mc²96

Installation & Service Guide

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1. Introduction

About this Manual

This document describes the hardware, installation and service procedures for the **mc²96** control surface.

Look out for the following which indicate:

Notes - points of clarification.

Tips - useful tips and short cuts.

Attention - alert you when an action should *always* be observed.

Further Information

Mechanical drawings and data sheets (including weights and dimensions) are available from the **Downloads** area at www.lawo.com (after **Login**)..

We also recommend that you carefully observe the release notes delivered with your system.

Lawo User Registration

For access to the **Downloads** area and to receive regular product updates, please register at:

www.lawo.com/registration.

2. Important Safety Instructions

Please observe all of the instructions provided in the "General Safety Information for Lawo Equipment" booklet delivered with your devices. Double-click here to open the same information (as a pdf).

Please also observe the "Safety Information" included in the product data sheets. These are available from the **Downloads** area at www.lawo.com (after **Login**).

3. The Hardware

This chapter describes the control surface hardware and options.

3.1 Overview

The **mc²96** comes in a range of flexible frame sizes and layouts. The control surface includes integrated local IO and dual redundant power supplies. The frame is convection cooled and so there are no fans, except in the RTW TM9.

3.2 Frame Variants

The control surface can scale from 24 up to 120 faders. The five standard frame layouts are shown below.

The central bay (24C) houses the centre section with 8 main faders plus one 16-fader channel bay. Additional channel bays may then be added as required. Each 16-fader channel bay adds 510mm to the width of the console. The position of the central bay is flexible allowing for asymmetrical layouts which differ to those pictured below. Double-click here to view all possible frame variants (as a pdf).

A frame can be expanded by adding 16-fader stand-alone extenders up to the maximum of 120 faders. The number of faders in a frame can be increased by fitting the Fader Panel Upper and Xtra Main Faders options.

mc²96 Standard Frame Layouts

mc²96	STUDIO VERSION	MOBILE VERSION
24C	▪ Width: 1333 mm / 52.48 ” ▪ Weight: 102 kg / 224.9 lb	▪ Width: 1228 mm / 48.35 ” ▪ Weight: 79 kg / 174.2 lb
24C+16	▪ Width: 1843 mm / 72.56 ” ▪ Weight: 128 kg / 282.2 lb	▪ Width: 1738 mm / 68.43 ” ▪ Weight: 105 kg / 231.5 lb
16+24C+16	▪ Width: 2353 mm / 92.64 ” ▪ Weight: 152 kg / 335.1 lb	▪ Width: 2248 mm / 88.50 ” ▪ Weight: 129 kg / 284.4 lb
16+24C+32	▪ Width: 2863 mm / 112.72 ” ▪ Weight: 183 kg / 403.5 lb	▪ Width: 2758 mm / 108.58 ” ▪ Weight: 160 kg / 352.7 lb
32+24C+32	▪ Width: 3373 mm / 132.80 ” ▪ Weight: 214 kg / 471.8 lb	▪ Width: 3268 mm / 128.66 ” ▪ Weight: 191 kg / 421.1 lb
16 Fader Stand Alone	▪ Width: 633 mm / 24.92 ” ▪ Weight: 60 kg / 132.3 lb	▪ Width: 528 mm / 20.8 ” ▪ Weight: 37 kg / 81.6 lb



Surface module arrangement can be freely adjusted, allowing also for asymmetrical layouts.

The weights shown above for the "Studio Version" are for a console with no stand.

Mechanical drawings and data sheets for all frame variants are available from the **Downloads** area at www.lawo.com (after **Login**). To help locate the correct data sheet, please refer to the part numbers appendix.

To aid transportation, frames with up to three additional channel bays (72-fader) can be delivered either as a single monolithic frame (978/50-xy) or as a spit frame (978/51-xy). Frames with four or more additional channel bays (88-faders upwards) are always delivered as split frames (978/51-xy). Following transportation, split-frames must be combined to form a single unit.

3.3 Mounting Options

mc²96 Studio Version (with stand)



Each frame can be ordered for either Studio or OB-Van (Mobile) mounting.

The Studio version comes with wider side panels and a console stand (for a free-standing frame). The stand comprises two detachable legs which are supplied with wooden mounting plates to attach the legs to the frame.

The OB-Van version is fitted with narrow aluminum side plates and is designed for crossbar mounting (i.e. no feet or legs are supplied).

3.4 Channel Controls

Channel bays can be specified with either single or dual faders.

3.4.1 Single-Fader Bays

As standard, each channel bay is fitted with the following control panels.

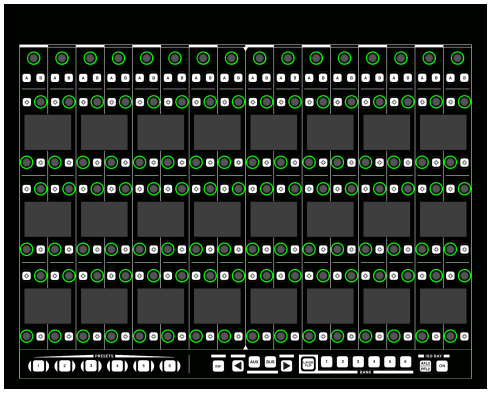
1 x Channel Display (978/13)

A high resolution, touch-screen TFT display.



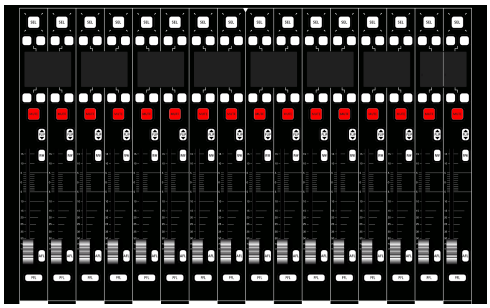
1 x FC Panel (978/11)

with 112 rotary encoders, 24 mini TFT displays, 148 push-buttons.



1 x Fader Panel (978/10)

with 16 x 100mm motorised faders, 8 mini TFT displays, 160 push-buttons.



3.4.2 Dual-Fader Bays

Optionally, the FC Panel (978/11) can be replaced by the Fader Panel Upper (978/12) to provide a second row of short-scale fader strips at the expense of Free Controls 3 to 6. The 978/12 can be fitted to individual bays as required, allowing you to combine single and dual-fader bays within the same surface.

1 x Channel Display (978/13)

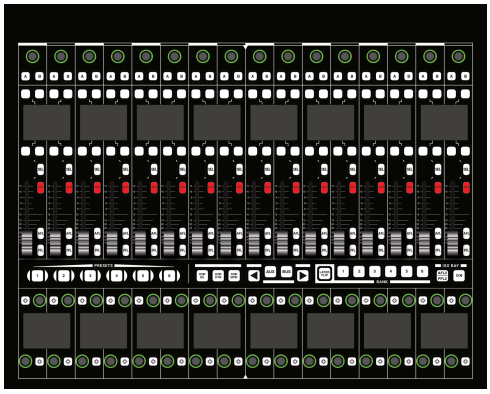
Identical to a standard channel bay.



1 x Fader Panel Upper (978/12)

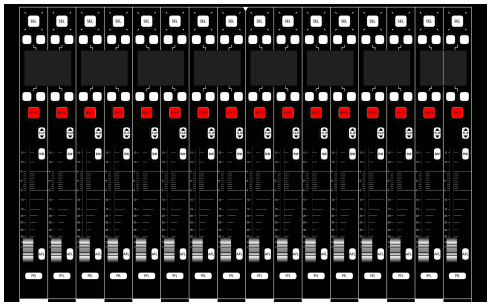
with 16 x 60mm motorised faders, 48 rotary encoders, 16 mini TFT displays, 214 push-buttons.

Replaces the 978/11.



1 x Fader Panel (978/10)

Identical to a standard channel bay.



3.4.3 Ethernet Bayserver

Internally, each channel bay is fitted with an Ethernet Bayserver mounted behind the display. This handles the control data within the bay, and connects to the internal network.

3.4.4 Further Information

All faders and rotary encoders are touch-sensitive.

You can find more information about the individual panels and displays in their data sheets.

3.5 Centre Section Controls

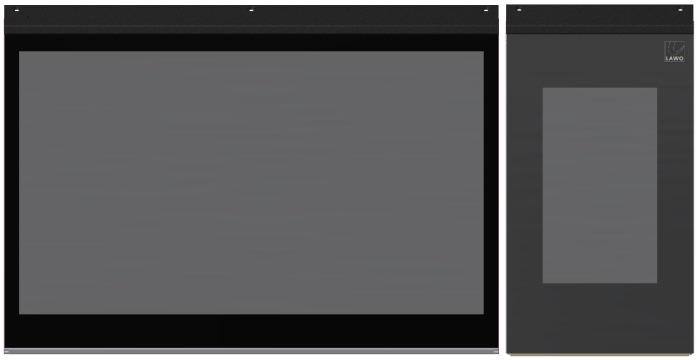
The centre section can be specified with either 8 or 16 main faders.

3.5.1 Standard Centre Section

As standard, the centre section is fitted with the following control panels.

1 x Channel Display (978/13)

A high resolution, touch-screen TFT display (identical to a channel bay). When fitted to the centre section, the display is known as the Central GUI.



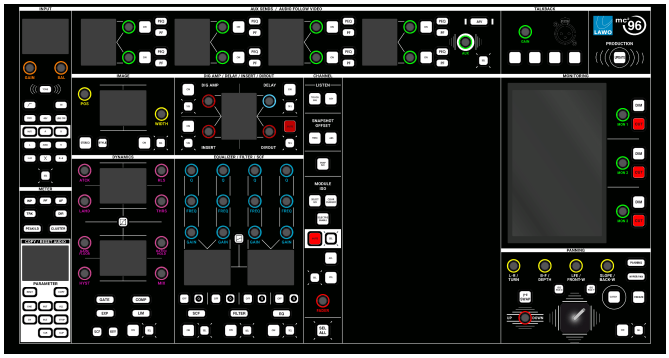
1 x RTW Panel (978/27)

A special version of the RTW TM9 for Lawo consoles.

1 x Central Panel Upper (978/21)

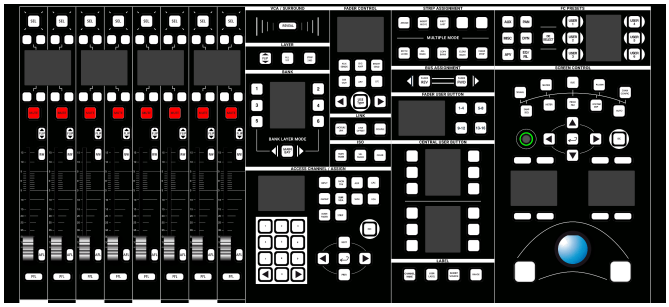
with 47 rotary encoders, 12 mini TFT displays, 1 touch-screen display, 1 motorised joystick, 1 XLR connector, 130 push-buttons.

The panel includes a space for up to two user panels. Unless otherwise specified, the console ships with two blanking panels (978/28).



1 x Central Panel Lower (978/20)

with 8 x 100mm motorised faders, 1 rotary encoder, 13 mini TFT displays, 1 trackball, 207 push-buttons.



3.5.2 Xtra Main Faders

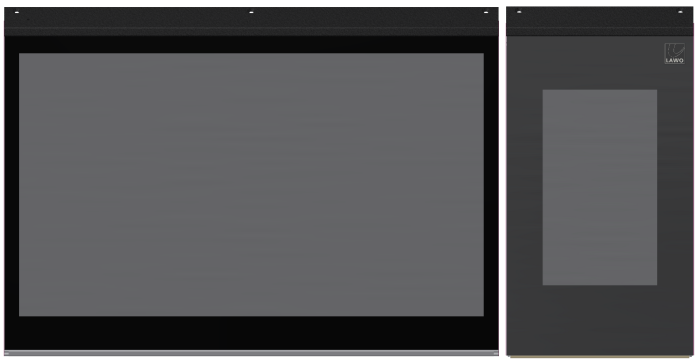
Optionally, the Central Panel Lower (978/20) can be replaced by the Xtra Central Panel Lower (978/22) to increase the number of main faders from 8 to 16. To support this option, the Central Panel Upper (978/21) *must* be fitted with the Xtra User Panel (978/23) to provide access to the following functions: FC PRESETS, LINK, ISO, STRIP ASSIGNMENT, FADER USER BUTTON and BUS ASSIGNMENT. This option can be retrofitted to existing consoles.

1 x Channel Display (978/13)

Identical to standard centre section.

1 x RTW Panel (978/27)

Identical to standard centre section.

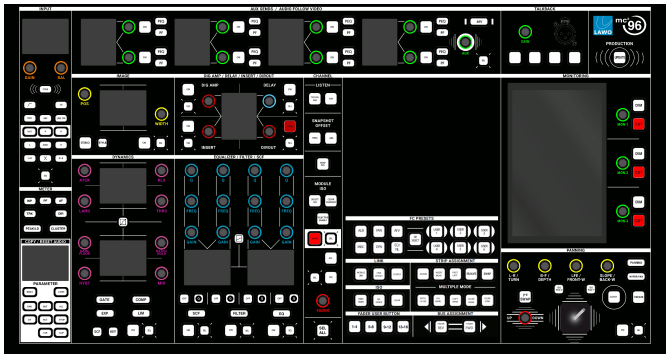


1 x Central Panel Upper (978/21)

Identical to standard centre section.

1 x Xtra User Panel (978/23)

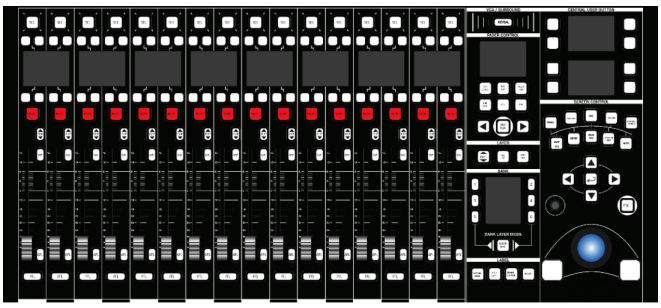
with 35 push-buttons.



1 x Xtra Central Panel Lower (978/22)

with 16 x 100mm motorised faders, 1 rotary encoder, 12 mini TFT displays, 1 trackball, 210 push-buttons.

Replaces the 978/20.



3.5.3 Ethernet Server

Internally, the central bay is fitted with an Ethernet server (mounted behind the display). This can be either a Bayserver or Gateserver. The differences are described later.

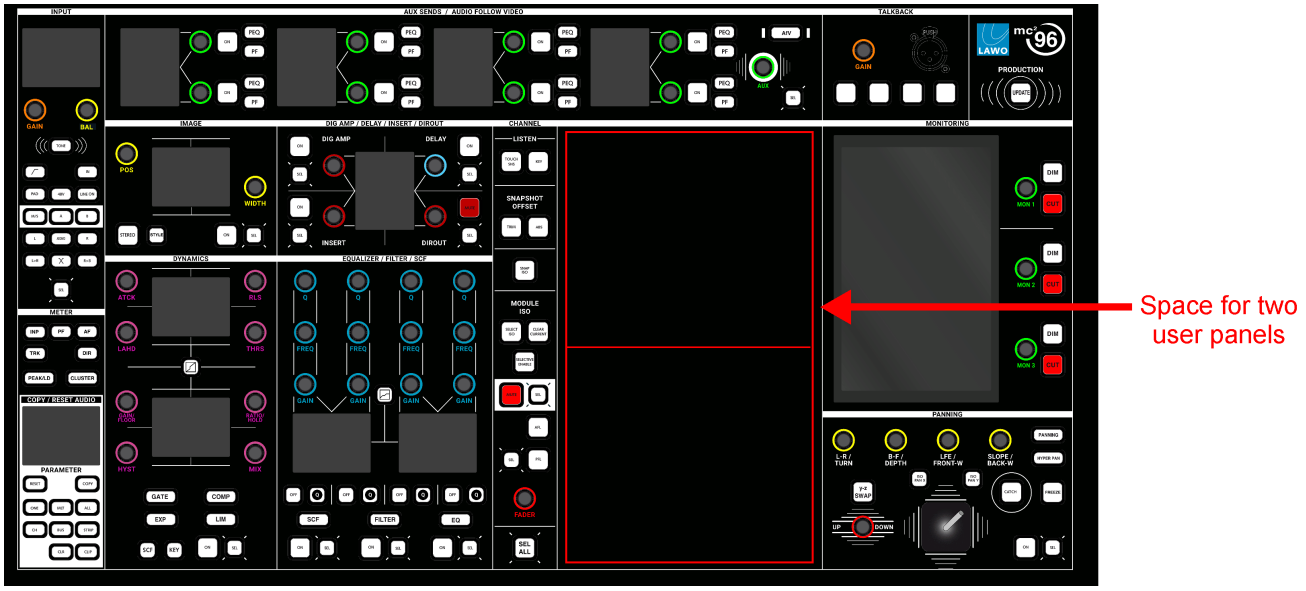
3.5.4 Further Information

All faders and rotary encoders are touch-sensitive.

You can find more information about the individual panels and displays in their data sheets.

3.6 Central User Panel Options

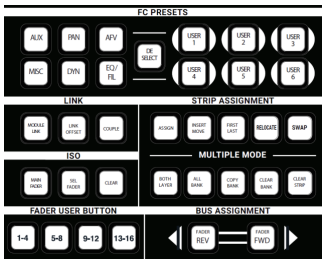
The Central Panel Upper (978/21) can be fitted with up to two Lawo User Panels. If the console is fitted with the Xtra Main Faders option, then the lower slot *must* be used for the XTRA USER PANEL (978/23). In all other cases, the two slots are freely configurable. Unless otherwise specified, the console ships with two blanking panels (978/28).



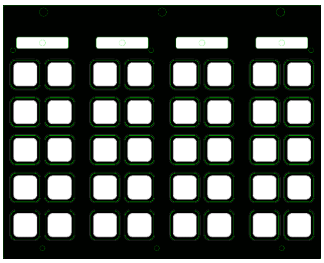
User Panel Options

Part No	User Panel Name	Description
978/23	XTRA USER PANEL	Must be fitted to an Xtra Main Faders console.
978/24	40 KEY USER PANEL	40 user-programmable buttons. Two panels can be fitted to provide 80 buttons.
978/25	REVEAL FADER	5 dedicated faders for revealing surround slaves.
978/26	AUTOMATION	Controls for the timecode automation system.
978/28	BLANKING PLATE	Single slot blanking panel.

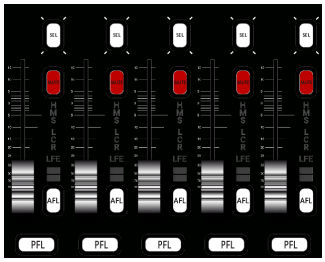
XTRA USER PANEL



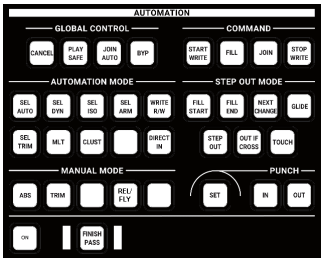
40 KEY USER PANEL



REVEAL FADER



AUTOMATION



3.7 Overbridge Metering



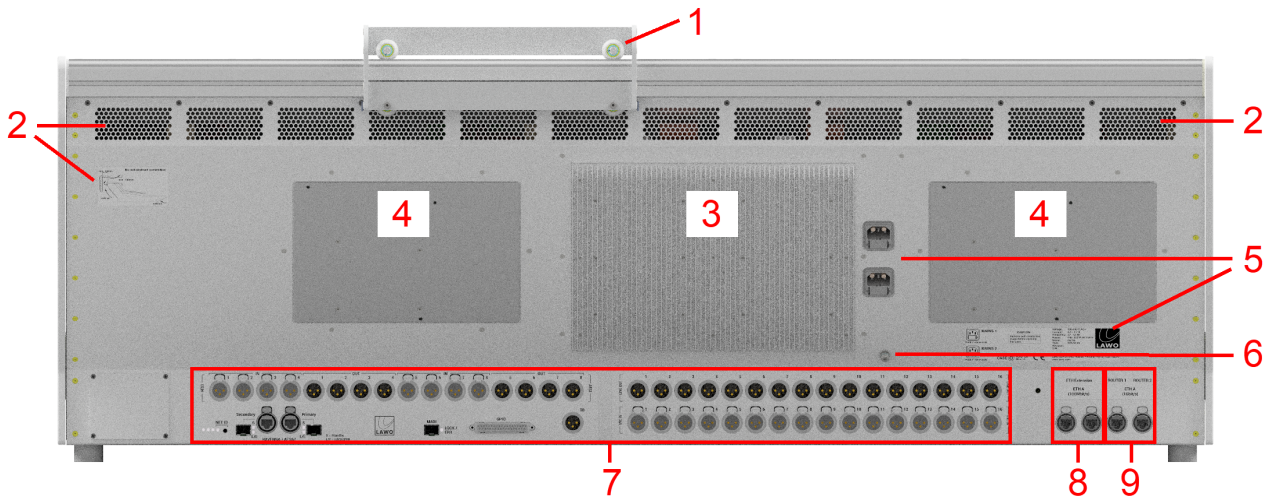
The console comes as standard with an RTW TM9 meter. This is a special version of the TM9, designed specifically for Lawo consoles. If the meter is removed, then a blanking panel (978/29) should be installed.

The meter provides 4 x AES3 inputs for multi-channel metering and 5 x GPI for external control. These are wired internally to the console's local IO. The default configuration sets the AES3 inputs to follow the **MON 1** monitor source selector. Alternatively, signals can be routed directly to the meter using the console GUI.

All other functions are operated via the meter's touch-screen display. Please refer to the documentation from RTW.

Note that meter includes a temperature-controlled fan to provide cooling at extreme temperatures (>70°C). Under normal operating conditions, the fan is inactive. When the meter boots up, the fan is tested. This means that you will hear the fan, momentarily, whenever the control surface power is applied.

3.8 Console Rear Panel



1 Removable Script Tray (optional)

One or more removable script trays may be ordered. The script tray glides across the top of the frame, and can be lifted on or off for removal.

2 Ventilation Holes & Sticker

The sticker shows the direction of airflow (required for convection cooling) and the minimum distance requirements (for installing the frame). It is important that cold air is taken in underneath the console, near the armrest, and that cold air flows externally upwards across the whole of the rear panel. This is because both the PSU heat sink (3) and Bayserver back plates (4) will dissipate heat during operation.

3 PSU Heat Sink

Radiates heat from the internal power supplies. The heat sink indicates the location of each PSU block within the frame.

4 Ethernet Server Back Plates

Radiates heat from the internal Ethernet servers. The back plates indicate their location within the frame.

5 MAINS 1 & 2

The **MAINS 1** & **MAINS 2** connectors supply AC mains power to the frame. The sticker states the AC mains requirements.

Depending on the frame size, one or more PSU "blocks" may be installed, each providing main and redundant power supplies. Therefore, in larger frames you will see more than one set of **MAINS** connectors.

6 CASE

The CASE grounding screw (M5 x 12mm) should be used to ground the frame.

7 Local IO Connector Panel

Here you will find the connections for the built-in local IO. These are described later.

8 ETH Extension

The first pair of network ports can be used to connect Extender frames.

9 Control Data to/from the Core

The second pair of network ports connect the control surface to the Core.

3.9 Ethernet Server Types

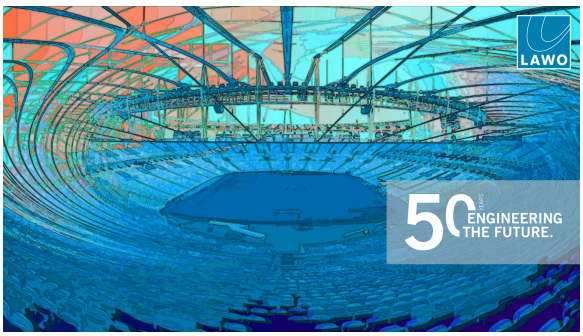
Internally, each channel and central bay is fitted with an Ethernet server. In channel bays, the server type is always the same: a Bayserver. For the central bay, there are two possibilities: either a Bayserver or Gateserver (supported from V6.4.0 onwards). This option determines how the control surface connects to the Core and, as a result, where it can be installed.

- Bayserver consoles connect directly to the ETHERNET A ports on the Nova73. Since the connection must be directly-wired, this limits the maximum distance between the surface and Core.
- Gateserver consoles connect to the Core via the Management Network. Since this supports Layer 3 routing, this allows the surface to be installed remotely from the Core.

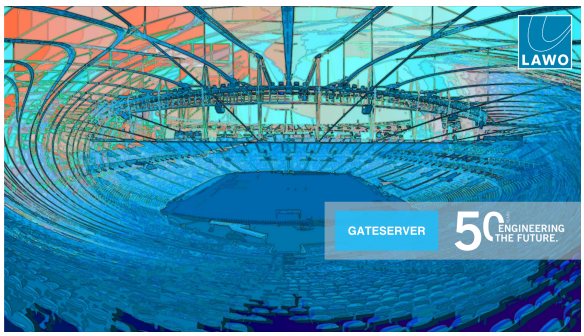
The internal and external wiring for each variant are described later.

Externally, there are two ways to determine the central server type: via the start-up screens on the Central GUI, or the Ethernet connector panel at the rear of the frame.

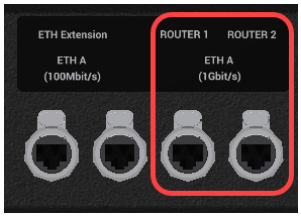
Start-up Screen (for Central Bayserver)



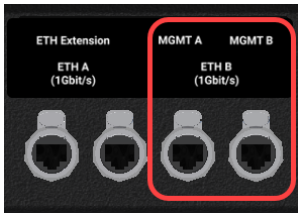
Start-up Screen (for Central Gateserver)



Rear Connector Panel (if Central Bayserver)



Rear Connector Panel (if Central Gateserver)



3.10 Control Surface Wiring

Internally, the control surface uses point-to-point connections, within each bay, to provide fault tolerance and convenient servicing. Any bay or panel can be isolated from the rest of the console, allowing panels and displays to be replaced during operation.

Firstly, within each bay, individual panels and displays connect to the Ethernet server (mounted behind the display). In channel bays, the connections are made using both USB and Display Port. In the centre section, the optional user panels connect via USB only, and there is also a USB hub which connects to the console keyboard and trackball.

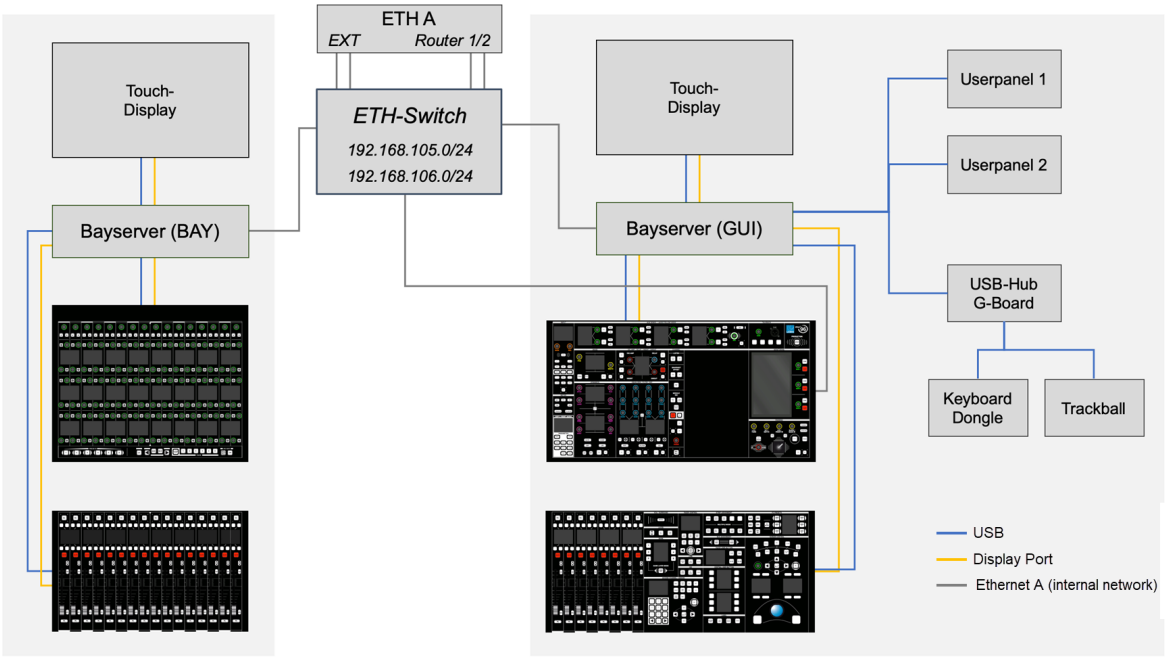
Each server then connects to an Ethernet switch to form what is known as the internal network or ETHERNET A. On the mc²96, the switch also connects to the Central Panel Upper to drive the touch-screen MONITORING display.

Externally, the following connections are wired from the internal network switch (on all consoles):

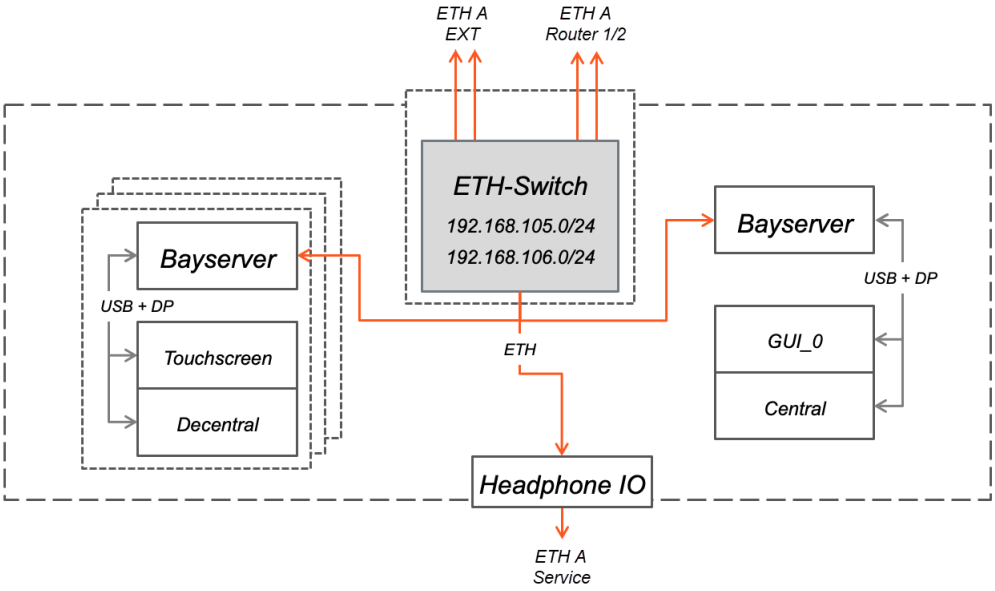
- **ETH Extension** (rear panel) - to connect extender frames.
- **ETH A** (front buffer) - to connect a service computer.

The remaining connections vary, depending on whether the central bay is fitted with a Bayserver or Gateserver.

3.10.1 Internal Wiring for Bayserver Console



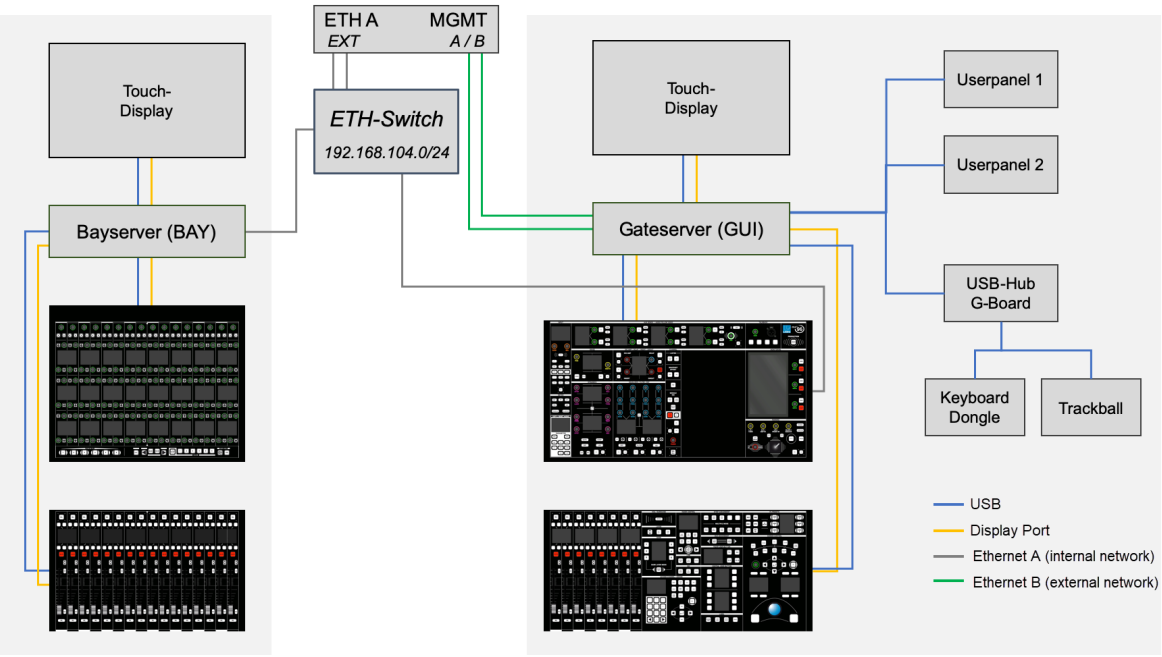
Schematics (Bayserver Console)



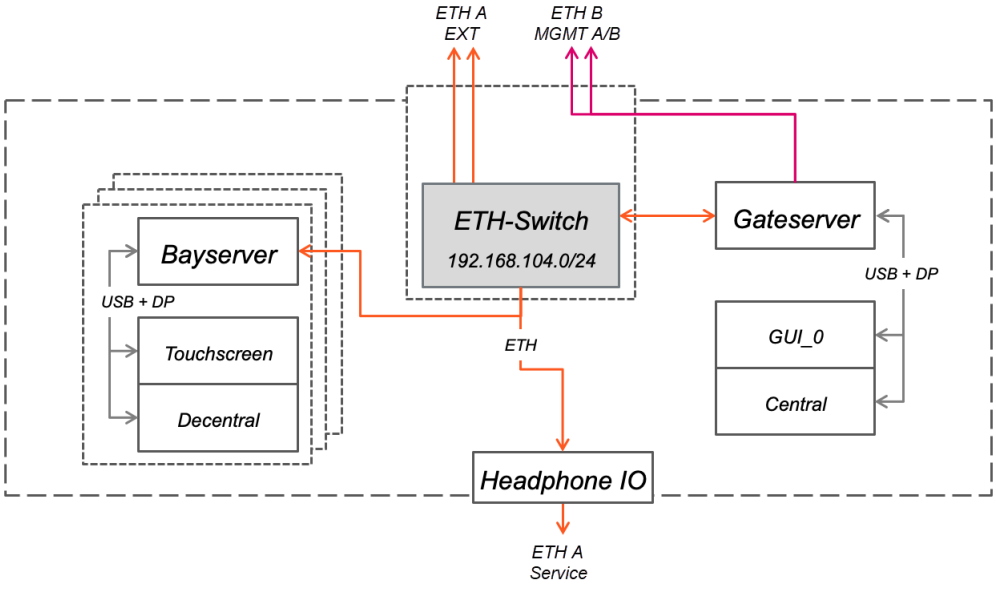
On a Bayserver console, there are a further two connections from the internal network switch: **ROUTER 1** and **ROUTER 2**. These must connect directly to the ETHERNET A ports on the Nova73 Router Modules. Only one connection is essential for operation. If a second Router Module is fitted, then a second connection should be made to support redundancy.

The control surface *must* be connected to the mc^2 control system (via ETHERNET A) in order to boot. Therefore, to start the system, both the control surface and Nova73 must be powered.

3.10.2 Internal Wiring for Gateserver Console



Schematics (Gateserver Console)



On a Gateserver console, there are a further two connections which come from the Gateserver: **MGMT A** and **MGMT B**. These *must* connect to the same Management Network as the Core's control ports (e.g. ETHERNET B if the Core is a Nova73). Only one connection is essential for operation. A second connection can be installed to support redundancy.

A Gateserver console can boot on its own once power is supplied to the control surface. To become fully operational, there must also be a valid network connection to the Core.

3.10.3 Additional Notes for Gateserver Consoles

The Gateserver provides a more sophisticated computing engine that can boot on its own once power is supplied to the control surface. To achieve this, the Gateserver has its own SSD storage containing the boot image. This must be updated separately using the mxUpdater utility (included with mxGUI).

After a successful boot, the Gateserver connects automatically to its partnered Core (by creating a VPN connection between the Gateserver and mc^2 control system). If there is no connection available, then the console will show "disconnected" screens. Once a valid network connection is established, the screens update to their "connected" state. This indicates that the console is ready for operation.

> For the console to become fully operational, there must be a valid network connection between the Gateserver and mc^2 control system.

4. Installation

This chapter describes how to install the control surface.

4.1 Unpacking

If the control surface comprises more than one frame, then each frame is delivered separately. All included accessories are shipped in the "Accessories" box. Any optional components are delivered in their own packing boxes.

Please check the contents of the shipping boxes, and in the event of any transport damage, contact your local Lawo representative or email support@lawo.com.

4.2 Packing List

Included

The following items are included with the control surface (in the "Accessories" box):

- **2 x 2m IEC power cables (country-specific)** - to connect mains power to the frame. If the surface contains more than one PSU block, then additional IEC power cables are supplied.
- **1 x Logitech wireless keyboard + USB dongle** - to be installed as the console keyboard. The USB cable is included for charging purposes.
- **1 x dust-cover** - to protect the console when not in use.
- **1 x tool case + tools** - for performing service procedures.
- **1 x USB memory card** - containing the latest software and configuration files.

If you have ordered the studio version, then this comes with the console stand: 2 x detachable legs + mounting plates.

Optional

The following items must be ordered separately.

- **SFP modules** - for the MADI and RAVENNA/AES67 ports.
- **Removable Script Tray (978/68)**.

4.3 Mounting the Frame

If the control surface is delivered as a split-frame, then the sections must be combined to form a single unit.

If you have ordered the studio version, then this comes with the console stand. The two detachable legs are packed separately and are delivered with wooden mounting plates to attach the legs to the frame.

The OB-Van version is designed for mounting onto a crossbar (not supplied). Note that a separate OB-Van mounting kit is not required as the screw threads are integrated into the frame.

> The frame *must* be mounted so that the faders work in a horizontal manner. It is forbidden to use the device in any other position, due to the convection airflow through and along the device.

All plug-in connectors are located on the front buffer and rear panel. Therefore, when installing, please leave enough room for the cables. You must also make sure that there is sufficient airflow around the device for cooling.

If you have Central User Panels to install, then bear this in mind before mounting the frame in its final location.

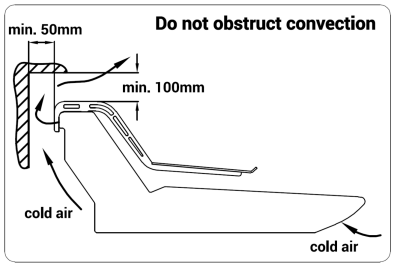
4.4 Dimensions and Weight

The dimensions and weight vary depending on the frame variant and control panel options. Mechanical drawings and data sheets for all frame variants are available from the **Downloads** area at www.lawo.com (after **Login**). To help locate the correct data sheet, please refer to the part numbers appendix.

4.5 Temperature and Cooling

Proper operation of the control surface can only be guaranteed at an ambient temperature between 10° C and 40° C and a relative humidity between 15% and 85% (not condensing).

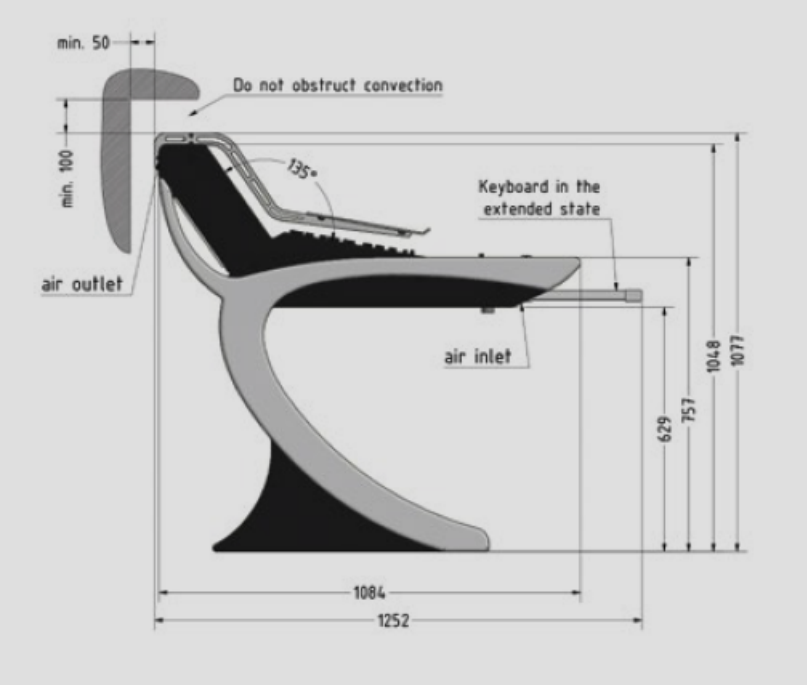
All frames are convection cooled. The housing is perforated to guide the air flow in and out of the unit. It is important that cold air is taken in underneath the console, near the armrest, and that cold air flows externally upwards across the whole of the rear panel. This is because both the PSU heat sinks and Ethernet server back plates will dissipate heat during operation. The sticker on the rear of the frame summarizes the requirements.



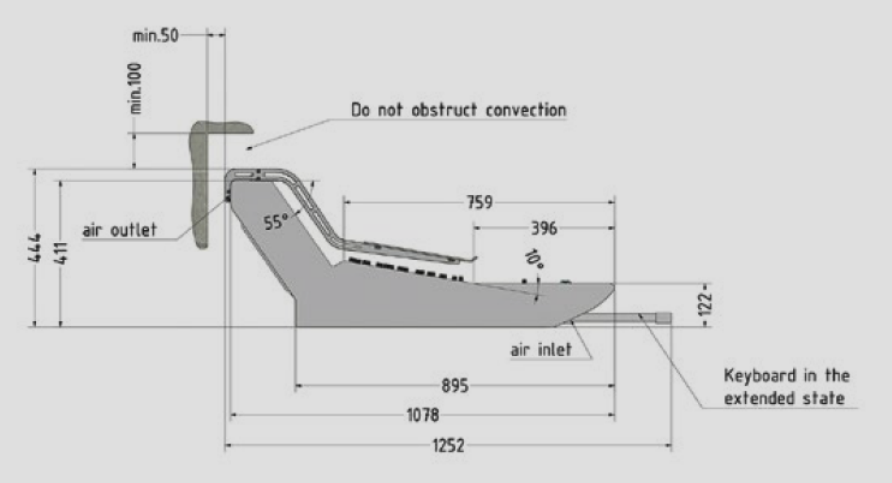
> *ALWAYS* observe the minimum distances around the console frame to allow for ventilation and cable ducting. Take care that no devices or cables obstruct the flow of air and, thereby, hinder cooling.

4.6 Minimum Distances for Control Surface Mounting

Studio Frame



OB Van Frame



4.7 Installing the Console Keyboard

The Logitech wireless keyboard (included in the "Accessories" box) is designed to sit on the pull-out drawer beneath the main faders:



The keyboard is available in one of two layouts: either English (default) or German. Following installation, be sure to select the correct layout from the Central GUI's **System Settings** display (in the **Global** -> **System** options).

The maximum load of the keyboard drawer is 10 kg.

DO NOT press down, sit on or place objects > 10 kg onto the pull-out drawer, as to do so may damage the drawer and console frame.

The keyboard is delivered with:

- 1 x Logitech USB dongle - to support wireless operation.
- 1 x USB cable - to charge the keyboard.

➢ **To install the keyboard:**

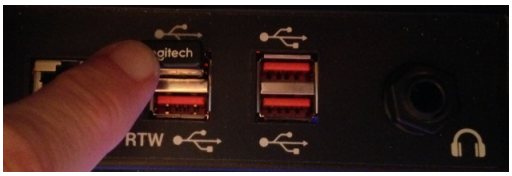
1. Using the cable provided, connect the keyboard to a powered USB port, and wait until the keyboard is fully charged.

2. Insert the Logitech USB dongle into one of the USB ports on the front of the console; any available port can be used.

Logitech USB dongle



Front Buffer USB Ports



Take care to connect the dongle to a Lawo system USB port and not the one marked "RTW"!

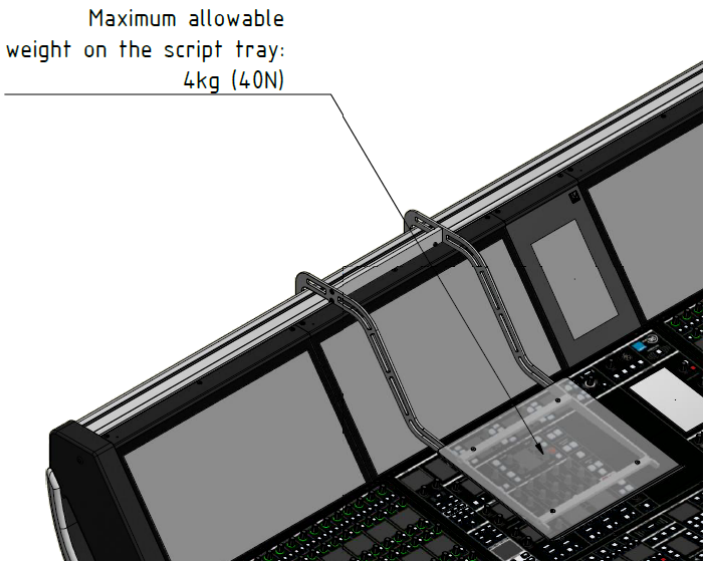
3. Follow the instructions supplied with the keyboard to pair the device.

4. Once the operation has been tested, the keyboard can be placed in the pull-out drawer.

Note that the keyboard will not work as a wired device (while charging), so take care to recharge the internal battery before there is no charge left!

If you lose the wireless USB dongle, then a replacement can be ordered from Logitech. Please consult the documentation supplied with the keyboard for details.

4.8 Fitting the Script Tray



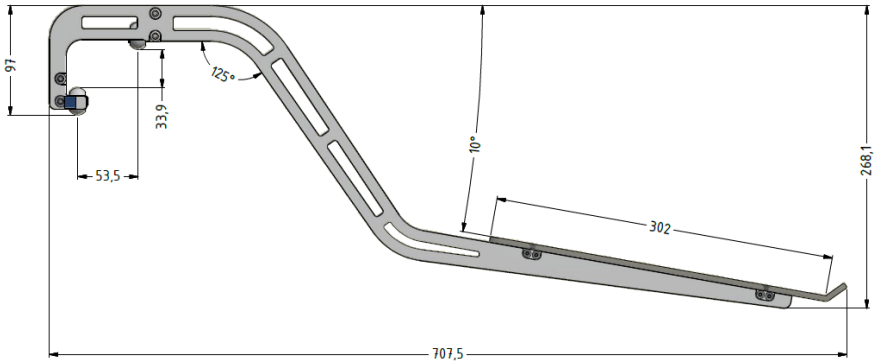
The script tray (978/68) is designed to be easily lifted on and off the console so that it may be removed when not required. Please note that there is no locking mechanism to anchor the script tray to the console, and so it *must* be removed for transportation.

When fitted, the tray glides to the left or right. The maximum load of the script tray is 4kg.

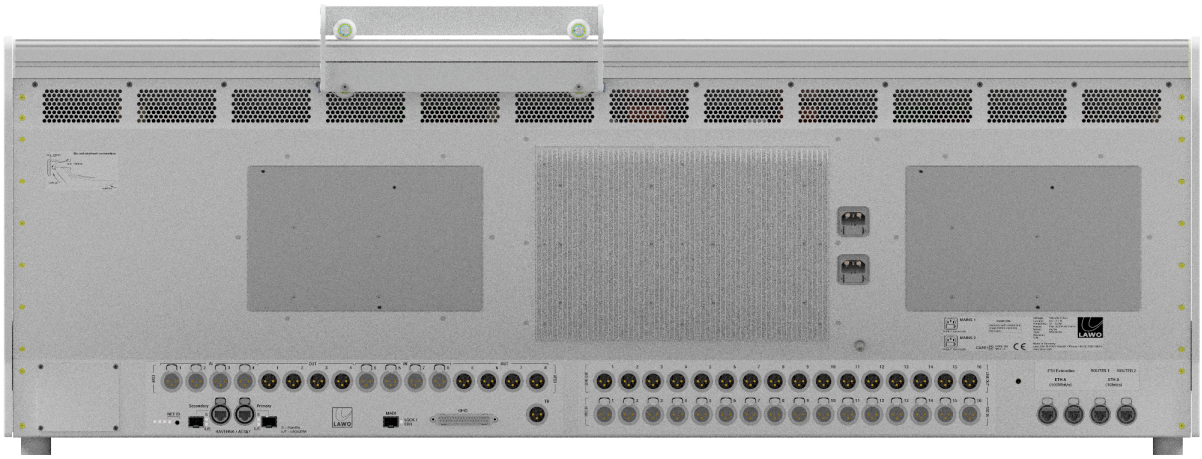
> *DO NOT* press down, sit on or place objects > 4kg onto the script tray, as to do so may damage the script tray and console surface.

Mechanical Drawings (Rear View & Side Profile)





4.9 Wiring from the Control Surface



The console rear panel provides the following connections:

- **MAINS 1 & MAINS 2** - AC mains power. Only one connection is essential for operation; the second provides redundancy.
- **CASE** - control surface grounding.
- **ETH Extension (ETH A)** - wiring to extender frames.
- **ROUTER 1 & 2** or **MGMT A & B** - control data to/from the Core or Management Network. Only one connection is essential for operation; the second provides redundancy.
- **AES3, MADI, GPIO, MIC, LINE** - audio and GPIO breakouts for the local IO.
- **RAVENNA/AES67** - multi-channel audio connection to the Core (for the local IO).
- **TB** - wired directly from the TALKBACK connector on the front panel.

You will also find headphone, USB and internal network connectors on the front buffer, and an XLR (for a talkback mic) on the front panel.

The topics which follow describe the connections in more detail.

4.10 Power

The control surface is powered by dual-redundant power supplies which are fitted internally within the frame. To operate the console, only one of the supplies is required. When both supplies are operational, the load is shared.

4.10.1 PSU Block Locations

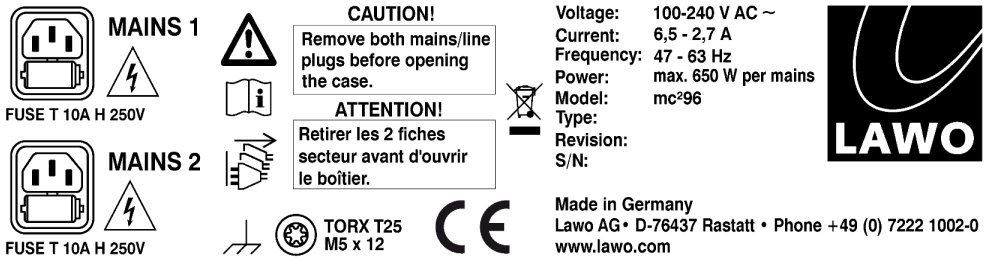
Depending on the frame size, more than one PSU block may be required. Double-click here to view the PSU block locations for all possible frame variants (as a pdf). Extender frames are fitted with their own PSU block.

The status of all PSU blocks can be monitored from the Central GUI (via the status bar). To change a faulty PSU, see Replacing a Console Power Supply.

4.10.2 Electrical Specification

The power consumption varies depending on the frame variant, so please reger to the "mc²96, 978-50-xy, 978-51-xy" data sheet. The sticker on the rear of the frame provides a summary.

AC Mains Requirements (sticker)



4.10.3 Mains Connections

The **MAINS** connectors are located on the frame's rear panel. There are two connectors, one for each of the internal supplies.

For redundancy it is recommended to connect both **MAINS** connectors, each to a separate phase of the AC mains circuit. The same two phases should be used for other PSU blocks within the same frame, so **MAINS 1** and **MAINS 3** connect to the first phase, while **MAINS 2** and **MAINS 4** connect to the second phase.

There is no on/off switch, and so the frame will boot as soon as mains power is supplied. It is recommended that you install a master power switch to control all the power supplied to the frame.

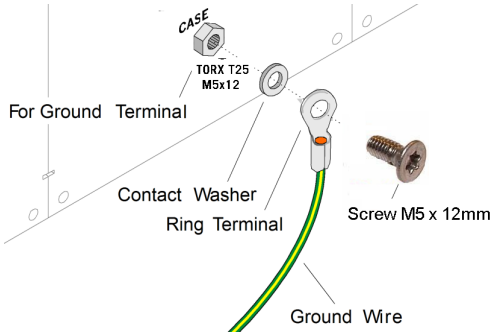
The **MAINS** connectors include an IEC locking mechanism for security. Please unlock before removing a connector. Be sure to turn the mains power off *BEFORE* connecting or disconnecting a cable.

> Each frame *MUST* be connected to the mains using the IEC power cables supplied with the system. When running with two mains supplies, make sure that both circuits lie on the same ground potential. Otherwise, an internal bridge of two grounding wires can lead to a ground loop!

4.11 Grounding

Although operator protection is guaranteed (the control surface is connected to the ground of the power supply system via the IEC power connectors), it is best to establish an additional ground for EMC reasons.

1. Fasten the grounding cable to the rear of the frame using the **CASE** grounding screw (M5 x 12mm):



The control surface must be on the same potential as all other system devices/modules. For Scandinavian countries, *ALWAYS* use a grounded mains connection, to prevent the device from being grounded through Ethernet or other signal connections.

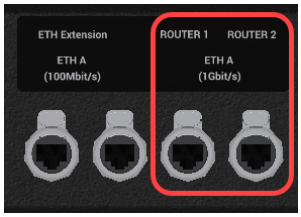
Grounding of Audio Interfaces

For compliance with AES3, digital interfaces should be connected to a field ground.

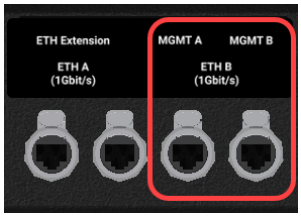
4.12 Control

The control data connection to the Core varies depending on whether the surface is fitted with a central Bayserver or Gateserver.

Rear Connector Panel (if Central Bayserver)



Rear Connector Panel (if Central Gateserver)



4.12.1 Wiring for Bayserver Consoles

The **ROUTER 1** and **ROUTER 2** ports must connect directly to the ETHERNET A ports on the Nova73 Router Modules. Only one connection is essential for operation. If a second Router Module is fitted, then a second connection should be made to support redundancy.

Connections are made via TCP/IP Ethernet.

> The connection(s) must be directly wired without any other network equipment between the ports.

Cable Specification

- **Cable**: CAT 5e; straight (1:1) Ethernet cable.
- **Connector**: RJ45.
- **Length**: up to 80m.

4.12.2 Wiring for Gateserver Consoles

The **MGMT A** & **MGMT B** ports must connect to the same Management Network as the Core's control ports (e.g. ETHERNET B if the Core is a Nova73). Only one connection is essential for operation. A second connection can be installed to support redundancy.

Connections are made via TCP/IP Ethernet.

Lawo may deliver a suitable network switch with the system. This could be replaced by any other suitable switch fabric that provides comparable performance.

> You must use a network switch and *NOT* a hub, and keep the Management Network separate from other traffic within the installation. The switch should support 1GB for best performance.

Cable Specification

- **Cable**: CAT 5 or better (CAT 5e/6/7); straight (1:1) Ethernet cable.
- **Connector**: RJ45.
- **Network Speed**: 1000, 100 or 10 Base-TX LAN. 1000 Base-TX (Gigabit Ethernet) is recommended.
- **Length**: up to 100m.

4.13 Installing Extender Frames

The control surface main frame includes two Ethernet extension ports. These can be used to connect Extender frames to the console's internal network (ETHERNET A).

If more Extender connections are required, then a Fast Ethernet switch must be installed. If the Extender frames have been delivered with the console, then a suitable switch will be supplied. If you are adding Extenders to an existing console, then you will need to purchase a switch before continuing. For advice, please contact your local Lawo representative or email support@lawo.com.

Installation

Extender frames should be mounted, powered and grounded in the same manner as the main frame.

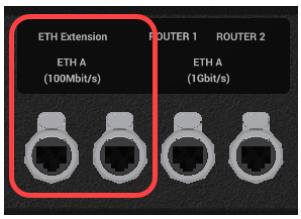
To make the connections, use a straight (1:1) network cable, of the type CAT 5e with RJ45 connectors. The maximum cable length = 80m.

Wiring (up to two Extender Frames)

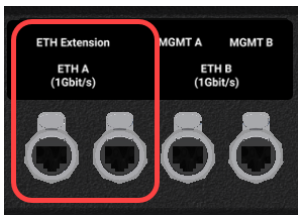
1. Connect one of the **ETH Extension** ports (on the main frame) to the **ETH Extension** port (on the Extender).

On the main frame, take care to connect an **ETH Extension** port, and not a **ROUTER** or **MGMT** port.

Rear Panel (for Central Bayserver)



Rear Panel (for Central Gateserver)



2. Repeat, using the spare port, to connect a second Extender.

Wiring (more than two Extender Frames)

1. Connect one of the **ETH Extension** ports (on the main frame) to a Fast Ethernet switch (described above).
2. From the switch, connect each of your Extender frames.

Setting the Bayserver Address

If you are adding a new extender, then you will need to adjust the Bayserver "Address" to determine the channel bay index of the frame (i.e. whether it controls faders 1-16, 17-32, etc).

4.14 Local IO

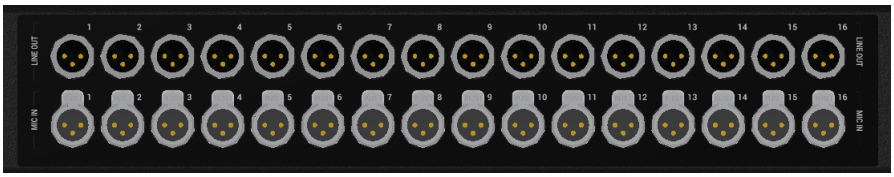
Every mc²96 control surface includes built-in IO known as the "Local IO". This is designed for local connections such as loudspeakers, metering, talkback and headphones. The local IO board is located inside the main frame (beneath the centre section). All connectors are accessed from the console's rear panel, except for the headphones which breakout on the front buffer.

The local IO provides 16 x Mic/Line in, 16 x Line out, 8 x AES3 IO, 1 x MADI (AES10), 2 x Phones, 8 x GPI and 8 x GPO for connection to external devices. Line out 1-8 are usually reserved for console monitoring. There is also 1 x RAVENNA/AES67 interface which connects the local IO to the Core.

On the mc²96, there are an additional 4 x AES3 out and 5 x GPO which are wired internally to the RTW meter in the centre section. These cannot be accessed externally, and so will be unused if the RTW meter is not fitted.

4.14.1 Local IO Connections

Rear Connector Panel: Right



Rear Connector Panel: Left



The following can be used connect external audio and GPIO devices:

- **16 x Mic/Line IN** - wired to 16 x XLR (female).
- **16 x Line OUT** - wired to 16 x XLR (male).
- **8 x AES3 IN** - wired to 8 x XLR (female).
- **8 x AES3 OUT** - wired to 8 x XLR (male).
- **1 x 64-channel MADI** - available via SFP. To use this port, you must fit a Lawo-certified SFP module.
- **8 x GPIO** - wired to 1 x 37-pin, D-type (female).

See Connector Pin-Outs for wiring information.

Note that:

- The **TB** connector is wired from the female talkback XLR (on the front panel).
- By default, **Line OUT 1-8** are routed from the MON 1 monitor output.
- You will find the two stereo headphone sockets on the front buffer.

The **RAVENNA/AES67** ports connect the local IO signals to the Core.

4.14.2 Connecting the Local IO to the Core

RAVENNA/AES67 Connections



To use the local IO signals, you must connect at least one of the **RAVENNA/AES67** ports to the Core. The connection can be made in one of two ways: either directly, point-to-point (using RAVENNA Link*), or indirectly via the Media Network (using RAVENNA).

Redundancy via SMPTE ST2022-7 (SPS) is only available when using a networked connection.

* RAVENNA Link is supported by Nova73 only.

Wiring

Internally, there is a single **RAVENNA/AES67** interface which is wired, externally, to two ports: **Primary** and **Secondary**. Each port is available on either copper or optical fiber (via SFP).

When using RAVENNA Link with Nova73, the connection to the Core *must* be directly wired from the **Primary** port. In this instance redundancy is not supported. Thus, in the event of a link failure, you will lose the local IO signals.

When using RAVENNA, the connection(s) to the Core *must* be made via the Media Network. If redundancy is not required then connect only the **Primary** port. If redundancy is required, then connect both the **Primary** AND **Secondary** ports to the red and blue networks.

In each case, the physical connections *must* match the AdminHD configuration.

Cable Specifications

To use the copper ports, choose an Ethernet cable that meets the following specification:

- **Cable**: CAT 5 or better (CAT 5e/6/7); straight (1:1) or crossed cable.
- **Connector**: RJ45.
- **Network Speed**: 1000, 100 or 10 Base-TX LAN. 1000 Base-TX (Gigabit Ethernet) is recommended.
- **Length**: up to 80m.

To use the optical fiber ports you must fit a Lawo-certified SFP module. The SFP determines the cable type, connector and maximum distance.

If both copper and fiber are installed at start-up, fiber is the preferred medium. In either case, the second medium can be hot-plugged without disturbing the current operating connection. If a connection breaks, then the interface automatically switches to the second medium (if installed). Note that there will be an audible audio interruption until the automatic stream setup re-establishes the connection. Therefore, the second medium should not be used to provide redundancy.

Status LEDs

The LOCK / ERR LED indicates the status of the connection:

- **Green, static** = the link is active, and the signal and streaming are ok.
- **Red, static or blinking** = the link is active but has one of the following errors: streaming format error, streaming lock error or stream is asynchronous.
- **Off** = no signal.

The Standby LED indicates the redundancy status:

- **Yellow** = the port is configured as a redundant port and is in standby.
- **Off** = the port is active.

NET ID

The **NET ID** button and LED can be used to reset the service IP address of the RAVENNA/AES67 interface to its default = **192.168.110.253**. Note that, for safety reasons, a press and hold is required; a quick press of the button performs no action.

First, make sure that the interface is booted and operating normally - the **NET ID** LED should be blinking yellow. Then, using a pointed object, press and hold the recessed button until the LED lights continuously. When the LED switches off, the reset is complete.

RAVENNA Link Specification

When using RAVENNA Link, the interface provides:

- RAVENNA Link 1.0: multi-channel digital audio-over-IP.
- Up to 128 bi-directional channels at 48kHz AND 96kHz.

RAVENNA Link connections *must* be directly wired (point-to-point).

RAVENNA Link is supported by Nova73 only.

To guarantee low latency, reliability and easy setup, do NOT connect any other network equipment between RAVENNA Link ports.

RAVENNA Specification

When using RAVENNA, the interface provides:

- RAVENNA: multi-channel digital audio-over-IP.
- Up to 128 bi-directional channels at 48kHz AND 96kHz.
- Up to 128 TX and 128 RX streams.

RAVENNA connections *must* be made via the Media Network (i.e. to and from a RAVENNA-compatible network switch). This ensures that the network's PTP clock signal is available to all streaming ports.

RAVENNA provides full SMPTE ST2110-30 and AES67 compatibility, since these protocols are a subset of the RAVENNA specification.

The Media Network *must* be properly configured and managed. i.e. it must use a suitable network architecture; all components must support multicast (as opposed to unicast); a proper Quality of Service (QoS) must be configured; and so on.

Please *DO NOT* attempt to connect the streaming ports using an unqualifying IP network, as correct operation cannot be guaranteed.

You can find more details about the data network requirements and suitable components in the Lawo IP Networking Guide.

4.15 SFP Modules

The following SFP modules are available for the relevant MADI and RAVENNA/AES67 ports. All SFPs must be Lawo-certified (as listed below). SFPs are not included and must be ordered separately. You will need one SFP for each port.

If fitting SFPs to both MADI and RAVENNA ports, take care not to mix up the SFP types.

➢ **MADI Interface SFP Modules**

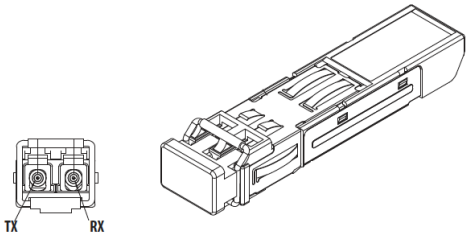
SFP Module Description	Part Number
MADI, 1310nm, multi-mode fiber, 2km	981/60-80
MADI, 1310nm, single-mode fiber, 20km	981/60-81
MADI, HD-BNC (75 ohm), copper, 100m	981/60-82

➢ **RAVENNA/AES67 Interface SFP Modules**

SFP Module Description	Part Number
1000 Base-SX: 850nm, -7dBm, multi-mode fiber, 550m	981/60-10
1000 Base-LX: 1310nm, -3dBm, single-mode fiber, 10km	981/60-20
1000 Base-ZX: 1550nm, 0dBm, single-mode fiber, 80km	981/60-30
1000 Base-T: RJ45, copper, 100m	981/60-60

Installing the SFPs

The SFP modules are hot-pluggable, and so they can be fitted or exchanged while the device is powered.



Front View

Side View with Dust Cap

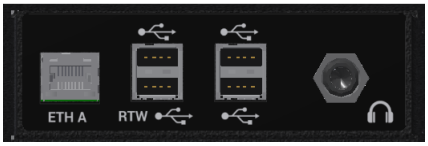
1. Remove the dust caps from both the port and SFP module.

Store these carefully so that they can be replaced if a module is removed.

2. Push the SFP module into the rectangular slot.
3. Press gently and firmly until the module locks into position.

Attention: Before removal, please unlock SFP modules to avoid mechanical damage to the slots.
If a module is removed, please refit the port's dust cap to protect the internal components.
You *must* use the correct fiber type for your remote device. Using the wrong fiber type or exceeding the maximum optical input power can result in malfunction of, or damage to, the optical device.

4.16 Front Buffer Connections



The following connections can be found on the front buffer (beneath the trackball).

1 x ETH A Network Port

Connects to the control surface internal network (ETHERNET A).

4 x USB 2.0 Ports

- 3 x USB - connect to the mc^2 control system. One port should be reserved for the wireless keyboard dongle. The other ports can be used to connect a USB memory stick (to save and load user data).
- 1 x USB (marked RTW) - connects to the RTW TM9 meter. Please refer to the TM9 user manual.

1 x Stereo Phones (HP 1)

This stereo phones output can be used to connect a pair of stereo headphones. The socket is wired from the Headphone 1 output which, by default, follows the MON 1 source selector (controlled from the MONITORING touch-screen).

1 x Stereo Phones (HP 2)

A second stereo phones socket (Headphone 2) can be found further along the arm rest. By default, this is follows the MON 2 source selector (controlled from the MONITORING touch-screen).

2 x Stereo Phones (HP 3 & HP 4)

On larger frames, two additional phones connectors operate in parallel with Headphones 1 & 2.

4.17 Connecting a Talkback Mic

Front Panel GAIN Control, User Buttons & Connector



Rear Panel Connectors



The female XLR on the Central Panel Upper (978/21) can be used to connect a talkback microphone.

It is wired directly to the male XLR (marked TB) on the console's rear panel. Note that the console does not include a dedicated talkback mic preamp, and so the rear panel TB connector must be wired either to an external communications system (via a mic preamp), or to one of the console's local IO mic/line inputs.

5. Service Procedures

This chapter describes the service procedures available for the hardware.

5.1 Preparation

Please read and observe ALL of the Important Safety Instructions BEFORE servicing any component.

The system carries highly sensitive electronic components, and therefore should only be handled by authorized personnel, and with the utmost care.

In particular, ALWAYS observe the following procedures:

- The workspace must be ESD proof.
- Before removing parts of the casing, shields, etc. the device MUST be switched off and disconnected from the mains supply.
- Check the unit for electrical safety after completing the work.

Using the Service Instructions

We recommend that you read all of the instructions in full before starting a procedure. Any product-specific tools, such as Torx drivers, can be found in the Lawo tool case delivered with your system.

Further Information

Mechanical drawings and data sheets are available from the **Downloads** area at www.lawo.com (after **Login**).

If you need further assistance, the Lawo Support Department can be contacted by email at support@lawo.com, or by telephone during normal working hours - please visit the **Support** area of the Lawo website for the most up-to-date contact details.

5.2 Restarting a Bayserver or Gateserver

Each bay has its own Ethernet server which can be restarted from the front panel. The procedure is the same for Bayservers (in channel bays) and the Gateserver (in the centre section). Note that if you restart the Gateserver, then this will affect the whole console.

You should perform this procedure if the graphics on an individual display freeze or look odd. Or, if the controls and indicators on a panel do not respond or update. These symptoms can sometimes occur if the server looses its Ethernet connection to the mc^2 control system.

1. Using a pointed object, press the recessed button at the top of the display:



The server restarts in a few seconds; during this time you will see the boot-up screen on the display. Once complete, communication with the control system is re-established, and the Channel Display (or Central GUI) is reinstated.

5.3 Replacing a Panel

Each control surface panel can be replaced without affecting the rest of the system. Please see Channel Controls and Centre Section Controls for a description of the panel options. To replace a lower panel, you must first lift the upper panel.

5.3.1 Replacing an Upper Panel

DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Remove the screws at the bottom of the panel using a T20 Torx driver.

The number of screws vary depending on the panel type: channel bay panels have three screws, while the central panel has four.



You should remove the screws completely and place them carefully to one side, so that they do not fall into the frame when the panel is lifted. The springs beneath the panel will raise it slightly from the frame.

2. Gently lift the panel using your fingers:



3. Use the Hood Fastener to keep the upper panel in place while you work.

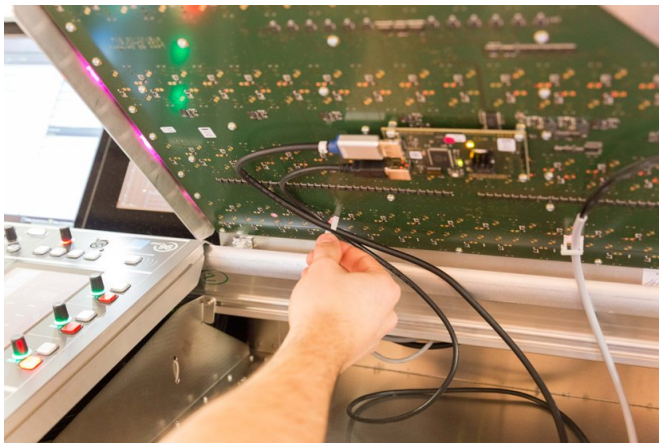
You can now continue on to step 4 (if replacing the upper panel), or skip ahead (if replacing the lower panel).

4. Remove the cables from their fasteners, and unplug the connectors taking note of where each one is fitted.

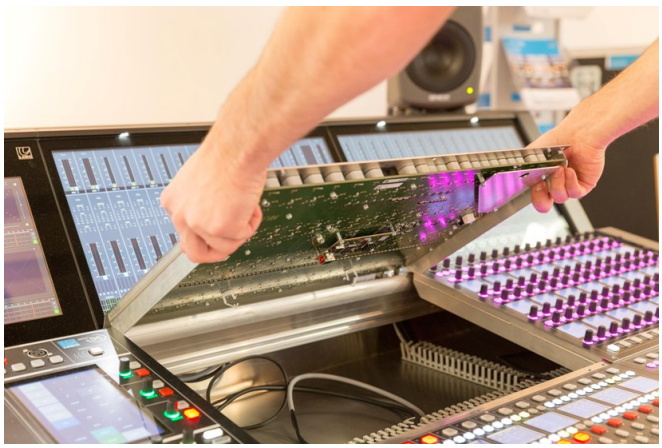
On channel bay panels, you will find 1 x Display Port, 1 x USB and 1 x power connector.

The Central Panel Upper has two additional connectors: 1 x RJ45 (Network) and 1 x talkback to the front panel XLR.

FC Panel: Cable Fasteners



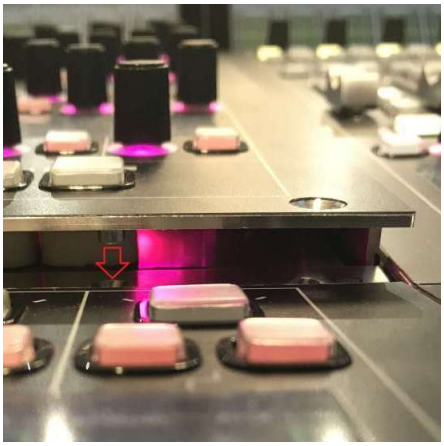
5. Carefully remove the panel by lifting it out of the frame. Lay it it face-down on a piece of foam, or similar ESD-proof protective material, away from the console.

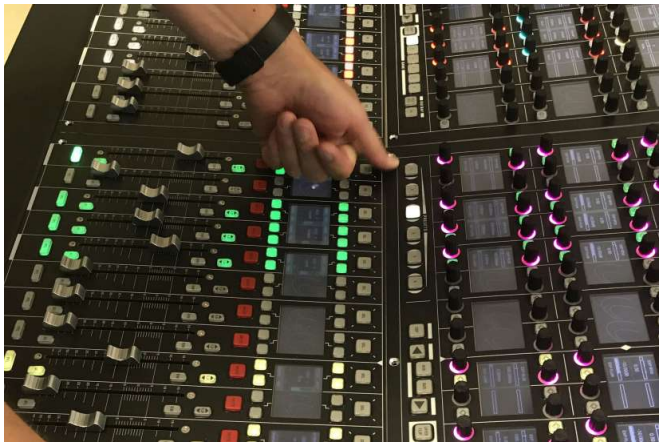


6. Check that the rotary switch settings on your replacement panel are correct - they should both be set to 0, irrespective of the frame position.

7. Insert and reconnect the replacement. Then gently lower the panel back into place.

It is important that the bolts fit into the holes as shown below, and that you press down only above these bolts until the fitting is correct:





8. Fasten the screws to secure the panel.

Once the control surface is powered, the panel will boot within a few seconds.

9. Restart the Bayserver to refresh the communication with the control system.

5.3.2 Replacing a Lower Panel

DO NOT attempt to open the frame without first disconnecting the mains supply.

1. First lift the upper panel, as described earlier, and secure it in place using the Hood Fastener.

Note that you do not need to disconnect the upper panel to remove the lower panel from the frame.

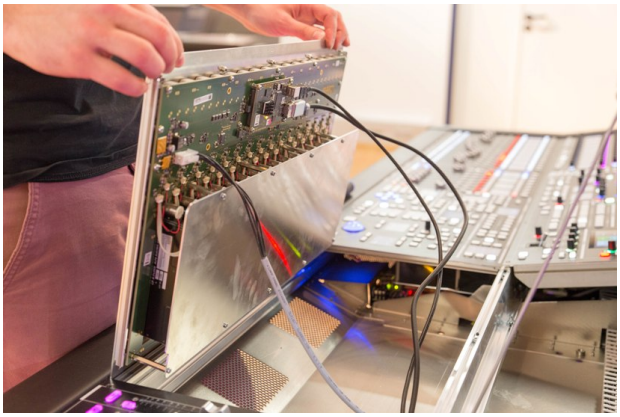
2. If you have not already done so, remove the screws at the bottom of the panel using a T20 Torx driver.

The number of screws vary depending on the panel type: channel bay panels have three screws, while the central panel has four.

You should remove the screws completely and place them carefully to one side, so that they do not fall into the frame.

3. Gently lift the panel by reaching around the aluminum profile and pushing upwards. Then use your fingers to lift the panel away from the frame:





4. Remove the cables from their fasteners, and unplug the connectors taking note of where each one is fitted.

On all of the lower panels you will find 1 x Display Port, 1 x USB and 1 x power connector.

5. Carefully remove the panel by lifting it out of the frame. Lay it it face-down on a piece of foam, or similar ESD-proof protective material, away from the console.

6. Check that the rotary switch settings on your replacement panel are correct - they should both be set to 0, irrespective of the frame position.

7. Insert and reconnect the replacement. Then gently lower the panel back into place.

8. Now refit the upper panel as described earlier, and fasten the screws to secure both panels.

Once the control surface is powered, the panel will boot within a few seconds.

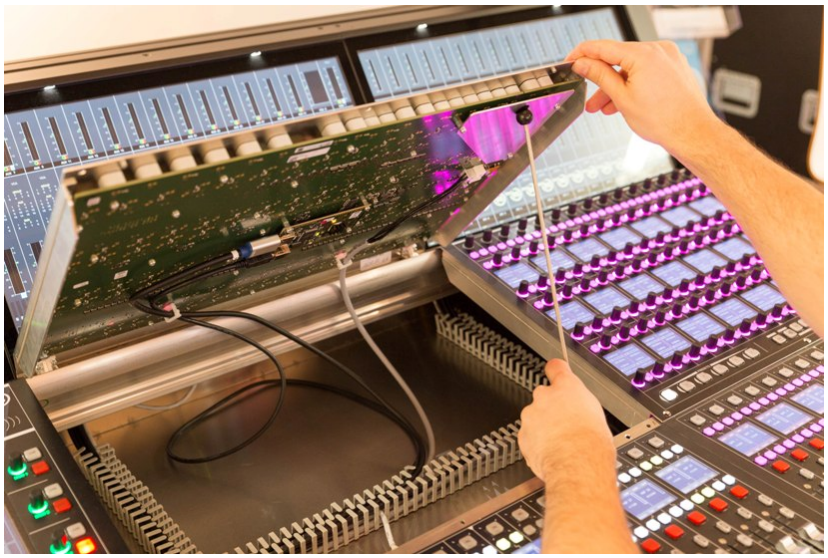
9. Restart the Bayserver to refresh the communication with the control system.

5.4 Using the Hood Fastener

The Hood Fastener can be used to keep an upper panel in place while you work.

> *DO NOT* attempt to open the frame without first disconnecting the mains supply.

1. Follow the previous section's steps to lift the panel - you will see the Hood Fastener stowed safely within the frame.
2. Release the fastener from its catch, and place the "ball" end into the cut-out in the metal plate:



When you have finished working inside the frame, replace the hood fastener safely back into its catch, before lowering the panel back into place. When closing the frame, it is important that the panel bolts fit into the frame holes, and that you press down only above these bolts until the fitting is correct. To see some photos, go to Replacing an Upper Panel.

5.5 Replacing a Fader

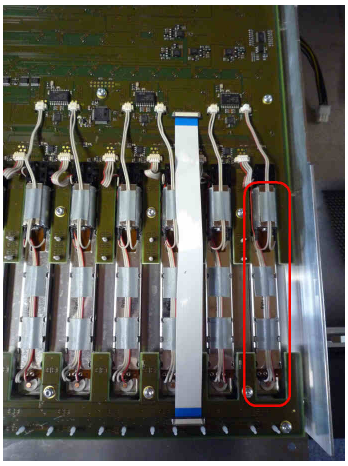
An individual fader unit can be replaced by removing the Fader Panel from the console. Note that the illustrations below show how to do this on a mc²36 MKI. However, the same procedure can be performed on a mc²96 console.

In our example, it is the left-hand fader with the panel face-up (Fader Number 1), which is being replaced:

Panel Face-up



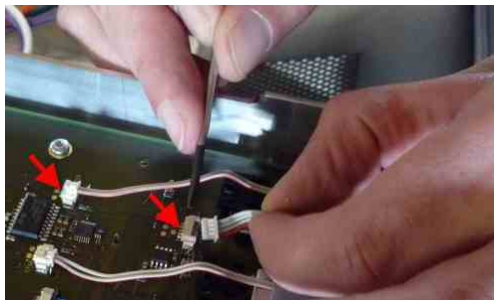
Panel Face-down



DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Remove the Fader Panel from the console frame as described earlier, and lay it it face-down on a piece of foam, or similar ESD-proof protective material, away from the console. Take care not to touch the flat foil cables.

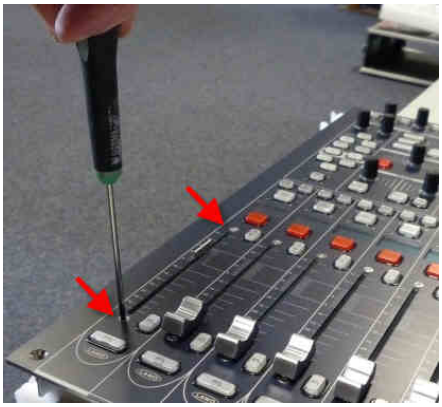
2. Using a small flat-blade screwdriver, release the catches to disconnect the fader unit cables - there are two cables to release:



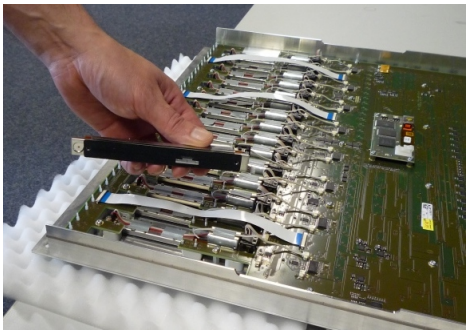
3. Turn the panel face-up and remove the fader cap.

4. Remove the two screws holding the fader unit in place (using a T10 Torx driver):





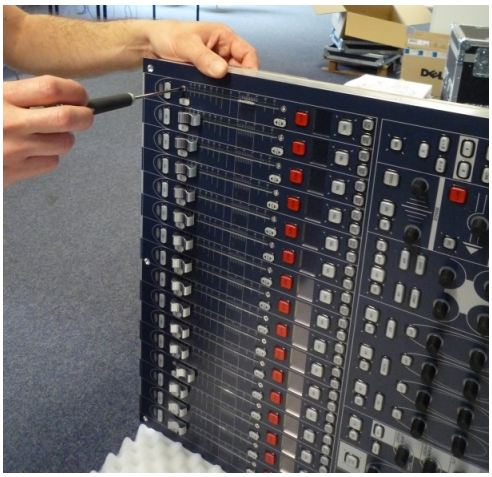
5. Turn the panel face-down and remove the fader unit. Note that the unit will be loose, and so it helps to support it from behind as you turn the panel.



You are now ready to fit the replacement.

6. Insert the new fader unit into position.

7. Carefully lift the panel onto its side, supporting the fader from behind, and replace the two front panel screws:



8. Turn the panel face-down once more and reconnect the two fader unit cables (see step 2).

9. Fit the panel back into the console frame, apply mains power and then restart the Bayserver (to refresh the communication). Then test the new fader's functionality.

5.6 Replacing a User Panel

The Central Panel Upper (978/21) contains two user panels which can be exchanged independently. Please see Central User Panels for a description of the available options.

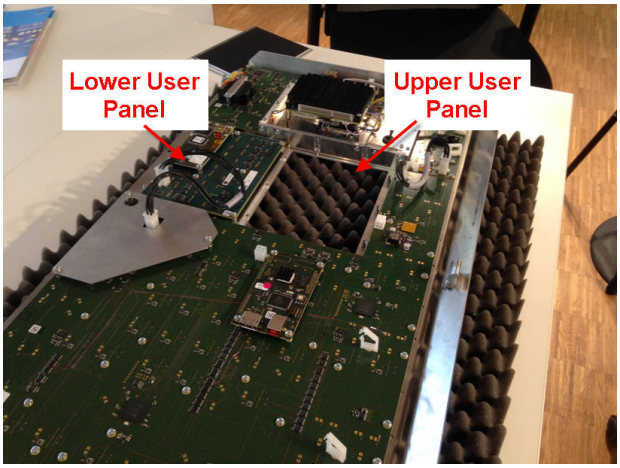
To exchange a user panel or re-arrange the layout, you will need to remove the Central Panel Upper from the console. Then, due to the thin blanking strip which attaches to the upper user panel, you should deal first with the lower panel, followed by the upper panel (as viewed from the front of the console).

In our example, a new user panel is being fitted to the upper slot:

Panel Face-up



Panel Face-down



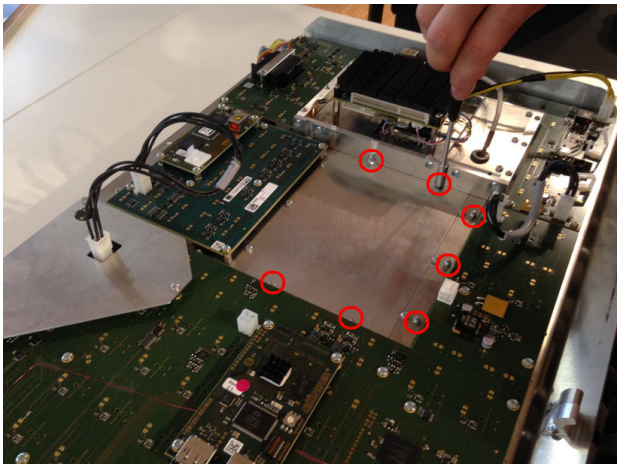
DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Remove the Central Panel Upper from the console frame as described earlier, and lay it it face-down on a piece of foam, or similar ESD-proof protective material, away from the console.

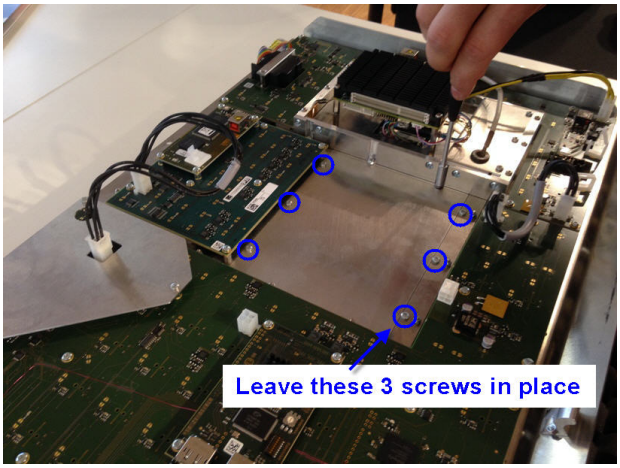
2. Using a Hex socket and then a Torx T10 driver, remove the nuts, washers and screws which hold the existing user panels in place.

There are seven Hex nuts and six T10 screws for each panel. However, when working on the upper panel, it is recommended to leave the three blanking strip screws in place so that the strip will come away with the user panel in step 3.

Hex Nut Positions



T10 Screw Positions



3. Turn the complete panel face-up, and push down on the user panels (or blanking panels) - they should come away from the main surface:

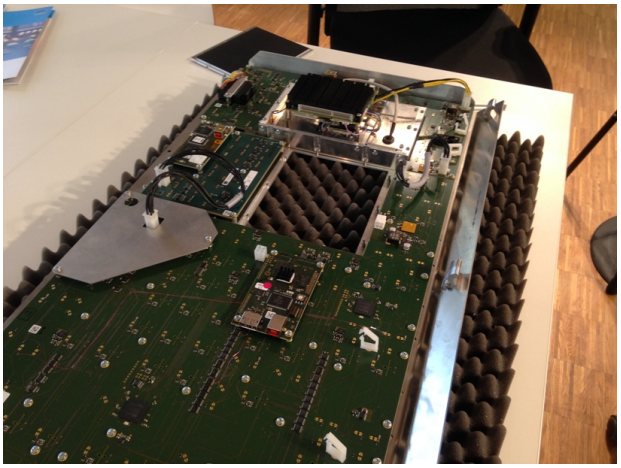


The panel edges are sharp, so take care to avoid the edges as you push down.

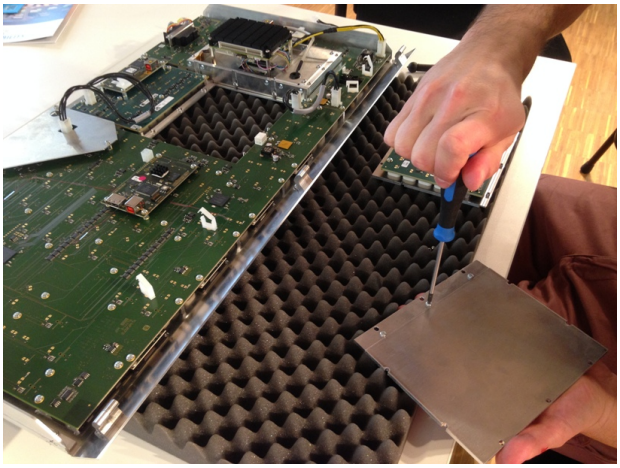
4. Turn the complete panel face-down to reveal the free slot(s).

If you are working on the upper slot, then now is the time to remove the three fixing screws which attach to the thin blanking strip. You will need to refit this later once the new panel is in place (see step 6).

Upper Panel Removed



Upper Panel Blanking Strip



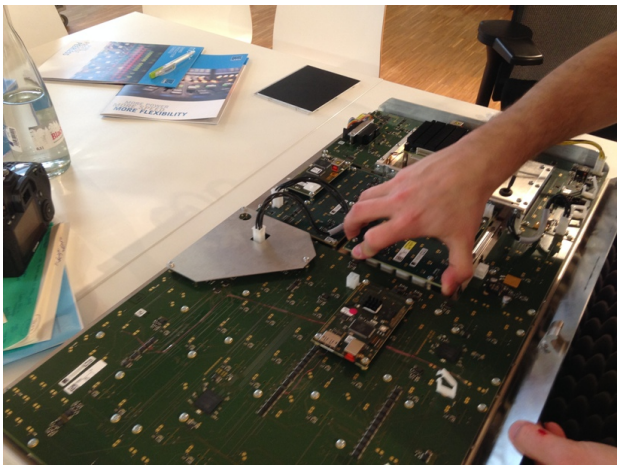
Any panels which have been removed should be stowed in a safe place or returned to Lawo AG.

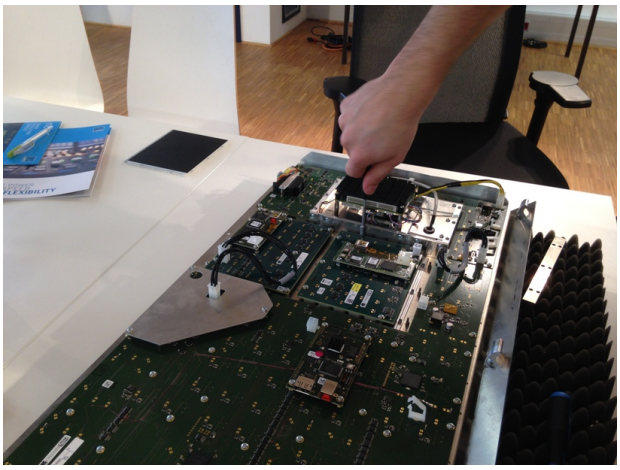
You are now ready to fit the replacement(s).

5. Position the new user panel into its slot, taking care to get the correct orientation! If replacing both panels at once, then start with the lower and then the upper slot.

Replace the nuts, washers and screws to secure the panels back into place.

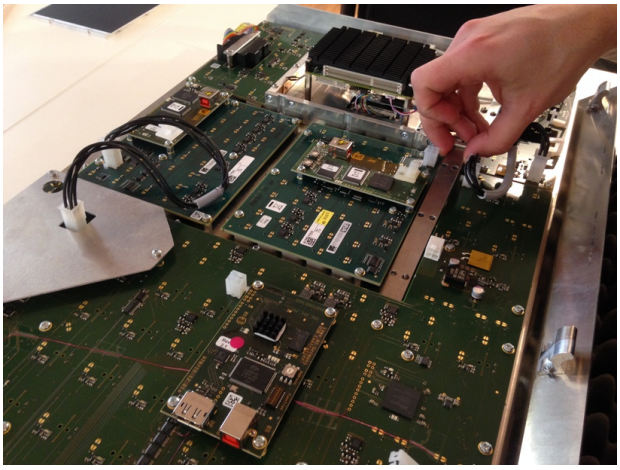
It is a good idea to fix the four Hex nuts on the side of each user panel first, and tighten these to bring the panel flush with the main surface. Then fit the remaining Hex nuts and T10 screws. For the upper panel slot, see also step 6.

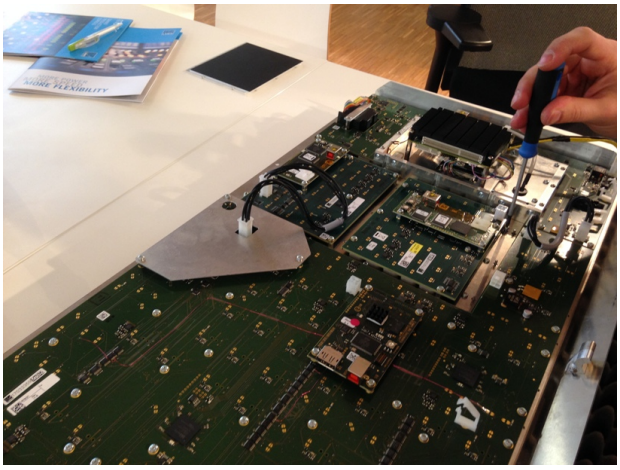




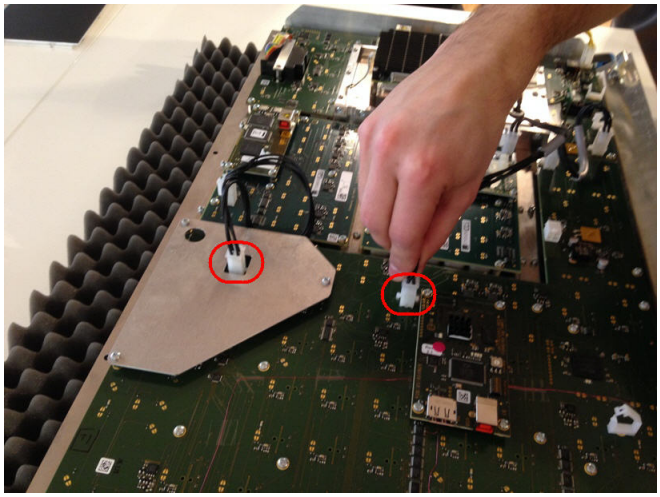
Before you continue, turn the complete panel face-up to check the fitting. Both user panels should be flush with the rest of the surface.

6. If you are working on the upper panel slot, then refit the thin blanking strip by positioning it, and securing the three T10 screws and three Hex nuts:





8. Once everything is secured, plug the bridging power connector from each user panel into the main control board (as shown below):



9. Fit the Central Panel Upper back into the console frame, apply mains power and then restart the Bayserver (to refresh the communication). Then test the user panel's functionality.

5.7 Replacing a TFT Display

Each of the touch-screen displays can be replaced without affecting the rest of the system.

If you need to replace the centre section display, then connect an mxGUI computer so that it can run online and provide continued access to central GUI operations.

DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Unfasten the three screws at the top of the display using a long T20 Torx driver, and gently tilt the unit forwards:



The Torx driver shaft *MUST* be long enough to turn the countersunk screws without scratching the front panel. If you attempt to use a short driver, or driver attachment, damage can occur.

2. Remove the connectors, taking note of where each one should be fitted.

Each display has 1 x Display Port, 1 x RJ45, 1 x USB and 1 x power connector. Note that the RJ45 network connector is used only to control the desk lamps and not for any other control data.

3. Carefully remove the display by lifting it out of the frame. Lay it it face-down on a piece of foam, or similar ESD-proof protective material, away from the console.

4. Fit the replacement in the reverse manner.

Once the control surface is powered, the display will refresh within a few seconds.

5. Restart the Bayserver to refresh the communication with the control system.

5.8 Calibrating a Touch-screen

The Channel and Central GUI touch-screen displays are calibrated before leaving the factory and require no further calibration by the customer.

5.9 Bayserver & Gateserver Switch Settings

Within each channel and central bay, individual panels and displays connect to an Ethernet Bayserver or Gateserver (mounted behind the display). In both cases, the servers have a number of switches which are used as follows.

- **S1 DIP Switch 1 (One PSU only)** – set to ON if only one PSU is connected.
- **S1 DIP Switch 2 (PSU Connected)** – set to ON if a PSU block is installed in the bay.
- **S1 DIP Switch 3 (Mirror Desk)** – set to ON if the bay is part of a Mirror Desk.
- **S1 DIP Switch 4 (GUI Mode)** – sets the GUI mode: ON = Central GUI, OFF = Channel Display.
- **S1 DIP Switch 5, 6, 7, 8** – are unused and should be set to OFF.
- **SW1 Rotary Switch (Address)** – sets the bay index, counted from left to right (in two's) as viewed from the front of the frame starting at 0.

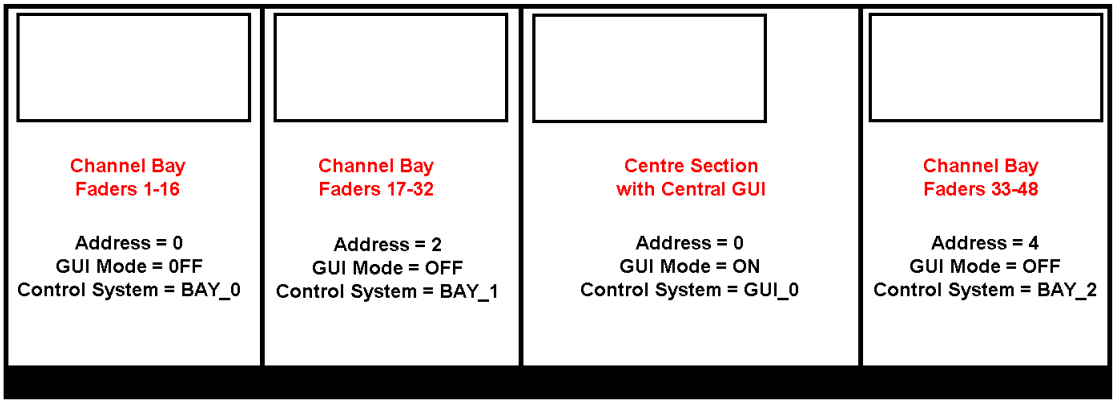
You may need to adjust the settings if you are replacing a TFT display or adding an extender frame.

Start by setting the **S1 DIP Switches 1, 2** and **3** to the correct positions (as described above).

If the server is fitted to a central bay, set the **S1 DIP Switch 4 (GUI Mode)** to **ON** and the **SW1 Rotary Switch (Address)** to **0**.

If the server is fitted to a channel bay, then set the **S1 DIP Switch 4 (GUI Mode)** to **OFF** and the **SW1 Rotary Switch (Address)** to the correct index number (**0**, **2**, **4**, etc).

The example below shows the correct settings for a 48-fader frame:



Adding a Stand Alone Extender

If an extender is added to the left of the main frame, then set the extender's **Address** to **0**, and shift the **Address** of each channel bay in the main frame upwards (for example, to **2**, **4**, **6**, etc).

If the extender is added to the right of the main frame, then only the address in the extender needs to be set. This should be counted upwards from the main frame. So to add an extender to our 48-fader example, its **Address** should be set to **6**.

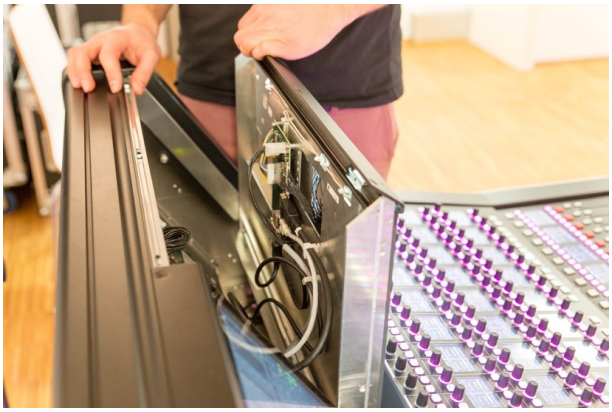
5.9.1 Adjusting the Bayserver Settings

The instructions below apply to a channel Bayserver. However, the settings for a Gateserver can be adjusted in a similar manner.

The Bayserver (or Gateserver) is mounted behind the bay's TFT display. Therefore, you will need to remove the display to access its switches.

DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Remove the TFT display from the bay you wish to adjust as described earlier.
2. Locate the S1 DIP switches and SW1 rotary switch on the Bayserver circuit board. The location and function of all connectors and switches is explained on the sticker.

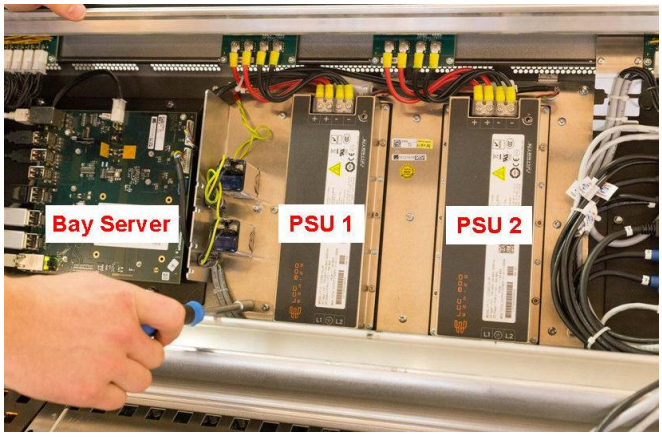




3. Set the **S1** DIP switches to the desired ON/OFF positions. Take care to set the correct positions, as the switches are mounted upside down when viewed from the front buffer.
4. Set the **SW1** rotary switch to the required address.
5. Replace the TFT display.

5.10 Replacing a Console Power Supply

The control surface is powered by dual-redundant power supplies which are fitted inside the frame behind the TFT display:



The two supplies come as a complete "PSU block" which can be replaced in its entirety - i.e. it is not possible to replace an individual supply.

Depending on the console size, more than one block may be fitted to the frame. Double-click here to view all the possible frame variants and PSU block locations (as a pdf).

To replace a PSU block you will need to remove the TFT display from the PSU bay.

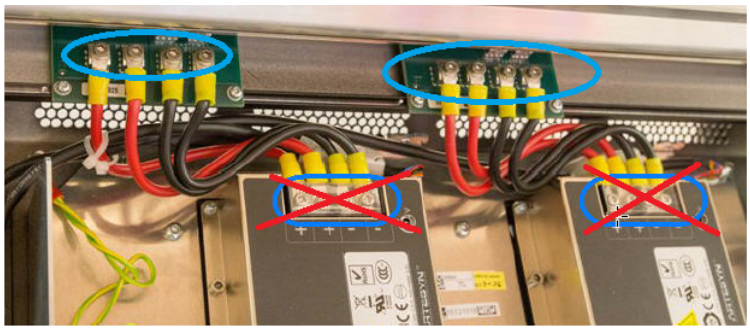
1. Turn off the power to the control surface by disconnecting *ALL* **MAINS** connectors - press the red button on the IEC connector to release the plug.

> You must remove the **MAINS** connectors from the frame, rather than from the wall, as the IEC sockets form part of the PSU module. If you do not, then the PSU module will get stuck during step 7.

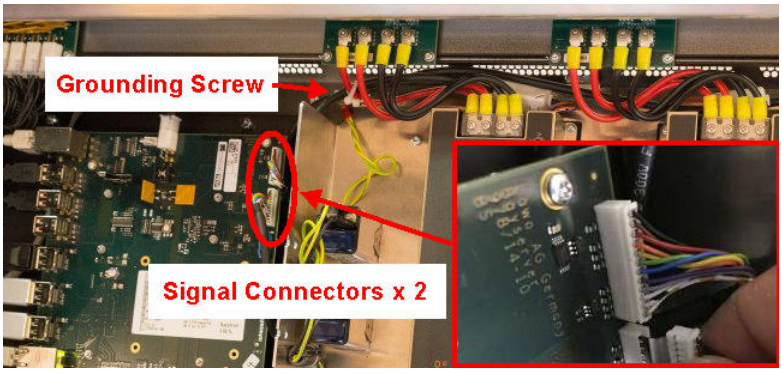
2. Locate the PSU bay and remove its TFT display as described earlier. You will see the PSU block and Bay Server mounted at the rear of the frame.

3. Using a T20 Torx driver, disconnect the PSU block from its distribution board by loosening the 8 screws shown below.

Take care NOT to disconnect the lower cables/screws:



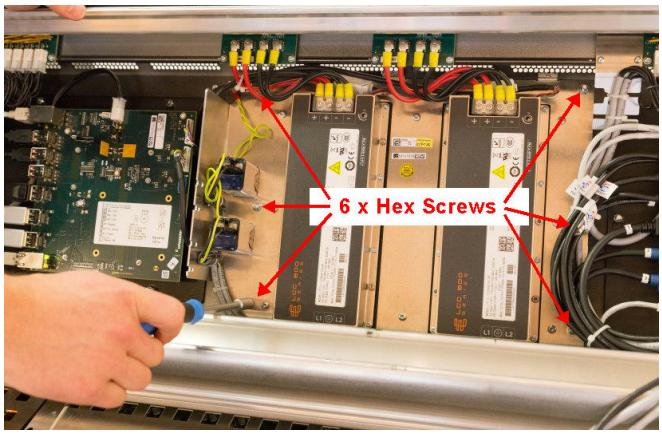
4. Remove the grounding cable by loosening its screw.
5. Unplug the two signal connectors (mounted on the BayServer):



Steps 3, 4 and 5 allow the PSU block to be removed with all of its cables (power, grounding and signal).

Do *NOT* disconnect any wires other than those shown.

6. Using a 8mm hex socket, remove the six nuts holding the PSU block in place:

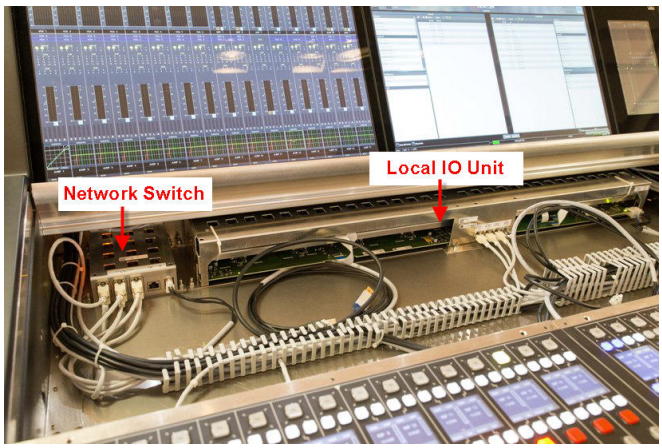


Take care *NOT* to drop any nuts or washers into the desk.

7. Remove the PSU block from the frame.
8. Now fit the replacement and secure using the six hex nuts shown in step 6.
9. Replace the power, signal and grounding cables (see steps 3 to 5).
10. Replace the TFT display.
11. When everything is back in place, re-connect the rear mains IEC power connectors, and power on.

5.11 Replacing the Local IO

The local IO exists as a self-contained unit which is mounted inside the control surface beneath the Central GUI display and the Channel display to its left:



To replace the local IO unit, you will need to disconnect all of its cabling from the rear panel, and remove the two front panels shown above.

DO NOT attempt to open the frame without first disconnecting the mains supply.

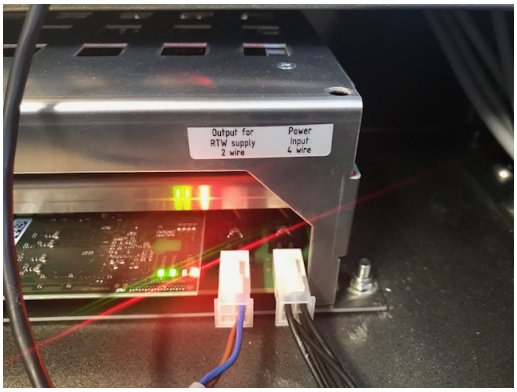
1. Disconnect all of the local IO cabling from the console's rear panel. See Local IO Connections.
2. Remove the upper panels from the central bay and the channel bay to its left as described earlier.

You will see the local IO carrier unit mounted at the rear of the frame.

3. Disconnect all of the internal connectors from the front of the unit, taking note of where each one should be fitted.

There are four RJ45 connectors on the left (which feed the RTW metering) and two power connectors on the right (an output to the RTW and input for the Local IO):





4. Now loosen the local IO unit from the console frame. There are three hex nuts holding the unit in place. You will need to remove the middle nut completely, and loosen the two side nuts by a few turns.



5. Carefully remove the unit by sliding it forwards and out of the console frame. Take care that the frame does not scrape the unit, and that the cables do not get caught:



6. Slide the replacement unit into the console frame, taking care not to scratch the unit or get any cables caught underneath.

7. Tighten the nuts shown in step 4 to hold the unit in place.

8. Replace the six connectors (see step 3).

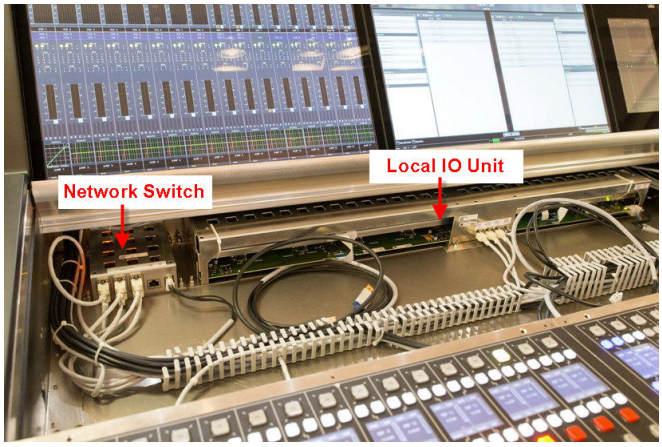
9. Replace the two panels (see step 2).

10. Replace the local IO connections on the rear panel.

11. When everything is back in place, re-connect the rear **MAINS** IEC power connectors, and power on. Then check the functionality of the local IO.

5.12 Replacing the Network Switch

The internal network switch, which distributes the ETHERNET A connections, is mounted inside the control surface below the Channel display to the left of the Central GUI. Internally, it is located on the left of the Local IO carrier unit:



To replace the switch, you will need to remove the upper panel from the channel bay housing the switch.

DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Remove the upper panel from the channel bay on the left of the centre section as described earlier.

You will see the network switch as shown above.

2. Disconnect all of the internal connectors from the front of the unit, taking note of where each one should be fitted.

There are several RJ45 network connectors on the left plus a single power connector on the right:



3. Now loosen the unit from the console frame. There are two hex nuts on each side of the unit holding it in place:



4. Carefully remove the unit by sliding it forwards and out of the console frame. Take care that the frame does not scrape the unit, and that the cables do not get caught.

5. Slide the replacement unit into the console frame, taking care not to scratch the unit or get any cables caught underneath. Tighten the nuts to hold the unit in place.

6. Replace the panel (see step 1).

Once the control surface is powered, the switch will boot within a few seconds.

7. Restart the Bayserver to refresh the communication with the control system.

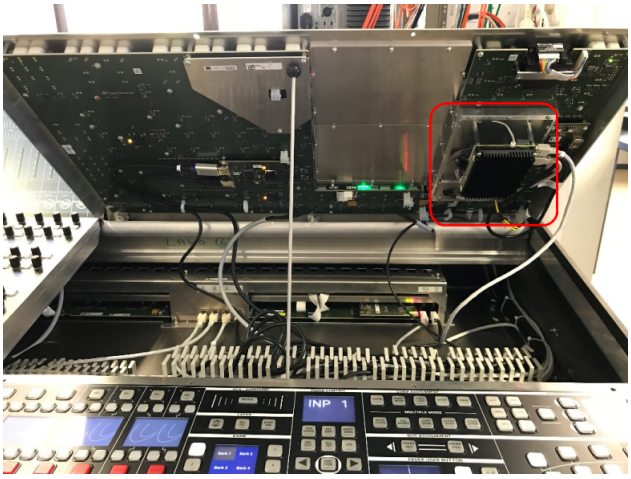
5.13 Replacing the Monitoring Computer

The Central Panel Upper (978/21) includes a touch-screen display which is controlled from a separate computer. The computer is mounted on the underside of the panel and can be exchanged by removing the panel from the frame:

MONITORING Display (during boot-up)

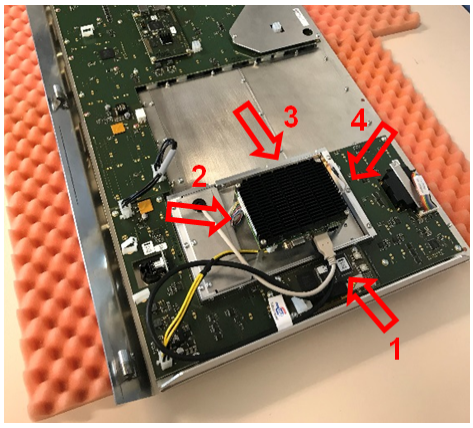


MONITORING Computer (viewed from underside)



DO NOT attempt to open the frame without first disconnecting the mains supply.

1. Remove the Central Panel Upper (978/21) as described earlier, and lay it face-down on a piece of foam, or similar ESD-proof protective material, away from the control surface.
2. Unplug the following connectors to disconnect the computer from the panel's control board:



1 = USB connectors x 2

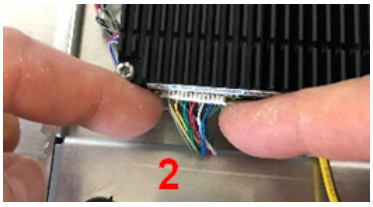
2 = LVDS connector x 1

3 = Backlight connector x 1

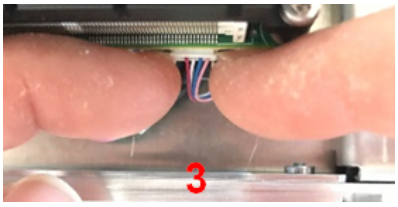
4 = Reset switch connector x 1

The following close-up photos show how to remove connectors 2, 3 and 4. When replacing connector 4, take care to fit the plug into the correct position.

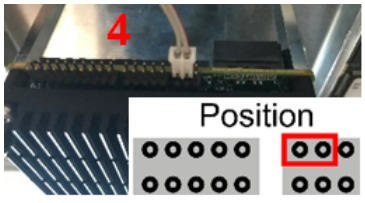
LVDS Connector



Backlight Connector

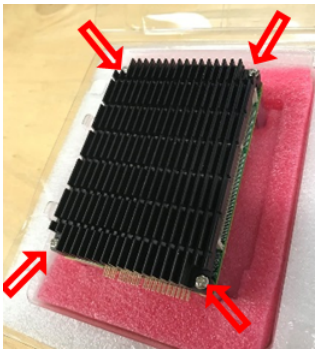


Reset Switch Connector



3. Prepare the replacement computer by removing its packaging and the four transportation screws:

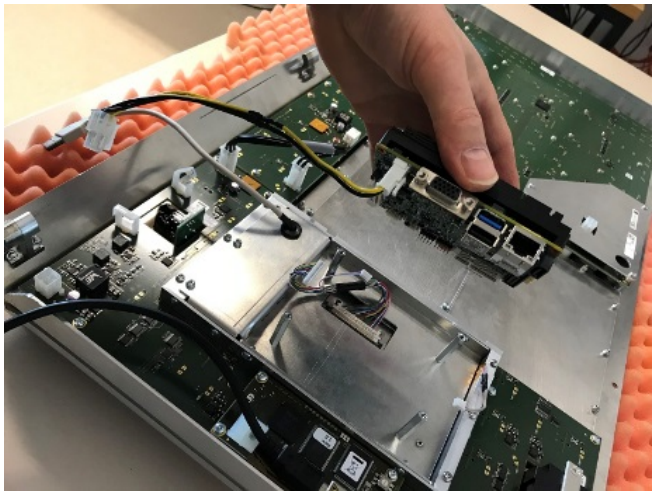




4. Using a T10 Torx driver, remove the four screws on the panel which hold the existing computer in place.

Take care *NOT* to drop any nuts or washers into the desk.

5. Lift the computer upwards and disconnect its power cable from the underside:



6. Then fit the power cable to the replacement and position the new computer into place. Secure the unit to the control panel using the four Torx 10 screws.
7. Reconnect all of the cables to the Central Panel Upper (see step 2).
8. Replace the Central Panel Upper.

Once the control surface is powered, the new computer will boot within a few seconds.

9. Restart the Bayserver to refresh the communication with the control system.

Before returning the faulty computer, please fix it to the heatsink using the four transportation screws shown in step 3. Then return the complete package to Lawo AG.

6. Appendices

This chapter includes further information which you may find useful.

6.1 Part Numbers

System Component		Part Number
mc²96 Frame	24C	978/50-00
	16 + 24C	978/50-10 or 978/51-10 (split)
	24C + 16	978/50-01 or 978/51-01 (split)
	16 + 24C + 16	978/50-11 or 978/51-11 (split)
	16F Extender	978/52
Other frame variants use part numbers 978/50-xy or 978/51-xy (split-frame), where x = the number of channel bays on the left; y = the number of channel bays on the right.		
Control Surface Modules	Fader Panel	978/10
	FC Panel	978/11
	Fader Panel Upper	978/12
	Channel Display	978/13
	Central Panel Lower	978/20
	Central Panel Upper	978/21
	Xtra Central Panel Lower	978/22
Central User Panel Options	Xtra Keys User Panel	978/23
	40 Key User Panel	978/24
	Reveal Fader User Panel	978/25
	Automation User Panel	978/26
	Blanking Plate User Panel	978/28
Overbridge Options	RTW TM9	978/27
	Blanking Panel	978/29
Internal Components	Local IO Unit	978/40
	PSU Block, double	978/43
	PSU Block, single (for Extender)	978/44
	Bayserver	978/14
	Gateserver	978/15
	Internal Network Switch (if central Bayserver)	978/41
	Internal Network Switch (if central Gateserver)	978/42
Accessories	Script Tray	978/68
	Recording Com Kit	958/80
	SFPs, see SFP Modules	981/60-xx

6.1.1 Data Sheets

Further technical information can be found in the product data sheets available from the **Downloads** area at www.lawo.com (after **Login**).

To help locate the correct data sheet, please use the part numbers listed above.

6.2 Wiring Diagrams

The following diagrams show the control surface internal wiring in more detail. In each case, double-click on a link to open the diagram (as a pdf).

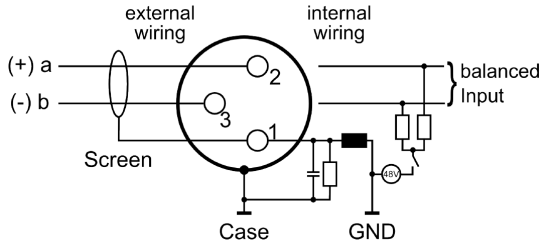
- Central Audio Wiring
- Bay FC Wiring
- Central FC Wiring
- Stand-alone Extender Wiring

6.3 Connector Pin-Outs & IO Specifications

The following connectors appear either on the rear panel or front buffer.

6.3.1 Mic/Line In

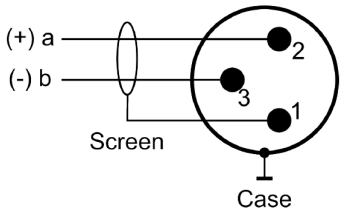
3-pin XLR connector, female.



All MIC/LINE IN connections are electronically balanced and floating (suitable for balanced or unbalanced use). They feature a discrete class-A preamplifier with superb performance at both low (mic) and high (line) levels. In addition to variable microphone pre-amp gain, each input comes with switchable 48V phantom power, a high-pass filter and 20dB PAD. The maximum analog input level (with the PAD enabled) is +24dBu.

6.3.2 Talkback (TB)

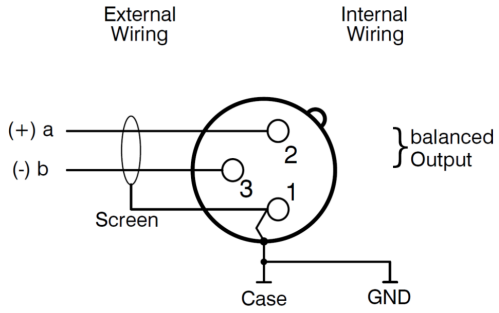
3-pin XLR connector, male.



This connector is wired from the 3-pin female XLR Talkback connector on the front panel.

6.3.3 Line Out

3-pin XLR connector, male.

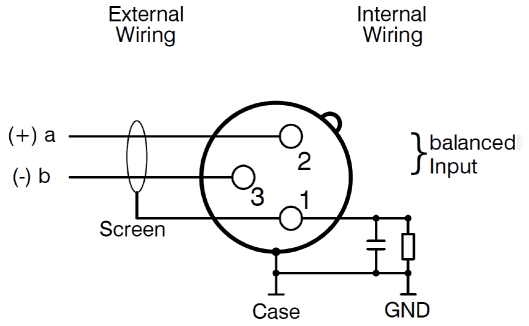


All LINE OUT connections are electronically balanced and floating (suitable for balanced or unbalanced use). For LINE OUTs, the maximum analog level can be adjusted to +12, +15, +18, +21 or +24 dBu relative to digital full scale (dBFS). This is a factory-configured setting; +24dBu is recommended.

For connection to an unbalanced input stage one line needs to be shorted to ground (hot or cold) like with a transformer-coupled output stage. The level will remain the same as with a balanced load.

6.3.4 AES3 In

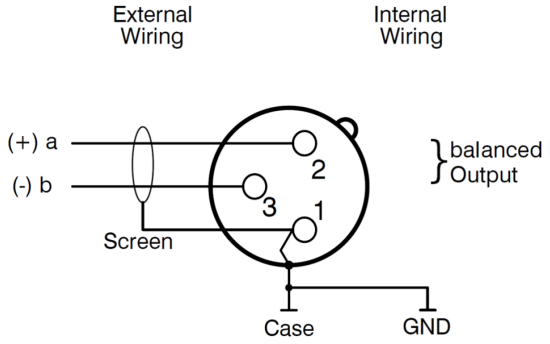
3-pin XLR connector, female.



All AES3 IN connections conform to the stereo AES3 standard. The inputs have sample rate conversion (SRC).

6.3.5 AES3 Out

3-pin XLR connector, male.



All AES3 OUT connections conform to the stereo AES3 standard.

6.3.6 MADI

The console's MADI interface conforms to AES 10, and supports up to 64 bi-directional channels at 48kHz, or 32-channels at 96kHz.

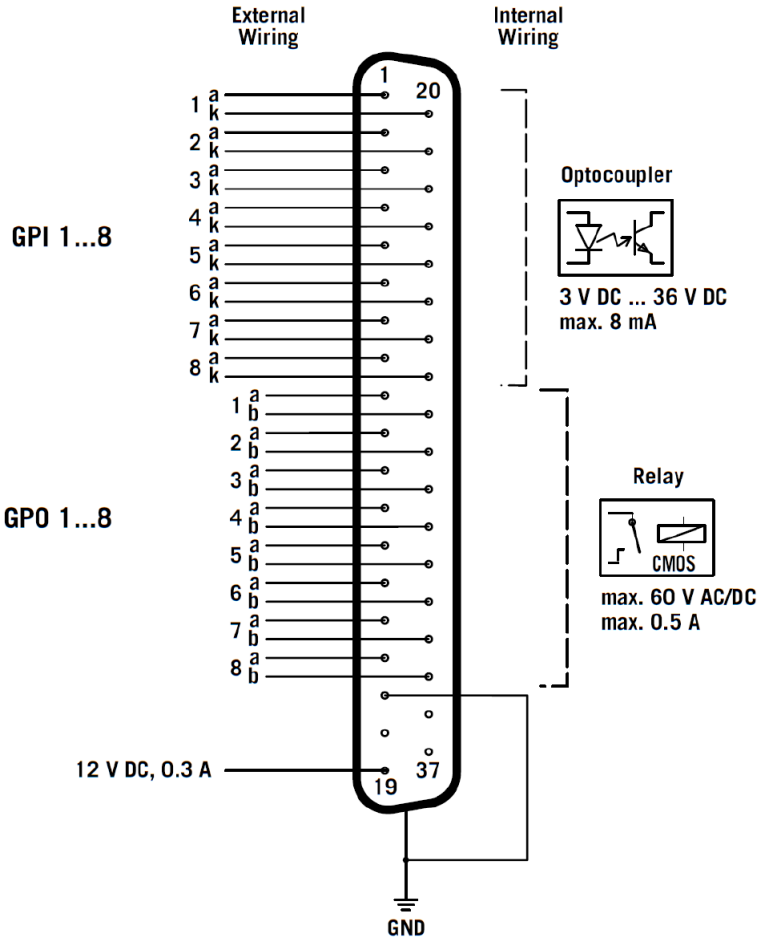
To use the interface you must fit a Lawo-certified SFP module. The SFP determines the cable type and connector. The maximum distance depends on the cable type.

The LOCK / ERR LED indicates the status of the MADI link:

- **Green** = valid MADI signal detected.
- **Red** = MADI signal or link error.
- **Off** = no signal detected.

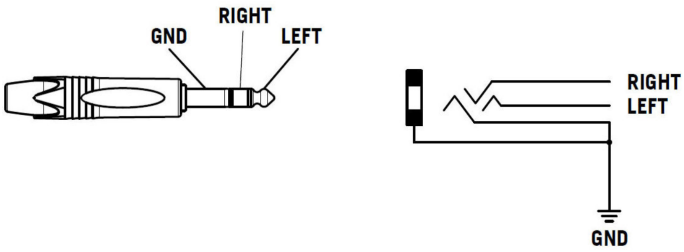
6.3.7 GPIO

37-pin D-type connector (DB37), female.



6.3.8 Headphones

6.35mm stereo jack connector.

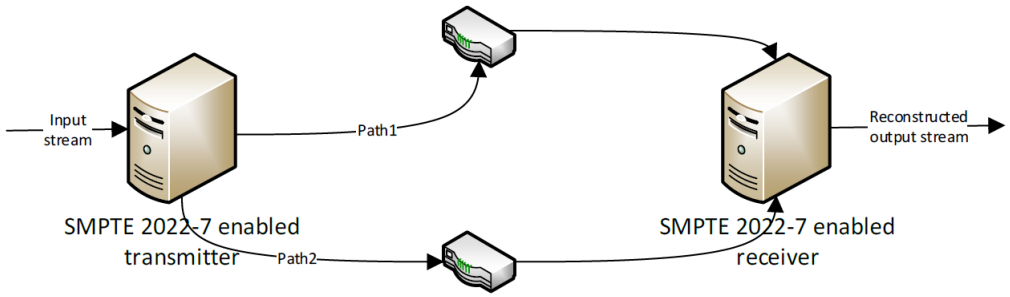


6.4 SMPTE ST2022-7 (SPS)

SMPTE ST2022-7 is a method of recovering lost data packets when streaming data over an IP network. The technology is also known as Seamless Protection Switching (SPS). Within a RAVENNA installation, it can be used to provide main and redundant paths for audio/video streams and PTP synchronization.

Concept

The diagram below illustrates the concept in a standard data network:



A SMPTE ST2022-7-enabled transmitter duplicates the input stream and sends it via two different network paths to the destination receiver. The receiver (also SMPTE ST2022-7-enabled) combines the data from both paths and reconstructs the original stream. If a packet from path 1 is missing, then the packet is taken from path 2. If path 1 is lost completely, then the entire stream is taken from path 2. And vice versa. The result is that the receiver can switch from one path to the other without impacting upon the stream content.

The network class determines how much delay between the two paths can be tolerated. Class C devices have an extended buffer size, and so can handle longer delays than Class A. Thus, Class C compatible devices can cope with a larger network infrastructure.

Configuration

To configure SMPTE ST2022-7, you will need to create two separate paths in the Media Network. This means doubling the network's infrastructure and then connecting each sending and receiving device to both paths. Within Lawo systems, the two paths are usually known as the primary (red) and secondary (blue) networks.

For partnering connections between the Core and a remote IO device, the streams are created automatically by the AdminHD configuration. For RAVENNA Tie-lines, the streams must be configured manually using the device's Web UI.

In all cases, you *must* use an odd/even pair of ports to configure SPS. i.e. ports 1+2 or 3+4, but not 2+3!