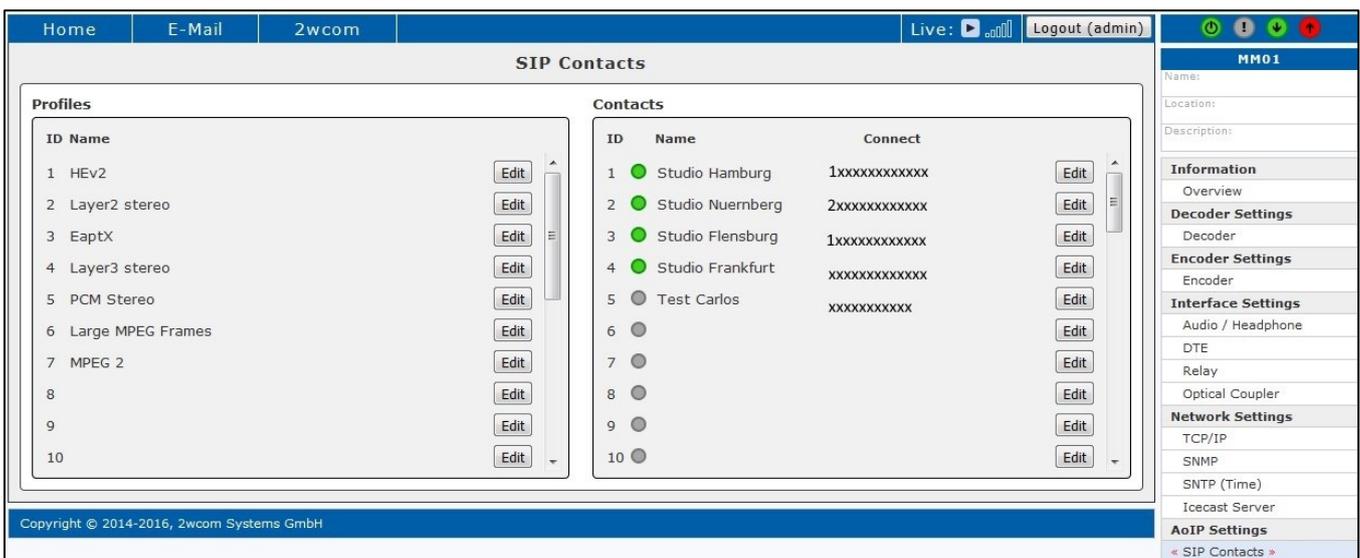
Figure 11: Preconfiguration of coding formats and SIP contacts

2. In the left block "Profiles" (see Figure 11) click the "Edit" button to create and to configure a coding profile. The window *Edit Profile* appears:
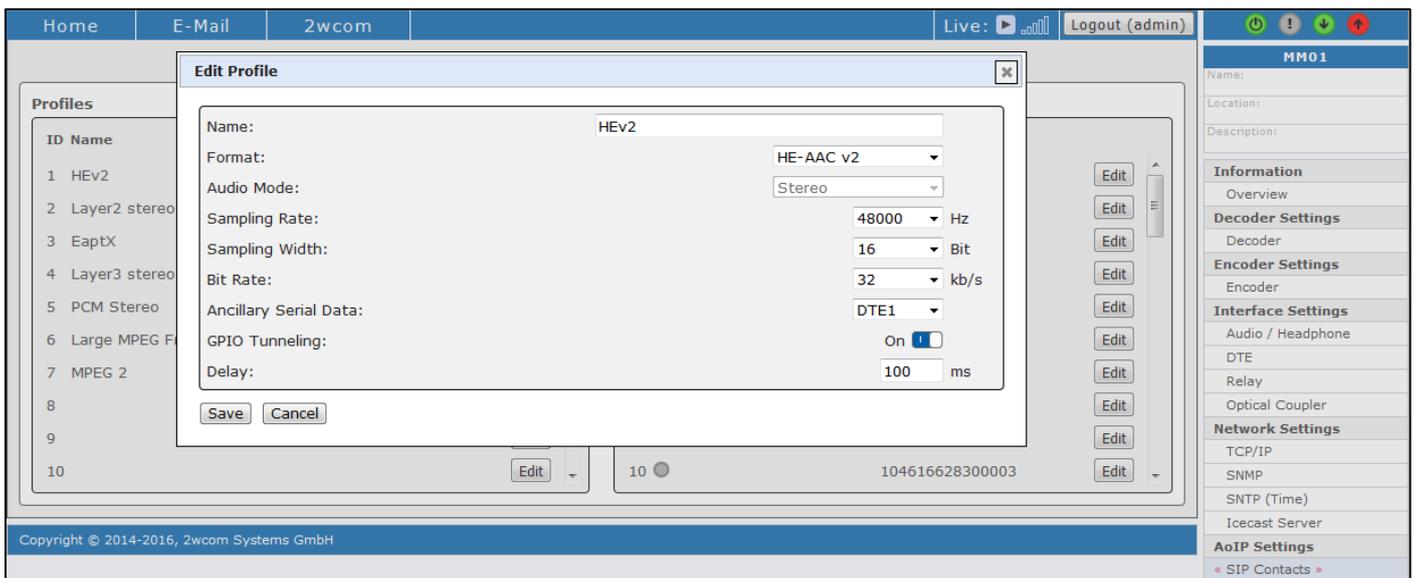
Figure 12: Preconfiguration of a coding profile

3. Define the name of the profile and set up the coder parameters (for more information about the coder configuration see section 13.4 "Set up the coder" on page 43).

4. Click the "Save" button to save the changes.

   NOTE: You can define up to 20 coding profiles.

5. In the right block "Contacts" in the same menu (see Figure 11) click the "Edit" button to create and to configure a SIP contact. The window *Edit Contact* appears:
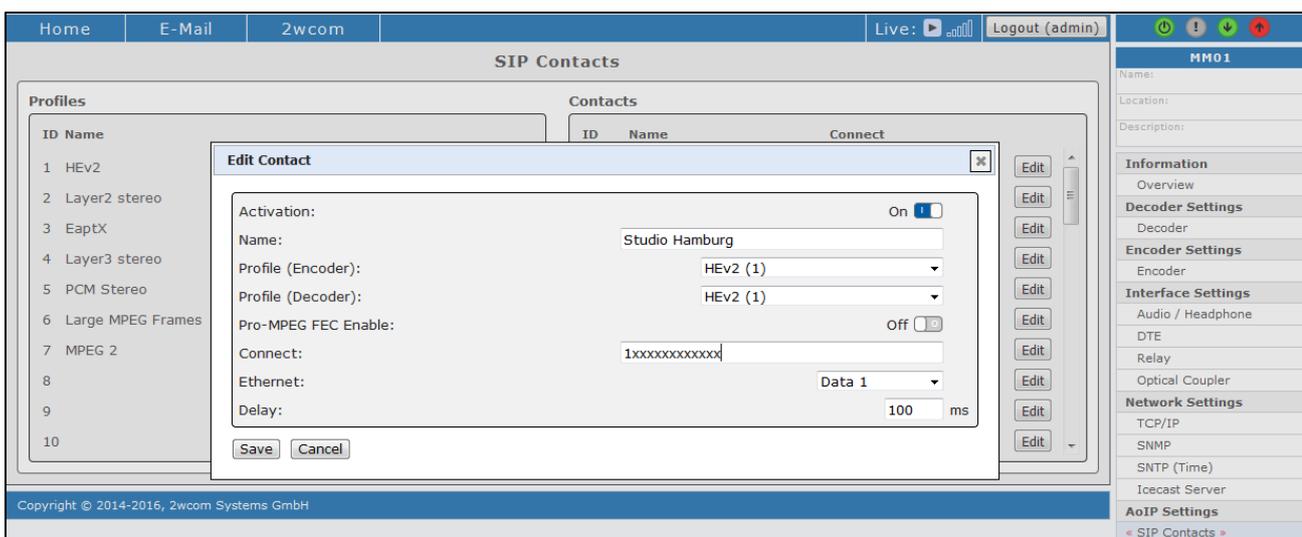
Figure 13: Preconfiguration of SIP contacts

6. Define the name of the contact and the phone number for connection.

7. Select the output interface in the field "Ethernet" ("Data 1/2")

8. In the field "Profile (Encoder/Decoder)" assign a defined coding profile to the SIP contact.

   NOTE:

   - "Profile Encoder" defines the audio format that the MM01 (encoder) should send;
   - "Profile Decoder" defines the audio format that the external encoder device should send;
   - Selection "none" sends/receives the stream configured under "Encoder/Decoder Settings" (for more information see sections 13 "Encoder Settings" on page 41 and 14 "Decoder Settings" on page 53).

9. Activate the configured SIP contact by selecting "ON" in the virtual switch "Activation", if the connection with this contact should be available.

10. Click the "Save" button to save the changes.

    NOTE: You can configure up to 40 contacts.

    ⇒ The LEDs near the activated contacts in the main menu "SIP Contacts" light green.

12.1.3. SIP Dial (Easy2Connect)

To establish a SIP connection and to start data transmission:

1. Select **AoIP Settings→SIP Dial** in the user web interface menu of the MM01. The page *Overview (SIP Dial)* appears:
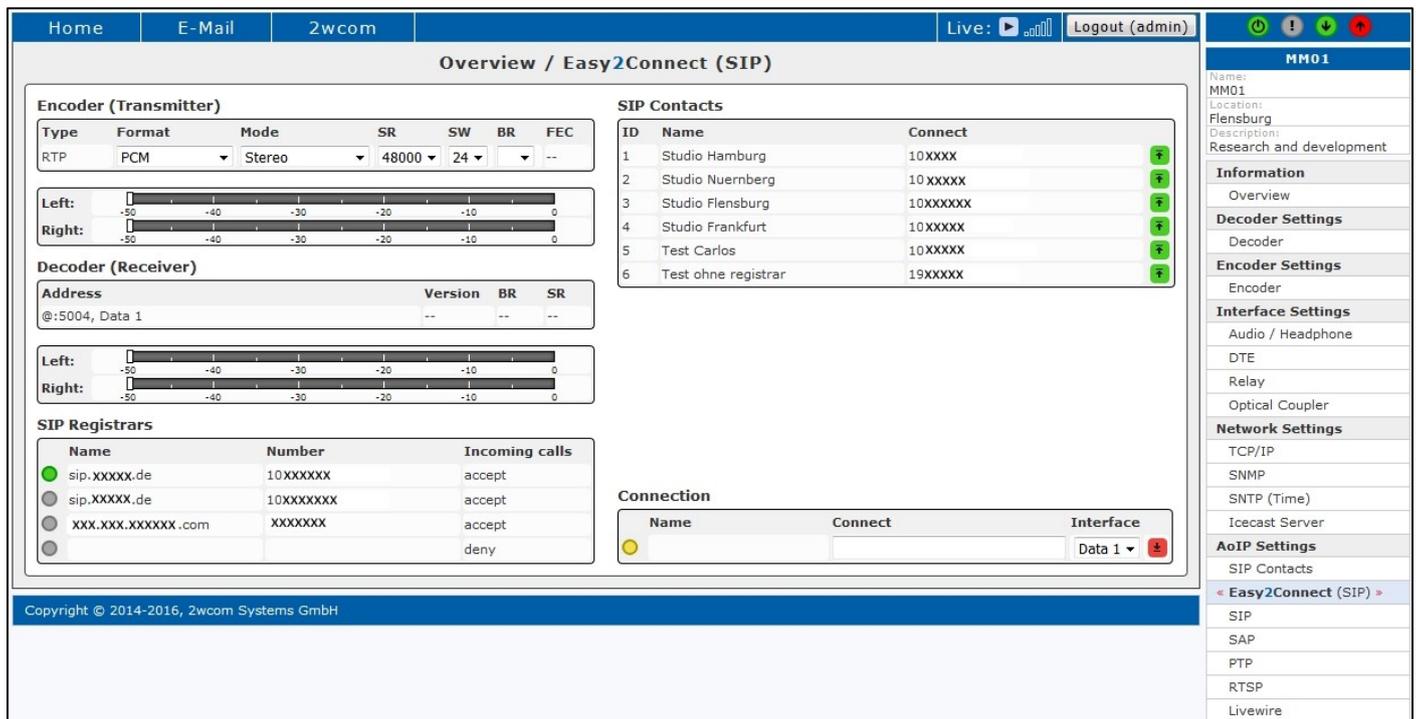
Figure 14: SIP Dial Easy2Connect – connection and data transfer

2. In the "SIP Contacts" block you can see the configured and activated contacts. Click the green icon ![icon] in the corresponding contact to start the connection.

3. To disable the connection click the red icon ![icon] in the "Connection" block.

---

4. In the "Encoder (Transmitter)" block you can see the general encoder configuration or directly change them for a quick dial (**Encoder Settings→Encoder**). If you haven't assigned any coding profile for Encoder to the chosen SIP contact (see section 12.1.2 on page 34), the MM01 uses the general encoder configuration for the outgoing audio stream.

> **NOTE**: For a **Quick Dial** just change the encoder configuration manually in the "Encoder (Transmitter)" block and enter the dial number directly into the "Connection" field. Die dial icon turns green. Select "Data 1/Data 2" in the dropdown menu "Interface" and you can start the connection:
>
>

5. In the "Decoder (Receiver)" block you can see the general decoder configuration (**Decoder Settings→Decoder**).

6. In the "SIP Registrars" block you can view the details of the incoming calls.

12.2. Set up SAP connection

To set up the SAP connection, you need administrator rights.

Log in to the "admin" account and open the menu "Session Announcement Protocol (SAP)" under **AoIP Settings→SAP** (see Figure 15).

Figure 15: SAP Settings

12.3. Set up PTP connection

Optionally, the MM01 supports the PTP V2 (Precision Time Protocol) network synchronization that allows fully synchronized stream operations.

To set up the PTP connection, you need administrator rights.

Log in to the "admin" account and open the menu "Precision Time Protocol (PTP)" under **AoIP Settings→PTP** (see Figure 16).

Figure 16: PTP Settings

Mode:	*none*, *master* (source for a synchronization reference), *slave* (destination for a synchronization reference) , *master/slave* (boundary clock)
TS proc mode:	*filter*, *raw*, *filter-weight*, *raw-weight*
UDP time to live:	Counter or timestamp for the lifetime of data in the network
Ethernet port:	*Data 1/Data 2*
Assume two step:	Activate the virtual switch to enable two step synchronization
Clock servo:	*pi, linear, ntp, off*
Delay filter:	*average, median,*
Delay mechanism:	*E2E* (End-to-end), *P2P* (Peer-to-peer)
Follow up info:	Activate the virtual switch to send follow up messages

12.4. Set up RTSP connection

To set up the RTSP connection, you need administrator rights. Log in to the "admin" account and open the menu "Realtime Streaming Protocol (RTSP)" under **AoIP Settings→RTSP** (Figure 17).

Figure 17: RTSP Settings

Mode: Possible options are *off, UDP, TCP* and *UDP/TCP*.

12.5. Set up Livewire connection

To set up the Livewire connection, you need administrator rights. Log in to the "admin" account and open the menu "Livewire" under **AoIP Settings→Livewire** (see Figure 18).

Figure 18: Livewire Settings

NOTICE	
	If you use Livewire as a source for the audio encoder, the sampling rate of only 48 KHz can be activated (see section 13.3 "Set up the input gain" on page 43).

General settings for Livewire

Hardware identification:	If you use several devices, give the name for identification.
Routing Protocol:	You can activate routing protocol to control several devices.
Ethernet:	Select the interface for Livewire connection: *Data 1/2*

Advertisement

Activation of the mode:	Special setting for Livewire: announcing of the data streams in the network. Routing protocol should be activated for this mode.

GPIO

Activation of the mode:	Activates GPIO: if activated, the MM01 can receive commandos via Livewire for external GPO switch. Routing protocol should be activated for this mode. For more information about GPIO and Livewire see section 15.4.3 "External GPO Switch" 83.
Name (GPO 1-5/6-10/11-12)	The MM01 is equipped with 12 GPOs. Livewire can address only groups of 5 GPOs at once. To assign separate GPOs to a group for Livewire, name each group of the available GPOs in the corresponding field.

13. Encoder Settings

The MM01 is able to receive, to encode and to distribute audio signals over two independent IP interfaces (10/100/1000-Base-T).

To set up encoder, you need to log in to the "admin" account.

✓ You have already connected the MM01 to the network 10/100-Base-T via the [Ctrl] interface and configured the access to the web user interface (s. section 8.2)

Necessary steps for operating the MM01 as an encoder are:

1. Connect the encoder
2. Activate audio sources
3. Set up the input gain
4. Set up the coder
5. Set up FEC for encoder
6. Set up output and destination
7. Set up switch criteria for encoder
8. Set up the monitoring and alarm control
9. Control the encoder status

The following sections describe the separate steps for encoding:

13.1. Connect the encoder

For data distribution, connect the device as follows:

1. If the MM01 should operate as an encoder, use the XLR jacks [Analog L/R IN]/[AES/EBU IN] to feed an analog/digital audio signal to the encoder.

2. To output the encoded signal over IP, use the [Data 1/Data 2] RJ-45 connectors for redundant distribution over IP.

NOTICE
False connection of the Ethernet interfaces will lead to incorrect operation Use the [Data 1/Data 2] connectors only for the data transfer (input/output). Use the [Ctrl] connector only for the access to the device via the web interface.

13.2. Activate audio sources

NOTE: The MM01 can operate in both modes at the same time: as encoder and decoder.

The MM01 is equipped with two parallel coders that can operate at the same time. For each coder you can configure different input sources (as a Main Source and an alternative Backup source) for an advanced backup management. The device is able to encode both input signals and to

automatically switch over between the sources for the output, if one of the signals fails. To set up switch criteria for encoder see section 13.7.

> ℹ **NOTE**: The current version of the MM01 is equipped with two possible input sources: analog and digital.

To activate und to configure the unit as an encoder for audio over IP:

1. Select **Encoder Settings→Encoder** in the web interface menu. The page *Encoder* appears.

2. Click the [Edit] button in the field **Main** in the block "Source" to activate and configure the Main Source for encoding input. The page *Edit Source* appears (see Figure 19).
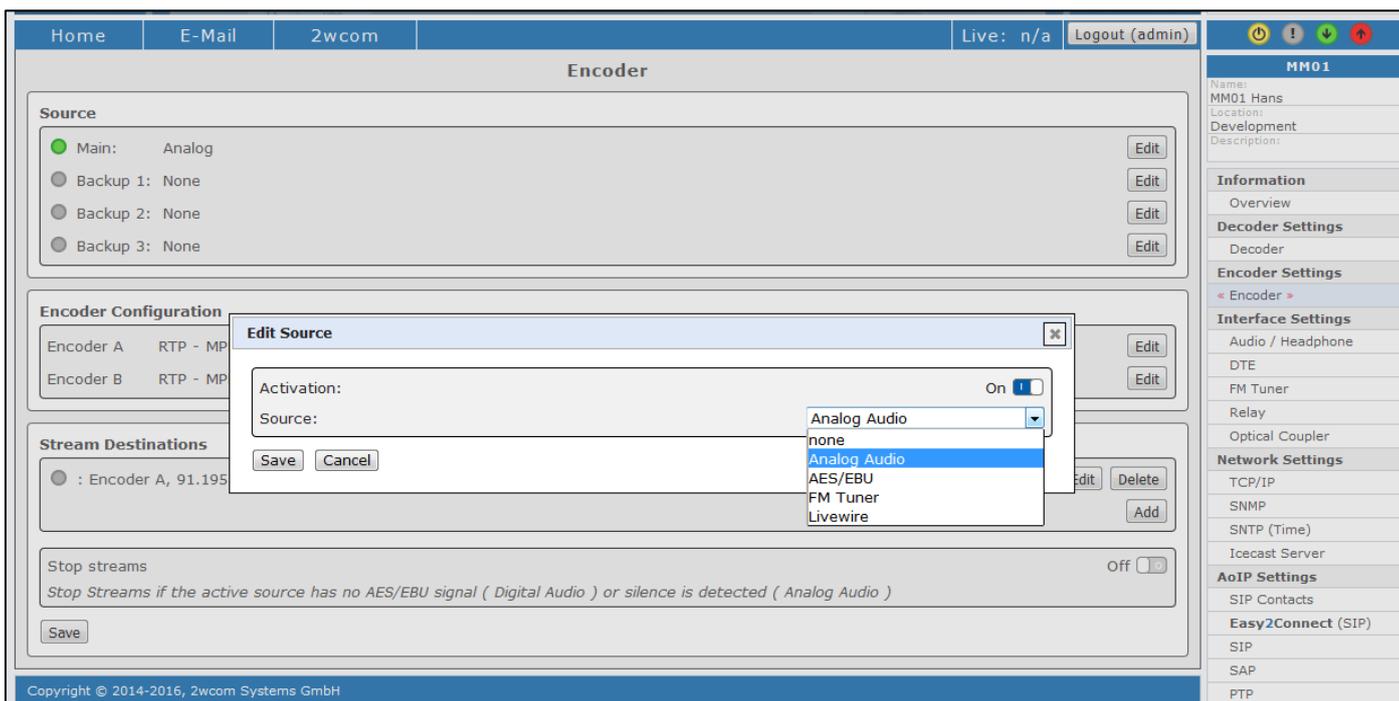
Figure 19: Encoder Settings – Input source

3. Activate encoding for the Main Source by selecting "ON" in the virtual switch "Activation" in the **Edit source** page.

4. Choose an audio input for the Main Source in the field **Source**. Possible options are: "none", "Analog Audio", "AES/EBU", "FM Tuner" and "Livewire".
   NOTE: For configuration of "FM Tuner" see section 11 "FM Tuner Settings" on page 30.
   For configuration of "Livewire" connection see section 12.5 on page 39.

> ℹ **NOTE**: The MM01 switches automatically to the source with a better input signal.

> ℹ **NOTE**: Input failure can be signaled by sending alarm via SNMP, LED or GPO. To set up alarm control for the inputs see section 13.8.1.

5. Click the [save] button to save the changes.

6. Analogously activate and configure backup sources in the field **Backup 1-3** (see Figure 19)

⇒ The virtual LED in the same window near the activated source lights green, if a signal is detected in the activated input interface or red, if no signal is detected in the input.

⇒ The virtual LED lights yellow, if the source is activated but is not used at the moment for the output.

13.3. Set up the input gain

The MM01 receives analog/digital audio signal over both inputs analog L/R IN and AES/EBU IN.

You can set up the level for both inputs under **Interface Settings→Audio** in the field "Gain" (see Figure 20).

Figure 20: Audio Input/Output Settings

The current level of the inputs is displayed on the display of the unit and in the user web interface under **Information→Overview** in the field "Audio Levels" (see Figure 21).
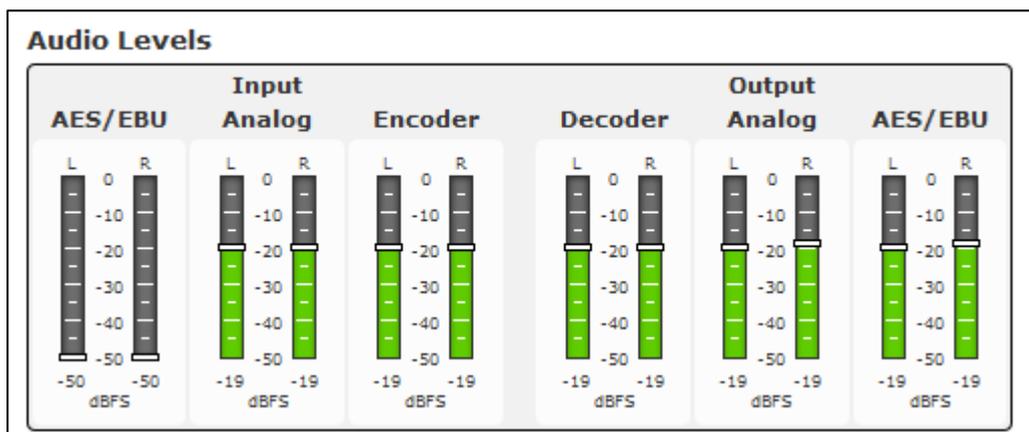
Figure 21: Overview – Audio Levels
green color – the level is under the recommended maximal value of -9dB
red color – the level is above the recommended maximal value of -9dB.

13.4. Set up the coder

The MM01 is able to send up to 32 individually configured streams at the same time. For each stream you can preset two coder configurations: Encoder A and Encoder B.

So that in the next step you can assign the preset configurations "Encoder A" or "Encoder B" to each stream and set up the destination (see section 13.6).

> **NOTE**: Encoder A and Encoder B could be configured using the same or different output types.

NOTICE	
	If you use FM Tuner or Livewire as a source for the audio encoder, the sampling rate of **only 48 KHz** can be activated.
	If the sampling rate of 192 kHz is used, the "Transparent Mode" must be activated under **Interface Settings→Audio/Headphone**.

To activate and to configure the coder settings for audio over IP:

1. Select **Encoder Settings→Encoder** in the user web interface menu of the MM01. The page *Encoder* appears.

2. Click the Edit button in the field **Encoder Configuration** to configure Encoder A and Encoder B. The page *Edit Source* appears (see Figure 22)*.*
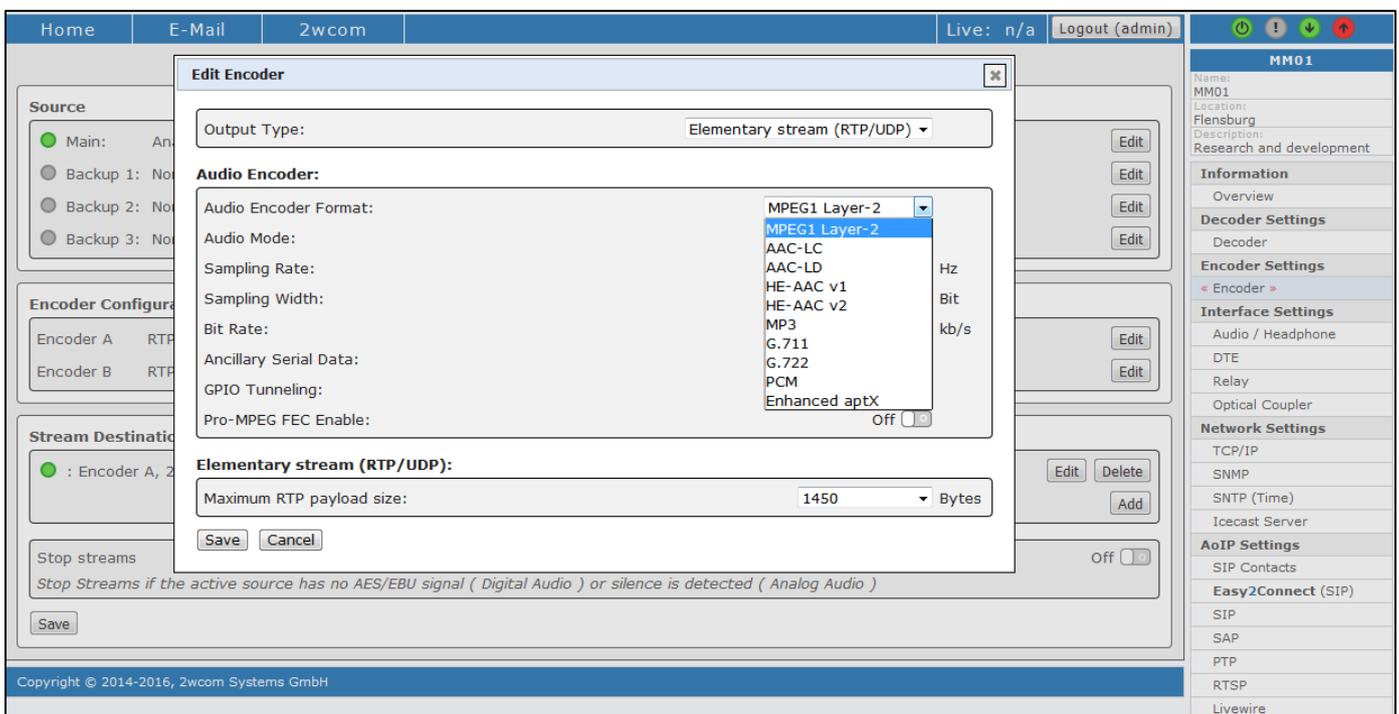
Figure 22: Encoder Configuration – Edit Coder

3. Choose the output stream in the dropdown menu **Output Type**: *Elementary stream (RTP/UDP)* or *Transportstream (RTP/UDP)*

4. Choose the audio codec in the dropdown menu **Audio Encoder Format**. For available formats see Figure 23.

5. Set up audio mode in the next dropdown menu, if applicable (see Figure 24).

6. Choose the desired value for **Sampling Rate**. You can set up the sampling rate in the range of 8000 … 48000 Hz.

   NOTE: The sampling rate for FM Tuner and Livewire can be configured only for 48 kHz.
   NOTE: If the sampling rate of 192 kHz is used, the "Transparent Mode" must be activated under **Interface Settings→Audio/Headphone**.
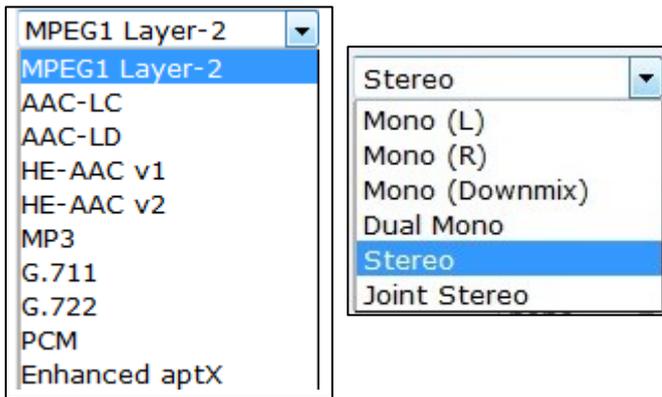
Figure 23 (left): Audio Encoder Format

Figure 24 (right): Audio Mode

7. Choose the desired value for **Sampling Width**. You can set up the sampling width in the range of 16 … 24 bit depending on the chosen audio format.

8. Choose the desired value for **Bit Rate** depending on the chosen audio format (64…384 kb/s).

9. To add the ancillary serial data to the data stream, choose the connected input DTE1 or DTE2.

10. For GPIO switch between encoder and decoder activate the function "GPIO Tunneling" by selecting "ON" in the virtual switch "Activation" (for more information see section 15.4.1 "GPIO Tunneling" on page 82).

11. Click the ⸢save⸥ button to save the changes.

12. Analogously configure Encoder B.

13.5. Set up FEC for encoder

The coder comes with Pro MPEG FEC (Practice #3 release 2) to reduce packet loss and burst errors in IP data stream.

To activate und to configure the error correction FEC for audio output over IP:

1. Open the window *Edit Encoder* under **Encoder Settings→Encoder** by clicking the ⸢Edit⸥ button in the field **Encoder Configuration**, to configure Encoder A and Encoder B. The page *Edit Source* appears (see Figure 22).

2. Activate the Pro MPEG Forward Error Correction by selecting the checkbox "Pro-MPEG FEC Enable". The current menu window will be extended.

3. You can set up the following FEC parameters for the IP output: *FEC mode, FEC column (L) port offset* and *FEC row (D) port offset*.

4. Enter zero for the *FEC column/row port offset*, if it is unused, or enter the OFFSET to the main destination port, where 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).

5. Click the ⸢save⸥ button to save the changes.

⇒ Under **Information→Overview** you can call up the current status of the FEC in the *Encoder Settings* block.

13.6. Set up output and destination

MM01 is able to output up to 32 streams (destinations) over IP at the same time. You can use both IP interfaces Data 1 and Data 2 for the same stream content and the same destination as a redundancy or send different stream contents to the same or different destinations:

– Several Unicast (point-to-point) streams
– Multicast Stream (point-to-multipoint)
– Broadcast (point-to-network)
– Dual Stream (2 redundant streams)

To each output stream you can assign one of the coder configurations Encoder A or Encoder B from section 13.3 and one of the Ethernet outputs Data 1 or Data 2.

To set up output streams and destinations:

1. Select **Encoder Settings➔Encoder** in the user web interface menu of the MM01. The page *Encoder* appears.

2. Click the ⸢Add⸥ button in the field **Stream Destinations** to create a new output stream configuration.

3. Click the ⸢Edit⸥ button to configure the output streams. The page *Edit Destination* appears (see Figure 25)*.*

4. Activate the output stream by selecting "ON" in the virtual switch "Activation".

5. Specify a name for the output stream in the "Name" field.

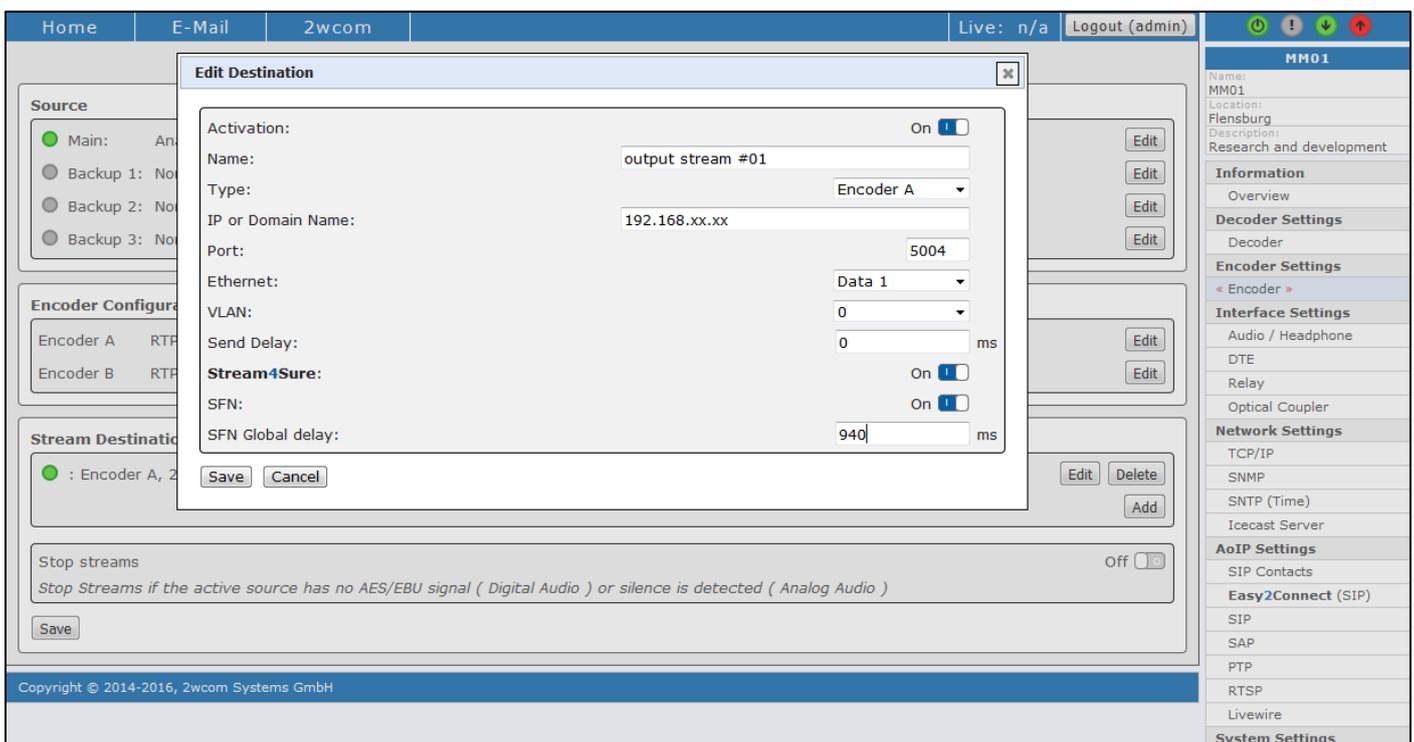6. Choose in the "Type" field "Encoder A" or "Encoder B" configured in section 13.3.

Figure 25: Encoder settings – Edit Destination

7. Set up the destination IP address, port number or Domain Name for the output stream.

8. Choose the Ethernet interface for the stream output: Data 1 or Data 2.

> **NOTE**: To configure the IP outputs Data 1/2 open the menu **Network Settings→TCP/IP** and see section 10.1

9. Set up the **send delay** time in *ms*, which the encoder should wait in order to send Audio over IP as an offset stream for redundancy (for more information about the values "Send Delay" see section 14.7.4 on page 74).

10. Activate **Stream4Sure** by selecting "ON" in the virtual switch "Activation" (for more information about **Stream4Sure** see section "Introduction" on page 6).

   NOTE:
   Under **Status→Stream4Sure** you can view the status of the function (see section 13.9 "View the encoder status" on page 51).

11. Optional: Activate network synchronization for SFN, if available (for more information see section "SFN Synchronization" on page 85).

> **NOTE**: In the SFN mode the sample rate converting is not possible.

NOTICE

	If you activate SFN and use **Encoder B**, the configured *Sampling Rate* of the Encoder A and Encoder B <u>must be the same</u>!

SFN   Enable SFN by selecting "ON" in the virtual switch "Activation". The MM01 can optionally distribute SFN synchronized Audio over IP. By using the Real Time Protocol (RTP) and GPS as time reference it is the state-of-the-art solution for distributing synchronized audio over IP. The timestamp creation is integrated in the MM01 so that MM01 encoders can provide perfectly synchronous audio to MM01 decoders.

Since this solution transmits only audio and not MPX, all subsequent stereo coders must also be in sync und use the same GPS time reference.

SFN Global Delay   Commando for all decoders, to wait for the defined time interval (milliseconds) before they simultaneously start to decode the distributed signal (for more information about the delay values see section 17 "Buffer Delay Management" on page 86).

12. Click the `save` button to save the changes or `Cancel` to restore the last settings.

13. Analogously activate and configure further output streams in the field **Stream Destinations.**

   ⇒ The virtual LED in the same window near the activated output stream lights green, if a signal is detected in the activated output interface or red, if no signal is detected on the input.

13.7. Set up switch criteria for encoder

The MM01 is equipped with two parallel coders that can operate at the same time. For each coder you can configure different input sources (as a Main Source and an alternative Backup source) for an advanced backup management (see section 13.2). The device is able to encode both input signals and to automatically switch over between the sources for the input, if one of the signals fails.

The following switch criteria for input sources in the encoder can be activated:

AES/EBU no signal	The encoder will switch to the next best audio input, if no digital audio signal is available in the activated audio input [AES/EBU IN].
Analog L silence detection	The encoder will switch to the next best audio input, if the device detects silence in the input of the left channel of the analog audio signal [Analog L IN]. You can set up the threshold value to define the silence level.
Analog R silence detection	The encoder will switch to the next best audio input, if the device detects silence in the input of the right channel of the analog audio signal [Analog R IN]. You can set up the threshold value to define the silence level.

To set up switch criteria for audio input sources in the encoder:

1. Open the configuration field **Audio Input** in the window *Switch Criteria* under **System Settings→Switch Criteria** in the web interface of the MM01 (see Figure 26).

2. Enable each switch criterion separately by activating the virtual switch "Enable", if this parameter should be monitored.

3. Enter the threshold value to define the silence level in dBFS.

Figure 26: Switch criteria for audio inputs in the encoder

4. Define for each criterion the delay time *T1* (in milliseconds) for switching release. The delay time from this defined value will be regarded by the system as "bad", so that after the delay time *T1* the device switches the audio source to the configured backup source.

5. Define for each criterion the delay time *T2* (in milliseconds) for switching end, how long a "good" signal for this parameter in the previous source should be available, before the system switches back.

6. Click the [save] button to save the changes.

⇒ The device switches to the next best audio input source.
⇒ The virtual LED lights green in the field "Source" under **Encoder Settings→Encoder** near the active source.
⇒ The configured alarms for audio input will be signaled via SNMP, by switching LED and/or a relay if enabled (see section 13.8.1).

13.8. Set up the monitoring and alarm control

The MM01 is able to monitor the encoding signal and to recognize errors in the inputs and outputs.

A triggered alarm is signaled by sending SNMP traps, activating of an available relay and, if configured, of the "Warning" LED on the web user interface page or on the front panel of the device.

13.8.1. Set up alarm for audio input

The following alarm functions for audio inputs can be activated:

AES/EBU no signal	Alarm is triggered, if no signal is detected at the audio input [AES/EBU IN].
Analog L silence detection	Alarm is triggered, if the device detects silence in the input of the left channel of the analog audio signal [Analog L IN]. You can set up the minimum value of the audio level, under that the alarm should be triggered.
Analog R silence detection	Alarm is triggered, if the device detects silence in the input of the right channel of the analog audio signal [Analog R IN]. You can set up the minimal value of the audio level, under that the alarm should be triggered.

> **ⓘ** **NOTE**: To set monitoring of the FM Tuner input, see section 14.7.4 on page 74.

To set up the monitoring and alarm function for the audio inputs:

1. Open the configuration menu **Audio Input** in the window *Alarm* under **System Settings→Alarm** in the web interface of the MM01 (see Figure 27).

Audio Input

	Enable	Priority	Value	T1 sec	T2 sec	SNMP	LED	GPO
🟢 AES/EBU no signal	▮▯	Error ▾		5	5	▮▯	▯▮	2 ▾
🟢 Analog L silence detection	▮▯	Error ▾	< -50 dBFS	5	5	▯▮	▮▯	--- ▾
⚪ Analog R silence detection	▯▮	Error ▾	< -60 dBFS	5	5	▯▮	▯▮	--- ▾

Figure 27: Alarm Settings – indication of audio data in the audio inputs.

The LED color means:

🟢 - *Monitoring is activated, no alarm is triggered*
⚪ - *Monitoring is deactivated*
🔴 - *Monitoring is activated, alarm is triggered*

2. Enable each alarm function separately by activating the virtual switch "Enable", if this parameter should be monitored.

3. Select for each alarm function the severity level of the alarm in the dropdown menu "Priority":

Level/Code	Priority	Meaning
0	Emergency	System is unusable
1	Alert	Action must be taken immediately
2	Critical	Critical conditions
3	Error	Error conditions
4	Warning	Warning conditions
5	Notice	Normal but significant condition
6	Informational	Informational messages
7	Debug	Debug-level messages

Table 2: Alarm Priority

The value 0 or Priority `Emergency` is the most critical and emergent level. 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 is the alarming case and what measures are necessary.

4. Define for each monitoring function the delay time *T1* (in seconds) for alarm trigger. The delay time from this defined value will be regarded by the system as "bad", so that after the delay time *T1* an alarm will be set off.

5. Define for each monitoring function the delay time *T2* (in seconds) for alarm end, how long a "good" signal for this parameter should be available, before the system switches off the alarm.

6. Enable checkbox "SNMP", if the alarm should be signaled by sending SNMP traps.

7. Enable checkbox "LED", if the alarm should be signaled by the Warning LED on the web user interface page or on the front panel of the device.

8. Choose in the dropdown menu "GPO" one of the available outputs that should switch to signal the alarm.
   NOTE: The corresponding GPO must be activated for the source "Alarm" under **Interface Settings→GPO** (see section 15.4.2 "Alarm over GPO" on page 83).

9. Click the `save` button to save the changes.

13.8.2. Set up alarm for encoding audio

The following alarm function for encoding can be activated:

No audio input	Alarm is set off, if the encoder doesn't detect audio in the input or can't encode it.

To set up the monitoring and alarm function for the encoding audio:

1. Open the configuration field **Encoder** in the window *Alarm* under **System Settings➔Alarm** in the web interface of the MM01 (see Figure 28).
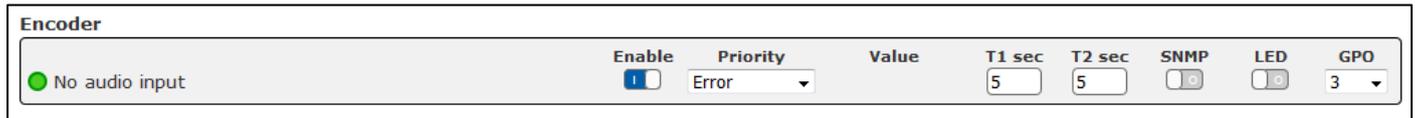

Figure 28: Alarm Settings – indication of audio data in the encoder.

The LED color means:

🟢 *- Monitoring is activated, no alarm is released*
⚪ *- Monitoring is deactivated*
🔴 *- Monitoring is activated, alarm is released*

2. For the further settings follow the same instructions as described in section 13.8.1.

13.9. View the encoder status

You can call up the current status of the encoder and of the incoming audio data at any time on the web user interface page or in the LCD menu of the device.

1. Under **Information➔Overview** you can see the details of the configured parameters of the encoding signal in *Encoder* field (see Figure 29).
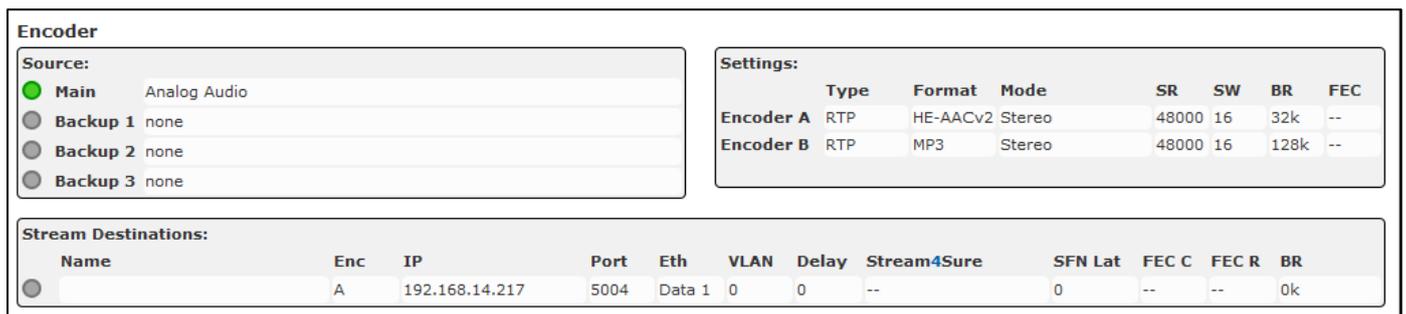
Figure 29: System Information – Encoder State

The LED color means:

🟢 *- active for decoding and is currently used for audio output*
🟡 *- active but is not used for audio output*
⚪ *- deactivated*
🔴 *- error*

2. In the "Source" block you can view the current status of the activated data inputs.

3. In the "Settings" block you can view the current configuration of the Encoder A/B.

   The following Abbreviations are used for the configured coder parameters:

- SR – Sampling Rate
- SW – Sampling Width
- BR – Bit Rate
- FEC – Forward Error Correction

4. In the "Stream Destinations" block you can view the current settings of the output streams. The following Abbreviations are used for the configured coder parameters:

- Eth – activated Ethernet output Data 1/2
- FEC C – FEC column (L) port offset
- FEC R - FEC row (D) port offset
- BR – Bit Rate

5. Under **Status→Stream4Sure Status** you can view the status of the decoder outputs and the sources (see Figure 30). The counters calculate the frequency of the shown parameters.
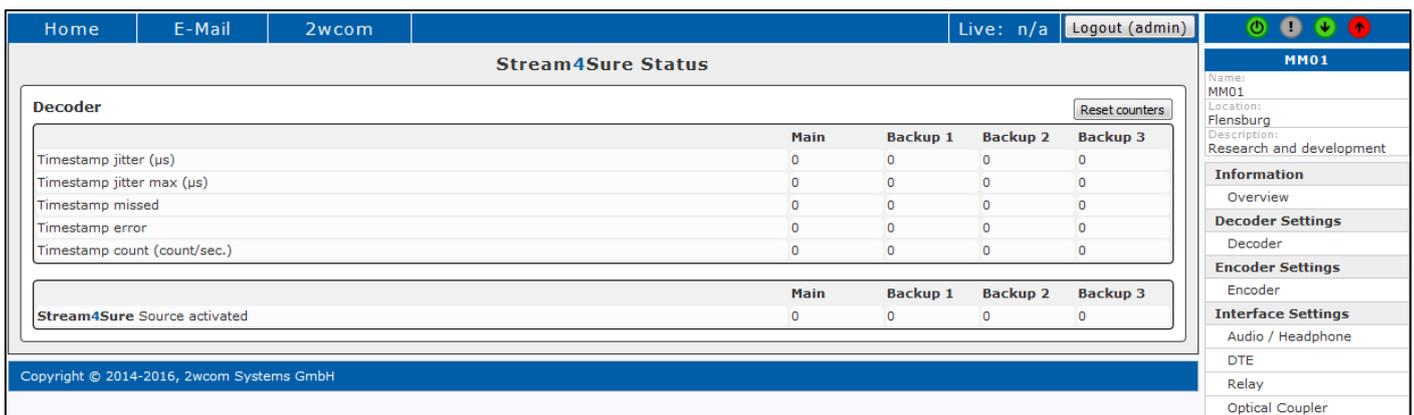
Figure 30: Stream4Sure Status

6. To reset the counters of the **Stream4Sure** status parameters, click the "Reset counters" button in the same menu.

7. Under **Status→FM Tuner** you can call up information about FM Tuner and RDS (see Figure 8 on page 31).

8. Under **Status→Log** you can call up information about the encoder status, device operation, data distribution and errors since the last event log deleting. A list with a description of the events with the timestamps is displayed in this menu (see section 18.16, Figure 72).

> **NOTE**: Configure alarm monitoring under **System Settings→Alarm** (see section 13.8). If the alarm monitoring for any parameter is deactivated, no information about the corresponding error will be shown in the log.
>
> To invert the relays and see the status of the switched relay in case of a triggered alarm, open the menu **Interface Settings→GPO** (former versions **Interface Settings→Relay**) and see section 15.3 "GPO" 80.

14. Decoder Settings

The MM01 receives audio signals over two independent IP interfaces (10/100/1000-Base-T) or internal storage (optional), decodes and outputs the signal as an analog or/and digital audio over Analog OUT or AES/EBU OUT outputs.

To set up decoder, you need to log in to the "admin" account.

✓ You have already connected the MM01 to the network [10/100-Base-T] and configured the access to the web user interface (see section 10.1)

Necessary steps for operating the MM01 as a decoder are:

1. Connect the decoder
2. Preset source streams
3. Activate source streams
4. Set up the output
5. Set up the error correction
6. Set up switch criteria for decoder
7. Set up the monitoring and alarm control
8. Set up buffer
9. View the decoder status

The following sections describe the separate steps for encoding:

14.1. Connect the decoder

For data distribution, connect the device as follows:

1. To feed two different or redundant encoded signals over two independent [1000-Base-T] inputs for decoding, use the RJ45 jacks [Data1/2].

2. To output the decoded analog/digital audio signal, use the XLR jacks [Analog L OUT/ Analog R OUT] and [AES/EBU OUT]

NOTICE

False connection of the Ethernet interfaces will lead to incorrect operation

Use the [Data 1/Data 2] connectors only for the data transfer (input/output).
Use the [Ctrl] connector only for the access to the device via the web interface.

14.2. Preset source streams

The MM01 is able automatically to switch over between alternative input sources as redundancy solution in case of failure.

NOTE: The MM01 can operate in both modes at the same time: as encoder and decoder.

You can individually define up to 8 input streams and assign one of them to the Main Source for decoding.

To define und to configure input sources for decoder:

1. Select **Decoder Settings→Decoder** in the web interface menu. The page *Decoder* appears.

2. To create a new source stream for decoding input click the Add button in the block "Source Streams".

3. To configure or to change an existing input stream click the Edit button. The page *Edit Source Stream* appears (see Figure 31)*.
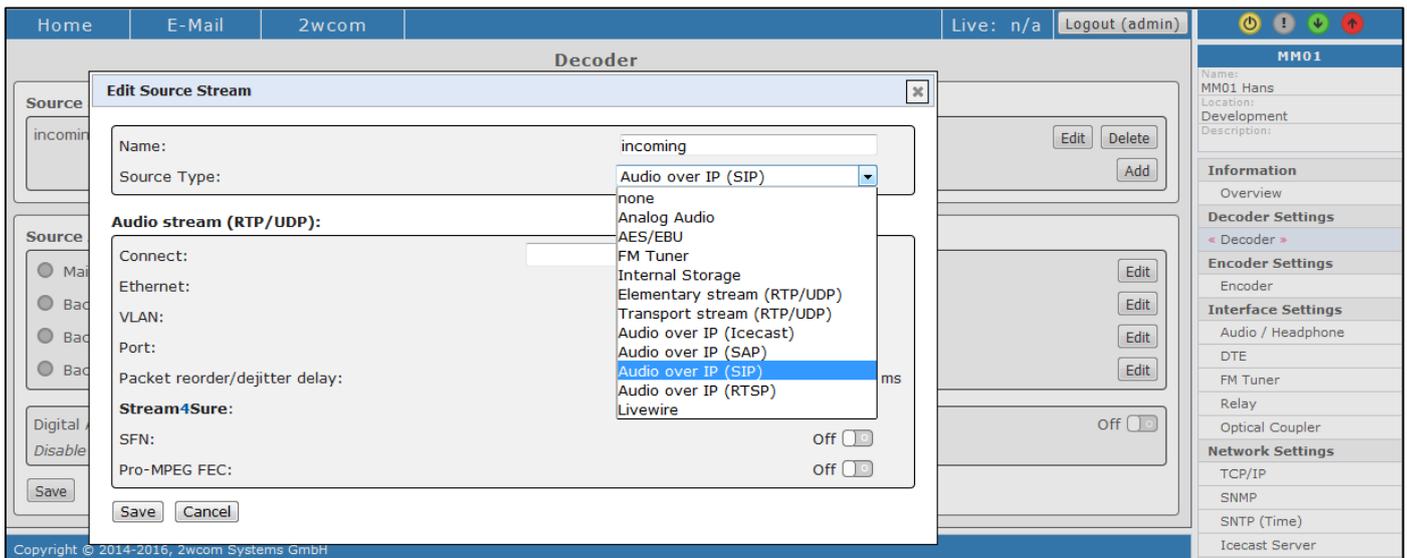
Figure 31: Decoder Settings – Input stream

4. Define the input stream name and choose the source type for decoding in the field **Source Type** (see Figure 31).

   NOTE: For configuration of "FM Tuner" see section 11 "FM Tuner Settings" on page 30. For configuration of "Livewire" connection see section 12.5 on page 39.

5. Configure the input streaming if applicable (for details see sections 14.2.1-14.2.8).

6. Click the save button to save the changes.

7. Define more input streams by clicking the Add button.

The following sections describe the settings available for definition of the alternative source types:

14.2.1. Internal Storage

You can decode and play files from an SD-Card. This option is recommended as an advanced redundancy for Backup Sources in case of IP input failure.

To define an internal storage as a source type for the decoder:

1. Upload the audio files that should be played from the internal storage in case of failure under **Status→Storage** (see Figure 2):

Figure 32: Audio files upload and status of the internal storage

2. Open window *Edit Source Stream* under **Decoder Settings→Decoder** as described in the first three steps in section 14.1 (see Figure 31).

3. Choose "Internal Storage" in the field **Source Type.** The menu will be extended to the block "Internal Storage" (see Figure 33).

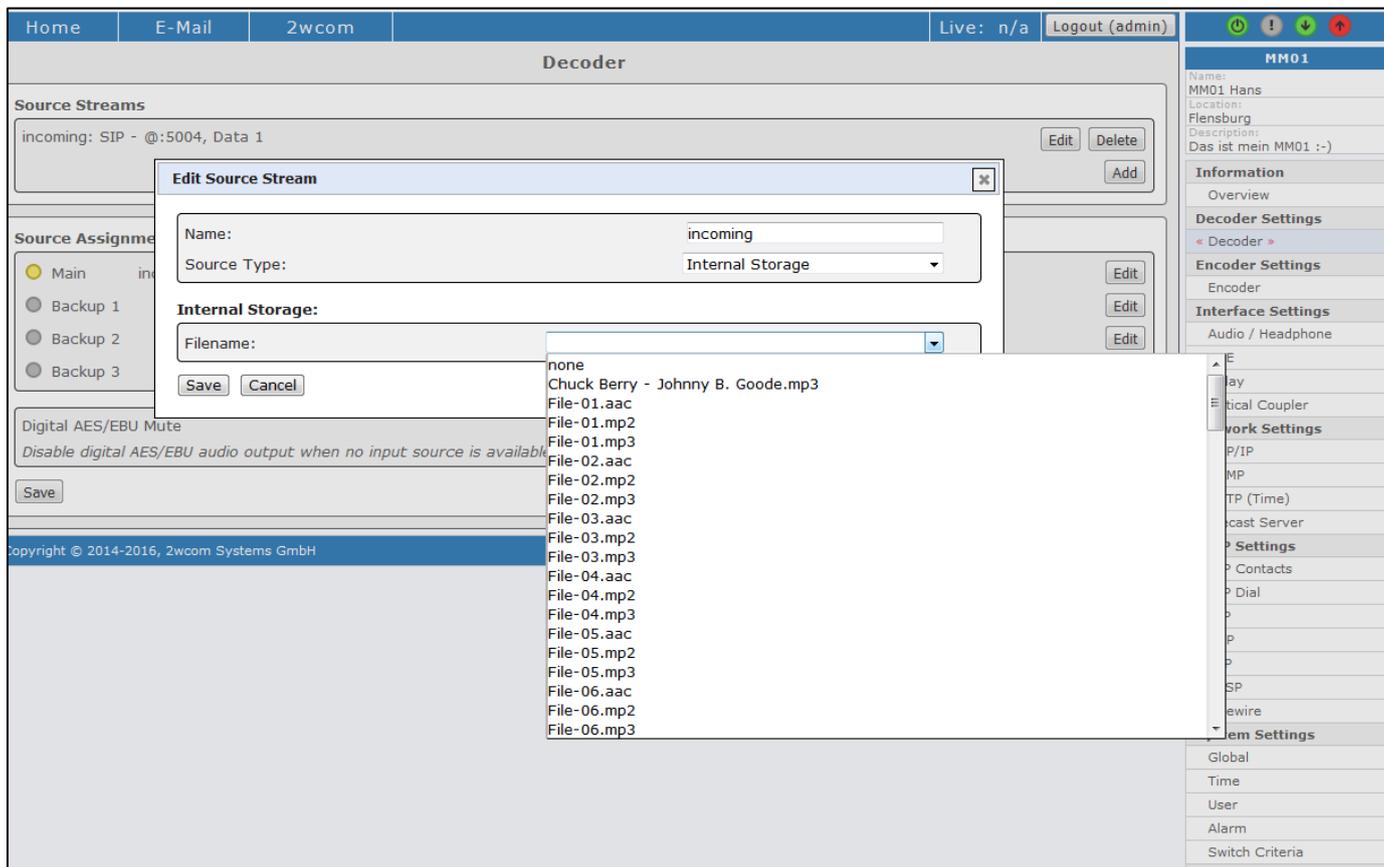4. Select the source audio file in the dropdown menu "Filename" for decoding.

Figure 33: Edit Internal Storage as a Source for Decoding

5. Click the `save` button to save the changes.

14.2.2. Elementary stream (RTP/UDP)

To define the Elementary stream as a source:

1. Choose "Elementary stream (RTP/UDP)" in the field **Source Type.** The menu will be extended to the block **Elementary stream (RTP/UDP)** (see Figure 34).
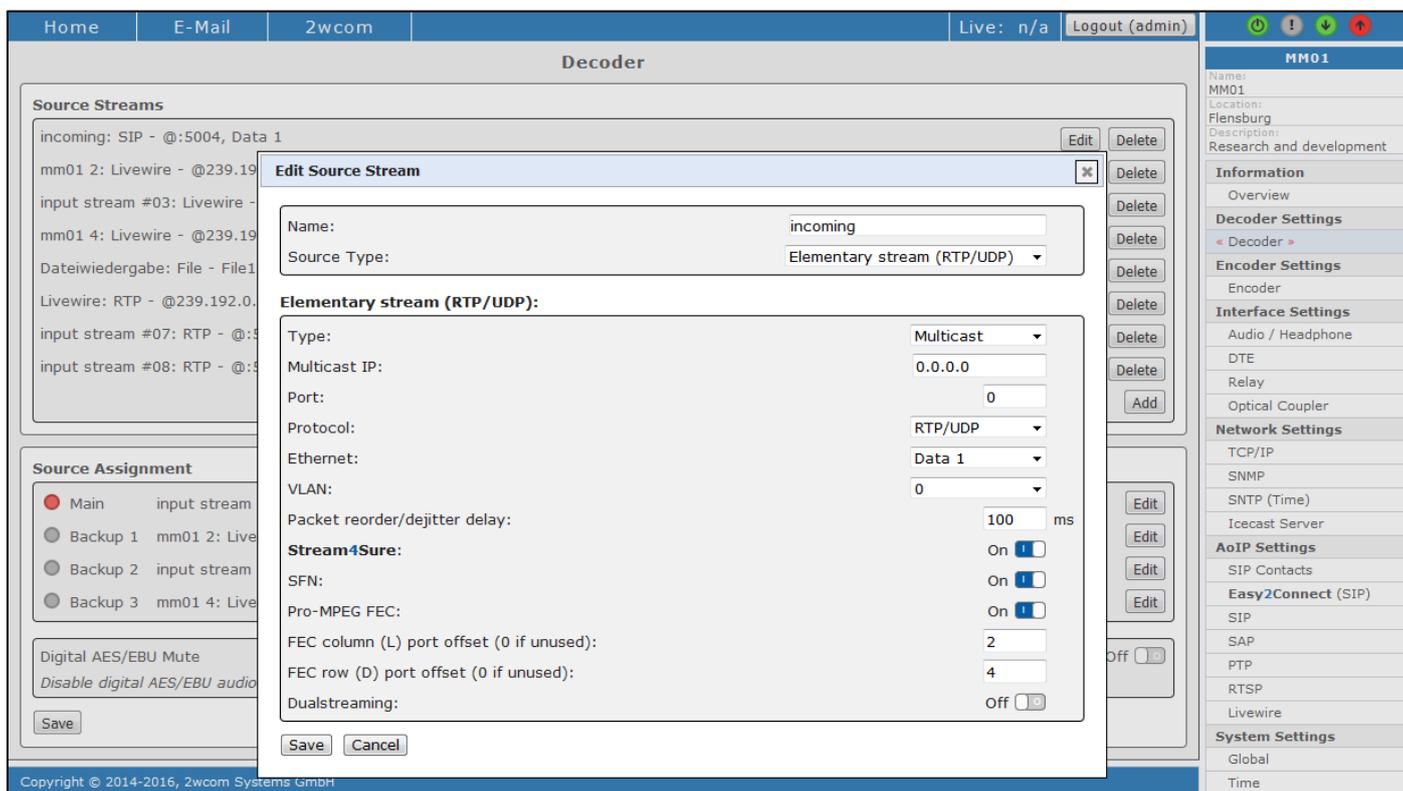
Figure 34: Input Source Settings – Elementary stream (RTP/UDP)

2. Enter the following data in the fields of the configuration of the Audio over IP input:

Type	Unicast/Multicast.
Multicast IP	IP for the destination Multicast group, if selected in the field **Type**.
Port	Sender UDP port (the same as configured in the encoder settings for output streaming).
Protocol	MPEG2 transport stream encapsulation, either UDP only or UDP/RTP. Note that beside the UDP/RTP also the RTCP packets are generated and sent in 5 second intervals. UDP/RTP allows reordering packets by means of sequence numbers.
Ethernet	Choose the Ethernet connector for the inputting signal: Data 1 or Data 2.
VLAN Enable	Select the checkbox to activate VLAN
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 and to compensate the jitter. Enter the value for this holding period in ms (for more information see section 17 "Buffer Delay Management" on page 86).
Stream4Sure	Enable the function **Stream4Sure** for transmission of up to 4 source streams if available by selecting "ON" in the virtual switch (for more information see section "Introduction" on page 6).
SFN	Enable SFN synchronization if applicable by selecting "ON" in the virtual switch (for more information see section "SFN Synchronization" on page 85).
Pro-MPEG FEC	Enable by selecting "ON" in the virtual switch (see section 14.2.4)

Dualstreaming	Enable by selecting "ON" in the virtual switch (see section 14.2.10).

3.   Click the save button to save the changes.

14.2.3. Transport stream (RTP/UDP)

To define the Transport stream over IP:

1.   Choose "Transport stream (RTP/UDP)" in the field **Source Type.** The menu will be extended to the block **Transport stream (RTP/UDP)** (see Figure 35).
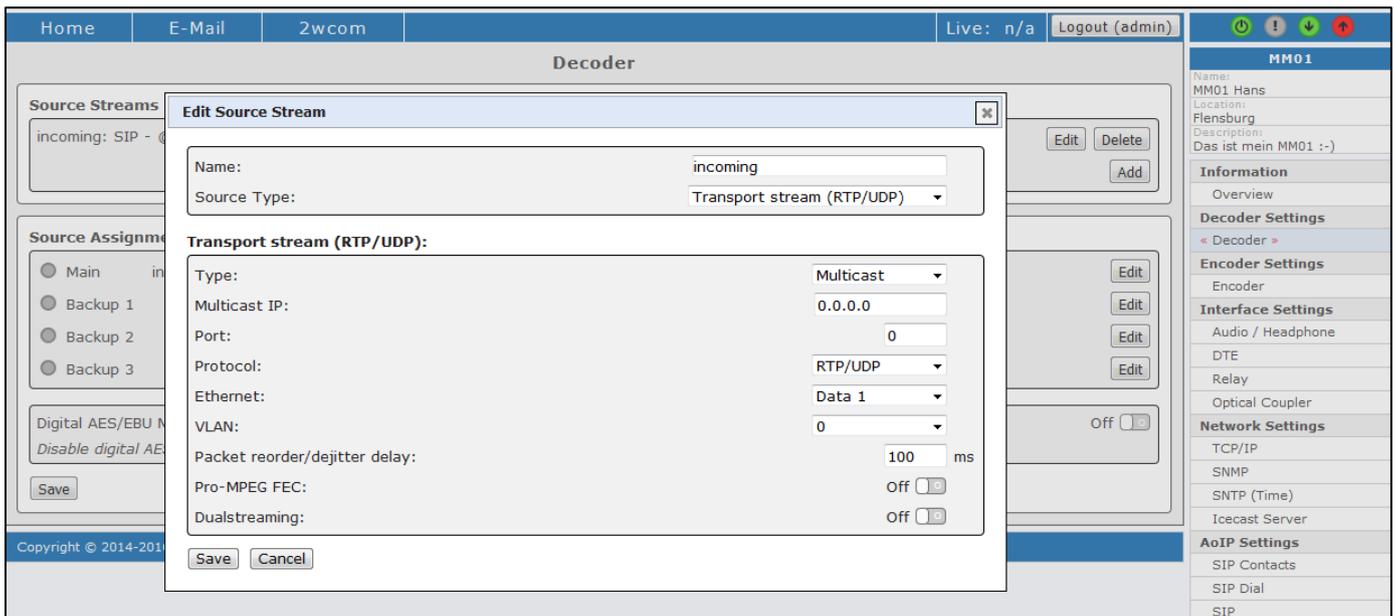

Figure 35: Input Source Settings – Transport stream over IP (RTP/UDP)

2.   Enter the following data in the fields of the configuration of the Transportstream over IP:

Type	Unicast/Multicast.
Multicast IP	IP for Multicast, if selected in the field **Type**.
Port	Sender UDP port (the same as configured in the encoder settings for output streaming).
Protocol	MPEG2 transport stream encapsulation, either UDP only or UDP/RTP. Note that besides the UDP/RTP also the RTCP packets are generated and sent in 5 second intervals. UDP/RTP allows reordering packets by means of sequence numbers.
Ethernet	Choose the Ethernet connector for the inputting signal: Data 1 or Data 2.
VLAN	Switch-Port Number
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 and to compensate the jitter. Enter the value for this holding period in µs (for more information see section 14.7.4 on page 74).

Pro-MPEG FEC	Enable by selecting "ON" in the virtual switch (see section 14.2.9 on page 63).
Dualstreaming	Enable by selecting "ON" in the virtual switch (see section 14.2.10 on page 64).

3. Click the ⌊save⌋ button to save the changes.

14.2.4. Audio over IP (Icecast)

To configure encoding parameters for Icecast server connection see section 12.1 "Set up SIP connection" on page 32.

To set up streaming over Icecast server:

1. Choose "Audio over IP (Icecast)" in the field Source Type. The menu will be extended to the block for Icecast settings.

2. Enter the URL for streaming and select Data Interface.
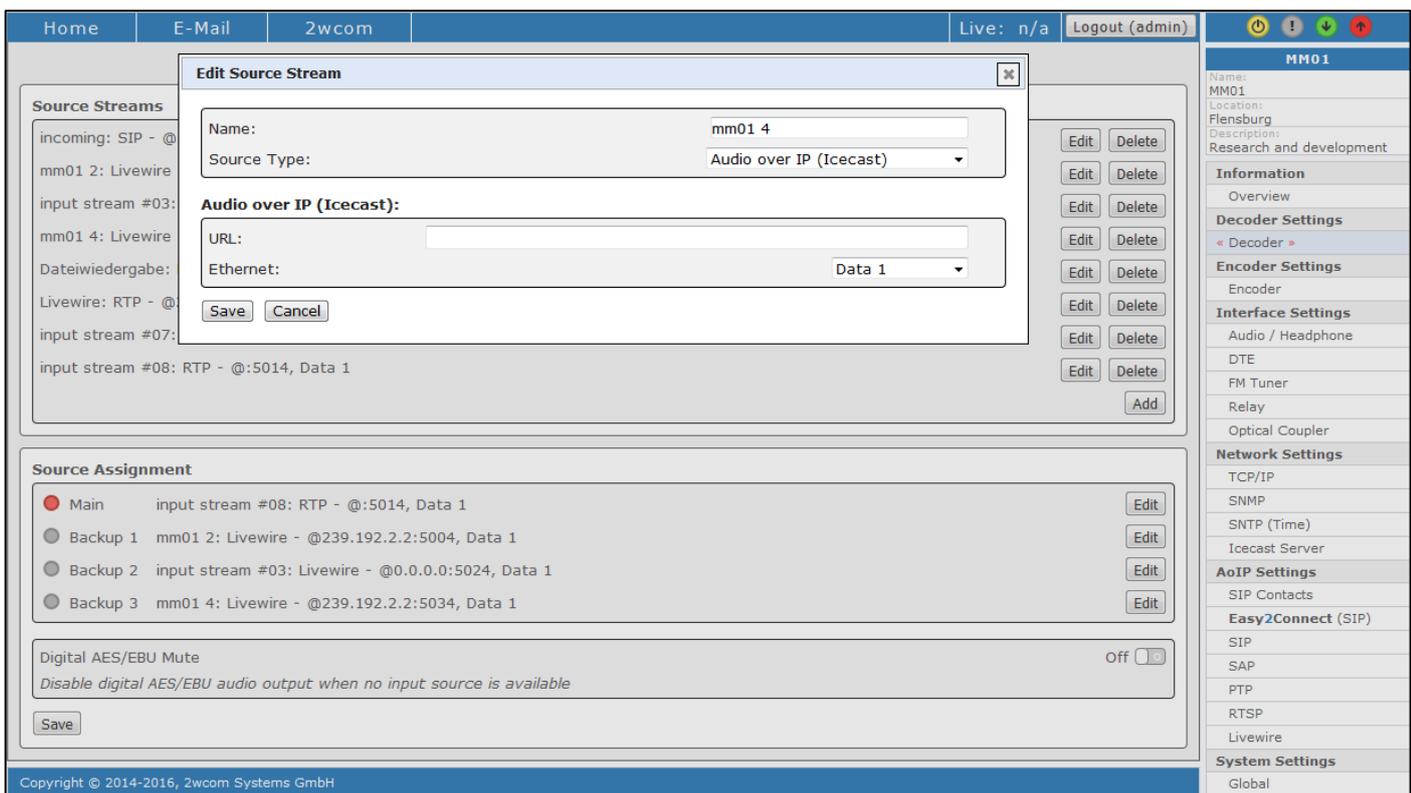
Figure 36: Input Source Settings – Icecast Server

14.2.5. SIP (RTP/UDP)

To configure SIP connection see section 12.1 "Set up SIP connection" on page 32.

To define the "SIP (RTP/UDP)" for the source stream:

1. Choose "SIP (RTP/UDP)" in the field Source Type. The menu will be extended to the block **Audio stream (RTP/UDP)** (see Figure 37).
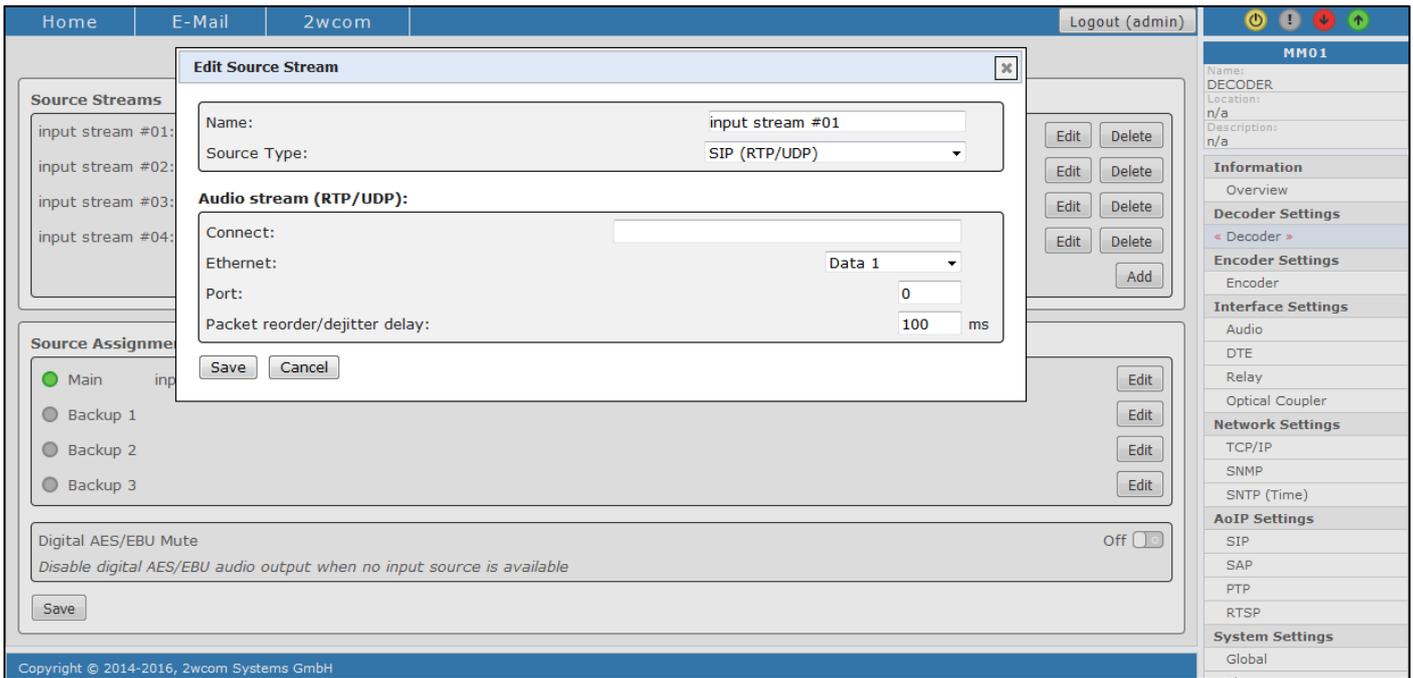

Figure 37: Input Source Settings – SIP audio stream (RTP/UDP)

2. Enter the following data in the fields of the configuration of the SIP Audio Stream:

Connect	Username/Address of the connecting device (registered second user agent).
Ethernet	Applicable only if you connect an external device directly via the IP address. Choose the Ethernet connector for the inputting signal: Data 1 or Data 2.
Port	Applicable only if you connect an external device directly via the IP address. Enter the UDP port of the sender.
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 and to compensate the jitter. Enter the value for this holding period in ms (for more information see section 14.8 "Set up buffer" on page 75).

3. Click the [save] button to save the changes.

14.2.6. SAP

To configure SAP connection see section 12.2 "Set up SAP connection" on page 37.

To define the "SAP" as a source stream:

1. Choose "SAP" in the field Source Type. The menu will be extended to the block **Elementary stream (RTP/UDP)** (see Figure 38).

2. Enter the data in the fields of the configuration of the Elementary stream (RTP/UDP) as described in section 14.2.2 on page 57.
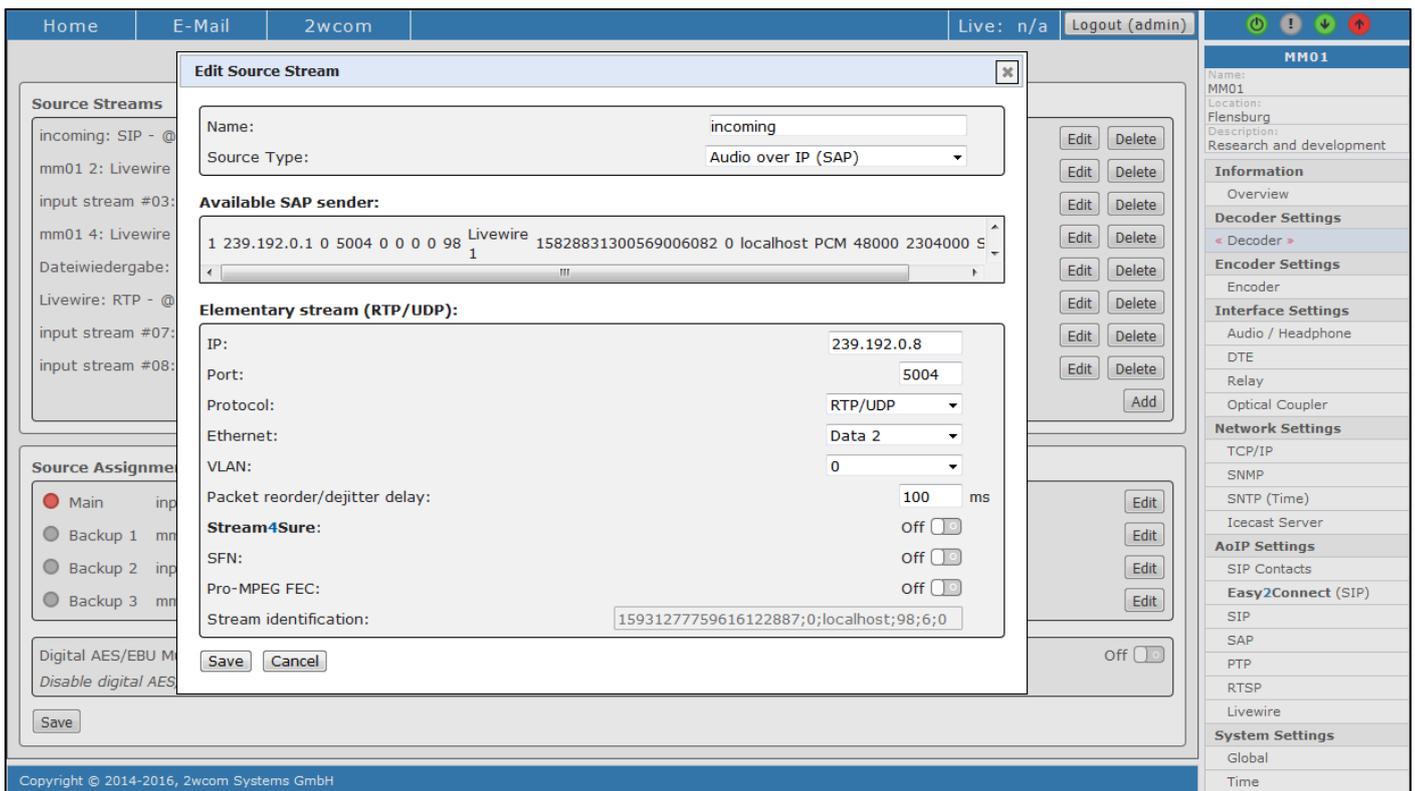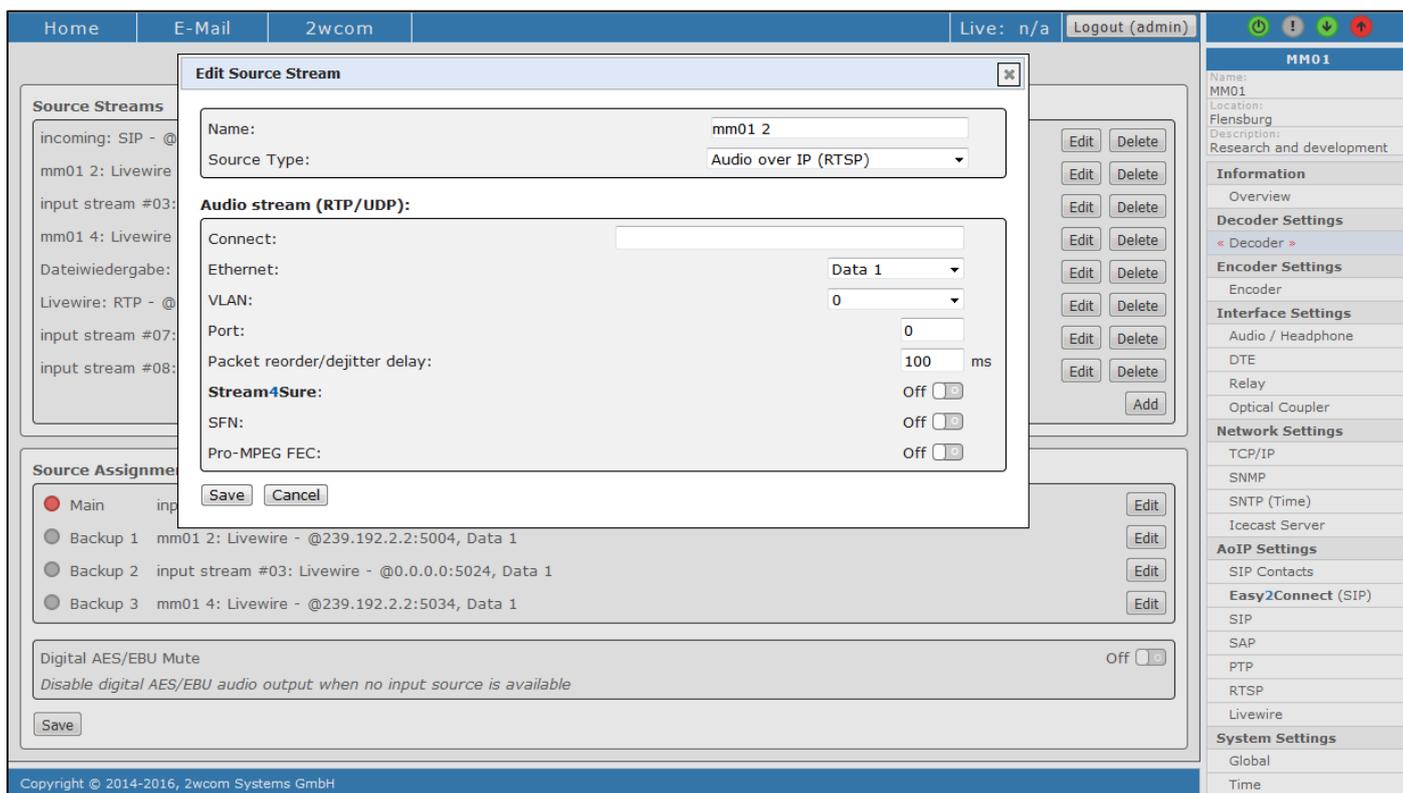

Figure 38: Edit Source Stream for Decoder – Audio over IP (SAP)

14.2.7. RTSP

To configure RTSP connection see section 12.4 "Set up RTSP connection" on page 39.

To define the RTSP for the source stream:

1. Choose "Audio over IP (RTSP)" in the field Source Type. The menu will be extended to the block **Audio stream (RTP/UDP)** (see Figure 39).

2. Enter the data in the fields of the configuration of the Elementary stream (RTP/UDP) as described in section 14.2.2 on page 57.

Figure 39: Edit Source Stream for Decoder – Audio over IP RTSP

14.2.8. Livewire

To configure Livewire connection see section 12.5 "Set up Livewire connection" on page 39:

To define the Livewire for the source stream:

1. Choose "Livewire" in the field Source Type. The menu will be extended to the block **Available Livewire sender** (see Figure 39).

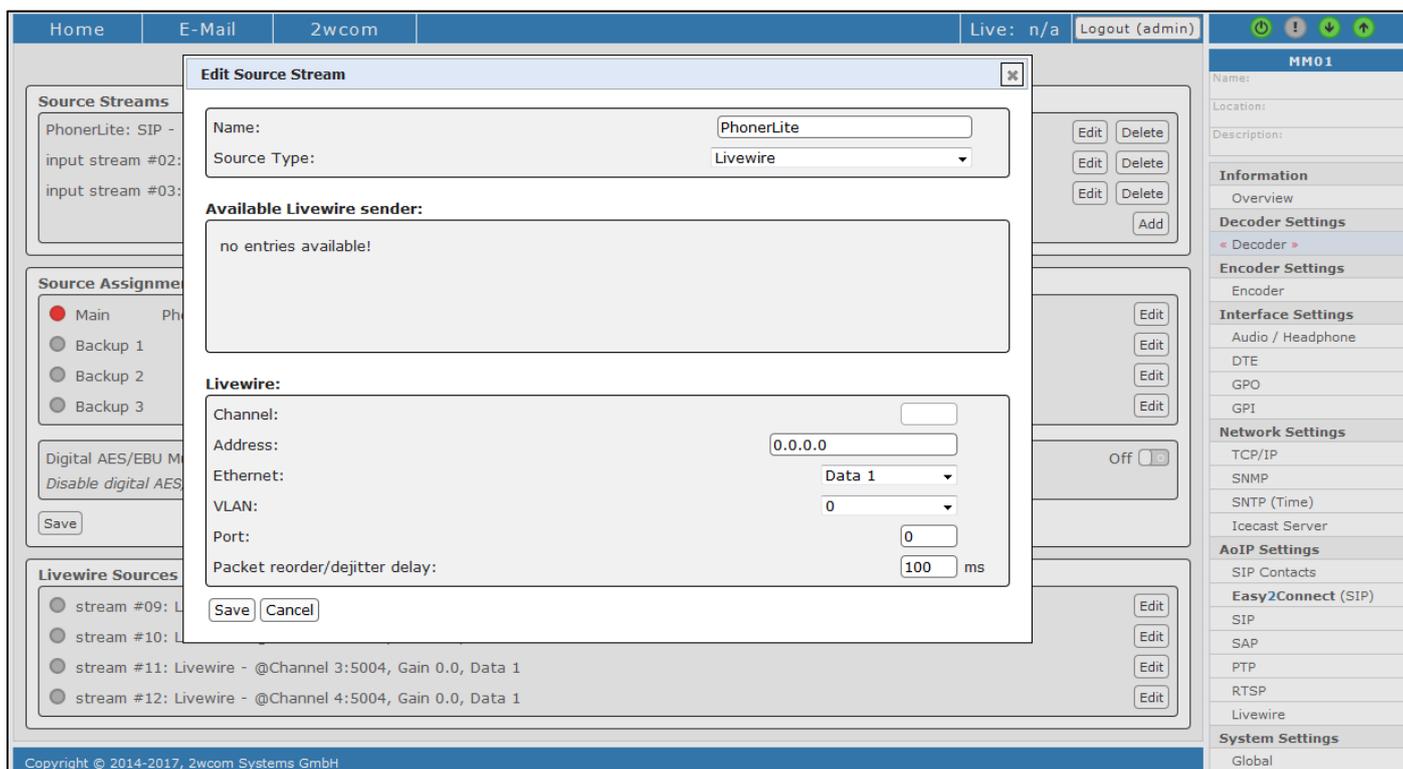2. Enter the data in the fields of the configuration for Livewire as described in section 14.2.2 on page 57.

Figure 40: Edit Source Stream for Decoder – Audio over IP Livewire

14.2.9. Set up FEC for decoder

The MM01 coder implements Pro MPEG FEC (Practice #3 release 2) to reduce packet loss and burst errors in IP data stream. If the incoming data stream is provided with Pro-MPEG FEC, you can activate it for the input source in the decoder.

> **NOTE**: If you activate FEC and use buffer, see section 14.8 "Set up buffer" on page 75 for more information about the buffer configuration.

Pro-MPEG FEC can be activated for both source types: Elementary Stream (RTP/UDP) and Transportstream (RTP/UDP).

To activate und to configure the error correction FEC for the preset source stream:

1. Open the window *Edit Source Stream* under **Decoder Settings→Decoder** by clicking the [Add] or the [Edit] button in the field **Source Streams**, to define or to edit the chosen input stream (see Figure 31)*.*

2. Activate the Pro MPEG Forward Error Correction by selecting "ON" in the virtual switch "Pro-MPEG FEC Enable". The current menu window will be extended.

3. You can set up the following FEC parameters for the IP output: *FEC column (L) port offset* and *FEC row (D) port offset*.

4. Enter zero for the *FEC column/row port offset,* if it is unused or enter the last number of the main destination port, where the data should be sent to.

5. Click the `save` button to save the changes.

⇒ Under **Information→Overview** you can call up the current status of the FEC in the *Decoder→IP* block.

14.2.10. Dual Streaming

The MM01 Decoder is equipped with two IP Ports that serve for dual streaming redundancy. The device is able to receive the same audio signal over dual IP inputs from different IP addresses and in different quality as a redundancy and to decode it to one digital/analog audio.

> **NOTE**: For receiving and decoding of 4 source streams with different codecs, use **Stream4Sure** (for more information see section "Introduction" on page 6). This function is combinable with Dual Streaming.

In case of alarm the MM01 can automatically switch to a configured backup stream. The main stream and Backup Sources can use different stream types and different IP inputs.

> **NOTE**: The decoder can receive and process one or dual stream over the same IP input or dual stream over two IP inputs as a redundancy

Preset the dual streaming for separate input streams in the source stream configuration and then select the input stream under the menu "Source Assignment":

To activate und to configure the coder settings for audio over IP:

1. Open the window *Edit Source Stream* under **Decoder Settings→Decoder** by clicking the `Add` or the `Edit` button in the field **Source Streams**, to define or to edit the chosen input stream (see Figure 31).

2. Set up the parameters as described in section 14.2.2 and 14.2.3.

3. Activate **Stream4Sure** by selecting "ON" in the virtual switch. To view the status of the function see section 13.9 "View the encoder status" on page 51.

4. Activate Dualstreaming by selecting "ON" in the virtual switch "Dualstreaming" in the last field. The menu will be expanded to the additional configuration (see Figure 41).

5. Configure the IP parameters for Dualstreaming. For the Ethernet input you can set up the same or different sources Data 1/2.
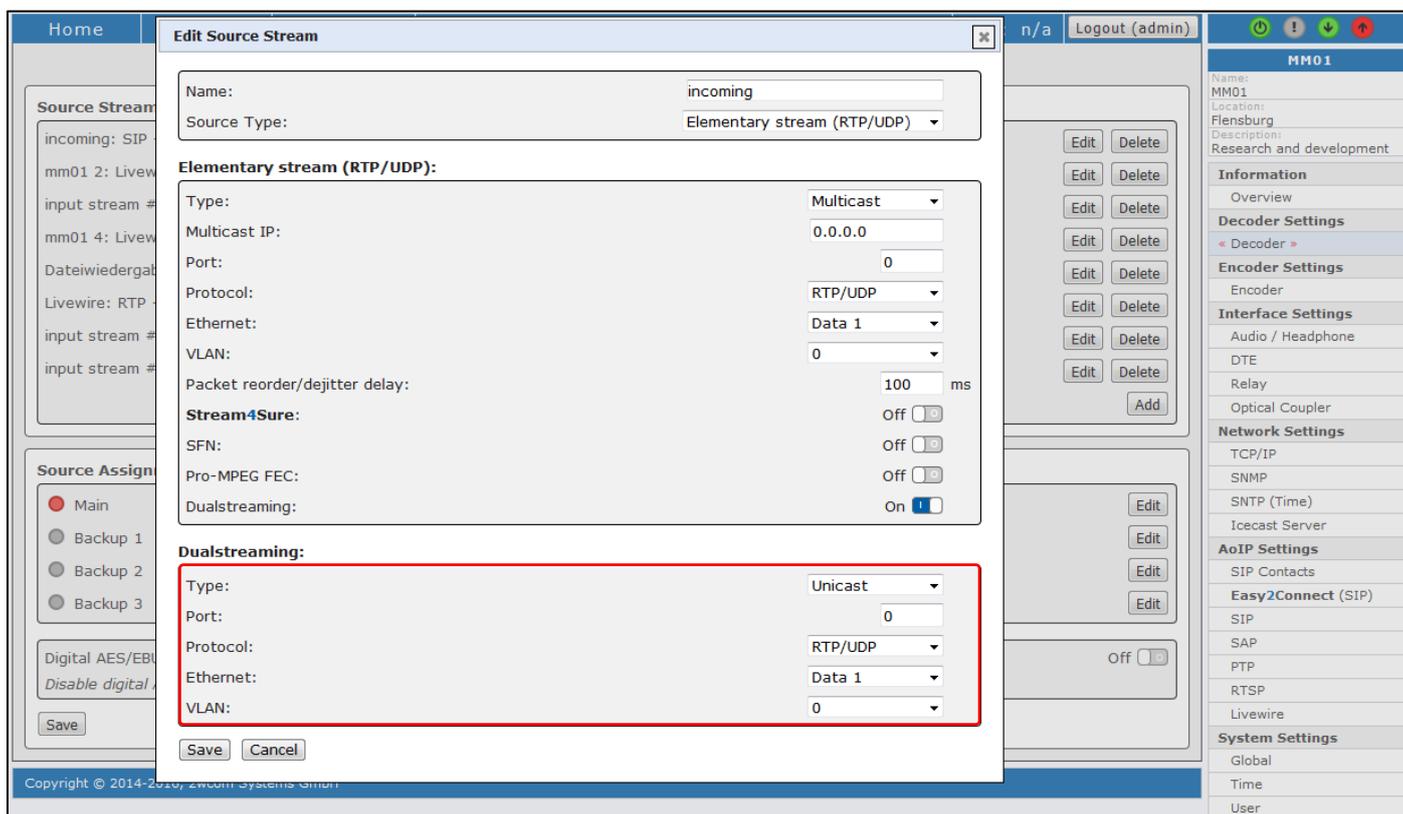
Figure 41: Dualstreaming settings for Decoder

6. Assign the configured dual input streaming to the Main Source in the menu "Source Assignment" (see Figure 42)

7. Click the [save] button to save the changes.

14.3. Activate source streams

Activate input sources (as a main source or as Backup Sources 1-3) in the field **Edit Source Assignment** by clicking the [Edit] button and choose in the dropdown menu "Source" the corresponding input stream defined in the previous step.

The decoder receives and processes all activated input sources and outputs one audio signal that has the higher priority (Main Source – Backup 1...4) and is error-free.

To assign the defined input streams to the Main Source (and/or Backup Sources 1-3) and to configure the decoder settings:

1. Select **Decoder Settings→Decoder** in the user web interface menu of the MM01. The page *Decoder* appears.

2. Click the [Edit] button in the field **Source Assignment** to configure the Main Source and Backup Sources 1-3. The page *Edit Source Assignment* appears (see Figure 42).

3. Activate an input signal as the Main Source for decoding by selecting "ON" in the virtual switch "Source".

4. Choose one of the defined input streams in the dropdown menu **Source** to assign it to the Main Source (see Figure 22).
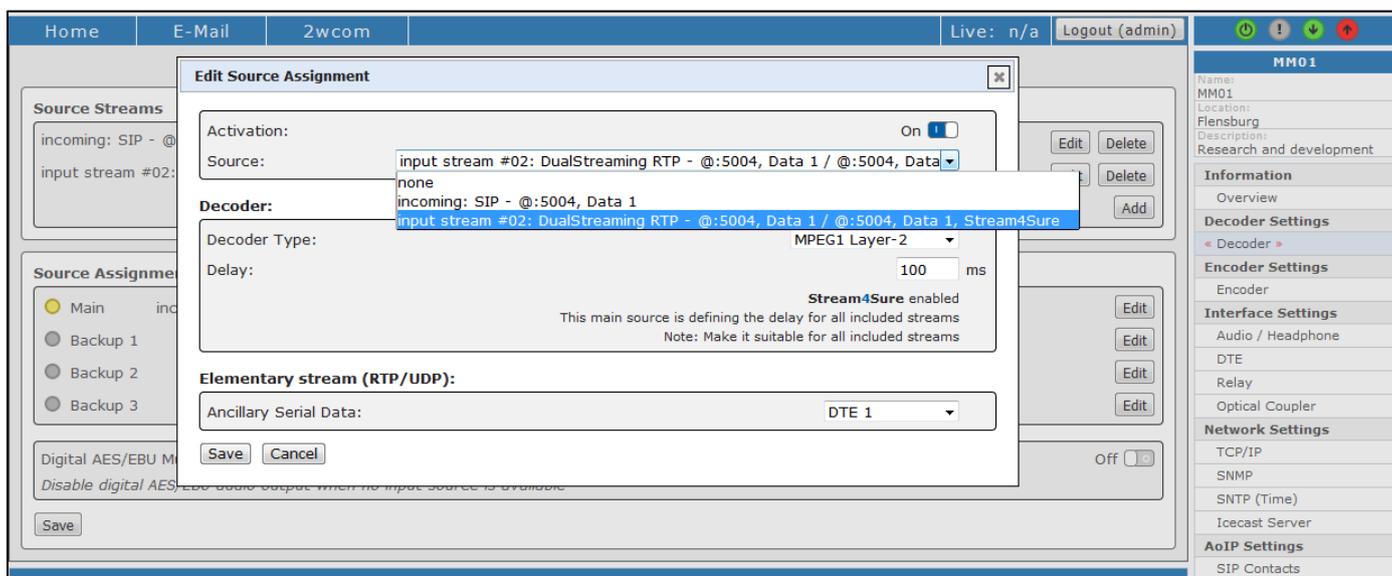
Figure 42: Decoder Settings – Input Source Assignment

5. In the block **Decoder** set up the delay time in ms for decoding the data if applicable.

NOTICE	
	The delay time must not exceed 200 ms if the sample rate is 192 kHz.

The delay buffer transforms the variable delay into a fixed delay. It holds the first samples decoded for a defined period of time before it plays them out in case of errors or damages in the decoded audio. Enter the value for this holding period.

> **NOTE**: If you activated FEC and use buffer, see section 14.8 "Set up buffer" on page 75 for more information about the delay configuration.

If the source of the input stream is "Elementary stream (RTP/UDP)" and SFN is activated for this stream (see Figure 34), the menu will be extended to field "SFN Fine adjustment". Enter the value in µs (see Figure 43). For more information about SFN settings see section 16 "SFN Synchronization" on page 85 and section 17.2 "Delay configuration for SFN Operation" on page 86.

6. If the input stream contains ancillary data, the MM01 can forward them to the serial outputs [DTE 1/2].
If the source of the input stream is "Elementary stream (RTP/UDP)", the menu will be extended to the dropdown menu "Elementary stream (RTP/UDP)".
If ancillary data is contained in the input stream, choose the serial output [DTE 1/2] for the ancillary data in the dropdown menu "Ancillary Serial Data" (see Figure 43).
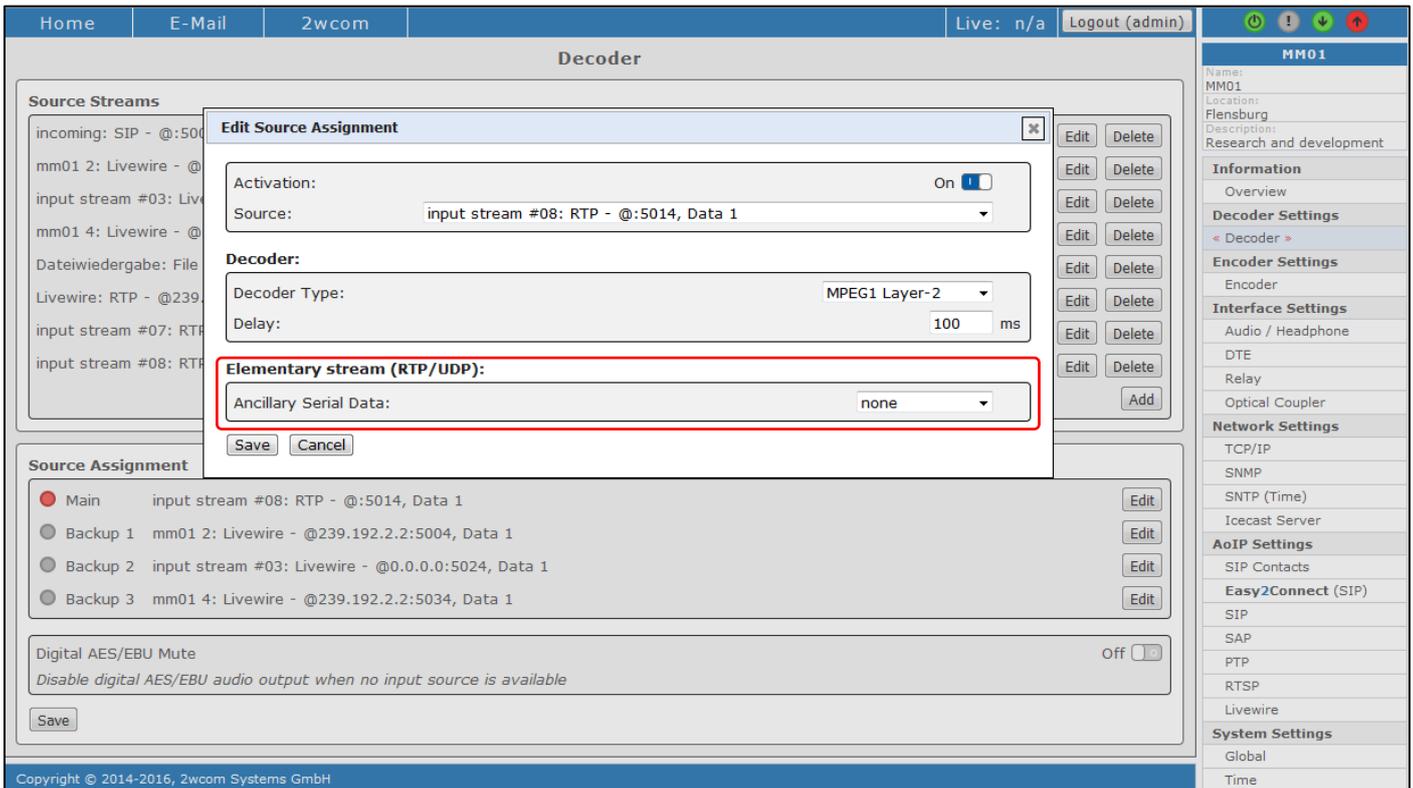
Figure 43: Decoder Settings for "Elementary stream (RTP/UDP)"

7. If the source for the input signal is "FM Tuner" (for monitoring or backup), set up the parameters for Decoder and RDS Data (see Figure 44).

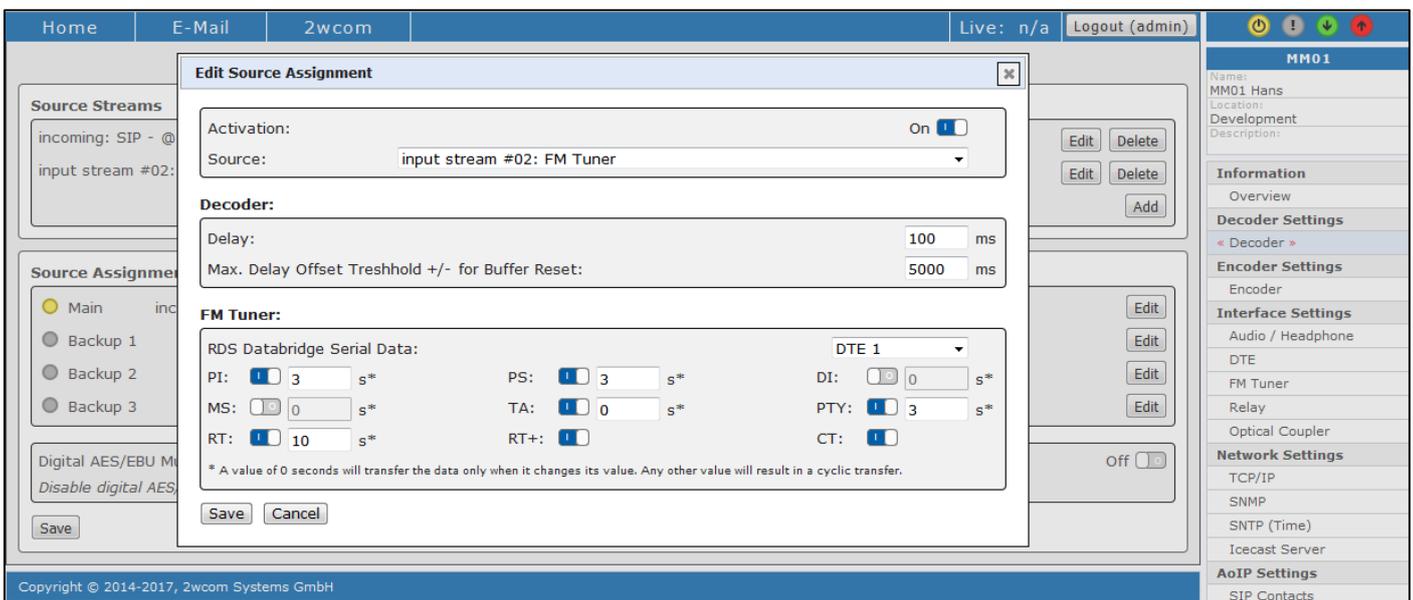**NOTE**: For configuration of "FM Tuner" see section 11 "FM Tuner Settings" on page 30.

Figure 44: Input Source Settings – FM Tuner

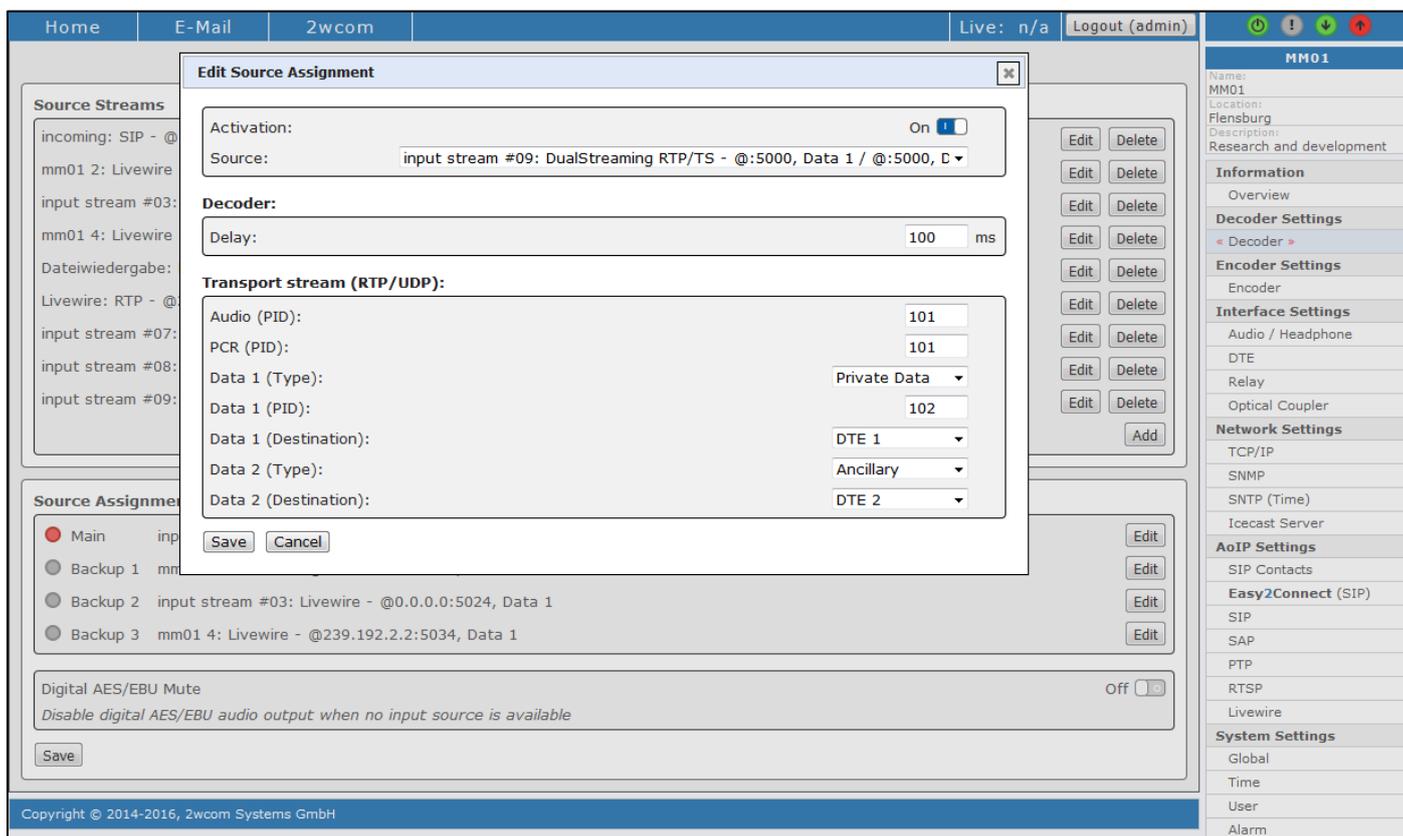8. If the source of the input stream is "Transportstream (RTP/UDP)", set up the parameters for the TS:

Figure 45: Decoder Settings for "Transportstream"

9. Click the `save` button to save the changes.

10. Analogously configure the Backup Sources 1-3.

14.4. Set up the output

The MM01 outputs the decoded audio signal as a digital and analog audio over both outputs [Analog L/R OUT] and [AES/EBU OUT].

You can set up the level for both outputs under **Interface Settings→Audio** in the field "Gain" (see Figure 20 on page 43).

The current level of the output gain is displayed on the display of the unit and in the user web interface under **Information→Overview** in the field "Audio Levels" (see Figure 21 on page 43).

If the input stream contains ancillary data, the MM01 can forward them to the serial outputs DTE 1/2. To set up the forwarding see section 14.3.

Under **Interface Settings→DTE** you can set up the baud rates for the serial outputs DTE 1/2:
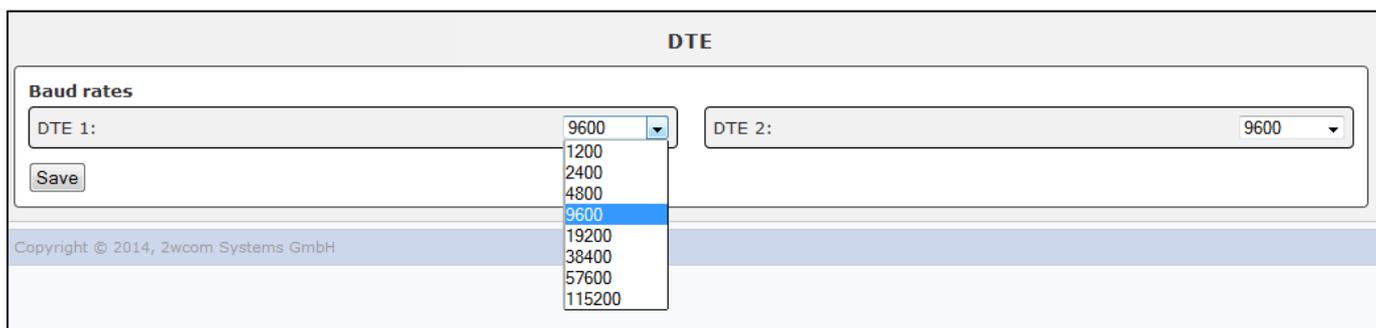
Figure 46: Interface Settings for DTE 1/2 outputs

Additionally, the MM01 decoder can output data from playout per Livewire. Edit Livewire streams for decoder output under **Decoder Settings→Decoder** in the "Livewire Sources" block (see Figure 44).
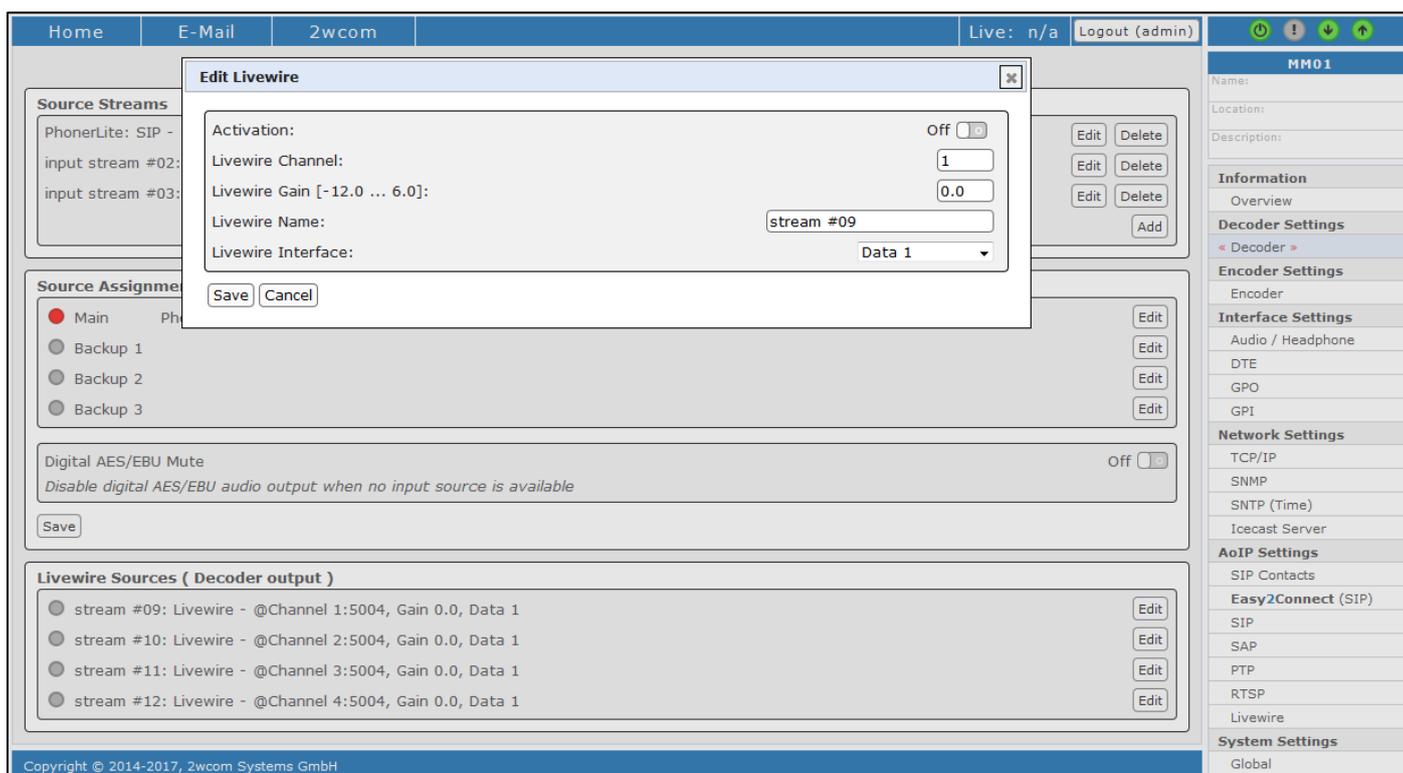

Figure 47: Livewire Sources setup for decoder output

14.5. Set up the error correction

The decoder implements Pro MPEG FEC (Code of Practice #3 release 2) to reduce packet loss and burst errors in IP data stream.

To activate und to configure the error correction FEC for decoding the input audio over IP:

1. Open the window *Edit Source Stream* under **Decoder Settings→Decoder** by clicking the Edit button in the field **Source Streams**, to configure input streams. The page *Edit Source Stream* appears (see Figure 31)*.*

2. Activate the Pro MPEG Forward Error Correction by selecting the checkbox "Pro-MPEG FEC Enable". The current menu window will be extended.

3. You can set up the following FEC parameters for the IP output: *FEC mode, FEC column (L) port offset* and *FEC row (D) port offset*.

4. Enter zero for the *FEC column/row port offset,* if it is unused or enter the last number of the main destination port, where the data has been sent to.

5. Click the ⎡save⎤ button to save the changes.

⇒ Under **Information→Overview** you can call up the current status of the FEC in the *Decoder* block (recovered/unrecovered IP packets). For more information see section 14.7.4.

14.6. Set up switch criteria for decoder

The MM01 decoder is able to automatically switch over between alternative sources as redundancy solution in case of failure. You can individually define up to 8 input streams and assign one of them to the Main Source and 3 Backup Sources for decoding (see Section 14.1 and 14.3).

The decoder receives and processes input streams from all activated input sources and outputs one audio signal that has the higher priority (Main Source – Backup 1…4) and is error-free. The device is able to automatically switch over between the Main and Backup sources for decoding, if one of the signals fails.

The following switch criteria for input sources in the decoder can be activated:

No audio output	The decoder will switch to the next best input source, if the it doesn't detect audio in the activated Main input stream or can't decode audio (digital or analog)
L silence detection	The decoder will switch to the next best input source, if it detects silence in the left channel of the decoded analog audio signal in the Main input stream. You can set up the threshold value to define the silence level.
R silence detection	The decoder will switch to the next best input source, if it detects silence in the right channel of the decoded analog audio signal in the Main input stream. You can set up the threshold value to define the silence level.
No input data	The decoder will switch to the next best input source, if no signal is available in the activated Gigabit IP input Data 1/2
PER	The decoder will switch to the next best input source, if packet errors are detected in the input signal received over the activated Gigabit IP input Data1/2. You can set up the minimal threshold value for the PER.

To set up switch criteria for input sources in the decoder:

1. Open the configuration field **Decoder** and **Streaming Input** in the window *Switch Criteria* under **System Settings→Switch Criteria** in the web interface of the MM01 (see Figure 26)**.**

Decoder

	Enable		Value		T1 ms	T2 ms
No audio output	☐				100	100
L silence detection	☐	<	-80	dBFS	5000	5000
R silence detection	☐	<	-80	dBFS	5000	5000

Streaming Input

	Enable		Value		T1 ms	T2 ms
No input data	☑				100	100
PER	☐	>	0	%	100	100

Figure 48: Switch criteria for input sources in the decoder

2. Enable each switch criterion separately in the corresponding checkbox "Enable", if this parameter should be monitored.

3. Enter the maximal threshold values to define the L/R silence level in dBFS and minimal percentage value for the PER.

4. Define for each criterion the delay time *T1* (in milliseconds) for switching release. The delay time from this defined value will be regarded by the system as "bad", so that after the delay time *T1* the device switches the input stream to the configured backup source.

5. Define for each criterion the delay time *T2* (in milliseconds) for switching end, how long a "good" signal for this parameter in the previous input stream should be available, before the system switches back.

6. Click the `save` button to save the changes.

    ⇒ The device switches to the next best input source.
    ⇒ The virtual LED lights green in the field "Source Assignment" under **Decoder Settings→Decoder** near the active source.
    ⇒ The configured alarms for "Decoder" and "Streaming Input" will be signaled via SNMP, by switching LED and/or a relay if enabled (see section 14.7).

14.7. Set up the monitoring and alarm control

The MM01 is able to monitor the decoding signal and to recognize errors in the inputs and outputs. If you operate the MM01 as a decoder, you can individually set up separate parameters for monitoring the decoder and sending alarm.

A released alarm is signaled by sending SNMP traps, activating of an available relay and, if configured, of the "Warning" LED on the web user interface page or on the front panel of the device.

14.7.1. Set up alarm for streaming input

The following alarm functions for streaming input can be activated:

No input data	Alarm is set off, if no signal is available in the Gigabit IP input Data 1/2
PER	Alarm is set off, if packet errors are detected in the input signal received over Gigabit IP input Data 1/2. The minimal percentage value for the PER is configurable, up to that the alarm should be set off.

To set up the monitoring and alarm function for the streaming input:

1. Open the configuration field **Streaming Input** in the end of the window *Alarm* under **System Settings→Alarm** in the web interface of the MM01 (see Figure 49).

Streaming Input	Enable	Priority	Value	T1 sec	T2 sec	SNMP	LED	GPO
⚪ No input data	⬜	Error ▾		5	5	⬜	⬜	3 ▾
⚪ PER	⬜	Error ▾	> 1.0 %	5	5	⬜	⬜	--- ▾
Save								

Figure 49: Alarm Settings – indication of the data in the Streaming Input.

The LED color means:

🟢 *- Monitoring is activated, no alarm is released*

⚪ *- Monitoring is deactivated*

🔴 *- Monitoring is activated, alarm is released*

2. Enable each alarm function separately in the corresponding checkbox "Enable", if this parameter should be monitored.

3. Select for each alarm function the severity level of the alarm in the dropdown menu "Priority":

Level/Code	Priority	Meaning
0	Emergency	System is unusable
1	Alert	Action must be taken immediately
2	Critical	Critical conditions
3	Error	Error conditions
4	Warning	Warning conditions
5	Notice	Normal but significant condition
6	Informational	Informational messages
7	Debug	Debug-level messages

Table 3: Alarm Priority

The value 0 or Priority `Emergency` is the most critical and emergent level. 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 is the alarming case and what measures are necessary.

4. Define for each monitoring function the delay time *T1* (in seconds) for alarm release. The delay time from this defined value will be regarded by the system as "bad", so that after the delay time *T1* an alarm will be set off.

5. Define for each monitoring function the delay time *T2* (in seconds) for alarm end, how long a "good" signal for this parameter should be available, before the system switches off the alarm.

6. Enable checkbox "SNMP", if the alarm should be signaled by sending SNMP traps.

7. Enable checkbox "LED", if the alarm should be signaled by the Warning LED on the web user interface page or on the front panel of the device.

8. Choose in the dropdown menu "GPO" one of the available outputs that should switch to signal the alarm.
   NOTE: The corresponding GPO must be activated for the source "Alarm" under **Interface Settings→GPO** (see section 15.4.2 "Alarm over GPO" on page 83).

9. Click the ⬚save button to save the changes.

14.7.2. Set up alarm for decoding audio

The following alarm functions for decoding can be activated:

No audio output	Alarm is set off, if the decoder doesn't detect audio in the input stream or can't decode audio (digital or analog)
L silence detection	Alarm is set off, if the decoder detects silence in the left channel of the decoded analog audio signal in the input stream. You can set up the maximal value of the audio level, under that the alarm should be set off.
R silence detection	Alarm is set off, if the device detects silence in the right channel of the decoded analog audio signal in the input stream. You can set up the maximal value of the audio level, under that the alarm should be set off.

To set up the monitoring and alarm function for the decoding audio:

1. Open the configuration field **Decoder** in the window *Alarm* under **System Settings→Alarm** in the web interface of the MM01 (see Figure 28).
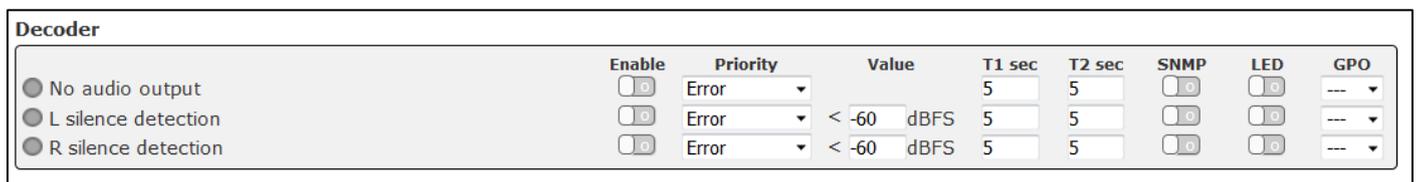
Figure 50: Alarm Settings – indication of decoded audio data in the decoder.

The LED color means:

🟢 *- Monitoring is activated, no alarm is released*

⚪ *- Monitoring is deactivated*

🔴 *- Monitoring is activated, alarm is released*

2. For the further settings follow the same instructions as described in section 14.7.1.

14.7.3. Set up alarm for audio output

The following alarm functions for the audio outputs can be activated:

AES/EBU no signal	Alarm is set off, if no decoded digital audio is available in the audio output [AES/EBU OUT].
Analog L silence detection	Alarm is set off, if the device detects silence in the output of the left channel of the analog audio signal [Analog L OUT]. You can set up the maximal value of the audio level, under that the alarm should be set off.
Analog R silence detection	Alarm is set off, if the device detects silence in the output of the right channel of the analog audio signal [Analog R OUT]. You can set up the maximal value of the audio level, under that the alarm should be set off.

To set up the monitoring and alarm function for the audio outputs:

1. Open the configuration field **Audio Output** in the window *Alarm* under **System Settings→Alarm** in the web interface of the MM01 (see Figure 27).

Figure 51: Alarm Settings – indication of decoded audio data in the output.

The LED color means:

🟢 *- Monitoring is activated, no alarm is released*

⚪ *- Monitoring is deactivated*

🔴 *- Monitoring is activated, alarm is released*

2. For the further settings follow the same instructions as described in section 14.7.1.

14.7.4. Set up alarm for FM Tuner

The following alarm functions for FM Tuner input can be activated:

RF Level	Alarm is triggered, if the input field strength exceeds the specified value
MPX Deviation	Alarm is triggered if the MPX deviation exceeds the entered level value (kHz)
No Pilot	Alarm is triggered, if no pilot sound in the RF signal is identified
Audio L/R silence detection	Alarm is triggered, if no audio signal but only noise is identified at the left or right channel
No RDS Sync	Alarm is triggered, if no RDS data is identified in the RF signal
RDS PI	Alarm is triggered, if no configured RDS program identification code is identified in the RF signal
RDS Block error rate	Alarm is triggered, if the RDS block error rate is above the configured value.

To set up the monitoring and alarm function for FM Tuner:

1. Open the configuration field **FM Tuner** in the end of the window *Alarm* under **System Settings→Alarm** in the web interface of the MM01 (see Figure 52).

Figure 52: Alarm settings – monitoring of the FM Tuner input
The LED color means:

🟢 *- Monitoring is activated, no alarm is released*
⚪ *- Monitoring is deactivated*
🔴 *- Monitoring is activated, alarm is released*

2. For the further settings follow the same instructions as described in section 14.7.1.

3. In the „RDS PI" block enter the correct RDS PI as a four-digit hexadecimal number in the first box `= 0000 (hex)`, to allow the monitoring system to recognize the correct program identification code (PI).

4. In the „RDS Block Error Rate" block enter the BER value for the received RDS blocks (percent) above that the alarm should be set off.

5. Under **Status→FM Tuner** you can call up information about FM Tuner and RDS (see Figure 8 on page 31).

14.8. Set up buffer

The buffer function is available only in the MM01 Decoder. The decoder is equipped with an <u>audio buffer</u> and a <u>dejitter buffer for IP</u>.

- <u>Audio buffer</u> is a delay buffer for decoded audio. It saves for example 100ms decoded audio to output it in case of failure; the device can use this time buffer for example to switch to the backup source or external source.

  To set up the value for audio delay in the decoder, follow the instructions in section 14.3 on page 65.
- <u>The dejitter buffer for IP</u> 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 and to compensate the jitter.
  To set up the value for this holding period in μs, follow the instructions in section 14.2.2 on page 56.

For more information see section 17 "Buffer Delay Management" on page 86.

You can view the current state of the Audio and IP buffer under **Information→Overview** in the user web interface. For more information see section 14.7.4 on page 51.

The detailed view of the buffering process for audio and IP during the last 4 minutes is displayed in the menu **Status→Buffer** in the user web interface (see Figure 53).
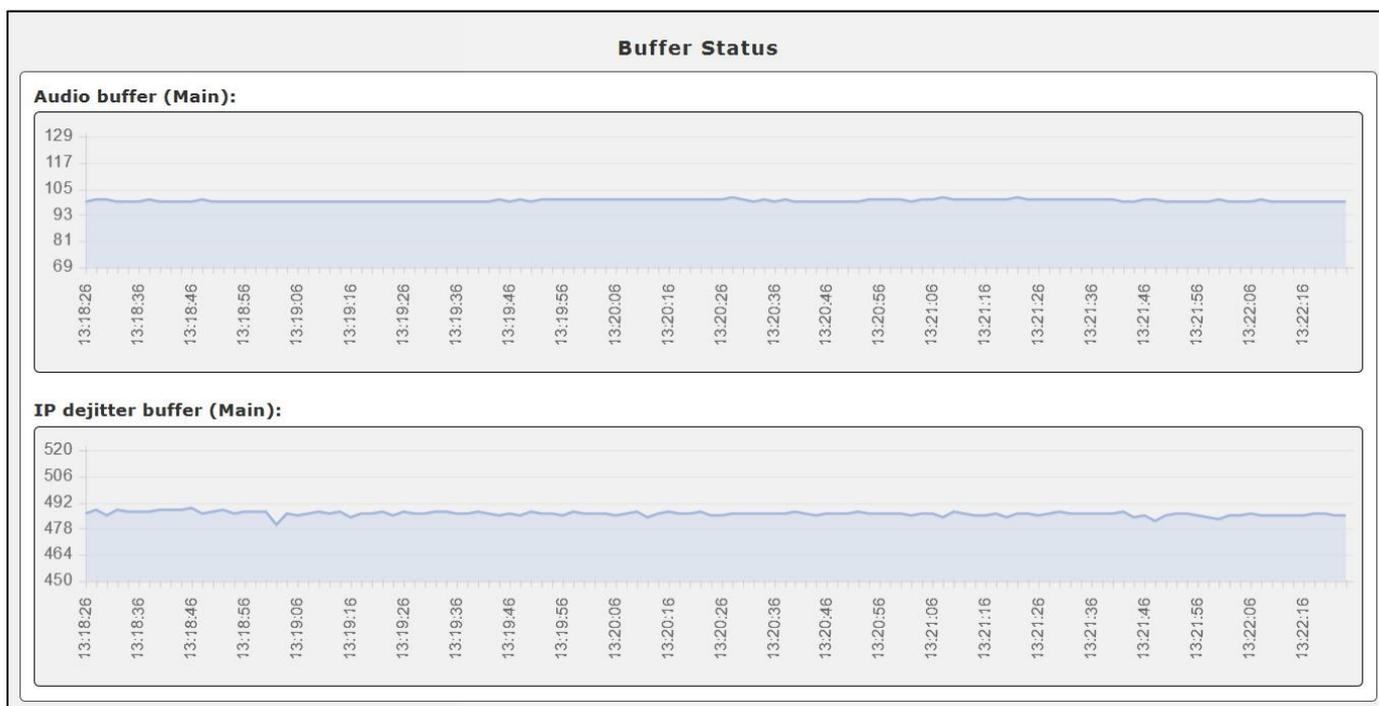
Figure 53: Status - Buffer

14.9. View the decoder status

You can view the current status of the decoder and of the incoming data at any time on the web user interface page or in the LCD menu of the device.

1. Under **Information→Overview** you can see the details of the configured parameters of the decoding signal in *Decoder* field (see Figure 29).

Figure 54: System Information – Decoder State

The LED color means:

- 🟢 *- active for decoding and is currently used for audio output*
- ⚪ *- deactivated*
- 🔴 *- error*
- 🟡 *- active but is not used for audio output*

2. In the left block you can view the name of the input stream, the type and the address of the activated data inputs Data 1/2.

3. In the "Audio" block you can view the status and the current parameters of the decoding audio (These are decoder settings set up under **Decoder Settings→Decoder→Edit Source Assignment**, see Figure 41 and Figure 22).

   The following Abbreviations are used for the configured coder parameters:

   – BR – Bit Rate

- SR – Sampling Rate
- Delay – Delay Buffer for decoded audio
- Error – the number of errors in the decoder (e.g. failed samples, no audio, PER etc.)

4. In the "IP" block you can view the current settings of the input streams over IP (Some IP settings can be set up under **Decoder Settings→Decoder→ Source Streams**, see Figure 34 and Figure 35)
   The following Abbreviations are used for the configured coder parameters:

   - BR – Bit Rate of the incoming IP packets (> than Audio BR because it includes the IP Header)
   - Delay – delay buffer to reorder and to dejitter the IP packets
   - Miss – the number of the lost/missing packets
   - Reord – the number of the carried out reorderings of the IP packets
   - FEC – the current FEC matrix in the stream
   - Recov – the number of the recovered packets
   - Unrec – the number of the unrecoverable packets

5. To reset error counters click the [Reset counters] button.

6. To view detailed information about the status of the decoder and of the input streams over IP, open the field **Decoder** under **Status→IP** (see Figure 71 "IP Status" on page 96).

7. To reset error counters click the [Reset counters] button.

8. To monitor the current outputting audio signal over headphone, open the field **Headphone** under **Interface Settings→Audio** and select "Decoder" in the dropdown menu "Audio Source" (see Figure 55):
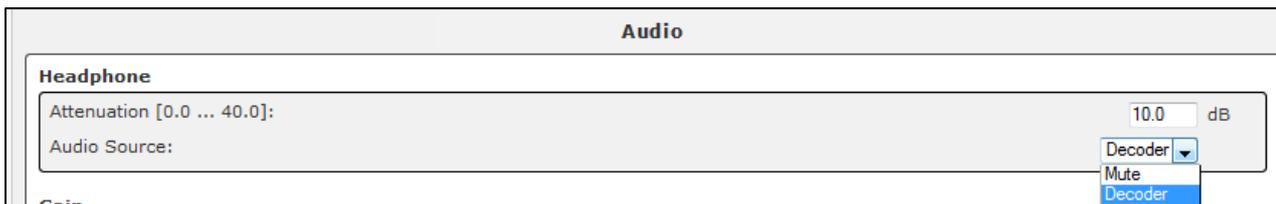
Figure 55: Headphone settings

9. Under **Status→FM Tuner** you can call up information about FM Tuner and RDS (see Figure 8 on page 31).

10. Under **Status→ Log** you can call up information about the decoder status, device operation, data distribution and errors since the last event log deleting. A list with a description of the events with the timestamps is displayed in this menu (see section 18.16, Figure 72).

> **NOTE**: Configure alarm monitoring under **System Settings→Alarm** (see section 14.7). If the alarm monitoring for any parameter is deactivated, no information about the corresponding error will be shown in the log.
>
> To reverse the relays and see the status of the switched relay in case of a triggered alarm, open the menu **Interface Settings→GPO** (former versions **Interface Settings→Relay**) and see section 15.3 "GPO" 80.

15. Interface settings

15.1. Audio

Under **Interface Settings→Audio** in the web interface of the MM01 you can activate the transparent mode, configure the headphone interface and set up gain for audio input/output.

Transparent Mode

The Audio Transparency Mode is available only for the **digital** AES/EBU input/output.

For proper decoding, the transparent mode should be activated in **both** end devices: encoder and decoder.

- Sample processing <u>without</u> enabled "Transparent Mode":
  o The MM01 transports the decoded audio samples (PCM) through the sample rate converter to the output.
  o The sample rate converter generates an exact sampling rate for the output, which the user has configured in the web interface (see section 13.4).
  o If the user has configured 48 kHz in the encoder, the sample rate converter generates the same frequency of 48 kHz in the output of the decoder.
  o In the input of the SRC the jitter of sampling rate is being converted into a constant determined sampling rate for the output.

- Sample processing with enabled "Transparent Mode":
  o The MM01 transports the decoded audio samples (PCM) <u>without</u> converting the sample rate <u>directly</u> to the output interface.

NOTICE
If the sampling rate of **192 kHz** is used, the "Transparent Mode" must be activated.

According to the AES-3 standard Data Jitter varies between max +/- 20 ns. Depending on the bit depth, the Signal to Noise Ratio has a better quality if SRC is <u>deactivated</u>.

The sample rate of the decoder follows the sample rate of the encoder by using a PLL.

The PLL is a software block in the decoder that determines the encoder speed. It does that by evaluating the Speed/Timing Interval of the incoming IP Packets matching against the resulting buffer level.

The PLL has some phases. At startup the control has an init phase until the encoder speed is found. Here the sampling frequency can vary up to +/- 20ns according to the AES/EBU standard.

After the init phase the PLL is locked and does only vary less.

If you want to use the transparent mode, activate the checkbox "Enable" in the menu **Transparent Mode** (see Figure 56).

Transparent Mode

Enable ☑

*If device is used as Encoder the correct sample rate and sample width has to be configured in **Encoder A***
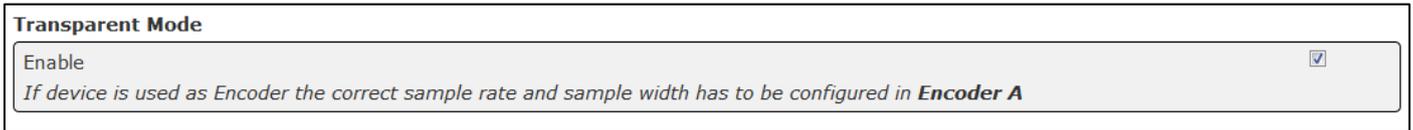
Figure 56: Interface Settings – Audio

Note that the configured sample rate and sample width must be correct and correspond to the real values of the signal.

Headphone

If you operate the device as a decoder you can monitor the outgoing audio signal over headphone or set it mute. For more information about the headphone settings for decoder see section 14.9 and Figure 55

Gain

If you operate the device as an encoder or/and as a decoder you can set up the level for digital/analog inputs and for digital/analog outputs. For more information about the gain settings for audio input see section 13.3 and for audio output see section 14.4.

15.2. DTE

This menu item is available under **Interface Settings→DTE** and is used to configure the serial RS-232 interfaces [DTE 1/2] of the device (see Figure 46 in section 14.4). To connect both serial interfaces use the serial breakout cable (not delivered).

Configurable settings are the baud rate for DTE 1/2.
Possible baud rates: 1200, 2400, 4800, 9600, 19200, 3DTE DAte8400, 57600, 115200 baud.

⇒ Save the settings by clicking the ⌊save⌋ button.
⇒ To view the status of the Data Interfaces, open the menu **Status→DTE Data**:

Figure 57: Status of the Data Interfaces

15.3. GPO

The MM01 unit is equipped with a 26 pole D-sub male connector with 12 GPIO outputs. The relays can be used for alerts of the monitoring function.
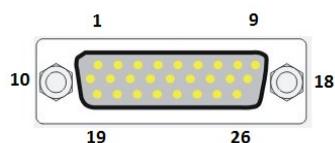
D-Sub male connector, high density, 26 pole

Relay Output

Table 4 displays the scheme of the possible switch contacts:

Relay No.	Switch contacts	Switch type
1	1,10	SPST, NO
2	11,19	SPST, NO
3	2,20	SPST, NO
4	3,12	SPST, NO
5	13,21	SPST, NO
6	4,22	SPST, NO

7	5,14	SPST, NO
8	15,23	SPST, NO
9	6,24	SPST, NO
10	7,16	SPST, NO
11		SPDT
12		SPDT
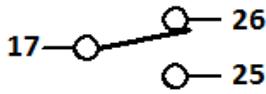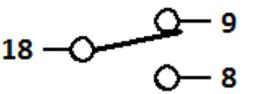
Table 4: Relay Output – switch contacts

NOTICE

	The relay contacts have maximum rating of 0.5 A at 30 V DC.

You can view the current state of the relays and invert the relay contacts under **Interface Settings→GPO** (former versions **Interface Settings→Relay**) (see Figure 58).
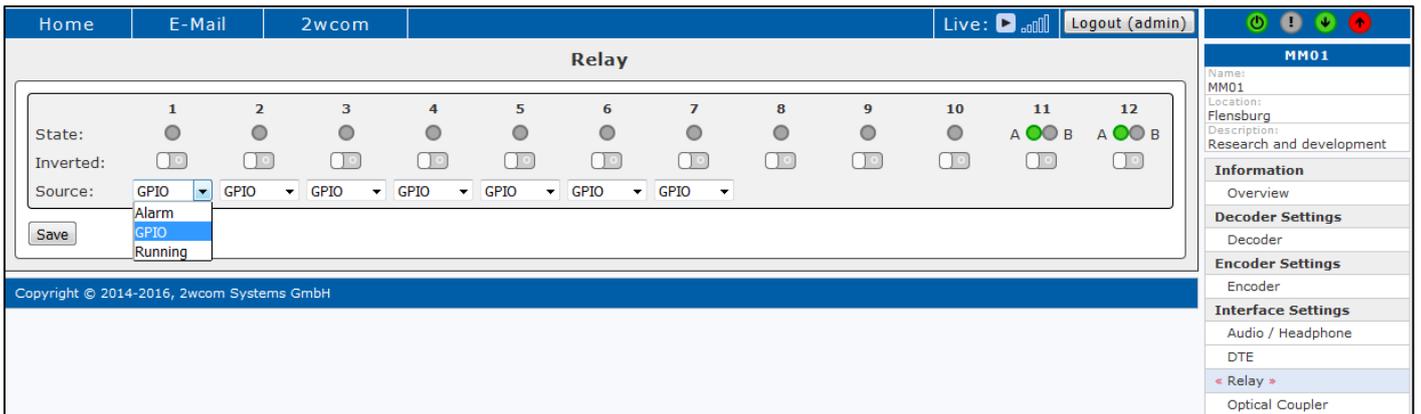
Figure 58: Interface Settings – Relays-Status

🟢 *– ON*
⚪ *– OFF*

The MM01 is equipped with 7 GPIO inputs, that you can use for GPIO forwarding or alarm signaling. To set the source of the inputs:

1. Open the menu "Relay" under **Interface Settings→GPO** (former versions **Interface Settings→Relay**) (see Figure 58).

2. Choose the source in the drop down menu for the relays 1-7.

3. Select "Alarm" for the relays that should be used for alarm forwarding.
   NOTE: You can set up the alarm parameters and the ways of alarm trigger under **System Settings→Alarm** in the user web interface of the device. For more information about alarm settings see section 13.8 for encoder and 14.7 for decoder.

---

4. Select GPIO to enable the control of the relay via GPIO-forwarding over the encoder inputs.

5. Select "Running" status to indicate that the application is running, for example during a reboot: the relay switches only after the device is completely ready for the operation.

6. Save the settings by clicking the „save" button.

Relays 1-10 are normal switchers, whereas relays 11-12 are changeover relays (position A/B). The state of a relay is ON, if the alarm that is assigned to this relay is triggered.

15.4. GPI

The MM01 is equiped with a 15 pole D-sub female connector with 7 GPIO inputs.

D-Sub female connector, 15 pole
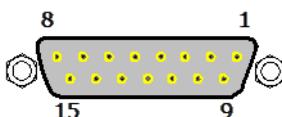
GPI

Table 5 displays the scheme of the pin assignment in the GPI:

GPI No.	Control Pin No.
1	1
2	2
3	3
4	4
5	5
6	6
7	7

Table 5: GPI – pin assignment

To actuate an input, pull the corresponding control pin electrically to ground (pins 9, 10, 11, 12, 13, 14, 15). The control current is less than 5 mA.

NOTICE	
	Voltage of outputs must not be negative or exceeding +0.7 V!

15.4.1. GPIO Tunneling

If you enable "GPIO tunneling" mode in the menu "Encoder Configuration" (see step 10. in section 13.4 on page 45), an actuation of a GPI activates a corresponding GPO in the destination device for example for relay switch (GPI1→GPO1, GPI2→GP02,… as shown in Figure 59).

Activate each output separately for GPIO tunneling under **Interface Settings→GPO** (see section "GPO" on page 81). Choose "GPIO" as a source for the GPO.
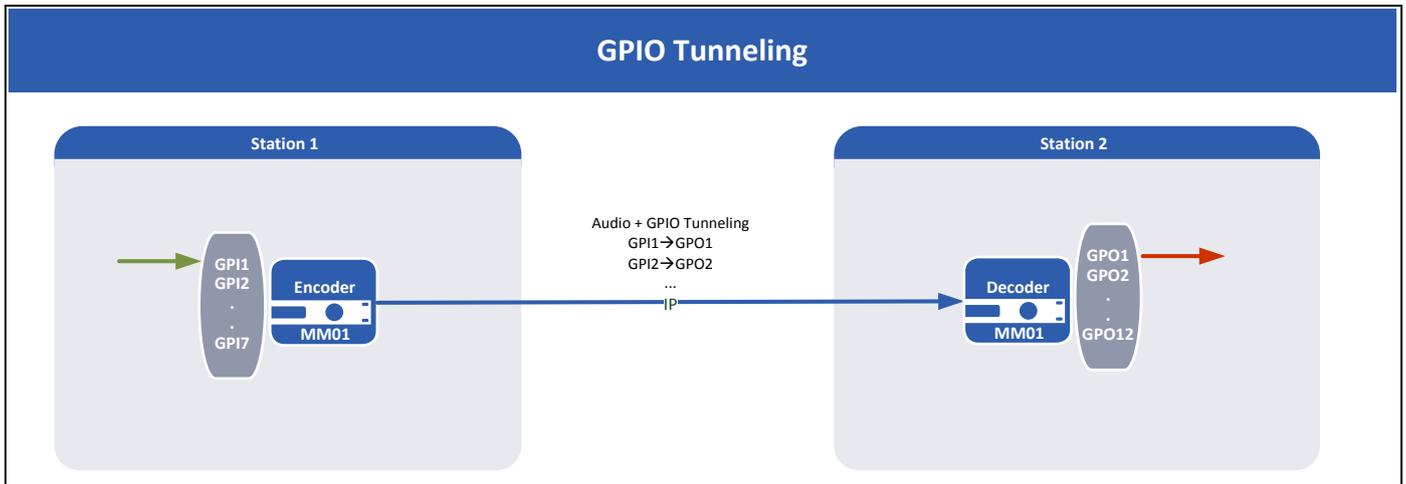
Figure 59: GPIO Tunneling

15.4.2. Alarm over GPO

Under **System Settings→Alarm** you can configure monitoring and alarm functions of some operation processes and use an available GPO for alarm signaling (see section 13.8 on page 49).

To configure the source of separate GPOs for alarm trigger use the menu **Interface Settings→GPO** (see section "GPO" on page 80).
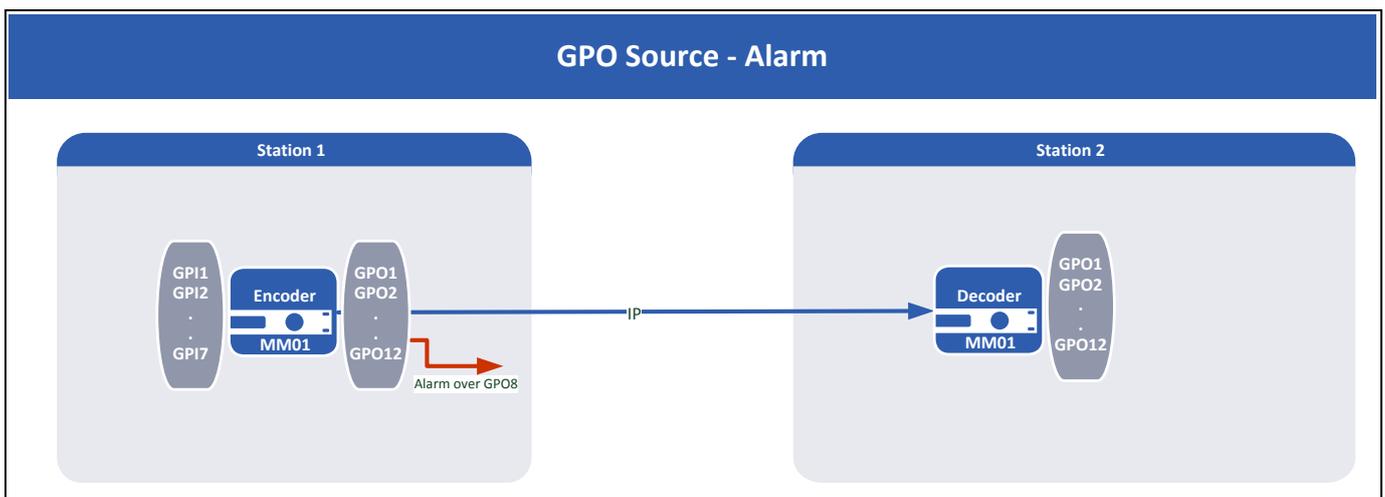
Figure 60: Alarm trigger over GPO

An example in Figure 60 shows a case of failure, when a triggered alarm activates a configured GPO (in the example GPO8).

15.4.3. External GPO Switch

If a GPO of the encoder is switched directly over an external signal (e.g. data over Livewire), the GPI stays unactuated and cannot forward the switching information to the destination device (decoder). In this case, if the Livewire switches the GPO directly, you can root this change to one of the GPIs under **Interface Settings→GPI** (see Figure 62). The configured GPI will then switch the corresponding GPO in the destination device via GPIO tunneling.
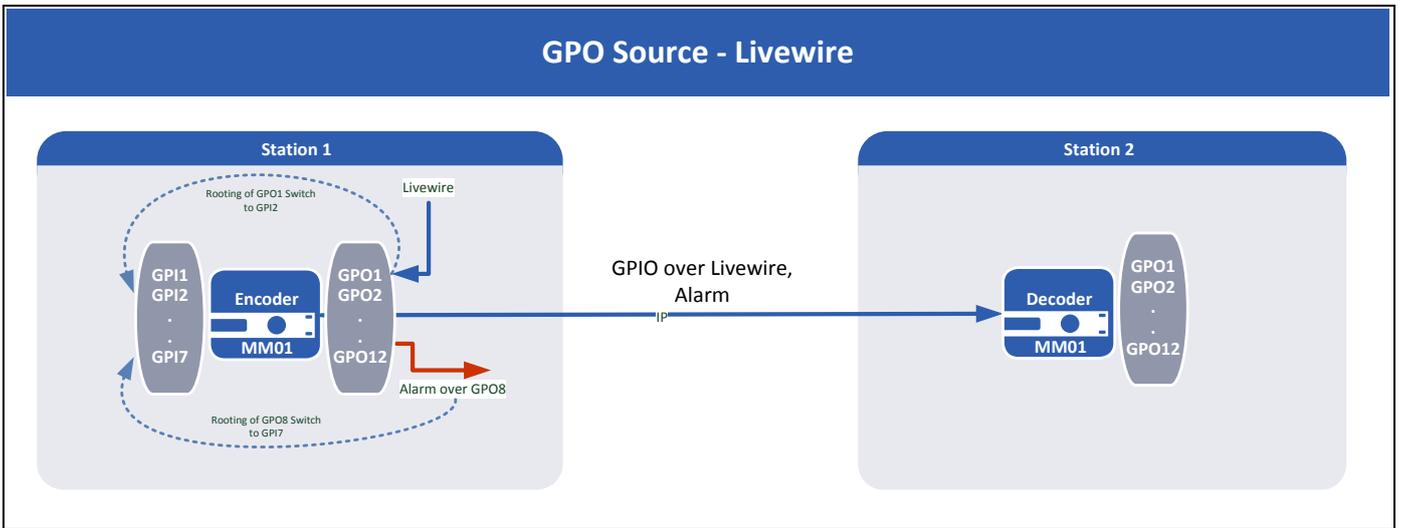
Figure 61: External GPO Switch – over Livewire

An example in Figure 61 shows a case, when GPO1 is switched by Livewire input and is rooted to the GPI2 for the further GPIO tunneling. This configuration is done in Figure 62.
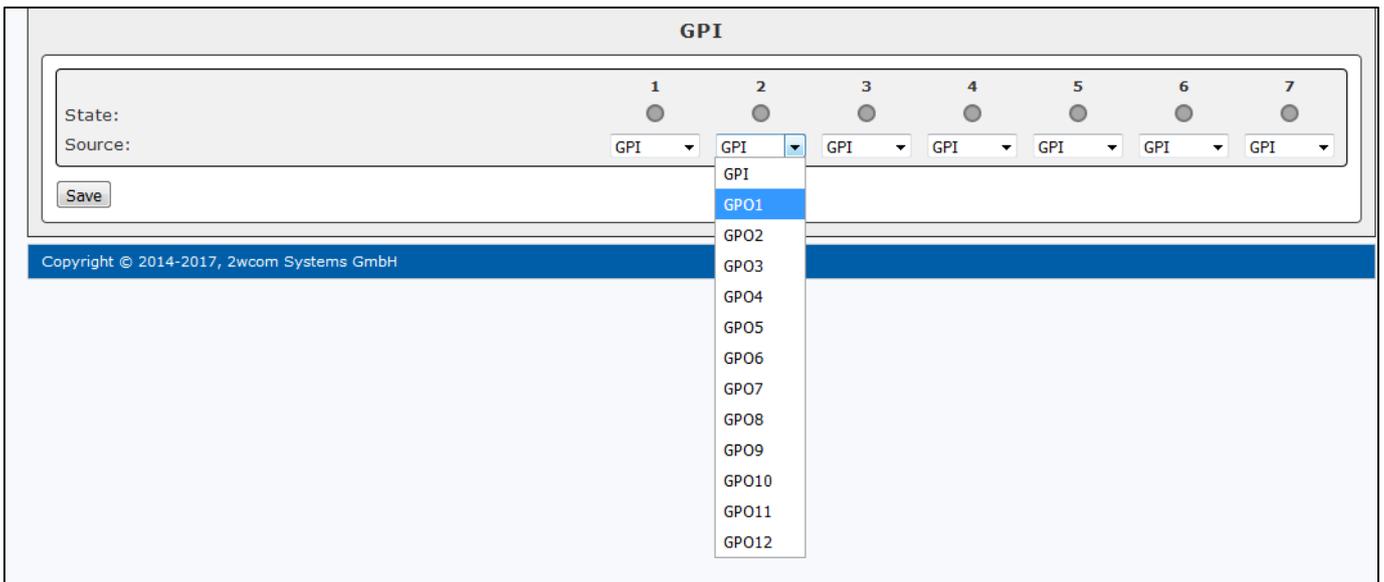
Figure 62: Interface Settings – GPI

🟢*– ON*

⚪*- OFF*

To activate a GPO for Livewire, enable the "GPIO" mode in the Livewire configuration menu under **AoIP Settings→Livewire** (see section 14.2.8 on page 62).

16. SFN Synchronization

The function of the network synchronization for SFN applications for the MM01 is optional and can be used for latency control. The SFN rights must be assigned for the MM01 devices.

For activating the SFN synchronization use the BNC connector [1 PPS].

<table>
<tr><td colspan="2">NOTICE</td></tr>
<tr><td></td><td>If you activate SFN in a "Stream Destination" of the Encoder and use Encoder B, the configured Sampling Rate of the Encoder A and Encoder B <u>must be the same </u>("Encoder Configuration", see section 43 "Set up the coder" on page 43).
The SFN synchronization can be used only with the following Sampling Rates: 32, 44.1, 48 and 192 kHz.</td></tr>
</table>

Enable and set up the SFN parameters for the <u>Encoder</u> in the menu **Encoder Setting→Stream Destination**. For more information see section 13.6 on page 47.

Enable SFN synchronization in the <u>Decoder</u> in the menu **Decoder Settings→Source Streams→ Edit**. For more information see section 14.2.2 on page 56.

The detailed view of the SFN status is displayed in the menu **Status→SFN**.

Figure 63: Status - SFN

NOTE: To reset error counters, click the „Reset counters" button.

17. Buffer Delay Management

When using the MM01 there are different stages where delay is introduced by processing or for security (i.e. FEC or dejitter buffer). For uninhibited operation, the user needs to make sure, that delay settings are in a safe area.

17.1. Basic delay setup

Delay is calculated in the following matter for a basic setup:

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

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

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

When no FEC is used a Dejitter / Reorder buffer can be used which will add delay in the length it is setup to. When FEC is used, there is a minimum delay that is required for safe operation (in the length of two full FEC matrices), anything 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 can always be seen in **Status→IP**. The user can use the additional delay setting to further delay the output up to 1000ms and the decoder will also have a small delay of <5ms.

FEC / Samplerate	132kHz	144kHz	176kHz	192kHz
4/2 CR	44ms	40ms	33ms	30ms
5/5 CR	136ms	125ms	102ms	94ms
10/4 CR	218ms	200ms	164ms	150ms
5/20 CR	545ms	500ms	409ms	375ms
20/5 CR	545ms	500ms	409ms	375ms
Expert mode	L*D*5,45 ms	L*D*5 ms	L*D*4,09 ms	L*D*3,75 ms

Table 6: Minimum FEC delays sizes

## 17.2. Delay configuration for SFN Operation

When the MM01 is used in SFN mode, the user needs to take extra precautions to ensure safe operation. It is recommended to have at least 100ms spare time after dejitter / reorder or FEC output delay. So a user must carefully select settings that ensure this:

SFN global delay – encoder processing delay – transmission delay on IP network – Dejitter / Reorder or FEC output delay >= 100ms

Three examples, demonstrating safe, unsafe and incorrect setups for SFN operation:
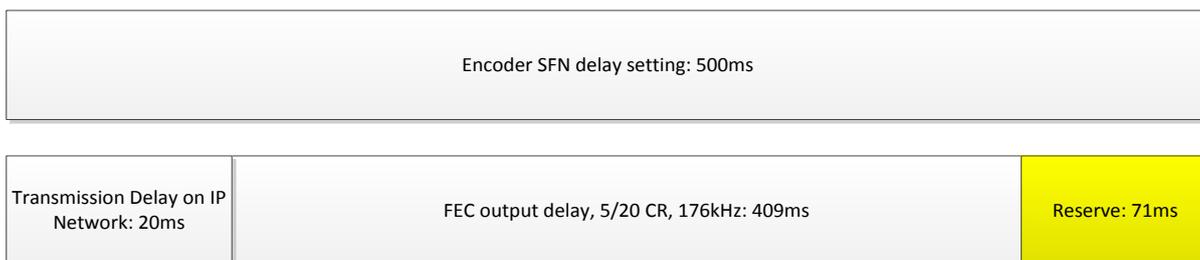
Example 1

This is a safe example setup with lots of spare time for SFN operation. The global SFN delay is set to 750ms, the network consume about 50ms and the decoder stores 250ms of IP data to dejitter / reorder purposes, which will leave 450ms that the decoder can buffer, before data needs to be put out.
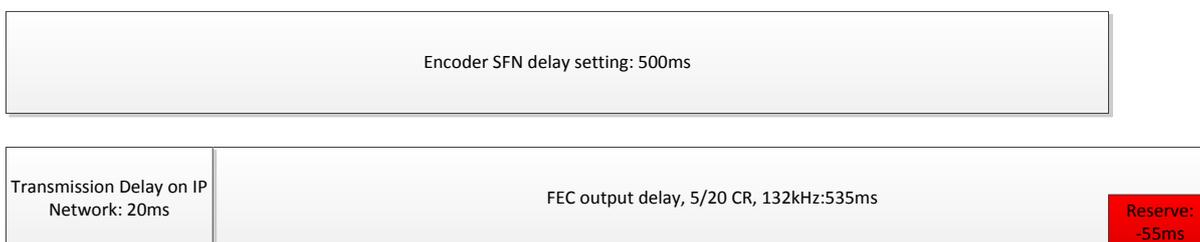
Encoder SFN delay setting: 750ms

Transmission Delay on IP Network: 50ms	Decoder Dejitter / Reorder delay: 250ms	Reserve: 450ms
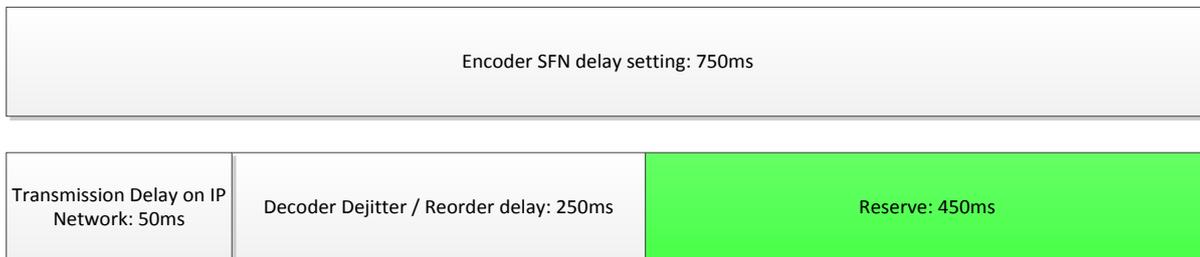
Example 2

This example shows settings that will still work in almost all cases, but are more prone to problems introduced by the IP network (rerouting, congestion, etc.) which might add unwanted additional delay for a short period of time, that might lead to decoder buffer depletion and service interruption.

Encoder SFN delay setting: 500ms

Transmission Delay on IP Network: 20ms	FEC output delay, 5/20 CR, 176kHz: 409ms	Reserve: 71ms

Example 3

This example shows, how incorrect delay settings can break SFN operation and move the playout accidentally into the next PPS cycle.

Encoder SFN delay setting: 500ms

Transmission Delay on IP Network: 20ms	FEC output delay, 5/20 CR, 132kHz:535ms	Reserve: -55ms

18. Device Settings

18.1. Enter the device information

To enter the name and description of the device for identification:

1. Open the window *Global* under **System Settings→Global**.

2. Enter the identification information of the device in the **System Info** field
   (see Figure 66 #2 on page 90).

3. Click the save button to save the changes.

⇒ The saved information is always displayed in the web user interface above the main menu.

18.2. View the system information

On the web user interface, you can view general settings of the device and current system information like uptime, serial number, firmware version, the temperature etc.

To view the system information:

1. Open the window *Global* under **System Settings→Global.**

2. The device information is displayed in the **System information** field (see Figure 66 on page 90 and on the right side of Figure 73 on page 96).

3. To view the current status of the device, open the field **Status** under **Information→Overview**
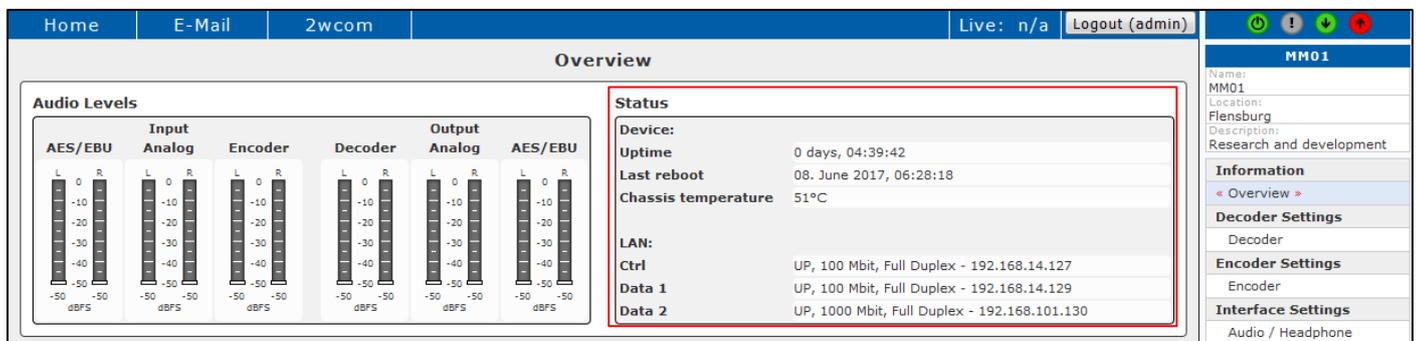
Figure 64: Information - Status of the device

4. To view the current electric potential of the device, sampling rate of AES and REF Inputs, open the window *Device Status* under **Status→Device:**
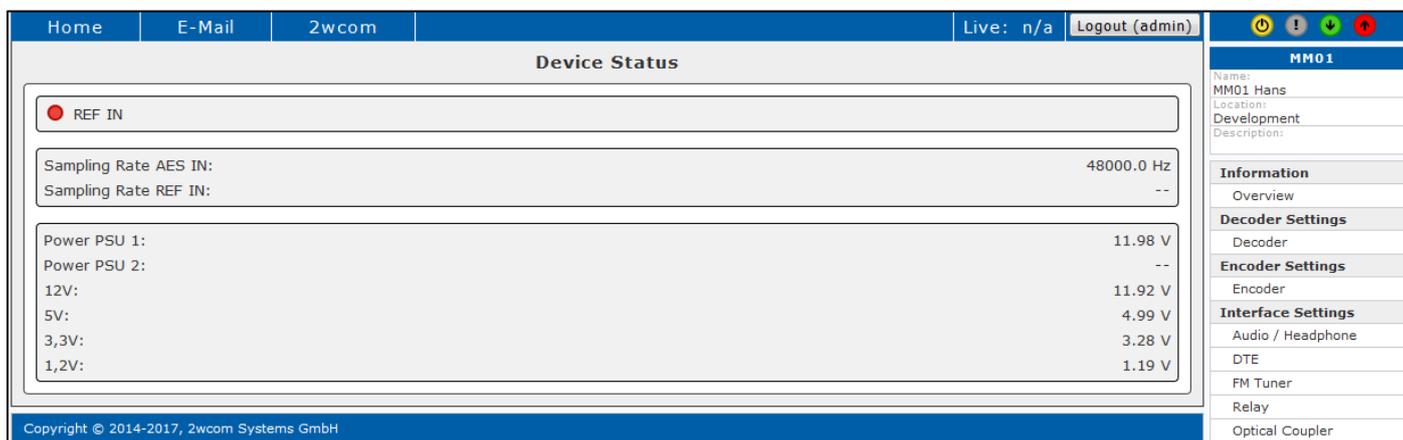
Figure 65: Status - current electric potential of the device

18.3. Reboot the device

To reboot the device:

1. Open the window *Global* under **System Settings→Global.**

2. Click the "Now" button in the "Control" block to reboot the device (see Figure 66, #1).

⇒ The device restarts

18.4. Restore factory settings

NOTICE	
	CAUTION: If you restore factory settings, all saved configurations made earlier by user will be deleted except for the IP address! This applies also for the access accounts!

To reset the device to the factory settings:

1. Open the window *Global* under **System Settings→Global** (see Figure 66, #1 on page 90)**.**

2. Click the "Now" button in the "Control" block to load factory settings.

18.5. Set up the session timeout

To set up the session timeout for the web user interface of the device:

1. Open the window *Global* under **System Settings→Global.**
2. Enter the value in min for the session timeout in the **Web interface** field (see Figure 66, #3):

Figure 66: System Settings - Global

3. Enter "zero" to deactivate the function.

4. Click the "Save" button to save the changes.

⇒   The current user will be automatically logged out after the configured period of inactivity (session timeout).

18.6.   Upload and activate settings stored locally

MM01 is able to store and load all settings in different CODEC interconnection profiles through the Web interface to an SD Card, USB stick or any other local store.

To upload settings stored locally:

1. Open the window *Global* under **System Settings→Global.**

2. Click the Browse button in the **Settings** field (see Figure 67, #1). The "Open file" dialog of your system software will be displayed.
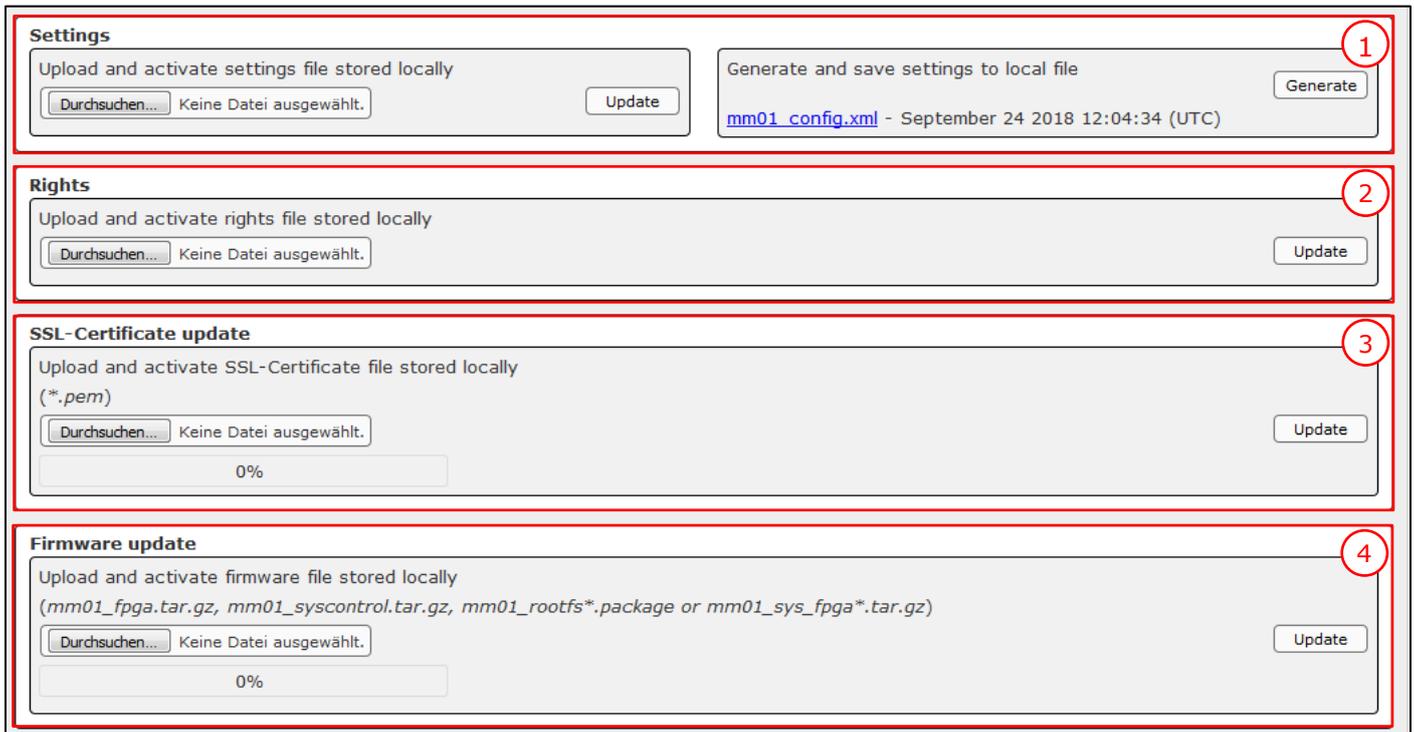
Figure 67: System Settings - Global

3. Choose the settings file in your browser.

4. Click the "Update" button to upload the file. The file upload can take longer and may not be interrupted.

5. Follow the prompt to restart the device after successful upload.

⇒   The new settings will be activated after the restart of the device.

18.7.   Save settings to local file

You can generate and save the current settings to local file.

Follow the steps below:

1. Open the window *Global* under **System Settings→Global** (see Figure 67, #1)**.**

2. Click the „Generate" button in the **Settings** field to start the generation of a settings file.

3. A link to that file will be shown. Right-click on it to save it to a location of your choice.

⇒   The saved settings can be uploaded in the **Upload Settings** field (see Section 18.6).

18.8.   Set up rights

Some functions are optional such as SFN, FEC, E-aptX, Dual Streaming, Ravenna, **Stream4Sure**, Icecast Server and other. To use these functions, additional rights must be set.

To upload and activate rights file stored locally:

1. Open the window *Global* under **System Settings→Global.**

---

2. Click the Browse button in the **Rights** field (see Figure 69, #2 on page 91). The "Open file" dialog of your system software will be displayed.

3. Choose the rights file in your browser.

4. Click the "Update" button to upload and to activate rights file. The file upload can take longer and may not be interrupted.

5. Follow the prompt to restart the device after successful upload

$\Rightarrow$ The new rights will be activated after the restart of the device.

$\Rightarrow$ You can view the active rights in the same menu in the "System information" block in the "Rights" field.

18.9. SSL-Certificate update

To upload and activate SSL-Certificate file stored locally:

1. Open the window *Global* under **System Settings→Global.**

2. Click the Browse button in the **SSL-Certificate update** field (see Figure 69, #3 on page 91). Select the file (PEM-File) and click "Update" button.

$\Rightarrow$ The file upload can take longer and my not be interrupted.

18.10. Upload and activate firmware stored locally

You can upload an ARM firmware stored locally or directly from an USB.

To upload and to activate the new firmware:

1. Open the window *Global* under **System Settings→Global.**

2. Click the Browse button in the **Firmware update** field (see Figure 69, #4 on page 91). The "Open file" dialog of your system software will be displayed.

3. Choose the firmware file.

4. Click the Update button, to start the file upload in the web browser. The file upload can take longer and may not be interrupted.

5. Follow the prompt to restart the device after successful upload.

$\Rightarrow$ The new firmware will be activated after the restart of the device.

18.11. Set up access for remote services

The MM01 has several options for an external access and control. You can connect to the MM01 using simple protocols FTP, SMTP and send files or health reports for support.

For the service communication use the 10/100/1000 Base-T interface [Ctrl]. Additionally, you can activate the interfaces [Data 1] and [Data 2] for service under **System Settings→Global** (see Figure 68, #1 on page 93).

18.11.1. Telnet access for support

The MM01 can be activated for the access from an external telnet client for example for 2wcom support. If you start the device, the access for telnet services is blocked in the device. You can activate telnet access for one operation session.

To allow an external telnet communication in the MM01:

1. Open the window *Global* under **System Settings→Global**.

2. Click the "Start" button in the **Telnet service** field to enable the telnet access for 2wcom support (see Figure 68, #3).

   ⇒ The virtual LED in the same field lights green.

3. Click the "Stop" button to disable the telnet access.
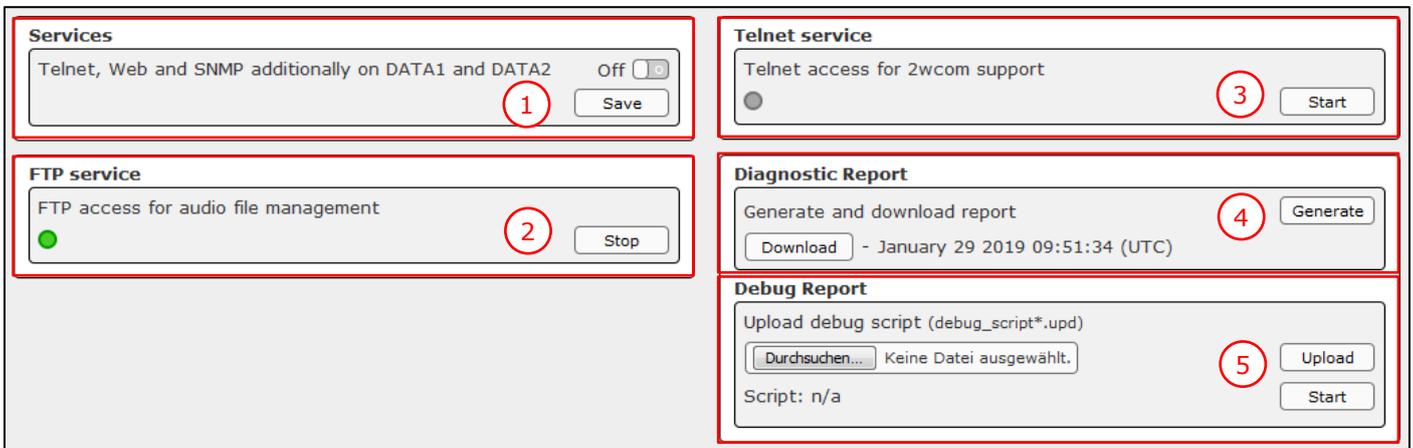
Figure 68: Global System Settings – Telnet service

18.12. Set up time

You can set up or change manually the present local time zone and date of the internal clock of the device.

To set up the internal clock of the device:

1. Open the window *Time* under **System Settings→Time** (see Figure 69).
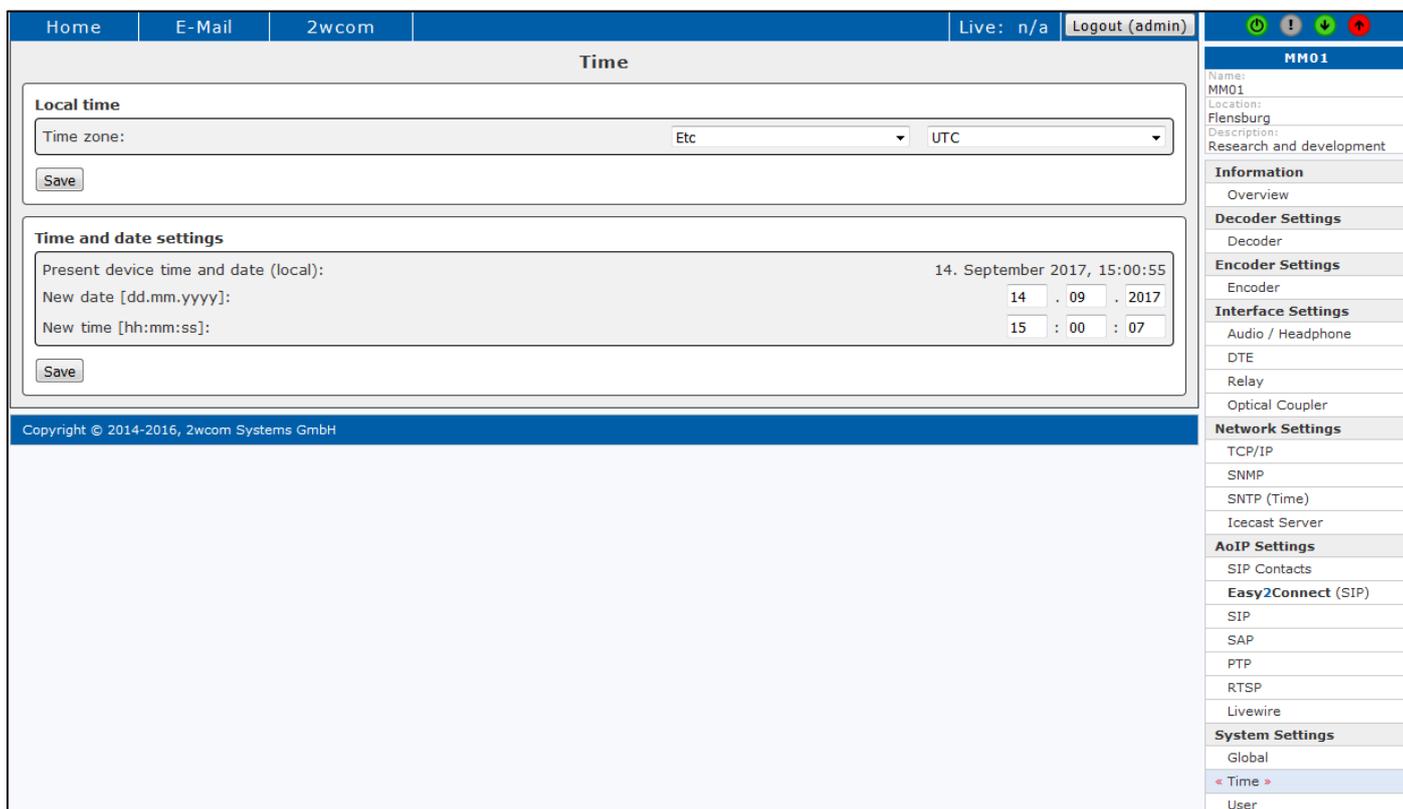
Figure 69: System Settings - Time

2. Choose the current time zone of the device in the **Time zone** field in the dropdown menu.

3. Click the save button to save the changes or the reset button to restore the last settings.

4. In the **Time and date settings** field, set up the internal time in the 24h format and the datum.

5. Click the save button to save the changes or the reset button to restore the last settings.

18.13. Configure user accounts

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 "FTP service" is used only for the access from an external FTP client for uploading audio files and saving them in the internal storage. The default password at delivery is "ftp".
NOTE: If you start the device, the FTP access for audio file management is blocked in the device. To activate the device for the FTP access, log in as Admin and click the "Start" button under **System Settings→Global** in the "FTP service" block in the web interface

Change the login data for the access after the first login to the web interface. To change the login data:

1. Open the window *User settings* under **System Settings→User.**

2. Change the login data for the full access in the **Admin account** field and repeat the new password.

3. Click the `save` button to save the changes or the `reset` button to restore the last settings.

4. Change the login data in the **Manager account** and **Guest account** field and repeat the new passwords.

5. Click the `save` button to save the changes or the `reset` button to restore the last settings.

NOTE: Consider the sensitive case while entering a new password!

18.14. Set up the alarm control of the device

To set up the monitoring and alarm function for the device:

1. Open the configuration field **Device** in the window *Alarm* under **System Settings→Alarm** in the web interface of the MM01 (see Figure 28).

Figure 70: Alarm Settings – monitoring of the device.

The LED color means:

🟢 *- Monitoring is activated, no alarm is released*
⚪ *- Monitoring is deactivated*
🔴 *- Monitoring is activated, alarm is released*

2. For the further settings follow the same instructions as described in section 14.7.1.

18.15. View the IP status

To view the IP Status, open the menu "IP Status" under **Status→IP** (see Figure 71).

Figure 71: IP Status

18.16. View the Log

The unit records the important system events such as coldstart, warmstart, firmware update, decoder/encoder processes, error messages etc. in a "Log".

To view and to edit the log:

1. Open the window *Log* under **Status→Log** in the end of the menu (see Figure 72).

Figure 72: Status - Logo

2. For more information about the priority of the messages see Table 2.

3. To save the list of messages as log file, click the Download button and choose the archive location on the directory tree and confirm the choice.

4. To clear the log, click the Clear button and confirm the choice.

19. Maintenance and servicing

Maintenance

No special maintenance is necessary on the device. Dust can be removed with a dry duster. For cleaning use only neutral, non-corrosive detergents applied to a cloth - not the device.

Servicing

The modules of the device are complex and should be serviced only by authorized personnel.

The 2wcom Systems GmbH is equipped with special measurement and repair kits. Therefore a repair by the user is not intended.

Calibration

Due to the design and construction of the device, no calibration is necessary.

20. Troubleshooting

The following chart is designed to help you to correct minor problems with the use of the device prior to contact our service department (report failures by email to *contact@2wcom.com* or fax to +49 461-662830-11). Also be sure to read the entire manual carefully, as this often helps in understanding and fixing typical problems.

Problem	Possible Cause	Solution
Device does not turn on	• Power cable is improperly connected • Mains supply failure • Blown fuse	• Check supply cord • Make sure that the power plug at the device is fully inserted • Check mains supply • Replace fuse by same type
Device cannot be operated via Ethernet	• Network cable not connected • IP address / TCP port is not known. • A device with the same IP address was connected a few minutes before. Then the ARP table still assigns the old MAC address to the IP address.	• Connect the network cable. • Use the default address 192.168.14.250. If the address was changed and is not known please see page 10. • Usually the ARP table is refreshed automatically after a few minutes by the operation system. For an instant access to the device please reset the ARP table of your computer e.g. by entering "arp –d" in the Windows Command Prompt.

For a support request to 2wcom team, please write the serial number of the device. The sticker with the serial number is normally on the rear side of the device: „S/N xxx.xxxxxx".
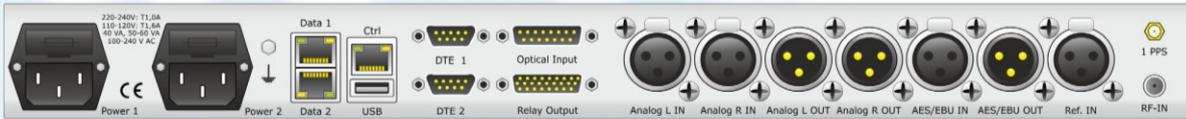
Rear view MM01 - Audio over IP Codec

MM01 - Audio over IP Codec – Technical Details

Audio (Encoder / Decoder)

Codecs

Standard	MPEG 1/2 Layer 2, 3 Linear PCM
Optional:	MPEG 2/4 AAC LC/LD, HEv1&v2 E-aptX ask for other codecs
Optional:	Bit transparent transmission of AES/EBU input (Audio and MPX)
Sample Rates	32 kHz, 44.1 kHz, 48 kHz optional: up to 192 kHz
Digital Audio Bandwidth	10 Hz through to 22.5 kHz mono & stereo
Sample Rate Converter	8:1 (with bypass modes)

Performance

Digital (in/out)	AES/EBU, 110 Ω bal., integrated XLR
Analog (in)	L/R, >10 kΩ bal., integrated XLR
Analog (out)	L/R, <20 Ω bal., integrated XLR
Headphone (out)	L/R, <10 Ω, 6.3 mm
Digital Reference Input	AES/EBU, 110 Ω bal., integrated XLR
Digital reference level	9 dBFS (adjustable)
Volume	-32...+6 dB
Dynamic Range	16 Bit, >89 dB 24 Bit >130dB
Frequency Response	0,1 dB; 20 Hz .. 20 kHz

Interfaces

Ethernet

Data	Audio, serial data and GPIO transmission, Controlling and Setup functions
Connector	3x RJ45
Type	Auto Switching 10/100/1000 BASE-T
Protocol	RTP/RTCP/UDP, IGMP, ICMP, DHCP, HTTP, FTP, SNMPv2c, NTP, SMTP (Mail), TCP (Icecast)

Serial

Interface	3x RS-232 (1 front, 2 rear) Sub D-9
Function	Front: Control, Rear: Data transmission
Data transmission format	MPEG ancillary data embedded in audio (IRT) Own IP link
Transmission rate	1200 to 115200 baud, asynchronous
USB	1x USB 2.0 Interface for service, configuration and firmware

Contact closure

Inputs	7 inputs (excludes option: 24 relay contacts) 15 pole sub-D female
Outputs	12 floating relays (10x SPST, 2x SPDT) (for DC: max. 30 V, 0.5 A) 26 pole sub-D male
Optional:	24 floating relays (excludes: 7 nputs)

Internal Storage

Data	internal Audio Files
Size	4 GB - 32 GB

Time synchronization (optional)

PTP	Network synchronization according to IEEE 1588-2008
1PPS	BNC - 75 Ω
10MHz	BNC - 75 Ω

Control & Monitor

Ethernet

Data	Controlling and Setup functions
Optional	Private data, MPEG ancillary data (IRT),
Protocol	2wcom NMS, Telnet, HTTP/HTTPS, SNMPv2c, UDP, IGMP, ICMP, DHCP, FTP, SNMPv2c, NTP, TCP (Icecast), PTP

Front panel

LCDisplay	Graphical, 264x64 pixel
Jog Wheel	Impulse, ENTER button
4 Duo LEDs	Power, Input, Output, Warning

General data

Power consumption	<40 VA (<20 W)
Case dimensions	19", 1 HU, depth: 310 mm, width: 424 mm, front panel: 484 mm
Weight	<6 kg
Housing	steel plate (aluminum-zinc coated)
Operating temp. range	0...+45°C
Storage temp. range	-40...+70°C
Power supply	1x internal, 90...260 VAC, 47...63 Hz 1x power port (rubber connector)
Optional:	
Redundant power supply 230 VAC	1x internal, 90...260 VAC, 47...63 Hz 1x power port (rubber connector), aut. switchover
Redundant power supply 48 VDC	1x internal 40...60 VDC 1x power port (Neutrik powerCON), aut. switchover
Languages	English

2WCOM
Wireless-World-Communication