

DAB/DAB+ systems



[Encoder | MUX | Switch]

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General

As a leading manufacturer of DAB systems, we offer complete solutions for a DAB headend in a wide variety of variants - according to your requirements.

We have been developing DAB systems since 1993, at that time as Philips Kommunikations Industrie AG.

The first STI-based DAB Headend with dynamic reconfiguration was a joint development with Deutsche Telekom, Rohde & Schwarz and the Fraunhofer Gesellschaft.

Digital Audio Broadcasting as the successor of analogue radio offers significant advantages: In addition to the much more efficient distribution option, various data services such as slideshows for album covers, TPEG for extended traffic information etc. can also be transferred in addition to the noise-free audio programs.

The multiplexing of a single frequency typically allows the creation of 15 to 20 audio programmes, so that a wide range of programmes is available within an ensemble.

Hardware-based DAB/DAB+ Audio Encoders can be installed separately and directly from the program providers. By avoiding multiple coding in the input, the best possible audio quality is achieved. Even a transmission over the Internet is secured and cost-efficiently possible.

Program providers who are also ensemble providers and broadcast several programs can set up software-based Audio Encoders directly on the Ensemble Multiplexer (Basic and Professional Version) or use single or four-channel hardware Audio Encoders.

The central system of a DAB headend is the Ensemble Multiplexer. Four different systems are available - from the simple and inexpensive Small Scale DAB multiplexer to the professional DAB multiplexer based on the Fraunhofer ContentServer.

Program providers who have the highest requirements for program availability can expand a DAB Headend partially or fully redundant. Necessary redundancy switches that guarantee trouble-free operation are also available, as well as ETI/EDI interface converters that enable connection to DAB systems that do not yet have IP-based EDI interfaces.

The ETI/EDI Monitoring Decoder can be used to monitor an ensemble multiplex. This provides an overview of all important parameters of an ensemble that are relevant to the transmitter and alerts via SNMP, for example, if a malfunction occurs in the DAB headend.

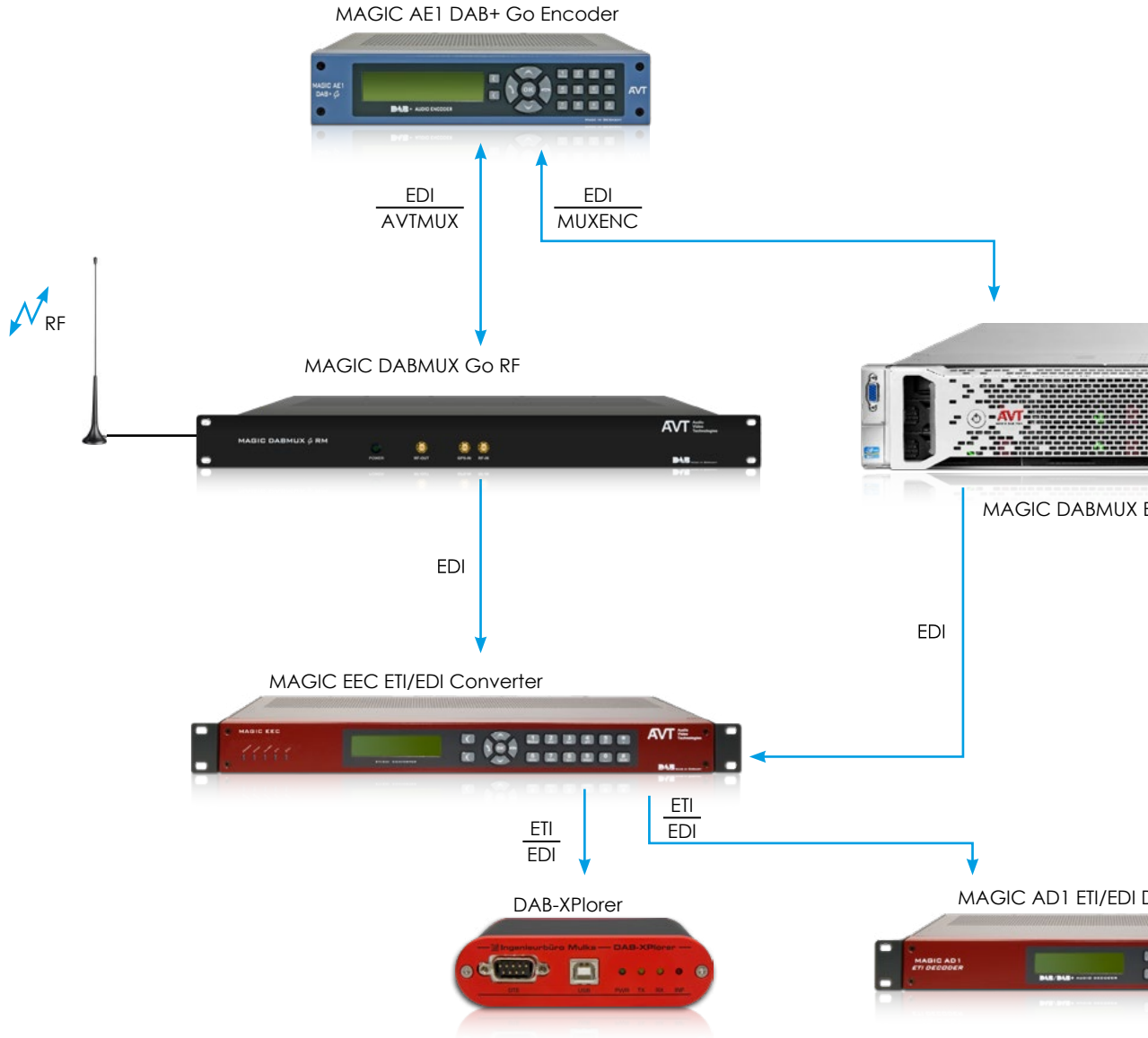
For more in-depth analysis of the DAB signal, a wired ETI/EDI analyser with integrated ensemble recorder and player is available as well as a system that can evaluate the received DAB RF signal in detail.

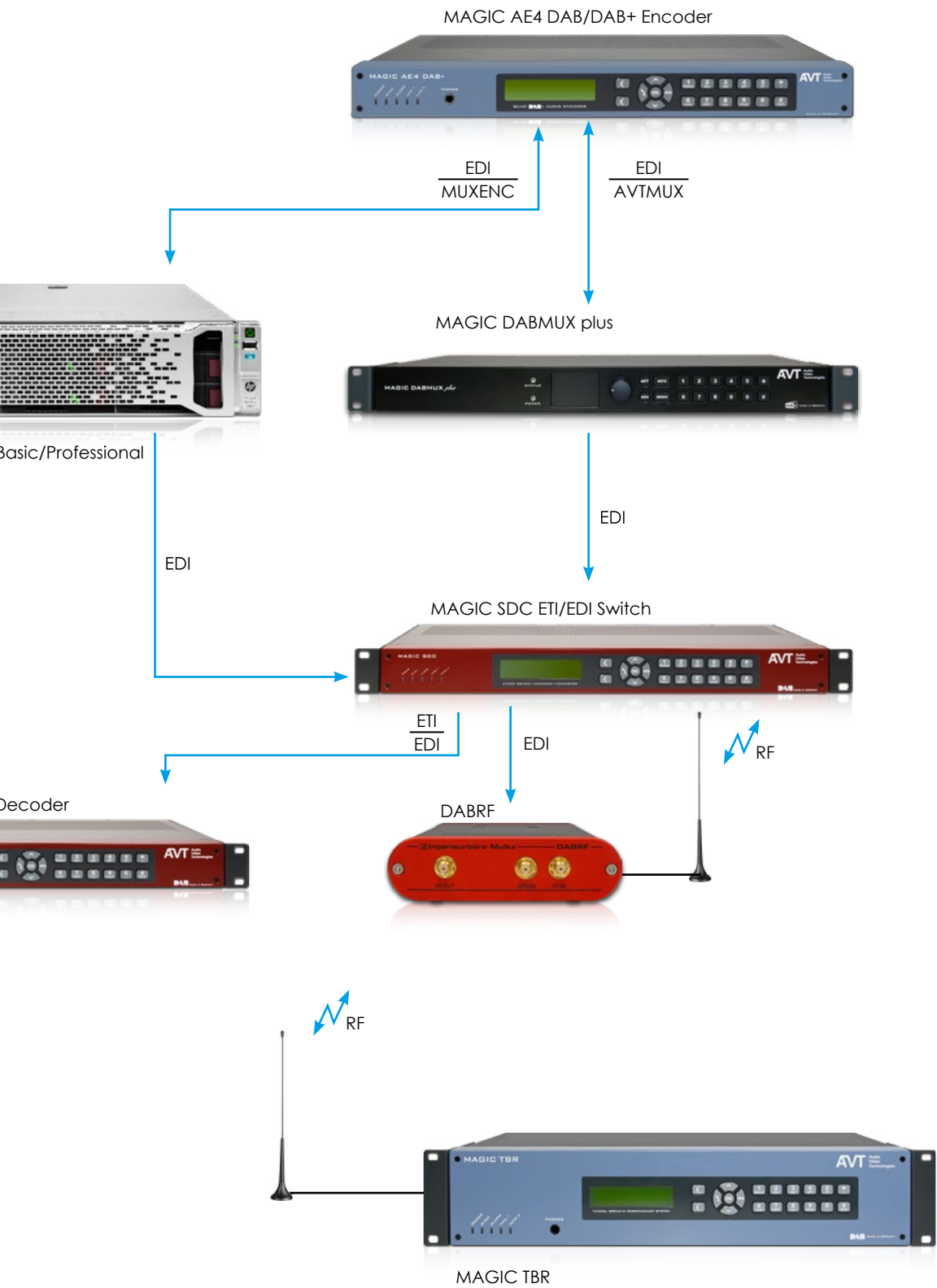
At the latest when the old analogue FM technology is transferred to DAB - as has already been done in Norway - road tunnels that use FM-based emergency announcement systems must also be converted to DAB.

The DSP-based, highly available and maintenance-free tunnel break-in system with integrated modulator and remodulator offers a voice break-in for up to two independent ensembles. An announcement is simultaneously made audible on all programs - regardless of which program the driver is listening to.

OVERVIEW

Overview





AUDIO ENCODER

DAB/DAB+ Audio Encoder

In this product catalogue we will use some symbols for the systems' features and their availability. Below you will find a description of all features.

Included

A blue symbol shows that the feature is available in the standard delivery version for the product described.

Option

A greyish-blue symbol shows that the feature is optionally available (associated with costs).

Not available

A light grey symbol shows that the feature is not supported by the product described.

DAB

DAB+

DAB/DAB+

The device supports DAB (ISO/MPEG 1/2 Layer 2) and/or DAB+ (MPEG4 HE-AAC v2).

UECP

UECP

The Universal Encoder Communication Protocol (UECP) is supported.

PAD

Programme-associated data

The system supports all available PAD services of the service/Ensemble Multiplexer, which are fed to the encoder remotely.

L-PAD

Local PAD

The system allows local feeding of the PAD services Dynamic Label and Slideshow.

SNMP

SNMP

SNMP protocol v1 and v2c for integration into a network management system is supported.

VLAN

VLAN

Service dependent VLANs (Virtual Local Area Networks) can be set up in the system configuration.

nx LAN

LAN interface(s)

The device has n x Ethernet interfaces.

n x AES

nxANA

AES/ANA

The device has n x digital AES/EBU and/or n x analogue stereo audio interfaces.

AES/ANA

AES/ANA

The device has an analogue and a digital stereo audio interface, which can be switched between.

AES67

AES67

The AES67 upgrade allows the use of additional audio channels over IP via AES67, the lowest common denominator of several similar technologies, e.g. Dante and Ravenna.

GPIO

GPIO

Programmable TTL interfaces and Relay contacts are available.

DEC

Monitoring Decoder

The system has a Monitoring Decoder.

Overview: Technical data

	MAGIC AE1 DAB+ Go	MAGIC AE4 DAB/DAB+
Feature		
Coding algorithms	MPEG4 HE-AAC v2 ETSI TS 102 563 (FhG-Licence)	MPEG4 HE-AAC v2 ETSI TS 102 563 ISO/MPEG 1/2 Layer 2 DAB EN 300401 (FhG-Licence)
Coding modes	Mono, Mono + SBR Stereo, Stereo + SBR Stereo + SBR + PS	Mono, Mono + SBR Stereo, Stereo + SBR Stereo + SBR + PS
Sampling frequencies	24, 48-kHz 16, 32-kHz	24, 48-kHz 16, 32-kHz
Data rates	8-kbit/s ... 192-kbit/s	8-kbit/s ... 384-kbit/s
Network interfaces	1 x LAN Fast Ethernet 3 IP addresses VLAN support	2 x LAN Fast Ethernet 6 IP addresses VLAN support Optional: LAN 3/4 module
Audio interfaces	XLR, analogue, electr. balanced digital AES/EBU with SRC	XLR, analogue, electr. balanced digital AES/EBU with SRC
AES67 channels/streams <i>Software Upgrade</i>	Optional: RX: 2 / 1 TX: 0 / 0	Optional: RX: 8 / 1 TX: 2 / 1
Audio level	-3 ... +9 dBu	-3 ... +9 dBu
Synchronisation	NTP, AES/EBU	NTP, AES/EBU
Protocols	Unicast, Simulcast (2 Streams), Multicast	Unicast, Simulcast (2 Streams), Multicast
Output	UDP (VDL) AVTMux with Secure Streaming Optional: EDI(ETI), FhG MuxEnc	UDP (VDL) AVTMux with Secure Streaming Optional: EDI(ETI), FhG MuxEnc
PAD/SI	Local services via LAN/FTP: Dynamic Label MOT Slideshow TA (TTL/UECP) PTy (UECP) All available PAD services are possible via data fed into the multiplexer	Local services via LAN/FTP: Dynamic Label MOT Slideshow TA (TTL/UECP) PTy (UECP) All available PAD services are possible via data fed into the multiplexer
GPIO	4 x TTL/2 x Relay	8 x TTL/8 x Relay
Monitoring	SNMP v1/v2c	SNMP v1/v2c
Power supply	external 12V power supply Optional: redundant power supply via external box	integrated 100 – 230 V AC Optional: external 5V power supply for redundant power
Frequency	50/60 Hz	50/60 Hz
Power consumption	12 W	15 W
Dimensions (H x W x D)	1U x ½x 19" x 21 cm	1U x 19" x 25 cm

AUDIO ENCODER

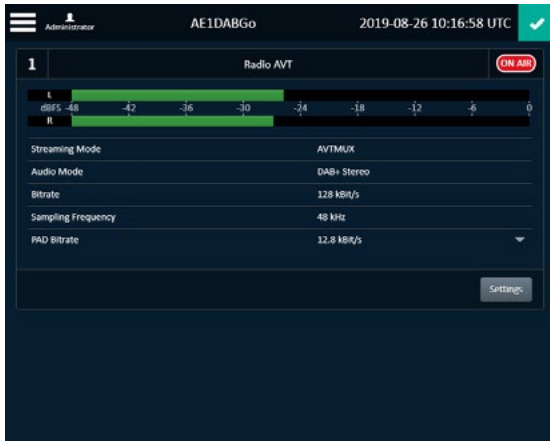
MAGIC AE1 DAB+ Go Audio Encoder



MAGIC AE1 DAB+ Go



- MPEG4 HE-AAC v2 (ETSI TS 102 563)
- Audio via IP to Ensemble Multiplexer
- AVTMUX with Secure Streaming, AVTVDL
- Optional EDI (ETI), FhG MuxEnc protocol
- PAD via LAN
- 16/32-kHz and 24/48-kHz sampling frequencies
- XLR inputs (analogue and digital)
- Optional: AES67 Software Upgrade
- Optional: redundant power supply via external box
- LAN interface for audio, PAD, control
- VLAN support
- SNMP v1/v2c
- GPIO contacts



The high quality and professional DSP-based hardware audio encoder **MAGIC AE1 DAB+ Go** is realized as a fanless 1/2 x 19" device and offers excellent audio quality thanks to the licenced Fraunhofer DAB+ algorithm.

The supplied **Windows software** allows the configuration of up to 100 systems. Alternatively a comfortable configuration and monitoring of the encoder is carried out via a modern HTML5-capable web browser.

Both **analogue** and **digital** audio interfaces are available for the input of the audio signal. With the **AES67 license**, an additional audio interface (two channels, one stream) can be used through a software upgrade.

In addition to the usual PAD feed via the multiplexer - which supports all standardized services - the PAD services **Dynamic Label** via FTP or UECP and **Slideshow** via FTP can also be fed in locally on the device.

In addition, a traffic announcement (**TA**) can be triggered very easily via UECP or a GPI contact.

Finally, the Audio Encoder allows direct transmission of the program type (**PTY**) like Rock, Pop etc. via UECP.

The transmission is monitored via the supplied Windows PC software or SNMP. Alternatively, an alarm can also be output via a GPO contact.

Up to **three IP addresses** can be assigned to the integrated network interface, so that a network separation for different applications is possible. The system also supports VLANs.

Communication between multiplexer and encoder is carried out via the **AVTMUX** protocol, which enables the control, monitoring and PAD transmission of the encoders from the multiplexer and guarantees secure transmission via **Secure Streaming**.

With this method, which has also proved its worth in the field of classical audio transmission, all IP packets are transmitted twice - with a delay. Due to the low bit rates with DAB+, the necessary doubling of the data rate is negligible. In addition, different routes can be implemented in the transmission path by using suitable addressing.

At the multiplexer (**MAGIC DABMUX Go** and **MAGIC DABMUX Plus**) all IP packets are reassembled correctly in time and duplicate received packets are rejected.

The system can also be used directly with the Open Source Multiplexer **ODR DabMux**. The necessary interface adaptations are available free of charge on the GitHub platform.

To mount two systems next to each other in a 1U 19" rack, the optional **Dual Mounting Kit** can be used.



MAGIC AE1 DAB+ Go – Rear side

AUDIO ENCODER

MAGIC AE4 DAB/DAB+ Audio Encoder



MAGIC AE4 DAB/DAB+



- Quad DAB/DAB+ encoder
- MPEG4 HE-AAC v2 (ETSI TS 102 563)
- ISO/MPEG 1/2 Layer 2 DAB Encoder (ETSI TS 103 466)
- Audio via IP to Ensemble Multiplexer
- AVTMUX with Secure Streaming
- Optional: EDI (ETI), FhG MuxEnc protocol
- Support of all data rates
- 24/48-kHz and 16/32-kHz sampling frequencies
- Monitoring Decoder
- Configuration via HTML5 web browser
- 4 x AES/EBU stereo inputs
- 1 x Analogue Stereo Input
- Optional: AES67 Software Upgrade
- Optional: 5V redundant power supply
- Analogue and digital output for monitoring
- Headphone interface for monitoring
- 2 x LAN interfaces
- Optional: LAN 3/4 module
- SNMP v1/v2c
- GPIO Contacts

The **MAGIC AE4 DAB/DAB+** Encoder offers in the standard version one DAB/DAB+ hardware encoder and can be optionally upgraded with three further encoders. Each of the four channels are independent and can be configured independently as a DAB or DAB+ encoder. The system is realized in a compact, fanless and DSP-based design.

The audio programs can be supplied via the four digital AES/EBU stereo interfaces. An analogue stereo interface is also available. An additional stereo channel per encoder (max. 4) is optionally available with the **AES67 software upgrade**.

The PAD is usually fed in via the Ensemble Multiplexer, which scans the PAD via the return path of the transmission protocol on the encoder. All PAD services supported by the multiplexer can be used.

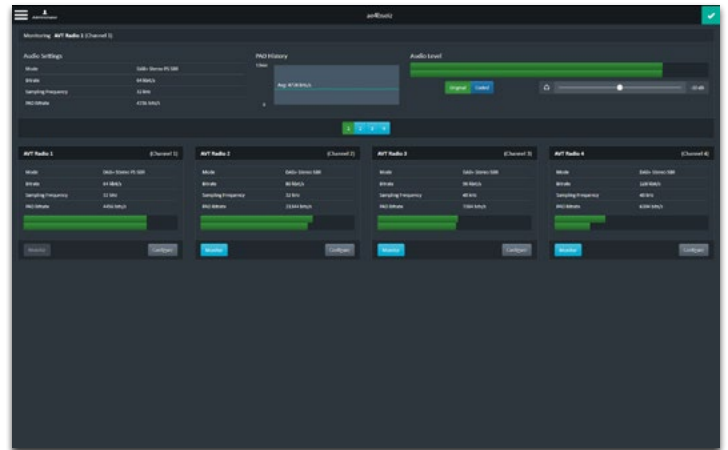
Alternatively, it is also possible to feed **PAD services** directly into the Encoder. Dynamic Label and MOT Slideshow are supported.

In addition to PAD, service information such as the Program Type (PTy) and Traffic Announcement (TA) can also be transmitted via UECP for each program. The triggering of a traffic announcement can be easily implemented via a TTL contact.

As transmission protocols with reconfiguration capability and PAD insertion, the system supports the proprietary standards **AVTMUX**, **FhG MuxEnc**, **AVTVDL** and **ODR DabMux**.

The EDI (ETI) standard also allows the system to be connected to almost any Ensemble Multiplexer from other manufacturers. In this case, however, reconfiguration and PAD feeding from the multiplexer is not possible, since EDI cannot transfer control information.

Two network interfaces are available as standard. Up to **three IP addresses** can be assigned to each Ethernet interface. With the **LAN 3/4 module**, MAGIC AE4 can be extended by two further LAN interfaces, so that in total four LAN interfaces are available.



In addition, the system supports VLANs for all kinds of services such as audio & PAD, SNMP, UECP and NTP, making it easy to separate the subnets for audio transmission, data transfer and management.

For monitoring, but also for assessing the quality of the encoded audio signal, a **Monitoring Decoder** is also integrated, which enables direct monitoring of the unencoded and encoded signal.

The monitoring can be done either via the headphone interface on the front or via the analogue and digital audio interfaces on the rear panel.

A comfortable configuration and monitoring of all four encoders is carried out via a modern HTML5-capable web browser.

In addition, the device can be integrated into a network management system via SNMP.

Finally, eight **TTL inputs/outputs** and eight **relays** can be freely programmed, e. g. for alarming.



MAGIC AE4 DAB/DAB+ – Rear side

DAB Service & Ensemble Multiplexer

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Not available

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PAD

Programme-associated data

The system has an integrated PAD inserter for Dynamic Label, Slideshow, etc.

NPAD

Non-programme-associated data

The system has an integrated NPAD inserter for EPG, TPEG, etc.

SI

Service Information

The system allows the insertion of service information, such as traffic announcements.

UECP

UECP

The Universal Encoder Communication Protocol (UECP) is supported.

n x EDI

n x EDI

The system allows to insert the contents of external EDI data streams.

ETI

ETI

The system has a 2-Mbit/s ETI input/output interface.

STI

STI

The system allows the insertion of contents of external STI (D+C) data streams.

AVTMUX

AVTMUX

External audio encoders can be controlled via the AVTMUX protocol. Secure Streaming is also supported.

MuxEnc

MuxEnc

External audio encoders can be controlled via the MuxEnc protocol.

Software Enc

Software Encoder

The system supports internal DAB/DAB+ Software Encoders.

Also available as a more economical backup software encoder if the main path is implemented with a hardware encoder.

SNMP

SNMP

SNMP protocol v1 and v2c for integration into a network management system is supported.

VLAN

VLAN

Service dependent VLANs (Virtual Local Area Networks) can be set up in the system configuration.

DSP

Digital signal processor

The device is implemented on a signal-processor based hardware platform.

MULTIPLEXER

PC

Server PC

The software multiplexer is implemented on a server PC under Linux (Ubuntu).

RF

RF modulator

The device has an integrated RF modulator for Band III. In addition, a GPS input for synchronisation is available.

+Lizenz

Licensing

The device is supplied with a software license plus a USB dongle license for general average purposes.

Player

Multimedia Player

The Basic/Professional license includes the free use of the Multimedia Player for two years.

n x LAN

n x LAN interfaces

The device has n x Ethernet interfaces.

Server Specification

The Fraunhofer based Ensemble Multiplexer hardware is a standard Server PC (typically HP DL380p Gen9). But customers can also use their own preferred platform. To avoid problems, it is helpful to check your server PC specification.

The standard server we deliver has the following features:

- HP DL380p Gen9 Server
- 1 x INTEL XEON 8-core processor
- 16 GB RAM
- 2 x 240 GB SSD (RAID)
- 4 x LAN GBit/s
- DVD ROM Drive
- Redundant Power Supply
- HP iLo Advanced 1 Year

SERVICE & ENSEMBLE MULTI

	MAGIC DABMUX Go RF	MAGIC DABMUX Go RF RM
Feature		
DAB Spezifikation	ETSI EN 300401 V2.1.1	ETSI EN 300401 V2.1.1
Basis	DSP hardware	DSP hardware
Network interfaces	1 x LAN GbE 3 IP addresses VLAN support	1 x LAN GbE 3 IP addresses VLAN support
Extension interfaces	-	-
Redundancy	no automatic adjustment	no automatic adjustment
Synchronisation	NTP GPS	NTP GPS
Protocols	Unicast, Simulcast, Multicast	Unicast, Simulcast, Multicast
Input	AVTMux with Secure Streaming for up to 20 encoders	AVTMux with Secure Streaming for up to 20 encoders
Output	2 x EDI subchannel extraction EDI(ETI)	2 x EDI subchannel extraction EDI(ETI)
Software Encoder	-	-
Reconfigurationen	manual, scheduler	manual, scheduler
Configuration	Web browser HTML5	Web browser HTML5
PAD Inserter	via Audio Encoder (FTP)	via Audio Encoder (FTP)
NPAD Inserter	via EDI extraction	via EDI extraction
SI	TA (UECP), PTy, Announcements	TA (UECP), PTy, Announcements
Supported DAB data services	Dynamic Label(+) MOT Slideshow	Dynamic Label(+) MOT Slideshow
Monitoring	SNMP v1/v2c	SNMP v1/v2c
Power supply	external 12V power supply	integrated 100 – 230 V AC Optional: 2 nd 100 – 230 V AC power supply
Mains frequency	50/60 Hz	50/60 Hz
Power consumption	15 W	15 W
GPS input (SMA)	Impedance: 50 Ω GPS antenna with 25 dBi amplification required	Impedance: 50 Ω GPS antenna with 25 dBi amplification required
RF output (SMA)	Level: -40 dBm ... -3 dBm @ 50 Ω	Level: -40 dBm ... -3 dBm @ 50 Ω
RF input (SMA)	for later applications	for later applications
Dimensions (H x W x D)	3 x 11 x 17,6 cm	1U x 19" x 17,5 cm

MULTIPLXER

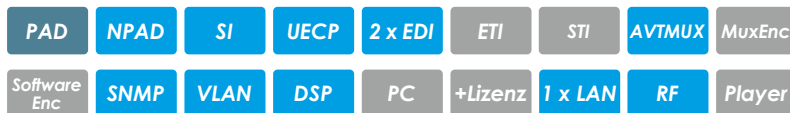
MAGIC DABMUX plus	MAGIC DABMUX Basic	MAGIC DABMUX Professional
ETSI EN 300401 V2.1.1	ETSI EN 300401 V1.4.1/V2.1.1	ETSI EN 300401 V1.4.1/V2.1.1
DSP hardware	Server PC Linux Ubuntu	Server PC Linux Ubuntu
3 x LAN GbE 9 IP addresses VLAN support	4 x LAN GbE (optional: 8 x LAN) multiple IP addresses VLAN support	4 x LAN GbE (optional: 8 x LAN) multiple IP addresses VLAN support
2 x USB 2.0 1 x SD Card Slot	-	-
with automatic adjustment	with automatic adjustment	with automatic adjustment
NTP	NTP	NTP
Unicast, Simulcast, Multicast	Unicast, Simulcast, Multicast	Unicast, Simulcast, Multicast
AVTMux with Secure Streaming for up to 25 encoders	MuxEnc with Secure Streaming	MuxEnc with Secure Streaming
4 x EDI subchannel extraction	Optional: EDI subchannel extraction	2 x EDI subchannel extraction
EDI(ETI)	EDI(ETI/STI)	EDI(ETI/STI)
-	optional: DAB/DAB+/Surround	optional: DAB/DAB+/Surround
manual, scheduler, external (SNMP, Ember+)	manual, scheduler, external (SNMP, RPC)	manual, scheduler, external (SNMP, RPC)
Web browser HTML5	Web browser	Web browser
yes or via Audio Encoder (FTP)	yes	yes
yes	yes	yes
TA (UECP), PTy, Announcements, Service Linking	all	all
Dynamic Label (+), MOT Slideshow, EPG, TPEG	all available services (acc. to list on page 32)	all available services (acc. to list on page 32)
SNMP v1/v2c	SNMP v1/v2c/v3	SNMP v1/v2c/v3
integrated 100 – 230 V AC	2 x integrated 100 – 230 V AC	2 x integrated 100 – 230 V AC
Optional: 12V power supply		
50/60 Hz	50/60 Hz	50/60 Hz
30 W	typical 100 W	typical 100 W
-	-	-
-	-	-
-	-	-
1U x 19" x 17,5 cm	2U x 19" x 85 cm	2U x 19" x 85 cm

ENSEMBLE MULTIPLEXER

MAGIC DABMUX Go RF Ensemble Multiplexer



MAGIC DABMUX Go



- DSP-based Ensemble Multiplexer
- 1 x GBit Ethernet
3 IP addresses
VLAN
- Configuration via web browser
- PAD insertion via Audio encoder (FTP)
- NPAD inserter for TPEG and SPI (EPG)
- Support of all other NPAD services
- Simplified program logo insertion
- Synchronization via NTP
- SNMP v1/v2c
- Manual reconfigurations
- Scheduled reconfigurations
- RF modulator + GPS synchronization
- Connection of up to 20 encoders possible
- Optional: 2nd power supply
(for RM version)

With the increasing interest in digital radio, even local radio, community radio and university radio stations ask for economic solutions for their program distribution via DAB+.

Our already existing professional Ensemble Multiplexers **MAGIC DABMUX Basic** and **MAGIC DABMUX Professional**, which are realised on a Server PC, offer almost all imaginable possibilities and display the DAB standard almost completely. Due to the high complexity and to cost reasons these systems are too complex for smaller program providers.

The also available Open-Source Version **ODR-DabMux** is free of charge, but requires a PC with Linux operating system and independent training and maintenance. Furthermore, the integrated FDK-AAC DAB+ Audio Encoder offers only a restricted Audio quality only in comparison with our professional Audio Encoders.

In interaction with our high-quality **MAGIC AE1 DAB+ Go** Audio Encoder and the new **MAGIC DABMUX Go** an economic alternative is available now.

MAGIC DABMUX Go RF is the smallest and only DSP-based Ensemble Multiplexer worldwide, thus providing high availability at an excellent performance. With **MAGIC DABMUX Go RF RM** there is also a 19" version that can be mounted in a rack.

Up to 20 program providers can be connected via external Audio Encoders. An installation of the Encoders directly in the studio avoids effectively an interference in Audio quality because of Codec cascading.

Special value was set on the easy configuration of the Ensemble Multiplexer, so that even users without DAB expert knowledge are able to set up the system. The configuration, operation and monitoring are effected via a HTML5-compatible web browser.

The highly compact DAB Ensemble Multiplexers facilitate a very simple Multiplex generation in accordance with standard ETSI EN 300 401. Despite its size, all features such as re-configuration (manually and scheduled), extraction of Sub Channels of other Multiplexers, integration of PAD and NPAD data services, creation of Service Information etc. are integrated.

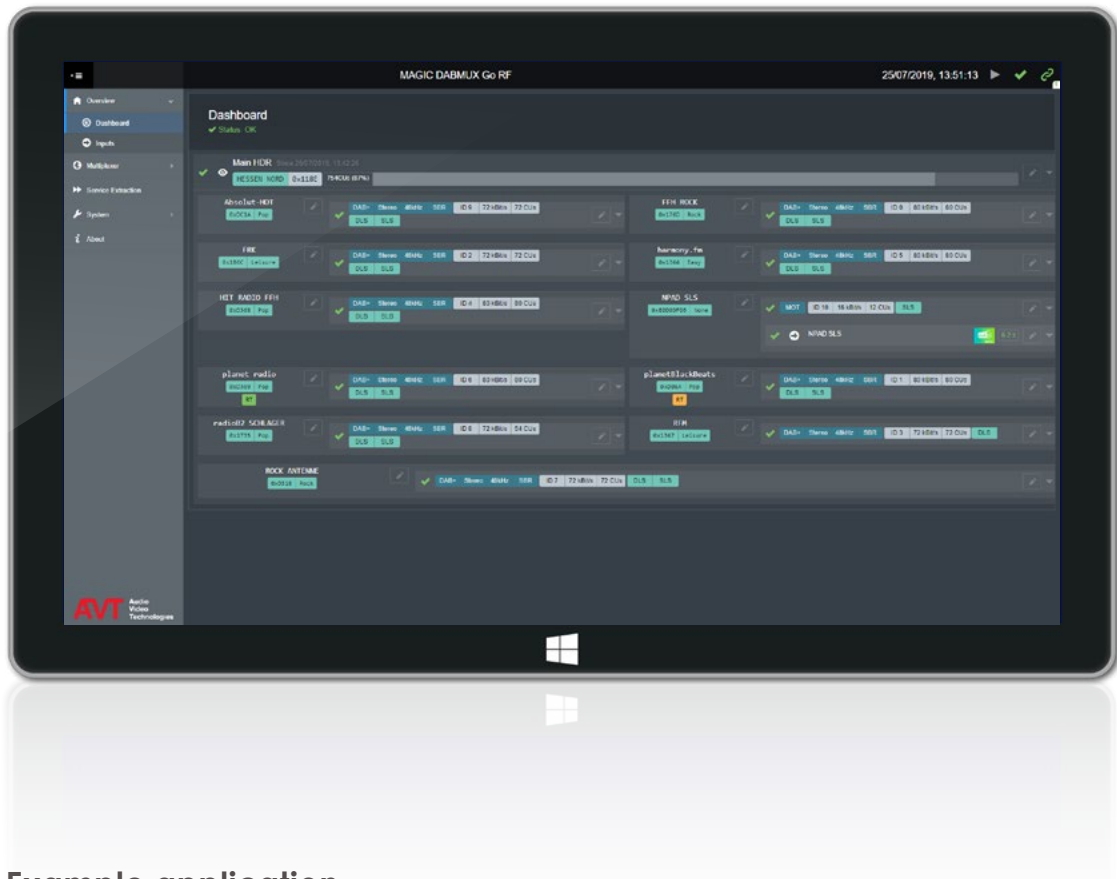
Audio Services can be supplied via the AVTMUX or the EDI(E-TI) protocol from external Multiplexers. As output signal both Multiplexer variants supply an EDI signal for transmission to the transmitters. With the integrated modulator, you can alternatively activate a power amplifier directly. This possibility is particularly of interest if you have only one transmitter site. The synchronisation is effected via NTP or via the integrated GPS receiver.

In general, all announcements (except OE announcements) are supported according to ETSI TS 101 756.

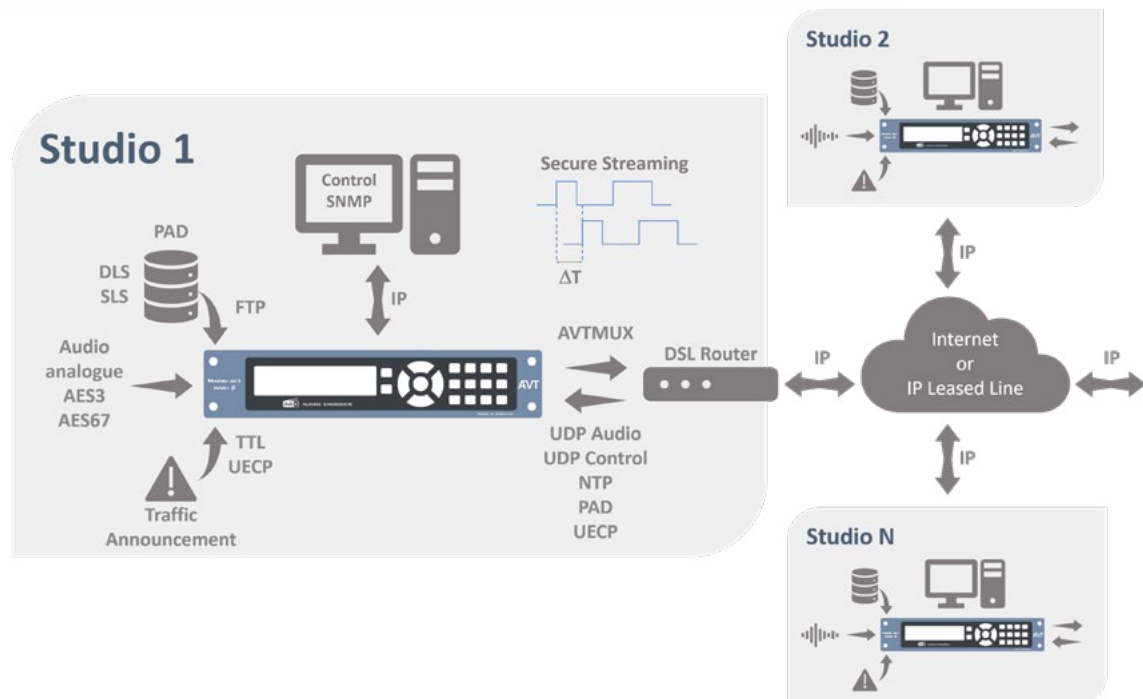
The RF input is intended for future applications. An external alarm can also be triggered via SNMP. The system has a GBit Ethernet network interface, which allows the configuration of up to three IP addresses as well as VLANs.

ENSEMBLE MULTIPLEXER

MAGIC DABMUX Go Web Browser Application



Example application



Options

- Emergency Warning Break-In Upgrade

The EWB upgrade, besides setting the correct announcement flag, enables the simultaneous replacement of all audio content by an emergency announcement. This ensures that the announcement is audible even with older receivers. One additional MAGIC AE1 DAB+ Go or MAGIC AE4 Audio Encoder is required as emergency audio source.

- Cable Upgrade

An additional operating mode for cable networks is offered with the Cable Upgrade. The EDI input signal is analyzed. The EDI output signal can be reformatted, the protection level and the service label can be changed.

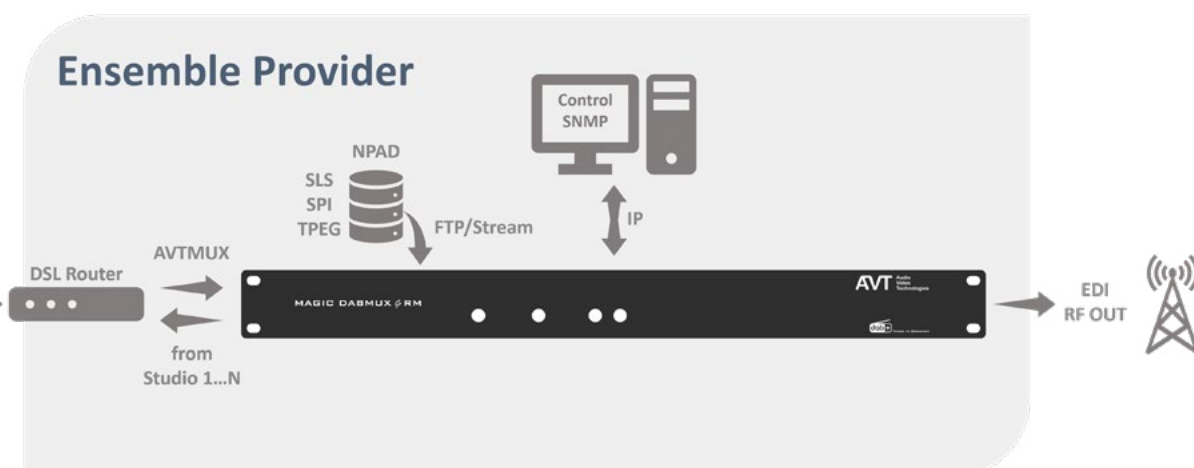
- Redundant power supply

For the full 19" version, a second integrated power supply is optional available as redundancy.

- MAGIC DABMUX Plus Upgrade

The system can be extended with the features of the MAGIC DABMUX plus multiplexer via software upgrade:

- Output: 4 x EDI (ETI) Simulcast
- Automatic Encoders and Multiplexer Redundancy
- 4 x integrated NPAD inserter
- 4 x EDI input incl. automatic service extraction
- Support of Service Linking, Dynamic Linkage Set Activation
- Integrated PAD inserter: SLS,DL(+)
- Connection of 25 encoders (with redundancy)

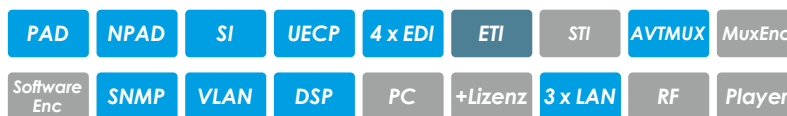


ENSEMBLE MULTIPLEXER

MAGIC DABMUX plus Ensemble Multiplexer



MAGIC DABMUX plus



- 19" x 1 U housing
- DSP hardware, no PC is required
- Coloured display
- 3 x GBit Ethernet
9 IP addresses
VLAN
- 2 x USB 2.0
- 1 x SD card slot
- EDI, optional ETI module
- Internal wide range power supply
- Redundant power supply via external 12V power supply
- Synchronisation via NTP
- Up to 25 Encoder on the input can be connected
- AVTMUX protocol with Secure Streaming for remote sites
- EDI input for subchannel extraction
- EDI input for Audio Encoder
- PAD Inserter for DLS(+) and SLS/ categorised SLS or alternatively PAD insertion via Audio encoder (FTP)
- NPAD inserter for TPEG and SPI (EPG)
- Support of all other NPAD services
- Simplified program logo insertion
- Full remote control of all encoders
- HTML5 web browser interface
- SNMP v1, v2c
- Redundancy support

The MAGIC DABMUX plus complements the DAB multiplexer family and offers the best of the Go and the Basic/Professional multiplexers. While the Go Multiplexer is intended for DAB beginners and the Basic and Professional multiplexers based on the Fraunhofer Content Server cover almost all features of the current DAB standard, the MAGIC DABMUX plus can be used for small-scale solutions as well as for high-end systems: MAGIC DABMUX plus combines significantly more computing power with a simple configuration.

The device is realized as a 19" x 1U system with integrated power supply and a redundant 12V power supply. The reliable signal processor-based system has three Gbit Ethernet interfaces which allow the configuration of up to three IP addresses per interface as well as VLANs. The system also provides 2 x USB 2.0 interfaces and an SD card slot for further applications. Via a module slot, the system can optionally be expanded with an **ETI E1/2-Mbit** or a **dual Ethernet module**. The system has a graphical, coloured display, but a more comfortable control, monitoring and very simple configuration is possible via a **HTML5-compatible web browser**.

Up to 25 program providers can be connected via external Audio Encoders. An installation of the Encoders directly in the studio avoids effectively an interference in Audio quality because of Codec cascading.

The main difference to the Go Multiplexer is its automated use in **redundant headends**, which the DABMUX plus supports.

In addition, the system offers dynamic reconfigurations (manual or scheduled), an integrated PAD/NPAD inserter, sub-channel extraction via EDI with simplified selection through analysis of the incoming signal, announcement support, service linking support, simplified provision of the program logo via SPI (EPG), audio encoder and multiplexer redundancy, etc.

In general, all announcements (except OE announcements) are supported according to ETSI TS 101 756.

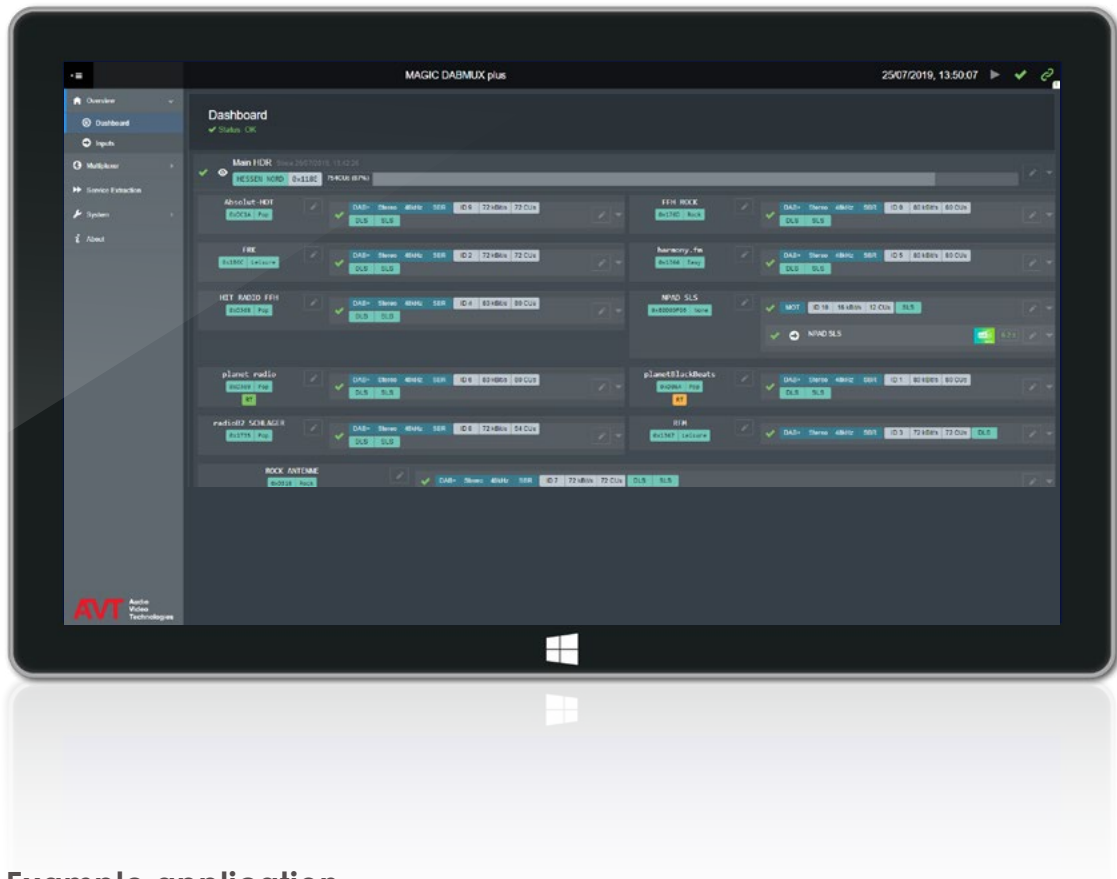
As a special feature, the Emergency Warning Break-In upgrade of DAB is optionally supported, which in addition to emergency signalling also enables the replacement of all audio content by an emergency announcement. This ensures that the announcement is audible even with older receivers.



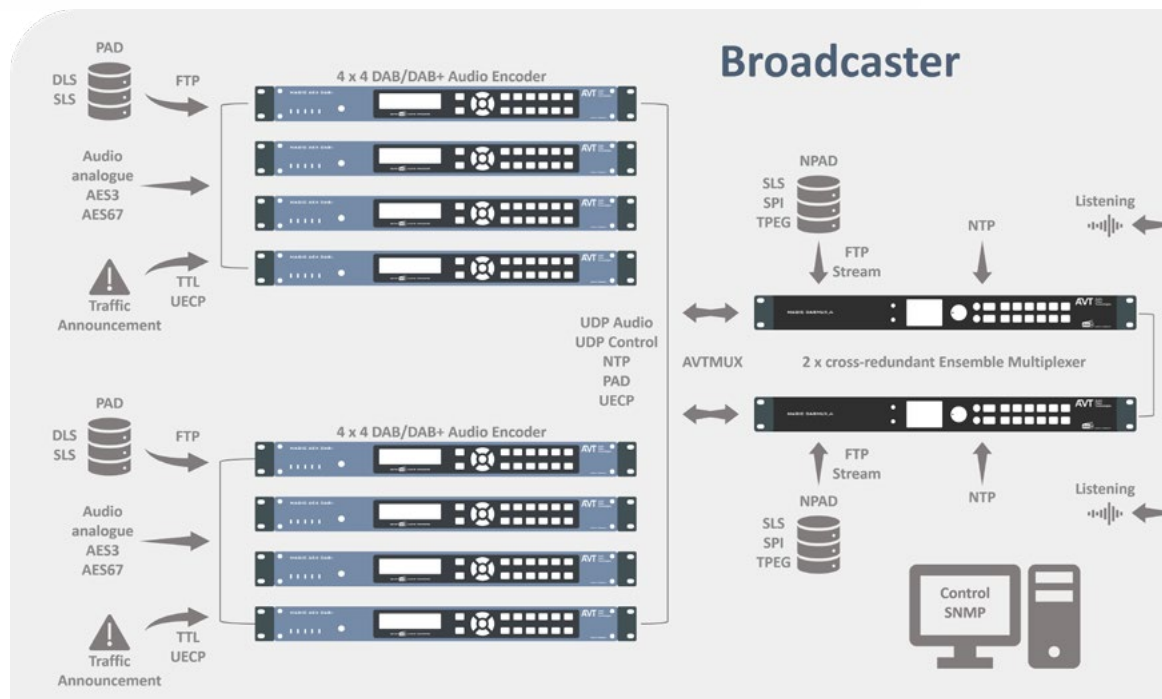
MAGIC DABMUX plus – Rear side

ENSEMBLE MULTIPLEXER

MAGIC DABMIX Plus Web Browser Application



Example application



Options

- Emergency Warning Break-In Upgrade

The EWB upgrade, besides setting the correct announcement flag, enables the simultaneous replacement of all audio content by an emergency announcement. This ensures that the announcement is audible even with older receivers. One additional MAGIC AE1 DAB+ Go or MAGIC AE4 Audio Encoder is required as emergency audio source.

- Cable Upgrade

An additional operating mode for cable networks is offered with the Cable Upgrade. The EDI input signal is analyzed and can be accepted with a key click. The EDI output signal can be reformatted, the protection level and the service label can be changed.

- ETI Module

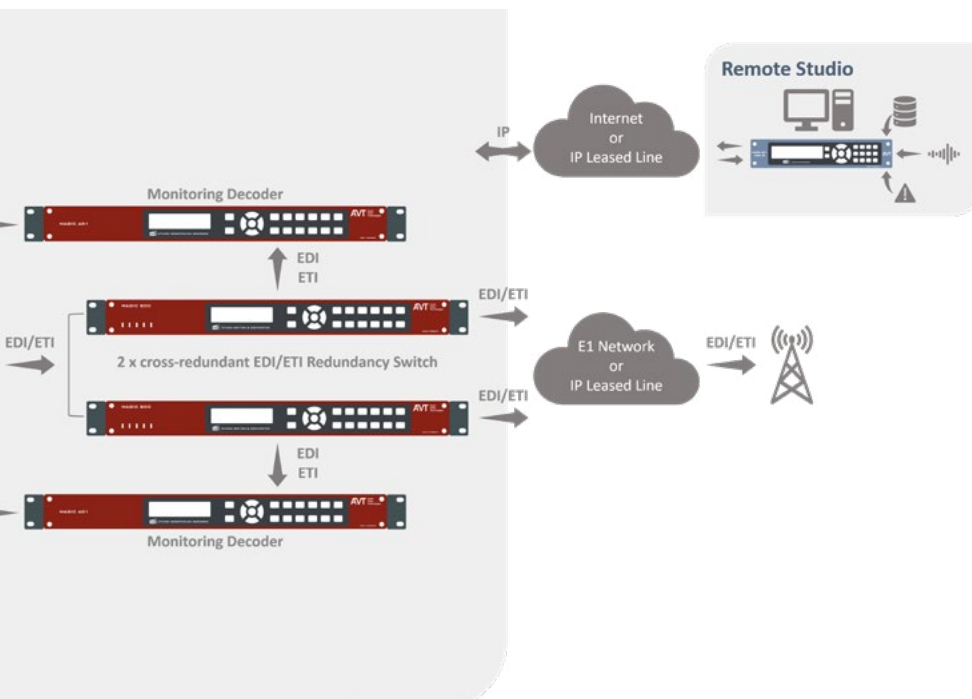
Via a module slot, the system can optionally be expanded with an ETI 2-Mbit module. In case of device failure, the ETI input is connected to the ETI output via a relay.

- Dual LAN Interface Module

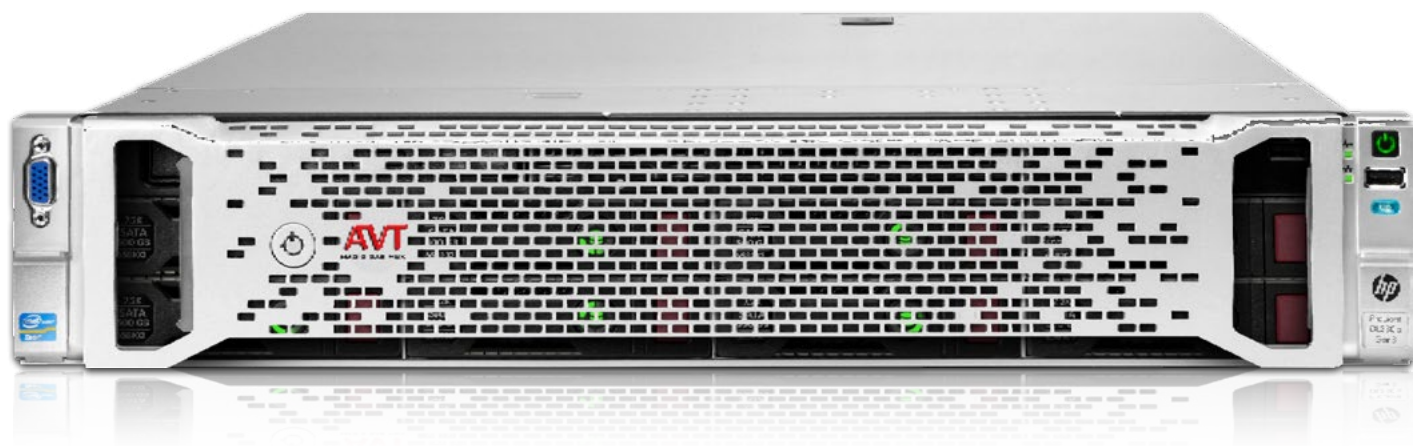
Optional the system can be extended with two additional 100Mbit Ethernet interfaces. The assignment of functions is freely configurable. The system then has a total of 5 LAN interfaces.

- Redundant power supply

With the optional 12V adapter a redundant power supply is available.

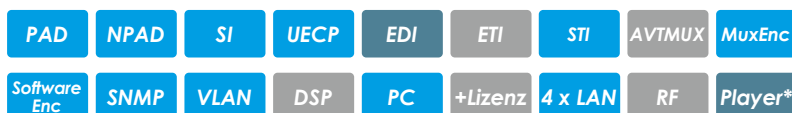


MAGIC DABMUX Basic & Professional Multiplexer

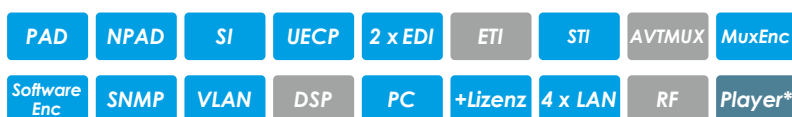


Based on Fraunhofer
ContentServer technology

MAGIC DABMUX Basic



MAGIC DABMUX Professional



- Server-PC-based Service & Ensemble Multiplexer
- Support of almost all features contained in the DAB standard
- Multiple redundancy
- Standard STI (D+C)
(STI to one multiplexer)
- Extended STI (D+C)
(STI to multiple multiplexers)
- Synchronization via NTP
- Connection of external audio encoders
- Support of internal software audio encoders
- Support of DAB Surround
- Journaline®

* Multimedia Player licence included for two years free of charge

MULTIPLEXER

The Ensemble Multiplexers **MAGIC DABMUX Basic** and **Professional** are based on the Fraunhofer ContentServer technology and offer a highly available professional DAB Digital Radio platform (Eureka 147 DAB).

The system supports all possible content and signalling options offered by DAB.

For integration into transmission networks, the system relies on modern IP technology, which enables a simple and cost-effective connection of all DAB system components such as encoders and Monitoring Decoders.

The multiplexer is only synchronized via NTP from a GPS-synchronous NTP server and can distribute the NTP to all remote audio encoders.

Thanks to the FhG MuxEnc protocol used, secure transmission between remote audio encoders and the multiplexer over long distances is possible without packet loss. In addition, this enables configuration, PAD transmission and monitoring of the remote hardware encoders. Alternatively, the encoders can also be connected via EDI if required.

In addition to the MAGIC hardware encoders, software encoders can also be used which can be operated on the Ensemble/Service Multiplexer. This option can be more efficient if many programs are already located at the location of the multiplexer. The connection of the audio sources is realized via external AXIA Livewire nodes.

Of course, it is possible to mix local software and remote hardware encoders.

The software multiplexer and the software encoders run on a server PC based LINUX Ubuntu platform.

Pre-installed complete systems (preferably HP servers**) or just the licences, which can be installed on own server PCs (compliant with specifications) are available.

The system can also be used as a service multiplexer to generate a pre-multiplex of all audio and data services locally.

The multiplexed data stream is then transmitted to the Ensemble Multiplexer via IP using the STI interface (Service Transport Interface).



The STI standard offers the great advantage that reconfigurations are transparently forwarded to the Ensemble Multiplexer so that a service provider can perform reconfigurations independently.

Each system variant offers the basic possibility of redundant operation with one or even several redundant multiplexers.

Both systems offer the unique option of optional DAB surround sound coding.

The multiplexer is operated via a web browser.

Options for both system variants

- The DCP MONITORING upgrade provides a detailed network analysis of the input signals (EDI and FhG MuxEnc). This option is especially useful when using remote audio encoders.
- The option ETI/STI/EDI/RDI ANALYSER/CONVERTER additionally allows a bit-accurate analysis (and conversion) of the mentioned formats.
- DAB Software Audio Encoder
- DAB+ Software Audio Encoder

Further options are available depending on the variant.

** The multiplexer hardware is based on standard server architecture. This server is for reference only and it is subject to change depending on actual server model availability from server manufacturers.

MAGIC DABMUX Basic Multiplexer

The **Basic** version of the Ensemble Multiplexer comprises all standard features for a classic DAB Ensemble including data services such as **Slideshow** and **Journaline®**.

The **license** for operating the multiplexer is delivered on a **USB dongle**.

Alternatively, a hardware-dependent **software license** can also be provided - but not both variants at the same time. The latter is reserved exclusively for the MAGIC DABMUX Professional version.

The Basic version includes a 24-month license for free use of the **Multimedia Player**.

Specific package options

- DATA Upgrade (TPEG and DL/DL+ via UECP)
- DATA PRO Upgrade (TPEG, DL/DL+ via UECP, BWS, TII/Region Editor and Live Socket API)

In addition, all functions of the Professional version are optionally available.

The BASIC Features in detail¹

- Firewall Professional
- Automatic leap second handling
- System checks (continuous self-monitoring)
- System config backup (at console)
- SNMP interface
- Security Summary (network config overview)
- Unlimited simultaneous multiplex output configuration definitions
- Broadcast scheduler (weekly/calendar)
- Announcement support (via UECP, HTML interface, FHT, LTP)
- AFS - Alternative Frequency Editor
- Support of external Audio Encoders (FhG MuxEnc)
- Dynamic Labels
- Dynamic Labels Plus (DL Plus), Intellitext
- Journaline®
- MOT Slideshow
- EPG - Electronic Programme Guide
- Support for multiple transmission priority classes
- Import via file FTP upload
- RSS/atom sources (Journaline®) import

¹) Details of the features are given in the appendix p. 42 ff.

MAGIC DABMUX Professional Multiplexer

The **Professional** version of the MAGIC DABMUX Ensemble Multiplexer offers all available functions of the Basic version.

The license for using the multiplexer is delivered in this variant as a hardware-dependent **software license** as well as a **USB dongle**.

The big advantage is that it is possible to activate redundant server hardware with the USB dongle within a few minutes in case of system failure.

In addition, the USB dongle can be used - but only for test purposes - to try out new releases and test new configurations in parallel to the actual on-air system.

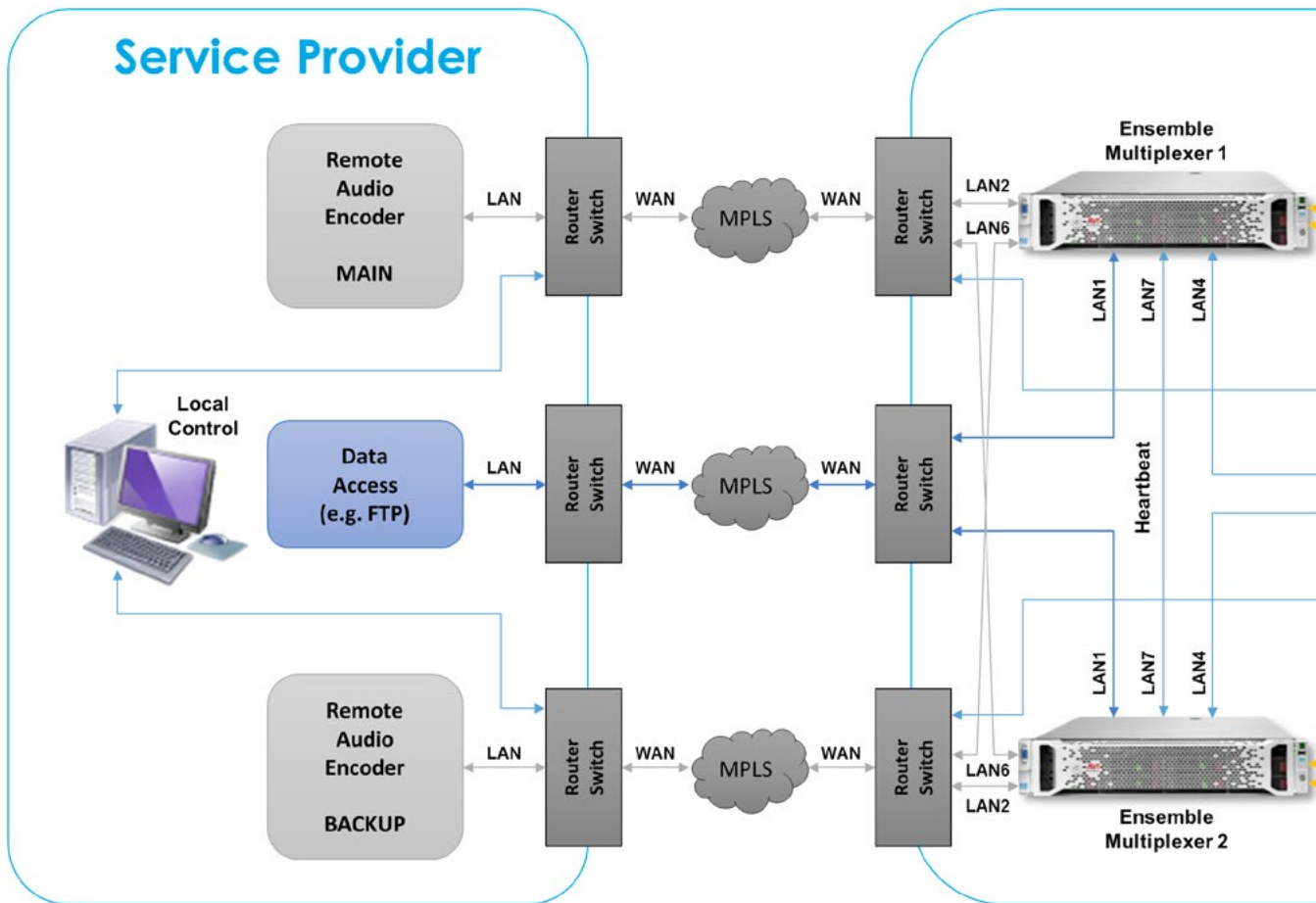
The Professional version also includes a 24-month license for free use of the **Multimedia Player. Remote & Recording** can also be used free of charge for two years.

The PROFESSIONAL Features in detail ¹

- Support for serial devices (GPS receiver, modem etc.)
 - System configuration remote up-/download
 - Email reports
 - Remote System Update
 - DCP Monitor
 - Redundancy Group Feature
 - Audio Cross Redundancy
 - STI-C Input/Output
 - Extended STI-C (xSTI-C)
 - 2 x EDI (ETI or STI-D) Inputs for subchannel extraction
 - TII & Region Definitions Editor
 - Extended Broadcast Information
 - Multiplexer output Live Monitoring/statistics
 - Multiplexer output EDI/ETI/Subchannel Recording
 - Live Audio input Analogue/Digital/Livewire/RAVENNA/AES67
 - Audio input as MP3/WAV, Playlist
 - Silence/Clipping detection and configuration
 - Local Audio backup source
 - Audio Input Amplification/MP3 Normalization
 - Dynamic changes to the program type (PTy)
 - Dynamic change of the currently active service link set
 - Dynamic change of announcement signalling
 - Other Ensemble Announcements (not available)
 - Service Information Signalling
 - Announcements for services, provided by a service multiplexer
 - Surround Sound Option incl. SX Pro
 - MOT Broadcast Website/Transparent file transfer
 - TMC – Traffic Message Channel
 - IP Insertion
 - TDC – Raw Data
 - DAB – FIC data keying (FIDC, SI, CA)
 - Import via HTML interface (Web-GUI)
 - Import of existing RSS/Atom sources (Dynamic Labels/Text Messages)
 - Import from existing RSS/Atom sources (Journaline)
 - Import via HTTP/FTP Mirroring
 - Import via Live Socket connection (API)
 - Import of UECP, Zenon, radio house telegram, line protocol (Dynamic Label/Text Messages & Journaline)
 - Automatic time-controlled mirroring option
 - Data import via secure connections
 - JSON/XML-RPC Import
 - JSON/XML-RPC Administration
 - Streaming Audio source
 - EWF – Emergency Warning Function
 - DCP Monitoring (Network analyzer)
 - Webstreaming Upgrade
 - Audio Backup Upgrade
-

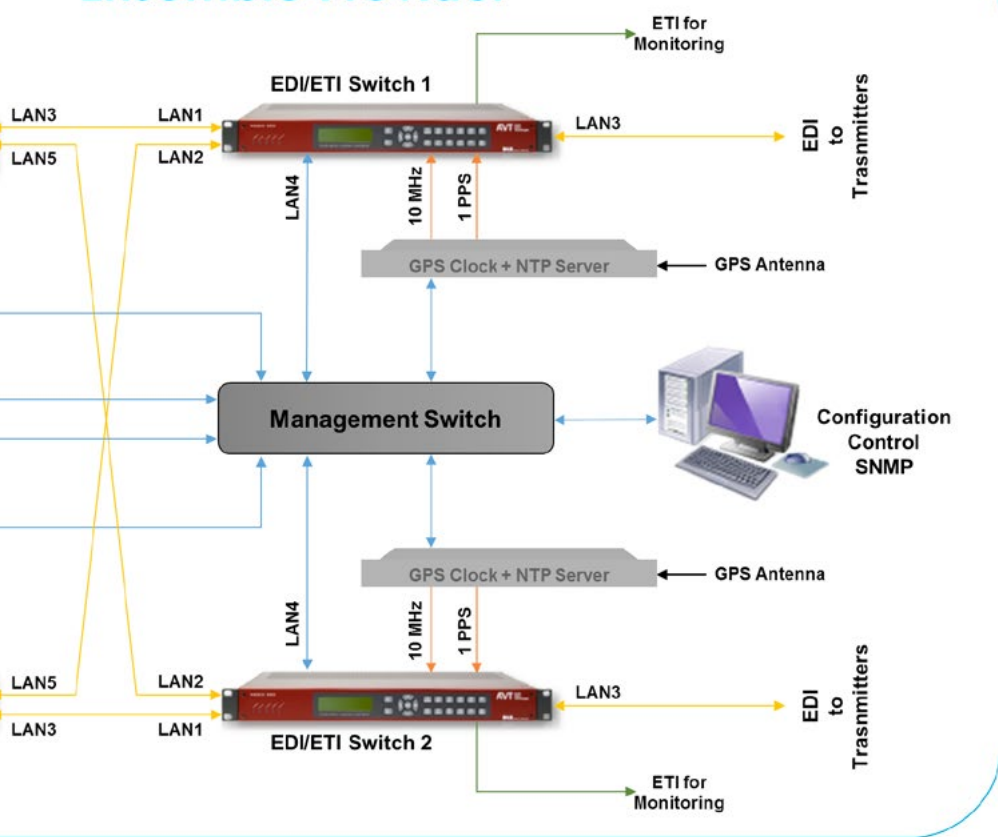
SERVICE & ENSEMBLE MULTI

Full redundant DAB Headend



MULTIPLER

Ensemble Provider



CONVERTER

MAGIC EEC ETI/EDI Converter



MAGIC EEC



MAGIC EEC with Monitoring



- ETI → EDI and EDI → ETI conversion
- 2 x LAN interfaces
- Optional: LAN 3/4 Upgrade
- Monitoring Output
- SNMP v1/v2c
- VLAN support
- GPIO contacts
- Graphical display
- Optional: redundant power supply

The **MAGIC EEC** allows the conversion from ETI to EDI and EDI to ETI signals.

Typical applications are Ensemble Multiplexers, which cannot generate an ETI signal anymore (e. g. Fraunhofer ContentServer), but which must be fed to the transmitter via E1 lines with ETI or Ensemble Multiplexers, which only have ETI inputs/outputs (e. g. Rohde & Schwarz DM001), but which are to be fed via IP lines with EDI.

The system has **two LAN interfaces** by default. These are freely programmable in terms of functions, configuration, monitoring, SNMP and EDI input/output.

The **ETI interface** has one G. 703/G. 704 input/output each.

The system is configured via the **PC software** included in the scope of delivery and displays the status of the ETI or EDI input data streams and all system parameters in a very clear manner.

All events are stored in the device in a log file, which can be retrieved via the PC software or alternatively stored in a network folder.

MAGIC EEC supports SNMP v1/v2c protocol for connection to up to four independent network management systems.

In addition, alarm messages can be output via eight potential-free and programmable contacts. Alternatively, eight programmable TTL GPIO contacts are available.

Options

- Monitoring output

A second ETI module can be optionally equipped, which means that an additional unrestricted ETI output is available. This can be used, for example, as a monitoring output or to supply a redundant Ensemble Multiplexer.

- SDC Upgrade

The optional SDC upgrade allows a MAGIC EEC system to be upgraded to a full-featured MAGIC SDC Switch & Converter.

- Dual converter mode

With this upgrade MAGIC EEC has two independent ETI/EDI converters. For the Dual Converter mode you need a MAGIC EEC with monitoring output (second ETI module).

- LAN 3/4 Upgrade

Optional extension with two additional Ethernet interfaces. The assignment of functions such as EDI, SNMP etc. is freely configurable. However, a second EDI module can then no longer be assembled.

- Redundant power supply

With the optional 5V adapter a redundant power supply is available.



MAGIC EEC with redundant power supply (above), MAGIC EEC with monitoring (below) – Rear side

SWITCH & CONVERTER

MAGIC SDC ETI/EDI Switch & Converter



MAGIC SDC EDI Switch & ETI Converter

EDI 1 x ETI SNMP VLAN 4 x LAN DSP

MAGIC SDC EDI Switch

EDI ETI SNMP VLAN 4 x LAN DSP

MAGIC SDC ETI/EDI Switch & Converter

EDI 2 x ETI SNMP VLAN 2 x LAN DSP

- Seamless switch for redundant Ensemble Multiplexers
- Switching EDI or ETI inputs
- Output signal EDI or ETI
- Up to 4 x LAN interfaces
- EDI/ETI monitoring output
- SNMP v1/v2c
- VLAN support
- GPIO contacts
- Graphical display
- Optional: redundant power supply

The **MAGIC SDC** enables trouble-free switching of a redundant DAB multiplexer system. To achieve this, continuous time information must be transmitted to a downstream DAB transmitter. Jumps, for example in the time stamp, or even missing time stamps cause a considerable loss of the transmission, since the transmitter would have to synchronize completely again.

With the MAGIC SDC, the output signal of each DAB multiplexer is permanently monitored. If an error is detected in a multiplex, the system automatically switches to the redundant input. The timestamp can be regenerated in the output signal of the switch, so that a continuous timestamp is guaranteed at the transmitter. The switching criteria as well as the switching behaviour (monostable, bistable) can be freely defined by the user.

The system can be used as a classic ETI switch for E1 G. 703/G. 704 lines or optionally as an EDI switch for IP networks.

If the EDI option is available, the system also enables conversion from EDI to ETI and vice versa, so that DAB multiplexers that no longer support a native ETI can still be integrated into the existing ETI infrastructure.

The system is configured via the **PC software** included in the scope of delivery and displays the status of the ETI/EDI input data streams and all system parameters in a very clear manner. The software can also be used to manually switch the input for e. g. service purposes. All events are stored in the device in a log file, which can be retrieved via the PC software or alternatively stored in a network folder.

MAGIC SDC supports SNMP v1/v2c protocol for connection to up to four independent network management systems.

The two or four available LAN interfaces are freely programmable in terms of configuration, monitoring, SNMP and EDI input/output.

MAGIC SDC is available in **different versions**. The system can be delivered with either four LAN interfaces and one ETI input/output or with two LAN interfaces and two ETI inputs/outputs. A pure EDI version is also available.

Optionally an external 5V power supply is available as **redundant power supply**.



MAGIC SDC EDI Switch & ETI Converter (above), MAGIC SDC ETI/EDI Switch & Converter (below) – Rear side

MAGIC AD1 ETI/EDI Decoder



MAGIC AD1



- ETI Decoder (NA, G. 704 and NI, G. 703)
- EDI Decoder (optional)
- Integrated DAB & DAB+ Decoder
- Simultaneous monitoring of all Audio sub-channels in the ETI signal
- Listening to one audio signal (expandable to multiple decoders)
- Analogue and digital AES3 output
- Additional headphone output
- Two relays and six GPIO contacts for external signalling
- Integrated level monitoring
- PAD monitoring
- NPAD monitoring (not Enhanced Packet Data)
- TA monitoring
- PTy information
- Integrated error memory with date and time
- Convenient configuration and monitoring software
- Control via LAN (optional second LAN interface)
- SNMP v1/v2c

The **MAGIC AD1 ETI** decoder enables monitoring of the DAB transmission signal at any location in the ETI/EDI distribution network.

The system can either be patched in directly to the ETI (NA, G. 704 and NI, G. 703) 2-Mbit/s signal to be monitored or connected parallel to the signal. Optionally, the connection can also be made via EDI. In case of failure of the device, the 2-Mbit-connection is bridged via a relay.

All audio programs contained in the ETI/EDI stream are monitored, whereby one of the programs can be decoded and listened to.

Additional ETI decoders can be cascaded via the 2-Mbit/s output so that several programs can be decoded at the same time.

The audio signal can be output in analogue and digital (AES3). There is also a headphone output.

The display shows all available programs as a list. Switching between the audio programs is done by simply pressing a button on the device. All relevant information on the currently selected programme can be retrieved.

Two relays and six GPIO contacts are available for external signalling.

In addition, all alarms can be stored internally in the system with date and time without PC.

The integrated LAN interface allows the system to be controlled and monitored. SNMP is also used to integrate the system into a network management system.

With the EDI option, an EDI signal can be transmitted via the LAN interface.

The possibility of extracting any program from the DAB ensemble allows a cost-effective audio program feed for non-DAB applications without the need to use additional transmission lines. This allows FM audio programs to be transmitted to station locations and audio programs to be fed into cable networks.

The supplied **Windows PC software** enables detailed error monitoring, decoding of the ETI data stream and reading of the error memory. All relevant information, such as 2-Mbit alarms, number of subchannels, subchannel types, etc., are displayed in a very clear way.



MAGIC AD1 with and without LAN2 extension – Rear side

DAB ANALYSER

DAB-XPlorer DAB Analyser



DAB-XPlorer



- Modular system consisting of hard- and software tools
- Hardware ETI interface and receiver hardware available
- Analysis of DAB multiplex on ETI, EDI and RDI signal
- Measuring of synchronism in SFNs
- Recording of ETI files from on-air signals via RDI
- ETI analysis for broadcasters
- Transmitter setup
- Coverage measuring
- SFN test
- Test of transmitter components
- Receiver test

The DAB-XPlorer is used for the analysis of data streams in DAB networks. The Ensemble Transport Interface (ETI) according to ETS 300 799 and the Receiver Data Interface (RDI) according to EN 50255 are supported.

The DAB-XPlorer allows a continuous real-time monitoring of the transport streams and indicates every alarm during the transmission.

Additionally, in parallel to the analysis, a simultaneous recording and playback of complete data streams is possible.

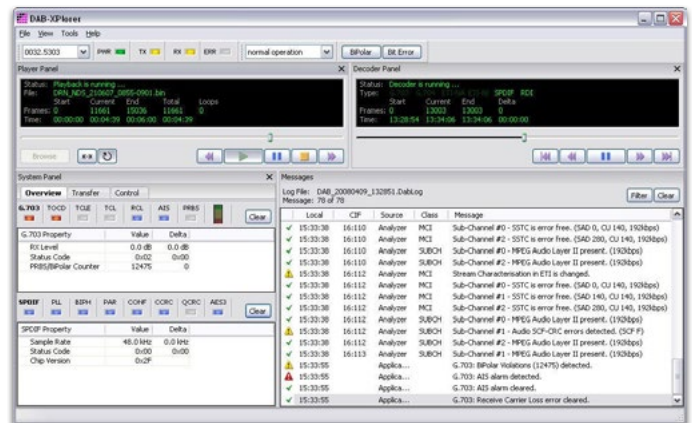
If you use this analysing tool with its fast localisation of errors in the transport stream, the operating effort in the DAB programme transmission network will be considerably reduced.

Preferably, it is used between Ensemble Multiplexer and COFDM sender.

Because of its dimensions and its light weight, the DAB-XPlorer is especially suitable for mobile use. The robust aluminium die-casting housing withstands even the rough field conditions

The DAB-XPlorer is available in two versions:

- USB Software Dongle for EDI input/output
- External USB Adapter for G.703 and SPDIF signals, integrated in a robust aluminium die-casting housing. The adapter is powered via the USB interface. The systems can be controlled via a Windows user-friendly graphical user interface (GUI).



The DAB-XPlorer software application is modular. The following tools are available:

- Ensemble Viewer
- ETI-XPlorer
- FIC-XPlorer
- Message Viewer
- Option: DAB+ Decoder / FEC / Streaming (EDI)
- Option: FIC-XTractor
- Option: PRBS-Analyzer
- Option: Recorder / Player / Timeshift Buffer
- Option: RDI-ETI-Converter
- Option: GPS-Campaign-Converter
- Option: Triggered Recorder



DAB-XPlorer – Rear side

RECEIVER & ANALYSER

DABRF Receiver & Analyser



DABRF



- Test receiver and modulator rolled into one
- RF recording with 1.6 MHz bandwidth
- Can be combined with software components of the DAB-XPlorer family
- COFDM modulator for simultaneous generation of up to four DAB blocks
- GPS receiver integrated
- Gigabit Ethernet interface
- Recording and analysing DAB signals
- Capturing of ETI files from on-air signals
- Coverage measuring
- SFN analysis
- COFDM modulator for receiver testing

The DABRF device was developed as core component of the tunnel break-in system, MAGIC TBR, that, in the event of a disaster, allows to supply a street tunnel with live warning messages via digital radio.

All digital signal processing functions are implemented in one powerful DSP and one FPGA. A Gigabit Ethernet interface and 512 MByte internal memory enable a wide-band connection between the DABRF and a PC or other external system components. The so created device is versatile and suitable for other applications as well.

In particular the DABRF replaces the established DAB test receiver, UEB400-DXP, within the DAB-XPlorer family. The DABRF offers great extensions of the powerful analysis tools of the DAB-XPlorer suite. It will support the already known functions:

- Recording of ETI data streams from a received on-air signal
- Multiplex analysis
- Coverage measuring with bit error rates and RF level,
- SFN analysis

Additionally, it will enable the following new functions to be realized by software extensions:

- RF recording in form of I/Q samples at a bandwidth of 1.6 MHz
- Replay of the recorded RF signal with a high dynamic range
- Simultaneous COFDM modulation of up to four different ETI or EDI data streams to four DAB blocks laying within a 37 MHz wide RF band
- Advanced RF analysis of the received signal, i.e. MER, inband spectrum, constellation diagram, channel impulse response etc.



DABRF – Rear side

TUNNEL BREAK-IN SYSTEM

MAGIC TBR Tunnel Break-In Rebroadcast System



MAGIC TBR



- DAB Receiver/Demodulator
- DAB Modulator/Repeater
- No GPS for synchronisation necessary
- An emergency announcement replaces all DAB/DAB+ programs at the same time
- Integrated Monitoring Decoder
- Flash Memory for announcements and PAD (Dynamic Label and Slideshow)
- Support of EWF
- 2 x analogue Audio inputs/outputs
- 4 x digital Audio inputs/outputs
- Headphones output
- 2 x Ethernet interfaces (for control, monitoring, SNMP and optional VoIP)
- Programmable GPIOs (8 x TTL, 8 x Relays)
- Clock inputs for future extensions
- Optional: Break-In via VoIP
- Optional: additional RF module for second Ensemble

The **MAGIC TBR Tunnel Break-in Rebroadcast** system is a DAB+ repeater and at the same time a Voice Break-in system in a 19" housing with only 2U, realized on a signal-processor based hardware platform.

The standard system has a **demodulator/modulator module** for one Ensemble. If required the system can be equipped with a further module for a **second Ensemble**. Both Ensembles are completely independent from each other – a separate break-in is also possible.

To cover all possible encoder scenarios for replacing all audio programs within an ensemble during an emergency announcement, three encoders per ensemble are integrated (with an extension module corresponding six encoders).

The entire multiplex is completely replicated and replaced frame-synchronously.

This technique was developed by the company Ingenieurbüro Mulka and applied for a European patent.

From the view of a DAB radio a continuous signal is received in terms of data rate, sampling frequency, error protection, but also CIF Counter, time etc. In this way it is guaranteed that the DAB receiver does not lose the synchronisation or even re-scans the DAB band.

If a driver hears another medium (e. g. CD) the receiver can be automatically switched to DAB mode by means of a suitable alarm signalling (if this is supported by the receiver).

The integrated flash memory allows the storage of prepared slideshows and dynamic labels as well as periodic repeating **information announcements**. These announcements can be activated automatically via a scheduler.

As not all tunnels are permanently staffed, it is possible to use VoIP telephony as an alternative to conventional analogue and digital audio interfaces. This can be used, for example, to connect to the tunnel from any mobile phone. For security reasons, **VoIP break-in** is protected by a PIN code or an access number list.

In parallel, PAD data in the form of a Slideshow and/or as Dynamic Label can be transmitted so that the respective information can also be presented visually.

The complete Ensemble can be monitored via a Monitoring Decoder.

In the standard operation mode the system functions a classic **repeater**. The DAB Ensemble is received by an antenna outside the tunnel, is filtered digitally and processed. Via the tunnel antenna the signal is broadcasted again.

A **GPS signal** is not required for this function. However, inputs are available for future extensions.

During the repeater operation the received Ensemble is analysed permanently to always have the current Multiplex Configuration Information (MCI) available – even after reconfigurations.



MAGIC TBR equipped with two RF modules – Rear side

Feature List MAGIC DABMUX Basic & Professional

- **Support for serial devices (GPS receiver, modem, etc.)**
Permits to connect serial devices to the ContentServer. These devices can e.g. be Meinberg GPS16x/GPS17x GPS receivers, some APC uninterruptible power supplies, serial data feeds (e.g. fed into a transparent data channel) or some modems.
- **System configuration remote up-/download**
Permits to create new backups of the current system configuration, and to restore previous backups. In addition, system configuration backup files can be downloaded or uploaded via the Web interface. A system configuration includes all system and broadcast related settings of the ContentServer, including network and redundancy group settings, Content Provider definitions, Multiplex configurations and schedules. In case of a hardware failure of a ContentServer, a previously downloaded system configuration can be used to quickly set up the replacement hardware with exactly the same settings.

Note: Uploaded content files such as Journaline and EPG XML files or Slideshow images are not part of the backup files and may need to be re-uploaded after restoring a backup on a new hardware; however, content to be mirrored or downloaded by the ContentServer from external servers is automatically restored.
- **E-mail reports**
Permits to automatically send e-mails to the administrator(s) of the ContentServer in case of system errors or warnings, e.g. if a hard disk fails, a network error is detected or data provision of a Service Multiplexer fails. The e-mails include a reference to the affected system as well as an error description. New e-mails are generated whenever the system error level changes, e.g. from OK to warning, from warning to error, or from critical error to OK. The type of system checks that potentially may trigger an e-mail report can be configured.

In addition, it is also possible to configure e-mail reports for individual Content Providers. I.e. an e-mail report is sent directly to an external Content Provider if its data upload fails or if audio provision via an internal or remote Audio Encoder fails. This type of notification is particularly valuable for live insertion of data (including audio sources) and import methods that run automatically without manual user interaction (such as RSS feeds).
- **Remote System Update**
Permits to update or upgrade the ContentServer system to the latest software release conveniently via the Web interface and without a need for physical access to the ContentServer.

The new system image can either be uploaded manually from the local PC via the Web interface, or be copied by the ContentServer directly from an external FTP/http server by providing the download-URL. Once the new system image is correctly stored on the ContentServer, the update procedure can be triggered as a second step at any time. The full system configuration and any uploaded content is preserved during the update process; however, the update will temporarily interrupt the generation of the broadcast signal. After the update process has finished, broadcast signal generation will resume.
- **DCP Monitor**
Permits to monitor any incoming DCP/IP based streams from external Audio Encoders (MuxEnc protocol), incoming streams from Service Multiplexers (EDI/ETI or STI/EDI) and the outgoing multiplex stream (EDI). The monitor shows long-term statistics including diagrams representing the network delay over time. The monitor is very helpful if there are issues on contribution (or distribution) networks. It can also monitor the output of the ContentServer's Redundancy Peers to detect discrepancies within the Redundancy Group.
- **Redundancy Group Feature**
Permits to operate two or more ContentServers as a Redundancy Group with frame synchronous output.

A Redundancy Group ensures that if one ContentServer hardware fails the output of another Redundancy Peer can continuously be forwarded to the distribution network. Downstream devices can switch on any frame-boundary without interrupting the transmission signal. In addition, this feature also permits maintenance tasks such as updating the ContentServer software or hardware maintenance without service interruption.

ContentServers operating as a Redundancy Group can either be co-located at the same site (hardware redundancy) or can be operated at different locations (site redundancy). The flexibility of the Redundancy Group approach permits to use more than two Redundancy Peers within a Redundancy Group.

In a Redundancy Group, the system configuration takes place centrally through a virtual IP address that is automatically always used by the ContentServer currently holding the role of Redundancy Authority. Any system or broadcast configuration changes are automatically forwarded to all members of the Redundancy Group, and multimedia content uploaded to the Redundancy Authority is automatically forwarded to all members of the Redundancy Group. In addition, scheduled or manually triggered dynamic reconfigurations are performed simultaneously and frame-synchronously by all members of the Redundancy Group, as are configuration changes announced and negotiated by external Service Multiplexers via STI-C or extended STI-C.

The output of all members of a Redundancy Group is either fed directly to transmitters for built-in switching, or will more typically - particularly for SFN (single frequency network) scenarios - be processed by a special EDI switch that selects the Redundancy Peer whose output is forwarded to the distribution network.

For multiplexers based on the ContentServer technology, this switching decision is further enhanced through special status and error signalling included in the EDI stream. The standard error level signalling contained in the EDI specification would not allow to distinguish between an EDI stream with a single audio stream carrying only silence versus another EDI stream from the same Redundancy Group where multiple audio streams carry only silence. Several downstream devices already incorporate this special and valuable ContentServer feature.
- **Audio Cross Redundancy**
All members of a Redundancy Group exchange the audio streams encoded by their internal Audio Encoders. So if e.g. audio provision to one ContentS-

ever fails (e.g. because of a faulty audio cable), this ContentServer will automatically insert the encoded audio of one of its Redundancy Peers into its own multiplex output.

- **DAB - STI-C input/output option**

Permits to connect DAB Service Multiplexers to DAB Ensemble Multiplexers.

Service Multiplexers are responsible for generating a defined portion of the overall ensemble. This concept is especially useful if multiple broadcasters share an ensemble (with one or more services each), but still want to be able to dynamically configure „their“ part of the ensemble without the need to coordinate with the other broadcasters or the operator of the Ensemble Multiplexer.

At the Ensemble Multiplexer, every connected Service Multiplexer gets assigned a part of the ensemble capacity and other constraints (including permitted service identifiers or subchannel IDs). Each Service Multiplexer automatically downloads those constraints from the Ensemble Multiplexer. The Service Multiplexer can then freely (re-)configure within these constraints, for instance it can add part-time services for special events. Reconfigurations scheduled or manually triggered at the Service Multiplexer are automatically negotiated with the Ensemble Multiplexer and will then occur at the agreed time without service interruption. This process works with full support for Redundancy Groups, both on Service Multiplexer side as well as on Ensemble Multiplexer side.

Each DAB ContentServer can either be a Service Multiplexer or an Ensemble Multiplexer.

To make use of the STI-C feature, Service Multiplexers and Ensemble Multiplexers need to be based on the ContentServer technology.

According to the DAB specification, DAB Ensemble Multiplexers can accept inputs from multiple Service Multiplexers simultaneously, but each Service Multiplexer can only be connected to one single Ensemble Multiplexer. This prevents DAB network models such as multiple individual (regionalized) DAB broadcasts with shared services managed by a single Service Multiplexer. See the description of „xSTI-C“ below for a solution.

- **DAB - xSTI-C (Extended STI-C)**

Permits to connect a DAB Service Multiplexer to multiple individual DAB Ensemble Multiplexers simultaneously. This allows for example to centrally manage and create national programmes and data services, and to insert those simultaneously into several regional Ensemble Multiplexers that in addition to these national programmes add their own specific and locally encoded regional programmes.

If changes to these national programmes are made at the Service Multiplexer (e.g. a new national service is added and the bit rates of all national programmes adjusted accordingly), then this change is automatically forwarded to all regional Ensemble Multiplexers and all ContentServers will then reconfigure to the new configuration at the same time without service interruption.

xSTI-C is fully compatible with the Redundancy Group feature - both on Service Multiplexer side as well as on Ensemble Multiplexer side.

To make use of the xSTI-C feature, Service Multiplexers and Ensemble Multiplexers need to be based on the ContentServer technology.

- **DAB - EDI (ETI or STI-D) Inputs for Subchannel Extraction**
Permits to extract DAB subchannels and their signalling from the EDI based output signal of a DAB Service Multiplexer or a DAB Ensemble Multiplexer. The EDI signal can carry either ETI (DAB ensemble multiplex) or STI-D (DAB service multiplex) information.

With subchannel extraction it is possible to extract just some of the DAB subchannels carried in the EDI input signal. For example, the multiplex signal of an adjacent DAB ensemble could serve as the EDI source, but only some of its services are extracted for later re-broadcast. However, a major drawback of this solution is that subchannel extraction is a static setup: it is necessary to manually configure which subchannels and what signalling has to be extracted, and same parts of the signalling may even have to be re-created statically at the ContentServer performing the subchannel extraction. In addition, many reconfigurations of the EDI input source (especially if the bitrate of extracted subchannels is changed) require time-synchronous manual reconfigurations at all ContentServers extracting subchannels from this EDI input source, which effectively prevents dynamic reconfigurations of the EDI input source.

In contrast, if a Service Multiplexer is connected via STI-C (or xSTI-C), then the Ensemble Multiplexer extracts all services and signalling; this setup supports autonomous and dynamic re-configurations of the Service Multiplexer, without the need to manually re-adjust the configuration at the Ensemble Multiplexer.

- **DAB - TII & Region Definitions Editor (Name of feature updated: „Transmitter TII codes and offset delays“)**

Permits to configure the TII codes (Transmitter Identification Information) and offset delays of all modulators/transmitters centrally at the ContentServer. So if changes to these parameters are necessary, they do not have to be adjusted directly at each modulator/transmitter.

- **DAB - Extended broadcast info (Ensemble configuration, FIG Layout)**

Shows parameters used within a DAB Multiplex, especially also parameters that are normally automatically determined by the ContentServer (e.g. subchannel identifiers).

This information is useful in setups with Service Multiplexers and Ensemble Multiplexers to manage the DAB identifiers (e.g. subchannel identifiers). It is also helpful for documentation purposes as it shows the detailed configuration and signalling parameters of a multiplex as a single document.

- **Multiplexer Output Live Monitoring/Statistics**

Permits to monitor what Dynamic Label/DL+, Text Messages, Slideshow or Journaline content is currently broadcast.

For Dynamic Labels, it is useful to verify if e.g. the DL+ tagging by the DL+ source is done correctly and to get live statistics on the sequence of DL/TM transmissions and segments (timing, repetitions, etc.).

For Slideshow, it is possible to see all slide parameters and verify their correctness, as well as obtaining transmission statistics.

This feature is especially helpful if a receiver's reaction to Dynamic Label/DL+/TM/slides and Journaline is not as expected. It then helps to determine whether the problem is already at content creation side.

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- **Multiplexer Output EDI / ETI / Subchannel Recording**
Permits to make a recording of the ETI output signal to a file for a pre-defined amount of time (e.g. 10 minutes), and to then download the recorded file through the Web interface, e.g. to upload it to WorldDAB's ETI library or for verification and documentation purposes.

It can also be used to provide recordings to receiver manufacturers to test/debug certain DAB features.
- **Audio input live analogue/digital/Livewire**
Permits to feed raw (not encoded) audio sources with proper GPS clock synchronisation to the ContentServer over regular IP network („Audio-over-IP“). If a studio is already deploying Livewire audio-over-IP functionality, the ContentServer can automatically subscribe to those streams available on the local network and feed them to the internal audio encoder(s). Besides Livewire, also the AES67 standard as well as Ravenna based streams are supported.

To feed legacy analogue (XLR) and/or digital (AES/EBU) input streams to the ContentServer, a Livewire node with one or several analogue/digital inputs is connected via IP network to the ContentServer.
- **Audio input as mp3/wav, playlist**
Permits to upload audio files to the ContentServer along with an optional playlist defining the file order. This can be useful e.g. to play pre-recorded audio at certain times (e.g. a two hours radio play for a student's radio).

It can also be used as backup-audio. If audio provision to an audio encoder fails (e.g. only silence is provided), then the ContentServer can play uploaded audio instead. See the description of the ‚Local Audio Backup Source‘ feature.
- **Silence/clipping detection and configuration**
Permits to detect if provided audio is too loud (clipping) or silent.

Thresholds for clipping and silence levels, as well as a grace periods for silence detection can be defined individually per audio source.

Together with „Audio input as mp3/wav“ it is then possible to switch to previously uploaded audio content if the live audio source fails and silence is detected. See the description of the ‚Local Audio Backup Source‘ feature.
- **Audio Backup Upgrade**
Allows to define audio service components with locally uploaded mp3/wav/playlist files (see ‚Audio input as mp3/wav‘ feature) as a backup content source for any externally provided live-audio source (feeding an internal audio encoder) or for externally connected audio encoders (if local encoder licenses are available). Once the external audio source fails to provide data or if silence is detected for a certain amount of time, the ContentServer's built-in audio encoder will automatically start-up with the local audio content as source, to provide a continuous (backup) audio service to the listeners.
- **Audio input signal amplification/mp3 normalization**
Sometimes the provided audio is too loud or too low in volume. It is then possible to adjust the audio level within some range, either attenuating or amplifying the audio source. The required volume adjustment level - if any - can be configured per audio source. Both the original audio level and the adjusted audio level can be monitored visually.
- **Dynamic changes of programme type (PTy)**
Permits to dynamically change the signalled programme type (Pty) of a service. An external source can dynamically provide the Pty code (e.g. via UECP or via software/API shipped and provided as part of the ContentServer). So if e.g. a news programme provides live coverage of a sports event, the Pty code could be changed from „news“ to „sport“ at any time without the need to create a modified multiplex configuration.
- **Dynamic change of the currently active service linkage set**
For some DAB transmission network setups it is possible that the service linking changes throughout the day, e.g. if adjacent DAB multiplexes usually carry the same content, but during advertisements or the news provide localized ads/news. In this case the service linking will usually tell the receiver that the audio of adjacent ensembles is the same as the audio on the tuned ensemble. But during advertisements (or local news), the service linking will indicate that the content is different.

An external source can dynamically change which service linkage set is active.
- **Dynamic change of announcement signalling**
Some radio stations only provide (traffic) announcements during the day.

With this feature it is possible to tell the receiver at night (or during a concert) that no (traffic) announcements are provided. Using this feature, enabling or disabling of announcement support is possible without the need to create modified multiplex configurations.
- **DAB - Other ensemble announcements (* no yet available)**
Permits to indicate that announcements for a DAB service are not carried on the tuned ensemble, but on another DAB ensemble. This could e.g. be used in a regional multiplex at night: if there are traffic events to report, the receiver could be told to tune to a national multiplex for these announcements. Another example is the multiplex-wide alarm announcement (part of the EWF - Emergency Warning Feature), where a DAB multiplex could tell the receivers to switch to a different DAB ensemble to present the emergency content currently carried on that other DAB ensemble.
- **DAB - Service information signalling**
The DAB standard demands that part-time services (e.g. a football service that is only broadcast during football matches) are signalled as such. This way the receiver knows when a currently off-air service will become on-air for the next time. The DAB standard also requires that services added, removed or transferred to another DAB ensemble are signalled in advance. This feature permits to configure and signal such planned changes and to signal part-time services.

- **DAB - Announcements for services provided by a Service Multiplexer**

For some setups, a national Service Multiplexer provides (via xSTI-C) national services to different regional Ensemble Multiplexers, but the traffic announcements are regional. So they are not carried within the national services.

This feature permits to signal for the services of the national Service Multiplexer to tune to the regional traffic announcement channel in case of (traffic) announcements.

- **Surround Sound option incl. SX Pro**

Permits to broadcast 5.1 Surround Sound via DAB instead of mono/stereo only. Surround Sound broadcast is backwards compatible to existing mono/stereo receivers: a standard receiver will play the stereo (or mono) portion of this audio signal, while a surround receiver will use the embedded hidden surround side-information to enhance the audio service to full and almost discrete quality multichannel audio.

If Surround Sound is enabled, most of the bitrate is used for the stereo (or mono) signal, only some kbps are needed to get surround sound on surround capable receivers. If a native 5.1 source signal is provided, this information is used for the Surround Sound encoding, and the stereo/mono downmix is created internally by the ContentServer's built-in audio encoder. If a stereo source signal is provided, the built-in SX Pro technology will automatically and continuously analyse the sound source and place the ambient elements in the rear channels.

This feature is only available with the internal audio encoders of the

ContentServer: DAB+ encoders for DAB ContentServers, and HE-AAC v2 encoders for DRM ContentServers.

- **MOT Broadcast Website/Transparent File Transmission**

Transparent File Transmission can be used for proprietary applications, e.g. to transfer a set of files and directories to the receiver. The MOT protocol ensures that the file set on the receiver is always consistent.

The MOT Broadcast Website application is obsolete in the DAB standard V2.1.1, but is still supported by the ContentServer for legacy purposes.

- **TPEG Traffic Information**

Permits to insert TPEG traffic information. TPEG can be considered the successor of RDS-TMC (traffic message channel) with many more capabilities than RDS-TMC.

- **TMC – Traffic Message Channel**

Obsolete in the DAB standard V2.1.1, but still supported by the ContentServer for legacy purposes.

- **IP Insertion**

Obsolete in the DAB standard V2.1.1, but still supported by the ContentServer for legacy purposes.

- **TDC – raw data**

TDC - the Transparent Data Channel - allows to transmit proprietary information with or without data groups. In addition, the ContentServer allows access to and data insertion into virtually any protocol level to give broadcasters maximum freedom for transmitting proprietary data or future applications (in addition to supporting all current well-defined user applications).

- **DAB - FIC Data Insertion (FIDC, SI, CA)**

Permits to insert individual signalling information into DAB's FIC signalling channel. This information can either be uploaded or provided in real-time from an outside source. This information is broadcast in addition to the signalling information describing the currently configured DAB broadcast signal.

- **Import via HTML interface (Web-GUI)**

Can be used to e.g. provide static Dynamic Labels/Text Messages (e.g. name of the programme, contact information, station's greeting message). Announcement signalling and Journaline content conveniently via a Web form using a standard web browser. To access this interface, the Content Provider needs to connect to the dedicated port 24 (well separated from the ContentServer's administration interface) and authenticate via personal login/password.

- **Import from existing RSS/Atom sources (Dynamic Labels/Text Messages)**

Permits to extract Dynamic Label/Text Message content from existing RSS/Atom sources. This can e.g. be used to extract news headlines from an already existing RSS feed of a radio station. Those messages can then be mixed with other sources for messages in a single service component.

Besides providing the URL of the intended RSS/Atom feed (optionally along with login credentials, if required), the time between regular automatic updates can be specified.

- **Import from existing RSS/Atom sources (Journaline)**

Permits to generate a Journaline sub-menu from an existing RSS/Atom feed. Optionally, the HTML formatting, image references, etc. can automatically be extracted and be imported from the content section of each RSS message. Many RSS/Atom feeds often only contain a headline and teaser text for each message, while the actual message content is carried on a referenced HTML page. Therefore the ContentServer can be ordered to follow those references (on a best-effort basis) and attempt to extract the full message content from those external HTML pages.

The RSS/Atom based sub-directories can be mixed with content from other sources to form the full Journaline service component. Besides providing the URL of the intended RSS/Atom feed (optionally along with login credentials, if required), the time between regular automatic updates can be specified.

- **Import via HTTP/FTP mirroring**

Permits to download content from an ftp or http server. Special rules at the ContentServer can be used to re-format the downloaded content, e.g. to extract a Dynamic Label/Text Message from a downloaded XML file.

- **Import via live socket connection (API)**

Permits to feed real-time data, e.g. Dynamic Labels/Text Messages or Slides via a proprietary interface to the ContentServer. This interface provides minimum insertion delay, while supporting login-credentials, hand-shake and flow-control.

Ready-to-use software for various platforms including the full source code and API documentation is shipped along with the ContentServer and available for download from the online documentation page.

The command-line software can e.g. be run on another computer. It can either be called for each content element upload and will exit when the ContentServer is ready to accept the next content element

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(flow-control). Or it can be told to periodically check for a local file with a given name for changes, and whenever the content of this file is changes, the updated content is forwarded to the ContentServer. So if the current title/artist information (or a slide) is stored by third-party software to this file, then such information can be easily forwarded to the ContentServer.

These command-line tools can also be called directly by third-party software to update title/artist information or slides, or the ContentServer's underlying real-time API can natively be supported in third-party software.

- **Import from UECP, Zenon, Funkhaustelegramm, Leitungsprotokoll (Dynamic Label/Text Messages & Journaline)**
Permits to e.g. use a feed based on the common UECP standard for in-house distribution of broadcast-related information (as also used for FM-RDS) to get Dynamic Label/DL+/Text Message content to the ContentServer via UDP/IP (or serial connection if supported).

- **Automatic Scheduled Mirroring option**
Permits to tell the ContentServer to automatically update content at certain intervals. This feature is particularly useful in combination with RSS/Atom feed sources or http/ftp mirroring imports.

- **Secure data import connections**
Permits to use encrypted and thus more secure transport protocols for data provision instead of/in addition to standard protocols (such as ftps instead of ftp).

- **JSON/XML-RPC import**
An http based interface to provide Dynamic Labels/DL+/Text Messages, Slides, Journaline content, (traffic) announcement signalling, programme type (PTy) signalling and activation of service linkage sets via JSON or XML-RPC.

The interface is particularly useful when integrating with third-party content/signalling sources, or if widely available standard command line tools or software plugins shall be used to communicate with the ContentServer. Login credentials are supported to ensure only authorized access to the ContentServer.

- **JSON/XML-RPC administration**
An interface that allows management tasks to be triggered or carried out via JSON/XML-RPC. Those tasks include for example the change of the current on-air broadcast configuration by switching between existing multiplex configurations, or switching to a weekly schedule.

The interface is particularly useful when integrating with third-party content/signalling sources, or if widely available standard command line tools or software plugins shall be used to communicate with the ContentServer. Login credentials are supported to ensure only authorized access to the ContentServer.

- **Webstreaming upgrade**
Permits to use many RTP (real-time streaming protocol) or Icecast/SHOUTcast audio sources as inputs for the internal audio encoders. These streaming protocols are widely used on the Internet.

For Icecast/SHOUTcast sources it is also possible to extract the contained title/artist information and to forward it as Dynamic Label/DL+/Text Message.

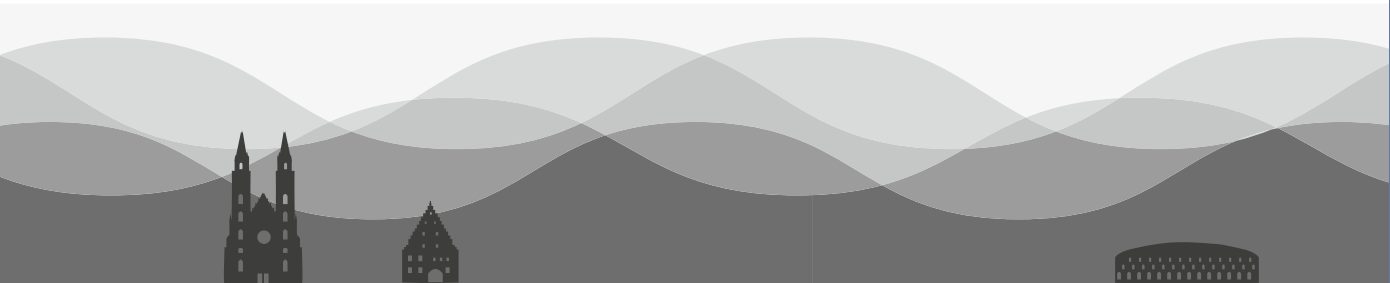
- **EFW - Emergency Warning Feature**
Emergency Warning Functionality allows to use the digital radio platform (DAB/DRM) for instant mass-alertion of the public in cases of pending disasters through their standard radio sets. It allows the broadcaster or the responsible authority to order receivers to switch to the emergency broadcast (which is carried either within the same or on another ensemble). Receivers may even monitor the alarm signalling in the background and then switch-on automatically in cases of emergencies.

While the EWF alarm signal needs to be carried in all transmissions covering the affected area, the actual emergency content only needs to be carried in a single multiplex/transmission covering the full affected area. The emergency content consists of the audio announcement, plus a Journaline based advanced text service, which provides detailed on-demand information and instructions in multiple languages simultaneously, and thus extends the reach of the emergency announcement to non-native speakers and hearing impaired users. It also allows the transmission of detailed information such as lists of locations for shelters sorted by region, which could otherwise not be made available over the audio channel (given that the information would be too detailed).

Technically the EWF Emergency Warning Functionality is not a new application definition, but merely a combination of existing DAB/DRM features along with the how-to specification for both broadcasters and receiver manufacturers.

The ContentServer supports both the signalling of alarm announcements and related alternative frequency information, as well as the encoding of the emergency content with audio and Journaline elements (along with instant dynamic reconfigurations of the on-air multiplex configuration if required).

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