STUDER
professional audio equipment

Studer D21m

I/O System Components

Product Information

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Prepared and edited by
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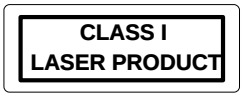
Subject to change

A Safety Information

	To reduce the risk of electric shock, do not remove covers. No user-serviceable parts inside. Refer servicing to qualified service personnel (i.e., persons having appropriate technical training and experience necessary to be aware of hazards to which they are exposed in performing a repair action, and of measures to minimize the danger of themselves).
	This symbol alerts the user to the presence of un-insulated *dangerous voltage* within the equipment that may be of sufficient magnitude to constitute a risk of electric shock to a person.
	This symbol alerts the user to *important instructions* for operating and maintenance in this documentation.
 	Assemblies or sub-assemblies of this product can contain opto-electronic devices. As long as these devices comply with Class I of laser or LED products according to EN 60825-1:1994, they will not be expressly marked on the product. If a special design should be covered by a higher class of this standard, the device concerned will be marked directly on the assembly or sub-assembly in accordance with the above standard.

A1 First Aid

In Case of Electric Shock:

Separate the person as quickly as possible from the electric power source:

- By switching off the equipment,
- By unplugging or disconnecting the mains cable, or
- By pushing the person away from the power source, using dry, insulating material (such as wood or plastic).
- After having suffered an electric shock, *always* consult a doctor.

Warning! ***Do not touch the person or his clothing before the power is turned off, otherwise you stand the risk of suffering an electric shock as well!***

If the Person is Unconscious:

- Lay the person down
- Turn him to one side
- Check the pulse
- Reanimate the person if respiration is poor
- *Call for a doctor immediately.*

B General Installation Instructions

Please consider besides these general instructions also any product-specific instructions in the “Installation” chapter of this manual.

B1 Unpacking

Check the equipment for any transport damage. If the unit is mechanically damaged, if liquids have been spilled or if objects have fallen into the unit, *it must not be connected to the AC power outlet, or it must be immediately disconnected by unplugging the power cable.* Repair must only be performed by trained personnel in accordance with the applicable regulations.

B2 Installation Site

Install the unit in a place where the following conditions are met:

- The temperature and the relative humidity of the environment must be within the specified limits during operation of the unit. Relevant values are the ones at the air inlets of the unit.
- Condensation must be avoided. If the unit is installed in a location with large variation of ambient temperature (e.g. in an OB-van), appropriate precautions must be taken before and after operation (for details on this subject, refer to Appendix 1).
- Unobstructed air flow is essential for proper operation. Air vents of the unit are a functional part of the design and must not be blocked in any way during operation (e.g. by objects placed upon them, placement of the unit on a soft surface, or installation of the unit within a rack or piece of furniture).
- The unit must not be heated up by external sources of heat radiation (sunlight, spot lights).

B3 Earthing and Power Supply

Earthing of units with mains supply (class I equipment) is performed via the protective earth (PE) conductor integrated in the mains cable. Units with battery operation (< 60 V, class III equipment) must be earthed separately.

Earthing the unit is one of the measures for protection against electrical shock hazard (dangerous body currents). Hazardous voltage may not only be caused by a defective power supply insulation, but may also be introduced by the connected audio or control cables.

If the unit is installed with one or several external connections, its earthing must be provided during operation as well as while the unit is not operated.

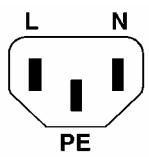
If the earthing connection can be interrupted, for example, by unplugging the mains plug of an external power supply unit, an additional, permanent earthing connection must be installed using the provided earth terminal.

Avoid ground loops (hum loops) by keeping the loop surface as small as possible (by consequently guiding the earth conductors in a narrow, parallel way), and reduce the noise current flowing through the loop by inserting an additional impedance (common-mode choke).

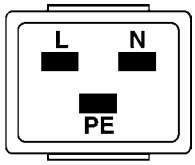
Class I Equipment (Mains Operation)

Should the equipment be delivered without a matching mains cable, the latter has to be prepared by a trained person using the attached female plug (IEC320/C13 or IEC320/C19) with respect to the applicable regulations in your country.
Before connecting the equipment to the AC power outlet, check that the local line voltage matches the equipment rating (voltage, frequency) within the admissible tolerance. The equipment fuses must be rated in accordance with the specifications on the equipment.
Equipment supplied with a 3-pole appliance inlet (protection conforming to class I equipment) *must* be connected to a 3-pole AC power outlet so that the equipment cabinet is connected to the protective earth.
For information on mains cable strain relief please refer to Appendix 2.

Female Plugs (IEC320), Front-Side View:



IEC 320 / C13



IEC 320 / C19

European Standard (CENELEC)		North American Standard (NAS)
Brown	**L (Live)**	Black
Blue	**N (Neutral)**	White
Green/Yellow	**PE (Protective Earth)**	Green (or Green/Yellow)

Class III Equipment (Battery Operation up to 60 V_{DC})

Equipment of this protection class must be earthed using the provided earth terminal, if one or more external signals are connected to the unit (see explanation at the beginning of this paragraph).

B4 Electromagnetic Compatibility (EMC)

The unit conforms to the protection requirements relevant to electromagnetic phenomena that are listed in guidelines 89/336/EC and FCC, part 15.

- The electromagnetic interference generated by the unit is limited in such a way that other equipment and systems can be operated normally.
- The unit is adequately protected against electromagnetic interference so that it can operate properly.

The unit has been tested and conforms to the EMC standards of the specified electromagnetic environment, as listed in the following declaration. The limits of these standards ensure protection of the environment and corresponding noise immunity of the equipment with appropriate probability. However, a professional installation and integration within the system are imperative prerequisites for operation without EMC problems.
For this purpose, the following measures must be followed:

- Install the equipment in accordance with the operating instructions. Use the supplied accessories.
- In the system and in the vicinity where the equipment is installed, use only components (systems, equipment) that also fulfill the EMC standards for the given environment.
- Use a system grounding concept that satisfies the safety requirements (class I equipment must be connected with a protective ground conduc-

tor) and that also takes into consideration the EMC requirements. When deciding between radial, surface, or combined grounding, the advantages and disadvantages should be carefully evaluated in each case.
- Use shielded cables where shielding is specified. The connection of the shield to the corresponding connector terminal or housing should have a large surface and be corrosion-proof. Please note that a cable shield connected only single-ended can act as a transmitting or receiving antenna within the corresponding frequency range.
- Avoid ground loops or reduce their adverse effects by keeping the loop surface as small as possible, and reduce the noise current flowing through the loop by inserting an additional impedance (e.g. common-mode choke).
- Reduce electrostatic discharge (ESD) of persons by installing an appropriate floor covering (e.g. a carpet with permanent electrostatic filaments) and by keeping the relative humidity above 30%. Further measures (e.g. conducting floor) are usually unnecessary and only effective if used together with corresponding personal equipment.
- When using equipment with touch-sensitive operator controls, please take care that the surrounding building structure allows for sufficient capacitive coupling of the operator. This coupling can be improved by an additional, conducting surface in the operator's area, connected to the equipment housing (e.g. metal foil underneath the floor covering, carpet with conductive backing).

C Maintenance

All air vents and openings for operating elements (faders, rotary knobs) must be checked on a regular basis, and cleaned in case of dust accumulation. For cleaning, a soft paint-brush or a vacuum cleaner is recommended.
Cleaning the surfaces of the unit is performed with a soft, dry cloth or a soft brush.
Persistent contamination can be treated with a cloth that is slightly humidified with a mild cleaning solution (soap-suds).
For cleaning display windows, commercially available computer/TV screen cleaners are suited. Use only a slightly damp (never wet) cloth.
Never use any solvents for cleaning the exterior of the unit! Liquids must never be sprayed or poured on directly!
For equipment-specific maintenance information please refer to the corresponding chapter in the Operating and Service Instructions manuals.

D Electrostatic Discharge during Maintenance and Repair

Caution:

Observe the precautions for handling devices sensitive to electrostatic discharge!
Many semiconductor components are sensitive to electrostatic discharge (ESD). The life-span of assemblies containing such components can be drastically reduced by improper handling during maintenance and repair work. Please observe the following rules when handling ESD sensitive components:
- ESD sensitive components should only be stored and transported in the packing material specifically provided for this purpose.
- *When performing a repair by replacing complete assemblies, the removed assembly must be sent back to the supplier in the same packing*

material in which the replacement assembly was shipped. If this should not be the case, any claim for a possible refund will be null and void.

- Unpacked ESD sensitive components should only be handled in ESD protected areas (EPA, e.g. area for field service, repair or service bench) and only be touched by persons who wear a wristlet that is connected to the ground potential of the repair or service bench by a series resistor. The equipment to be repaired or serviced as well as all tools and electrically semi-conducting work, storage, and floor mats should also be connected to this ground potential.
- The terminals of ESD sensitive components must not come in uncontrolled contact with electrostatically chargeable (voltage puncture) or metallic surfaces (discharge shock hazard).
- To prevent undefined transient stress of the components and possible damage due to inadmissible voltages or compensation currents, electrical connections should only be established or separated when the equipment is switched off and after any capacitor charges have decayed.

E Repair

Removal of housing parts, shields, etc. exposes energized parts. For this reason the following precautions must be observed:

- Maintenance may only be performed by trained personnel in accordance with the applicable regulations.
- The equipment must be switched off and disconnected from the AC power outlet before any housing parts are removed.
- Even if the equipment is disconnected from the power outlet, parts with hazardous charges (e.g. capacitors, picture tubes) must not be touched until they have been properly discharged. Do not touch hot components (power semiconductors, heat sinks, etc.) before they have cooled off.
- If maintenance is performed on a unit that is opened and switched on, no un-insulated circuit components and metallic semiconductor housings must be touched, neither with your bare hands nor with un-insulated tools.

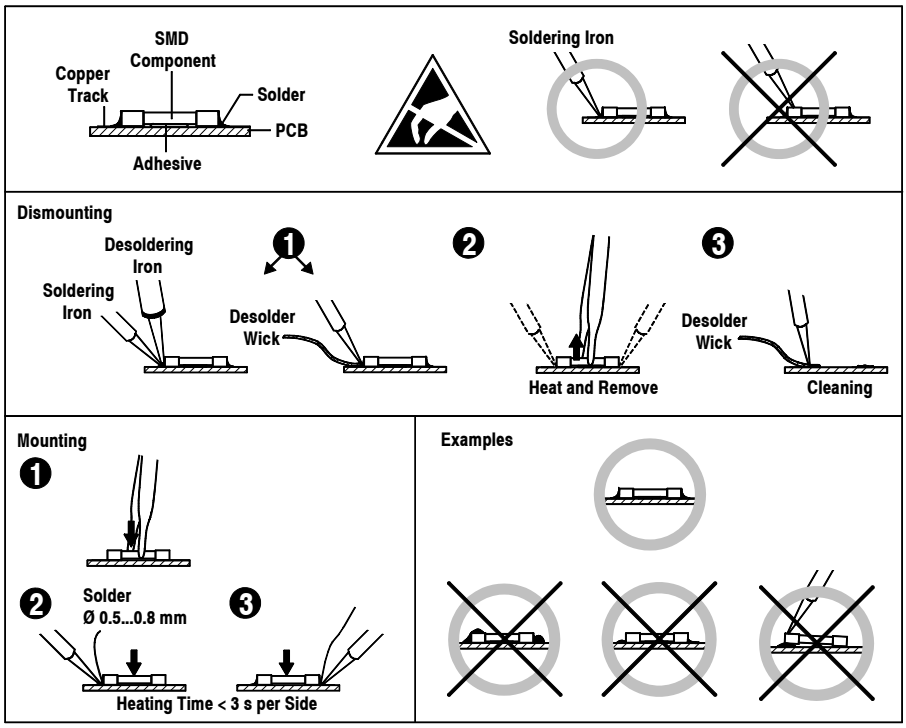
Certain components pose additional hazards:

- *Explosion hazard* from lithium batteries, electrolytic capacitors and power semiconductors (watch the component's polarity. Do not short battery terminals. Replace batteries only by the same type).
- *Implosion hazard* from evacuated display units.
- *Radiation hazard* from laser units (non-ionizing), picture tubes (ionizing).
- *Caustic effect* of display units (LCD) and components containing liquid electrolyte.

Such components should only be handled by trained personnel who are properly protected (e.g. safety goggles, gloves).

E1 SMD Components

Studer has no commercially available SMD components in stock for service purposes. For repair, the corresponding devices have to be purchased locally. The specifications of special components can be found in the service manual.
SMD components should only be replaced by skilled specialists using appropriate tools. No warranty claims will be accepted for circuit boards that have been damaged. Proper and improper SMD soldering joints are illustrated below.



F Disposal

Disposal of Packing Materials

The packing materials have been selected with environmental and disposal issues in mind. All packing material can be recycled. Recycling packing saves raw materials and reduces the volume of waste.
If you need to dispose of the transport packing materials, please try to use recyclable means.

Disposal of Used Equipment

Used equipment contains valuable raw materials as well as materials that must be disposed of professionally. Please return your used equipment via an authorized specialist dealer or via the public waste disposal system, ensuring any material that can be recycled is.
Please take care that your used equipment cannot be abused. To avoid abuse, delete sensitive data from any data storage media. After having disconnected your used equipment from the mains supply, make sure that the mains connector and the mains cable are made useless.

G Declarations of Conformity

G1 Class A Equipment - FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Caution: *Any changes or modifications not expressly approved by the manufacturer vant information in this manual.*

G2 CE Declaration of Conformity

We,
Studer Professional Audio GmbH,
CH-8105 Regensdorf,
declare under our sole responsibility that the product
Studer D21m, Digital I/O System
(starting with serial no. 0001)
to which this declaration relates, according to following regulations of EU directives and amendments

- Low Voltage (LVD):
  73/23/EEC + 93/68/EEC
- Electromagnetic Compatibility (EMC):
  89/336/EEC + 92/31/EEC + 93/68/EEC

is in conformity with the following standards or normative documents:

- Safety:
  EN 60950-1:2000 (Class I equipment)
- Safety of laser products:
  EN 60825-1:2004 + A11 + A2, EN60825-2:2000
- EMC:
  EN 55103-1/-2:1996, electromagnetic environments E2 and E4.

Regensdorf, November 12, 2004

B. Hochstrasser, President

M. Lienert, Manager R&D

Appendix 1: Air Temperature and Humidity

General

Normal operation of the unit or system is warranted under the following ambient conditions defined by *EN 60721-3-3, set IE32, value 3K3.*
This standard consists of an extensive catalogue of parameters, the most important of which are: ambient temperature +5...+40 °C, relative humidity 5...85% (i.e., no formation of condensation or ice); absolute humidity 1...25 g/m³; rate of temperature change < 0.5 °C/min. These parameters are dealt with in the following paragraphs.
Under these conditions the unit or system starts and works without any problem. Beyond these specifications, possible problems are described in the following paragraphs.

Ambient Temperature

Units and systems by Studer are generally designed for an ambient temperature range (i.e. temperature of the incoming air) of +5...+40 °C. When rack mounting the units, the intended air flow and herewith adequate cooling must be provided. The following facts must be considered:

- The admissible ambient temperature range for operation of the semiconductor components is 0 °C to +70 °C (commercial temperature range for operation).
- The air flow through the installation must provide that the outgoing air is always cooler than 70 °C.
- Average heat increase of the cooling air shall be about 20 K, allowing for an additional maximum 10 K increase at the hot components.
- In order to dissipate 1 kW with this admissible average heat increase, an air flow of 2.65 m³/min is required.

Example: A rack dissipating *P = 800 W* requires an air flow of *0.8 * 2.65 m³/min* which corresponds to *2.12 m³/min.*

- If the cooling function of the installation must be monitored (e.g. for fan failure or illumination with spot lamps), the outgoing air temperature must be measured directly above the modules at several places within the rack. The trigger temperature of the sensors should be 65 to 70 °C.

Frost and Dew

The unsealed system parts (connector areas and semiconductor pins) allow for a minute formation of ice or frost. However, formation of dew visible with the naked eye will already lead to malfunctions. In practice, reliable operation can be expected in a temperature range above –15 °C, if the following general rule is considered for putting the cold system into operation:
If the air within the system is cooled down, the relative humidity rises. If it reaches 100%, condensation will arise, usually in the boundary layer between the air and a cooler surface, together with formation of ice or dew at sensitive areas of the system (contacts, IC pins, etc.). Once internal condensation occurs, trouble-free operation cannot be guaranteed, independent of temperature.

Before putting into operation, the system must be checked for internal formation of condensation or ice. Only with a minute formation of ice, direct

evaporation (sublimation) may be expected; otherwise the system must be heated and dried while switched off.

A system without visible internal formation of ice or condensation should be heated up with its own heat dissipation, as homogeneously (and subsequently as slow) as possible; the ambient temperature should then always be lower than the one of the outgoing air.

If it is absolutely necessary to operate the cold system immediately within warm ambient air, this air must be dehydrated. In such a case, the absolute humidity must be so low that the relative humidity, related to the coldest system surface, always remains below 100%.

Ensure that the enclosed air is as dry as possible when powering off (i.e. before switching off in winter, aerate the room with cold, dry air, and remove humid objects as clothes from the room).

These relationships are visible from the following climatogram. For a controlled procedure, thermometer and hygrometer as well as a thermometer within the system will be required.

Example 1: An OB-van having an internal temperature of 20 °C and relative humidity of 40% is switched off in the evening. If temperature falls below +5 °C, dew or ice will be forming.

Example 2: An OB-van is heated up in the morning with air of 20 °C and a relative humidity of 40%. On all parts being cooler than +5 °C, dew or ice will be forming.

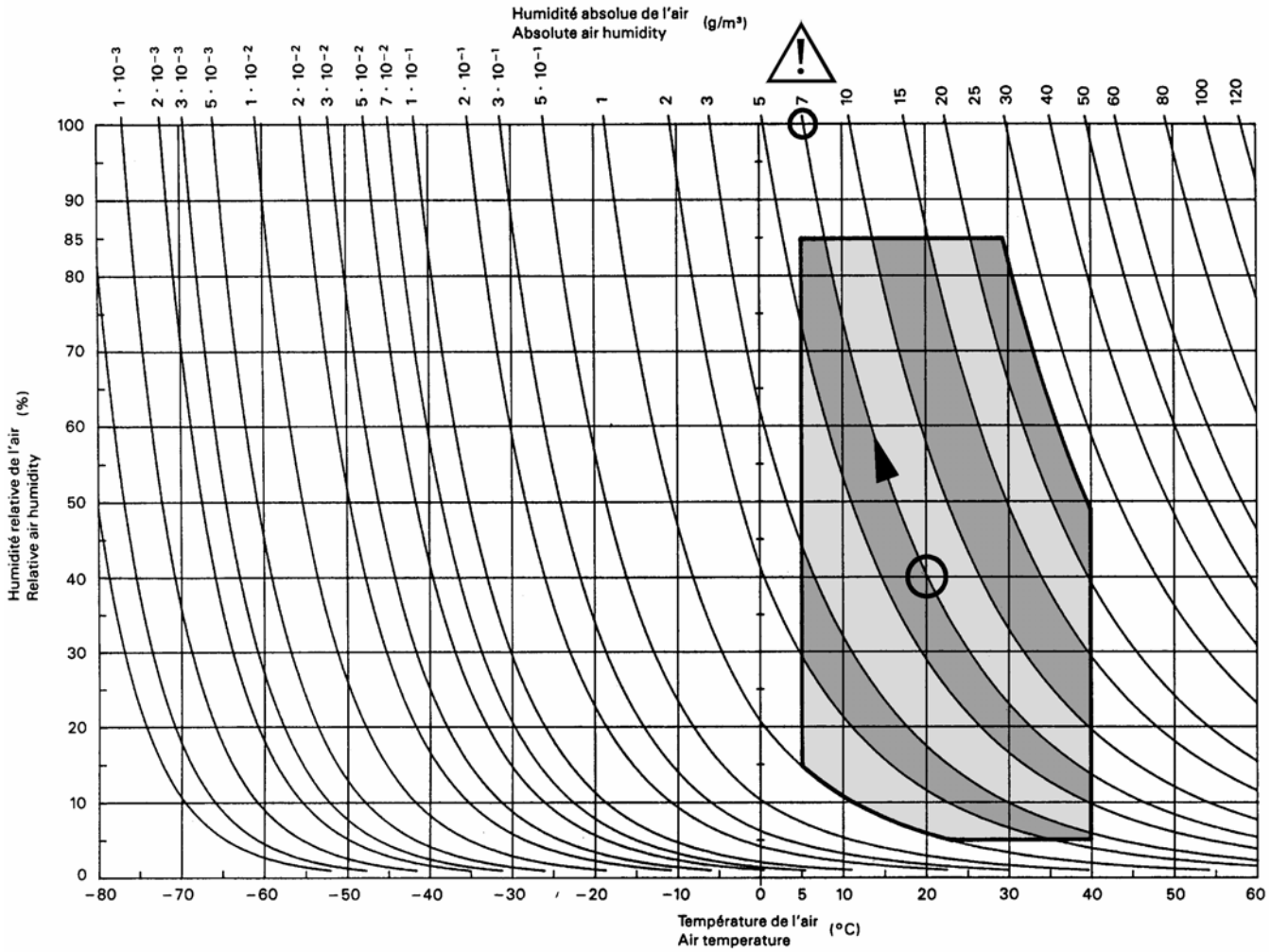


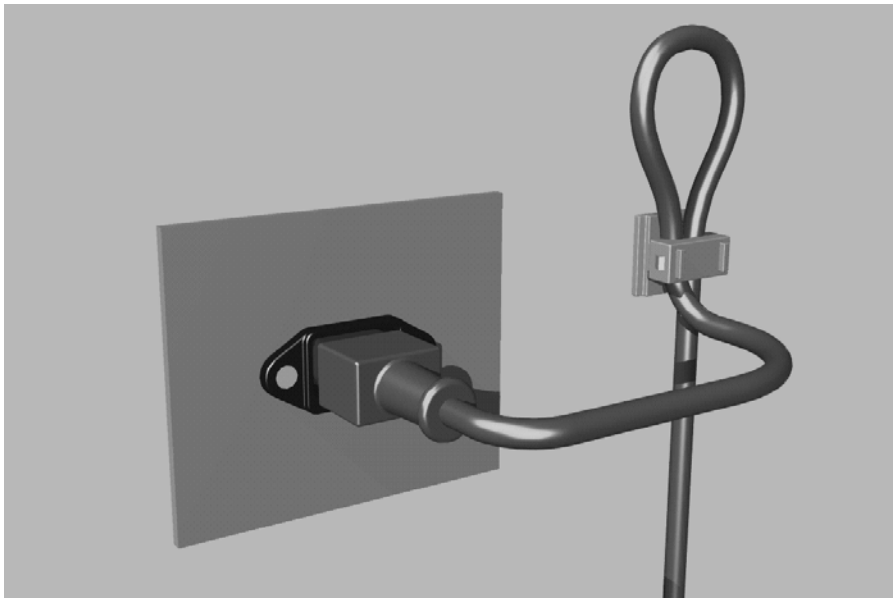
Figure B.3 – Climatogramme pour catégorie 3K3

Climatogram for class 3K3

721-3-3 © CEI:1994

Appendix 2: Mains Connector Strain Relief

For anchoring connectors without a mechanical lock (e.g. IEC mains connectors), we recommend the following arrangement:



Procedure: The cable clamp shipped with your unit is auto-adhesive. For mounting please follow the rules below:

- The surface to be adhered to must be clean, dry, and free from grease, oil, or other contaminants. Recommended application temperature range is +20...+40 °C.
- Remove the plastic protective backing from the rear side of the clamp and apply it firmly to the surface at the desired position. Allow as much time as possible for curing. The bond continues to develop for as long as 24 hours.
- For improved stability, the clamp should be fixed with a screw. For this purpose, a self-tapping screw and an M4 bolt and nut are included.
- Place the cable into the clamp as shown in the illustration above and firmly press down the internal top cover until the cable is fixed.

Appendix 3: Software License

Use of the software is subject to the Studer Professional Audio Software License Agreement set forth below. Using the software indicates your acceptance of this license agreement. If you do not accept these license terms, you are not authorized to use this software.

Under the condition and within the scope of the following Terms and Conditions, Studer Professional Audio AG (hereinafter "Studer") grants the right to use programs developed by Studer as well as those of third parties which have been installed by Studer on or within its products. References to the license programs shall be references to the newest release of a license program installed at the Customer's site.

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The following Terms and Conditions grant the right to use all programs of Studer that are part of the System and/or its options at the time of its delivery to the Customer, as well as the installation software on the original data disk and the accompanying documentation ("License Material"). In this Agreement the word "Programs" shall have the meaning of programs and data written in machine code.

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Principle

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Reverse engineering is only permitted with the express consent of Studer. The consent of Studer can be obtained but is not limited to the case in which the interface-software can not be provided by Studer. In any case Studer has to be informed immediately upon complete or partial reverse engineering.

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Warranty, Disclaimer, and Liability

For all issues not covered herewithin, refer to the "General Terms and Conditions of Sales and Delivery" being part of the sales contract.

CONTENTS

Disclaimer

1 GENERAL

1.1 Utilization for the Purpose Intended

The D21m system is intended for professional use.
It is presumed that the unit is operated only by trained personnel. Servicing is reserved to skilled technicians.

The electrical connections may be connected only to the voltages and signals designated in this manual.

1.2 First Steps

1.2.1 Unpacking and Inspection

Your new system is shipped in a special packing which protects the units against mechanical shock during transit. Care should be exercised when unpacking so that the surfaces do not get marred.
Check the condition of the equipment for signs of shipping damage. If there should be any complaints you should immediately notify the forwarding agent and your nearest Studer distributor.
Please retain the original packing material because it offers the best protection in case your equipment ever needs to be transported.

1.2.2 Installation

Primary Voltage:

The power supply unit is auto-ranging; it can be used for mains voltages in a range of 100 to 240 V_{AC}, 50 to 60 Hz.

Power Connection:

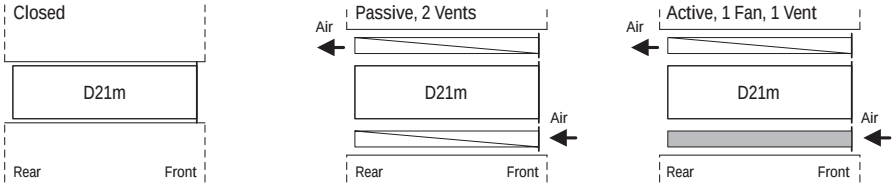
The attached female IEC 320/C13 mains cable socket has to be connected to an appropriate mains cable by a trained technician, respecting your local regulations. Refer to the “Installation, Operation, and Waste Disposal” chapter at the beginning of this manual.

Earthing:

This equipment must be earthed, due to the mains input filter network being connected to the mains earth.
Some consideration must be given to the earthing arrangement of the system, at the center of which is the frame. The frame is earthed to the mains earth via the power supply. Ground loops may occur where signal processing equipment, patched to the frame, has its signal earth commoned to the equipment chassis.

Temperature Regulations:

The unit must not be used in conditions of excessive heat or cold, near any source of moisture, in excessively humid environments, or in positions where it is likely to be subjected to vibration or dust. The ambient temperature range for normal operation of the unit is +5...+40° C.
Under standard circumstances (open 19” frame) and an ambient temperature between +5 and +40° C, the power dissipations listed below must not be exceeded. Please note that these figures may change for special environments, such as air-conditioned machine rooms, etc.
(continued on next page)



Operating Mode	Total Height	Max. Power Dissipation
Closed	3 U	40 W
Passive, w. Vents	5 U	80 W
Active, w. Fan and Vent	5 U	200 W

Card No.	Card Name	Power Dissipation (approx.)
	Backplane with power supply	10 W
1.949.427	Mic/Line in card	11 W
1.949.428	Analog insert card	2 W
1.949.421	Line In card	7 W
1.949.420	Line out card	7 W
1.949.422	AES/EBU card	3.5 W
1.949.423	AES/EBU card with input SFC	4.5 W
1.949.424	AES/EBU card with input/output SFC	5.5 W
1.949.430	MADI card, multi-mode fibre	4 W
1.949.431	MADI card, single-mode fibre	4 W
1.949.433	MADI card, twisted pair	4 W
1.949.425	ADAT I/O card	1.7 W
1.949.429	ADAT card, long-distance option	1.7 W
1.949.426	TDIF I/O card	1 W
1.949.441	SDI input card (16 channels)	4 W
1.949.442	SDI input/output card (8 channels)	4 W
1.949.443	Dolby® E/Digital decoder card, single	2.5 W
1.949.444	Dolby® E/Digital decoder card, dual	4 W
1.949.445	CobraNet® card	4.5 W
1.949.446	Aviom A-Net® card	2 W
1.949.435	GPIO card	3 W
1.949.436	GPIO card with relay outputs	2 W
1.949.412	HD card S	5 W
1.949.415	HD RS422 card	5 W
1.949.411	MADI HD card, multi-mode fibre	5.5 W
1.949.413	MADI HD card, single-mode fibre	5.5 W
1.949.414	MADI HD card, twisted pair	5.5 W
1.949.437	Serial card	0.2 W
1.949.438	Serial Merger card	0.6 W
1.949.439	Serial RJ45 card	0.2 W
1.949.440	Dual Merger card	1.2 W
-	Ethersound card	3 W

1.2.3 Adjustments, Repair, Cleaning

Danger:

All internal adjustments as well as repair work on this product must be performed by expert technicians!

Replacing the Supply Unit:

The primary fuse is located within the power supply module and cannot be changed. In case of failure, the complete power supply unit must be replaced. Please ask your nearest Studer representative.

Cleaning:

Do not use any liquids to clean the exterior of the unit. A soft, dry cloth or brush will usually do.

For cleaning the display windows, most of the commercially available window or computer/TV screen cleaners are suited. *Use only a slightly damp (never wet) cloth. Never use any solvent!*

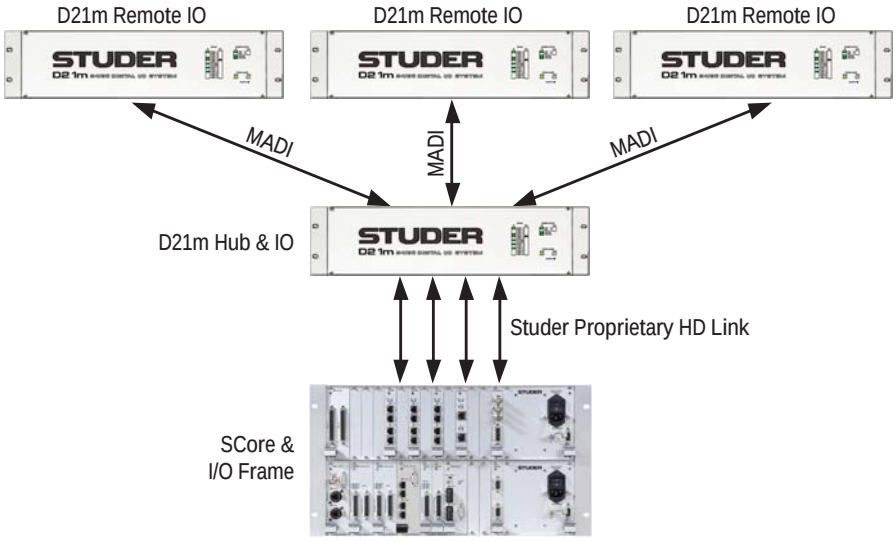
2 INTRODUCTION

The D21m I/O system provides very cost-effective inputs and outputs with maximum flexibility while maintaining the well-known Studer sound quality. It is the first Studer I/O system providing full 96 kHz operation. Different I/O modules can be plugged into a frame, providing I/O systems tailor-made to customer needs. And all this comes with an unequalled form factor. Full redundancy is available starting from power supplies going up to redundant interconnections and DSP cards.

Note: The examples in this document use the SCore. Although most applications refer to this usage, the majority is also valid for use with the Performa core.

2.1 System Philosophy

When using the D21m I/O system the DSP core itself does not provide I/O, but is connected to the first D21m frame within the system (acting as a hub) by using Studer proprietary “HD Link” technology. On the DSP core side, the connection is made to the DSP card(s) directly. Link distance is limited to 10 m, so the first I/O box should be located close to the DSP core. From that frame it is possible to run optical-fiber MADI links to multiple places, up to several kilometers away. By using this “star” architecture it is ensured that a possible problem with one of the remote I/O boxes will not lead to a general breakdown of the whole I/O system. A maximum of six remote I/O boxes (stage boxes) may be connected to one hub frame. Should more I/O channels be required then multiples of the “local frames” (hubs) may be used within the system.



Redundancy issues are regarded as highly important. It is therefore possible to run any MADI links with redundant cables. The system is automatically switching to the redundant connection in case the primary connection should fail. For 96 kHz operation the second link can be used as a channel count extension, transferring a total of 64 MADI channels even at 96 kHz sampling frequency. The “redundant” MADI link may also be used for sharing an I/O box between two consoles.

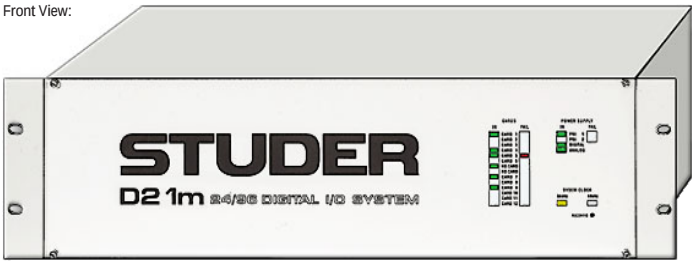
The MADI link between the first D21m frame (hub) and the remote I/O boxes, in addition, carries all control signals needed to control the microphone amplifier cards, to interrogate the state (health) of any remote I/O card and to display it within the console’s system surveyor page. This is without sacrificing

any audio channels within the MADI link. Additionally, an RS422 signal can be “tunneled” through the MADI connection. In this way e.g. a MIDI device can be connected to the remote I/O box and find the “extension” connector on the hub frame next to the core again.

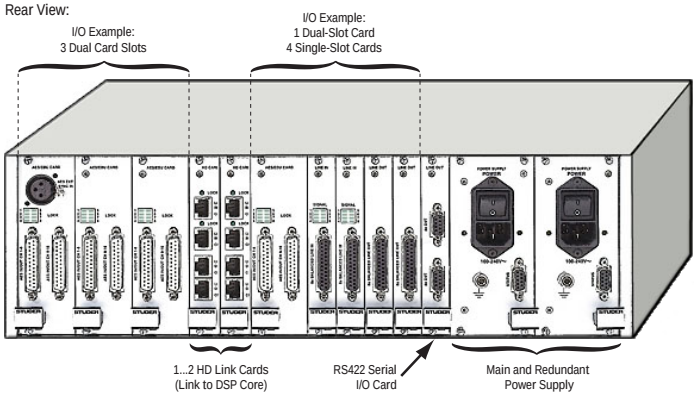
Notes: Unlike the Studer D19m I/O system, the D21m system is engineered as an I/O system for use together with a Studer digital console, i.e., using the D21m system as a “standalone” analog-to-digital or digital-to-analog converter only works if MADI I/O is used on the digital side; for more information on this subject please refer to chapter 5.7. Inserting, e.g., an AES/EBU card and a Line input card and getting the A/D-converted signal out of the AES/EBU card directly is not possible. This can be done only if the audio is routed with a DSP core. Since the MADI signal to the D21m remote I/O box is used to synchronize the unit, a stable, low-jitter MADI signal is necessary in order to reach maximum audio quality. This is guaranteed by Studer equipment.
However, two I/O boxes can be interconnected using MADI, where one of them must be switched to “Master” mode. In such a case up to 64 audio channels may be transmitted between two frames (applicable for MADI HD cards 1.949.411.23, 1.949.413.22, 1.949.414.20, or newer).

2.2 The Frame and its Cards

Front View:



Rear View:

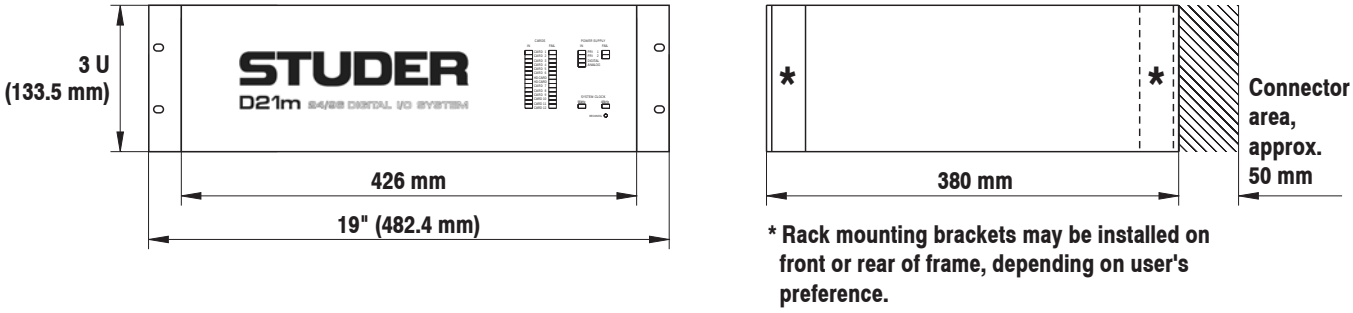


The 3 U frame provides 12 slots for I/O card insertion. Each card may provide a different number of I/O channels, depending on its capabilities (e.g. a microphone card provides four channels of microphone inputs, while an ADAT card provides 16 channels of inputs and outputs simultaneously). Some cards are mechanically occupying two slots, and therefore a maximum of 6 double-width cards may be inserted into a frame. An overview of the different cards currently available is given in chapter 6.1.

The frame hosts one or two “High Density Link” cards (short: HD Link), providing the main audio connection to the DSP core. From the HD card(s) the signals are redirected to the different types of I/O cards in the frame. Therefore at least one HD card must be inserted in the frame.
The frame may be equipped with redundant power supplies, the status of which can be displayed in the Vista console’s system surveyor page.
Please note that the rack mounting brackets may be installed either on the front (as shown on the opposite page) or on the rear of the frame.

2.3 Hub Frame

The difference between a D21m frame acting as a hub or as a remote I/O box is the type of HD Link and RS422 cards inserted. The HD Link card in the hub frame hosts four RJ45 connectors for connection to the DSP core, providing 192 channels (96 in case of the Performa core) of audio coming from the DSP core through 2 cables into the frame (audio outputs), as well as 192 channels from the frame through 2 cables into the DSP core (audio inputs). The length of the high-density link cables must not exceed 10 meters (30 feet).
If multiple remote I/O boxes are connected to one hub frame, more channels need to be transferred to the DSP core. In this case it is possible to insert a second HD card into the hub frame, expanding its capabilities to handle 384 inputs and outputs to the DSP core (192 outputs in case of the Performa core).



2.4 Remote I/O Frame

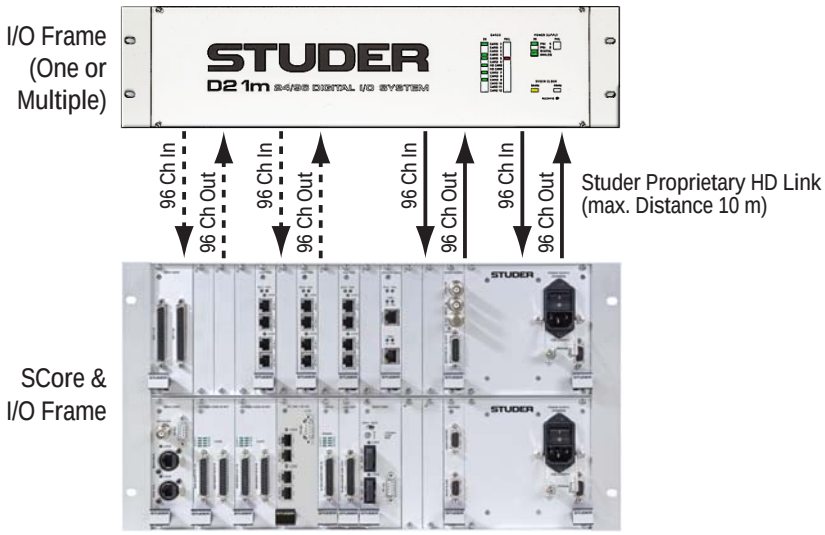
The frame placed remotely is equipped with a special MADI HD card. This version of the card is not equipped with the Studer proprietary high-density link but with standard MADI optical interfaces. This format allows transferring 64 channels of inputs and outputs between the remote I/O box and the hub frame simultaneously.
Frame dimensions are the same as shown in 2.3 above.

2.5 Vista Surveyor Software

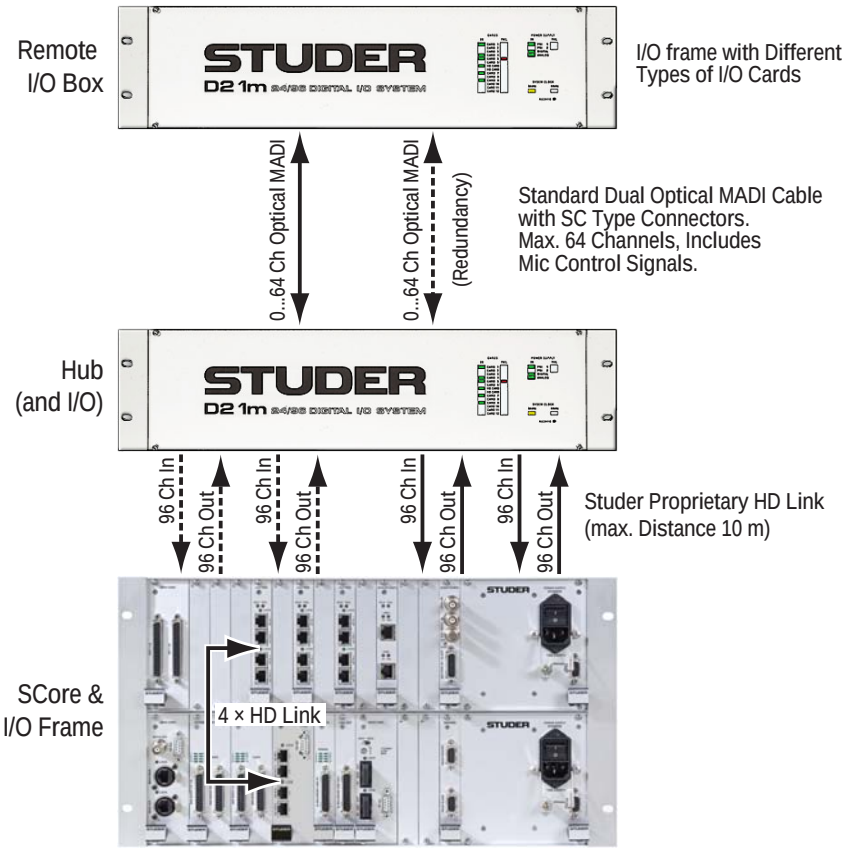
The surveyor on the graphic controller (GC) screen of the Vista consoles will indicate the whole I/O system, including the health state of each I/O card and the power supplies. If the hardware found at startup time is not identical to what the system expects, the user is asked whether the expectations should permanently be changed or whether the user has temporarily changed the I/O configuration (such as having moved a remote I/O box to another place for the current production). In both cases the surveyor application indicates “green”, unless the user tells it to wait for the missing I/O components.
There is no need to tell the system which channel has a microphone preamplifier included, since this detection is done automatically. However, it is necessary to define which HD link of the hub frame is going to which PED21m card within the Performa DSP core. This is done in a software menu accessible for system administrators only.

3 APPLICATIONS

3.1 Local I/O Only (Located Close to Core)



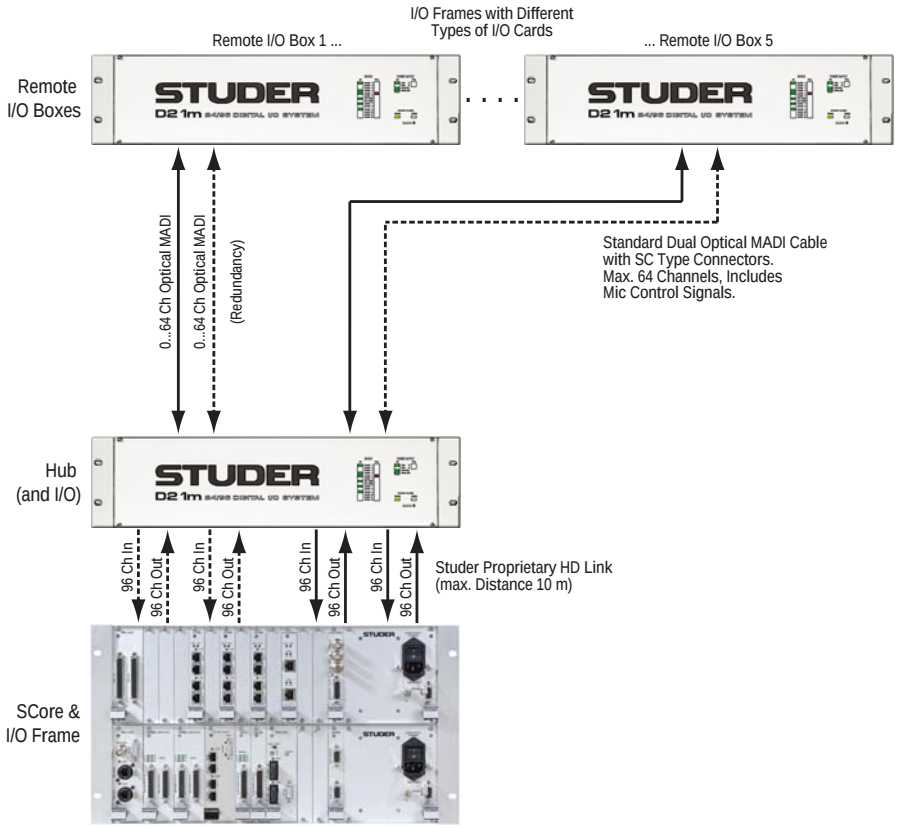
3.2 One I/O Box within Long Distance



Notes: Both the remote I/O box and the local hub frame are standard D21m frames, providing the possibility to insert any I/O cards available for the D21m I/O system. The hub frame may therefore also be used for any audio I/O located close to the DSP core.

The channel count of the MADI link may be set in steps of eight channels using card-internal DIP switches. In order to provide synchronization and surveyor information it is necessary to provide a MADI link to and from the remote I/O boxes at all times, even if the channel count should be set to 0.
The protocol switch on the front panel of the MADI I/O card may be set to “64 channel” to allow maximum usage of the available channels. This switch may only have to be set to “56 channel” protocol for operation with third-party MADI devices (in case no remote I/O box is connected to the MADI I/O card).
If 64 channels of MADI transmission are required when working at 96 kHz, the redundant MADI line can be used as a “channel extension” for transmitting the MADI channels 33-64 (29-56). This must be set accordingly with a DIP switch on the MADI I/O card inserted in the hub frame.

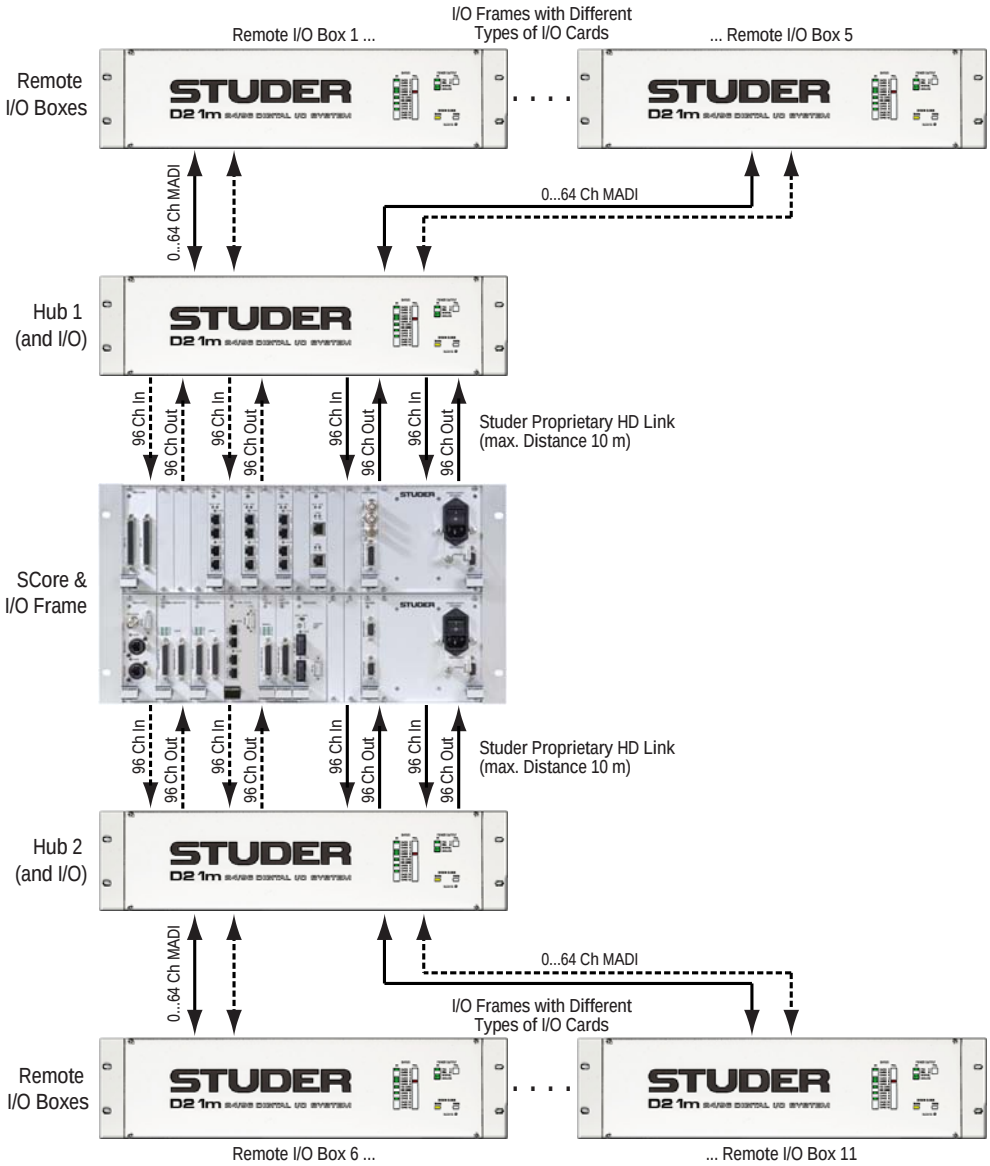
3.3 Multiple I/O Boxes, Long Distance



Notes: Both the remote I/O box and the local hub frames are standard D21m frames, providing the possibility to insert any I/O card available for the D21m I/O system. The hub frame may therefore also be used for any audio I/O located close to the DSP core.
Up to 5 remote I/O boxes can be connected to one hub frame. The last slot is occupied with one ADAT card (or AES/EBU card in case of operation with the Performa core) in order to provide I/O for monitoring and talkback of the desk.
The channel count of the MADI link may be set in steps of eight channels using card-internal DIP switches. In order to provide synchronization and surveyor information it is necessary to provide a MADI link to and from the remote I/O boxes at all times, even if the channel count should be set to 0.

The protocol switch on the front panel of the MADI I/O card may be set to “64 channel” allowing maximum usage of the available channels. This switch may only have to be set to “56 channel” protocol for operation with third-party MADI devices (in case no remote I/O box is connected to the MADI I/O card).
If 64 channels of MADI transmission are required when working at 96 kHz, the redundant MADI line can be used as a “channel extension” for transmitting the MADI channels 33-64 (29-56). This must be set accordingly with a DIP switch on the MADI I/O card inserted in the hub frame.

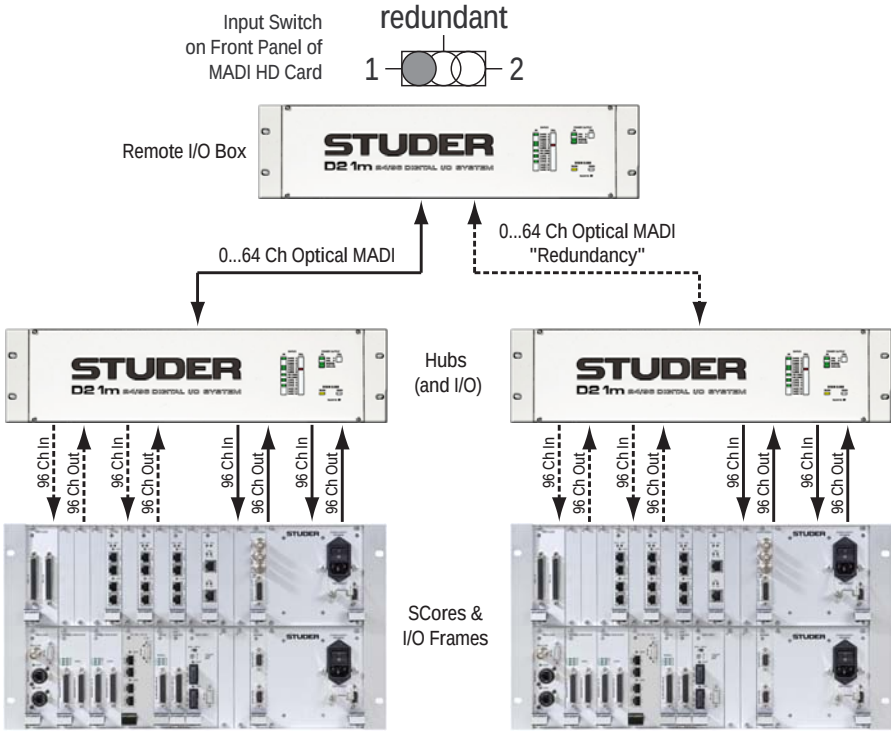
3.4 Multiple Hubs, Multiple I/O Boxes, Long Distance



Notes: Both the remote I/O box and the local hub frames are standard D21m frames, providing the possibility to insert any I/O card available for the D21m I/O system. The hub frame may therefore also be used for any audio I/O located close to the DSP core.
Up to 6 remote I/O boxes can be connected per hub frame, except in the first hub frame, where one slot is occupied with one ADAT card (or AES/EBU

card in case of operation with the Performa core) in order to provide I/O for monitoring and talkback of the desk.
The RS422 link for the second hub may be taken from the Vista desk by using a further RS422 port.
The channel count of the MADI link may be set in steps of eight channels using card-internal DIP switches. In order to provide synchronization and surveyor information it is necessary to provide a MADI link to and from the remote I/O boxes at all times, even if the channel count should be set to 0.
The protocol switch on the front panel of the MADI I/O card may be set to “64 channel” to allow maximum usage of the available channels. This switch may only have to be set to “56 channel” protocol for operation with third-party MADI devices (in case no remote I/O box is connected to the MADI I/O card).
If 64 channels of MADI transmission are required when working at 96 kHz, the redundant MADI line can be used as a “channel extension” for transmitting the MADI channels 33-64 (29-56). This must be set accordingly with a DIP switch on the MADI I/O card inserted in the hub frame.

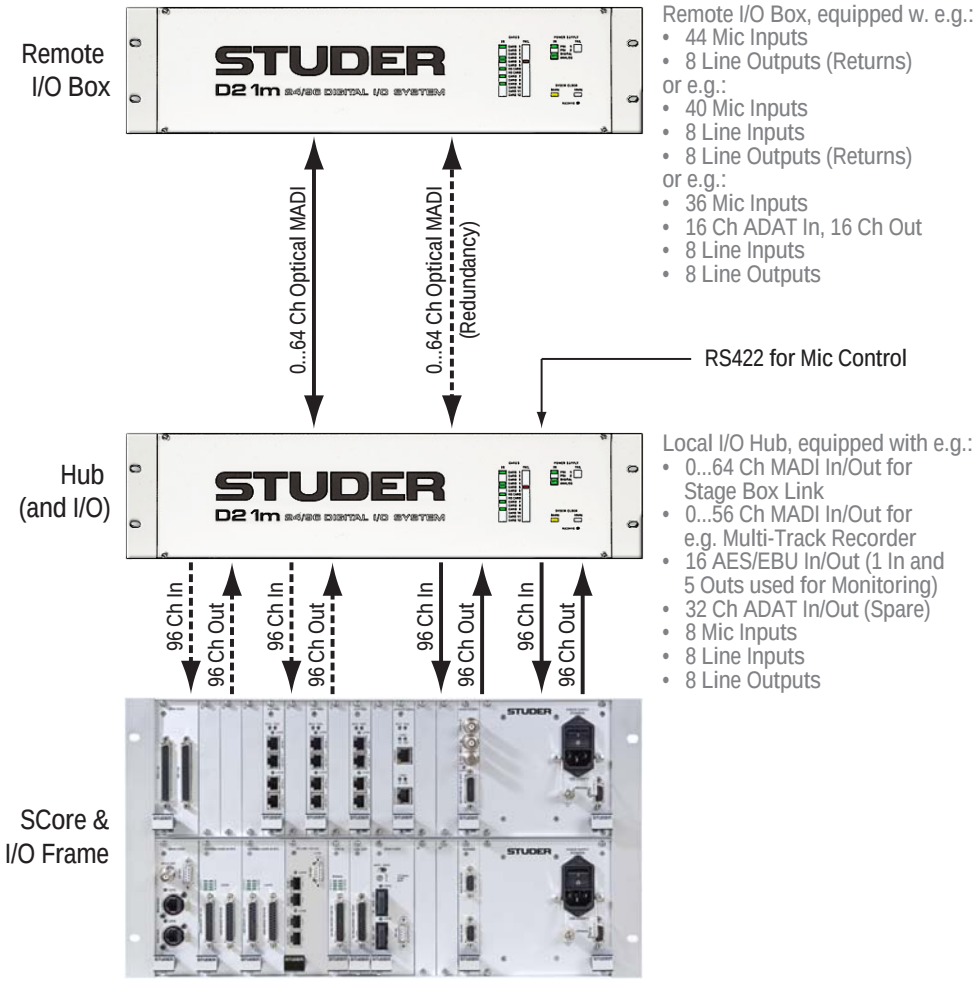
3.5 Shared I/O



It is possible to connect one remote I/O box to two hubs or consoles at the same time. This allows sharing of one box between two consoles. While the audio inputs are fed to both consoles, the outputs on that I/O box may only be fed by one of the two consoles at a time. An input selector switch on the MADI HD card determines from which console the audio outputs are fed. At the same time only the currently selected console will be able to display health information in the surveyor. If the switch is set to “redundant”, the remote I/O box jumps freely onto the second input in case the signal is lost on the main input. Unless the signal is interrupted on the redundant input, too, the system will not switch back to the main input in order to avoid undefined switching in case of a bad MADI connection.

4 SYSTEM EXAMPLES

4.1 System with Remote and Local I/O



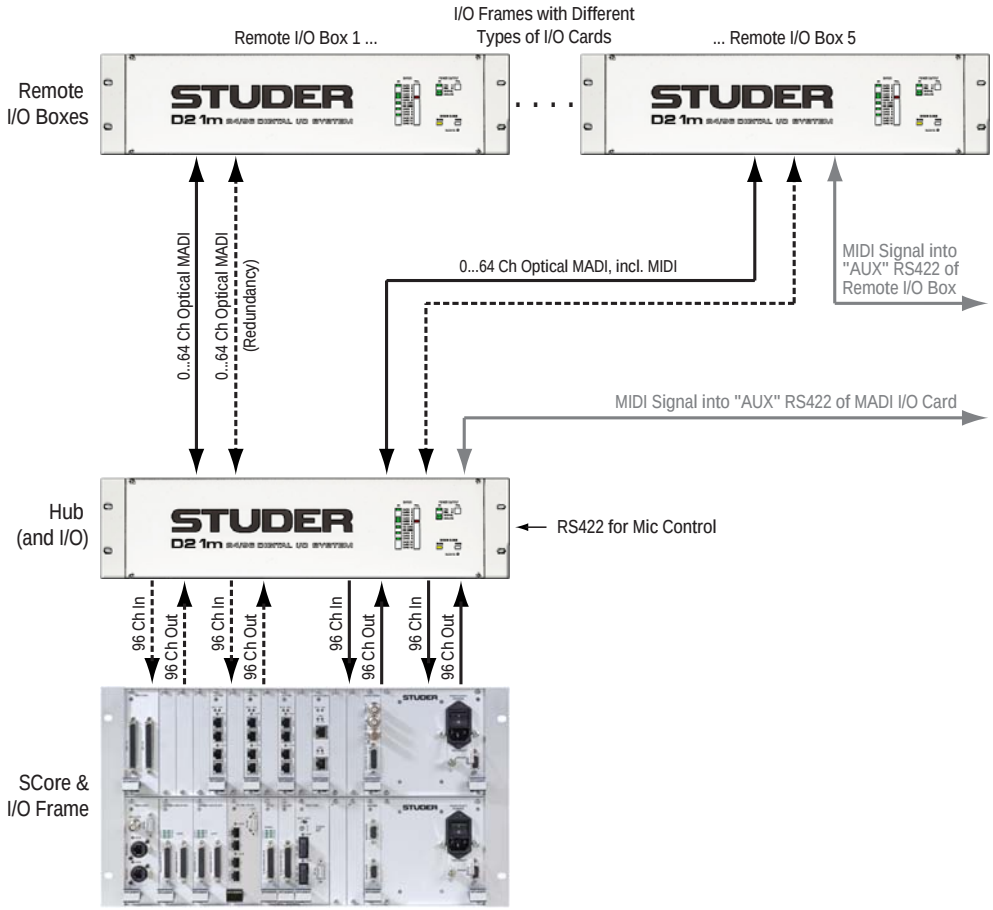
Notes: Some of the I/O cards are “double-width”, of which a maximum of 6 may be fitted in one D21m frame. When only using single-width cards, a maximum of 12 can be fitted. Therefore, e.g. a maximum of 48 microphone inputs may be fitted in one (full) frame. If outputs are required as well, up to 44 microphone inputs are possible since then at least one slot is used for an 8-channel line output card.

Input and Output cards may be inserted in any order. The system is filling up the MADI channels automatically, starting from the leftmost card subsequently to the right.

Since the MADI bandwidth can only be adjusted in steps of 8 channels, an odd number of microphone cards (providing 4 inputs each) will result in 4 MADI channels without audio.

The MADI HD card versions 1.949.411.21/1.949.413.21 and newer support operation with two MADI HD cards in one frame, extending the total channel count between the hub frame and the remote I/O box to 128. The same channel count is reached in 96 kHz mode. *For details please refer to chapter 6.5.3.*

4.2 System with Remote MIDI Connection



Any serial signal, such as MIDI or Sony 9-pin (machine control) may be transmitted through a MADI connection without losing any audio bandwidth or microphone control of the remote I/O box. An RS422 connector labeled “Aux” can be found on the MADI I/O card (hub frame side) as well as on the serial card of the remote I/O frame. This card is located between slot 12 and the power supplies. The required baud rate is set on the MADI I/O (local) and MADI HD (remote) cards.

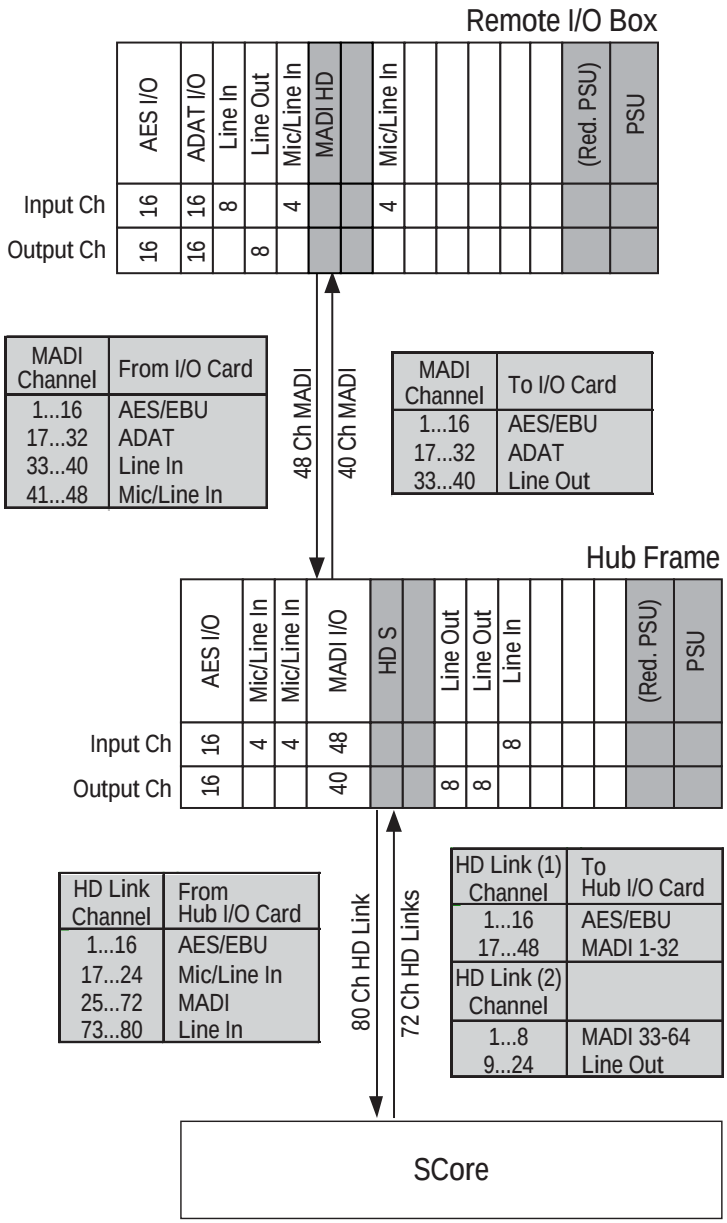
5 ADDITIONAL INFORMATION

5.1 Mapping of I/O Cards to MADI and HD Link Channels

The HD card is redirecting the audio channels from the different I/O cards into the Studer proprietary HD link format (in case of a hub) or MADI (in case of a remote I/O box). In order to design a complete I/O system, it is mandatory to know which channels of the I/O cards end up being redirected to which one of e.g. the 64 MADI channels. This will influence the way the configuration editor software is used and the labels are selected when starting the operation of a new system.

General rule: The HD card fills in all channels starting from the left side of the frame (slot 1) to the right. Input and output cards may therefore be mixed, but their order dictates the "filling up" of MADI outputs from the frame. In the same way the order of outputs from left to right is defining which MADI inputs are being redirected to that card. The same rule applies for the Studer proprietary HD link format.

The following example illustrates the rules within a complex I/O system:



5.2 Special Case: Microphone/Line Input Card

The smallest modularity of channels used up within the MADI and Core link is eight. If an odd number of Mic/Line input cards is used, they should be inserted in pairs, with the last card in an odd slot (no. 1, 3, 5...) This single card will allocate 8 channels but only 4 of them will have audio. If a Mic/Line input card pair uses Analog Insert cards, they should be placed in the next double slot on the right, as shown in chapter 5.3.
For clearness, see the following examples:

Example 1:

Input Cards	MADI Channel Usage
10 Mic/Line Input cards (40 channels)	1...40
2 Line Input cards (16 channels)	41...56

Example 2:

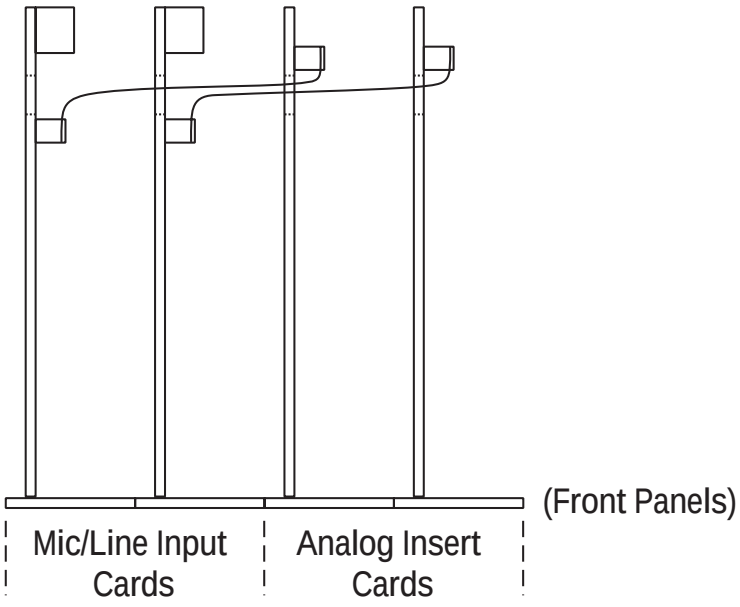
Input Cards	MADI Channel Usage
9 Mic/Line Input cards (36 channels)	1...36 *(37...40 no audio)*
2 Line Input cards (16 channels)	41...56

Example 3:

Input Cards	MADI Channel Usage
9 Mic/Line Input cards (36 channels)	1...36 *(37...40 no audio)*
3 Line Input cards (24 channels)	41...64

5.3 Analog Insert Cards

If you plan to equip the I/O box with Analog Insert cards, it is wise to avoid channels without signal by installing two Mic/Line Input cards next to each other, followed by two Analog Insert cards to their right. The Analog Insert cards will be connected to “their” Mic/Line Input card by a ribbon cable. After that, more Mic/Line Input cards may be inserted. This way all channels within the hub-to-core link will be carrying audio, since there is always a group of 8 channels inserted next to each other. The two Analog Insert cards will not use any channels within the link. The ribbon cables are lead through slots provided in both the Mic/Line Input and Analog Insert cards.



5.4 96 kHz Operation

D21m Frame:

The D21m I/O system is fully supporting 96 kHz operation. For digital formats, the following standards are supported:

AES/EBU 2 channels are sent over one cable, both at 48 kHz and 96 kHz, just by doubling the clock frequency of the transmitted signal in 96 kHz operation.

MADI 0...64 channels are transmitted at 48 kHz (depending on the DIP switch settings), and 0...32 channels are transmitted at 96 kHz. In the latter mode, the clock frequency is doubled to 96 kHz, similar to the AES/EBU format. In order to reach 64 channels of transmission between remote I/O boxes and the hub frame at 96 kHz, the card's redundant MADI connections can be selected to transmit the "lost" half of the first cable. This is done by a DIP switch on both the MADI I/O and the MADI HD cards.

ADAT At 96 kHz, only 8 channels are transmitted (4 per optical interface).

TDIF At 96 kHz, only 8 channels are transmitted.

MADI HD If more than 32 channels are required in 96 kHz mode, the AUX interface must be used as a "channel extension" to the main interface (i.e., DIP switch #1 is OFF); it will then transmit channels 33...64 of the 96 kHz MADI signal. Subsequently, MADI connection redundancy will not be available in 96 kHz mode when exceeding a total channel count of 32 into or out of the remote I/O box.

Performa Core:

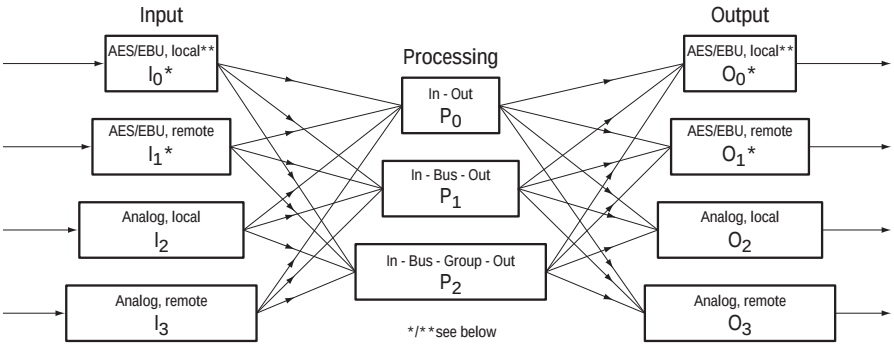
- For 96 kHz operation, the DSP core must only contain PE and PED21m cards and a MemNet card type 1.950.621.xx *(not 1.950.620.xx)* or newer.
- In addition, the Performa core must contain a "Revision A" backplane.
- An external, high-quality (low-jitter) 96 kHz sync signal in AES/EBU format must be provided.
- The session configuration has to be re-calculated. Some I/O channels may then have no audio but will still show up in the patch window. This is due to the fact that some I/O cards (e.g. ADAT) will provide only half the number of audio channels at 96 kHz.

48 kHz		96 kHz	
I/O Card Configuration (from Left to Right)	HD Link Channel Usage	I/O Card Configuration (from Left to Right)	HD Link Channel Usage
AES/EBU (16 Channels)	1...16	AES/EBU (16 Channels)	1...16
ADAT (16 Channels)	17...32	ADAT (16 Channels)	17...32 *(25...32 no audio)*
Line Input (8 Channels)	33...40	Line Input (8 Channels)	33...40
Mic/Line Input (4 Channels)	41...44	Mic/Line Input (4 Channels)	41...44
Mic/Line Input (4 Channels)	45...48	Mic/Line Input (4 Channels)	45...48

Please note that the Studer proprietary HD link is providing 96 channels of inputs to and 48 channels of outputs from the Performa core, in both 48 kHz and 96 kHz operation.

5.5 Input/Output Delays

Different DSP core types as well as the different I/O cards cause different delays. Several facts require additional consideration. Total I/O delay is the sum of the delays given in the tables below and depends on configuration.



D21m I/O
(Independent of Core Type)

Block	48 kHz		96 kHz	
	[smpl]	[µs]	[smpl]	[µs]
I_0 */**	0	0	0	0
I_1 *	7	146	7	73
I_2	38	792	38	396
I_3	45	938	45	469
O_0 */**	0	0	0	0
O_1 *	4	83	5	52
O_2	28	583	28	292
O_3	32	667	33	344

* Enabled input and output SFCs each cause an additional delay, depending on input and output sampling frequencies – for details refer to chapter 5.5.1.

** Local MADI, ADAT, and TDIF interfaces have approximately the same delay as the AES/EBU interface (±1...2 samples)

Processing / Compact SCore
(OnAir 3000)

Block	48 kHz	
	[smpl]	[µs]
P_0	16	333
P_1	37	771
P_2	53	1104

Processing / SCore Live
(OnAir 3000, Vista, Route 6000)

Block	48 kHz		96 kHz	
	[smpl]	[µs]	[smpl]	[µs]
P_0	16	333	18	188
P_1	34	708	36	375
P_2	47	979	49	510

Processing / Performa Core
(Vista)

Block	48 kHz		96 kHz	
	[smpl]	[µs]	[smpl]	[µs]
P_0	15	313	20	208
P_1	31	646	54	563
P_2	43	896	78	813

5.5.1 Additional SFC Delay

Enabled input and output SFCs each cause an additional delay (D) depending on the input and output sampling rates (f_{S_IN} and f_{S_OUT}).
Input and output delays can be calculated using the following formulas:

$$[1]\ f_{S\_IN} > f_{S\_OUT}:\ D = \frac{16}{f_{S\_IN}} + \frac{32}{f_{S\_OUT}}\ [s] \qquad [2]\ f_{S\_OUT} > f_{S\_IN}:\ D = \frac{48}{f_{S\_IN}}\ [s]$$

Examples: *For a 96 kHz input signal and a 48 kHz system clock (i.e., the input SFC's output), the input delay is **40 output samples** or 833 µs (formula [1]).*
*For a 48 kHz system clock (i.e., the output SFC's input) and a 96 kHz output signal, the output delay is **96 output samples** or 1 ms (formula [2]).*

5.5.2 Additional Processing Delay

Processing Block	Compact SCore	SCore Live***	Comment
Limiter	1 ms	-	if active
Monitoring Module	1 sample	-	Signal path, e.g. to phones out
TB Sum / Monitor Sum	5 samples	5 samples	
Core-Core MADI Link	17 samples	17 samples	
Insert Send	5 samples	5 samples	
Output Sum*	16 samples	13 samples	
Program Output**	5 samples	5 samples	
Assignable Process	-	5 samples	e.g. fader, stereo -> mono

* Delay from a channel input to a summing output
** Delay from a summing output to a master/group output
*** Independent of the sampling frequency (48 or 96 kHz)

5.6 The MADI Interface: 64 or 56 Channels?

The D21m I/O system is fully supporting the MADI protocol of 56 channels (standard MADI) as well as 64 channels (not supported by all third-party MADI devices). Protocol selection is done on the front panel switch of the MADI I/O card. Between a D21m hub and a D21m remote I/O box always 64-channel format should be selected, since the MADI HD card in the remote I/O box expects the 64 channel protocol.

Note: The protocol switch on the front panel of the MADI I/O card is not related to the channel count setting by the DIP switch on the card itself. In other words, you possibly only use 32 MADI channels (determined by DIP switch), but you nevertheless have to select whether the standard MADI protocol ("56 channels") or the extended version is used. The correct setting of the protocol switch on the front panel is purely depending on the third-party equipment connected to that MADI interface.

5.7 Standalone D21m I/O System

Previously only available for Studer digital mixing consoles, the D21m I/O system is now opened up for use with any audio equipment. With the introduction of the D21m remote control software, the microphone amps and A/D converters become available to a wide range of applications, such as recording, broadcast, and live sound.
A D21m I/O frame can be connected to any 3rd-party device using its optical MADI interface. The remote control software runs on a PC, connected to the I/O frame over an additional RS422 serial connection. This software may even rut at the same time as DAW software.
The I/O frame itself is highly modular, and it is possible to select from a variety of I/O cards. Thanks to the two MADI interfaces the D21m I/O keeps its channel count high even in 96 kHz mode. This makes this product ideal for any use with a Digital Audio Workstation (DAW). In 48 kHz mode the second MADI interface interface serves as a digital split output for feeding any additional audio device or as a redundant audio link.
In facilities containing Studer Vista consoles, the investment is broadened by the extreme versatility of the D21m stage boxes. One day they can be used on stage, connected to the Studer console, and the next day in the recording studio in order to bring superb audio quality to lower-cost recording equipment.

Remote Software

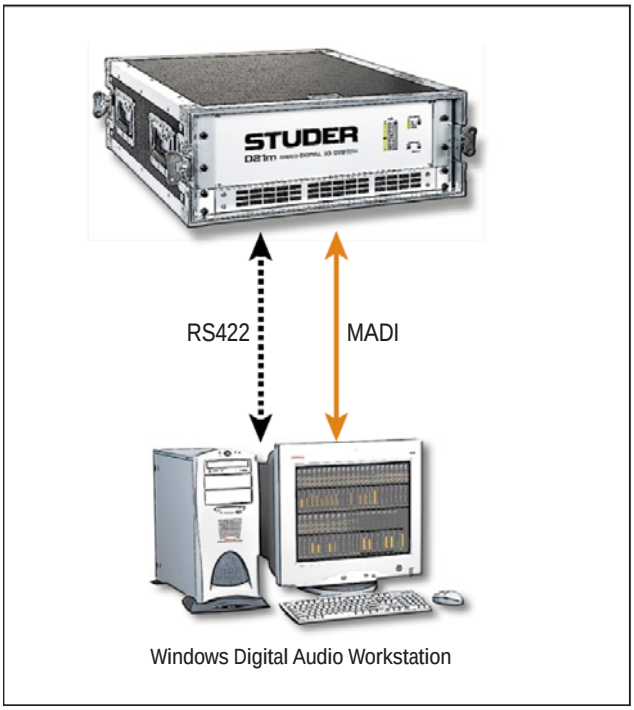
The control software is an application running under Microsoft Windows XP on any regular PC with an RS422 serial port. The software automatically detects the connected hardware and allows controlling the microphone amplifier's parameters, such as phantom power, high-pass filter, soft clipping, analog insert, gain, labeling and color coding the inputs, and stereo linking two subsequent channels.
These parameters may be stored and recalled using snapshot files. Spare inputs may be hidden from the screen, while the used ones can be arranged in any order. Operating speed is maximized by the ability to group inputs in a Vista-like way ("ganging").

MADI Interface

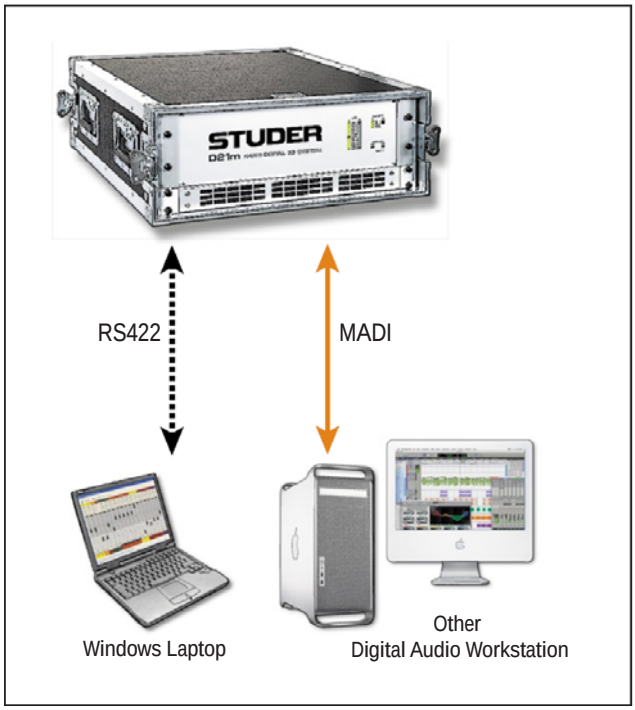
The MADI IF of the D21m frame supports both the standard MADI protocol with up to 56 audio channels as well as the extended protocol with 64 channels. Protocols are selected on the front panel of the frame.

The frame acts as a clock slave and synchronizes to the optical MADI signal. It therefore automatically detects the clock rate of the connected audio device. Supported clock rates are 44.1, 48, 88.2, and 96 kHz.
In 44.1 and 48 kHz mode the two MADI interfaces work in parallel. One of them may be used as a digital split output or for redundancy. In 88.2 or 96 kHz mode the MADI IF only transmits a maximum of 32 channels. Therefore the second MADI IF is used to bring back the original total channel count.

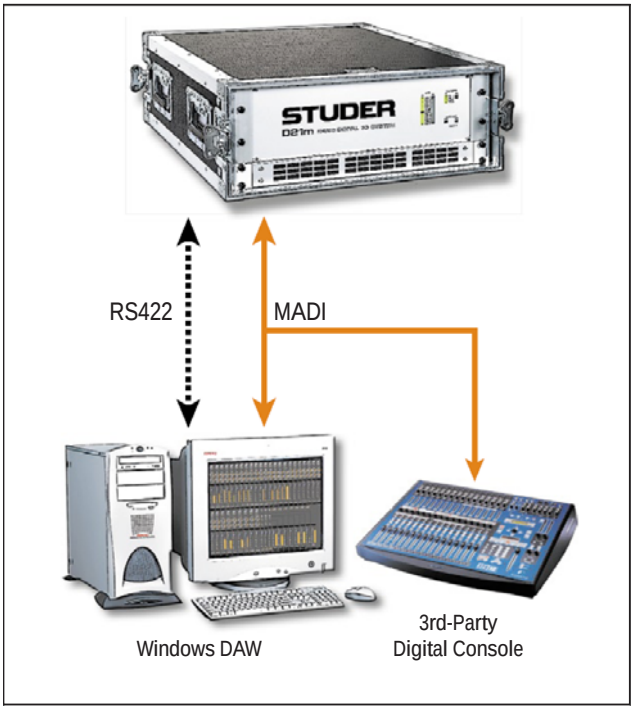
Application Examples:



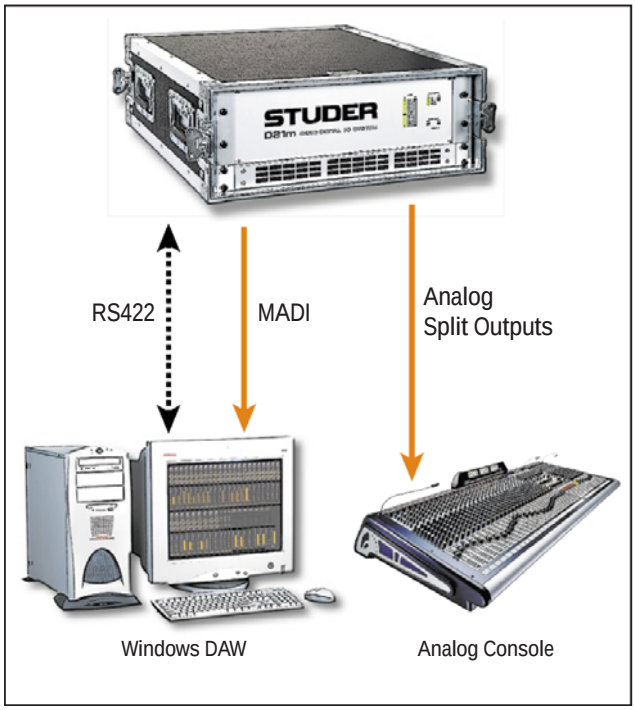
Recording with Windows DAW



Recording with non-Windows DAW



Live recording with 3rd-party digital PA console



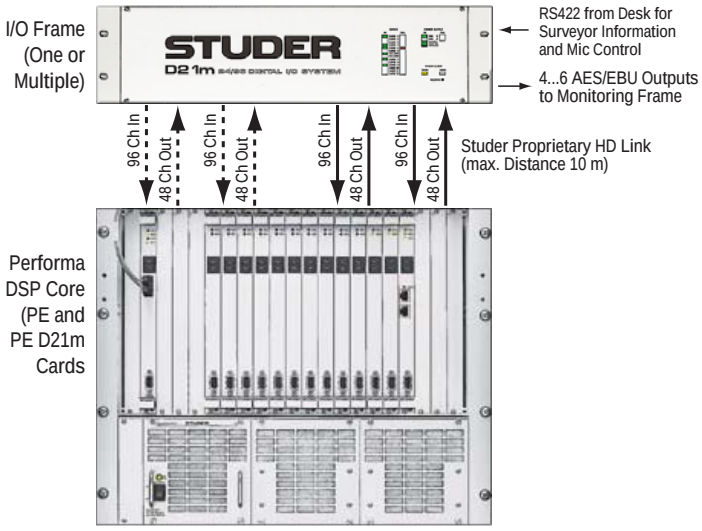
Live recording with analog PA console

5.8 Connection to the Performa Core

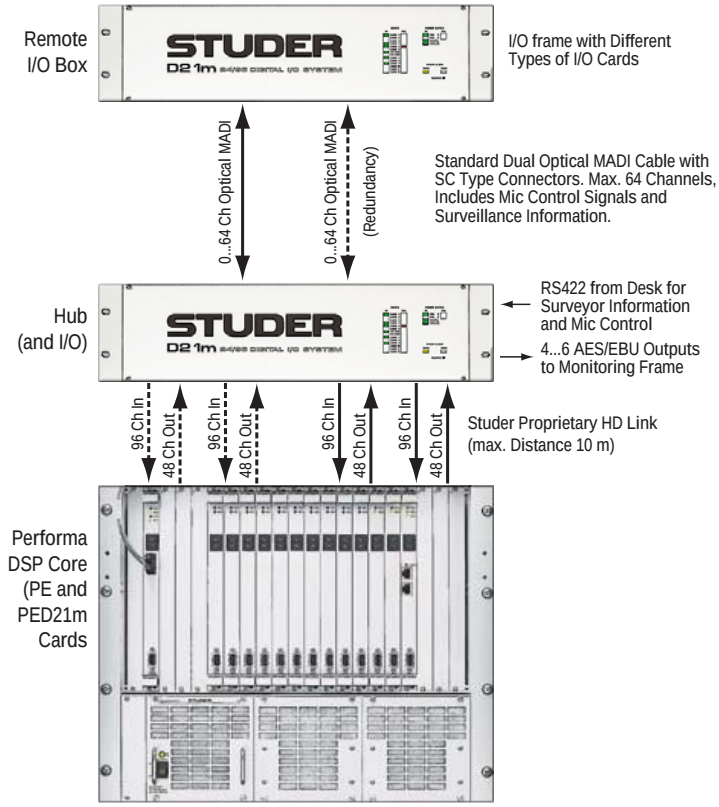
The Performa core is connected to the D21m I/O System in a similar way as the SCore. The main difference is that the HD link connection from the core towards the D21m I/O frame only carries up to 48 channels (at both 48 and 96 kHz). In order to implement a correct mapping of the I/O cards' channels to the HD Link, the "Performa Mode" switch (or jumper) must be ON on the HD cards. In the Performa core, use of the PE-D21m card (1.950.606.22) is mandatory. Each card implements one HD link input with up to 96 channels, and one HD link output with up to 48 channels.

Application Examples:

Local I/O Only (located close to the core)



Remote I/O Box (within long distance)



6 D21m MODULES

6.1 Available Cards

Name	I/O Format	# of Console Input Channels	# of Console Output Channels	Connector Type	Width (Slots)	Order No.
Analog I/O Cards						
Mic/Line Input (incl. Dir. Outs)	Mic/Line	4	(4 Dir. Outs)	D25 f	single	1.949.427
Analog Insert *	Line	4	4	D25 f	single	1.949.428
Analog Line In	Line	8	–	D25 f	single	1.949.421
Analog Line Out	Line	–	8	D25 f	single	1.949.420
Digital I/O Cards						
AES I/O (no SFC)	AES/EBU	8 stereo (16 mono)	8 stereo (16 mono)	2 × D25 f	double **	1.949.422
AES I/O (SFC on Inputs)	AES/EBU	8 stereo (16 mono)	8 stereo (16 mono)	2 × D25 f	double **	1.949.423
AES I/O (SFC on Inputs and Outputs)	AES/EBU	8 stereo (16 mono)	8 stereo (16 mono)	2 × D25 f; ext. sync XLR	double **	1.949.424
MADI I/O */****	MADI	64 at 48 kHz (32 with red., 64 without red. at 96 kHz)	64 at 48 kHz (32 with red., 64 without red. at 96 kHz)	SC (optical) SC (optical) 2 × RJ45	double **	1.949.430 1.949.431 1.949.433
ADAT I/O	ADAT	16 at 48 kHz (8 at 96 kHz)	16 at 48 kHz (8 at 96 kHz)	TOSLINK (optical)	single	1.949.425 1.949.429
TDIF I/O	TDIF	16 at 48 kHz (8 at 96 kHz)	16 at 48 kHz (8 at 96 kHz)	2 × D25 f	double **	1.949.426
SDI Input	SDI / HD SDI	8	–	2 × BNC	single	1.949.441
SDI I/O	SDI / HD SDI	8	8	4 × BNC	single	1.949.442
Dolby® E/Digital Decoder	AES/EBU	8 (Dolby® E decoded) 8 × 2 (Dolby® E encoded)	2 stereo (4 mono) 4 stereo (8 mono)	D15 f	single	1.949.443 1.949.444
CobraNet® I/O	CobraNet	32	32	2 × RJ45	single	1.949.445
Aviom A-Net® Output	A-Net	–	16	RJ45	single	1.949.446
EtherSound® I/O ***	EtherSound	64	64	3 × RJ45	double **	-
Non-Audio I/O Cards						
GPIO w. Open-Collector Outp.	GPIO	16	16	2 × D25 f	double **	1.949.435
GPIO w. Relay Outputs	GPIO	16	16	2 × D37 f	double **	1.949.436
HD Cards						
HD S	HD Link	max. 96	max. 96	4 × RJ45	single	1.949.412
HD RS422	HD Link + RS422	max. 96	max. 96	4 × RJ45, D9 f	double **	1.949.415
MADI HD	MADI	64 at 48 kHz (32 with red., 64 without red. at 96 kHz)	64 at 48 kHz (32 with red., 64 without red. at 96 kHz)	SC (optical) SC (optical) RJ45	double **	1.949.411 1.949.413 1.949.414
Serial / Merger Cards						
Serial	RS422	-	-	D9 f	single	1.949.437
Serial Merger	RS422	-	-	2 × D9 f	single	1.949.438
Serial RJ45	RS422	-	-	RJ45	single	1.949.439
Dual Merger RJ45	RS422	-	-	4 × RJ45	single	1.949.440
Supply / Miscellaneous						
Primary Power Supply Unit						1.949.404
LED/PSII PCB						1.949.402
Extender Card						1.949.408
Air Deflector/Filter Unit						1.949.599
Fan Unit						1.949.597
XLR Break-Out Boxes *(see chapter 6.7.5.1)*						div.
AES/EBU on BNC Break-Out Box						1.949.586
GPIO Break-Out Box						1.949.588

* The Analog Insert card belongs to the Mic/Line Input card to its left. *It does not communicate with the HD card.* The insert send signal is always present and may be used as an additional direct output. The insert return is activated by the software (console).

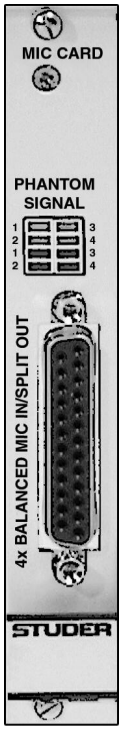
** Double-width cards must be inserted into odd slot numbers (e.g. slots 1, 3, 5…).

*** The number of channels transmitted to and from a card may be defined in steps of 8 channels by using DIP switches on the card.

**** Regardless of the number of channels defined with the DIP switches, a switch on the front panel switches the MADI protocol between the standard 56-channel format and the extended 64-channel format. Therefore this switch may have to be set to “56 channel” protocol in order to operate correctly with third-party MADI devices. In this case the number of channels set internally should not exceed 56.

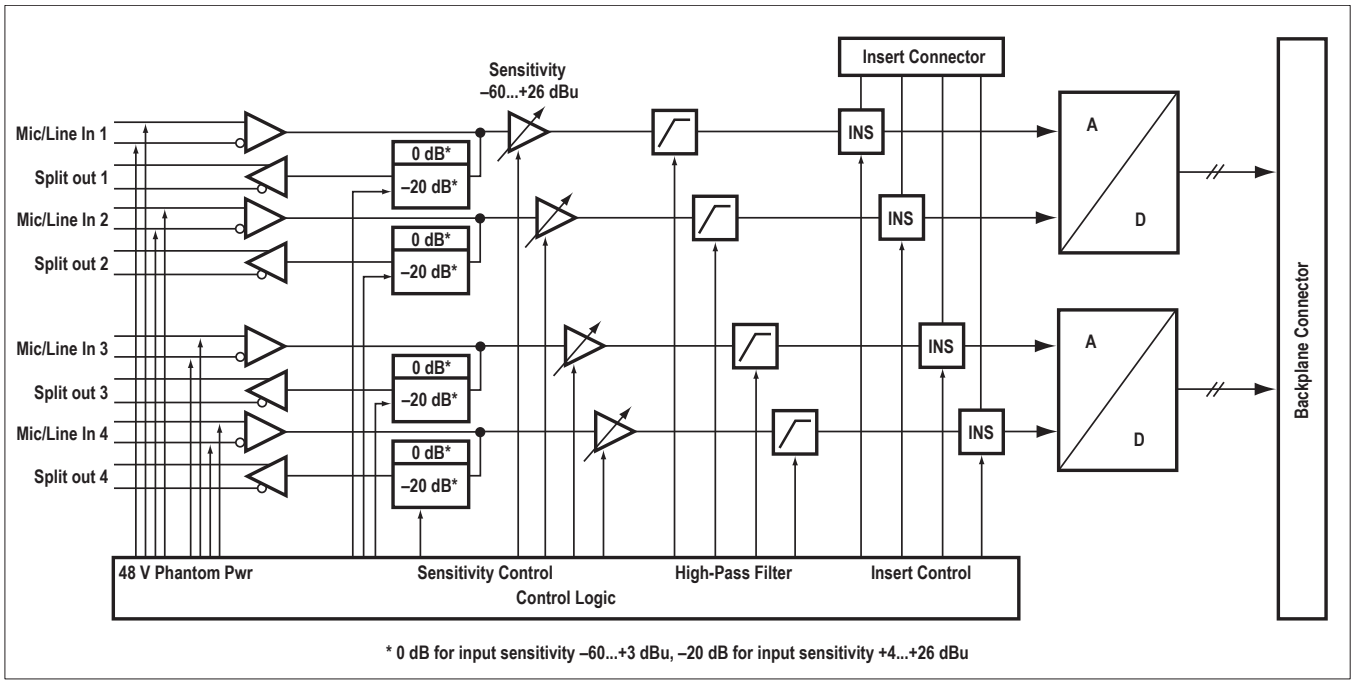
6.2 Analog I/O Cards

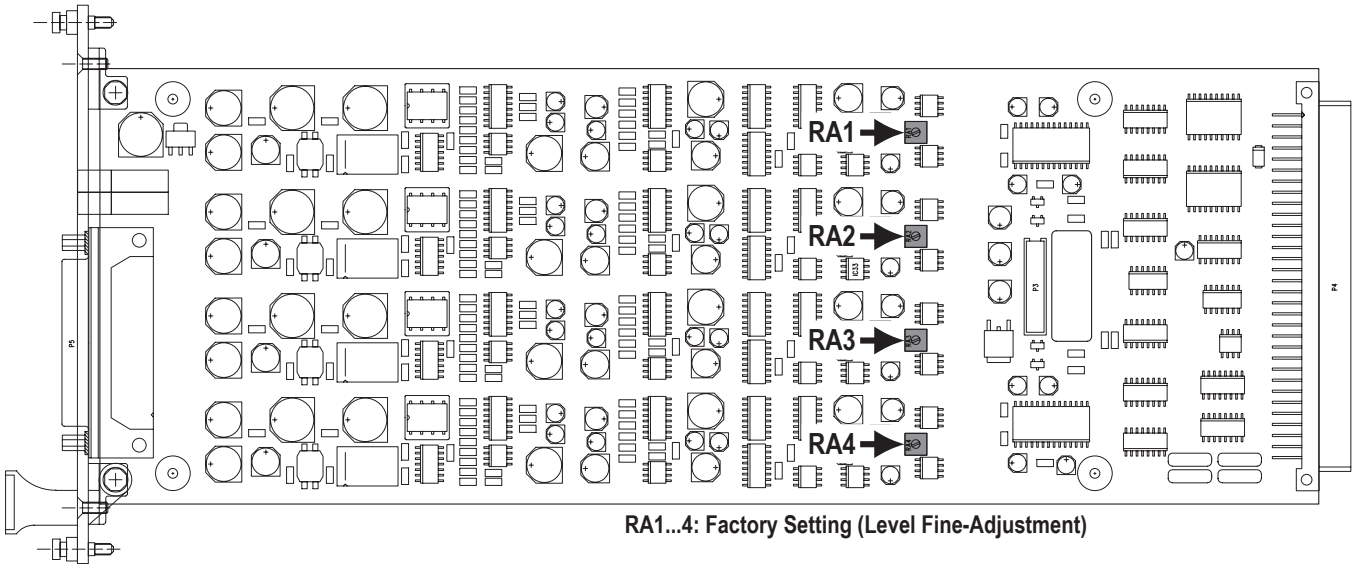
6.2.1 Mic/Line In Card 1.949.427



Four analog microphone/line inputs, electronically balanced, with 24 bit, 44.1/48/88.2/96 kHz delta-sigma A/D converters (mic/line sensitivity, gain setting in 1 dB steps, low-cut filter, soft clipping and 48 V phantom power on/off controlled by console software); four analog split outputs, electronically balanced. Green "signal present" and yellow "phantom power" indicators per channel. Inputs and split outputs on standard 25-pin D-type connector (female).

Input sensitivity (for 0 dB_{FS})	–60…+26 dBu
Input impedance	1.8 kΩ
Split out gain (input sensitivity –60…+3 dBu)	0 dB
(input sensitivity +4…+26 dBu)	–20 dB
Split out impedance	50 Ω
Equivalent input noise (R_i 200 Ω, max. gain)	–124 dBu
Crosstalk (1 kHz)	< –110 dB
Frequency response (30 Hz...20 kHz)	–0.2 dB
THD&N (35 Hz...20 kHz, –1 dB_{FS}, min. gain)	< –97 dB_{FS}
(1 kHz, –30 dB_{FS}, min. gain)	< –111 dB_{FS}
(input level 6 dBu, min. gain)	< –107 dB_{FS}
CMRR (30 Hz...20 kHz, all gain settings)	> 55 dB
(1 kHz, input sensitivity –10...+26 dBu for 0 dB_{FS})	typ. 100 dB
Low-cut filter	75 Hz / 12 dB/oct.
Input delay (local)	38 samples (0.79 ms @ 48 kHz)
(remote)	45 samples (0.94 ms @ 48 kHz)
Current consumption (7 V)	0.2 A
(±15 V)	0.25 A
Operating temperature	0...40° C





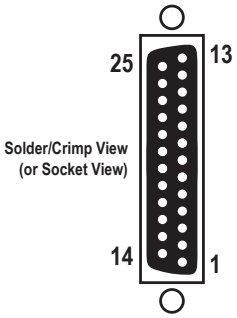
RA1...4: Factory Setting (Level Fine-Adjustment)

LEDs: **PHANTOM 1...4** For each channel a yellow LED indicates if the pantom supply is on.

SIGNAL 1...4 For each channel a green LED indicates if input signal is present; its brightness is a rough indication of the signal level.

Alignment: **RA1...4** *Please note that the input level trimmer potentiometers are factory-set. They need to be adjusted only after having repaired the card.*
Select 15 dBu input sensitivity. Feed an analog signal with a level of +6 dBu to one of the analog inputs. Measure the digital output level either on the MADI output or, after routing through the core, on one of the AES/EBU outputs. Adjust the level with the corresponding FINE ADJUST trimmer potentiometer to –9 dB_{FS}.

Connector Pin Assignment: (25-pin D-type, female)

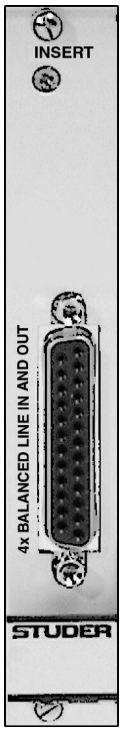


Pin	Signal	Pin	Signal
1	CH 4 split out +	14	CH 4 split out –
2	CH 4 split out GND	15	CH 3 split out +
3	CH 3 split out –	16	CH 3 split out GND
4	CH 2 split out +	17	CH 2 split out –
5	CH 2 split out GND	18	CH 1 split out +
6	CH 1 split out –	19	CH 1 split out GND
7	CH 4 in +	20	CH 4 in –
8	CH 4 in GND	21	CH 3 in +
9	CH 3 in –	22	CH 3 in GND
10	CH 2 in +	23	CH 2 in –
11	CH 2 in GND	24	CH 1 in +
12	CH 1 in –	25	CH 1 in GND
13	n.c.		

Important!

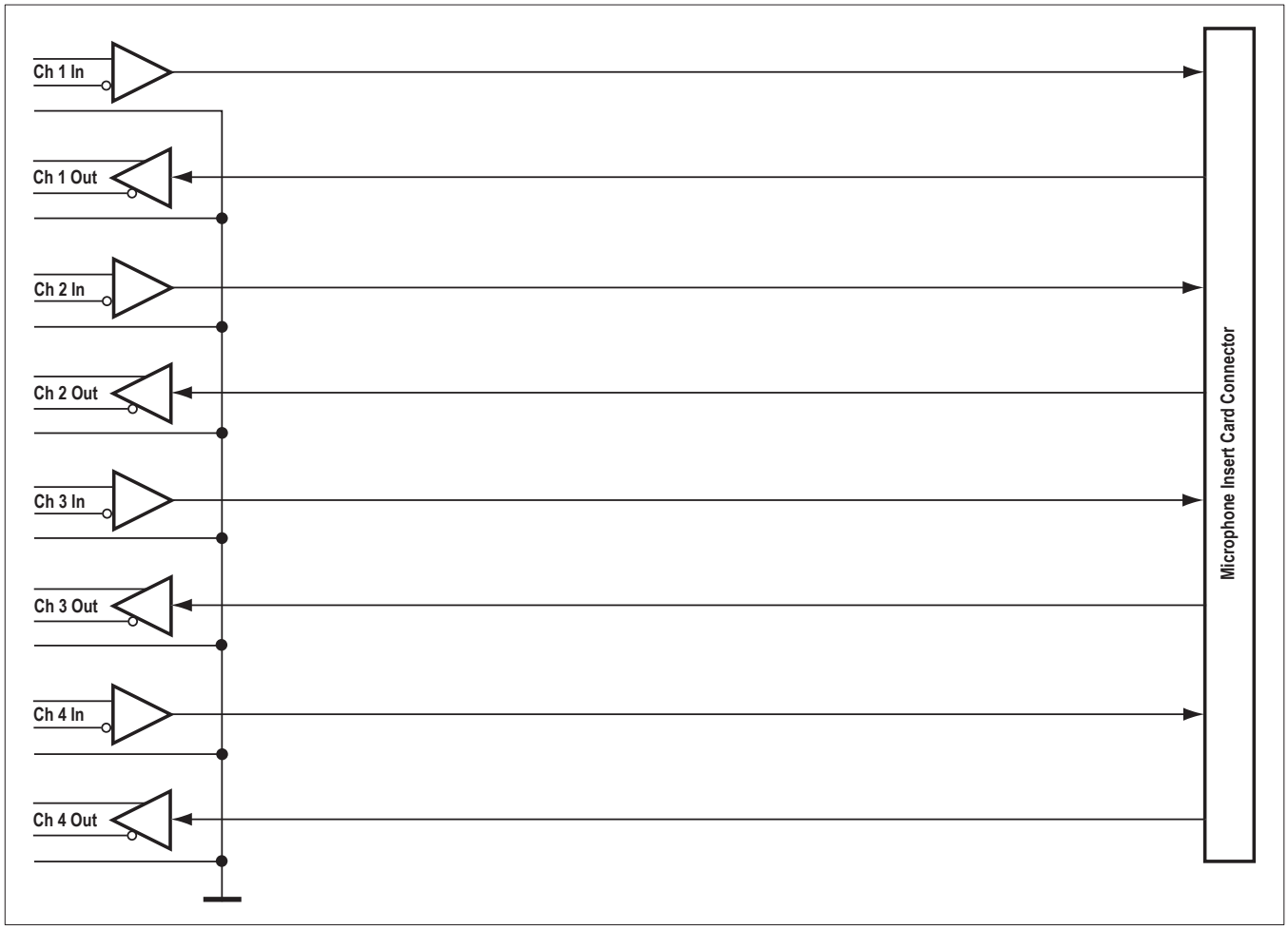
If wired correctly, the microphones are isolated from the D21m chassis. The circuit inside the microphone takes its supply from pins 2 and 3 (+ and –) for the positive, and from pin 1 (GND) for the negative reference. If a patch bay is implemented, GND (pin 1 on XLR connector) of each microphone input must be connected to its corresponding GND pin, *but not to the chassis*. If chassis instead of GND is used as negative reference for a microphone, it can occur that the GND net of the D21m is pulled towards –48 V. This causes the HD link receivers not to work correctly or to be damaged, depending on the type and number of microphones connected.
As a workaround, GND and chassis may be connected inside the D21m frame. In cases where currents flow between the chassis nets of multiple devices, the analog signals can degrade in quality (e.g. perceivable as hum).

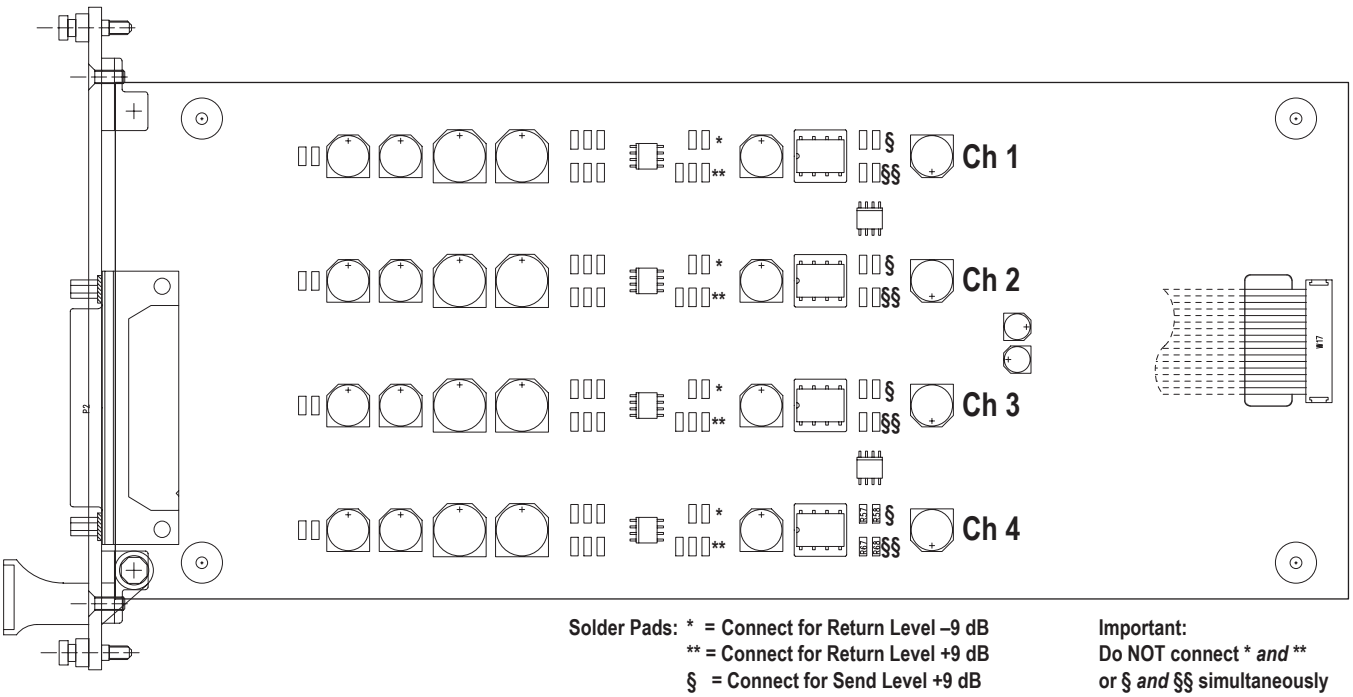
6.2.2 Analog Insert Card 1.949.428



This card is intended for use with a D21m Mic/Line In card and features four electronically balanced analog inserts. The insert sends are always active, return on/off is controlled by the console software (default off). Insert sends and returns on standard 25-pin D-type connector (female).
The connection to the Mic/Line In card is established with a ribbon cable.
It is recommended to place a pair of insert cards next to a pair of Mic/Line In cards in order to avoid HD Link channels without audio. For details on the card placement, refer to chapter 5.3.

In/out level (for 0 dB_{FS})	15 dBu (6 or 24 dBu w. soldering jumper)
Input impedance	10 kΩ
Output impedance	50 Ω
Current consumption (±15 V)	0.05 A
Operating temperature	0...40° C





Solder Pads: * = Connect for Return Level –9 dB
**** = Connect for Return Level +9 dB**
§ = Connect for Send Level +9 dB
§§ = Connect for Send Level –9 dB

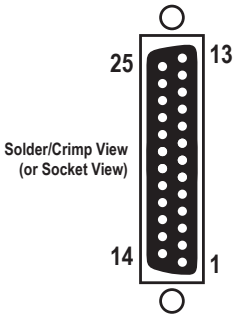
Important:
Do NOT connect * *and* ** or § *and* §§ simultaneously on the same channel!

Solder Pads:

Nominal send/return levels are +15 dBu for full scale modulation. These levels may be boosted or cut by 9 dB (i.e., set to +6 dBu or +24 dBu) individually per channel and for send and return, refer to the illustration above. *Please note that the corresponding +9 dB and –9 dB solder pads must not be connected simultaneously.*

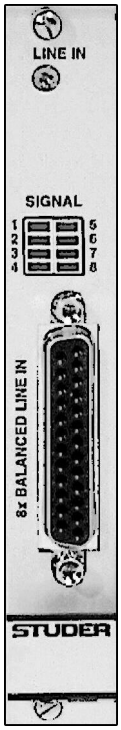
Connector Pin Assignment:

(25-pin D-type, female)



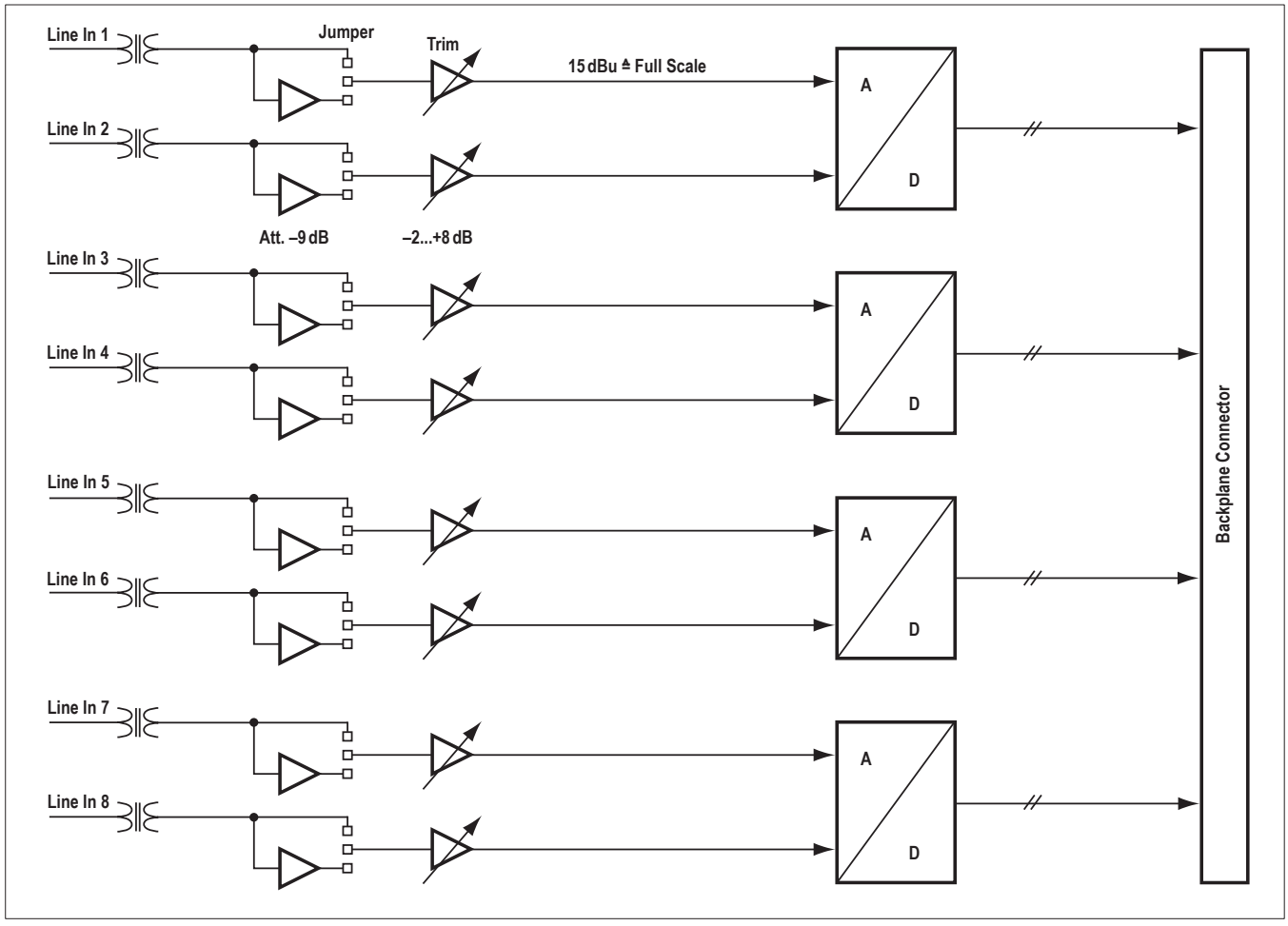
Pin	Signal	Pin	Signal
1	CH 4 out +	14	CH 4 out –
2	CH 4 out GND	15	CH 3 out +
3	CH 3 out –	16	CH 3 out GND
4	CH 2 out +	17	CH 2 out –
5	CH 2 out GND	18	CH 1 out +
6	CH 1 out –	19	CH 1 out GND
7	CH 4 in +	20	CH 4 in –
8	CH 4 in GND	21	CH 3 in +
9	CH 3 in –	22	CH 3 in GND
10	CH 2 in +	23	CH 2 in –
11	CH 2 in GND	24	CH 1 in +
12	CH 1 in –	25	CH 1 in GND
13	n.c.		

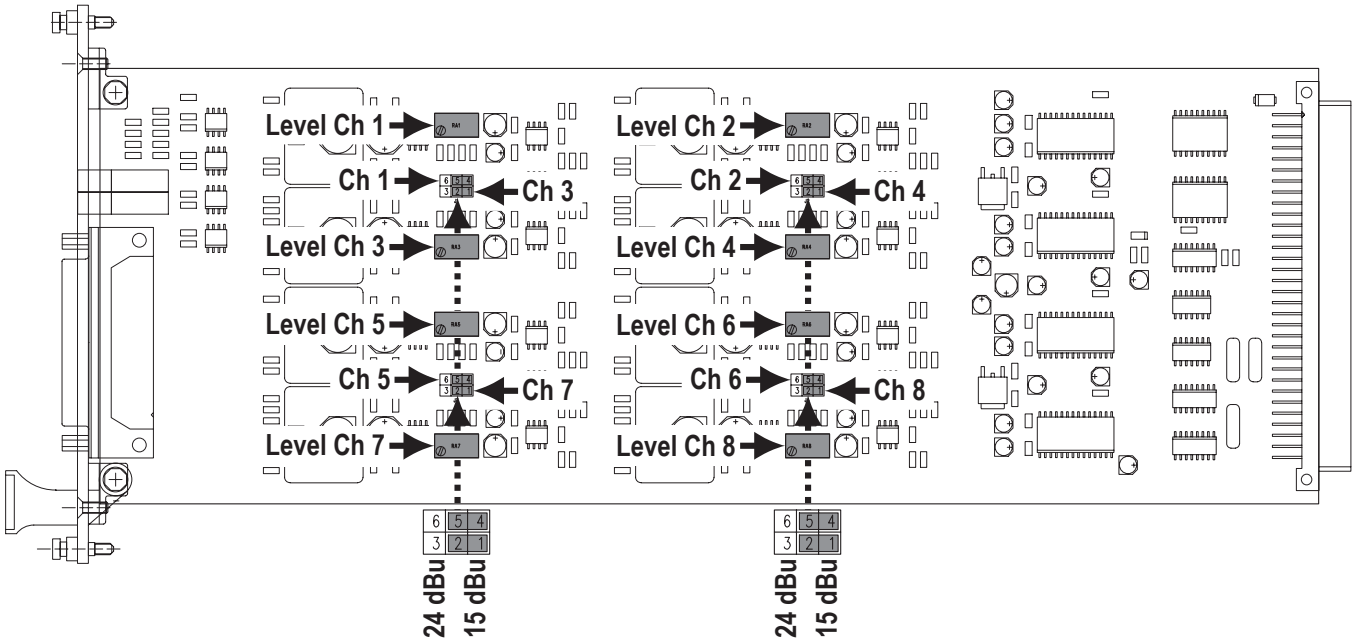
6.2.3 Line In Card 1.949.421



Eight-channel line input card with 24 bit, 44.1/48/88.2/96 kHz A/D Converter, delta-sigma conversion. Transformer-balanced inputs. 96 kHz, 88.2 kHz, 48 kHz, or 44.1 kHz operation. 7...26 dBu input sensitivity. “Signal present” LED indicator. Inputs on standard 25-pin D-type connector (female).

Input level (for 0 dB_{FS})	15/24 dBu (fixed, jumper-selectable), or 7...26 dBu (adjustable)
Input impedance	> 10 kΩ
Frequency response (20 Hz...20 kHz)	–0.2 dB
THD&N (35 Hz...20 kHz, –1 dB_{FS}, min. gain)	< –97 dB_{FS}
(1 kHz, –30 dB_{FS}, min. gain)	< –111 dB_{FS}
Crosstalk (1 kHz)	< –110 dB
Input delay (local)	38 samples (0.79 ms @ 48 kHz)
(remote)	45 samples (0.94 ms @ 48 kHz)
Current consumption (7 V)	0.42 A
(±15 V)	0.1 A
Operating temperature	0...40° C



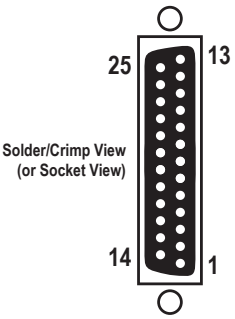


Jumpers: **Level (Ch1...8)** Two positions each: 15 dBu (factory default) or 24 dBu.

LEDs: **SIGNAL 1...8** For each of the eight channels a green LED indicates if input signal is present; its brightness is a rough indication of the signal level.

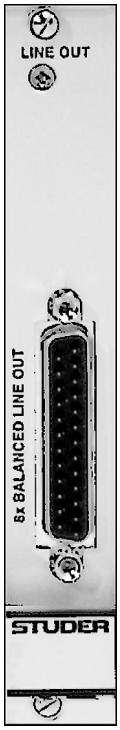
Alignment: **RA1...8** *The trimmer potentiometers are factory aligned for 0 dB gain of the "Trim" stage in the block diagram on the left.*
Set jumper to 15 dBu or 24 dBu. Feed an analog signal with a level of +6 dBu or +15 dBu, respectively, to one of the analog inputs. Measure the level on a digital output. Adjust the level with the corresponding LEVEL trimmer potentiometer to –9 dB_{FS}. If a different input sensitivity has to be adjusted, select the desired range with the jumper and use the LEVEL trimmer potentiometer to adjust to the desired level.
Repeat this alignment for all inputs.

Connector Pin Assignment: (25-pin D-type, female)



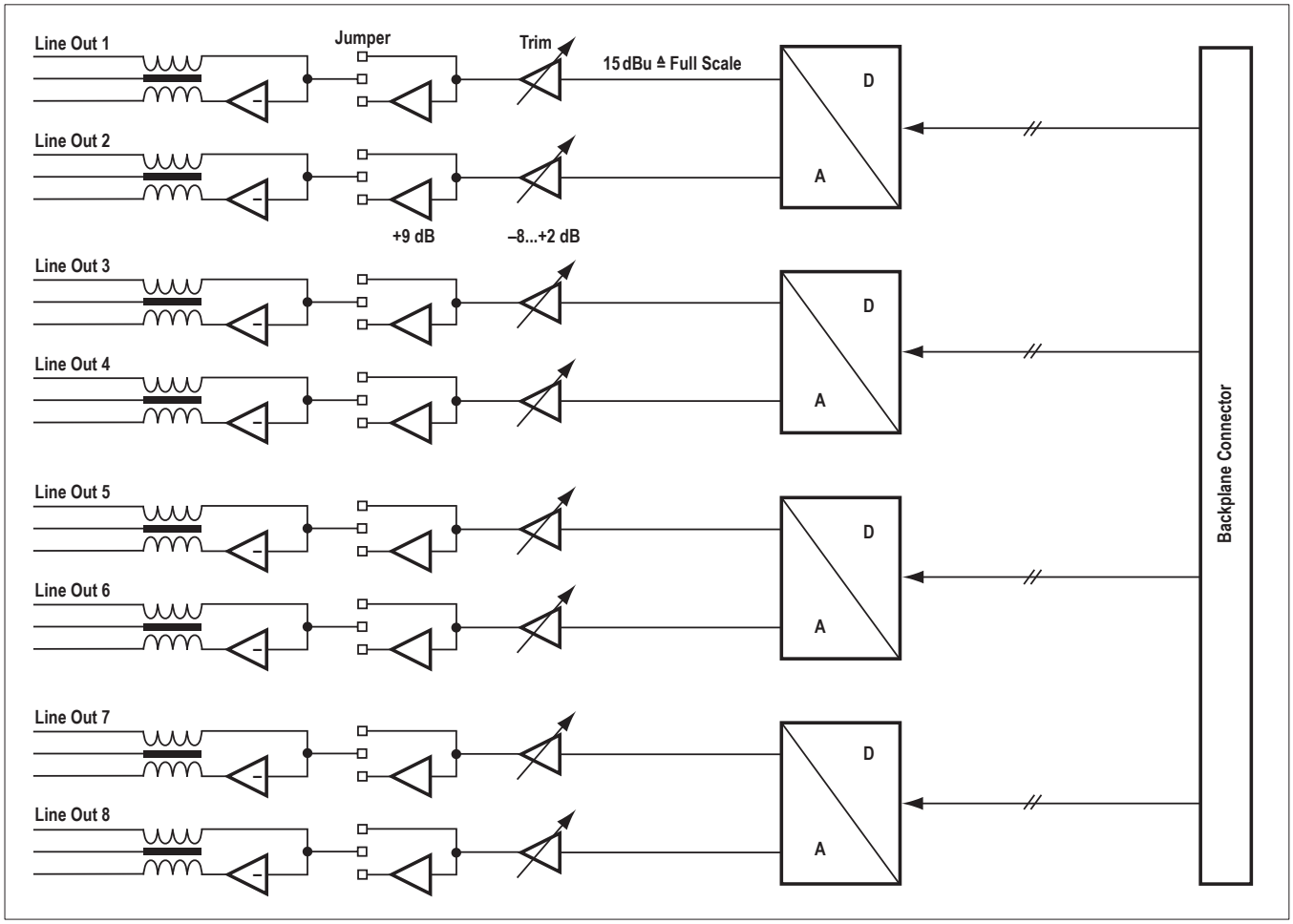
Pin	Signal	Pin	Signal
1	CH 8 in +	14	CH 8 in –
2	CH 8 in GND	15	CH 7 in +
3	CH 7 in –	16	CH 7 in GND
4	CH 6 in +	17	CH 6 in –
5	CH 6 in GND	18	CH 5 in +
6	CH 5 in –	19	CH 5 in GND
7	CH 4 in +	20	CH 4 in –
8	CH 4 in GND	21	CH 3 in +
9	CH 3 in –	22	CH 3 in GND
10	CH 2 in +	23	CH 2 in –
11	CH 2 in GND	24	CH 1 in +
12	CH 1 in –	25	CH 1 in GND
13	n.c.		

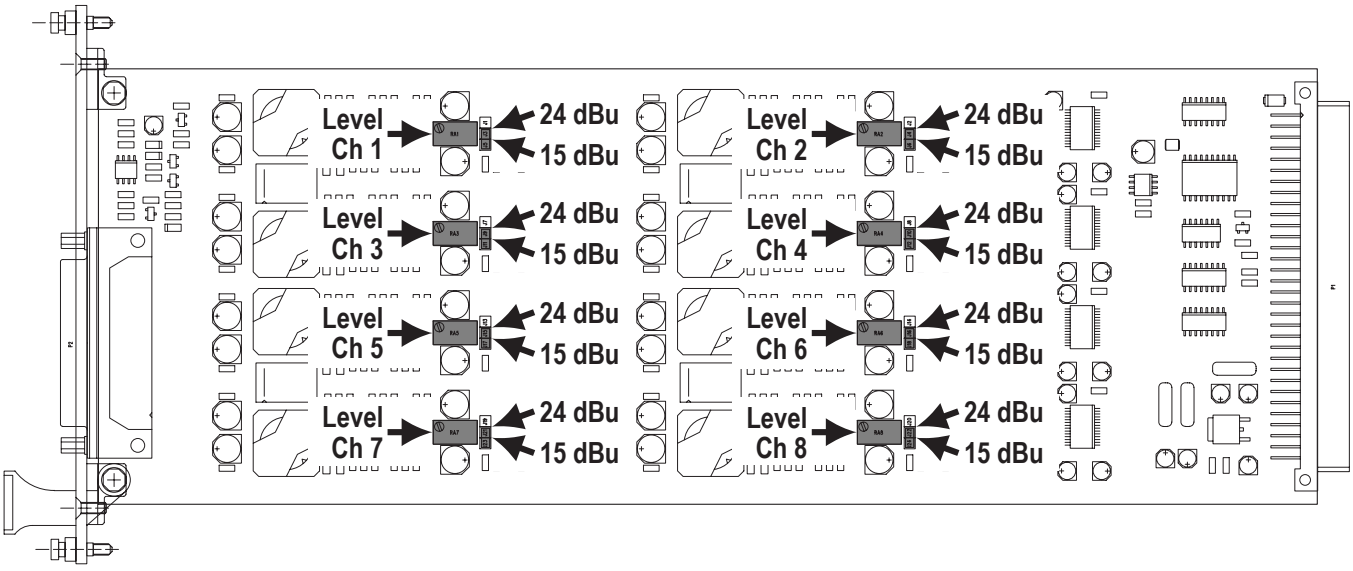
6.2.4 Line Out Card 1.949.420



Eight-channel, 24 bit line output card with 24 bit D/A converters with 96 kHz, 88.2 kHz, 48 kHz, or 44.1 kHz operation. Electronically balanced outputs. 7…26 dBu max. output level. Outputs on standard 25-pin D-type connector (female).

Output level (for 0 dB_{FS})	15/24 dBu (fixed, jumper-selectable), or 7...26 dBu (adjustable)
Output impedance	40 Ω
Min. load (at +24 dBu)	600 Ω
Frequency response (20 Hz...20 kHz)	–0.2 dB
THD&N (20 Hz...20 kHz, –1 dB_{FS}, jumper at 15 dBu fixed)	< –90 dB_{FS}
(1 kHz, –30 dB_{FS}, jumper at 15 dBu fixed)	< –110 dB_{FS}
Crosstalk (1 kHz)	< –110 dB
Output delay (local)	28 samples (0.58 ms @ 48 kHz)
(remote)	32 samples (0.67 ms @ 48 kHz)
Current consumption (7 V)	0.23 A
(±15 V)	0.25 A
Operating temperature	0...40° C

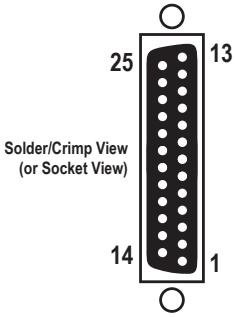




Jumpers: **Level (Ch1...8)** Two positions each: 15 dBu (factory default) or 24 dBu.

Alignment: **RA1...8** *The trimmer potentiometers are factory aligned for 0 dB gain of the "Trim" stage in the block diagram on the left.*
Feed a digital audio signal with a level of –10 dB_{FS} to the card. Set the jumpers to either 15 or 24 dBu and measure on an output. Use the corresponding LEVEL trimmer potentiometers to set the output level to +5 or +14 dBu, respectively. If a different output level is required, select the desired range with the jumper and use the LEVEL trimmer potentiometer to adjust to the desired level.
Repeat this alignment for all outputs.

Connector Pin Assignment: (25-pin D-type, female)

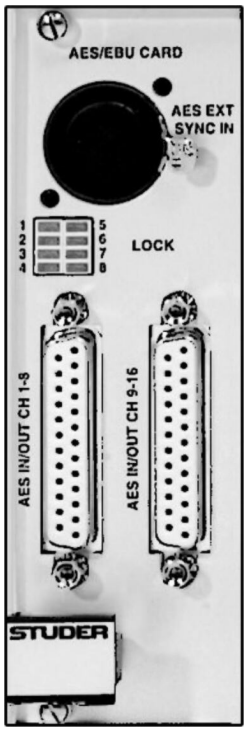


Pin	Signal	Pin	Signal
1	CH 8 out +	14	CH 8 out –
2	CH 8 out GND	15	CH 7 out +
3	CH 7 out –	16	CH 7 out GND
4	CH 6 out +	17	CH 6 out –
5	CH 6 out GND	18	CH 5 out +
6	CH 5 out –	19	CH 5 out GND
7	CH 4 out +	20	CH 4 out –
8	CH 4 out GND	21	CH 3 out +
9	CH 3 out –	22	CH 3 out GND
10	CH 2 out +	23	CH 2 out –
11	CH 2 out GND	24	CH 1 out +
12	CH 1 out –	25	CH 1 out GND
13	n.c.		

6.3 Digital I/O Cards

6.3.1 AES/EBU I/O Cards

1.949.422, 1.949.423, 1.949.424



AES/EBU input/output card with 16 Ch I/O. With input and output SFCs (1.949.424), with input SFCs only (1.949.423), or without SFCs (1.949.422 – *not available for OnAir 3000*). Selectable output sampling frequencies: 96 kHz, 48 kHz, 44.1 kHz, or external reference (22...108 kHz). Input SFCs can be bypassed individually. Output SFCs can be bypassed in groups of four. Output dither is selectable for every AES/EBU output from 24 bit, 20 bit, 18 bit or 16 bit. Settings are made with jumpers. Inputs and outputs on standard 25-pin D-type connectors (female).

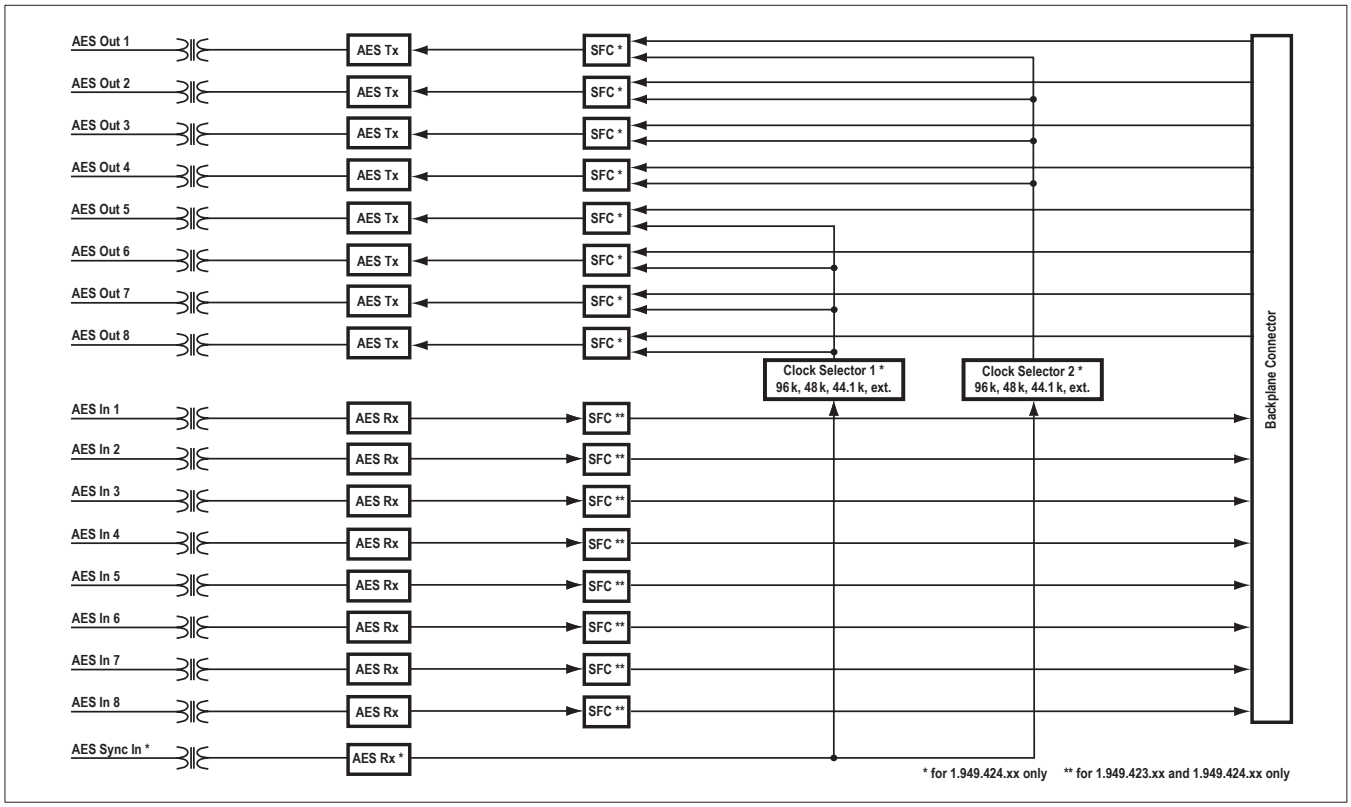
SFC Delay: *Enabled input and output SFCs each cause a delay (D) that depends on the SFC's input and output sampling frequency (f_{S_IN} and f_{S_OUT}). Input and output delays can be calculated using the formulas below.*

[1] $f_{S\_IN} > f_{S\_OUT}$: $D = \frac{16}{f_{S\_IN}} + \frac{32}{f_{S\_OUT}}$ [s] **[2]** $f_{S\_OUT} > f_{S\_IN}$: $D = \frac{48}{f_{S\_IN}}$ [s]

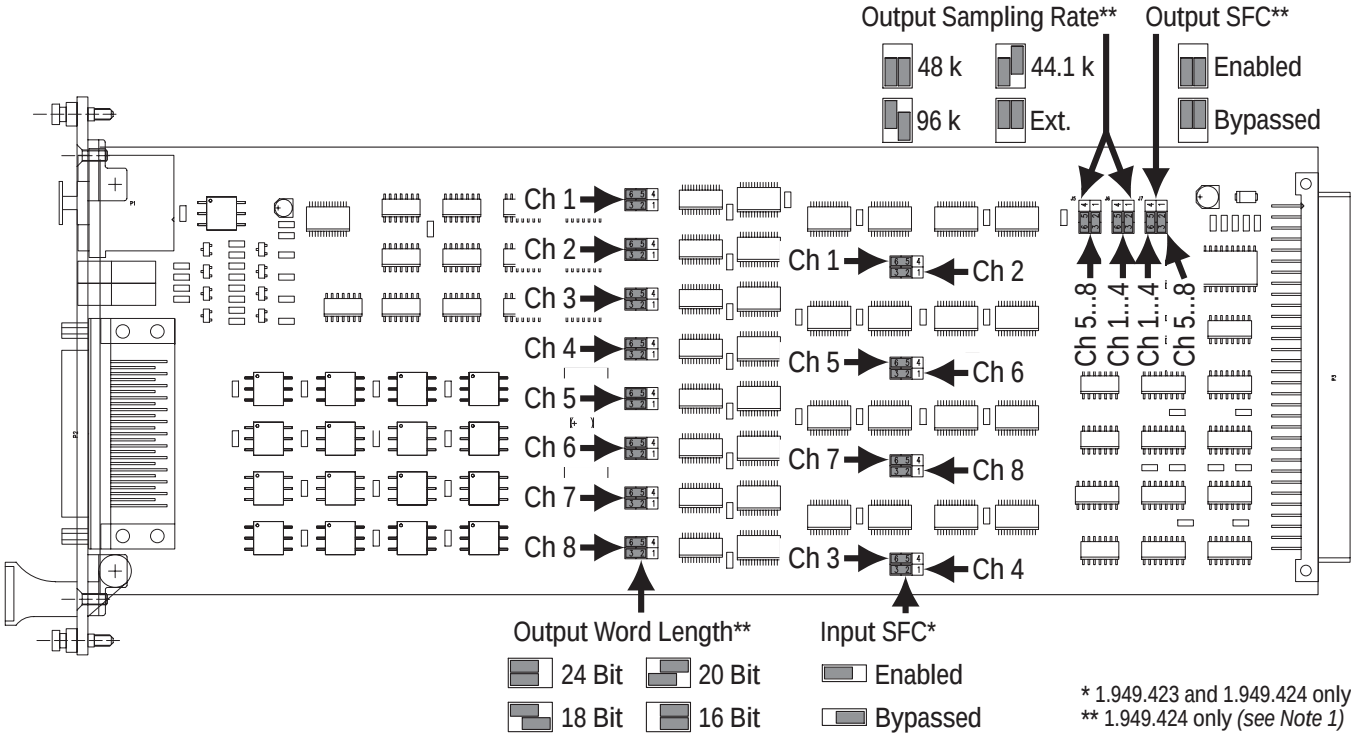
Examples:

- *For a 96 kHz input signal and a 48 kHz system clock (i.e., the "output signal" of the input SFC), the input delay is **40 output samples** or 0.833 ms (formula "1").*
- *For a 48 kHz system clock (i.e., the "input signal" of the output SFC) and a 96 kHz output signal, the output delay is **96 output samples** or 1 ms (formula "2").*

Note: *If the core is operating with a 44.1 or 88.2 kHz system clock, the output sampling frequency will be 44.1 or 88.2 kHz, regardless of the jumper selection – unless the external sync input is used and* **Ext.** *is selected; then, the output sampling frequency corresponds to the one of the external sync signal.*



Input / output impedance		110 Ω
Input sensitivity		min. 0.2 V
Output level (into 110 Ω)		5 V
SFC range		22...108 kHz
Current consumption	(3.3 V)	1.949.422: 0.2 A; ..423: 0.4 A; ..424: 0.6 A
	(5 V)	0.65 A
Operating temperature		0...40° C



LEDs: **LOCK 1...8** These green LEDs are on if a valid AES/EBU signal is available at the inputs.

Jumpers: **Output Word Length** *(1.949.424 only)* Used to set the resolution (output word length) for outputs 1...8.

Please note that for a word length reduction the output SFCs must be set to Enabled*; if so, the output word length is always 21 bit maximum. Whenever an SFC is enabled, the three least significant bits (LSB) are set to digital zero. This results in the specified dynamic range of 120 dB.*

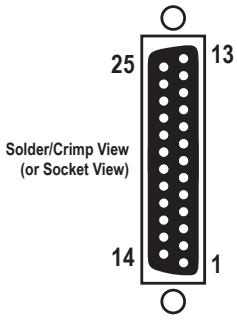
Input SFC *(1.949.423 and 1.949.424 only)* Enabling or bypassing of the SFCs for individual AES/EBU input channels.

Output Sampling frequency *(1.949.424 only)* The output sampling frequency may be set for the AES/EBU output channel groups 1...4 and 5...8; selection from 44.1 kHz, 48 kHz, 96 kHz, or synchronized by the signal at the **AES EXT SYNC IN** connector *(see "Note" above)*.

If no valid signal is provided at the **AES EXT SYNC IN** connector but Ext. is selected, the output sampling frequency will be set to the system clock. Outputs set to Ext. can therefore be used in a very flexible way: Connect no external sync signal, if not necessary, so that the output will be clocked with the internal system clock. As soon as an external sync signal is provided to the **AES EXT SYNC IN** connector, the output will be clocked with the ext. sync signal.

Output SFC / WL Reduction *(1.949.424 only)* Enabling/bypassing of the output SFCs, separate for the AES/EBU output channel groups 1...4 and 5...8. *Please note that for word length reduction the output SFCs must be set to* Enabled.

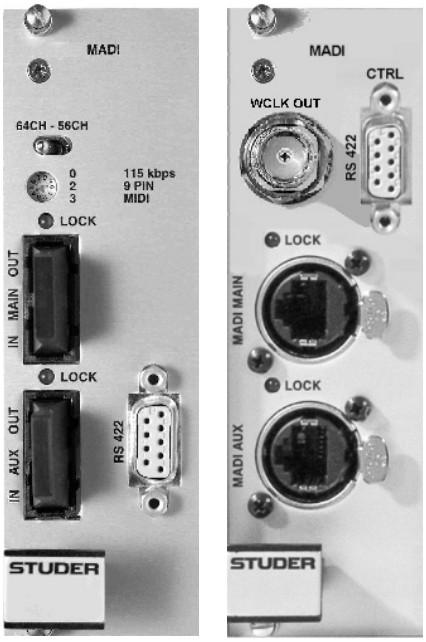
Connector Pin Assignment: (2 × 25-pin D-type, female)



Pin	Signal "CH 1...8"	Signal "CH 9...16"	Pin	Signal "CH 1...8"	Signal "CH 9...16"
1	CH 7/8 out +	CH 15/16 out +	14	CH 7/8 out –	CH 15/16 out –
2	CH 7/8 out screen	CH 15/16 out screen	15	CH 5/6 out +	CH 13/14 out +
3	CH 5/6 out –	CH 13/14 out –	16	CH 5/6 out screen	CH 13/14 out screen
4	CH 3/4 out +	CH 11/12 out +	17	CH 3/4 out –	CH 11/12 out –
5	CH 3/4 out screen	CH 11/12 out screen	18	CH 1/2 out +	CH 9/10 out +
6	CH 1/2 out –	CH 9/10 out –	19	CH 1/2 out screen	CH 9/10 out screen
7	CH 7/8 in +	CH 15/16 in +	20	CH 7/8 in –	CH 15/16 in –
8	CH 7/8 in screen	CH 15/16 in screen	21	CH 5/6 in +	CH 13/14 in +
9	CH 5/6 in –	CH 13/14 in –	22	CH 5/6 in screen	CH 13/14 in screen
10	CH 3/4 in +	CH 11/12 in +	23	CH 3/4 in –	CH 11/12 in –
11	CH 3/4 in screen	CH 11/12 in screen	24	CH 1/2 in +	CH 9/10 in +
12	CH 1/2 in –	CH 9/10 in –	25	CH 1/2 in screen	CH 9/10 in screen
13	n.c.	n.c.			

6.3.2 MADI I/O Cards

1.949.430, 1.949.431, 1.949.433

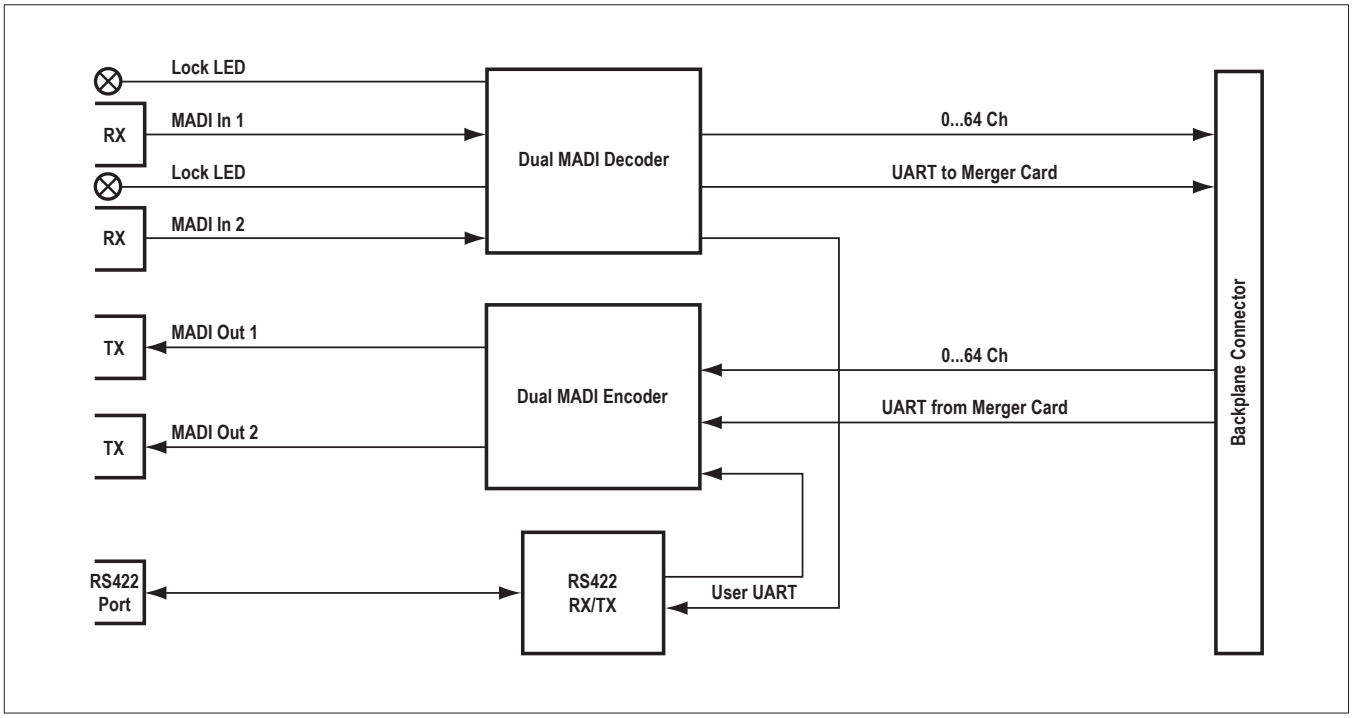


The MADI I/O card can establish a 64-channel MADI input and output to the D21m frame, with 44.1/48/88.2/96 kHz operation. Optical inputs and outputs are provided on SC connectors available in multi-mode and single-mode versions, as well as a version with RJ45 connectors for twisted-pair cable and an additional word clock output on a BNC socket.
The auxiliary interface can be used as a redundant link or, in 96 kHz operation, to extend the number of channels from 32 back to 64.
It is possible to transmit any serial control signals, such as MIDI or Sony 9-pin (machine control) through a MADI connection without losing any audio bandwidth or microphone control of the remote I/O box. For this purpose, an RS422 connector is located on this card (hub frame side). The desired baud rate can be set with a rotary switch. The pinout of the RS422 connector can be set to “device” or “controller” with a DIP switch, depending on the 3rd party serial device connected.

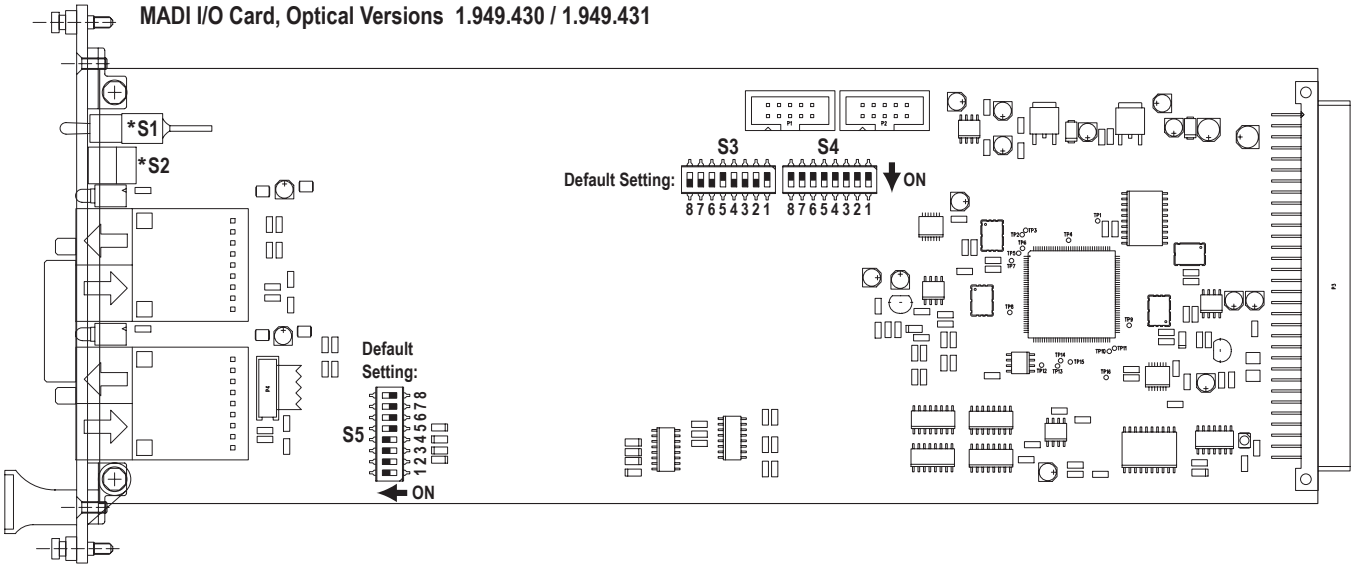
Max. cable length	(1.949.430, multi-mode fibre, 1300 nm*)	2 km
	(1.949.431, single-mode fibre, 1300 nm*)	15 km
	(1.949.433, CAT5e or better, flexible braid)	<75 m
	(1.949.433, CAT7, solid core)	<120 m

** different wavelengths on request*

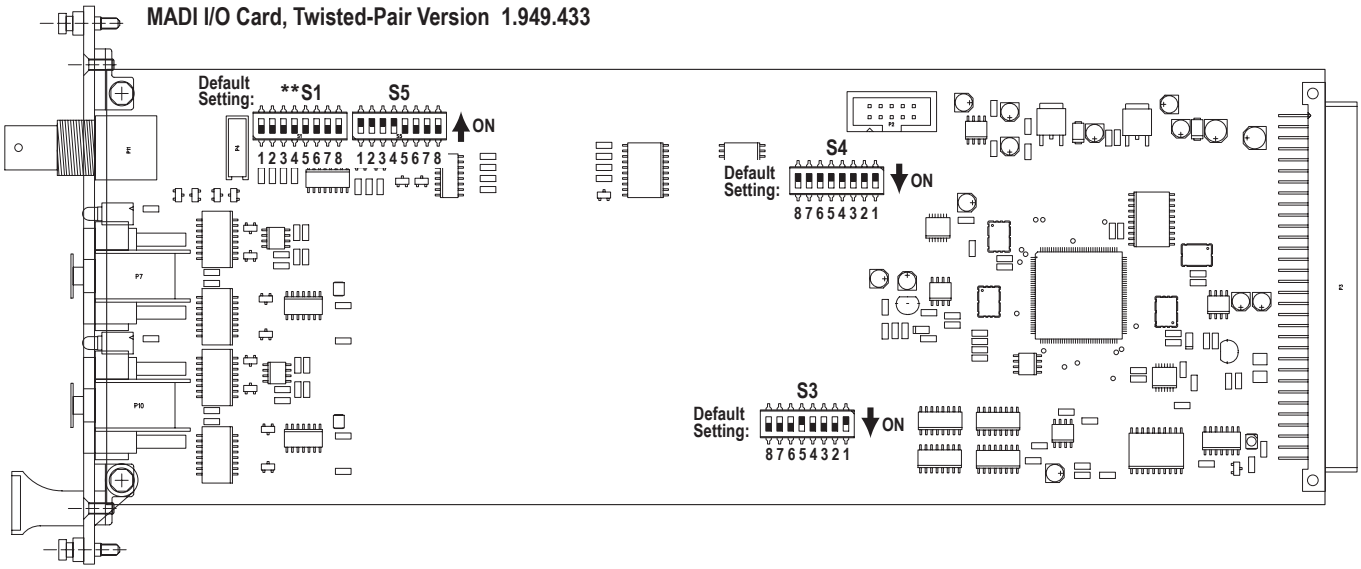
Input frequencies		44.1/48/88.2/96 kHz ±100 ppm
Current consumption	(3.3 V)	0.4 A
	(5 V)	0.4 A
Operating temperature		0...40° C



MADI I/O Card, Optical Versions 1.949.430 / 1.949.431



MADI I/O Card, Twisted-Pair Version 1.949.433



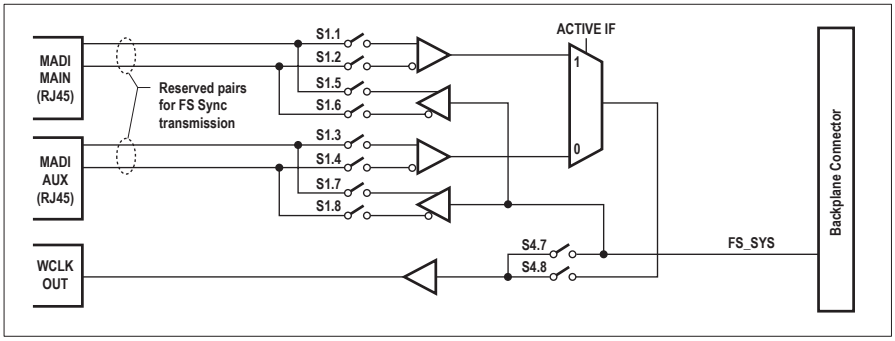
Switches:

***S1** *(On versions 1.949.430, 1.949.431 only)*
Toggle switch for 64 (factory default) or 56 channel selection.

****S1** *(On version 1.949.433 only)*
In case of connecting two cores, they must be synchronized. The twisted-pair cable version of the MADI card provides a reserved wire pair for both the main and aux RJ45 sockets on which the sync signal can be transferred. The sync transfer direction (from master to slave) is set using the DIP switches S1 and S4.7/.8. P*lease note that in such a case the twisted-pair wiring has to be done with a crossover cable. On the slave core, the WCLK output must be patched to the WCLK input of the audio clock card.*

(refer to the block diagram on the opposite page)

1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	Card is Master *(factory default)*
ON	ON	ON	ON	OFF	OFF	OFF	OFF	Card is Slave
NO OTHER SETTINGS ALLOWED !								



***S2** *(On versions 1.949.430, 1.949.431 only)*
Rotary switch for baud rate selection of the RS422 user interface:

Position	Setting
0	115'200 bps *(factory default)*
1	57'600 bps
2	38'400 bps (9-pin)
3	31'250 bps (MIDI)
4	19'200 bps
5	9'600 bps
6...9	Reserved for future use

S3 DIP switch for D21m channel count setting:

1	2	3	4	5	6	7	8	Number of Channels
ON	ON	ON	ON	-	-	-	-	**0 inputs**
ON	ON	ON	OFF	-	-	-	-	**8 inputs**
ON	ON	OFF	ON	-	-	-	-	**16 inputs**
ON	ON	OFF	OFF	-	-	-	-	**24 inputs**
ON	OFF	ON	ON	-	-	-	-	**32 inputs**
ON	OFF	ON	OFF	-	-	-	-	**40 inputs**
ON	OFF	OFF	ON	-	-	-	-	**48 inputs**
ON	OFF	OFF	OFF	-	-	-	-	**56 inputs**
OFF	ON	ON	ON	-	-	-	-	**64 inputs** *(factory default)*
OFF : OFF	ON : OFF	ON : OFF	OFF : OFF	- - -	- - -	- - -	- - -	***NOT ALLOWED***
-	-	-	-	ON	ON	ON	ON	**0 outputs**
-	-	-	-	ON	ON	ON	OFF	**8 outputs**
-	-	-	-	ON	ON	OFF	ON	**16 outputs**
-	-	-	-	ON	ON	OFF	OFF	**24 outputs**
-	-	-	-	ON	OFF	ON	ON	**32 outputs**
-	-	-	-	ON	OFF	ON	OFF	**40 outputs**
-	-	-	-	ON	OFF	OFF	ON	**48 outputs**
-	-	-	-	ON	OFF	OFF	OFF	**56 outputs**
-	-	-	-	OFF	ON	ON	ON	**64 outputs** *(factory default)*
- - -	- - -	- - -	- - -	OFF : OFF	ON : OFF	ON : OFF	OFF : OFF	***NOT ALLOWED***

S4 DIP switch for MADI setting *(on version 1.949.433, the switches 4...8 are used differently, as indicated below)*:

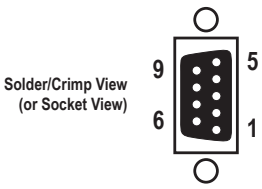
Card Versions	Switch	Setting			
ALL MADI Cards	**1**	OFF: AUX IF is used for channel extension at 96 kHz *(factory default)* ON: AUX IF is used for redundancy at 96 kHz *(in 48 kHz mode, AUX IF is used for redundancy regardless of the switch setting)*			
	2, 3	Both OFF: Standard operation *(factory default)* Both ON: No communication on system UART (used for Hub-Hub interconnection) *One ON and one OFF:* ***NOT ALLOWED****.*			
Optical Versions only (1.949.430, 1.949.431)	**4...7**	Must be set to OFF *(factory default)*			
	8	Not used *(factory default: OFF)*			
Twisted-Pair Cable Version only (1.949.433)	**4**	**5**	**6**	**Baud Rate**	
	OFF	OFF	OFF	115'200 bps *(factory default)*	
	OFF	OFF	ON	57'600 bps	
	OFF	ON	OFF	38'400 bps (9-pin)	
	OFF	ON	ON	31'250 bps (MIDI)	
	ON	OFF	OFF	19'200 bps	
	ON	OFF	ON	9'600 bps	
	ON ... ON	ON ... ON	OFF ... OFF	Reserved for future use	
	7	**8**	**Setting (refer to **S1 above)**		
	ON	OFF	BNC output carries D21m system word clock *(factory default)*		
	OFF	ON	BNC output carries received word clock		

S5 DIP switch for RS422 pinout selection:

1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	**RS422 Controller pinout**
ON	ON	ON	ON	OFF	OFF	OFF	OFF	**RS422 Device pinout** *(factory default)*
NO OTHER SETTINGS ALLOWED!								

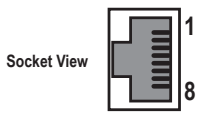
Connector Pin Assignments:

CTRL (9-pin D-type, female)



Pin	RS422 Controller	RS422 Device
1	Chassis	Chassis
2	RxD –	TxD –
3	TxD +	RxD +
4	GND	GND
5	n.c.	n.c.
6	GND	GND
7	RxD +	TxD +
8	TxD –	RxD –
9	Chassis	Chassis

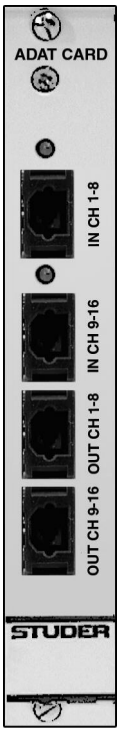
MADI MAIN / MADI AUX (8-pin RJ45) *(on version 1.949.433 only)*



Pin	Signal
1	MADI TxD +
2	MADI TxD –
3	MADI RxD +
4	WCLK TXD/RXD +
5	WCLK TXD/RXD –
6	MADI RxD –
7	reserved
8	reserved

LEDs: On if a valid MADI signal is available at the input that is locked to the system clock.

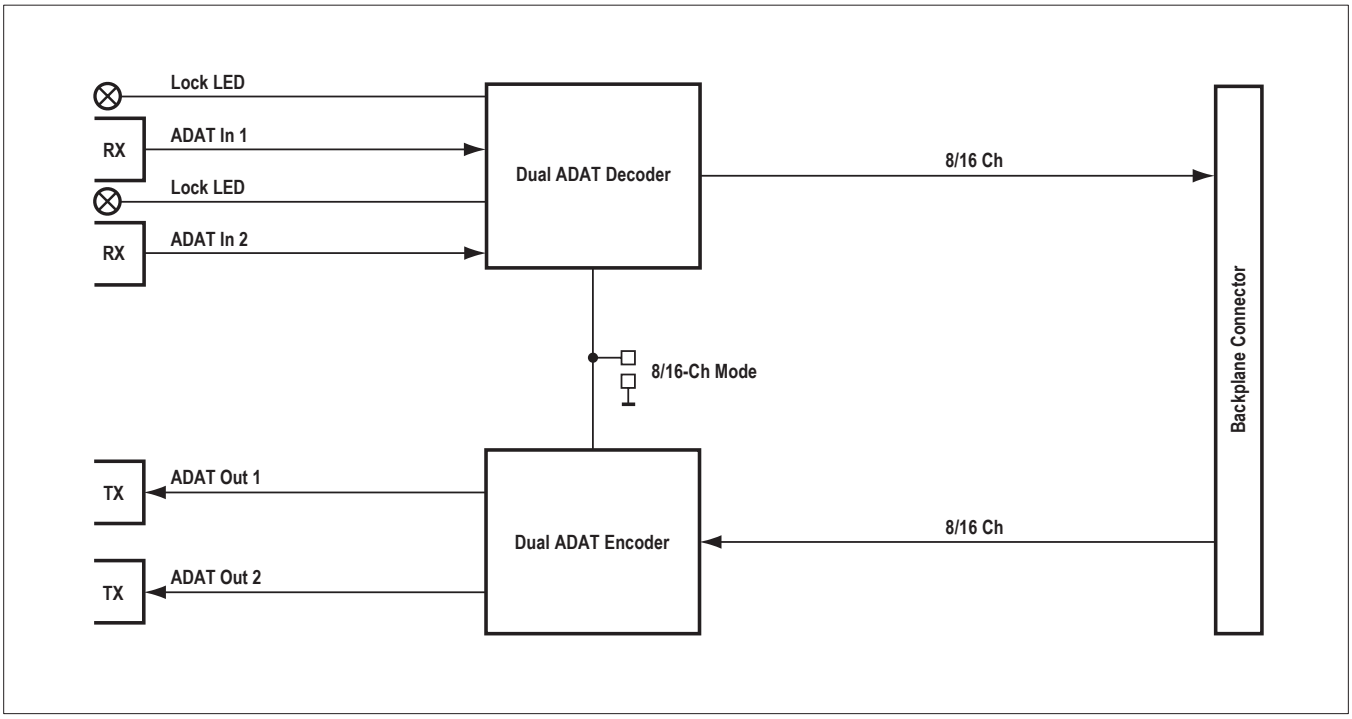
6.3.3 ADAT I/O Cards 1.949.425, 1.949.429

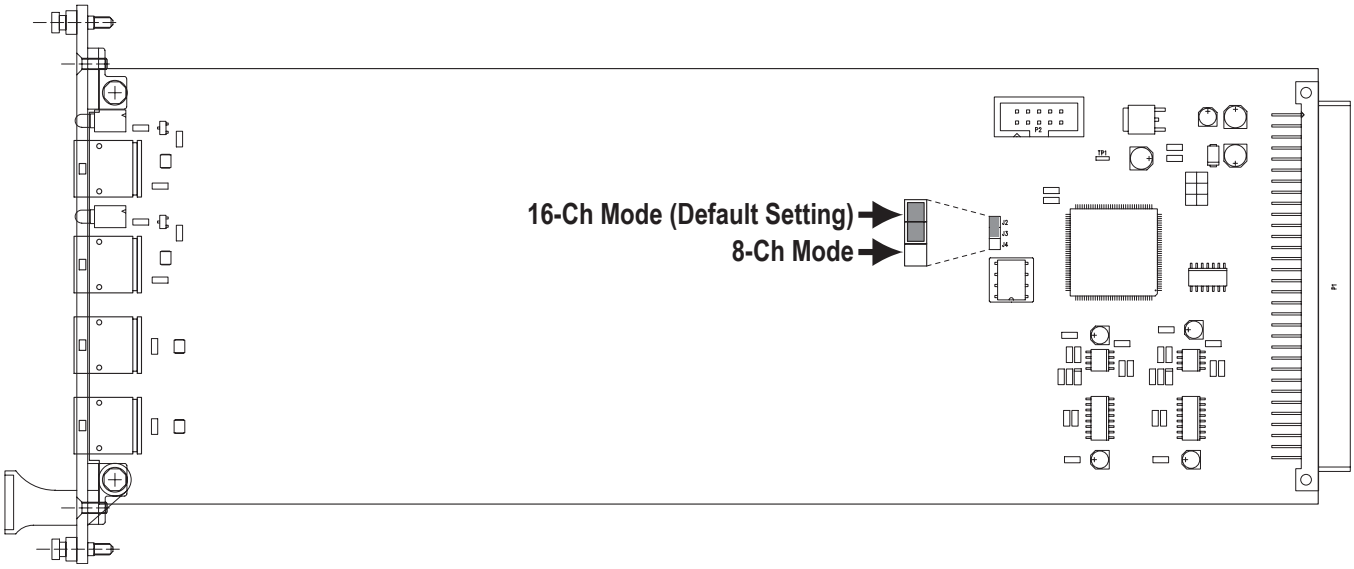


Two optical eight-channel ADAT inputs and outputs. 44.1/48/88.2/96 kHz operation; optional long-distance version 1.949.429. Optical inputs and outputs are provided on TosLink connectors available in APF (all-plastic fibre) and PCF (plastic-clad fibre) versions. In 96 kHz operation, the number of channels is limited to eight, i.e. four per I/O.

Max. distance	(1.949.425, APF version)	5 m
	(1.949.429, PCF version)	300 m*
Current consumption	(3.3 V)	0.1 A
	(5 V)	0.2 A
Operating temperature		0...40° C

* distances up to 1000 m are possible (available upon special request).



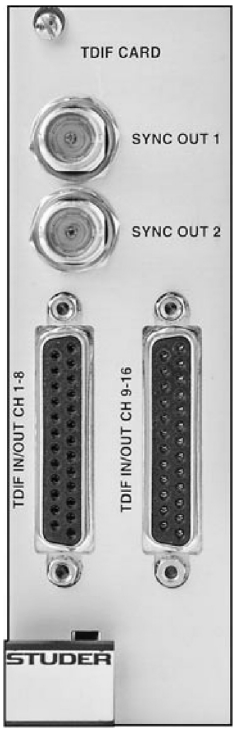


LEDs: **IN CH 1-8, 9-16** These LEDs indicate that valid ADAT signals are available at the respective inputs.

Jumper: **8/16 Ch Mode** In 96 kHz mode the card handles a total of 8 channels (4 per interface). In order to avoid different numbers of channels when switching from 96 kHz to 48 kHz and vice versa, it is possible to restrict the card to 8 channels even in 48 kHz mode. In such a case only the first interface (**IN/OUT CH 1-8**) is active, as shown in the table below.

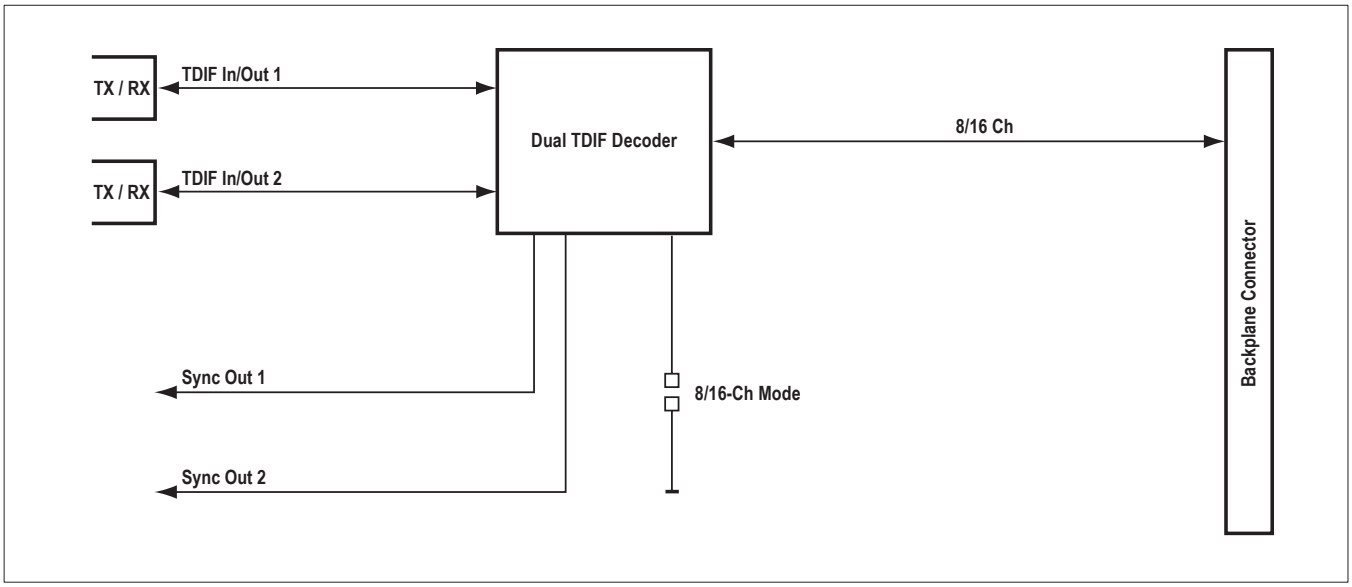
Jumper Setting	Channels on Backplane	Interface 1	Interface 2
16-Ch Mode (factory default)	16 in, 16 out	48 kHz: Ch 1...8	48 kHz: Ch 9...16
		96 kHz: Ch 1...4	96 kHz: Ch 5...8
8-Ch Mode	8 in, 8 out	48 kHz: Ch 1...8	48 kHz: unused
		96 kHz: Ch 1...4	96 kHz: Ch 5...8

6.3.4 TDIF I/O Card 1.949.426



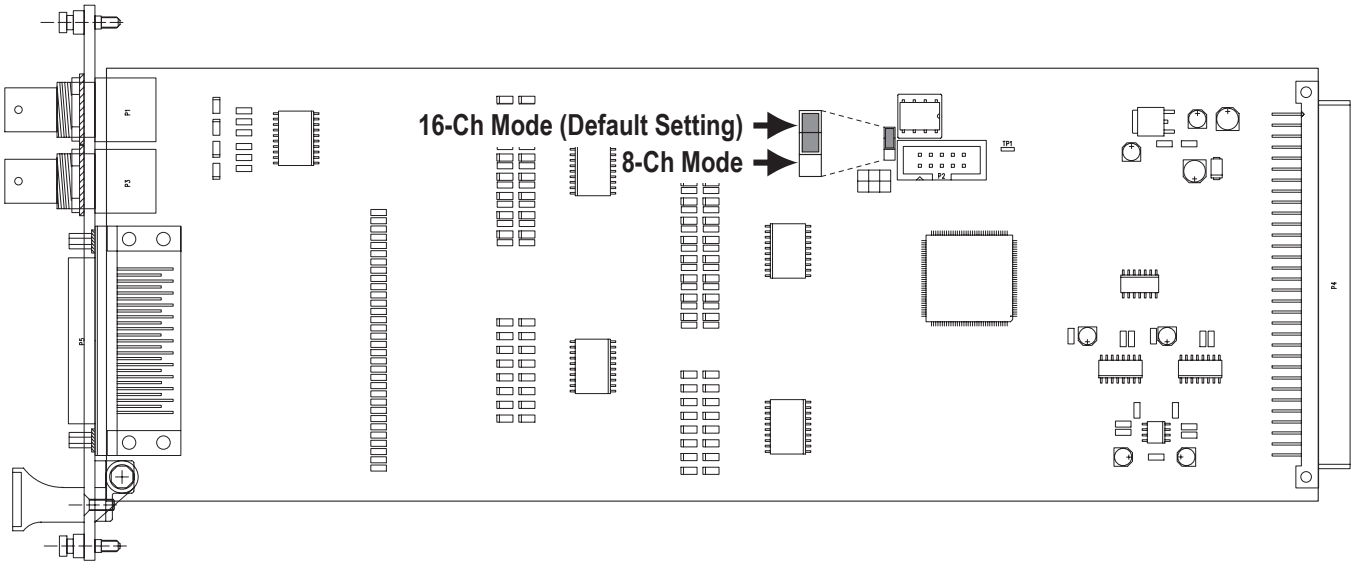
This card provides two eight-channel TDIF I/O interfaces with 96 kHz, 88.2 kHz, 48 kHz, or 44.1 kHz operation with wordclock sync outputs on BNC connectors. Inputs and outputs are provided on standard 25-pin D-type connectors (female).
In 96 kHz operation, the number of channels is limited to eight, i.e. four per I/O.

TDIF inputs/outputs	according to TDIF specifications
Current consumption (3.3 V)	5 mA
(5 V)	0.1 A
Operating temperature	0...40° C

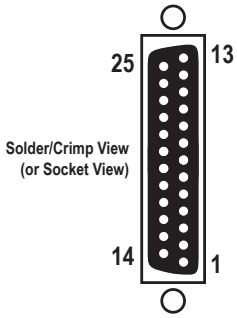


Jumper: 8/16 Ch Mode In 96 kHz mode the card handles a total of 8 channels (4 per interface). In order to avoid different numbers of channels when switching from 96 kHz to 48 kHz and vice versa, it is possible to restrict the card to 8 channels even in 48 kHz mode. In such a case only the first interface (**TDIF IN/OUT CH 1-8**) is active, as shown in the table below.

Jumper Setting	Channels on Backplane	Interface 1	Interface 2
16-Ch Mode (factory default)	16 in, 16 out	48 kHz: Ch 1...8	48 kHz: Ch 9...16
		96 kHz: Ch 1...4	96 kHz: Ch 5...8
8-Ch Mode	8 in, 8 out	48 kHz: Ch 1...8	48 kHz: unused
		96 kHz: Ch 1...4	96 kHz: Ch 5...8

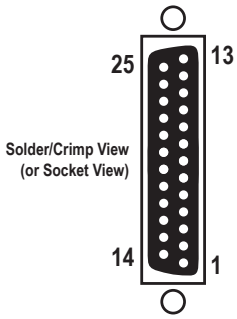


Connector Pin Assignment, 48 kHz Operation (2 × 25-pin D-type, female)



Pin	Signal CH 1...8	Signal CH 9...16	Pin	Signal CH 1...8	Signal CH 9...16
1	CH 1/2 out	CH 9/10 out	14	GND	GND
2	CH 3/4 out	CH 11/12 out	15	GND	GND
3	CH 5/6 out	CH 13/14 out	16	GND	GND
4	CH 7/8 out	CH 15/16 out	17	GND	GND
5	LRCK out	LRCK out	18	EMPH out	EMPH out
6	FS 0 out	FS 0 out	19	FS1 out	FS1 out
7	GND	GND	20	FS0 in	FS0 in
8	FS 1 in	FS 1 in	21	EMPH in	EMPH in
9	LRCK in	LRCK in	22	GND	GND
10	CH 7/8 in	CH 15/16 in	23	GND	GND
11	CH 5/6 in	CH 13/14 in	24	GND	GND
12	CH 3/4 in	CH 11/12 in	25	GND	GND
13	CH 1/2 in	CH 9/10 in			

Connector Pin Assignment, 96 kHz Operation (2 × 25-pin D-type, female)

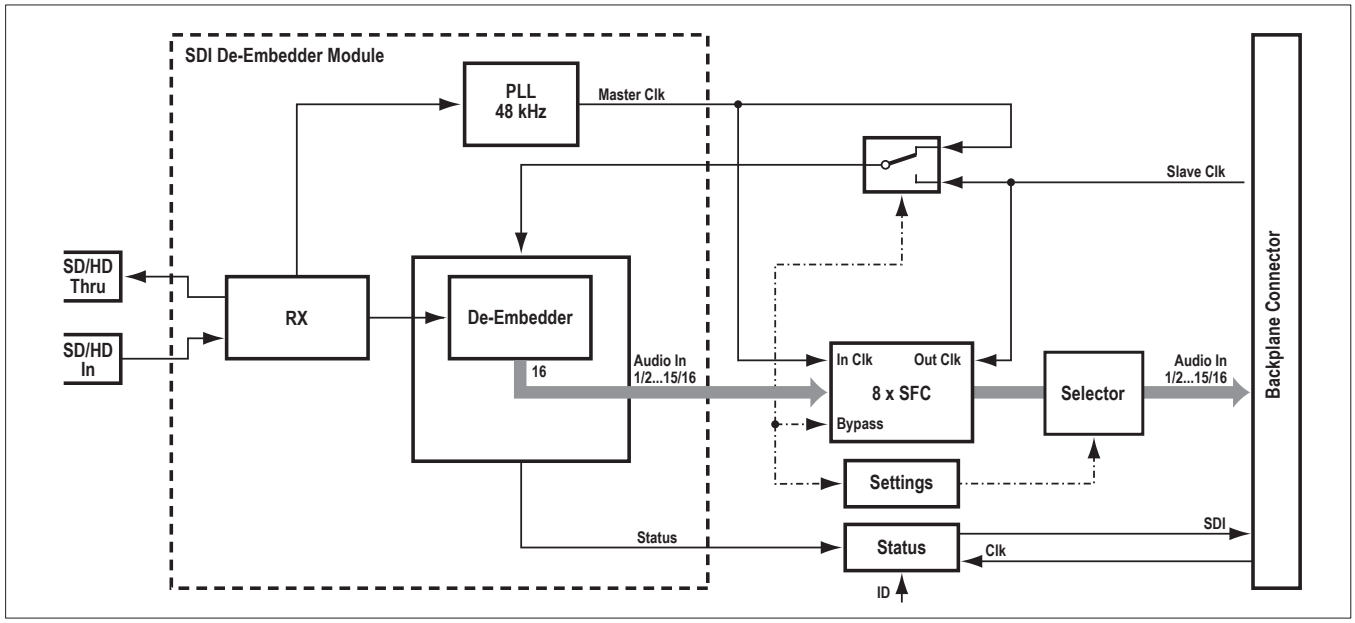


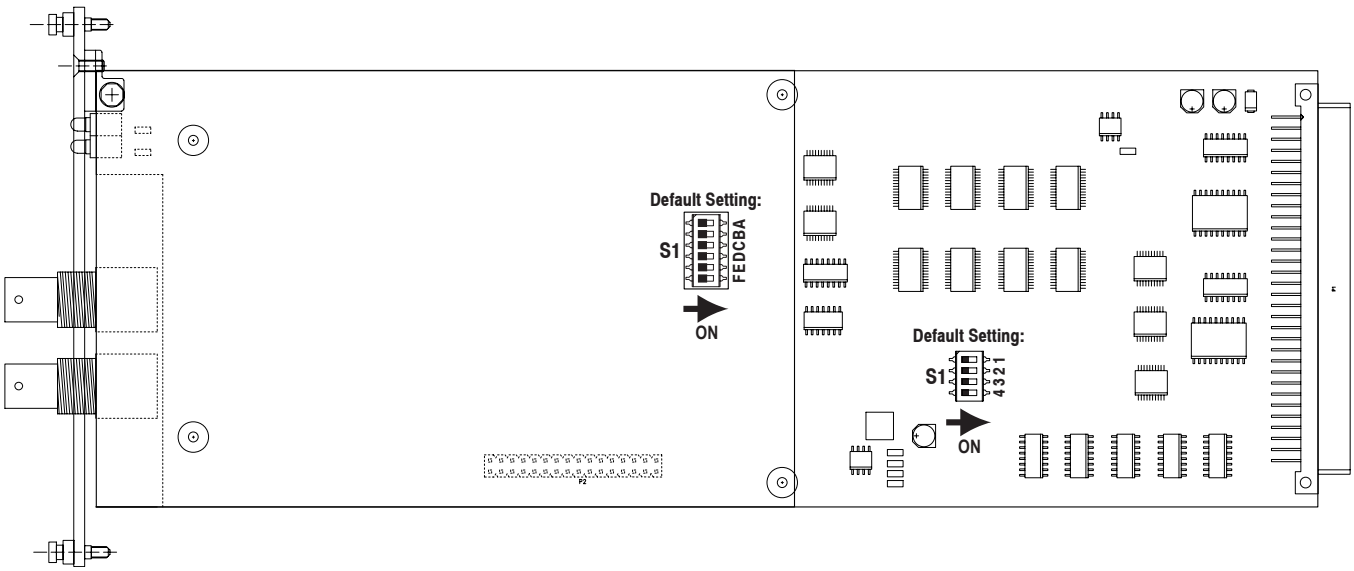
Pin	Signal CH 1...8	Signal CH 9...16	Pin	Signal CH 1...8	Signal CH 9...16
1	CH 1 out	CH 5 out	14	GND	GND
2	CH 2 out	CH 6 out	15	GND	GND
3	CH 3 out	CH 7 out	16	GND	GND
4	CH 4 out	CH 8 out	17	GND	GND
5	LRCK out	LRCK out	18	EMPH out	EMPH out
6	FS 0 out	FS 0 out	19	FS1 out	FS1 out
7	GND	GND	20	FS0 in	FS0 in
8	FS 1 in	FS 1 in	21	EMPH in	EMPH in
9	LRCK in	LRCK in	22	GND	GND
10	CH 4 in	CH 8 in	23	GND	GND
11	CH 3 in	CH 7 in	24	GND	GND
12	CH 2 in	CH 6 in	25	GND	GND
13	CH 1 in	CH 5 in			

6.3.5 SDI Input Card 1.949.441

The HD/SD SDI (serial digital interface) 16-channel de-embedder card is able to de-embed eight or 16 audio channels from SDI-SD as well as from SDI-HD video streams. For the D21m I/O system it acts as an eight-or 16-channel audio input card. These two modes are determined by hardware switches located on the card.
The SDI standard defines up to 16 audio channels transmitted within a video signal. These 16 channels are divided into four groups of four each. The user can determine by hardware switches whether all four groups, or only groups 1+2, or only groups 3+4 will be de-embedded.
The card hosts SFCs (sampling frequency converters) that are bypassed per default. When bypassed, the SDI card is fully compatible to receiving embedded Dolby® E audio data. The SFCs can be enabled in case the audio extracted from the SDI stream is not in sync with the local system. This means that the mixing console can run fully independent of the video sync used for SDI.
This card works at a sampling frequency of 48 kHz only.

Modes	8- or 16-ch console input (de-embedder)
Selectable SDI groups	1&2, 3&4, or all
Video connectors	IN, THROUGH (BNC, 75 Ω)
Current consumption (5 V)	1 A
Operating temperature	0...40° C





LEDs:

SDI LOCK Indicates a valid SDI signal at the input.

HD Indicates a valid HD SDI signal at the input.

DIP Switches:

S1

Switch	Setting
1	OFF: 16-channel mode *(factory default)* ON: 8-channel mode
2	OFF: Group 1/2 used in 8-channel mode *(factory default)* ON: Group 3/4 used in 8-channel mode
3	OFF: SFC disabled *(factory default)* ON: SFC enabled
4	reserved *(must always be OFF; factory default)*

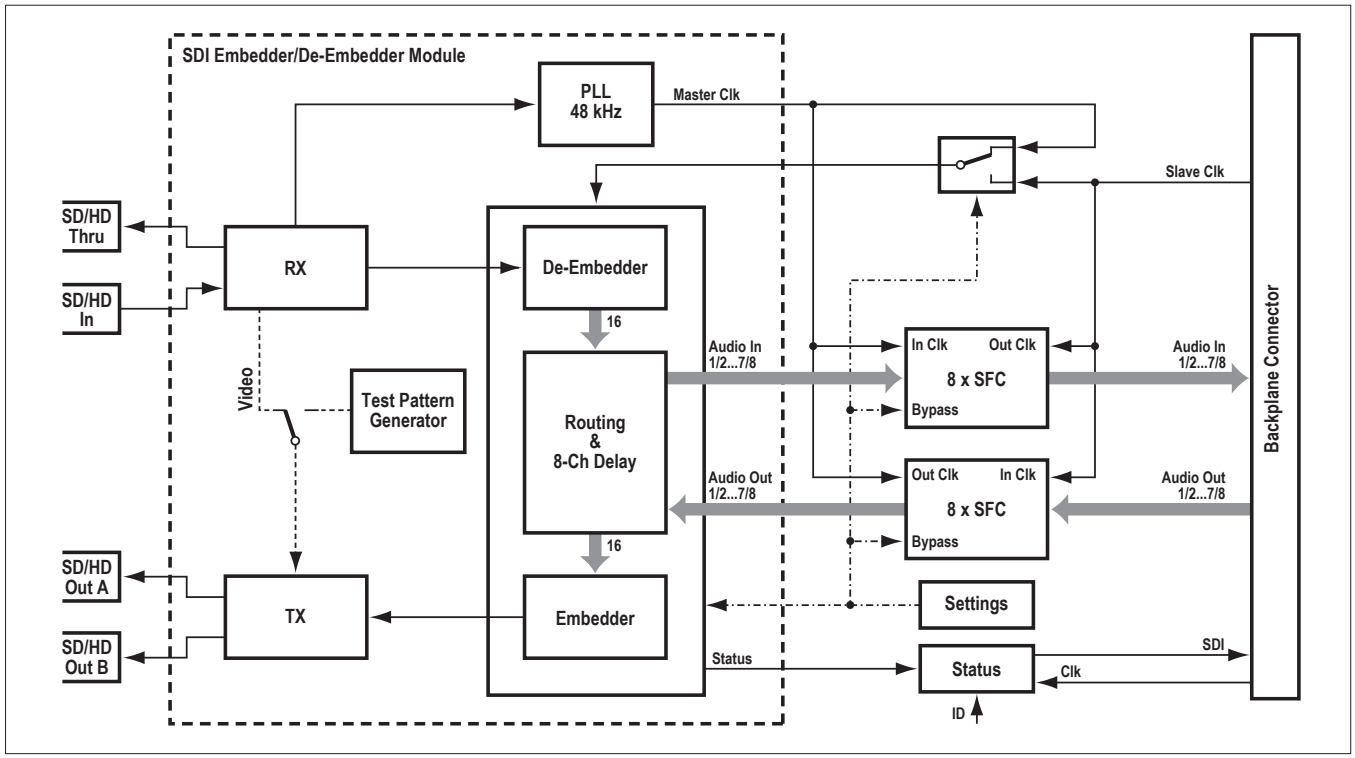
S1

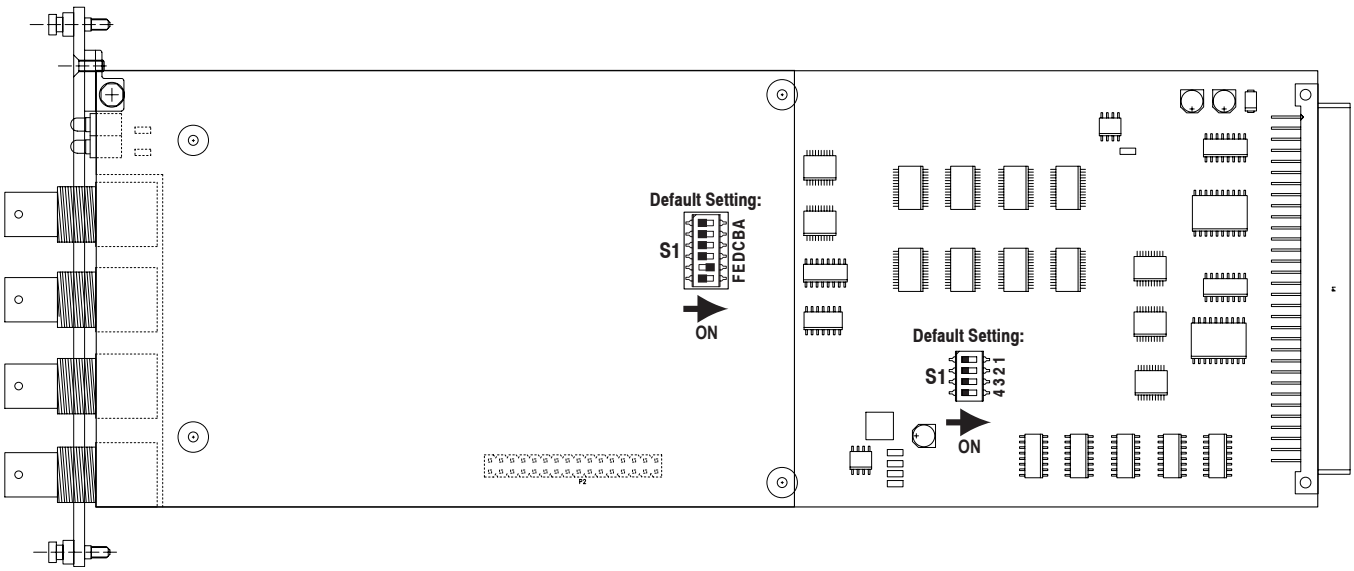
Switch	Setting
A...F	reserved *(default: OFF)*

6.3.6 SDI I/O Card 1.949.442

The HD/SD SDI (serial digital interface) embedder/de-embedder card is able to handle video signals according to the SD as well as the HD standard. It can act as an eight-channel embedder, an eight-channel de-embedder, or as a combination of the two. Therefore, for the D21m I/O system it may act as an eight-channel audio input card, an eight-channel audio output card, or an eight-channel input and output card. These three modes are determined by hardware switches located on the card.
The SDI standard defines up to 16 audio channels transmitted within a video signal. These 16 channels are divided into four groups of four channels each. The user can select which two groups are to be embedded or de-embedded by hardware switches on the card: either groups 1&2, or groups 3&4. It is also possible to clear the SDI data structure possibly present in the incoming video signal and to allocate the groups from scratch.
The D21m SDI card hosts sampling frequency converters for both the audio inputs (de-embedding) and outputs (embedding). So the mixing console can run independent of the video sync used for SDI. The sampling frequency converters can be bypassed. When bypassed, the SDI card is fully compatible to transmitting the Dolby® E audio format.
This card works at a sampling frequency of 48 kHz only.

Modes	8-ch console output (embedder), 8-ch console input (de-embedder), or 8-ch console input and 8-ch console output (de-embedder/embedder)
Selectable SDI groups	1&2, or 3&4
Video connectors	IN, OUT A, OUT B, THROUGH (BNC, 75 Ω)
Current consumption (5 V)	1 A
Operating temperature	0...40° C





LEDs:

SDI LOCK Indicates a valid SDI signal at the input.

HD Indicates a valid HD SDI signal at the input.

DIP Switches:

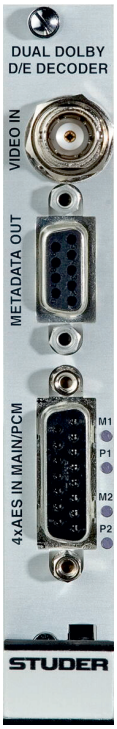
S1

Switch	Setting
1	OFF: Enable de-embedder *(factory default)*
2	OFF: Enable embedder *(factory default)*
3	OFF: SFC bypass *(factory default)*
4	reserved *(must always be OFF)*

S1

Switch	Setting
A	OFF: De-embedder groups 1&2 *(factory default)* ON: De-embedder groups 3&4
B	OFF: Embedder groups 1&2 *(factory default)* ON: Embedder groups 3&4
C	ON: All audio data in SDI will be cleared *(factory default: OFF)*
D	OFF: no delay *(factory default)* ON: 40 ms delay on all 8 SDI in channels
E	OFF: transparent for channel status bit ON: generate channel status bit *(factory default)*
F	OFF: NTSC 525 test pattern is generated if no SDI input signal is present *(factory default)* ON: NTSC 1080i60 test pattern if no SDI input signal is present

6.3.7 Dolby® E/Digital Decoder Card 1.949.443 (single-decoder) / 1.949.444 (dual-decoder)



About Dolby® E

Dolby® E allows encoding of up to 8 mono audio channels and some metadata into a pair of two channels (e.g. AES/EBU) by using 20 audio bits thereof. Both encoding and decoding processes create one video frame of delay. Since the encoded data is packaged in sizes of one video frame it is possible to "edit" the encoded stream, as long as the edits are synchronized with the video frames and the stream is not modified in any way (e.g. level changes applied). For more details on Dolby® E please refer to www.dolby.com.

The Studer Decoder

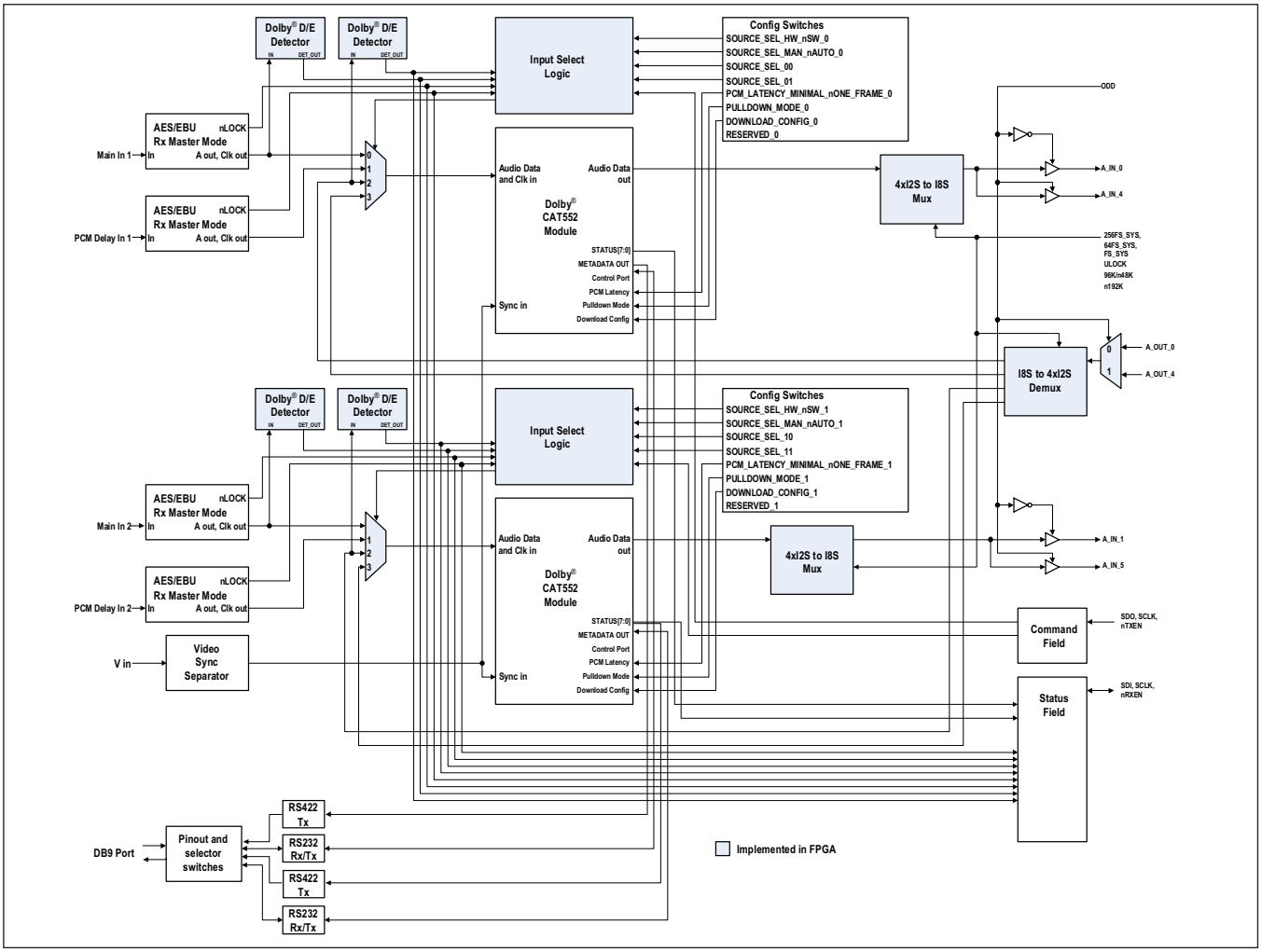
The D21m Dolby® E/Digital card hosts one or two Dolby® E decoder modules. Each one is functionally very similar to one Dolby® DP572 decoder. Both are operating independently, and the information given below is valid independently for both decoders as well. The dual-decoder card receives four AES/EBU pairs the front panel input, or eight mono channels from the console-internal patch (showing up as patch destinations). Each pair may contain a Dolby E or Dolby Digital encoded signal. The card returns a total of max. 16 channels to the console patch (showing up as patch sources).

The single-decoder card returns up to eight channels to the console patch (eight sources) and shows eight inputs on the patch. Input channels 5...8 are unused.

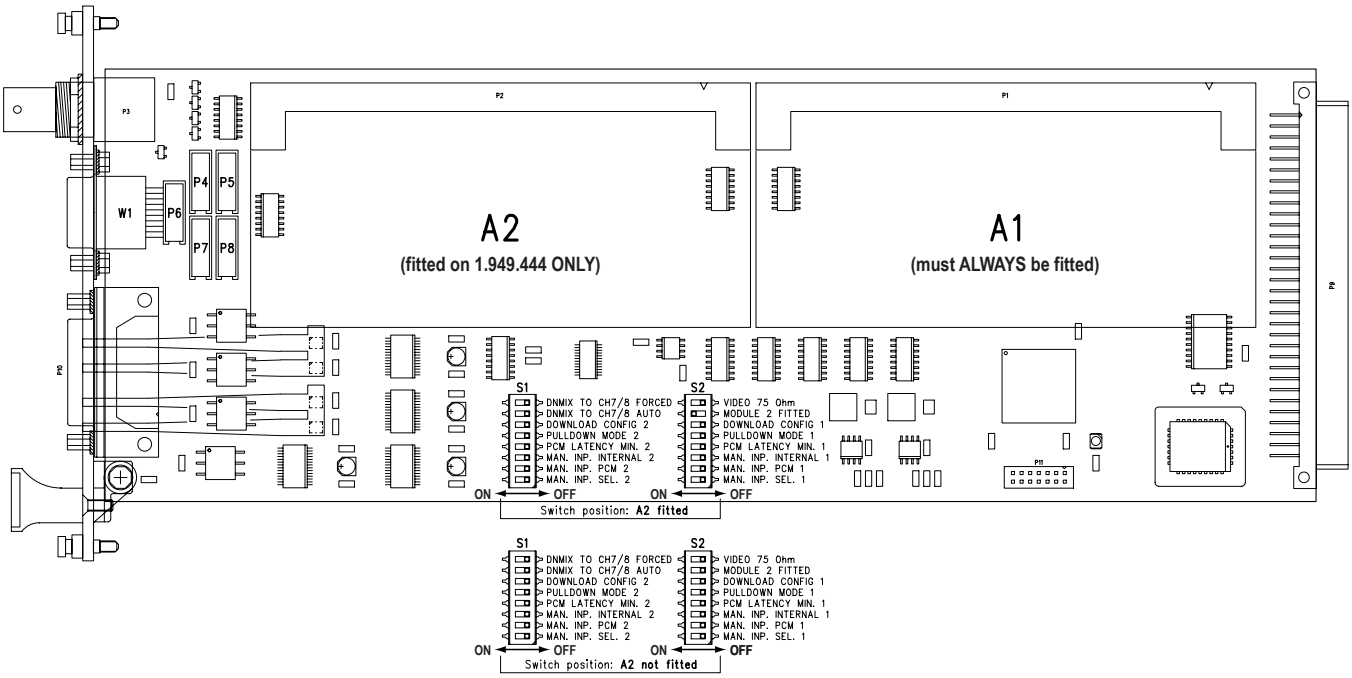
Notes:

The single-decoder card only works correctly if the Dolby® E decoder module is fitted in position A1.

Both cards work at sampling frequencies of 44.1 or 48 kHz only.



Current consumption	(3.3 V)	0.2 A
	(5 V)	0.8 A (1.949.443); 1.3 A (1.949.444)
Operating temperature		0...40° C



LEDs:

M1 / M2 Indicate that a valid AES/EBU signal is detected on main input 1/2.

P1 / P2 Indicate that a valid AES/EBU signal is detected on fallback input 1/2.

Note: These LEDs do not indicate Dolby® E status, but just the lock status of the AES/EBU inputs on the front panel.

DIP Switches: **S2.1 ... S2.3**

S2.1	S2.2	S2.3	Module 1 Input Select
x	x	OFF	**Automatic source selection** *(factory default: All OFF)*
OFF	OFF	ON	**Front port main**
OFF	ON	ON	**Front port PCM delay**
ON	OFF	ON	**Rear (backplane / fallback) main**
ON	ON	ON	**Rear (backplane / fallback) main**

While it is possible to manually select individual inputs both from the front panel connectors as well as from the console-internal patch, the card hosts an automatic source selection mode where the inputs are chosen automatically according to the following priorities:

- Whenever a valid AES/EBU signal is detected ("locked" status) on the 15-pin front panel connector, this input has priority over the console-internal patch sources. Hence if it is requested to feed the decoder with a console-internal signal selected via the patch window, no valid AES/EBU input signal is allowed on the front panel connector.
- However, if no valid AES/EBU signal is detected on the front panel inputs, the card is getting its inputs from the console-internal patch. These inputs are referred to as "Rear/Backplane Inputs". Selection is as follows:
  - Input 1, 2: Main priority input for Dolby® E signal, decoder 1.
  - Input 3, 4: Backplane input of decoder 1; is automatically selected in case no Dolby® E signal is present on main input (1, 2). Please note that a Dolby® E signal can be fed into this input, too, and it will be decoded correctly. However, if a Dolby® E signal is detected on the main input, this will be taken with higher priority.

S2.4

S2.4	PCM Latency (Module 1 only)
OFF	**PCM signal is delayed by 1 video frame** *(factory default)*
ON	**PCM signal is minimally delayed**

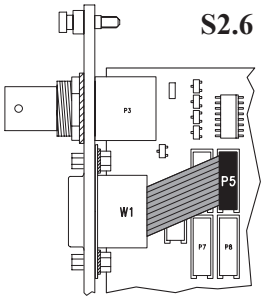
Decoding a Dolby® E stream always causes a delay of one video frame. In case a regular PCM signal is fed to the card, this can be delayed by one video frame, too. If required, this delay may be de-activated in order to pass through a PCM signal with a minimal delay. The front panel VIDEO IN sync input is used to detect video frames in order to delay the PCM signal accordingly. The video sync input doesn't necessarily have to be connected in case of Dolby® E , since the sync is indicated within the Dolby® E stream.

S2.5

S2.5	Module 1 Pulldown Mode
OFF	**Pulldown mode is off** *(factory default)*
ON	**Pulldown mode is on**

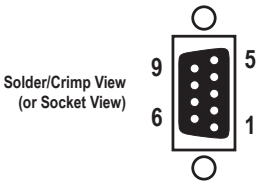
Pulldown mode ON allows the input of audio signals with a "drop frame" sampling frequency of 47.952 kHz instead of 48 kHz. The output, however, always runs at 48 kHz.

S2.6



S2.6	Module 1 Configuration Download
OFF	**Standard operation** *(factory default)*
ON	**Configuration download via RS232**

If firmware download to decoder module 1 is required, plug the short flat cable (W1) coming from the METADATA OUT front-panel socket to the PCB socket P5 (labeled UPDATE1).
The pin assignment of the METADATA OUT socket (9-pin D-type, female) in this case is as follows:



Pin	Signal	Pin	Signal
1	**n.c.**	6	**n.c.**
2	**DOUT_1**	7	**n.c.**
3	**DIN_1**	8	**n.c.**
4	**n.c.**	9	**n.c.**
5	**n.c.**		

S2.7

S2.7	Module 2 Installed
OFF	**No** *(factory default if not installed, i.e., for 1.949.443)*
ON	**Yes** *(factory default if installed, i.e., for 1.949.444)*

S2.8

S2.8	Video Termination
OFF	**Hi-Z** *(factory default)*
ON	**75 Ω**

S1.1 ... S1.3

S1.1	S1.2	S1.3	Module 2 Input Select
x	x	OFF	**Automatic source selection** *(factory default: All OFF)*
OFF	OFF	ON	**Front port main**
OFF	ON	ON	**Front port PCM delay**
ON	OFF	ON	**Rear (backplane) main**
ON	ON	ON	**Rear (backplane) PCM delay**

Same as S2.1 ... S2.3 above, but for module 2 (if installed).

S1.4

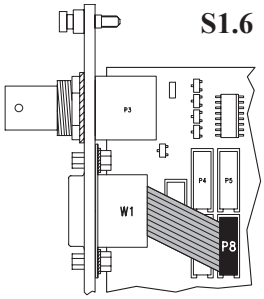
S1.4	PCM Latency (Module 2 only)
OFF	**PCM signal is delayed by 1 video frame** *(factory default)*
ON	**PCM signal is minimally delayed**

Same as S2.4 above, but for module 2.

S1.5

S1.5	Module 2 Pulldown Mode
OFF	**Pulldown mode is off** *(factory default)*
ON	**Pulldown mode is on**

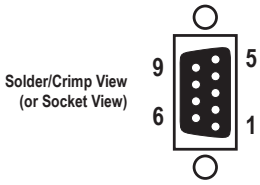
Same as S2.5 above, but for module 2.



S1.6

S1.6	Module 2 Configuration Download
OFF	**Standard operation** *(factory default)*
ON	**Configuration download via RS232**

If firmware download to decoder module 2 is required, plug the short flat cable (W1) coming from the METADATA OUT front-panel socket to the PCB socket P8 (labeled UPDATE2).
The pin assignment of the METADATA OUT socket (9-pin D-type, female) in this case is as follows:



Pin	Signal	Pin	Signal
1	**n.c.**	6	**n.c.**
2	**DOUT_2**	7	**n.c.**
3	**DIN_2**	8	**n.c.**
4	**n.c.**	9	**n.c.**
5	**n.c.**		

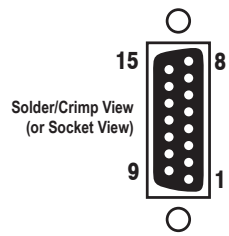
S1.7 / S1.8

S1.7	S1.8	Downmix to Ch 7/8 (or 15/16, resp.)
OFF	OFF	**No downmix** *(factory default)*
ON	OFF	**Automatic downmix**
OFF	ON	**Forced downmix**

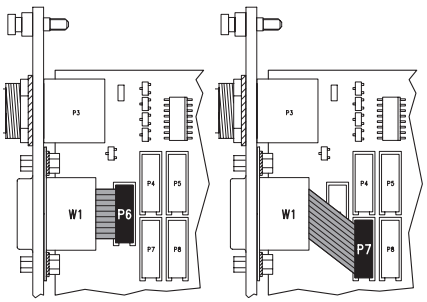
Metadata and Downmixing: A Dolby® E stream contains metadata with various information on the encoded signal. This information can be read out from the front panel connector. The D21m Dolby® E decoder card only uses this information in case a 2-channel stereo downmix is required from a 5.1-channel surround signal within the Dolby® E stream; then the decoder interprets the center and surround channel levels and uses them for the internal downmixer that is activated by the DIP switches S1.7 and S1.8. The downmix can be made constantly available and, subsequently, overwriting any audio data that was contained on these channels beforehand ("forced downmix"), or it is possible to "fill" the channels 7/8 or 15/16 only if the metadata indicate that these channels are not being used otherwise (automatic downmix).

Connector Pin Assignments:

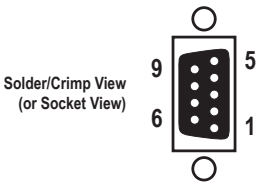
2 x AES IN MAIN/PCM (15-pin D-type, female)



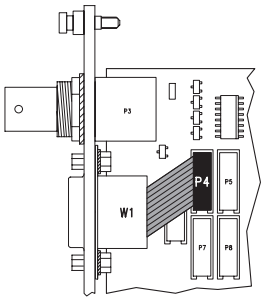
Pin	Signal	Pin	Signal
1	**Main In 1 +**	9	**Main In 1 –**
2	**Main In 1 Chassis**	10	**PCM Delay In 1 Chassis**
3	**PCM Delay In 1 –**	11	**PCM Delay In 1 +**
4	**n.c.**	12	**n.c.**
5	**Main In 2 +**	13	**Main In 2 –**
6	**Main In 2 Chassis**	14	**PCM Delay In 2 Chassis**
7	**PCM Delay In 2 –**	15	**PCM Delay In 2 +**
8	**n.c.**		



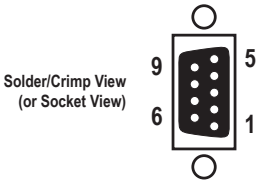
METADATA OUT (9-pin D-type, female)
The Metadata Out socket allows sending the meta data of either module or of both modules at once.
If the meta data of either decoder module 1 or 2 is required, plug the short flat cable (W1) coming from the METADATA OUT front-panel socket to the PCB socket P6 (labeled META1; *factory default*), or to PCB socket P7 (META2), respectively.
The pin assignment of the METADATA OUT socket (9-pin D-type, female) in this case is as follows:



Pin	Signal	Pin	Signal
1	Chassis	6	GND
2	n.c.	7	n.c.
3	META_1+ / META_2+	8	META_1– / META_2–
4	GND	9	Chassis
5	n.c.		



If the meta data of both decoder modules is required, plug the short flat cable (W1) coming from the METADATA OUT front-panel socket to the PCB socket P4 (labeled META1+2).



Please note that in this case the pin assignment of the METADATA OUT socket (9-pin D-type, female) is *non-standard*:

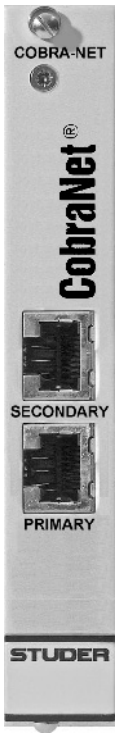
Pin	Signal	Pin	Signal
1	Chassis	6	GND
2	n.c.	7	META_2–
3	META_1+	8	META_1–
4	META_2+	9	Chassis
5	n.c.		

Possible Pitfalls with Dolby® E

In order to transmit or record a Dolby® E encoded signal, *the whole signal path must be 100% transparent,* regarding the 20 audio bits contained within the data stream. In case of problems with decoding the Dolby® E signal and possibly getting white noise instead of the decoded signal, the whole signal path should be checked. It may be worthwhile verifying the following points:

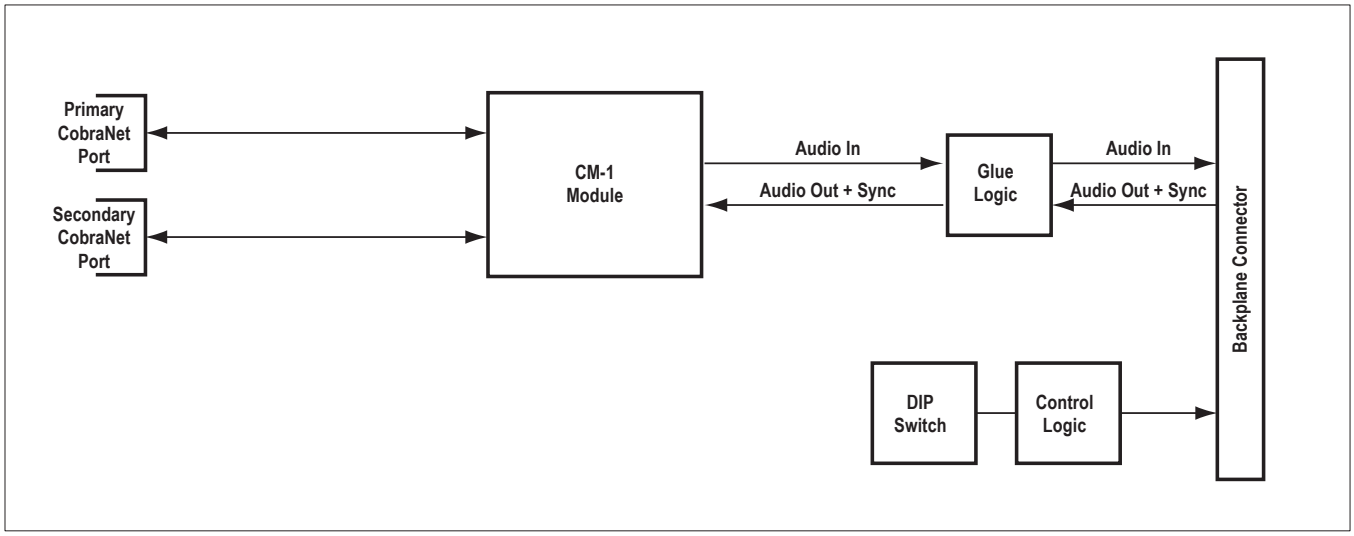
- Are there any sampling frequency converters (e.g. when using the D21m Dolby® E decoder card together with the D21m SDI card) in the signal chain? If so, they must be bypassed; otherwise the Dolby® E stream is modified and cannot be decoded anymore.
- In case the signal is sourced from a video tape machine: Is the machine set up to be transparent for the recorded audio signals? Several machines require seting the tracks to “DATA” mode in order to guarantee unity gain while recording or playing back Dolby® E streams.
- Is the card receiving the Dolby® E stream from the console-internal patch? If so, are both tracks patched to the correct two inputs of the card? (Decoder 1 main: channels 1 and 2; decoder 1 PCM: channels 3 and 4; decoder 2 main: channels 5 and 6; decoder 2 PCM: channels 7 and 8).
- If getting a wrong signal or no signal at all: Are any AES/EBU signals present at the front panel while console-internal streams should be decoded? If the card is in “automatic source selection” mode, the front inputs have top priority, regardless whether a Dolby® E stream is recognized or not.

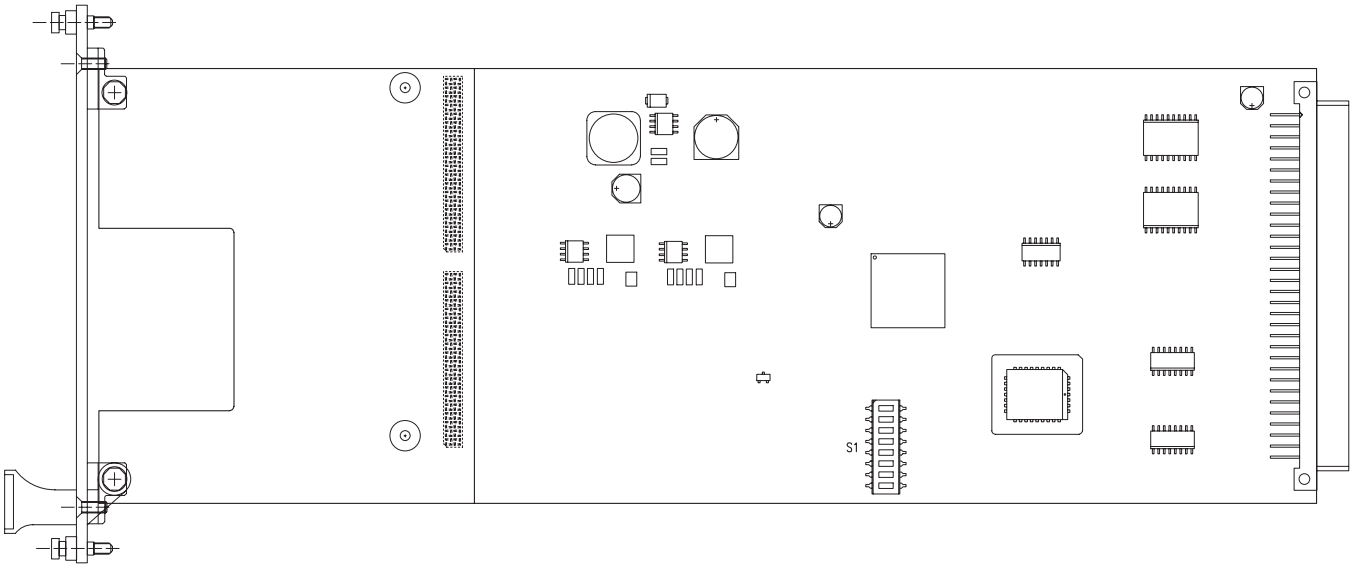
6.3.8 CobraNet® Card 1.949.445



This card allows sending and receiving of up to 32 audio channels to/from a CobraNet®. DIP switches on the card allow setting the number of input or output channels seen by the console. Default setting is 32 output and no input channels. All settings of the CobraNet® module are made through SNMP. Per default, the module is configured to be the conductor (synchronization master) and providing multicast bundles 1...4 to the CobraNet® network. This setting is ideal for e.g. providing audio channels to a PA, installed sound, or monitoring system using CobraNet®.
For further information on CobraNet®, please refer to the CobraNet® user's manual or to www.cobranet.info.

Current consumption (5 V)	800 mA
Operating temperature	0...40° C





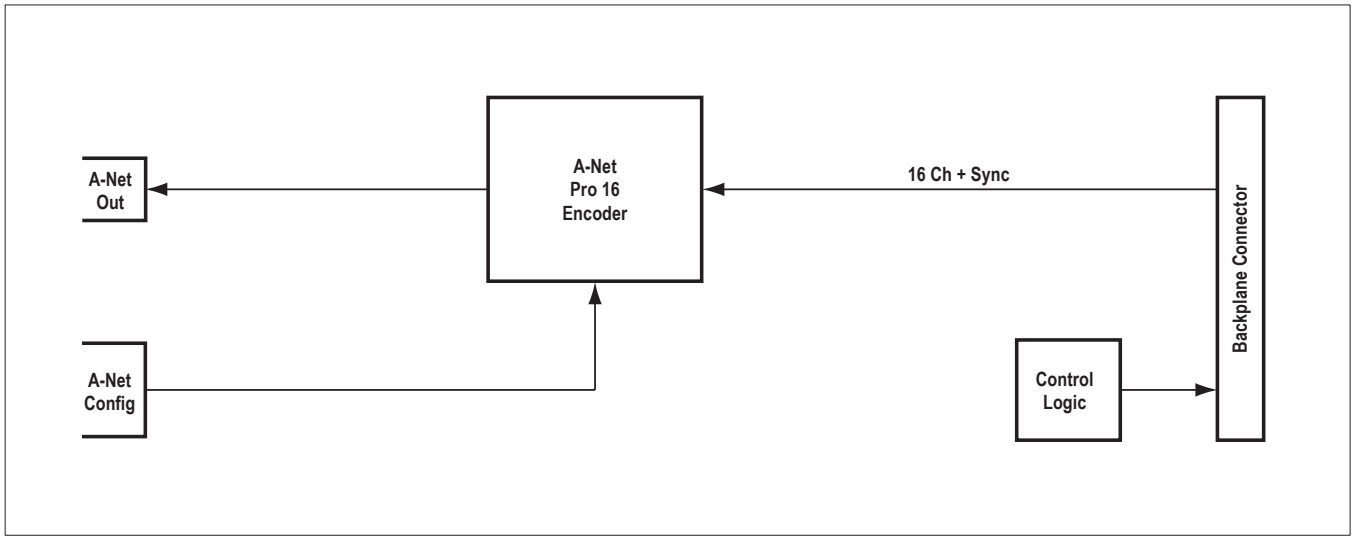
DIP Switch: **S1** DIP switch for D21m channel count setting:

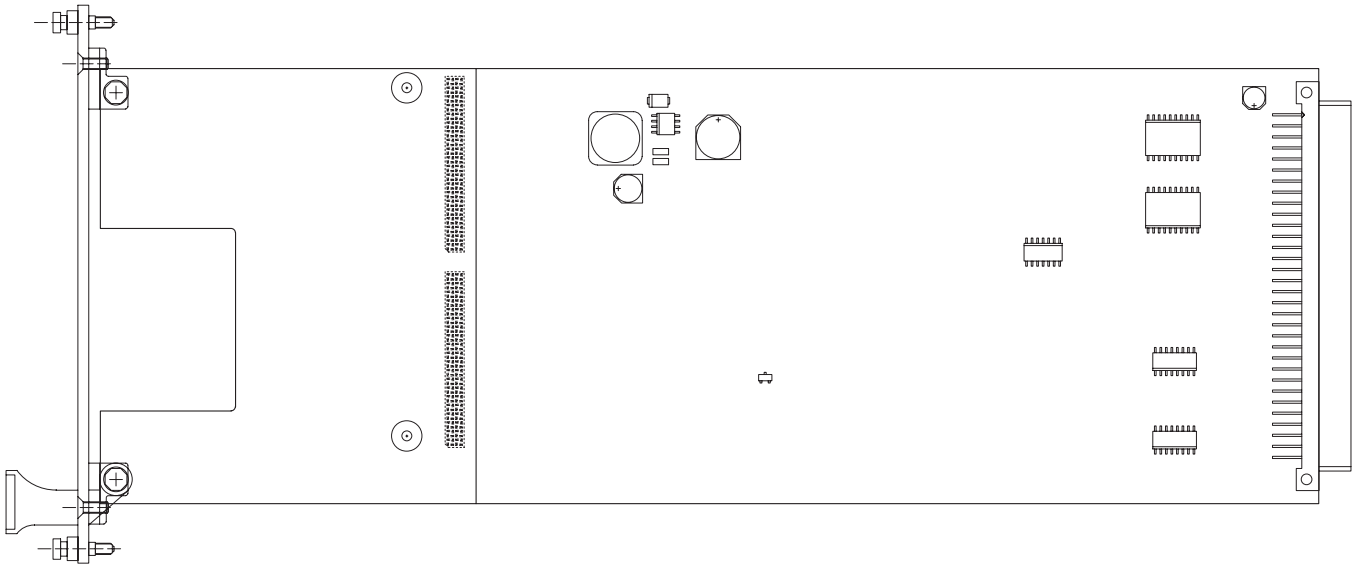
1	2	3	4	5	6	7	8	Number of Channels
OFF	OFF	OFF	OFF	-	-	-	-	**0 inputs** *(factory default)*
OFF	OFF	OFF	ON	-	-	-	-	**8 inputs**
OFF	OFF	ON	OFF	-	-	-	-	**16 inputs**
OFF	OFF	ON	ON	-	-	-	-	**24 inputs**
OFF	ON	OFF	OFF	-	-	-	-	**32 inputs**
OFF : ON	ON : ON	OFF : ON	ON : ON	- - -	- - -	- - -	- - -	***NOT ALLOWED***
-	-	-	-	OFF	OFF	OFF	OFF	**0 outputs**
-	-	-	-	OFF	OFF	OFF	ON	**8 outputs**
-	-	-	-	OFF	OFF	ON	OFF	**16 outputs**
-	-	-	-	OFF	OFF	ON	ON	**24 outputs**
-	-	-	-	OFF	ON	OFF	OFF	**32 outputs** *(factory default)*
- - -	- - -	- - -	- - -	OFF : ON	ON : ON	OFF : ON	ON : ON	***NOT ALLOWED***

6.3.9 Aviom A-Net® Card 1.949.446

This card allows implementing the head of an Aviom A-Net® Pro-16 chain. With this standard, 16 mono signals can be fed to an infinite number of Aviom personal mixers (such as the A-16 II) may be connected in a daisy chain configuration. The D21m A-Net® card will be the start of the chain and provide the audio and synchronization data to the chain. DIP switches on the front panel allow grouping two adjacent channels to one stereo channel, and generating a test tone.
This card works at sampling frequencies of 44.1 or 48 kHz only.

Current consumption (5 V)	250 mA
Operating temperature	0...40° C



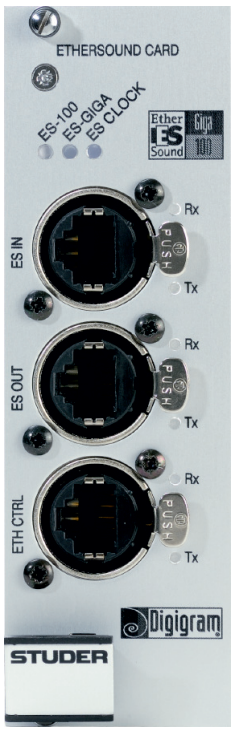


Front-Panel Switch:

Position	Setting
1	OFF: Channels 1 and 2 are mono *(factory default)* ON: Channels 1 and 2 are a stereo group
2	OFF: Channels 3 and 4 are mono *(factory default)* ON: Channels 3 and 4 are a stereo group
3	OFF: Channels 5 and 6 are mono *(factory default)* ON: Channels 5 and 6 are a stereo group
4	OFF: Channels 7 and 8 are mono *(factory default)* ON: Channels 7 and 8 are a stereo group
5	OFF: Channels 9 and 10 are mono *(factory default)* ON: Channels 9 and 10 are a stereo group
6	OFF: Channels 11 and 12 are mono *(factory default)* ON: Channels 11 and 12 are a stereo group
7	OFF: Channels 13 and 14 are mono *(factory default)* ON: Channels 13 and 14 are a stereo group
8	OFF: Channels 15 and 16 are mono *(factory default)* ON: Channels 15 and 16 are a stereo group
9	OFF: Test tone generator off *(factory default)* ON: Test tone generator on

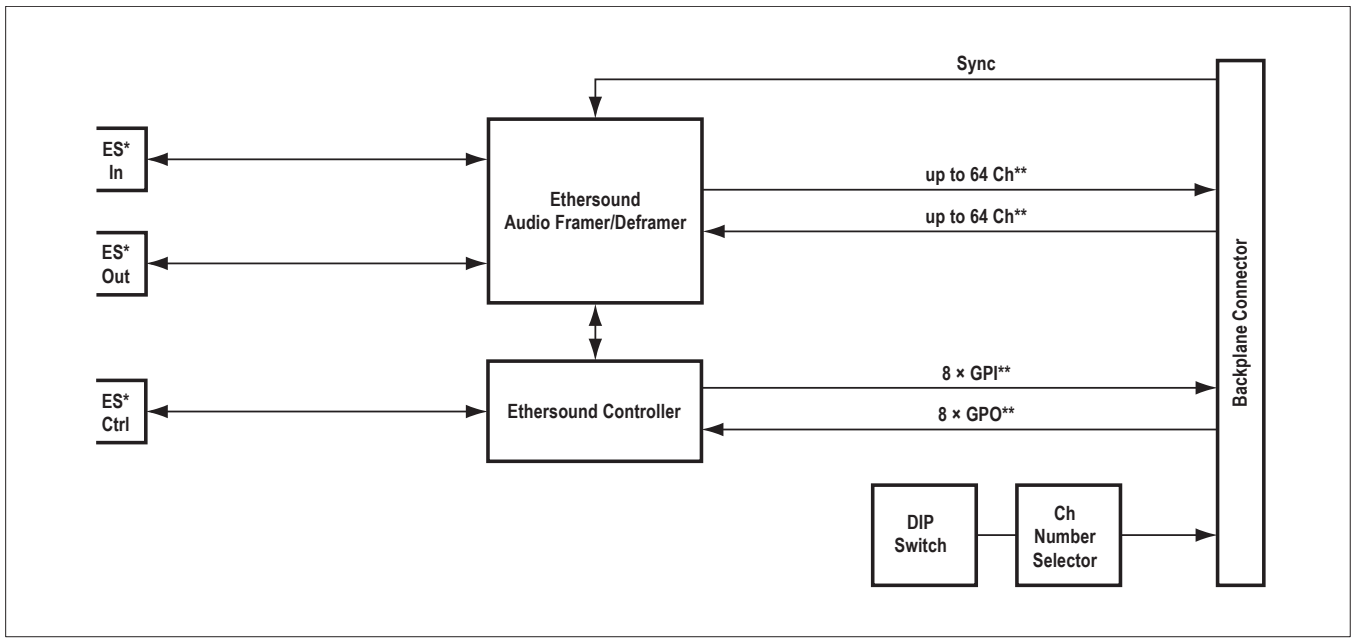
6.3.10 EtherSound® Card

(please contact www.digigram.com for further details)



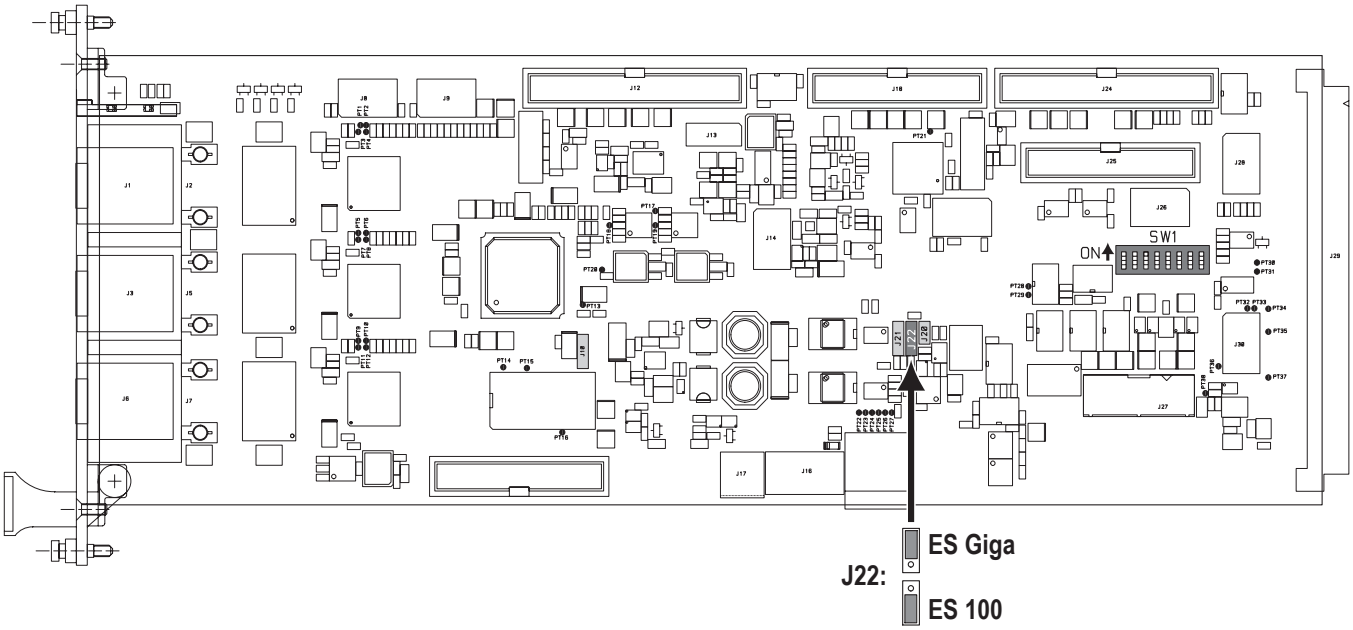
The EtherSound® card allows connecting the D21m I/O System to an EtherSound® network. Towards the D21m system, it acts similar to a MADI card combined with a GPIO card. The number of audio channels used can be configured with DIP switches. The included, virtual GPIO card allows, e.g., routing a GPO of the mixing console to the GPO of a distant EtherSound® device on the network. Configuration of the EtherSound® network is performed either through the ETH CTRL connector or from a remote location on the EtherSound® network, e.g. using the EtherSound® EScontrol software.
The EtherSound® card works with EtherSound® ES-Giga System Transport networks or with EtherSound® ES-100 Audio Transport networks. The operating mode of the card (ES-100 or ES-Giga) is selected by setting jumper J22 (see opposite page). The selected mode will be displayed on the front panel LEDs.
The audio clock of the EtherSound® network must be synchronous with the D21m I/O system's audio clock. This is ensured either by using the EtherSound® card as clock source of the EtherSound® network, or by feeding the device that is actually the EtherSound® network clock source with a word clock synchronous with the D21m I/O system's audio clock.
This card works at sampling frequencies of 44.1 or 48 kHz (88.2/96 kHz ready).

Current consumption (5 V) 750 mA max.
Operating temperature 0...40° C



* For more information on network topology and possible connections, please refer to the Ethersound documentation (www.ethersound.com).

** GPIs are GPOs on the Ethersound network, and vice versa. Audio outputs are audio inputs on the Ethersound network, and vice versa.



LEDs: **ES-100, ES-GIGA ES CLOCK**

Indicate the mode selected with jumper J22.

Green: The card is the clock source of the EtherSound® network.

Red *(only in case of a ring network topology):* The card was defined to be the clock source of the EtherSound® network, but it is not, due to a device or cable failure in the ring.

Flashing red *(only in case of a ring network topology)**:*** The card was not defined to be the clock source of the EtherSound® network, but it actually is, due to a device or cable failure in the ring located just next to the card.

Dark: The card is not the EtherSound® clock source.

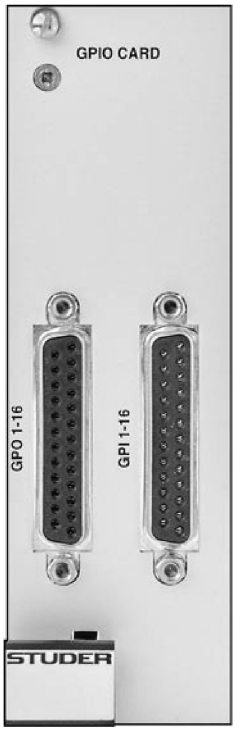
DIP Switch: **SW1**

DIP switch for D21m channel count setting:

1	2	3	4	5	6	7	8	Number of Channels
OFF	OFF	OFF	OFF	-	-	-	-	**0 inputs**
OFF	OFF	OFF	ON	-	-	-	-	**8 inputs**
OFF	OFF	ON	OFF	-	-	-	-	**16 inputs**
OFF	OFF	ON	ON	-	-	-	-	**24 inputs**
OFF	ON	OFF	OFF	-	-	-	-	**32 inputs**
OFF	ON	OFF	ON	-	-	-	-	**40 inputs**
OFF	ON	ON	OFF	-	-	-	-	**48 inputs**
OFF	ON	ON	ON	-	-	-	-	**56 inputs**
ON	OFF	OFF	OFF	-	-	-	-	**64 inputs** *(factory default)*
ON : ON	OFF : ON	OFF : ON	ON : ON	- - -	- - -	- - -	- - -	***NOT ALLOWED***
-	-	-	-	OFF	OFF	OFF	OFF	**0 outputs**
-	-	-	-	OFF	OFF	OFF	ON	**8 outputs**
-	-	-	-	OFF	OFF	ON	OFF	**16 outputs**
-	-	-	-	OFF	OFF	ON	ON	**24 outputs**
-	-	-	-	OFF	ON	OFF	OFF	**32 outputs**
-	-	-	-	OFF	ON	OFF	ON	**40 outputs**
-	-	-	-	OFF	ON	ON	OFF	**48 outputs**
-	-	-	-	OFF	ON	ON	ON	**56 outputs**
-	-	-	-	ON	OFF	OFF	OFF	**64 outputs** *(factory default)*
- - -	- - -	- - -	- - -	ON : ON	OFF : ON	OFF : ON	ON : ON	***NOT ALLOWED***

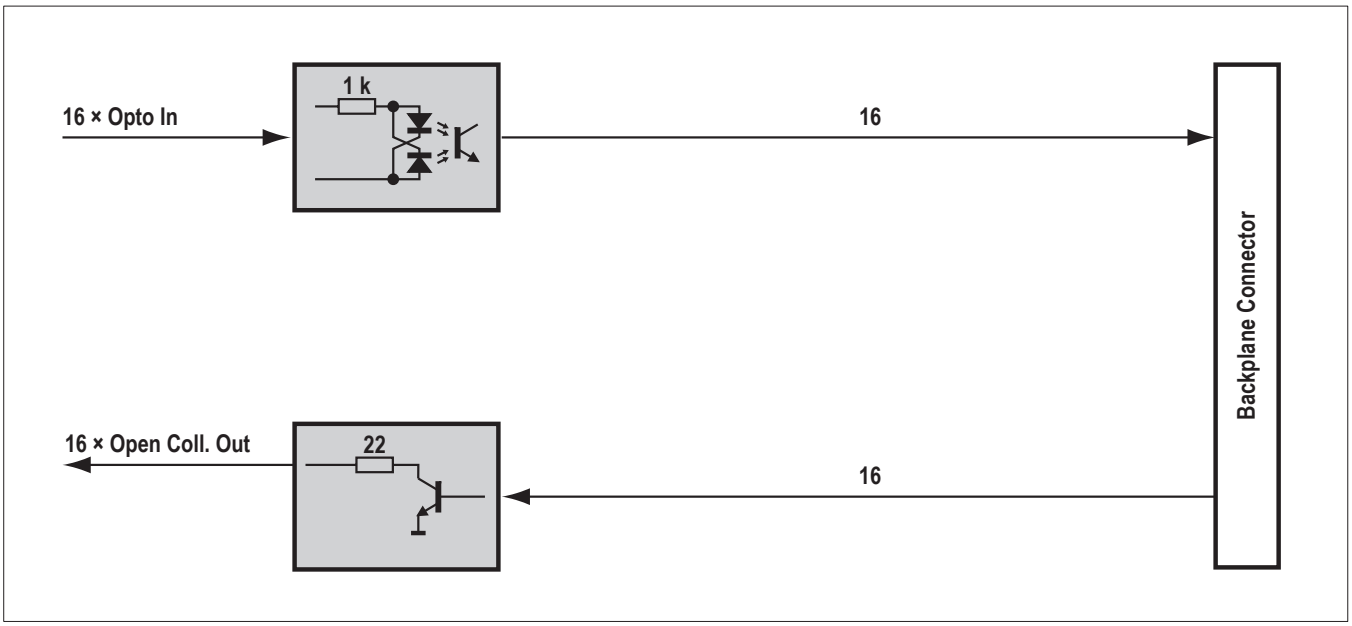
6.4 Non-Audio I/O Cards

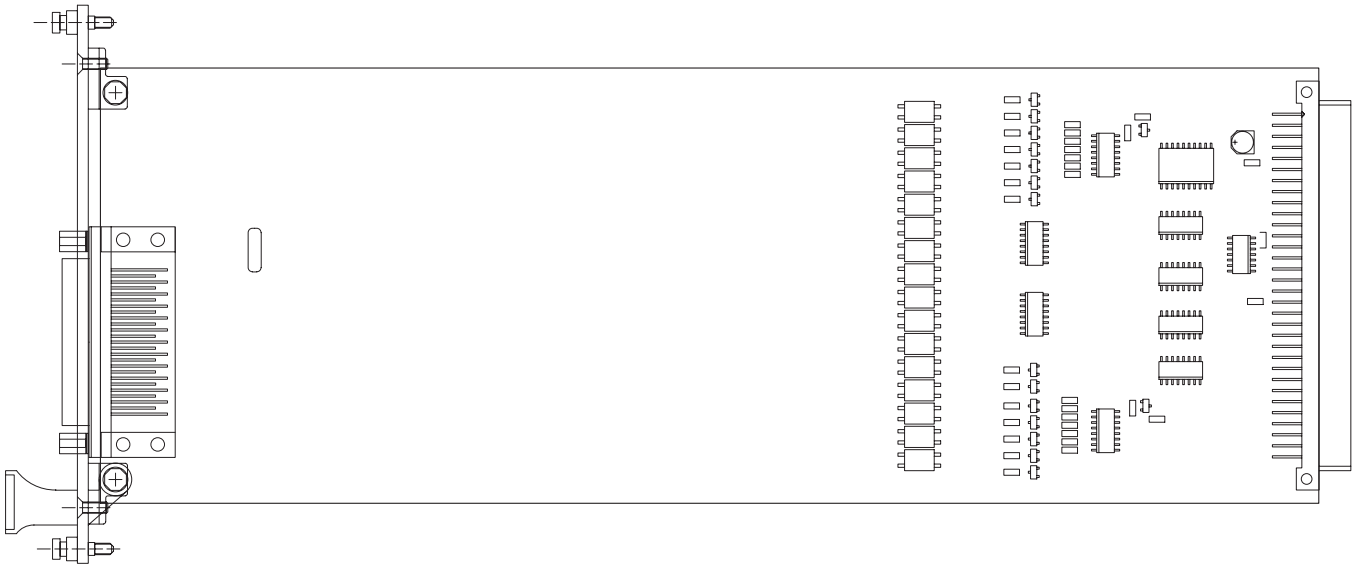
6.4.1 GPIO Card 1.949.435



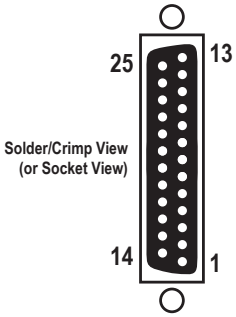
For general-purpose input/output control signals, this card provides 16 electrically isolated opto-coupler inputs (5...12 V_{DC}) and 16 open-collector outputs. 5 V_{DC} supply pins are available. Inputs and outputs on standard 25-pin D-type connectors (female).

Current consumption (5 V)	max. 0.65 A
Operating temperature	0...40° C





Connector Pin Assignment: (25-pin D-type, female)



Pin	Signal "GPI 1-16"	Signal "GPO 1-16"	Pin	Signal "GPI 1-16"	Signal "GPO 1-16"
1	GPI 1...4 common	GPO 1	14	GPI 11	GPO 14
2	GPI 1	GPO 2	15	GPI 12	GPO 15
3	GPI 2	GPO 3	16	GPI 13...16 common	GPO 16
4	GPI 3	GPO 4	17	GPI 13	GND (0 V)
5	GPI 4	GPO 5	18	GPI 14	GND (0 V)
6	GPI 5...8 common	GPO 6	19	GPI 15	GND (0 V)
7	GPI 5	GPO 7	20	GPI 16	GND (0 V)
8	GPI 6	GPO 8	21	GND (0 V)	GND (0 V)
9	GPI 7	GPO 9	22	V_{CC} (+5 V) *	V_{CC} (+5 V) *
10	GPI 8	GPO 10	23	V_{CC} (+5 V) *	V_{CC} (+5 V) *
11	GPI 9...12 common	GPO 11	24	V_{CC} (+5 V) *	V_{CC} (+5 V) *
12	GPI 9	GPO 12	25	V_{CC} (+5 V) *	V_{CC} (+5 V) *
13	GPI 10	GPO 13	*** 650 mA max. total**		

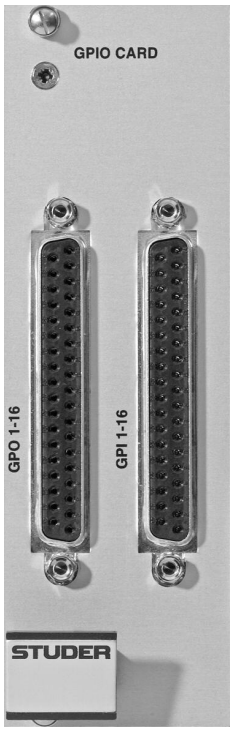
Application:

Inputs Control inputs can be used either with the internal +5 V_{DC} supply voltage, or with external voltages (5...12 V_{DC}), regardless of the polarity. For higher voltages (48 V max.), appropriate series resistors *must* be used, see table below. Please note that the control inputs are arranged in groups of four, each group having one of the control connections in common. Total current supplied by all +5 V_{DC} pins of one card *must not* exceed 650 mA.

Input Voltage	Series Resistor
24 V_{DC}	2.2 kΩ min.
36 V_{DC}	3.3 kΩ min.
48 V_{DC}	4.7 kΩ min.

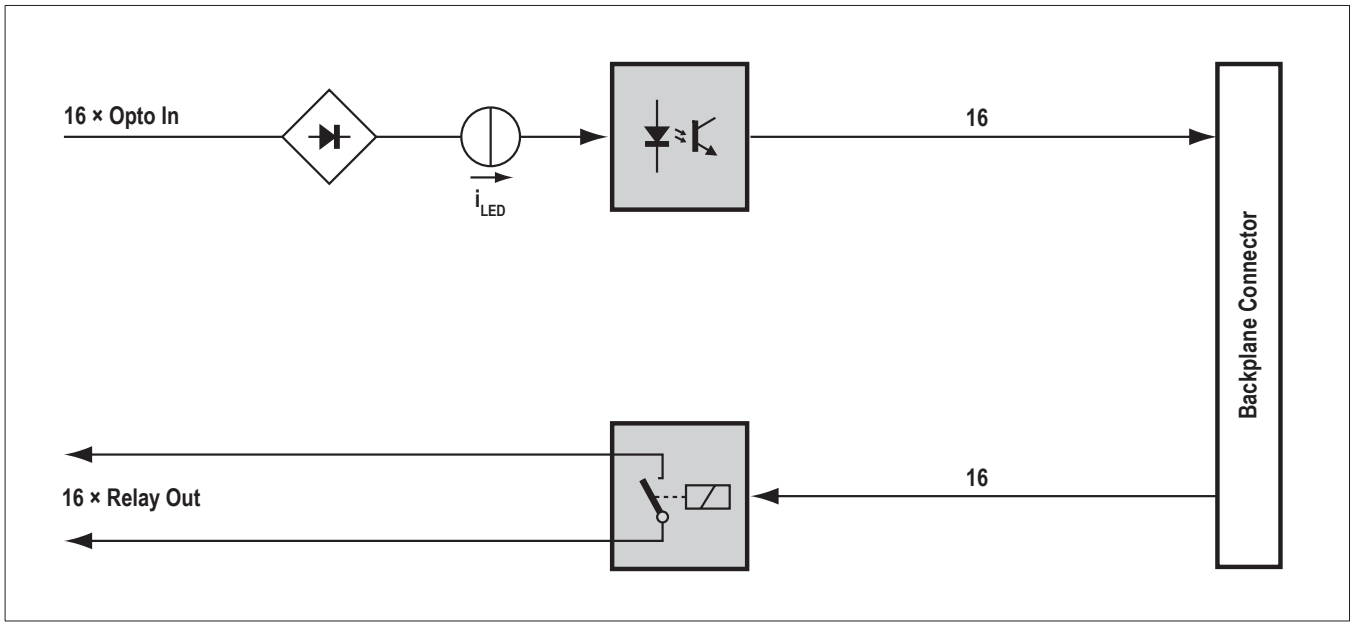
Outputs Control outputs are open-collector outputs pulling to GND if active. For activating e.g. relays or LEDs, either the internal +5 V_{DC} supply voltage or external voltages of up to 24 V_{DC} may be used. Output current *must not* exceed 50 mA per output. Please make sure to use appropriate series resistors if necessary. Total current supplied by all +5 V_{DC} pins of one card *must not* exceed 650 mA.

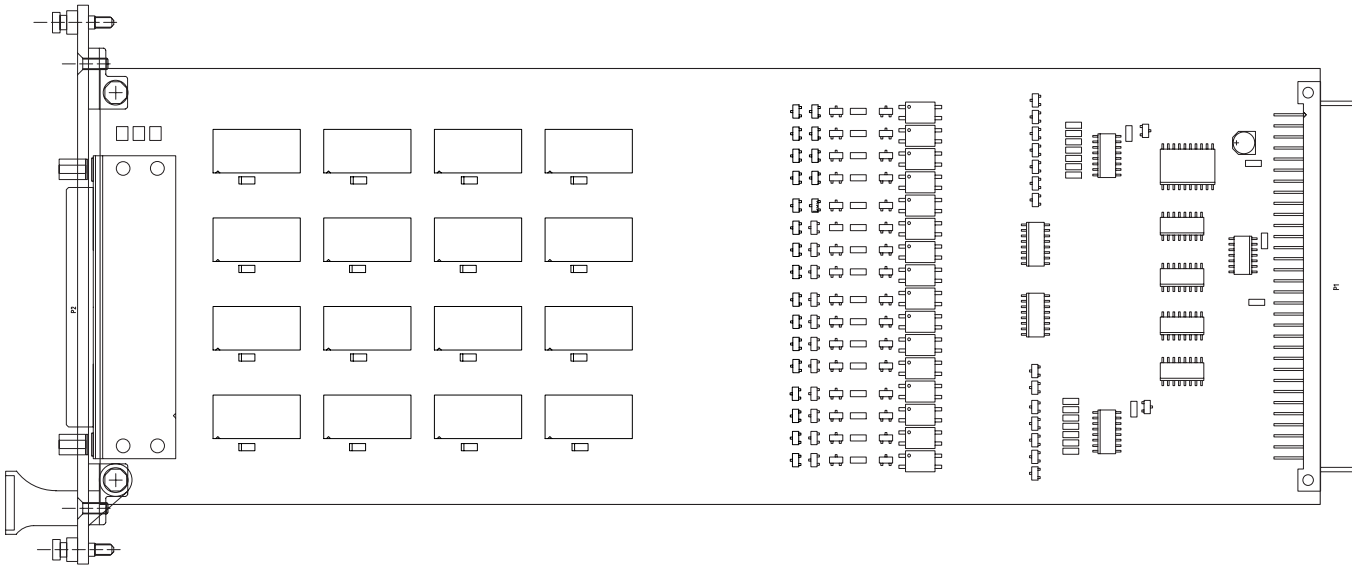
6.4.2 GPIO Card with Relay Outputs 1.949.436



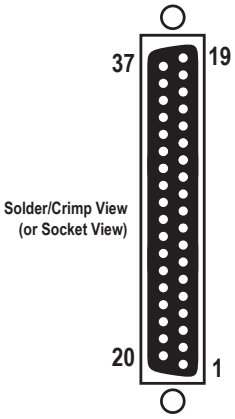
For general-purpose applications requiring total electrical isolation, this card provides 16 electrically isolated opto-coupler inputs with integrated current sink (5...24 V_{DC}) and 16 electrically isolated outputs using SPST relay contacts. 5 V_{DC} supply pins are available. Inputs and outputs on standard 37-pin D-type connectors (female).

Current consumption (5 V)	0.8 A max. (earlier version: 1.1 A max.)
Operating temperature	0...40° C
Output contact rating	0.5 A/125 V_{AC}; 0.7 A/30 V_{DC}; 0.3 A/100 V_{DC}





Connector Pin Assignment: (37-pin D-type, female)



Pin	Signal "GPI 1-16"	Signal "GPO 1-16"	Pin	Signal "GPI 1-16"	Signal "GPO 1-16"
1	GPI 1a	GPO 1a	20	GPI 1b	GPO 1b
2	GPI 2a	GPO 2a	21	GPI 2b	GPO 2b
3	GPI 3a	GPO 3a	22	GPI 3b	GPO 3b
4	GPI 4a	GPO 4a	23	GPI 4b	GPO 4b
5	GPI 5a	GPO 5a	24	GPI 5b	GPO 5b
6	GPI 6a	GPO 6a	25	GPI 6b	GPO 6b
7	GPI 7a	GPO 7a	26	GPI 7b	GPO 7b
8	GPI 8a	GPO 8a	27	GPI 8b	GPO 8b
9	GPI 9a	GPO 9a	28	GPI 9b	GPO 9b
10	GPI 10a	GPO 10a	29	GPI 10b	GPO 10b
11	GPI 11a	GPO 11a	30	GPI 11b	GPO 11b
12	GPI 12a	GPO 12a	31	GPI 12b	GPO 12b
13	GPI 13a	GPO 13a	32	GPI 13b	GPO 13b
14	GPI 14a	GPO 14a	33	GPI 14b	GPO 14b
15	GPI 15a	GPO 15a	34	GPI 15b	GPO 15b
16	GPI 16a	GPO 16a	35	GPI 16b	GPO 16b
17	GND (0 V)	GND (0 V)	36	V_{CC} (+5 V) *	V_{CC} (+5 V) *
18	GND (0 V)	GND (0 V)	37	V_{CC} (+5 V) *	V_{CC} (+5 V) *
19	GND (0 V)	GND (0 V)	** 600 mA max. total*		

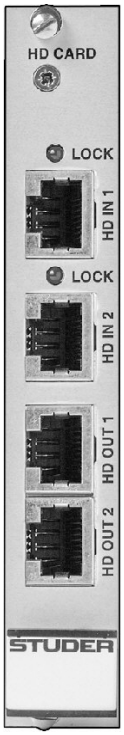
Application:

Inputs Control inputs (GPI Xa/b) are completely independent and electrically isolated. They may be used either with the internal +5 V_{DC} supply voltage, or with external voltages of 5...24 V_{DC}, regardless of the polarity. Total current supplied by all +5 V_{DC} pins of one card *must not* exceed 600 mA.

Outputs Control outputs (GPO Xa/b) are completely independent, electrically isolated relay contacts, closed if active. Contact rating is 0.5 A for 125 V_{AC}, 0.7 A for 30 V_{DC}, or 0.3 A for 100 V_{DC}. The +5 V_{DC} supply voltage or the ground (GND) terminals, together with the relay contacts, may be used to generate an output signal. Total current supplied by all +5 V_{DC} pins of one card *must not* exceed 600 mA.

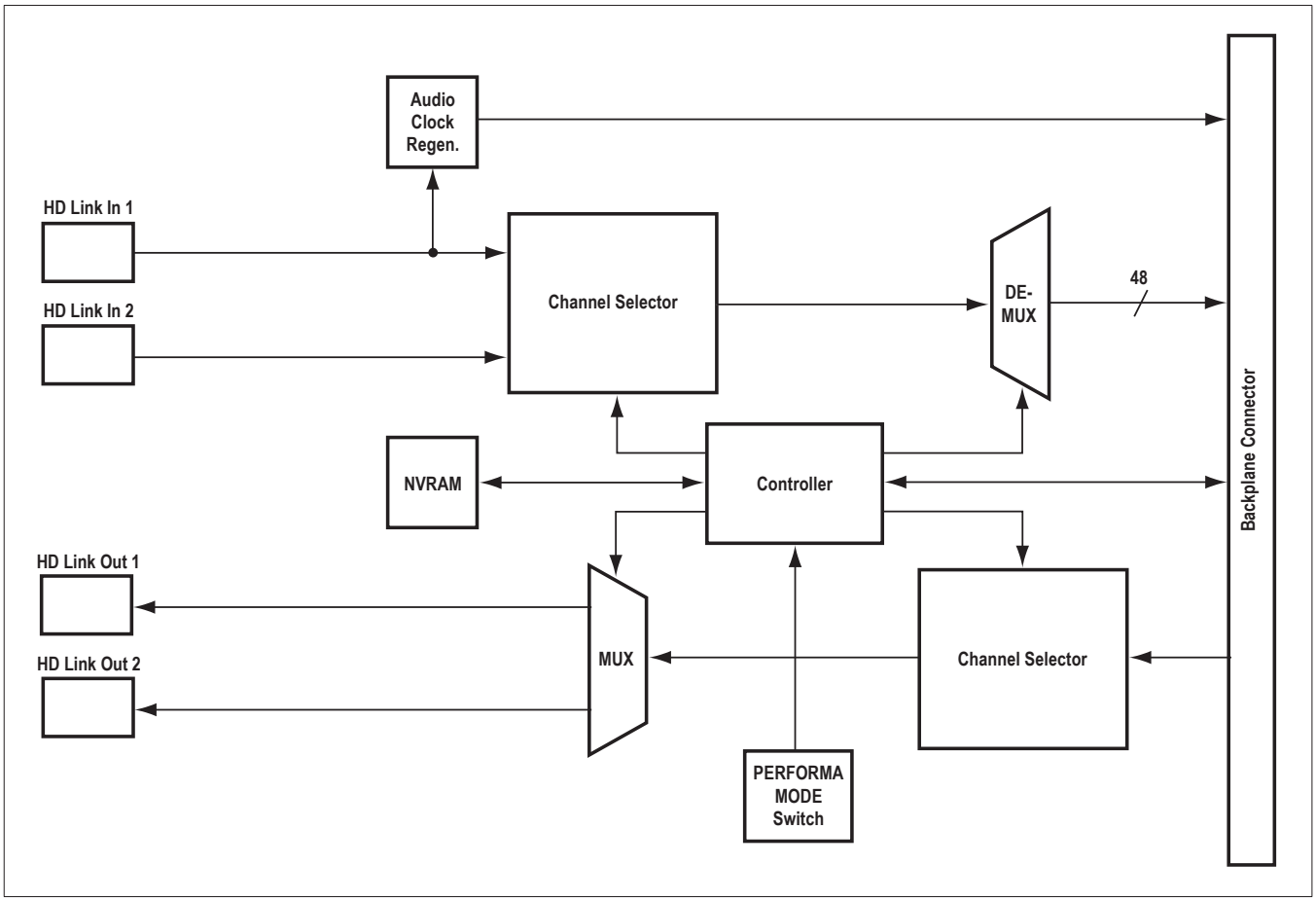
6.5 HD Cards

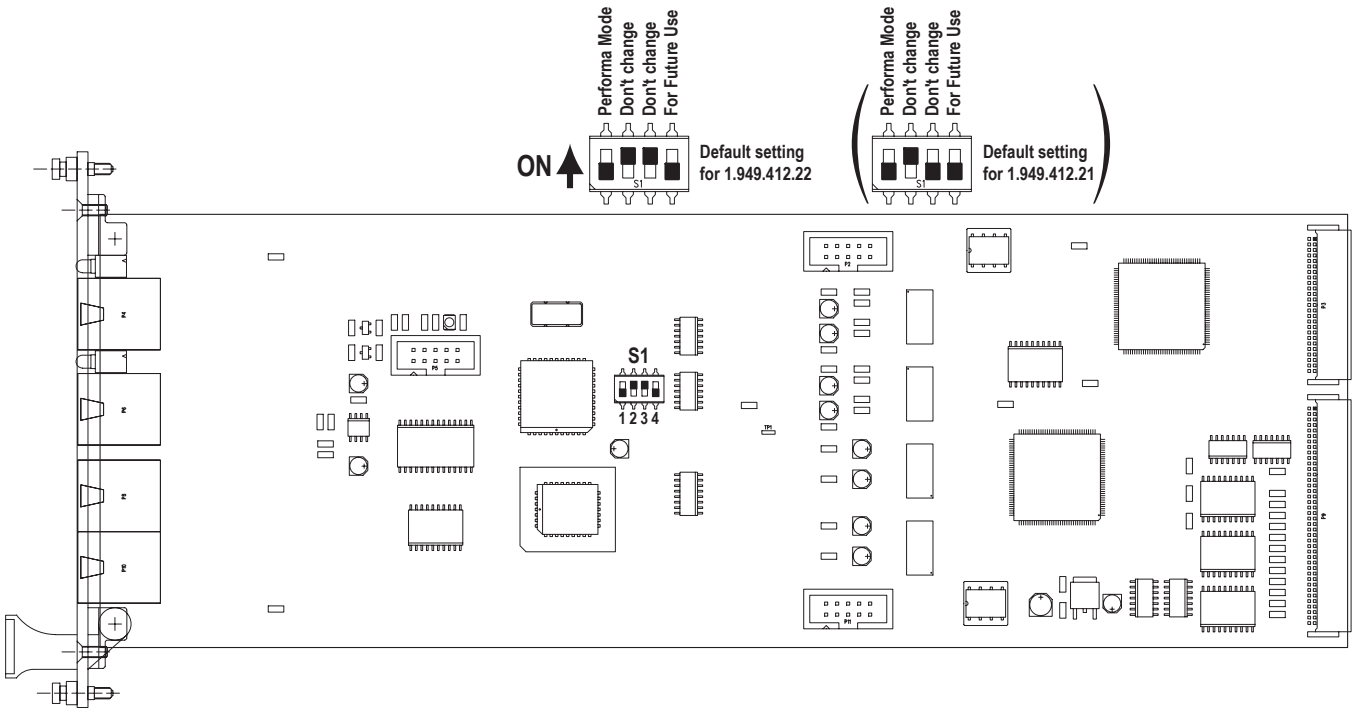
6.5.1 HD Card S 1.949.412



The D21m HD card S provides the link to the DSP core systems. Each input and output can handle up to 96 channels in each supported sampling frequency (in combination with the Performa core, the number of I/O channels is restricted to 48). The system clock used is taken from the host DSP system, so no extra synchronization is needed.
The card detects all other I/O cards that are inserted into the D21m system and displays their presence on the front panel of the frame. Once all audio interface cards are plugged in, pressing the **RECONFIG** key on the front panel confirms the configuration to the system. Then all cards are activated and their audio signals are fed into the HD link.

Host link interface cable type	CAT-5 UTP Cable
Cable length	up to 10 m
Connector	RJ-45
Capacity of one CAT-5 connection	96 channels
Current consumption (3.3 V)	approx. 600 mA
(5.0 V)	<50 mA
Operating temperature	0...40° C



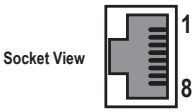


LEDs: On if a valid signal is available at the input that is locked to the system clock.

DIP switch: When using the Performa core, only 48 channels can be transmitted from the core to the D21m system. In order not to lose audio data, the channel selector of the HD card S has to be configured to this mode by setting switch #1 of DIP switch S1 to the ON position.
The other three switches #2...4 have to remain in their default positions and must not be changed.

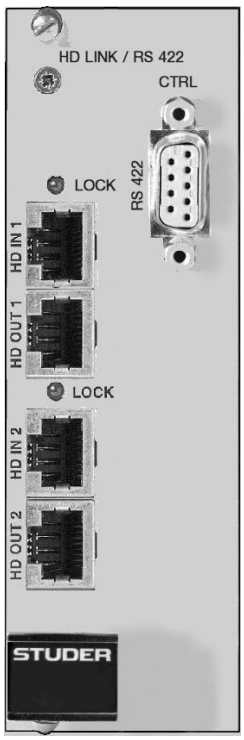
Note: The default settings for the card versions 1.949.412.21 and 1.949.412.22 are different, as shown in the diagram above.

Connector Pin Assignment: (8-pin RJ45)



Pin	Signal (Input)	Signal (Output)
1	Rx 0 +	Tx 0 +
2	Rx 0 –	Tx 0 –
3	Rx 1 +	Tx 1 +
4	Rx Clk +	Tx Clk +
5	Rx Clk –	Tx Clk –
6	Rx 1 –	Tx 1 –
7	Rx 2 +	Tx 2 +
8	Rx 2 –	Tx 2 –

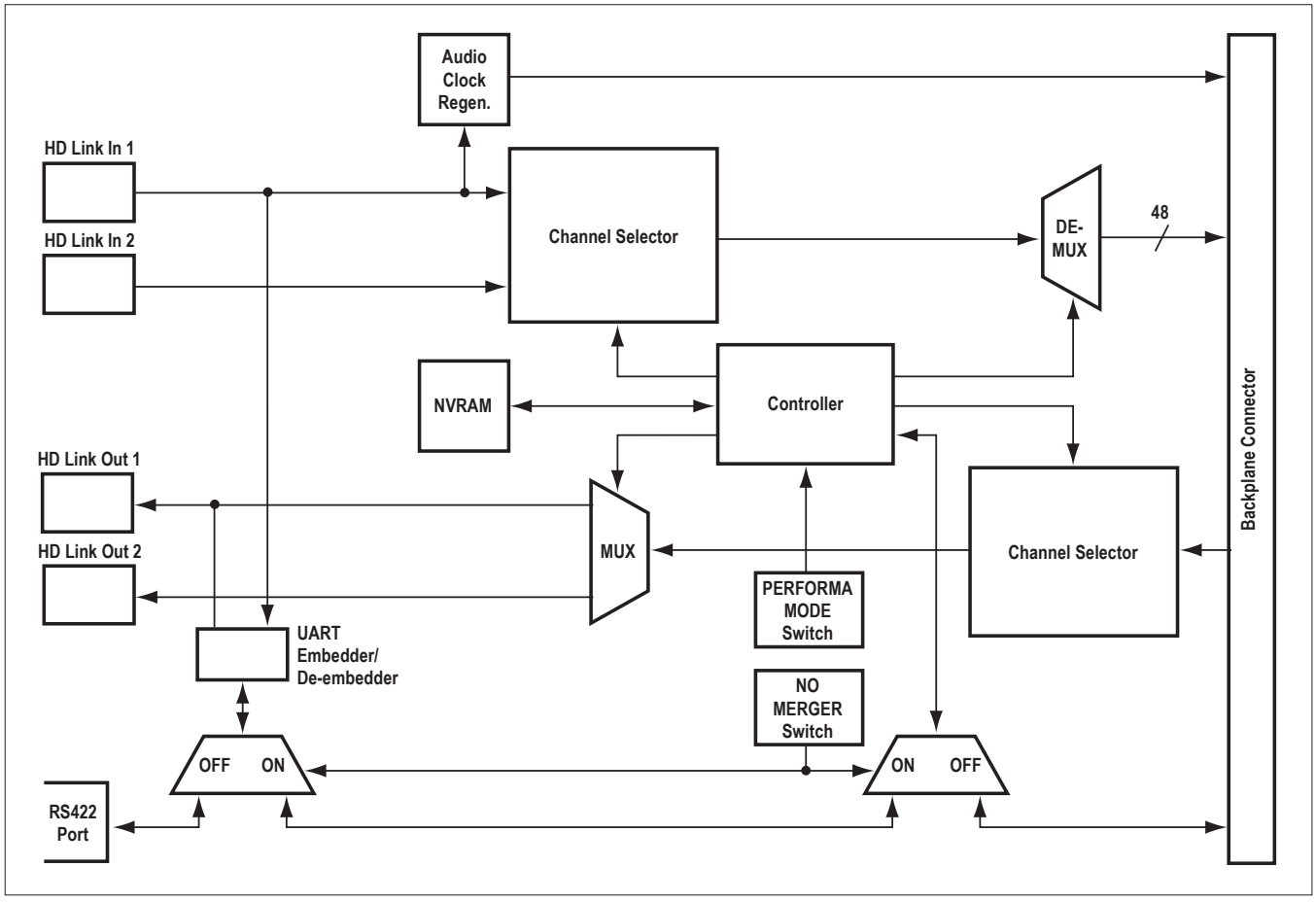
6.5.2 HD RS422 Card 1.949.415

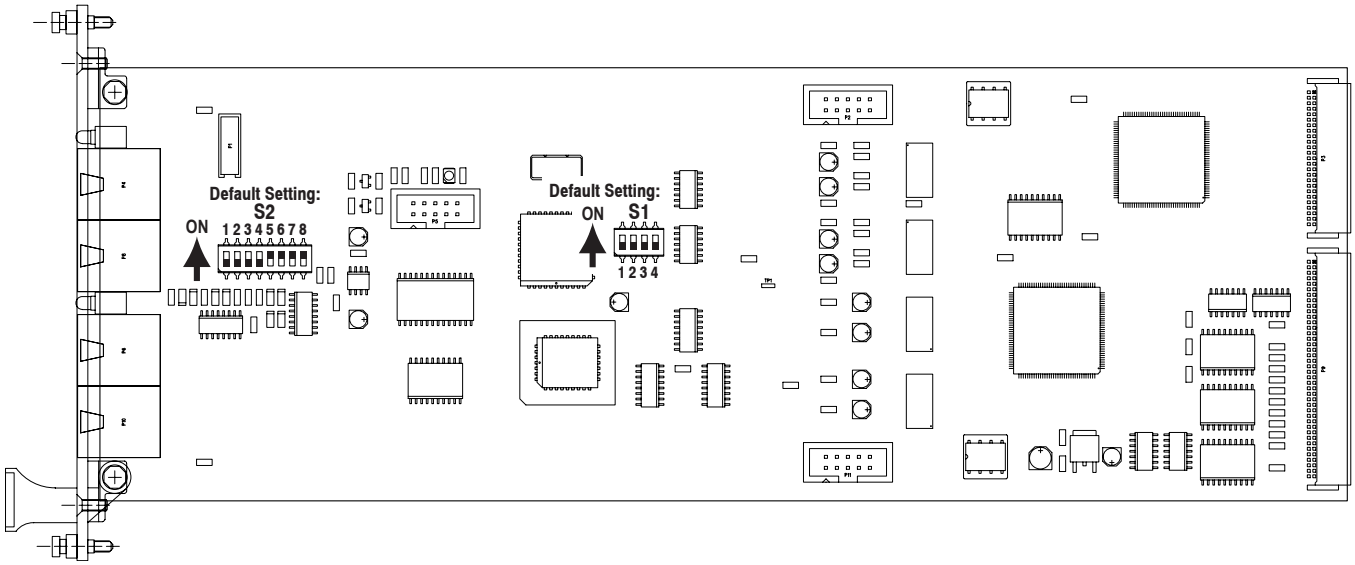


HD: The D21m HD RS422 card provides the link to the DSP core systems. Each input and output can handle up to 96 channels in each supported sampling frequency (in combination with the Performa core, the number of I/O channels is restricted to 48). The system clock used is taken from the host DSP system, so no extra synchronization is needed.
The card detects all other I/O cards that are inserted into the D21m system and displays their presence on the front panel of the frame. Once all audio interface cards are plugged in, pressing the **RECONFIG** key on the front panel confirms the configuration to the system. Then all cards are activated and their audio signals are fed into the HD link.

RS422: RS422 serial control data from the HD link may be transmitted either to the card's RS422 port (then, the controller is connected to the backplane for use with merger), or to the controller (then the RS422 port is deactivated); selection is done with a DIP switch.
The pinout of the RS422 connector can be set to "device" or "controller" with a DIP switch, depending on the 3rd-party serial device connected.

Host link interface cable type	CAT-5 UTP Cable
Cable length	up to 10 m
Connector	RJ-45
Capacity of one CAT-5 connection	96 channels
Max. RS422 cable length	1000 m
Current consumption (3.3 V)	approx. 600 mA
(5.0 V)	<50 mA
Operating temperature	0...40° C





LEDs: **LOCK** On if a valid signal is available at the input that is locked to the system clock.

DIP Switches: **S1**

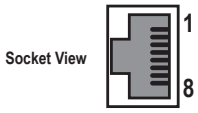
Switch	Setting
1	OFF: Standard mode, 96 channels on each HD IN *(factory default)* ON: Performa mode, 48 channels on each HD IN
2	OFF: Control data is passed from HD link to RS422 port *(factory default);* controller connected to backplane, for use with merger ON: Control data is passed from HD link to controller; RS422 port inactive
3 4	reserved *(factory default: OFF)*

S2

1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	**RS422 controller pinout** *(factory default)*
ON	ON	ON	ON	OFF	OFF	OFF	OFF	**RS422 device pinout**
NO OTHER SETTINGS ALLOWED!								

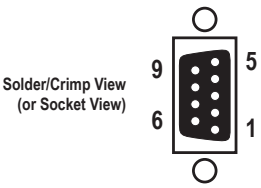
Connector Pin Assignments:

HD LINK (8-pin RJ45)



Pin	Signal (Input)	Signal (Output)
1	Rx 0 +	Tx 0 +
2	Rx 0 –	Tx 0 –
3	Rx 1 +	Tx 1 +
4	Rx Clk +	Tx Clk +
5	Rx Clk –	Tx Clk –
6	Rx 1 –	Tx 1 –
7	Rx 2 +	Tx 2 +
8	Rx 2 –	Tx 2 –

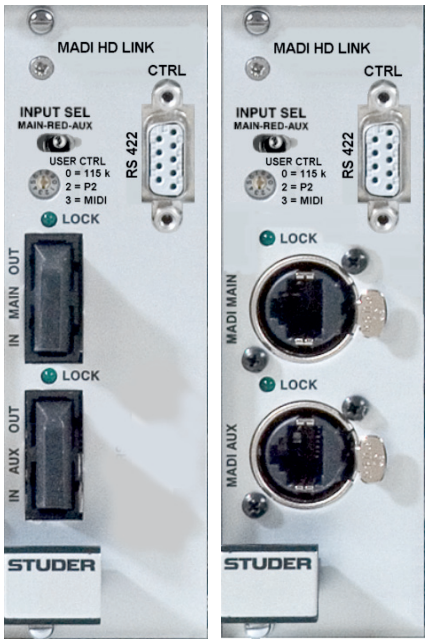
RS422 (9-pin D-type, female)



Pin	RS422 Controller	RS422 Device
1	Chassis	Chassis
2	RxD –	TxD –
3	TxD +	RxD +
4	GND	GND
5	n.c.	n.c.
6	GND	GND
7	RxD +	TxD +
8	TxD –	RxD –
9	Chassis	Chassis

6.5.3 MADI HD Cards

1.949.411, 1.949.413, 1.949.414



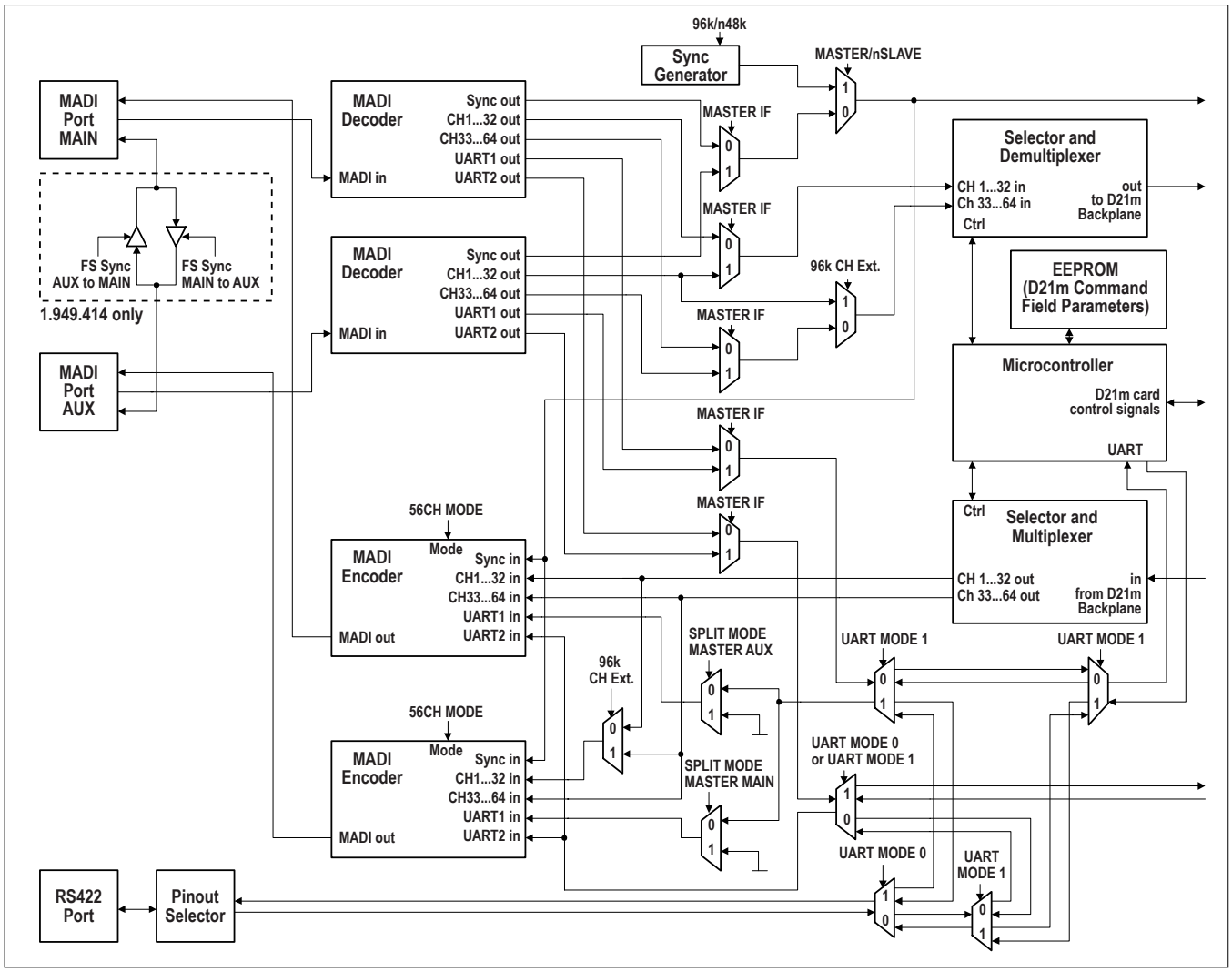
Please note: *Starting with order nos. 1.949.411.24 and 1.949.413.23, resp., the MADI HD cards have been equipped with the larger dual-slot front panel containing an additional RS422 control connector (left picture). At the same time the MADI HD card with RJ45 connectors (1.949.414) was introduced (right picture).*

The D21m MADI HD card is plugged into an HD card slot in the remote I/O box and provides the link to the hub frame. The two interfaces offer up to 64 audio channels with 44.1/48/88.2/96 kHz operation, together with embedded control and user-accessible serial connection in each direction.

The auxiliary interface can be used as a redundant link or, in 88.2/96 kHz operation, to extend the number of channels from 32 back to 64.

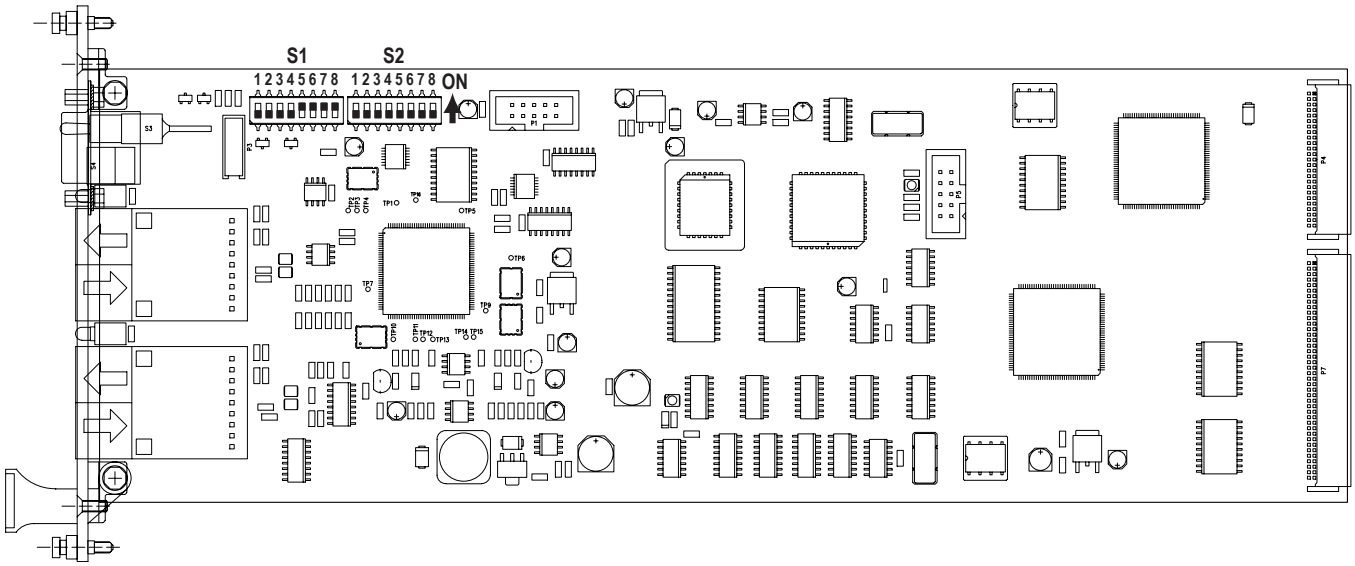
In slave mode, the card extracts the system clock from the incoming MADI signals and provides it to the entire remote I/O box. It detects all other I/O cards that are inserted into the D21m system and displays their presence on the front panel of the frame. Once all audio interface cards are plugged in, pressing the **RECONFIG** key on the front panel confirms the configuration to the system. Then all cards are activated and their audio signals are fed into the MADI link.

The card can also be switched to master mode; it then runs with an internal 48 or 96 kHz reference.

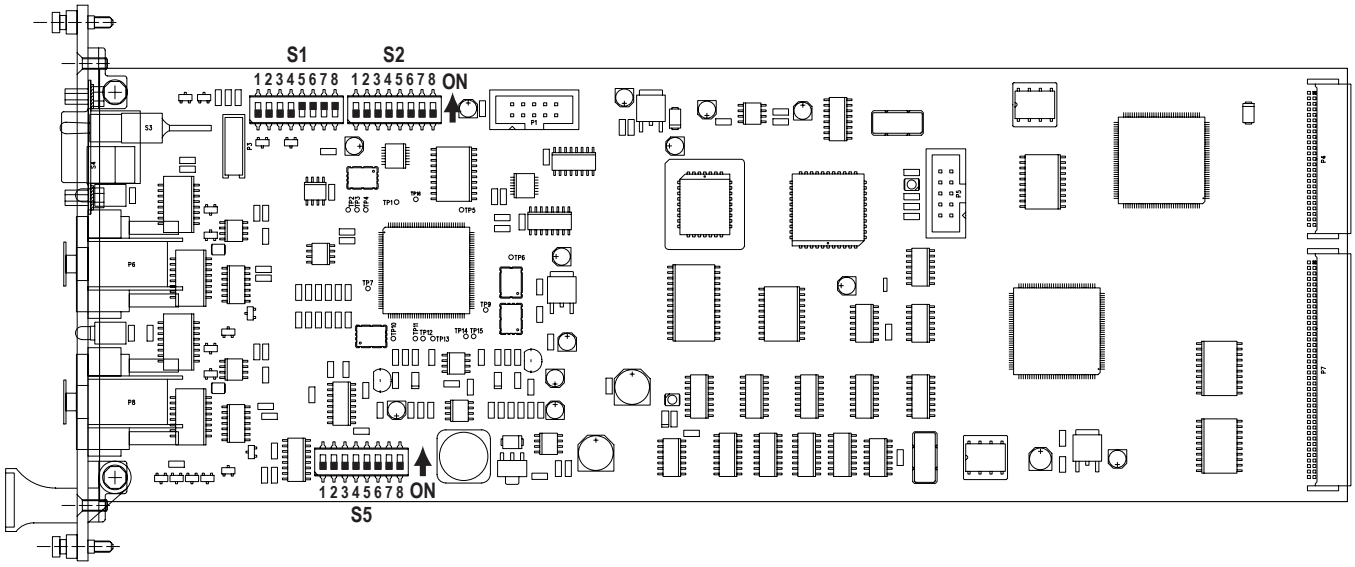


Cable length	1.949.411, multi-mode fibre	<2 km
	1.949.413, single-mode fibre	<15 km (<40 km on request)
	1.949.414, CAT5e or better, flexible braid	<75 m
	CAT7, solid core	<120 m
Input frequencies		44.1/48/88.2/96 kHz ±100 ppm
Current consumption	(3.3 V/5 V)	0.9 A/0.25 A
Operating temperature		0...40° C

1.949.411, 1.949.413:



1.949.414:



LEDs: On if a valid MADI signal is present at the input.

Switches: **S1** DIP switch for pinout selection of the front-panel RS422 connector:

1	2	3	4	5	6	7	8	
ON	ON	ON	ON	OFF	OFF	OFF	OFF	**Device pinout**
OFF	OFF	OFF	OFF	ON	ON	ON	ON	**Controller pinout** *(factory default)*
NO OTHER SETTINGS ALLOWED!								

S2 DIP switch for MADI setting:

Switch	Setting		
1	OFF: AUX is used as redundant port at 88.2 / 96 kHz *(factory default)* ON: AUX is used as CH33...64 at 88.2 / 96 kHz		
2	OFF: 64 MADI channels *(factory default)* ON: 56 MADI channels (standard setting for legacy products)		
3, 4	3	4	
	OFF	OFF	MADI1 – Microcontroller / MADI 2 – Front connector *(factory default)*
	ON	OFF	MADI1 – Microcontroller / MADI 2 – Backplane
	OFF	ON	Microcontroller – Front connector / MADI 2 – Backplane
	ON	ON	MADI1 – Front connector / MADI 2 – Backplane
			[Block diagram: UART MODE 1]
			[Block diagram: UART MODE 0]
5	OFF: Slave – clock from MADI signal *(factory default)* [Block diagram: MASTER/nSLAVE = 0]		
	ON: Master – clock from local generator [Block diagram: MASTER/nSLAVE = 1]		
6	OFF: Master mode sampling frequency 48 kHz *(factory default)* [Block diagram: 96k/n48k = 0]		
	ON: Master mode sampling frequency 96 kHz [Block diagram: 96k/n48k = 1]		
7, 8	reserved *(factory default: OFF)*		

S3 3-position toggle switch for input selection (MAIN / REDundant / AUX).
MAIN: MADI input is forced to MAIN port (split mode master AUX = 0)
RED: MADI input is used from either MAIN or AUX port
AUX: MADI input is forced to AUX Port (split mode master MAIN = 1).

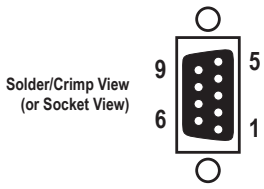
S4 Rotary switch for baud rate selection of the MADI 2 link:

Position	Setting
0	115'200 bps *(factory default)*
1	57'600 bps
2	38'400 bps (9-pin)
3	31'250 bps (MIDI)
4	19'200 bps
5	9'600 bps
6...9	Reserved for future use

S5 DIP switch for FS Sync forward selection *(1.949.414 only)*:

1	2	3	4	5	6	7	8	
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	No forward *(factory default)*
ON	ON	ON	ON	OFF	OFF	OFF	OFF	Main to AUX
OFF	OFF	OFF	OFF	ON	ON	ON	ON	AUX to Main
NO OTHER SETTINGS ALLOWED!								

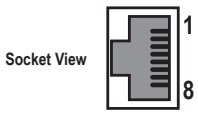
Connector Pin Assignments:



RS422 (9-pin D-type, female)

Pin	RS422 Controller	RS422 Device
1	Chassis	Chassis
2	RxD –	TxD –
3	TxD +	RxD +
4	GND	GND
5	n.c.	n.c.
6	GND	GND
7	RxD +	TxD +
8	TxD –	RxD –
9	Chassis	Chassis

MADI MAIN / MADI AUX (8-pin RJ45)
(on twisted-pair cable version 1.949.414 only)



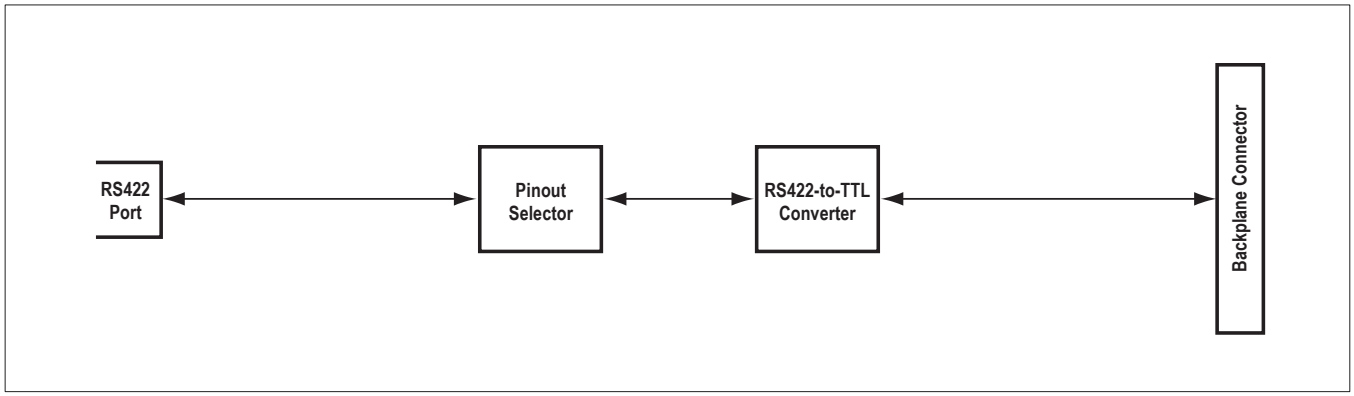
Pin	Signal
1	MADI RxD +
2	MADI RxD –
3	MADI TxD +
4	WCLK TxD/RxD +
5	WCLK TxD/RxD –
6	MADI TxD –
7	reserved
8	reserved

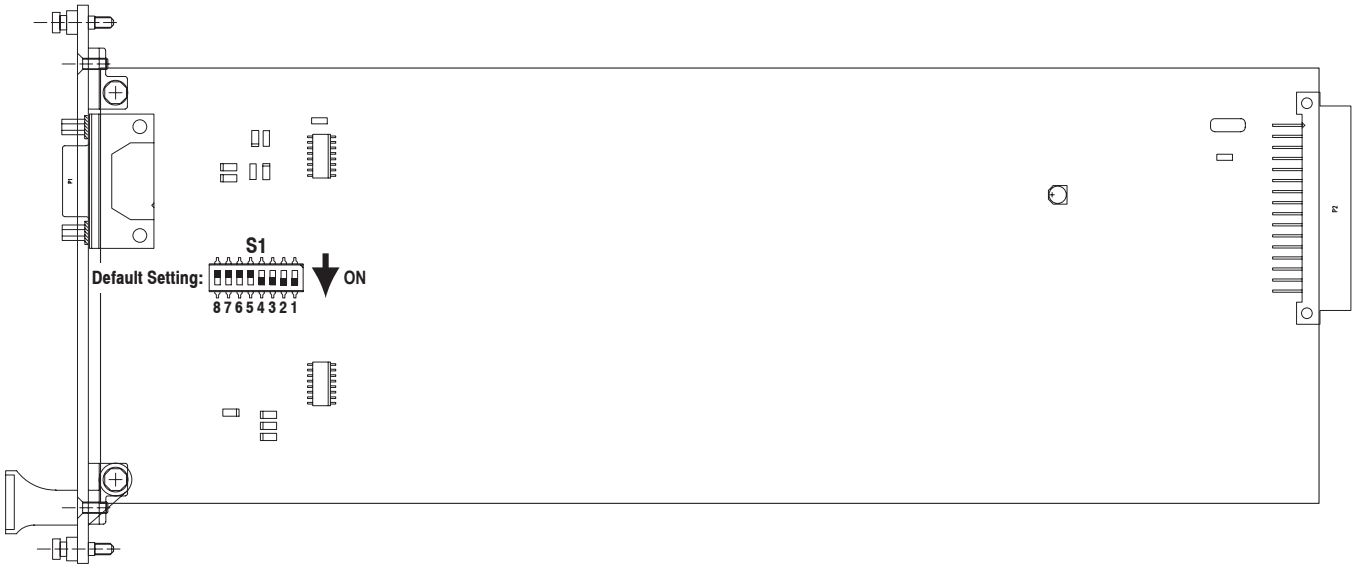
6.6 Serial/Merger Cards

6.6.1 Serial Card 1.949.437

It is possible to transmit any RS422 serial signals, such as MIDI or Sony 9-pin (machine control) through a MADI connection without losing any audio channels or microphone control of the remote I/O box.
A 9-pin D-type connector can be found on the MADI I/O card (hub frame side) as well as on the serial card of the remote I/O frame. This card is located between slot 12 and the power supplies. The required baud rate is set on the MADI HD card with a rotary switch.
The pinout of the RS422 connector can be set to "device" or "controller" with a DIP switch, depending on the 3rd-party serial device connected.

Max. RS422 cable length	1000 m
Current consumption (5 V)	20 mA
Operating temperature	0...40° C

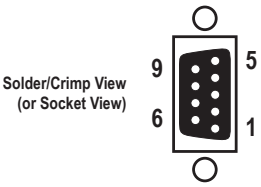




DIP Switch: S1, DIP switch for RS422 pinout selection:

1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	**RS422 Controller pinout**
ON	ON	ON	ON	OFF	OFF	OFF	OFF	**RS422 Device pinout** *(factory default)*
NO OTHER SETTINGS ALLOWED!								

Connector Pin Assignment: (9-pin D-type, female)

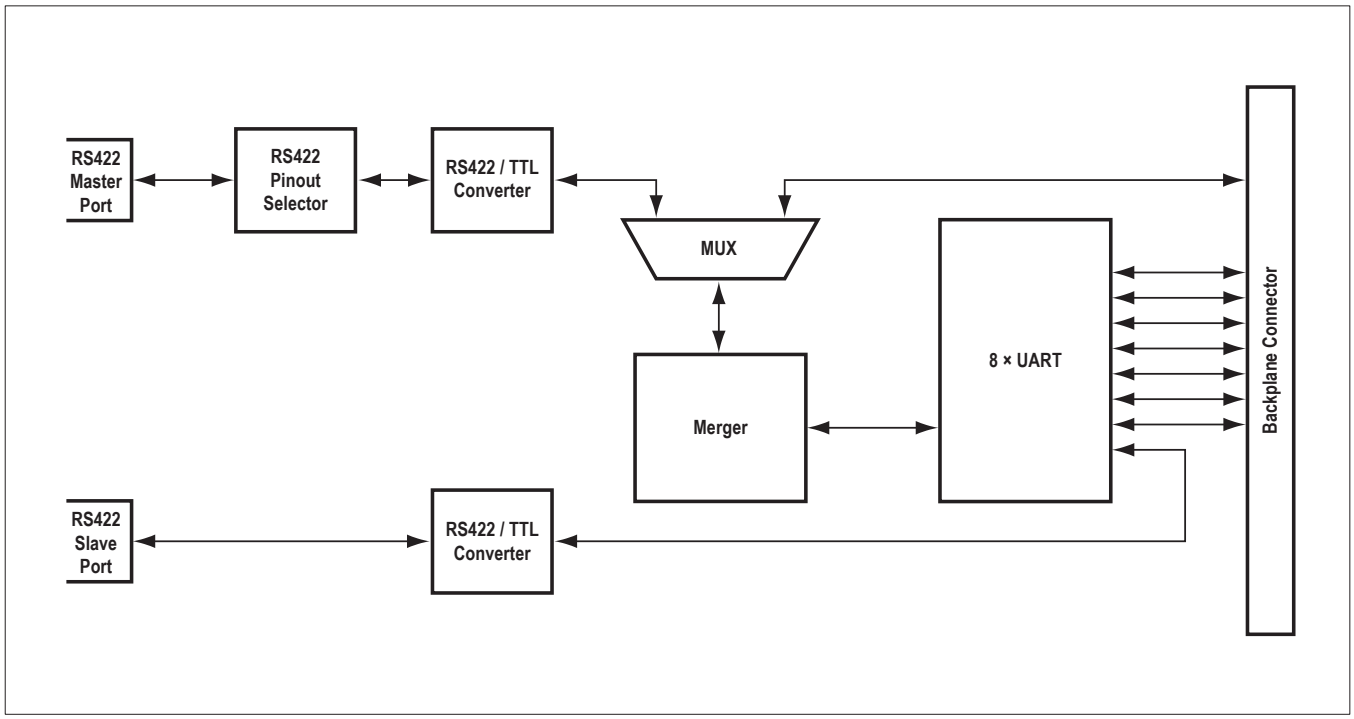


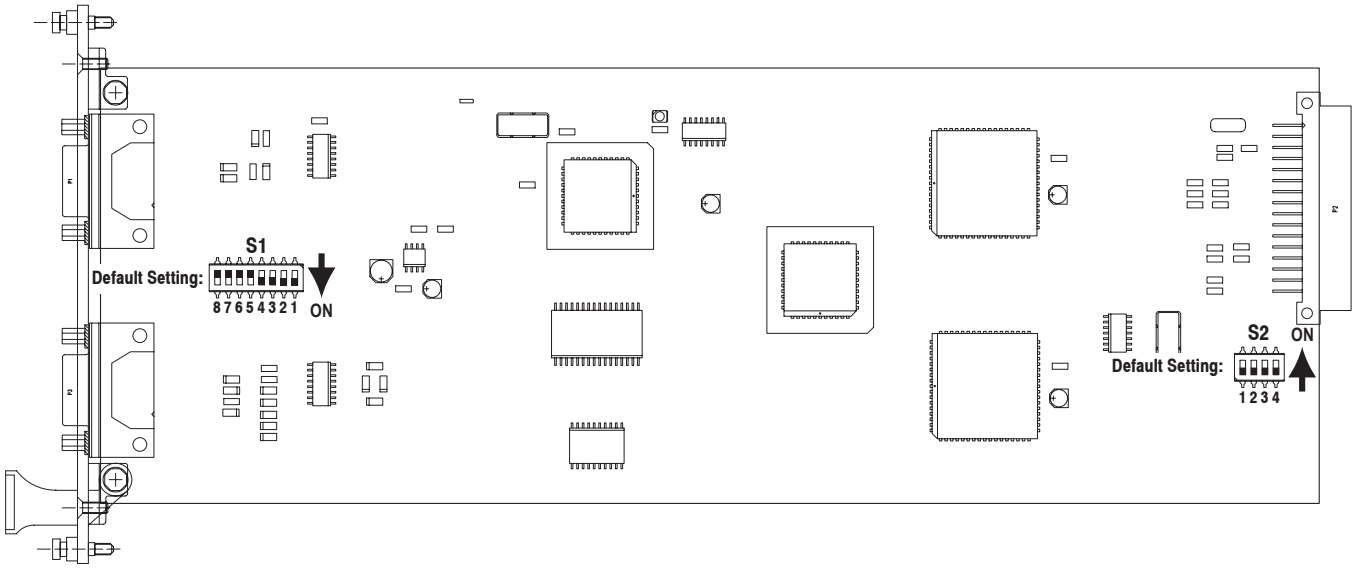
Pin	RS422 Controller	RS422 Device
1	Chassis	Chassis
2	RxD –	TxD –
3	TxD +	RxD +
4	GND	GND
5	n.c.	n.c.
6	GND	GND
7	RxD +	TxD +
8	TxD –	RxD –
9	Chassis	Chassis

6.6.2 Serial Merger Card 1.949.438

This card is used to feed any Studer-internal control signals into the hub I/O frame. A serial connection is made between the Studer product (such as a Vista or OnAir 3000 console) and the MASTER connector of the card.
In case of an OnAir 3000 console, the SLAVE connector may be used to connect a second local I/O frame.
In Vista 5 applications where the card is installed in the core frame, the host port must be accessed through the front-panel MASTER connector instead of from the backplane; this selection is done with a DIP switch that has been added in versions 1.949.438.22 and up.

Max. RS422 cable length	1000 m
Current consumption (5 V)	80 mA
Operating temperature	0...40° C





DIP Switches:

S1 DIP switch for RS422 pinout selection *(for the upper connector P1 only)*:

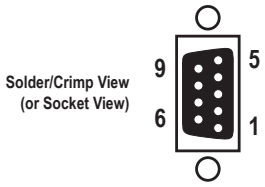
1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	RS422 Controller pinout
ON	ON	ON	ON	OFF	OFF	OFF	OFF	RS422 Device pinout *(factory default)*
NO OTHER SETTINGS ALLOWED!								

S2 DIP switch for master port selection *(versions 1.949.438.22 and up)*:

1	2	3	4	Setting
OFF				Depending on application *(factory default)*: – SCore: Master port connected to bridge/host card – D21m stand-alone mode: Master port connected to front-panel MASTER socket
ON				Master port forced to front-panel MASTER socket *(Vista 5 only)*
	OFF	OFF	OFF	reserved - ***NO OTHER SETTINGS ALLOWED!***

Connector Pin Assignment:

RS422 MASTER (9-pin D-type, female)



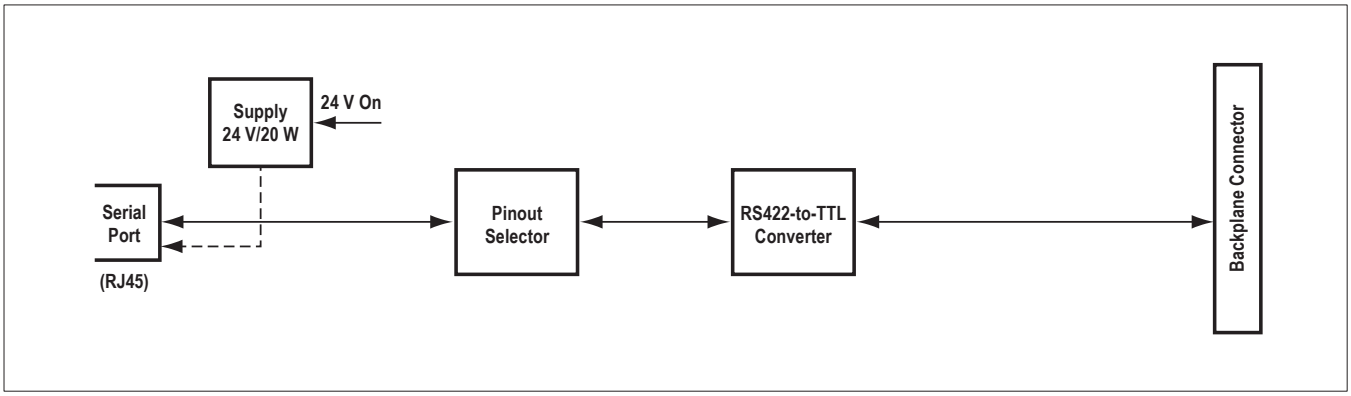
Pin	RS422 Controller	RS422 Device
1	Chassis	Chassis
2	RxD –	TxD –
3	TxD +	RxD +
4	GND	GND
5	n.c.	n.c.
6	GND	GND
7	RxD +	TxD +
8	TxD –	RxD –
9	Chassis	Chassis

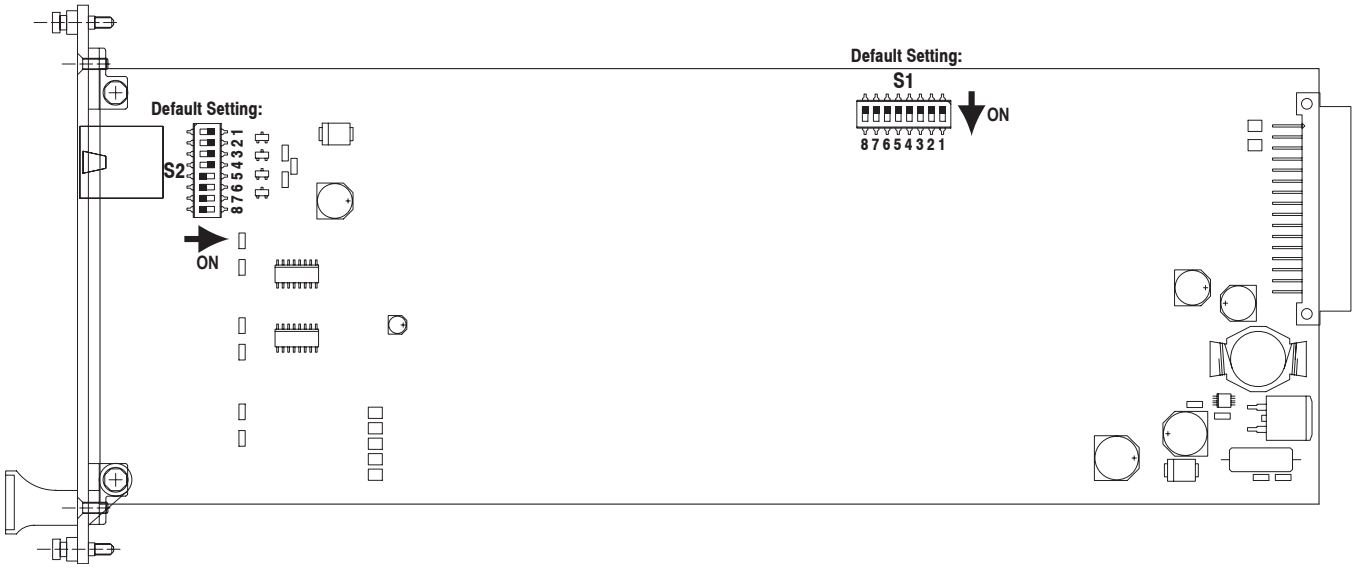
Note: *The* **RS422 SLAVE** *connector (P2) is always wired in controller mode.*

6.6.3 Serial RJ45 Card 1.949.439

It is possible to transmit any RS422 serial signals, such as MIDI or Sony 9-pin (machine control) through a MADI connection without losing any audio channels or microphone control of the remote I/O box.
The pinout of the 8-pin RJ45 connector can be set to “device” or “controller” with a DIP switch, depending on the serial device connected. Standard Ethernet UTP wiring for connecting the hub frame to the serial card. may be used.
An OnAir 3000 desk module connected to the RJ45 connector may be supplied by the card (24 V; 20 W max.), can be activated with a DIP switch.

Max. UTP (CAT5) cable length		25 m
Current consumption	(5 V)	20 mA
	(5 V, 24 V supply loaded)	5 A
Operating temperature		0...40° C





DIP Switches:

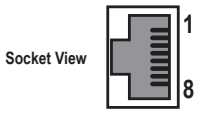
S1 DIP switch for parameter setting:

No.	Setting
1...5	not used. *Default: OFF*
6	ON: +24 V_{DC} supply switched to pins 1 and 2 of the RJ45 connector (used for supplying an OnAir 3000 desk module). *Default: OFF*
7...8	not used. *Default: OFF*

S2 DIP switch for RS422 pinout selection:

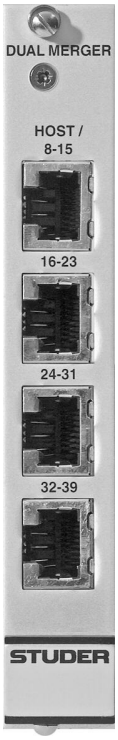
1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	**RS422 Controller pinout**
ON	ON	ON	ON	OFF	OFF	OFF	OFF	**RS422 Device pinout** *(factory default)*
NO OTHER SETTINGS ALLOWED!								

Connector Pin Assignment: (8-pin RJ45)



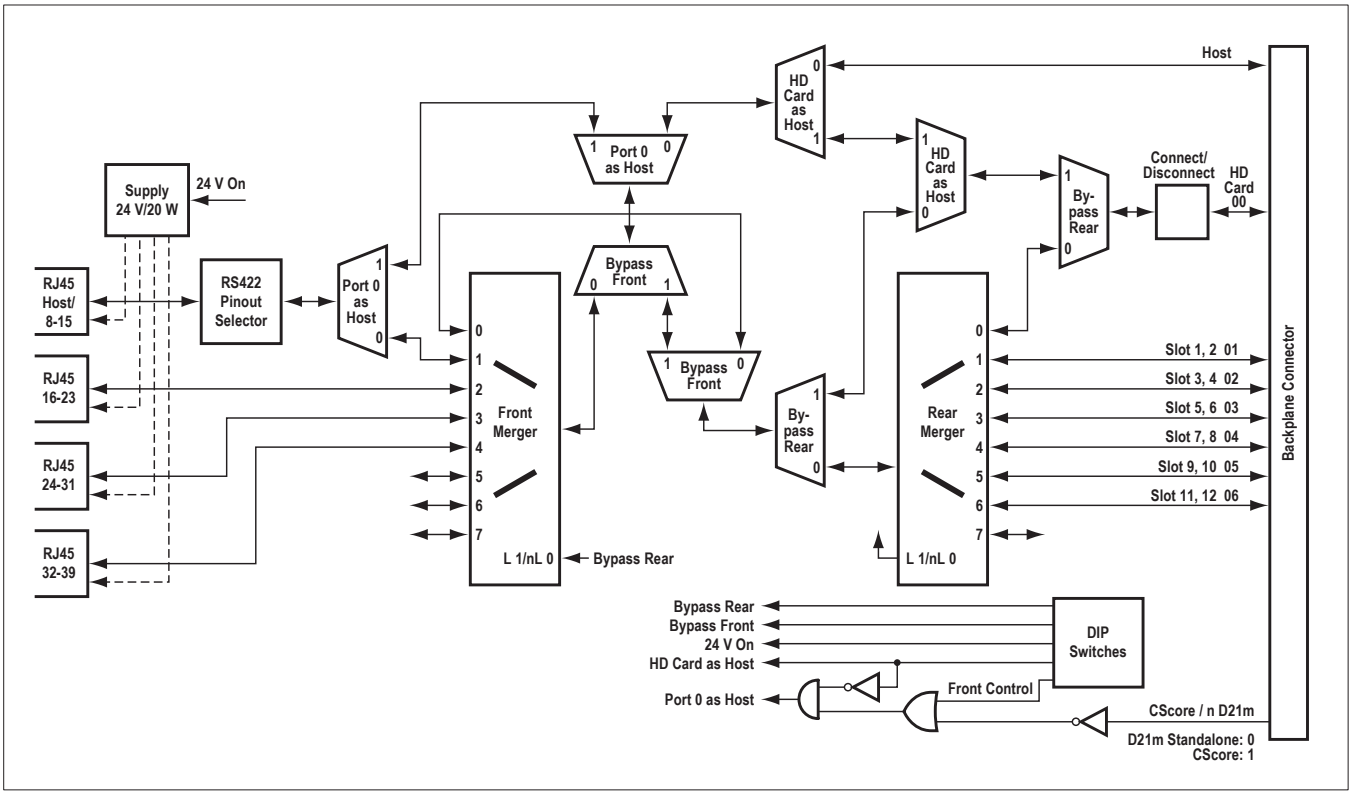
Pin	RS422 Controller	RS422 Device
1	* n.c.	* n.c.
2	* n.c.	* n.c.
3	TxD +	RxD +
4	RxD +	TxD +
5	RxD –	TxD –
6	TxD –	RxD –
7	GND	GND
8	GND	GND
* or +24 V_{DC} if SW 6 of DIP switch 1 is set to ON		

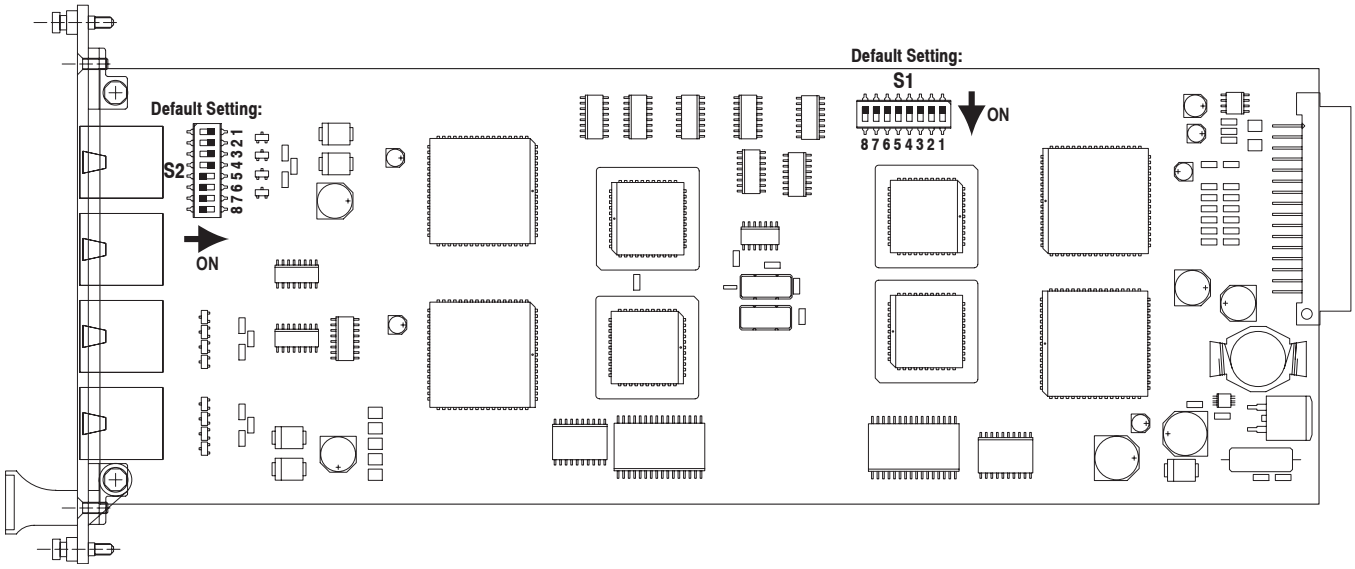
6.6.4 Dual Merger Card 1.949.440



This card is used to feed any Studer-internal control signals into the hub I/O frame. A serial connection is made between the Studer product (such as Vista or OnAir 3000 consoles) and the **HOST** connector of the card. In certain SCore applications the host port is connected internally through the backplane. The non-host ports may be used to connect other local I/O frames.
OnAir 3000 desk modules connected to the RJ45 connectors may be supplied by the card (24 V; 20 W total per Dual Merger card), can be activated with a DIP switch.

Max. CAT5 cable length		25 m
Current consumption	(5 V)	160 mA
	(5 V, 24 V supply loaded)	5.16 A
Operating temperature		0...40° C





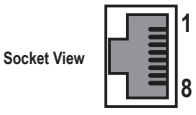
DIP Switches: **S1** DIP switch for parameter/routing setting:

No.	Setting	Default Setting
1	ON: Bypass rear	OFF
2	ON: Bypass front	OFF
3	ON: Front control	OFF
4	ON: HD card as host	OFF
5	not used	OFF
6	ON: +24 V_{DC} supply switched to pins 1 and 2 of all RJ45 connectors simultaneously (used for supplying OnAir 3000 desk modules)	OFF
7	* ON: HD card connect	ON
8	* ON: HD card connect	ON
*** Must be set to identical positions**		

S2 DIP switch for RS422 pinout selection of the **HOST/8-15** connector:

1	2	3	4	5	6	7	8	Setting
OFF	OFF	OFF	OFF	ON	ON	ON	ON	**RS422 Controller pinout**
ON	ON	ON	ON	OFF	OFF	OFF	OFF	**RS422 Device pinout** *(factory default)*
NO OTHER SETTINGS ALLOWED!								

Connector Pin Assignment: (8-pin RJ45)



Pin	RS422 Controller	RS422 Device
1	* n.c.	* n.c.
2	* n.c.	* n.c.
3	TxD +	RxD +
4	RxD +	TxD +
5	RxD –	TxD –
6	TxD –	RxD –
7	GND	GND
8	GND	GND
* or +24 V_{DC} if SW 6 of DIP switch 1 is set to ON		

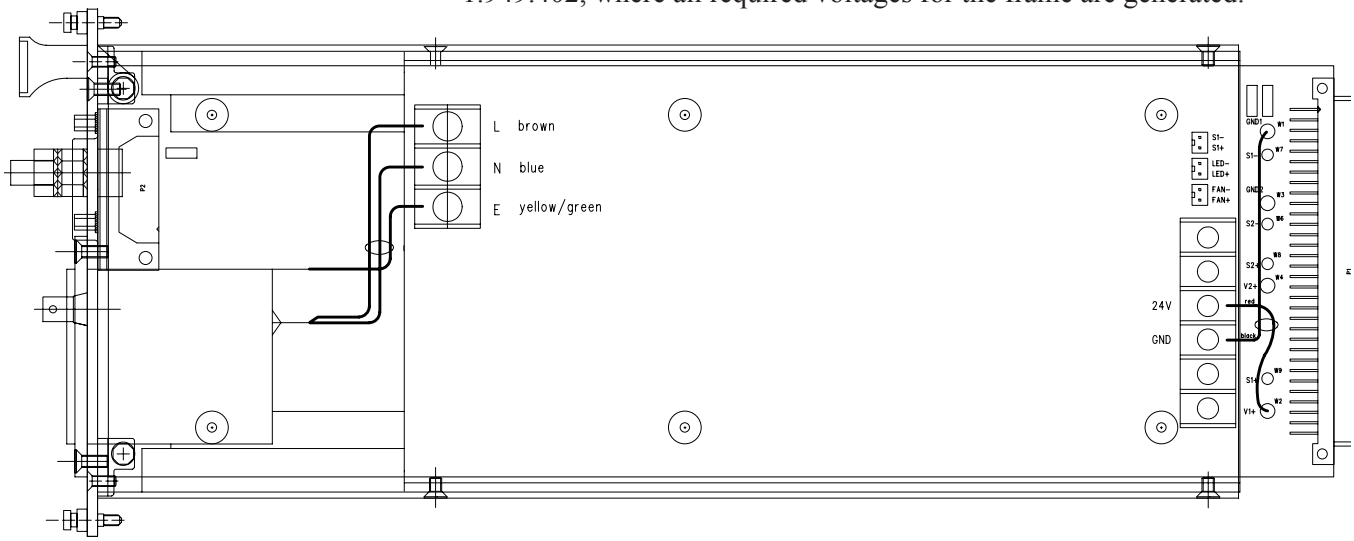
Note: *The three lower connectors* **16-23**, **24-31**, *and* **32-39** *are always wired in "controller" mode and cannot be switched to "device" mode.*

6.7 Power Supply and Miscellaneous

6.7.1 Primary Power Supply

1.949.404 (earlier version: 1.949.403)

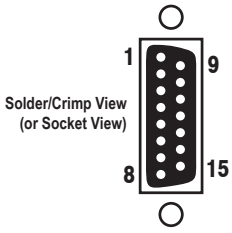
The D21m I/O frame may be equipped with either one or, for redundancy purposes, with two primary power supply units.
The module used is a primary switching AC/DC converter with an input voltage range of 90...264 V_{AC}/50...60 Hz, automatic power factor correction and a standard IEC mains inlet. Output is 24 V_{DC}/max. 8.5 A. *It contains no adjustable elements; if the internal primary fuse should fail, the unit must be returned to the factory for repair.*
The primary power supply unit(s) is/are plugged directly into the PSII PCB 1.949.402, where all required voltages for the frame are generated.



FAN/STATUS Connector:

This front-panel connector (15-pin D-type f for 1.949.404; 9-pin D-type f for 1.949.403) is used to output an electrically isolated status signal when the primary power supply (or one of them) should fail. The contacts of a relay located on the LED/PSII PCB are available on this connector, as well as a +24 V_{DC} supply and ground. The relay is energized as long as all supply voltages are ok, pins 4 and 6 (or pins 1 and 2 on 1.949.403) are connected then. In case of failure of any of the frame's supply voltages, pins 6 and 8 (or pins 2 and 3 on 1.949.403) are connected. *Please note that only the connector of the right-hand primary PSU can be used for the status signal, even if two primary power supply units are installed in the D21m I/O frame.*
The 15-pin connector on the current version 1.949.404 allows the additional supply of a fan unit (1.949.597) using a 1:1 m/f cable (89.20.1167, included with the fan unit).

Pin Assignment:

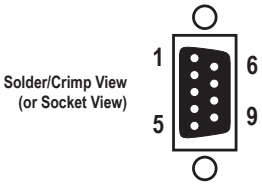


FAN/STATUS (15-pin D-type, female) on 1.949.404:

Pin	Signal	Pin	Signal
1	+24 V_{DC} (fan supply, 650 mA max.)	9	GND
2	reserved - ***do not connect!***	10	n.c.
3	GND	11	n.c.
4	* Relay NO (normally open)	12	reserved - ***do not connect!***
5	** Fan supply OK (active low)	13	** Fan in (active low)
6	* Relay COMMON	14	reserved - ***do not connect!***
7	GND	15	n.c.
8	Relay NC (normally closed)		

* Connected if everything is ok ** Status signals, foreseen for fan supervision

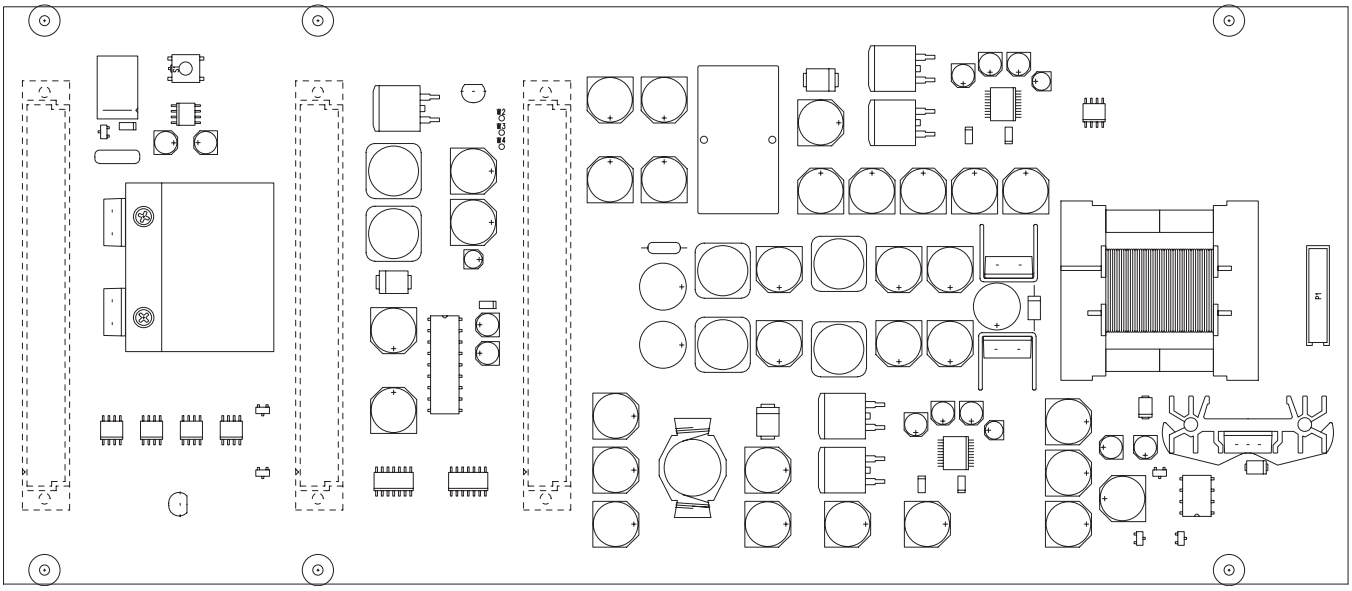
STATUS *(9-pin D-type, female) on earlier version 1.949.403:*



Pin	Signal
1	* Relay NO (normally open)
2	* Relay COMMON
3	Relay NC (normally closed)
4	n.c.
5	n.c.
6	+24 V_{DC} (650 mA max.)
7	n.c.
8	GND
9	GND
	* *Connected if everything is ok*

6.7.2 LED/PSII PCB 1.949.402

The primary power supply unit(s) as well as the frame's backplane PCB are directly plugged to the PSII PCB. It generates all the DC voltages required by the frame from the 24 V_{DC} delivered by the primary power supply unit(s), and it constantly monitors all supply voltages. As long as everything is ok, a relay is energized. In case of failure of any one of the supply voltages, the relay releases. Both NO and NC relay contacts are available on the **FAN/STATUS** front panel connector *of the right-hand primary PSU only*.



The PSII PCB contains no adjustable elements.

The LED part of the PCB (not shown here) is located behind the frame's front panel and connected with a ribbon cable to P1 of the PSII PCB; it indicates available/missing cards and supply voltages as well as the boot sequence and errors while booting.

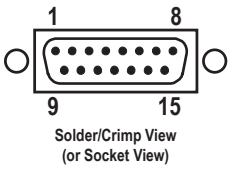
6.7.3 Air Deflector/Filter Unit 1.949.599

If a D21m I/O frame has a power dissipation of less than 80 W, air deflector/filter units should be used on top of and below the frame. For frames dissipating more power, an air deflector/filter unit should be used on top of the frame, combined with a fan unit (see below) at its bottom. If space is available, a second air deflector/filter unit may be used below the fan unit, increasing the air intake cross-section and thus improving the cooling efficiency.
For more information on cooling and guidelines for power dissipation estimation refer to chapter 1.2.2, paragraph “thermal considerations”.

6.7.4 Fan Unit 1.949.597

In cases where the power dissipation of a D21m I/O frame exceeds 80 W, active cooling is imperative. If no cooling system for the whole rack is used, this 1U fan unit is required underneath the D21m frame. Seven fans draw air in from the front (filtered) and from the bottom (unfiltered) and blow it out upward. The bottom is open and allows installing an additional air deflector/filter unit underneath the fan unit as described above, increasing the air intake cross-section. In most cases, however, closing the fan unit’s bottom with a piece of metal sheet is sufficient.
For power supply to the fans and fan status monitoring, two connectors – one at the front, the second at the rear of the unit – are provided. They are connected in parallel, so either one can be used depending on the application. If any of the fans should have a short or open circuit, the alarm signal is triggered.
A 15-pin D-type cable (order no. 89.20.1167) for connection to the primary PSU is required.
Please note that currently the fan monitoring is implemented for the use of the fan unit within an SCore Live only.
For more information on cooling as well as guidelines for power dissipation estimation refer to chapter 1.2.2, paragraph “thermal considerations”.

Pin Assignment:



FAN/STATUS (15-pin D-type, male):

Pin	Signal	Pin	Signal
1	$+V_{cc}$ (+15...24 V)	9	GND
2	n.c.	10	n.c.
3	GND	11	reserved (NTC)
4	n.c.	12	n.c.
5	Alarm relay + (open collector pulling up to V_{cc} if active)	13	GND
6	n.c.	14	n.c.
7	GND	15	reserved (Alarm LED+)
8	n.c.		

6.7.5 Break-Out Boxes

For implementing low-granularity standard terminals, a set of passive break-out boxes has been developed.

6.7.5.1 XLR Break-Out Box

This box is implemented as a configurable, modular system. The empty box (1.949.580) can be equipped with different options for the left and right part. The picture above shows a break-out box equipped with two options no. 3 for microphone inputs (2 × 4 XLR 3f) and the corresponding split outputs (2 x 4 XLR 3m). On the rear of the box two 25-pin D-type sockets (f) are provided for connection to the card(s) . For matching cables please refer to chapter 6.7.6.

Available Options:

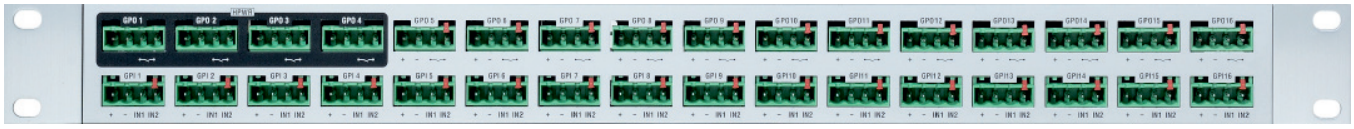
Option	Description	Order no.	Remarks
1	8 × XLR f to 1 × DB25 f	1.949.581	for 1 × Line input
2	8 × XLR m to 1 × DB25 f	1.949.582	for 1 × Line output
3	4 × XLR f / 4 × XLR m to 1 × DB25 f	1.949.583	for 1 × Mic input/Split output or 1 × Mic Insert send/return or 1 × AES/EBU input/output
4	8 × XLR f to 2 × DB25 f	1.949.584	for 2 × Mic input or 2 × AES/EBU input
5	4 × XLR f to 1 × DB25 f, 4 × blank cover	1.949.585	for 1 × Mic input or 1 × AES/EBU input
6	8 × blank cover	8 × 31.03.0111	

All XLR connectors can be custom-labeled with an inlay label.

6.7.5.2 AES/EBU on BNC Break-Out Box 1.949.586

This 19”/1 U box allows converting AES/EBU signals from balanced to unbalanced on BNC connectors and vice-versa. Each connector pair (in and out) can be custom-labeled with an inlay label. On the rear of the box four 25-pin D-type sockets (f) are provided for connection to the AES/EBU cards. For matching cables please refer to chapter 6.7.6.
Maximum cable lengths are 10 m for the D-type cables, and 100 m for the BNC cables.

6.7.5.3 GPIO Break-Out Box 1.949.588



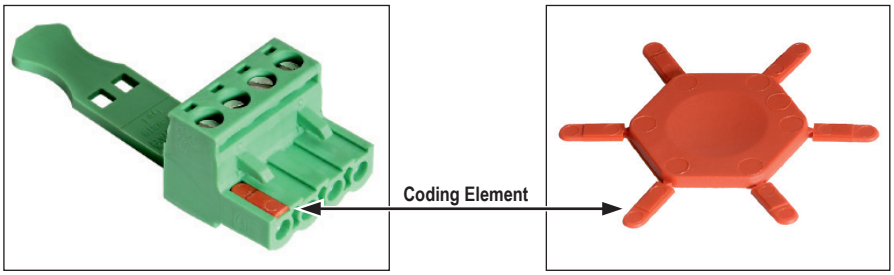
For easier wiring of single GPI and/or GPO signals, this break-out box can be used. 16 GPI signals and 12 of the 16 GPO signals of a GPIO card with relay outputs (1.949.436) are wired to single, 4-pin Combicon terminals (see below), providing the relay contacts or opto-coupler inputs, as well as GND and a short circuit-proof 5 V_{DC} supply.

If voltages exceeding 50 V (AC or DC) are switched, the break-out box must be placed within a closed rack in order to avoid shock hazards by touching the contacts!

Four of the 16 GPO signals (GPO 1...4, *marked in black on the front panel*) are connected to solid-state relays whose power terminals are wired to the Combicon terminals. These power contacts can switch AC loads from 24...240 V with a maximum total current of 5 A over all 4 relays.

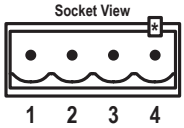
For safety reasons, these four terminals have no additional GND and 5 V supply. All remaining low-voltage terminals (GPI 1...16, GPO 5...16) are coded on pin #4 in order to prevent high-voltage connectors being inserted by mistake.

The high-voltage connectors must be coded, as shown below; six coding elements (order no. 54.25.1100) are included with the break-out box.



Eight 4-pin Combicon connectors with screw terminals (54.25.1104) are included with the break-out box. If more connectors are required, please order separately. On the rear of the box two 37-pin D-type sockets (f) are provided for connection to the GPIO card. For matching cables please refer to chapter 6.7.6.

Pin Assignment:



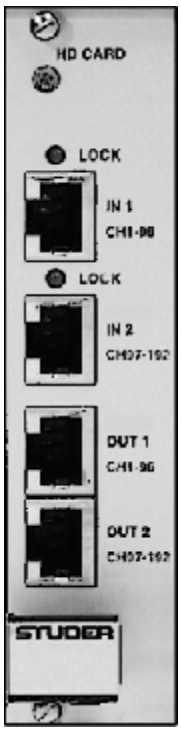
Pin	GPO 1...4 (Outputs) (upper row, *coded*)	GPO 5...16 (Outputs) (opper row, *uncoded*)	GPI 1...16 (Inputs) (lower row, *uncoded*)
1	n.c.	+5 V	+5 V
2	n.c.	GND	GND
3	Power Relay, Contact 1	GPO Relay, Contact 1	Optocoupler Input 1
4	Power Relay, Contact 2	GPO Relay, Contact 2	Optocoupler Input 2

6.7.6 Cables

Description	Length [m]	Order no.
DB25 and DB37 Cables		
DB25 m-m 1:1 cable, 8 × shielded	0.45	89.20.1161
DB25 m-m 1:1 cable, 8 × shielded	0.9	89.20.1174
DB25 m-m 1:1 cable, 8 × shielded	1.5	89.20.1170
DB37 m-m 1:1 cable	0.9	89.20.1178
DB25 m to XLR Adapter Cables		
DB25 m to 8 × XLR f (Line In)	3	54.21.2402
DB25 m to 8 × XLR m (Line Out)	3	54.21.2403
DB25 m to 4 × XLR f + 4 × XLR m (for Mic In/Split Out, Mic Insert Send/Return, or AES/EBU In/Out)	3	54.21.2401
Optical Cables		
SC to SC, multi-mode (62.5 / 125 µm)	1	89.10.0016
SC to SC, multi-mode (62.5 / 125 µm)	2	89.10.0013
SC to SC, multi-mode (62.5 / 125 µm)	3	89.10.0015
SC to SC, multi-mode (62.5 / 125 µm)	5	10.332.057.05
SC to SC, multi-mode (62.5 / 125 µm)	10	10.332.057.10
SC to SC, multi-mode (62.5 / 125 µm)	15	10.332.057.15
SC to SC, multi-mode (62.5 / 125 µm)	20	10.332.057.20
SC to SC, multi-mode (62.5 / 125 µm)	25	10.332.057.25
SC to SC, multi-mode (62.5 / 125 µm)	30	10.332.057.30
SC to SC, multi-mode (62.5 / 125 µm)	35	10.332.057.35
SC to SC, multi-mode (62.5 / 125 µm)	40	10.332.057.40
SC to SC, multi-mode (62.5 / 125 µm)	50	10.332.057.50
SC to SC, multi-mode (62.5 / 125 µm)	60	10.332.057.60
SC to SC, multi-mode (62.5 / 125 µm)	65	10.332.057.65
SC to SC, multi-mode (62.5 / 125 µm)	100	10.332.100.22
SC to SC, multi-mode (62.5 / 125 µm)	130	10.332.130.22
SC to SC, single mode (9 / 125 µm)	2	10.332.157.02
SC to SC, single mode (9 / 125 µm)	40	10.332.157.40
Neutrik OpticalCon Heavy-Duty Cables		
Assembled cable on drum	50	89.10.0151
Assembled cable on drum	100	89.10.0152
Assembled cable on drum	150	89.10.0153
Assembled cable on drum	200	89.10.0154
Bulkhead adapter, OpticalCon to LC	-	89.10.0150
Patch cable, LC to SC	5	89.10.0159

6.8 Discontinued Components *(not available for new systems)*

6.8.1 HD Card 1.949.410

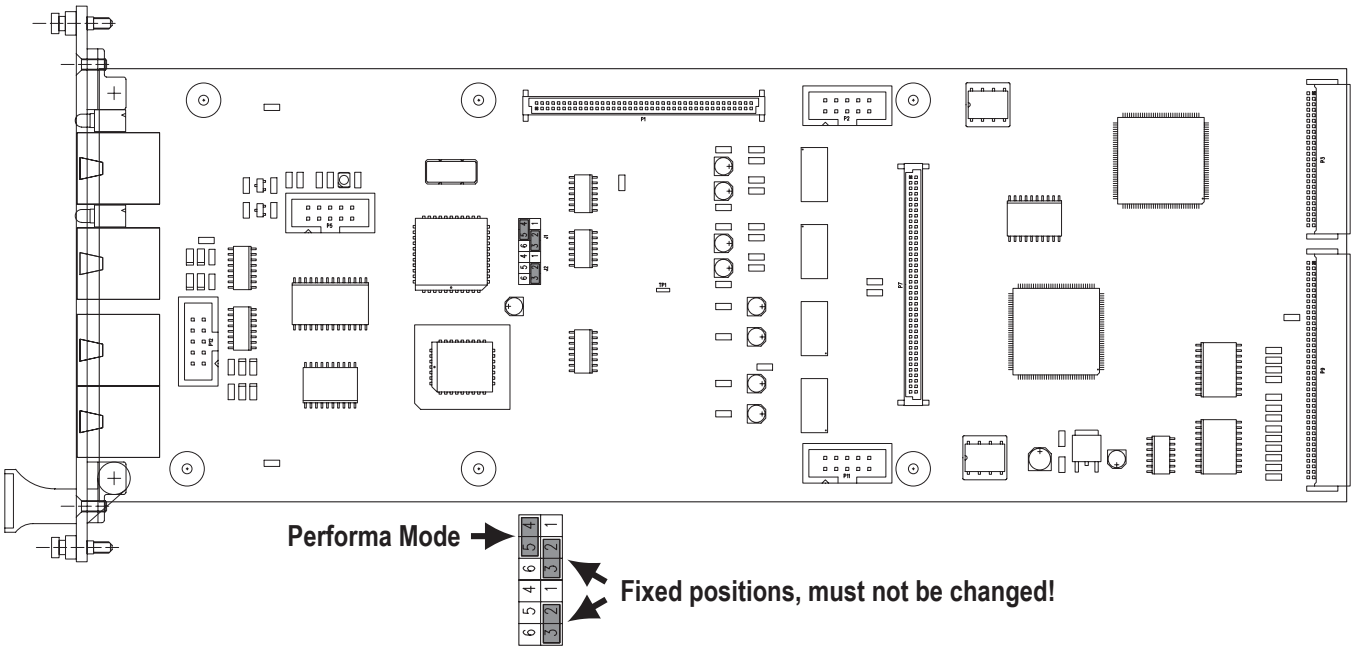


Please note that this card has been replaced by the D21m HD card S (see chapter 6.5.1) and is not available for new systems.

The D21m HD card provides the link to the DSP core systems. Each input and output can handle up to 96 channels in each supported sampling frequency (in combination with the Performa core, the number of I/O channels is restricted to 48). The system clock used is taken from the host DSP system, so no extra synchronization is needed.

The card detects all other I/O cards that are inserted into the D21m system and displays their presence on the front panel of the frame. Once all audio interface cards are plugged in, pressing the **RECONFIG** key on the front panel confirms the configuration to the system. Then all cards are activated and their audio signals are fed into the HD link.

Host link interface cable type	CAT-5 UTP Cable
Cable length	up to 10 m
Connector	RJ-45
Capacity of one CAT-5 connection	96 channels
Current consumption (3.3 V)	approx. 600 mA
(5.0 V)	<50 mA
Operating temperature	0...40° C



LEDs: On if a valid signal is present at the input that is locked to the system clock.

Jumpers: When using the Performa core, only 48 channels can be transmitted from the core to the D21m system. In order not to lose audio data, the channel selector of the HD Card has to be configured to this mode by a jumper on the card.
The other two jumpers have to remain in their default positions and must not be changed.

Connector Pin Assignment: See chapter 6.5.1