COMBIMUX DT88, the compact 2 Mbps Multiplexer/ Demultiplexer with integrated Audio Codecs

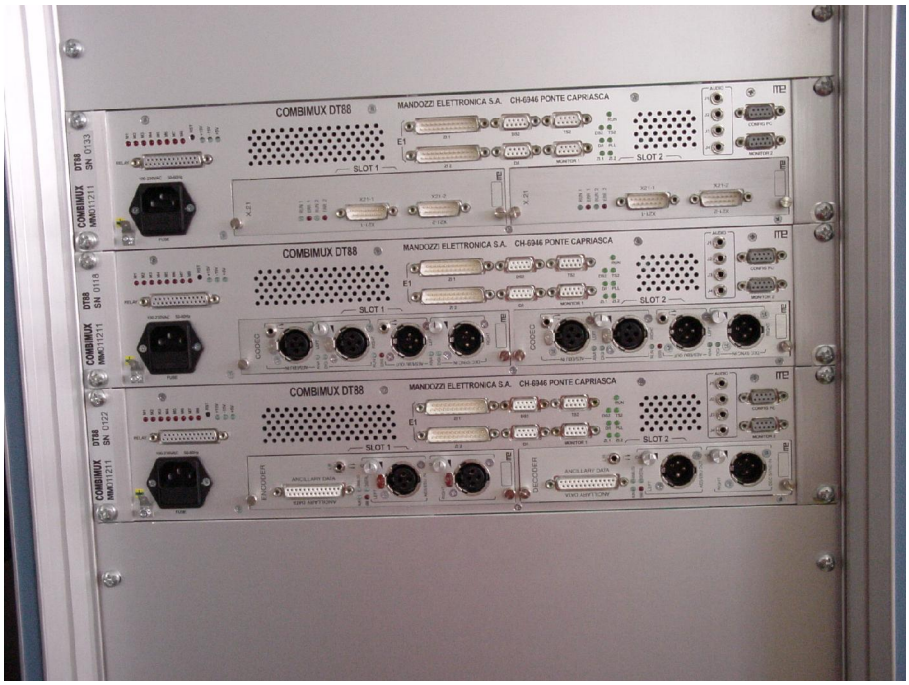
1. General description

COMBIMUX DT88 is the small brother of the famous COMBIMUX DT99. It is ideal for applications where space in the 19" cabinets is limited, and where two interface modules per line end are sufficient (2 Encoders or 2 Decoders or 1 Encoder plus 1 Decoder or 2 Codecs) to transmit up to two stereo signals plus data. The most important features of DT88 are:

- **Small size**: 19" case with a height of only 2 HU (87.5 mm) and a depth of only 260 mm.

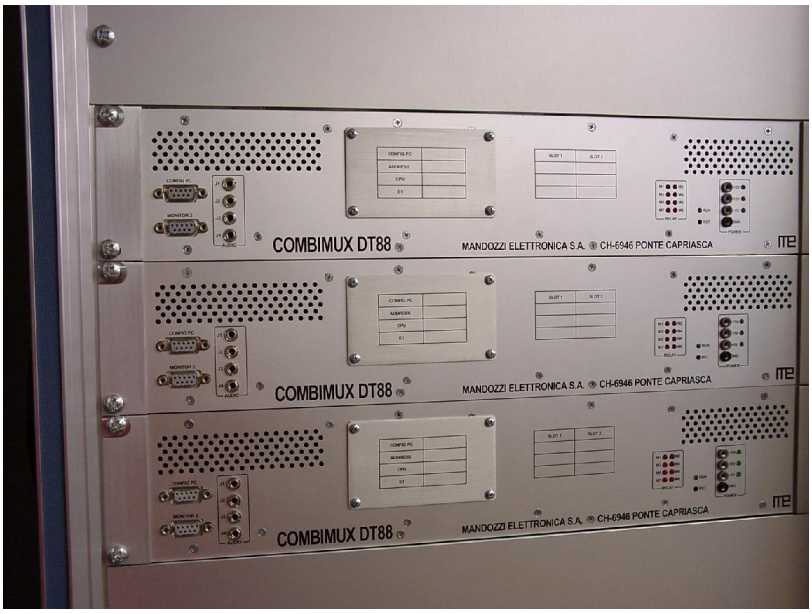
- **Space-saving equipment installation**: The cases can be directly stacked without the need for air space between the equipment for cooling.

- **Flexible rack mounting**: The cases can be mounted into the 19" cabinets in three different ways:



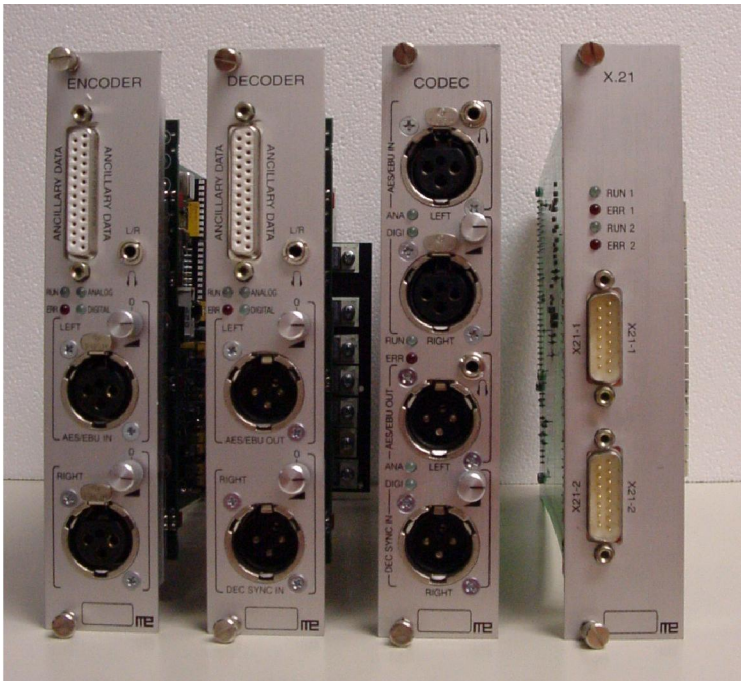
1. Connectors accessible from the front.

2. Connectors accessible from the front with equipment placed backwards to avoid connectors from protruding

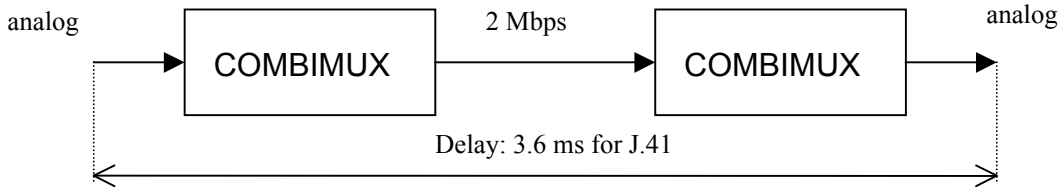


3. Connectors accessible from the back

- **Modularity**: Possibility to insert up to two interface modules of any type desired.



- **High-speed transmission**: Only 3.6 ms processing time from analog input to analog output via 2 Mbps interfaces with J.41 coding.



COMBIMUX DT88 is a universal system for the transmission of audio and data signals via 2 Mbps channels. Its 19" cabinet holds up to two local I/O modules, e.g. encoders and/or decoders that can be configured by jumpers and by software to operate in several ITU-T and ISO/MPEG audio coding modes. COMBIMUX DT88 does also perform the Drop & Insert functions. The equipment is configured by a PC using the COMBISOFT program that selects the coding procedure, allocates the time slots to the various audio signals and monitors the operational state.

COMBIMUX offers the following features:

- Mono-directional or bi-directional transmission of audio and data signals on 2 Mbps channels according to the following standards: ITU-T J.41, J,57, G.722, X.21 (audio and data); ISO MPEG 1 Layer II (encoder and decoder) and Layer III (for the time being decoder only) (AAC in preparation).
- Analog and/or digital (AES/EBU) audio interfaces. The digital interfaces are equipped with sampling rate converters.
- Drop & Insert according to ITU-T G.737.
- Configuration and monitoring functions (local and remote) by means of PCs with user surfaces working under Windows 95, 98, 2000, NT and XP.
- Several equipment can be cascaded (e.g. in order to increase the number of audio interfaces).
- The equipment is especially designed to be installed in severe electromagnetic environments
- Due to the interchangeability of the local I/O modules, the possibility to configure them by software or jumpers and to equip them with customer specified connectors, COMBIMUX satisfies the most various requirements.
- All modules can be replaced under power.

COMBIMUX DT 88 is built into a 19" cabinet of two height units (h x w x d = 87.5 x 485 x 260 mm) that can be equipped with two input/output modules. The power supply module, the central processor and the 2 Mbps module are integrated into the cabinet.

2. Description of the modules

2.1 CPU (integrated into the case)

The CPU module manages the COMBIMUX, stores the configuration also in the case of power failure and communicates with the configuration PC via an RS232 interface (9 pole SubD connector “CONFIG PC”). The J.41 and J.57 coding mode of the Encoder and Decoder modules can be defined by jumpers on the CPU module. This allows the modules to be automatically configured after their hot plug in. The CPU module also contains 8 relays for the control of 8 galvanically insulated contacts that are available on a 25 pole SubD connector. They can be used for controlling, signalling or alarming. LEDs indicate the various operational states of the equipment and the states of the alarm relays.

2.2 E1 (integrated into the case)

The E1 module realises the interfacing between the external 2 Mbps lines and the local I/O modules. Up to three 2 Mbps lines can be connected to the module. Two are bi-directional (the main interface and the drop / insert interface), whereas the third one is mono-directional (“monitoring output”) and can be used as second, de-coupled output. The E1 module manages the 2 Mbps inputs and outputs as well as the local I/O modules. It is capable of realising all imaginable connections between these interfaces and performs the multiplexing/demultiplexing of the signals, obviously respecting the rules that a 2 Mbps signal carries up to 30 time slots of 64 kbps each (number 1 to 15 and 17 to 30). One MPEG coded mono or stereo signal occupies between one and six time slots according to the audio quality desired, a mono signal coded according to J.41 always 6 slots, and a signal transmitted according to J.57 occupies either 24 (J.57-H.11 standard) or 30 time slots (J.57-H.12 standard). Signals coded according to or G.722 always occupy one time slot each. The management software prevents the operator from breaking these rules.

The free capacity of time slot 16 is used for the remote control of COMBIMUX equipment.

The E1 module transmits - via time slot 16 - two channels of 2.4 kBd data called ZI1 and ZI2. In order to be compatible with the BARCO codecs, the data is transmitted with a 21 kHz sampling frequency.

The E1 module is also responsible for the clock signal that can be supplied from four different sources (selected by the configuration PC):

1. An external 2.048 MHz reference signal (sine or square signal or G.703 signal)
2. The main 2 Mbps signal
3. The drop / insert 2 Mbps signal
4. The internal oscillator

The E1 module is equipped with 6 connectors for:

1. The main 2 Mbps signal (“DS2”): 9 pole SubD or 2 x BNC
2. The drop / insert 2 Mbps signal (“D/I”): 9 pole SubD or 2 x BNC
3. The monitoring or second output 2 Mbps signal (“MONITOR”): 9 pole SubD or 1 BNC
4. The external clock signal (“TS2"): 9 pole SubD or 1 BNC
5. The ZI1 data transmitted on time slot 16 of the main 2 Mbps signal (“ZI1”): 25 pole SubD

6. The ZI2 data transmitted on time slot 16 of the main 2 Mbps signal (“ZI2”): 25 pole SubD

The front panel of the E1 module is equipped with LEDs that indicate the operational state of the module.

2.3 ENCODER (pluggable)

The ENCODER encodes two mono audio signals according to the following formats: ISO MPEG 1 Layer II, ITU-T G.722, J.41 and J.57. AAC is in preparation. The audio input signals can be either analog or digital (AES/EBU). The analog/ digital interface and the coding procedure can be selected by software. The J.41 and J.57 modes can also be set by jumpers on the CPU module allowing automatic reconfiguration of the ENCODER after hot plug in. For digital input signals, the integrated sampling rate converter allows signals with sampling frequencies between 24 and 56 kHz to be processed.

- In MPEG mode the ENCODER transmits data in the form of ancillary data.
- In J.57 mode it transmits data of 2 x 1 kbps.
- In J.41 mode the module transmits - via a separate time slot - 38.4 kBd data plus 7 parallel signals.

The ENCODER module carries on its front panel two XLR connectors for the audio signals and one 25 pole SubD connector for the data. The upper XLR connector is used for the left analog channel or for the AES/EBU signal, the lower one for the right analog channel. The front panel also features two monitoring output connector groups with individual level adjustment of the two analog signals. They are used to monitor the audio input signals of the ENCODER module. Due to the integrated D/A converter, the monitoring output can also be used for digital audio input signals.

The front panel of the E1 module is equipped with LEDs that indicate the operational state of the module.

2.4 DECODER (pluggable)

The DECODER decodes two mono audio signals according to the following formats: ISO MPEG 1 Layer II and Layer III, ITU-T G.722, J.41 and J.57. AAC is in preparation. The coding procedure can be selected by software. The output signals may be analog or digital (AES/EBU) (selectable by software). The J.41 and J.57 modes can also be set by jumpers on the CPU module allowing automatic reconfiguration of the DECODER after hot plug in. The digital signals have a sampling frequency of 48 kHz, or - due to the sampling rate converters - the digital output signals can be synchronised by external clock signals of 24 to 56 kHz.

- In MPEG mode the ENCODER receives data in the form of ancillary data.
- In J.57 mode it receives data of 2 x 1 kbps.
- In J.41 mode the module receives - via a separate time slot - 38.4 kBd data plus 7 parallel signals.

The DECODER module carries on its front panel two XLR connectors for the audio signals and one 25 pole SubD connector for the data. The upper XLR connector is used for the left analog channel or for the AES/EBU signal, the lower one for the

right analog channel or - for digital output signals - it can be used to input the external sampling rate clock. The front panel also features two monitoring output connector groups with individual level adjustment of the two analog signals. They are used to monitor the audio output signals of the DECODER module. Due to the integrated D/A converter, the monitoring output can also be used for digital audio output signals.

The front panel of the E1 module is equipped with LEDs that indicate the operational state of the module.

2.5 CODEC (pluggable)

This module can encode two audio signals and decode two other ones according to the following standards: G.722, J.41 (audio only). The coding procedure can be selected by jumpers or by software. The audio signals can be either analog or digital AES/EBU (selectable by jumpers and by software). The CODEC module carries on its front panel four XLR connectors for audio signals. For digital input signals, the integrated sampling rate converter allows signals with sampling frequencies between 24 and 56 kHz to be processed. The sampling frequency of the digital output signals is either 48 kHz, or it can be synchronised to an external clock signal received as dummy AES signal. The input and output audio signals can be monitored, and two potentiometers adjust the monitoring levels.

The front panel of the E1 module is equipped with LEDs that indicate the operational state of the module.

2.6 X.21 (pluggable)

This module allows two data streams to be inserted and two other ones to be extracted into/from the 2 Mbps frame. These signals are processed in transparent mode without changing their contents that can represent either audio or data signals. The front panel carries two 15 pole SubD connectors for the two digital data signals.

Possible data rates: 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 24, 30 time slots.

Each of the two interfaces can be configured by software to work either as DCE (clock from the 2 Mbps network) or DTE (clock from the external equipment).

The front panel of the E1 module is equipped with LEDs that indicate the operational state of the module.

2.8 Power supply unit (integrated into the case)

COMBIMUX DT88 is supplied from 230 VAC. LEDs indicate the availability of the voltages feeding the COMBIMUX modules.

3 Control software

The COMBISOFT program is supplied free of charge with COMBIMUX. It is used to configure and monitor one equipment each on the two line ends by one PC that is connected to the CPU module of any COMBIMUX.

COMBISOFT is used for the hardware configuration of COMBIMUX, to select the compression modes of the various audio signals, to allocate the time slots to the audio signals, to adjust the audio levels, to configure the alarm outputs, to monitor the operational state of the modules, etc.

The program generates log files with the set-up changes (e.g. coding algorithm, time slot occupation. etc.) and state changes (e.g. LOS, MPEG frame loss, etc.).

COMBISOFT is self-explanatory and very easy to use.