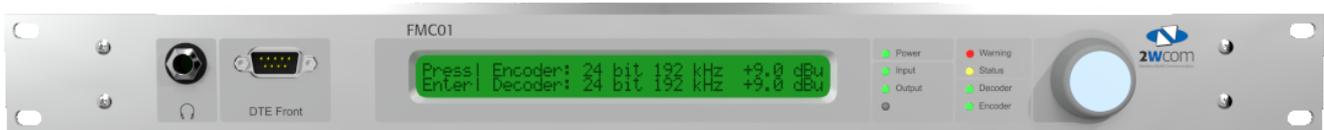


FMC01 FM MPX Codec

MPX over IP



FMC01 User Manual v01.62

August 2018

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1. Symbols in this manual

1.1. 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

1.2. 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.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Describes precautions necessary to protect the equipment.



NOTE: Useful information for the user.

2. Introduction

Description The FMC01s main function is to distribute FM MPX signal using the Internet Protocol (**IP**) via a 10/100/1000-Base-T network interface with bit rate up to 4.48 Mbit/s. The device has two main operation modes:

- encoding and transmitting FM MPX over IP;
- receiving and decoding FM MPX over IP.

Thus, the FMC01 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. The IP data stream is protected by a forward error correction (FEC) (FEC mode 4x2 ... 20x5) scheme to account for packet loss (IP).

The FMC01 is also able to decode and monitor RDS data and to separate stereo signal.

TS protection The FMC01 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 encoder output and decoder input for redundancy (1x Ethernet LAN 10/100/1000 base-T (RJ 45) interface).

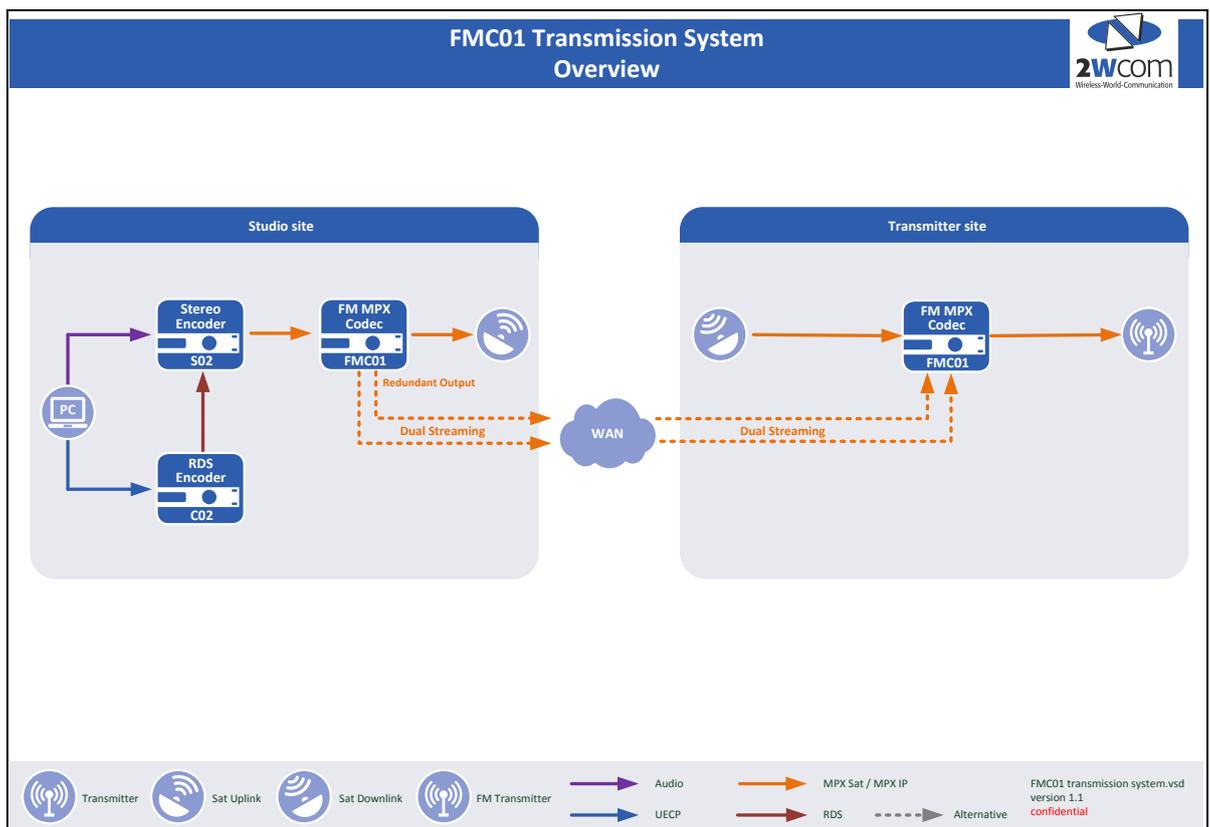


Figure 1: Overview of the FM MPX transmission chain for the FMC01

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

SNMP

Additional monitoring of the device using SNMP is possible. Rudimentary device control, status information and alarm trap generation is featured.

LCD and jog wheel

Simple configurations can be made via LCD menu and jog wheel.

Functions

Table 1 shows the main functions of the FMC01:

STANDARD	Encoding FM MPX → IP	The FMC01 can: <ul style="list-style-type: none">- reduce the bandwidth of the FM MPX signal for IP- reduce the bit depth to increase the quality of an error correction- digitize/encode the FM MPX signal and output it over IP
	Decoding IP → FM MPX	The FMC01 can: <ul style="list-style-type: none">- receive data stream over IP,- decode FM MPX signal from the IP data stream and output it- decode stereo signal- decode and monitor RDS data
Optional		<ul style="list-style-type: none">- Coder and Decoder in the same equipment- Dual Streaming: double transmission over different transmission routes protects against complete line failures

Table 1: Overview of the main functions of the FMC01

User

Only experienced technical personal or engineers should operate the FMC01. Basic knowledge about FM and IP networks is required.

Process

FM MPX digitalization

- analog MPX signal reception via BNC or XLR connector

FM MPX → IP encoding

- signal encoding
- adding error correction data to the data stream
- redundant output of the data stream over IP (option: Dual Streaming)

IP → FM MPX decoding

- data stream reception over IP (1000-Base-T, redundant input possible)
- error detection and correction
- sample rate synchronization
- digital to analog conversion of the signal
- output of the analog MPX signal over BNC and XLR connectors



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.

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, sent 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 electrical 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:

	<ul style="list-style-type: none"> - non-ventilated environment, for example a narrow shelf or built-in wardrobe; - extremely warm or cold place; - direct sunlight exposure; - too high or too low temperature; - extremely wet or dusty environment. <p>Do not operate the device in the presence of flammable gases.</p> <p>Do not cover the ventilation openings of the device to avoid heat accumulation.</p> <p>Do not put objects with open flames such as burning candles on the device.</p> <p>Do not put heavy objects on the supply cord. A damaged cord can lead to fire or electric shock hazards.</p> <p>To disconnect the supply cord, drag always the plug and never the cable to avoid the cord damage.</p>
--	---

⚠ WARNING	
	<p>WARNING of explosive atmosphere</p> <p>Risk of the explosion hazard.</p> <p>Do not use the device in an explosive environment.</p>
	<p>WARNING of hot surface</p> <p>The surface of the device can heat up during operation. The device is equipped with a passive cooling system. However, it does not switch off automatically, if it is overheated.</p> <p>Do not touch the surface of the device during operation.</p>

NOTICE	
	<p>CAUTION: Risk of equipment damage</p> <p><i>Before the first operation:</i></p> <p>Check the housing, the front panel, the supply cord and the plug for visible damage (e.g. scratches, cracks, damaged isolation and abrasion)</p> <p>In case of damage, unplug immediately the supply cord. Never operate device with a damaged supply cord.</p>

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

- FMC01
- Power supply cord*
- Patch cable
- PC Software to download: "FMC01" 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 V AC, 50 to 60 Hz. 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



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 button ;
- if you don't want to save the changes, press the button  in the input fields of the web interface. Saved changes cannot be reset by this button to a default.



NOTE: Each field has to be saved individually.

If you change data in several fields, you must click  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  or  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 dial and LCD on the device is similar to these descriptions.

7.2. Operation via LCD / jog dial

Some basic functions of the device can also be operated via the LCD/jog dial at the device. The operation works analogously to the web interface descriptions. If a function of the web interface is applicable for the LCD/ jog dial, 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 dial.
- To move the cursor "➤" in the menu structure, turn the jog dial.
- To open a menu entry or to confirm a setting, push the jog dial.
- If a configurable menu entry is selected, it is displayed in brackets "> <" and you can adjust it by turning the jog dial.
- To confirm the adjustment, push the jog dial.
- To return to a previous menu level, activate the menu entry "Back".

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!

If the device is compatible, connect the power supply cord fully to the IEC power connector at the back panel of the device and a mains power outlet.

⇒ The "Power" LED will then turn on.

8.2. Network configuration

For delivery the device is configured with default settings for the first connection via the IP interface.

To configure the IP settings:

1. Use the jog wheel to select "**Interface**→**TCP/IP**".
2. Configure settings for your existing IP network (IP address, netmask, gateway etc.; consult the responsible network administrator if applicable).
3. Save the settings by using the jog wheel and reboot the device.
4. Connect a network patch cable to the "10/100-Base-T" connector on the back panel of the device and your existing IP network.

⇒ Your device is now connected to 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 "admin"/"admin"

⇒ After entering the correct login data (case sensitive), the main FMC01 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 devices

For data distribution, connect the devices as follows:

1. If the FMC01 should operate as an encoder, use the XLR or the BNC [MPX IN 1/2] jack to feed an MPX signal to the FM MPX.
2. To output the encoded signal over IP, use [1000-Base-T] interface for distribution over IP.
3. If the FMC01 should operate as a decoder, use [1000-Base-T] to receive the signal over IP for decoding.
4. To output the decoded MPX signal, use the XLR or the BNC jack [MPX OUT 1/2].

8.5. Encoder activation



NOTE: The FMC01 can operate in both modes at the same time: as encoder and decoder (optional).

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

1. Select **Codec Settings→Encoder** in the web interface menu. The window *Encoder settings* appears.
2. Activate the encoding function by selecting the radio button "ON" in the field **Activation**.
3. Choose an activated input for the MPX signal in the field **Source**: BNC (MPX IN 2), XLR (MPX IN 1) or a 400 Hz testing signal.
4. Configure the "Destination Address" and "Destination port" of the destination decoder.
5. Enable SFN and enter the value for "SFN Delay" (more to SFN Delay see section 11.5 on page 29).
6. Click the button to save the changes.

⇒ The device is functioning now as an encoder.

8.6. Decoder activation



NOTE: The FMC01 can operate in both modes at the same time: as encoder and decoder (optional).
If the FMC01 is operating in both modes, it can receive and decode only one input signal: either its own encoded MPX or an MPX signal received over IP.

To activate and to configure the unit as a decoder:

1. Select **Codec Settings→Decoder** in the web interface menu. The window *Decoder settings* appears.
2. Activate the decoding function by selecting the radio button "ON" in the field **Activation**.
3. Choose an activated input for the encoded MPX signal in the field **Source**:
 - "Gigabit IP", if the FMC01 should decode an external signal over IP input, or
 - "Encoder", if the FMC01 is operating in both modes: as encoder and decoder and should decode its own internal signal.
4. If you set the source "Gigabit IP" in the previous step, configure, the port of the source and, if applicable, the "Multicast Address".
5. Enter the value for "FEC output delay" and "Additional SFN Delay" for activated SFN mode (more to FEC output delay and SFN Delay see section 14 "Buffer Delay Management" on page 48).
6. Click the button to save the changes.

⇒ The device is functioning now as a decoder.



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.

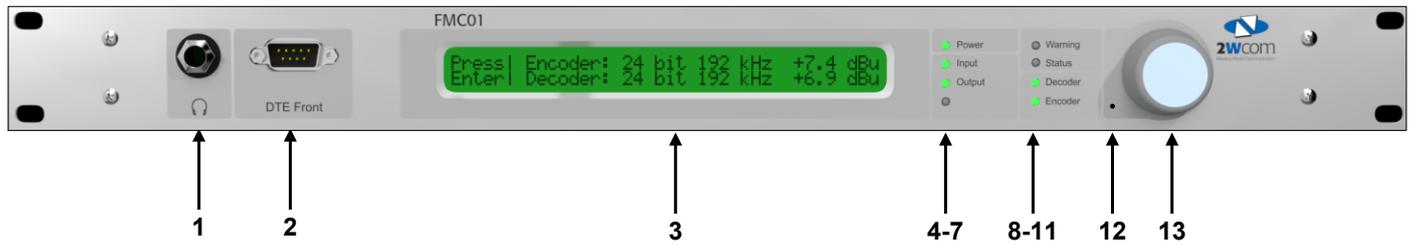
8.7. Adjust volume levels

To adjust the volume level:

1. Select **Interface Settings→Stereo Decoder** to set up the audio source: "Encoder" or "Decoder".
2. Select **Interface Settings→Level** in the web interface menu or use the jog wheel to select "Interface→Volume".
3. Configure the audio volume for the headphone output.

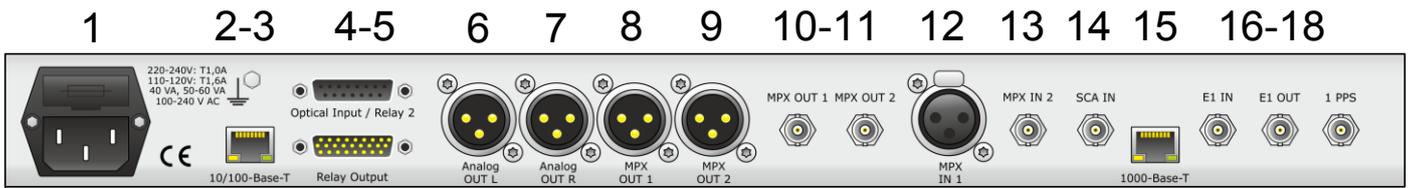
9. Control Elements and Connectors

9.1. Front Panel



- | | | |
|----|---------------|---|
| 1 | Headphones | 6.3 mm / 1/4" socket for the connection of headphones. The device can be configured to output the received and decoded audio data on this output. |
| 2 | [Front] | 9 pole D-Sub male connector; only for device servicing purposes. |
| 3 | LCD screen | Illuminated, Liquid Crystal Display (LCD) with two rows of up to 40 characters. |
| 4 | [Power] LED | Activated (green color) if the power supply is ok. |
| 5 | [Input] LED | Activated (green color) if a signal is detected on an input interface (MPX IN or IP).
If the FM01 operates as an encoder and as a decoder, the LED lights green only if both inputs are ok. The LED is off, if one of the inputs detects a failure (MPX IN or IP). |
| 6 | [Output] LED | Activated (green color) if a signal is detected on an output interface (MPX OUT or IP). |
| 7 | LED | No function |
| 8 | [Warning] LED | Activated (red color) if the monitoring function detected the triggering of one of the configured alarms. |
| 9 | [Status] LED | Activated (yellow color) during the start-up and expires, when the device is ready for operation. |
| 10 | [Decoder] LED | Activated (green color) if the device operates as a decoder. |
| 11 | [Encoder] | Activated (green color) if the device operates as an encoder. |
| 12 | Reset button | Recessed reset button for resetting the device in case of a malfunction. |
| 13 | Jog dial | Jog dial for the device operation via the LCD screen on the device. Turn the jog dial to place the cursor on the desired menu entry and push the jog dial to activate the highlighted menu entry. |

9.2. Back Panel



- | | | |
|---|----------------------------|---|
| 1 | IEC power supply connector | Standardized IEC supply connector with integrated fuse holder.
Fuse ratings depending on mains supply voltage:
100-120V: T1.6A, time lag type, 5x20 mm, 250 V
220-240V: T1A, time lag type, 5x20 mm, 250 V |
| 2 | [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.

- | | | |
|-------|-----------------------|--|
| 3 | [10/100-Base-T] | RJ-45 connector 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). |
| 4 | [Optical Input/Relay] | 15 pole D-Sub connector optical input; no function. |
| 5 | [Relay Output] | 26 pole D-Sub connector; switch 12 (optional 24) contacts of the integrated relays. The relays can be activated for monitoring in case of an alarm. |
| 6-7 | [Analog OUT L/R] | XLR female socket; output of the left/right channel of the analog audio signal with configurable signal level.
This is an additional option for monitoring an outputting audio signal. |
| 8-9 | [MPX OUT 1/2] | XLR female socket; output of the decoded MPX signal (symmetrical signal transmission). |
| 10-11 | [MPX OUT 1/2] | BNC connector; output of the decoded MPX signal (unsymmetrical signal transmission). |
| 12 | [MPX IN 1] | XLR male socket; input of an MPX signal for encoding and further distribution over IP. |
| 13 | [MPX IN 2] | BNC connector; input of an MPX signal for encoding and further distribution over IP. |
| 14 | [SCA IN] | BNC connector; auxiliary input. |

15	[1000-Base-T]	RJ-45 connector for Gigabit Ethernet data communication. This interface is used to transceive MPEG2 transport streams or RAW data via UDP, UDP/RTP, as Unicast or Multicast IGMPv2. The LED's at the socket show the link status (green; active if a physical network connection exists) and the activity status (yellow, blinks if data communication is active).
16	[E1 IN]	BNC connector; no function.
17	[E1 OUT 1]	BNC connector; no function.
18	[E1 OUT 2]/[1 PPS]	BNC connector; no function/PPS input (if SFN synchronization available)

10. Network Settings

- ✓ You have already connected the device to the network [10/100-Base-T] and configured the access to the web user interface (see Section 8.2 and 8.3).

10.1. TCP/IP: configuration of the Ethernet interfaces

You can configure the Ethernet interface (control/monitoring) of the device under **Network Settings**→**TCP/IP**

10.1.1. Control interface (10/100Base-T)

In block **Control Interface (10/100Base-T)** the following parameters can be configured or changed:

<i>MAC address:</i>	The current MAC address is shown in this field.
<i>DHCP:</i>	Activate or deactivate the Dynamic Host Configuration Protocol which enables the device to get an IP Address automatically.
<i>IP-address:</i>	Individual address that is necessary to identify hardware in an IP network like the internet or intranet.
<i>Subnet mask:</i>	Bit mask, which separates an IP address into a network part and a host part.
<i>Gateway:</i>	Address of the local system that is used for the internet access (e.g. the router).
<i>Primary DNS:</i>	IP address of the primary Domain Name Service (DNS) server.
<i>Secondary DNS:</i>	IP address of the secondary Domain Name Service (DNS) server.

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

⇒ Save the settings by clicking the  button.

LCD-menu: **Interface**→**TCP/IP**

10.1.2. Data interface (1000Base-T)

In block **Data Interface (1000Base-T)** you can configure or change the following parameters of the Gigabit-Ethernet interface (TS-streaming):

<i>MAC address:</i>	The current MAC address is shown in this field.
<i>IP-address:</i>	Individual address that is necessary to identify hardware in an IP network like the internet or intranet.
<i>Subnet mask:</i>	Bit mask, which separates an IP address into a network part and a host part.
<i>Gateway:</i>	Address of the local system that is used for the internet access (e.g. the router).

Ethernet speed selection Available settings in the dropdown menu: Autonegotiation/10/100/1000 Mbit/s.

VLAN: Activate or deactivate the Virtual Local Area Network (VLAN).

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

⇒ Save the settings by clicking the button.

10.2. SNTP settings: configuration of date and time

This menu item is available under **Network Settings**→**SNTP** and is used to enable the automatic synchronization of the date and time of the device with an external SNTP server (see Fig. 1).

SNTP

1.SNTP Server IP:	<input type="text" value="0.0.0.0"/>
2.SNTP Server IP:	<input type="text" value="0.0.0.0"/>
Update interval [min. 30 sec]:	<input type="text" value="30"/>
Synchronisation:	<input checked="" type="radio"/> on <input type="radio"/> off
Last synchronisation:	Not synchronized yet

Fig. 1 Network settings - SNTP

In block **Control Interface (10/100Base-T)** the following parameters can be configured or changed:

- | | |
|-------------------------------|--|
| 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. |
| Synchronisation | Selection if the device clock should be synchronized via SNTP or not. |
| Last synchronisation | Information about the last synchronisation. |

⇒ Save the settings by clicking the button.

LCD menu: **Interface**→**TCP/IP** (SNTP IP1, SNTP IP2).



NOTE: Additionally, you can read out and manually set up the current date and time in the internal clock of the device under **System Settings→Time**.

10.3. 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 Fig. 2).

The screenshot shows the SNMP configuration page. At the top, there are navigation tabs: Home, E-Mail, 2wcom, Input (with a green indicator), and Warning (with a grey indicator). The main content area is titled "SNMP" and is divided into four sections:

- First manager:** 1. IP Address: 0.0.0.0; Send trap: on off
- Second manager:** 2. IP Address: 0.0.0.0; Send trap: on off
- Read community:** 1. read community: public; 2. read community: public
- Write community:** 1. write community: private; 2. write community: private

Each manager and community section has "reset" and "save" buttons. The right sidebar contains a menu with the following items:

- FM MPX Codec
- Information
- System
- Codec Settings
- Encoder
- Decoder
- Interface Settings
- MPX
- RDS Decoder
- Stereo Decoder
- Level
- Relay
- Network Settings
- TCP/IP
- SNTP
- » SNMP « (highlighted)
- System Settings
- Global
- Time
- User
- Alarm
- Status
- RDS
- SFN
- IP 1000Base-T
- Event Log

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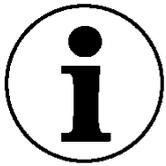
Fig. 2: Network Settings – SNMP.

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  button.



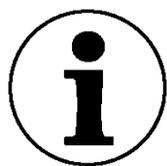
NOTE: For the correct processing of the received SNMP traps of the device, device-specific MIB files are necessary which must be integrated to the used SNMP manager program. These MIB files need to be compiled by the SNMP manager tool and are provided via email.

From ARM firmware version 5.35 you can directly download the current MIB files matching to the firmware from the Web interface by clicking the corresponding link (see Fig. 3 red frame).

Fig. 3: Network Settings – SNMP: MIB files download

SNMP traps used by the monitoring function:

Trap No.	Trap Name	Monitoring Function
1	RDS available	Signals the RDS status in the input MPX signal (available/not available)
2	RDS PI	Signals the program identification code
3	RDS PS	Signals the program service name
4	E1 In available	Signals the input signal status received over E1 (available/not available)
5	E1 packet errors	Signals packet errors in the input signal received over E1 (available/not available)
6	E1 In FEC BER	Bit error rate of the input signal received over E1 (value)
7	IP In available	Signals the input signal status received over IP (available/not available)
8	IP In Packet error	Signals packet errors in the input signal received over IP (available/not available)
9	SFN 1 PPS Error	Status of SFN 1PPS Loss has changed
10	MPX In level	Status of MPX Input level error has changed
11	MPX Out level	Status of MPX Output level error has changed



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 Sections 11.6 on page 30 and 12.6 on page 41.

11. Encoder Settings

The FMC01 is able to receive, to encode and to distribute the FM MPX signals over IP (10/100/1000-Base-T).

- ✓ You have already connected the FMC01 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 FMC01 as an encoder are:

1. [Connect the encoder](#)
2. [Activate the encoder](#)
3. [Set up the IP output](#)
4. [Set up the error correction](#)
5. [Set up SFN Delay](#)
6. [Set up monitoring and alarm control](#)
7. [View the encoder status](#)

The following sections describe the separate steps for encoding:

11.1. Connect the encoder

For data distribution, connect the device as follows:

1. To feed an MPX signal that should be encoded for further distribution over IP, use the XLR or the BNC [MPX IN 1/2] jack (see Section 9.2)
2. To output the encoded signal, use the [1000-Base-T] jack for distribution over IP.

11.2. Activate the encoder



NOTE: The FMC01 can operate in both modes at the same time: as encoder and decoder (optional).

If your device can operate in both modes and is activated for encoder, Gigabit IP input for the decoder will be unavailable. TS input for decoding is possible only from the internal encoder.

1. Open the window *Encoder settings* under **Codec Settings**→**Encoder** in the web user interface of the FMC01 (see Fig. 4).
2. Activate the encoding function by selecting the radio button "ON" in the **Activation** field.
3. Choose the connected input source for the MPX signal in the **Source** field: XLR, BNC or a 400 Hz test tone that replaces the input signal.
4. Choose the preferred bit depth in the **Bit depth** field. You can set up the bit depth in the range between 16 and 24 bit.
5. Choose the preferred sample rate in the **Sample rate** field. You can set up the sample rate in the range between 132 and 192 kHz.
6. Click the button to save the changes.

Home	E-Mail	2wcom	Input ●	Warning ●
Encoder settings			FM MPX Codec	
			Information	
			System	
			Codec Settings	
			» Encoder «	
			Decoder	
			Interface Settings	
			MPX	
			RDS Decoder	
			Stereo Decoder	
			Level	
			Relay	
			Network Settings	
			TCP/IP	
			SNTP	
			SNMP	
			System Settings	
			Global	
			Time	
			User	
			Alarm	
			Status	
			RDS	
			SFN	
			IP 1000Base-T	
			Event Log	

Activation: on off

Source: generate 400Hz ▼

Bit depth: 24 bit ▼

Sample rate: 192 kHz ▼

Redundant output: on ▼

Destination Address: 223.0.0.0

Destination Port: 1234

Destination Address (backup): 239.1.1.6

Destination Port (backup): 1234

Source Port: 1234

FEC mode: 4/2 CR ▼

SFN mode: on off

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Fig. 4: Codec Settings – Encoder configuration

NOTE: If you use the XLR connector for the distribution of the FM MPX signal, set up „ground“ or „float“ for the common potential of the grounding under **Interface Settings→MPX**.

11.3. Set up the IP output

The FMC01 encoder can optionally output the encoded audio signal in double streams for redundancy (Dual Streaming).

Configure the following parameters to set up the IP output for the encoder:

1. Open the window *Encoder settings* under **Codec Settings→Encoder** in the web user interface of the FMC01 (see Fig. 4).
2. Activate Dual Streaming by selecting “on” in the dropdown menu “Redundant output”, if this option is available for your FMC01.
3. Enter the following data in the fields for the configuration of the IP 1000Base-T output:

Destination address: The IP address of the destination decoder (Unicast, Multicast address).
 Destination port: The UDP port of the destination decoder.
 Destination address (backup): The IP address of the destination decoder for the redundant output.
 Destination port (backup): The UDP port of the destination decoder for the redundant output.

 **NOTE:** The same parameter for the "Source" must be configured in the destination decoder (**Codec Settings→Decoder**). Check that no other encoder is sending the same multicast.

 **NOTE:** For maximum effectiveness of dual streaming, make sure that both streams arrive at the destination with minimal delay in regard to each other. This delay must be less than the size of the packet reorder and dejitter delay buffer. Ideally, both streams arrive in short succession to each other.

Source port: Sender UDP port for the outgoing data stream. If there is no special requirement for the source port (i.g. firewall), use by default the same number as the decoder port is using.

4. Click the button to save the changes.
5. Under **Status→IP 1000Base-T** you can call up the current status of the IP 1000Base-T connection as *Ethernet link status* and *Ethernet speed*.

11.4. Set up the error correction (FEC)

The FMC01 is able to identify possible errors in the data stream while encoding and outputting signals and to correct them (FEC). The coder implements ProMPEG FEC (Practice #3 release 2) to reduce packet loss and burst errors in IP data stream. FEC generates additional packets using matrixes that are implemented into the data stream. Every FEC matrix has got Columns and Rows to create additional packets.

The amount of error correction data increases the probability that the errors will be corrected.

Note that FEC (Forward Error Correction) is able to repair packet lost by adding redundant data streams at the cost of higher bandwidth and longer output delay (for more information about FEC delay sizes see section 14 „Buffer Delay Management“ on page 48).

Under **Codec Settings→Encoder** you can set up the FEC matrix for the IP output.

The possible FEC parameters are:

Columns	Rows	Mode	Description
		off	Forward Error Correction is disabled
		Expert	manual FEC configuration (FEC column and row count, FEC column and row Port)
4	2	CR	

5	5	CR
10	4	CR
5	20	CR
20	5	CR

Click the button to save the changes.

11.5. Set up SFN Delay

For the synchronization with the destination decoder enable "SFN mode" (if applicable) by selecting the radio button "ON" under **Codec Settings**→**Encoder**. The menu will be extended to field "SFN Delay" (see Fig. 5).

Enter the value in ms that stays above the minimum sum of the IP latency (expected transmission delay according to your line speed), dejitter buffer ("FEC output delay") and "additional SFN delay" of the decoder plus 100 ms and does not exceed 950 ms (the interval should stay under one second for the proper 1 PPS synchronization).

Note that for SFN synchronization you need to use the "1 PPS" connector [1PPS].

If you activated FEC mode and use buffer, see section 14 "Buffer Delay Management" on page 48 for more information about the delay configuration.

For more information about SFN settings see section 13 "SFN Synchronization" on page 47.

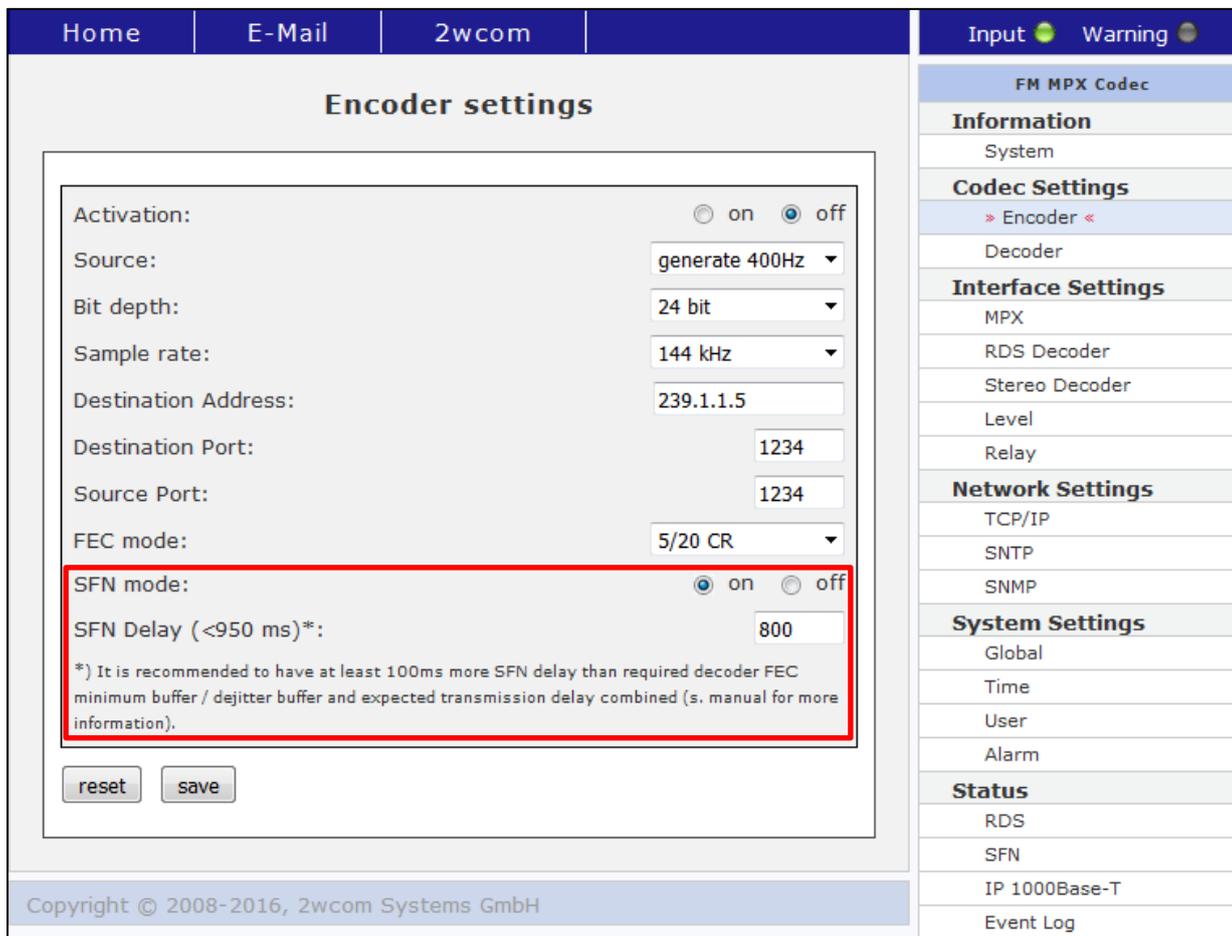


Fig. 5: SFN configuration for Encoder

11.6. Set up the monitoring and alarm control

11.6.1. Set up alarm for MPX input

To monitor a valid MPX input in the encoder, you can activate the following alarm function:

MPX In audio level	Alarm is set active, if the level of input MPX falls below the configured value.
--------------------	--



NOTE: You can also use RDS monitoring to monitor a valid MPX input for the encoder (see section 11.6.2 "Set up alarm for RDS").

If the encoder detects no RDS availability within the MPX signal, it means that the inputting MPX signal is also not available. This is much more reliable than "silence detection" because of possible pauses in the audio signal that can cause false alarm.

To set up monitoring and alarm functions for MPX input:

1. Open the configuration field **MPX Input** in the window *Alarm settings* under **System Settings**→**Alarm** in the web interface of the FMC01 (see Fig. 6).

The screenshot shows the 'Alarm settings' web interface. The 'MPX Input' section is highlighted with a red box. It contains the following settings:

- MPX In audio level:** Enabled . Threshold: ≥ -40 dBu. T1: 10 ms. T2: 1000 ms. SNMP: . LED: . Relay: ---.
- MPX Output:** Enabled . Threshold: ≥ -40 dBu. T1: 1000 ms. T2: 1000 ms. SNMP: . LED: . Relay: ---.
- RDS:** Enabled . T1: 1000 ms. T2: 1000 ms. SNMP: . LED: . Relay: 1.

The right sidebar shows a navigation menu with 'Alarm' selected.

Fig. 6: Alarm Settings – measurement of the MPX level in the MPX stream

The LED color means:

- Monitoring is activated, no alarm is released
- Monitoring is deactivated
- Monitoring is activated, alarm is released

2. Enable the alarm function in the corresponding checkbox "Enabled", if this parameter should be monitored.
3. Define the minimal valid good value of the MPX level in dBu, below that the alarm should be set activated.



NOTE: If you deactivate the monitoring of MPX Input signal, the FMC01 will still measure the MPX input level.

If the level falls below the minimal good value configured in the following menu, this error will be indicated by the virtual LED (red) near the "Source" field in the "Encoder State" block under **Information→System**, even if the monitoring of this alarm function is deactivated (see Fig. 9 on page 34).

4. Define 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 activated.
5. Define 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 top of the web user interface page or on the front panel of the device.
8. Choose in the dropdown menu "Relay" one of the available relays that should switch to signal the alarm.
9. Click the button to save the changes.

11.6.2. Set up alarm for RDS

The FMC01 is equipped with an RDS decoder and is able to recognize and to monitor the RDS data in an MPX signal. If you operate the FMC01 as an encoder, you can monitor and control the RDS decoder.

The following alarm functions can be activated:

RDS available	Alarm is set activated, if no RDS is available in the MPX stream (also if the MPX stream is not available in the input)
RDS PI	Alarm is set activated, if no or a false program identification code is detected in the RDS stream
RDS PS	Alarm is set activated, if no or a false program service name is detected in the RDS stream



NOTE: You can also use RDS monitoring to monitor a valid MPX input for the encoder. If the encoder detects no RDS availability within the MPX signal, it means that the inputting MPX signal is also not available.

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

More information about the available SNMP traps you can find in Section 10.3 "Monitoring function: configuration of SNMP" on page 23.

To set up monitoring and alarm functions for controlling the RDS signal:

1. Open the window *RDS Decoder* under **Interface Settings**→**RDS Decoder** in the web user interface of the FMC01.
2. Choose "Encoder" in the dropdown menu as a source for the RDS decoder (see Fig. 7).
3. Click the button to save the changes.

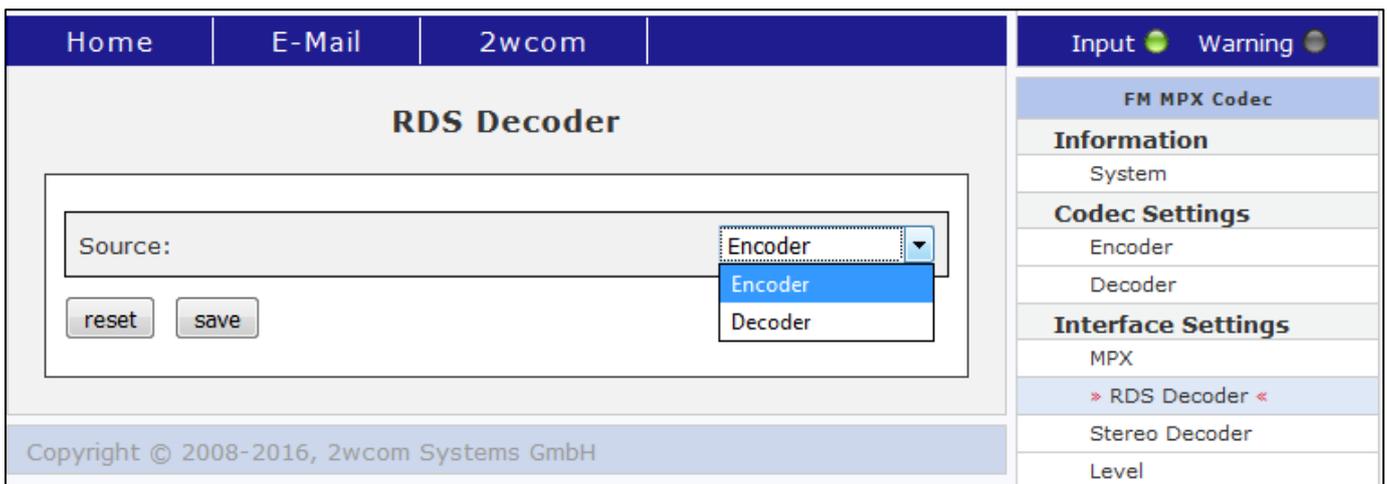


Fig. 7: RDS Decoder settings

4. Open the configuration field **RDS** in the window *Alarm settings* under **System Settings**→**Alarm** in the web interface of the FMC01 (see Fig. 8).
5. Enable each alarm function separately in the corresponding checkbox "Enabled", if this parameter should be monitored.
6. 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 activated.
7. 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.
8. Enable checkbox "SNMP", if the alarm should be signaled by sending SNMP traps.

9. Enable checkbox "LED", if the alarm should be signaled by the Warning LED on the top of the web user interface page or on the front panel of the device.
10. Choose in the dropdown menu "Relay" one of the available relays that should switch to signal the alarm.

Alarm settings

RDS

 RDS available Enabled

T1 ms T2 ms

SNMP LED Relay

 RDS PI Enabled

= (hex) T1 ms T2 ms

SNMP LED Relay

 RDS PS Enabled

= T1 ms T2 ms

SNMP LED Relay

Fig. 8: Alarm Settings – indication of the RDS data in the MPX stream

The LED color means:

-  - Monitoring is activated, no alarm is released
-  - Monitoring is deactivated
-  - Monitoring is activated, alarm is released

11. In the „RDS PI“ block enter the correct RDS PI as a four-digit hexadecimal number in the first box (hex), to allow the monitoring system to recognize the correct program identification code (PI) and to send alarm, if the device detects no or a false PI.
12. In the „RDS PS“ block enter the correct RDS PS in the first box , in order to allow the monitoring system to recognize the correct program service name (PS) and to send alarm, if the device detects no or a false PS.
13. Click the button to save the changes.

11.7. View the encoder status

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

1. Under **Information**→**System** you can see the details of the configured parameters of the encoding signal in *Encoder State* (see Fig. 9) field or directly on the LC display.

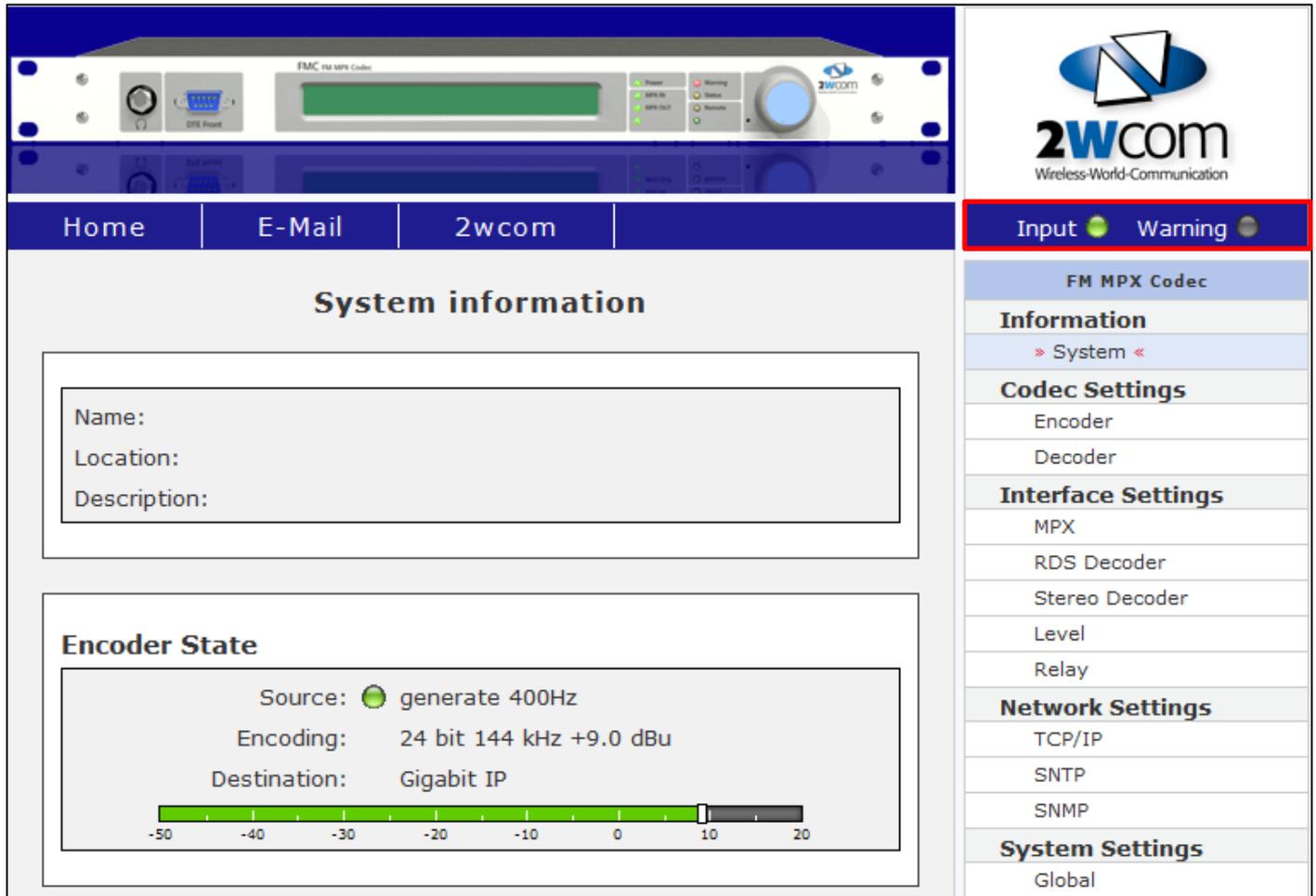


Fig. 9: System Information – Encoder State

The LED color means:

-  - MPX input is active
-  - encoder is deactivated
-  - error in the MPX input



NOTE: If you deactivate the monitoring of MPX Input signal, the FMC01 will still measure the MPX input level and indicate it via the LED in the System Information menu.

2. The “Input” LED on the top of the web interface (see red box in Fig. 9) is the same as the “Input” LED on the front of the device. It lights green, if a signal is detected on an input interface (MPX IN or IP).

If the FM01 operates as an encoder and as a decoder, the LED lights green only if both inputs are ok. The LED is off, if one of the inputs detects a failure (MPX IN or IP)

3. The “Warning” LED on the top of the web interface is the same as the “Warning” LED on the front of the device.

It lights red, if one of the configured alarms is triggered. The LED is off, if no alarm is active.

- Under **Status→RDS** you can call up the current information about the decoded RDS data.

RDS	
PI:	AFFE
PS:	2wcom
TP:	0
TA:	0
PTY:	0
RT:	
CT:	

Fig. 10: Status - RDS

- Under **Status→Event Log** you can call up information about the 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 Fig. 11). To delete the last events click the button

Event Log			
Nr.	Timestamp	Message	
1	16-10-20 12:56:52	Monitoring Start	
3	16-10-20 12:56:00	RDS PI - State: FAILURE (0000, ref:0000)	
4	16-10-20 12:55:59	RDS PS - State: FAILURE ("", ref:"")	
5	16-10-20 12:55:57	RDS available - State: FAILURE	
6	16-10-20 12:55:55	Monitoring Start	
7	16-10-17 12:12:53	1PPS Loss - State: OK	
8	16-10-17 12:12:29	1PPS Loss - State: FAILURE	
9	16-10-17 12:12:27	Monitoring Start	
10	16-10-17 12:11:52	1PPS Loss - State: FAILURE	
11	16-10-17 12:08:20	Monitoring Start	
12	16-10-17 11:22:35	Monitoring Start	
13	16-10-17 11:22:35	System Start (WarmStart)	
14	16-10-17 13:00:04	Monitoring Start	
15	16-10-17 13:00:04	System Start (WarmStart)	
16	16-10-17 12:51:25	Monitoring Start	
17	16-10-17 12:51:25	System Start (WarmStart)	
18	16-10-17 12:32:38	Monitoring Start	
19	16-10-17 12:32:38	System Start (WarmStart)	
20	16-10-17 12:26:57	Monitoring Start	
21	16-10-17 12:26:57	System Start (WarmStart)	
22	16-10-17 12:18:37	Monitoring Start	
23	16-10-17 12:18:37	System Start (WarmStart)	
24	16-10-17 12:14:42	Monitoring Start	

Fig. 11: Status – Event Log

12. Decoder Settings

The FMC01 is able to receive, to encode and to distribute the FM MPX signals over IP (10/100/1000-Base-T).

- ✓ You have already connected the FMC01 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 FMC01 as a decoder are:

1. [Connect the decoder](#)
2. [Activate the decoder](#)
3. [Set up the IP data source](#)
4. [Set up the error correction](#)
5. [Set up SFN mode](#)
6. [Set up monitoring and alarm control](#)
7. [View the decoder status](#)

The following sections describe the separate steps for decoding:

12.1. Connect the decoder

For data distribution, connect the device as follows:

1. To feed an encoded signal over [1000-Base-T], use the [1000-Base-T] jack to receive the signal over IP for decoding (see Section 9.2).
2. To output the decoded MPX signal, use the XLR or the BNC jack [MPX OUT 1/2].

12.2. Activate the decoder



NOTE: The FMC01 can operate in both modes at the same time: as encoder and decoder (optional).

If your device can operate in both modes and is activated for encoder, Gigabit IP input for the decoder will be unavailable. TS input for decoding is possible only from the internal encoder.

To activate and to configure the unit as a decoder for MPX:

1. Select **Codec Settings→Decoder** in the web interface menu. The window *Decoder settings* is displayed (Fig. 12).

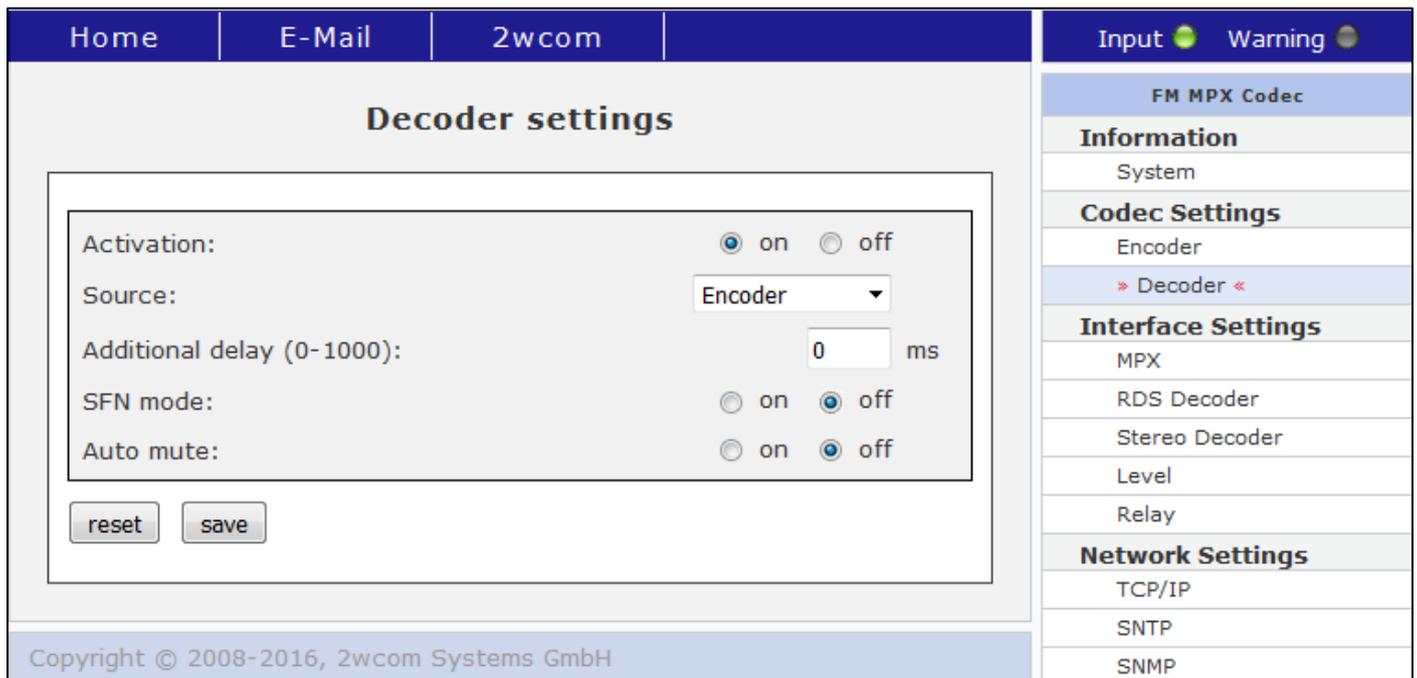


Fig. 12: Decoder Settings

2. Activate the decoding function by selecting the radio button "ON" in the **Activation** field.
 3. Choose the input source "Encoder" or "Gigabit IP" (if available) in the **Source** field. If you choose "Gigabit IP", additional fields for connection configuration will appear (see Fig. 13). The source "Encoder" is available only if the device can operate in both modes: as an Encoder and as a Decoder and Encoder is activated. For Encoder output no further settings are necessary.
 4. Click the button to save the changes.
- ⇒ The device operates now as a decoder for the incoming signal from internal Encoder or over IP.

12.3. Set up the IP data source

The FMC01 decoder can optionally receive the same audio signal in double streams over IP input as a redundancy and to decode it to one digital/analog audio.



NOTE: Setup of the IP data source is available only for input audio over IP.

If your device can operate in both modes and is activated for encoder, no IP configuration in the decoder is available.

If you have chosen the input source "Gigabit IP" in the previous step, enter the following parameters to set up the IP input:

1. Open the window *Decoder settings* under **Codec Settings**→**Decoder** in the web user interface of the FMC01 (see Fig. 13).
2. Activate Dual Streaming by selecting "on" in the dropdown menu "Redundant input", if this option is available for your FMC01.

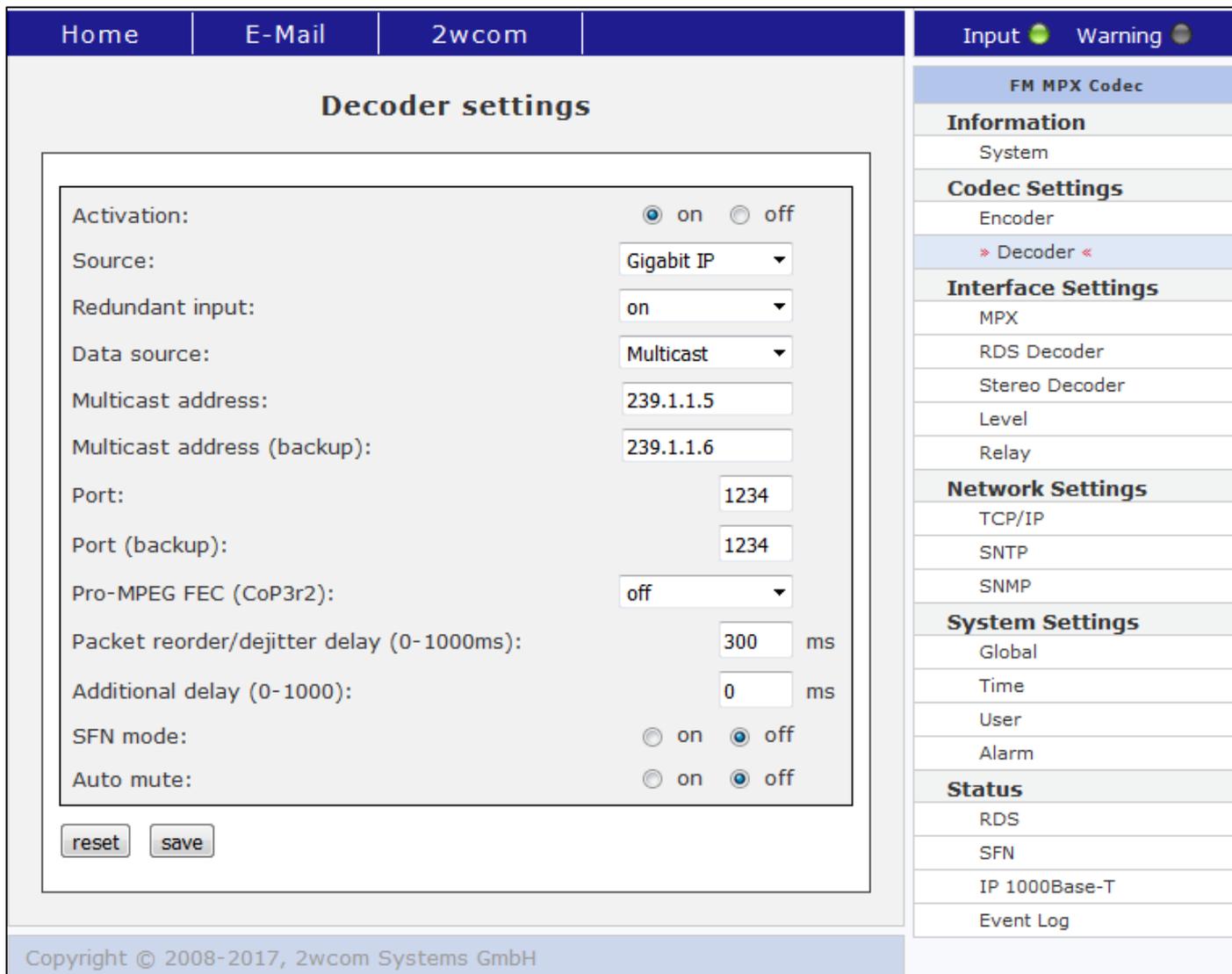


Fig. 13: Codec Settings – Decoder configuration

3. Enter the following data in the fields of the configuration of the IP 1000Base-T input:

- Data source: Unicast/Multicast
- Multicast address: the same as configured in the encoder settings
- Multicast address (backup): the same as configured in the encoder settings for redundant output
- Port: Sender UDP port (the same as configured in the encoder settings for redundant output).
- Port (backup): Sender UDP port (the same as configured in the encoder settings for the redundant output)

4. Click the **save** button to save the changes.

5. Under **Status**→**IP 1000Base-T** you can call up the current status of the IP 1000Base-T connection as *Ethernet link status* and *Ethernet speed*.

12.4. Set up the error correction (FEC)

The FMC01 is able to identify possible errors in the data stream while encoding and outputting signals and to correct them (FEC).



NOTE: FEC is available only for input audio over IP.

If your device can operate in both modes and is also activated for encoder, no FEC configuration in the decoder is possible.

The data for error correction is implemented into the data stream. The amount of error correction data increases the probability that the errors will be repaired.

For the IP data stream, the coder uses ProMPEG FEC (Code of Practice #3 release 2 – “CoP3r2”) to reduce packet loss and burst errors. This can be activated in the encoder settings (**Codec Settings**→**Encoder**: FEC mode “on”). If you configured IP as an input and FEC is available in the incoming data stream, set up the FEC as follows:

1. Open the window *Decoder settings* under **Codec Settings**→**Decoder** in the web user interface of the FMC01.
2. Choose the mode for the ProMPEG FEC in the drop down menu “Pro-MPEG FEC (CoP3r2)”: *off*, *On (Expert)*, *On (Auto)*.
3. If you set “off” for the ProMPEG FEC, the FEC will be deactivated and an additional field “Packet reorder/dejitter delay” will appear (see Fig. 14).

The screenshot displays the 'Decoder settings' web interface. The main content area contains the following settings:

- Activation: on off
- Source: Gigabit IP
- Redundant input: off
- Data source: Multicast
- Multicast address: 239.1.1.5
- Port: 1234
- Pro-MPEG FEC (CoP3r2): off
- Packet reorder/dejitter delay (0-1000ms): 300 ms** (highlighted with a red box)
- Additional delay (0-1000): 0 ms
- SFN mode: on off
- Auto mute: on off

Buttons for 'reset' and 'save' are located at the bottom left. The right sidebar shows a navigation menu with 'Decoder' selected under 'Codec Settings'. The footer contains the copyright notice: 'Copyright © 2008-2017, 2wcom Systems GmbH'.

Fig. 14: Decoder settings – packet reorder delay for disabled Pro-MPEG FEC

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 "Buffer Delay Management" on page 47).

- If you set "On (Expert)" for the ProMPEG FEC, additional fields for manual configuration of FEC will appear. Use this mode only if the encoder is also set up for manual FEC configuration.

Set up exactly the same values for the following FEC parameters as configured in the Encoder: *FEC column (L) Port* and *FEC row (D)*. If the ports are unused, enter zero.

- If you set "On (Auto)" for the ProMPEG FEC, the decoder will automatically recognize the FEC scheme of the incoming TS (see Fig. 15).

The screenshot shows the 'Decoder settings' web interface. The 'Pro-MPEG FEC (CoP3r2)' dropdown menu is highlighted with a red box and is set to 'On (Auto)'. Other settings include:

- Activation: on off
- Source: Gigabit IP
- Redundant input: off
- Data source: Multicast
- Multicast address: 239.1.1.5
- Port: 1234
- FEC output delay (0-1000ms)*: 300 ms
- Additional delay (0-1000): 0 ms
- SFN mode: on off
- Auto mute: on off

 The interface also features a sidebar on the right with sections for 'Information', 'Codec Settings', 'Interface Settings', 'Network Settings', 'System Settings', and 'Status'. The 'Status' section includes 'RDS', 'SFN', and 'IP 1000Base-T'.

Fig. 15: FEC configuration for Decoder

- For activated ProMPEG FEC enter the "FEC output delay" in the range between 0 and 1000 ms (for more information see section "Buffer Delay Management" on page 47).
- Click the button to save the changes.
- Under **Status**→**IP 1000Base-T** you can call up the current status of the ProMPEG FEC in the *Pro-MPEG FEC* block.

Home | E-Mail | 2wcom | Input ● Warning ●

IP 1000Base-T

Ethernet link status: Up	
Ethernet speed: 1000 Mbit/s	
Pro-MPEG FEC	
FEC column count L:	5
FEC row count D:	20
FEC IP packets restored:	0
IP PER:	0.00E-0
IP PER (backup):	0.00E-0
IP PER (combined):	0.00E-0
FEC output delay:	375

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FM MPX Codec

Information

System

Codec Settings

Encoder

Decoder

Interface Settings

MPX

RDS Decoder

Stereo Decoder

Level

Relay

Network Settings

TCP/IP

SNTP

SNMP

System Settings

Global

Time

User

Alarm

Status

RDS

SFN

» IP 1000Base-T «

Event Log

Fig. 16: ProMPEG FEC status for the Decoder.

12.5. Set up SFN mode

Enable SFN synchronization if applicable by selecting "ON" in the virtual switch and enter a value for "Additional SFN delay" under **Codec Settings**→**Decoder** (for more information see section 13 "SFN Synchronization" on page 47 and section 14 "Buffer Delay Management" on page 48).

12.6. Set up monitoring and alarm control

The FMC01 is equipped with an RDS decoder and is able to recognize and to monitor the RDS data in the decoded MPX signal. If you operate the FMC01 as a decoder, you can monitor and control the RDS decoder.

A further monitoring function in the decoder recognizes, if an incoming IP signal is available, and analyzes the errors that occur during the distribution.

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

More information about the available SNMP traps you can find in Section 10.3.

12.6.1. Set up alarm for RDS

The following alarm functions for RDS can be activated:

RDS available	Alarm is set activated, if no RDS is available in the MPX stream
RDS PI	Alarm is set activated, if no or a false program identification code is detected in the RDS stream
RDS PS	Alarm is set activated, if no or a false program service name is detected in the RDS stream



NOTE: If you operate the device as an encoder, please, follow the instructions for configuration of the RDS monitoring function in Section 11.6.2 on page 31.

To set up the RDS monitoring and alarm function in case of operating the FMC01 as a decoder:

1. Open the window *RDS Decoder* under **Interface Settings**→**RDS Decoder** in the web user interface of the FMC01.
2. Choose "Decoder" in the dropdown menu as a source for the RDS decoder (see Fig. 17).



Fig. 17: RDS Decoder settings

3. Click the button to save the changes.
4. To set up alarm settings for RDS decoder, follow the instructions in Section 11.6.2 "Set up alarm for RDS" on page 31.

12.6.2. Set up alarm for Gigabit IP input



NOTE: Alarm settings should be activated only if Gigabit IP is configured as the source for the decoder.

If your device can operate in both modes and is also activated for encoder, no Gigabit IP input in the decoder is possible.

The following alarm functions for Gigabit IP input can be activated:

IP data available	Alarm is set activated, if no signal is available in the Gigabit IP input
IP packet errors	Alarm is set activated, if packet errors are detected in the input signal received over Gigabit IP input.

To set up monitoring and alarm functions for the Gigabit IP input:

1. Open the configuration field **Gigabit IP Input** in the window *Alarm settings* under **System Settings**→**Alarm** in the web interface of the FMC01 (see Fig. 18).

Gigabit IP Input

IP data available Enabled

T1 ms T2 ms

SNMP LED Relay ---

IP packet errors Enabled

T1 ms T2 ms

SNMP LED Relay ---

Fig. 18: Alarm Settings – indication of the data in the Gigabit IP 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 “Enabled”, if this parameter should be monitored.
3. 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 activated.
4. 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.
5. Enable checkbox “SNMP”, if the alarm should be signaled by sending SNMP traps.
6. Enable checkbox “LED”, if the alarm should be signaled by the Warning LED on the top of the web user interface page or on the front panel of the device.
7. Choose in the dropdown menu “Relay” one of the available relays that should switch to signal the alarm.
8. Click the button to save the changes.

12.6.3. Set up alarm for MPX output

To monitor a valid MPX signal in the input TS, you can monitor the MPX output in the decoder. You can activate the following alarm functions:

MPX OUT audio level	Alarm is set activated, if the level of output MPX falls below the configured value.
---------------------	--

To set up monitoring and alarm functions for MPX output:

1. Open the configuration field **MPX Output** in the window *Alarm settings* under **System Settings**→**Alarm** in the web interface of the FMC01 (see Fig. 6 on page 30).
2. Enable the alarm function in the corresponding checkbox "Enabled", if this parameter should be monitored.
3. Define the minimal valid good value of the MPX level in dBu, below that the alarm should be set activated.
4. Define 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 activated.
5. Define 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 top of the web user interface page or on the front panel of the device.
8. Choose in the dropdown menu "Relay" one of the available relays that should switch to signal the alarm.
9. Click the button to save the changes.

⇒ The MPX OUT level can be viewed under **Information**→**System** in the *Decoder State* field (see Fig. 19 on page 45).

12.7. View the decoder status

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

1. Under **Information**→**System** you can see the details of the configured parameters of the decoding signal in *Decoder State* (see Fig. 19) field or directly on the LC display.

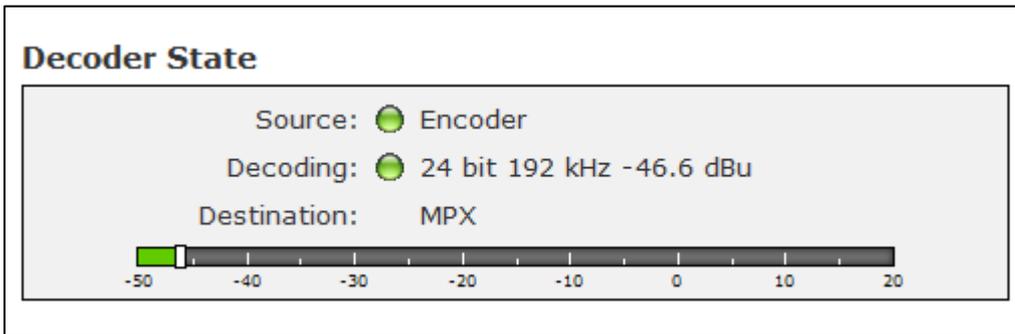


Fig. 19: System Information – Decoder State

The LED color means:

-  - active
-  - deactivated
-  - error

2. The "Input" LED on the top of the web interface (see red box in Fig. 9 on page 34) is the same as the "Input" LED on the front of the device. It lights green, if a signal is detected on an input interface (MPX IN or IP).

If the FM01 operates as an encoder and as a decoder, the LED lights green only if both inputs are ok. The LED is off, if one of the inputs detects a failure (MPX IN or IP)

3. Under **Status→RDS** you can call up the current information about the decoded RDS data.

RDS	
PI:	AFFE
PS:	2wcom
TP:	0
TA:	0
PTY:	0
RT:	
CT:	

Fig. 20: Status - RDS

4. Under **Status→Event Log** you can call up information about the 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 Fig. 11). To delete the last events click the button

Home		E-Mail		2wcom		Input <input type="radio"/>		Warning <input type="radio"/>	
Event Log						FM MPX Codec			
						Information			
						System			
						Codec Settings			
						Encoder			
						Decoder			
						Interface Settings			
						MPX			
						RDS Decoder			
						Stereo Decoder			
						Level			
						Relay			
						Network Settings			
						TCP/IP			
						SNTP			
						SNMP			
						System Settings			
						Global			
						Time			
						User			
						Alarm			
						Status			
						RDS			
						SFN			
						IP 1000Base-T			
						» Event Log «			

Nr.	Timestamp	Message
1	16-11-04 10:09:10	MPX Out audio level - State: OK (-47, ref:-50)
2	16-11-04 10:08:32	MPX Out audio level - State: FAILURE (-81, ref:-50)
3	16-11-04 10:06:31	MPX Out audio level - State: OK (-47, ref:-50)
4	16-11-04 10:01:52	MPX Out audio level - State: FAILURE (-66, ref:-50)
5	16-11-04 10:01:50	Monitoring Start
6	16-11-04 09:58:17	Monitoring Start
7	16-11-04 09:50:09	IP data available - State: OK
8	16-11-04 09:50:08	Monitoring Start
9	16-11-04 09:50:08	System Start (WarmStart)
10	16-11-04 08:52:54	Monitoring Start
11	16-11-04 08:36:06	Monitoring Start
12	16-11-03 14:46:19	Monitoring Start
13	16-11-03 14:46:19	System Start (WarmStart)
14	16-11-03 14:37:15	Monitoring Start
15	16-11-03 14:37:15	System Start (WarmStart)
16	16-11-03 14:33:01	MPX Out audio level - State: OK (8, ref:-40)
17	16-11-03 14:29:50	MPX Out audio level - State: FAILURE (-81, ref:-40)
18	16-11-03 14:24:14	Monitoring Start
19	16-11-03 14:24:14	System Start (WarmStart)

Fig. 21: Status – Event Log

13. SFN Synchronization

The function of the network synchronization for SFN applications for the FMC01 is optional and can be used for latency control. The SFN rights must be assigned for the FMC01 devices.

For activating the SFN synchronization use the "1 PPS" BNC connector.

Enable and set up the SFN parameters for the Encoder in the menu **Codec Setting**→**Encoder**. For more information see section 11.5 "Set up SFN Delay" on page 29.

Enable SFN synchronization in the Decoder in the menu **Codec Settings**→**Decoder**. For more information see section 12.5 "Set up SFN mode" on page 41.

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

SFN status	
1PPS Error count:	1
Buffer level:	670
Reset count:	0
Transmission delay:	376 ms
Global delay:	800 ms
Accuracy:	-0.9 μs

Fig. 22: Status – SFN

The following parameter can be viewed in the "SFN Status" menu:

<i>1PPS Error count:</i>	Decoder and Encoder: error will be counted if no 1 PPS signal is sent (i.g. [1 PPS] connector is not connected)
<i>Buffer level:</i>	only Decoder: current amount of packets in the encoder buffer for the "SFN buffer delay".
<i>Reset count:</i>	only Decoder: amount of renewed SFN synchronizations after each error.
<i>Transmission delay:</i>	only Decoder: total delay of IP latency (expected transmission delay) and dejitter buffer ("FEC output delay") (ms)
<i>Global delay:</i>	only Decoder: "SFN delay" configured in the encoder
<i>Accuracy:</i>	only Decoder: deviation of the SFN synchronization (stability; value $\pm\mu\text{s}$)

14. Buffer Delay Management

When using the FMC01 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.

14.1. Basic delay setup

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

$$\text{Encoder processing delay} + \text{transmission delay on IP network} + \text{decoder processing delay}$$

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:

$$\text{Dejitter/ Reorder or FEC output delay} + \text{additional delay} + \text{decoder processing delay}$$

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→1000Base-T**. 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 2: Minimum FEC delays sizes

14.2. Delay configuration for SFN Operation

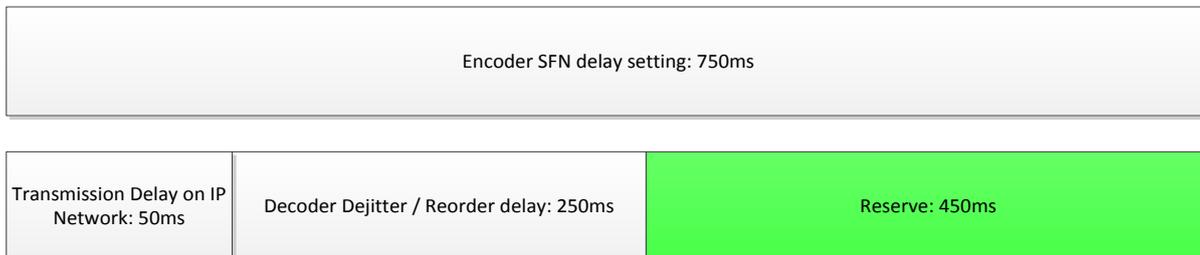
When the FMC01 is used in SFN mode, the user needs to take extra precautions to ensure safe operation. It is recommended to have at least 100ms spare time after dejitter / reorder or FEC output delay. So a user must carefully select settings that ensure this:

$$\text{SFN global delay} - \text{encoder processing delay} - \text{transmission delay on IP network} - \text{Dejitter / Reorder or FEC output delay} \geq 100\text{ms}$$

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

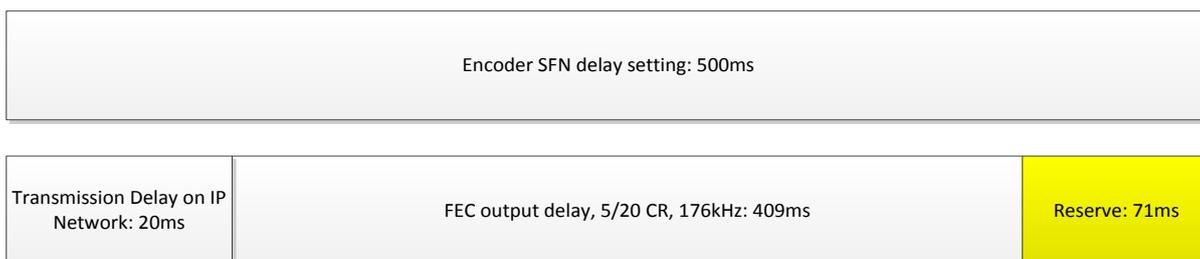
Example 1

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.



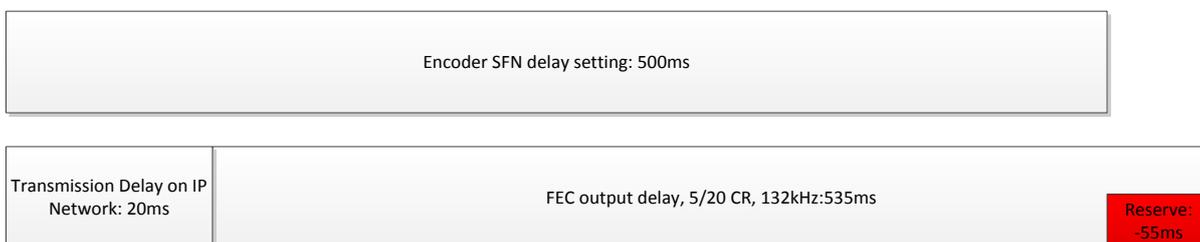
Example 2

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.



Example 3

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



15. Global Settings

15.1. 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 settings* under **System Settings**→**Global**.
2. The device information is displayed in the **System information** field (see Fig. 23).

System information	
Last reboot [dd.mm.yyyy hh:mm:ss]:	04. November 2016, 09:50:03
Uptime [days, hh:mm:ss]:	0 days, 00:42:17
Serial number:	660.000023
Device type:	FMC01
BIOS firmware version:	V03.02
ARM firmware version:	V05.30 build 0005
DSP firmware version:	V05.09 build 0075
FPGA firmware version:	V02.02 build 0006
MIB version:	V01.11 (2016-10-26)
Rights:	Encoder Decoder Gigabit IP Pro-MPEG FEC SFN Decode Encoder
Device temperature:	59 °C

Network Settings
TCP/IP
SNTP
SNMP
System Settings
» Global «
Time
User
Alarm
Status
RDS
SFN
IP 1000Base-T
Event Log

Fig. 23: Global System Settings – System Information

15.2. Enter the device information

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

1. Open the window *Global settings* under **System Settings**→**Global**.
2. Enter the identification information of the device in the **System parameter** field (see Fig. 24).

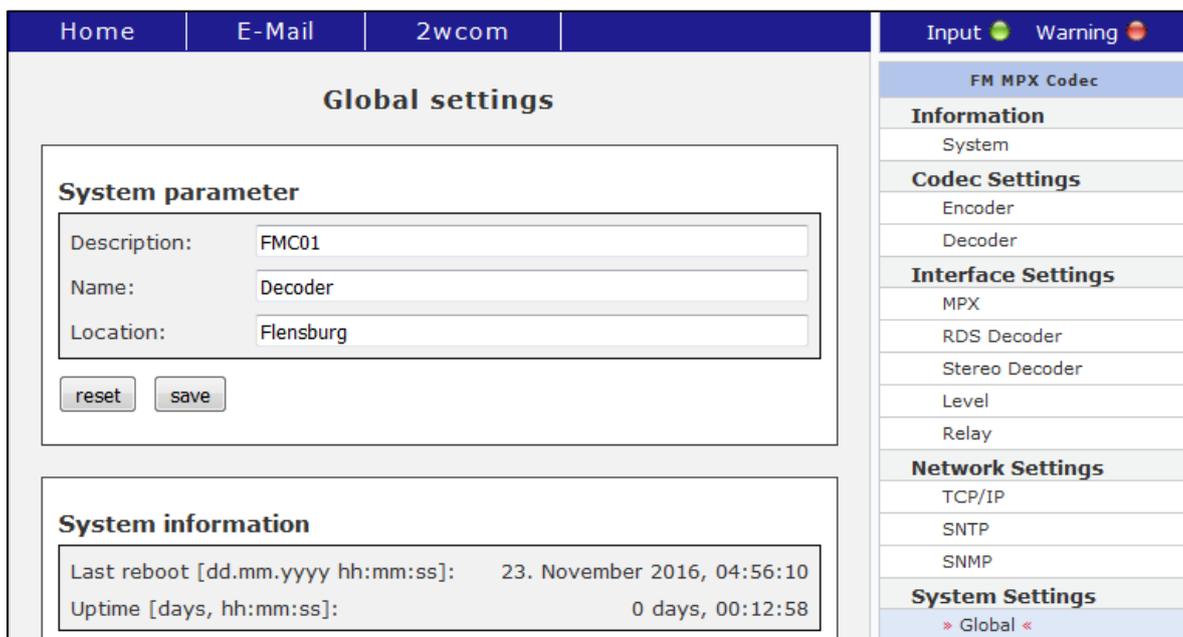


Fig. 24: Global System Settings – System parameter

3. Click the button to save the changes or the button to restore the last settings.
- ⇒ The saved information can be viewed under **Information→System** in the web user interface.

15.3. Upload and activate settings stored locally

You can restore device settings saved locally.

To upload settings stored locally:

1. Open the window *Global settings* under **System Settings→Global**.
 2. Click the Browse button in the **Settings** field. The “Open file” dialog of your system software will be displayed.
 3. Choose the settings file in your browser.
 4. Click the 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.

15.4. Save settings to local file

You can download the current settings and save them as a file.

To save setting to local file:

1. Open the window *Global settings* under **System Settings→Global**.
2. Click the button in the **Settings** field to start the file download in the web browser.
3. Choose the archive location on the directory tree and confirm the choice.

⇒ The saved settings can be uploaded in the "Upload Settings" field (see Section 15.3).

15.5. Upload and activate firmware stored locally

You can upload an ARM firmware stored locally. To upload and to activate the new firmware:

1. Open the window *Global settings* under **System Settings→Global**.
2. Click the Browse button in the **Firmware update** field. The "Open file" dialog of your system software will be displayed.
3. Choose the firmware file.
4. Click the 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.

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

15.6. 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 Fig. 25).

Home | E-Mail | 2wcom | Input | Warning

Time

Time zone

Time zone: (UTC+1:00) Amsterdam, Berlin, Bern, Rome, Stockholm, ▾

Automatic daylight saving time (DST): yes ▾

DST Start: Last ▾ Sunday ▾ of March ▾
at 02:00 ▾ local time

DST End: Last ▾ Sunday ▾ of October ▾
at 03:00 ▾ local time

Time and date settings

Present local device time and date: 04.11.16 10:34:24

New local time [hh:mm:ss]: 10 : 34 : 07

New date [dd.mm.yyyy]: 04 . 11 . 2016

FM MPX Codec

Information

System

Codec Settings

Encoder

Decoder

Interface Settings

MPX

RDS Decoder

Stereo Decoder

Level

Relay

Network Settings

TCP/IP

SNTP

SNMP

System Settings

Global

» Time «

User

Alarm

Status

RDS

SFN

IP 1000Base-T

Event Log

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Fig. 25: System Settings - Time

2. Choose the current time zone of the device in the **Time zone** field in the dropdown menu.
 3. Choose YES in the dropdown menu "Automatic daylight saving time (DST)" to activate the automatic changing the clocks.
 4. Choose the beginning and the end of the summertime in the dropdown menu.
 5. Click the button to save the changes or the button to restore the last settings.
 6. In the **Time and date settings** field, set up the internal time in the 24h format and the datum.
 7. Click the button to save the changes or the button to restore the last settings.
- ⇒ The current time and datum of the internal clock is displayed under "Present local device time and date" in the same **Time and date settings** field (see Fig. 25).

15.7. Configure user accounts

The default accounts are a read-only access (Guest account) and a full access (Admin account). Change the login data for the access after the first login to the web user 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 button to save the changes or the button to restore the last settings.
4. Change the login data for the read-only access in the **Guest account** field and repeat the new password.
5. Click the button to save the changes or the button to restore the last settings.



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

15.8. Set up the attenuation of the audio outputs

The FMC01 is equipped with a stereo decoder that can decode audio signals from an MPX stream. Therefore, you can immediately listen to the audio program distributed over the MPX signal, in order to monitor, if the distribution proceeds without errors.

For the audio output three ways are possible:

- Analogous audio connectors [Analog OUT L/R] on the back panel of the device
- Headphone jack on the front panel of the device
- BNC or XLR connectors [MPX OUT 1/2] on the back panel of the device

This function enables monitoring of the inputting and outputting signals:

- If you operate the FMC01 as an encoder, you can listen to the audio program distributed over the inputting MPX stream (source configuration: **Interface Settings→Stereo Decoder→Source: Encoder**).

- If you operate the FMC01 as a decoder, you can listen to the audio program distributed over the outputting decoded MPX stream (source configuration: **Interface Settings**→**Stereo Decoder**→**Source: Decoder**).

To set up attenuation of the audio signal:

1. Open the window *Level* under **Interface Settings**→**Level** (see Fig. 26).
2. In the **Audio** field, enter attenuation for the analogous audio output and headphone jack.
3. In the **MPX** field, enter attenuation for the MPX audio outputs.
4. Click the button to save the changes or the button to restore the last settings.

The screenshot shows the 'Level' settings page. At the top, there are navigation tabs: Home, E-Mail, 2wcom, Input, and Warning. The main content area is titled 'Level' and contains two sections: 'Audio' and 'MPX'. The 'Audio' section has two input fields: 'Analog [-32dB - 6dB]' with a value of 0.0 and 'Headphone [-32dB - 6dB]' with a value of -32.0. The 'MPX' section has four input fields: 'XLR1 [-32dB - 6dB]' (0.0), 'XLR2 [-32dB - 6dB]' (0.0), 'BNC1 [-32dB - 6dB]' (0.0), and 'BNC2 [-32dB - 6dB]' (0.0). Below the MPX fields are 'reset' and 'save' buttons. The right sidebar contains a menu with the following items: FM MPX Codec, Information (System), Codec Settings (Encoder, Decoder), Interface Settings (MPX, RDS Decoder, Stereo Decoder, > Level <, Relay), Network Settings (TCP/IP, SNTP, SNMP), System Settings (Global, Time, User, Alarm), and Status (RDS, SFN, IP 1000Base-T, Event Log). The footer of the page reads 'Copyright © 2008-2016, 2wcom Systems GmbH'.

Fig. 26: Level settings for the audio outputs

15.9. Restart the device

To restart the device:

1. Open the window *Global Settings* under **System Settings**→**Global**.
2. Click the button in the last field of the web page to reboot the device (see Fig. 27).



Fig. 27: Restart menu in the web user interface under System Settings – Global

⇒ The device restarts

15.10. 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!

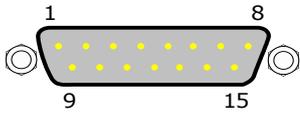
This applies also to the access accounts!

To reset the device to the factory settings:

1. Open the window *Global Settings* under **System Settings**→**Global**.
2. Click the button in the last field of the web page to restore factory settings (see Fig. 27).

16. Relay Output

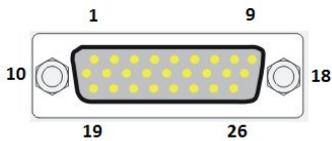
The FMC01 unit is either equipped with a D-Sub 15 pole male connector or a high density D-Sub 26 pole male connector. Additional relay outputs have to be ordered with the unit or the unit has to be sent back for servicing/upgrading at a later date.



D-Sub male connector, 15 pole

Relay Output

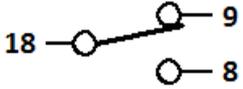
<i>Relay No.</i>	<i>Switch contacts</i>	<i>Switch type</i>
1	1,9	SPST, NO
2	2,10	SPST, NO
3	3,11	SPST, NO
4	4,12	SPST, NO
5	5,13	SPST, NO
6	6,14	SPST, NO
7		SPDT



D-Sub male connector, high density, 26 pole

Relay Output

<i>Relay No.</i>	<i>Switch contacts</i>	<i>Switch type</i>
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
----	---	------

NOTICE

The relay contacts have a rating of 0.5 A at max. 24 V DC. The maximum current is 1 A!

17. 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.

18. 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	<ul style="list-style-type: none"> • Power cable is improperly connected • Mains supply failure • Blown fuse 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Connect the network cable. • Use the default address 192.168.14.250. If the address was changed and is not known please see page 7. • 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.
RDS signal distorted	<ul style="list-style-type: none"> • Improper signal cable • Signal cable defect 	<ul style="list-style-type: none"> • Use proper, screened cable only • Use faultless signal cable
SNMP Get requests are not working	<ul style="list-style-type: none"> • SNMP community strings of the device and the SNMP management tool are not aligned. 	<ul style="list-style-type: none"> • Check/Align the SNMP community strings (see section 10.3 on page 23).
Relay output is not actuated as desired	<ul style="list-style-type: none"> • Relay output is not actuated as desired 	<ul style="list-style-type: none"> • Check/Change programming of the relay functions (see section 16 on page 56)



Rear view FMC01

FMC01 - FM MPX Codec - Technical Details

Encoder Inputs

FM MPX signal

Signal	FM MPX
Frequency response	E1: 20 Hz - 60 kHz: <0,05 dB IP: 20 Hz - 90 kHz: <0,05 dB
Input Voltage range	0 ... 14 dBu
Connectors MPX IN	1x XLR, balanced, <20 Ω 1x BNC, 75 Ω, unbalanced

Encoder Outputs

E1

Protocol	G.703, G.704 (on request)
Data rate	2.048 kbps
Coding format	HDB3
Connectors E1 OUT	2x BNC, 75 Ω, unbalanced

Gigabit IP

Type	10/100/1000 Base-T
Data	MPEG TS or RAW Data via UDP, UDP/ RTP, as Unicast or Multicast IGMPv2 RJ45

Connectors

Audio

Volume	-32...+6 dB
Headphone	L/R, <10 Ω, 6.3 mm
Analogue	L/R, <20 Ω, balanced, XLR

Decoder Inputs

E1

Protocol	G.703, G.704 (optional)
Data rate	2.048 kbps
Coding format	HDB3
Connectors E1 IN	1x BNC, 75 Ω, unbalanced

Gigabit IP

Data	MPEG TS or RAW Data via UDP, UDP/ RTP, as Unicast or Multicast IGMPv2
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Decoder Outputs

FM MPX signal

Signal	FM MPX
Frequency Response	E1: 20 Hz - 60 kHz: <0,05 dB IP: 20 Hz - 90 kHz: <0,05 dB
Stereo separation	>55 dB
Harmonic distortion	<0,0025 dB
SNR (CCIR-weighted)	>75 dB
SNR (A-weighted)	>90 dB

Connectors MPX OUT	2x XLR, balanced, >10 kΩ 2x BNC, 75 Ω, unbalanced
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Audio

Volume	-32...+6 dB
Headphone	L/R, <10 Ω, 6.3 mm
Analogue	L/R, <20 Ω, balanced, XLR

Codec

Data

Type	100% Loss less audio encoding & decoding
Bit depth	E1: 12-15 bit IP: 16-24 bit
Sample rate	E1: 132 kHz IP: 192 kHz
Encoding type	PCM raw
FEC	E1: Read Solomon FEC IP: ProMPEG FEC Practice #3 release 2
Bandwidth E1	2,048 Mbit/s
Bandwidth IP	4x4 FEC, add. 15 ms delay: 4,48 Mbit/s 4x4 FEC, add. 149 ms delay: 3,54 Mbit/s 10x10 FEC, add. 133 ms delay: 3,55 Mbit/s 10x10 FEC, add. 933 ms delay: 2,83 Mbit/s

Control & Monitor

Ethernet

Data	Controlling and Setup functions
Connector	RJ45
Type	Auto Switching
Protocol	10/100 BASE-T HTTP, SNMPv2c, SMTP, UDP, SNTP, TCP

Contact closure

Inputs	7 opto isolated inputs (excludes option: 24 relay contacts)
Outputs	15 pole sub-D female 12 floating relays (10x SPST, 2x SPDT) (for DC: max. 30 V, 1 A, 10 W) 26 pole sub-D male 24 floating relays (excludes: 7 opto isolated inputs)
optional:	Serial Data Connector Transmission rate
Serial	1x RS-232C (1 front)
Data	service
Connector	9 pole sub-D male
Transmission rate	1200 to 115200 baud, asynchronous

Front panel

LCDisplay	2x 40 characters
Jog Wheel	Impulse, ENTER button
7 LEDs	Power, Input, Output, Warning, Status, Encoder, Decoder

FM & RDS

FM	Internal Demodulation of MPX Signal and output via XLR and Headphone
RDS	Decoding and control of PI and PS on the web frontend, optional decoding of all data via RDS-LAB

General data

Power consumption	20 VA
Case dimensions	19", 1 HU, depth: 310 mm, width: 424 mm, front panel: 484 mm
Weight	<4 kg
Housing	steel plate (aluminum-zinc coated)
Operating temp. range	0...+45°C
Storage temp. range	-40...+70°C
Power supply	internal, 90...260 V, 47...63 Hz
Languages	English

Version 02.11.2016
These data are subject to
modifications and amendments.
Errors excepted

