Operating Instructions

STUDER
AUDIO CONSOLE 990

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CAUTION
RISK OF ELECTRIC SHOCK DO NOT OPEN
ATTENTION
RISQUE DE CHOC ELECTRIQUE NE PAS OUVRIR
ACHTUNG
GEFAHR: ELEKTRISCHER SCHLAG NICHT ÖFFNEN

To reduce the risk of electric shock, do not remove covers (or back). No user-serviceable parts inside. Refer servicing to qualified service personnel.

Afin de prévenir un choc électrique, ne pas enlever les couvercles (où l'arrière) de l'appareil. Il ne se trouve à l'intérieur aucune pièce pouvant être réparée par l'usager.

Um die Gefahr eines elektrischen Schlages zu vermeiden, entfernen Sie keine Abdeckungen (oder Rückwand). Überlassen Sie die Wartung und Reparatur dem qualifizierten Fachpersonal.



This symbol is intended to alert the user to presence of uninsulated **"dangerous voltage"** within the apparatus that may be of sufficient magnitude to constitute a risk of electric shock to a person.

Ce symbole indique à l'utilisateur qu'il existent à l'intérieur de l'appareil des **"tensions dangereuses"**. Ces tensions élevées entrainent un risque de choc électrique en cas de contact.

Dieses Symbol deutet dem Anwender an, dass im Geräteinnern die Gefahr der Berührung von **"gefährlicher Spannung"** besteht. Die Grösse der Spannung kann zu einem elektrischen Schlag führen.



This symbol is intended to alert the user to the presence of **important instructions** for operating and maintenance in the enclosed documentation.

Ce symbole indique à l'utilisateur que la documentation jointe contient **d'importantes instructions** concernant le fonctionnement et la maintenance.

Dieses Symbol deutet dem Anwender an, dass die beigelegte Dokumentation **wichtige Hinweise** für Betrieb und Wartung beinhaltet.

CAUTION:	Lithium Battery. Danger of explosion by incorrect handling. Replace by battery of the same make and type only.
ATTENTION:	Pile au lithium. Danger d'explosion en cas de manipulation incorrecte. Ne remplacer que par un modèle de même type.
ACHTUNG:	Explosionsgefahr bei unsachgemässem Auswechseln der Lithiumbatterie. Nur durch den selben Typ ersetzen.
ADVARSEL:	Lithiumbatterei. Eksplosinsfare. Udskinftning ma kun foretages af en sagkyndig of som beskrevet i servicemanualen (DK).

FIRST AID
(in case of electric shock)

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

- by switching off the equipment
- or by unplugging or disconnecting the mains cable
- pushing the person away from the power source by using dry insulating material (such as wood or plastic).
- After having sustained 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 SUSTAINING AN ELECTRIC SHOCK AS WELL!

2. If the person is unconscious

- check the pulse,
- reanimate the person if respiration is poor,
- lay the body down and turn it to one side, call for a doctor immediately.

PREMIERS SECOURS
(en cas d'électrocution)

1. Si la personne est dans l'impossibilité de se libérer:

- Couper l'interrupteur principal
- Couper le courant
- Repousser la personne de l'appareil à l'aide d'un objet en matière non conductrice (matière plastique ou bois)
- Après une électrocution, consulter un médecin.

ATTENTION!

NE JAMAIS TOUCHER UNE PERSONNE QUI EST SOUS TENSION, SOUS PEINE DE SUBIR EGALEMENT UNE ELECTROCUTION.

2. En cas de perte de connaissance de la personne électrocutée:

- Controller le pouls
- Si nécessaire, pratiquer la respiration artificielle
- Placer l'accidenté sur le flanc et consulter un médecin.

ERSTE HILFE
(bei Stromunfällen)

1. Bei einem Stromunfall die betroffene Person so rasch wie möglich vom Strom trennen:

- Durch Ausschalten des Gerätes
- Ziehen oder Unterbrechen der Netzzuleitung
- Betroffene Person mit isoliertem Material (Holz, Kunststoff) von der Gefahrenquelle wegstossen
- Nach einem Stromunfall sollte immer ein Arzt aufgesucht werden.

ACHTUNG!

EINE UNTER SPANNUNG STEHENDE PERSON DARF NICHT BERÜHRT WERDEN. SIE KÖNNEN DABEI SELBST ELEKTRISIERT WERDEN!

2. Bei Bewusstlosigkeit des Verunfallten:

- Puls kontrollieren,
- bei ausgesetzter Atmung künstlich beatmen,
- Seitenlagerung des Verunfallten vornehmen und Arzt verständigen.

Installation, Betrieb und Entsorgung

Vor der Installation des Gerätes müssen die hier aufgeführten und auch die weiter in dieser Anleitung mit ⚠ bezeichneten Hinweise gelesen und während der Installation und des Betriebes beachtet werden.
Das Gerät und sein Zubehör ist auf allfällige Transportschäden zu untersuchen.
Ein Gerät, das mechanische Beschädigung aufweist oder in welches Flüssigkeit oder Gegenstände eingedrungen sind, darf nicht ans Netz angeschlossen oder muss sofort durch Ziehen des Netzsteckers vom Netz getrennt werden. Das Öffnen und Instandsetzen des Gerätes darf nur vom Fachpersonal unter Einhaltung der geltenden Vorschriften durchgeführt werden.

Falls dem Gerät kein konfektioniertes Netzkabel beiliegt, muss dieses durch eine Fachperson unter Verwendung der mitgelieferten Kabel-Gerätesteckdose IEC320/C13 oder IEC320/C19 und unter Berücksichtigung der einschlägigen, im geweiligen Lande geltenden Bestimmungen angefertigt werden; siehe Bild unten.
Vor Anschluss des Netzkabels an die Netzsteckdose muss überprüft werden, ob die Stromversorgungs- und Anschlusswerte des Gerätes (Netzspannung, Netzfrequenz) innerhalb der erlaubten Toleranzen liegen. Die im Gerät eingesetzten Sicherungen müssen den am Gerät angebrachten Angaben entsprechen.
Ein Gerät mit einem dreipoligen Gerätestecker (Gerät der Schutzklasse I) muss an eine dreipolige Netzsteckdose angeschlossen und somit das Gerätegehäuse mit dem Schutzleiter der Netzinstallation verbunden werden (Für Dänemark gelten Starkstrombestimmungen, Abschnitt 107).

Installation, Operation, and Waste Disposal

Before you install the equipment, please read and adhere to the following recommendations and all sections of these instructions marked with ⚠.

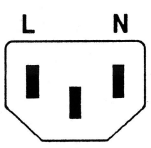
Check the equipment for any transport damage.

A unit that is mechanically damaged or which has been penetrated by liquids or foreign objects must not be connected to the AC power outlet or must be immediately disconnected by unplugging the power cable. Repairs must only be performed by trained personnel in accordance with the applicable regulations.

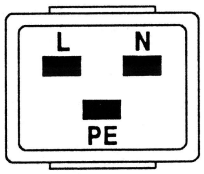
Should the equipment be delivered without a matching mains cable, the latter has to be prepared by a trained person using the attached female plug (IEC320/C13 or IEC320/C19) with respect to the applicable regulations in your country - see diagram below.

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 (equipment conforming to protection class I) must be connected to a 3-pole AC power outlet so that the equipment cabinet is connected to the protective earth conductor of the AC supply (for Denmark the Heavy Current Regulations, Section 107, are applicable).



IEC 320 / C13



IEC 320 / C19

Female plug (IEC320), view from contact side:

L ..... live; brown	National American Standard: black
N ..... neutral; blue	white
PE ... protective earth; green and yellow	green

Connecteur femelle (IEC320), vue de la face aux contacts:

L.....phase, brun	Standard National Américain: noir
N.....neutre, bleu	blanc
PE....terre protective; vert et jaune	vert

Ansicht auf Steckkontakte der Kabel-Gerätesteckdose (IEC320):

L.....Polleiter, braun	USA-Standard: schwarz
N.....Neutralleiter, hellblau	weiss
PE....Schutzleiter, gelb/grün	grün

Bei der Installation des Gerätes muss **vermieden** werden, dass:

- das Gerät Regen, Feuchtigkeit, direkter Sonneneinstrahlung oder übermässiger Wärmestrahlung von Wärmequellen (Heizgeräte, Heizungen, Spotlampen) ausgesetzt wird
- die für den Betrieb des Gerätes benötigte Luftzirkulation beeinträchtigt und dadurch die zulässige maximale Lufttemperatur der Geräteumgebung überschritten wird (Wärmestau)
- die Belüftungsöffnungen des Gerätes blockiert oder abgedeckt werden.

Das Gerät und seine Verpackung darf nur sachgerecht entsorgt werden. Alle Teile des Gerätes, die gefährliche Stoffe (Quecksilber, Cadmium) enthalten, müssen als Sondermüll behandelt werden.

Verbrauchte Batterien und Akkus müssen dem Hersteller zur Entsorgung zurückgegeben oder entsprechend den spezifischen Bestimmungen Ihres Landes fachgerecht entsorgt werden.

Wartung und Reparatur

Durch Entfernen von Gehäuseteilen, Abschirmungen etc. werden stromführende Teile freigelegt. Aus diesem Grund müssen u.a. die folgenden Grundsätze beachtet werden:
Eingriffe in das Gerät dürfen nur von Fachpersonal unter Einhaltung der geltenden Vorschriften vorgenommen werden.
Vor Entfernen von Gehäuseteilen muss das Gerät ausgeschaltet und vom Netz getrennt werden.
Bei geöffnetem, vom Netz getrenntem Gerät dürfen Teile mit gefährlichen Ladungen (z. B. Kondensatoren, Bildröhren) erst nach kontrollierter Entladung, heiße Bauteile (Leistungshalbleiter, Kühlkörper etc.) erst nach deren Abkühlen berührt werden.

Bei Wartungsarbeiten am geöffneten, unter Netzspannung stehenden Gerät dürfen blanke Schaltungsteile und metallene Halbleitergehäuse weder direkt noch mit einem nichtisolierten Werkzeug berührt werden.
Zusätzliche Gefahren bestehen bei unsachgemässer Handhabung besonderer Komponenten:

- **Explosionsgefahr** bei Lithiumzellen, Elektrolyt-Kondensatoren und Leistungshalbleitern
- **Implosionsgefahr** bei evakuierten Anzeigeeinheiten
- **Strahlungsgefahr** bei Lasereinheiten (nichtionisierend), Bildröhren (ionisierend)
- **Verätzungsgefahr** bei Anzeigeeinheiten (LCD) und Komponenten mit flüssigem Elektrolyt.

Solche Komponenten dürfen nur von dafür ausgebildetem Fachpersonal unter Verwendung von vorgeschriebenen Schutzmitteln (u.a. Schutzbrille, Handschuhe) gehandhabt werden.

The equipment installation **must satisfy** the following requirements:

- Protection against rain, humidity, direct solar irradiation or strong thermal radiation from heat sources (heaters, radiators, spotlights).
- Unobstructed air circulation so that the maximum air temperature in the equipment environment will not be exceeded (no heat accumulation).
- Ventilation louvers of the equipment must not be blocked or covered.

The equipment and its packing materials should ultimately be disposed off in accordance with the applicable regulations only. All parts of the equipment that contain hazardous substances (mercury, cadmium) must be treated as toxic waste.
Weak batteries or exhausted rechargeable batteries must be returned to the manufacturer for competent disposal or must be disposed of in accordance with the environmental protection regulations applicable for your country.

Maintenance and Repair

The removal of housing parts, shields, etc. exposes energized parts. For this reason the following precautions should be observed:
Maintenance should only be performed by trained personnel in accordance with the applicable regulations.
The equipment should be switched off and disconnected from the AC power outlet before any housing parts are removed.
Even after the equipment has been disconnected from the power, parts with hazardous charges (e.g. capacitors, picture tubes) should only be touched after they have been properly discharged. Hot components (power semiconductors, heat sinks, etc.) should only be touched after they have cooled off.

If maintenance is performed on a unit that is opened and switched on, no uninsulated circuit components and metallic semiconductor housings should be touched neither with your bare hands nor with uninsulated tools.
Certain components pose additional hazards:

- **Explosion hazard** from lithium batteries, electrolytic capacitors and power semiconductors
- **Implosion hazard** from evacuated display units
- **Radiation hazard** from laser units (non-ionizing), picture tubes (ionizing)
- **Caustic effect** of display units (LCD) and such components containig liquid electrolyte.

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

Für Wartung und Reparatur der sicherheitsrelevanten Teile des Gerätes darf nur Ersatzmaterial nach Herstellerspezifikation verwendet werden.

Das Gerät muss ordnungsgemäss und regelmässig gewartet und somit in sicherem Zustand erhalten werden. Bei ungenügender Wartung oder bei Änderungen der sicherheitsrelevanten Teile des Gerätes erlischt die entsprechende Produktehaftung des Herstellers.

For maintenance work and repair on components that influence the equipment safety, only replacement material conforming to the manufacturer's specifications may be used.

The equipment should be properly serviced in regular intervals and be maintained in safe operating condition. If the equipment is not properly maintained or if any modifications are made to components that influence safety, the manufacturer's product liability gets void.

Elektrostatische Entladung (ESD) bei Wartung und Reparatur

Electrostatic Discharge (ESD) during Maintenance and Repair



ATTENTION: **Observe precautions for handling devices sensitive to electrostatic discharge!**

ATTENTION: **Respecter les précautions d'usage concernant la manipulation de composants sensibles à l'électricité statique!**

ACHTUNG: **Vorsichtsmassnahmen bei Handhabung elektrostatisch entladungsgefährdeter Bauelemente beachten!**

Viele ICs und andere Halbleiter sind empfindlich gegen elektrostatische Entladung (ESD). Unfachgerechte Behandlung von Baugruppen mit solchen Komponenten bei Wartung und Reparatur kann deren Lebensdauer drastisch vermindern.
Bei der Handhabung der ESD-empfindlichen Komponenten sind u.a. folgende Regeln zu beachten:

- ESD-empfindliche Komponenten dürfen ausschliesslich in dafür bestimmten und bezeichneten Verpakkungen gelagert und transportiert werden.
- Unverpackte, ESD-empfindliche Komponenten dürfen nur in den dafür eingerichteten Schutzzonen (EPA, z.B. Gebiet für Feldservice, Reparatur- oder Serviceplatz) gehandhabt und nur von Personen berührt werden, die durch ein Handgelenkband mit Serienwiderstand mit dem Massepotential des Reparatur- oder Serviceplatzes verbunden sind. Das gewartete oder reparierte Gerät wie auch Werkzeuge, Hilfsmittel, EPA-taugliche (elektrisch halbleitende) Arbeits-, Ablage- und Bodenmatten müssen ebenfalls mit diesem Potential verbunden sein.
- Die Anschlüsse der ESD-empfindlichen Komponenten dürfen unkontrolliert weder mit elektrostatisch aufladbaren (Gefahr von Spannungsdurchschlag), noch mit metallischen Oberflächen (Schockentladungsgefahr) in Berührung kommen.
- Um undefinierte transiente Beanspruchung der Komponenten und deren eventuelle Beschädigung durch unerlaubte Spannung oder Ausgleichsströme zu vermeiden, dürfen elektrische Verbindungen nur am abgeschalteten Gerät und nach dem Abbau allfälliger Kondensatorladungen hergestellt oder getrennt werden.

Many ICs and semiconductors are sensitive to electrostatic discharge (ESD). The life of components containing such elements 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.
- 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 and all tools, aids, as well as electrically semiconducting 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.

SMD-Bauelemente

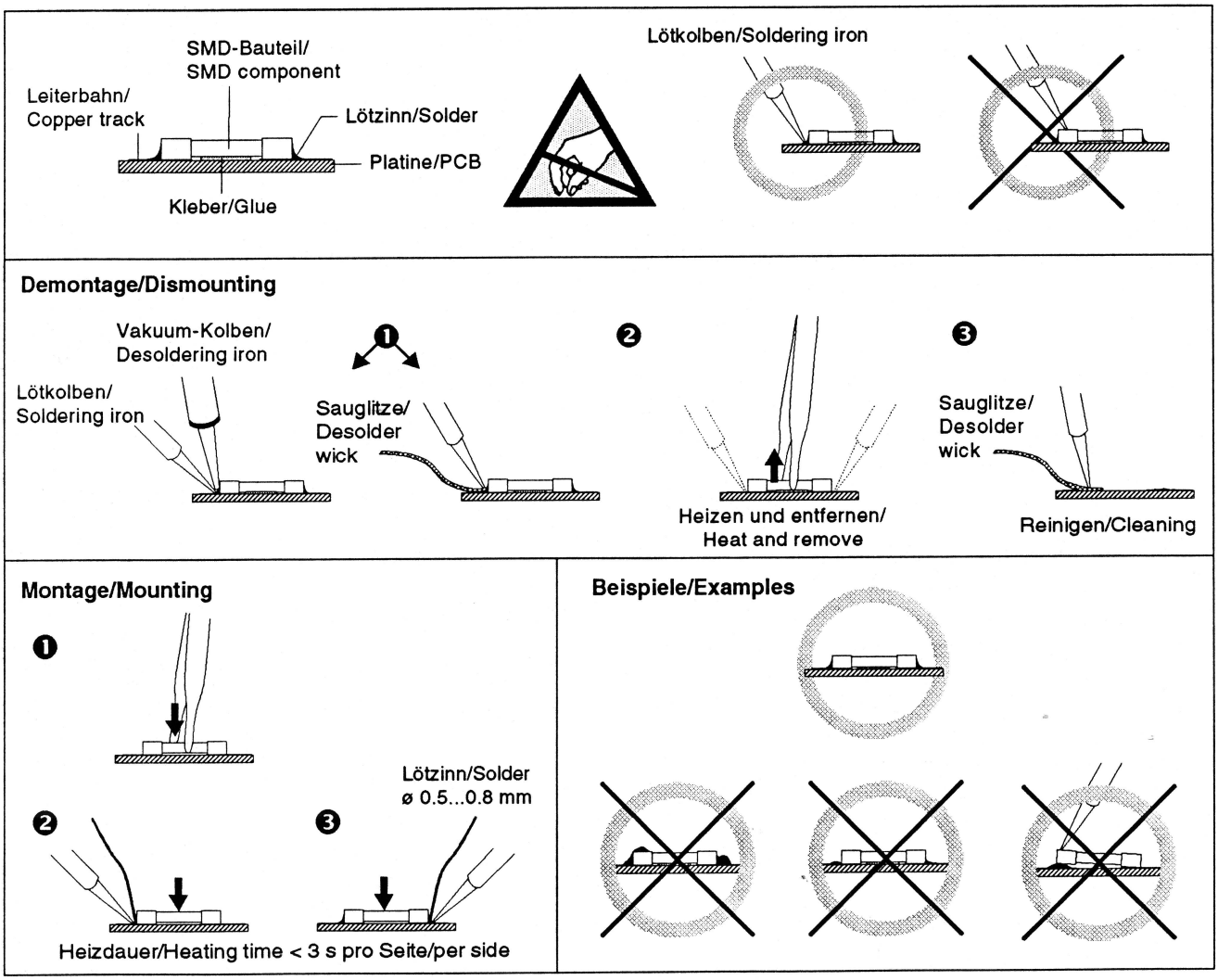
Der Austausch von SMD-Bauelementen ist ausschliesslich geübten Fachleuten vorbehalten. Für verwüstete Platinen können keine Ersatzansprüche geltend gemacht werden. Beispiele für korrekte und falsche SMD-Lötverbindungen in der Abbildung weiter unten.

Bei Studer werden keine handelsüblichen SMD-Teile bewirtschaftet. Für Reparaturen sind die notwendigen Bauteile lokal zu beschaffen. Die Spezifikationen aller Komponenten finden Sie in den Positionslisten im Schemateil.
Spezialkomponenten sind in der Positionsliste mit einer Artikelnummer versehen und können bei Studer unter dieser Nummer bezogen werden.

SMD Components

SMDs should only be replaced by skilled specialists. No warranty claims will be accepted for circuit boards that have been ruined. Proper and improper SMD soldering joints are depicted below.

Studer does not keep any commercially available SMDs in stock. For repairs the corresponding devices should be purchased locally. The specifications of all components can be found in the parts lists in the diagram section.
Special components having a part number in the parts list can be ordered from Studer by specifying this number.



Störstrahlung und Störfestigkeit

Das Gerät entspricht den Schutzanforderungen auf dem Gebiet der elektromagnetischen Phänomene, die u.a. in den Richtlinien 89/336/EWG und FCC, Part 15, aufgeführt sind :

1. Die vom Gerät erzeugten elektromagnetischen Aussendungen sind soweit begrenzt, dass ein bestimmungsgemässer Betrieb anderer Geräte und Systeme möglich ist.
2. Das Gerät weist eine angemessene Festigkeit gegen elektromagnetische Störungen auf, so dass sein bestimmungsgemässer Betrieb möglich ist.

Das Gerät wurde getestet und erfüllt die Bedingungen der im Kapitel "Technische Daten" aufgeführten EMV-Standards. Die Limiten dieser Standards gewährleisten mit einer angemessenen Wahrscheinlichkeit sowohl einen Schutz der Umgebung wie auch entsprechende Störfestigkeit des Gerätes. Eine absolute Garantie, dass keine unerlaubte elektromagnetische Beeinträchtigung während des Gerätebetriebes entsteht, ist jedoch nicht gegeben.

Um die Wahrscheinlichkeit solcher Beeinträchtigung weitgehend auszuschliessen, sind u.a. folgende Massnahmen zu beachten:

- Installieren Sie das Gerät gemäss den Angaben in der Bedienungsanleitung, und verwenden Sie das mitgelieferte Zubehör.
- Verwenden Sie im System und in der Umgebung, in denen das Gerät eingesetzt ist, nur Komponenten (Anlagen, Geräte), die ihrerseits die Anforderungen der obenerwähnten Standards erfüllen.
- Sehen Sie ein Erdungskonzept des Systems vor, das sowohl die Sicherheitsanforderungen (die Erdung der Geräte gemäss Schutzklasse I mit einem Schutzleiter muss gewährleistet sein), wie auch die EMV-Belange berücksichtigt. Bei der Entscheidung zwischen stern- oder flächenförmiger bzw. kombinierter Erdung sind Vor- und Nachteile gegeneinander abzuwägen.
- Benutzen Sie abgeschirmte Kabel für die Verbindungen, für welche eine Abschirmung vorgesehen ist. Achten Sie auf einwandfreie, grossflächige, korrosionsbeständige Verbindung der Abschirmung zum entsprechenden Steckeranschluss bzw. zum Steckergehäuse. Beachten Sie, dass eine nur an einem Ende angeschlossene Kabelabschirmung als Sende- bzw. Empfangsantenne wirken kann (z.B. bei wirksamer Kabellänge von 5 m oberhalb von 10 MHz), und dass die Flanken der digitalen Kommunikationssignale hochfrequente Aussendungen verursachen (z.B. LS- oder HC-Logik bis 30 MHz).
- Vermeiden Sie Bildung von Stromschleifen oder vermindern Sie deren unerwünschte Auswirkung, indem Sie deren Fläche möglichst klein halten und den darin fliessenden Strom durch Einfügen einer Impedanz (z.B. Gleichtaktdrossel) reduzieren.

Electromagnetic Compatibility

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

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

The equipment has been tested and conforms to the EMC standards applicable to residential, commercial and light industry, as listed in the section "Technical Data". The limits of these standards reasonably ensure protection of the environment and corresponding noise immunity of the equipment. However, it is not absolutely warranted that the equipment will not be adversely affected by electromagnetic interference during operation.

To minimize the probability of electromagnetic interference as far as possible, the following recommendations should 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 above EMC standards.
- Use a system grounding concept that satisfies the safety requirements (protection class I equipment must be connected with a protective ground conductor) 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 (e.g. with an effective cable length of 5 m, the frequency is above 10 MHz) and that the edges of the digital communication signals cause high-frequency radiation (e.g. LS or HC logic up to 30 MHz).
- Avoid current 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 rejection choke).

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 could void the user's authority to operate the equipment. Also refer to relevant information in this manual.

Section 1: General

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1. Introduction

With the introduction of the 990 Series mixing desks, the STUDER mixer family gains a very important member. Based on the proven analogue signal processing, a new, modern mixing desk concept has been developed. The new 990 Series features extensive control possibi- lities as well as various data storage and reset procedures. This enables the 990 Series to bring enormous advantages in all areas of audio work where instant reset and central control are needed.

Areas of application:

- Broadcast: production and live broadcast
- Theater and Film industry mixers
- In-line consoles for multitrack recording/mixing
- Post production

The main principle of the 990 series is the integration of standard studio equipment into a centrally controlled studio system. The possibility to integrate a complex synchronisation system or to form a local network including various types of equipment is the real advantage of the 990 series. Such a "STUDIO COMPUTER" based system offers the engineer an enormous field of information and services which are becoming a necessity in the studio environment.

Operational concept:

Having in mind the need to give the engineer as much detailed information and control as possible, and at the same time to keep the console simple and easy to use, the layout of various functions of the console has been split: the controls are partly installed on the channels themselves, and partly designed to be centrally assignable and controllable.

Modular units:

The console channels have been split into various units to provide for a great variety of configurations within the standard frames:

Input unit: It is the core of each channel and does practically all audio signal processing

Fader unit: It is a standard unit in each input channel and contains the fader itself, together with the controlling microprocessor.

In-line unit: It is necessary for inline operation.

Optional units:

- BARGRAPH UNIT (built into the meter panel)
- DYNAMICS UNIT (for installation on the meter panel)
- ALPHANUMERIC DISPLAY unit (built in above the Fader unit). The audio groups can be configured in much the same way as the input channels. The master and monitoring units are different in construction, in the way that a modular system consisting of separate eurocards (for audio processing) and panel units (for control) is configured. This construction allows a lot of reserve for extensions or custom user modifications.

2 Technical Description

2.1 Audio signal processing

The 990 Series desks use analogue audio signal processing. A special feature of the 990 is the digitally controlled input stage, which eliminates all rotary switches and potentiometers and enables **storage and setting** of all parameters. MDAC's are used for fine adjusting the input attenuator. The low noise, low distortion **STUDER VCA**'s are used extensively for level control of the audio signal.
The VCA faders come in two lengths, 104mm used as "MAIN" or "LARGE" fader, and 83mm for use as "SMALL" fader. The MAIN faders can also be motorised as an option. The STUDER motorised fader enables optimal visual control of VCA settings in conjunction with automation and audio subgrouping.

The **AUX sends** offer the possibility of assignment to two separate bus systems(A or B), having altogether 16 outputs (8 Mono and 4 Stereo).

The **audio signal** of each channel can be assigned to any of the output buses:
a) **32 multitrack buses** (BUS 1...32) expandable to 48 buses
b) **8 group buses** (Mono, GROUP 1...8)
c) **4 summing buses** (Stereo, ΣA ... ΣD)

Another special feature of the 990 console is the integrated **multiplex bus** system(MPX), which enables individual clean feeds in each input channel. This MPX bus is in stereo, so that even stereo clean feeds are available. The assignment onto the MPX bus is individually switchable in each channel, so that the composition of the clean feeds can be freely selected.

2.2 Desk control system

The Desk Control System of the 990 Series controls the vital functions of the desk, to name a few:

- storing of all analogue controls and switch settings
- resetting the desk to any stored configuration
- automation of analogue faders and switch settings
- help during complex operations (subgrouping, sequencing of snapshots)
- housekeeping functions for multitrack recording and mixing (track lists, title and cue lists)

Audio signal control:

- All the switching functions can be stored, recalled and instantly reset.
- All the VCA levels can be stored, recalled and instantly reset.
- The potentiometer settings can be stored and recalled but not instantly reset. An operation called "RECALL" is needed to reset the pot settings to stored positions by means of comparing the stored values to the actual ones on a graphic or numeric display.

How the Desk Control System works:

All the **channel information** is processed by a **microprocessor** built into every fader unit.
The **general desk control** and processing is dealt with in the **main computer**. The channels and their associated microprocessors are all connected to the main computer via a high-speed bus system.
The same bus carries the **subgrouping** information, and is also shared by the **automation** system. Every desk in the 990 Series is equipped with VCA subgrouping, and is ready for automation without hardware changes.

There are separate control panels for the overall system control (storage and recall of console statuses). 2 different versions of these central control panels can be provided:

"Snapshot unit":

- storing of VCA levels and switch settings
- recall of stored settings
- sequencing of stored snapshots

"PC Graphic Control Unit:"

- all store and recall functions
- all desk control functions
- dynamic automation
- visual control on a built-in monitor
- separate control monitor available
- PC-system based

It is possible to upgrade a console, which is initially euipped with the "snapshot unit", to the "PC graphic control unit", if there is enough space for the keyboard, the display unit and the computer itself.

2.3 Varianten, Mechanik

Grundsätzlich sind verschiedene Varianten des Regiepultrahmens möglich, die sich in der Tiefe unterscheiden:

- Standard-Regiepult
- Inline-Regiepult

Teilchassis Die Regiepulte sind aus mehreren Teilchassis zusammengesetzt, die unterschiedliche Breite aufweisen können:

a) Chassis für 12 Einheiten à 40 mm Breite
b) Chassis für 16 Einheiten à 40 mm Breite

Die Breite der Mischpulteinheiten beträgt 40 mm oder Vielfache davon.
Für die Unterbringung der optionalen **Dynamikeinheiten** gibt es einen zusätzlichen Aufbau auf dem Meter Panel. Dieses **"Top Panel"** hat eine Länge von 95 mm und eine Neigung von 82°.

STANDARD-Regiepult für Anwendungen ohne Mehrkanalmaschine (bis zu 80 Eingangskanäle, 8 Gruppen, 4 Stereo-Summen) mit folgenden Einbauplätzen:

- Fader Panel, Länge 230 mm, Neigung 0°
- Input Panel, Länge 420 mm, Neigung 7,5°
- Meter Panel, Länge 190 mm, Neigung 75°

Höhe: STANDARD-Regiepult: 1042 mm
STANDARD-Regiepult mit "Top Panel": 1145 mm

Tiefe: STANDARD-Regiepult: 1035 mm
Mit Hilfe des abklappbaren Vorderteils des Pultes ist es möglich, die Tiefe für Transportzwecke auf unter 800 mm zu reduzieren.

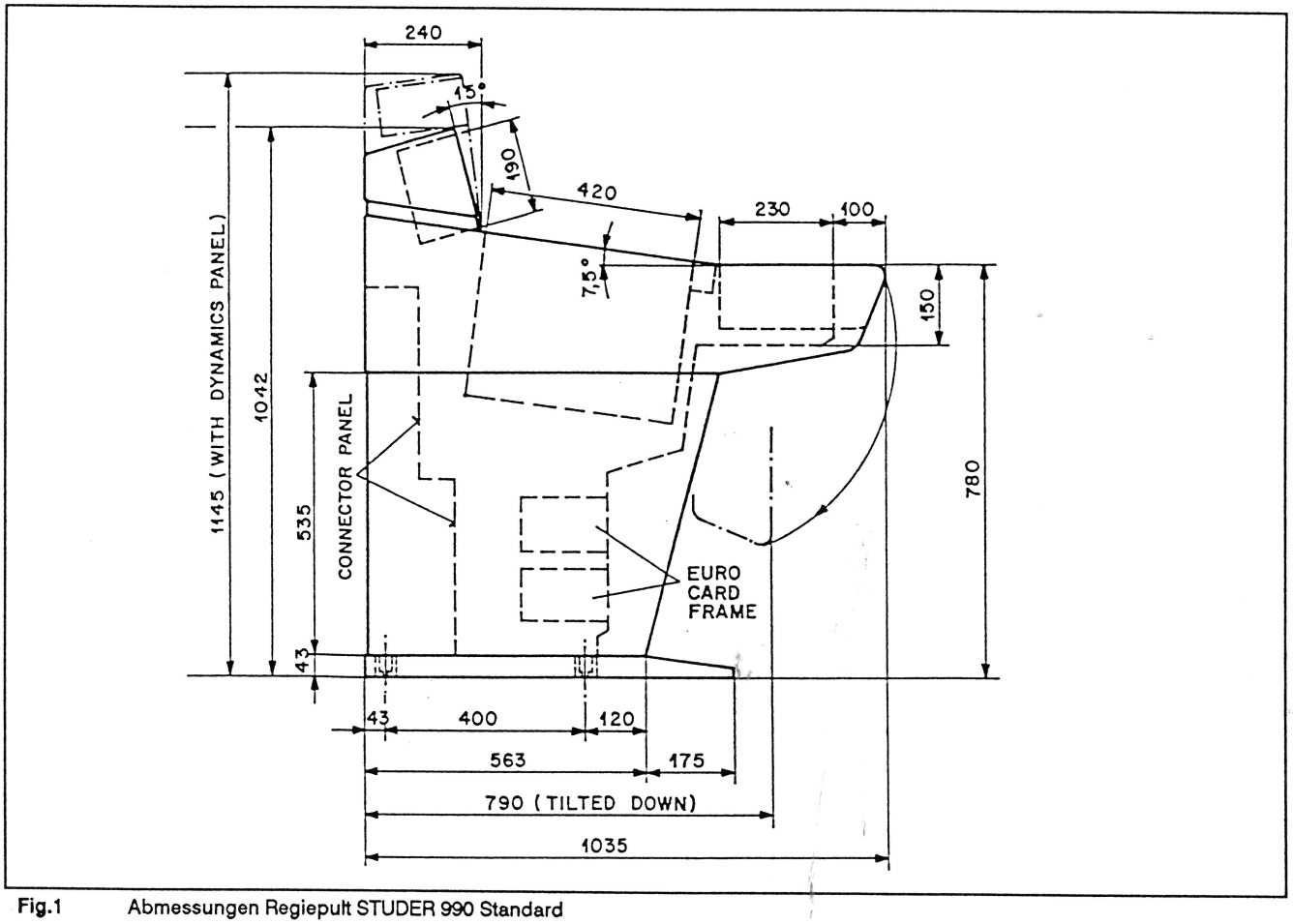


Fig.1 Abmessungen Regiepult STUDER 990 Standard

INLINE-Regiepult

für Anwendungen mit Mehrkanalmaschine (bis zu 80 Eingangskanäle, 8 Gruppen, 4 Stereo-Summen, 32 Mehrkanal-Sammelschienen, erweiterbar auf 48) mit folgenden Einbauplätzen:

- Fader Panel, Länge 230 mm, Neigung 0°
- Inline Panel, Länge 190 mm, Neigung 7,5°
- Input Panel, Länge 420 mm, Neigung 7,5°
- Meter Panel, Länge 190 mm, Neigung 75°

Höhe: INLINE-Regiepult: 1070 mm
INLINE-Regiepult mit "Top Panel": 1170 mm

Tiefe: INLINE-Regiepult: 1230 mm
Mit Hilfe des abklappbaren Vorderteils des Pultes ist es möglich, die Tiefe für Transportzwecke auf unter 800 mm zu reduzieren.

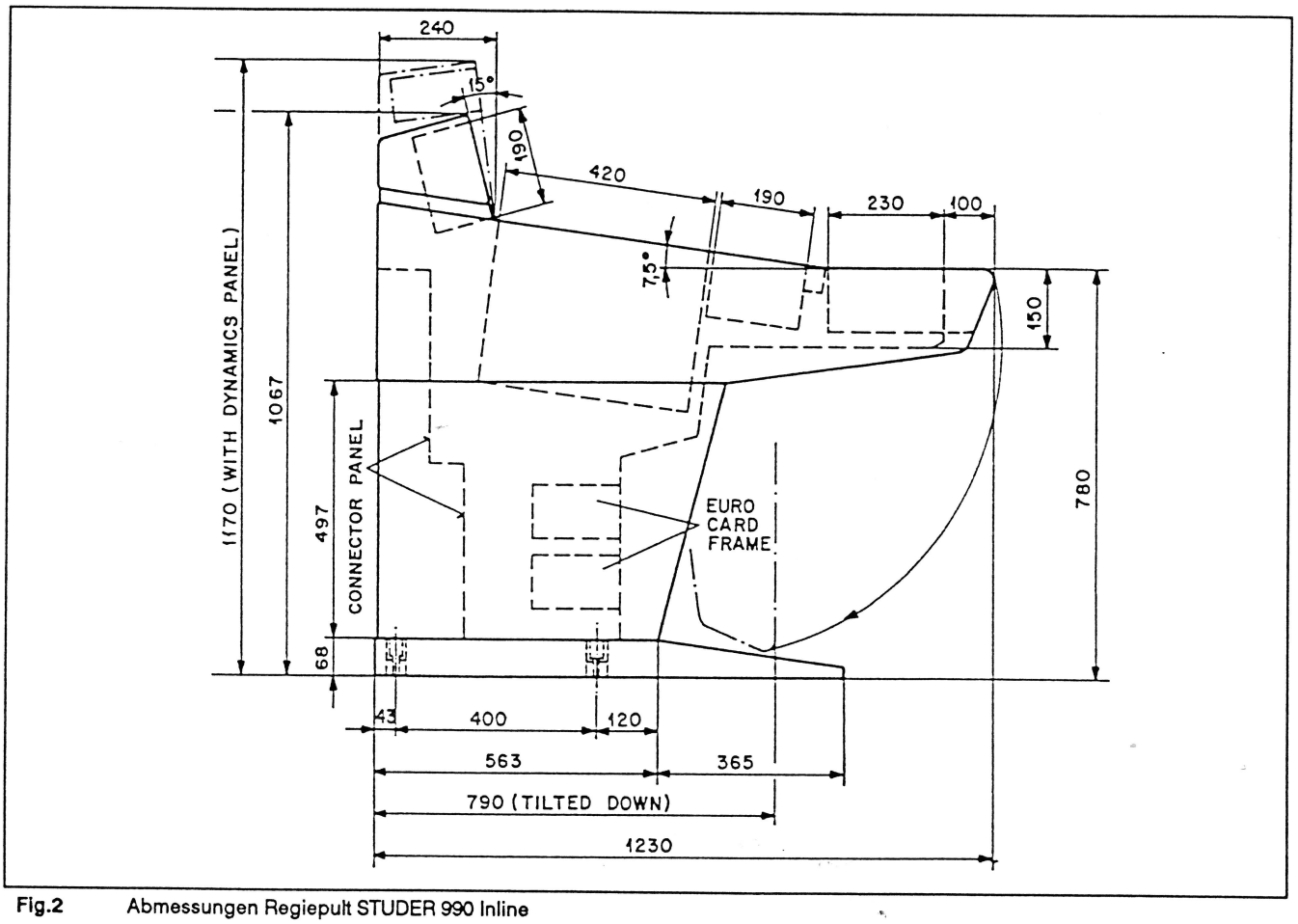


Fig.2 Abmessungen Regiepult STUDER 990 Inline

Patch Panel

Das Steckfeld ist ein optionaler Bestandteil des Regiepults. Es besteht standardmässig aus Tiny-Telephone-Jacks (Bantam-Jacks). Jeder Steckfeldstreifen enthält 2 Reihen mit je 48 Jacks. Durch eine spezielle Konstruktion ist es möglich, Teile des Steckfelds zu ersetzen, ohne in die Verdrahtung des Pultes eingreifen zu müssen.
Die Steckfeldstreifen sind in einem zusätzlichen Chassis (12 Einheiten breit) am rechten oder linken Ende des Pultes untergebracht. Dieses Chassis bietet Platz für zusätzliche Einbauten von Geräten mit 19-Zoll-Befestigung.

Europakarten

Im Unterteil des Pultes ist das Europakarten-Gestell untergebracht. Alle Europakarten sind von vorne zugänglich.

2.4 Installation, power supply

Connectors:

The power supply and the Studio Computer are mounted in a separate 19" rack. All connections to and from the desk are via XLR and multipin connectors situated beneath the removable rear plates of the chassis. All audio connections are wired to 39 pin connectors according DIN 41 618 ("Siemens" type). XLR connectors are optionally available for microphone connections.

Power supply

The power supply is housed in a 19" rack mount unit 4 U high (for consoles having more than 32 inputs it may be necessary to install 2 or more of these units).

Power supply features:

- stabilized, low noise supply for audio circuits with multiple independent outputs and tracking regulation of positive and negative voltages. Ramp start after power-on to reduce thumps and electronic component stress.
- comprehensive temperature and overvoltage protection with indi- cation of failure in console.
- Diagnosis connector, accessible from front, for monitoring of all important parameters during operation.
- integrated adjustable power-on delay and peak current limiting on mains supply.
- integrated "Standby power supply" for powering of memory chips when console is switched off.
- Additional battery backup
- Phantom powering internally selectable 12, 24 or 48 volts
- operation with or without fan, internally selectable
- remote power on/off switching from console

The supply for the logic and processor circuits and the LEDs is delivered by **switching power supplies** built into the eurocard frame of the console.
The brightness of all LEDs and of the VFD bargraph meters is adjustable via a rotary potentiometer from front to accomodate various lighting conditions.

Host computer:

The host computer is located in a 19" rack mount unit 6 U high. The host is a multiprocessor system based on the industry standard VME bus.

3. Preliminary Electrical Specifications

General:

- Voltages in dBu are referred to 0.775V.

0 dBu ≙ 0,775 $V_{eff.}$

- Channel and master faders are set to 0 dB. (Position of the linear faders)
- Line outputs are loaded with 600Ω.
- External sources have a source impedance of ≤ 200Ω.
- Data given are valid from 31.5Hz...16kHz.
- Levels are measured with a continuous sine wave.
  (0 VU ≙ 6 dB below nominal level)

3.1 Levels

Inputs:	MIC Sensitivity adjustable in 1dB steps	**-70dBu ...+20dBu**
	LINE Sensitivity adjustable in 1dB steps	**+6dBu** **±10dB**
	TAPE Sensitivity adjustable in 1dB steps	**+6dBu** **±10dB**
Insertion points:	INSERT level:	**+6dBu**. (balanced)
Outputs:	Presettable within a range of (Main-, auxilliary-, studio-, monitor outputs)	**+6dBu ... +15dBu** (load 600Ω)

Maximum levels

Inputs:	MIC:	**+24dBu**	
	LINE:	**+24dBu**	
	TAPE:	**+24dBu**	
	INSERT:	**+20dBu**	
Outputs:	Line:	**+24dBu**	
	Monitor:	**+18dBu**	
	Studio:	**+18dBu**	
	Insert:	**+20dBu**	
	Headphones:	**+20dBu**	(unloaded)
Overload margin:	at the channel fader (PF) (k_{tot} 1%)		**20dB**
	at the master fader (PF) (k_{tot} 1%)		**20dB**

3.2 Impedances, Loads

Inputs:	MIC:	range -60 ... -10dB	≥	**1,2kΩ**
		range -10 ... +20dB	≥	**5kΩ**
	LINE + TAPE:		≥	**10kΩ**
	INSERT:		≈	**5kΩ**
Outputs:	Main-, auxiliary-, studio-, monitor outputs:		≤	**50Ω**
	Headphones output:		≈	**135Ω**
	INSERT:		≤	**50Ω**
Description:	MIC:	balanced, floating, source	≤	**200Ω**
	LINE:	balanced, floating, source	≤	**200Ω**
	TAPE:	balanced, source	≤	**200Ω**
	INSERT:	balanced, source	≤	**200Ω**
	Line outputs:	balanced, floating, load	≥	**200Ω**
	Studio output:	balanced, floating, load	≥	**600Ω**
	Monitor output:	balanced, floating, load	≥	**600Ω**
	Insert output:	balanced, load	≥	**2kΩ**
	Headphones:	unbal., recommended load	≥	**200Ω**

3.3 Frequency Response (Mono Input Unit, version "A")

	Filters off; frequency range 31,5Hz...16kHz	**+0,5dB / -1dB**
Filter:	Bass cut 12dB/octave 3dB point adjustable (roll-off)	**30Hz ...330Hz**
Equalizer:	Treble control, shelving HF Adjustable attack frequency	**±15dB** **700Hz ...16kHz**
	Treble control, bell HF **±15dB** Adjustable center frequency	**700Hz ...16kHz**
	Bass control, shelving LF Adjustable attack frequency	**±15dB** **30Hz ...600Hz**
	Bass control, bell LF Adjustable center frequency	**±15dB** **30Hz ...600Hz**

Presence/absence filter, bell HMF		**±15dB**	
Adjustable center frequency		**350Hz ... 7kHz**	
	Q 'narrow':	Q ≈ 3	(at max. boost)
	Q 'wide':	Q ≈ 1	(at max. boost)

Presence/absence filter, bell LMF		**±15dB**	
Adjustable center frequency		**100Hz ... 2kHz**	
	Q 'narrow':	Q ≈ 3	(at max. boost)
	Q 'wide':	Q ≈ 1	(at max. boost)

3.4 Noise weighted

Noise voltages are measured with a true RMS voltmeter and an equivalent noise bandwith of 30Hz...23kHz (e.g. Siemens U2033 or equal).

Noise figure of the microphone input: **F ≤ 4dB**
(Source impedance = 200 Ω)

Signal-to-noise ratio **> 98dB**
(Master fader closed)

One channel:
Input and master faders 0dB; line input, unity gain;

filters off	**> 95dB**
filters on (linear)	**> 87dB**

4 channels:
Input and master faders 0dB; line input, unity gain;

filters off	**> 90dB**
filters on (linear)	**> 82dB**

16 channels:
Input and master faders 0dB; line input, unity gain;

filters off	**> 84dB**
filters on (linear)	**> 76dB**

3.5 Distortion and Crosstalk

Distortion: Line level in frequency range **≤ 0,1%**

Crosstalk: Crosstalk from master to master **> 80dB**

3.6 Power Supply

Mains operation, mains voltage selector for:
100V, 120V, 140V, 200V, 220V, 240V AC ±10%

Internal supply voltage:

+15V	Audio electronics
-15V	Audio electronics
+5V	Logic
var.	LED
48V	Phantom powering

Section 2 Channel related units

CONTENTS

Input units

Mono input unit 1.990.210

Mono input unit "B" 1.990.220

Stereo input unit universal (MCH) 1.990.230

Stereo input unit High Level + EQ (MCH) 1.990.232

Stereo input unit High Level (MCH) 1.990.235

Stereo input unit universal "B" 1.990.240

Stereo input unit High Level + EQ "B" 1.990.242

Stereo input unit High Level "B" 1.990.245

Fader units

Input fader unit 1.990.110

Inline unit (small fader) 1.990.410

Dynamics unit 1.990.510

VFD bargraph meter 1.990.620

3 MONO INPUT UNITS

3.1 Input unit mono (MCH) 1.990.210

3.1.1 General

This unit is used in all Inline consoles. It contains the electronics for both signal paths of an inline channel except the multitrack bus assignment, which is located on eurocards underneath. This eurocard contains a 32 bus assignment, which can be expanded to 48 buses by adding additional cards.

3.1.2 Channel input

MIC Variable sensitivity from -70 to +20 dBu, balanced and floating input, switchable phantom powering.

LINE A Electronically balanced line input, set for nominal line level, +/- 10 dB trim, also used for optional remote controlled mic preamps.

LINE B Balanced floating line input, set for nominal line level, +/- 10 dB trim.

BUS RET,
TAPE RET Electronically balanced line input, set for nominal line level, +/- 10 dB trim.

The Channel input stage is digitally controlled, gain trimming is done in 1 dB increments via "+" and "-" keys, the chosen gain is displayed on the two digit display.

Φ Phase reverse switch, active on all inputs
PWR Phantom power switch

3.1.3 Filter

IN High-pass filter, switchable in/out
Filter with 12 dB/octave slope, continously variable cut-off frequency 30 ... 300 Hz.

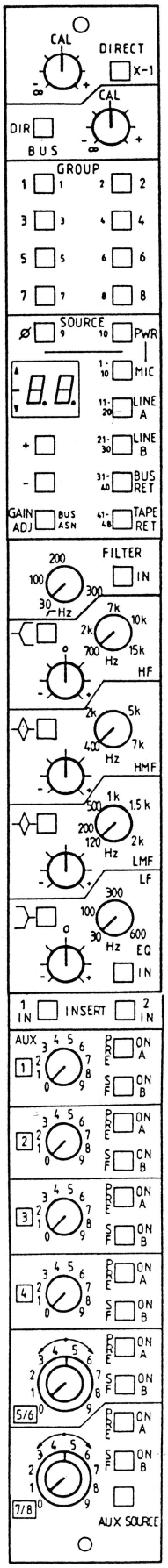
3.1.4 Equalizer section

EQ IN in/out switch.

HF High frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 700 Hz...15 kHz, bell/shelving switch

HMF/
LMF Hi-mid and Lo-mid parametric EQ, +/-15 dB boost/cut, continuously variable frequency 400 Hz ... 7 kHz, resp. 120 Hz ... 2 kHz. Q switch per section, Q = 1 or 3

LF low frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 30 Hz ... 600 Hz, bell/shelving switch.



Input Unit MONO (MCH)
1.990.210

3.1.5 Insert points

There are two Insert points, both electronically balanced. The insert points can be configured via software to be pre or post equalizer.

INSERT 1 IN Insert point 1, in/out switchable,
INSERT 2 IN Insert point 2, in/out switchable.

3.1.6 Auxiliary sends

AUX 1 ... AUX 4 : 4 Mono auxiliary sends,
level adjustable,
ON A, ON B assignable to two output busses (A and B)
PRE switchable pre/post fader,
SF switchable main/small fader,

AUX 5/6, AUX 7/8 : 2 Stereo auxiliary sends,
level and pan adjustable,
ON A, ON B assignable to two output busses (A and B)
PRE switchable pre/post fader,
SF switchable main/small fader,

AUX SOURCE Function flip switch, determines AUX SEND key functions :
1st level : ON A, ON B switching for AUX 1...8,
2nd level : "pre fader", "small fader" switching.

3.1.7 Audio grouping

GROUP 1..8 Keys for audio subgrouping.
Groups 1,3,5,7 serve as left and groups 2,4,6,8 as right in stereo applications as determined by associated PAN pots.

3.1.8 Direct output

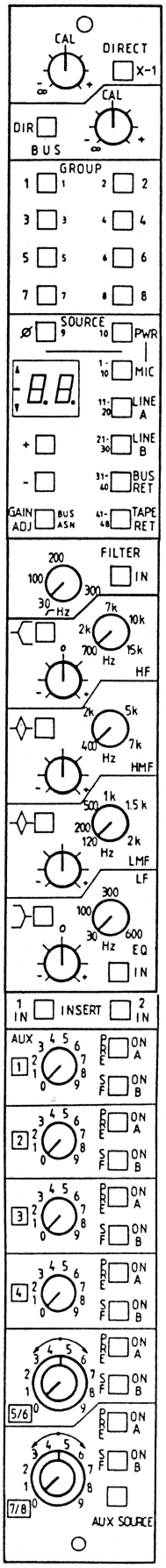
Electronically balanced output; normally fed from the signal pre or post main fader. It can be internally wired to look at the same signal as chosen for the AUX 4 or AUX 5/6. It is level adjustable, the pot is indented in the calibrated position. Talkback can be inserted via central Talkback Panel.

X-1 Key to enable X-1 operation (for mix-minus feeds).

3.1.9 Bus output

Electronically balanced output; normally delivers the output of the corresponding multitrack summing bus. Level adjustable via potentiometer, indented in the calibrated position. Talkback can be inserted via central Talkback Panel.

DIRECT The routing of the multitrack summing bus to the output is defeated; instead of this the "post fader" signal of the input channel is routed to the bus output directly.



Input Unit MONO (MCH)
1.990.210

3.2 Input unit mono (B) 1.990.220

3.2.1 General

This is a simplified version of the Mono Input Unit MCH, which is used for series 990 STANDARD consoles.

The main differences are:
- only 1 signal path
- 3 inputs: MIC, LINE A, LINE B
- only 1 insert point
- 8 AUX sends (4 x mono, 2 x stereo)
- no acces to multitrack buses
- no bus output

3.2.2 Channel input

MIC Variable sensitivity from -70 to +20 dBu, balanced and floating input, switchable phantom powering.

LINE A Electronically balanced line input, set for nominal line level, +/- 10 dB trim, also used for optional remote controlled mic preamps.

LINE B Balanced floating line input, set for nominal line level, +/- 10 dB trim.

The Channel input stage is digitally controlled, gain trimming is done in 1 dB increments via "+" and "-" keys, the chosen gain is displayed on the two digit display.

Φ Phase reverse switch, active on all inputs
PWR Phantom power switch

3.2.3 Filter

IN High-pass filter, switchable in/out
Filter with 12 dB/octave slope, continously variable cut-off frequency 30 ... 300 Hz.

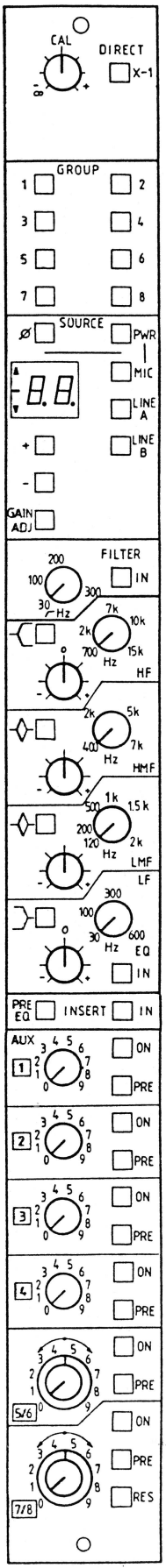
3.2.4 Equalizer section

EQ IN in/out switch.

HF High frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 700 Hz...15 kHz, bell/shelving switch.

HMF/ LMF Hi-mid and Lo-mid parametric EQ, +/-15 dB boost/cut, continuously variable frequency 400 Hz ... 7 kHz, resp. 120 Hz ... 2 kHz, Q switch per section, Q = 1 or 3.

LF low frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 30 Hz ... 600 Hz, bell/shelving switch.



Input Unit MONO (B)
1.990.220

3.2.5 Insert point

INSERT IN Insert point in/out switchable,
PRE EQ Insert switchable pre/post equalizer.
The insert send and return are electronically balanced.

3.2.6 Auxiliary sends

AUX 1 ... AUX 4 : 4 Mono auxiliary sends,
level adjustable,
ON on/off switchable
PRE switchable pre/post fader.

AUX 5/6, AUX 7/8 : 2 Stereo auxiliary sends,
level and pan adjustable,
ON on/off switchable
PRE switchable pre/post fader.

RES reserved for future applications.

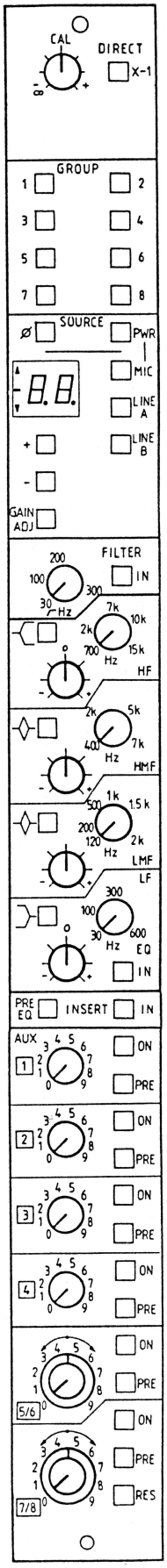
3.2.7 Audio grouping

GROUP 1..8 Keys for audio subgrouping.
Groups 1,3,5,7 serve as left and groups 2,4,6,8 as right in stereo applications as determined by associated PAN pots.

3.2.8 Direct output

Electronically balanced output; normally fed from the signal pre or post main fader. It can be internally wired to look at the same signal as chosen for the AUX 4 or AUX 5/6. It is level adjustable, the pot is indented in the calibrated position. Talkback can be inserted via central Talkback Panel.

X-1 Key to enable X-1 operation (for mix-minus feeds).



Input Unit MONO (B)
1.990.220

4 STEREO INPUT UNITS

4.1 Input unit stereo universal (MCH) 1.990.230

4.1.1 General

This input unit is used for stereophonic or 2-channel microphone and line level signals in series 990 INLINE consoles. It is not possible to install an "inline unit" in a stereo input channel. The mounting space normally used for the inline unit can be used for other units, e.g. monitoring or control units.

4.1.2 Channel input

MIC 2-channel balanced floating input, variable sensitivity from -70 to +20 dBu, switchable phantom powering

LINE 2-channel balanced floating line input, set for nominal line level, +/- 10 dB trim

MONO switchable mono function
X Exchange of channel 1 and 2.
MS Activates the built-in MS decoder. An incoming MS (mid/side) signal will be converted to an standard left/right signal.
Φ Phase reverse switch, active on channel 1 of both inputs. After pressing the "GAIN ADJ/BUS ASN" key it is possible to reverse the phase of channel 2.
PWR Phantom powering on/off switchable.

The Channel input stage is digitally controlled, gain trimming is done in 1 dB increments via "+" and "-" keys, the chosen gain is displayed on the two digit display.
It is possible to adjust the balance of the incoming signals in the input stage. After pressing the "GAIN ADJ" key it is possible to trim the gain of channel 1 (left) by +/- 6 dB relative to channel 2. Step size is 0.5 dB, gain trim is indicated on the 2-digit-display resp. the arrow-LEDs beneath the display.

SPREAD Stereo width control with rotary potentiometer, range : 0 = mono ... 1 = normal ... 2 = extreme
IN switchable on/off.

4.1.3 Filter

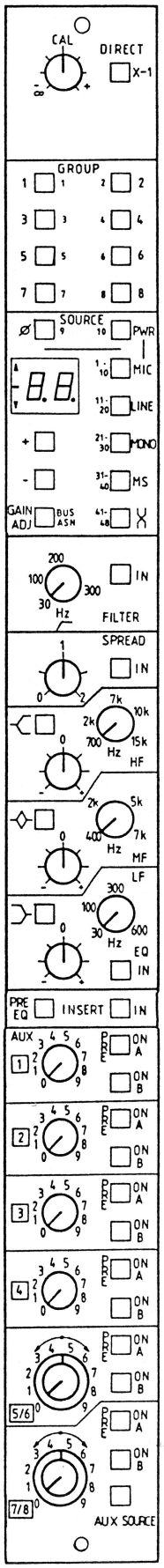
IN High-pass filter, switchable in/out
Filter with 12 dB/octave slope, continously variable cut-off frequency 30 ... 300 Hz.

4.1.4 Equalizer section

EQ IN in/out switch.

HF High frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 700 Hz...15 kHz, bell/shelving switch.

MF mid frequency parametric EQ, +/-15 dB boost/cut, continuously variable frequency 400 Hz ... 7 kHz,



Input Unit STEREO
Universal (MCH) 1.990.230

Q switch, Q = 1 or 3.

LF low frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 30 Hz ... 600 Hz, bell/shelving switch.

4.1.5 Insert point

INSERT IN Insert point in/out switchable,
PRE EQ Insert switchable pre/post equalizer.
The insert sends and returns are electronically balanced.

4.1.6 Auxiliary sends

AUX 1 ... AUX 4 : 4 Mono AUX sends (sum of CH 1 + 2), level adjustable,
ON A, ON B assignable to 2 output buses (A and B),
PRE switchable pre/post fader.

AUX 5/6, AUX 7/8 : 2 Stereo AUX sends, level and pan adjustable,
ON A, ON B assignable to 2 output buses (A and B),
PRE switchable pre/post fader.

AUX SOURCE Function flip switch, determines AUX SEND key function
1st level : ON A, ON B switching for AUX 1...8,
2nd level : "pre fader" switching.

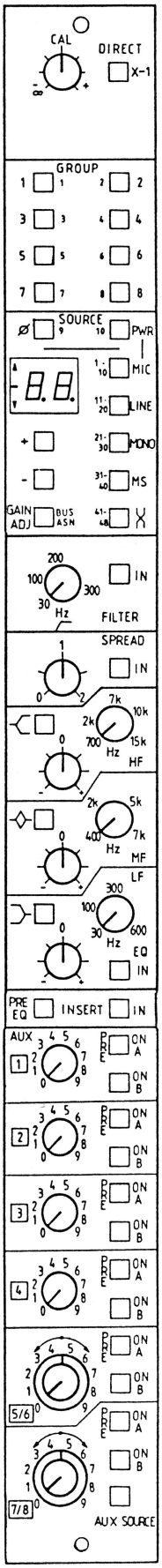
4.1.7 Audio grouping

GROUP 1..8 Keys for audio subgrouping.
Groups 1,3,5,7 serve as left and groups 2,4,6,8 as right in stereo applications as determined by associated PAN pots.

4.1.8 Direct output

2-channel electronically balanced output; normally fed from the signal pre or post main fader. It can be internally wired to look at the same signal as chosen for the AUX 5/6. It is level adjustable, the pot is indented in the calibrated position. Talkback can be inserted via central Talkback Panel.

X-1 Key to enable X-1 operation (for mix-minus feeds).



Input Unit STEREO
Universal (MCH) 1.990.230

4.2 Input unit stereo HL + EQ (MCH) 1.990.232

4.2.1 General

This input unit is used for stereophonic or 2-channel line level signals in series 990 INLINE consoles. It is not possible to install an "inline unit" in a stereo input channel. The mounting space normally used for the inline unit can be used for other units, e.g. monitoring or control units.

4.2.2 Channel input

LINE A 2-channel electronically balanced line input, set for nominal line level, +/- 10 dB trim, also used for optional remote controlled mic preamps.

LINE B 2-channel balanced floating line input, set for nominal line level, +/- 10 dB trim.

CH 1 Selection of the input signal channel 1 (left), which is routed to both internal signal paths.
CH 2 Selection of the input signal channel 2 (right), which is routed to both internal signal paths.
CH 1 + CH 2 Mono function
X Exchange of channel 1 and 2

Φ Phase reverse switch, active on channel 1 of both inputs. After pressing the "GAIN ADJ/BUS ASN" key it is possible to reverse the phase of channel 2.

The Channel input stage is digitally controlled, gain trimming is done in 1 dB increments via "+" and "-" keys, the chosen gain is displayed on the two digit display. It is possible to adjust the balance of the incoming signals in the input stage. After pressing the "GAIN ADJ" key it is possible to trim the gain of channel 1 (left) by +/- 6 dB relative to channel 2. Step size is 0.5 dB, gain trim is indicated on the 2-digit-display resp. the arrow-LEDs beneath the display.

SPREAD Stereo width control with rotary potentiometer, range : 0 = mono ... 1 = normal ... 2 = extreme
IN switchable on/off.

4.2.3 Filter

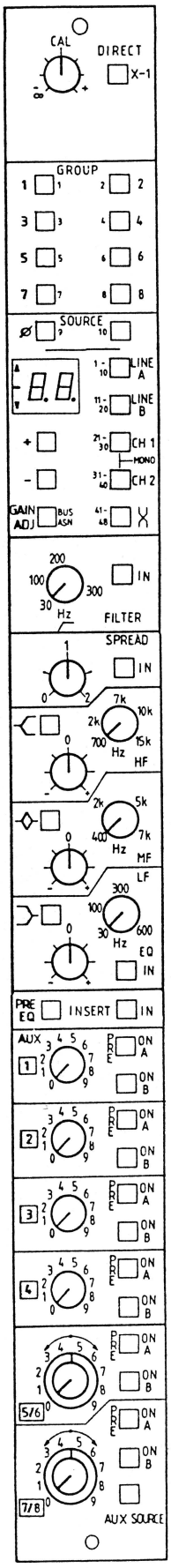
IN High-pass filter, switchable in/out
Filter with 12 dB/octave slope, continously variable cut-off frequency 30 ... 300 Hz.

4.2.4 Equalizer section

EQ IN in/out switch.

HF High frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 700 Hz...15 kHz, bell/shelving switch.

MF mid frequency parametric EQ, +/-15 dB boost/cut, continuously variable frequency 400 Hz ... 7 kHz, Q switch, Q = 1 or 3.



Input Unit STEREO
HL + EQ (MCH) 1.990.232

LF low frequency EQ, +/- 15 dB boost/cut, continuously variable frequency 30 Hz ... 600 Hz, bell/shelving switch.

4.2.5 Insert point

INSERT IN Insert point in/out switchable,
PRE EQ Insert switchable pre/post equalizer.
The insert sends and returns are electronically balanced.

4.2.6 Auxiliary sends

AUX 1 ... AUX 4 : 4 Mono AUX sends (sum of CH 1 + 2), level adjustable,
ON A, ON B assignable to 2 output buses (A and B),
PRE switchable pre/post fader.

AUX 5/6, AUX 7/8 : 2 Stereo AUX sends, level and pan adjustable,
ON A, ON B assignable to 2 output buses (A and B),
PRE switchable pre/post fader.

AUX SOURCE Function flip switch, determines AUX SEND key functions :
1st level : ON A, ON B switching for AUX 1...8,
2nd level : "pre fader" switching.

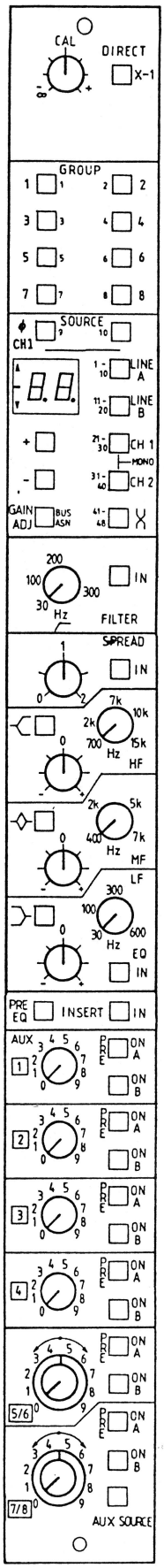
4.2.7 Audio grouping

GROUP 1..8 Keys for audio subgrouping.
Groups 1,3,5,7 serve as left and groups 2,4,6,8 as right in stereo applications as determined by associated PAN pots.

4.2.8 Direct output

2-channel electronically balanced output; normally fed from the signal pre or post main fader. It can be internally wired to look at the same signal as chosen for the AUX 5/6. It is level adjustable, the pot is indented in the calibrated position. Talkback can be inserted via central Talkback Panel.

X-1 Key to enable X-1 operation (for mix-minus feeds).



Input Unit STEREO
HL + EQ (MCH) 1.990.232

4.3 Input unit stereo HL (MCH) 1.990.235

This unit will be used in series 990 INLINE consoles. It has the same input and output structure as the "Input unit stereo HL + EQ", but has reduced processing facilities :

- no high-pass filter,
- no equalizer,
- no stereo spread function.

4.4 Input unit stereo universal (B) 1.990.240

This input unit is also intended for use with series 990 STANDARD consoles. It enables the processing of stereophonic microphone and line level input signals. The description is the same as for the "Input unit stereo universal (MCH)", with the following differences :

- only 8 AUX sends (4 x mono, 2 x stereo)
- no access to multitrack buses

4.5 Input unit stereo HL + EQ (B) 1.990.242

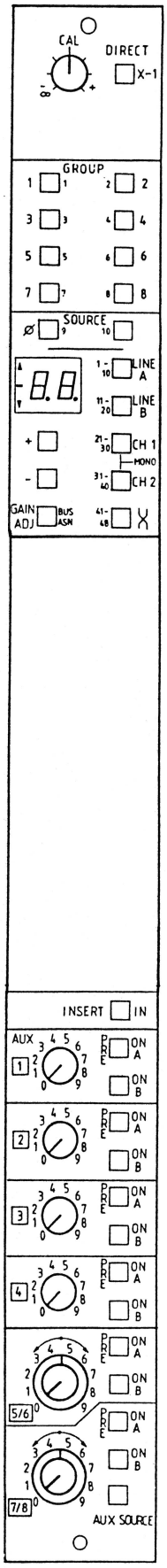
This input unit is intended for use with series 990 STANDARD consoles. It enables the processing of stereophonic or 2-channel input signals. The description is the same as for the "Input unit stereo HL + EQ (MCH)", with the following differences :

- only 8 AUX sends (4 x mono, 2 x stereo)
- no access to multitrack buses

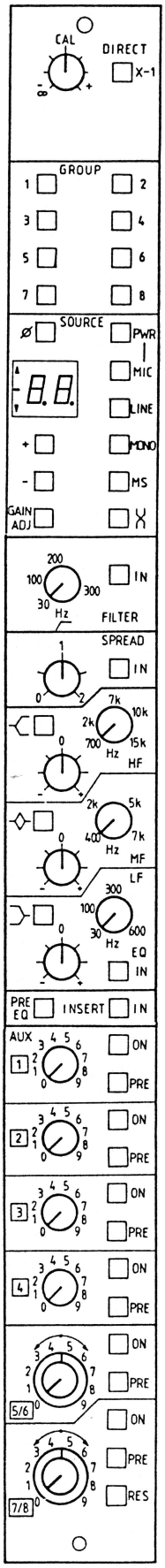
4.6 Input unit stereo HL (B) 1.990.245

This unit has the same input and output structure as the unit mentioned above, but has reduced processing facilities :

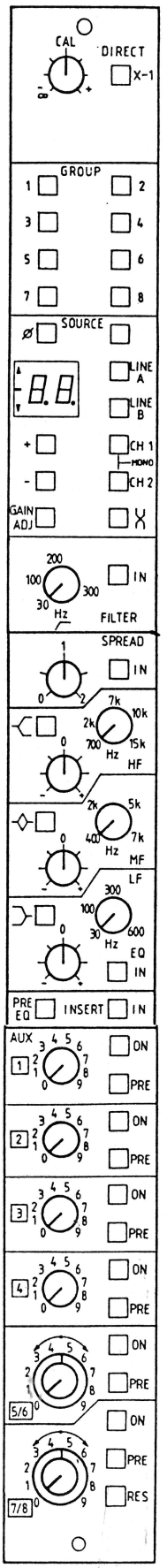
- no high-pass filter
- no equalizer
- no stereo spread



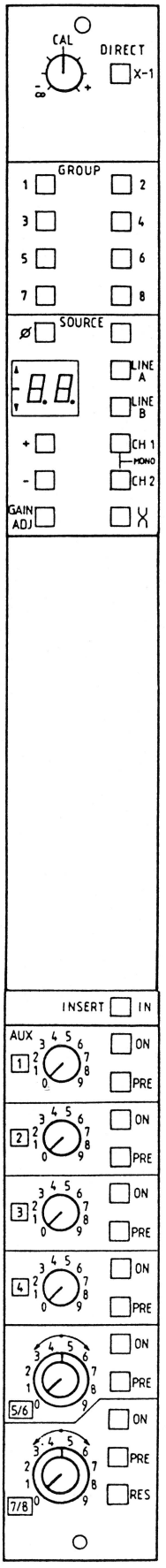
Input Unit STEREO
HL (MCH) 1.990.235



Input Unit STEREO
Universal (B)-1.990.240



Input Unit STEREO
HL + EQ (B)1.990.242



Input Unit STEREO
HL (B)1.990.245

6 FADER UNITS

6.1 Input fader unit 1.990.110

6.1.1 Fader section

The main fader (stroke length 104 mm) controls the VCA. There is also an optional motorized version.
ON On/off switch for the main fader signal
PFL Pre-Fade-Listen key
SOLO After-Pan-Listen or Solo-In-Place key, depending on the central selection.

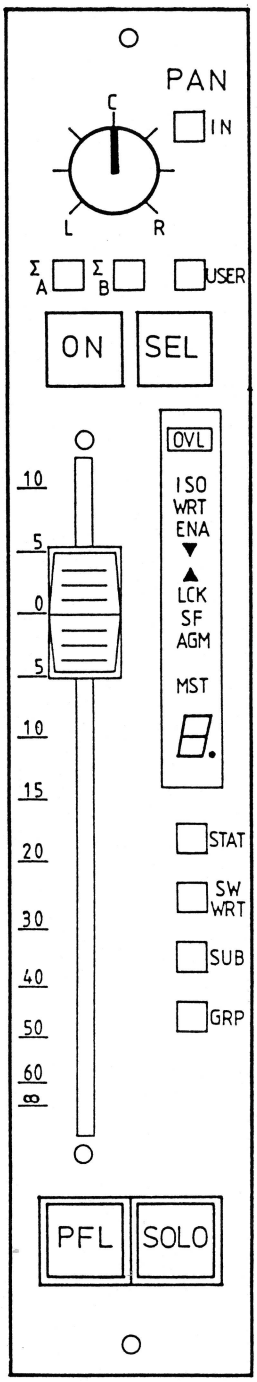
6.1.2 Automation, subgrouping

The display window:
OVL Overload indication
ISO The fader is isolated from any automation
WRT The fader is in the WRITE status
ENA The fader is ready for UPDATE/WRITE operation
The two LED's beside the small fader are used to show the deviation of the VCA voltage from the actual fader position.
LCK The fader is disconnected from all centrally controlled switching
SF The small fader is processed
AGM Not used
MST Indication of the VCA-Master function
The seven-segment display shows the VCA grouping assignment.

Keys:
STAT =Status, control of automatio status on a channel by channel basis
SW WRT =Switch Write, controls the automation of switch settings
SUB Building of subgroups for grouped switching
GRP =Group, access key for VCA subgrouping

6.1.3 Miscellaneous functions

PAN PAN pot, in/out switchable
Σ A/Σ B Routing to stereo summing buses A and B
SEL Key to invoke the central HELP functions, also used for status display functions and input of commands
USER User definable function key



Input Fader Unit
1.990.110

6.1.4 Input fader STEREO

The Stereo Input Fader Unit has the same construction as the Mono Input Fader Unit. One fader is controlling both channels of the unit.
Instead of the PAN pot, there is an Image Shift Controller, which enables left/right shifting of the whole stereo image without loss of stereo localization.
This control in conjunction with the balance and basis width controls on the Input Unit STEREO enables wide possibilities of stereo image processing.
On request the pot can be configured to work as a standard balance control.

7 Other channel related units

7.1 Inline unit 1.990.410

General :
This unit contains all controls necessary for the second signal path of an INLINE console. The various processing features and the symmetric bus assign structure of the two faders (main and small fader) make this unit a true second signal path in each channel, which can be used e.g. as an additional line return during mixdown.

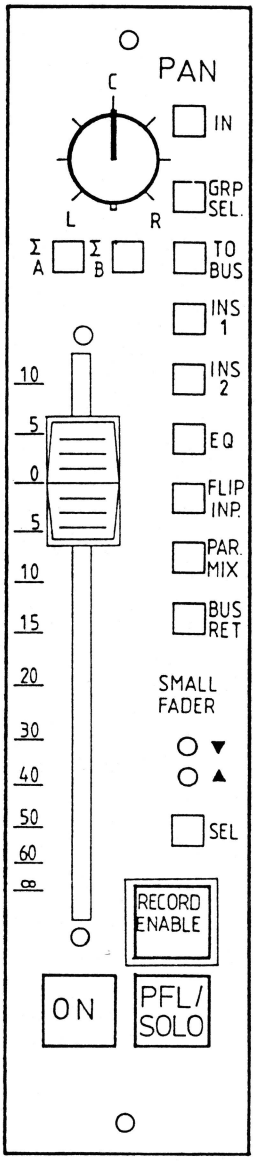
Signal flow control :
BUS RET Chooses the signal to be monitored; "Bus Return" monitors the desk output, "Tape Return" monitors tape machine signal.
PAR MIX Lifts the small fader signal from the monitor path and reroutes it to the channel input.
FLIP INPUT Effectively flips the input signals of the main and small fader.

Signal processing control :
EQ Switches the equalizer section into the signal path of the small fader
INS 1 Assigns Insert Point 1 into the signal path of the small fader
INS 2 Assigns Insert Point 2 into the signal path of the small fader

Output assignment control :
GRP SEL Enables the Group Select keys (in the Input Unit) to assign the small fader signal to the audio subgroups.
TO BUS Switches the small fader signal onto the bus assignment
Σ A / Σ B Switches the small fader signal onto the stereo summing buses A and B

The small fader (stroke length 83 mm) is used to control the level of the monitor path. The PAN potentiometer is in/out switchable, active on the signal after small fader.

Miscellaneous functions :
ON On/off switch for the small fader signal
PFL/SOLO Key to activate the PFL/After-Pan-Listen/ Solo-In-Place functions
REC RDY Key to activate the "Record Ready" function of the multitrack tape machine
SEL Key to select the special functions of the In-line Unit, supported by the Master Control Unit
The two LED's beside the small fader are used to show the deviation of the VCA voltage from the actual fader position.



Inline Unit
1.990.410

7.2 Dynamics unit 1.990.510

The Dynamics Unit offers the Gate-, Compressor- and Limiter-functions. The side chain signal for the Dynamics Unit is taken from one of the insert points in the same channel. This allows additional external side chain signal processing or inserting external keying signals to the Dynamics Unit.
The actual dynamic processing of the audio signal is done in the standard Fader thus avoiding the need for an additional VCA in the audio path.
The gain reduction of the compressor section is automatically taken care of by an internal gain make-up circuit. This keeps peak levels in the optimum range under all conditions.
Dynamic processing of the small fader signal is possible by switching the insert point into the small fader path.

Gate section:

GATE Switches the Gate function in and out. The activity of the Gate circuits is indicated by a "GATE" LED.

FAST ATT Switches the gate attack time from normal (1200 µs) to fast (200 µs).

THRESHOLD Pot to adjust gate threshold level from 0 dB to -50 dBu.

RANGE Pot to determine the depth of gating from 0 dB to 50 dB.

REL TIME Controls the Release time of both Gate and Compressor sections in 9 steps. Functions as a ring key, the setting is indicated by 5 LED's from "slow" to "fast".

Compressor section :

COMP Switches the Compressor in and out. The LED Gain Reduction Meter (GRM) indicates the gain reduction for a particular setting.

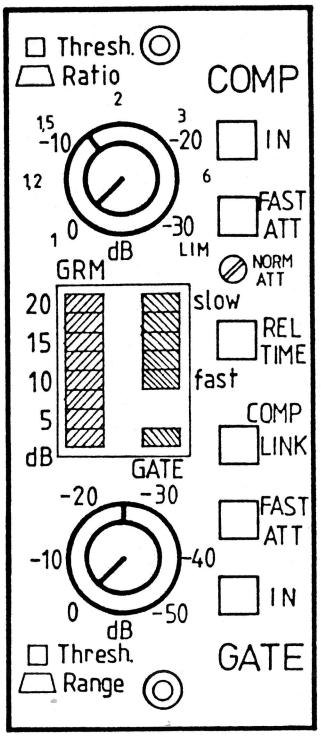
FAST ATT Switches to fast attack time (300 µs)

NORM ATT The trimpot with screwdriver operation enables adjustment of the standard attack time between 300 µs and approx. 1.5 ms.

THRESHOLD Pot to adjust Compressor threshold level from 0 to -30 dBu.

RATIO Pot to set the slope of compressing. Range from 1:1 (fully counter-clockwise) through to 6:1. Full clockwise position gives Limiter function.

GRM "Gain Reduction Meter", indicates amount of gain reduction of the Compressor/Limiter.



Dynamics Unit
1.990.510

7.3 4 CH VFD bargraph meter 1.990.620

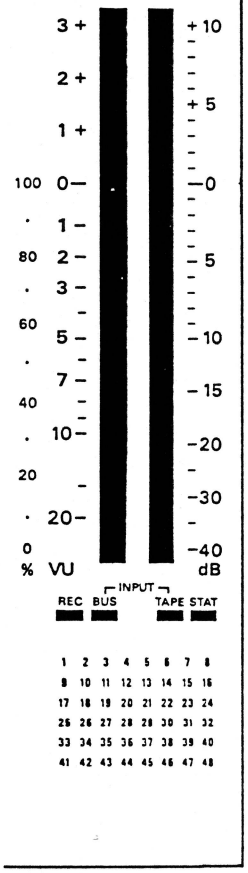
General:
This bargraph meter is four standard units wide and contains the level meters for four mono or stereo channels. It can also show up to eight DC voltages, and optionally bus assignment and various status information. This unit is mainly used for the input channels in INLINE consoles, but can also be used for STANDARD consoles and for group, master and monitor level indication.

Audio level meter:
The meter unit consists of two 100-segment Bargraph indicators per channel (Vacuum Fluorescent Display). The meters can be used to display mono or stereo audio levels. The meter is switchable between two different standards and characteristics (PPM/VU).
Additional features :
- scale PPM : - 40 ... + 10 dB
- scale VU : - 20 ... + 3 VU
- integration time PPM : acc. DIN, switchable 0.1 ms
- integration time VU : acc. ANSI
- switchable sensitivity + 20 dB
- bar/dot indication switchable
- peak memory, switchable manual/auto reset
- integrated "line-up mode", with reference memory and difference indication
- input electronically balanced

DC indication:
The bargraph meters can be used to indicate DC voltages. This is used to show VCA levels and also used in the RECALL procedure. During Recall, one of the Bargraphs shows the recorded VCA level and the other shows the actual position of the fader, making direct comparison and adjustment easy and fast.

Bus assignment indication :
In an in-line configuration, the multitrack bus assignment is done centrally. The meter unit holds four sets of bus assignment indicators, facilitating instant control of buses (1 to 48) assigned for each channel.

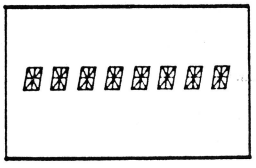
Other indicators :
REC Indication of tape machine status
BUS/TAPE Indication of Bargraph mode, i.e. of the source from which the Bargraph is fed.
STAT indicator for recall procedure



4 CH VFD Bargraph Unit
1.990.620

7.4 Display module 1.990.090

The 8 digit Alphanumeric Display Unit can be optionally built in each channel of the 990 Series desks. It is located on top of the large fader instead of the labelling strip. The display can serve various tasks:
- "electronic naming" of channels (KICK, VOX, etc)
- operational support (in RECALL procedures, etc)
- indication of status information



Display Module
1.990.090

Section 3 Master units for audio and controlling

CONTENTS

Group units

Mono group unit (MCH) 1.990.255

Stereo group unit "B" 1.990.265

Stereo group unit (MCH) 1.990.275

Stereo group unit "B" 1.990.285

Group fader unit 1.990.130

Master fader unit 1.990.140

AUX master unit 1.990.310

Master audio units

Monitoring system description

Source selector panel 1.990.490/390

Control room monitor panel 1.990.420

Studio monitor panel 1.990.430

PFL, talkback & headphones panel 1.990.440

Master control units

Talkback mic / display control unit 1.990.652/653

5 GROUP UNITS, MONO and STEREO

5.1 Group unit mono (MCH) 1.990.255

5.1.1 General

The audio group units are used for summing and processing the audio signals which have been assigned to a particular group bus. These units represent an intermediate stage between input channels and master outputs. For the 8 group buses, which can be accessed from each input unit in the 990, a maximum of 8 mono group units can be installed.

5.1.2 Input section / insert

A summing amplifier for the corresponding bus forms the input stage of the group unit. The following insert point is electronically balanced (send and return).

INSERT IN Insert switchable in/out

5.1.3 Auxiliary sends

AUX 1 ... AUX 4 : 4 Mono AUX sends, level adjustable,
ON A, ON B assignable to 2 output buses (A and B),
PRE switchable pre/post fader.

AUX 5/6, AUX 7/8 : 2 Stereo AUX sends,
level and pan adjustable,
ON A, ON B assignable to 2 output buses (A and B),
PRE switchable pre/post fader.

AUX SOURCE Function flip switch, determines AUX SEND key function
1st level : ON A, ON B switching for AUX 1...8,
2nd level : "pre fader" switching.

5.1.4 Bus assign

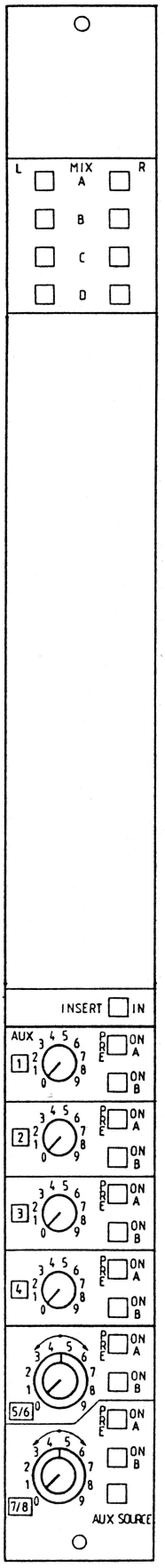
The signal after the panorama potentiometer (located in the group fader unit) can be assigned to the stereo master outputs, separately for left and right channel.

Σ A,B,C,D L-R 8 keys for stereo master assignment

As an option it is possible to assign the group unit signal after pan-pot onto the multitrack buses. The assignment can be operated via the "Central assign unit".

5.1.5 Direct output

The direct output of the group unit is electronically balanced; it can be sourced pre or after fader.



Group Unit MONO (MCH)
1.990.255

5.2 Group unit mono (B) 1.990.265

This group unit is intended for series 990 STANDARD consoles, which are not equipped with multitrack facilities.

Differences to the corresponding "MCH" unit :
- only 8 AUX send buses (4 x mono, 2 x stereo)
- no access to multitrack buses

5.3 Group unit stereo (MCH) 1.990.275

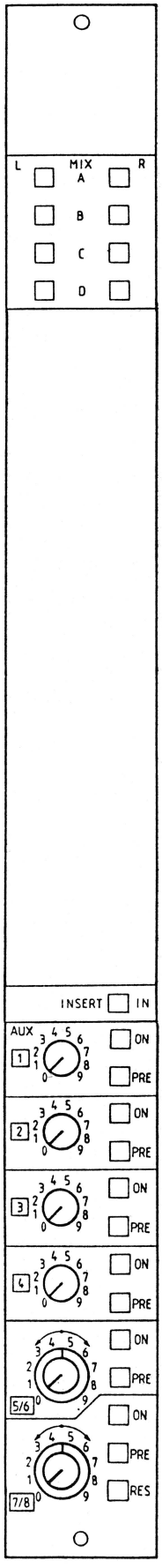
This unit has a 2-channel audio path from input to output, and is intended for INLINE consoles. The available functions are the same as in the "Group unit mono MCH".

Layout, see "Group unit mono MCH".

5.4 Group unit stereo (B) 1.990.285

Group unit with 2-channel signal path, but for STANDARD consoles.

Layout, see "Group unit mono B".



Group Unit MONO (B)
1.990.265

6.2 Group fader unit 1.990.130

6.2.1 Fader section

The main fader (stroke length 104 mm) controls the VCA. There is also an optional motorized version.

ON On/off switch for the main fader signal
PFL Pre-Fade-Listen key
SOLO After-Pan-Listen or Solo-In-Place key, depending on the central selection.

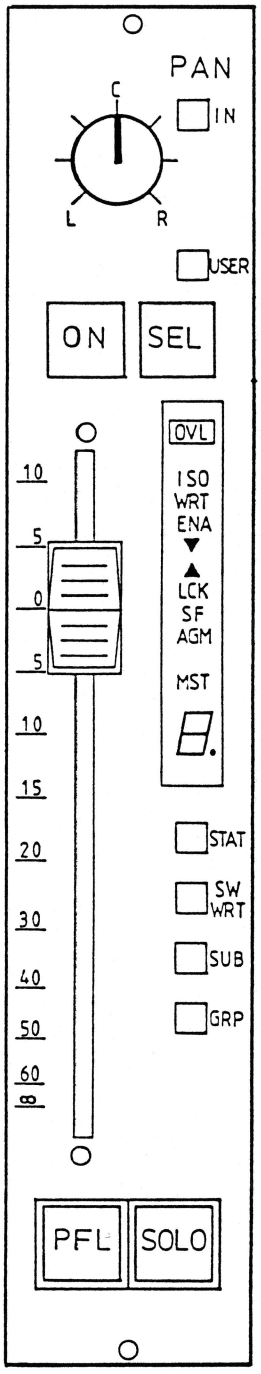
6.2.2 Automation, subgrouping

The display window:
OVL Overload indication
ISO The fader is isolated from any automation
WRT The fader is in the WRITE status
ENA The fader is ready for UPDATE/WRITE operation
The two LED's beside the small fader are used to show the deviation of the VCA voltage from the actual fader position.
LCK The fader is disconnected from all centrally controlled switching
SF not used
AGM = Audio Group Master : fader controls the level of the audio group signal path
MST Indication of the VCA-Master function
The seven-segment display shows the VCA grouping assignment.

Keys:
STAT =Status, control of automatio status on a channel by channel basis
SW WRT =Switch Write, controls the automation of switch settings
SUB Building of subgroups for grouped switching
GRP =Group, access key for VCA subgrouping

6.2.3 Miscellaneous functions

PAN PAN pot, in/out switchable
SEL Key to invoke the central HELP functions, also used for status display functions and input of commands
USER User definable function key



Group Fader Unit 1.990.130

6.2.4 Group fader STEREO

The stereo group fader unit has the same construction as the mono group fader unit. One fader is controlling both channels of the unit. Instead of the PAN pot, there is an Image Shift Controller, which enables left/right shifting of the whole stereo image without loss of stereo localization.
On request the pot can be configured to work as a standard balance control.

6.3 Master fader unit 1.990.140

6.3.1 Fader section

The main fader (stroke length 104 mm) controls the VCA. There is also an optional motorized version.

ON On/off switch for the large fader signal

PFL Pre-Fade-Listen key

6.3.2 Automation, subgrouping

The master fader has the same automation possibilities as the standard input fader, and also participates in the subgrouping in the same way.

6.3.3 Miscellaneous functions

SEL Key to invoke the central HELP functions, also used for status display functions and input of commands

USER User definable function key, can be used for activation and tally of a fader start function, etc

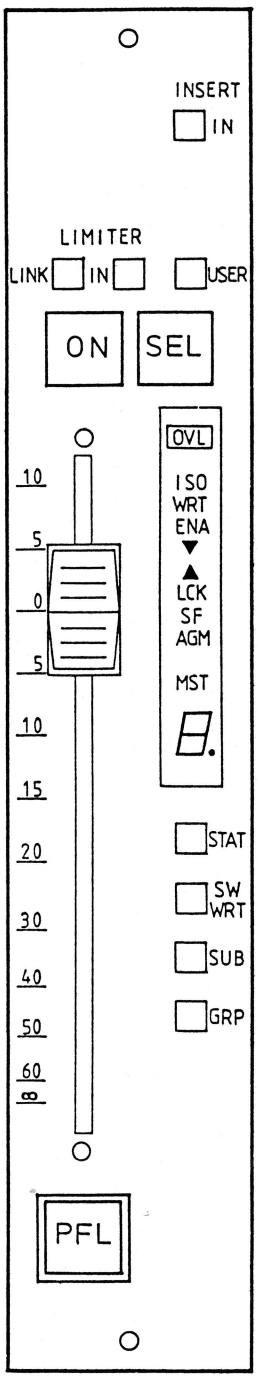
INS IN Activates a pre fader, electronically balanced, switchable insert point

LIM IN Optional limiter for each summing channel, on/off switchable

LINK Coupling of the limiter function with the adjacent channel

6.3.4 Master fader STEREO

The same fader unit is used for both mono and stereo master outputs. If stereo masters are used, the same fader controls both channels, and the optional limiter is coupled as standard.



Master Fader Unit
1.990.140

8 AUX MASTER UNIT 1.990.310

This unit serves for mixing and processing of the auxiliary outputs. The AUX Master Unit has three sections: two mono AUX masters and one stereo AUX master, the latter with an added Balance pot.
Fro an INLINE console four AUX master units are needed to control the 16 AUX send channels.
For STANDARD consoles with 8 AUX buses two AUX master units are needed.

Controls (per section) :

LEVEL Pot to adjust the AUX output level
AUX ON Switches the AUX section on and off

EQ IN Switches the Equalizer in/out :
low frequency boost/cut +/- 15 dB at 60 Hz,
high frequency boost/cut +/- 15 dB at 15 kHz

SOLO PFL or Solo key (internally selectable)

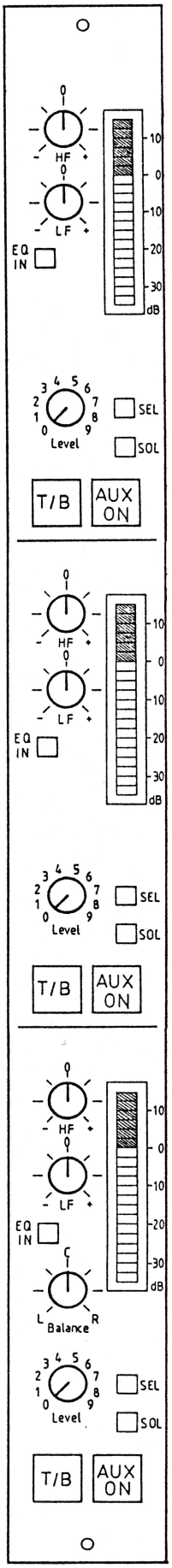
T/B Activates talkback into selected AUX send

SEL Key for configuring of talkback groups

Each AUX send section has a **LED level display.**

The **stereo AUX** section has a **Balance control** pot.

The outputs are balanced and floating.



Aux Master Unit
1.990.310

9 MASTER AUDIO UNITS

9.1 Monitoring system description

The monitoring, talkback and signalling system has been divided in 2 parts : panel units and eurocards, which are controlled by a special microprocessor system. This makes it easier to satisfy each customers special needs regarding console layout and functions. An extensive configuration file is used to determine the actual behavior of the system.
The monitoring system has the following basic characteristics :

- Control room 1 monitor, max. 80 source select keys
- optional Control room 2 monitor, max. 80 source select keys

- Studio 1 monitor, max. 25 source select keys
- optional Studio 2 monitor, max. 25 source select keys

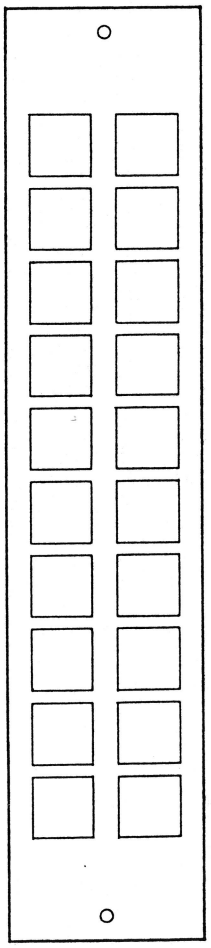
9.2 Source selector panel 20/40 PB 1.990.490/390

These units serve for operating the source selection of control room and studio monitors.

2 versions are available :

1) source selector panel 20 PB 1.990.490, length 190 mm
2) source selector panel 40 PB 1.990.390, length 420 mm

The relation between source select keys and relay cards is programmable. In addition it is possible to split the source selector into max. 4 sections, each of them having a "select" key. For each source you can select wether the switching is 1-channel or 2-channel. The control room monitor allows an optional key for switching between interlocking and individual operation of the source select keys.
The switching of audio signals is balanced and floating.



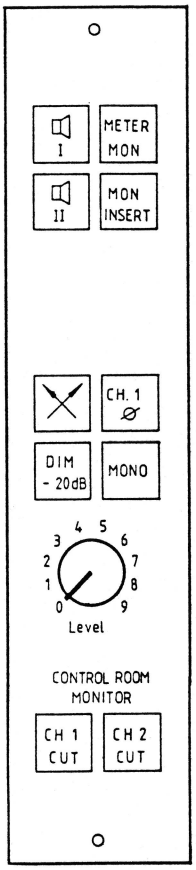
Source Selector Panel 20 PB
1.990.490

9.3 Control room monitor panel 1.990.420

The control room monitor panel has controls for the conditioning of the monitor signal, which is selected by means of the above mentioned source selector panels.
The Control Room Monitor Panel offers the following functions:

- meter selector : Σ <--> MON
- channel flip L <--> R
- phase reversal of the left channel
- mono summing
- DIM function (-20 dB)
- CUT function, separate or both channels
- VCA controlled level
- optional balance control
- optional electronically balanced insert points
- alternate monitor select keys (max. 4 pairs)

The main monitoring output is balanced and floating.



CR Monitor Control Panel
1.990.420

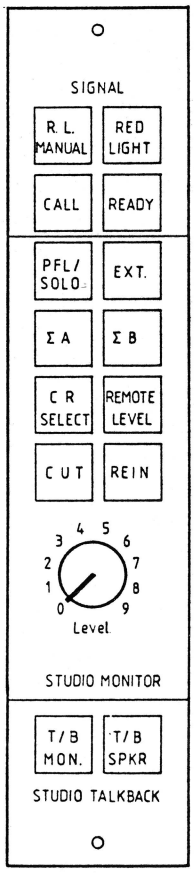
9.4 Studio monitor panel 1.990.430

The studio monitor panel houses the controls for studio monitors, talkback controls and the studio signalization system, thus uniting all studio communication controls in one panel.
Depending on the studio configuration, a 990 Series desk can have one or more Studio Monitor Panels, or none at all...

Signalization:
- Red light control (automatic and manual)
- CALL key and light
- READY signal (switchable)

Studio monitor functions:
- 5 source select keys (expandable to 25)
- switch for external monitor level control
- CUT key
- "Reinjection": deactivation of automatic CUT function
- level control (optional balance control)
- optional separate output, pre/post level control

Talkback:
- talkback to the studio monitor output
- talkback to a separate output (studio communication speaker, etc)



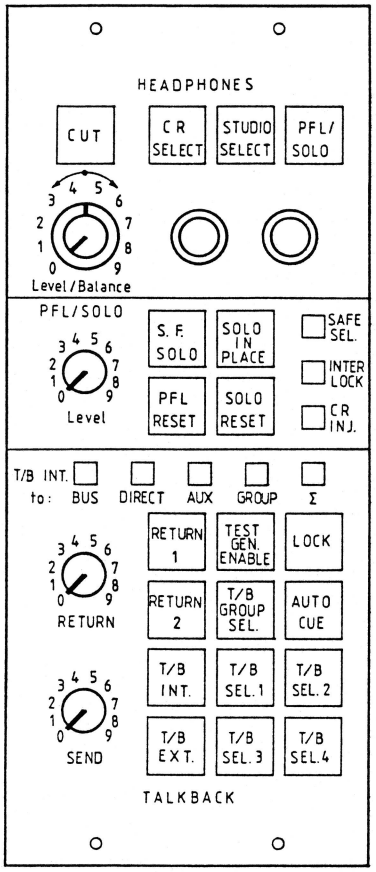
Studio Monitor Control Panel
1.990.430

9.5 PFL, talkback & headphones panel 1.990.440

The PFL, Talkback & Headphones Panel holds the circuits necessary for central operation and control of the desk. Only one panel per desk is fitted as standard.

Headphones control:

- 3 source select keys (can be expanded)
- CUT key
- level and balance controls
- optional built in headphone jacks



PFL, Talkback, Headphones Panel 1.990.440

PFL/SOLO functions:

PFL RESET Indication and cancelling of PFL status

SOLO RESET Indication and cancelling of SOLO status

SOLO-IN-PLACE Turns standard "positional SOLO" into "SOLO-IN-PLACE"

SF SOLO Toggles the S.F. control function between PFL and SOLO

SAFE SEL Programming key for the "Solo Safe" function

INTERLOCK Enables INTERLOCK mode. Newly activated PFL and SOLO keys release previously activated PFL and SOLO keys.

CR INJ Enables the PFL and SOLO signals onto the control room monitors

Level control pot for the inbuilt PFL speaker.

Talkback functions:

T/B EXT 1 Talkback to a separate dedicated output (expandable)
T/B INT Desk internal talkback, can be routed to the following :
BUS, DIRECT, AUX, GROUP, Σ

T/B GROUP SEL Key for programming of talkback groups
T/B SEL 1,2,3,4 Keys for activation of programmable talkback groups

LOCK Talkback keys can be switched over from momentary action to latching function

AUTOCUE Automatic activation of talkback system, controlled by external logic signal

TEST GEN ENABLE Switches on the test generator (generator fitted in the meter panel)
RETURN 1, RETURN 2 Two switchable talkback returns

SEND Level Level adjust for talkback send
RETURN Level Level adjust for talkback return

10 MASTER CONTROL UNITS

10.1 TB mic / display control unit 1.990.652/653

This unit contains a range of functions, which are needed only once per console.

Talkback mic :
Alternatively to the standard dynamic mic mounted on a goose neck it is possible to install a flush-mounted electret microphone.

"POWER" :
By means of the two keys the console can be switched on and off remotely without accessing the power supply units. Both keys have to be pressed simultaneously to prevent unwanted operation.
PRESET Indication of the preset mode of operation
STANDBY Indication of the standby power supply function
ON/ALARM Indication of power supply status

"Overload/User" :
OVERLOAD 1 Indicates that one of the input or group channels has a signal exceeding +15 dBu internal level.
OVERLOAD 2 / RESET Indicates that one of the input or group channels has a signal excceding +19 dBu internal level. The information is kept until reset by the operator.

USR/USER 1/USER 2 Keys and indicators for customer specific installations.

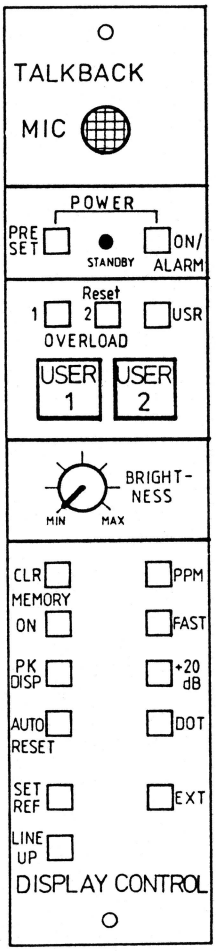
"Brightness" :
This potentiometer enables dimming of all LEDs and VF bargraph indicators.

"Display control" :
This set of controls is used to control the "4 CH VFD bargraph meter", which can be installed in the console. A limited number of functions can also be applied to the STUDER gas discharge bargraph meters.

PPM switching between VU and PPM characteristics.
FAST switching of the PPM integration time
+ 20 dB switching of the sensitivity of the meter
DOT switching between bar and dot display mode
EXT activation of an external DC input

MEMORY CLR reset of the internal peak memory
MEMORY ON activation of peak memory
PK DISP =peak display, switching of peak indication
AUT RES =auto reset : peak memory will be reset automatically after approx. 3 seconds.

SET REF actual meter indication will be memorized for line-up mode.
LINE UP switching to "line-up mode" : indication of difference between actual level and REF value.



TB MIC / Display Control Unit 1.990.652/653

Section 4 Audio Console Control

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2. Overview of the audio mixer control 2
3. Central processor (host processor) 1.990.930 4
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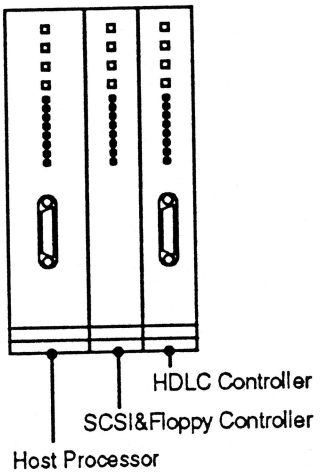
1. Elements of the audio mixer control

Processor modules

The audio mixer control hardware is implemented on three plug-in modules. These are installed in a 19" rack-mount housing either directly in the console or in a separate rack.

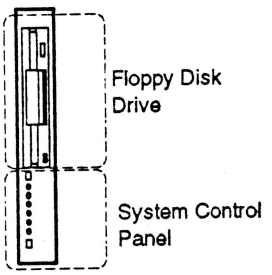
- HOST processor 1.990.930
- SCSI & floppy controller 1.990.935
- HDLC controller 1.990.940



System control field and floppy disk drive

The drive for 3½" diskettes also contains the most important display and control elements for controlling the audio console.

- Floppy disk unit 1.990.800



Module processors

Each CHANNEL is equipped with a module processor that is installed in the fader panel. It controls all channel functions.

- Module Processor Board 1.990.190.20

The key fields for CENTRAL OPERATING FUNCTIONS are controlled by two module processors that are combined into a single unit:

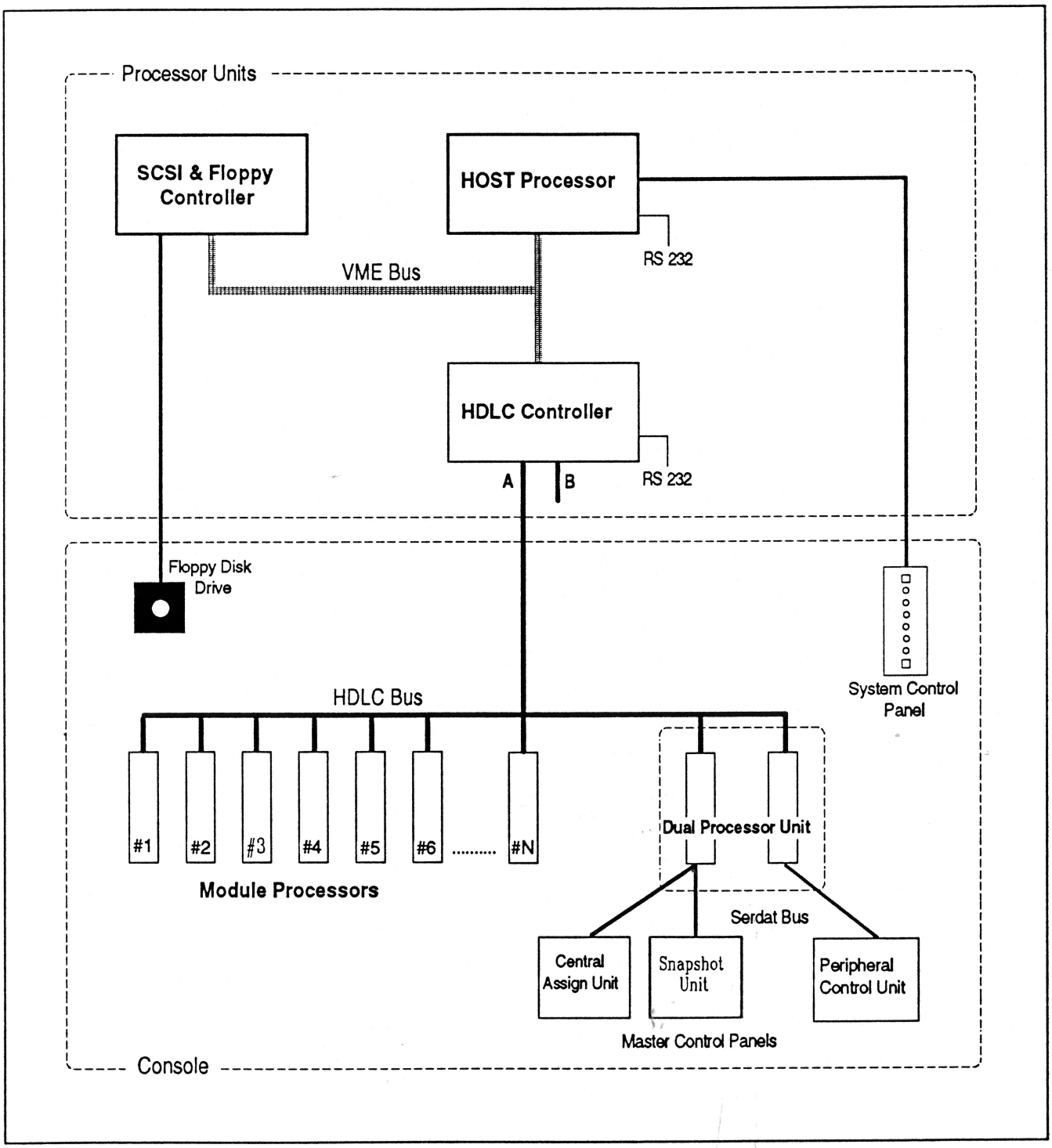
- Dual processor unit 1.990.192.00

The functions are allocated as follows:

1. Central audio circuits:
   - Control room monitor panel 1.990.420
   - Studio monitor control panel 1.990.430
   - PFL/TB/headphone panel 1.990.440
   - Source selector panel 1.990.390/490
2. Central operating units:
   - Central assign unit 1.990.815
   - Snapshot unit 1.990.810

2. Overview of the audio mixer control

All switching functions and potentiometer settings of the Studer 990 audio console are controlled and stored digitally. Because central operating units are used, all switching operations must be continually monitored and recorded. The following block diagram illustrates the basic concept of the audio mixer control.



Block diagram audio console control: The processors involved in the audio mixer control are installed in a separate rack housing. In addition each audio mixer channel is equipped with its own module processor. Central control functions are performed by the dual processor unit.

Structure:

The control functions are allocated to three hierarchical levels:

1st level	Central processor:	■ HOST processor	1.990.930
		■ SCSI & floppy controller	1.990.935
2nd level	HDLC bus controller		1.990.940
3rd level	Module processors and dual processor unit		1.990.190/192

Communication:

To minimize the data flow, all switching functions are executed directly in the channel by the MODULE PROCESSORS. A high-speed bus interconnects the module processors with the central processor, the host processor. The data flow on this bus is controlled by the HDLC bus controller. It translates the communication protocol of the lowest hierarchical level (HDLC bus) to the bus system of the middle and top level (VME bus).
Diskettes (or hard disk) as permanent storage devices for system program and user data can be interfaced via the SCSI & FLOPPY CONTROLLER.
For service purposes two RS 232 interfaces are available that provide access to all existing operating data.

Console states:

The HOST PROCESSOR records all console states in a log that is accessed by the central operating units. Central switching requests are transmitted to the HOST and sent by the latter to the corresponding module processor where the function is executed in the same manner as if a local key were actuated.

Data protection:

All processors are equipped with a working storage in which the application programs and operating data are stored. The MEMORY CONTENTS and consequently the current console settings are retained when the operating voltage is switched off. For this purpose the power supply generates a standby voltage which in the event of a power failure is supplied by batteries (installed in the power supply). If the processor board is removed or the power supply unit is disconnected from the audio console, the data are protected by additional buffer capacitors. After the buffer capacity of at least one hour has expired, the memory content will be lost.

Software:

The software can be subdivided into three groups:
- Operating system
- Firmware
- Application program

Operating system

The operating system is a device-independent program that establishes the necessary prerequisites for operating the processors.

Firmware

The firmware contains those parts of the program that reside permanently in the equipment ROM. They start up the processors after power is switched on. The firmware controls the initial program loading from diskette or hard disk.

Application program

All specific applications are implemented in this mixed program package. This includes for example the second part of the system initialization, the data management, the execution of the operator commands as well as input and output operations. Parts of the application programs are loaded into the working storage of all processors.

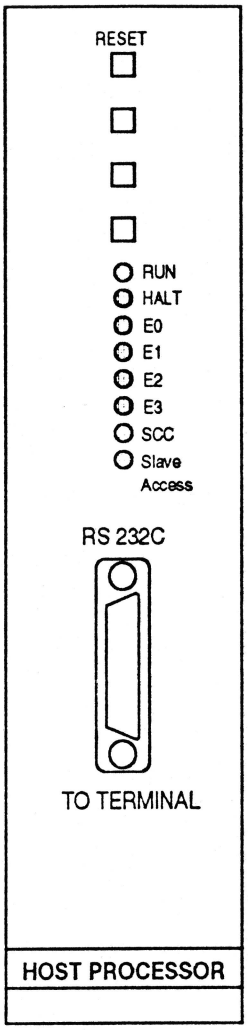
3. Central processor (host processor) 1.990.930

Operator controls:

Although the host processor module is equipped with four keys, only the RESET key is functional. The LEDs and the RS 232 interface are used for function tests and fault locating.

RESET key

This key initiates a hardware reset of the entire audio mixer control. The reset is followed by a start procedure in which the programs of all processors are tested and reloaded, if necessary. The control system may possibly request access to the system diskette (yellow LED "SYSDISK" of the floppy drive).
If no program needs to be reloaded, the memory contents remain unchanged which means that the previous audio console settings are retained.



Status indication:

RUN Work cycles of the central processing unit (CPU) are indicated.

HALT The CPU is in HALT mode and no longer executes any functions. The RESET key must be pressed to restart the system.

E0 ... E3 These four red LEDs code the error messages of the hardware self-test in accordance with the table below. If an error is detected, it will also be indicated on the system control field of the floppy disk unit (LED 'CHECK HW').

SCC Access by the CPU to the serial communication chips.

SLAVE ACCESS Access of the CPU to the dual port RAM of a slave processor

E3	E2	E1	E0	Localization of the HW fault
0	0	0	0	No fault
0	0	0	1	SRAM
0	0	1	0	DMA controller
0	0	1	1	PIT (parallel interface/timer)
0	1	0	0	SCC (serial communications controller)
0	1	0	1	FPCP (floating point coprocessor; option)
0	1	1	0	RTC (real time clock)
0	1	1	1	EPROM checksum error
1	0	0	0	SCSI & floppy controller board
1	0	0	1	Floppy disk drive
1	0	1	0	Hard disk drive
1	0	1	1	HDLC controller board #1
1	1	0	0	HDLC controller board #2
1	1	0	1	Spare
1	1	1	0	Spare
1	1	1	1	End of SRAM test

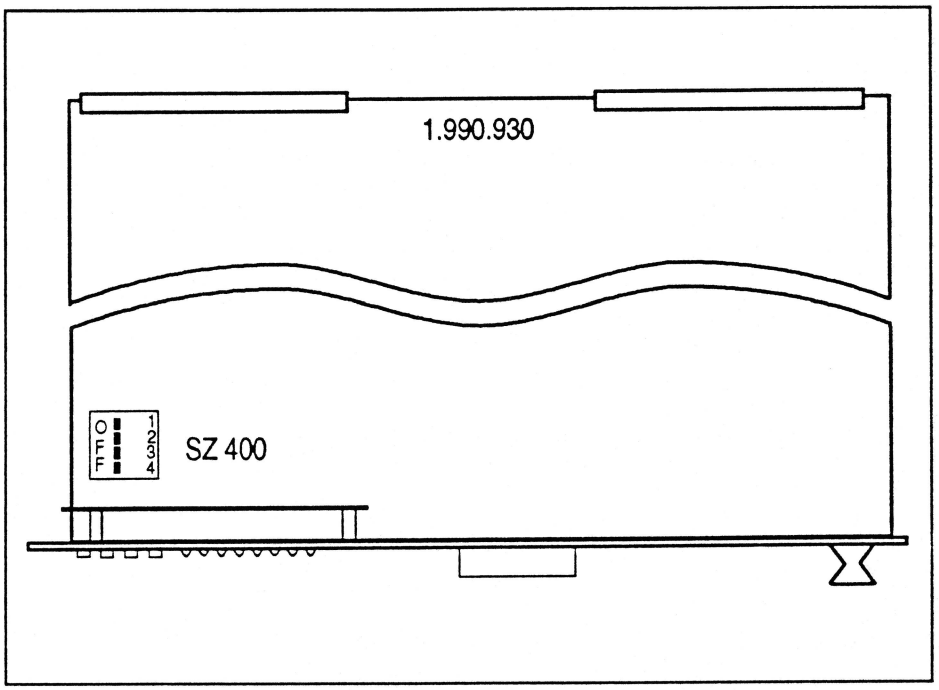
"0" = LED dark / "1" = LED light

Please note that the hardware self-test can be bypassed by DIL switch No. 4. In this case the error indications are also disabled.

Interface:

The serial RS 232 interface is intended for connecting a service terminal. A second, similar port is available on the back of the processor rack. However, not both connectors are enabled in all cases.

DIL switch settings:



Host processor: The DIL switch SZ 400 is located at the top edge behind the front plate.

The following four settings can be established on the HOST processor 1.990.930:

NR	OFF	ON
1	Application Program	Monitor
2	Bus Master	Standalone Mode
3	Bypass RAM Test	Execute RAM Test
4	Bypass HW Test	Execute HW Test

Default: The default setting of all coding switches is the OFF position. Different settings should only be established for maintenance work.

4. SCSI & floppy controller 1.990.935

Status indications: The hard disk and diskette drive controller is equipped with six red error and two yellow function indicator lamps. Some of the malfunctions are also indicated on the control panels. The existing keys have no function.

NOT READY The drive is not ready for operation. No diskette is inserted.

WRITE PROT Write protection: The write command cannot be executed because the diskette is write protected.

DISK FULL Insufficient space available on the disk. Controller is unable to execute the last command.

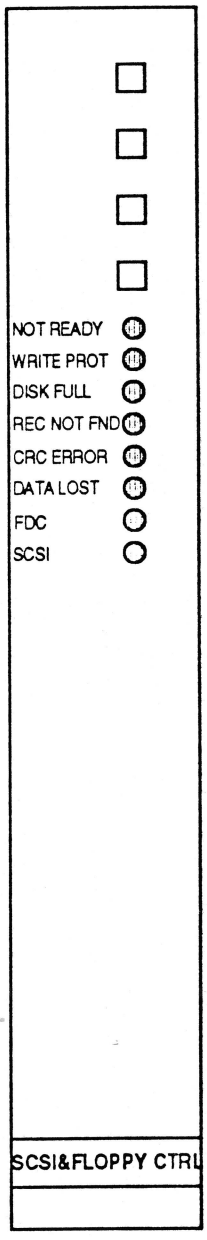
REC NOT FND Record not found: Controller is unable to locate the desired record.

CRC ERROR Diskette not formatted or checksum error during read/write.

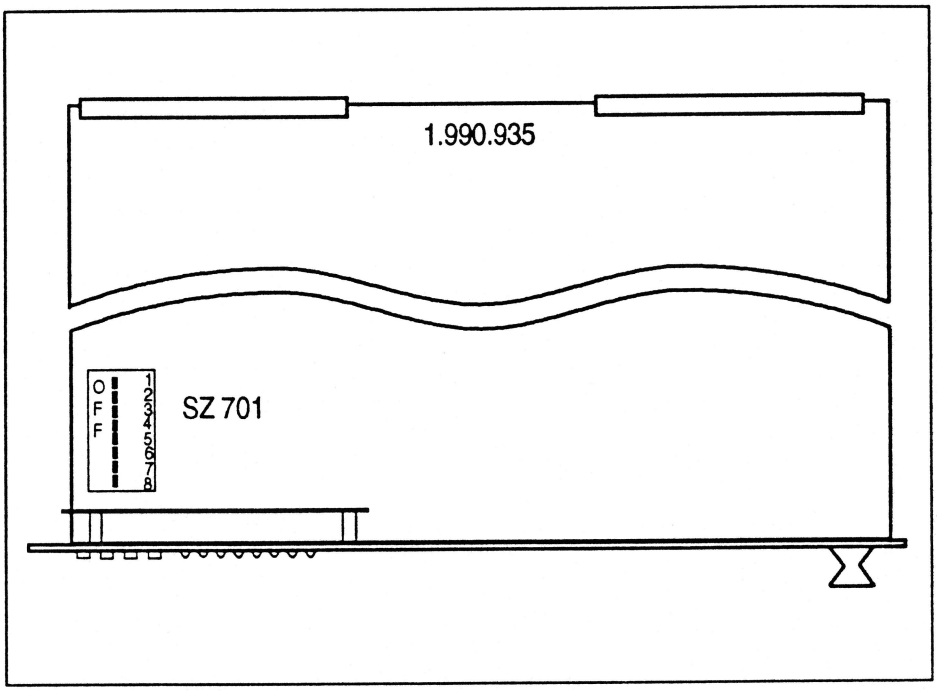
DATA LOST The controller was unable to read the serial data stream within the time allowed. As a consequence the data have been lost.

FDC Floppy disk controller is being accessed.

SCSI The SCSI controller is being accessed.



DIL switch setting:



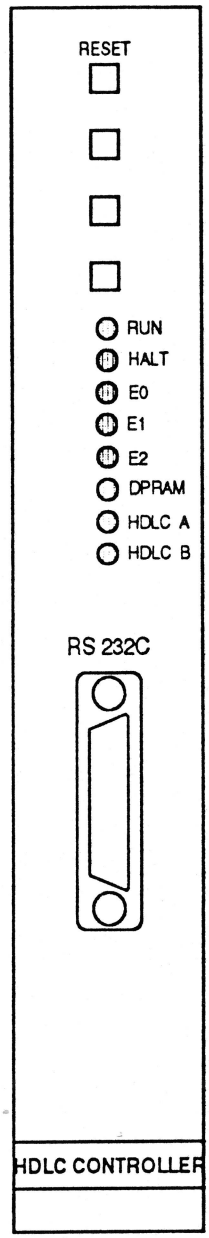
SCSI & floppy controller An 8-position switch is located at the top edge behind the front plate.

The DIL switch SZ701 determines the following functions:

NR	OFF	ON
1	Normal	Test
2	not used	not used
3	Read Track Side 0	Read Track Side 1
4	Drive 3, 80 Tracks	Drive 3, 40 Tracks
5	Drive 2, 80 Tracks	Drive 2, 40 Tracks
6	Drive 1, 80 Tracks	Drive 1, 40 Tracks
7	Drive 0, 80 Tracks	Drive 0, 40 Tracks
8	not used	not used

Default: The default setting of all coding switches is the OFF position. These switch settings should only be changed by trained service personnel.

5. HDLC controller 1.990.940



Operator controls: The RESET key is the only control that influences the bus controller. It initiates a hardware reset, i.e. a self-test and possibly reloading of the software. In contrast to the RESET key of the host processor, the central processor is not affected by the HDLC controller reset.

Status indications: The indicator lamps are color coded: yellow for functions and red for faults.

RUN Work cycles of the central processing unit (CPU) are indicated.

HALT The CPU is in HALT mode and no longer executes any functions. To restart the CPU the RESET key must be pressed.

E0 ... E2 Three red LEDs code the error messages of the hardware self-test according to the following table. If an error has been detected, the CHECK HW lamp on the floppy disk unit is also switched on.

DPRAM Access of the CPU to the dual port RAM

HDLC A not used

HDLC B not used

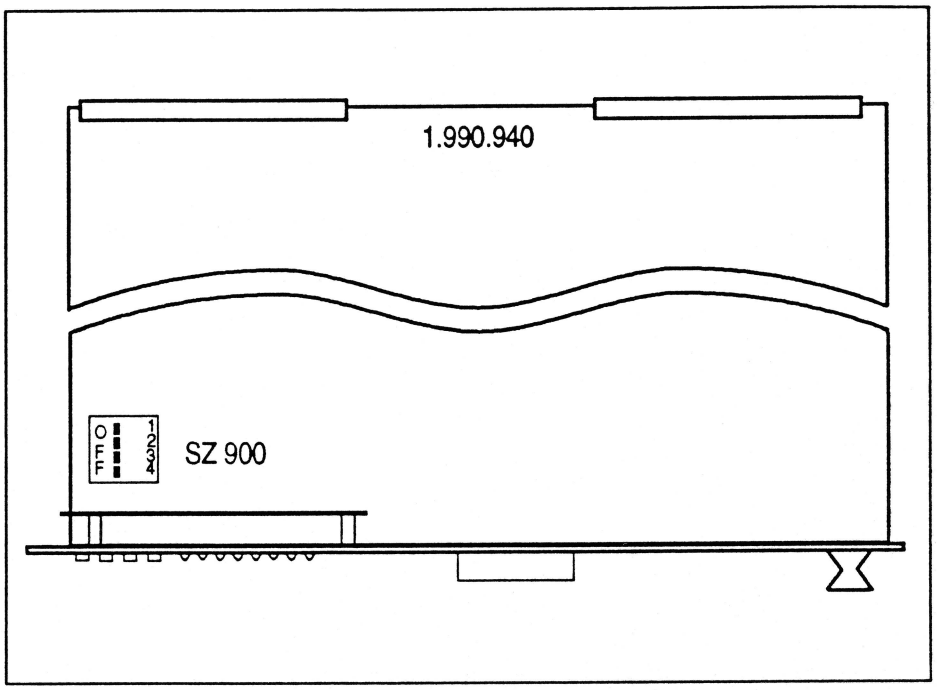
E2	E1	E0	Localization of the HW error
0	0	0	No error
0	0	1	SRAM
0	1	0	DMA controller
0	1	1	PIT (parallel interface/timer)
1	0	0	ACIA (Async. ser. comm. IF adapter)
1	0	1	HSCX HDLC comm. controller
1	1	0	IGOR (interrupt generator; option)
1	1	1	EPROM checksum error

"0" = LED dark / **"1"** = LED light

Also for this unit the hardware self-test can be selected with DIL switch No. 4

Interface: The serial RS 232 interface is used for service work that relates to the HDLC controller.

DIL switch settings:



HDLC controller The DIL switch SZ900 is located behind the front plate near the keys.

The following functions can be set on the HDLC controller:

NR	OFF	ON
1	Application Program	Monitor
2	Normal Mode	Standalone Mode
3	- - -	- - -
4	Bypass HW Test	Execute HW Test

Default The default setting of the coding switches is the OFF position. These switch settings should only be changed by trained service personnel.

6. Floppy disk unit 1.990.800

Format:

The diskette drive reads and writes 3.5" diskettes that have a storage capacity of 1.44 MB (double sided, high density). Because they are formatted in the MS DOS format, the diskettes are compatible with IBM PC systems operating under DOS version 3.30 or higher.
The diskette drive is used for reading all system programs and for reading and writing user data (snapshots, sequences, automation data).

System control field:

The **central operating and display field** of the host processor is located on the front plate. These messages make the function states of the hidden processor rack visible.

Operation:

The diskette drive is operated on the snapshot unit (see Section 10). User data can be loaded (DISK LOAD) or saved (DISK STORE) and new diskettes can be formatted (DISK EDIT).

Inserting the diskettes

Insert the diskettes into the drive with the slanted corner facing toward the front and the top. To eject the diskette press the black key on the top right.

ENABLE + LOAD

When these two keys are pressed simultaneously, all programs are reloaded regardless of the current audio mixer state. The system diskette (SYS_DISK_1) must be inserted in the drive.
During the loading operation the LOAD key is light.

LOAD

If a loading operation pauses because the diskette needs to be changed, the LOAD key starts to flash. After the correct diskette has been inserted, press the LOAD key to resume the loading operation.

Status Indicators:

READY

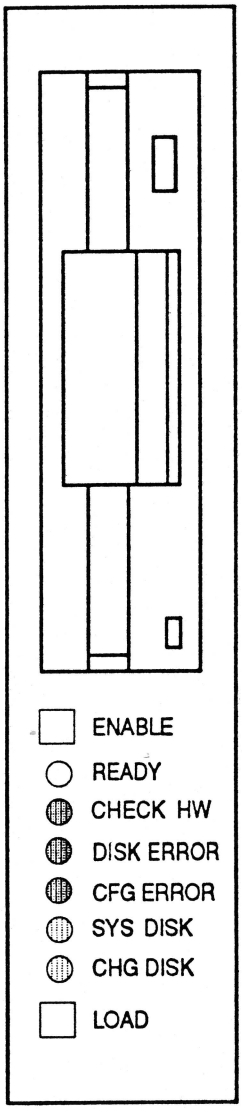
The green LED indicates that the audio mixer control is ready for operation. It should be light after a successful start-up. Errors are indicated by red LEDs.

CHECK HW

Check the processor rack. The computer has detected a fault in its hardware (HW). Additional information is provided by the display fields of the three computer modules.

DISK ERROR

An error has occurred during a read or write operation. Is no diskette or the wrong diskette inserted, is it unformatted, defective or write protected? The display field of the SCSI & floppy controller may provide additional information (HW rack).



CFG ERROR The audio console configuration as specified in the operating software, differs from the actually existing and operational modules. Under certain circumstances it may no longer be possible to operate the audio console.

SYS DISK The yellow LED SYSTEM DISK requests you to insert the system diskette. The computer checks the label of the diskette and expects SYS_DISK# (# = sequence number of the diskettes, starting with 1).

CHG DISK If the system software is stored on multiple diskettes, the program uses the yellow CHANGE DISK LED to signal that the next diskette should be inserted. Press the LOAD key after the diskette has been changed.

7. Organization of the data

Different data in large quantities are generated within the audio mixer control. To simplify their interpretation, system and user data are kept strictly separate:

- System data: System programs
  System configuration data
- User data console states (snapshots, selections, sequences)

The following labelling convention is used for diskettes or the hard disk:

- System disk:
  Label: SYS_DISK# (# = sequence number starting with 1)
  Only system diskettes that have such a label will be read.

- User disk:
  Label: DATA_990_ddmmyy (dd: day / mm: month / yy: year)
  The user disk can have any label. The above label is the default for diskettes formatted by the HOST.

7.1 System disk

System data: System data may only be stored on a diskette identified as a system disk. System data include all files containing system programs (operating system and applications) and configurations for host, HDLC and module processors. If these files cannot be accommodated on a single diskette, they are allocated to multiple diskettes which are labelled as SYS_DISK_1, SYS_DISK_2, etc.

Important: User data will not be accepted from a system disk.

File naming: The FILENAMES have the following format:

Host file: **CSLXWWYY.EXT**
HDLC file: **HDLXWWYY.EXT**
Module file: **T##VWWYY.EXT**

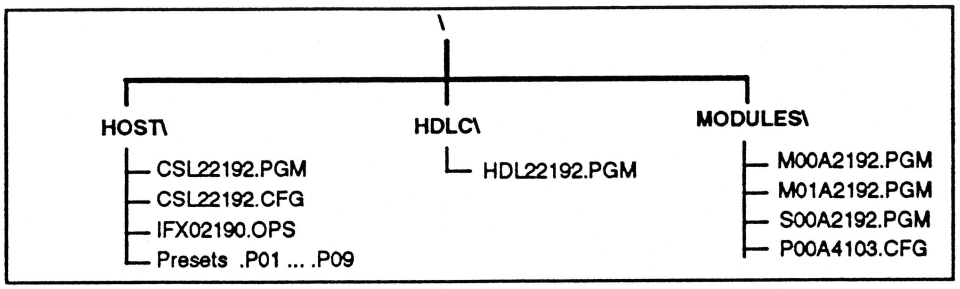
Abbreviations:

CSL HOST file
HDL File of the HDLC controller
T Module type
- **M** Mono input
- **S** Stereo input
- **G** Group mono/stereo
- **O** Output (aux, master, bus selection)
- **P** PCU (monitor unit)
- **C** Control panels (snapshot, central bus selection)

A separate table defines which assemblies are affected within the module type)
X Program version (0...9)
V Version identification for special software (A...Z)
WW Week
YY Year
.EXT The EXTension characterizes various file types and must not be changed:
- **.PGM** Executable application programs
- **.OPS** Executable operating system programs
- **.CFG** Configuration file
- **.P01** File with preset 1
- **.P02** File with preset 2; etc up to preset 9

Tree structure:

The system files are arranged in three main directories. The presets are also part of the system disk.



Data structure of the system disk: The three hierarchical levels of the control correspond to the three directories. The coded naming and the mandatory extensions declare the content of the files.

7.2 User disk

A user disk is a diskette that is reserved for user data. The diskette volume label is freely selectable. If the diskettes are formatted in the floppy disk drive of the console, the volume label created will have the following format: DATA_990_ddmmyy (ddmmyy = formatting day-month-year).

User data:

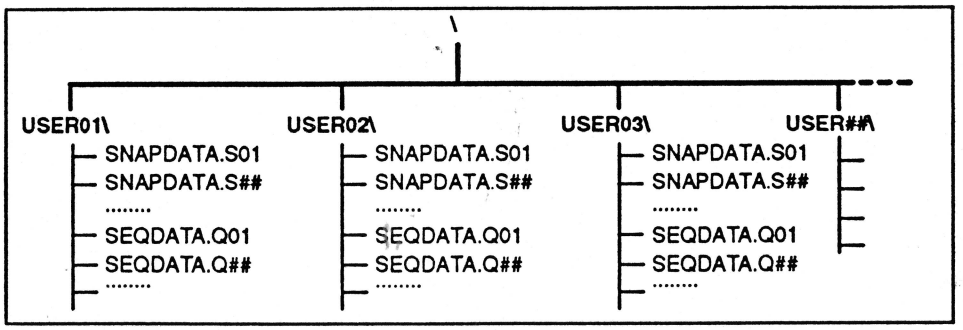
The data generated during the operation can be stored on request by the user. These data do not contain any programs and are kept strictly separate from the system data. The only exception is the audio console configuration file. It is copied by the system to every user diskette so that the configuration to which the user data relate can be identified.

File naming:

Each complete memory content, i.e. 99 snapshots with selections and 9 sequences, are stored in a separate directory. An individual snapshot or an individual sequence are stored as a data file.

Directory	USER##\	Directory for the complete memory content. The Snapshot Unit calls it 'set ##'. '##' = consecutive number.
Data file	\SNAPDATA.**S##**	File name for one of the 99 snapshots per USER## directory.
	\SEQDATA.**Q##**	File name for one of the nine sequences per directory.

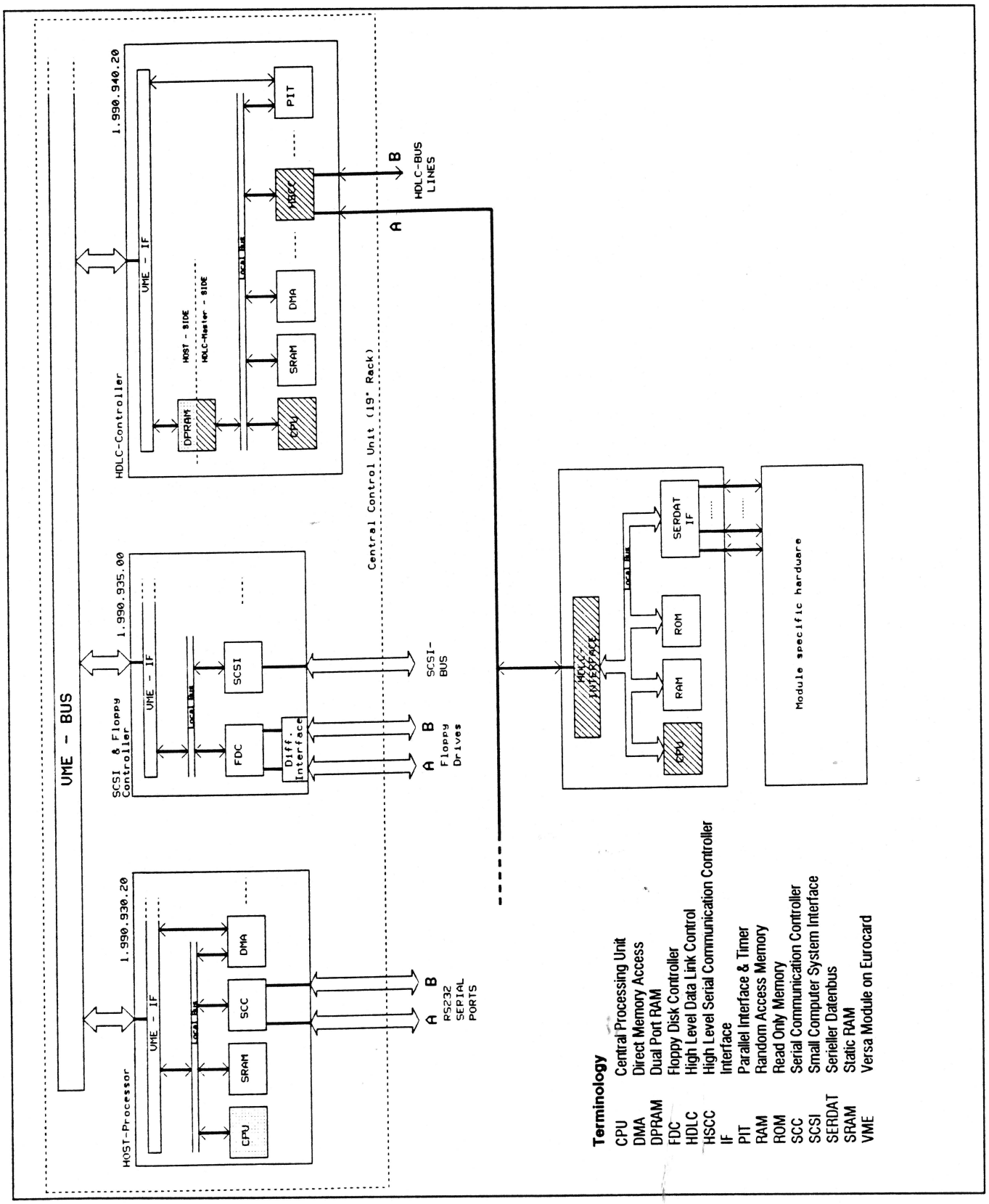
Tree structure:



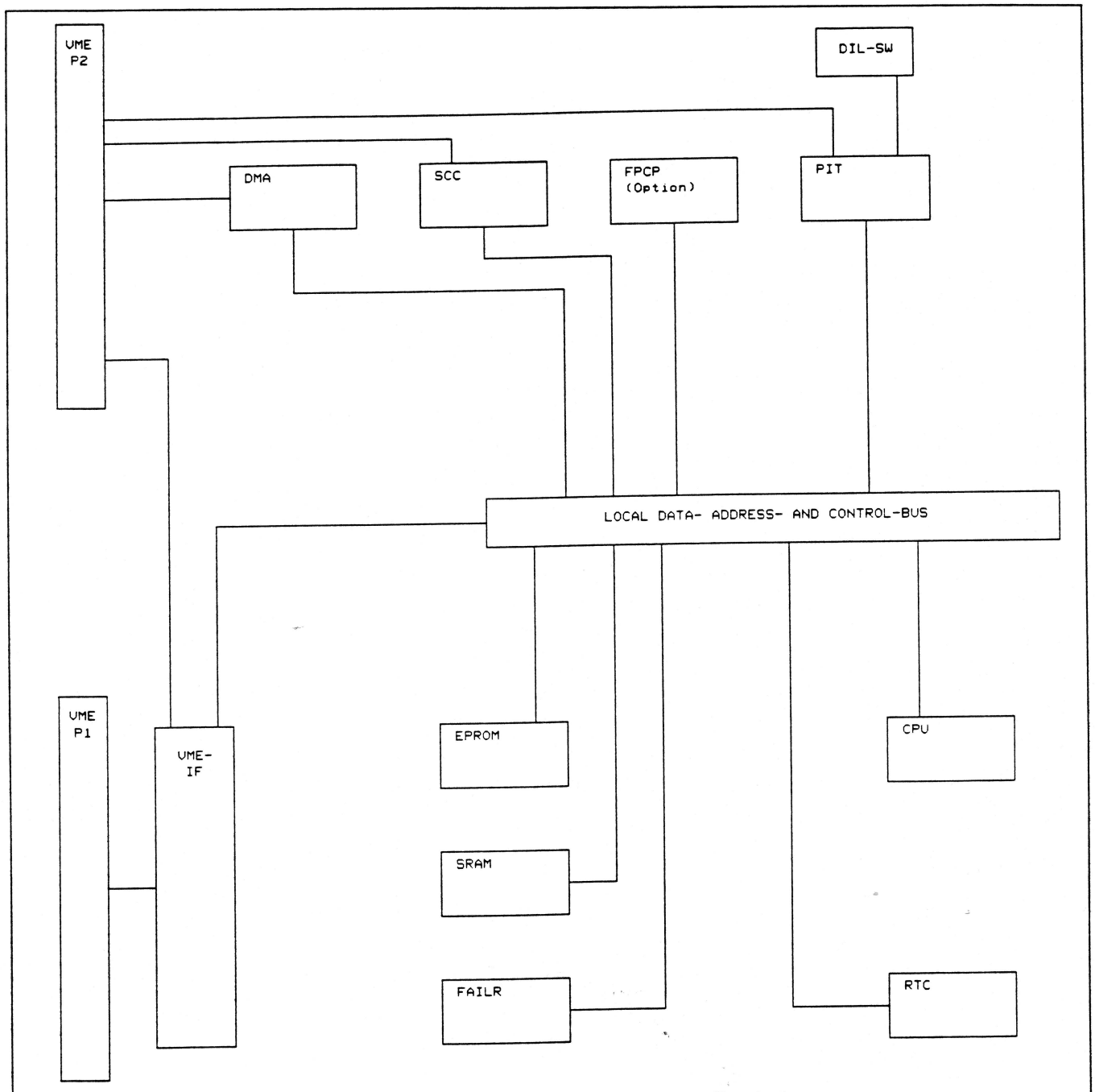
Data structure of the user disk: The memory register of the snapshot unit is stored in a separate directory 'USER##'. A data file is created for each snapshot or sequence. The extensions identify the type and number of data records.

8. Block diagrams

8.1 System overview



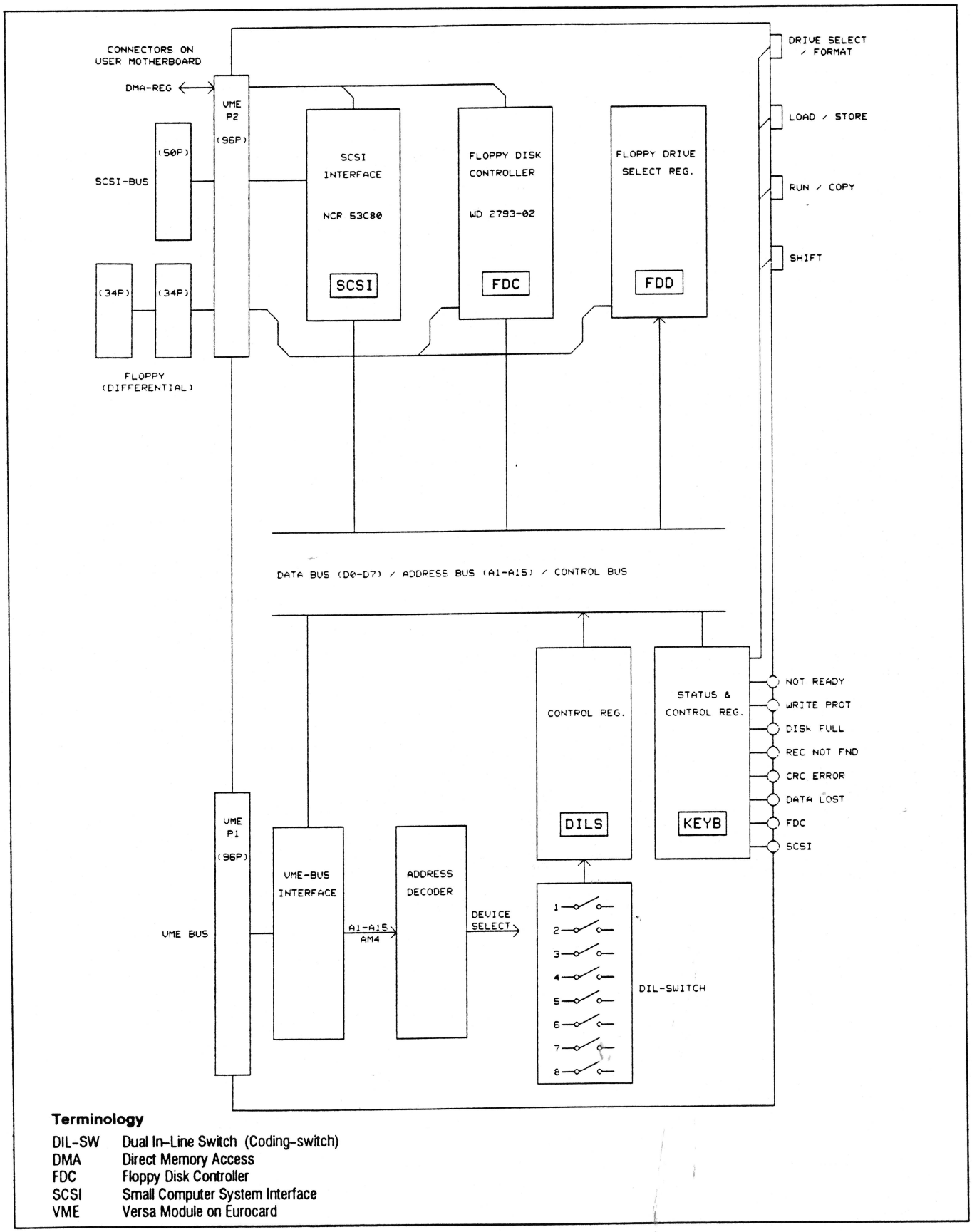
8.2 HOST-processor block diagram 1.990.930



Terminology

CPU	Central Processing Unit
DIL-SW	Dual In-Line Switch (Coding switch)
DMA	Direct Memory Access
EPROM	Erasable Programmable Read Only Memory
FAILR	Error Display & Key Register
FPCP	Floating Point Co-Processor
IF	Interface
PIT	Parallel Interface & Timer
RTC	Real Time Clock
SCC	Serial Communication Controller
SRAM	Static RAM
VME	Versa Module on Eurocard

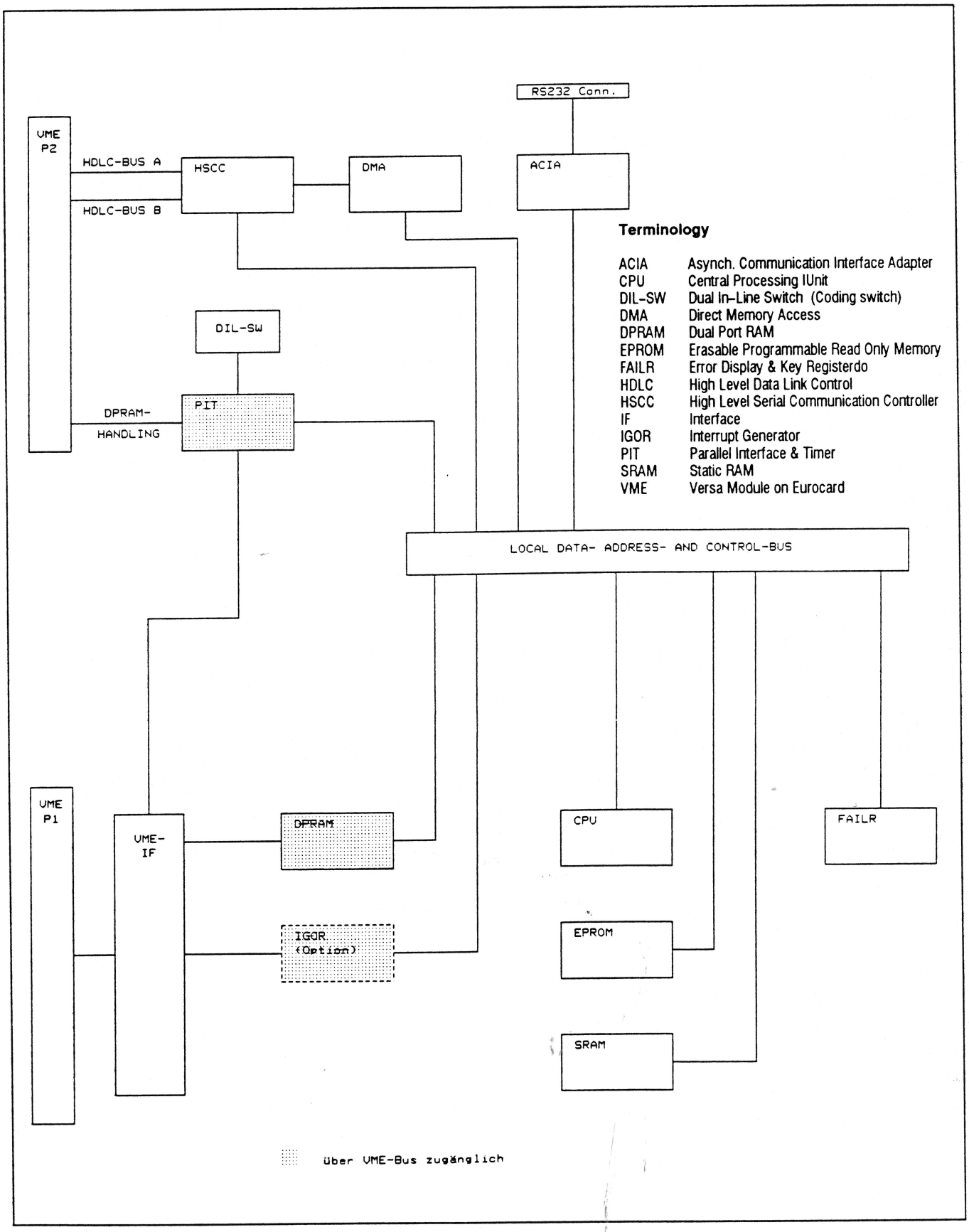
8.3 SCSI & floppy controller block diagram 1.990.935



Terminology

DIL-SW	Dual In-Line Switch (Coding-switch)
DMA	Direct Memory Access
FDC	Floppy Disk Controller
SCSI	Small Computer System Interface
VME	Versa Module on Eurocard

8.4 HDLC master block diagram 1.990.940



Terminology

ACIA	Asynch. Communication Interface Adapter
CPU	Central Processing IUnit
DIL-SW	Dual In-Line Switch (Coding switch)
DMA	Direct Memory Access
DPRAM	Dual Port RAM
EPROM	Erasable Programmable Read Only Memory
FAILR	Error Display & Key Registerdo
HDLC	High Level Data Link Control
HSCC	High Level Serial Communication Controller
IF	Interface
IGOR	Interrupt Generator
PIT	Parallel Interface & Timer
SRAM	Static RAM
VME	Versa Module on Eurocard

Section 5 System Start: Power Supply and Initialization

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1. Power supply

1.1 Description of the supply concept

Primary power circuits

- **Power transformer block**
  The power transformer block is switched on and off by means of the power switch. Because it supplies the operating voltages, it is equipped with an RF filter and an overcurrent trip. The line voltage selector and the primary fuse F6 are located on the front.

- **Standby supply block:**
  A separate block supplies the standby voltage. It feeds the numerous memory modules of the audio console control when the power supply block is switched off. The standby supply block can be connected to any primary voltage of 100 ... 240VAC without adjustment. It is not connected to a power switch and should be connected permanently to the AC power source. Switching off the main power to the entire audio control room should not affect the AC power source of the standby supply.

Mains connections

- 3-Pin appliance inlet 16A/250V for the power transformer block.
- 3-Pin appliance inlet 6A/250V for the standby supply block.

Secondary power circuits

- The **power transformer block unit** produces the following voltages:
  - ±15V DC stabilized
  - ±12V DC stabilized (hard disc and RS 232 interface)
  - 48V DC stabilized (phantom supply)
    Option: The factory can also set the phantom voltage to 12 or 24V.
  - +25V DC for supplying the voltage converters in the audio console.

- **Standby supply block**
  The standby voltage is +5V DC stabilized. It is used for preserving the memory data of the audio console control, and for supplying the alarm and control circuits of the power supply unit. It also supplies the current for illuminating the POWER ON keys.
  If the standby voltage fails, the memories are supplied by two batteries. In this case all LEDs on the audio remain dark to minimize the battery drain.
  The standby voltage must be available for switching on the power transformer block.

- The **voltage converters** in the audio console (EU standard PCB 1.915.111) generate the following two voltages from the +25V DC:
  - +5 VDC stabilized, for the logic circuits and computer systems.
  - approx. +4V DC for the LED supply.

Modular system

Several power supply versions are available with which the different power requirements of the various mixing consoles can be satisfied. Each power supply can be equipped with one or two transformers for the AC power supply. On the left-hand side there is room for the standby power supply and the monitoring logic. On the far right there is a small space for up to two additional stabilized voltages.

For each console at least one MASTER unit is used. If the mixing console draws more power, additional SLAVE units are configured which are coupled to the master unit via a control line.
The number of EU-standard converter boards in the audio console can be matched to the required power.

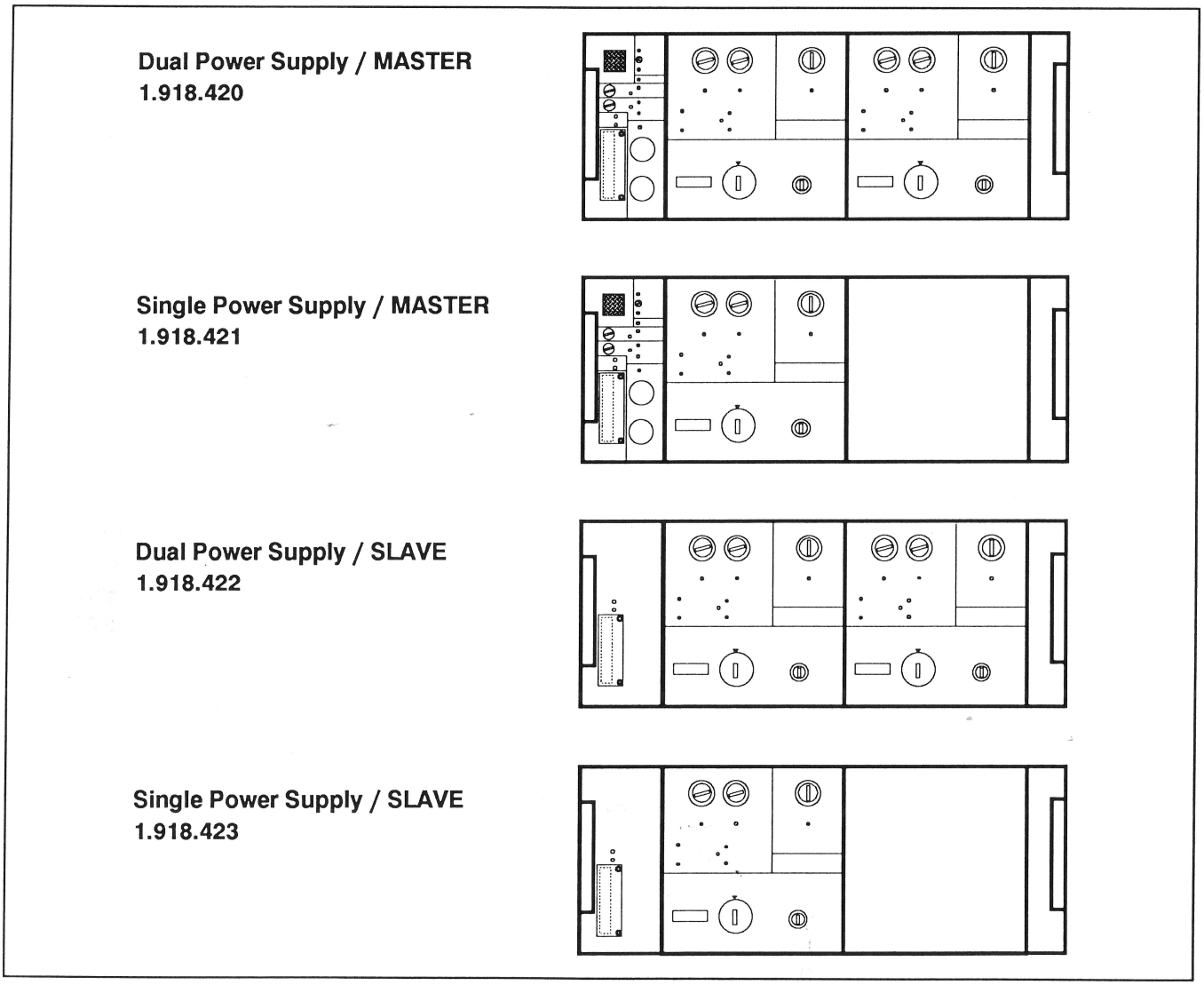
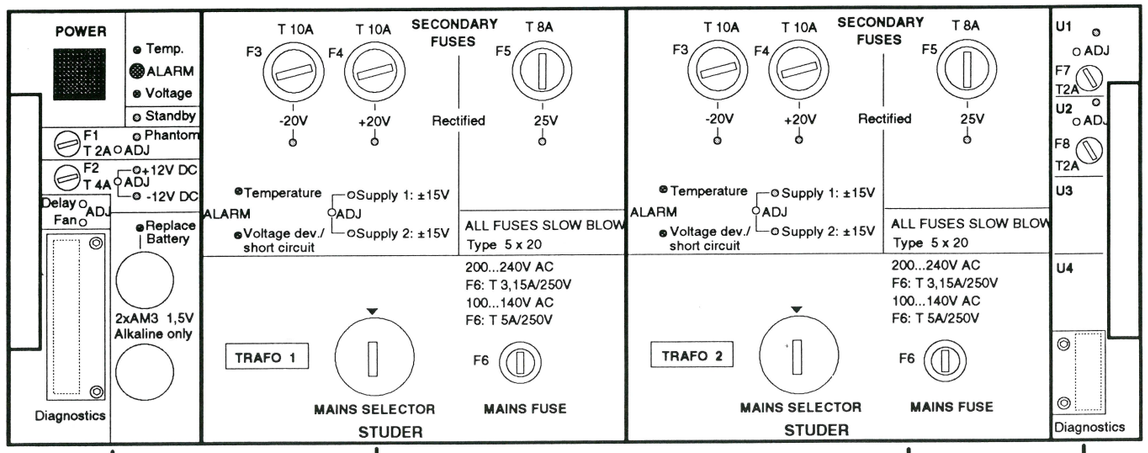


Fig. 1 The four basic versions of the modular power supply concept.

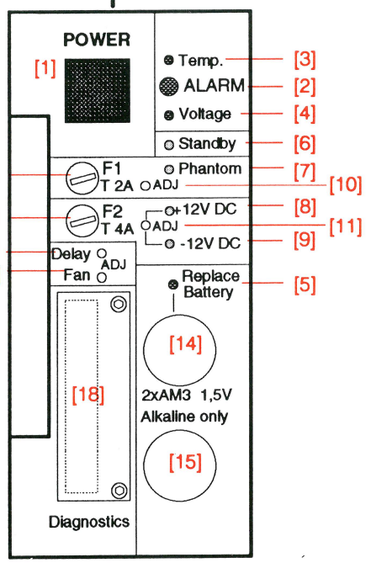
Backup power supply unit

If maximum reliability is required, a second complete power supply unit can be connected and operated in parallel. If a fault occurs in the active unit, the backup unit is automatically activated (CHANGEOVER) without significant voltage drop. The reliability of the converters can be enhanced in the same manner. The alarm system monitors the backup power supply as well.

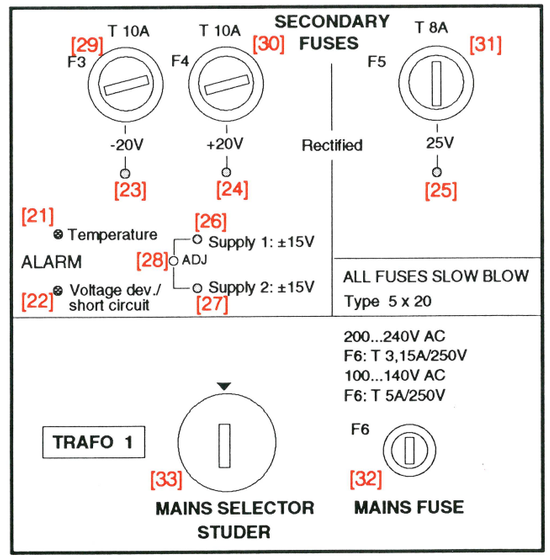
Front View



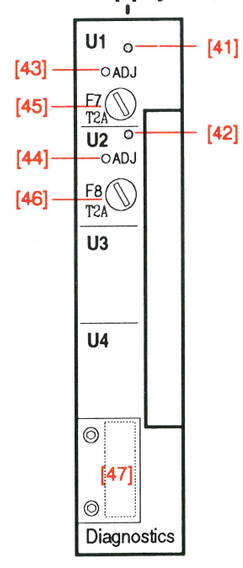
Standby / Phantom



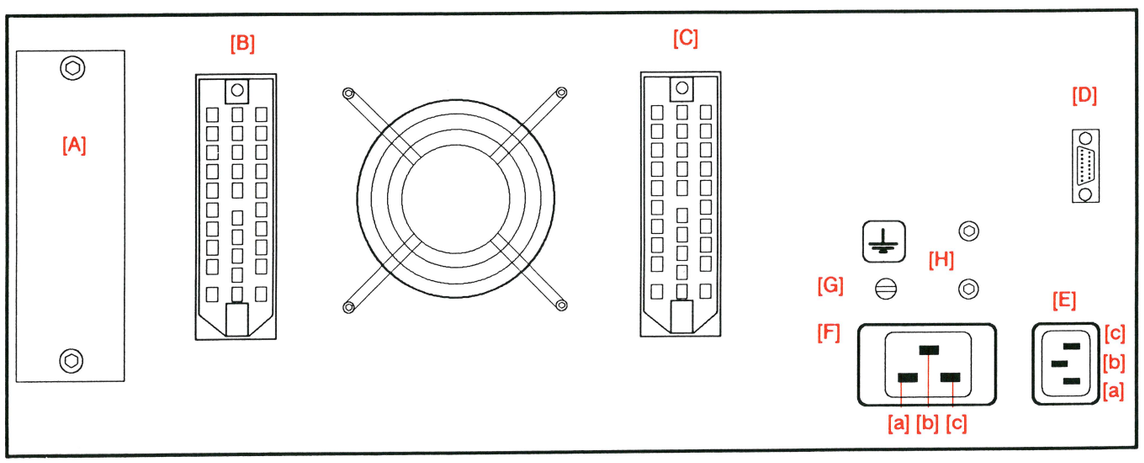
Power Transformer Block



Optional Supply



Rear View



POWER SUPPLY

1.2 Operator controls

The index numbers in the illustration on the opposite page are used in this manual as cross-references to the controls and indicators.

Front panel, left		Standby / phantom supply
[1]	**POWER key and pilot light**	Switches the power on and off. The POWER key indicates the operating state (On↔Off) of the power supply unit: light or flashing → on / dark → off. When this key is flashing the audio console can be switched on with the studio master switch (see 1.3.3). In the event of an alarm the POWER key flashes alternatingly with the large alarm LED [2]. In battery standby mode this key remains dark.
[2]	**ALARM**	If any fault exists in the power supply itself, this LED flashes slowly (2 Hz). In normal operation this LED remains dark. (see 1.4.3)
[3]	**TEMPERATURE**	This LED flashes if the temperature of the heat sinks ±12V, +5V standby or phantom supply is too high (>120°C).
[4]	**VOLTAGE**	This LED flashes if an overvoltage occurs on the phantom- or ±12V supply.
[5]	**REPLACE BATTERY**	If the battery voltage drops too low, this LED starts to flash. This signals that the batteries should be replaced.
[6]	**STANDBY**	Function indicator of the standby power supply. This LED is light when the +5V are available.
[7]	**PHANTOM**	Function indicator of the phantom power supply. Depending on the version the phantom voltage is +12, +24 or +48V.
[8]	**+12V DC**	Function indicator of the +12V supply.
[9]	**-12V DC**	Function indicator of the -12V supply.
[10]	**ADJ. (Phantom)**	Trimmer for fine-adjusting the phantom voltage. (12/24/48V changeover in the power supply unit by jumper settings and solder straps on the transformer, see 1.3.6)
[11]	**ADJ. ±12V DC**	Trimmer for aligning the +12V and -12V. Both are adjusted at the same time.
[12]	**DELAY**	Trimmer for adjusting the power-on delay. (see 1.3.7)
[13]	**FAN**	Trimmer for adjusting the temperature at which the ventilator switches to maximum power. (see 1.3.5)
[14,15]	**BATTERIES**	Two 1.5V alkaline batteries preserve the memory content of the audio console control in the event of a standby power failure. The battery condition is monitored and the low condition signalled by LED [5]. Use only alkaline batteries. In case of standby power failure the data are protected for at least 2 to 3 months.
[16]	**F1, T 2A**	Fuse for the phantom supply.
[17]	**F2, T 4A**	Fuse for the +12V supply.
[18]	**DIAGNOSTICS**	Behind this cover plate there is a 40-pin connector for plugging in the diagnose board 1.918.080. (see 1.4.4)

Front panels, center		Power transformer block
[21]	**TEMPERATURE**	This LED flashes if the temperature of the heat sink or the transformer is too high (>120°C).
[22]	**VOLTAGE DEV./ SHORT CIRCUIT**	This LED flashes if there is an overvoltage or short circuit in one of the ±15V supplies.
[23]	**-20V**	This function indicator LED is light as long as the -20V are available. The -15V are generated from this voltage.

EDITION: 4. September 1991

[24]	**+20V**	This function indicator LED is light as long as the +20V are available (uncontrolled, rectified) for the +15 V are available.
[25]	**25V**	Function indicator of the 25V supply for the converters. (In no-load condition this voltage can reach up to 30 V)
[26]	**SUPPLY 1: ±15V**	This function indicator is light as long as the ±15V I are available.
[27]	**SUPPLY 2: ±15V**	This function indicator is light as long as the ±15V II are available.
[28]	**ADJ.**	Trimmer for concurrent adjustment of the +15V and -15V I & II.
[29]	**F3, T 10A**	Fuse for the -15V supplies (I & II).
[30]	**F4, T 10A**	Fuse for the +15V supplies (I & II).
[31]	**F5, T 8A**	Fuse for the 25V supply (converter).
[32]	**MAINS FUSE, F6**	Primary fuse for this transformer block. The fuse rating must be matched to the line voltage as shown above the fuse holder.
[33]	**MAINS SELECTOR**	Line voltage selector.

Front panel right — **Optional supply** (only if option 1 or 2 is installed)

[41]	**U1**	Function indicator for the spare voltage U1.
[42]	**U2**	Function indicator for the spare voltage U2.
[43]	**U1 ADJ**	Trimmer for adjusting the backup voltage U1. (only with option 2)
[44]	**U2 ADJ**	Trimmer for adjusting the backup voltage U2. (only with option 2)
[45]	**F7, T 2A**	Fuse for the backup voltage U1.
[46]	**F8, T 2A**	Fuse for the backup voltage U2.
[47]	**DIAGNOSTICS**	Behind this cover plate there is a 16-pin connector for plugging in the diagnose board 1.918.080. The voltage and currents relating to U1 and U2 can be measured on the diagnose board. (see 1.4.4 and 4.1)

Connector panel

[A]		Unused connector opening
[B]		30-Pin knife connector (DIN 41622) with secondary voltages.
[C]		30-Pin knife connector (DIN 41622) with secondary voltages.
[D]		15-Pin D-type connector for the control line.
[E]		Power inlet for the standby supply block 6A/250V (see 1.3.2)
	[a]	Phase
	[b]	Protective ground
	[c]	Neutral
[F]		Power inlet for the power transformer block 16A/250V (see 1.3.2) Same pin assignment [a] ...[c] as for [E].
[G]		Ground terminal with clamping screw.
[H]		Internal protective ground to the power supply. These screws should never be unfastened. Use terminal [G] for the studio ground.

1.3 Connections and adjustments

1.3.1 Configurations

The cabling arrangement depends on which of the three possible configurations is selected:

1. HOST processor installed in the audio console
2. HOST processor installed in an external rack
3. Dual supply with internal HOST.
4. Dual power supply with external HOST.

HOST in the audio console:

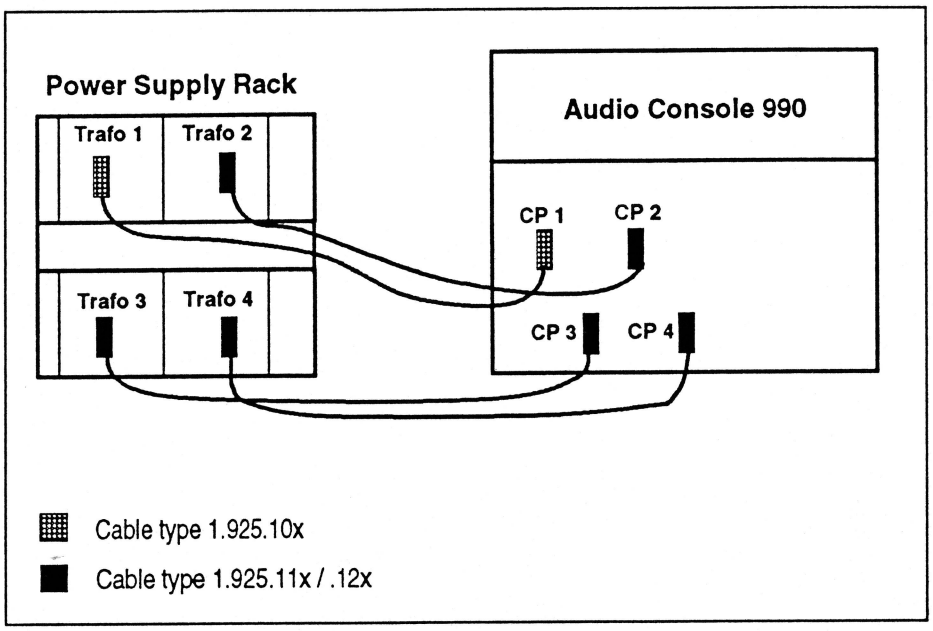


Fig. 2 The HOST processor is installed in the audio console. Each transformer block is connected directly to the console.

HOST external:

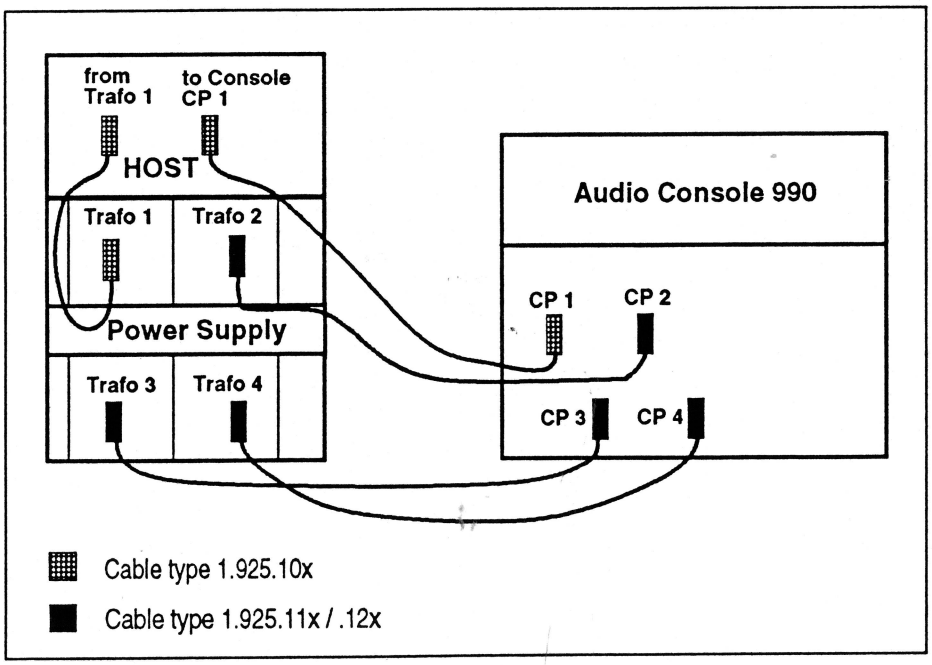


Fig. 3 The HOST processor is installed in an external rack, e.g. together with the power supply. Transformer 1 is connected to the processor rack and the latter first to the audio console. The same cable types can be used for both connections. Under no circumstances should transformer 1 be connected **directly** to the audio console!

Dual supply:
HOST in the audio console

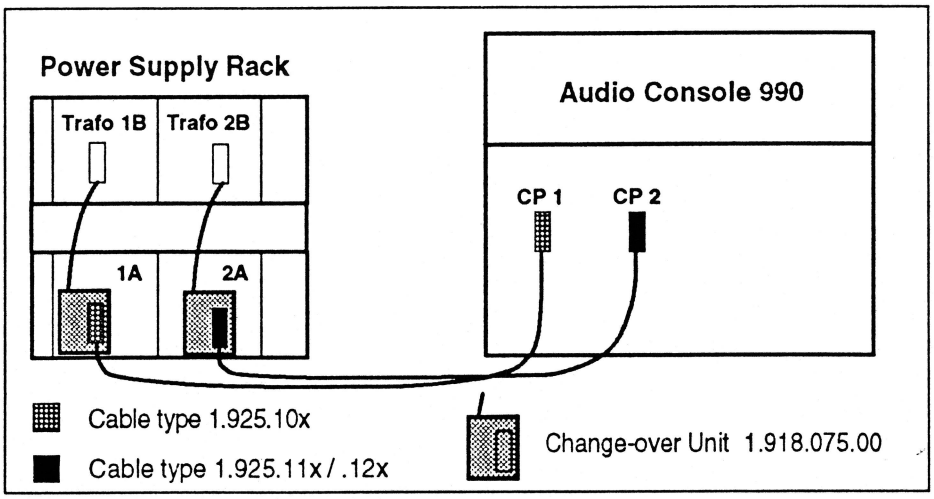


Fig. 4 The entire power supply is redundant. The CHANGEOVER unit interconnects each transformer with its backup transformer and connects the higher of the two voltages to the audio console.

Dual supply:
HOST external

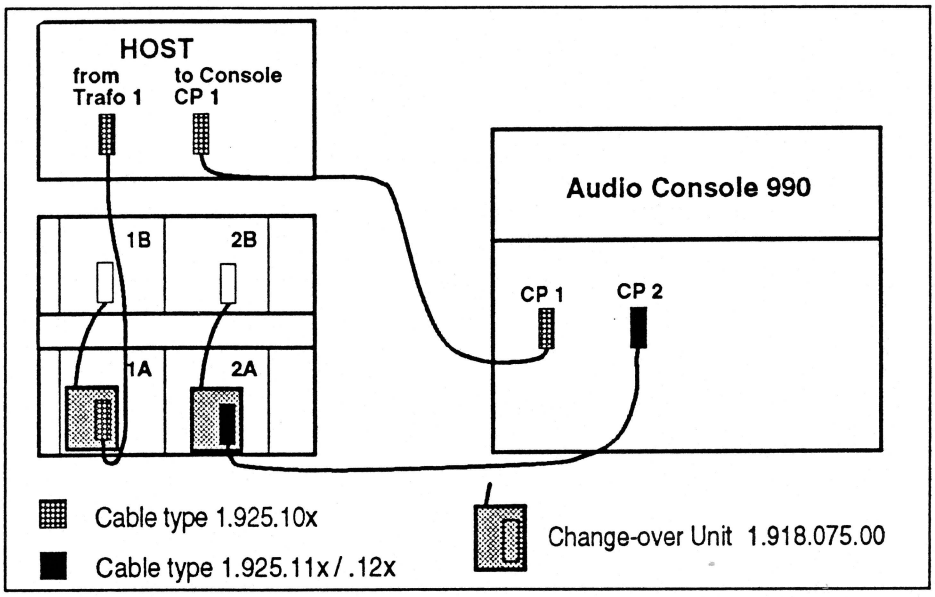


Fig. 5 The CHANGE-OVER unit of transformer 1 supplies the external processor rack. From there the connection to the console is established. Transformer 1A, backup transformer 1B or their changeover units should **never** be connected **directly** to the console.

Ground connection: The wiring of the studio ground depends on the specific customer requirements.

1.3.2 AC power connections

Before you cable the power transformer block [F], make sure that the line voltage selector setting and the fuse rating are correct. The line voltage selector [33] and the fuse [32] are accessible from the front. The primary fuse F6 should be rated as follows:

100 ...140V AC	F6: **5.0**A/250V slow
200 ...240V AC	F6: **3.15**A/250V slow

The standby supply block [E] should be permanently connected to the AC power source. It can be connected to any 100...240V AC outlet without adjustment. Protection on the secondary side is provided by a PTC resistor (0.3A).

1.3.3 Cabling between the power supply and the audio console

The secondary voltages are taken individually from each transformer via a multiconductor cable to the audio console. The individual power supply units are interconnected by a control cable. The following diagram illustrates the cabling for a system in which the HOST processor is integrated in the audio console. Please note the different connection of the standby and the main power blocks on the primary side.

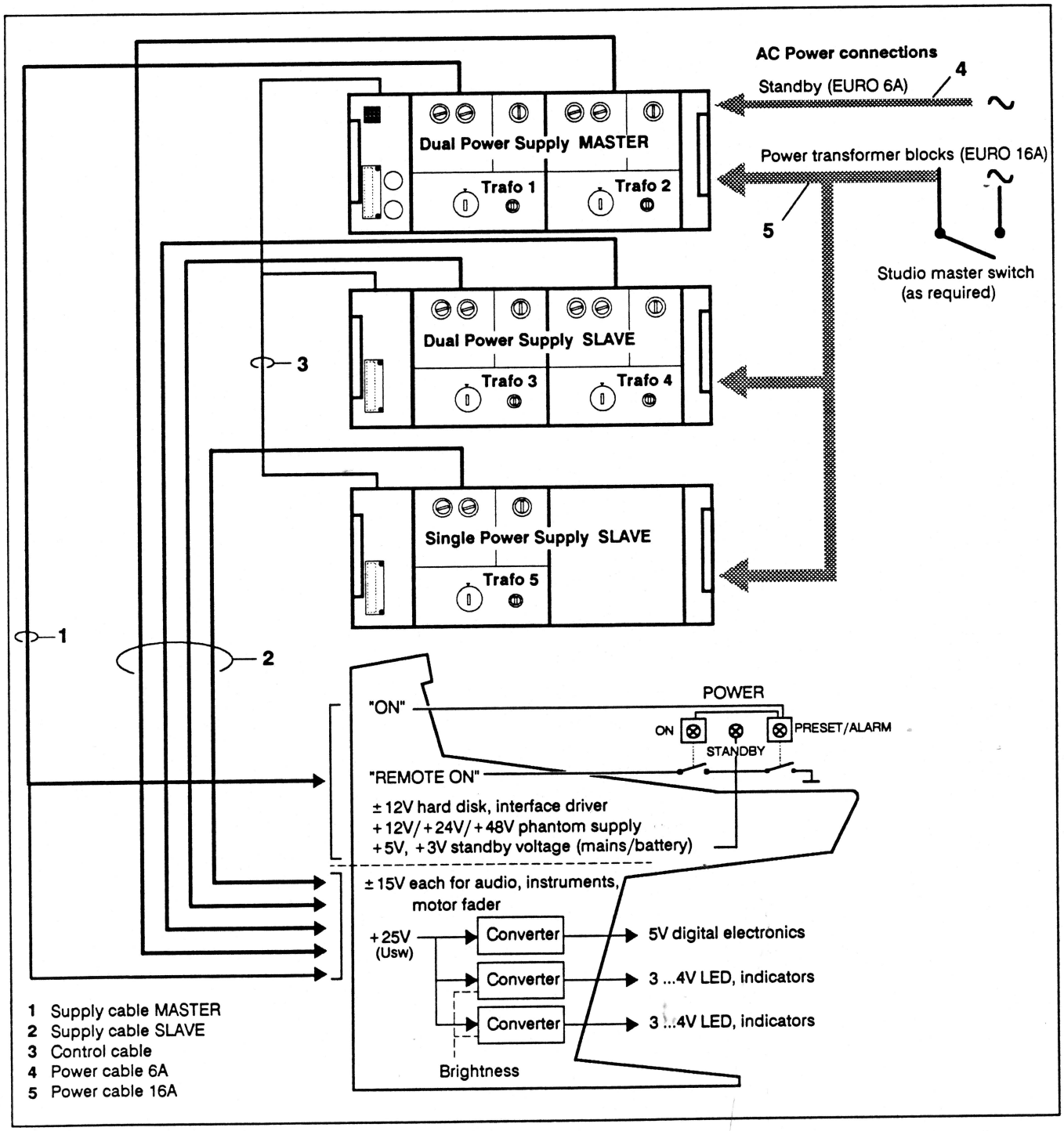


Fig.6 Cabling of the power supply: From the transformers the multiconductor cables take the secondary voltage to the audio console. The 'Master' supply cable connects the phantom supply, standby supply, and the control lines. A control cable interconnects the alarm and function monitoring system of the slave power supplies with the master.

1.3.4 Power connection cables

For the connection power supply → mixing console, three types of power connection cables are used:

Connection cable 'Master' — Connection from the master power supply transformer block 1 to the audio console. In addition to the ±15V this line carries the phantom and standby voltages, ±12V, as well as control lines. Two of these cables are needed for connecting an external HOST between transformer 1 and the audio console. **1.925.10x.00**

Connection cable 'Slave' — This cable is used for connecting each additional transformer to the audio console. **1.925.11x.00**

Conn. cable 'Slave/AUX' — This cable corresponds to the 'Slave' connection cable with four additional conductors for two optional voltages (U1 and U2 of the optional supply 1 or 2). **1.925.12x.00**

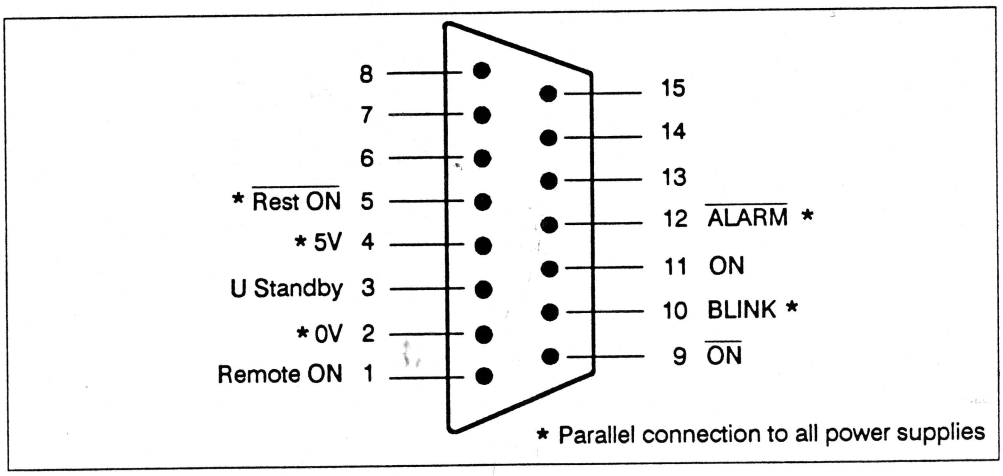
Cable length — The cable length is coded with one digit in the part number. For the cables described above the letter '**x**' is to be substituted by a number 0...9 which corresponds to the lengths shown in the table below:

1.925.10**x**.00 Power connection cable 'Master'
1.925.11**x**.00 Power connection cable 'Slave'
1.925.12**x**.00 Power connection cable 'Slave/Aux'

Value for '**x**'	0	1	2	3	4	5	6	7	8	9
Length (in meters)	1,0	1,5	2,5	5,0	7,5	10,0	12,5	15,0	17,5	20,0

Control cable — D-type 15-conductor cable for interconnecting the power supply units. This cable is manufactured as ordered by the customer.

Pin assignment of the 15-pin D-type control cable connector

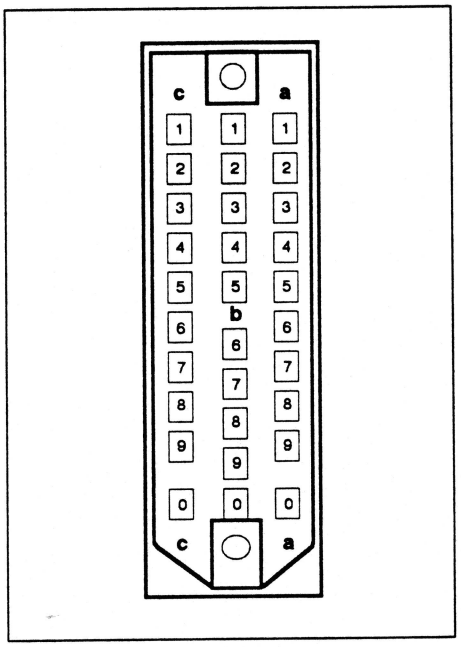


Power cable 16A
3 × 2,5mm²; with connector SEV type 12; 3m **10.223.001.13**
3 × 2,5mm²; without connector; 3m **10.223.001.03**

Power cable 6A
3 × 0,75mm²; with connector SEV type 12; 2.5m **10.223.001.11**
3 × 0,75mm²; without connector; 2.5m **10.223.001.01**

Pin assignment of the supply cable connectors:
All power connection cables have 14 conductors with a cross-section of 1.5 mm^2 each. To reduce the voltage drop across the cable, the ±15 V are partially supplied via two conductors. The designations I and II refer to the left-hand and the right-hand transformer.

30-Pin connector DIN 41622



Connection cable 'Master' 1.925.10x

Conductor No.	Signal	Contact
1	+Usw	0 c
2	-Usw	0 a
3	+15V I	9 c
4	-15V I	8 c
5	-15V II	7 c
6	+15V II	6 c
7	0V Audio	5 c
8	-12V	4 b
9	+12V	3 b
10	Phantom	2 b
11	+5V S.B.	1 b
12	0V (12V)	4 a
13	Remote ON	2 a
14	LED ON	1 a

Connection cable 'Slave' 1.925.11x

Conductor No.	Signal	Contact
1	+Usw	0 c
2	-Usw	0 a
3	+15V I	9 c
4	-15V I	8 c
5	-15V II	7 c
6	+15V II	6 c
7	0V Audio	5 c
8	-Usw	0 b
9	+Usw	9 b
10	0V Erde	8 b
11	+15V I	9 a
12	-15V I	8 a
13	-15V II	7 a
14	+15V II	6 a

Connection cable 'Slave/Aux' 1.925.12x

Conductor No.	Signal	Contact
1	+Usw	0 c
2	-Usw	0 a
3	+15V I	9 c
4	-15V I	8 c
5	-15V II	7 c
6	+15V II	6 c
7	0V Audio	5 c
8	-Ures I	4 c
9	+Ures I	3 c
10	-Ures II	2 c
11	+Ures II	1 c
12	0V Erde	8 b
13	+15V I	9 a
14	-15V I	8 a

Cables of the same type can be connected in series to form an extension.

1.3.5 Ventilator adjustment

The ventilator has two capacity stages. Above the adjustable temperature threshold it is switched to maximum power. The operating mode below this temperature threshold can be set with a jumper either to maximum speed, reduced speed, or zero speed.

Jumper setting

The performance of the ventilator below the temperature threshold T_{vent} can be set on the PCB 1.918.088 (phantom/standby/±12V board) and 1.918.089 (Feed-through board) by means of jumper **J6**.

Ventilator performance with various jumper settings:

Jumper J6:	A	B	OFF
Temp. < T_{vent}	low	high	off
Temp. > T_{vent}	high	high	high

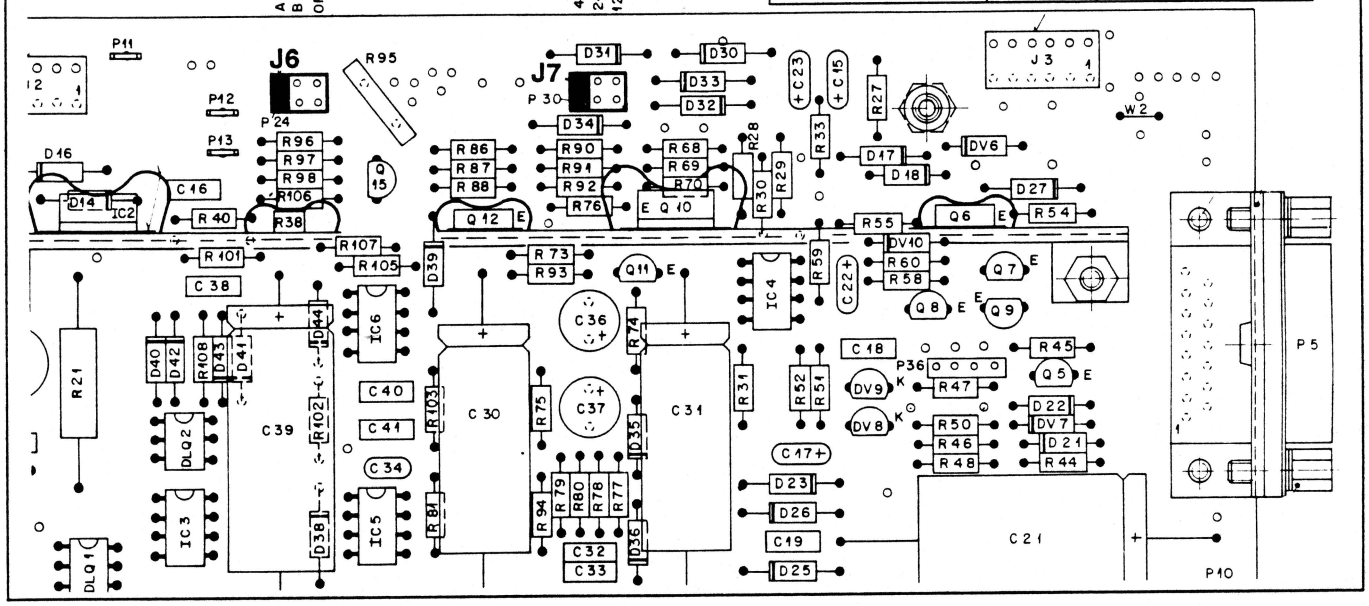


Fig. 7 **Phantom/standby/±12V board 1.918.088** and **Feed-through board 1.918.089:** Jumper settings for ventilator and phantom supply.

Temperature threshold T_{vent}

With the trimmer FAN [13] you can set the temperature above which the ventilator runs with maximum power.

- Connect the diagnose board (1.918.080) to the DIAGNOSTICS [18] connector. U_{temp} and U_{vent} are correlated with the temperature as follows:

U_{vent} / U_{temp}	Temperature
1,0V	40°C
1,5V	55°C
2,0V	65°C
2,5V	80°C
3,0V	95°C
3,5V	120°C

The voltage U_{vent} represents the highest value of each temperature sensor: transformer 1; transformer 2; heat sink 1, heat sink 2, standby/phantom heatsink

- Measure U_{vent} and adjust it with the trimmer FAN [13]. As soon as U_{temp} becomes greater than U_{vent}, the ventilator is switched to maximum power.

1.3.6 Changing the phantom supply voltage

The phantom supply can be set to 12V, 24V, or 48V. For this purpose the **solder straps** on the **transformer 1.910.503** must be changed as shown in Fig. 8.
In addition the position of jumper **J7** must be changed on the Phantom/S.B./ ±12V board **1.918.088** (see Fig. 7).

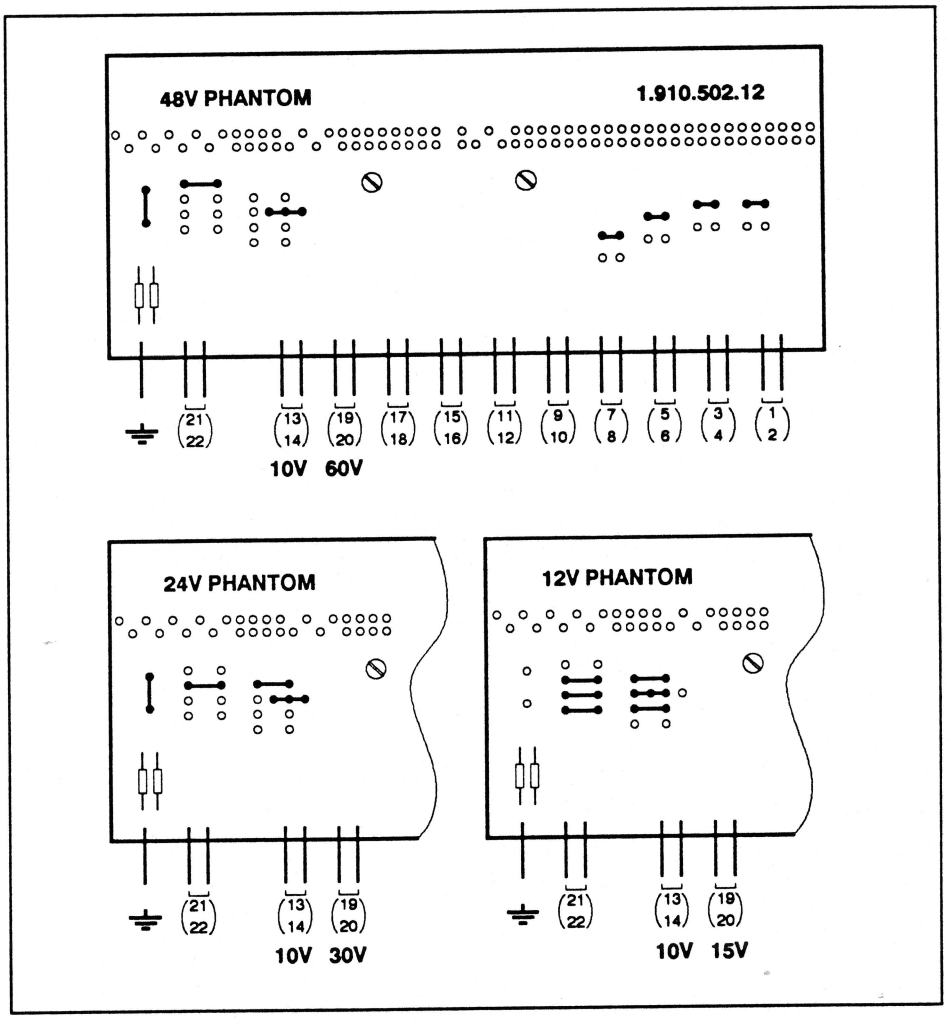


Fig. 8 The phantom voltage can be set on the transformer board by soldering in straps.

Note: If the phantom supply is replaced, also the phantom resistors on the **connection board 1.992.160** of the input units must be adapted. These resistors are located somewhat concealed next to the connectors P9 (top connector for input units). In mono units two resistors must be changed for each channel. For stereo universal units there are four such resistors.

Phantom-supply	**R1 ...R8 R11 ...R18**	**Tolerance**
48V	6,8kΩ	0,1%
24V	4,3kΩ	0,1%
12V	680Ω	0,1%

1.3.7 Adjusting the power-on delay

The power-on delay prevents the occurrence of overloads in a system configured with multiple power supply units. The delay between the transformers within the same housing is 100 ms. For retransmitting the power-on pulse, a variable delay element (DELAY [12]) is installed at the input of the units.
As a second protection the inrush current is limited by NTC resistors.
The delay time can be set by ear. The power-on switching click of the individual transformers should be audible in regular intervals.

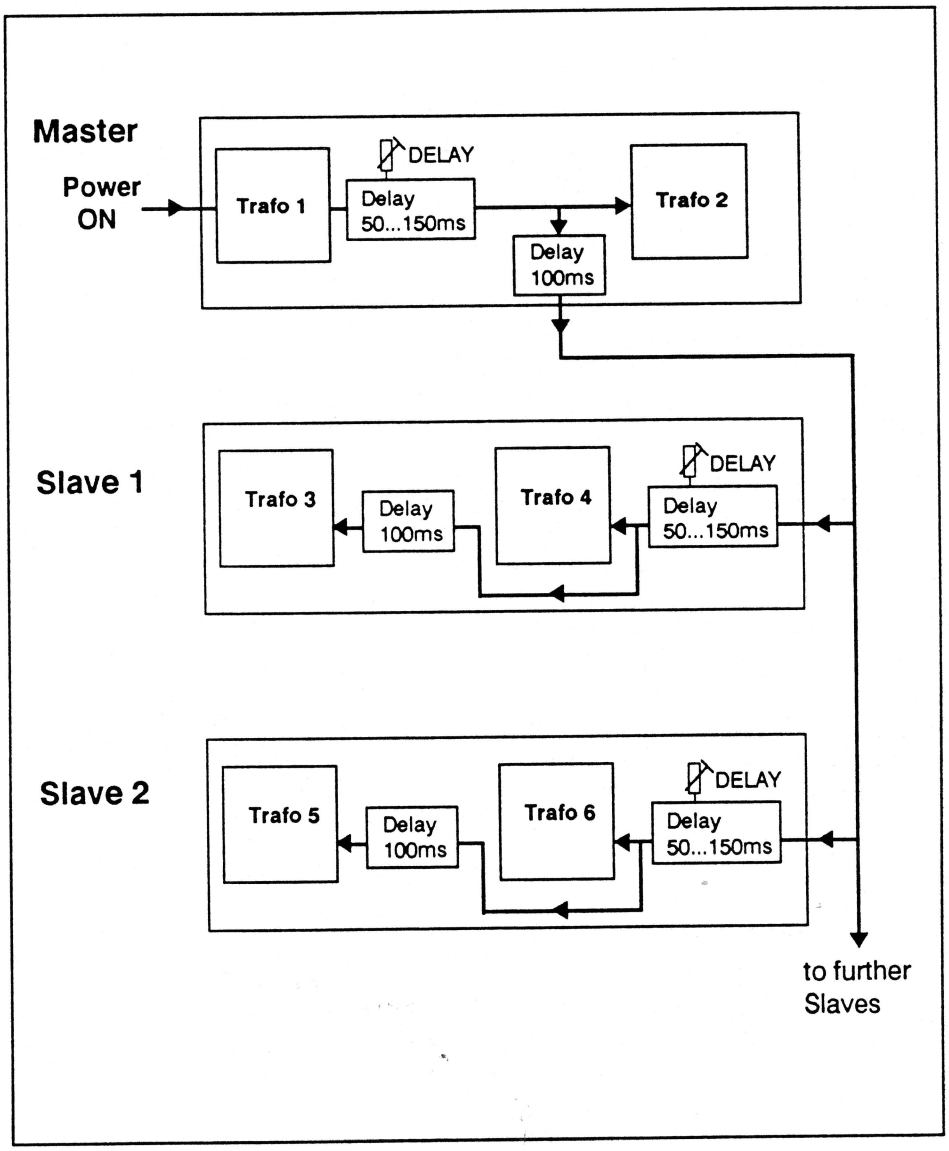


Fig. 9 Expiration of the power-on delay: The variable delay time DELAY can be set with the trimmer [12] on the front panel. On slave power supplies the left-hand front plate is not labelled, however, the FAN and DELAY trimmers are arranged in the same way as on the master power supplies.

1.4 Function monitoring and alarm system

1.4.1 General

Comprehensive automatic checks have been provided to ensure utmost reliability in the power supply. The pilot LEDs signal the correct operation of the monitored functions. A networked alarm system reports system faults to the master power supply and to the audio console.

Networking

With the networked alarm system it is possible to diagnose a fault in:

- Master unit(s)
- Slave unit(s)
- Standby supply block(s)
- Standby batteries
- Backup power supply unit(s)

Alarm: flashing frequency **2Hz**

- Converters (in the console)
- Backup converters (console)

Alarm: flashing frequency **5Hz**

Pilot lamps

When the equipment functions correctly, all yellow LEDs should be light. They turn dark as soon as the measured output voltages are outside the corresponding tolerance range. In this way the functions can be monitored also visually.

Fault indication

Only red LEDs are used for fault indication. They provide information on the nature of the fault and identify the affected transformer block.

1.4.2 Function monitoring

Self-diagnosis of the power supply is achieved by monitoring and displaying its functions. The values of the following parameters are monitored and trigger an alarm if they leave the tolerance band.

Temperature

If the temperature of a transformer or heat sink exceeds 120°C, the affected transformer block switches off. The following indicators are activated:

- The ALARM [2] and POWER LED [1] flash slowly (2 Hz).
- The corresponding red TEMPERATURE LED [3] or [21] flashes.

Undervoltage

If an undervoltage occurs on an output, the corresponding pilot LED switches off.

- The ALARM [2] and POWER [1] flash (2 Hz).
- The yellow pilot LED of the corresponding voltage switches off.

Overvoltage

If an overvoltage is present on an output, the monitoring system switches the corresponding transformer block off.

- The ALARM [2] and POWER LED [1] flash (2 Hz).
- The corresponding red VOLTAGE LED [4] or [22] flashes.

Short circuit (secondary side)

If the short circuit on a ±15V output exceeds about one second, the corresponding transformer block is switched off.

- The ALARM [2] and POWER LED [1] flash (2 Hz).
- The corresponding red VOLTAGE DEV./SHORT CIRCUIT LED [22] flashes.

1.4.3 Alarm system

The alarm system basically fulfills two functions:

1. Signalling of missing or low voltages by flashing LEDs.
2. Powering off the affected transformer block if there is a possibility that the electronics of the power supply unit or the audio console could suffer damage. This is the case under the following conditions:
   - Power transformer temperature exceeds 120°C
   - Heat sink temperature exceeds 120°C
   - Short circuit on ±15V
   - Overvoltage on a ±15V output
   - Overvoltage on the output of the phantom supply

IMPORTANT: If the left-hand transformer block of the MASTER power supply switches off, all associated slave transformers will also be switched off. (The master provides e.g. the phantom supply. Continued operation would generally make little sense.)

If the function monitoring has switched off a transformer block, the power supply **must be switched off and on again** after the fault has been remedied. It does not automatically power on after the fault has been cleared!

Flashing for a few seconds after power on is normal because the voltage is built up slowly and undervoltage is initially signalled.

Block diagram of the alarm system

This example illustrates a dual supply with changeover unit (see 5.).

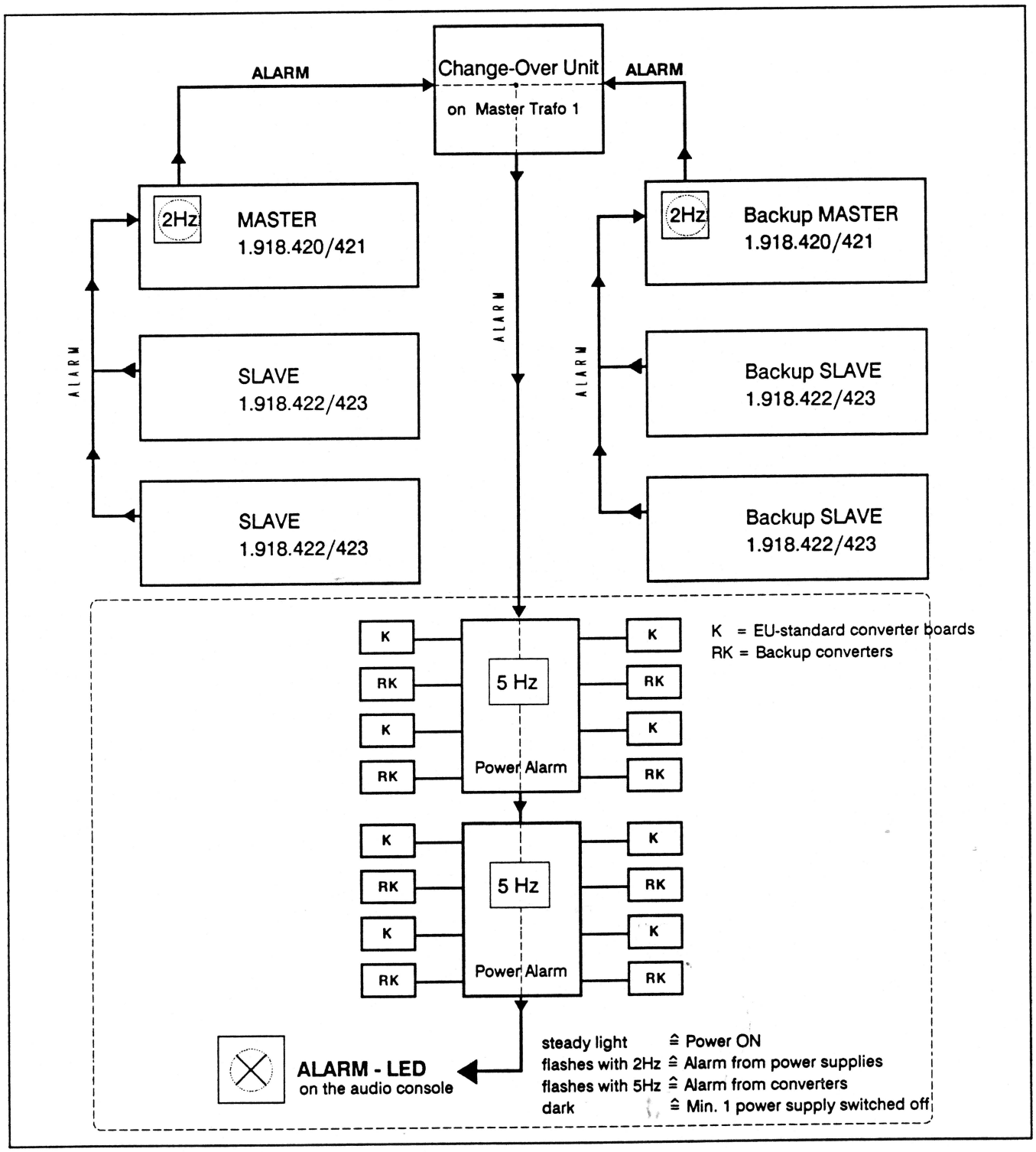


Fig. 10 The networked alarm system of the power supply monitors also the availability of the backup power supply units and voltage converters.

Exceptions: Options 1 and 2 (Power Amp. Rect. 1.918.086 and Dual Stabilizer 1.918.087) are not monitored.

1.4.4 Diagnose connector

The principal voltages and currents are terminated on a 40-pin diagnose connector. The **diagnose board 1.918.080** is available as an accessory on which these variables can be conveniently measured. 6-pin to 40-pin card edge connectors are mounted on the cascade type cable harness so that the latter can be used universally. When this cable is connected to a circuit board, the signals can be easily tapped on the numbered measuring pins.

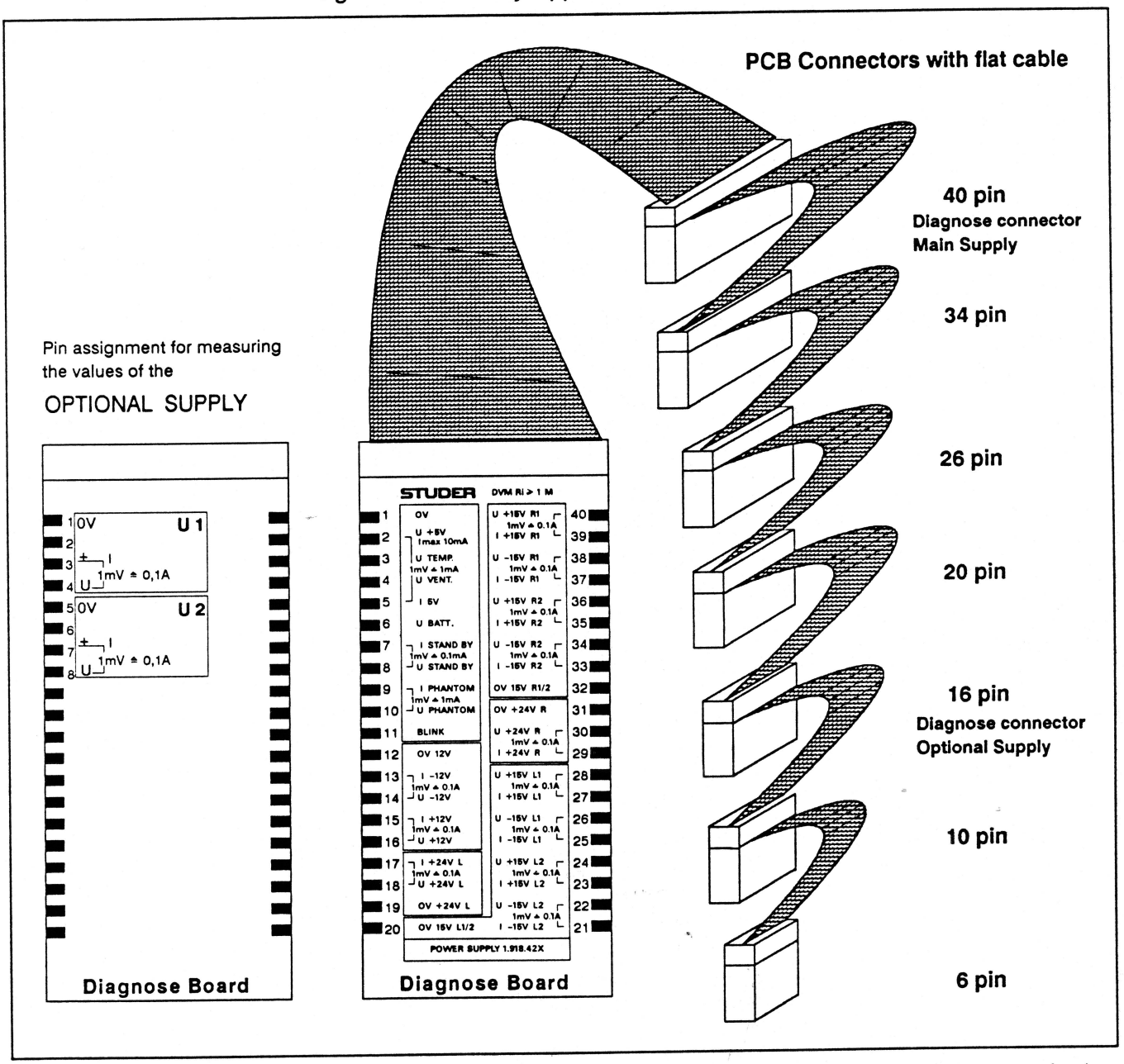


Fig. 11 Diagnose board 1.918.080 with universal cable harness. On the left the measured values for the diagnose connector of options 1 and 2 are listed.

Note:

- The test points in the power supply are decoupled via 1 kΩ (short-circuit proof)
- For auxiliary purposes the +5V can be tapped between pins 1 and 2 with max. 10 mA.
- Use a voltmeter with Ri ≥1 MΩ

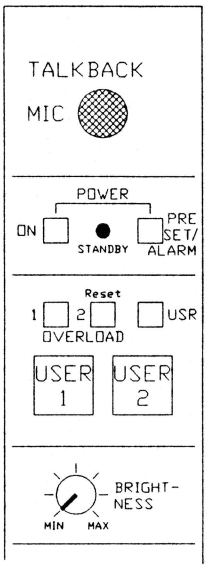
2. System start

2.1 Power-on

The standby supply block is continually connected to the mains. It supplies the voltage with which the power transformer block is switched on and off.
The power supply can be switched on from the master power supply or from the audio console.

Power on from console:

The keys and indicators of the power supply are located below the talk back microphone on the display panel. The ON and PRESET/ALARM keys must be pressed simultaneously for switching the system on or off.



PRESET / ALARM This key is pressed together with the ON key for switching the system on. In normal operation this key is continuously light.
As an alarm indicator it signals slowly flashing (2 Hz) a fault in one of the power supply units. Rapid flashing (5 Hz) signals a fault in EU-standard converter boards in the audio console. (Operation with change-over units)

ON Power-on key used together with PRESET/ALARM. This luminous key indicates that the audio console is energized.

STANDBY This yellow LED indicates that the standby supply block functions correctly. In battery operation this LED remains dark.

Power on at power supply:

The power supply can be switched on or off with the POWER key [1] of the master power supply.

Power up with studio master switch:

The power supply can also be switched on and off with a studio master switch. The "on/off" state remains stored.

Switching states of the **POWER key** [1]: (on the power supply unit)

Power supply	Studio master switch ON	OFF
ON	**light**	flashing
OFF	dark	dark

Power-on delay:

In a system with multiple power supply units, a power inrush overload could occur when power is switched on. To prevent this, a power-on delay circuit has been installed (see 1.3.7).

Power on after alarm:

The power relays switch the supply voltages of the transformers and are integrated into the alarm system: If a malfunction occurs, the power transformer block is switched off if damage to the equipment could occur. After the fault has been remedied the audio console must be switched off and on again.

Dual power supply with changeover unit:

If a dual power supply (see 5.) is used, the master and the backup master supplies must be in the same switching state (on ↔ off). If this is not the case one system is always disabled.
'Power on' at the console controls both master supplies simultaneously.

2.2 Initialization

Start-up

After the operating voltage has been attained, the control is initialized automatically. This involves the start-up of the 3-level processor hierarchy from top to bottom.
The system checks the availability of its hardware and software. The integrity of the program code is verified by means of checksums. If a program is missing or if a checksum is incorrect, the program is reloaded from the system disk. In view of the large number of processors this test procedure is important. It also has the advantage that all error-free data of the last operating states are preserved: The work can be resumed where it was interrupted on the previous day.

RESET

- RESET corresponds in all aspects to a restart as described below (Initialization sequence). It is initiated with the reset key of the HOST processor.

- It is possible to reload all programs without verifying the checksums. In this case the user data in working storage are deleted. To prevent inadvertent actuation, two keys must be pressed simultaneously:

ENABLE + LOAD start the system at the lowest possible level. Both keys are located in the system control field (floppy drive).

Initialization sequence:

The **first part** of the system start is controlled by the programs located in ROM:

Hardware test The HOST hardware is tested comprehensively.

↓

Checksum operating system The checksum of the operating system is verified.

↓

Checksum application The application program of the HOST is checked.

↓

Loading The operating system and the application program of the HOST are reloaded, if necessary.

The HOST PROCESSOR is now ready for operation and takes over the **second part** of the initialization.

Checksum configuration The audio console configuration file is checked.

↓

HDLC controller Hardware and program check of the HDLC controller by the HOST.

↓

Module processors The connections to all modules are established and checked.

↓

Loading The software of all modules with an undefined state is reloaded.

↓

Operation All necessary audio console configurations are checked and reloaded if needed. A run command to all processors enables the operation.

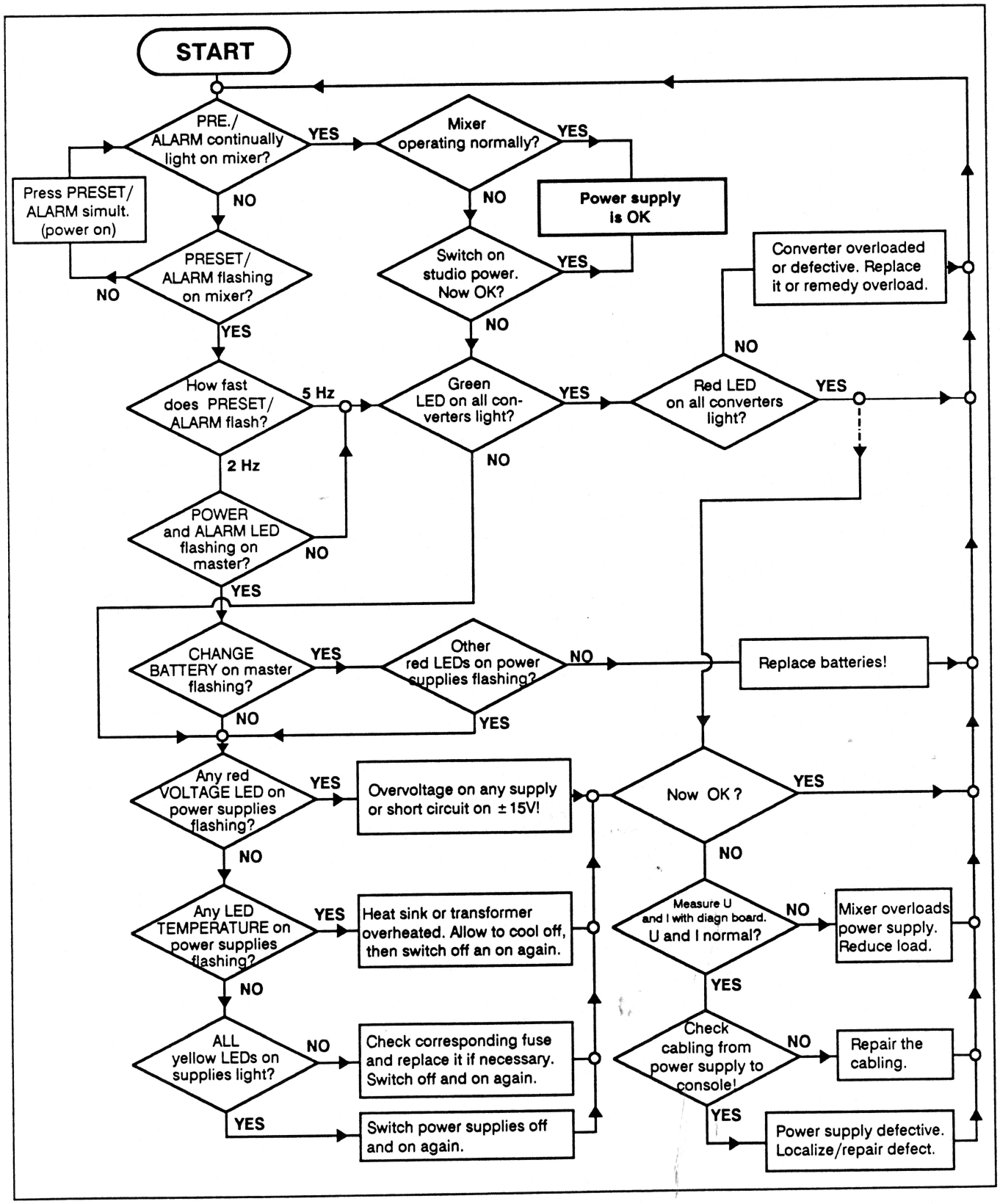
↓

Ready The green LED of the system control panel signals ready for operation.

3. Troubleshooting in alarm state

The power supply alarm is output on the audio console (display control unit) as well as on the master power supply. The flashing frequency provides preliminary information:

2Hz → Power supply
5Hz → Converter boards in the audio console



4. Options

In addition to the universal configuration capabilities, an extension of the power supply modules is possible for special applications. For this purpose an additional circuit board is installed on the right-hand side (optional supply). Its primary AC voltage is supplied by the power transformer blocks.

4.1 General information to options 1 & 2

Connection to the console

The voltage supplied by the optional circuit boards are connected to the contacts reserved for this purpose (30-pin connector [B]). In place of the 'Slave' supply cable, the 'Slave/Aux' cable 1.925.12x.00 is used (see 1.3.4). The spare voltages U1 and U2 are listed as $\pm U_{res}$ I and II in the pin assignment on page 5/10.

Diagnose connector

The diagnose board can be connected to the 16-pin diagnose connector. The pin numbering is the only valid labelling. The values of the auxiliary supply can be measured on the pins listed below. The test points are decoupled with 1 kΩ. A voltmeter with Ri ≥ 1 MΩ must be used for performing the measurements. (see 1.4.4)

Voltages:	$+U_{res}$ I(U1)	Pin **4**	$-U_{res}$ I(U1)	Pin **1**
	$+U_{res}$II(U2)	Pin **8**	$-U_{res}$ II(U1)	Pin **5**

Currents: 1mV measured corresponds to a current of 100mA.

I_{res} I	Pin 3: +	Pin 4: -
I_{res} II	Pin 7: +	Pin 8: -

All other contacts should not be connected.

Alarm system

The options are not integrated in the alarm system.

4.2 Option 1

The audio console contains two power amplifiers which must be supplied separately (STUDER power amplifier 1.915.440/441).

Material:

■ Power amp. rectifier	1.918.086.00
■ List of stranded wires	1.918.086.93
■ Front panel, right	1.918.420.45
■ Connector cover 16-pin	1.918.420.47
■ Installation material	

Two identical but separate systems are implemented on the board. The inrush current is limited by an NTC resistor. After the rectifier the voltage is smoothed, and the ripple current in the supply cable is consequently reduced. Yellow LEDs indicate that the amplifiers are ready for operation.
The current and voltage of this board can be checked on a 16-pin diagnostic connector.

Technical data:

Current:		I =	1.5A (ED 50%)
Voltage:		U =	approx. 42V (depending on the line voltage and load)
Fuse:	F7, F8:		2A (slow)

4.3 Option 2

Two additional stabilized DC voltages are needed in the audio console.

Material:

■ Dual stabilizer/rectifier board	1.918.087.00
■ List of stranded wires	1.918.086.93
■ Front panel, right	1.918.420.45
■ Connector cover 16-pin	1.918.420.47
■ Installation material	

This board contains two identical but separate systems. The output voltages are selected by means of jumpers. The system can be operated with a max. 63 VDC on the charging capacitor if it is not loaded with the maximum output current in continuous duty.
The maximum input voltage for system II is 35 VDC on the charging capacitor. The maximum current is limited electronically. The unit is switched off with a delay if the current is too high in order to protect it from overheating. Operation can only be resumed after the power supply has been switched off and on. A crowbar protects the assembly from overvoltages.
Two yellow LEDs signal the operating state. The currents and voltages can be measured on the 16-pin diagnostic connector.

Technical data:

Current:	I	=	1A...2.5A (depending on total power dissipation)
Voltages:	U	=	5V, 6V, 12V, 24V (adjustable with 3 jumpers and precision trimmers).
Fuse:	F7, F8:		2A (slow)

Fuses of this rating limit the output current to approx. 1.5A. For higher currents the front panel will be correspondingly labelled.

5. Dual supply with "Change-over" mode

General

In applications where maximum reliability is required, possible defects in the power supply should also be taken into consideration. By installing redundant components it is possible to compensate the failure of one unit without causing an equipment malfunction. Two configurations are possible:

- Spare circuit boards are installed for all EU standard converter PCB's.
- The entire power pack system as well as the converter boards are redundant.

5.1 Block diagram "Change-over" mode

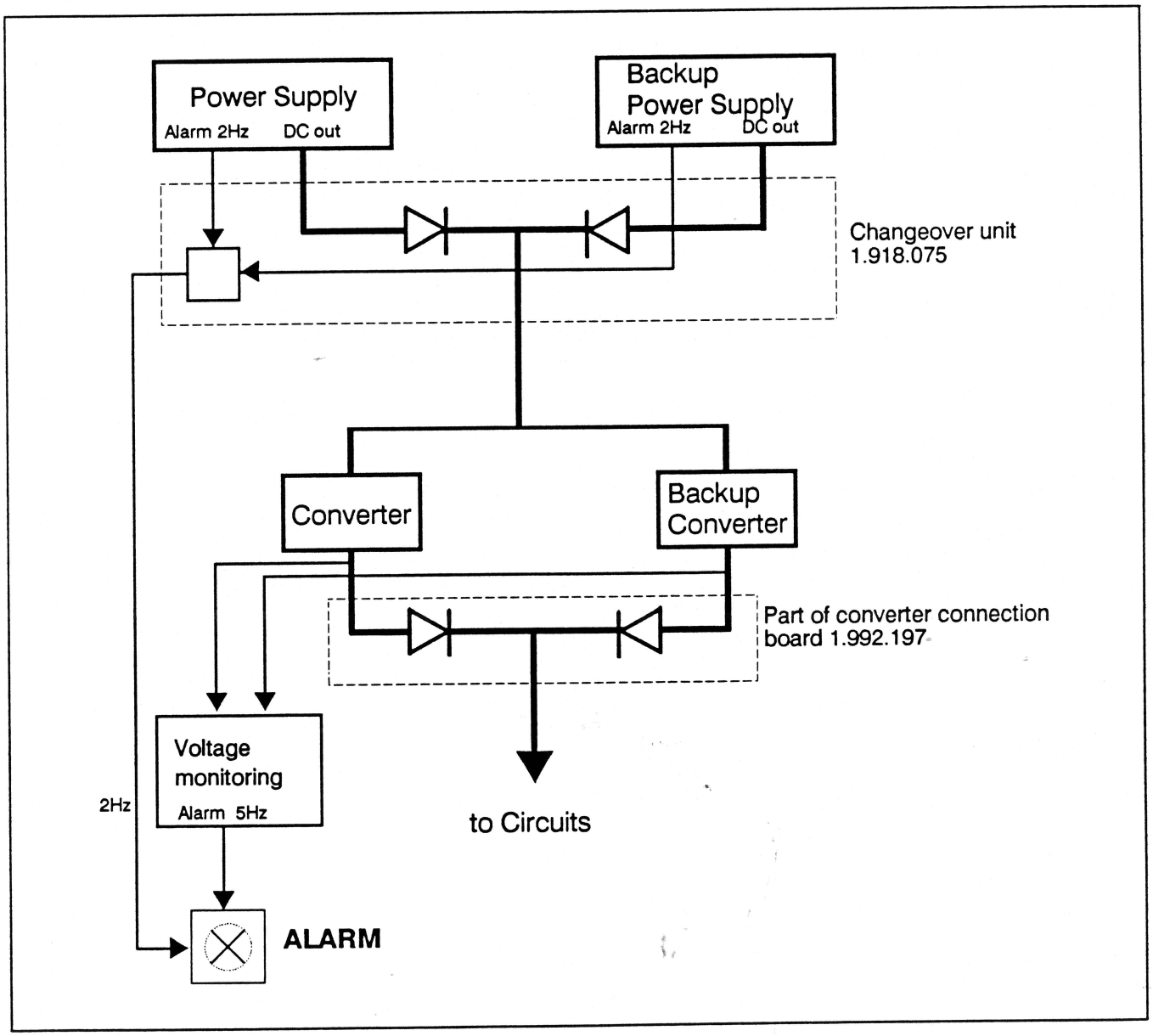


Fig. 12 Dual power supply with redundant power packs and converter boards. The alarm system also monitors the correct function of the backup units.

5.2 Converter change-over

A redundant board is installed for each converter board. These two boards are interconnected on a bus via diodes in such a way that in the event that one board fails the function is taken over by the other board without interruption. The output voltages are monitored on a separate module. If one of the boards fails, an alarm is signalled by 5 Hz flashing of the PRESET/ALARM LED.

Retrofitting with backup converters is very difficult because the wiring of complete power supply system must be changed.

5.3 Power supply change-over

The entire power supply complex comprising master and slave equipment exists twice. The output voltages of each pair of main and backup supply are cabled to the mixing console via change-over units. If a supply voltage fails, this change-over unit switches automatically to the backup transformer without interruption. The change-over unit is plugged into the 30-pin socket of the transformer block (see 1.3.1, Fig. 4).

Retrofitting with plug-in change-over units is possible without difficulty.

Required material:
- For each power supply a backup unit of the same type
- For each existing supply cable 1 change-over unit 1.918.075

5.4 Alarm system and change-over mode

The alarm system is designed for simultaneous monitoring of the power supply and the backup system. Even if the backup power supplies are not under load, all variables captured by the alarm system are monitored. The availability of the backup system is always monitored as long as both power supplies are switched on (see 1.4.3, Fig. 10).

Section 6 Source selection and Audio Routing

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1.2 Inline unit (Small Fader) 3
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2. Audio routing

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2.2 Audio routing block diagram 6
2.3 Bus selection possibilities 7
2.4 The Central Assign Unit 7
2.5 Selecting a mixing console unit 8
2.6 Routing to the MIX bus 10
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2.9 Routing to the AUX and MULTIPLEX bus (MPX) 14
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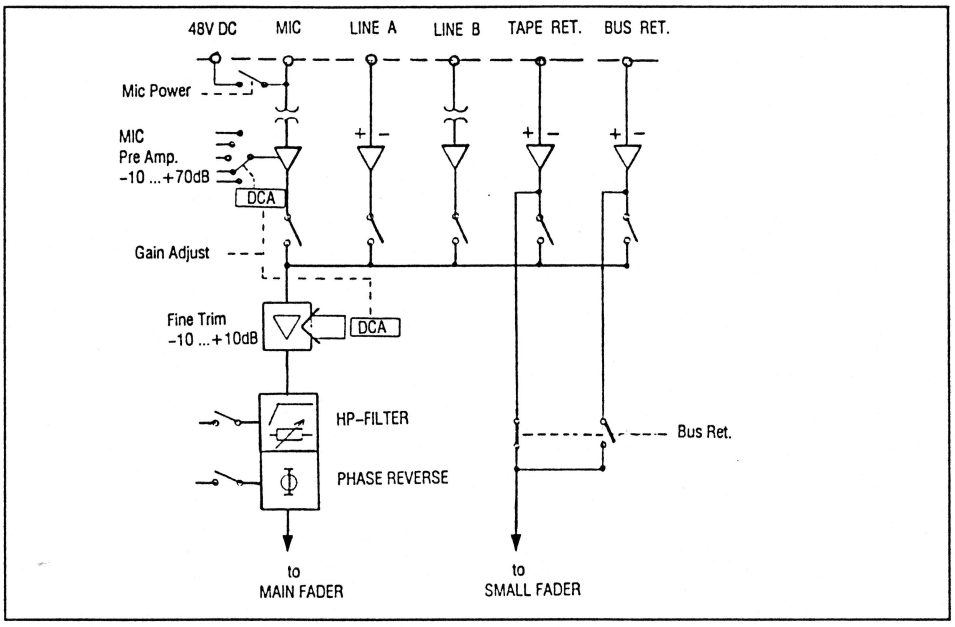
1. Source selection

1.1 Mono input units

The signal source for the main fader is selected on the mono input unit. The in-line unit is equipped with a "bus return" selection button that switches the signal of the small fader from tape return to bus return.

Block diagram inputs:



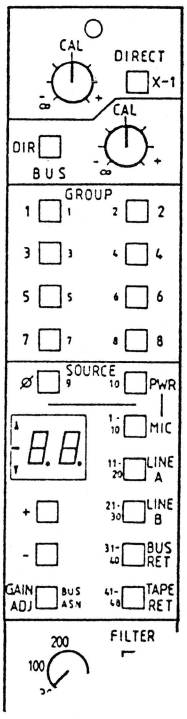
Input section of the mono input units (MCH)

Source selection

The interlocking source selection keys are located in the SOURCE field. The GAIN ADJUST/BUS ASSIGN key controls their alternate functions and should not be light when a source is to be selected. The input gain is displayed digitally in decibels and can be varied with the "+" / "-" keys in 1 dB steps within the following limits:

- Microphone: -20...+80dB
  (corresponds to a sensitivity of +26 ...-74dBu relative to nominal level: 0dB ≙ +6dBu)
- Line A and B: -10...+10dB
- Tape Return: -10...+10dB
- Bus Return: -10...+10dB

If the "+" / "-" keys are continually pressed, the gain is incremented or decremented by one step in intervals of 0.5 seconds. After 3 to 4 consecutive steps, the step width is increased as follows: 1dB → 2dB → 3dB → 5dB → 10dB

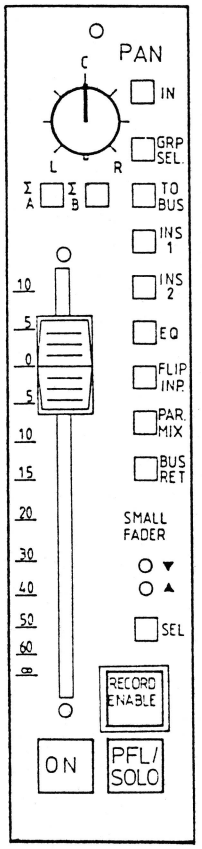


Phase position The phase position of the above inputs can be rotated by 180° with the "Ø" key.

Phantom supply The POWER (PWR) key switches the 48 VDC phantom supply on and off.

Insertion points The insertion points INSERT 1 and 2 can be switched on and off individually. The arrangement on the signal path is determined by the system software.

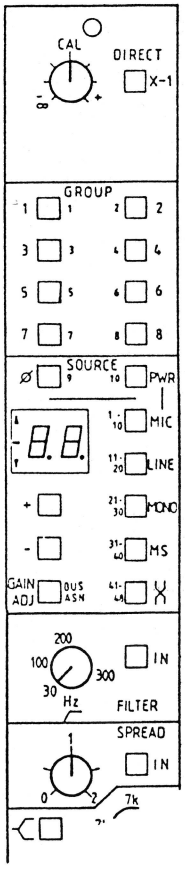
1.2 Inline unit (small fader)



The standard signal of the small fader is the TAPE RETURN, which can also be selected on the main fader. The **BUS RETURN** key connects the BUS OUTPUT signal to the small fader. It should be noted that this output depends on the status of the BUS DIR key. Many configurations are possible which are described in general in Section 2, and individually in Section 1 under 4.1.

1.3 Stereo input units

The source selection and the adjustment of the input sensitivity are basically the same as for the mono input units. The stereo input units are not designed for use with an inline unit.
There are two different versions: with microphone input (= stereo universal) and without microphone input (= stereo high level).



Stereo universal unit:

The microphone input with switch-controlled phantom supply (PWR key) also processes signals in **MS stereophony**. When the MS key is pressed, the left channel (M+S) and the right (M–S) channel are generated from the center signal and the side signal of this microphone arrangement. The level ratio between the M and S signals, and consequently the base width, can be adjusted with the balance control of the fader unit.
Microphone connection: **M** → left / **S** → right

The line input in stereo mode is balanced and floating.

The input gain can be adjusted within the following limits:

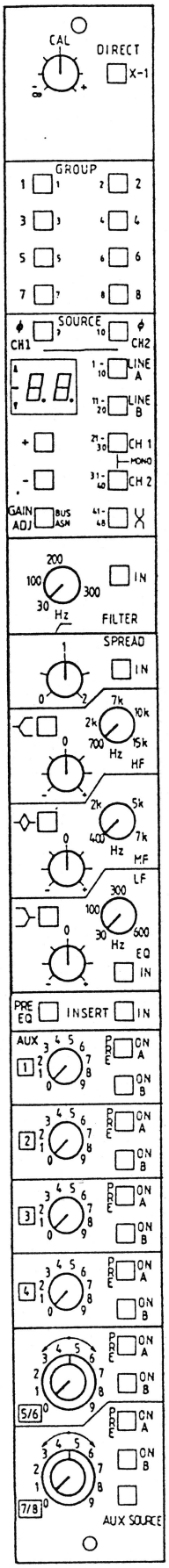
- Microphone, stereo: –20...+80dB
- Line: –10...+10dB

Phase The "Ø" key rotates the electrical phase position of the left input channel (CH 1) by 180°. The phase position of the right channel (CH 2) cannot be influenced.

Mono Adds both channels to a mono signal. The mono setup applies to both inputs.

Channel swapping "×" Swaps the channels of the two inputs.

AUDIO ROUTING



Stereo high-level input:

In place of the microphone input, two high-level inputs are available. The input LINE A is balanced electronically, LINE B with a transformer. In mono mode it is possible to connect an individual channel to both stereo channels.

Adjustment range of the input gain:

- Line A: -10...+10 dB
- Line B: -10...+10 dB

Phase

The phase switches Ø CH1 and Ø CH2 separately invert the phase of the left (CH 1) input channel and the right (CH 2) input channel.

CH1/CH2

Each of these keys connects the corresponding channel 1 (CH 1, left) or channel 2 (CH 2, right) to both channels of the stereo signal path.

Mono

When both keys are pressed together (CH 1 + CH 2) a mono signal is created from both channels.

Channel swapping "×"

Swaps the left channel and the right channel of both inputs.

Insertion point:

All stereo inputs are equipped with an electronically balanced INSERT. It can be switched on and off and be arranged before or after the equalizer.

2. Audio routing

2.1 General

The comprehensive range of buses offers a variety of connection possibilities for each input channel. In the case of inline consoles they are almost doubled because the small fader audio signal is processed separately. First the buses available on the console are described. The separate branching possibilities from the signal path of the main fader and the small fader are identified with the abbreviations MF and SF:

MF: Main Fader
SF: Small Fader

MIX Bus	**AL - AR; BL - BR; CL - CR; DL - DR;** 4 Stereo master buses designated as A to D with suffix "L" for the left channel and suffix "R" for the right channel.	4x**MF** 4x**SF**
GROUP Bus	**1 .... 8** Group bus for the 8 mono groups.	8x**MF** 8x**SF**
MULTITRACK Bus	**1 .... 48** Bus for multitrack tape recorders with up to 48 channels.	48x**MF** ↔ 48x**SF** Switchable per channel
AUX Bus	**A1 .... A4** Mono; **A5/6, A7/8** Stereo; **B1 .... B4** Mono; **B5/6, B7/8** Stereo; Bus for 16 auxiliary paths, signal tapped before (PF) or after (AF) the faders.	**MF** ↔ **SF** **MF** ↔ **SF** Individually switchable per auxiliary path
MPX Bus	Multiplex bus, **1** stereo bus For returning to the mono unit, a mono signal is centrally generated from the MPX bus and taken to an MPX mono line to which there is no direct access.	**only MF**

Abbreviations

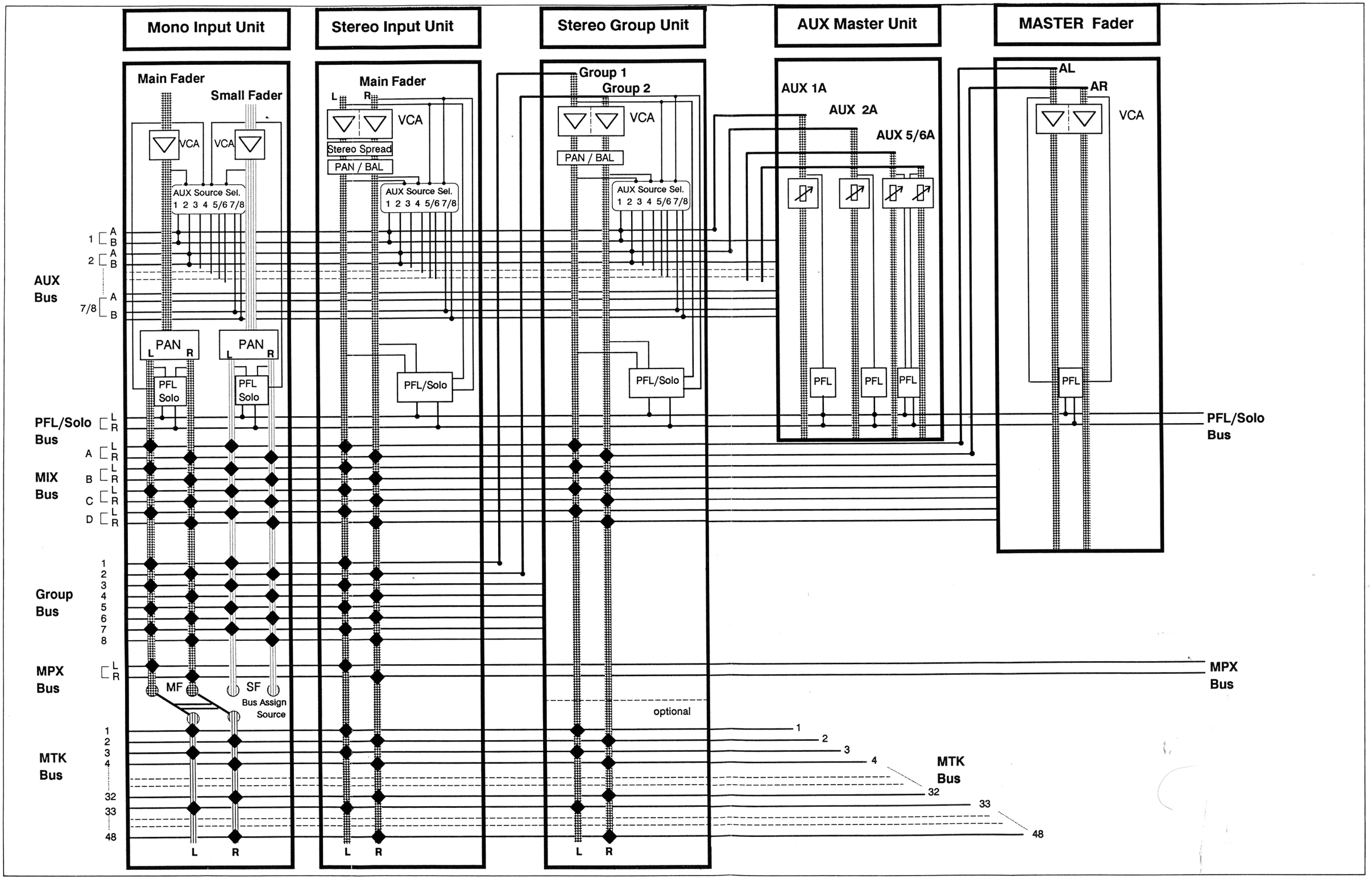
The following abbreviations are used on the display:

Input unit No.	`I_ 1, I_ 2, ... I_64`	(I=Input)
Group unit No.	`G_ 1, G_ 2, ... G_ 8`	(G=Group)
Master unit No.	`M_AL, M_AR, ... M_DR`	(M=Master)
Multitrack bus No.	`IX 1, IX 2, ... IX48`	The letter X in the second position identifies it as a bus.
Group bus No.	`GX 1, GX 2, ... GX 8`	
Mix bus No.	`MXAL, MXAR, ... MXDR`	
Multiplex bus No.	`_MPX`	
Aux send A bus No.	`AX 1, AX 2, AX 3, AX 4, AX56, AX78`	
Aux send B bus No.	`BX 1, BX 2, BX 3, BX 4, BX56, BX78`	

Block diagram

The bus selection possibilities are summarized in the block diagram on the next page.

2.2 Audio routing block diagram



2.3 Bus selection possibilities

The central operation of the switching functions permits various methods for selecting a bus and for displaying the corresponding assignment:

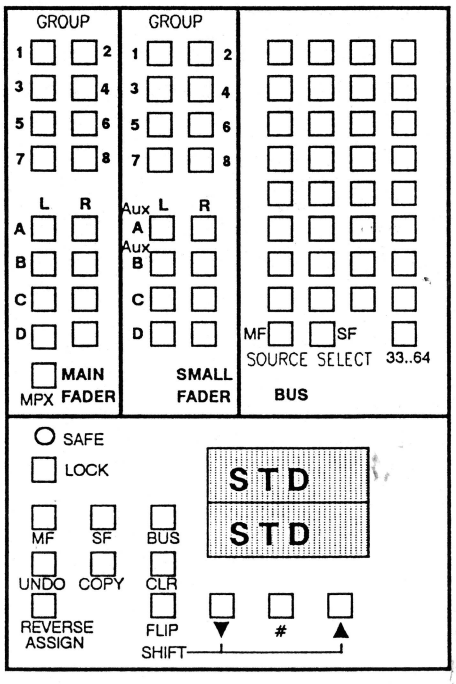
- Bus selection directly on the input channel.
- Selection on the central assign unit (CAU).
- Reverse procedure: Selecting the input units that are to feed a bus in "Reverse Assign" mode on the central assign unit.

In the following Sections, all buses are discussed based on the first two selection possibilities. The "Reverse Assign" mode is treated separately in Section 2.10.

2.4 The Central Assign unit 1.990.815

The central assign unit (CAU) is used for controlling and entering the bus selection. This unit enhances the operating convenience and provides functional clarity. Practically all functions can be performed also on the channel modules. A central assign unit is not required in all cases, but it expands the operating facilities by the following functions:

- Selection of the C and D bus exclusively on the central assign unit.
- Separate bus selection for the left and right channel.
- Greater operating convenience through central clearing and copying of the selection state.
- Reverse assign mode.



All changes in the selection state are displayed on the luminous keys of the CAU and simultaneously on the peripheral units.
(The operator controls of the CAU are described in Chapter 3 under Section 3.3).

2.5 Selecting a mixing console unit

Before the bus selection of a mixing console unit from the central assign unit (CAU) can be processed, a connection must be established between these two devices. This procedure is referred to as "Selection". It is always the first step of a centrally controlled operation and can be executed as follows:

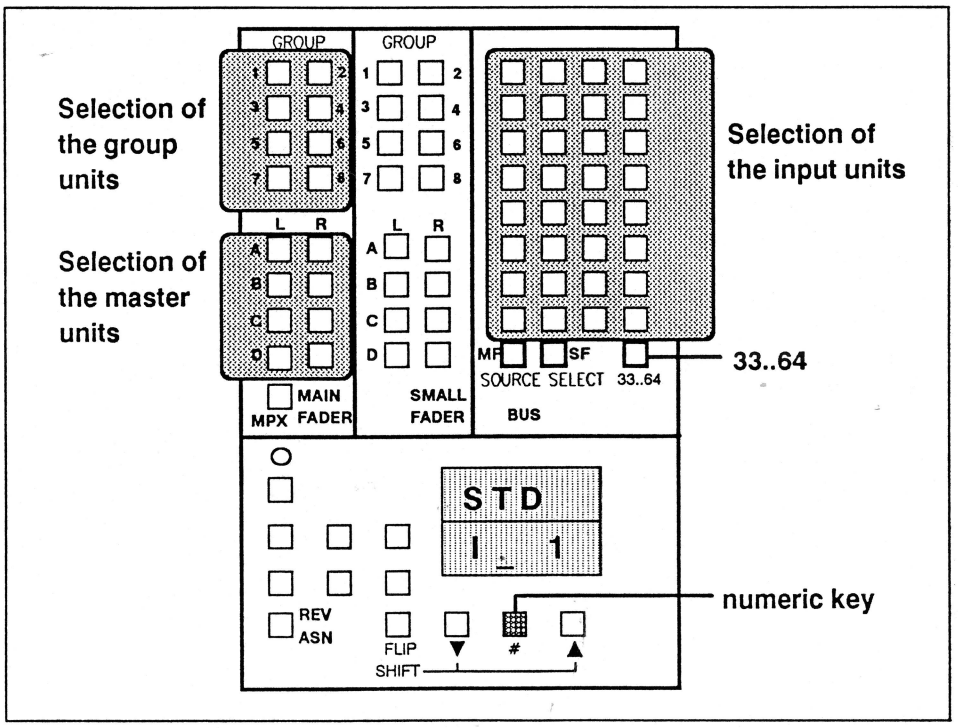
Selecting on the mixing console unit:

All relevant mixing console units are equipped with a SELECT key (SEL on fader units) which establishes a data link to the CAU. The SEL key of a selected unit is identified with a green light. When a new selection is made, the CAU always switches to the standard operating mode.

Selecting from the CAU:

A mixing console unit can be selected directly by entering the channel number. Press the "#" key in the control section, followed by a numeric key of the main fader (MF) or bus section. In this way the correspondingly assigned input, group or master unit is selected and displayed in the lower line.

Keys		Display
[#] + MF group [1]	→ Group unit 1 selected	G_ 1
[#] + MF Σ [AL]	→ Master unit for master AL selected	M_AL
[#] + BUS [1]	→ Input unit number 1 selected	I_ 1



Direct selection on the central assign unit. Example: input unit 1

The "#" key lights up as soon as a selection process is started. The process can be cancelled by pressing this key a second time.

Scan forward/backward [▼] [▲]

With the arrow keys you can scan forward or backward from the currently displayed to the next functional unit. After the last module, a wraparound occurs to the first module. The category of the selected units is not affected (inputs, groups, etc.).

[▲] The next higher unit of the same category is selected.

[▼] The next lower number is selected.

LOCK key

The lock key inhibits the peripheral selection of units. The connection to the CAU can only be established by the latter. This permits undisturbed operation on the CAU. The red luminous key signals that external selection requests are ignored.

"SAFE" LED

The "SAFE" LED is light if the bus selection status of all units is protected against modifications from the CAU. On the units themselves all functions remain operable. This write protection can be switched on and off by means of the **[LOCK]** + **[SHIFT]** keys.

Error possibilities:

- Selection of a nonexisting channel:
  If the channel does not exist in the console configuration (system software), the selection is ignored. If the selected unit is configured but not ready, an error messages is output on the display.
- Selection attempts are ignored as long as an operation (copy/clear) is in progress on the CAU or if the lock function is active.
- Digits that are entered incorrectly during the selection on the CAU can be overwritten. A correction facility is, therefore, not necessary.

Error messages:

Errors are signalled with the message **ERR*** on the display. The operator functions are reenabled after this message has been acknowledged by pressing any key on the CAU.

2.6 Routing to the MIX bus

When a mixing console unit is selected, its status is displayed in the luminous key field of the CAU. The designation and the number of the unit are shown on the lower display line.
For each channel of an inline console, a main fader and a small fader signal can simultaneously be connected to the MIX bus independently of each other.

MIX bus:	Input channel	Central assign unit (CAU)
Main fader:	On the **fader unit** the two stereo masters A and B can be selected. The keys **ΣA** and **ΣB** simultaneously connect the left channel and the right channel. The masters C and D can only be selected on the CAU.	To connect the audio signal to the masters, only the corresponding selection keys **ΣAL ...ΣDR** in the **main fader section** need to be actuated. (1)
Small fader:	On the **inline unit** (small fader) the SF stereo signal is connected to the masters A and B by means of the keys **ΣA** and **ΣB**. The masters C and D can only be selected on the CAU.	On inline consoles with a small fader, the signal can be assigned to a master a second time in the **small fader section**. (2) All selection keys function as momentary action keys that toggle between the ON ↔ OFF positions.
	Group unit	**Central assign unit (CAU)**
	On the **group unit** a signal can be individually fed to each channel of all four masters A–D. In the MIX field the keys **AL–DR** must be pressed for this purpose.	When the group unit is selected (display: G_#), the selection for the mix bus is initiated by pressing the master keys (1) of the main fader section.

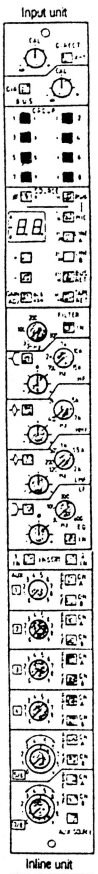
2.7 Routing to the GROUP bus

	Input channel	Central assign unit (CAU)
Main fader:	In the **Group** section of the input units the keys **1 - 8** are used for the main selection function of the group bus. The GAIN ADJ key should be dark (alternate function BUS ASSIGN disabled).	Press the **Group 1 - 8** keys in the main fader section. (3)
Small fader:	On the **inline unit** press the **GRP SEL** (group select) key. When this key is pressed it is possible to connect the small fader signal to the groups via the group selection keys **1 - 8**.	The small fader signal can be connected separately to the group bus by means of the **Group 1 - 8** keys in the small fader section. (4)

Operator controls for bus selection:

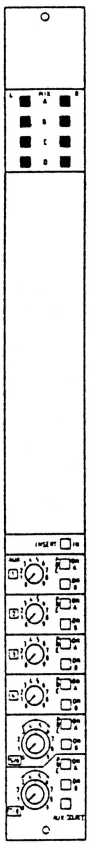
Input channel:

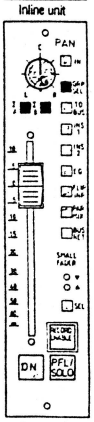
Group
1 – 8



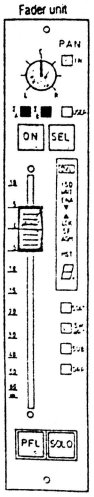
Group unit:

ΣAL ..
.. ΣDR





← Group Select
← ΣA, ΣB (SF Signal)

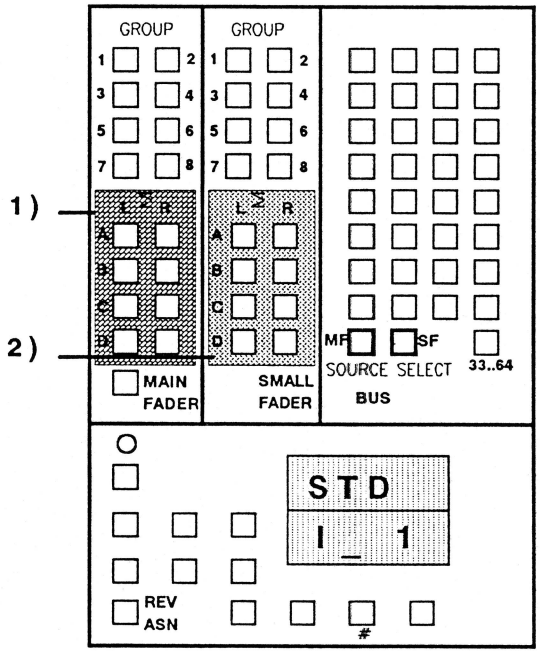


← ΣA, ΣB (MF Signal)

MIX and GROUP bus

Central assign unit (CAU):

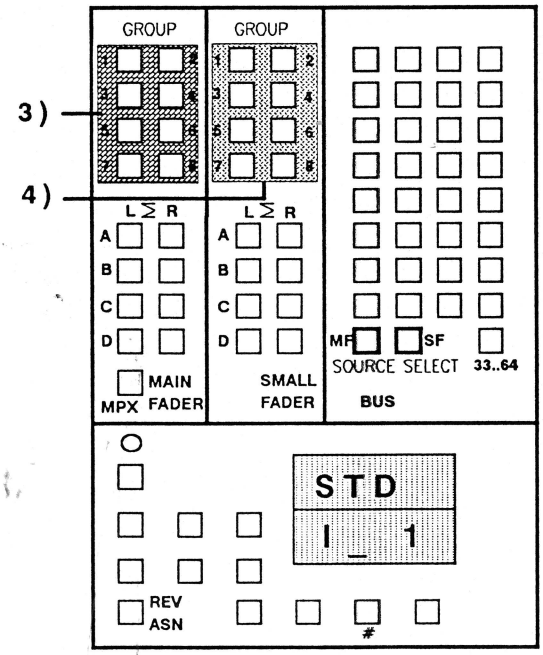
Routing to the master:



Index 1) and 2 see text.

The display shows the selected input unit.
(STD = standard operating mode)

Routing to the GROUP bus:



Index 3) and 4) see text.

2.8 Routing to the MULTITRACK bus (MTK)

Selecting the signal source

The MTK bus can only be fed from the main fader or from the small fader. Therefore the source must be selected first.

Input channel

The inline unit is equipped with the toggle key **TO BUS**. If this key is light, the small fader signal is connected to the MTK bus, otherwise the main fader signal.

Central assign unit (CAU)

The source is selected in the **Bus** section with the SOURCE SELECT keys **MF** and **SF**. These keys are interlocked.

Bus selection

On the input units the MTK bus selection is always implemented with three keys:

1 GAIN ADJ must be light and thus signal **BUS ASN**.
2 Press a range key **1-10...41-48** in the source field.
3 With the **yellow** lettered **numeric keys** (group/source field) enter the units digit within the selected range (possibly several simultaneously).

48 MTK buses can be selected directly. The selection status is displayed in groups of 10 according to the currently illuminated range key.

The MTK buses **1 - 32** can be selected and deselected (toggle function) directly with the numeric keys of the BUS section. With the **33..64** key the second operating level for the numbers 33 - 64 is activated (33..64 is light).
The selection of a nonexisting bus will be ignored.

Group unit (type MCH)

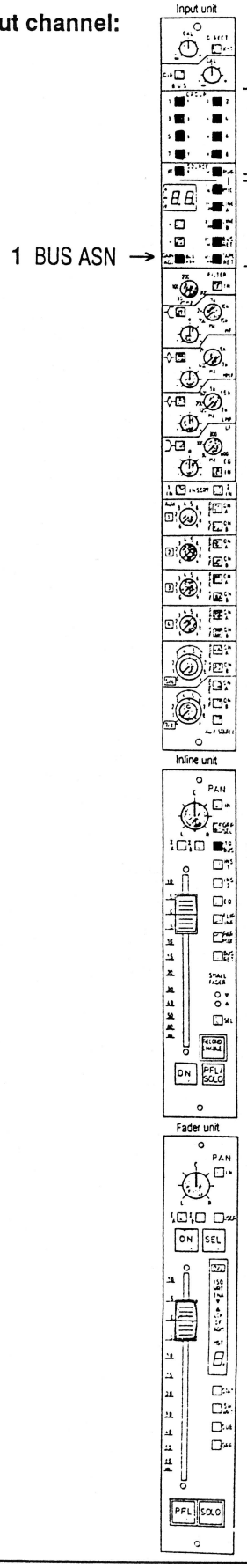
The feeding of the group signals to the multitrack bus cannot be switch-controlled on the group unit itself.

Central assign unit (CAU)

After the group unit has been selected, the MTK bus is selected **as described above** by means of the numeric keys of the **BUS** section.
The source selection (MF/MS) is not applicable to the group units.

Operator controls for bus selection:

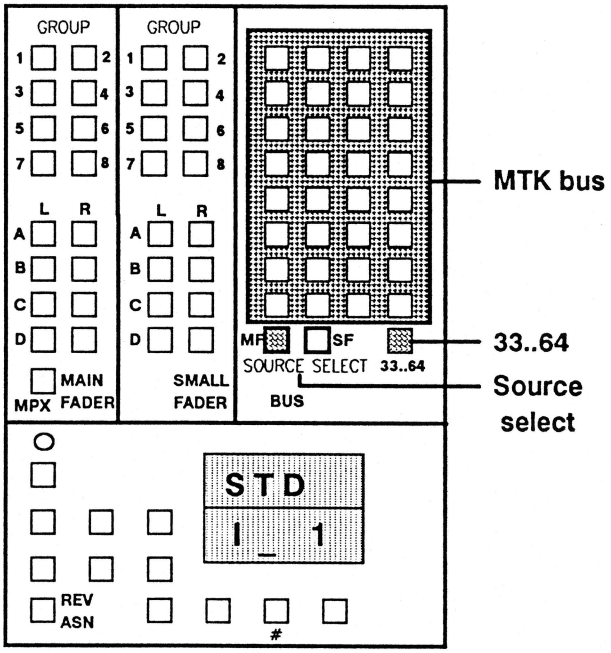
Input channel:



Multitrack bus

Central assign unit (CAU):

Routing to the multitrack bus:



2.9 Routing to the AUXILIARY path bus (AUX) and to the MULTIPLEX bus (MPX)

The signal flow to the AUX bus involves a source selection that changes over between the main fader and the small fader. This selection is independent of other settings. (Keys SF/ON B; see 2.10)

AUX bus:

Input channel

To activate the auxiliary masters, the level must be set and at least one of the AUX send keys **ON A** or **ON B** must be pressed. This means that with each AUX an auxiliary mixdown A and B can be fed with the same level.
The **AUX SOURCE** key in the AUX 7/8 field activates the PRE and SF functions (yellow lettering) of all AUX send keys:
PRE = signal tapping before the fader (normal: after fader)
SF controls the AUX source selection: Small fader signal if this key is light, main fader signal if this key is dark.

Central assign unit (CAU)

The auxiliary masters can only be selected on the input unit itself.
In reverse assign mode it is possible, however, to display and process the selection of an AUX master (see below).

Group unit (type MCH)

The operator controls for selecting the auxiliary masters correspond to those of the input channels. The small fader is not applicable as a signal source for the group units.
(AUX source: SF)

Central assign unit (CAU)

This selection is only possible in reverse assign mode (see below).

Multiplex bus:

Input channel

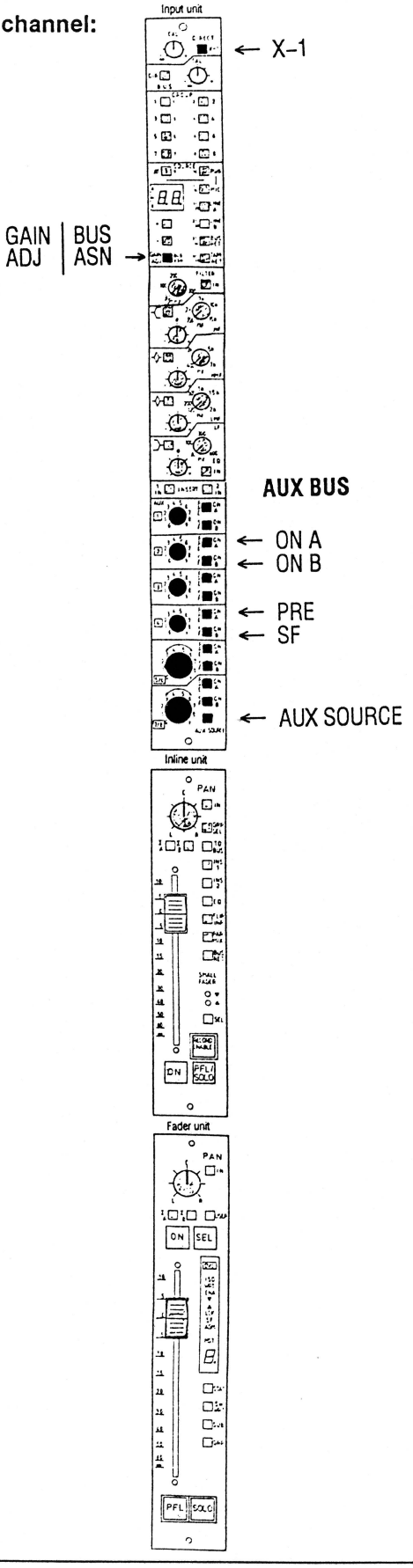
When the **GAIN ADJ** key is light, **X-1** on the top of the unit is to be actuated. (If GAIN ADJ is not light, a mix-minus signal is connected to the direct output!).

Central assign unit (CAU)

The **MPX bus** key connects the main fader signal to the multiplex bus. This possibility is not available for the small fader signal.

Operator controls for the bus selection:

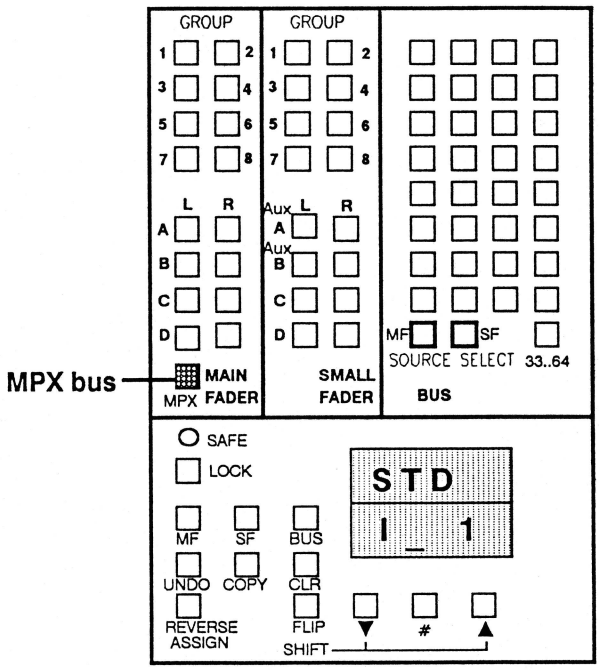
Input channel:



AUX and MPX bus

Central assign unit (CAU):

Routing to the multiplex bus:



The **AUX bus** can only be selected locally.

(In REVERSE ASSIGN mode the sources feeding an AUX bus can be selected, however.)

2.10 Routing in Reverse Assign mode

The reverse assign mode is able to display all mixing console units that feed a specific bus and to process the selections. For the AUX bus which in standard mode cannot be selected on the central assign unit (CAU), the reverse assign mode offers a central access facility. When this mode is active the REVERSE ASSIGN key is light. (The wording "REV" may be displayed.)

Changing the operating mode

The **REVERSE ASSIGN** key changes the operating mode of the CAU from standard to reverse assign mode and vice versa. The following rules define which bus or which mixing console unit is selected after changing the operating mode.

1. After the changeover from a mixing console unit, a corresponding bus with the same number as the unit is selected as follows:

Input unit **I_ ***	↔	Multitrack bus **IX ***
Group unit **G_ ***	↔	Group bus **GX ***
Master unit **M_ ***	↔	Mix bus **MX ***

2. If there is no corresponding unit or bus the last selection in this operating mode is performed.
3. If no selection has been made previously (i.e. after reload of all programs) the display shows STD (standard) or REV (reverse assign) respectively. The selection of a bus is done as described below.

Overview

Key: ← **[Reverse Assign]** →

Mode: STANDARD Mixing console units		REVERSE ASSIGN Buses
input unit **I_ ***	↔	**IX *** multitrack bus
group unit **G_ ***	↔	**GX *** group bus
master unit **M_ ***	↔	**MX *** mix bus
previously selected unit	←	**AX *** Aux send bus A
	←	**BX *** Aux send bus B
	←	**_MPX** multiplex bus

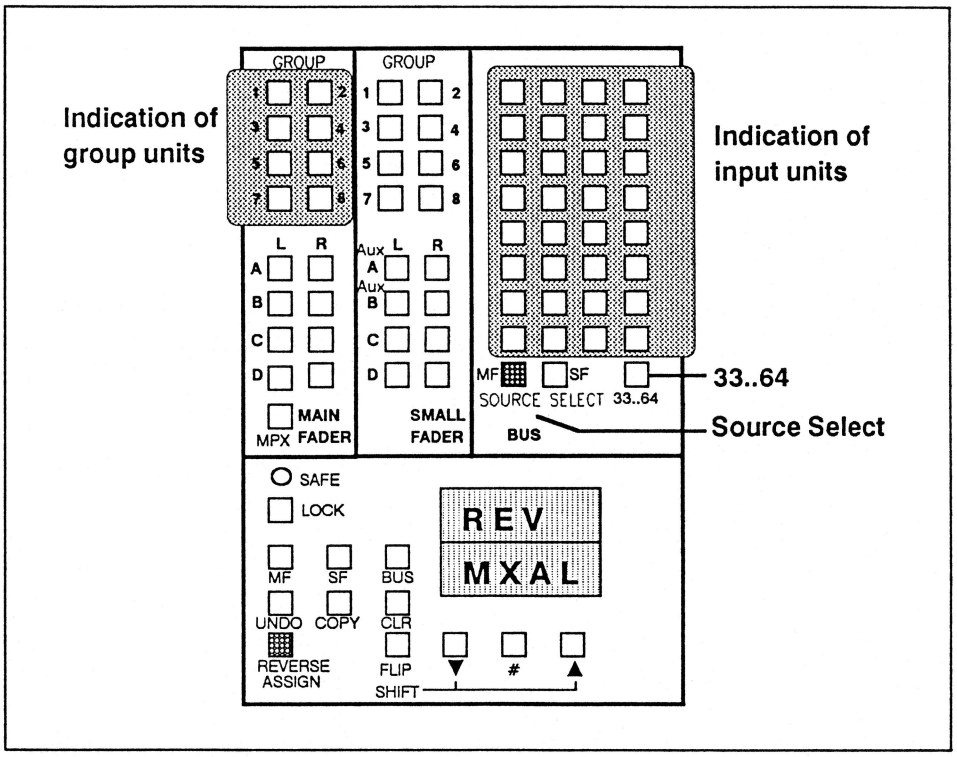
Direct bus selection

The key pads of the CAU are lettered for the standard mode. The Sections BUS, MAIN FADER (MF) and SMALL FADER (SF) are used for selecting a bus. In **REVERSE ASSIGN mode** the buses are selected by the following entries:

Mix bus	[#] + MF keys Σ **[AL ...DR]**	→ Selection of MIX bus AL ...DR
Group bus	[#] + MF keys group **[1 ...8]**	→ Selection of group bus 1 ...8
MTK bus	[#] + BUS keys **[1 ...32]**	→ Selection of MTK bus 1 ...32
	[#] + **[33..64]** + BUS keys **[33 ...64]**	→ Selection of MTK bus 33 ...64
AUX bus	[#] + SF **[AUX A]** + SF Group **[1 ...8]**	→ Selection of AUX bus A1 ...A8
	[#] + SF **[AUX B]** + SF Group **[1 ...8]**	→ Selection of AUX bus B1 ...B8
MPX bus	[#] + **[MPX bus]**	→ Selection of the multiplex bus

MIX bus routing selections

The selected MIX bus is shown in the lower display line. In the bus field those **input units** are displayed that feed this master. If more than 32 inputs exists, inputs 33 to 64 can be displayed by pressing the 33..64 key. **Group units** with access to the MIX bus are indicated with the lights in the group keys 1 - 8 of the MAIN FADER section. If the main fader sources are indicated, the **MF** SOURCE SELECT key is light, if the small fader sources are indicated the **SF** key is light. These two keys are interlocked.



Reverse assign: The mixing console units feeding the MIX bus "AL" are displayed.

When making the selections please note that the luminous state of the source select key determines whether a signal is picked up from the main fader or the small fader. In reverse assign mode it is necessary to select the stereo signal of each channel individually. (Second channel may possibly be connected with the copy command).

Group bus routing selections

The group bus is **only** fed by **input units**. The setup procedure and display method is identical to the MIX bus. It should be noted that from a mono input an **MF** and **SF** signal can be routed **simultaneously** to the group bus. Which signal is processed depends on which SOURCE SELECT key is momentarily light.
Also on the input unit the group selection for MF and SF is indicated separately. The indication with the GROUP 1-8 keys normally applies to the main fader, unless the GROUP SELECT key (GRP SEL) is light on the inline unit (small fader).

MTK bus routing selections:

- **of input channels**

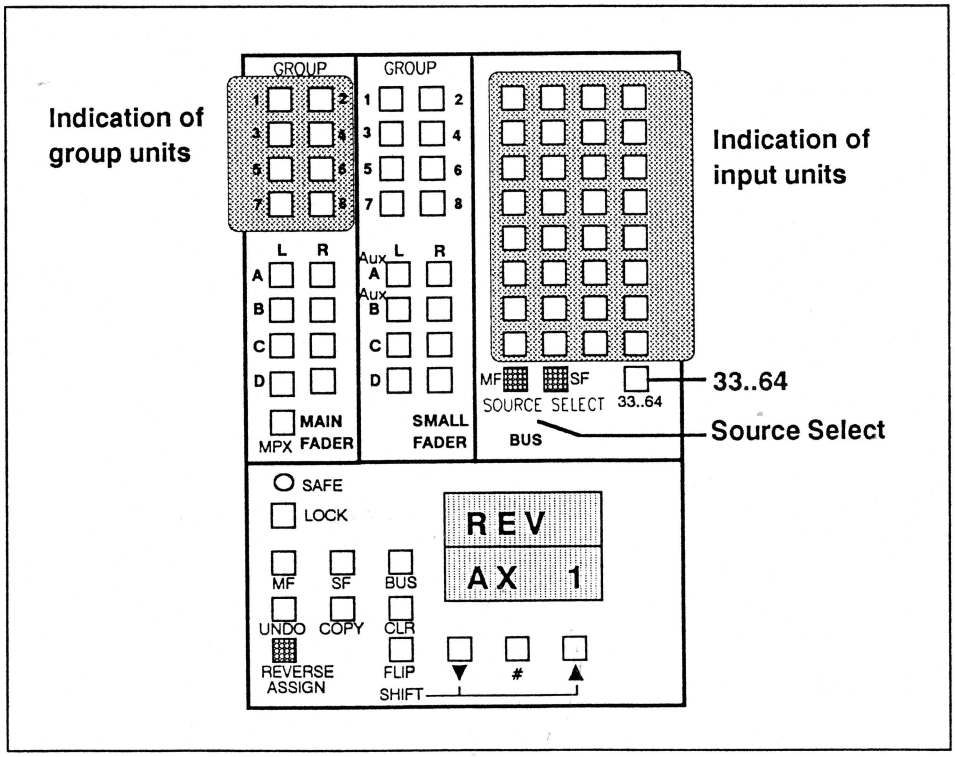
The feeding to the MTK bus is only open for one signal source per channel (MF/SF). After this function has been activated, all feedings to the multitrack bus are indicated, regardless of the source (SOURCE SELECT MF and SF are light). This provides a reliable overview of what is feeding the bus.
The selected inputs are processed separately for **MF** and **SF** signals if one of the two keys MF or SF is held down. In this key position the source is included in the selection.
If a new selection is made but no SOURCE SELECT key is pressed, the source selected locally on the input will be taken (toggle key **TO BUS** on the inline unit).
If more than 32 input channels exist, the indication of channels 33-64 in the BUS section can be activated by pressing the 33..64 key.

- **of group units**

The group units feeding the selected MTK bus are indicated with the luminous keys **GROUP 1 ...8** of the MAIN FADER section where the selections can also be processed.

AUX bus routing selections

As in the case of the MTK bus, the source signal for the AUX bus originates either from the MF or SF. The indication and bus selection of **input channels** in the BUS section is analogous to the MTK bus.
The **PRE/POST** changeover cannot be influenced. It is determined by the setting on the input unit.
Group units that feed the AUX bus are indicated with the luminous keys Group 1-8 of the MAIN FADER section.



Reverse assign: The units feeding the AUX bus "AX 1" are indicated.

MPX bus routing selections

The multiplex bus is fed only by the main fader signals of the input units. They are indicated in the BUS section (changeover to the range 33-64 with the 33..64 key).
It should be noted, however, that the selection of the MPX bus is indicated on the input unit (key X-1 is light) only when the GAIN ADJ key is also light.

2.11 Copying and clearing the routing data

The data for the bus selection can be copied to other units. Existing selections will be overwritten. If the target unit is not equipped with the same capabilities as the source unit, only the common functions are copied.
Copying processes between dissimilar units do not make sense and are acknowledged with an error message. (Example: input → master)

Access area

In copy and clear functions the routing data for the main fader and the small fader as well as the entire MTK bus selection can be handled separately in according with the three sections of the CAU. For each of the three areas there is one key (**MF, SF, BUS**) in the control section which is light when the access to this area is enabled. In the basic setting all three keys are light which signals unrestricted access.

In REVERSE ASSIGN mode it is not possible to determine the access area for these operations. The MF, SF and BUS keys remain dark because they are **disabled**. However, all data are copied or cleared without limitation.

Copying the routing data

1. Select the **source unit**

2. First copy the **source** indication into the **upper line** because the routing data are always copied from the upper to the lower display line. All changes of routing data always relate to the lower display line.
   [SHIFT] + [▲]
   If necessary it is also possible to copy the upper display line to the lower display line with [SHHIFT] + [▼]

3. Select **target unit.** It will appear in the **lower display line**.

4. Select the **access area** (only in STANDARD mode):
   [MF], **[SF]**, **[BUS]** must be light for unrestricted access to all data.

5. Initiate the copy operation:
   [COPY]
   The COPY key flashes if the source and target unit are not compatible or if the access area is fully restricted (MF, SF and BUS keys are all dark).

6. The operation just performed can be immediately reversed with:
   [UNDO]

Clearing the routing data

1. The unit with the bus data to be cleared **must be selected.** It should be shown in the lower display line.

2. The **access area** can be restricted with the **MF**, **SF** and **BUS** keys: Only areas with a luminous key can be cleared.
In REVERSE ASSIGN mode the access restriction is not applicable, as previously described for the copy operation. Clear disconnects all units from the selected bus.

3. Initiate the clear operation by pressing the CLR key:
[CLEAR]

4. The operation just performed can be immediately reversed with:
[UNDO]

Section 7 VCA fader: Status indications and grouping

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This Section discusses the versatile operating facilities that become available through the utilization of VCA faders.

1. VCA fader

VCA:

With the VCA stage (voltage-controlled amplifier) an AF signal can be regulated by means of a control voltage. When such voltage-controlled amplifiers are used, not the modulation itself but only the control voltage is adjusted by the fader. It is obvious that this control facility can also be used for other purposes and that the VCA can be influenced with additional control voltages. For example limiter compressors or gates can directly control the VCA of an input channel. By grouping it is also possible to simultaneously control several VCA stages with the same control voltage. A circuit logic determines which control values are taken into consideration:

Influencing variables:

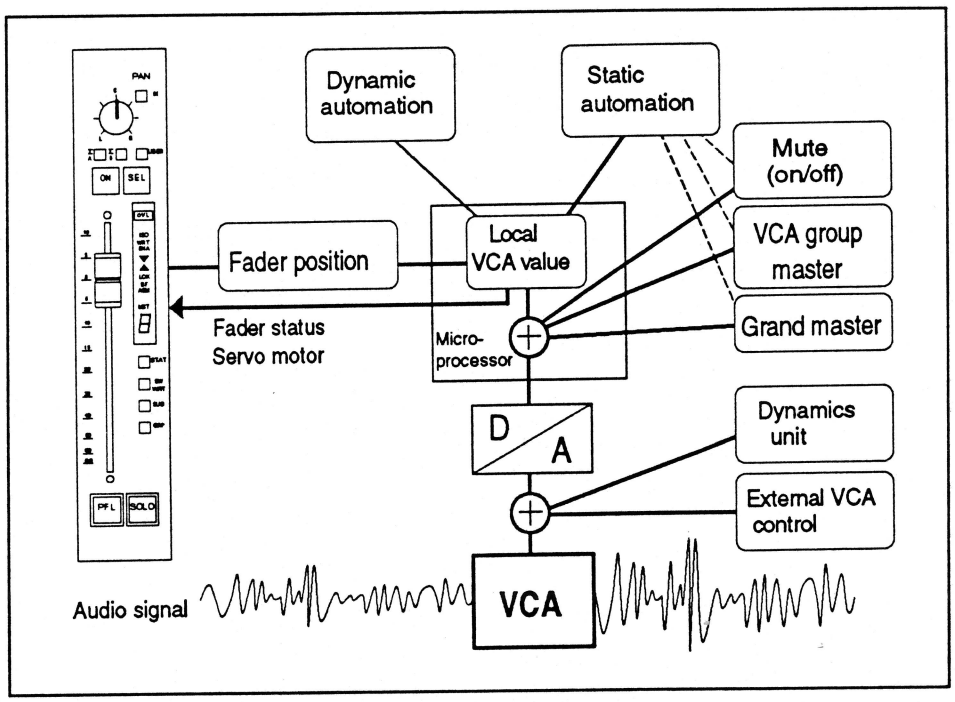


Fig. 1 The VCA fader is influenced by different control voltages.

For the user there is an important consequence: The gain of the audio signal can be changed without having to move the corresponding fader. As a consequence the fader scale does not always correspond to the actual gain setting. Faders that are equipped with a servo motor can, however, indicate the actual level setting. For reasons of functional clarity the fader motor follows only the changes made on the local fader. The static and dynamic fader automation overwrites this local VCA value and consequently also activates the motor fader. However, the latter does not respond to control influences by the VCA groups, dynamic unit and muting of the channel.

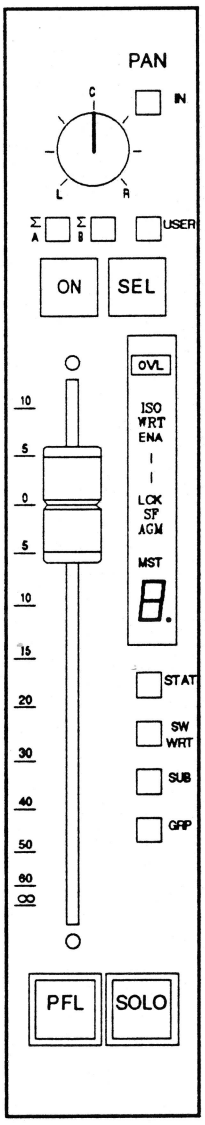
'Offset' of the VCA:

Frequently the situation occurs where there is a difference (offset) between the position of the VCA and the fader setting. Because the VCA is adjustable but the fader frequently not, the automatic changeover can cause a mutual offset between these two elements. The gain set on the VCA is overwritten with the new value when a snapshot is set. The processor now compares the new VCA position with the fader setting and calculates the offset. Motor faders can correct their setting during the automatic changeover. But situations can nevertheless occur in which a motor fader does not indicate the level setting.
(see Section 3.1)

2. Status indications

Fader-status:

With respect to its fader, the grouping and the automation capability the VCA can take different switching states. This fader status is indicated on the fader unit.



LED-Indicator	Function
<ISO>	The ISOLATE MODE is important for the dynamic automation. As per definition the setting of the fader and the corresponding local VCA value always coincide when changing into ISOLATE MODE.
<ISO> <ENA>	In the ISOLATE ENABLE status all fader functions are enabled for operation. The ISO and ENA LEDs are simultaneously light. This can be considered as the normal state.
▼ ▲	If the fader has not been 'nulled', one of the arrows indicates the direction of the VCA position. If the VCA setting exceeds the upper limit of the control range (>+10dB) the down LED starts flashing. The presence of control voltages like mutes, VCA groups, grand master or dynamic control is also indicated with flashing arrow LED's. During 'nulling' of the fader the arrows show the direction of fader movement.
<SF>	This flashing LED signals that the MAIN fader indicates and processes the settings of the small fader.
<AGM>	A VCA Separate Group master fader shows the Audio Group Master display if its 'Alternate Fader' participates in the VCA group. (explanation see 6. and 8.)
<MST>	The master fader of a VCA group is identified by this indicator.
<WRT> <LCK>	These two indicators are intended for future applications.

Motor fader

All motor faders are equipped with a black fader knob out of conductive material, which makes it touch senisitive. When touching the fader knob the motor is disabled after a short period and the fader can be adjusted manually. This touch sensor operates exclusively with the black, conductive fader knobs.

3. Indicators for fader and VCA position

The VCA fader can have a large number of operating states. Essentially we must differentiate the following situations:

- Fader position and local VCA value match ('nulled').
  The arrow LED's are not steadily light but may be flashing.
- Fader position and local VCA value are offset (not 'nulled').
  One arrow LED is light.
- VCA value is outside the working range of +10 ...-100dB.
  One arrow LED is flashing.

3.1 Fader not 'nulled'

An offset between the fader setting and the local VCA setting is shown by a light arrow LED to signal that the gain readable on the fader scale is not correct. The steadily light arrow points in the direction of the VCA setting viewed from the fader knob position. When the fader is moved, the arrow direction does not change because the offset value is constant.
With the aid of the scale it is still possible to make relative level changes. A fader movement by e.g. 10dB is correctly translated to the VCA, regardless of the absolute position of the fader.

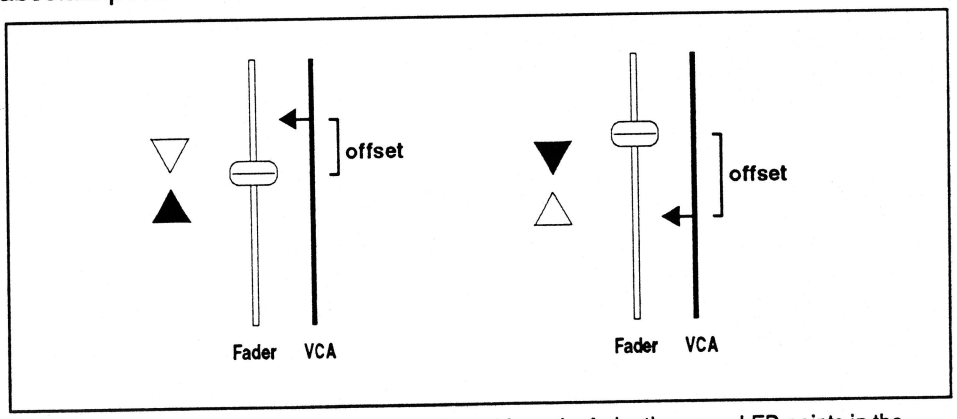


Fig. 2 Fader and VCA with 'OFFSET': Viewed from the fader the arrow LED points in the direction of the VCA setting.

Motor fader: Faders equipped with a servo motor are updated to the new VCA position. This adjustment is undesirable in the following cases:

- VCA group: The level control by the VCA MASTER (see below) has no influence on the fader motor. As a result the level settings of the VCA slaves relative to each other remain continuously visible.
- The same applies to the VCA control by a GRAND MASTER (see below).
- Control voltages generated by the compressor or gate do not cause any change in the fader position. The arrow LEDs do not indicate the offset.

Arrow indicator If a motor fader can't reach its target position because of a mechanical obstacle the arrow LED starts flashing and the motor is switched off.

3.2 Influence of superposed VCA control voltages

Fig. 1 illustrates the difference between the local VCA value and and the various superposed control voltages such as mutes, VCA group master, garnd master, dynamics unit and external VCA control.
These parameters change the VCA gain setting of a channel but they will not be displayed as an offset. Consequently the position of a 'nulled' fader (no offset displayed) does not match the VCA setting if the channel is controlled by any VCA group master, external VCA control or a dynamics unit.

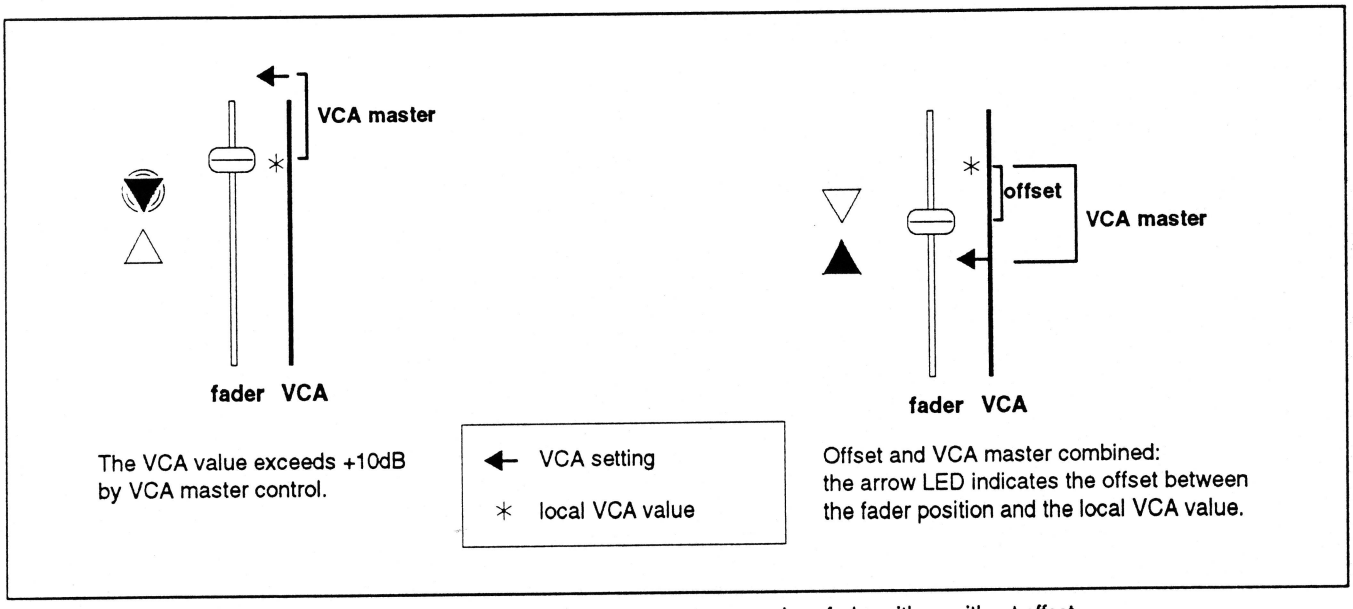


Fig. 3 This example illustrates the influence of a VCA group master on a slave fader with or without offset.

3.3 VCA outside the control range

The fader and VCA have a control range of +10dB ...-100dB. If the VCA is shifted relative to the fader, it is clear that it will exceed its upper or lower limit if the fader is fully deflected. It should be noted, however, that the opposite limit cannot be reached because the fader will have reached its stop position earlier.
Even if there is no offset the control range of the VCA can be exceeded by the central control (VCA group).
As soon as the theoretical VCA setting exceeds the upper limit of its control range, the arrow **LED** starts **flashing**. In this case the VCA is set to maximum gain. There is no indication if the lower limit is exceeded.

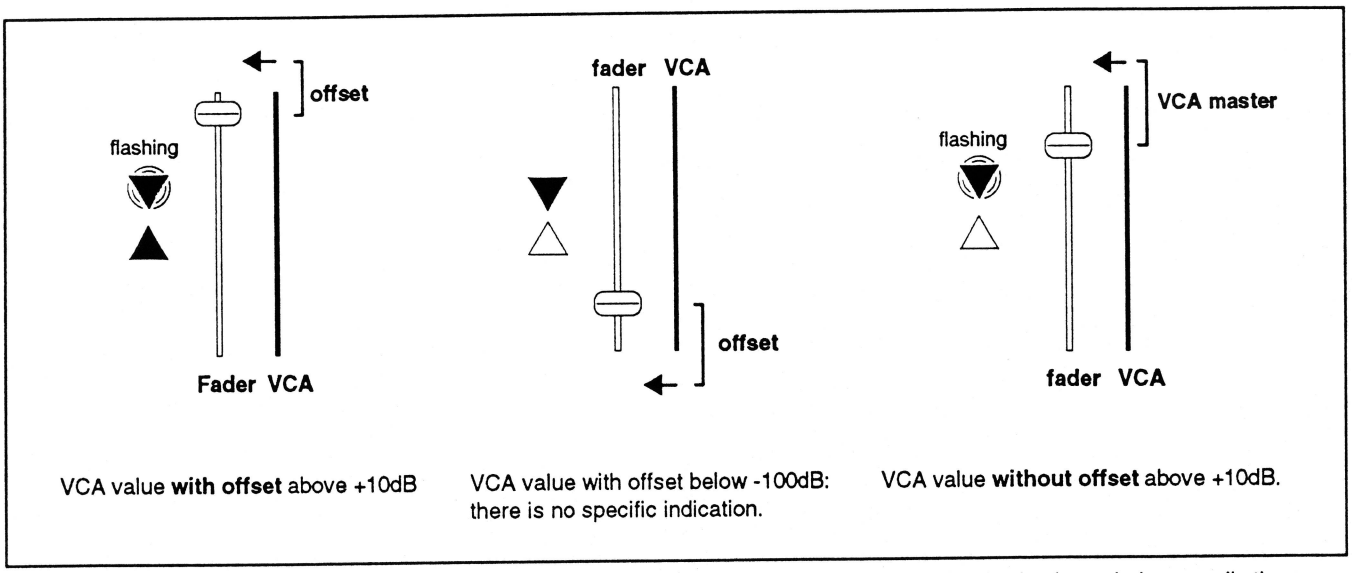


Fig. 4 If a VCA is driven beyond its control range, one arrow LED flashes as a warning. This indication has priority over all others.

The channel processor calculates with any theoretically set VCA value. However, the control voltage it outputs is limited to the control range.

4. 'Nulling' the fader

By 'nulling' of the fader we mean the alignment of the VCA and fader position to an offset value of zero. Basically there are two procedures: 1) The fader can be matched to the VCA position, and 2) the VCA can be matched to the fader position. Central control influences on the VCA are ignored for the 'nulling'. A nulled fader indicates the local contribution to the level control and not necessarily the absolute VCA position!

Matching the fader:

With the SELECT key of the fader the interlock between the fader and VCA is cancelled. As long as the SELECT key is pressed, the fader can be adjusted without affecting the VCA and consequently the signal level in the channel. When this key is released, both elements are again interlocked in the new position. With this function it is possible to manually null or 'de-null' the fader. The fader can also be given an offset manually, for example, in order to limit the control range in one direction.

Key	Function
[SEL]↓	Keep the SELECT key pressed.
▼ ▲	Move the fader in the direction of the arrow until the LED is dark. If the VCA is outside the control range, it cannot be nulled in a single movement.
[SEL]↑	Release the SELECT key. The arrow LED's remain dark.

When nulling the fader the nominal value is considered to be attained if it is within the tolerance window of ±0.5dB.

Matching the VCA:

The more simple nulling method is to allow the VCA to jump to the position that is given by the momentary fader setting. Of course this causes a level change in the channel. As mentioned previously, a fader is always nulled after the change from ISOLATE/ENABLED mode to ISOLATE mode. This rule can be exploited by using the status change for automatically cancelling an offset:

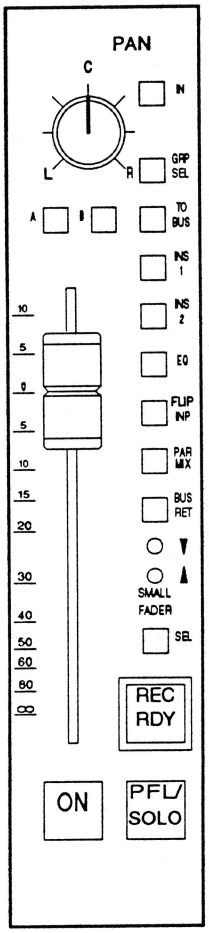
Key	Function
[STAT]	Switch to the ISOLATE mode with the STATUS key. The indication changes from <ISO> <ENA> to <ISO>. With this changeover the VCA is aligned to the value set with the fader.
[STAT]	Return to normal operation by pressing the STATUS key. The fader remains nulled.

5. Operating the small fader

The **small fader (SF)** has the same functions as the **main fader (MF)**. For indicating the VCA mode, however, only the two arrow LEDs are available. The complete status of the small fader can be processed with the indicators and operator controls of the main fader.

Editing the VCA status

The indicators and operator controls of the main fader signal the VCA status of the small fader when the **<SF>** indicator is light. In this situation the main fader can no longer be operated. Any offset indication of the SF-VCA relates to the position of the main fader knob.



Switching SF to MF

On the main fader the status of the small fader appears on the display. All VCA-related functions of the MF keys GRP, STAT, SEL and ON are now enabled for the small fader. All other fader functions remain indicated on the small fader itself and are enabled.

Key	Function
[GRP] Main Fader **+ [SEL]** Small Fader	Simultaneously press the GROUP key on the main fader and the SELECT key on the small fader. The status of the small fader is now indicated on the main fader module and the SF LED is light. Press these two keys again to switch back to normal operation.

Nulling the small fader

Analogous to the main fader, the small fader is decoupled from the VCA when the SELECT key is pressed so that it can be nulled (see 4).
It is only possible to have the VCA jump to the position of the small fader knob if the small fader is switched to the main fader.

6. VCA grouping

Several faders that need to be controlled jointly can be combined into a **VCA group**. The VCA master controls all input faders of the VCA group and consequently influences the levels of all modulation paths derived after the faders of these channels.
By contrast the **audio groups** are additional signal paths whose master level can be adjusted by a separate group fader.

A fader acting as a VCA master controls all level potentiometers of a group. In the STUDER 990 mixing console, three different grouping possibilities exist and there is an overall (grand master) control facility for all input faders.

6.1 Glossary of terms

Free grouping system

This type of grouping can comprise up to 8 VCA group. As the name implies, the master of each group can be freely selected. Each main fader except a 'Separate Masters' can be the group master.

Separate grouping system

With the SEPARATE GROUPING SYSTEM 8 additional VCA groups can be formed. The master faders are defined individually in the mixing console configuration.

Submaster grouping system

A second group system can be superimposed on the separate groups. Up to four SUBMASTER GROUPS control the masters of the separate groups.

Grand master

A main fader which is not a VCA group master can be designated as the GRAND MASTER. This fader controls directly the main and small fader levels of all input channels.

6.2 Switching capabilities with VCA groups

Each fader can be a member of a VCA group. The small faders are restricted to the slave function. A fader can belong to only one group. Only for the separate group masters there is the higher ranking SUBMASTER function. In this case VCA masters are combined to form a superimposed group system.

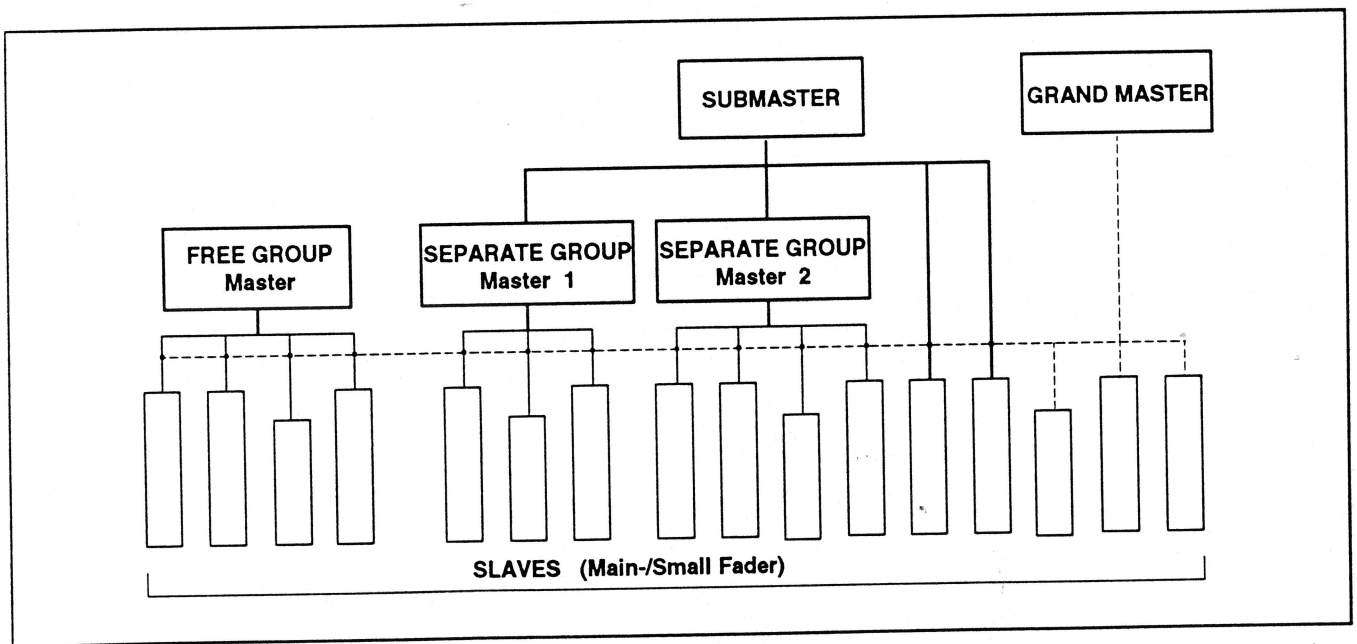


Fig. 5 Simplified representation of the structure of 'Free groups', 'Separate groups' with 'Submaster' and 'Grand master'. Main faders and small faders can be used as SLAVES of the VCA grouping system.

Switching functions

A VCA group controls not only the levels in groups but also the solo and mute functions.

SOLO The SOLO key of a VCA master switches the solo function on or off on all slaves of the group. Locally on the slaves the SOLO key can still be operated. This capability also remains for the alternate fader of the group master which behaves like a normal slave.

SOLO-IN-PLACE When the SOLO key of a VCA master is pressed, the SOLO-IN-PLACE method is activated on all slaves.

PFL VCA grouping has no influence on the PFL function.

MUTE The ON key of the VCA master mutes all corresponding slaves. However, the slaves can also be operated individually. If a slave is muted locally, it remains muted even if the entire group is reactivated with the ON key on the VCA master. The individual channel as well as the VCA master must be ON for a signal to be through-connected.

6.3 Special features of the VCA group master

FREE GROUPS / Alternate Fader

In the free grouping system an audio fader can become the VCA master. As such it fulfills two functions: firstly it remains the audio fader of a channel, and in addition it controls a VCA group. These two functions are handled separately in the STUDER 990 mixing console.
As soon as a VCA master is set, a new, second fader is created in this channel by computation. The audio fader operates in the background and we refer to this fader as the ALTERNATE FADER of the VCA master. Normally on the fader unit the status of the group master is represented. However, the fader unit can also be changed over in such a way that the audio fader existing in the background is displayed.

Key	Function
[GRP]+[SUB]	When these two keys are pressed simultaneously on the VCA master, the indicators and the processing are switched to the alternate fader. The **'MST'** LED **flashes** to signal that a VCA master fader also exists for this fader. To switch back to the VCA master these two keys must be pressed again.

An alternate fader exists for all VCA masters. The only exception on certain consoles are the separate group masters. If reserved fader units without audio function are installed as VCA masters, the alternate fader function is not supported.

SEPARATE GROUPS / Audio group master

The SEPARATE GROUP masters are frequently set up as a secondary function of the audio groups. In order to separate these two functions, the alternate fader does not automatically become the slave of the separate group master. But it can be desginated as a slave of this group exclusively. In this case the separate group master controls the audio group and consequently is also the audio group master (see Section 8).

6.4 Behaviour with motor faders

The servo motor always moves the fader into the position that has been set once locally on the fader itself. Influences of a VCA master or grand master are not updated.

When the VCA master is switched over to its **alternate fader**, the fader unit receives completely new parameters. For this reason the fader jumps to the new position. A similar situation occurs when a **small fader** is edited on the main fader. Also in this case the motor fader temporarily establishes the fader position of the small fader.

7. Free grouping system

The FREE GROUPING SYSTEM has the following characteristics:

- Max. 8 groups.
- All faders, except the separate group master, can belong to a free group.
- Each participating fader, except the small faders, can be used as a master.
- The individual groups may not overlap with each other.
- Indication of the group number with decimal point on the 7-segement display of the fader.
- The alternate fader of the group masters are always slaves of this group.

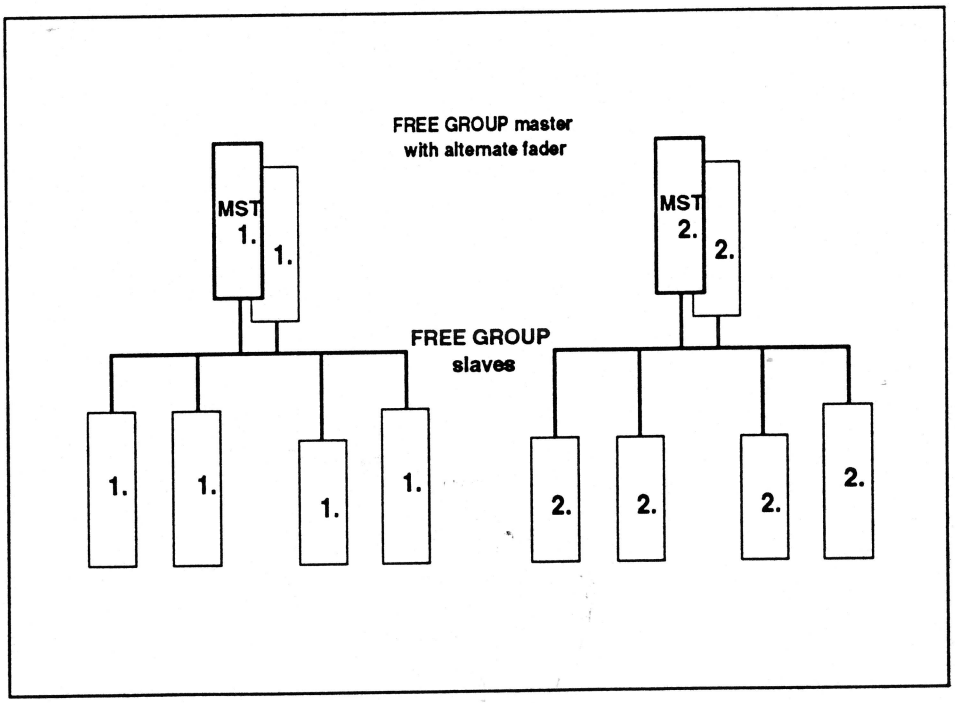


Fig. 6 Structure of the FREE GROUPING SYSTEM: The group numbers are assigned consecutively. No overlap may exist between the different groups.

Setting up a new group

As the first step a master must be designated for the new VCA group. If the desired fader is already a slave of a different group, it is automatically removed from this group and then becomes the master of the new group. Any attempt to include an existing master in a new group will be ignored.

Taste	Funktion
[GRP]+[STAT]	Simultaneously press both keys on the desired VCA master fader. The group number appears on the display of the fader and the **'MST'** LED is activated. For additional signalization the SELECT key flashes. Any fader (except separate group masters) can now be assigned to this group as slaves.
[SEL]	For this purpose press the corresponding SELECT keys. In response the VCA group slaves display the group number. The SELECT and GROUP keys are light. An existing member can be removed from a group with the SELECT key.
[GRP]	When the VCA is complete, the grouping function is terminated by pressing one of the GROUP keys that are light. The SELECT and GROUP keys are switched off.

Identification of the free group

- SLAVES indicate the group number with a decimal point.
- MASTERS also indicate the group number. In addition the LED field **'MST'** (master) is light.
- ALTERNATE FADER: When the audio fader belonging to the master is edited, 'MST' flashes. The Group number appears on the 7-segment display.

Modifying a group

When the GROUP key of a VCA master or slave is pressed, the group is displayed, i.e. the GROUP and SELECT keys of all group members light up. On the master the SELECT key flashes. In this condition the group can be modified by including or removing slave faders. By pressing the SELECT key, fader units are included in or removed from the group. Slaves of other groups change their group as soon as they are selected. Selection of VCA masters is not allowed and has no effect.

Swapping the MASTER

The master function can be reassigned to a slave fader within the group:
First display the desired VCA group by pressing a GROUP key. Simultaneously press the keys **[GRP] and [STAT]** of the selected slave which is to become the master. The existing master now becomes a **slave** and the slave becomes the master. Confirm the grouping by pressing one of the luminous GROUP keys.

Cancelling a group

A group is broken up by cancelling the master function. All affiliated faders become independent. The group number is again available for assignment. For clearing out a group simultaneously press the keys **[GRP] and [STAT]** on the **master.**

8. Separate grouping system

The SEPARATE GROUPING SYSTEM is characterized as follows:

- Maximum 8 groups.
- Each fader can be the slave of a separate group. (Separate group masters as slaves are discussed in Section 9).
- The master faders and their group numbers are determined by the console configuration.
- Several separate groups can be combined in max. 4 SUBMASTER GROUPS (see Section 9).
- The group numbers are displayed on the faders without decimal point.
- The alternate fader of the VCA master faders are not necessarily slaves of this group and must be assigned like normal slaves. They can't belong to a group other than the 'own' group.

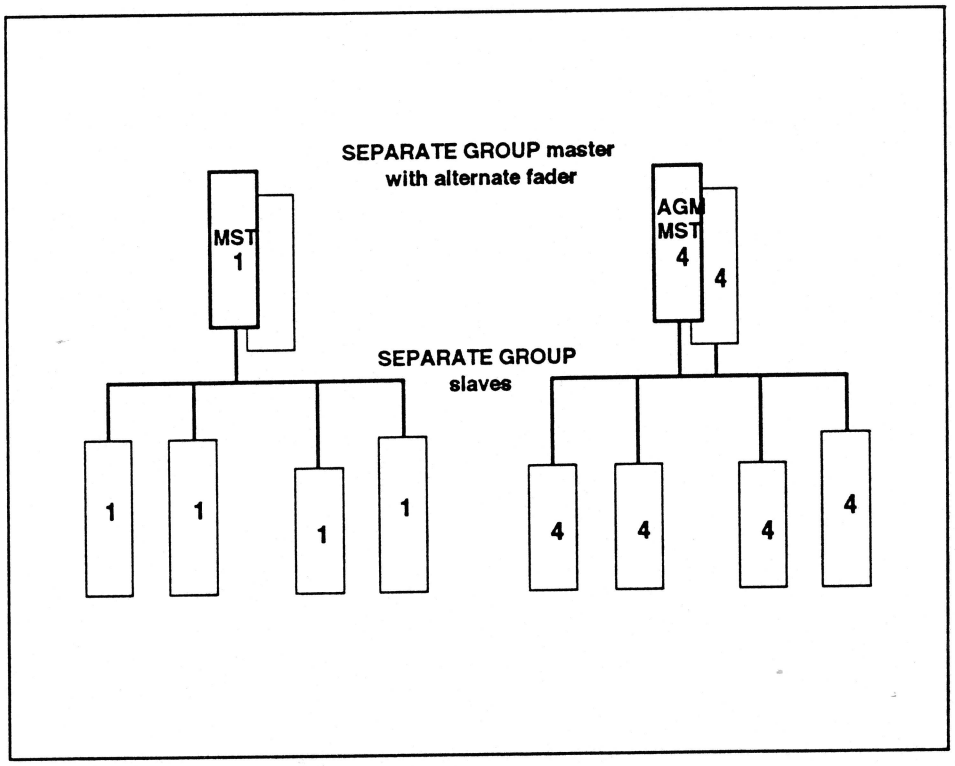


Fig. 7 The SEPARATE GROUPING SYSTEM is based on defined VCA master faders with assigned group numbers.

Setting up a new group

Also in this case grouping is started by activating the master. The free separate group masters can be recognized by the glowing **'MST'** LED and missing group number. All existing faders can be used as slaves, however, the conditions for the submaster grouping system must be taken into consideration.
(see Section 9)

Key	Function
[GRP]	Because the separate group master have already been defined as such, only the grouping needs to be activated. Corresponding to the free groups the SELECT key flashes, the 'MST' LED and the GROUP key are light. In the display of the fader the assigned group number is shown. The fact that the decimal point is missing distinguishes separate groups form free groups.
[SEL]	The **slave** is assigned with the SELECT key of the corresponding fader. On the selected slaves the keys **[GRP] and [SEL]** are light. The difference to the free groups is that the alternate fader of the VCA master does not automatically belong to the group. It can be assigned to this group with the SELECT key (of the master fader). On the display of the master the **'AGM'** LED is activated.
[GRP]	To terminate the grouping function press one of the luminous GROUP keys.

Alternate fader

Frequently the master faders of the audio groups are also configured as separate group masters. The alternate fader of such a VCA master is consequently the master fader of an audio group. If it participates in the VCA group as a slave, the VCA master is also the master of the audio group. To make this condition clear the **'AGM'** (audio group master) LED is light when the alternate fader is a member of the VCA group (selection with SEL key). To change over from the VCA master to the alternate fader, press [GRP] and [SUB].

Identification of a separate group

- SLAVES show their group number without decimal point.
- A MASTER is identified in that the 'MST' LED is light and the group number has no decimal point.
- ALTERNATE FADER: If the master is switched to the alternate fader, **'MST'** flashes. If the alternate FADER belongs to the VCA group, also the group number is indicated.

Modifying the group

Press the GROUP key of a group member to display the VCA group. The GROUP and SELECT keys of all group members are light and the master is identified by the flashing SELECT key. The composition of the group can be modified in this state with the aid of the SELECT keys. Terminate the grouping function by pressing one of the illuminated GROUP keys.

Cancelling a group

Like in the case of the free group, a separate group is cleared out by cancelling the master function:
Simultaneously press the **[GRP] and [STAT]** keys of the separate group master to dissolve the group. All indications related to this group will be cancelled.

9. Submaster grouping

The SUBMASTER group is a second VCA grouping level of the separate grouping system. Individual separate groups are combined and controlled by a submaster. A separate group master is converted to a submaster, as soon as it manages other separate masters as slaves.

The system is characterized as follows:

- Max. 4 submaster groups.
- Only separate group masters can function as a SUBMASTER.
- Any fader can be a slave of a submaster group, however, the separate group masters are a mandatory component.
- The submaster has the same relationship to its alternate fader as a separate group master. The alternate fader can only be assigned to the submaster as a direct VCA slave.
- Submaster groups are not numbered separately. A submaster retains the number it has been assigned as a separate group master.

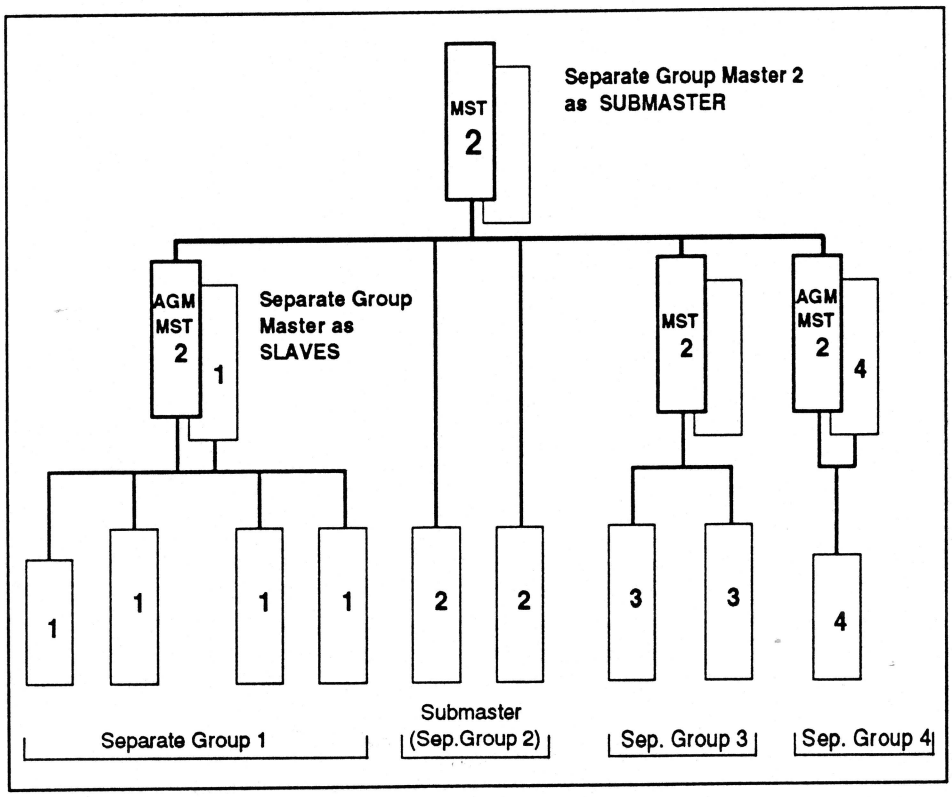


Fig. 8 SUBMASTER groups are the only VCA groups in which VCA masters can be included as slaves. However, these are limited to separate groups. This illustration gives an example in which the separate group master 2 functions as a submaster. The number of the submaster is displayed flashing on the separate group masters 1, 3 and 4 that operate as slaves.

Setting up a submaster

As soon as any separate master is designated to a separate group as **a slave**, a submaster group is created. The master of this group then becomes the SUBMASTER. In all other respects the procedure is the same as for processing a separate group.

Identification of the sub-masters

- The SUBMASTER itself looks like a separate master (group number and 'MST' indication).
- SLAVES have a flashing group number to signal the existence of a submaster group. They all have the same number as the submaster.
- The ALTERNATE FADER of the submaster is displayed when 'MST' is flashing.

Modifying a group

For editing a submaster group, the GROUP key of the submaster itself or of a slave input channel must be pressed. As a result the submaster group is called without the slaves of the separate master. Modifications are made in the same way as for other VCA groups.

Dissolving a group

With the cancellation of the submaster function the submaster group is disassembled into its separate groups which continue to exist under their own group numbers.
Straight slaves of the submaster become autonomous again:
Simultaneously press the **[GRP] and [STAT]** keys of the submaster.

10. Grand master

An additional VCA control facility is the GRAND MASTER function with which all input faders can be controlled simultaneously. Such an application can be useful for simultaneously fading out all input channels or for adjusting generally unfavourable fader positions.

Characteristics:

- Max. 1 grand master.
- Any large fader that is not a VCA master can be the grand master.
- The main faders and small faders of all inputs channels are SLAVES. (The influence of the grand master can be restricted in the configuration data)
- The grand master acts independently of any VCA groups directly on the VCA stages of the input channels. Groups and master channels are not influenced.

Setting up the grand master

Any main fader, group fader or master fader that is not already the master of any VCA group can be used as the grand master. On this fader press the **[GRP] and [SW WRT]** keys simultaneously to designate this fader as the grand master. A **'g'** appears in the display of the fader.
A fader that is a GRAND MASTER cannot simultaneously perform any other VCA control function. Its alternate fader cannot be edited.

Identification of the grand master

The grand master is easily recognizable by the flashing **'g'** on the display.

Cancelling the grand master

The grand master function should be considered as a transient state of the mixing console. It can be cancelled with the same key combination [GRP] and [SW WRT] that was used for setting the function. The level corrections that were made by the grand master on all input faders will also be completely cancelled.

Section 10 Console Automation

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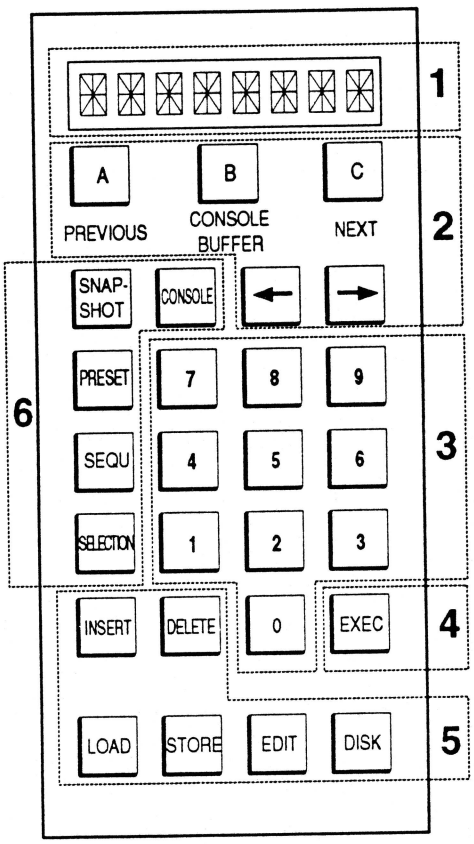
1. Snapshot unit 1.990.810

The snapshot unit is able to re-establish complete mixing console setups. The snapshot supplies all parameters of the input channels as well as the audio and control units. A planned production can thus be prepared and stored as a sequence of snapshots.



Designation of the control key groups:

1 Display field

2 Register call and sequence control

3 Numeric keypad

4 Command key

5 Operations keys

6 Key functions

1.1 Terminology

Snapshot

A snapshot refers to the storage of the currently active mixing console setup. It comprises all switching functions and potentiometer settings. When a snapshot is subsequently recalled, the settings of the switches and the VCA level potentiometers are reestablished. Potentiometers must be set manually to the stored reference value by means of a recall procedure.
The snapshot unit has a memory capacity of 99 snapshots.

Preset

The configuration software contains up to 9 factory programmed mixing console setups which can be used for restoring the console quickly to a predefined basic setting. A preset comprises the same parameters as a snapshot, but in contrast to the latter the preset cannot as easily be modified by the user (see 1.7).

Sequence

A sequence of mixing console settings can be created from memory positions containing snapshot or preset numbers. Nine memory locations for sequences comprising up to 256 positions are available.

Selections

Presets and snapshots influence the status of virtually all mixing console functions. With a selection it is possible to limit the action range and to inhibit the status change of specific function groups. A selection can not only be done for a snapshot or preset but also as a permanent function for the console.
Automatical changes of the console status are performed only on functions selected on the console as well as on the snapshot or preset.

1.2 Operating concept considerations

Basic principles

The SNAPSHOT UNIT is designed as a compact control panel for the efficient execution of sophisticated procedures. The operating concept is based on the following objectives:

- **Functional clarity**
  Compact design with special display elements
- **Continuous status information**
  The command paths and operations can be followed based on the displayed information and the illuminated keys.
- **Direct access capability**
  Three separate memory keys as well as the concept of key functions optimize the routine tasks while maintaining operational reliability.
  Selection by means of the arrow keys is limited to rarely used functions.
- **Specific error processing**
  Errors are analyzed: meaningless entries are ignored. If an operator error has occurred, an informative message is output. Simple correction facilities simplify the operation and enhance the learning process.
- **Intuitive command structure**
  The command sequences are based on easy-to-remember language patterns.

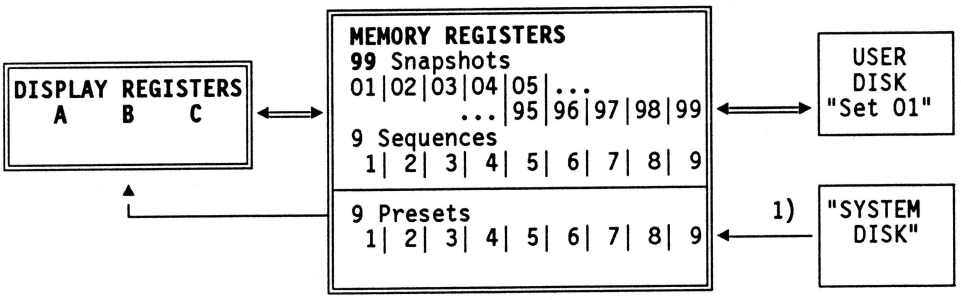
Correction facilities

An operating procedure represents a decision path in a hierarchical environment. Each key depression leads to the next hierarchical level. When all necessary entries have been made, the operation is executed with the command key. There are three methods for cancelling a decision:

- At each stage of the input procedure all keys that initiate a valid command cancel each other.
  - Example 1: LOAD / PRESET 1 / CONSOLE has been entered. The target CONSOLE can be modified by pressing A, B or C.
  - Example 2: SNAPSHOT has been entered as the start of a command. This selection is cancelled if any equivalent key is pressed: LOAD; STORE, DISK, SELECTION, SEQUENCE. The other keys have no function because they can never appear at the start of a command.
    (The selection of equivalent commands depends also on the operating mode. In the SEQUENCE mode, INSERT may also be feasible as the first entry).
- All keys are on/off switching (toggle function). An entry is cancelled by pressing the same key again. In this way a change at the preceding level can be made.
  - Example: STORE / A / SNAPSHOT has been entered but C should be stored. Cancel SNAPSHOT by pressing this key again, then enter C.
- Each command can be completely cancelled by pressing the first key of the command sequence again.

1.3 Memory organization

Once the memory organization of the snapshot unit is understood, the operating concept becomes self-evident.



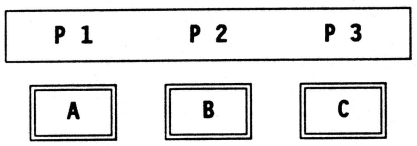
1) The installation of the 9 presets with the system diskette is a one-time operation.

Memory registers

For storing the snapshots and sequences, numbered memory locations are available that can be accessed via a keying sequence. The content of this memory can be saved on a diskette. Conversely, various sets containing up to 99 snapshots and 9 sequences can be loaded from the diskette into memory.

Display registers

In addition to the aforementioned memory registers there are three memory locations that fulfill a special function. The display registers A, B, and C can be addressed by pressing a single key. The memory content is displayed directly above the corresponding keys A, B and C:



Display registers A, B, C: The presets P1... P3 are resident in the three display registers.

The content of the display registers is preserved when the mixing console is switched off. However, it is not part of the set of snapshots and sequences that can be stored on a diskette.

The ADVANTAGE of the display registers is that they provide fast access to the three most frequently used mixing console setups via the keys A, B, and C. The momentary snapshots or presets can be loaded from their memory location into one of the registers A... C and displayed (Example: S04, P2, S10). If necessary, the console setup can be changed quickly by pressing the corresponding register key.

When a new snapshot is created it can first be stored in one of the display registers before selecting one of the 99 memory addresses that should eventually receive the new setting.

In SEQUENCE MODE the display registers are used for representing the position of the sequence. For a detailed description refer to Section 1.8.

Data backup

The memories are protected against loss of data by twin power supplies as well as buffer batteries. When the mixing console is powered on, the previous operating state is automatically reestablished. A backup copy of the snapshots and sequences can also be stored on diskette.

1.4 Date exchange with the floppy disk

General

The snapshot unit uses the diskette drive for storing and loading user data contained in the memory registers. The 99 snapshots and 9 sequences are referred to as SETs and stored on the diskette in a directory called "USER##\". The individual snapshots and sequences are files within this directory.

When the DISK key is pressed at the start of a command sequence, this means that an operation with the diskette drive is desired. The following diskette drive functions are supported:

- **DISK LOAD** — All loading operations from diskette
- **DISK EDIT** — Special operations: diskette formatting
- **DISK STORE** — All storage operations on diskette

DISK LOAD

Insert the data diskette into the drive.

Key		Display	Function
[DISK]		SET 01	Select the set by entering the desired number
[LOAD]		ALL	With the arrow keys you can select the scope of data to be selected. You can scroll through the menu on the display can in either direction. "ALL" loads the entire set.
	[→]	ALL SNAP	Load all snapshots of the set.
	[→]	ALL SEQU	Load all sequences of the set.
	[→]	SANP ##	Load an individual snapshot: enter a 2-digit number
	[→]	SEQU #	Load an individual sequence: enter a 1-digit number
			With the [←] key you can scroll backward through the menu.
[EXEC]			Activates the selection and initiates the load command.
		SURE ?	In the first three cases this inquiry prevents that an existing, complete data set is inadvertently overwritten in the storage register.
			The **DELETE** key (red) flashes: By pressing this key you can reselect the data area. You can cancel the DISK LOAD operation at any time by pressing the **DISK** key.
[LOAD]		LOAD ...	The load operation is being executed.

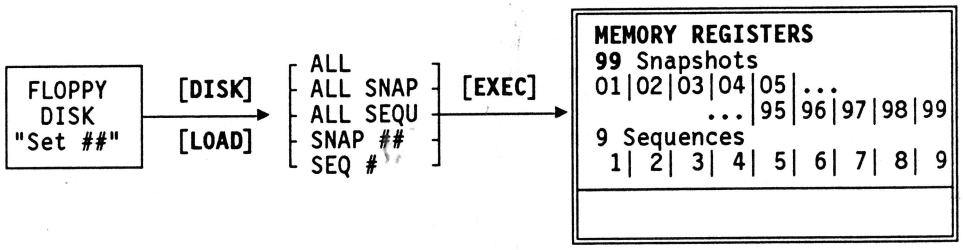


Diagram of the **DISK LOAD function** for loading the snapshots and sequences from a data diskette into the memory registers.

DISK EDIT

This menu is used for formatting the diskette according to the MS-DOS format. The 3½" diskettes are formatted for 1.44 MB and are compatible with MS DOS version 3.30 or newer.

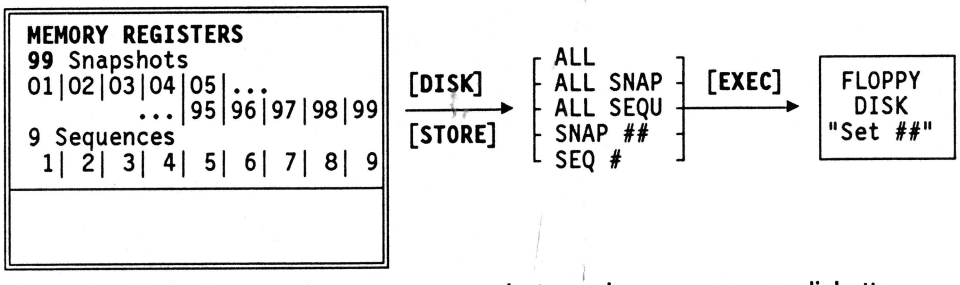
- CAUTION: The formatting function will erase all data previously recorded on the diskette!

Key	Display	Function
[DISK]	SET 01	This standard display message has no meaning in this case.
[EDIT]	FORMAT	Only available menu selection: Formatting: Insert the diskette to be formatted into the drive.
[EXEC]	SURE ?	You can cancel the EXECUTE command by pressing the red flashing **DELETE** key. The disk edit menu can be cancelled by pressing the DISK key.
[EDIT]	FORMATIN	Formatting is in progress.

DISK STORE

Insert the diskette that is to receive the data into the drive.

Key	Display	Function
[DISK]	SET ##	The previously loaded set number is displayed. To store the data under a new set number, enter an unused set number.
[STORE]	ALL	As in the case of the load function, the range of data to be stored can be limited. "ALL" stores the content of the entire memory register.
[→]	ALL SNAP	Store all snapshots of the set
[→]	ALL SEQU	Store all sequences of the set
[→]	SNAP ##	Store an individual snapshot: enter a 2-digit number
[→]	SEQU #	Store an individual sequence: enter a 1-digit number
[EXE]	SURE ?	A confirmation is required if the complete data area is to be stored (ALL, ALL SNAP, ALL SEQU). The **"DELETE"** key flashes (red): By pressing this key you can reselect the data range to be stored. DISK STORE remains active. The store function can be terminated at any time by pressing the DISK key.
[STORE]	SAVE...	The store operation is being executed.



The **DISK STORE operation** stores snapshots and sequences on diskette.

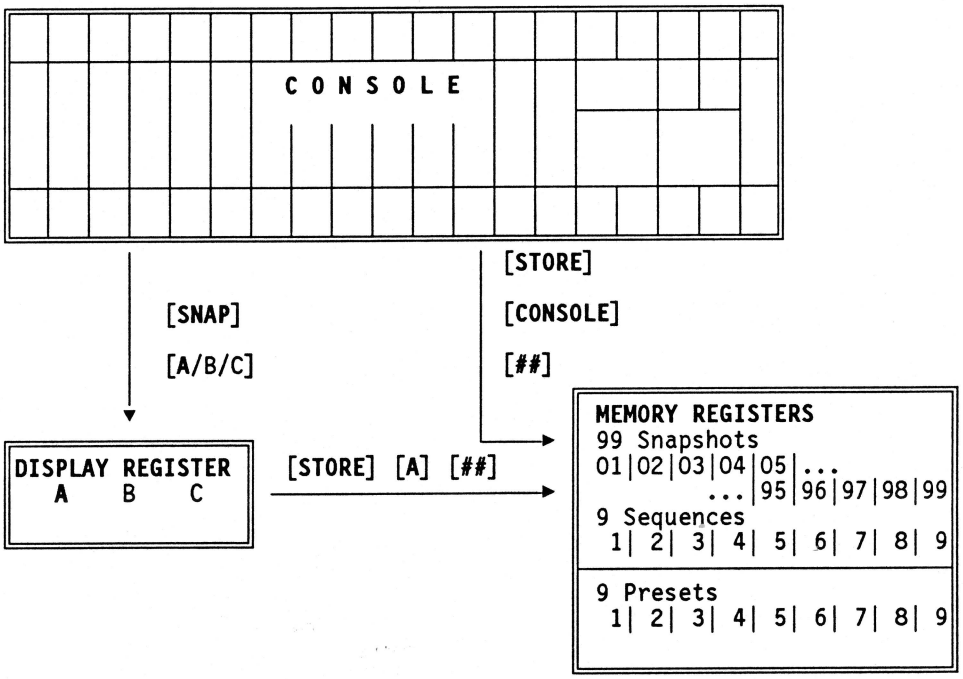
1.5 Storing the mixing console setups

There are two ways of saving the momentary switching state of the mixing console:

- Storing the data in position A, B or C of the display register
- Storing the data directly in a snapshot memory location (memory register)

Loading a snapshot into the display register

Key	Display	Function
[SNAPSHOT]	SNAP	The momentary mixing console setup is loaded into the display register A. The old content of A is overwritten. An "A" appears on the display.
[A]	SNAP A	
[EXEC]	A	



Storing a snapshot: The switching state of the mixing console is stored either in the display register or directly in a snapshot memory location.

Loading a snapshot into a memory register

Key	Display	Function
[STORE]	STORE	The momentary mixing console setup is loaded into the memory register by entering the STORE command and a 2-digit snapshot memory number. The default number is the previously accessed memory number. It can be overwritten with a new number.
[CONSOLE]	ST CO>	
[# #]	ST CO>##	
[EXEC]		

Storing the display register

The display registers content can be transferred into the memory register with a STORE command. This step is mandatory if a new snapshot from A, B or C is to be included into the current SET.

Key	Display	Function
[STORE]	STORE	In this example the snapshot in display register A is to be saved
[A]	ST A>	in memory ##. The previously loaded memory number is dis-
[# #]	ST A>##	played as the default number and can be overwritten by entering a new number.
[EXEC]		The same procedure applies analogously to registers B and C.
	NOTE:	When individual snapshots or sequences are stored, the specified memory location will be overwritten without prior confirmation.

1.6 Recall of mixing console setups

There are three possibilities of reestablishing a mixing console setup stored in the form of a preset or snapshot:

- Recalling a setup currently located in the display register.
- Direct recall of a snapshot from the memory.
- Direct recall of a preset from the memory.

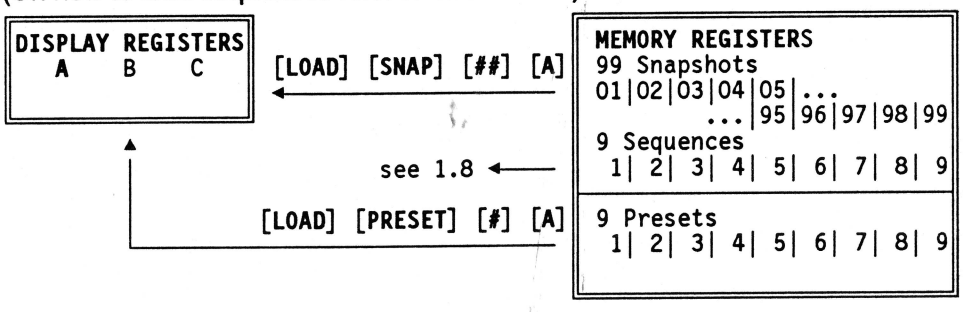
The first method is only feasible if the display register has previously been loaded with the desired snapshot or preset. Access to the setups in the display register is fast and simple. For this reason it may be advantageous to transfer the most frequently used presets or snapshots into the display registers. The start routine loads presets 1 to 3 into the registers A to C.

Loading presets and snapshots into the display register

When data are loaded into one of the display registers A, B or C, the old content of the corresponding register is overwritten with the data and will be lost.

Key	Display	Function
[LOAD]	LOAD	The LOAD command always comprises a source and a target
[PRESET]	LPRSET1	specification. Sources are snapshots, presets and sequences.
[#]	LPRSET#	Selectable targets are the registers A, B and C as well as the
[A]		mixing console. In the following example the preset P# is loaded
[EXEC]	P#	into the display register A.

The procedure for snapshots is analogous and shown in the diagram below. (On how to load sequences refer to Section 1.8.)



Recall from A, B or C

The setup stored in the display register A is to be reestablished in the mixing console.

Key	Function
[A]	Same procedures for registers B and C.
[EXEC]	

Direct recall of presets

The preset number # is to be reestablished in the console:

Key	Display	Function
[LOAD]	LOAD	The LOAD key is light until the operation is completed. This function can be cancelled at any time by pressing the LOAD key again.
[PRESET]	LPRSET1	The option "PRESET" can be overwritten by another valid function (Snapshot, Sequence) by pressing the corresponding key.
[#]	LPRSET#	Enter the preset number (1-9)
[CONSOLE]		With the LOAD command it is possible to load a snapshot also into the display register. In this case the CONSOLE must be specified as the target.
[EXEC]		

Direct recall of snapshots

A mixing console setup stored under the number ## is to be recalled from the memory register.

Key	Display	Function
[LOAD]	LOAD	The LOAD function always follows the same procedure. It is based on the following syntax: "Load" - "Which source" - "To which target" !
[SNAPSHOT]	L SNAP	
[# #]	L SNAP##	
[CONSOLE]		
[EXEC]		

1.7 Storing your own presets

Presets and snapshots differ in the way they are stored. They are equal with regard to the contents. Therefore a snapshot can be turned into a preset by simply changing its name.

- Establish the setup desired as PRESET on the console.
- Store the console state as a snapshot on a diskette (user disk).
- Insert the diskette into a PC floppy disk drive. Start any kind of file manager program and look at the contents of the user disk. Directories and file extensions are described in section 4 of this manual. (see 7.2 User Disk)
- Rename the snapshot file to a preset file with the desired number, e.g. rename snapshot 15 to preset 6: SNAPDATA.S15 → PREDATA.P06
- Move the new preset file to the System Disk into the directory '\HOST'. You will find there the already existing presets.
- To load this new preset into the console the programs have to be reloaded from diskette. Insert the System Disk in the Floppy Disk Unit and press the ENABLE and LOAD keys simultaneously.

1.8 Operating with sequences

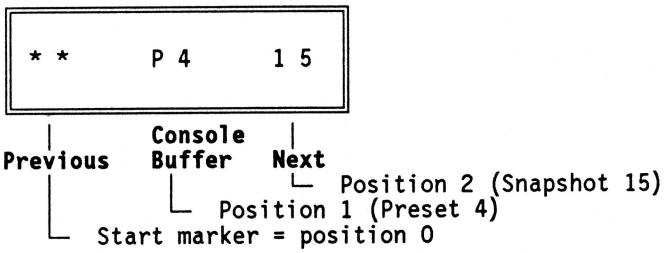
A SEQUENCE is a chain of snapshots and presets. For planable production operations the sequence of required console setups can be prepared in advance and stored in one of the 9 sequence memory locations of the memory register.
The sequence can comprise up to 255 snapshots and/or presets. The start of a sequence is identified by the start marker "***".
To permit faster access to the sequences, they are displayed in groups of 3.

SEQUENCE mode

This mode is called and terminated by pressing the **SEQUENCE** key. The active state is indicated by a green light in the key.
If any function not belonging to the sequence mode is activated, the normal operating mode is automatically reestablished. The sequence currently being processed is not affected by this. One sequence is always active in the working memory, irrespective of the current operating mode. It reappears on the display as soon as the sequence mode is reselected.

Displaying a sequence:

The display registers A, B and C contain a sequence position increasing from A to C.



The **keys A, B and C** have a second designation for the sequence mode:

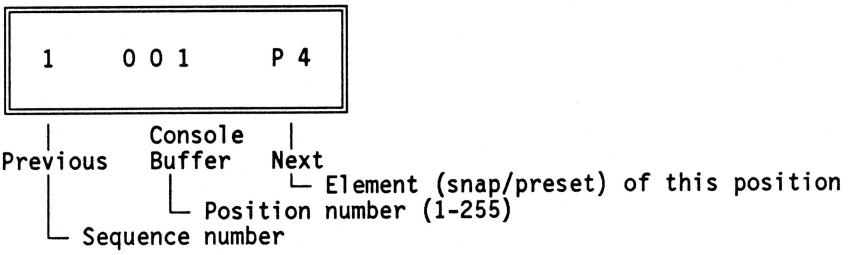
"PREVIOUS": Access to the previous sequence section. The previous position is displayed above this key.

"CONSOLE BUFFER": The current mixing console setup is shown in the middle of the display. If any changes have been made to this setup, you can reestablish the previous state by pressing the CONSOLE BUFFER key. This key is also used if the sequence has been shifted with the arrow keys. In this case the displayed position can be setup in the console.

"NEXT": Access to the next position or display of the next position within the sequence. This key is normally used for controlling the execution of a sequence.

SEQUENCE EDIT mode

The SEQUENCE EDIT mode displays the sequence and position number of one specific position as supplementary information. The other functions are the same as in the sequence mode.
The SEQUENCE EDIT mode is activated by pressing the **EDIT key** in the sequence mode. The display shown above will change to the following format after the EDIT key has been pressed:



The positions to the left or right can be displayed by pressing the **arrow keys**.

GO TO function: In the SEQUENCE EDIT mode you can select a position number directly:

[←]+[→]	GOTO 000	While holding down one arrow key also press the other.
[###]	GOTO ###	Enter the position number.
[EXEC]	4 ### P2	The selected position is displayed. In our example position No. 4 with element P2 (preset 2).

Loading a sequence

A sequence can only be loaded from the memory locations 1 to 9. In order to create a new sequence from scratch, sequence No. 0 must be loaded. This is a "blank" sequence with which a new basic framework can be fetched and an existing sequence overwritten. In this way a sequence that is no longer needed can be deleted from working storage.

Key	Display	Function
[LOAD]	LOAD	The previously described LOAD function is called for activating a
[SEQUENCE]	L SEQU	sequence from the memory register. The number of the
[#]	L SEQU #	previously accessed sequence is displayed and can be overwritten with a new digit.
[EXEC]		A start marker as well as the positions 1 and 2 or the sequence number appear on the display.

The function LOAD SEQUENCE must be initiated in NORMAL operation before the SEQUENCE mode is activated.

Message **UNDEFSEQ** Undefined sequence! The specified sequence is not available.

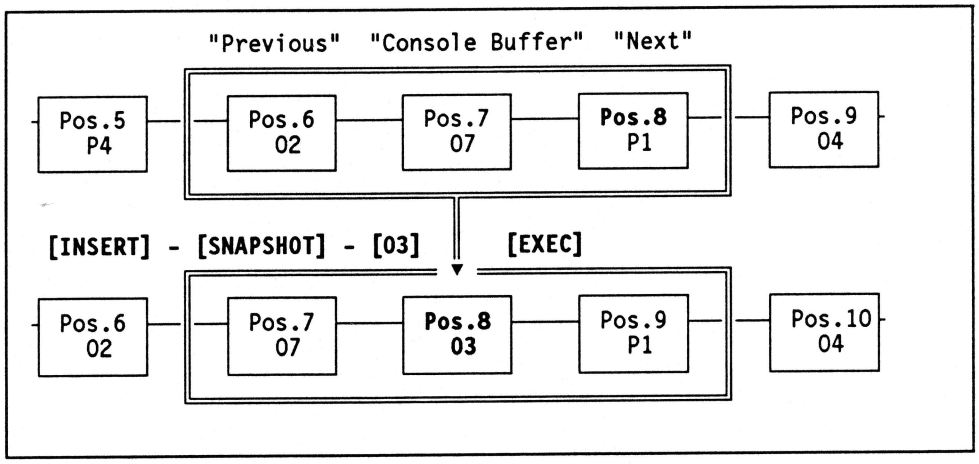
Creating a sequence

Snapshots and presets are chained into a sequence by means of the INSERT functions. The INSERT command shifts the existing positions to the left by one position. The new entry is always stored in the CONSOLE BUFFER display position that has now been cleared.
Call the sequence mode by pressing the **SEQUENCE** key.

[INSERT] [SNAPSHOT] [##] [EXEC]
[INSERT] [PRESET] [#] [EXEC]

With the **INSERT** function you can also enter new positions into existing sequences. The new element is inserted between the positions CONSOLE BUFFER and NEXT and on completion of the operation it is displayed in the CONSOLE BUFFER.

Key	Display	Function
	02 07 P1	Snapshot ## is to be inserted between snapshot 07 and preset
[INSERT]	**07 __ P1**	P1. When the insert key is pressed the two preceding positions
		are shifted one position to the left so that a gap is created. You
[SNAP]	**07 00 P1**	now specify the information to be inserted into this gap. The
[##]	**02 ## P1**	advantage of this method is that the sequence is automatically
[EXEC]		rearranged.



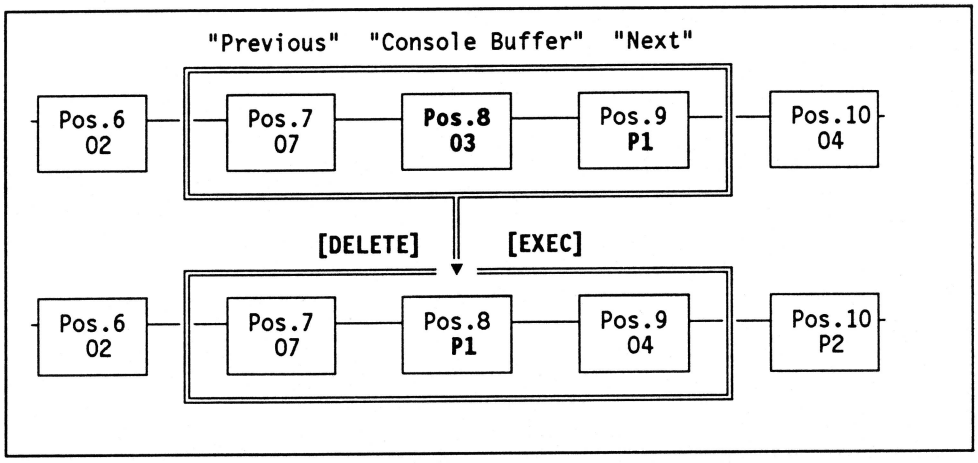
INSERT key: A new setup is inserted into an existing sequence at the CONSOLE BUFFER position and shifts the existing setups on the display to the left by one position.

Deleting a position

The DELETE key removes the position of a sequence that is currently displayed in the CONSOLE BUFFER. The elements with a higher number are shifted to the left and thus close the gap.

Key	Display	Function
	07 03 P1	Snapshot 03 is to be deleted.
[DELETE]	**07 03 P1**	Only the element in the CONSOLE BUFFER is deleted. The
[EXEC]	**07 P1 04**	elements with a higher position number are shifted to the left by
		one position.

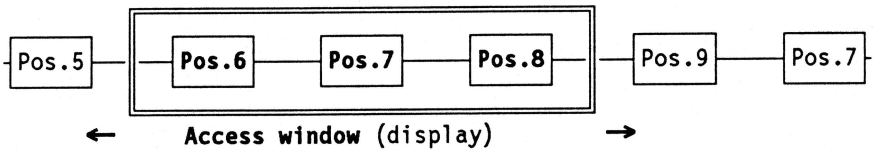
The process is illustrated in the diagram on the following page.



DELETE key: The element of the CONSOLE BUFFER position is deleted from the sequence. The subsequent elements are shifted to the left by one position.

Shifting the access window

The access is limited to the three positions shown on the display. This window can be shifted with the arrow keys in either direction so that any position can be found.



[←] Shift the window to the left, i.e. toward the start of the sequence. This key has no effect if position 1 is already in the CONSOLE BUFFER.

[→] Shift the window to the right, i.e. toward the end of the sequence. This key becomes inactive as soon as the last element is located in the CONSOLE BUFFER.

Recalling a sequence

With the three keys PREVIOUS, CONSOLE BUFFER, and NEXT, followed by EXEC you can set up a position of the sequence in the console. For executing a sequence press the NEXT key. With each call the sequence is shifted to the right by one position so that the next position is automatically activated when the NEXT key is pressed. A sequence can also be processed backward by pressing the PREVIOUS key.

Key	Display	Function
[NEXT]	01 02 03	The position in the CONSOLE BUFFER is currently active in the
[EXEC]	02 03 04	mixing console (snapshot 02), the previous setup was snapshot
[NEXT]		01. Position 03 is now located in the NEXT position, etc.

A sequence can be controlled in the same way in SEQUENCE EDIT mode. This mode could be advantages because the position number is displayed. However, the display now shows only the information for 1 position.

Storing the sequence Like the LOAD function, STORE can only be used in normal operation.

Key	Display	Function
[SEQUENCE]		Terminates the sequence mode.
[STORE]	STORE	The sequence is transferred into one of the positions 1... 9 of the
[SEQUENCE]	ST SEQ	memory register. A backup copy of the sequences together with
[#]	ST SEQ #	the snapshots can be created as a set on the floppy disk.
[EXEC]		

1.9 Operating with selections

With the SELECTION facility the status changes effected by presets and snapshots can be limited to certain functional groups and channels. Snapshots and presets may exclusively **access selected parts** of the console. A selection can be done independently for a single snapshot and for the console. Only functions selected both in the snapshot and on the console are recalled.
However, all the console data are stored in every snapshot in order to support later modifications of the selection.
In the basic setup all functions can be set automatically and are consequently selected. The selections are always enabled: there's no need to switch them on or off.

We differentiate between **two types** of selections:

Console selection: The CONSOLE selection applies to automatic status changes on the mixing console. Functions that are not selected are protected from being changed over by snapshots or presets. The console selection cannot be stored or called but is always active and can be modified at any time.

Snapshot selection: The snapshot selection determines the parameters that will be recalled with the particular snapshot. With each snapshot the corresponding selection is stored or retrieved.

Both types of selections are effective at the same time:
Only those functions that are selected in both selections will be set automatically.

Function groups: A selection does not process every function individually. The mixing console is subdivided into function groups which are then selected as the smallest possible unit.
In the SELECTION EDIT mode (snapshot unit) the selection status of each function group is signalled with an illuminated or flashing key. At the same time the snapshot unit offers central access to the selection menu.

Modifying selections ..

The snapshot parameters not used by a selection can be selected and reutilized later. It is possible to modify a selection at any time.
On the console the selection of each function group can be defined individually. From the snapshot unit however the selections for a function group are always set across all channels. Both facilities can be used at the same time.

.. on the console:

The procedure is very simple: Set the SELECTION EDIT mode on the snapshot unit. The function groups are now indicated with one illuminated key per group. When the key is actuated the **group is not selected** and the key starts to **flash**. To change the selection press the key again. The group is now **selected** and the corresponding key is **continuously light**.
All selections of an **entire channel** can be set or cancelled jointly with the **SELECT** key of the fader unit.

.. with the snapshot unit:

The central editing of selections always effects **all units of the same type**. The function groups are accessible via a menu that offers four sections: INPUT, GROUP, MASTER and MONITOR.
The individual selections of these four categories are accessible as submenus. Switching from the main menu to the submenu or vice versa is possible with the **EXECUTE** key. The **arrow keys** are used for browsing through the menu items.
For **setting** a **selection** the desired function must be on the display. To select enter the digit **'1'**; digit **'0'** indicates that the function is not selected. The selections are immediately indicated on the console in accordance with these codes.
The snapshot unit functions simply as an input device. The actual selection status is indicated on the console.

1.9.1 SELECTION EDIT mode

In SELECTION EDIT mode either the console selection or the selection of the snapshot shown in the display register can be processed. Selections can only be called from the NORMAL operating mode.

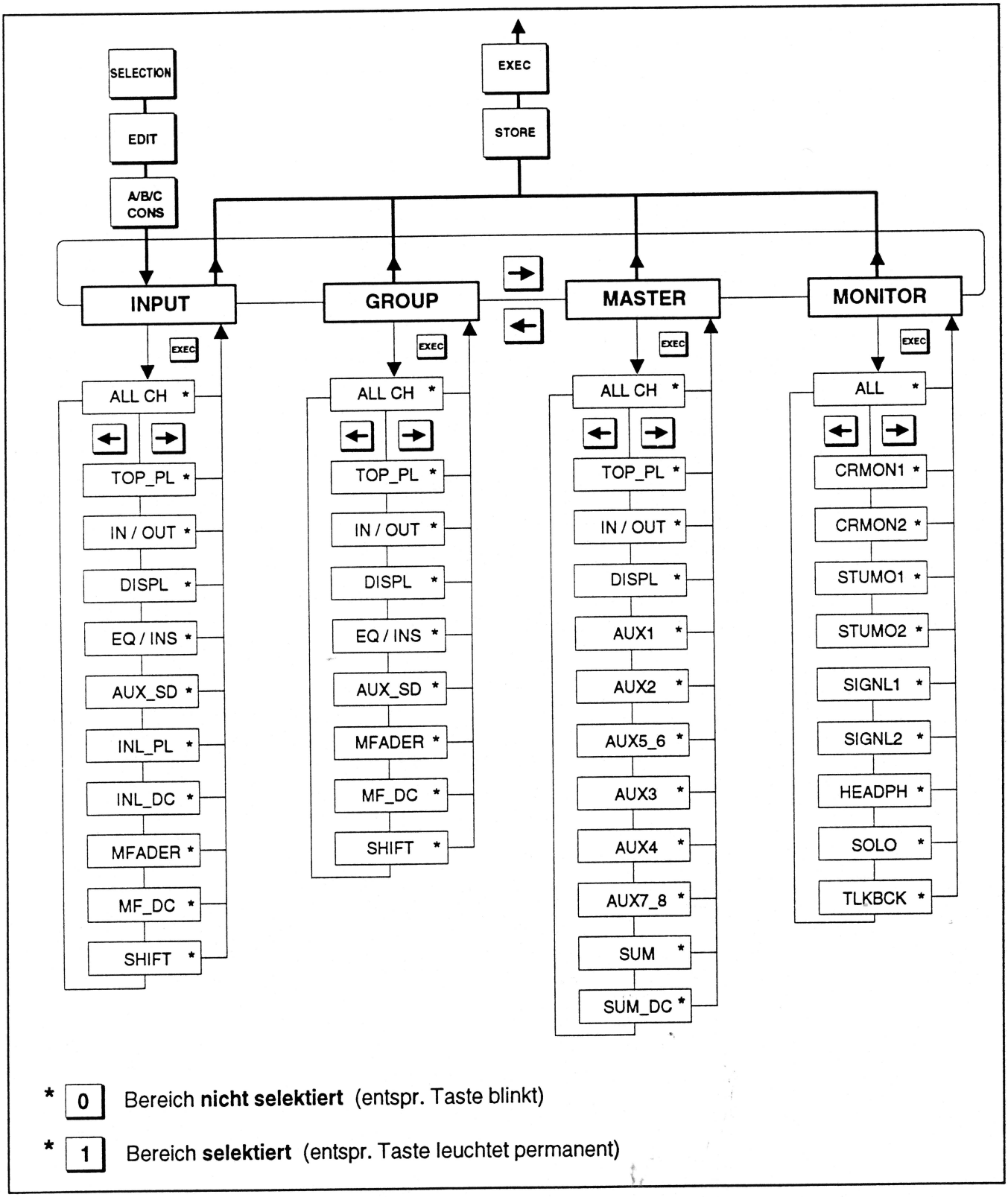
Key	Indication	Function
[SELECTION]	SELECT'N	When this mode is selected one of the four possible, displayable
[EDIT]	S EDIT	selection types must be designated:
• [A]	INPUT	A, B and C for the snapshots currently shown in the display
• [B]	INPUT	register, CONSOLE for displaying the console selection.
• [C]	INPUT	
• [CONS]	INPUT	

On the mixing console the selection information is shown by sections with one illuminated key each on the corresponding modules:

- Key is **steady light** — These functions are **selected** and are modified or transmitted by a snapshot.
- Key **flashes** — This function group is **not selected**.

In SELECTION EDIT mode the mixing console cannot be operated, however signal processing will not be interrupted.

SELECTIONS



SELECTION EDIT Menu for modifying selections: With the arrow keys you can select one of the four main menus. The EXECUTE key activates the submenu which can also be paged through with the arrow keys. Selections are set with the digit '1' and cancelled with '0'. Press EXECUTE to return to the main menu for editing other selections or press STORE to quit the SELECTION EDIT menu.

Comparing selections: In SELECTION EDIT mode the currently edited selection is indicated with the register keys A, B, C and CONSOLE. You can change between these selections as desired by pressing these keys.

Terminating SELECTION EDIT: To permanently store the changes made in a selection, the SELECTION EDIT mode must be terminated in the following way, otherwise the new entries will be lost.

1) Using the changes Press the EXEC key to return from the submenu to the main menu. Then quitt the SELECTION EDIT mode with the STORE key.

Key	Function
[STORE]	The modified selection shall be used.
[A]	The register in which the selection is to be stored can still be modified. In this
[B]	way it is possible to transfer the currently displayed selection to a snapshot in
[C]	the memory register A, B or C or to the console.
[CONS]	(see below: 'Copying selections').
[EXEC]	Terminates the SELECTION EDIT mode; the modified selection is effective and now stored in the display register together with the snapshot. To store the snapshot it must be saved in a memory location (see 1.5 'Storing the display register')

2) Cancellation Like all functions of the snapshot unit also the selection mode can be cancelled with the function key that was pressed first. All modifications made to the selection will be reversed.

[SELECTION] Terminates the SELECTION EDIT mode, the selection remains unchanged.

Copying selections: A selection can be copied by editing it and storing it in a new address.

- Example: Transfer the console selection to snapshot A.
  SELECTION / EDIT / CONS / EXEC : To edit the console selection.
  SELECTION / STORE / A / EXEC : Stores this selection in register A.

To save the snapshot with the new selection, register A must be stored in a snapshot memory location (see above):
[STORE] [A] [##] [EXEC]

Deleting selections: The delete function can be used for removing a complete selection. All functions of the specified setting (A, B, C, console) will be selected:

Key	Indication	Function
[SELECTION]	SELECT'N	The function 'Delete selection' is called directly from
[DELETE]	M DEL	the normal operating state.
• [A]	M DEL A	Designation of one of the four possible selections: registers A, B,
• [B]	M DEL B	or C or the console.
• [C]	M DEL C	
• [CONS]	M DEL CO	
[EXEC]		Deleting a selection means to reselect all functions.

1.9.2 SELECTIONS of the 'INPUT' and 'GROUP' sections

TOP PANEL

- Indication with **COMP FAST ATT** key on the dynamics unit.
- Selection for all switching functions of the dynamics unit.

INPUT/OUTPUT

- Indication with the **LINE** or **LINE A** key of the input.
- This selection is available on input units only. It comprises the source selection, input gain, stereo spread and assignment of the multitrack bus for the main fader as well as the status of the direct output and the bus output. The USER key of the main fader is also selected.
  The group assignment is selected in the MAIN FADER and INLINE PANEL selections. All keys for shift functions are treated in the SHIFT selection.

DISPLAY

- Indication with **SW WRITE** key of the main fader.
- Selection for the 'Alphanumeric Display Unit'.

EQ/INSERT

- Indication with **INSERT IN** or **INSERT 2 IN** key of the input and group units.
- The switching functions of the bass cut filter, equalizer and inserts are combined in this selection..

AUX SEND

- Indication with AUX1 **ON** or **ON A** key.
- Selection with all switching functions of the AUX section.The only exception is the AUX SOURCE key; its state but not the settings accessible with this key are contained in the SHIFT selection.

INLINE PANEL

- Indication with red **PAN IN** key of the inline unit (small fader).
- The selection of the small fader affects the keys of the inline unit as well as the input unit with the following functions:
  Source selection small fader, flip input, parallel mix, bus assignment to audio groups and masters, EQ, insert routing (insert to SF), INS 1, INS 2, panorama SF, ON/OFF SF.
- This selection does not affect the small fader VCA level and the functions PFL/solo, REC ready and select.

INLINE DC

- Indication with the **ON** key of the small fader.
- Selection for the small fader VCA level. VCA group information is permanently selected and doesn't make part of any specific selection.

MAIN FADER

- Indication with **PAN IN** key of the main fader.
- The main fader selection comprises the bus assignment to groups and masters for the main fader, panorama MF, PFL MF, solo MF and ON/OFF MF. The level of the main fader is included in the MAIN FADER DC selection.
  A comprehensive master selection exists on the group units which is also included in the MAIN FADER selection.

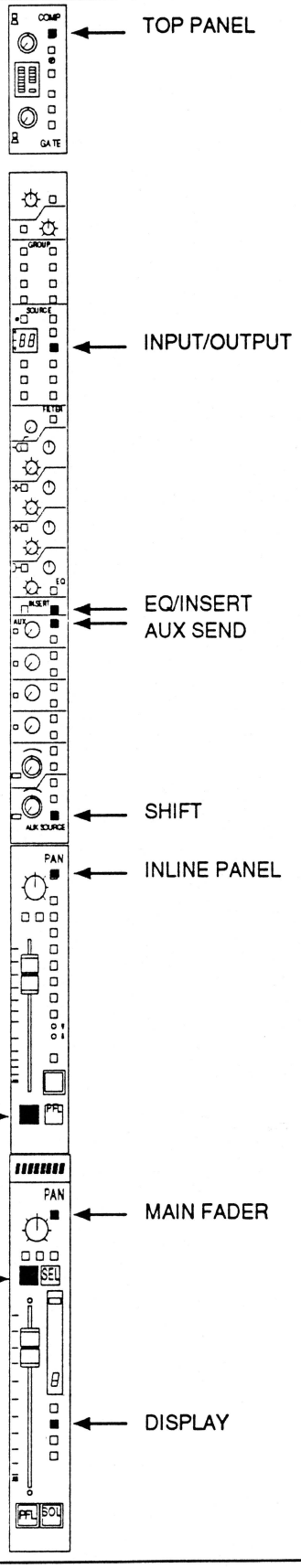
MAIN FADER DC

- Indication with the **ON** key of the main fader.
- Selection for the main fader VCA level. VCA group information is permanently selected and doesn't make part of any specific selection.

SHIFT

- Indication with the **AUX SOURCE** key of the input unit.
- Selection exclusively for the state of the shift keys (gain adjust, AUX source) but not for the functions. This selection is not used with inupt units type 'B' and with group units.

INPUT and GROUP Sections



Selection of the INPUT and GROUP sections. Indication of the selection state on the console in SELECTION EDIT mode. A permanently light key indicates a selected section whereas the keys for not selected function groups are flashing.

1.9.3 SELECTIONS of the 'MASTER' section

The MASTER selections deal with the auxiliary masters and with the master faders.

ALL CHANNEL
- 'All channel' treats all master units.

TOP PANEL
- Indication with **COMP FAST ATT** key of the dynamics unit.
- Selection with all switching functions of the dynamics unit.

INPUT/OUTPUT
- This selection is an optional feature and requires special configuration. There's no indication for this on the console.
- The selection contains the optional bus assignment from master units to the multitrack bus.

DISPLAY
- Indication with **SW WRITE** key of the master fader.
- Selection of the alphanumeric display.

AUX 1
- Indication with **EQ IN** key of AUX master 1.
- All AUX selections include the two functions EQ IN and AUX ON. The SOLO and Talk Back functions make part of the corresponding selections of the MONITOR section.

AUX 2
- Indication with **EQ IN** key of AUX master 2.
- Selection according to AUX 1.

AUX 5/6
- Indication with **EQ IN** key of AUX master 5/6.
- Selection according to AUX 1.

AUX 3
- Indication with **EQ IN** key of AUX master 3.
- Selection according to AUX 1.

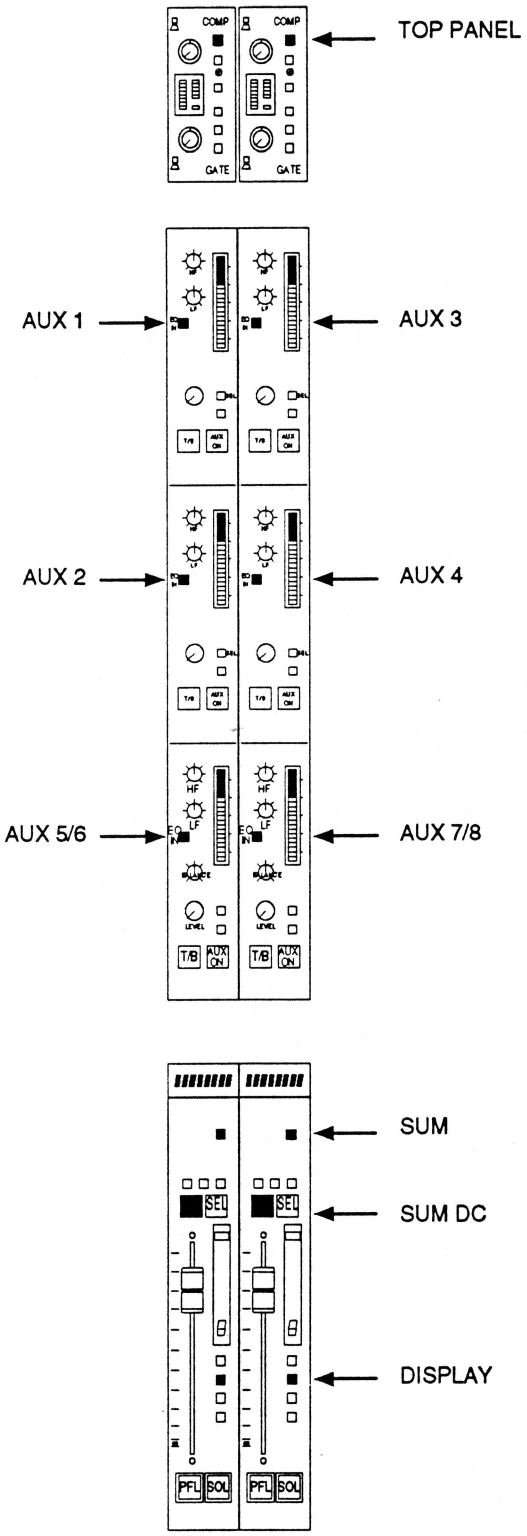
AUX 4
- Indication with **EQ IN** key of AUX master 4.
- Selection according to AUX 1.

AUX 7/8
- Indication with **EQ IN** key of AUX master 7/8.
- Selection according to AUX 1.

SUM
- Indication with **INS IN** key of the master fader.
- Selection with the functions limiter IN and LINK, insert and ON.

SUM DC
- Indication with **ON** key of the master fader.
- Selection for the VCA value of the master fader.

MASTER selections



Selections of the MASTER section in SELECTION EDIT mode: The SELECT key of the master fader changes the selection state of a whole master channel. In the master section there is a wide range of individual configuration possibilities.

1.9.4 SELECTIONS of the 'MONITOR' section

The monitor functions are operated via the modules CR Monitor (1.990.420), Studio Monitor (1.990.430), and PFL, TB, Headphones Panel (1.990.440). Depending on the configuration several monitor panels may be installed.

CR MONITOR 1

- Indication with **CH 1 CUT** key of control room monitor 1.
- Selection for all functions of the CR Monitor panel 1 including the source selector.

CR MONITOR 2

- Indication with **CH 1 CUT** key of control room monitor 2.
- Selection for all functions of the CR Monitor panel 2 including the source selector.

STUDIO MONITOR 1

- Indication with **CUT** key of studio monitor 1.
- Selection for all functions of the Studio Monitor panel 1 including the source selector.

STUDIO MONITOR 2

- Indication with **CUT** key of studio monitor 2.
- Selection for all functions of the Studio Monitor panel 2 including the source selector.

SIGNALIZATION 1

- Indication with **CALL** key of studio monitor 1.
- Selection for the functions RED LIGHT, RED L. MANUAL, CALL and READY on the Studio Monitor panel 1.

SIGNALIZATION 2

- Indication with **CALL** key of studio monitor 2.
- Selection for the functions RED LIGHT, RED L. MANUAL, CALL and READY on the Studio Monitor panel 2.

HEADPHONES

- Indication with **CUT** key in the headphones section of the PFL/TB/headphones panel.
- Selection of all headphones functions on the PFL/TB/headphones panel.

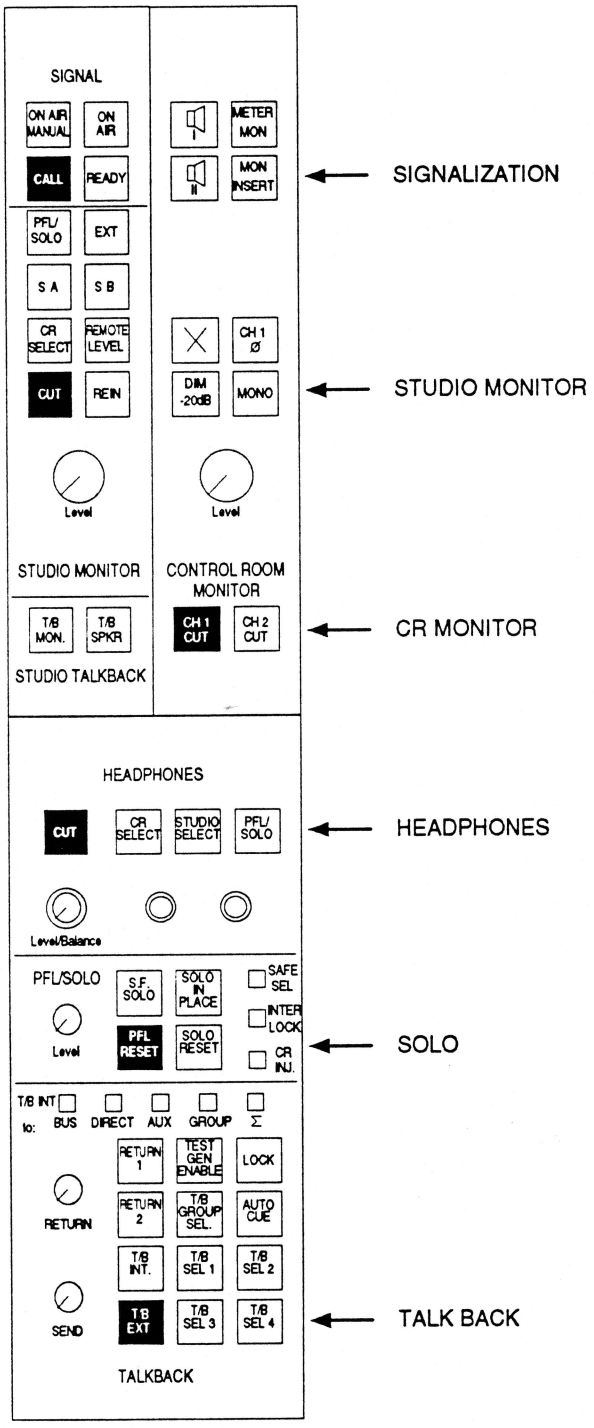
SOLO

- Indication with **PFL RESET** key in the PFL/SOLO section of the PFL/TB/headphones panel.
- Selection for all locally (on channels) and centrally (PFL/TB/headphones panel) controlled PFL/SOLO functions.

TALK BACK

- Indication with **T/B EXT** key in the talk back section of the PFL/TB/headphones panel.
- Selection for all functions in the TALK BACK section.

MONITOR selections



Selections of the MONITOR section. Indication of the selection in SELECTION EDIT mode: A permanently light key indicates a selected section whereas the keys for not selected function groups are flashing.

1.10 Table of error messages

Display	Message
DIR_ERR	Directory (set) doesn't exist
DISK_ERR	Insert diskette correctly
DISKFULL	No more empty space on diskette
FORMATER	Formating is not possible
FORMATIN	Formating is in progress
IFXE-734	Input/output error
NO_DATA	No data available
NO_DISK	No diskette inserted in disk drive
NO_SEQ	No sequence available
NO_SNAP	No snapshots available
NOTFOUND	The files (snapshots, sequences) to be loaded are not existing on the diskette
READ-ERR	An error occured during a read operation
UNDEF_P	Undefined preset! The requested preset doesn't exist. An empty memory location is specified as the source in a load operation.
UNDEF_RG	Undefined register! No data in the requested memory register
UNDEF_SN	Undefined snapshot! The requested snapshot doesn't exist. An empty memory location is specified as the source in a load operation.
UNDEFSEQ	Undefined sequence! The requested sequence doesn't exist. An empty memory location is specified as the source in a load operation.
WRIT_ERR	An error occured during a write operation
WRITPROT	The inserted diskette is write protected and storing is disabled.
WRONGDSK	Wrong disk inserted.