
Digital Mixing System for Broadcast and Production

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Studer On-Air 5000

I Introduction

The advent of DAB (Digital Audio Broadcasting), the transition from analog to digital interconnections between studios and transmitter sites, and the rise of digital audio storage media mean that today's broadcasters need an easy-to-use, flexible and ergonomic mixing console solution with fully-digital audio and data processing.

A user-friendly mixing console is also invaluable for producing actuality, features, and pre-recording combined speech and music programme material.

With its great flexibility and clear functional layout, the new On-Air 5000 mixing console fits the bill for both tasks. Whoever is sitting at the controls – disk jockey, sports reporter, newsreader, broadcast recording engineer – a personal “chip card” configures the console to each user's special needs in a fraction of a second.

The console was designed with a strong emphasis on communication with the outside world: sports reporters, telephone and studio discussions, election results, etc. The console features up to 16 return feeds. Two separate multiplex levels allow a clean-feed to every broadcast participant, while people waiting to go on-air can talk with the programme producer via a second conference level.

EBU-compliant calling tones and incoming call sensors (1900 Hz), plus automatic switching between conference levels when a fader is opened make it easier to communicate with outside sources.

A client/server architecture, with the “Active VMC” (Virtual Mixing Console) as the server, makes for a highly customisable console. Signal processing uses the same DSP core found in the D950 digital console and in the MADi router. This state-of-the-art technology sets new standards of flexibility and sonic quality.

The console is comprised of four functional units with control surfaces and displays. Being mechanically separate, modules may be built-in to a presentation suite using the customer's preferred arrangement, or whatever best matches the studio design.

I.1 Fader Block

- Maximum 32 linear faders organised in blocks of four, which may be arranged in any desired groups of 8 or 16 each on either side of a central script area, or conventionally in a continuous row.
- One assignable rotary encoder, two keys and a four-character display per channel.
- 8-character alphanumeric source display.
- Separate PFL, ON, SELECT and TALKBACK keys per channel.

I.2 Central Control Unit

- Each channel's SELECT key accesses the central control unit, where gain, filters, EQ, compressor, limiter, and auxiliary outputs can be individually adjusted.
- Basic console setup keys; user-specific settings are saved on a “chip card”.
- Input matrix control and function assignment for the channel-strip rotary encoders and keys takes place here.
- N-1 clean-feeds send a return signal to every source. External participants can talk amongst themselves and with the studio presenter during preparation and discussion pauses, without disturbing the broadcast programme.

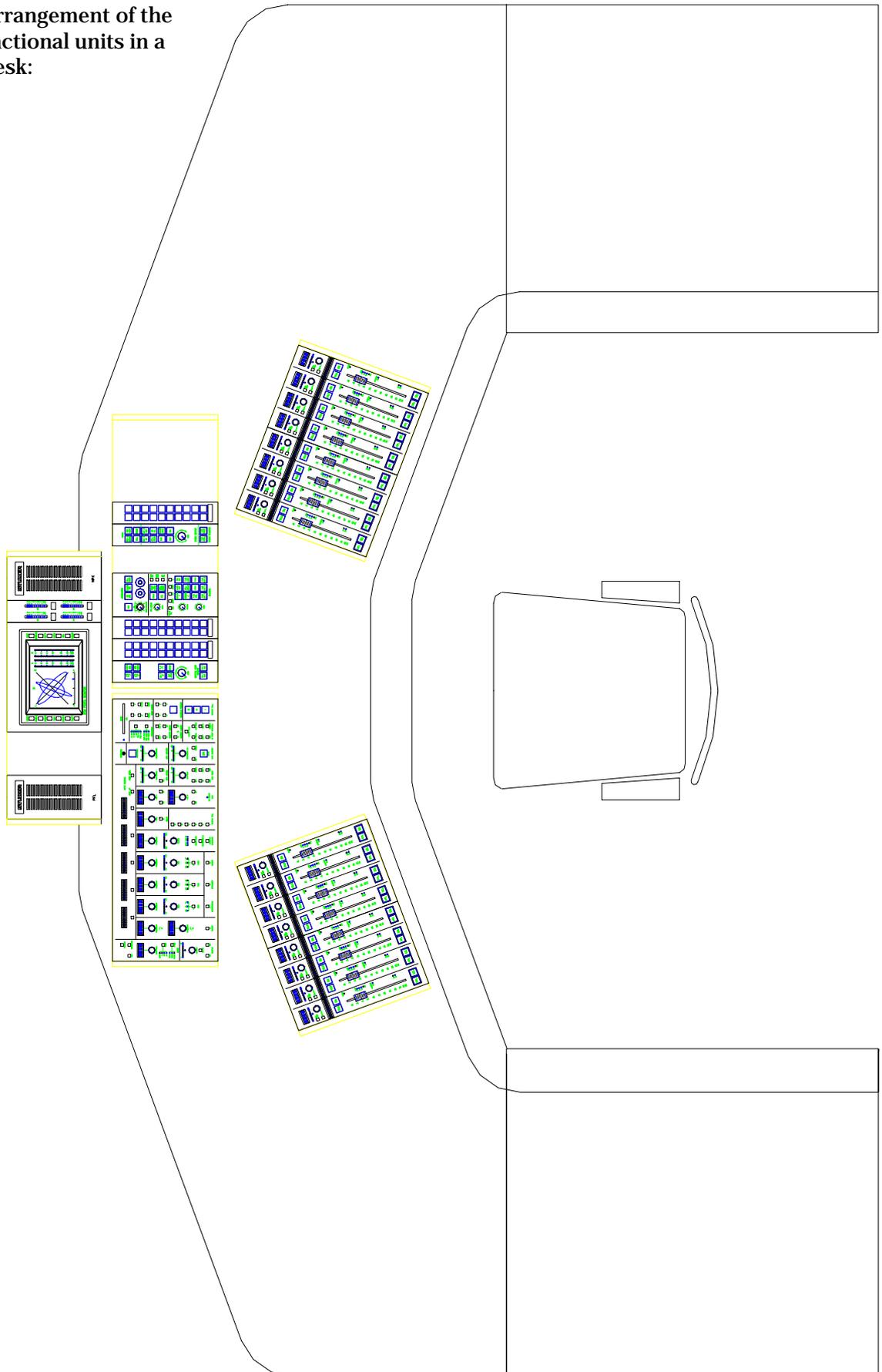
I.3 Monitoring and Meter Bridge

The monitor area and meter bridge are fitted to customer specifications using standard Studer console modules. Additional lamp and key clusters for remote control, signalling and commands can also be integrated here.

I.4 System Integration

Converters and digital processing units are housed in a 19-inch rack with facilities for direct connection to a switching centre via optical MADi links. Combined with a MADi router in the main switching centre, this provides an extremely flexible, cost-effective and future-proof solution.

One possible arrangement of the On-Air 5000 functional units in a presentation desk:



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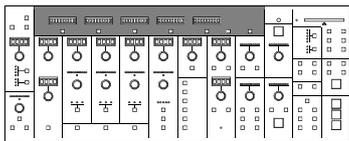
2 Functional Description: Central Control Unit

The central control unit has two main areas. The nine-units wide area to the left controls an input channel, i.e. it is *channel-oriented*. Pressing a fader strip's SELECT key allows channel adjustments to be made on the central control unit.

The right hand area of the central control unit handles higher-level functions, i.e. it is *console-oriented*. This area manages bus control, general console settings, and ancillary functions like the test tone generator.

2.1 Central Control Unit, Channel-Oriented Area

2.1.1 INPUT ROUTING

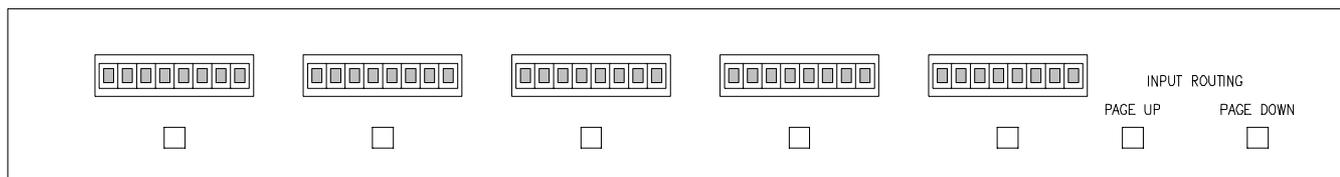


Five 8-character displays label a group of sources connected to the console either directly, or via the MADI router.

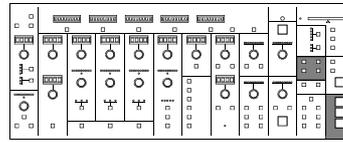
The PAGE UP and PAGE DOWN keys scroll through the groups. Pressing the key below the display assigns the displayed source to the selected input channel. The selected source's label then also appears in the channel strip display above the fader.

Any previously assigned source is automatically disconnected and replaced by the new one.

It is possible to route the same source to two input channels in parallel. Source control (e.g. microphone preamplifier gain and phantom power) may then be effected from either channel. Fader start activates when at least one of the input channels is opened.



2.1.2 OUTPUT ROUTING

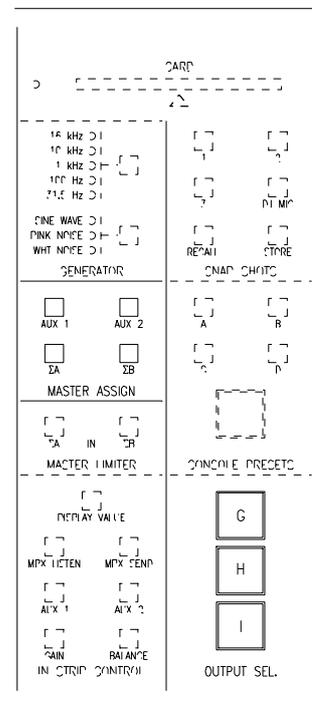


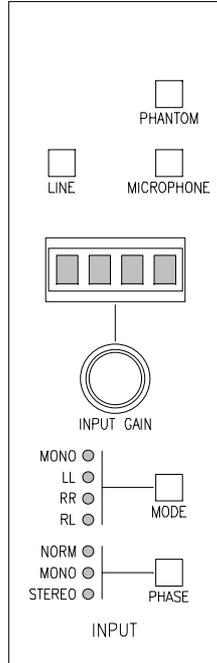
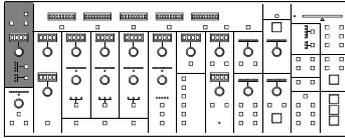
All outputs are configurable via the console computer's graphical interface.

MPX SEND outputs are assigned to input channels. Selecting the channel strip input automatically switches the corresponding multiplex output. Here too, basic configuration can be made via the console computer's graphical interface.

The three OUTPUT SEL G/H/I keys and the MASTER ASSIGN keys in the console-oriented area of the central control unit allow three outputs and (optionally) master and AUX channels to be sent to the displayed outputs via the console's routing matrix.

Each output may be routed to any desired number of output lines. A second output cannot be routed to a previously selected output line. However, doing this clears the previous routing configuration.





2.1.3 Input

The input field groups together the functions associated with a channel strip input section. Input channels always operate as stereo pairs; mono signals are routed in parallel to the left and right channels. Default settings are underlined in the following text.

GAIN

The INPUT GAIN rotary encoder

- Adjusts the microphone preamplifier gain, if mic preamps are installed. The setting appears in the display above (internal gain trim is set to 0 dB).
- Adjusts the internal (digital) gain trim, if there is no preamplifier.

PHANTOM

Switches microphone phantom power on and off (if a microphone preamplifier is present).

MIC, LINE

MIC/LINE selection (if a microphone preamplifier is present).

MODE

Controls assignment of the stereo input pair. Five options may be selected in sequence:

- NORM (left input to left output, right input to right output): no display, i.e. all LEDs are dark.
- **MONO** (left and right inputs are summed and switched to both outputs): red LED
- **LL** (L input to both outputs): red LED.
- **RR** (R input to both outputs): red LED.
- **RL** (R input to L output, L input to R output): red LED.

The key illuminates when the mode is anything other than NORM.

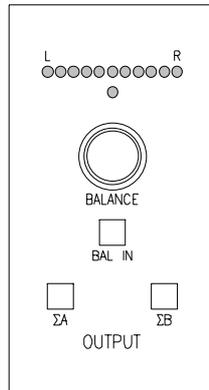
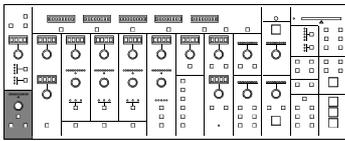
PHASE

There are three options:

- NORM – no phase inversion: green LED
- **MONO** – L and R phase inverted: red LED
- **STEREO** – L phase inverted: red LED

Pressing the PHASE key cycles through the three options. The key illuminates when the mode is anything other than NORM.

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2.1.4 Output

All functions related to the main output and the input channel bus selection are controlled from here.

BALANCE

Rotary encoder, display and key.

- The green, central LED illuminates when the BAL IN key is “off”.
- The BALANCE rotary encoder positions the source on the stereo soundstage when the BAL IN key is “on” (illuminated red). The green LED is dark.
- The red LED bargraph always indicates the virtual position of the source between L(ef) and R(ight), even when the BAL IN key is switched “off”. This allows source pre-panning even while the balance function is disabled.

Range for mono sources (*for mono sources, this control is used as PAN function*):

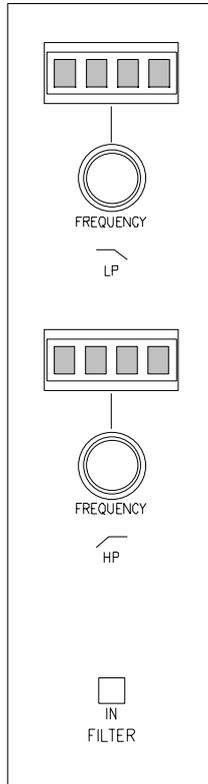
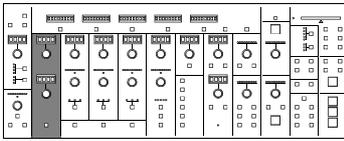
3 dB attenuation of both channels in the mid position, 0 dB or ∞ attenuation of one or the other channel, respectively, at either extreme.

Range for stereo sources:

0 dB attenuation of both channels in the center position, +3 dB gain of one, ∞ attenuation of the other channel at either extreme.

ΣA and ΣB

Output selectors for stereo master bus A and/or stereo master bus B.

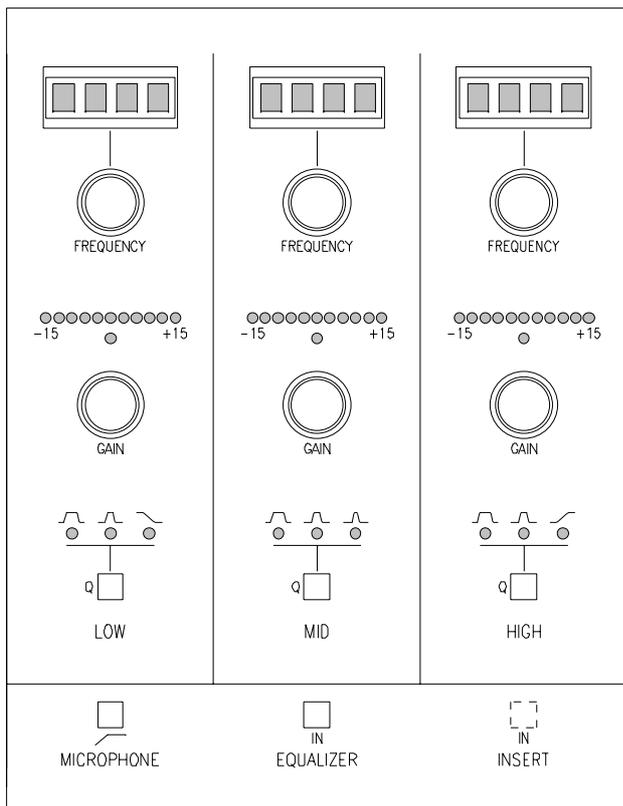
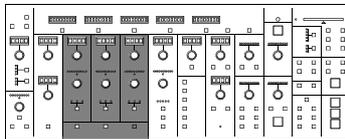


2.1.5 Low- and High-Pass Filters

FILTER IN

Master enable/disable for both filters.

- Low-pass filter: 12 dB/octave rolloff, 62-step cutoff frequency adjustment from 500 Hz to 16 kHz in 1/12-octave increments. The frequency setting appears in the four-digit display.
- High-pass filter: 12 dB/octave rolloff, 62-step cutoff frequency adjustment from 31 Hz to 1 kHz in 1/12-octave increments. The frequency setting appears in the four-digit display.



2.1.6 Equalizer

Three-band equalizer with adjustable boost/cut from -15 to +15 dB. The set frequency appears on a four-digit display, a horizontal LED bargraph indicates boost/cut. The central green LED illuminates to indicate the flat position (0 dB).

EQUALIZER IN

Equalizer enable/disable key.

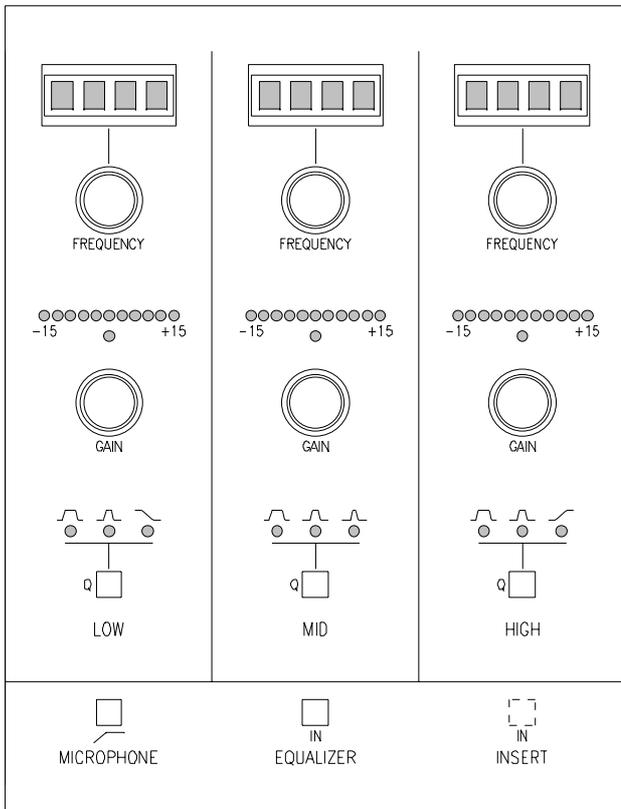
LOW

The Q key selects the filter characteristic: peaking, $Q = 0.4$ or 1 , or shelving. 62-step centre/turnover FREQUENCY adjustment from 31 Hz to 1 kHz in 1/12-octave increments; the GAIN rotary encoder controls the boost/cut setting.

MID

The Q key selects the filter characteristic: $Q = 0.4$, 1 or 2 . 62-step centre frequency adjustment from 200 Hz to 6.1 kHz in 1/12-octave increments; the GAIN rotary encoder controls the boost/cut setting.

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HIGH

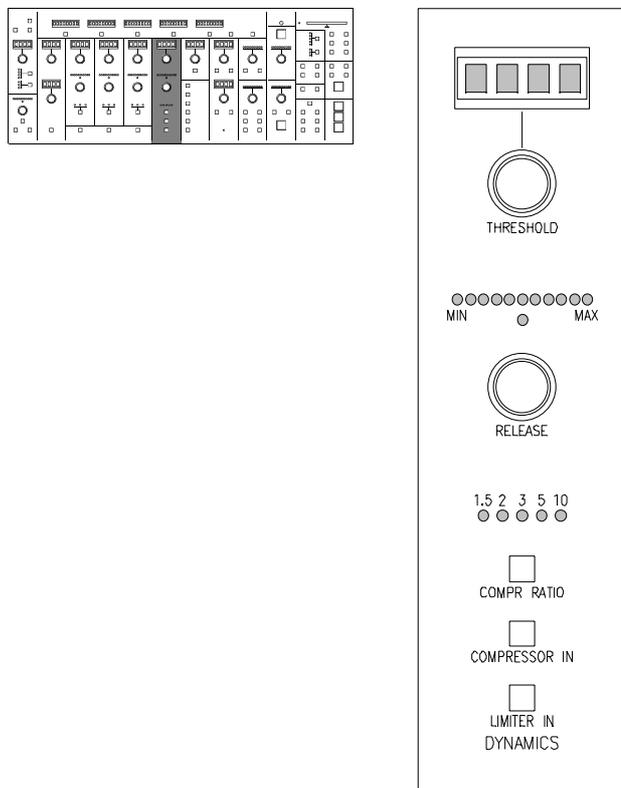
The Q key selects the filter characteristic: peaking, $Q = 0.4$ or 1 , or shelving. 62-step centre/turnover FREQUENCY adjustment from 500 Hz to 16 kHz in 1/12-octave increments; the GAIN rotary encoder controls the boost/cut setting.

MICROPHONE

This key remotely controls the microphone pre-amplifier's analog subsonic filter (cutoff frequency 75 Hz, 12 dB/octave rolloff). (Effective only if there is a microphone preamplifier.)

2.1.7 Insert (Option)

Input channels may include a pre-EQ insert point, if desired. The INSERT IN key (at the bottom right of the EQUALIZER area) activates this feature.



2.1.8 Dynamics

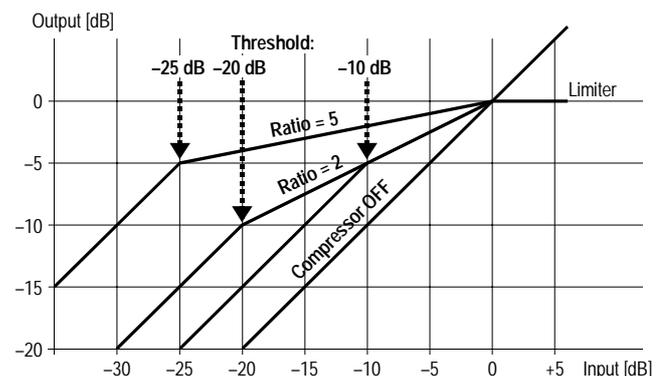
LIMITER / COMPRESSOR IN

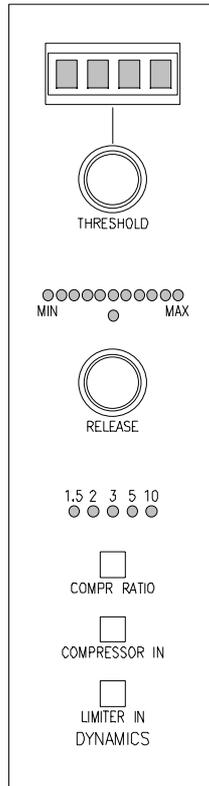
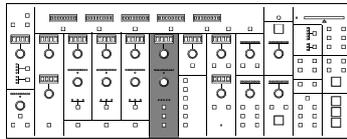
Separate keys switch the compressor and limiter sections on and off.

THRESHOLD

Rotary encoder for adjusting compressor gain and knee (threshold) as a function of the compression ratio; adjustment range -48 dB to 0 dB in 1 dB increments.

The compression ratio may be set to 1.5, 2, 3, 5 and 10 using the COMP. RATIO key.



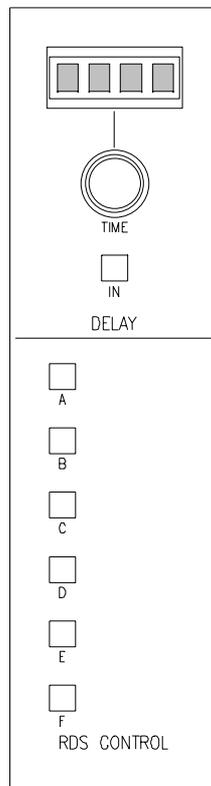
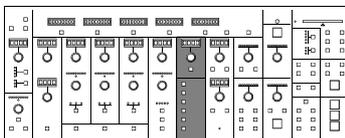


RELEASE

Rotary encoder for adjusting the compressor release time, adjustable from 100 ms to 3 s.

LIMITER

The limiter cut-in point is fixed in the configuration file according to the specified headroom (adjustment range: $-6 \text{ dB}_{\text{FS}}$ to $-20 \text{ dB}_{\text{FS}}$). The release time may also be configured from 1 to 5 s. Hold time: 16.6 ms



2.1.9 Delay / RDS Control

DELAY

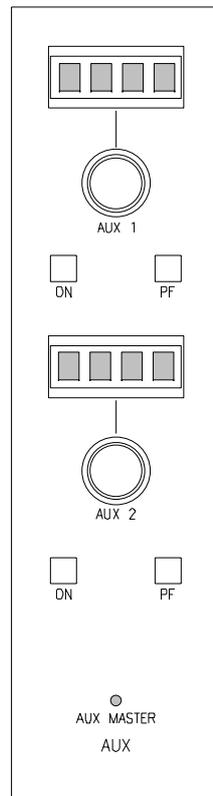
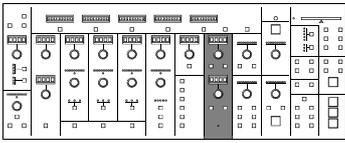
Variable signal delay from 1 sample to 240 ms. The DELAY IN key activates the delay, while the TIME rotary encoder adjusts the delay time, which is displayed in samples from 1 to 47 samples, and from 1 ms to 240 ms thereafter.

RDS CONTROL

The six keys labelled A to F (illuminated yellow) allow the selected input channel to be assigned an RDS identification (e.g. music, news, traffic announcement, etc.). This identification is added outside the console as an identification bit in the digital transmission signal, when the corresponding channel goes on-air.

The On-Air 5000 console provides a separate output with 6 logical signals for controlling the RDS coder.

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2.1.10 AUX

There are two stereo auxiliary channels, AUX 1 and AUX 2.

AUX 1 / 2 ON

The green ON key activates the AUX channel.

PF

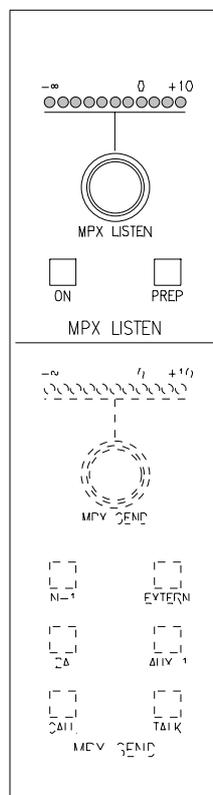
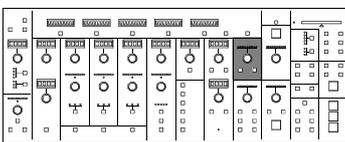
The yellow PF key switches the corresponding AUX tap point from after-fader to pre-fader.

AUX 1 / 2

Rotary encoder for adjusting the AUX send level, displayed in dB.

AUX MASTER

This rotary encoder adjusts the AUX output level of the AUX section selected by MASTER ASSIGN AUX 1 or AUX 2. The red AUX MASTER LED lights in this mode.



2.1.11 MPX LISTEN

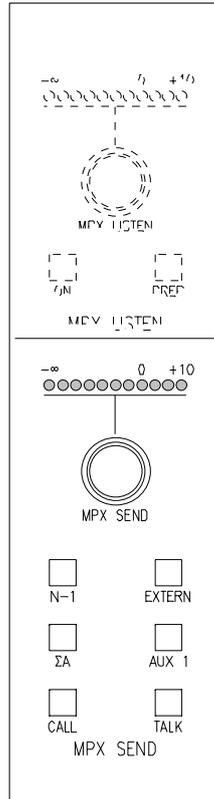
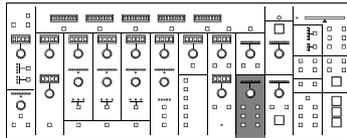
MPX LISTEN / ON

Switches the input channel's pre-fader signal to the MPX LISTEN loudspeaker. The MPX LISTEN rotary encoder adjusts the monitoring level, which is displayed on the corresponding LED bargraph. The MPX listen output is muted when the channel goes on-air (fader open, bus selected, ON key pressed).

MPX LISTEN / PREP

The PREP key readies the channel for preparation or rehearsal mode on pressing the MASTER PREPARATION key (see MPX MASTER field).

PREP mode establishes a pre-fader mix of all channels switched to PREP, which is returned to MPX participants minus their own contribution (N-1, clean-feed). This allows all participants to hear and discuss with each other during the preparation phase or between broadcasts, without affecting live transmission.



When one of them goes on-air, this channel exits PREP mode and returns to normal MPX mode. The participant's return channel now carries the source selected by MPX SEND instead of the other, off-air participants.

2.1.12 MPX SEND

The four keys N-1, EXTERN, ΣA, AUX 1 select separate return signals for each participant. The return signal level may be adjusted using the MPX SEND rotary encoder. Level is displayed on the corresponding LED bargraph.

N-1

Transmission signal (ΣA) excluding the participant's own contribution.

ΣA

Transmission signal including the participant's own contribution.

AUX 1

The mix appearing on the AUX 1 auxiliary channel.

EXTERN

Any source connected to the patch panel (usually off-air reception of the current broadcast programme).

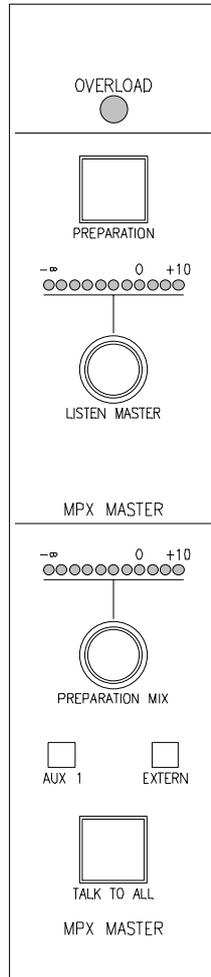
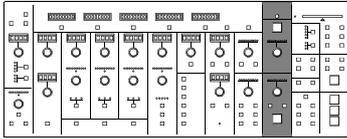
CALL

The CALL key applies a 1900 Hz call signal to the SEND output.

TALK

The TALK key operates in parallel with the TALK key in the corresponding channel's fader strip, and is used for issuing instructions to the selected SEND output. An LED in the key and a buzzer indicate incoming 1900 Hz call signals from participants. LED and buzzer remain active until the corresponding TALK key is pressed.

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2.2 Central Control Unit, Console-Oriented Area

2.2.1 MPX MASTER

PREPARATION

This key places all channels preselected with MPX LISTEN PREP (see above) in preparation or rehearsal mode. This establishes a group of participants who can discuss independently of the live broadcast.

LISTEN MASTER

This rotary encoder adjusts the sum level of all channels switched to MPX LISTEN. Level is displayed on the corresponding LED bargraph.

PREPARATION MIX

Either the live broadcast or an external source can be mixed with the PREPARATION group described above. The PREPARATION rotary encoder adjusts the level, which is displayed on the corresponding LED bargraph.

The following sources can be selected with the two keys:

AUX 1

The mix appearing on the AUX 1 auxiliary channel.

EXTERN

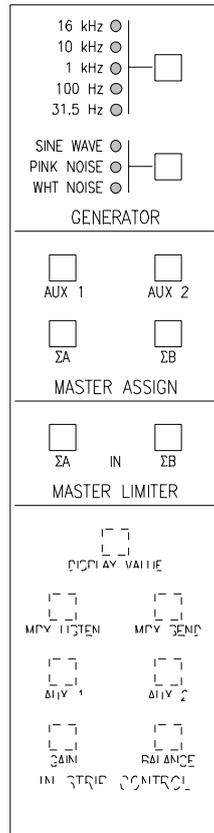
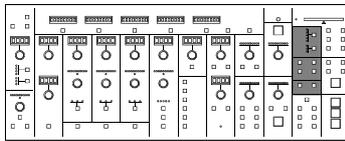
Any source connected to the patch panel (usually off-air reception of the current broadcast programme).

TALK TO ALL

This key addresses all MPX SEND channels simultaneously.

2.2.2 OVERLOAD

The red OVERLOAD LED illuminates when a fixed alarm threshold is exceeded anywhere within the console.



2.2.3 GENERATOR

MODE

The lower key switches between white and pink noise, or a sine-wave signal.

SINE WAVE

The upper key selects the frequency in SINE WAVE mode.

The following frequencies are available: 16 kHz, 10 kHz, 1 kHz, 100 Hz and 31.5 Hz.

2.2.4 MASTER ASSIGN

The four MASTER ASSIGN keys switch the channel-oriented area of the central control unit to MASTER channels. If configured (customer-specific), it is possible to adjust the master output level at both AUX rotary encoders, insert equalizers, and set up the desired destinations via the routing selector.

The AUX 1 and AUX 2 rotary encoders become the main controls for AUX 1 and AUX 2 (the AUX MASTER LED illuminates, see the AUX paragraph above), and OUTPUT ROUTING is enabled.

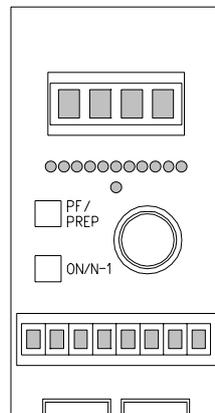
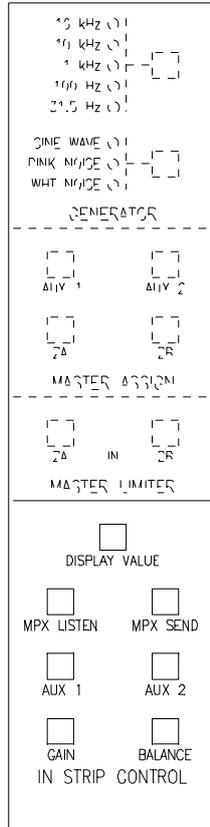
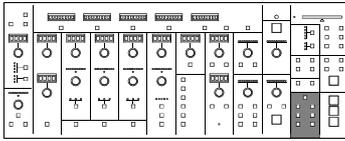
Only OUTPUT ROUTING is enabled for ΣA and ΣB .

2.2.5 MASTER LIMITER

ΣA IN, ΣB IN

These keys enable/disable the permanently assigned limiters in the A and B master outputs. Red LEDs in the keys indicate that the limiter is enabled.

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2.2.6 In Strip Control

The IN STRIP CONTROL keys delegate certain control functions from the central control unit to the upper portion of the fader strips. The rotary encoder, two keys and the associated four-character display in each input channel are assigned the following functions:

MPX LISTEN

Assigns the MPX LISTEN functions to the upper portion of all fader strips (see figure below).

The ON key switches the input channel's pre-fader signal to the MPX LISTEN loudspeaker. The rotary encoder adjusts the monitoring level, which is displayed on the LED bargraph immediately above. The PF/PREP key readies the appropriate channel for switching to preparation/rehearsal mode when the PREPARATION key in the MPX MASTER area is pressed.

When a channel strip goes on-air (fader open, master bus selected, ON key pressed), the MPX LISTEN output mutes and the PREP mode is cancelled.

MPX SEND

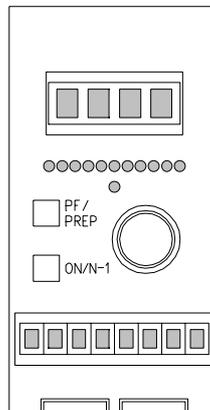
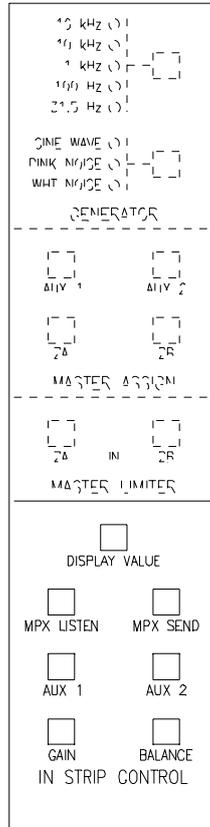
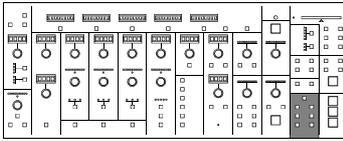
Assigns the MPX SEND functions to the upper portion of all fader strips.

The rotary encoder adjusts the MPX SEND level, which is displayed on the LED bargraph immediately above. Pressing the ON key switches the return output to N-1. There is no function assigned to the PF/PREP key.

AUX 1 / AUX 2

Assigns the AUX 1 and AUX 2 functions to the portion of all fader strips.

The green ON key activates the AUX channel. The yellow PF/PREP key switches the corresponding AUX tap point from after-fader to pre-fader. The rotary encoder adjusts the AUX SEND level, which is displayed in dB.



GAIN

Assigns the INPUT GAIN functions to the upper portion of all fader strips.

The rotary encoder

- adjusts the microphone preamplifier gain, if present. The gain setting appears in the display above (internal gain trim is set to 0 dB).
- adjusts the internal (digital) gain trim, when there is no preamplifier available.

BALANCE

Assigns the BALANCE functions to the upper portion of all fader strips.

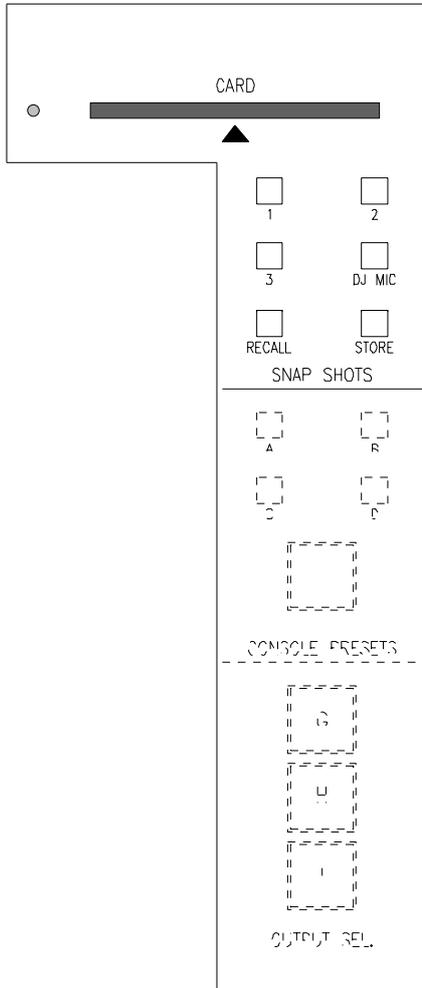
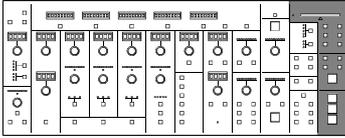
The green central LED illuminates when the ON key is switched off. When the ON key is switched on (green), the rotary encoder positions the source on the stereo soundstage and the green LED extinguishes. The red LED bargraph always indicates the virtual position of the source between L(ef) and R(ight). This allows source pre-panning even while the balance function is disabled.

DISPLAY VALUE

This key switches the four-character fader strip displays over to indicate the current settings.

Normally, these display the “in strip control labels”, as they appear in the fader strip layout. Activating the DISPLAY VALUE key reveals the values currently set in all channels.

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2.2.7 CONSOLE PRESETS

The CONSOLE PRESETS area is subdivided into an upper area that users can access individually, and a lower area with fixed functions.

CARD

The slot labelled CARD accepts a personal identification card. This works like a key, giving access to the snapshot memories stored using this key. Saved data may or may not be modified, depending on the card type.

An empty card slot enables a memory area that is freely accessible to all users. From here, users can recall the first four console setups via the SNAP SHOTS keys.

SNAP SHOTS

This area comprises four yellow SET keys, a green RECALL key, and a red STORE key.

SNAP SHOTS / DJ MIC

This key affects only the DJ microphone channel, by setting all its channel parameters to the current user's stored values. This allows individual gain, equalizer and filter settings to be assigned for each cardholder.

SNAP SHOTS / 1, 2, 3

These keys allow the cardholder to recall three complete console setups (snapshots), and save them if authorised to do so.

SNAP SHOTS / RECALL

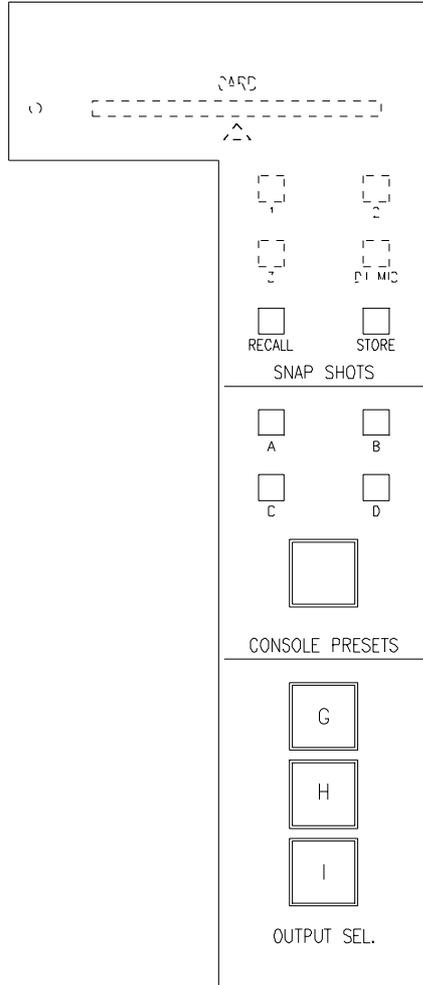
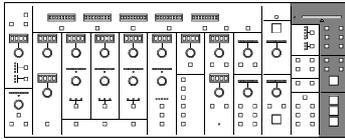
Preparation key to set one of the states described above.

Operating example:

SNAP SHOTS / RECALL (RECALL key lights up green),

SNAP SHOTS / 1; a double-click recalls snapshot no. 1, the previously selected CONSOLE PRESETS key extinguishes, and the SNAP SHOTS / 1 key illuminates.

This sets all console parameters to new values.



SNAP SHOTS / STORE

Preparation key to save the current console state.

Operation is similar to the RECALL procedure, i.e.:

SNAP SHOTS / STORE (red STORE key illuminates),

SNAP SHOTS / 1; double-click to start the save procedure; any previously selected CONSOLE PRESETS key extinguishes; the SNAP SHOTS / RECALL key illuminates.

The current console status is now stored in the cardholder's memory area "1".

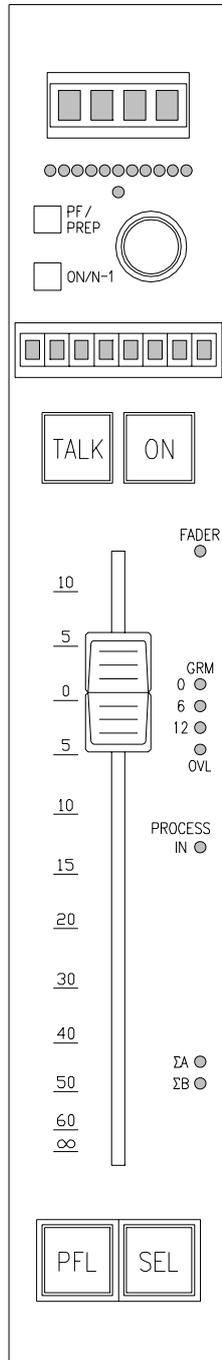
CONSOLE PRESETS (lower area)

The five yellow keys recall fixed console states (presets) that are accessible by all users (even without an ID card). These presets can only be modified by the supervisor, using the master card.

OUTPUT SEL.

The G, H and I keys may be used in conjunction with a broadcast automation system, or configured to allow OUTPUT ROUTING of three lines.

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3 Functional Description: Fader Block

A fader block incorporates controls for four input channels. Two to four blocks may be installed, depending on the size of the console. This represents 8 to 32 simultaneously operable input channels.

3.1 Upper Area

The upper area of each fader strip features one rotary encoder, two keys and a four-character display. The functions of these elements are assigned by the keys in the IN STRIP CONTROL area of the central control unit.

MPX LISTEN

Selecting MPX LISTEN in the IN STRIP CONTROL area assigns MPX LISTEN functions to the upper portion of all fader strips.

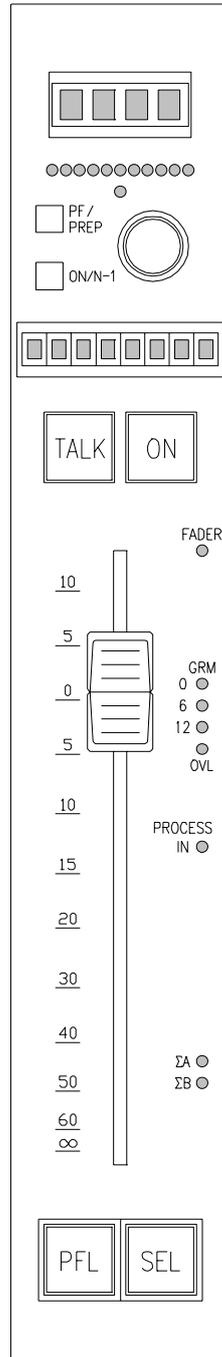
The ON key switches the input channel's pre-fader signal to the MPX LISTEN loudspeaker. The rotary encoder adjusts the monitor level, which is displayed on the LED bargraph immediately above. The PF/PREP key readies the channel for switching to preparation/rehearsal mode when the PREPARATION key in the MPX MASTER area is pressed.

When a channel strip goes on-air (fader open, master bus selected, ON key pressed), the MPX LISTEN output is muted and the PREP mode is canceled.

MPX SEND

Selecting MPX SEND in the IN STRIP CONTROL area assigns MPX SEND functions to the upper portion of all fader strips.

The rotary encoder adjusts the MPX SEND level, which is displayed on the LED bargraph immediately above. Pressing the ON key switches the return output to N-1. There is no function assigned to the PF/PREP key.



AUX 1 / AUX 2

Selecting AUX 1 or AUX 2 in the IN STRIP CONTROL area assigns AUX 1 or AUX 2 functions to the upper portion of all fader strips.

The green ON key activates the AUX channel. The yellow PF/PREP key switches the corresponding AUX tap point from after-fader to pre-fader. The rotary encoder adjusts the AUX SEND level, which is displayed in dB.

GAIN

Selecting GAIN in the IN STRIP CONTROL area assigns GAIN functions to the upper portion of all fader strips.

The rotary encoder

- adjusts the microphone preamplifier gain, if applicable. The gain setting appears in the display above (internal gain trim is set to 0 dB).
- adjusts the internal (digital) gain trim, when there is no preamplifier.

BALANCE

Selecting BALANCE in the IN STRIP CONTROL area assigns BALANCE functions to the upper portion of all fader strips.

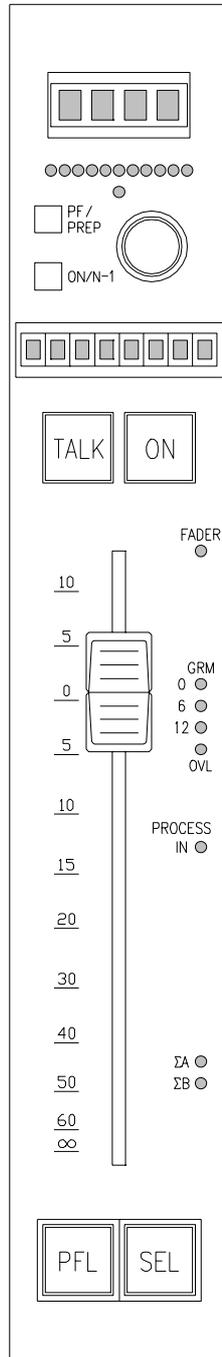
The green central LED lights up when the ON key is switched off. When the ON key is switched on (green), the rotary encoder positions the source on the stereo soundstage and the green LED extinguishes. The red LED bargraph always indicates the virtual position of the source between L(ef) and R(ight). This allows source pre-panning even while the balance function is disabled.

DISPLAY VALUE

This key switches the contents of the four-character fader strip displays to indicate the current settings.

Normally, these display the “in strip control labels”, as they appear in the fader strip layout. Activating the DISPLAY VALUE key reveals the values currently in effect for all channels.

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3.2 Eight-Character Display

Displays the label of the connected source. Should a source label be assigned to an input line (e.g. SC BERN), this label is displayed in place of the input line number (e.g. EL 2).

3.3 Select / ON Keys

SELECT

The SELECT key switches the central control unit to the corresponding input channel strip.

ON

Facilitates click-free channel strip switching while the fader is open. Triggers fader start, provided the fader is open.

3.4 Fader and Display LEDs

The fader adjusts the channel level. An integrated end-switch, together with the ON key, serves to start and stop remote-controllable sources. An open end-switch activates the green FADER LED.

GRM and OVL LEDs

The group of three yellow GRM (Gain Reduction Meter) LEDs shows the amount of gain reduction contributed by the limiter or compressor. The red OVL (overload) LED illuminates should the maximum permissible internal level be exceeded. The overload display in the central control unit activates simultaneously.

PROCESS IN

Indicates that a signal processing unit is inserted and modifying the audio signal (e.g. filters, equalizer, delay, etc.).

ΣA / ΣB LEDs

Indicate the selected master output.

3.5 PFL and Talk Keys

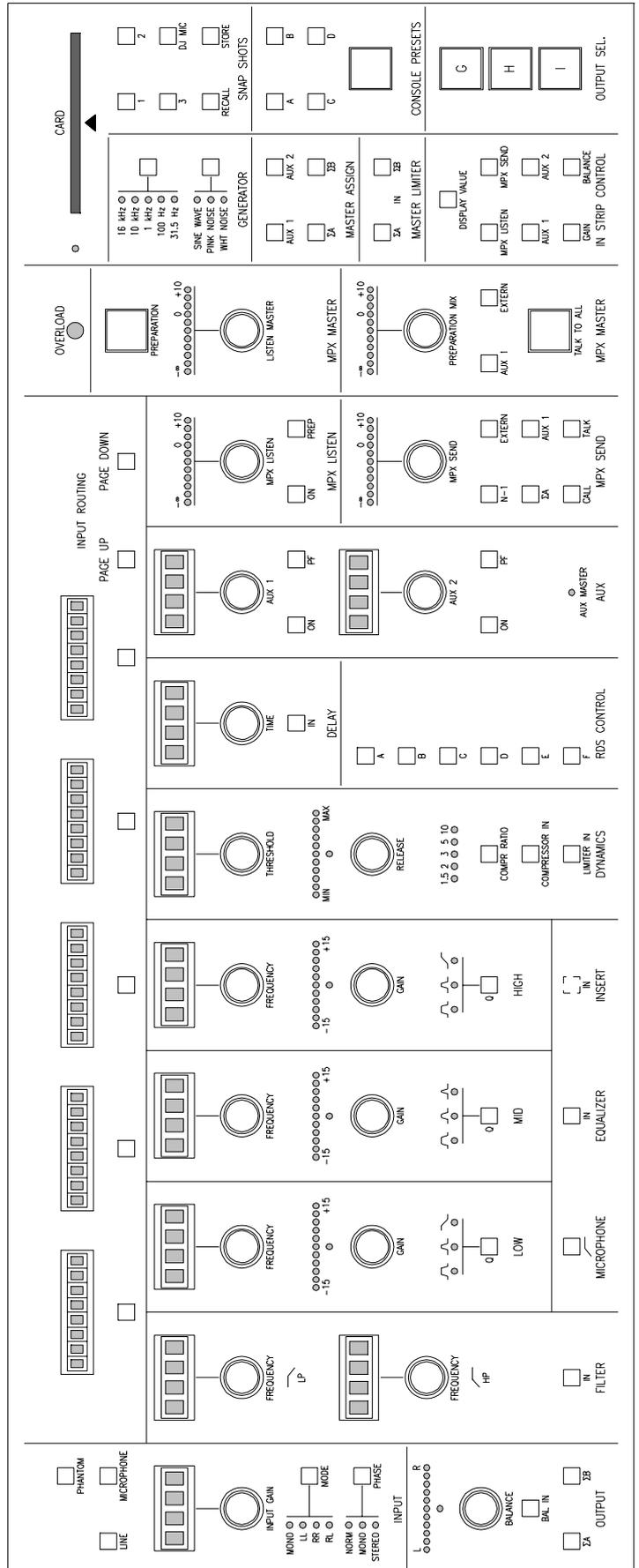
PFL

Pre-fader listening key. The PFL signal is interrupted as soon as audio is actually routed through (configurable).

TALK

For issuing instructions to the selected MPX SEND output. An LED in the key and a buzzer indicate incoming 1900 Hz call signals from participants. The LED and buzzer remain active until the corresponding TALK key is pressed.

Central Control Unit:

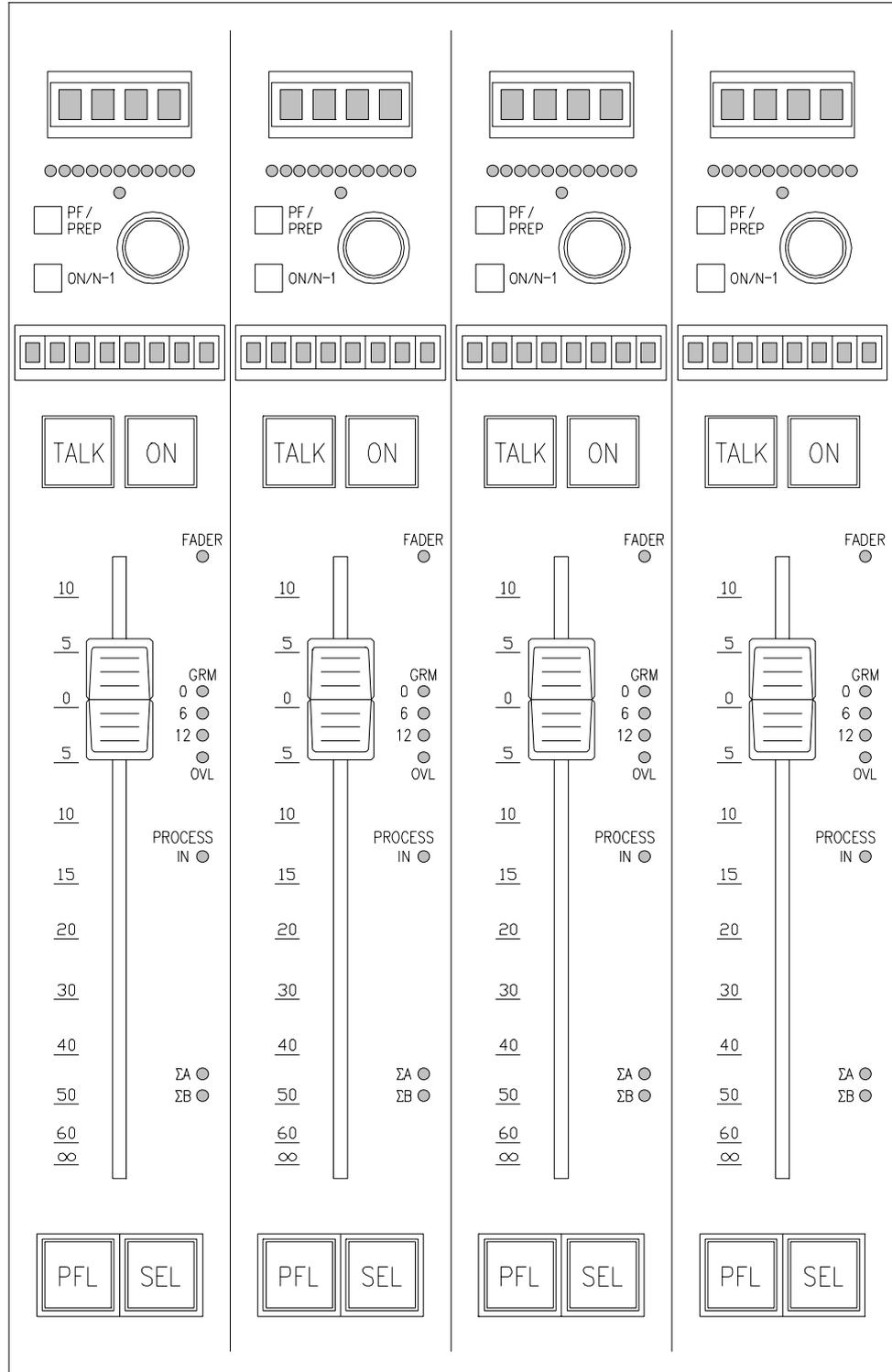


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IN STRIPS LABELS:

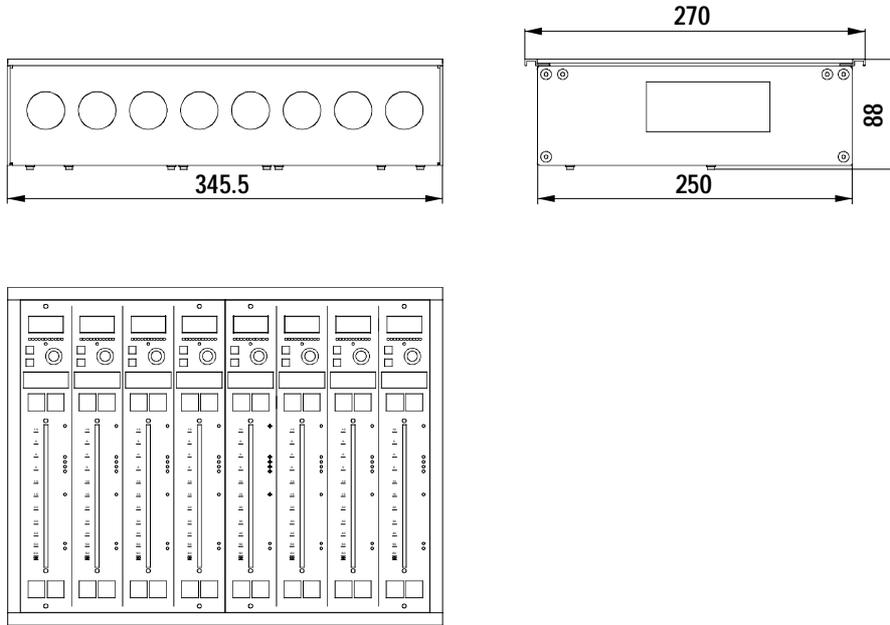
GAIN	BAL	AUX 1	AUX 2	MPXS	MPXL
Mic Gain	Balance	Aux 1 Gain	Aux 2 Gain	Multiplex send	Multiplex listen
Line Gain					
Digital Trim					

Fader Block:

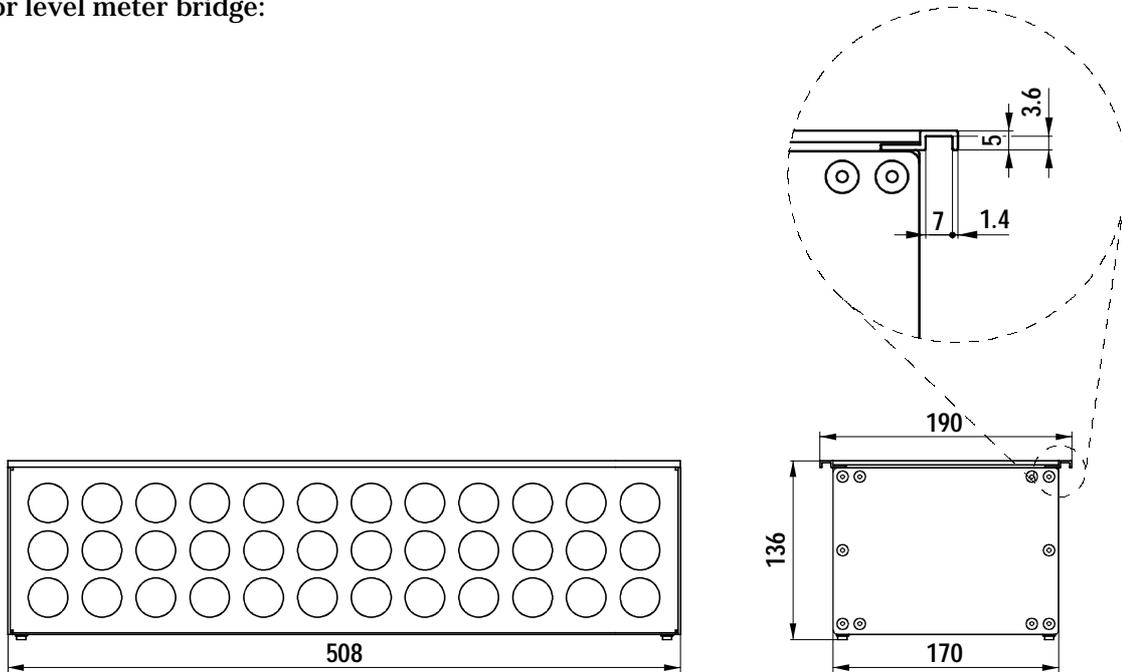


Dimensions (in mm):

Frame for two Fader Modules with four faders each (or one Fader Module and other modules, e.g. Remote Control units):



Frame for level meter bridge:



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Central Control Unit and Monitoring Unit:

