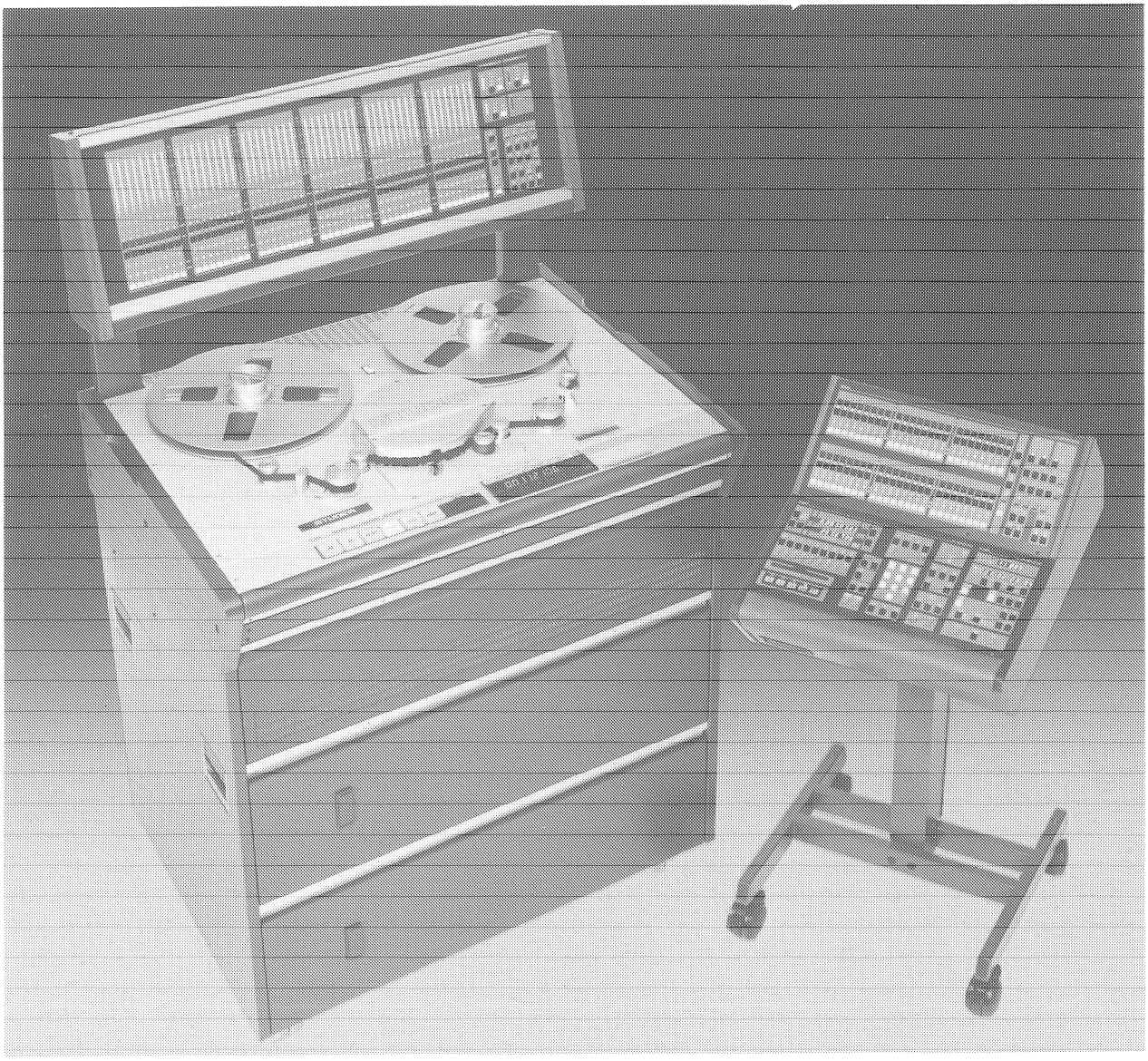
STUDER D820 MCH

24/48-Track Digital Tape Recorder

Operating Instructions



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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 cover (or back). No user-serviceable parts inside. Refer servicing to qualified service personnel.

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

Um die Gefahr des elektrischen Schlages zu vermeiden, entfernen Sie keine Abdeckung (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 person.

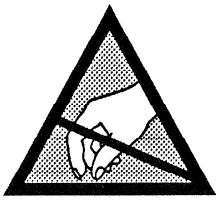
Ce symbole indique à l'utilisateur qu' existent à l'intérieur de l'appareil des **"tensions dangereuses"**. Ces tensions élevées entrainent un risque de choc électrique en cas de contact.

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

This symbol is intended to alert the user to the presence of **important instructions** for operating and maintence (servicing) 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.



ATTENTION: Observe precaution for handling electrostatic discharge sensitive devices! Refer to section ESD.

ATTENTION: Respecter les précautions d'usage concernant la manipulation de composants sensibles à l'électricité statique. Voir chapitre ESD correspondant.

ACHTUNG: Vorsichtsmassnahmen bei Handhabung elektrostatisch entladungsgefährdeter Bauelemente beachten! Siehe Abschnitt ESD.

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, 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.

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.

ERSTE HILFE
(bei Stromunfällen)

1. Bei einem Stromunfall die betroffene Person so rasch wie möglich vom Strom trennen:
- Durch Ausschalten des Gerätes
- Ausziehen oder unterbrechen der Netzzuleitung
- Betroffene Personen mit isoliertem Material (Holz, Kunststoff) von der Gefahrenquelle wegstossen
- Nach einem Stromunfall sollte immer ein Arzt aufgesucht werden.

WARNING!

DO NOT TOUCH THE PERSON OR HIS CLOTHING BEFORE POWER IS TURNED OFF, OTHERWISE YOU STAND THE RISK OF SUSTAINING AN ELECTRIC SHOCK AS WELL!

ATTENTION!

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

ACHTUNG!

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

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.

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.

2. Bei Bewusstlosigkeit des Verunfallten:
- Puls kontrollieren,
- bei ausgesetzter Atmung künstlich beatmen,
- Seitenlagerung des Verun-fallten vornehmen und Arzt verständigen.

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

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 Herausziehen des Netzsteckers vom Netz getrennt werden. Das Öffnen und Instandsetzen des Gerätes darf nur vom Fachpersonal unter Einhaltung der geltenden Vorschriften durchgeführt werden.

Für die Netzverbindung ist das mitgelieferte Netzkabel zu verwenden. Vor Anschluss des Netzkabels an die Netzsteckdose müssen die Stromversorgungswerte und die Anschlusswerte des Gerätes (Netzspannung, Netzfrequenz) überprüft werden, ob sie in den erlaubten Toleranzen liegen. Die im Gerät eingesetzten Sicherungen müssen den an dem Gerät angebrachten Angaben entsprechen.

Ein Gerät mit einem dreipoligen Netzstecker (Gerät der Schutzklasse I) muss an eine dreipolige Netzsteckdose angeschlossen und somit das Gerät mit dem Schutzleiter der Strominstallation verbunden werden (Für Dänemark gelten Starkstrombestimmungen, Abschnitt 107). Der im Gerät eingebaute dreipolige Apparatestecker muss mit einem Kabelstecker Bauart IEC 320 (16A; Stecker mit weiblichen Kontakten) nach untenstehendem Bild angeschlossen werden:

Operation and waste disposal

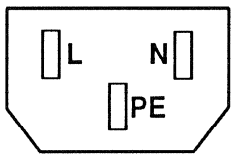
Before you install the equipment, please read and adhere to the following recommendations and all sections of these instructions marked with ⚠.

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.

Use the supplied power cable for connecting the unit to the AC power outlet. Before you connect 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 power plug (equipment conforming to protection class I) must be connected to a 3-pole AC power outlet so that the equipment is connected to the ground conductor of the AC supply. (For Denmark the Heavy current regulations, Section 107, are applicable). The 3-pole appliance inlet must be connected to an IEC 320 connector (16A) with female contacts as shown in the diagram below:



View of cable female socket:
L .....live,phase; brown — National American Standard: black
N .....neutral; blue — white
PE ....protective earth; green-and-yellow — green

Vue de la partie femelle du câble d'alimentation:
L.....phase, brune — Standard National Américain: noire
N.....neutr, bleue — blanc
PE....terre protectif, verte et jaune — verte

Ansicht gegen Steckkontakte des Kabelsteckers
L.....Polleiter — braun
N.....Neutralleiter — hellblau
PE....Schutzleiter — gelb/grün

Die Installation des Gerätes muss **vermeiden** 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, Kadmium) beinhalten, wie z.B. Batterien und Akkumulatoren, müssen als Sondermüll behandelt werden.

Wartung und Reparatur

Durch Entfernen von Gehäuseteilen, Abschirmungen etc. werden stromführende Teile freigelegt. Aus diesem Grunde müssen u.a. die folgenden Grundsätze beachtet werden:
Eingriff in das Gerät darf nur vom 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 deren kontrolliertem Entladen und heiße Bauteile (Leistungshalbleiter, Kühlkörper etc.) erst nach deren Abkühlen berührt werden.
Bei Wartungsarbeiten am geöffneten, unter Netzspannung stehenden Gerät dürfen **keine blanken** Schaltungsteile und metallene Halbleitergehäuse weder direkt noch mit einem nichtisolierten Werkzeug berührt werden.
Zusätzliche Gefahren bestehen bei unsachgemässer Handhabung besonderer Komponenten:

- **Explosionsgefahr** bei Lithiumzellen, elektrolytischen 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 vom dafür ausgebildeten 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 not blocked or covered.

The equipment and its packing material should ultimately be disposed off in accordance with the applicable regulations. All parts of the equipment that contain hazardous substances (mercury, cadmium) such as batteries must be treated as toxic waste.

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 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 Wartungsarbeiten und Reparaturen der sicherheitsrelevanten Teile des Gerätes darf **nur Ersatzmaterial nach Herstellerspezifikation** verwendet werden, gebrauchte Batterien und Akkumulatoren müssen fachgerecht entsorgt werden.

Das Gerät muss ordnungsgemäß und regelmäßig gewartet und somit im sicheren Zustand erhalten werden. Bei ungenügender Wartung oder bei Änderungen der sicherheitsrelevanten Teile des Gerätes erlischt entsprechende Produktehaftung des Herstellers.

Störaussendung 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 für Bereiche Wohnung, Büro und leichte Industrie ausgelegt sind. 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 möglichst auszuschliessen, sind u.a. folgende Massnahmen zu beachten:

- Installieren Sie das Gerät nach Angaben in der Bedienungsanleitung, verwenden Sie das mitgelieferte Zubehör.
- Verwenden Sie im System und in der Umgebung, in denen das Gerät eingesetzt ist, nur solche Komponenten (Anlagen, Geräte), die ihrerseits die Anforderungen der obenerwähnten Standards erfüllen.
- Sehen Sie ein Erdungskonzept des Systems vor, das sowohl die Sicherheitsanforderungen (Erdung der Geräte Schutzklasse I mit einem Schutzleiter muss gewährleistet sein), wie auch die EMV- Belange berücksichtigt. Bei der Entscheidung zwischen sternförmiger, flächenförmiger oder kombinierter Erdung sind Vor- und Nachteile gegeneinander abzuwägen.

For maintenance work and repair on components that influence the equipment safety, only **replacement material conforming to the manufacturer's specifications** may be used. Discharged batteries must be disposed of in accordance with the applicable environmental protection regulations.
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 the equipment safety, the manufacturer's product liability becomes void.

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.

- 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 resp. zum Steckergehäuse. Beachten Sie, dass eine nur an einem Ende angeschlossene Kabelabschirmung als eine Sende- resp. Empfangsantenne wirkt (z.B. bei wirksamer Kabellänge von 5m oberhalb von 10MHz) und dass die Flanken der digitalen Kommunikationssignale hochfrequente Aussendungen verursachen (z.B. LS- oder HC-Logik bis 30MHz).
- Vermeiden Sie Bildung von Stromschlaufen oder vermindern Sie deren unerwünschte Auswirkung, indem Sie die Fläche der Schlaufe möglichst klein halten und den in der Schlaufe fliessenden Störstrom durch Einfügen einer zusätzlichen Impedanz (z.B. Gleichtaktdrossel) reduzieren.

- Use screened cables where screening is specified. The connection of the screening to the corresponding connector terminal or housing should have a large surface and be corrosion-proof. Please note that a cable screen connected at only one side acts and a transmitting or receiving antenna (e.g. with an effective cable length of 5m the frequency is above 10MHz) and that the edges of the digital communication signals cause high-frequency radiation (e.g. LS or HC logic up to 30MHz).
- Avoid current loops or prevent 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).

Elektrostatische Entladung (ESD) bei Wartung und Reparatur

Viele IC 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 müssen ausschliesslich in dafür bestimmten und bezeichneten Verpackungen gelagert und transportiert werden.
- Unverpackte ESD-empfindliche Komponenten dürfen nur in den dafür eingerichteten ESD-Schutzzonen (EPA, z.B. Gebiet für Feldservice, Reparaturplatz oder Serviceplatz) gehandhabt und nur von Personen berührt werden, die über ein Handgelenkband mit Widerstand mit dem Massepotential des Reparatur- oder Serviceplatzes verbunden sind. Das gewartete oder reparierte Gerät wie auch sämtliche Werkzeuge, Hilfsmittel, EPA-taugliche (elektrisch halbleitende) Arbeits-, Ablage- und Bodenmatten müssen ebenfalls mit diesem Massepotential 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 mit unerlaubter Spannung oder Ausgleichsstrom zu vermeiden, dürfen elektrische Verbindungen nur am abgeschalteten Gerät nach dem Abbau allfälliger Kondensatorladungen erstellt oder getrennt werden.

Electrostatic discharge (ESD) during maintenance and repair

Many ICs and semiconductors are sensitive to electrostatic discharge (ESD). The life of components containing such elements can be drastically reduced by improper handling of such components 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 zones (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. The equipment to be repaired or serviced and all tools, aids, electrically semiconducting work, storage and floor mats should also be connected to this ground potential.
- The terminals of ESD sensitive components should 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.

Table of Contents

1 Getting started

1.1 Utilization for the purpose intended

The STUDER D820 MCH is a digital multitrack tape recorder designed for professional use. Make sure the electrical cables are connected to the appropriate voltages and signals. Only precision NAB reels for ½" audio tape are permitted for use. For operation the turning lock in the centre of the reel adapters must be tightened.

1.2 Special Features of the D820 MCH

With its compact and highly rugged design, its versatile interfaces and multiple microprocessors, the STUDER D820 MCH achieves an exceptionally high level of operational convenience and thus satisfies all requirements of a universal studio machine destined for use in radio or television studios, disc recording studios, in theater, film or scientific applications, be it in single machine configurations or as part of modern synchronizing systems.

DASH format

Full compatibility to 24-track DASH machines is ensured because this is part of the far-sighted concept of the DASH format. The first 24 tracks of the 48-track double density DASH format are compatible with the normal density format of all 24-track DASH machines. In the double density format tracks 25 to 48 are interleaved between the "normal" tracks 1 to 24. For this reason the D820 MCH can reproduce or record any DASH multitrack format.

Advanced head technology

The ultra stable headblock of the D820 MCH is equipped with two thin-film record heads and a ferrite reproduce head. The head arrangement in a write-read-write configuration permits seemless punch-in and punch-out without affecting the data integrity.
An additional erase head for the four AUX tracks ensures full compatibility also with DASH tapes on which the auxiliary tracks were still recorded with bias.

Latest tape deck design

The extremely stable tape deck of the D820 MCH machines is based on the reliable and established design of the 820 Series. The tape speed of 30 ips corresponds to a sampling rate of 48 kHz; ½"-tape reels with a diameter of up to 14" can be mounted. The maximum recording time with such a tape is one hour (approx. 65 minutes at 44.1 kHz).
The tape deck can be remote controlled by means of the standard parallel interface of the 820 Series. This interface can also be used for external synchronizers. In addition, the D820 MCH is equipped with a serial interface with ES bus protocol.

CUE tracks of high audio quality

Two of the four AUX tracks can be used as CUE tracks. A pulse width modulator (PWM) developed by STUDER ensures the high audio quality required for this type of application.

Ping-pong or track bouncing

Internal routing makes a geomatrically, sample accurate copying from any track to one or more other tracks possible.
In the track bouncing mode up to four tracks can be copied internally in the digital domain to four additional tracks.
Switching from one track to any or several other tracks is possible by digital copying in real time.

Built-in time code generator

The internal generator produces or reads any SMPTE, EBU or film code and can also be synchronized by an external clock.

Built-in synchronizer

The internal synchronizer supports all functions required for synchronizing the D820 MCH with audio or video machines. The audio-related, sample accurate synchronization between DASH machines is based on the reference track (AUX 2) which means that two D820 MCH can be synchronized.
The extended functions include "edit wait", "edit lock", "automatic offset retention", and "instant lock", which are implemented in the same manner as on the STUDER TLS 4000.

Logically arranged display and control panel

For each channel the D820 MCH features a 30-segment PPM (LED bargraph) with a 60 dB display range. The comprehensive audio channel control facilities include: ping-pong, group programming, individual emphasis setting, keys for programmable user functions, "master safe", "auto mute", and "auto input".

Output with negative delay

Signal may caused by external audio processing or mixdown can be significant and adversely affect the accuracy of editing operations. However, the D820 MCH is capable of accurately compensating such delays by giving the audio signal output a programmable, positive lead relative to the normal, internal timing.

Digital formats for inputs and outputs

AES/EBU, MADI and SDIF multichannel. The 2-channel AES/EBU format can be assigned to any two channels.

Reference quality A/D and D/A converters

Special, ultra low-noise passive filters have been developed for A/D conversion. The D/A converters are equipped with digital filters and 4-times oversampling.

Vast choice of external clock sources

The D820 MCH can be integrated easily into any type of system. All commonly used video and audio clocks are accepted as an external reference.

Remote control

Comprehensive remote control facilities have been achieved through a unique bus system for different control units: for the autolocator with synchronizer, and for the audio channels of the remote control, or via the parallel interface from a mixing console. A separate line voltage supply is no longer needed for the remote control.

Test signal generator installed

In the "Test" function, the internal DSPs (Digital Signal Processors) generate a series of test signals which, when injected into the audio paths, can be very useful for troubleshooting in complex configurations.

DSP for audio signal processing

Each audio channel is equipped with a fast digital signal processor (DSP) for crossfade functions within the range of 1 to 700 ms, for switching sequences and error corrections.

Sound memory

The D820 MCH is equipped with a sound memory in which audio signals with a duration of up to 47.5 seconds at 44.1 kHz sampling rate can be buffered. This offers new and efficient editing capabilities which were not achievable with tape recorders in the past.

1.3 Installation

1.3.1 Unpacking and Checking Procedure

The D820 MCH tape recorder is shipped in two special packings which protect the equipment against mechanical shock in transit. Care should be exercised when unpacking the machine so that the equipment surfaces do not become marred.
Verify that the content of the packings agrees with the items listed on the enclosed shipping list and check the condition of the equipment. If there are any signs of shipping damage you should notify immediately the forwarding agent as well as the nearest STUDER distributor. Please retain the original packing material because it offers the best protection in case your equipment ever needs to be transported.

1.3.2 Panel Installation Instruction

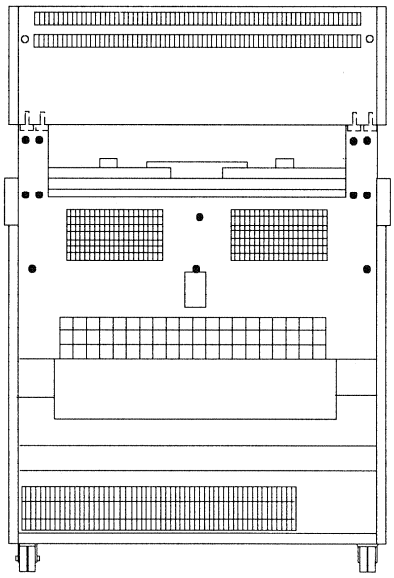
Panel and tape recorder are being delivered separately. To install the panel on the tape recorder proceed as follows:

Procedure:

Refer to drawing " D820 MCH rear view".

- Unscrew 12 hex-screws [1] 2.5mm on the rear panel of the D820 MCH and remove rear panel.
- Install panel and secure with two hex-screws [3] 5.0mm on the left and right hand side.
- Loosen the two tin-plated screws [2] on the panel rear. Push the snap catch of the operating unit slightly downward while simultaneously opening the panel.
- Lace the two cable connections from the recorder to the panel and plug them into the display back panel board 1.862.819.00.
- Re-install D820 MCH rear panel and fasten it with the 12 hex-screws [1].
- Close the panel and secure it with the two tin-plated screws.

D820 MCH rear view:



- [1] Hex screw 2,5 mm
- [2] Hex screw 2,5 mm
- [3] Hex screw 5,0 mm

1.3.3 Installation Site

Environment

The D820 MCH recorder should be installed in a dust-free and adequately ventilated environment. The technical data of this machine are guaranteed for an ambient air temperature range of 5°C to 40°C with a relative humidity of 20% to 90% (non-condensing).

Cooling

The equipment should be installed in such a way that the free circulation of air is not obstructed. Heat accumulation can occur particularly when the equipment is installed in a niche. When the machine is in operation, the air circulation zone should not be used as a storage area for manuals, etc.

Electromagnetism

Do not install the equipment in proximity to strong electromagnetic fields. General sources of interference are: strong load fluctuations on adjacent power current lines, high-performance transformers, elevator motors as well as nearby radio and TV transmitters.

Installation in a niche

The back of the machine should remain accessible for service work. When installed in a niche it should be possible to move the machine without having to disconnect the cables.

1.3.4 Line voltage

CAUTION!

The D820 MCH can only be operated with 220 V ±10%, 50/60 Hz.

- In countries with different line voltages an external transformer must be connected ahead of the input.
- The 3-phase mains installation used in the U.S.A. can be reduced to two phases by means of a special cable. In this way a voltage of 208 V can be obtained which suffices for the correct operation of the D820 MCH.

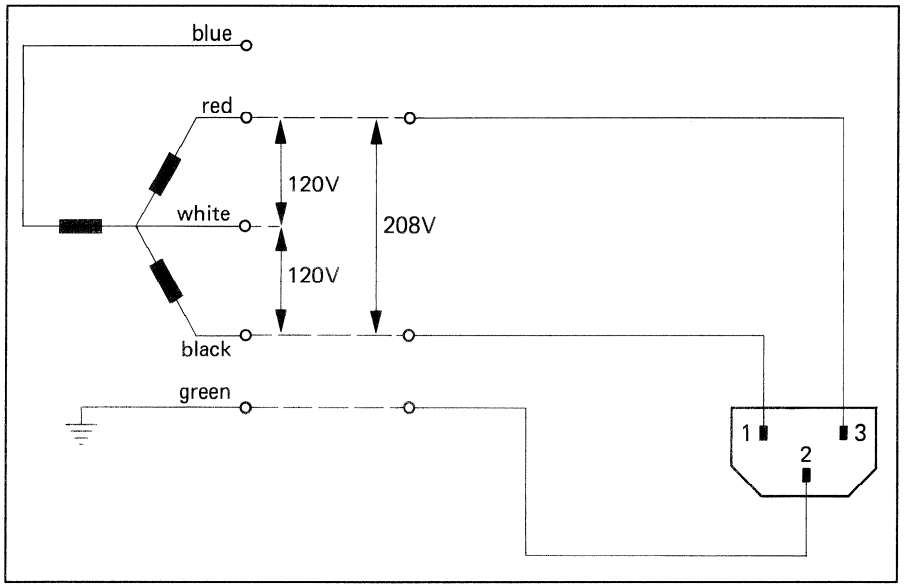


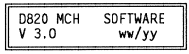
Fig. 1.3.4 Diagram of the special cable for 208 V.

1.4 Software version

The descriptions in this manual are based on the final software version 3.0 offering the full range of functions.

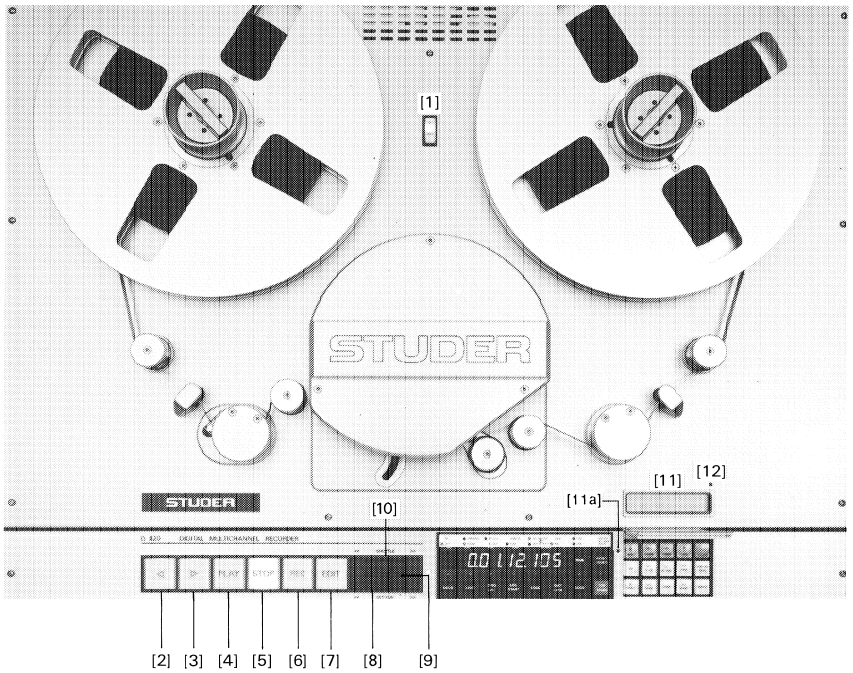
Displaying the Software version

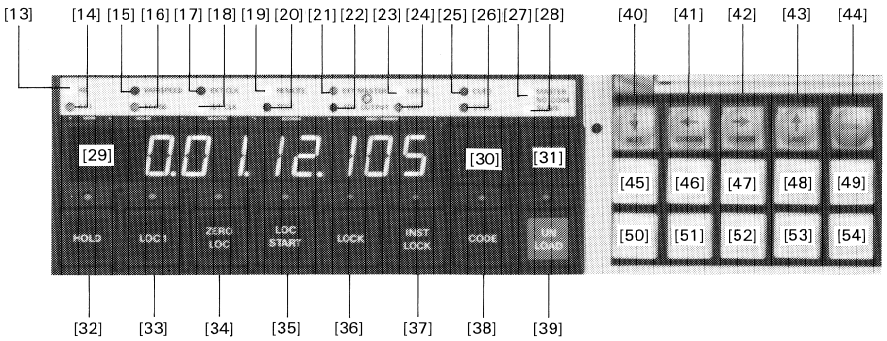
Press the LAST ↑ key to display the software version on the LCD. This indication disappears after a short period.



2 Operating Instructions D820 MCH

2.1 Operating Controls, Tape Deck





2.1.1 Power switch

[1] Power switch

After power up, the microprocessor automatically tests the main functions and any errors are shown on the service display.
When the machine is powered up the operating state in effect before the last power off is displayed.

Exceptions:
- The tape recorder is always switched to STOP (if there is no tape or if it is inserted loosely, the STOP key flashes).
- All channels are switched to SAFE
- Sampling rate: corresponds to the previously selected clock reference and VARISPEED OFF.

2.1.2 Main key panel

[2] ◄ Rewind key

[3] ► Forward wind key

[4] PLAY Play key

[5] STOP Has priority over the tape transport keys and cancels any active synchronizer LOOP.
If STOP is pressed together with LOC START or LOC1, the stored locator addresses are displayed.

[6] REC Record key, effective only together with PLAY.

[7] EDIT Edit function, activates the SET/CUE wheel and disengages the position of the antiscrape flutter roller.

[8] SET/CUE wheel Multifunction wheel:
- In conjunction with the EDIT key: Permits positioning of the tape; the tape moves in synchronism with the SET/CUE wheel.
- In conjunction with the system display and the cursor keys: As a "potentiometer" for setting various parameters.

[9] SHUTTLE BAR Bar between the SHUTTLE wheel and the SET/CUE wheel. When the SHUTTLE BAR is pressed the winding speed selected with the SHUTTLE wheel is stored and maintained.

[10] SHUTTLE wheel For positioning the tape with continuously variable winding speed. Center position = STOP, left-hand end position = max. SHUTTLE reverse speed, right-hand end position = max. SHUTTLE forward speed.

[11] System display Pilot LEDs for the function and programming keypad (refer to next Section) and for error messages.

[11a] Program lock For accessing the SETUP, FUNCTION and ALIGNMENT branches, this screw must be given 2–3 counterclockwise turns (hexagon-socket-screw key 2.5 mm).

[12] Brightness control Slotted screw for adjusting the brightness of the system display.

2.1.3 Secondary keypad

[13] LED 48 kHz Is lit when the D820 MCH operates with a sampling frequency of 48 kHz.

[14] LED 44.1 kHz Is lit when the D820 MCH operates with a sampling frequency of 44.1 kHz.

[15] LED VS mode Is lit when the D820 MCH operates in varispeed mode.

[16] LED 44.056 kHz Is lit when the D820 MCH operates with a sampling frequency of 44.056 kHz.

[17] LED Extern Clock Is lit when the D820 MCH is operated with an external clock. Flashes if the external clock is not valid.

[18] LED Intern Clock Is lit when the D820 MCH is operated with the internal clock.

[19] LED Remote Is lit when the D820 MCH remote control has been activated with the REMOTE button located under the hinged cover.

[20] LED Test Mode Is lit when the D820 MCH operates in test mode.

[21] LED Extern Master Is lit when the RT or TC of an external master is displayed.

[22] LED Advanced Output Is lit when the D820 MCH is operated in advanced output mode (standard user key 3).

[23] LED Local Is lit when the RT or TC from the tape of the D820 MCH is displayed.

[24] LED DIFF Is lit when the tape counter has been changed over with the code key **[38]** to differential indication (difference of the tape position between master and slave).

[25] LED CUED Is lit when the D820 MCH has reached the parking address (cue point) with the internal synchronizer.

[26] LED SYNC Is lit when the D820 MCH, has reached synchronism with the master its via internal synchronizer.

[27] LED MASTER (NO CODE) Glows if no valid TC data are available on the TC input.

[28] LED SLAVE (NO CODE) Glows if no valid TC can be read from the tape of the D820 MCH.

[29] Display Real-time indication at all tape speeds in hours, minutes, seconds and milliseconds. Switchable to displaying a second counter with user-selectable reference LAP (L), reference track RT (r) and time code TC (t).

[30] TIME Changeover of the tape timer display between tape counter, TC (t), RT (r) and LAP (L). The machine and the remote control always display the same time base.

[31] RESET TIMER Reset key for the tape counter or LAP (L) display.

[32] HOLD Freezes the momentarily displayed tape timer reading (also LAP). The frozen tape position can be stored as a locate address by pressing a LOC key. The tape timer then continues to run normally (HOLD is dark). Pressing the same LOC key again initiates an automatic search of the stored tape address.

[33] LOC 1 Automatic search of the tape address stored in LOC 1. The LOCATE address is displayed for as long as this key is pressed. The internal memory always relates to the actual tape position, i.e. if the tape counter is set to zero with the RESET TIMER key, the LOCATE address is automatically recalculated.

[34] ZERO LOC Automatic search of the tape address corresponding to the counter reading 0.00.00.0.

[35] LOC START Automatic search of the tape address at which the last PLAY command was entered (while the tape was standing still). Depending on the programming (LOC START PLAY, LOC START STOP or LOC START REC function), the machine switches subsequently to PLAY, STOP or RECORD mode.
Default: LOC START STOP.

[36] LOCK Activates the synchronizer mode in which the D820 MCH (slave) attempts to lock to the master based on a time reference (TC or RT).

[37] INST. LOCK Analogous to LOCK. In addition the momentary time difference between the D820 MCH (slave) and the master is stored in the offset register, and LOCK is initiated with active offset.

[38] CODE Change over of the tape timer display to: SLAVE (tape address of D820 MCH), MASTER (external source), and DIFF (difference between MASTER and SLAVE)

[39] UNLOAD Key for retracting the tape guide assembly. Spooling motor control switched off. Effective in STOP only.

2.1.4 Function and Programming Keypad (under the hinged cover)

[40] ↓NEXT
[41] ←CURSOR
[42] →CURSOR
[43] ↑LAST
Keys for paging through the menu and for moving the cursor on the system display.

[44] STORE Key for storing a modified parameter, for switching over a function that is not assigned to any key, for reprogramming a key function (if pressed together with the corresponding USER key) or for acknowledging an error message.

[45] AOR If activated in synchronizer mode, time jumps in the code of the D820 MCH (slave) are automatically accumulated and used immediately as the offset.

[46] SET TC GEN On/off switch for setting the parameters of the internal time code generator.

[47] SET LOC ADDR For entering locator addresses

[48] SET TIMER For programming the timer (see sect. 2.3.4.)

[49] SAMPLING FREQU To select the sampling rate

[50] SET OFFSET For entering the offset between MASTER and SLAVE

[51] EXT CLOCK Changeover between the internal quartz or an external clock reference.

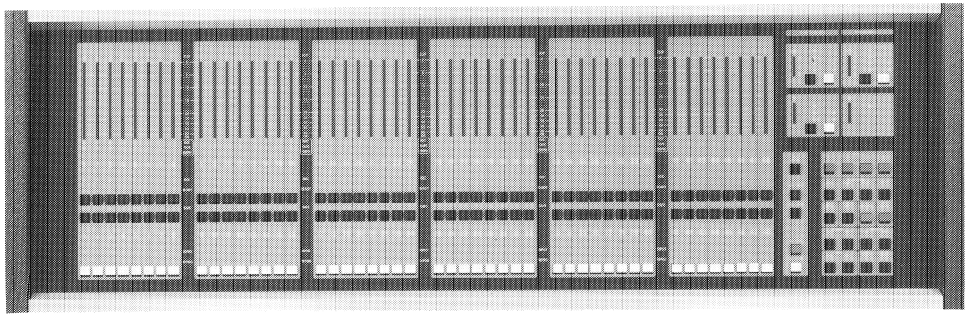
[52] VARISP On/off switch for variable tape speed

[53] SET VARISP Activates the VARISPEED input with the aid of the SET/CUE wheel.

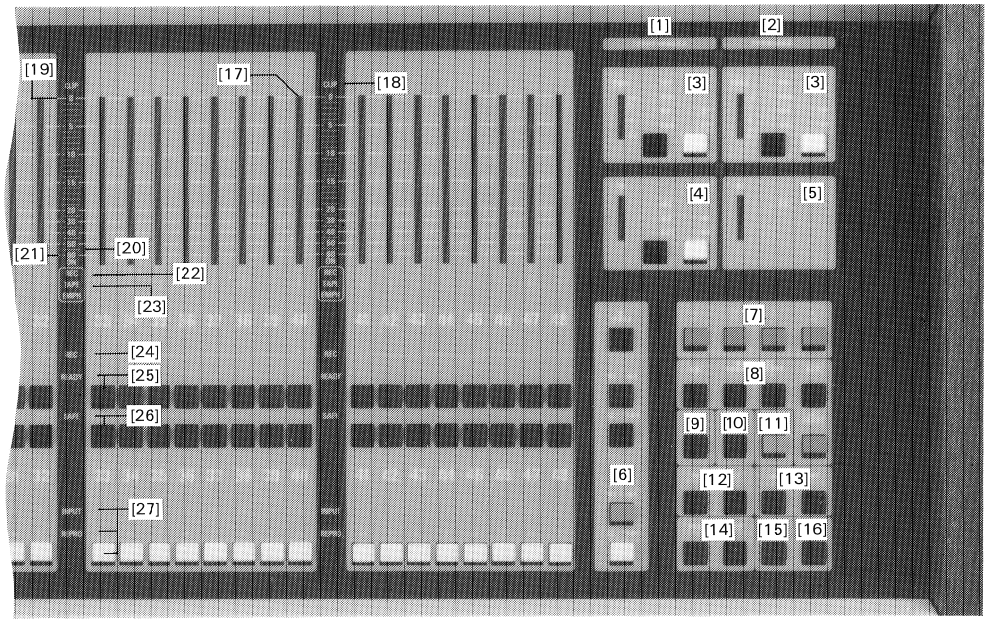
[54] REMOTE Activates the remote control unit.

2.2 Channel Controls

Overview:



2.2.1 Explanation of Keys/Operating



[1] Format mismatch

This LED flashes if the recorder is controlled with an external clock reference whose sampling frequency does not match the sampling frequency on the tape. An error message is shown on the display.

[2] System Error

The LED flashes to indicate faults in the power supply, tape deck, electronics, etc. A corresponding error message is shown on the display. The error messages explained in section 13.

[3] CUE1 and CUE2

The CUE channels 1 and 2 can be switched to SAFE, READY or AREC with one changeover key each. The current state is indicated by the corresponding LED.

AREC: Autorecord cue tracks; if this mode is selected, the cue channels switch to record automatically as soon as the machine is started in play mode.

[4] TC

SAFE and READY for the time code track are activated with a toggle switch. The current state is indicated by the corresponding LED.

[5] RT

The red LED is lit when the RT track (reference track) is in record mode. Safe/ready for the RT track can be preselected by activating the corresponding RECORD MODE:

- NEW REC: RT track set to READY
- ASSEMBLE REC: RT track set to READY
- INSERT REC: RT track set to SAFE

[6] ALL keys

ALL READY: The ALL READY key must be pressed together with the ALL ENABLE key. All 48 audio channels are simultaneously switched to record mode.

ALL SAFE: The ALL SAFE key inhibits recording on all 48 channels.

ALL INP: Connects the signals available on the inputs of the 48 audio tracks to the corresponding outputs.

ALL REP: Connects the signals of all 48 audio channels from tape to the audio outputs.

ALL ENABLE: See description of ALL READY

[7] USER keys

The USER keys are programmed with the following functions:

USER 1: **TC LOCK** ON/OFF (F064)
When LED is lit: TC LOCK switched on.

USER 2: **TC INPUT** GEN/EXT (F065)
When LED is lit: TC is recorded from the external input.

USER 3: **ADVANCED OUTPUT** ON/OFF (F001)
When LED is lit: Advanced output mode is switched on.

USER 4: **LIBRARY WIND** ON/OFF (F020)
When LED is lit: Library wind speed is preselected.

[8] RECORD MODE keys

SET ENABLE: Enable key for the functions NEW, ASSEMBLE, INSERT and MUTE. This key must be pressed simultaneously with the key for the desired function.

NEW: NEW RECORD MODE
Only if all digital audio channels are set to READY will all channels be switched to RECORD with the REC command. Recording with the 1st record head (NEW REC HEAD) and RT encoding.

ASSEM: ASSEMBLE RECORD MODE
Only if all digital audio channels are set to READY will all channels be switched to RECORD with the REC command. Recording with the 2nd record head (SYNC REC HEAD) and continours RT encoding (JAM SYNC).

INSERT: INSERT RECORD MODE
The REC command switches all READY channels to RECORD. RT must exist! Recording with the 2nd record head (SYNC REC HEAD).
No RT recording.

MUTE:
- This key switches to the **RECORD MUTE SET** mode and back. The RECORD MUTE LED **flashes** in set mode. In this mode the tracks for recording a digital "zero" signal can be selected with the INPUT/REPRO keys. Selected channels are indicated with a lit INPUT LED. **ALL ENABLE** and **ALL INPUT** pressed together switch all tracks simultaneously to RECORD MUTE.
- The **RECORD MUTE** mode is switched on or off if the SET ENABLE key is depressed while RECORD MUTE is pressed.

Note As soon as MUTE is activ (MUTE LED is lit) the INPUT LED's are flasching in all tracks preselected for mute operation. In other tracks (MUTE LED dark) the ordinary display is shown.

[9] PING-PONG

The PING-PONG function copys one digital audio channel to one or several other digital audio channels (internal connections). This function is disabled in NEW RECORD mode.

Setting procedure:

1 Calling the PING-PONG mode:
Press the PING-PONG key.
- PING-PONG LED flashes = programming mode active.
- One REPRO LED indicates the source channel
- All target channels are indicated with lit INPUT LEDs.

2 Select the source (channel to be copied):
Switch the source channel to **REPRO** with the INPUT/REPRO key (toggle function on/off). As only one channel can be copied the previously selected source has first to be switched off.
- The REPRO LED of the selected channel, i.e. the source channel from which the recording is to be copied, will light up (only one channel).

3 Select the target (channels on which to be recorded):
The source can be copied to several target channels. These have to be switched to INPUT with the INPUT/REPRO key (toggle function on/off).
- The INPUT LEDs of the selected target channels are lit.

4 Storing the programmed function:
Press the PING-PONG key.
- PING-PONG LED lights up permanently = function active.
- The selected target channels are switched to READY automatically.
- Ping-pong source- and target channels are switched to REPRO automatically.
  The machine is ready for the copying (transfer) process.
- SAFE/READY and INPUT/REPRO functions for the remaining channels are again normally active.

5 Start PING-PONG recording (PLAY + RECORD)

6 Terminate the PING-PONG mode:
Press the PING-PONG key.
- The PING-PONG LED turns off.

Note: The PING-PONG configuration is stored after the ping-pong mode has been terminated and after power off.

[10] MASTER SAFE

ON: LED is lit: Recording inhibited. All channel (digital audio and Cue) are automatically switched to SAFE.
OFF: LED dark: Recording is possible.

[11] REHEARSE

ON: LED is lit: This function simulates recording without writing on tape. All READY channels are switched to INPUT at the next punch-in, but the signal is not transmitted to the record head. The PLAY and RECORD keys are flashing. This functions is only enabled in INSERT and ASSEMBLE RECORD modes.
OFF: LED dark: In RECORD mode all READY channels are recorded.

[12] CHANNEL

2-button operation with INPUT/REPRO keys.

OFF: Switches an audio track completely off, i.e. the corresponding audio output is muted. The bottom LED in the bargraph of the corresponding track turns off. No signals will be recorded on a track that has been switched off. All indications of such a channel are turned off.
For switching off a track, simultaneously press the CHANNEL OFF key and the INPUT/REPRO key of the corresponding track.

ON: Reactivates a track that has been switched off with the CHANNEL OFF function. For this purpose press the CHANNEL ON key simultaneously with the INPUT/REPRO key of the corresponding track.
Confirmation: The red LED "ON" of the corresponding bargraph display is lit.

Notes:
- If instead of an INPUT/REPRO key the ALL ENABLE key is pressed, all disabled tracks are reactivated.
- In RECORD mode the tracks can not be switched on or off.

[13] EMPHASIS

2-button operation with INPUT/REPRO keys.

ON: Activates the emphasis filter (only for digital audio channels switched to "analog input").
While the ON key is held down (ON LED lights up as long as this key is pressed), you can activate the emphasis filters in the analog input of one or several digital audio channels (the REC EMPH LEDs of the corresponding channels will light up) by pressing the INPUT/REPRO keys.
- To switch on emphasis in all channels simultaneously press ALL ENABLE and EMPHASIS ON.

OFF: Deactivates the emphasis filters. Operation analogous to ON.

Note: For mixed operation analog/digital input:
The emphasis filters exist only in the analog input path and not in the digital input path. The activation of the emphasis filters consequently applies to those channels only which are switched to "Input analog". In the case of "Input analog" the "REC EMPH LEDs" indicate whether or not the emphasis filter in the corresponding channel is switched on. For "Input digital" the "REC EMPH LEDs" indicate whether or not the emphasis bit in the input data of the corresponding channel is set.

[14] PEAK HOLD

OFF LED dark: The level indicator (bargraph) displays the current audio level by means of a number of LED segments (column).

TEMPORARY Pressing the PEAK key **once** (LED lights up) activates the **temporary** PEAK HOLD mode.
The peak level is indicated for approx. 3 seconds by the top LED segment of the bargraph. The peak level is then reset unless it is overwritten by an even higher level.

PERMANENT Pressing the PEAK key **twice** (LED continues to be lit) activates the **permanent** PEAK HOLD mode.
In this mode the peak level is stored for an indefinite time and displayed by the top LED segment. This mode is very useful for optimizing the level setting for a recording because the top segment represents the highest level that has occurred. To cancel the PEAK HOLD MODE press the PEAK HOLD key again.

RESET The currently stored peak level value is reset to -60 dB and the highest LED segment held in PEAK HOLD mode is switched off.

[15] AUTO INPUT

ON: LED is lit: The digital audio and the two cue channels are automatically switched to "Input" (INPUT LEDs are lit) if the recorder is not in PLAY or RECORD mode.
The desired operating mode has to be selected in the System Display (F002: AUTO INPUT A/B)
OFF: LED is dark: The normal "INPUT/REPRO" configuration will be re-established as it existed prior to the activation of AUTO INPUT.

Note: There are two AUTO INPUT modes:
In mode A all channels switch to "Input", in mode B only those channels which are in "READY" condition.
(Setting in menu Functions/Audio/F002: AUTO INPUT A/B)

[16] AUTO MUTE

ON: LED is lit: The cue tracks are muted when PLAY, EDIT and SHUTTLE mode is terminated.
OFF: LED is dark: The audio outputs of the cue tracks remain always active.

[17] BARGRAPH scale

The scale is linear, but subdivided into two sections with different resolution:
0 ... -20 dB 1 LED ≙ 1 dB
- 20 ... -60 dB 1 LED ≙ 5 dB

[18] Clip

Clipping: This LED indicates overload of the A/D converter. They are active in INPUT condition for analog inputs and in REPRO condition during RECORD mode.

[19] 0 dB

The peak value of the signal is between 0 dB ... 0.75 dB.

[20] -55 dB

The peak value of the signal is between -55 dB ... -59.75 dB.

[21] -60 dB

The peak value of the signal is between -60 dB ... 63.5 dB.

[22] REC (EMPH)

LED for emphasis On/Off (Emphasis filter in the analog input).

[23] TAPE (EMPH) LED for emphasis on tape Yes/No (Data on tape were recorded with emphasis).

[24] REC Red LED pilot for Record (channel is in record mode).

[25] READY Pushbutton to activate the record READY (Standby) function. When activated, the green LED flashes.

[26] SAFE Pushbutton to prevent accidental erasure by disabling the record function. The yellow LED for the respective channel is on when recording is disabled.

[27] INPUT / REPRO Pushbutton allowing to select the monitoring of the input- or the output signal. The selected monitoring mode is signalled by the respective yellow LEDs.

2.3 System Display

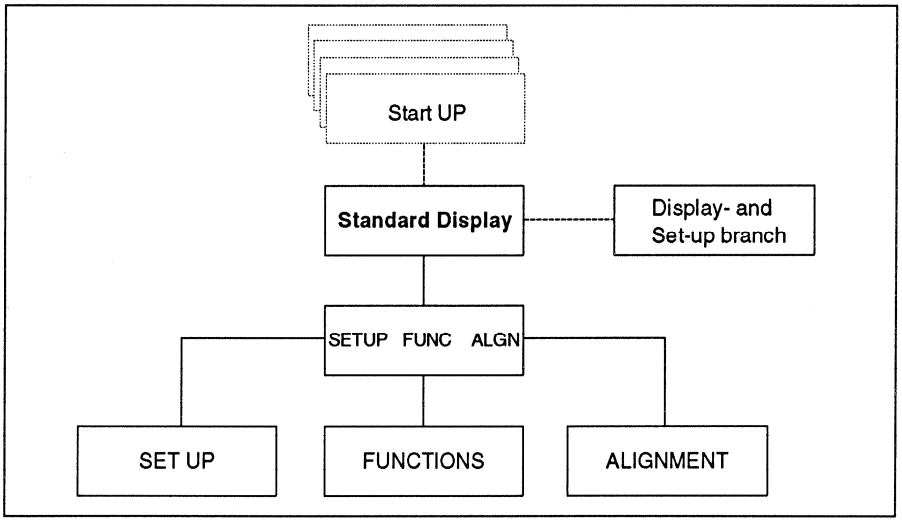
2.3.1 Function

The system display is an alphanumeric LC display for indicating the system state, line level, time code on tape, and error messages. It is also used for reading the parameters of the programmed USER keys.

Note:
- Words written in capital letters such as NEXT, UP, DOWN refer to operating control keys or displays.

2.3.2 Menu tree

The menu tree basically has four main branches:
- Display and setup branch for the keys providing direct access to functions and settings located under the hinged cover.
  (exceptions: AOR, sampling frequency, ext. clock, remote).
- SET UP branch
- FUNCTIONS branch
- ALIGNMENT branch



Note: Values that flash on the LC display are not stored yet. When STORE is pressed, the flashing value is stored and the flashing changes to continuous light.

2.3.3 Access to the menu tree

NEXT↓, LAST↑, CURSOR ←/→

With the four blue keys located under the hinged cover you can navigate through the menu tree to the desired setup windows.
In normal operation, the following **standard window** is displayed:

```
CLIP LEVEL: xx.x dBu
TC ON TAPE: yy Frm/s
```

It provides information about the currently set clip level as well as the frame rate detected on the TC track.
Input range: xx.x: 14.0 ... 24.0 dBu
yy: -- / 24 / 25 / 29 / 30 Frm/s.
-- means frame rate still unknown or undefined

LAST ↑ When you press the key LAST, the same information is displayed which also appeared for a few seconds when the machine was switched on.
These are:

```
D820 MCH MULTICHANNEL
DASH TAPE RECORDER
```

Machine type and recording method. (DASH: Digital Audio Stationary Head).

```
D820 MCH   SOFTWARE
V 3.0        ww/yy
```

Start of the system test with information on the software version and date.
(ww = week, yy = year).

Important: Please specify this software release date in all inquiries to a Studer dealer.

```
CONFIGURATION:
XX CHANNELS
```

Configuration of channels according to the setting of jumper JP2 on the CIF-Board. (XX = 8 / 16 / 24 / 32 / 40 / 48 channels)

```
ERROR MESSAGE:
no errors detected
```

When the D820 MCH is powered on, a system test is performed. If no errors are detected, the above window is displayed, otherwise a plain text error message is shown (see Section 4.8).

Errors If any error or warning situation (e.g. malfunction, instruction error, missing clock, incorrect sampling frequency, etc.) occurs during operation, an error message is displayed automatically. Error messages can be acknowledged or recalled on the display by pressing the STORE key. If more than one message exists, they can be recalled by pressing the STORE key repetitively.

2.3.4 Direct access keys for functions and settings

Frequently used functions and settings can be accessed by the SET function keys located under the hinged cover. With the exeption of AOR these settings are not available in the menu tree.
The corresponding settings appear on the display after a SET function key has been pressed.

Example:

SET OFFSET

```
SET SYNCHR OFFSET
+0.04.09.234
```

Setting an address

Position the cursor with the cursor keys ← / → below the desired number and change the value with the SET/CUE wheel. When the complete address has been entered, press the STORE key to save the address. The figure being changed flashes until it will be stored.
All other parameters are changed analogously.

Quitting the menu

To return to the standard window, press the key LAST↑, the two keys NEXT↓ + LAST↑ or the SET key.

Example: Changing the tape timer mode

Display shows:

Operator action:

- Switch the machine to STOP
- Press the following SET function key located under the hinged cover:

  SET TIMER

- With the SET/CUE wheel modify the value as desired.
- Move the cursor with the cursor keys to the desired figure.

```
SET TAPE TIMER
  +2.01.25.164
```

- Press STORE to save the setting or quit this mode by pressing
- Repeat the SET TIMER key and steps for the rest of the figures

```
SET TAPE TIMER
  +0.04.24.000
```

Example: Setting the time code generator mode

Display shows:

Operator action:

- Switch the machine to STOP
- Press the following SET function key:

  SET TC GEN

SET: TC GENERATOR
MODE ADDR

- Pres CURSOR → to change the frame rate.
- Press CURSOR ↓ to select TC GENERATOR MODE

TC GENERATOR MODE
M:freerun FR:25F/s

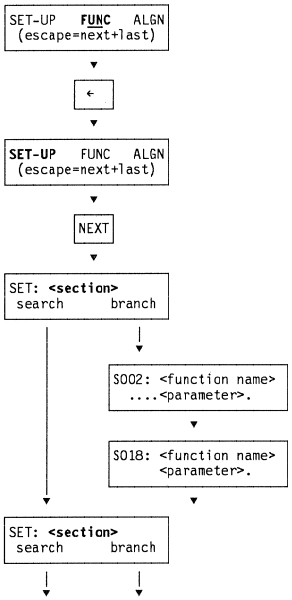
- With the SET/CUE wheel change the value to 30 F/s.
- Press STORE to save the setting or quit this mode by pressing the SET TC GEN key again.

2.3.5 SET-UP menu

Menu / cursor

The SET-UP menu contains alphabetically sorted sections for configuration settings.
With the **blue keys NEXT↓, CURSOR ←/→, LAST↑** you can navigate the cursor through the menu.
Position the cursor (represented as an underscore character) below **"search"** and press the NEXT↓ key to step forward to the next section.
If you now position the cursor below **"branch"** and press the NEXT↓ key, the submenu for entering the parameters is activated.

Starting from the standard window activate the SET-UP branch by pressing the NEXT key. Access the SET-UP as follows:



Change settings

The **parameters** are entered with the **SET/CUE wheel** and saved in memory when the **STORE key** is pressed. The selected value flashes on the display until it will be stored.

Note: As long as the STORE key remains pressed, the values selected with the SET/CUE wheel are continually stored. The final value in memory is the one which was in effect when the STORE key has been released.

In order to enter a parameter that consists of several digits, the latter must be set consecutively with the SET/CUE wheel. For this purpose position the cursor below the corresponding digit. As soon as all digits are set correctly press STORE.

Example: Set Library wind to 8m/s

Display shows:

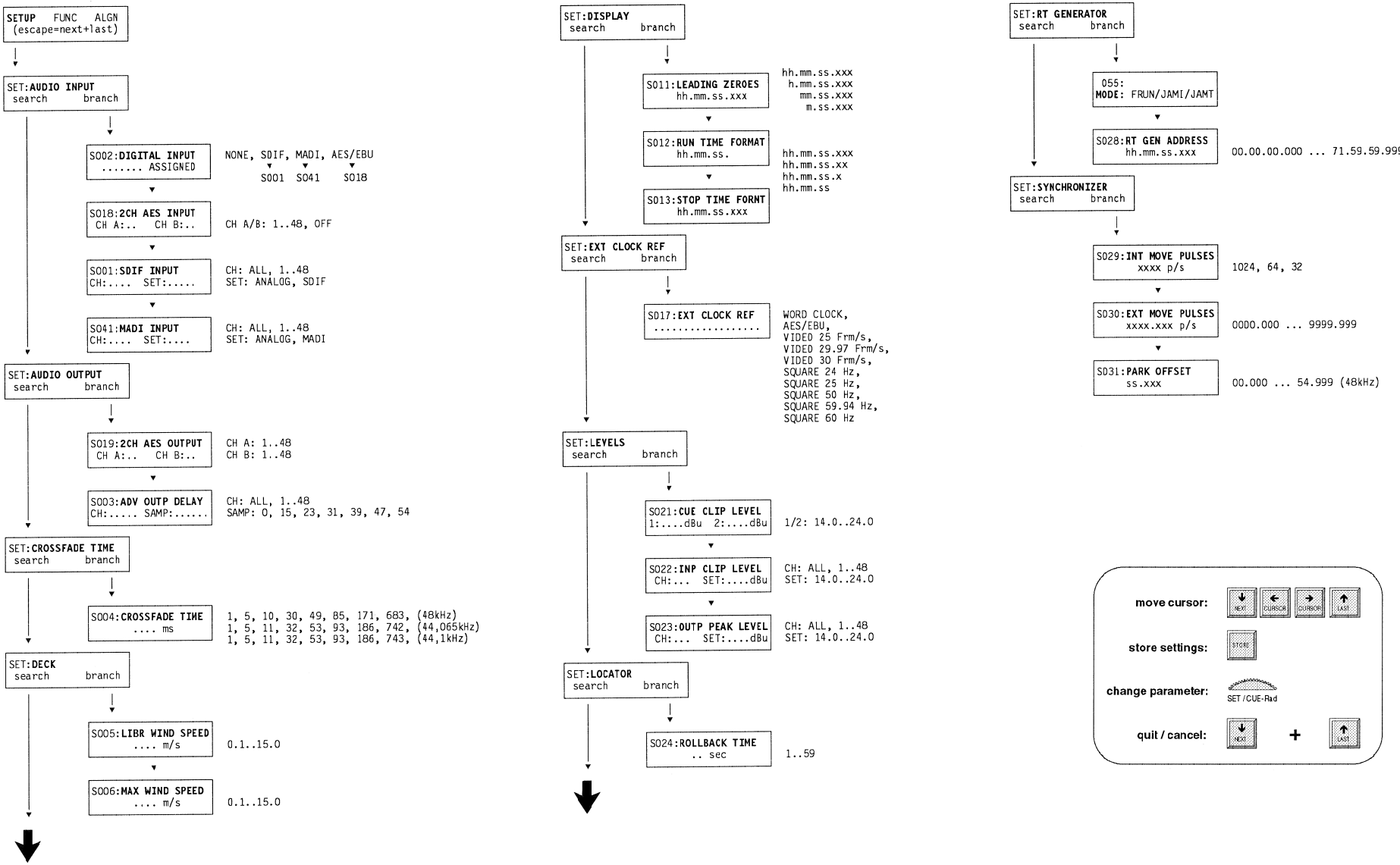
S005:LIBR WIND SPEED
8.0 m/s

Operator action:

- Switch the machine to STOP
- Press the following keys:
  ↓ ← 4x ↓ → ↓
- With the SET/CUE wheel change the value to 8m/s.
- Press STORE to save the setting.
- To quit the menu branch, press NEXT and LAST simultaneously or page to the next programming with the NEXT key.

SET-UP

SW V 3.0


SETUP FUNC ALGN
(escape=next+last)
SET:AUDIO INPUT
search branch
S002:DIGITAL INPUT
..... ASSIGNED
NONE, SDIF, MADI, AES/EBU
S001 S041 S018
S018:2CH AES INPUT
CH A:.. CH B:..
CH A/B: 1..48, OFF
S001:SDIF INPUT
CH:.... SET:.....
CH: ALL, 1..48
SET: ANALOG, SDIF
S041:MADI INPUT
CH:.... SET:....
CH: ALL, 1..48
SET: ANALOG, MADI
SET:AUDIO OUTPUT
search branch
S019:2CH AES OUTPUT
CH A:.. CH B:..
CH A: 1..48
CH B: 1..48
S003:ADV OUTP DELAY
CH:..... SAMP:.....
CH: ALL, 1..48
SAMP: 0, 15, 23, 31, 39, 47, 54
SET:CROSSFADE TIME
search branch
S004:CROSSFADE TIME
.... ms
1, 5, 10, 30, 49, 85, 171, 683, (48kHz)
1, 5, 11, 32, 53, 93, 186, 742, (44,065kHz)
1, 5, 11, 32, 53, 93, 186, 743, (44,1kHz)
SET:DECK
search branch
S005:LIBR WIND SPEED
.... m/s
0.1..15.0
S006:MAX WIND SPEED
.... m/s
0.1..15.0
SET:DISPLAY
search branch
S011:LEADING ZEROES
hh.mm.ss.xxx
hh.mm.ss.xxx
h.mm.ss.xxx
mm.ss.xxx
m.ss.xxx
S012:RUN TIME FORMAT
hh.mm.ss.
hh.mm.ss.xxx
hh.mm.ss.xx
hh.mm.ss.x
hh.mm.ss
S013:STOP TIME FORNT
hh.mm.ss.xxx
SET:EXT CLOCK REF
search branch
S017:EXT CLOCK REF
.....
WORD CLOCK,
AES/EBU,
VIDEO 25 Frm/s,
VIDEO 29.97 Frm/s,
VIDEO 30 Frm/s,
SQUARE 24 Hz,
SQUARE 25 Hz,
SQUARE 50 Hz,
SQUARE 59.94 Hz,
SQUARE 60 Hz
SET:LEVELS
search branch
S021:CUE CLIP LEVEL
1:....dBu 2:....dBu
1/2: 14.0..24.0
S022:INP CLIP LEVEL
CH:... SET:....dBu
CH: ALL, 1..48
SET: 14.0..24.0
S023:OUTP PEAK LEVEL
CH:... SET:....dBu
CH: ALL, 1..48
SET: 14.0..24.0
SET:LOCATOR
search branch
S024:ROLLBACK TIME
.. sec
1..59
SET:RT GENERATOR
search branch
055:
MODE: FRUN/JAMI/JAMT
S028:RT GEN ADDRESS
hh.mm.ss.xxx
00.00.00.000 ... 71.59.59.999
SET:SYNCHRONIZER
search branch
S029:INT MOVE PULSES
xxxx p/s
1024, 64, 32
S030:EXT MOVE PULSES
xxxx.xxx p/s
0000.000 ... 9999.999
S031:PARK OFFSET
ss.xxx
00.000 ... 54.999 (48kHz)
move cursor:
NEXT
CURSOR
CURSOR
LAST
store settings:
STORE
change parameter:
SET / CUE-Rad
quit / cancel:
NEXT
+
LAST

SET-UP description

AUDIO INPUT

```
S002: DIGITAL INPUT
fffffff  assigned
```

```
fffffff: NONE (=analog IN)
                MADI
                SDIF
                AES/EBU
```

The input selector switch of every digital audio channel is either set to MADI (48CH), SDIF (48CH) or AES/EBU (2CH) or to analog input (NONE). For every digital format there is a menu for track assignment. Digital input formats can't be mixed. Single channels may be fed with an analog input signal while other channels are configured for digital input.

After the selection of an input source with the SET/CUE wheel save the setting with STORE. If the message "assign" is flashing in the display all channels are set to ANALOG or are switched OFF in the corresponding assignment menu (see below). If you press STORE once again the track assignment menu for the chosen digital format is called (see S001, S018, S041).

Selecting the input source

1) Call menu **DIGITAL INPUT** (S002): Select source signal digital / analog.
2) If a digital input format has been selected press STORE once again. The corresponding **track assignment** menu appears. Enter the desired tracks.
3) Set **clock reference** INT/EXT. (EXT CLOCK key or menu F013)
4) For external clock reference set desired **clock format** (menu S017).

```
S018: 2CH AES INPUT
 CH A:..    CH B:..
```

```
CH A/B: 1..48, OFF
```

This menu assigns one track each to channel A and B of the AES/EBU interface. The assigned audio tracks are switched to DIGITAL INPUT automatically if AES/EBU is selected as a digital input format (S002). All other input channels are set to analog input. It is not possible to assign both AES/EBU channels to the same audio track.
If the digital **input format** (S001) is set to **AES/EBU** the following settings are automatically configured.

- Clock setting for AES/EBU format: CLOCK REFERENCE = **EXT CLOCK** (see F013)
- EXT CLOCK REF = **AES/EBU** (see S017).
- The two tracks assigned to the AES/EBU channels are switched to DIGITAL INPUT, all other tracks to ANALOG INPUT.

```
S001: SDIF INPUT
 CH:...   SET:......
```

```
CH: ALL, 1..48
SET: ANALOG, SDIF
```

This menu determines the track configuration in case that **SDIF** is selected as a digital input format. A digital or an anlog input source can be selected for each track individually or for all tracks at once. It is thus possible to combine one digital input format with analog inputs. Several digital formats can never be recorded at the same time.
First select a single or all channels and second determine the signal source (analog/SDIF). The setting of each track has to be saved with the STORE key.
If CH = ALL is selected and not all channels are switched to ANALOG or DIGITAL input, the wording "**INDIV**"(idual) is shown on the display.
The message "**assign**" flashes after storing SDIF in the menu DIGITAL INPUT if all audio tracks are set to ANALOG. Only if SDIF is selected for at least one track the wording "**assigned**" is displayed steadily.
The **CLOCK REFERENCE** for **SDIF signals** has to be set to EXTERNAL (F013 or EXT CLOCK key).

```
S041: MADI INPUT
 CH:...   SET:......
```

```
CH: ALL, 1..48
SET: ANALOG, MADI
```

This menu determines the track configuration in case that **MADI** is selected as a digital input format. It is only active if the optional **MADI interface** is available. A digital or an anlog input source can be selected for each track individually or for all tracks at once. It is thus possible to combine MADI input channels with analog inputs. Several digital formats can never be recorded at the same time.
First select a single or all channels and second determine the signal source (ANALOG/MADI). The setting of each track has to be saved with the STORE key.
If CH = ALL is selected and not all channels are switched to ANALOG or DIGITAL input, the wording "**INDIV**"(idual) is shown on the display.

The message **"assign"** flashes after storing MADI in the menu DIGITAL INPUT if all audio tracks are set to ANALOG. Only if MADI is selected for at least one track the wording **"assigned"** is displayed steadily.
The **CLOCK REFERENCE** for **MADI signals** has to be set to EXTERNAL (F013 or EXT CLOCK key) and the format (S017) to WORD CLOCK or to AES/EBU.

AUDIO OUTPUT

All analog and digital output signals are available at the same time independantly of the selected signal source.

```
S019: 2CH AES OUTPUT
 CH A:..    CH B:..
```

CH A/B: 1..48

Specifies the digital audio channel(s) to be assigned to the audio channels A and B of the AES/EBU interface. The same digital audio channel can be assigned to both AES/EBU output channels.

```
S003: ADV OUTP DELAY
CH:...    SAMP:.....
```

CH: ALL, 1..48
SAMP: 0, 15, 23, 31, 39, 47, 54 f

Setting the delay time for ADVANCED OUTPUT mode (see F001). The delay is measured in samples and can be selected in 7 steps. The delay time varies slightly depending on the sampling frequency (see following table).

PRE-DELAY	DIGITALLY COMPENSATED TIME (µs)		
SAMPLES:	48,0 kHz	44,1 kHz	44,056 kHz
0	0	0	0
15	312,5	339,8	340,1
23	479,2	521,0	521,5
31	645,8	702,2	702,9
39	812,5	883,5	884,4
47	979,2	1064,71	1065,8
54	1125,0	1223,3	1224,5

With the "0" setting you can remove individual channels from the ADVANCED OUTPUT MODE.

CROSSFADE TIME

```
S004: CROSSFADE TIME
      .... ms
```

The crossfade time can be set in 8 steps. The displayed value corresponds to the following actual crossfade times:

1, 5, 10, 30, 49, 85, 171, 683 (48kHz)
1, 5, 11, 32, 53, 93, 186, 742 (44,1kHz)
1, 5, 11, 32, 53, 93, 186, 743 (44,065kHz)

CROSSFADE TIME in **ms**		
48.0 kHz	44.1 kHz	44.065 kHz
1.0	1.1	1.1
4.9	5.3	5.3
10.2	11.1	11.1
29.7	32.3	32.3
48.8	53.1	53.1
85.3	92.8	92.9
170.7	185.6	185.8
682.7	742.3	743.0

DECK

S005:**LIBR WIND SPEED**
.... m/s

0.1..15.0

Specifies the maximum winding speed for library wind (see F020). The library wind speed can be no greater than the maximum spooling speed (see S006).

S006: **MAX WIND SPEED**
.... m/s

5.0..15.0

Specifies the maximum winding speed in all spooling modes. Also see S005: LIBR WIND SPEED.

DISPLAY

S011: **LEADING ZEROES**
hh.mm.ss.xxx

Specifies the number of leading zeros on the time display while the tape is moving.

format:	example 1:	example 2:	example 3:
hh.mm.ss.xxx	00.00.00.000	6.57.39.245	-0.00.02.768
h.mm.ss.xxx	0.00.00.000	6.57.39.245	-0.00.02.768
mm.ss.xxx	00.00.000	6.57.39.245	- 00.02.768
m.ss.xxx	0.00.000	6.57.39.245	- 0.02.768

S012:**RUN TIME FORMAT**
hh.mm.ss.xxx

Specifies the number of trailing zeros on the time display while the tape is moving.

S013:**STOP TIME FORMT**
hh.mm.ss.xxx

Specifies the number of trailing zeros on the time display while the tape stands still:

Stop Time format:	display "**Frames**"	display "**ms**"
hh.mm.ss.xxx	1.35.45.**18**	2.57.39.**245**
hh.mm.ss.xx	1.35.45.**18**	2.57.39.**24**
hh.mm.ss.x	1.35.45	2.57.39.**2**
hh.mm.ss	1.35.45	2.57.39

EXT CLOCK REF

S017: **EXT CLOCK REF**
.....

see table →

Specifies the external clock reference for synchronisation of the digital audio signal. The reference selected in this menu will only be used if the CLOCK REFERENCE is set to EXTERNAL. (F013 or EXT CLOCK key)

EXT. CLOCK REFERENCE	VARISPEED	SAMPLE FREQ.SELECTION
WORD CLOCK	disabled	disabled (auto)
AES/EBU	disabled	disabled (auto)
VIDEO 25 Frm/s	enabled	enabled
VIDEO 29.97 Frm/s	enabled	enabled
VIDEO 30 Frm/s	enabled	enabled
SQUARE 24 Hz	enabled	enabled
SQUARE 25 Hz	enabled	enabled
SQUARE 50 Hz	enabled	enabled
SQUARE 59.97 Hz	enabled	enabled
SQUARE 60 Hz	enabled	enabled

LEVELS

S021: **CUE CLIP LEVEL**
1:....dBu 2:....dBu

1/2: 14.0..24.0

Specifies the input - and output clipping levels for the **CUE-TRACKS.**
Inputs: A signal voltage corresponding to clipping level on the input, results in maximum digital modulation on tape (0dB).
Ausgänge: Maximum digital modulation on tape (0dB) results in a clip level voltage at the analog outputs.
Factory setting: +15.0dBu

S022:**INP CLIP LEVEL**
CH:... SET:....dBu

CH: ALL, 1..48
SET: 14.0..24.0

Specifies the analog **input clipping level** for the digital **audio channels.** A signal voltage corresponding to clipping level on the input, results in maximum digital modulation on tape (0dB).
Factory setting: +15.0dBu

If CH = ALL is selected and not all channels are set to the same level, the wording "**INDIV**"(idual) is shown on the display.

S023:**OUTP PEAK LEVEL**
CH:... SET:....dBu

CH: ALL, 1..48
SET: 14.0..24.0

Specifies the analog **output peak levels** for the digital **audio channels.** The peak output level corresponds to the maximum output level (0dB).

Factory setting: +15.0dBu
If CH = ALL is selected and not all channels are set to the same level, the wording "**INDIV**"(idual) is shown on the display.

LOCATOR

S024: **ROLLBACK TIME**
.. sec

1..59

Sets the ROLLBACK time for ROLLBACK mode (the tape transport rewinds by the ROLLBACK amount and, depending on the programmed ROLLBACK mode (see F045), subsequently activates either the STOP, PLAY or RECORD function. The programmed ROLLBACK time can be displayed by pressing the STOP and ROLLBACK keys.

RT GENERATOR

S055:
MODE: FRUN/JAMI/JAMT

Changeover of the RT GENERATOR mode. The Reference Track GENERATOR can generate RT addresses in three different ways:

FRUN: **FREE-RUN** mode: When switching the recorder to record in the NEW RECORD mode the counter will start at the pre-programmed address. Programming of the RT generator address: see S028.

JAMI: **JAM INPUT**: An externally supplied RT address can be recorded. The RT generator synchronizes to the incoming RT signal.
(Connector EXT RT IN). Available only in NEW and INSERT RECORD MODES.

JAMT: **JAM TAPE**: The RT generator reads the RT address from tape and starts at this address for continuing a recording on an already existing RT code (ASSEMBLE and INSERT RECORD MODES only).

S028: **RT GEN ADDRESS**
hh.mm.ss.xxx

00.00.00.000 ... 71.59.59.999

Sets the RT GENERATOR SECTOR address according to the specified time address.
Prior to the recording of the RT-track in the NEW RECORD mode the start address of the RT-generator can here be set.

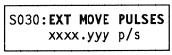
SYNCHRONIZER

S029:**INT MOVE PULSES**
xxxx p/s

1024, 64, 32

Specifies the number of move pulses per second being produced by the tape timer circuit. This parameter has to be set according to the jumper setting on the TAPE DECK COUNTER/TIMER board.

Note Jumper set towards centre of the board 1.820.823: 1024 p/s
Jumper set towards edge of the board 1.820.823: 64 p/s



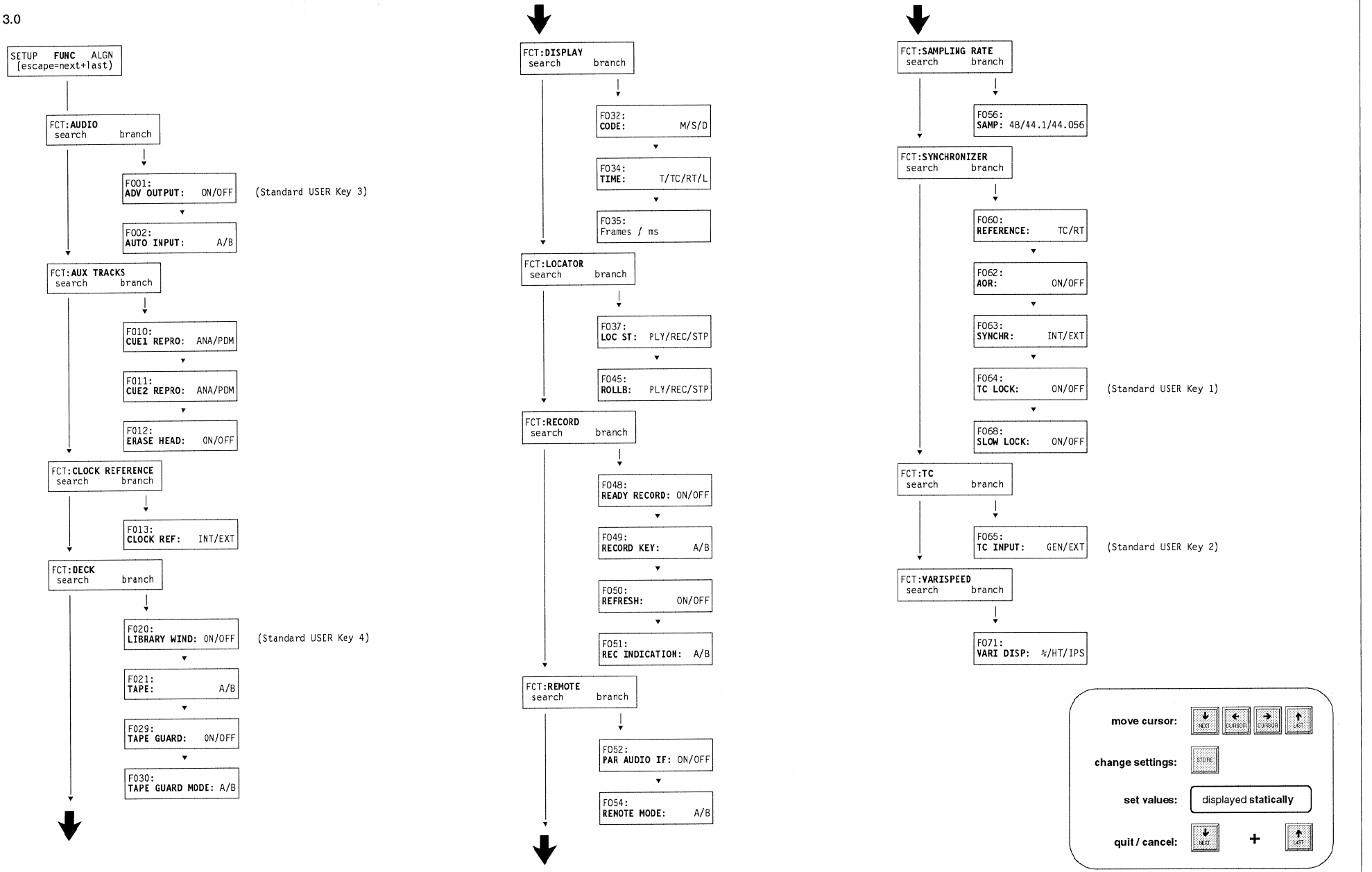
Specifies the nnumber of MOVE PULSES per second of the master recorder in synchronized operation. The internal synchronizer uses the move pulses as a substitute for missing TIMECODE or RT signals when they can't be read during winding

00.000 .. 59.999

Specifies the PARK OFFSET. A slave machine linked with the internal synchronizer to a master is positioned by the PARK OFFSET (seconds and frames) before the master if the later is in STOP mode.

FUNCTIONS

SW V 3.0



EDITION: 2. August 1993

2.3.6 FUNCTIONS menu

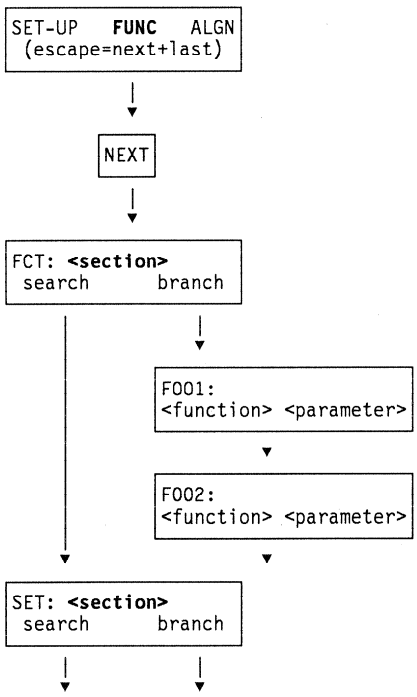
Like the SET-UP menu, the FUNCTIONS menu contains alphabetically sorted sections which are shown on the display under <section>. The following parameters of the function menu can alternatively be set with a key.

- Function CLOCK REF F013 (EXT CLOCK key)
- Function CODE F032
- Function TIME F034
- Function SAMP F056 (SAMPLING FREQU key)
- Function AOR F062

Menu / cursor

With the **blue keys NEXT↓, CURSOR ←/→, LAST↑** you can navigate the cursor through the menu.
Position the cursor (represented as an underscore character) below **"search"** and press the NEXT↓ key to step forward to the next section.
If you position the cursor below **"branch"** and press the NEXT↓ key, the submenu for entering the parameters is activated.

Starting from the standard window, activate the menu selection by pressing the NEXT key. Enter the FUNCTIONS branch with NEXT again.



Change functions

To modify a function proceed as follows: All available parameters are displayed in the window of a particular function. The set values are displayed statically, all other values are flashing. The function setting is changed and immediately stored if the STORE key is pressed. If there are several parameters press STORE repetitively until the desired setting is displayed without flashing.

Currently set functions

The set functions are displayed **statically.**
Disabled parameters are **flashing.**

Description of the FUNCTIONS menu

AUDIO

```
F001:
ADV OUTPUT:   ON/OFF
```

Standard **USER Key 3**

Switches the machine to ADVANCED OUTPUT MODE. Can be changed over in STOP mode only.

ON: ADVANCED OUTPUT MODE is active.
This mode is used if tracks existing on the tape are to be processed by external units and it they have to be returned to the tape in synchronism.
In advanced output mode the audio signals are output with a "negative delay" (i.e. early) and can thus compensate the delay of an external unit (e.g. digital mixing console or effect machine). Different compensation times can be selected in S0003.

OFF: NORMAL MODE. Compensation of the I/O delay is not possible (default).

```
F002:
AUTO INPUT:     A/B
```

AUTO INPUT switches all DIGITAL AUDIO channels and the CUE tracks to INPUT, provided the recorder does not operate in PLAY mode. AUTO INPUT has two modes which can be selected with this function.

A: AUTO INPUT MODE A switches **all** channels and cue tracks to input (Default).

B: AUTO INPUT MODE B switches only the READY channels to input.

AUX TRACK

```
F010:
CUE1 REPRO:   ANA/PDM
```

```
F011:
CUE2 REPRO:   ANA/PDM
```

The D820 MCH tape recorder does not use any bias current when recording **CUE tracks**, instead it uses the **PDM technique** (Puls Density Modulation). Certain other digital multitrack machines use the conventional method (with bias) for recording the CUE tracks. If tapes are played back that have not been recorded by the D820 MCH, the CUE reproduce electronics may possibly have to be switched to ANALOG demodulation.

ANA: For reproducing CUE tracks recorded in analog mode.

PDM: For reproducing CUE tracks recorded with PDM (Default).

```
F012:
ERASE HEAD:   ON/OFF
```

In NEW and ASSEMBLE RECORD mode the erase head for the AUX tracks is always enabled. When the machine is switched to INSERT RECORD MODE, the erase head is switched off, but the erase head can be switched on again by the user.

ON: The erase head is switched on in INSERT RECORD mode (if the corresponding channel is switched to READY).

OFF: The erase head remains switched off in INSERT RECORD mode.
Application: Erases the TC and/or CUE tracks.
The erase head does not have to be switched on if TC and/or CUE tracks are recorded by the D820 MCH.

CLOCK REFERENCE

```
F013:
CLOCK REF:    INT/EXT
```

The D820 MCH can either be controlled either by the built-in clock (quartz) or by an external clock generator (e.g. AES/EBU interface, word clock for a different digital tape recorder).
See also S017: EXT CLOCK REF.

INT: Switches the tape recorder to INTERNAL CLOCK operation if there is not AES/EBU format set (S002) otherwise it is without function (Default).

EXT: Switches the tape recorder to EXTERNAL CLOCK operation.

DECK

F020:
LIBRARY WIND: ON/OFF

Standard **USER Key 4**

LIBRARY WIND can be selected together with any spooling function (e.g. rewind, fast forward, locate). The spooling speed is reduced to a preselected value between 0.1 and 15.0 m/sec.
See also: LIBR. WIND SPEED.

ON: Winding with reduced library wind speed
OFF: Winding with maximum spooling speed (Default).

F021:
TAPE: A/B

The D820 MCH can store the head parameters for two different types of tape, referred to as TAPE A and TAPE B.

A: Selects tape type A (Default) Factory setting for AMPEX 467.
B: Selects tape type B. Factory setting for Sony Digital Tape.

F029:
TAPE GUARD: ON/OFF

From the difference in the rotational speeds of the two reels the machine knows that only a few turns of tape are left on the supply reel.

ON: Reduces the spooling speed or stops the spooling operation (depending in whether TAPE GUARD MODE A or B is selected) shortly before the tape unthreads (TAPE OUT). Also see F030 (Default).
OFF: The spooling speed is not reduced or the spooling operation does not stop before the tape unthreads.

F030:
TAPE GUARD MODE: A/B

Selects the type of TAPE GUARD function. See F029.

A: TAPE GUARD reduces the spooling speed.
B: TAPE GUARD stops the spooling operation.

DISPLAY

F032:
CODE: M/S/D

Changes over the code display mode. See also F034.

M: The EXTERNAL MASTER TAPE TIME is displayed. Depending on the selected display mode this can be the TIME CODE (TC) or REFERENCE TIME (RT).
S: The SLAVE (LOCAL) TAPE TIME is displayed. Depending on the selected display mode this can be either the TAPE TIMER, RELATIVE TAPE TIMER (LAP), TIME CODE (TC) or the REFERENCE TIME (RT).
D: The difference between the EXTERNAL MASTER TIME and the SLAVE (LOCAL) TAPE TIME is displayed. Depending on the selected display mode this can be either the TIME CODE (TC) or the REFERENCE TIME (RT).

F034:
TIME: T/TC/RT/L

Changes over the time display mode.

T: The tape timer is displayed.
TC: The time code is displayed.
RT: The REFERENCE time (RT) is displayed.
L: The relative tape timer (LAP) is displayed.

F035:
Frames / ms

Changes over the display mode for TC and RT between milliseconds and "frames". The settings of the SET-UP menus S012 (Run Time Format) and S013 (Stop Time Format) determine the number of trailing figures.

Frames Frames are displayed (max. 2 figures)
ms Milliseconds are displayed (max. 3 figures)

LOCATOR

F037:
LOC ST: PLY/REC/STP

Changes over the LOCATE START mode. The LOCATE START command searches the tape address at which the last PLAY command was entered and, depending on the programmed LOCATE START mode, switches to PLAY, RECORD or STOP.

PLY: Switch to PLAY when the locator position is reached.
REC: Switch to RECORD when the locator position is reached.
STP: Switch to STOP when the locator position is reached (default).

F045:
ROLLB: PLY/REC/STP

Changes over the ROLLBACK mode. ROLLBACK rewinds the tape by a preprogrammed time amount.
Depending on the programmed ROLLBACK mode the machine subsequently switches either to PLAY, RECORD or STOP mode. For programming of the ROLLBACK time: see S024.

PLY: Switches to PLAY after the ROLLBACK.
REC: Switches to RECORD after the ROLLBACK.
STP: Switches to STOP after the ROLLBACK (Default).

RECORD

F048:
READY RECORD: ON/OFF

The READY RECORD function influences the punch-in behavior of the digital audio channels in conjunction with the READY and RECORD keys.

ON: The digital audio channels switched to READY remain in READY state even if the machine is already operating in record mode.
The channels are switched to RECORD mode when the next RECORD command is entered (Default).
OFF: The digital audio channels switched to READY switch immediately to RECORD if the machine operates in record mode.

F049:
RECORD KEY: A/B

The RECORD KEY function influences the nature in which the tape recorder is switched to record mode in conjunction with the PLAY/RECORD keys.

A: The PLAY and RECORD keys must be pressed simultaneously for switching to RECORD when adding additional channels to the RECORD mode while a recording is in progress (Default).
B: If the machine is already operating in PLAY mode, record can be activated with the RECORD key alone (i.e. without pressing PLAY a second time).

F050:
REFRESH: ON/OFF

The REFRESH function improves the signal quality of an older tape in which CRC errors exist. The REFRESH function can only be activated in INSERT RECORD mode and STOP mode.

ON: Activates the REFRESH function. In this mode the data stored on tape are overwritten by the own data from which any CRC errors have been removed.
OFF: Disables the REFRESH function → normal record operation (Default).

F051:
REC INDICATION: A/B

Normally a tape recorder can only be switched to record mode if at least one digital audio channel is set to READY. With RECORD INDICATION it is possible to switch to record mode even if no channel has been set to READY.

A: At least one digital audio channel must be set to READY before the tape recorder can be switched to record mode.
B: The tape recorder can be switched to record mode even if all digital audio channels are set to SAFE (Default).

REMOTE

F052:
PAR AUDIO IF: ON/OFF

To prevent conflicts between the PARALLEL AUDIO IF (PAI on the REMBUS) with the CHANNEL CONTROL unit and the key functions of the display field, the keys of the CHANNEL CONTROL UNIT and the display panel must be disabled when the PARALLEL AUDIO interface is used.

ON: The PARALLEL AUDIO interface is activated. The keys of the CHANNEL CONTROL UNIT and the display panel are disabled.

OFF: The PARALLEL AUDIO interface is disabled. the keys on the CHANNEL CONTROL UNIT and on the display panel are active (Default).

F054:
REMOTE MODE: A/B

REMOTE MODE specifies whether or not the local key fields are enabled if REMOTE UNITS are active.

A: If REMOTE is active, the local key fields are disabled. However, the REMOTE key on the local keyboard is always active.

B: The local key fields remain enabled when REMOTE is active (Default).

SAMPLING RATE

F056:
SAMP: 48/44.1/44.056

Changeover of the sampling frequency. The sampling frequency cannot be changed if the machine operates in EXTERNAL CLOCK MODE with the AES/EBU interface, or if WORD CLOCK has been selected as the clock reference. In this case the machine switches automatically to the corresponding sampling frequency. In play mode the machine can also switch automatically to the correct sampling frequency based on the RT CONTROL WORD recorded on the tape.

SYNCHRONIZER

F060:
REFERENCE: TC/RT

Changeover of the SYNCHRONIZER REFERENCE. The internal synchronizer can operate with different code reference signals:

TC: The synchronization is based on the MASTER TIME CODE signal supplied by an external reference and the SLAVE (LOCAL) TIME CODE signal.

RT: The synchronization is based on the MASTER REFERENCE TRACK signal from a second D820MCH and the SLAVE (LOCAL) REFERENCE TRACK signal. In this mode a sample-accurate synchronisation between the two machines is possible.

F062:
AOR: ON/OFF

AUTOMATIC OFFSET RETENTION adds the time code jumps automatically to the SYNCHRONIZER OFFSET REGISTER.

ON: STORE OFFSET enabled.

OFF: STORE OFFSET disabled. The SYNCHRONIZER OFFSET REGISTER is not updated when time code jumps occur.

F063:
SYNCHR: INT/EXT

Changeover between Synchronisation with the INTERNAL synchronizer and EXTERNAL synchronization.
During the LOCK procedure this changeover is disabled.

INT: Activates the internal synchronization. All functions that relate to the internal synchronization (e.g. LOCK, INST LOCK, EDIT WAIT, EDIT LOCK) are enabled. The external synchronization is disabled.

EXT: The external synchronization is enabled if REMOTE is active (REMOTE LED is light). The internal synchronizer and all functions connected therewith (e.g. LOCK, INST LOCK, EDIT WAIT, EDIT LOCK) are disabled.

F064:
TC LOCK: ON/OFF

Standard **USER Key 1**

TC LOCK can be used for synchronizing the D820MCH with an analog tape recorder that does not support a clock reference but supplies only a TC signal.

ON: The D820 MCH does not synchronize with an external clock signal but is controlled only by the time code of the master. The quality of the output channels can deteriorate because the clock of the converters contains the wow and flutter of the master machine.

OFF: When the time code difference between the master and the slave has been reduced to zero, the clock reference (S017/F013) is activated. In this condition the D820 MCH is stable and in exact synchronism with the master.

F068:
SLOW LOCK: ON/OFF

The SLOW LOCK function makes the readjustments inaudible while synchronizing with the internal synchronizer. It is enabled only if TC LOCK = ON.

ON SLOW LOCK MODE: TC differences are reduced slowly and inaudibly.

OFF Normal operation: The readjustment by the synchonizer is performed rapidly.

TIME CODE (TC)

F065:
TC INPUT: GEN/EXT

Standard **USER Key 2**

Two sources can be assigned to the time code channel.

GEN: The TC will be recorded from the internal time code generator.

EXT: The TC will be recorded from an external reference.

VARISPEED

F071:
VARI DISP: %/HT/IPS

Changeover of the varispeed display mode:

%: The varispeed deviation is displayed/entered as a percentage of the nominal tape speed.

HT: The varispeed deviation is displayed/entered as semitones.

IPS: The varispeed deviation is displayed/entered as the absolute tape speed in inches per second.

2.3.7 ALIGNMENT menu

The ALIGNMENT menu contains alphabetically sorted alignment parameters. The settings in this menu are serious adjustments requiring the knowledge of a service technician.

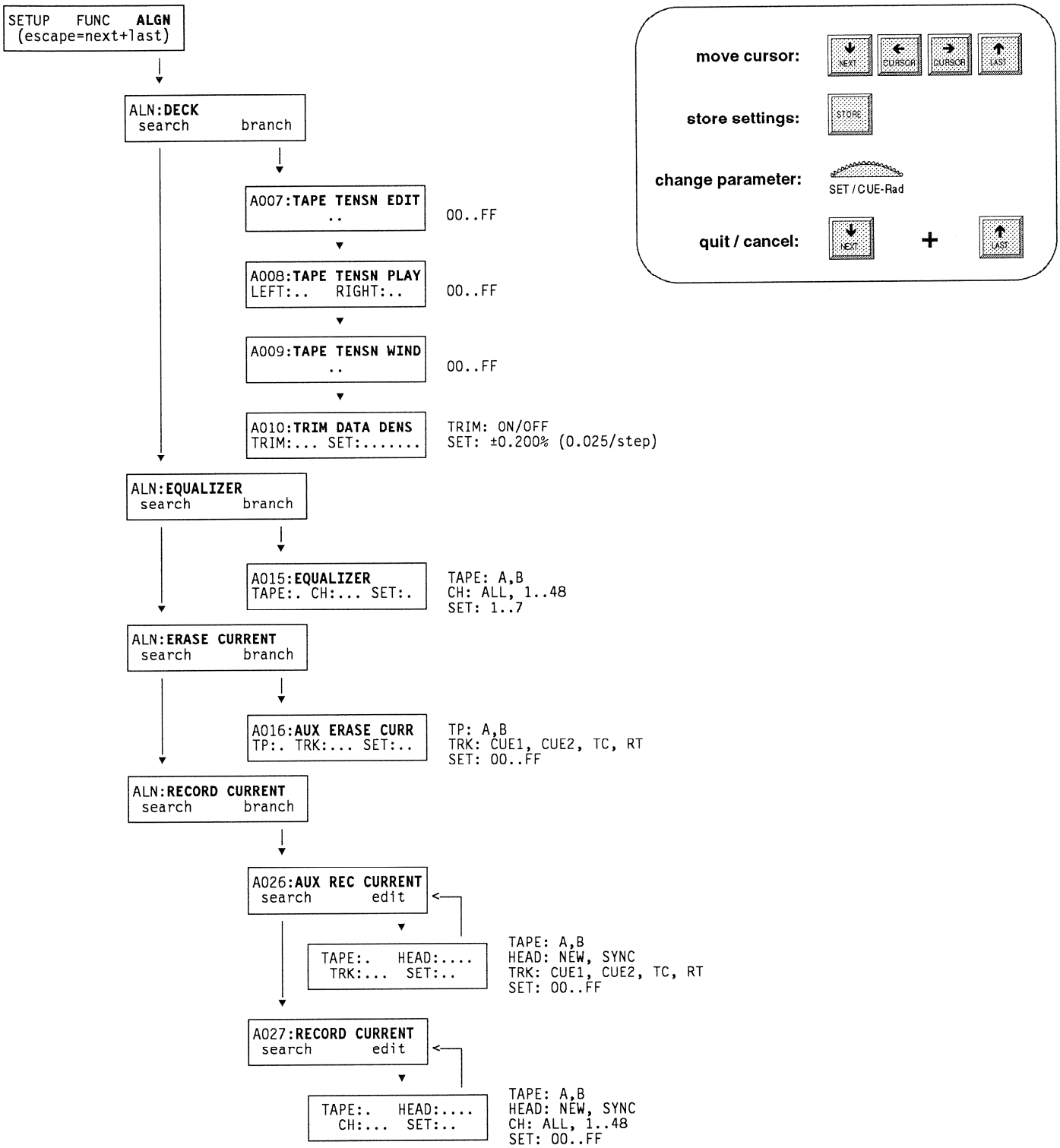
- TAPE DECK
- EQUALIZER
- ERASE CURRENT
- RECORD CURRENT

Screw lock

The access to the ALIGNMENT menu is protected by a screw lock between the RESET TIMER and the NEXT↓ keys. Open the SCREW LOCK [11a] by giving the screw one turn counterclockwise with a 2.5 mm hexagon-socket-screw key. The ALIGNMENT menu will not be displayed as long as the screw is locked.

ALIGNMENT

SW V 3.0



Only service technicians are allowed to change the settings in the ALIGNMENT menu.
Every parameter is factory adjusted for each machine.

Prior to any change of the alignment note or save (backup on tape or on a personal computer) **the factory settings!**

DECK

```
A007:TAPE TENSN EDIT
        ..
```

00..FF

Specifies the tape tension for EDIT mode.

```
A008:TAPE TENSN PLAY
LEFT:..   RIGHT:..
```

00..FF

Specifies the tape tensions in play mode.

```
A009:TAPE TENSN WIND
        ..
```

00..FF

Specifies the tape tension in spooling mode.

```
A010: TRIM DATA DENS
TRIM:...  SET:......
```

TRIM: ON/OFF
SET: +/-0.200% (0.025/step)

The nominal tape speed of the tape recorder must be trimmed to the standard data density of the calibration tape in order to ensure the D820 MCH records the data in the ASSEMBLE RECORD mode with the correct density.
TRIM can only be activated in STOP mode at 48.0kHz sampling frequency. When TRIM is switched off, the current TRIM value is shown on the display. This value represents the deviation relative to nominal tape speed of 30ips at 48kHz.

EQUALIZER

```
A015: EQUALIZER
TAPE:. CH:... SET:.
```

TAPE: A,B CH:ALL,1..48 SET:0..7

Specifies the equalization parameters for the individual audio channels. There are two sets of parameters, one for tape type A and one for tape type B (tape type selection: see F021).

ERASE CURRENT

```
A016: AUX ERASE CURR
TP:. TRK:... SET:..
```

TP: A,B TRK: CUE1,CUE2,TC,RT
SET: 00..FF

Specifies the erase currents for the auxiliary tracks. There are two sets of parameters, one for tape type A and one for tape type B (tape type selection: see F021).

RECORD CURRENT

```
A026:AUX REC CURRENT
 search       edit
TAPE:.   HEAD:....
 TRK:...  SET:..
```

TAPE: A,B HEAD:NEW,SYNC
TRK: CUE1/2,TC,RT SET:00..FF

Specifies the RECORD CURRENT for the auxiliary tracks. There are four parameter sets: two for tape type A and two for tape type B (tape type selection: see F021). For each tape type there is one set for the NEW RECORD HEAD and one for the SYNC RECORD HEAD.

```
A027: RECORD CURRENT
 search       edit
TAPE:.   HEAD:....
  CH:...  SET:..
```

TAPE:A,B HEAD:NEW,SYNC
TCH:ALL,1..48 SET:00..FF

Specifies the RECORD CURRENT for the digital audio channels. There are four parameter sets: two for tape type A and two for tape type B (tape type selection: see F021). For each tape type there is one set for the NEW RECORD HEAD and one for the SYNC RECORD HEAD.

2.4 Operation

2.4.1 Power-on sequence

During the power-on sequence, i.e. while the processor is being initialized, certain keys and pilot lamps such as READY and REC may light up. During this time the record function is electronically inhibited.

LC-Display

The following information (depending on the machine configuration) appears consecutively on the LC display for a few seconds. These windows can be recalled at any time by pressing the LAST key.

```
D820 MCH MULTICHANNEL
DASH TAPE RECORDER
```

Machine type and recording method (DASH: Digital Audio Stationary Head).

↓

```
D820 MCH   SOFTWARE
V 3.0        ww/yy
```

Start of system test with information on software version and date (ww = week, yy = year).

Important: In all inquiries to a Studer dealer please specify the software release date.

↓

```
CONFIGURATION:
XX CHANNELS
```

Channel configuration of the machine according to jumper JP2 on the CIF-Board. (XX = 8 / 16 / 24 / 32 / 40 / 48 Kanäle)

↓

```
ERROR MESSAGE:
no errors detected
```

If an error is detected, a corresponding plain text message is displayed, see section 13.

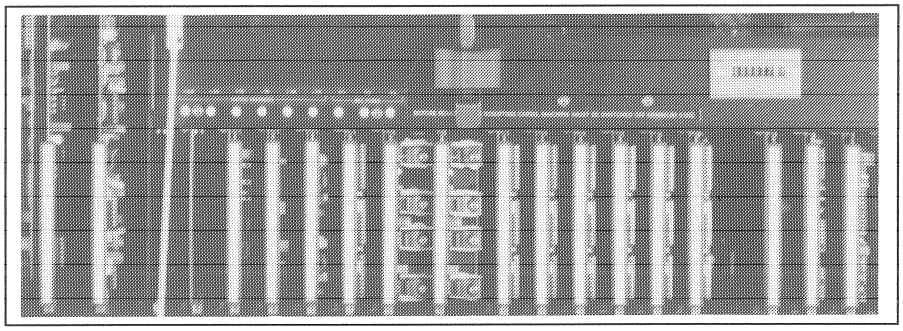
↓

Standard window

```
CLIP LEVEL:  xx.x dBu
TC ON TAPE:  yy Frm/s
```

Supply voltage monitoring

Behind the top front cover of the electronics racks there are six green LEDs that indicate the presence of the tape deck supply voltages: +5.6 V, +24 V, +15 V, -15 V, +26 V, -26 V. The three tape deck fuses are also tested, see illustration below. If these are OK, one LED lights up for each (F1, F2, F3).
The presence of the +5 V, ±18 V for the audio electronics is indicated directly on the left-hand and right-hand power supplies in the two bottom racks.
The fuses (F1-F11) are located on the back of the D820 MCH.



Signal lights on the electronic boards

For the normal day to day operation the signal lights on the electronic boards under the front cover are of secondary importance.

2.4.2 Threading the tape

Installing the reels

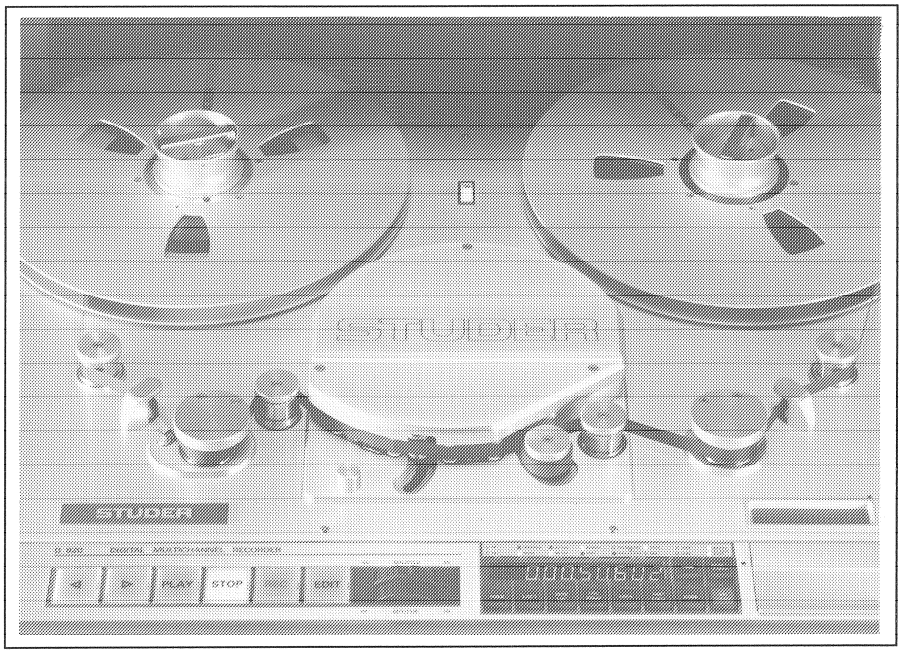
Only precision NAB reels for ½" audio tape are permitted for use. For operation the turning lock in the centre of the reel adapters must be tightened.

Inserting the tape

Insert the tape as shown in the diagram below.
Place the tape leader on the empty reel and secure it by giving the reel a few turns. As soon as you press a tape command key, the pinch roller assembly engages and the spooling motors as well as the tape tension monitoring circuit are activated.

Determining the pancake size

For optimum tape tension control, the pancake sizes are an important parameter. For determining these values, the tape must be spooled (forward or backward) for a few seconds after the tape has been inserted or after the machine has been switched on again.
At the start of the tape, the tape timer can be set to zero with the RESET key.



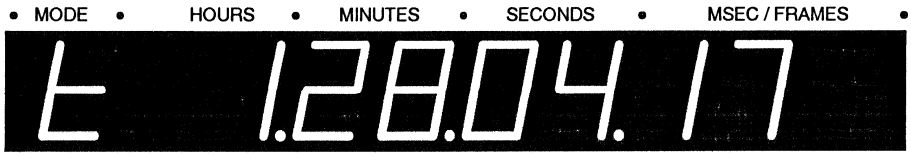
2.4.3 Setting the tape timer display mode

By pressing the TIME button or in the menu Functions / Display / F034 you can toggle between the following display modes:

- Elapsed playing time (real time counter).
- Time code (TC)
- Reference track (RT)
- Elapsed playing time (LAP). The LAP timer is a second timer which does not influence the normal timer.

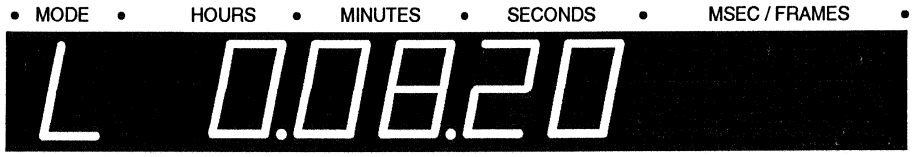
The locator addresses as well as the Auxilliary Register are not affected by the tape timer changeover.

If TC or RT is displayed, you can select with the CODE key whether you want the code to be displayed from tape, from the external master source or as the difference between master and slave (DIFF).
The corresponding letter (L), (t) or (r) at the left side of the display shows the selected mode.



LAP timer

The LAP timer can be set to zero in any tape position by pressing the RESET key. In this way the exact playing time of a selection can be determined without having to calculate the difference between the start and end time.



2.4.4 Adjusting the input and output levels

The audio levels can be individually adjusted for each channel between +14.0 and +24.0 dBu. These settings are software controlled and are described in the SET-UP menu (see Section 2.3.5). Adjustment facilities are available for:

- CUE CLIP LEVEL
- INPUT CLIP LEVEL
- OUTPUT PEAK LEVEL

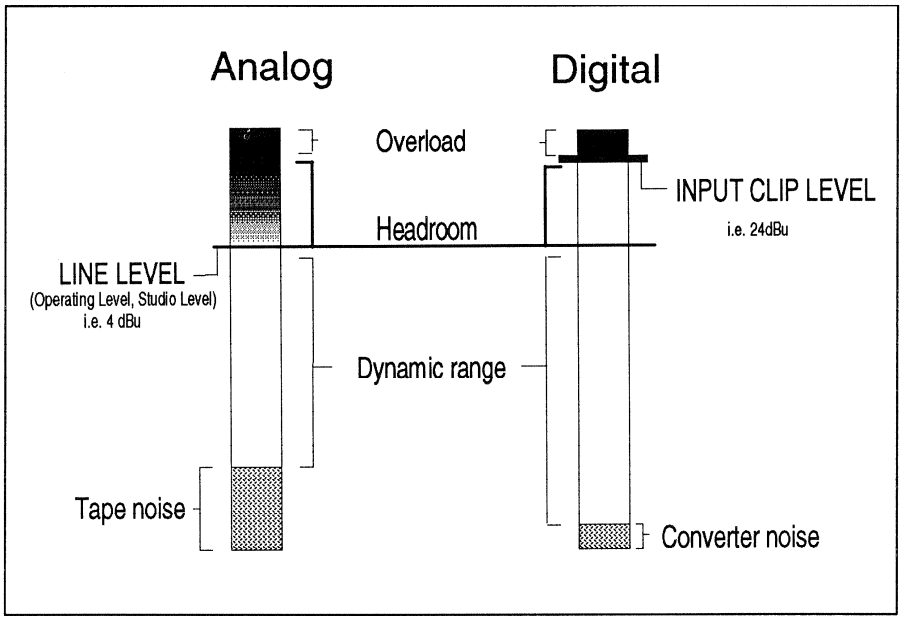
The setting depends on the following 2 factors:

- Your studio level
- Desired headroom

Example: Your studio level is nominally +6 dB and in addition you want a headroom of +10 dB. By adding these two values we obtain the desired clipping level of +16 dBu (response time 10 ms).

Headroom

In an analog tape recording the tape is being saturated by excessive levels. Although the distortion increases audibly, the transition into the distortion range is relatively moderate.
In digital audio recordings the situation is different. There is no transition between full level and the onset of distortion. When the maximum level is reached, there are no further digital levels, the 16 bit are exhausted. The consequence is severe distortion.
The "tolerance threshold" known from analog productions is being replaced by a sufficiently large headroom.



Comparison between analog and digital level

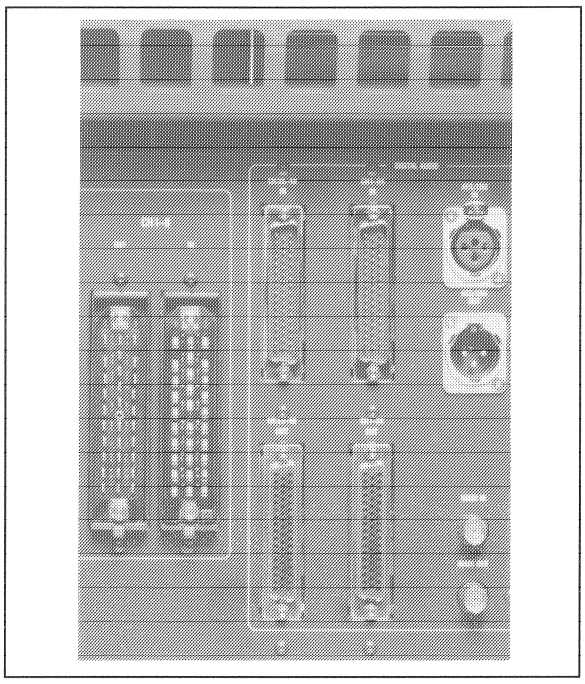
Note: In normal operation the programmed overload level is shown on the LC system display. If the INPUT CLIP LEVEL and the OUTPUT PEAK LEVEL were set to different values, the message "CLIP LEVEL: INDIV" is displayed.

2.4.5 Changeover between analog/digital mode

The D820 MCH can operate with the following audio signals:
- Analog audio signals via the 30-pin connectors.
- Digital audio signal in SDIF format via the 50-pin D-type connectors
- Two-channel AES/EBU digital audio signal via the XLR connectors
- Digital audio signal in MADI format (option)

A mixture of analog and digital inputs is possible. Mixing of the digital input formats is not feasible.

The audio mode is defined in the SET-UP menu according to Section 2.3.5.



Audio connector panel

2.4.6 Selecting the sampling frequency

The D820 MCH can operate at sampling frequencies of 48kHz, 44.1kHz or 44.056kHz. The sampling frequency must be selected at the time the tape is formatted in NEW RECORD mode because this information is recorded on the reference track.

Setting

- The smpling frequency is cyclically switched between the three possible values with the **SAMPLING FREQU** key. The setting is displayed with a yellow LED above the tape timer.
- The same setting can alternatively be made in the FUNCTIONS menu **SAMPLING RATE** (F056).

When a formatted tape is played, the D820 MCH automatically selects the correct sampling frequency based on the RT information.

2.4.7 Selecting the INT/EXT clock source

The D820 MCH can operate with its own internal clock source or in synchronism with various external clock sources. The INT/EXT selection key is located in the function and programming field under the hinged cover (F013).
The external clock format must be determined in the SET_UP menu EXT CLOCK REF (S017). Possible clock sources are:

- Word Clock
- AES/EBU
- Video 25 frames/s
- Video 29.97 frames/s
- Video 30 frames/s
- Square-wave signal 24 Hz
- Square-wave signal 25 Hz
- Square-wave signal 50 Hz
- Square-wave signal 59.94 Hz
- Square-wave signal 60 Hz

2.4.8 Varispeed

With the built-in varispeed control you can adjust the tape speed within the range of ±12.5% relative to the nominal tape speed.

Display modes

If varispeed is on the tape speed is displayed on the LCD. One out of three display modes can be selected in the menu Functions / Varispeed / VARI DISP:

- Deviation in semitones
- Deviation in percent of the nominal tape speed
- Actual tape speed in inches per second (ips).

SET VARISPEED

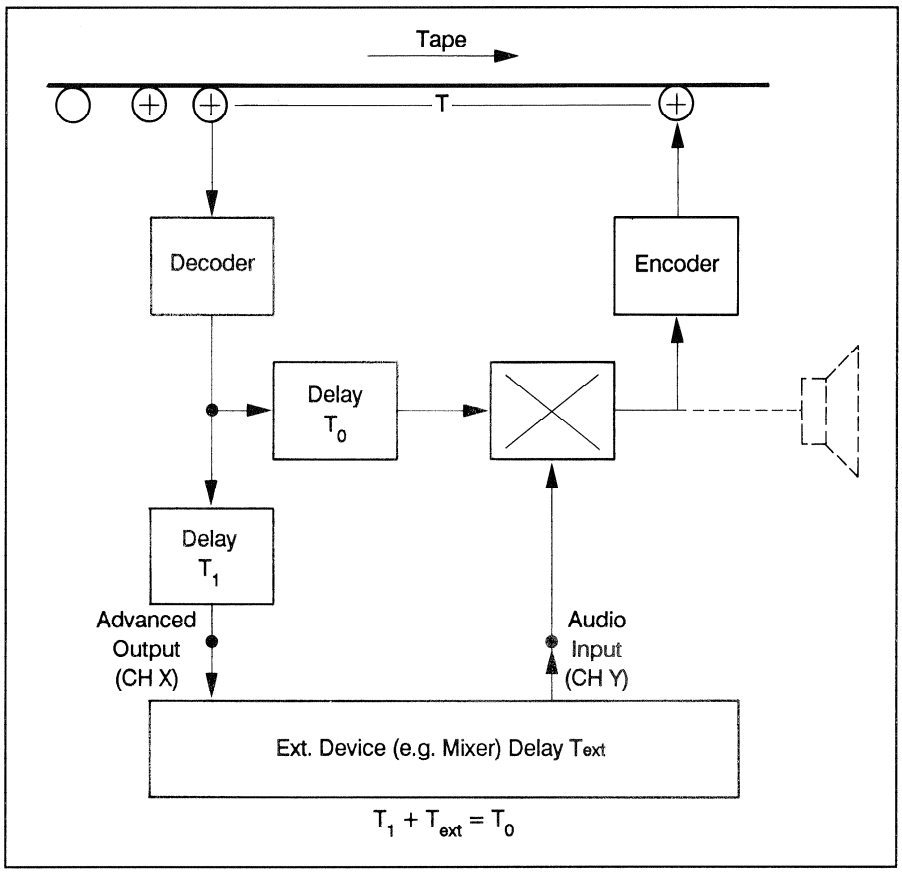
The tape speed can be preselected with the SET VARISPEED key and with the SET/CUE wheel or on the remote control. The nominal tape speed is not influenced yet. Save the setting with the STORE key or quit with the SET VARISPEED key.

Varispeed ON / OFF

To change from the nominal tape speed to varispeed, press the VARISPEED key; the VARISPEED LED flashes.

2.4.9 Advanced output

This mode is used for recording additional tracks in synchronism with existing tracks. If the external equipment has signal delays (e.g. a digital mixing console), time compensation is necessary to match already existing recordings.
The Advanced Output mode may be switched on in INSERT RECORD mode for each track idividually.



Principle: D820 MCH in INSERT REC MODE + ADVANCED OUTPUT

The delay time of the external equipment must be set as time compensation in the menu Set Audio Output / Adv. Output Delay (S003).
The setting "0 samples" compensates for the digital in- and outputs of the D820 MCH. The delay time through the analog outputs and inputs is 23 samples (D/A and A/D conversion).

DELAY	TIME COMPENSATION (µs)		
SAMPLES:	48,0 kHz	44,1 kHz	44,056 kHz
0	0	0	0
15	312,5	339,8	340,1
23	479,2	521,0	521,5
31	645,8	702,2	702,9
39	812,5	883,5	884,4
47	979,2	1064,71	1065,8
54	1125,0	1223,3	1224,5

Advanced output ON

USER key 3 switches the outputs to ADVANCED OUTPUT mode. The USER key is lit as well as the LED **ADV OUTPUT** next to the tape timer. All channels configured for advanced output (menu S003) send out a pre-delayed signal.

2.4.10 Playback

The PLAY key or a fader start device can be used for starting the tape recording in play mode. The PLAY lamp lights up.
If PLAY is pressed while a recording is in progress, the machine switches to play without interruption. If PLAY is selected in spooling mode, the machine decelerates the tape, the PLAY function is preselected and the PLAY key flashes until the play command is executed. From play mode you can switch directly to spooling mode or to a locator function.
If the machine operates in REHEARSE mode, the PLAY key flashes when it is activated.

2.4.11 Spooling

The ◄/► keys activate fast forward or rewind respectively. The spooling speed can be defined in the SET-UP branch within the range of 0.5 m/s and 15 m/s in steps of 0.1 m/s.

The spooling functions can be canceled with the STOP, PLAY, REC+PLAY, EDIT or LOC command.
The tape deck functions can be selected directly, i.e. without selecting STOP as an intermediate function.
From spooling mode you can switch directly to play or record. In this case the preselected keys flash until the corresponding tape speed has been attained.

Library Wind

To prevent damage to the tape edge due to irregular pancakes, the spooling speed can be reduced for tapes intended for long term storage (library). The speed can be varied between 0.1 m/s and 15 m/s in steps of 0.1 m/s. The STUDER recommendation is **5 m/s**.
Library wind can be switched on/off with the **USER key 4** or function F020.

2.4.12 Stop

The STOP key has the highest priority and interrupts all other modes such as play, record, spooling and locator.
The tape tension control is always active. For one-handed cueing you can position the tape by turning one of the two spindles.
A command entered during the deceleration phase is executed as soon as the tape speed corresponds to the requirements of the selected function.

2.4.13 Editing, tape cutting

On the D820 MCH physical cutting of the tape is possible also. However, in contrast to analog tapes, certain restrictions with respect to the distance between two edit points have to be taken into consideration. Proceed carefully in order to prevent muting of the signal.
Cuts should only be made in sections containing audio pauses, or else, electronic editing is to be preferred, whenever possible.

Cueing

During manual cueing the digital tracks cannot be read directly. For this reason, a mixdown or a suited output track must first be copied to the CUE track. Two CUE tracks are available, see also Section 2.5.6.

Searching for an edit or cue point

- If specific tape segments must be eliminated, you can search for the approximate tape location with PLAY, ◄/►– or the locator function (or with the aid of the SHUTTLE wheel on the remote control).
- Press the EDIT key and move the tape to the exact position by carefully turning one of the two spindles.

Marking and cutting

Mark the tape position located in front of the reproduce head with a grease pen or a soft pencil on the back of the oxide coating. Insert the tape into the splicing block (option 1.862.117.00) in such a way that the tape can be cut with a razor blade in the slot provided.

Splicing the tape

Place the two tape ends with the oxide coating facing downward into the splicing block. Butt the ends together (without overlap and without gap!) and join them exactly with adhesive tape.

2.4.14 Locator (on the D820 MCH)

The locator supports the following operating modes:

ZERO LOC

- **Zero locator**: When you press this key the tape spools forward or backward to the **zero position** of the tape timer, regardless of the display mode (Tape counter, TC, RT, LAP timer).

LOC START

- When you press this key the tape spools forward or backward to the address at which the **last PLAY command** was entered. Depending on the programming (Functions / Locator / LOC ST; F037), the machine subsequently switches to STOP, PLAY or RECORD.

LOCATOR

- A tape address can be stored in the locator memory and searched automatically in spooling mode by pressing the LOC1 key.

The locator function can be canceled by pressing <, >, STOP or EDIT.

Storing locators

- Freeze the tape position in the display with the HOLD key. Then press LOC1 to store this address in the locator memory 1. Now the tape counter is running free again.
- Any address can be set on the LC display and stored to locator memory 1..5: Press SET LOC ADDR. The LC display shows the memory number (A: 1...5), the time base (; t; r; L) and the locator address. Set the new address with the SET/CUE wheel and press STORE (see operation of the SET-UP menu).

The LOC keys can be programmed in an easier way on the remote control.

Displaying LOC1 address

- Press a LOC key while the STOP key is kept pressed. The address stored in the locator memory is displayed.
- For displaying locator 1...5 press the SET LOC ADDR key and select a locator number ("A:") with the SET/CUE wheel.

Preselecting PLAY or REC

Press PLAY once during a locate function (ZERO, LOC, LOC START, LOC1) or press PLAY together with REC to switch the machine automatically to record or play when the corresponding tape address is reached.
All locate addresses remain stored when the machine is switched off.

2.5 Record mode

In this section the settings required for recording on a digital multitrack tape recorder are discussed. An overview of the necessary steps is listed below.

Preparatory steps

1) Formatting of the new tape; determine the sampling frequency.
2) Set the **RECORD MODE**.
3) Select the **AUDIO INPUTS** for all tracks
   (menu set AUDIO INPUT)
   For analog signal sources check the clip level setting
   (menu set LEVELS)
4) Set the **CLOCK REFERENCE**
   (EXT CLOCK key; menu set EXT CLOCK REF)
5) Prepare the **TC recording**; select a TC source.
   If needed set TC generator and TC sync (SET TC GEN key).
6) **Select the tracks** for recording (SAFE / READY)

RECORD settings

The settings in the menu FUNCTIONS / RECORD determine the behavior of the machine in record mode.

- **READY RECORD** influences the punch-in behavior of SAFE tracks when switched to READY during recording. See functions F048.
- **RECORD KEY** determines whether only the RECORD key or the REC + PLAY keys together have to be pressed for punch-in.
- **RECORD INDICATION** determines whether a recording can be started or not if all tracks are switched to SAFE.

If **REC and PLAY** are pressed simultaneously the machine switches to record mode and the PLAY and REC keys light up.
If you press PLAY and REC in spooling mode, the machine decelerates the tape. The function is preselected, the REC and PLAY keys flash.
As soon as the tape has reached nominal speed, the record function is activated and these two keys change to steady light. From record mode you can switch directly to spooling mode or to a locator function.

MASTER SAFE key

The MASTER SAFE function is a higher ranking recording inhibition. READY commands are ignored as long as MASTER SAFE is active, and the machine cannot be prepared for a recording.

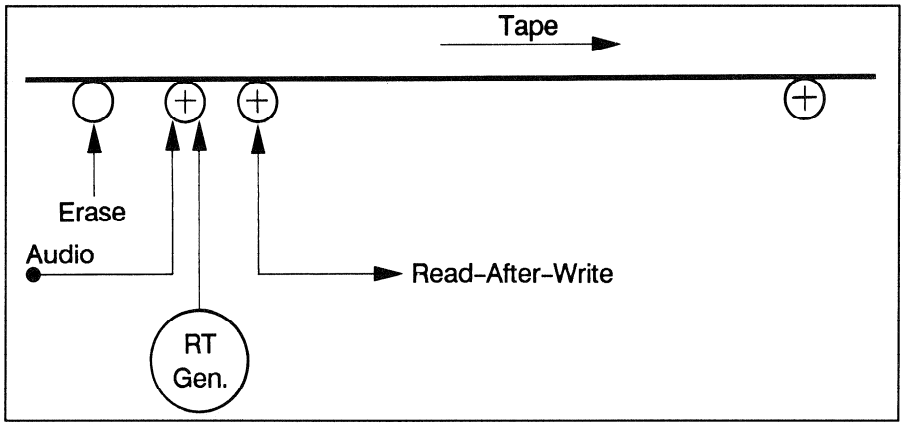
2.5.1 Tape formatting and initial recording

If a tape has never before been used on a D820 MCH or a similar machine, a **REFERENCE TRACK** (RT) must first be recorded from the start to the end of the tape in **NEW RECORD** mode.
This track is required for reference sectoring of the audio data and consequently determines the data distribution on the tape.

2.5.2 New Record mode

Activation

The NEW RECORD mode can only be activated if a tape is threaded and the machine is switched to STOP. Simultaneously press the **SET ENABLE** and the **NEW** keys to switch to NEW RECORD mode.
In this mode the machine operates with the first record head. This head simultaneously records the RT signals and the audio signals. READ AFTER WRITE is possible in this mode because the first record head is located before the reproduce head. The recording can be monitored from tape (REPRO).



Application

NEW RECORD mode is used for formatting virgin tapes or for reformatting existing tapes (erase/overwrite). For this process **all 48 or 24 audio channels must be switched to READY!**
When NEW RECORD is activated, the RT address starts automatically with the time set in the RT generator (S028: RT GEN ADDRESS).
Any audio data already existing on the tape will be destroyed and cannot be recovered.

Auxiliary tracks

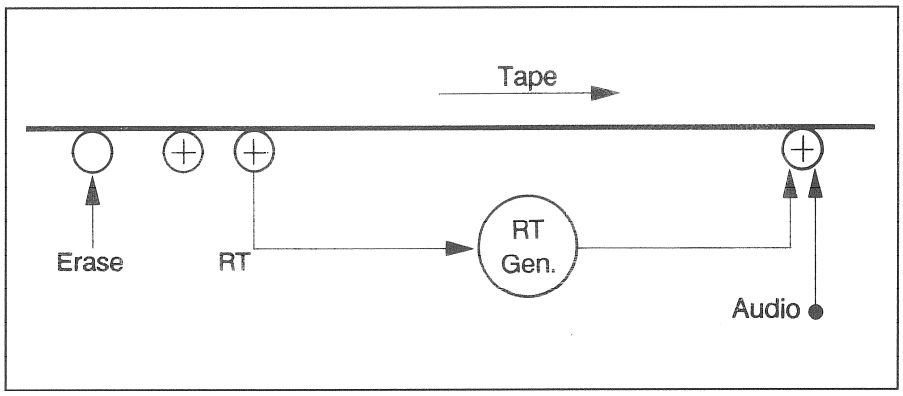
The auxiliary tracks CUE 1, CUE 2 and TC do not have to be recorded; however, if this is desired, they must be switched to READY before RECORD is activated.

TC generator

If the tape is subsequently used in a synchronous (TC) environment, make sure that the TC generator (internal or external) is synchronized to the required reference clock (e.g. video).
The procedure for setting the internal TC generator is described in Section 2.5.7.

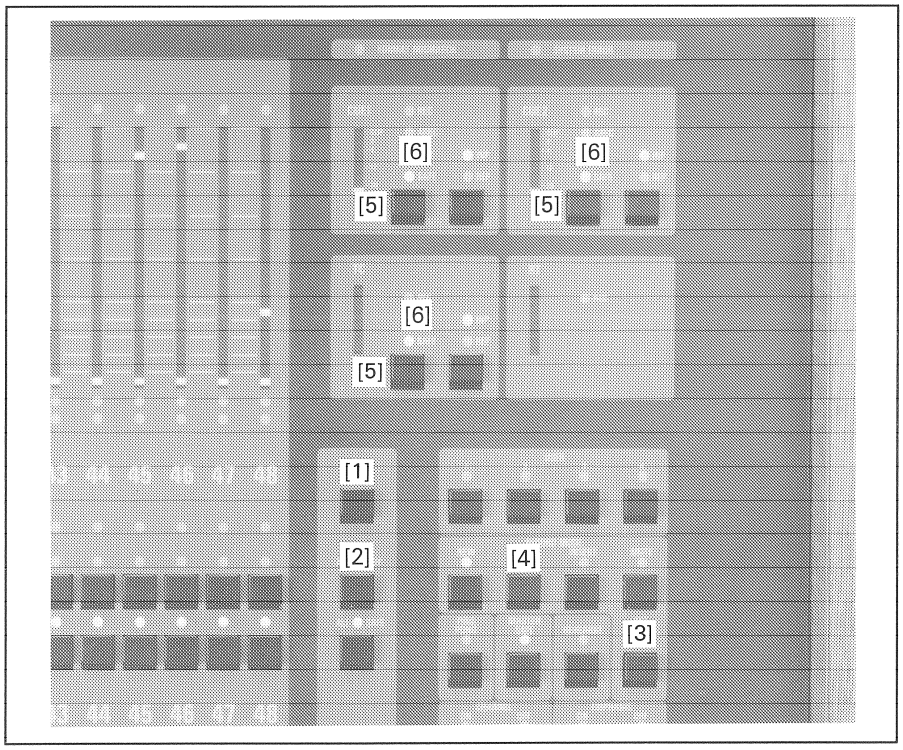
2.5.3 Assemble Record mode

This mode is used if a recording is to be made on a tape that is not formatted to the end. Like in NEW RECORD mode, all channels must be switched to READY which means that any information existing on the 24 or 48 channels will be overwritten. Since the SYNC record head is used, READ AFTER WRITE is not possible. When the machine is switched to RECORD, the reference track is continued at the point where the recording was interrupted so that a continuous reference track from start to end is produced.



Selecting the ASSEMBLE RECORD mode

As in NEW RECORD mode the machine has to be switched to STOP. Then press the **SET ENABLE** and **ASSEM** keys simultaneously. **All 24 or 48 digital audio channels must be switched to READY.** For this purpose press the ALL ENABLE [1] key and subsequently the ALL RDY [2] key. When all channels are in READY condition. If the TC and CUE tracks are to be recorded, the corresponding SAFE/READY key must be pressed until the green LED [shows the READY condition.

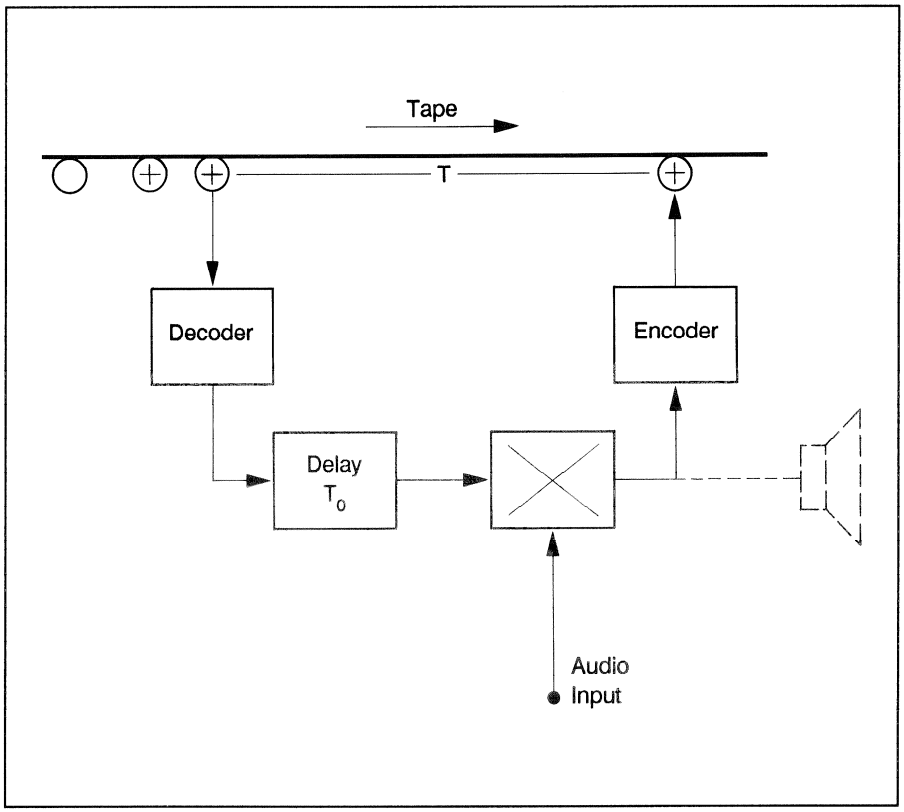


The procedure for setting the internal TC generator is described in Section 2.5.7. Before the changeover to RECORD, the machine must read the RT information. For this reason the punch-in must occur in a position at which valid RT information still exists.

2.5.4 Insert Record

This is the "normal" recording mode and can be compared with the record mode of an analog machine. The D820 MCH has to be switched to STOP for changing over the record mode. INSERT RECORD is activated by simultaneously pressing the **SET ENABLE** and **INSERT** keys.

In this case the SYNC RECORD head is used for recording the audio signal in synchronism with the previously recorded RT signal. Since the SYNC RECORD sound head is located after the reproduce head, READ AFTER WRITE is not possible (during recording the signals cannot be monitored off tape). The D820 MCH consequently connects the output signal of each recording channel to INPUT so that the monitored signal corresponds to the one on tape.



In INSERT RECORD mode the RT information is not overwritten and the tracks can be switched individually to SAFE/READY.

2.5.5 Record Mute

The MUTE function can be used for recording a digital "zero" signal in any record mode. In RECORD MUTE SET mode a configuration of MUTE tracks can be entered and recalled later.

Set MUTE tracks

The **MUTE** key switches to the **RECORD MUTE SET** mode and back. The RECORD MUTE LED **flashes** in set mode. In this mode the tracks for recording a digital "zero" signal can be selected with the INPUT/REPRO keys. Selected channels are indicated with a lit INPUT LED. **ALL ENABLE** and **ALL INPUT** pressed together switch all tracks simultaneously to RECORD MUTE.
To cancel this function press the MUTE key again.

Activating RECORD MUTE

For activating RECORD MUTE, simultaneously press the **SET ENABLE** and **MUTE** keys. (A tape must be loaded and the machine switched to STOP.)
Press the READY keys of the desired tracks and start recording a digital "zero" signal.
If in MUTE mode the output signal of a track is switched to INPUT, the input LED starts flashing. The input signal is connected-through to the output but it isn't recorded onto tape while MUTE is active.
In REPRO condition the outputs remain absolutely mute.
To cancel this function press the MUTE key again.

This function can also be used for erasing unwanted data by means of punch-in and punch-out (spot erase). For greater accuracy, an automatic punch-in/punch-out can be programmed with the autolocator of the machine.

2.5.6 Recording the cue tracks

CUE tracks

The two analog CUE tracks are used for searching a cue point on the tape since digital audio tracks can only be read within a speed deviation of ±12.5% from the nominal speed.

Connectors, levels

The input and output signals of the CUE tracks are available at the balanced XLR connectors. Their level can be specified in the set-up menu S021; (CUE CLIP LEVEL).
The **outputs CUE 1/2 OUT** can separately be fed with the **INPUT** signal (CUE 1/2 IN) or with the **REPRO** signal from tape. This is selected with the white keys in the CUE area on the display panel an indicated with the INP / REP LEDs.

Status of the CUE tracks

The status of the CUE tracks is changed cyclically from **SAFE** to **READY** and to **AUTO RECORD**.

SAFE / READY These settings are the same as in audio channels.

AREC AUTO RECORD: The CUE track normally goes into record mode at the RECORD command. If AREC is selected the CUE track goes into record at the **PLAY** command. This function is used for copying an externally made mix of audio tracks to the two CUE tracks.
AUTO RECORD is enabled only in INSERT RECORD MODE.

REC This red LED indicates when permanently lit, that a CUE track is in RECORD mode.

2.5.7 Recording the time code track

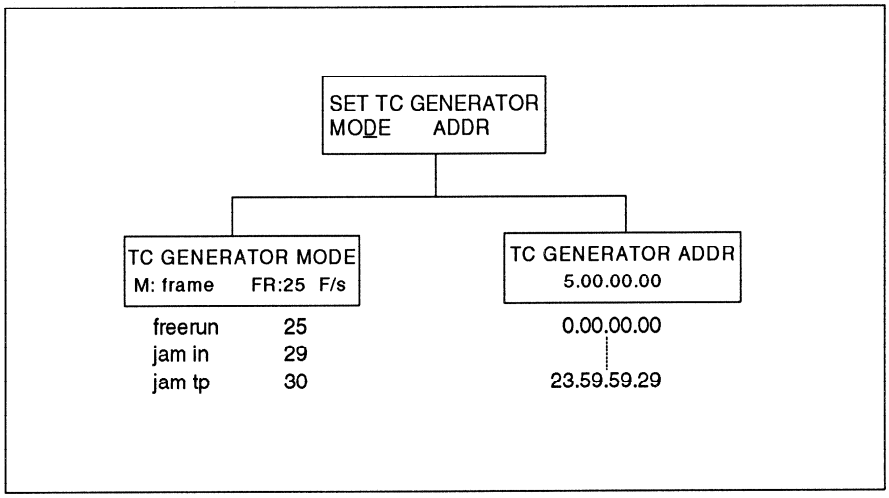
The D820 MCH is equipped with a separate time code track that is independent of the 24/48 digital audio tracks and the two CUE tracks. The TC can be recorded from the internal TC generator or from an external source.
The **USER KEY 2** or the **function menu F065** unit is used for changing over between the 2 sources.

- If the yellow LED of the USER KEY 2 is dark, the time code track is recorded from the signal supplied by the internal generator.
- If the yellow LED for USER KEY 2 is lit, the information supplied through the external TC input TC EXT is recorded.

Internal TC generator

Set TC GENERATOR

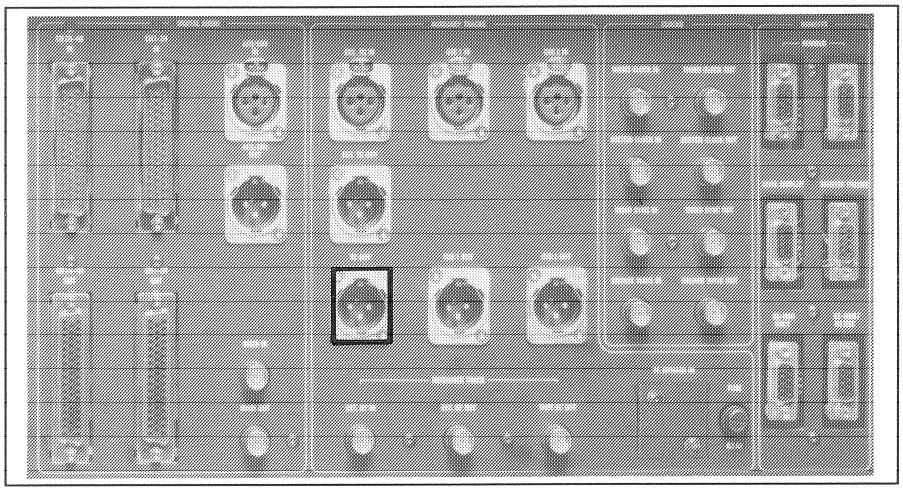
A specific address, operating mode and frame rate can be entered by pressing the SET TC GEN key on the function and programming key pad.
The following options are displayed:



The TC generator can be operated in **FREERUN** mode, in jam to an incoming TC.
In **JAM INPUT** mode the external time code is read, synchronously re-generated and recorded on tape.
JAM TAPE continues the TC recording on tape without any gap. It is therefore used in ASSEMBLE and INSERT RECORD mode. (disabled in NEW RECORD)
In all JAM operating modes code (TC or RT) must first be read before new code can be written. Furthermore the frame rate of the TC generator must match the rate of the TC source. You can set the frame rate to 30, 29.97 or 25 frms/s.

Set TC generator address

The starting address of the TC generator is specified in the submenu ADDRESS of the SET TC GENERATOR function (key).
The desired time can be entered in hours, minutes, seconds and frames with the aid of the SET/CUE wheel. After the desired TC address has been entered press the red STORE key. This sets the generator to the entered start time. The generator is automatically reset to this time when the TC track is switched to READY and the tape deck is switched to RECORD.
The TC generator output (TC switched to INPUT) can be tapped on the TC OUT connector on the rear panel.

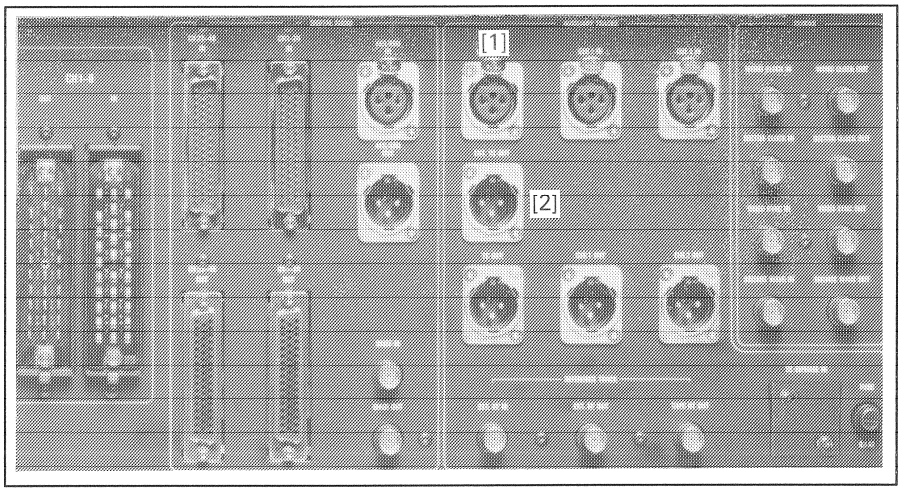


Pin assignment of the TC OUT connector

TC recording from an external source

An external TC source can be selected with the **USER key 2** or with the functions menu setting **TC INPUT** (F065). The USER key 2 is lit.

An external TC signal can be fed via the EXT.TC INPUT [1] XLR connector on the rear panel. This signal is through-connected to the EXT.TC OUT [2] connector.



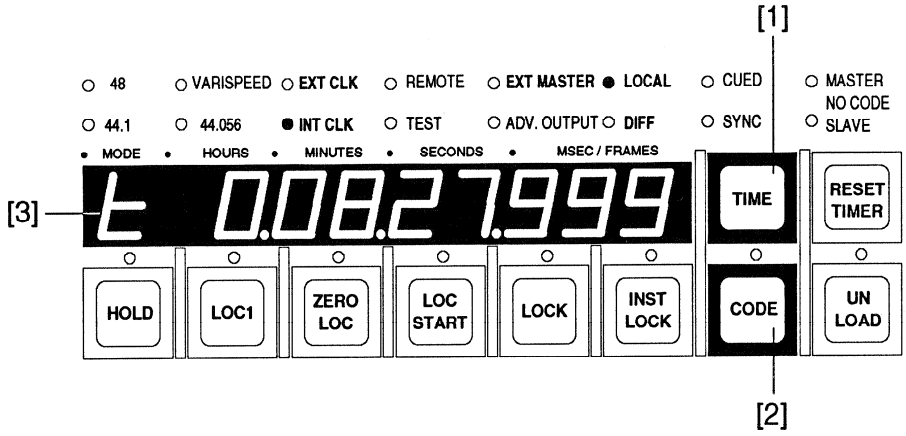
2.5.8 Reading out the time code (TC) on the tape timer display

TIME

The tape timer display can be changed over to **displaying the time code** by repetitively pressing the **TIME** key [1] until a "t" [3] appears on the left-hand side of the display.

CODE

EXT MASTER (external master), **LOCAL** (TC from tape) or **DIFF** (difference between master and slave code) can be selected by repetitively pressing the CODE key [2] until the yellow LED above the display shows the desired operating mode.



2.6 Synchronizing with the internal synchronizer

Built-in synchronizer

The internal synchronizer provides all required functions for synchronizing the D820 MCH with audio or video machines. A reference to the TC or RT is possible. The audio related, sample accurate synchronization between DASH machines is based on the reference track - this is the most accurate way of synchronizing two D820 MCH machines.

2.6.1 Synchronization and integration into other systems

In many applications the digital tape recorder is not an independent unit connected to a mixing console, but rather it is part of a complex system comprising an editor or controller, different audio devices and video machines.

For a functional system, three interfaces must be adapted correctly:

- the **digital audio format**, S002 (AUDIO INPUT) and S001, S018, S041.
- the **synchronization signal**, S017 (EXT CLOCK REFERENCE)
- the **control signals**, (ES bus, master tallies, etc.)

2.6.2 Interface for synchronization signals

Clocks

The clock reference of the D820 MCH is generated by the internal generator. It can also be synchronized to an external clock source (e.g. composite video signal).
This external reference is necessary if two digital units are to be coupled for digital audio data transfer, or for rigid (frame accurate) synchronization to a video system.

LOCK

The synchronization procedure initiated with the "LOCK" command is executed as follows:

1. The difference between the desired position specified by the external time code source and the time code on tape is calculated. By means of the spooling motors and the capstan motor the difference is reduced to (nearly) zero. During this time the audio signals from tape are muted.

2. When synchronism has been achieved, the tape recorder switches to the specified clock source. Muting of the signals from tape is canceled.

Note: When formatting the tapes make sure that the time code to be recorded is synchronized to the required reference (example: external TC generator). If time code is written from the internal generator or if synchronization to RT is required, the D820 MCH must already be synchronized to the external reference when the tape is formatted.

RT-Synchronization

If the **master machine is also a D820 MCH**, RT/RT synchronization can be selected. In this case the RT signals rather than the SMPTE/EBU time code are used and the synchronization is most accurate (sample accurate resolution).

TC Lock

If the **master machine does not offer a clock reference** or if no common clock reference is available, the "TC LOCK" mode can be selected. In this case the machine never switches to the external clock source but remains always under control of the external time code. Muting of the audio signals from tape is canceled.

Clock sources

The following external clock sources can be accommodated:

- **Word clock** (as a 48/44.1/44.056 square-wave signal or derived from the AES/EBU signal).
- **Video clock** (as a square-wave signal or composite video / composite sync signal with 24/25/29.97/30 frames/s).
- External **varispeed signal** (9600 Hz corresponds to 30 ips).

Video synchronization

The D820 is also equipped with a **time code generator** that can be coupled with the external video sync signal (if available). If in play mode a video format is selected as an EXT. CLOCK REFERENCE, the phase of the output time code is synchronized in such a way that it is in phase with the incoming video clock.

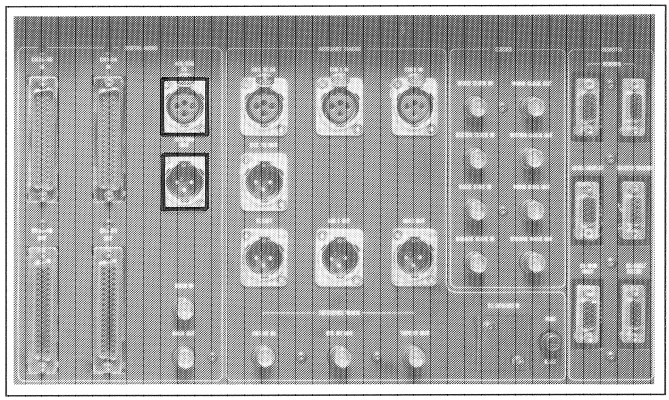
2.7 AES/EBU interface

2.7.1 Selecting a suitable signal source

The D820 MCH can be connected to other digital equipment (e.g. CD player) via the 2-channel AES/EBU interface, if the latter is also equipped with an AES/EBU interface.

The AES/EBU input circuit of the D820 MCH accepts all common implementations. The professional format is supported actively, the consumer format (SPDIF) can also be read.
The signal levels and the XLR connector type always conform to the professional standard.

The connectors for the AES/EBU interface are located on the rear panel. One XLR connector for the input and one for the output exists.



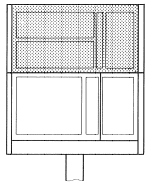
2.7.2 Assigning the 2CH AES/EBU inputs and outputs

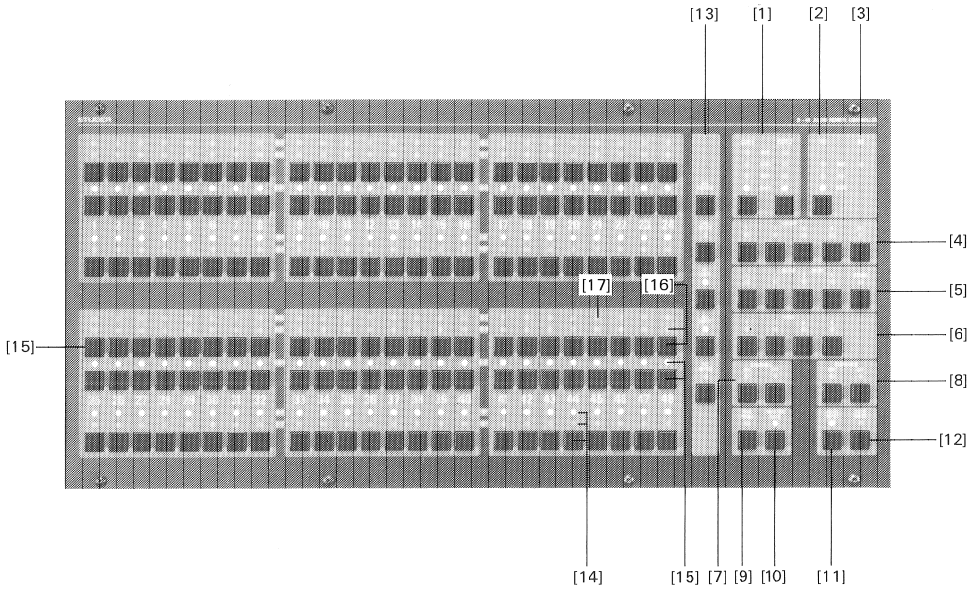
The input/output channel is selected in the INTERFACE branch (S018-S019) of the SET-UP menu. For detailed information on the SET-UP menu please refer to Section 2.3.5.

When the two input channels "Digital Format AES/EBU" are assigned, they are automatically switched to DIGITAL INPUT. All other channels are switched to ANALOG INPUT. The old INPUT ANALOG/DIGITAL configuration remains stored and is re-established as soon as the DIGITAL FORMAT is switched back to SDIF. It is possible to assign both outputs (but not the inputs) to the same channel.

3 Remote Control Operation

3.1 Audio Remote





[1] CUE1 and CUE2

The CUE channels 1 and 2 are switched to SAFE, READY, or AREC with one selector switch each. The current mode is indicated by the corresponding LED.

AREC: Autorecord cue tracks; if this mode is selected, the cue channels are switching to record as soon as the machine enters play mode.

[2] TC

SAFE and READY for the time code track are controlled with one selector key each. The current mode is signalled by the corresponding LED.

[3] RT

The red LED is lit when the RT track (reference track) is in record mode. Safe/ready is preselected by means of the RECORD MODE:

- NEW REC: RT track set to READY
- ASSEMBLE REC: RT track set to READY
- INSERT REC: RT track set to SAFE

[4] GROUP keys

With the keys **SET** and **GROUP 1 to 4** you can combine several tracks into a group.
The track status of this group can subsequently be set with the ALL keys (ALL READY, ALL SAFE, ALL INPUT, ALL REPRO).
The status of the tracks that are not included in the group will not be affected.

Defining a group

With the SET key any number of channels can be assigned to a group. The procedure is started and terminated by pressing the SET key.

1. Press the SET key once to enter the SET group mode. Any other SET mode is canceled (SET record mute, memory, ping pong, track slipping, track bouncing)
   - The SET LED lights up.
   - The INPUT/REPRO LEDs switch off.
2. Press the corresponding GROUP key (1 to 4) once
   - Group selection.
   - The GROUP LED lights up.
   - The SET LED flashes.
   - The INPUT LEDs of the previously programmed channels of this group light up.
3. By pressing the INPUT/REPRO keys any number of channels can be added to or deleted from this group.
   - The INPUT LEDs of the channels assigned to this group are lit.
4. Press the SET key once.
   - Terminates the programming mode.
   - The SET LED switches off.
   - The GROUP LED switches off.
   - The INPUT & REPRO LEDs return to the state they were in before the SET mode was initiated.

Switching over to a group

Press the desired **GROUP** key together with any **ALL** key. All tracks of the group are switched to Safe, Ready Input or Repro.

[5] SETUP MEMORY

Four memory locations are available for storing four different track setups. The current state of all 48 tracks (SAFE/READY, INPUT/REPRO) can be written into a memory as follows:

Store setup First press the STORE key and then

Recall setup Press the desired memory key (1...4).
The stored track state can subsequently be retrieved by pressing the corresponding memory key (1...4).

[6] USER keys

These keys are also programmed on the display panel.
The factory preprograms the USER keys as follows:

USER 1:	TC LOCK ON/OFF	(F064)
USER 2:	TC INPUT GEN/EXT	(F065)
USER 3:	ADVANCED OUTPUT ON/OFF	(F001)
USER 4:	LIBRARY WIND ON/OFF	(F020)

[7] CHANNEL ON/OFF

Switches a channel on or off if pressed together with the INPUT / REPRO key of the channel.
The function is identical to the same key on the display panel.

[8] EMPHASIS ON/OFF

Switches the emphasis filter for recording analog signals on or off. Press together with an INPUT / REPRO key. Indication of the emphasis setting on the display panel and on the remote display.
The function is identical to the same key on the display panel.

[9] PING PONG

Copying of a digital audio channel to one or several other audio channels (internal connections).
The function is identical to the same key on the display panel.

[10] MASTER SAFE

ON: LED is lit: Recording disabled. All tracks (digital audio and auxiliary tracks) are automatically switched to SAFE.
OFF: LED dark: Recording enabled.

[11] AUTO INPUT

ON: LED is lit: The digital audio tracks and the two cue tracks are automatically switched to INPUT (INPUT LEDs are light) if the machine is not in PLAY or RECORD mode.
OFF: Disables the AUTO INPUT mode. The LED is dark.

Note: AUTO INPUT can be operated in modes A and B. In mode A all tracks, in mode B only tracks in ready status switch to INPUT.
(Setting in the menu Functions / Audio / F002: AUTO INPUT A/B)

[12] AUTO MUTE

ON: LED is lit: The cue tracks are automatically muted until the nominal play speed is attained (except in EDIT and SHUTTLE mode).
OFF: LED dark: The audio outputs of the cue track are always active.

[13] ALL keys

ALL READY The ALL READY key must be pressed together with the ALL ENABLE key. All 48 audio channels are switched to ready.

ALL SAFE ALL SAFE inhibits recording on all 48 channels.

ALL INP With ALL INP the signal available on the inputs of the 48 audio tracks is connected to the corresponding outputs.

ALL REP ALL REP connects the signal of all 48 audio channels from tape to the audio outputs.

ALL ENABLE See description of ALL READY

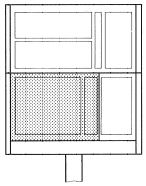
[14] INPUT/REPRO White keys for changing over between monitoring the input signal or the output signal off tape. The selected operating mode is indicated by the corresponding yellow LEDs.

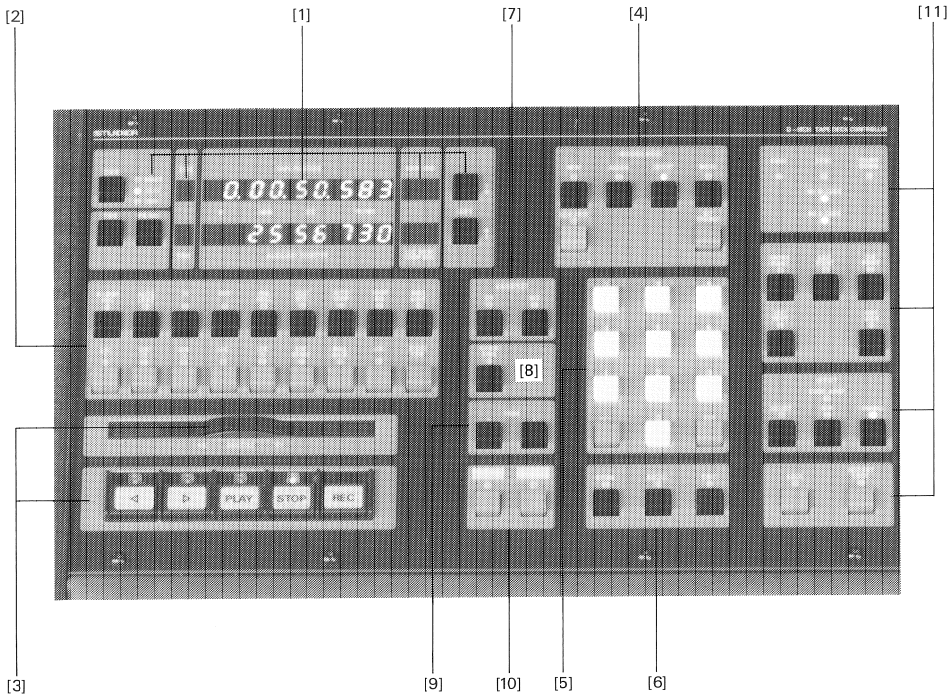
[15] SAFE Black keys for activating or deactivating the record inhibition. The yellow LED is on when recording is disabled for the respective channel.

[16] READY Green keys for activating or deactivating the record inhibition. In the active state the green LED flashes.

[17] REC This red LED indicates that a track is in RECORD mode.

3.2 Tape Deck Remote Control





3.2.1 Explanation of Keys on Tape Deck Remote Control

The autolocator concept as used for analog machines has been largely adopted with certain enhancements to the operating panel. These enhancements essentially relate to:

- Time indication, locate and loop functions are based not only on move pulses but also on TC and RT.
- Supplementary keys for determining the REC mode and the crossfade time
- Connection to D820 MCH via rembus. Also, the channel remote controls (audio remote controller and parallel audio interface) are operated through this bus.

[1] Display

The display comprises two rows of twelve 7-segment positions each. The first position (from the left) indicates the TIME base (timer, lap, TC, RT).
The subsequent nine positions indicate the hours, minutes, seconds, milliseconds (or frames). Negative 2-digit hours cannot be shown on this display. The last two positions are index registers for locator and loop mode.
The upper row normally displays the momentary **TAPE POSITION** in the selected mode, while the lower row displays the content of the **AUXILIARY REGISTER**.
The controls associated with the 7-segment display are the two COPY keys and the three toggle keys CODE, TIME, and FR/MS.

COPY ↑ / ↓ With the two keys COPY, located on the right-hand side of the 7-segment display, you can transfer the tape addresses, incl. time mode, into the Aux register, or set the timer or the LAP timer.

↓ Copy the tape position display to the Aux register.
TC and RT can only be copied in this direction.

↑ Copy the Aux register to the Tape Position display. This operation is only enabled in tape timer or LAP mode. In this way you can set the tape timer to any address entered into the Aux register. To reset the Tape timer press CLEAR to reset the Aux register and copy it to the Tape Position display.

CODE When the TC or RT time base is selected, you can use the CODE key to change over the display between the tape position of the master (external source) or the slave (local machine) or their difference (slave minus master).

TIME With the TIME key you can change over between the four time bases (time, TC, RT, lap). The same timer is displayed on the machine as on the remote control.

FR/MS

The FR/MS toggle key switches the time code reading between frames and milliseconds.

[2] Loop and locate keypad

The loop functions are located in the upper row, the locate functions in the lower row.

A LOOP REC AUTO LOOP RECORD initialises an automatic recording loop with punch-in/punch-out commands. The auxiliary keys for this loop are: AUTOLOAD, IN, OUT, PREROLL, POSTROLL.

AUTO LOAD With AUTO LOAD you can define the punch-in/punch-out locations for the A LOOP REC function on the fly.

IN and OUT With IN and OUT you can display and define the punch-in/punch-out locations for the A LOOP REC function via the Aux registers.

PREROLL and POSTROLL With PREROLL and POSTROLL you can display and define the preroll and post-roll time in AUTO LOOP RECORD mode.

AUTO LOOP AUTO LOOP starts an automatic loop between a start and a stop address. Two locate memories can be selected as start- and end-point with the LOOP SEL key.

LOOP SEL With the LOOP SELECT key the locate memories for the AUTO LOOP function are specified. The locator number and the address of the start point is displayed in the Aux register. The same data of the end point are shown in the tape position display.
After having switched on the LOOP SELECT function, enter the locator numbers for start- and end-point with two digits. If you switch LOOP SELECT off again all inputs will be stored.

INST LOOP INSTANT LOOP starts a loop between the momentary tape position (end) and the address stored in the Aux register (start).
Instant loop can easily be started in PLAY mode ("on the fly") as follows:
Press the COPY ↓ key at the desired start point. The momentary address is copied to the Aux register. When the end-point is reached press the INST LOOP key and the determined sequence will be repeated endlessly.

LOC 1 to LOC 5 LOC 1 to LOC 5 start positioning the tape at the address stored in the corresponding memories.

LOC START LOC START locates the address of the last play command.

ROLLBACK ROLLBACK rewinds the tape by the amount defined as the rollback time. (Setting in menu Set-up / Locator S024).

LOC LOC positions the tape at the address displayed in the Aux register.
A particular tape position can be entered in the Aux register (numeric keypad) and then located with the LOC command.

STORE CUE STORE CUE transfers the momentary tape position to a locate memory number 00...99. The number of the locate memory is automatically specified. The value displayed (last) in the Aux register field "LOC MEM" augmented by one makes the new number.

[3] Tape transport command keys The tape transport command keys STOP, PLAY, REC, FW, RW and the SHUTTLE wheel have the same function as on the machine itself.

[4] RECORD MODE The record mode functions SET ENABLE, NEW, ASSEM, INSERT, MUTE and REHEARSE have the same function as on the machine itself.

SET ENABLE SET ENABLE is used for setting the functions NEW, ASSEM, INSERT, MUTE (2-key function with corresponding mode key).

REHEARSE REHEARSE is used for simulating the punch-in/punch-out process.

[5] Numeric keypad The numeric keypad comprises the eleven keys '0' to '9' and '±' by means of which any address can be entered into the Aux registers, plus the CLEAR key which overwrites the Aux register with the value 0.00.00.000.

[6] STORE, RECALL, CALC **STORE**, followed by a parameter key or a numeric entry copies the content of the Aux register into the corresponding memory. For locators two figures (00...99) or a single negative figure (-0...-9) have to be entered as a memory number.
RECALL, followed by a numeric entry, recalls the content of the corresponding register into the Aux register. (The LOC key would have to be pressed to position the tape at this address.)
CALC enables the calculator mode.

[7] VARISPEED **ON** Switches the VARISPEED ON or OFF.

SET SET (in conjunction with the TRIM +/- keys) establishes the varispeed deviation.

[8] X-FADE TIME This key displays the CROSSFADE TIME of the punch-in/punch-out process. The setting corresponds to the set-up menu S004.

[9] TRIM

With the TRIM +/- keys you can increment or decrement the value in the Aux register.
In CALC mode these keys effect the calculations.

[10] KEY MACRO The two MACRO keys can memorize and recall a sequence of up to ten key commands on the tape deck controller.
Programming is started with STORE and the desired MACRO key pressed simultaneously. Then enter the key commands and finaly press the STORE key.

[11] Synchronizer The internal synchronizer of the machine can be operated with the aid of the keys located on the right-hand side of the numeric keypad.

CUED/COUNTDOWN The lamps CUED and COUNT DOWN are only active in edit mode and indicate the status of the editing operation.

SYNC The SYNC lamp is lit when the master and slave are synchronized.

NO M CODE NO M CODE is lit if no MASTER code (TC or RT from tape) is available.

NO S CODE NO S CODE is lit if no SLAVE code (TC or RT from tape) is available.

ENTRY POINT, EXIT POINT CUE POINT With ENTRY POINT, EXIT POINT and CUE POINT you can display and define the punch-in/punch-out and cue points via the Aux register.

EDIT WAIT EDIT WAIT parks the D820 at the cue point. When the master reaches the cue point, the D820 synchronizes to the master until the master leaves play. Programmed punch-in / punch-out is possible.

EDIT LOCK Same as EDIT WAIT jet the D820 remains synchronized even when the master leaves play.

OFFSET REGIST With OFFSET REGIST you can display or set the synchronizer offset via the Aux register.

AOR CODE JUMP AOR activates the auto offset retention function in lock mode. The CODE JUMP lamp lights up in AOR when a code jump is detected.

OFFSET ENABLE The OFFSET ENABLE function permits lock mode with synchronizer offset.

LOCK, INST LOCK LOCK and INST LOCK initiate the synchronization command. The LOCK command controls the machine in such a way that the time code difference between the master and the slave becomes negligibly small, except for the specified offset.
INST LOCK sets the offset to the time difference existing at the time this command is initiated, and synchronization is performed in the same way as for LOCK.

3.2.2 Operating Instructions

3.2.2.1 Aux Register

The lower display line is called AUXILIARY REGISTER. It is used for diplaying tape addresses and various parameters. Inputs on the numeric keypad are written into the Aux register. It also serves for the handling of all locator functions. In loop mode start and end addresses of the loop can be displayed at the same time.

The following examples may give an idea of the use of the AUX REGISTER.

- Display for values entered on the numeric keypad.
- Recall of a locate memory: The RECALL key followed by one of the 110 locator numbers displays the address. The locator number is displayed in the locate memory field ("LOC MEM") to the right of the Aux register.
- Modification of the momentary Aux register address with the TRIM +/– keys.
- With the COPY ↓ key the momentary tape position is copied to the Aux register. There it can be stored as a locator, used for a later LOC operation or as a start point for the INSTANT LOOP.
- The CALCULATOR computes tape addresses and shows the result in the Aux register.
- General parameters as crossfade time, rollback time, edit points etc. are displayed in the Aux register and can be modified with the numeric keypad or with the keys TRIM +/–.

3.2.2.2 Locator

Storing the locator address

A locator address can be stored into one of the 110 locate memories as follows:

1. **Press STORE** followed by a **locator number** -9...-0 / 00 / 01...99 entered via the numeric keypad. The value of the Aux register will be stored into the specified locate memory. Its number is displayed in the LOC MEM field.
2. A quick way of storing a locator is the **STORE CUE** function. The tape position is copied into the Aux register and automatically stored. For this purpose the locator number (last) displayed in the LOC MEM field of the Aux register is augmented by one. STORE CUE addresses the 100 positive numbers from 00 to 99 only. It can be operated during PLAY to catch tape positions "on the fly".

Notes:

- The Loc address is always stored together with the time mode displayed in the Aux register.
- When the tape timer or lap timer is reset, the locate memories, for which the time addresses have been stored in timer or lap mode, will be recomputed automatically so that they always relate to the same tape location.

Recall of locator addresses

Press the RECALL key followed by the locator number -9...-0 / 00 / 01...99. The address and the locate memory number are displayed in the Aux register.

The locator function can be executed as follows:

1. The **LOC** key performs a locate command. The tape is positioned at the address shown in the Aux register.
   To position at locator number -5 first recall its address and second press LOC.
2. The keys **LOC1... LOC5** directly position the tape at the addresses stored in the locate memories 01...05.

Note: During the locate process the target address with the corresponding time mode is displayed in the Aux register.

Preselecting a command during locate

After having reached the locate point the machine switches to STOP. During the locate process PLAY or RECORD can be preselected. Simply press the desired function keys PLAY or PLAY + REC. The preselected keys are flashing until the operating mode is established.

3.2.2.3 Rollback

The ROLLBACK function rewinds the tape by an adjustable period of max. 59 seconds. The machine then switches to a selectable operating mode PLAY, RECORD or STOP.

Start Rollback

Press the **ROLLBACK** key.
If the rollback key is pressed during rollback, the rollback time is displayed.

Set Rollback time

The rollback time can be defined in two ways:

1. **Numeric entry** between 1 and 59 seconds, followed by **STORE** and **ROLLBACK**.
2. Press **RECALL** followed by **ROLLBACK**. In this case the rollback time is displayed in the Aux register. It can be modified with the TRIM keys. The content of the Aux register will automatically be stored.
   You can terminate this edit mode in two different ways:
   - Press the ROLLBACK key again
   - Automatically after a timeout of 5 seconds since the depression of the last TRIM key.

Setting the operating mode

The menu Functions / Locator / ROLLBACK (F045) specifies the operating mode to which the machine will switch after completion of the rollback function. You can select PLAY / RECORD / STOP.

3.2.3 Loop Commands

LOOP operations means repeated, automated playback of a sequence between adjustable start and end points.
There are three types of loop commands:

- **AUTO LOOP**: locator memories can be specified as start and end points with the LOOP SELECT function.
- **INSTANT LOOP**: This function is ideally suited to quickly repeat a sequence during playback. The Aux register is taken as the start point. The end point is defined by the moment when INST LOOP is pressed.
- **AUTO LOOP RECORD**: This LOOP function performs automated punch-in and -out with dajustable preroll and postroll periods. Finally the tape is rewound to the start of preroll.

  The two particular memory keys IN and OUT store the punch-in and -out addresses. The PREROLL and POSTROLL time are separately adjustable.

Start LOOP

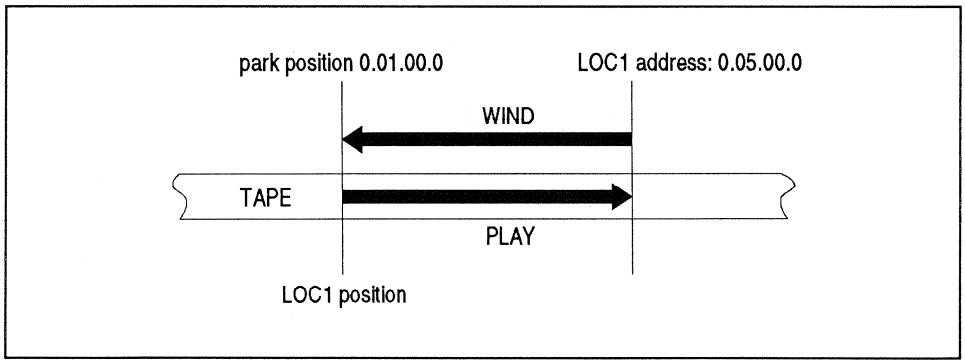
The LOOP keys immediately execute the LOOP commands provided that the start and end points are accurately set.
AUTO LOOP REC only prepares for the recording. It has to be started with the REC + PLAY keys.

Stop LOOP

The following functions terminate any LOOP function:
PLAY; STOP; RECORD; REWIND; FOREWIND; Shuttle,
AUTO LOOP; A LOOP REC; INST LOOP
LOC; LOC1...LOC5; LOC START; ROLLBACK
LOCK; INST LOCK; EDIT WAIT; EDIT LOCK

3.2.3.1 AUTO LOOP function

In AUTO LOOP mode two locator memories can be specified as start and end point. The machine first performs a locate to the loop start, then continues in play mode until the end point is reached, followed by rewind to the start point, from where the process repeats itself.
During the locate phase to the start point the starting address and its memory number are displayed in the Aux register. During the play phase the end address is displayed in the Aux register.



Set start and end point

The LOOP SELECT key displays specifies the two locate memory numbers used as start and end points.

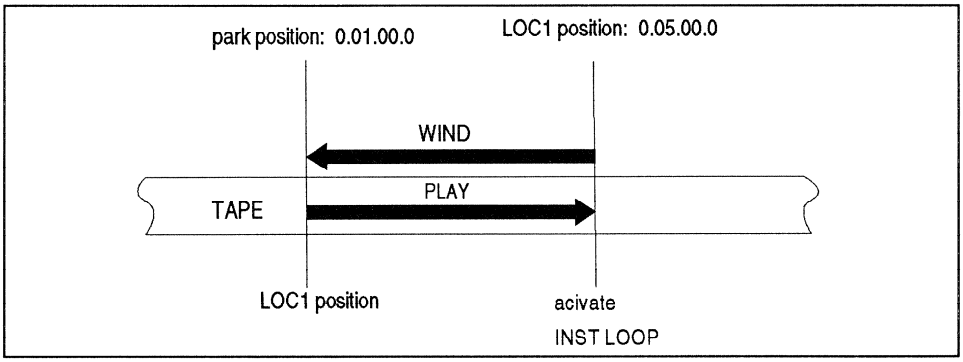
- Press **LOOP SEL**. The LOOP SEL LED lights up and the last loop parameters are displayed.
- Enter first the two digits for the locate memory number of the start point, then those of the end point.
- The start locator is displayed as the index in the LOOP BEG field on the right of the Aux register whose content, i.e. the time, is displayed in the Aux register. The end locator is displayed as the index in the LOOP END field on the right of the tape position, but its content is not displayed.
- As long as the LED is lit the LOOP SEL mode can be terminated by pressing the LOOP SEL key again.

Start AUTO LOOP

Press AUTO LOOP to start this mode. During LOOP the parameters can not be changed. Commands that would alter the content of the Aux register are disabled (e.g.RECALL locator, X-FADE) while AUTO LOOP is active.

3.2.3.2 INSTANT LOOP function

INSTANT LOOP is a quick way for repeating a sequence as a loop. Start and end points are easily determined during playback ("on the fly").



Set start point

The start address of the loop is the content of the Aux register. During playback simply press COPY↓ to catch the address of the desired start point. There are more ways of determining the start address.

- Enter the start address on the numeric keypad.
- If the start address is stored in a locate memory press RECALL and enter the memory number. The address is displayed in the Aux register.
- A nearly correct start address in the Aux register can be modified with the TRIM +/- keys.

Set the end point

The end address is determined when loop is started with the **INST LOOP** key. The machine immediately rewinds to the start point (Aux register) and starts playback. As soon as the end point is reached this process is repeated.

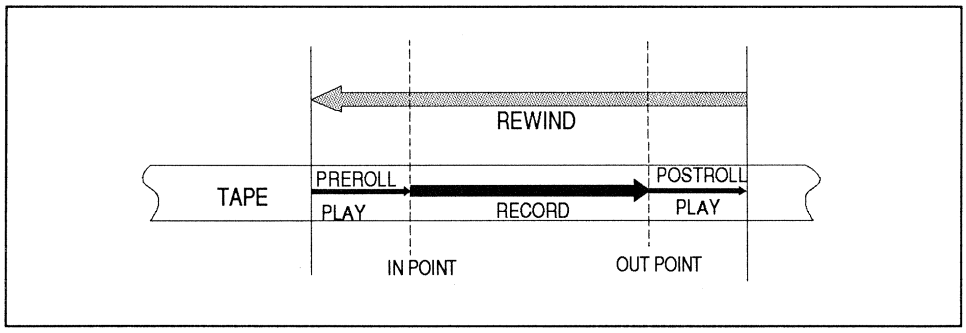
Notes:

- While the start point is being searched, the starting address is displayed in the Aux register. During the play phase, the end address is displayed in the Aux register.
- The end address of the loop can be modified at any time with the two TRIM keys, even during the locate phase to the start point when the end address is not shown in the Aux register.
- Commands that would modify the content of the Aux register (e.g. RECALL locate memory or X-FADE TIME) are disabled during the INSTANT LOOP mode.

3.2.3.3 AUTO LOOP RECORD function

With the AUTO LOOP RECORD you can execute a loop with automatic punch-in and punch-out with playback phases called PREROLL and POSTROLL.
The parameters PREROLL, IN, OUT and POSTROLL are used for AUTO LOOP mode. The AUTO LOAD function determines the start (IN) and end (OUT) points.

After the A LOOP REC command the machine positions at the "punch-in address less preroll time". With the PLAY + REC keys one record loop is started. First PLAY is active during preroll. At the punch-IN point the RECORD mode is activated. After punch-OUT there is another playback phase for as long as the postroll time. Finally the tape is rewound to the beginning of this process and parked in STOP mode.
The next cycle has to be started with PLAY + REC.



Store punch-in point

The **IN** key is a memory for the punch-in point. It is operated like a locate memory.

- Put the punch-in address into the Aux register by:
  - numerical entry
  - copying from the tape position display (COPY ↓)
  - recall of a locate memory (if available)
- Press **STORE** followed by **IN**.

Store punch-out point

The punch-out point can be defined the same way as the IN point. Both addresses have to relate to the same time base (TC, RT, timer).
The duration of the recording must be greater than 50ms. Otherwise the message "**no punch**" is displayed.

- Put the punch-out address into the Aux register.
- Press **STORE** followed by **OUT**.

Modify IN / OUT

The IN and OUT addresses can easily be modified with the TRIM +/- keys.

- Press **IN** or **OUT**. The address is displayed in the Aux register.
- Use the **TRIM +/-** keys to modify the value. The displayed value is automatically stored.
- To quit press **IN** or **OUT** again or edit any other parameter (preroll time, crossfade time,..)

AUTO LOAD function

The punch-in and punch-out time can be defined during playback ("on the fly") with the aid of the AUTO LOAD function. The REHEARSE function protects the data on tape during AUTO LOAD. The RECORD command is only simulated.

- Position the tape before the punch-in point.
- Press **AUTO LOAD**.
- Start **PLAY**BACK.
- At the **punch-in** point press **PLAY + REC**. The IN address is set.
- At the **punch-out** point press **PLAY**. The OUT address is set.
- Press AUTO LOAD again to quit or change over to A LOOP REC mode.

Set PREROLL time

- Numeric input between 0 and 99 seconds.
- Press STORE and PREROLL.

Set POSTROLL time

- Numeric input between 0 and 99 seconds.
- Press STORE and POSTROLL.

Modify PRE-/POSTROLL

With the TRIM keys you can modify the preroll or postroll time.

- Press **PREROLL** or **POSTROLL**. The set value is displayed in the Aux register.
- Use the **TRIM +/-** keys to modify the setting. The displayed value is automatically stored.
- To quit press PREROLL or POSTROLL again or edit any other parameter (IN, OUT, crossfade time,..)

Starting AUTO LOOP REC

Press the **A LOOP REC** key to start the RECORD LOOP function. The tape is rewound and parked at the starting point (punch-in time less preroll time). If the desired tracks are prepared and switched to READY start the record loop with **PLAY + REC**.
The AUTO LOAD key is disabled during AUTO LOOP RECORD. The IN and OUT point can't be modified while the loop is in progress.
Commands that would modify the content of the Aux register (e.g. RECALL locate memory or X-FADE TIME) are disabled during the A REC LOOP mode.

Notes:

- A LOOP REC must be deactivated explicitly. This function has no time-out.
- During PREROLL the Aux register displays the punch-in time. The IN LED is lit.
- During RECORD the Aux register displays the punch-out time. The OUT LED is lit.
- During POSTROLL the Aux register displays the end address of the loop (Punch-out time plus postroll time).

3.2.4 REC Mode

The REC mode can be set with the aid of the SET ENABLE key and one of the keys NEW, ASSEM, INSERT.

NEW: NEW RECORD MODE; see 2.5.2

ASSEM: ASSEMBLE RECORD MODE; see 2.5.3

INSERT: INSERT RECORD MODE; see 2.5.4

MUTE: RECORD MUTE; see 2.5.5.

REHEARSE: **ON**: REHEARSE is active only in the assemble and insert modes. It is used for simulating punch-in/punch-out operations. If REHEARSE is active, the machine behaves as in record mode but no recording is made on tape. The PLAY and REC LEDs flash.
OFF: Tracks on which READY is selected, switch to record mode at the REC command.

3.2.5 Calculator Mode

The built-in CALCULATOR computes sums and differences in all time formats (TC, RT, LAP, TIMER). Starting times, end times or playing times can easily be calculated.

Calculator ON Press the CALC key to activate the calculator. The yellow CALC LED lights up. The content of the Aux register is copied into an invisible computing register.

enter time Enter the term of a sum or subtraction into the Aux register in one of the known ways:
- numerical entry
- RECALL of a locator
- Editing IN, OUT, ENTRY, CUE, EXIT points or the OFFSET REGISTER with the corresponding keys.
- Copying the tape position with the COPY↓ key.

compute The keys **TRIM+** and **TRIM-** execute the addition or subtraction. The previous value of the Aux register (now copied to the computing register) is computed with the present value.

result
- The result is displayed in the Aux register and is simultaneously copied to the computing register.
- The result is based on the time display mode that had been present when the calulator was switched on.
- The calulated time can be stored in a locate memory.
- To continue calculations enter the next time value and press a TRIM key.

delete entry The Aux register is deleted with **CLEAR**.

delete all The Aux register and the computing register are deleted with **CLEAR** and **CALC** pressed simultaneously.

Calculator OFF Press the CALC key again or activate any edit mode (preroll, set varispeed..).

3.2.6 Varispeed

SET VARISPEED

The varispeed deviation can be set by pressing the VARISPEED SET key which activates the varispeed edit mode. The varispeed can be varied with the TRIM keys within the range of ±12.5% in steps of 0.1%. Whatever is shown in the Aux register will automatically be stored. The edit mode can be terminated in two different ways:

- By pressing the VARISPEED SET key again.
- By editing an other parameter.

Varispeed ON / OFF

Varispeed can be switched on or off by pressing the VARISPEED ON key. VARISPEED SET is also possible when varispeed is active.

3.2.7 Crossfade Time

The punch-in/punch-out crossfade time can be set by pressing the **X-FADE TIME** key which activates the X-fade time edit mode. With the TRIM keys you can select between seven different crossfade times. Whatever is shown in the Aux register will automatically be stored. The varispeed edit mode can be terminated in two different ways:

- By pressing the X-FADE TIME key again.
- By editing an other parameter.

3.2.8 Synchronizer Functions

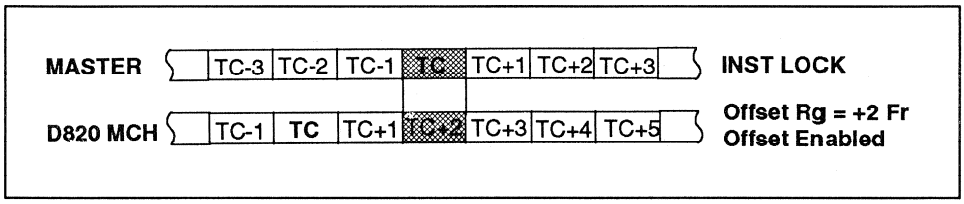
The available synchronizer functions are LOCK and INST LOCK.

LOCK

In LOCK mode the machine is controlled in such a way that the time code difference between master and slave approaches zero. D=S-M-O (S=slave, M=master, O=offset).

INST LOCK

In INST LOCK mode the offset is set to the time code difference existing at the time the command is initiated, and the synchronization process is performed in the same way as in LOCK mode (with ENABLE OFFSET = on). The master and the slave must supply the same time reference. RT/RT and TC/TC synchronization is feasible, but no mixed mode. Whether the synchronization is based on TC or RT is determined by the LCD menu command "Synchronizer reference" on the machine and is not related to the time mode of the "Tape position" indication. The same also applies to the two lamps NO M CODE and NO S CODE.



3.2.8.1 Setting the Offset Register

The offset can be entered in two different ways:

- Load it into the Aux register as described above and store it by pressing STORE and OFFSET. Please note that only offset values from -9:59:59:999 to 14:00:00:000 can be entered.
- Press the **OFFSET REGIST** key in order to activate the offset edit mode. With the TRIM keys you can now modify the offset value. Whatever appears in the Aux register will automatically be stored.

The edit mode can be cancelled in two different ways:

- By pressing the OFFSET REGIST key again.
- By editing an other parameter.

3.2.8.2 Enabling the Offset Register

The offset is activated by pressing the OFFSET ENABLE key. This is the normal situation or the default value at power up. The offset is deactivated by pressing this key again. If a LOCK command were now entered, synchronization with offset = 0 would take place, even though the offset register retains the old value.

3.2.8.3 Slow Lock Mode

The slow lock function works in synchronizer LOCK mode. If differences of more than one second arise because of NOMINAL OFFSET entry or because of jumps in the master or slave code, they are inaudibly minimized by the capstan synchronizer.
SLOW LOCK is active only if **all of the following conditions** are satisfied:

- SLOW LOCK ON (LED is lit)
- Synchronizer reference = TC (F060)
- Snchronizer INTERNAL (F063)
- TC LOCK ON (USER key 1 lit / F064)
- LOCK status achieved; LOCK is on

3.2.8.4 Automatic Offset Retention (AOR)

In this mode, jumps in the master or slave code are accumulated to an additional offset value that is hidden for the user. When a jump occurs, the slave does not switch to chase mode. If the machine is stopped or the tape is rewound, the accumulated offset is reset. However, the offset register will not be overwritten. The AOR mode is cancelled by pressing this key again. A yellow LED is lit when this function is active.

3.2.8.5 Synchronizer EDIT Functions

There are two edit functions: EDIT WAIT and EDIT LOCK.

EDIT WAIT

EDIT WAIT permits the execution of a preprogrammed sequence. The machine first parks at an address (Park point) and waits for the master. As soon as the latter reaches the parking point, the slave is started and synchronized.
If and ENTRY and EXIT POINT are programmed, punch-in and punch-out are possible.

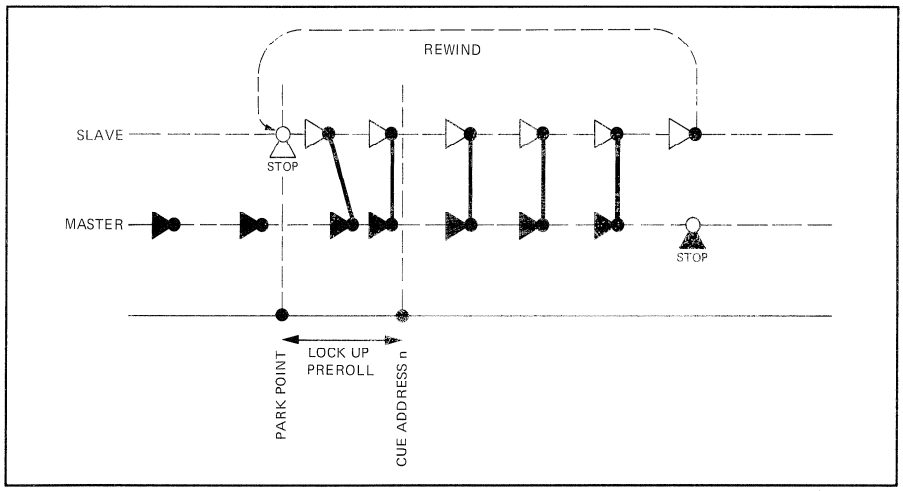
Restrictions

- ENTRY and EXIT points must be at least 50ms apart and have the same time base.Otherwise there will be no punch-in/-out and the message "no punch" is displayed.
- If the slave is not yet synchronized at the punch-in point there will be no punch-in.

Synchronisation is continued until the play sync mode must be terminated. The slave rewinds to the parking point and waits for the next event.

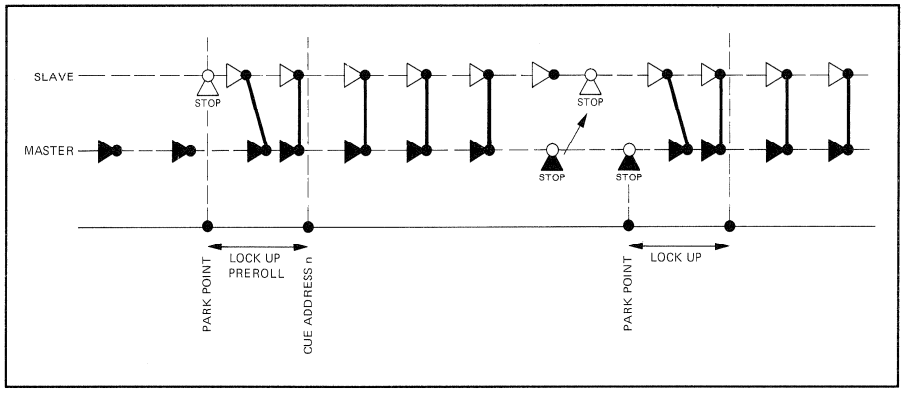
EDIT WAIT command

The EDIT WAIT command advises the slave machine to position the tape at the park point.
The yellow LED is lit when the function is active.
This function can be terminated at any time by activating another synchronizer function, by pressing a tape command key or by pressing EDIT WAIT again.



EDIT LOCK

EDIT LOCK is similar to EDIT WAIT except, when the PLAY SYNC mode is terminated, the slave follows the master rather than returning to the parking point. The yellow LED switches off and the LOCK LED lights up because the new condition corresponds to the LOCK state. A reparking can be performed by entering the command.



3.2.8.6 Determining the CUE-, ENTRY- and EXIT point

Three parameters must be defined: Cuepoint, Entrypoint and Exitpoint. All three parameters must be specified on the same time base (TC, RT, timer).

Set CUE-/ENTRY-/EXIT-points

- Enter the desired cuepoint (or entrypoint or exitpoint) into the Aux register
- Press STORE followed by the suitable key CUE POINT ,ENTR YPOINT or EXIT POINT.

Modify points

- Press the CUE POINT (or ENTRY POINT or EXIT POINT) key in order to activate the corresponding edit mode. The CUEPOINT (or or ENTRYPOINT or EXITPOINT) can be modified with the **TRIM+/- keys**. Whatever is displayed in the Aux register will automatically be stored.
- To delete the address entirely press **CLEAR**.
- The edit mode can be terminated in two different ways:
  - By pressing the CUEPOINT (or ENTRYPOINT or EXITPOINT) key again.
  - By editing an other parameter.

3.2.8.7 EDIT mode indications

The corresponding process is started by pressing the EDIT WAIT or EDIT LOCK key. LEDs are signalling the respective condition of the slave machine.

CUED This green LED is lit when the slave waits at the parking point.

SYNC This green LED is lit when the slave runs synchronous to the master.

COUNT DOWN This yellow LED lights up when the slave waits for the master and the master is located only five seconds before the parking point. This LED switches off when the master has reached the parking point.

Note: The CUED and COUNT DOWN LEDs are only used in conjunction with the edit commands described in this section.

3.2.9 KEY MACRO programming

What is a KEY MACRO

The tape deck controller is equiped with two KEY MACRO buttons. They can store a sequence of up to ten key commands. These commands are automatically executed in the same sequence if a programmed MACRO key is pressed.

Exceptions

The following functions of the tape deck controller can't be programmed in a macro.

- movements of the SHUTTLE wheel
- STORE key
- the second KEY MACRO button

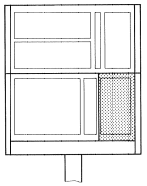
Programming

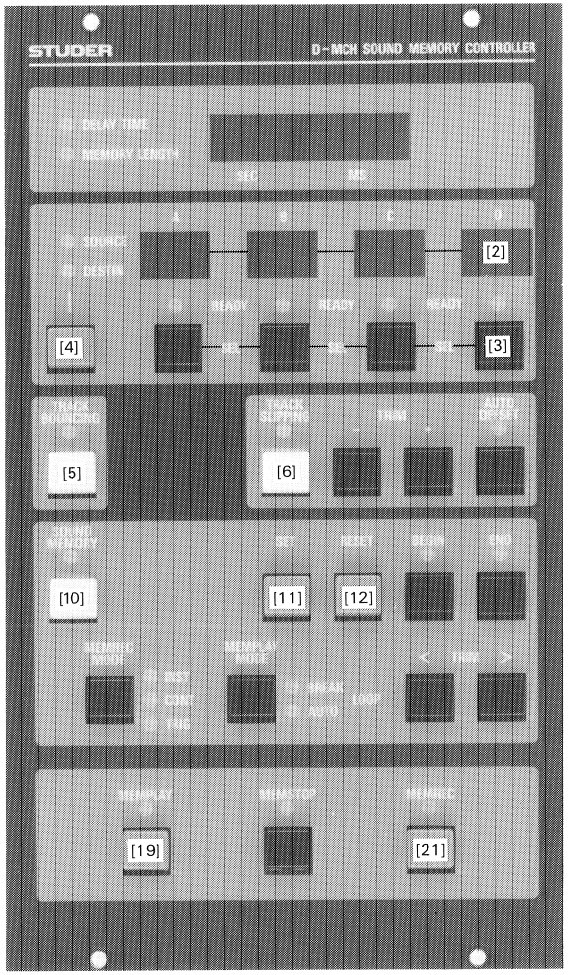
- Press STORE followed by the desired KEY MACRO button. The STORE LED is flashing while the MACRO key is lit. The number of programmed steps is displayed in the Aux register.
- To delete the previous programming press CLEAR followed by the KEY MACRO button. The display shows the message "STEPS 00".
- Enter the desired sequence of commands now. The number of steps is permanently displayed.
- To terminate programming press the STORE key.

Execute KEY MACRO

The programmed commands are immediately executed if a KEY MACRO button is pressed. The KEY MACRO LED remains dark. All restrictions on functions are valid.

3.3 Audio Memory (Sound Memory)



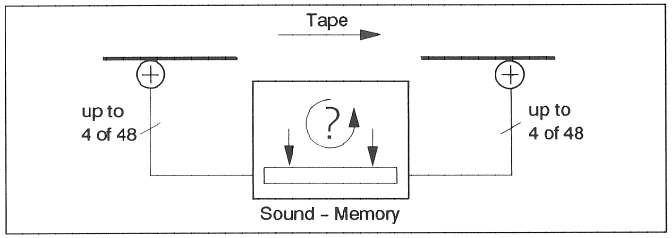


3.3.1 Introduction

The D820 MCH tape recorder is equipped with a 32 Mbit audio memory board on which 47.5 seconds of audio data (fs = 44.1 kHz) can be stored. The audio memory board supports the following three basic configurations:

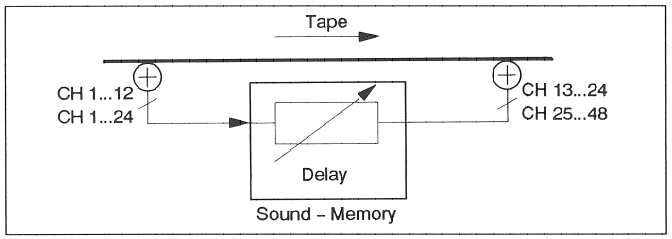
Audio memory

Filling the memory with data, editing the start and end points, reading out the memory, and transferring the data to tape, see 3.3.2.



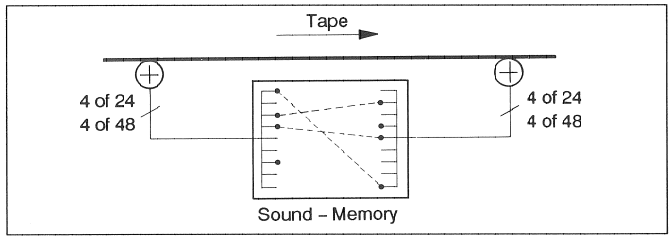
Track-Slipping

Copying of up to 12 or 24 tracks with an insertable, adjustable delay, see 3.3.3.



Track-Bouncing

Sample-accurate copying of up to 4 tracks to other tracks, see 3.3.4.



3.3.2 Audio memory

Note: **The audio memory can be activated only when the D820 MCH is operated in INSERT REC mode.**

Activation

To determine the source and the destination tracks for sound memory functions activate the SET mode with the SOUND MEMORY [10] key. The yellow LED flashes.

Assigning the source and destination channels

Press a SEL key [3], the green LED lights up. Press the INP/REPRO key of the desired source channel. The channel number appears on the display [2].
With the SOURCE DESTIN key [4] switch to DESTINATION and press the INP/REP key of the desired destination channel. The channel number appears on the display [2]. You can alternatively enter a channel number on the numeric keypad.
The procedure for the A-D memory is identical. The assignment of source and destination channels is permanently stored even after switching off the machine. All channel assignments can be reset if the CLR and SOUND MEMORY keys are pressed simultaneously in SET mode.

Press the SOUND MEMORY [10] to terminate the input operation; the yellow LED lights up.

Max. memory duration

This time depends on the number of channels and can be read out on the TIME display.

Number of selected channels	Memory duration at 48 kHz sampling frequency
1 channel	43,690s
2 channels	21,845s
3 channels	14,564s
4 channels	10,923s

3 Memory conditions [MEMREC]

MEMREC MODE

By pressing the MEMREC MODE key [15] you can select the following memory modes:

INST Automatically terminates the storage function when the memory is full.

CONT When a memory overflow occurs, the oldest data are overwritten, i.e. the newest data are always retained in the memory. The storage function is only terminated when the MEMSTOP key is pressed.

TRIG When you press the MEMREC key the audio memory is switched to standby mode. The recording function can be started ("triggered") by pressing the MEMSTOP key.
The memory is filled with 500 msec of data preceding the trigger point. The remaining operation is identical to CONT.

Playback

MEMPLAY Activates the playback of the audio memory. The destination channels are automatically switched to input.

MEMPLAY MODE With this key you can toggle between AUTO and BREAK play mode.

AUTO LOOP The memory content is endlessly repeated in a loop.

BREAK LOOP In control monitoring the memory content is repeated endlessly in a loop. However, a 500 ms pause is inserted between the end and the start of the loop (see next Section).

Transferring the memory content to tape

Starting the transfer Start the desired tracks in REC mode. The audio memory switches automatically to MEMPLAY and the data in the audio memory are automatically transferred to the tape.

AUTO LOOP activated The transfer stops automatically when the machine terminates the REC mode or if MEMSTOP [20] is pressed.

BREAK LOOP activated The transmission stops automatically when the end of the audio memory is reached. The selected destination channels are automatically switched off from recording.

Determining the begin of the audio memory recording

BEGIN When you press BEGIN, a 3 seconds loop, starting from the current start mark, is played. During the playback the start mark can be adjusted with the TRIM [7,8] keys.
MEMSTOP [20] interrupts the loop.
MEMPLAY [19] plays the memory content from the new starting point.

END When you press END, a 3 seconds loop, is played that ends at the current end mark. During playback the end mark can be adjusted with the TRIM [7,8] keys.
MEMSTOP [20] interrupts the loop.
MEMPLAY [19] plays the memory content up to the new end point.

Note: The start or end point can be defined "on the fly" during the playback by simultaneously pressing SET and BEGIN or END.
RESET and BEGIN or END sets the begin or end mark to the absolute start of the memory or the absolute end of the memory. The data are not erased.

Terminating the audio memory mode

Press the SOUND MEMORY [20] key: This terminates the audio memory mode and a different mode can be selected.

Note: While MEMPLAY is active the other audio inputs for the destination channels are disabled. It is possible to load data into the audio memory directly from an audio input. In this case the source channel must be switched to INPUT during the recording.

3.3.3 Track Slipping

Characteristics

- Channels 1-12 or 1-24 can be delayed.
- The delayed version of channel 1 is copied to channel 25 (channel 2 to channel 26, channel 24 to channel 48).
- The delay is identical for all selected channels. The maximum possible DELAY TIME is shown on the display (1).

Activation

Press the TRACK SLIPPING [6] key, the yellow LED flashes.

Assigning the source and destination channels

Press INPUT/REPRO of the channel to be delayed. The REPRO LED of the channel to be delayed and the LED of the corresponding destination channel are flashing. The TIME display [1] shows the max. delay time as a function of the number of activated channels.
To terminate the input function, press the TRACK SLIPPING [6] key again; the yellow LED flashes.

Note: All destination channels are automatically switched to READY. Track slipping is also possible directly from an analog input.

Max. delay time

The maximum achievable delay depends on the number of channels.
The delay time is shown on the TIME display [2]. Fine-adjustment of the desired delay time is possible with the TRIM [7,8] keys.

Auto offset

When AUTO OFFSET [9] is activated, the programmed track slipping time is automatically copied into the synchronizer offset register.

Terminating the track slipping mode

Press the TRACK SLIPPING MODE [6] key again to terminate the track slipping mode. A different mode can now be selected.

3.3.4 Track bouncing mode (ping-pong)

Activation

Press the TRACK BOUNCING [5] key, the yellow LED flashes.

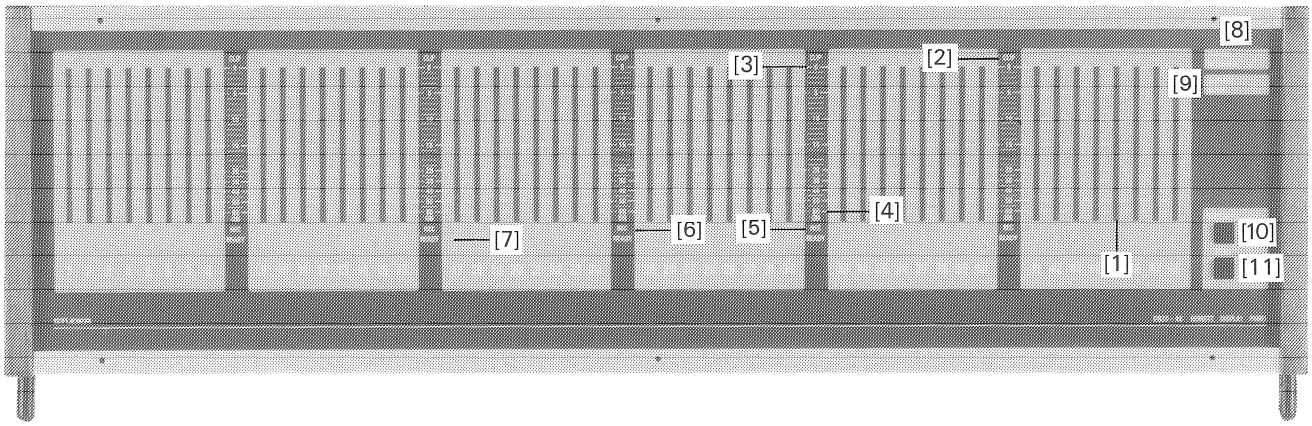
Assigning the source and destination keys

Press the desired key SEL A, B, C, D [3], the SEL LED lights up. With the numeric keys of the channel control you can now define or change the source/destination channels. The corresponding channel number appears on the display. Pressing SEL [3] and CLR [2] cancels the corresponding source or destination assignment. This is confirmed on the display with "--".
The procedure of the A-D memory is identical. To terminate the input function press the TRACK BOUNCING [5] key again; the yellow LED flashes.

Terminating the track bouncing mode

Press the TRACK BOUNCING MODE [5] key again to terminate the track slipping mode. A different mode can now be selected.

3.4 Remote Level Display



[1] BARGRAPH scale

The scale is linear, but subdivided into two sections with different resolution:
0 ... -20 dB 1 LED ≡ 1 dB
- 20 ... -60 dB 1 LED ≡ 5 dB

[2] Clip

(Clipping) the A/D converter is overloaded (indication always active in INPUT mode of the analog inputs; in the REPRO mode only if in REC)

[3] 0 dB

The peak value of the signal is between 0 dB ... 0.75 dB.

[4] -55 dB

The peak value of the signal is between -55 dB ... -59.75 dB.

[5] -60 dB

The peak value of the signal is between -60 dB ... 63.5 dB.

[6] REC

Red LED for recording.

[7] READY

Record ready pilot (green LED)

[8] FORMAT MISMATCH

This LED flashes if the recorder is operated with an external clock reference whose sampling frequency does not agree with the sampling frequency recorded on tape. An error message is output on the display.

[9] SYSTEM ERROR

This LED flashes to signal malfunctions and faults in the power supply, tape transport, electronics, etc. A corresponding error message will be shown on the system display.

[10] PEAK HOLD

momentary Pressing this key **once** switches on the MOMENTARY PEAK HOLD mode.
The momentary peak level is stored and displayed for approx. 3 seconds. If a higher value occurs the memory content will be overwritten. After approx. 3 seconds the memory is cleared.

permanent Pressing this key **twice** switches on the PERMANENT PEAK HOLD mode.
The absolute peak value is stored and indicated. It is updated only when a higher value occurs.

[11] RESET

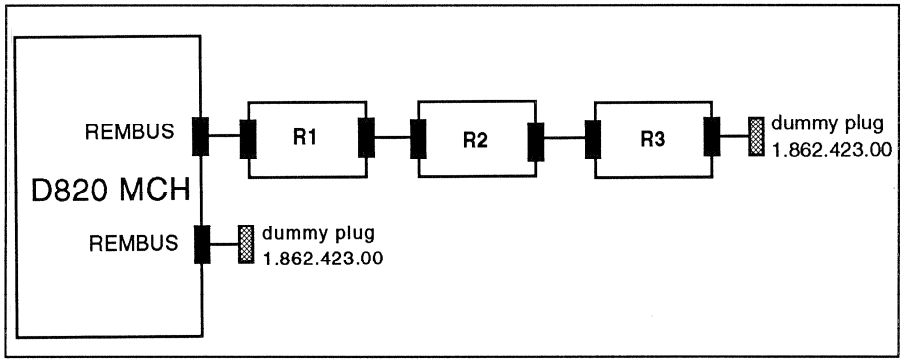
The stored PEAK HOLD value is cancelled, i.e. set to -60 dB.

4 Connecting the Remotes to the D820 MCH

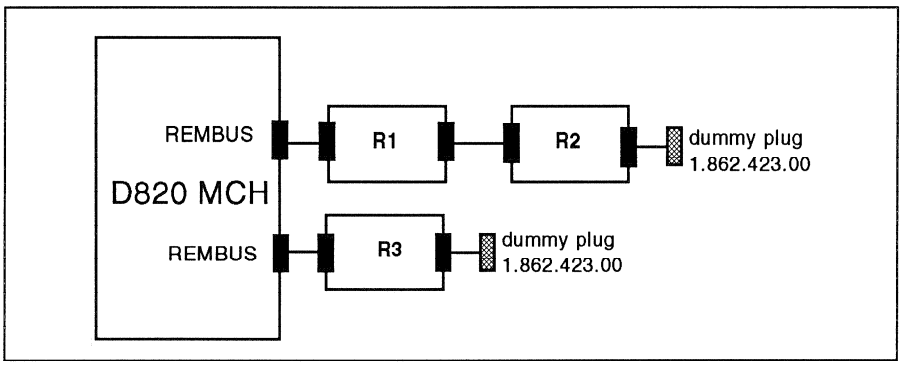
Warning: Remote controls must not be connected or disconnected when the associated equipment is under power!

The audio and tape deck control as well as the PAI can be connected to the machine via the REMBUS. If only one remote control exists, the following setup is recommended:
One of the two Rembus connectors of the machine is to be connected to one of the two Rembus connectors on the remote control by means of the REMBUS cable 1.862.421.00. However, if more than one remote control exists, two connection configurations are feasible:

Configuration 1: Particularly suited if all remote controls (F1 to F3) are located nearby.



Configuration 2: Particularly suited if one of the remote controls (F3 in the example) is located closer to the machine than the other remote controls.



Note:

- **Unused REMBUS-connectors** have to be terminated in any configuration on the machine and on the remote controls as well! Use dummy plug 1.862.423.00.
- If needed, a longer **interconnecting cable** (50 ft) may be used. Contact your STUDER dealer.
- A flat-cable is used to connect the **SOUND MEMORY** unit to the tape deck remote control.

4.1 Parallel Audio Interface (PAI)

General

The parallel audio interface (PAI) converts the serial remote control format (REMBUS) of the D820 MCH to the parallel format and vice versa. In this way each individual digital audio channel and the aux tracks Cue1, Cue2, TC as well as selected special functions can be programmed from a mixing console. On the machine side the connection is established via the 9-pin D-type REMBUS connector. On the mixing console the parallel control lines are available in up to 7 groups on a 50-pin and an optional 9-pin D-type connector.

These 7 groups comprise:

- 6 Audio groups for the control lines of 8 digital audio channels each.
- 1 Master group for the control lines of the 3 aux channels Cue1, Cue2, TC und the selected special functions.

Signals

The control lines consist of a switch input line (from the mixing console to the tape recorder), whose signal names start with "S-" and of lamp output lines (from the tape recorder to the mixing console) whose signal names start with "B". Lines that are not connected or undefined are designated as "not used".

Control lines per Audio group

50-pin D-type connector

(Main lines for 8 digital audio channels)
8 Input/repro switch command lines (switch on = repro)
8 Safe/ready switch command lines (switch on = ready)
8 Input lamp output lines
8 Repro lamp output lines
8 Record lamp output lines
8 Ready lamp output lines

9-pin D-type connector

(optional lines for 8 digital audio channels)
8 Safe lamp output lines

Control lines per Master group

50-pin D-type connector

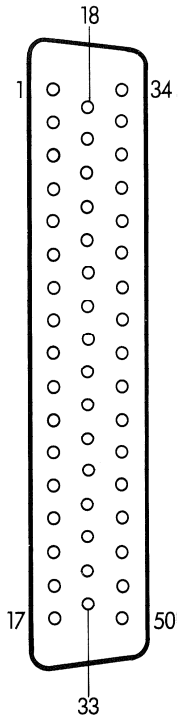
(Main lines for the 3 aux channels Cue1, Cue2, TC, and special functions)
3 Input/repro switch command lines (switch on = repro)
3 Safe/ready switch command lines (switch on = ready)
1 All input switch command line
1 All repro switch command line
1 All ready switch command line
1 All safe switch command line
1 Master safe switch command line
1 Rehearse switch command line
1 Record mute switch command line
1 Autoinput switch command line
1 Automute switch command line
3 Input lamp output lines
3 Repro lamp output lines
3 Record lamp output lines
3 Ready lamp output lines
3 Safe lamp output lines
1 All input lamp output line
1 All repro lamp output line
1 All ready lamp output line
1 All safe lamp output line
14 Spare lines (not used)

9-pin D-type connector (Optional lines for special functions)

1 Master safe lamp output line
1 Rehearse lamp output line
1 Record mute lamp output line
1 Autoinput lamp output line
1 Automute lamp output line
1 Ground line (DGND)
3 Spare lines (not used)

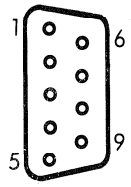
4.1.1 Connectors

50-pin D-type



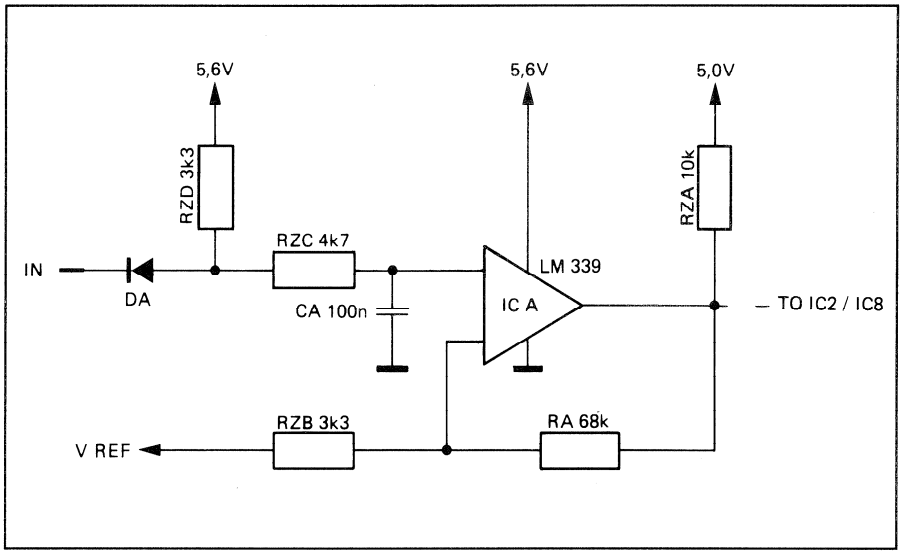
D	Audio1-8	Audio9-16	Audio17-24	Audio25-32	Audio32-40	Audio41-48	Master
01	DGND	DGND	DGND	DGND	DGND	DGND	DGND
02	S-REP-01	S-REP-09	S-REP-17	S-REP-25	B-SAF-33	S-REP-33	S-REP-CUE1
03	S-REP-04	S-REP-12	S-REP209	S-REP-28	S-REP-36	S-REP-44	S-REA-CUE2
04	S-REA-01	S-REA-09	S-REA-17	S-REA-33	S-REA-33	S-REA-41	S-M.REA
05	S-REA-02	S-REA-10	S-REA-18	S-REA-26	S-REA-34	S-REA-42	S-ALL-SAFE
06	S-REA-05	S-REA-13	S-REA-21	S-REA-29	S-REA-37	S-REH-45	S-REH
07	B-RCD-01	B-RCD-09	B-RCD-17	B-RCD-25	B-RCD-33	B-RCD-41	N.C.
08	B-RCD-03	B-RCD-11	B-RVD-19	B-RCD-27	B-RCD-35	B-RCD-43	B-REA-CUE1
09	B-RCD-06	B-RCD-14	B-RCD-22	B-RCD-30	B-RCD-38	B-RCD-46	B INP-CUE1
10	B-INP-01	B-INP-09	B-INP-17	B-INP-25	B-INP-33	B-INP-41	N.C.
11	B-INP-04	B-INP-12	B-INP-29	B-INP-28	B-INP-36	B-INP-44	B-SAF-CUE2
12	B-REP-01	B-REP-09	B-REP-17	B-REP-25	B-REP-33	B-REP-41	N.C.
13	B-REP-02	B-REP-10	B-REP-18	B-REP-26	B-REP-34	B-REP-42	B-REC-TC
14	B-REP-05	B-REP-13	B-REP-21	B-REP-29	B-REP-37	B-REP-45	B-REP-TC
15	B-REA-01	B-REA-09	B-REA-17	B-REA-25	B-REA-33	B-REA-41	N.C.
16	B-REA-03	B-REA-11	B-REA-19	B-REA-27	B-REA-35	B-REA-43	ALL SAFE
17	B-REA-06	B-REA-14	B-REA-22	B-REA-30	B-REA-38	B-REA-46	N.C.
18	S-REP-02	S-REP-10	S-REP-18	S-REP-26	S-REP-34	S-REP-42	S-REA-CUEI
19	S-REP-05	S-REP-13	S-REP-21	S-REP-29	S-REP-37	S-REP-45	S-REP-TC
20	S-REP-07	S-REP-15	S-REP-23	S-REP-31	S-REP-39	S-REP-47	N.C.
21	S-REA-03	S-REA-11	S-REA-19	S-REA-27	S-REA-35	S-REA-43	S-ALL-INP
22	S-REA-06	S-REA-14	S-REA-22	S-REA-30	S-REA-38	S-REA-46	S-MASTERSAFE
23	B-RCD-02	B-RCD-10	B-RCD-18	B-RCD-26	B-RCD-34	B-RCD-42	B-REC-CUE1
24	B-RCD-04	B-RCD-12	B-RCD-20	B-RCD-28	B-RCD-36	B-RCD-44	B-SAF-CUE1
25	B-RCD-07	B-RCD-15	B-RCD-23	B-RCD-31	B-RCD-39	B-RCD-47	N.C.
26	B-INP-02	B-INP-10	B-INP-18	B-INP-26	B-INP-34	B-INP-42	B-REC-CUE2
27	B-INP-05	B-INP-13	B-INP-21	B-INP-29	B-INP-37	B-INP-45	B-REP-CUE2
28	B-INP-07	B-INP-15	B-INP-23	B-INP-31	B-INP-39	B-INP-47	N.C.
29	B-REP-03	B-REP-11	B-REP-19	B-REP-27	B-REP-35	B-REP-43	B-REA-TC
30	B-REP-06	B-REP-14	B-REP-22	B-REP-30	B-REP-38	S-REH-46	B-INP-TC
31	B-REA-02	B-REA-10	B-REA-18	B-REA-26	B-REA-34	B-REA-42	B-M.REP
32	B-REA-04	B-REA-12	B-REA-20	B-REA-28	B-REA-36	B-REA-44	B-ALL-INP
33	B-REA-07	B-REA-15	B-REA-23	B-REA-31	B-REA-39	B-REA-47	N.C.
34	S-REP-03	S-REP-11	S-REP-19	S-REP-27	B-SAF-35	S-REP-43	S-REP-CUE2
35	S-REP-06	S-REP-14	S-REP-22	S-REP-30	S-REP-38	S-REP-46	S-REA-TC
36	S-REP-08	S-REP-16	S-REP-24	S-REP-32	S-REP-40	S-REP-48	S-REC MUTE
37	S-REA-04	S-REA-12	S-REA-20	S-REA-28	S-REA-36	S-REA-44	S-MREP
38	S-REA-07	S-REA-15	S-REA-23	S-REA-31	S-REA-39	S-REA-47	S-AU.INP
39	S-REA-08	S-REA-16	S-REA-24	S-REA-32	S-REA-40	S-REA-48	S-AU.MU
40	B-RCD-05	B-RCD-13	B-RVD-21	B-RCD-29	B-RCD-37	B-RCD-45	B-REP-CUE1
41	B-RCD-08	B-RCD-16	B-RCD-24	B-RCD-32	B-RCD-40	B-RCD-48	N.C.
42	B-INP-03	B-INP-11	B-INP-19	B-INP-27	B-INP-35	B-INP-43	B-REA-CUE2
43	B-INP-06	B-INP-14	B-INP-22	B-INP-30	B-INP-38	B-INP-46	B-INP-CUE2
44	B-INP-08	B-INP-16	B-INP-24	B-INP-32	B-INP-40	B-INP-48	N.C.
45	B-REP-04	B-REP-12	B-REP-20	B-REP-28	B-REP-36	B-REP-44	B-SAF-TC
46	B-REP-07	B-REP-15	B-REP-23	B-REP-31	B-REP-39	B-REP-47	N.C.
47	B-REP-08	B-REP-16	B-REP-24	B-REP-32	B-REP-40	S-REP-48	N.C.
48	B-REA-05	B-REA-13	B-REA-21	B-REA-29	B-REA-37	B-REA-45	B-ALL-REP
49	B-REA-08	B-REA-16	B-REA-24	B-REA-32	B-REA-40	B-REA-48	N.C.
50	VCC	VCC	VCC	VCC	VCC	VCC	VCC

9-pin D-type

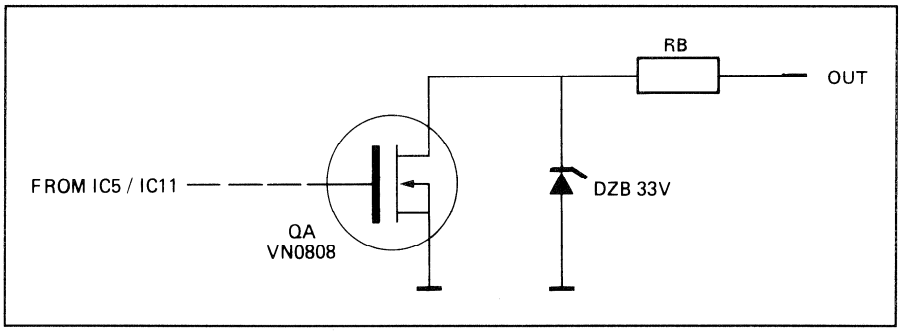


D	Audio1-8	Audio9-16	Audio17-24	Audio25-32	Audio32-40	Audio41-48	Master
01	DGND	DGND	DGND	DGND	DGND	DGND	DGND
02	B-SAF-01	B-SAF-09	B-SAF-17	B-SAF-25	B-SAF-33	B-SAF-41	n.c.
03	B-SAF-03	B-SAF-11	B-SAF-19	B-SAF-27	B-SAF-35	B-SAF-43	B-REH
04	B-SAF-05	B-SAF-13	B-SAF-21	B-SAF-29	B-SAF-37	B-SAF-45	n.c.
05	B-SAF-07	B-SAF-15	B-SAF-23	B-SAF-31	B-SAF-39	B-SAF-47	B-AUTOINP
06	B-SAF-02	B-SAF-10	B-SAF-18	B-SAF-26	B-SAF-34	B-SAF-42	n.c.
07	B-SAF-04	B-SAF-12	B-SAF-20	B-SAF-28	B-SAF-36	B-SAF-44	B-MASTERSAFE
08	B-SAF-06	B-SAF-14	B-SAF-22	B-SAF-30	B-SAF-38	B-SAF-46	B-REC MUTE
09	B-SAF-08	B-SAF-16	B-SAF-24	B-SAF-32	B-SAF-40	B-SAF-48	B-AUTO MUTE

4.1.2 Switch command- and lamp output circuits

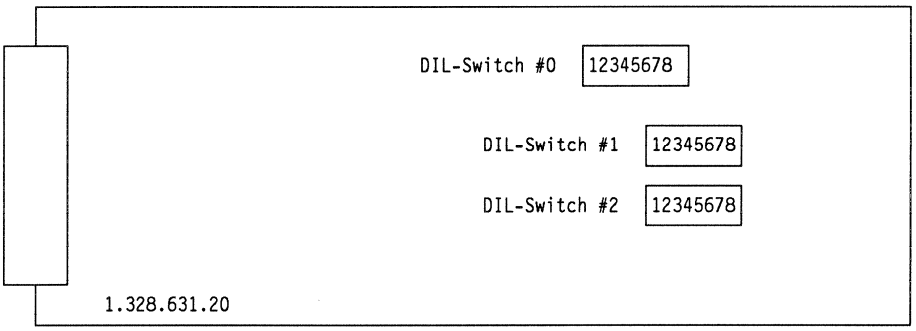


Switch command circuit: Signals "S-.. "



Lamp output circuit: Signals "B.. "

4.1.3 Configuring the Parallel Audio Interface



Switch #0: Rembus Address select
1,2: ON
3...8: OFF

Switch #1: Parallel Audio Interface Configuration Switch #1
1: Digital Audio Group #1 (CH1..CH8)
2: Digital Audio Group #2 (CH9..CH16)
3: Digital Audio Group #3 (CH17..CH24)
4: Digital Audio Group #4 (CH25..CH32)
5: Digital Audio Group #5 (CH33..CH40)
6: Digital Audio Group #6 (CH41..CH48)
7: Cue Tracks
8: TC Track

Switch #2: Parallel Audio Interface Configuration Switch #2
1: All Ready
2: All Safe
3: All Input
4: All Repro
5: Rehearse
6: Master Safe
7: Auto Input
8: Auto Mute

To activate a function from the PAI, the corresponding DIL-Switch has to be set to the ON position. In this case, the function thus selected will be deactivated on the Display Panel and the Channel Remote Control.

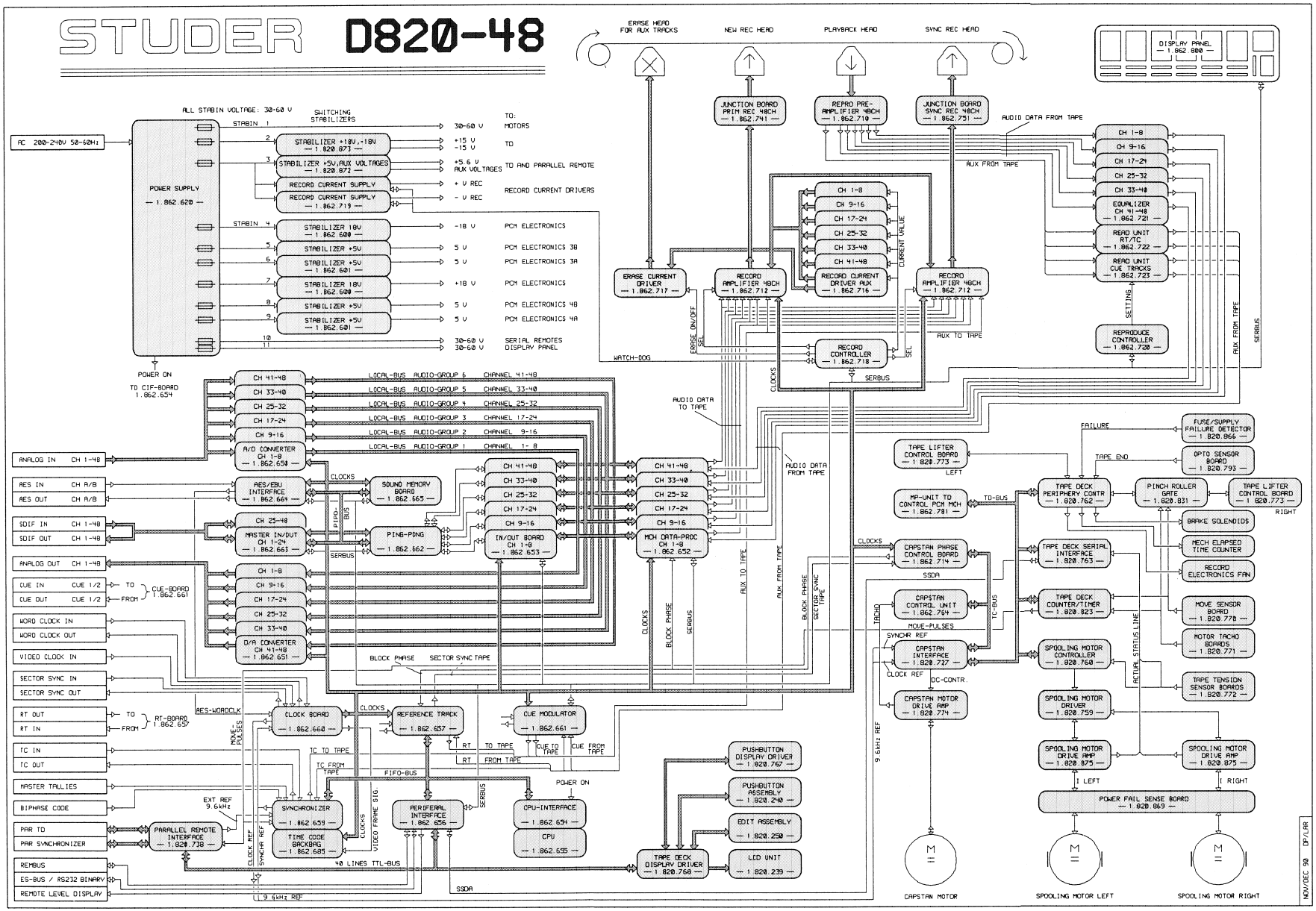
4.2 Computer connection for the SET-UP HANDLER

5 Technical Data

Recording format:	**DASH-F**		
Number of tracks	**Digital Audio:**	D820-48	**48 tracks**
		D820-24 (upgradable to 48 tracks)	**24 tracks**
	Auxiliary:	D820 MCH	**Reference track** **TC track** **2 CUE tracks**
Sampling rate:	**48kHz, 44.1kHz, 47.952kHz, 44.056kHz** (switchable)		
Tape speed:	**30 ips** (76.2cm/s at f_S = 48kHz		
Varispeed:	**±12.5%**		
Recording time:	**approx. 60 min.** (14" reel, 2680 m) at f_S = 48kHz **approx. 65 min.** (14" reel, 2680 m) at f_S = 44.1kHz		
Winding time:	**approx. 3 min.** (14" reel, 2680 m)		
Quantization:	**16 bit** linear		
Frequency response:	**20Hz ... 20kHz**, ±0.3dB		
THD + Noise:	**< -85dB** (20Hz ... 20kHz, f_S = 48kHz)		
Wow and flutter:	**below measurable limit**		
Crosstalk attenuation:	**> 80dB** (20Hz ... 20kHz, f_S = 48kHz)		
Emphasis:	**50µs/15µs** (selectable for each channel individually)		
Analog inputs:	**To record Digital Audio Tracks,** transformer balanced, imp. > 10kΩ:		**+14 ... +24dBu**
	CUE Tracks, transformer balanced imp. > 10kΩ:		**+14 ... +24dBu**
Analog outputs:	**To record Digital Digital Audio Tracks,** electronically balanced, imp. < 50Ω:		**+14 ... +24dBu**
	CUE Tracks, electronically balanced, imp. < 50Ω:		**+14 ... +24dBu**
Digital inputs:	**SDIF-2,**	D-sub/50 pin male	
	AES/EBU,	XLR/3 pin female	
	MADI,	BNC	
Digital outputs:	**SDIF-2,**	D-sub/50 pin male	
	AES/EBU,	XLR/3 pin female	
	MADI,	BNC	

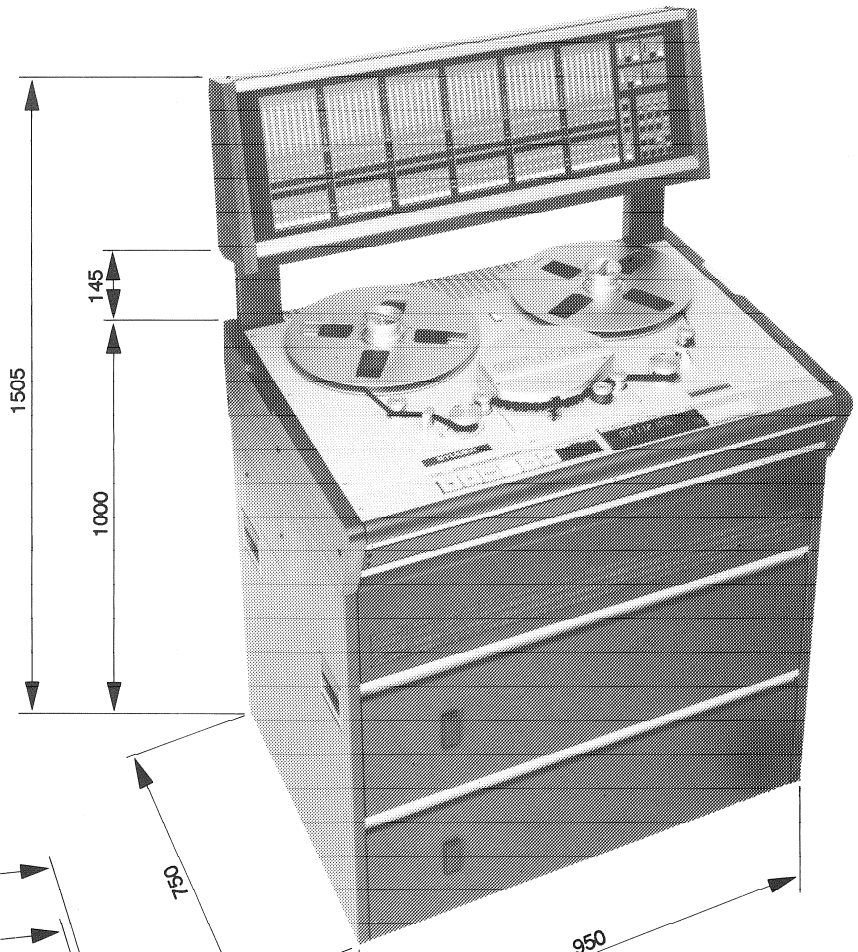
Clock input:	**Wordclock,**	TTL level, BNC
	Sector Clock,	TTL level, BNC
	Video Sync	(with loop-through), BNC
	Square Wave	(with loop-through), BNC
Clock outputs:	**Wordclock,**	TTL level, BNC
	Sector Clock,	TTL level, BNC
Other inputs:	**Time Code**	(with loop-through), XLR/3 pin female
	Reference Track	(with loop-through), TTL level, BNC
Other outputs:	**Time Code,**	XLR/3 pin male
	Reference Track,	TTL level, BNC
Control ports:	**REMBUS**	(with loop-through), balanced, Studer standard (for Autolocator, Channel Control and Parallel Audio IF)
	Level Display,	balanced, Studer standard (for Remote Level Display)
	ES-Bus	(with loop-through), balanced
	Parallel Remote & Synchronizer	
	Master Tallies Input	
Power requirements:	**200 ... 240V**, 50/60Hz	
Power consumption:	**1.2kW** (typ.)	
Working temperature:	**+5°C ... +40°C**	
Humidity:	**20% ... 90%**, (non condensing)	
Dimensions:	**950 (W) × 1505 (H) × 740 (D) mm** (with overbridge mounted)	
Weight:	**290kg**	

5.1 Blockdiagram D820 MCH

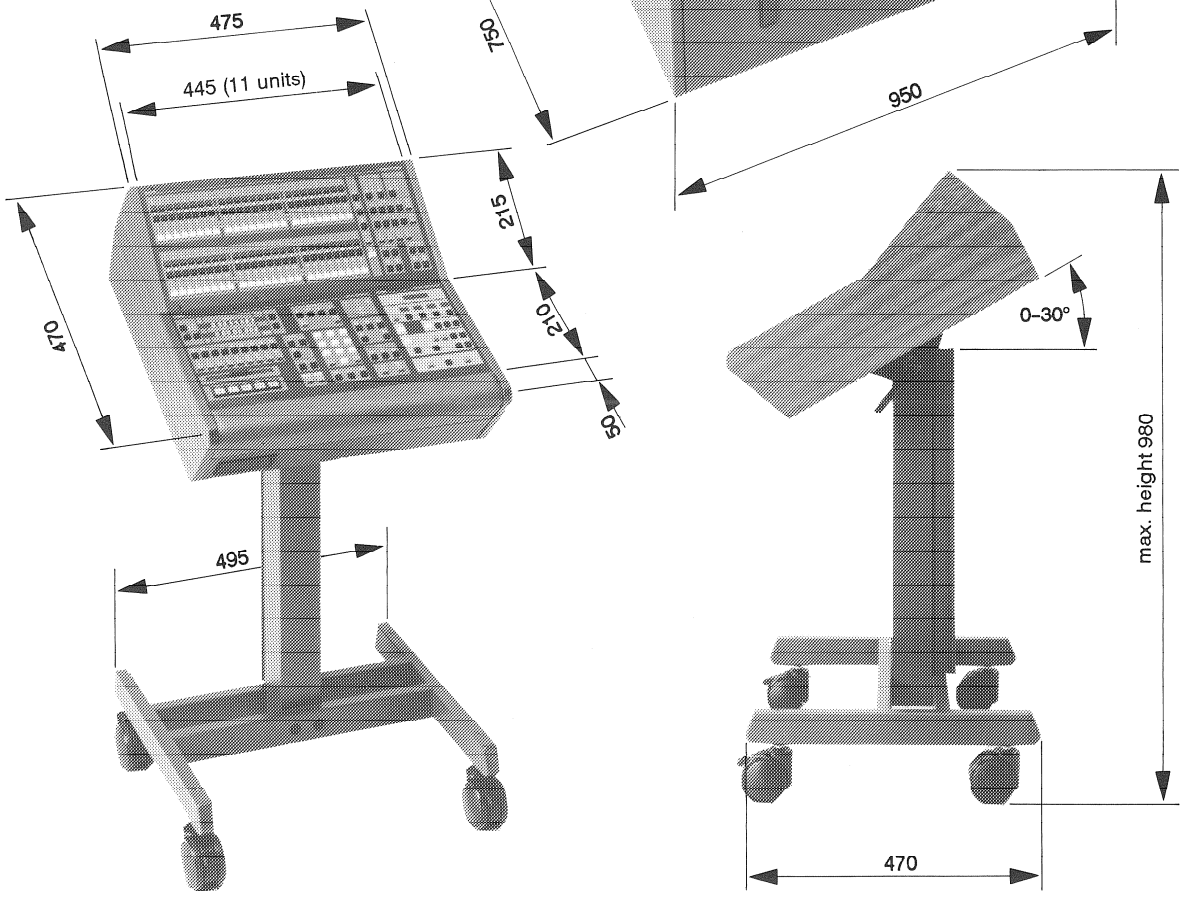


5.2 Mechanical Data

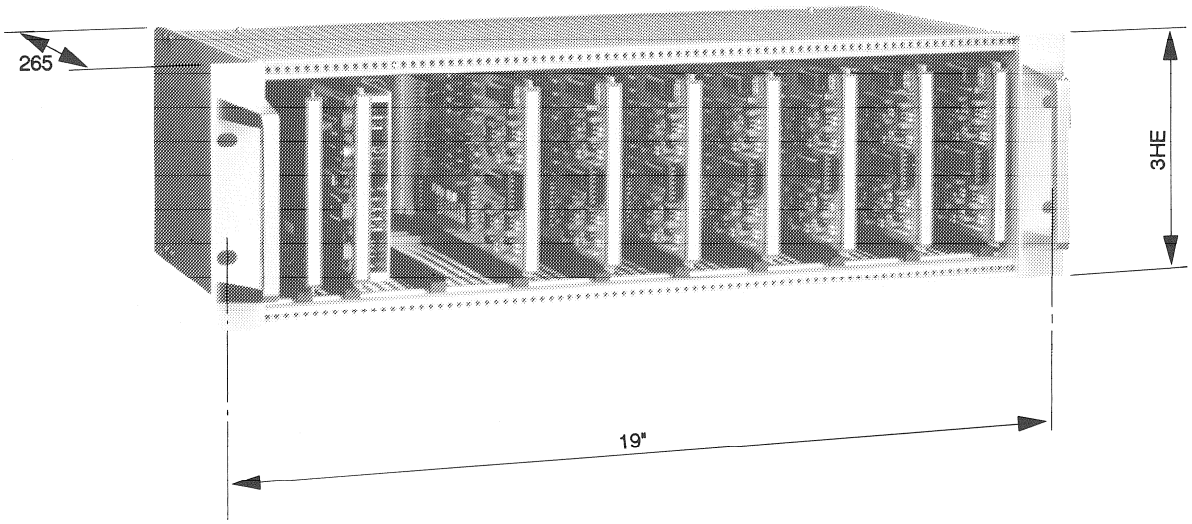
D820 MCH



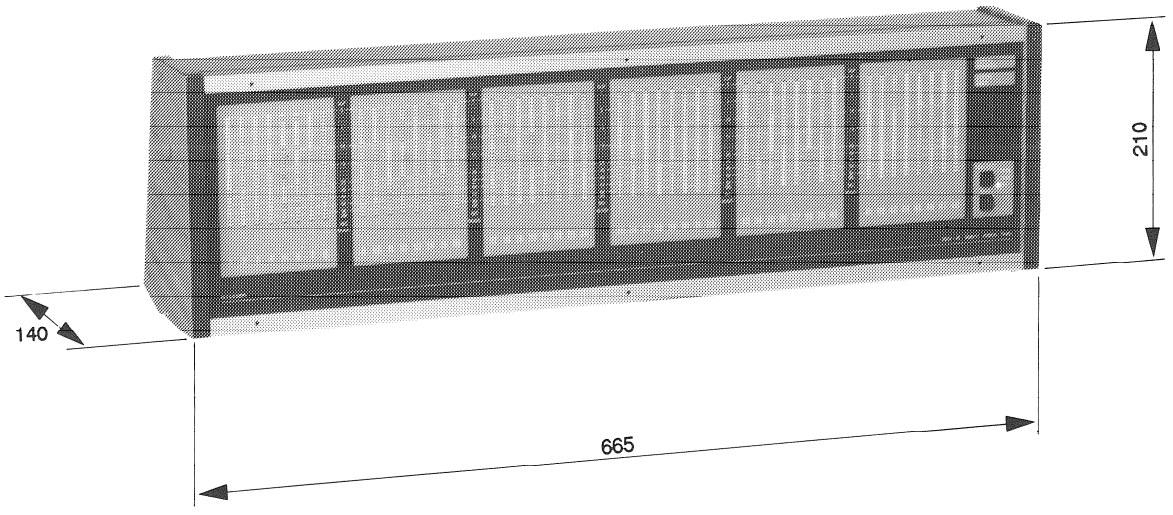
Console:



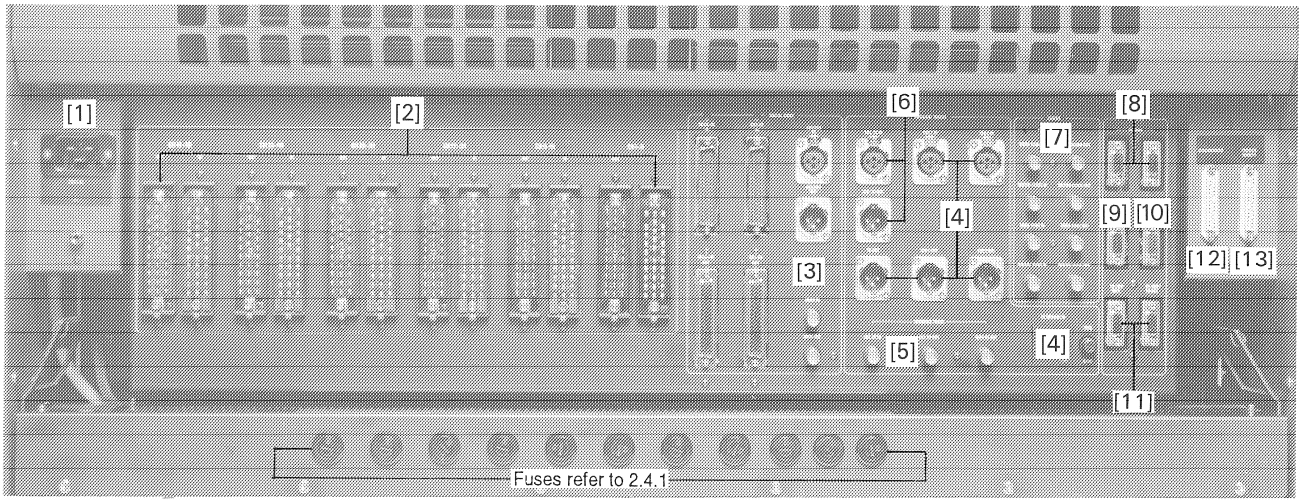
PAI (Parallel Audio Interface)



Remote Level Display



6 Connector panel



[1] Power Connector, refer to 6.1

[2] Analog Audio, refer to 6.2

[3] Digital Audio, refer to 6.3

[4] Auxiliary Tracks, refer to 6.4

[5] Reference Tracks, refer to 6.5

[6] External Timecode, refer to 6.6

[7] Clocks, refer to 6.7

[8] Rembus, refer to 6.8.1

[9] Level Display, refer to 6.8.2

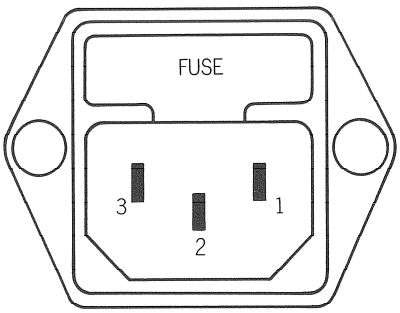
[10] Master Tallies Input, refer to 6.8.3

[11] ES Bus/RS 232, refer to 6.8.4

[12] Synchronizer, refer to 6.8.5

[13] Parallel Remote, refer to 6.8.6

6.1 Power Connector



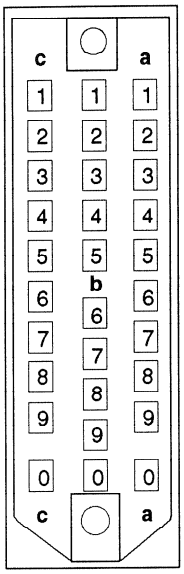
1 = Phase
2 = Protective Ground
3 = Neutral

6.2 Analog Audio

Applicable to all inputs: Balanced, input impedance 10 kΩ (f ≤ 1 kHz), max. input 24 dBu.

Applicable to all outputs: Output (source) impedance < 50 Ω (f < 20 kHz), max. output level with balanced load = 24 dBu, with unbalanced load = 22.5 dBu.

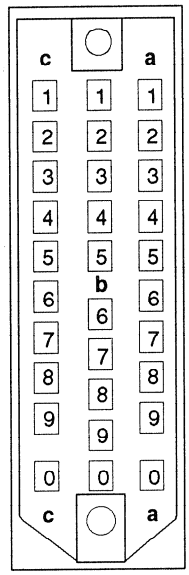
CH1-8 IN Inputs for channels 1 to 8
Pin assignment (IEC 130.6, 30-pin, female):



Pin	Signal name	Description
1a	CO_AIN01	Channel 1 (+)
1b	COIAIN01	Channel 1 (-)
1c	GND	Ground
2a	CO_AIN02	Channel 2 (+)
2b	COIAIN02	Channel 2 (-)
2c	GND	Ground
3a	CO_AIN03	Channel 3 (+)
3b	COIAIN03	Channel 3 (-)
3c	GND	Ground
4a	CO_AIN04	Channel 4 (+)
4b	COIAIN04	Channel 4 (-)
4c	GND	Ground
5a	CO_AIN05	Channel 5 (+)
5b	COIAIN05	Channel 5 (-)
5c	GND	Ground
6a	CO_AIN06	Channel 6 (+)
6b	COIAIN06	Channel 6 (-)
6c	GND	Ground
7a	CO_AIN07	Channel 7 (+)
7b	COIAIN07	Channel 7 (-)
7c	GND	Ground
8a	CO_AIN08	Channel 8 (+)
8b	COIAIN08	Channel 8 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH9-16 IN



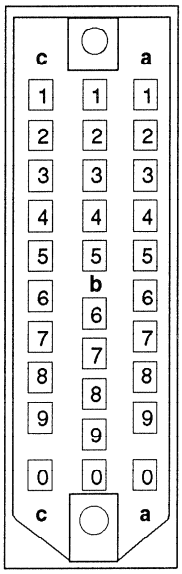
Inputs for channels 9 to 16
Pin assignment (IEC 130.6, 30-pin, female):

Pin	Signal name	Description
1a	CO_AIN09	Channel 9 (+)
1b	COIAIN09	Channel 9 (-)
1c	GND	Ground
2a	CO_AIN10	Channel 10 (+)
2b	COIAIN10	Channel 10 (-)
2c	GND	Ground
3a	CO_AIN11	Channel 11 (+)
3b	COIAIN11	Channel 11 (-)
3c	GND	Ground
4a	CO_AIN12	Channel 12 (+)
4b	COIAIN12	Channel 12 (-)
4c	GND	Ground
5a	CO_AIN13	Channel 13 (+)
5b	COIAIN13	Channel 13 (-)
5c	GND	Ground
6a	CO_AIN14	Channel 14 (+)
6b	COIAIN14	Channel 14 (-)
6c	GND	Ground
7a	CO_AIN15	Channel 15 (+)
7b	COIAIN15	Channel 15 (-)
7c	GND	Ground
8a	CO_AIN16	Channel 16 (+)
8b	COIAIN16	Channel 16 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 17-24 IN

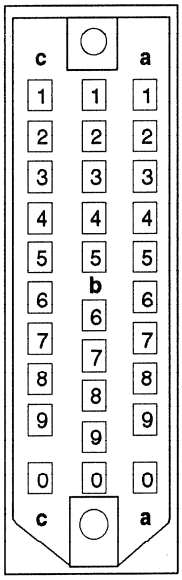
Inputs for channels 17 to 24
Pin assignment (IEC 130.6, 30-pin, female):



Pin	Signal name	Description
1a	CO_AIN17	Channel 17 (+)
1b	COIAIN17	Channel 17 (-)
1c	GND	Ground
2a	CO_AIN18	Channel 18 (+)
2b	COIAIN18	Channel 18 (-)
2c	GND	Ground
3a	CO_AIN19	Channel 19 (+)
3b	COIAIN19	Channel 19 (-)
3c	GND	Ground
4a	CO_AIN20	Channel 20 (+)
4b	COIAIN20	Channel 20 (-)
4c	GND	Ground
5a	CO_AIN21	Channel 21 (+)
5b	COIAIN21	Channel 21 (-)
5c	GND	Ground
6a	CO_AIN22	Channel 22 (+)
6b	COIAIN22	Channel 22 (-)
6c	GND	Ground
7a	CO_AIN23	Channel 23 (+)
7b	COIAIN23	Channel 23 (-)
7c	GND	Ground
8a	CO_AIN24	Channel 24 (+)
8b	COIAIN24	Channel 24 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 25-32 IN



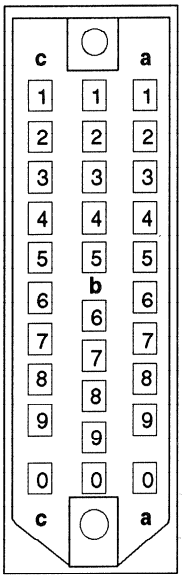
Inputs for channels 25 to 32
Pin assignment (IEC 130.6, 30-pin, female):

Pin	Signal name	Description
1a	CO_AIN25	Channel 25 (+)
1b	COIAIN25	Channel 25 (-)
1c	GND	Ground
2a	CO_AIN26	Channel 26 (+)
2b	COIAIN26	Channel 26 (-)
2c	GND	Ground
3a	CO_AIN27	Channel 27 (+)
3b	COIAIN27	Channel 27 (-)
3c	GND	Ground
4a	CO_AIN28	Channel 28 (+)
4b	COIAIN28	Channel 28 (-)
4c	GND	Ground
5a	CO_AIN29	Channel 29 (+)
5b	COIAIN29	Channel 29 (-)
5c	GND	Ground
6a	CO_AIN30	Channel 30 (+)
6b	COIAIN30	Channel 30 (-)
6c	GND	Ground
7a	CO_AIN31	Channel 31 (+)
7b	COIAIN31	Channel 31 (-)
7c	GND	Ground
8a	CO_AIN32	Channel 32 (+)
8b	COIAIN32	Channel 32 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 33-40 IN

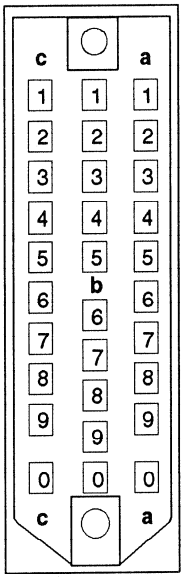
Inputs for channels 33 to 40
Pin assignment (IEC 130.6, 30-pin, female):



Pin	Signal name	Description
1a	CO_AIN33	Channel 33 (+)
1b	COIAIN33	Channel 33 (-)
1c	GND	Ground
2a	CO_AIN34	Channel 34 (+)
2b	COIAIN34	Channel 34 (-)
2c	GND	Ground
3a	CO_AIN35	Channel 35 (+)
3b	COIAIN35	Channel 35 (-)
3c	GND	Ground
4a	CO_AIN36	Channel 36 (+)
4b	COIAIN36	Channel 36 (-)
4c	GND	Ground
5a	CO_AIN37	Channel 37 (+)
5b	COIAIN37	Channel 37 (-)
5c	GND	Ground
6a	CO_AIN38	Channel 38 (+)
6b	COIAIN38	Channel 38 (-)
6c	GND	Ground
7a	CO_AIN39	Channel 39 (+)
7b	COIAIN39	Channel 39 (-)
7c	GND	Ground
8a	CO_AIN40	Channel 40 (+)
8b	COIAIN40	Channel 40 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 41-48 IN

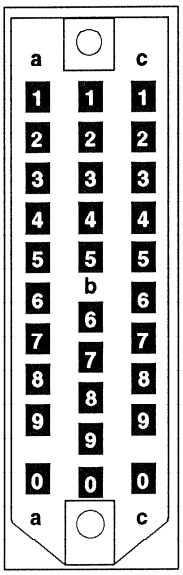


Inputs for channels 41 to 48
Pin assignment (IEC 130.6, 30-pin, female):

Pin	Signal name	Description
1a	CO_AIN41	Channel 41 (+)
1b	COIAIN41	Channel 41 (-)
1c	GND	Ground
2a	CO_AIN42	Channel 42 (+)
2b	COIAIN42	Channel 42 (-)
2c	GND	Ground
3a	CO_AIN43	Channel 43 (+)
3b	COIAIN43	Channel 43 (-)
3c	GND	Ground
4a	CO_AIN44	Channel 44 (+)
4b	COIAIN44	Channel 44 (-)
4c	GND	Ground
5a	CO_AIN45	Channel 45 (+)
5b	COIAIN45	Channel 45 (-)
5c	GND	Ground
6a	CO_AIN46	Channel 46 (+)
6b	COIAIN46	Channel 46 (-)
6c	GND	Ground
7a	CO_AIN47	Channel 47 (+)
7b	COIAIN47	Channel 47 (-)
7c	GND	Ground
8a	CO_AIN48	Channel 48 (+)
8b	COIAIN48	Channel 48 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 1-8 OUT

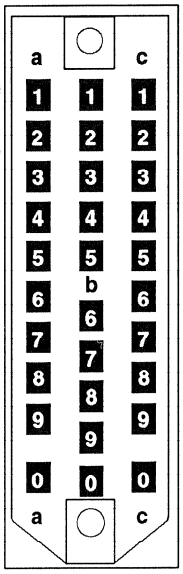


Outputs for channels 1 to 8
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	CO_AIN01	Channel 1 (+)
1b	COIAIN01	Channel 1 (-)
1c	GND	Ground
2a	CO_AIN02	Channel 2 (+)
2b	COIAIN02	Channel 2 (-)
2c	GND	Ground
3a	CO_AIN03	Channel 3 (+)
3b	COIAIN03	Channel 3 (-)
3c	GND	Ground
4a	CO_AIN04	Channel 4 (+)
4b	COIAIN04	Channel 4 (-)
4c	GND	Ground
5a	CO_AIN05	Channel 5 (+)
5b	COIAIN05	Channel 5 (-)
5c	GND	Ground
6a	CO_AIN06	Channel 6 (+)
6b	COIAIN06	Channel 6 (-)
6c	GND	Ground
7a	CO_AIN07	Channel 7 (+)
7b	COIAIN07	Channel 7 (-)
7c	GND	Ground
8a	CO_AIN08	Channel 8 (+)
8b	COIAIN08	Channel 8 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 9-16 OUT

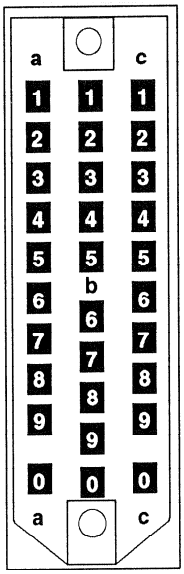


Outputs for channels 9 to 16
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	CO_AIN09	Channel 9 (+)
1b	COIAIN09	Channel 9 (-)
1c	GND	Ground
2a	CO_AIN10	Channel 10 (+)
2b	COIAIN10	Channel 10 (-)
2c	GND	Ground
3a	CO_AIN11	Channel 11 (+)
3b	COIAIN11	Channel 11 (-)
3c	GND	Ground
4a	CO_AIN12	Channel 12 (+)
4b	COIAIN12	Channel 12 (-)
4c	GND	Ground
5a	CO_AIN13	Channel 13 (+)
5b	COIAIN13	Channel 13 (-)
5c	GND	Ground
6a	CO_AIN14	Channel 14 (+)
6b	COIAIN14	Channel 14 (-)
6c	GND	Ground
7a	CO_AIN15	Channel 15 (+)
7b	COIAIN15	Channel 15 (-)
7c	GND	Ground
8a	CO_AIN16	Channel 16 (+)
8b	COIAIN16	Channel 16 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 17-24 OUT

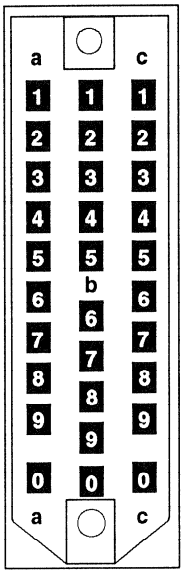


Outputs for channels 17 to 24
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	CO_AIN17	Channel 17 (+)
1b	COIAIN17	Channel 17 (-)
1c	GND	Ground
2a	CO_AIN18	Channel 18 (+)
2b	COIAIN18	Channel 18 (-)
2c	GND	Ground
3a	CO_AIN19	Channel 19 (+)
3b	COIAIN19	Channel 19 (-)
3c	GND	Ground
4a	CO_AIN20	Channel 20 (+)
4b	COIAIN20	Channel 20 (-)
4c	GND	Ground
5a	CO_AIN21	Channel 21 (+)
5b	COIAIN21	Channel 21 (-)
5c	GND	Ground
6a	CO_AIN22	Channel 22 (+)
6b	COIAIN22	Channel 22 (-)
6c	GND	Ground
7a	CO_AIN23	Channel 23 (+)
7b	COIAIN23	Channel 23 (-)
7c	GND	Ground
8a	CO_AIN24	Channel 24 (+)
8b	COIAIN24	Channel 24 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 25-32 OUT



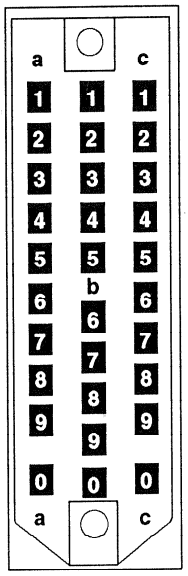
Outputs for channels 25 to 32
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	CO_AIN25	Channel 25 (+)
1b	COIAIN25	Channel 25 (-)
1c	GND	Ground
2a	CO_AIN26	Channel 26 (+)
2b	COIAIN26	Channel 26 (-)
2c	GND	Ground
3a	CO_AIN27	Channel 27 (+)
3b	COIAIN27	Channel 27 (-)
3c	GND	Ground
4a	CO_AIN28	Channel 28 (+)
4b	COIAIN28	Channel 28 (-)
4c	GND	Ground
5a	CO_AIN29	Channel 29 (+)
5b	COIAIN29	Channel 29 (-)
5c	GND	Ground
6a	CO_AIN30	Channel 30 (+)
6b	COIAIN30	Channel 30 (-)
6c	GND	Ground
7a	CO_AIN31	Channel 31 (+)
7b	COIAIN31	Channel 31 (-)
7c	GND	Ground
8a	CO_AIN32	Channel 32 (+)
8b	COIAIN32	Channel 32 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 33-40 OUT

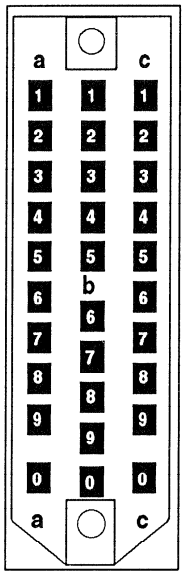
Outputs for channels 33 to 40
Pin assignment (IEC 130.6, 30-pin, male):



Pin	Signal name	Description
1a	CO_AIN33	Channel 33 (+)
1b	COIAIN33	Channel 33 (-)
1c	GND	Ground
2a	CO_AIN34	Channel 34 (+)
2b	COIAIN34	Channel 34 (-)
2c	GND	Ground
3a	CO_AIN35	Channel 35 (+)
3b	COIAIN35	Channel 35 (-)
3c	GND	Ground
4a	CO_AIN36	Channel 36 (+)
4b	COIAIN36	Channel 36 (-)
4c	GND	Ground
5a	CO_AIN37	Channel 37 (+)
5b	COIAIN37	Channel 37 (-)
5c	GND	Ground
6a	CO_AIN38	Channel 38 (+)
6b	COIAIN38	Channel 38 (-)
6c	GND	Ground
7a	CO_AIN39	Channel 39 (+)
7b	COIAIN39	Channel 39 (-)
7c	GND	Ground
8a	CO_AIN40	Channel 40 (+)
8b	COIAIN40	Channel 40 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

CH 41-48 OUT



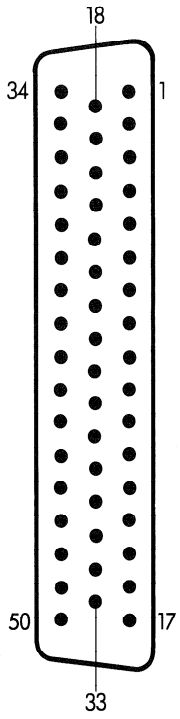
Outputs for channels 41 to 48
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	CO_AIN41	Channel 41 (+)
1b	COIAIN41	Channel 41 (-)
1c	GND	Ground
2a	CO_AIN42	Channel 42 (+)
2b	COIAIN42	Channel 42 (-)
2c	GND	Ground
3a	CO_AIN43	Channel 43 (+)
3b	COIAIN43	Channel 43 (-)
3c	GND	Ground
4a	CO_AIN44	Channel 44 (+)
4b	COIAIN44	Channel 44 (-)
4c	GND	Ground
5a	CO_AIN45	Channel 45 (+)
5b	COIAIN45	Channel 45 (-)
5c	GND	Ground
6a	CO_AIN46	Channel 46 (+)
6b	COIAIN46	Channel 46 (-)
6c	GND	Ground
7a	CO_AIN47	Channel 47 (+)
7b	COIAIN47	Channel 47 (-)
7c	GND	Ground
8a	CO_AIN48	Channel 48 (+)
8b	COIAIN48	Channel 48 (-)
8c	GND	Ground
9a	---	
9b	---	
9c	GND	Ground
10a	---	
10b	---	
10c	GND	Ground

--- ≡ not assigned

6.3 Digital Audio

CH 1-24 IN



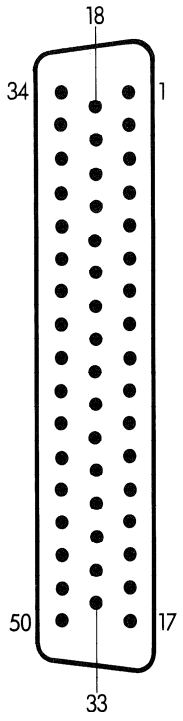
- All signals: RS422

Inputs for channels 1 to 24
Pin assignment (Sub-D, 50-pin, male):

Pin	Signal name	Description
01	CO_ID01A	Channel 1 (–)
02	CO_D01A	Channel 1 (+)
03	CO_ID02A	Channel 2 (–)
04	CO_D02A	Channel 2 (+)
05	CO_ID03A	Channel 3 (–)
06	CO_D03A	Channel 3 (+)
07	CO_ID04A	Channel 4 (–)
08	CO_D04A	Channel 4 (+)
09	CO_ID05A	Channel 5 (–)
10	CO_D05A	Channel 5 (+)
11	CO_ID06A	Channel 6 (–)
12	CO_D06A	Channel 6 (+)
13	CO_ID07A	Channel 7 (–)
14	CO_D07A	Channel 7 (+)
15	CO_ID08A	Channel 8 (–)
16	CO_D08A	Channel 8 (+)
17	CO_ID09A	Channel 9 (–)
18	CO_D09A	Channel 9 (+)
19	CO_ID10A	Channel 10 (–)
20	CO_D10A	Channel 10 (+)
21	CO_ID11A	Channel 11 (–)
22	CO_D11A	Channel 11 (+)
23	CO_ID12A	Channel 12 (–)
24	CO_D12A	Channel 12 (+)
25	CO_ID13A	Channel 13 (–)
26	CO_D13A	Channel 13 (+)
27	CO_ID14A	Channel 14 (–)
28	CO_D14A	Channel 14 (+)
29	CO_ID15A	Channel 15 (–)
30	CO_D15A	Channel 15 (+)
31	CO_ID16A	Channel 16 (–)
32	CO_D16A	Channel 16 (+)
33	CO_ID17A	Channel 17 (–)
34	CO_D17A	Channel 17 (+)
35	CO_ID18A	Channel 18 (–)
36	CO_D18A	Channel 18 (+)
37	CO_ID19A	Channel 19 (–)
38	CO_D19A	Channel 19 (+)
39	CO_ID20A	Channel 20 (–)
40	CO_D20A	Channel 20 (+)
41	CO_ID21A	Channel 21 (–)
42	CO_D21A	Channel 21 (+)
43	CO_ID22A	Channel 22 (–)
44	CO_D22A	Channel 22 (+)
45	CO_ID23A	Channel 23 (–)
46	CO_D23A	Channel 23 (+)
47	CO_ID24A	Channel 24 (–)
48	CO_D24A	Channel 24 (+)
49	---	
50	---	

--- ≡ not assigned

CH 25-48 IN



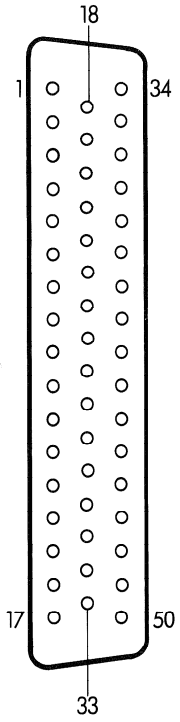
Inputs for channels 25 to 48
Pin assignment (Sub-D, 50-pin, male):

Pin	Signal name	Description
01	CO_ID01B	Channel 25 (-)
02	CO_D01B	Channel 25 (+)
03	CO_ID02B	Channel 26 (-)
04	CO_D02B	Channel 26 (+)
05	CO_ID03B	Channel 27 (-)
06	CO_D03B	Channel 27 (+)
07	CO_ID04B	Channel 28 (-)
08	CO_D04B	Channel 28 (+)
09	CO_ID05B	Channel 29 (-)
10	CO_D05B	Channel 29 (+)
11	CO_ID06B	Channel 30 (-)
12	CO_D06B	Channel 30 (+)
13	CO_ID07B	Channel 31 (-)
14	CO_D07B	Channel 31 (+)
15	CO_ID08B	Channel 32 (-)
16	CO_D08B	Channel 32 (+)
17	CO_ID09B	Channel 33 (-)
18	CO_D09B	Channel 33 (+)
19	CO_ID10B	Channel 34 (-)
20	CO_D10B	Channel 34 (+)
21	CO_ID11B	Channel 35 (-)
22	CO_D11B	Channel 35 (+)
23	CO_ID12B	Channel 36 (-)
24	CO_D12B	Channel 36 (+)
25	CO_ID13B	Channel 37 (-)
26	CO_D13B	Channel 37 (+)
27	CO_ID14B	Channel 38 (-)
28	CO_D14B	Channel 38 (+)
29	CO_ID15B	Channel 39 (-)
30	CO_D15B	Channel 39 (+)
31	CO_ID16B	Channel 40 (-)
32	CO_D16B	Channel 40 (+)
33	CO_ID17B	Channel 41 (-)
34	CO_D17B	Channel 41 (+)
35	CO_ID18B	Channel 42 (-)
36	CO_D18B	Channel 42 (+)
37	CO_ID19B	Channel 43 (-)
38	CO_D19B	Channel 43 (+)
39	CO_ID20B	Channel 44 (-)
40	CO_D20B	Channel 44 (+)
41	CO_ID21B	Channel 45 (-)
42	CO_D21B	Channel 45 (+)
43	CO_ID22B	Channel 46 (-)
44	CO_D22B	Channel 46 (+)
45	CO_ID23B	Channel 47 (-)
46	CO_D23B	Channel 47 (+)
47	CO_ID24B	Channel 48 (-)
48	CO_D24B	Channel 48 (+)
49	---	
50	---	

--- ≡ not assigned

CH 1-24 OUT

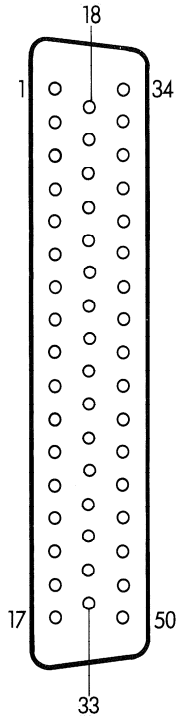
Outputs for channels 1 to 24
Pin assignment (Sub-D, 50-pin, female):



Pin	Signal name	Description
01	MI_ID01A	Channel 1 (-)
02	MI_D01A	Channel 1 (+)
03	MI_ID02A	Channel 2 (-)
04	MI_D02A	Channel 2 (+)
05	MI_ID03A	Channel 3 (-)
06	MI_D03A	Channel 3 (+)
07	MI_ID04A	Channel 4 (-)
08	MI_D04A	Channel 4 (+)
09	MI_ID05A	Channel 5 (-)
10	MI_D05A	Channel 5 (+)
11	MI_ID06A	Channel 6 (-)
12	MI_D06A	Channel 6 (+)
13	MI_ID07A	Channel 7 (-)
14	MI_D07A	Channel 7 (+)
15	MI_ID08A	Channel 8 (-)
16	MI_D08A	Channel 8 (+)
17	MI_ID09A	Channel 9 (-)
18	MI_D09A	Channel 9 (+)
19	MI_ID10A	Channel 10 (-)
20	MI_D10A	Channel 10 (+)
21	MI_ID11A	Channel 11 (-)
22	MI_D11A	Channel 11 (+)
23	MI_ID12A	Channel 12 (-)
24	MI_D12A	Channel 12 (+)
25	MI_ID13A	Channel 13 (-)
26	MI_D13A	Channel 13 (+)
27	MI_ID14A	Channel 14 (-)
28	MI_D14A	Channel 14 (+)
29	MI_ID15A	Channel 15 (-)
30	MI_D15A	Channel 15 (+)
31	MI_ID16A	Channel 16 (-)
32	MI_D16A	Channel 16 (+)
33	MI_ID17A	Channel 17 (-)
34	MI_D17A	Channel 17 (+)
35	MI_ID18A	Channel 18 (-)
36	MI_D18A	Channel 18 (+)
37	MI_ID19A	Channel 19 (-)
38	MI_D19A	Channel 19 (+)
39	MI_ID20A	Channel 20 (-)
40	MI_D20A	Channel 20 (+)
41	MI_ID21A	Channel 21 (-)
42	MI_D21A	Channel 21 (+)
43	MI_ID22A	Channel 22 (-)
44	MI_D22A	Channel 22 (+)
45	MI_ID23A	Channel 23 (-)
46	MI_D23A	Channel 23 (+)
47	MI_ID24A	Channel 24 (-)
48	MI_D24A	Channel 24 (+)
49	---	
50	---	

--- ≡ not assigned

CH 25-48 OUT

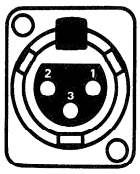


Outputs for channels 25 to 48
Pin assignment (Sub-D, 50-pin, female):

Pin	Signal name	Description
01	MI_ID01B	Channel 25 (-)
02	MI_D01B	Channel 25 (+)
03	MI_ID02B	Channel 26 (-)
04	MI_D02B	Channel 26 (+)
05	MI_ID03B	Channel 27 (-)
06	MI_D03B	Channel 27 (+)
07	MI_ID04B	Channel 28 (-)
08	MI_D04B	Channel 28 (+)
09	MI_ID05B	Channel 29 (-)
10	MI_D05B	Channel 29 (+)
11	MI_ID06B	Channel 30 (-)
12	MI_D06B	Channel 30 (+)
13	MI_ID07B	Channel 31 (-)
14	MI_D07B	Channel 31 (+)
15	MI_ID08B	Channel 32 (-)
16	MI_D08B	Channel 32 (+)
17	MI_ID09B	Channel 33 (-)
18	MI_D09B	Channel 33 (+)
19	MI_ID10B	Channel 34 (-)
20	MI_D10B	Channel 34 (+)
21	MI_ID11B	Channel 35 (-)
22	MI_D11B	Channel 35 (+)
23	MI_ID12B	Channel 36 (-)
24	MI_D12B	Channel 36 (+)
25	MI_ID13B	Channel 37 (-)
26	MI_D13B	Channel 37 (+)
27	MI_ID14B	Channel 38 (-)
28	MI_D14B	Channel 38 (+)
29	MI_ID15B	Channel 39 (-)
30	MI_D15B	Channel 39 (+)
31	MI_ID16B	Channel 40 (-)
32	MI_D16B	Channel 40 (+)
33	MI_ID17B	Channel 41 (-)
34	MI_D17B	Channel 41 (+)
35	MI_ID18B	Channel 42 (-)
36	MI_D18B	Channel 42 (+)
37	MI_ID19B	Channel 43 (-)
38	MI_D19B	Channel 43 (+)
39	MI_ID20B	Channel 44 (-)
40	MI_D20B	Channel 44 (+)
41	MI_ID21B	Channel 45 (-)
42	MI_D21B	Channel 45 (+)
43	MI_ID22B	Channel 46 (-)
44	MI_D22B	Channel 46 (+)
45	MI_ID23B	Channel 47 (-)
46	MI_D23B	Channel 47 (+)
47	MI_ID24B	Channel 48 (-)
48	MI_D24B	Channel 48 (+)
49	---	
50	---	

--- ≡ not assigned

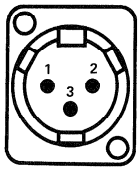
AES/EBU IN



Input
Pin assignment (XLR, 3-pin, female)

Pin	Signal name	Description
01	GND	Ground
02	CO_AESIN	Input +
03	COIAESIN	Input -
	SHELL	Chassis

AES/EBU OUT

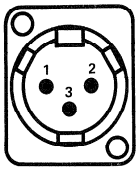


Output
Pin assignment (XLR, 3-pin, male):

Pin	Signal name	Description
01	GND	Ground
02	AI_AESO	Output +
03	AI_IAESO	Output -
	SHELL	Chassis

6.4 Auxiliary Tracks

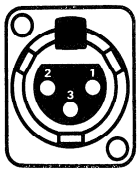
TC OUT



Output for internal time code
Pin assignment (XLR, 3-pin, male):

Pin	Signal name	Description
01	GND	Ground
02	SS_TCOUT	Output +
03	SSITCOUT	Output -
	SHELL	Chassis

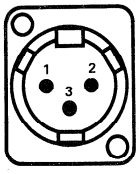
CUE 1 IN



Input (left-hand channel)
Pin assignment (XLR, 3-pin, female):

Pin	Signal name	Description
01	GND	Ground
02	CO_CUE1	Input +
03	CO_ICUE1	Input -
	SHELL	Chassis

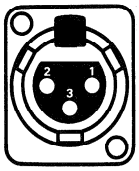
CUE 1 OUT



Output (left-hand channel)
Pin assignment (XLR, 3-pin, male):

Pin	Signal name	Description
01	GND	Ground
02	CU_OUT1	Output +
03	CU_IOUT1	Output -
	SHELL	Chassis

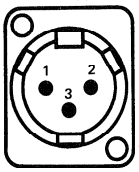
CUE 2 IN



Input (right-hand channel)
Pin assignment (XLR, 3-pin, female):

Pin	Signal name	Description
01	GND	Ground
02	CU_CUE2	Input +
03	CU_ICUE2	Input -
	SHELL	Chassis

CUE 2 OUT



Output (right-hand channel)
Pin assignment (XLR, 3-pin, male):

Pin	Signal name	Description
01	GND	Ground
02	CU_OUT2	Output +
03	CU_IOUT2	Output -
	SHELL	Chassis

6.5 Reference Tracks

EXT.RT IN

Input or external reference time (RT)
Pin assignment (BNC):

Pin	Signal name	Description
01	CO_RTIN GND	Input RT Signal (TTL Level) Ground

Pin 01 ≡ center conductor

EXT. RT OUT

Output for looped external reference time
Pin assignment (BNC):

Pin	Signal name	Description
01	CO_RTIN GND	Input RT Signal (TTL Level) Ground

Pin 01 ≡ center conductor

TAPE RT OUT

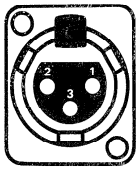
Output for tape RT
Pin assignment (BNC):

Pin	Signal name	Description
01	RT_RTOUT GND	Tape RT Signal (TTL Level) Ground

Pin 01 ≡ center conductor

6.6 External Timecode

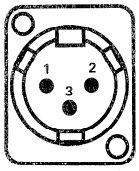
EXT. TC IN



Input for external Time Code
Pin assignment (XLR, 3 -pin, female):

Pin	Signal name	Description
01	GND	Ground
02	CO_TCIN	Input +
03	CO_ITCIN	Input -
	SHELL	Chassis

EXT. TC OUT



Output for looped-through external Time Code
Pin assignment (XLR, 3 -pin, male):

Pin	Signal name	Description
01	GND	Ground
02	CO_TCIN	Input +
03	CO_ITCIN	Input -
	SHELL	Chassis

6.7 Clocks

WORD CLOCK IN

Input (BNC)

Pin	Signal name	Description
01	CO_WKI	Word Clock Input (TTL Level)
	CO_WKIGN	Ground

Pin 01 ≡ center conductor

WORD CLOCK OUT

Output (BNC)

Pin	Signal name	Description
01	CK_WKO1	Word Clock Output (TTL Level)
	CK_WKOGN	Ground

Pin 01 ≡ center conductor

SECTOR CLOCK IN

Input (BNC)

Pin	Signal name	Description
01	CO_SKI	Sector Clock Input (TTL Level)
	CO_SKIGN	Ground

Pin 01 ≡ center conductor

SECTOR CLOCK OUT

Output (BNC)

Pin	Signal name	Description
01	CK_SKO CK_SKOGN	Sector Clock Output (TTL Level) Ground

Pin 01 ≡ center conductor

VIDEO SYNC IN

Input (BNC)

Pin	Signal name	Description
01	CO_VU CO_CVGND	Composite Video Input (Video Level) Ground

Pin 01 ≡ center conductor

VIDEO SYNC OUT

Output (BNC)

Pin	Signal name	Description
01	CO_CV CO_CVGND	Composite Video Input, connected-through Ground

Pin 01 ≡ center conductor

SQUARE WAVE IN

Input (BNC)

Pin	Signal name	Description
01	CO_SW CO_SWGND	Video Square Wave Input (TTL Level) Ground

Pin 01 ≡ center conductor

SQUARE WAVE OUT

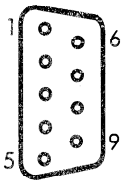
Output (BNC)

Pin	Signal name	Description
01	CO_SW CO_SWGND	Video Square Wave Inp. connected-through Ground

Pin 01 ≡ center conductor

6.8 Remotes

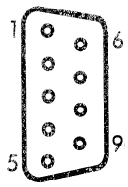
6.8.1 Rembus



Two parallel-connected Sub-D connectors for RS485.
Pin assignment (Sub-D, 9-pin, female):

Pin	Signal name	Description
01	PI_RCLK	Clock line +
02	PI_RRXD	Receive data line +
03	PI_RTXD	Transmit data line +
04	PI_RES1	Coding (protection)
05	0STABIN	Ground
06	PI_IRCLK	Clock line -
07	PI_IRRXD	Receive data line -
08	PI_IRTXD	Transmit data line -
09	STABINX	Remote supply voltage (+ 30 V...60 V)

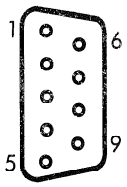
6.8.2 Level Display



Via this RS422 output you can connect a remote display panel.
Pin assignment (Sub-D, 9-pin, female):

Pin	Signal name	Description
01		Key
02	PI_ECLK	Clock +
03	PI_EDAT	Data +
04	PI_ETPH	Transmission phase +
05	0STABIN	Ground
06	PI_IECLK	Clock -
07	PI_IEDAT	Data -
08	PI_IETPH	Transmission phase -
09	STABINZ	Remote supply voltage (+ 30 V...60 V)

6.8.3 Master Tallies Input

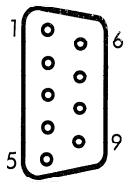


Pin assignment (Sub-D, 9-pin, female):

Pin	Signal name	Description
01	GND	Ground
02	CO_TSTOP +	STOP
03	CO_MOVE1 *	MOVE reference signal 1 (CLK)
04	CO_TPLAY +	PLAY
05	GND	Ground
06	CO_TFREC +	FOLLOW RECORD
07		
08	CO_TREC	RECORD
09	CO_MOVE2 *	MOVE reference signal 2 (DIR)

* Input (TTL level)
\+ Switch input, LOW level activates the command

6.8.4 ES Bus/RS232

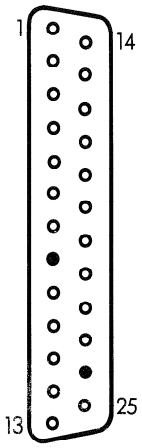


Two parallel-connected Sub-D connectors for the SMPTE/EBU BUS (RS422).
Pin assignment (Sub-D, 9-pin, female):

Pin	Signal name	Description
01	PI_EBUFG	Frame ground
02	PI_EBUTA	Transmit (bal: RS422-HI)
03	PI_EBURB	Receive (bal: RS422-LO / unbal: RS232C)
04	PI_EBURC	Receive (bal: RS422-Common → 0.0 V)
05		
06	PI_EBUTC	Transmit (bal: RS422-Common → 0.0 V)
07	PI_EBUTB	Transmit (bal: RS422-LO / unbal: RS232C)
08	PI_EBURA	Receive (bal: RS422-HI)
09	PI_EBUFG	Frame ground

Important: If the BIN BUS (RS232C) has been selected (with jumper on the PIF board), only one connector may be used!

6.8.5 Synchronizer



Pin assignment (Sub-D, 25-pin, female):

Pin	Signal name		Description
01	+0.0		Ground
02	BR-REW	*	Pilot lamp, REWIND
03	BR-FORW	*	Pilot lamp, FORWARD
04	BR-VRSPD	*	Pilot lamp, VARISPEED (alternately HIGH and LOW when active)
05	SR-VRSPD	+	Switch for VARISPEED command
06	SR-REHSL	+	Switch for REHEARSAL command
07	OR-MVCLK	*	Output for TAPE MOVE CLOCK signal (1024 or 64 pulse at 30 ips, corresponding to jumper position on board 1.820.823.00, pulse duty factor 50%)
08	KEY		Coding
09	BR-REC	*	Pilot lamp, RECORD
10	OR-MVDIR	*	Output for TAPE MOVE DIRECTION signal (rewind = LOW, forward = HIGH)
11	OR-CMCLK	*	Output for CAPST. M. MOVE CLOCK signal (4800 impulses/sec at 30 ips)
12	OR-SYENB		Output for SYNCHRONIZER ENABLE signal (LOW if tape is threaded and recorder ready; HIGH when tape not tensioned)
13	IR-REFEX		Input for external capstan PLL reference (9,6 kHz ≡ 30 ips or 48 kHz sampling frequency, TTL level recommended; max. input voltage = +30 V)
14	+0.0		Ground
15	BR-PLAY	*	Pilot lamp, PLAY
16	BR-STOP	*	Pilot lamp, STOP
17	SR-LIFT	+	Switch for LIFTER command
18	SR-MUTE	+	Switch for MUTE command (no influence on TC channel)
19	SR-REC	+	Switch for RECORD command
20	SR-REW	+	Switch for REWIND command
21	SR-FORW	+	Switch for FORWARD command
22	SR-PLAY	+	Switch for PLAY command
23	SR-STOP	+	Switch for STOP command
24	KEY		Coding
25	+24.0		+24 V supply (max. 300 mA)

* Open collector output, active LOW. No internal pull-up resistor, max. HIGH level = +30V. Max. load current 200 mA, internal current limiting resistor 22Ω.

\+ Switch input, LOW level activates the command. Internal pull-up resistor 4.7kΩ connected to the +24V supply, max. HIGH input level = +30V, logic level: LOW = 0to +4V; HIGH = +7.5 to +30V.

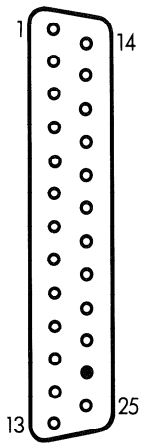
	Order Number
Connector assembly	20.020.303.15
Connector housing, 25-pin	54.13.7022
Connector, 25-pin, coded	10.217.001.05

6.8.6 Parallel Remote

Via this 25-pin Sub-D connector (female) you can connect a parallel remote control unit that supports the following capabilities:

- Remote control of the tape deck functions with feedback (, , PLAY, STOP and REC)
- RESET TIMER (reset the tape counter)
- ZERO LOC (automatically search the tape address 0.00.00.0)
- LOC START (automatically search the tape address at which the last PLAY command has been entered)
- LIFTER (lift the tape off the heads in spooling mode for as long as this key is pressed)
- FADER (activate the fader start circuit)
- VARISPEED (variable tape speed)

Pin assignment (SUB-D, 25-pin, female):



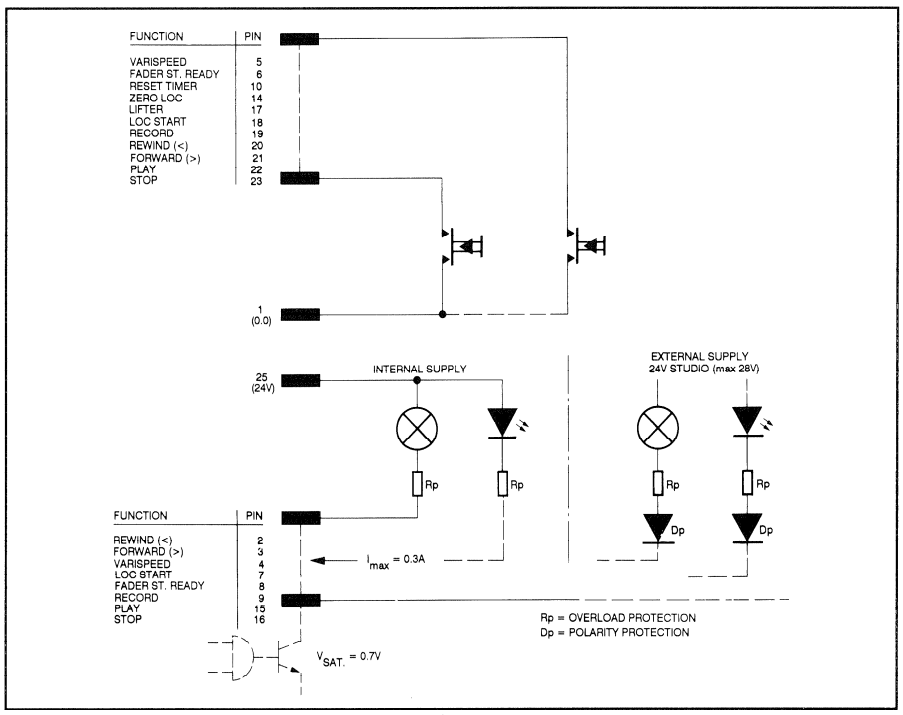
Pin	Signal name		Description
01	+0.0		Ground
02	BR-REW	*	Pilot lamp, REWIND
03	BR-FORW	*	Pilot lamp, FORWARD
04	BR-VRSPD	*	Pilot lamp, VARISPEED (alternately HIGH and LOW when active)
05	SR-VRSPD	+	Switch for VARISPEED command
06	SR-FADRY	+	Switch for FADER START READY
07	BR-LOCST	*	Pilot lamp, LOC START
08	BR-FADRY	*	Pilot lamp, FADER START READY
09	BR-REC	*	Pilot lamp, RECORD
10	SR-RESET	+	Switch for RESET TIMER command
11	FAD1		Input FADER START command, line A
12	FAD2		Input FADER START command, line B (FADER START active if 5..24 VAC or DC are present between pins 11 and 12)
13	IR-REFEX		Input for external capstan PLL reference (9,6 kHz ≡ 30 ips or 48 kHz sampling frequency, TTL-Level recommended; maximum input voltage +12 V)
14	SR-OLOC	+	Switch for ZERO LOC command
15	BR-PLAY	*	Pilot lamp, PLAY
16	BR-STOP	*	Pilot lamp, STOP
17	SR-LIFT	+	Switch for LIFTER command
18	SR-LOCST	+	Switch for LOC START command
19	SR-REC	+	Switch for RECORD command
20	SR-REW	+	Switch for REWIND command
21	SR-FORW	+	Switch for FORWARD command
22	SR-PLAY	+	Switch for PLAY command
23	SR-STOP	+	Switch for STOP command
24	KEY		Coding
25	+24.0		+24 V supply (max. 300 mA)

* Open collector output, active LOW. No internal pull-up resistor, max. HIGH level = +30V. Max. load current 200mA, internal current limiting resistor 22Ω.

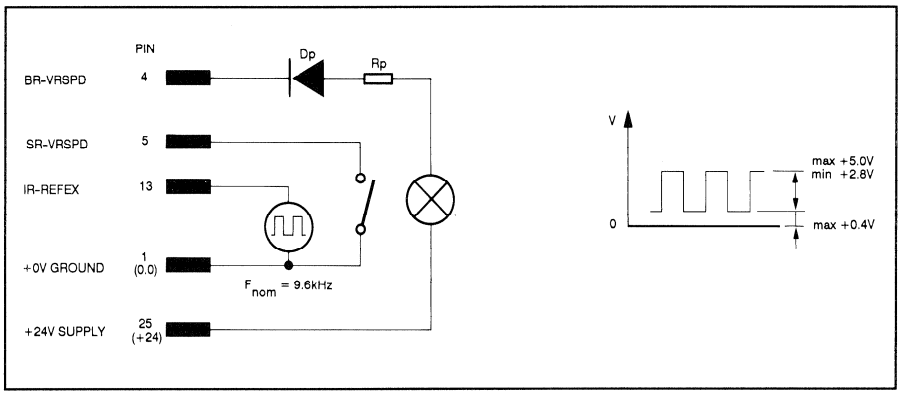
\+ Switch input, LOW level activates the command. Internal pull-up resistor 4.7kΩ connected to the +24 V supply, max. HIGH input level = +30V, logic level: LOW = 0to +4V; HIGH = +7.5 to +30V.

	Order Number
Connector assembly	20.020.303.16
Connector housing, 25-pin	54.13.7022
Connector, 25-pin, coded	10.217.001.06

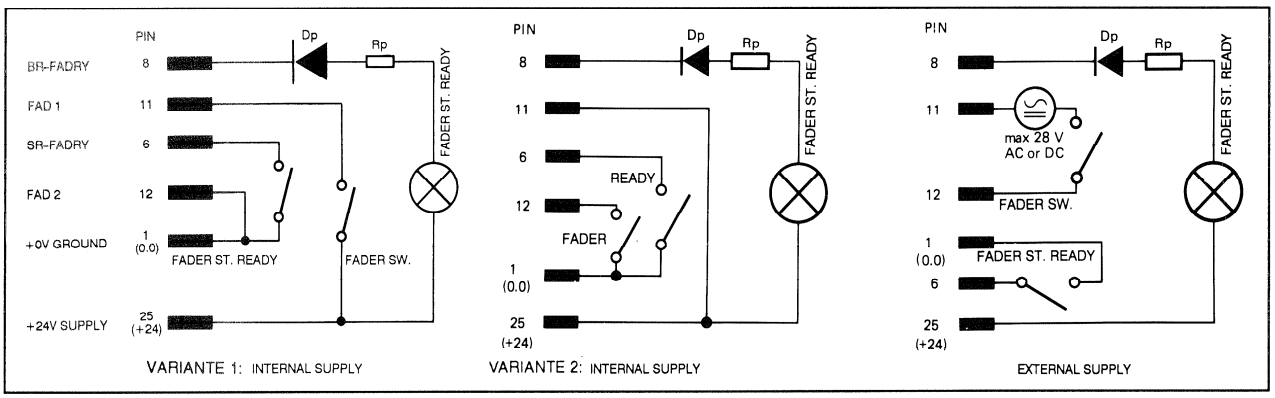
Remote control circuit



Varispeed circuit

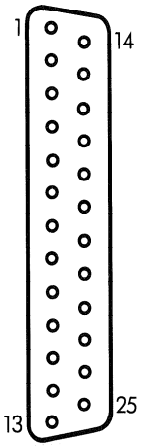


Fader start circuit



Important! If incandescent lamps are used for return signalling, the inrush current must not exceed 0.3A.

7 Test Interface



Behind the cover on the front panel there is a 25-pin Sub-D connector to which a terminal or a PC can be connected for test, monitoring and backup functions.
Pin assignment (Sub-D, 25-pin, female):

Pin	Signal name	Description
02	TX	Transmit line
03	RX	Receive line
07	+ 0.0	Ground

All other contacts are unused.

Data size:

Baud	Data	Stop	Parity
9600	8	1	no

8 Jumper Array

8.1 Clock Board 1.862.660.xx

JP 1 plugged-in: Normal operating mode (18.432 MHz oscillator activ)
JP 1 removed: Test mode

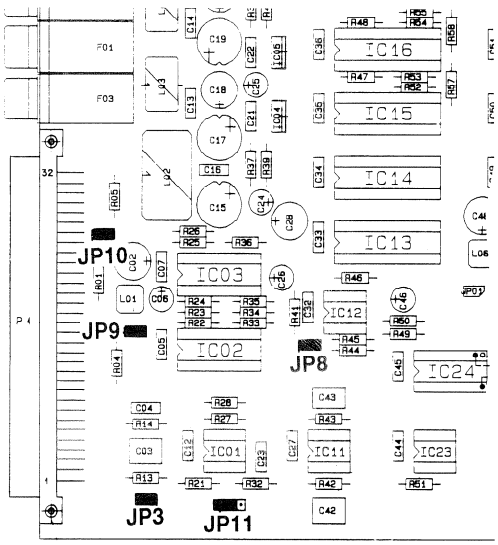
JP 3 plugged-in: Input impedance for video = 75 Ohm
JP 3 removed: Input impedance for video = 1 kOhm

JP 8 plugged-in: Input impedance for sectorclock = 75 Ohm
JP 8 removed: Input impedance for sectorclock = 1 kOhm

JP 9 plugged-in: Input impedance for wordclock = 75 Ohm
JP 9 removed: Input impedance for wordclock = 1 kOhm

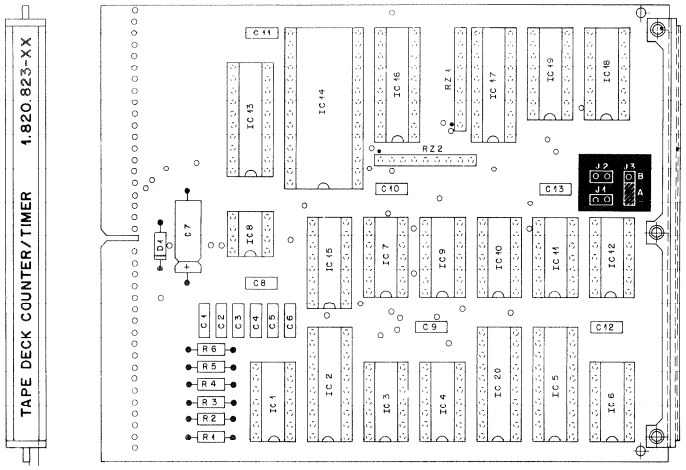
JP 10 plugged-in: Input impedance for squarewave = 75 Ohm
JP 10 removed: Input impedance for squarewave = 1 kOhm

JP 11 plugged left: Syncpulse from video negative (most common)
JP 11 plugged right: Syncpulse from video positive



8.2 Tape Deck Counter Timer Board 1.820.823.xx

Jumper Position	Meaning
J3A	1024 Hz pulse at 30 inch/s
J1+J3B	64 Hz pulse at 30 inch/s
J2+J3B	32 Hz pulse at 30 inch/s



9 Transferring the machine parameters (backup)

Parameter diskette

The D820 MCH is shipped with a diskette that contains the machine parameters such as tape tension, erase current, etc.

If the machine data are lost, for example after the installation of a software update, all settings can be reloaded via the TEST interface.

Auxiliary material

For transferring the data the following auxiliary material is required:

- 1 IBM compatible PC
- 1 3 ½" diskette drive
- 1 RS 232 interface
- 1 Prefabricated cable (for pin assignment see section 7)

Data transfer

A detailed description of the procedure can be found on the "READ_ME.1ST" file located on the same diskette.

Note: This diskette contains the original factory settings. For this reason we strongly recommend that you copy the current data to a diskette before making any changes.

10 DASH format

The DASH (Digital Audio Stationary Head) format describes a tape recording method that is based on an agreement between different manufacturers of digital tape recorders. The objective is to ensure full compatibility of tapes that have been recorded on units of different makes.

10.1 DASH versions

The DASH versions are characterized by different tape speeds and different numbers of channels. This results in a different number of tracks per channel. In addition we distinguish between "normal" and "double" density recordings (the latter produces twice the number of tracks in the same space).
The longitudinal recording density is the same in all DASH versions, i.e. 38.4 kbit/inch, including 50% redundancy, regardless of the tape speed and the sampling frequency. This means that at half the tape speed twice as many recording tracks per channel must be available. In addition the tape speed is directly proportional to the sampling frequency for a given number of tracks per channel.
With the DASH format, 1/4" and 1/2" tapes can be recorded.
The following tables provide information on the various DASH versions:

	TAPE SPEED FAST	MEDIUM	SLOW
TRACK/CHANNEL	1	2	4
48 kHz SAMPLING FREQUENCY	76,20 cm/s 30 ips	38,10 cm/s 15 ips	19,05 cm/s 7,5 ips
44,1 kHz SAMPLING FREQUENCY	70,01 cm/s 27,56 ips	35,00 cm/s 13,78 ips	17,50 cm/s 6,89 ips

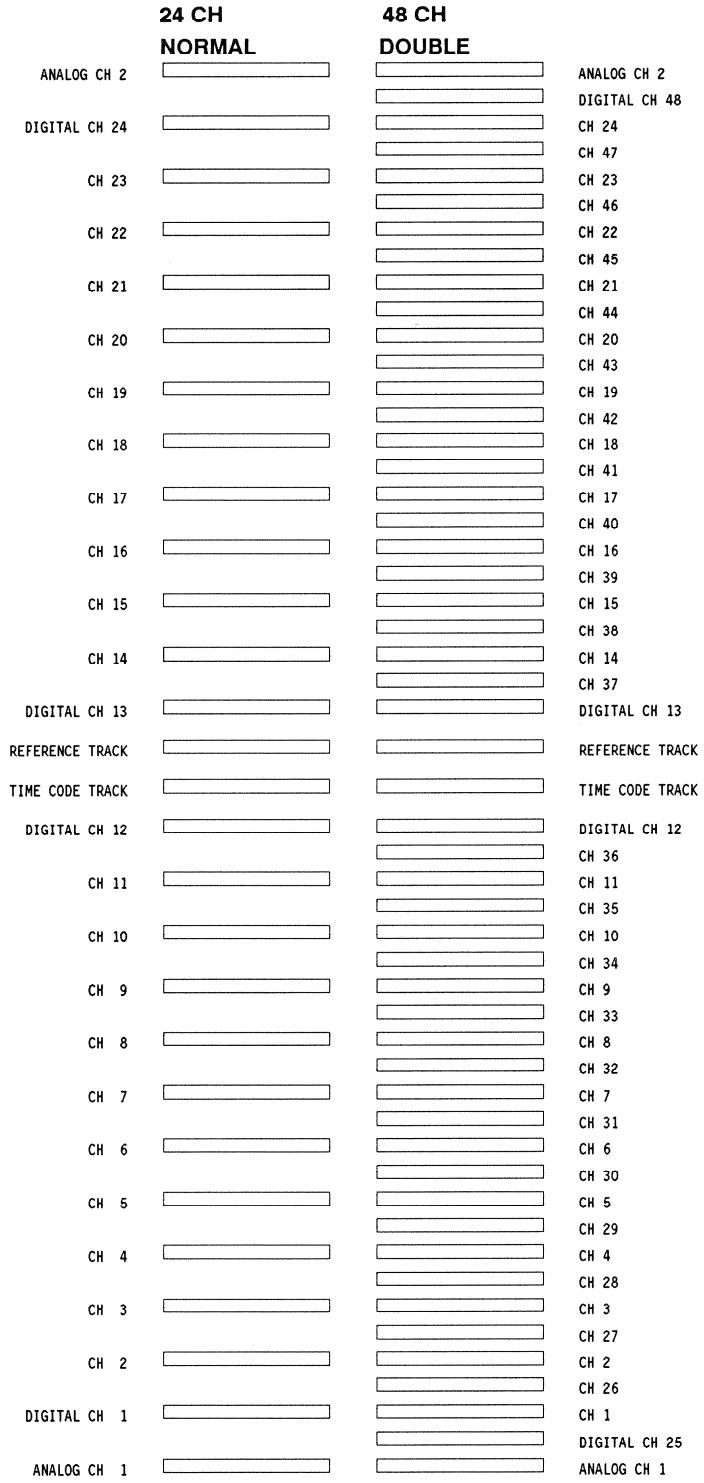
TAPE WIDTH		1/4 "		1/2 "	
RECORDING DENSITY		NORMAL	DOUBLE	NORMAL	DOUBLE
NUMBER OF DIGITAL AUDIO TRACKS		8	16	**24**	**48**
NUMBER OF DIGITAL AUDIO TRACKS	FAST MEDIUM SLOW	8 4, 2 2	16 8 4, 2	24 12 6	48 24 12
NUMBER OF AUXILIARY TRACKS		4	4	4	4

Although the DASH format offers a multitude of possibilities, only two versions have been implemented in practice (bold entries in the above table)

DASH multichannel as in D820-MCH:	Tape speed fast (30 ips), tape width 1/2" Normal density: 24 channels (1 track/channel) Double density: 48 channels (1 track/channel)
Twin DASH 2-channel as in D820-X:	Tape speed medium (15 ips), tape width 1/4" Normal density: 2 Channels (4 track/channels)

In the following we will only discuss the DASH multichannel version.

10.2 Track arrangement for DASH 24 and 48 channel machines



This diagram shows that on a 48-channel machine a 24-channel tape can be played back (or recorded) without setup change because the channels 1 to 24 are in the same location for either number of channels.

10.3 Coding the digital audio data

Block structure:

Each data track is coded individually and consists of so-called blocks. The block is the smallest detectable unit on tape and comprises 192 bits of digital audio information (12 sampling values of 16 bits each) and 96 bits redundancy information for error detection and correction, i.e. a total of 288 bits. The 96 bits of redundancy information consist of one 16-bit sync word (for detecting the block start), four 16-bit parity words (for error correction) and one 16-bit CRC word (for error detection). Within the sync word 2 bits are reserved for block numbering within a sector (1 sector = 4 blocks). An additional bit (however only within the first block of a sector) provides information on whether the digital audio data of the corresponding channel have been recorded with or without emphasis. A sector is the smallest unit of the reference time track whose 28-bit sector counter, together with the aforementioned block numbering, permits highly accurate positioning on the tape.

Interleaving of information:

A data block is constructed from digital audio sampling values that are not adjacent but far apart. In addition also the parities that would belong to a block are written together with the audio data of different blocks. As a result the entire information is spread on the time axis in such a way that a dropout on tape causes bit errors that can be detected with CRC and corrected with the aid of the parities. This technique is referred to as interleaving, and the corresponding code as CIC (Cross Interleave Code). A dropout of up to 30 blocks (approx. 5.7 mm) can theoretically be restored 100% in the DASH format, however, only if all data before and after the dropout are absolutely error-free.

Individual track coding:

Since each individual digital track is encoded independently of the others, a dropout on a track has no influence on the other tracks. This individual coding also has the advantage that only a single track needs to be rerecorded when new information is written on only one channel.

Channel coding:

Before the digital audio data, coded in this manner, are transmitted to the record electronics, they are processed for channel coding. The HDM-1 code has been selected for the DASH format. In this, long sequences of zeros or ones as well as fast data changes zero-one-zero or one-zero-one are prevented to eliminate DC-like signals or very high change frequencies so that the spectral characteristics of the heads and the tape can be optimally exploited.

In the reproduce mode, an attempt is first made to detect and decode the blocks based on their sync word. Whether or not the corresponding block is error-free can subsequently be determined with the CRCs. After de-interleaving, existing errors are corrected, based on the parity information. The CRC takes place before the error correction. The so-called CRC error rate (in ppm, i.e. number of defective blocks in 1 million input blocks) is a measure of the quality of the recording, of the tape itself and the playback process as such.

10.4 Coding of the reference track

The reference track consists of consecutively numbered sectors. 1 sector corresponds to 4 digital audio blocks and is coded with 64 bits of which 4 bits represent the sync word, 16 bits the control word, 28 bits the sector number (sector address) and 16 bits the CRC. These bits are biphase mark coded before they are transmitted to the record electronics. The control word contains important system information and it has the following format:

Bit-N0.	Designation	STUDER 48 CH	STUDER 24 CH	Condition
15	Twin id.	0	0	
14 - 12	Sampling freq.	001 010 100	001 010 100	fs=48 kHz fs=44.1 fs=44.056
11 - 9	Format id.	100	000	
8 - 6	Aux tracks id.	101	101	
5 - 0	Reserved	000000	000000	

The reference time track is used for the following purposes:

- apstan motor control to obtain the correct tape speed for reading or sync recording the digital audio data
- determining the sampling frequency of the recorded data
- Absolute time reference on tape (time display, locate, etc.).
- Sample-accurate synchronization of 2 DASH machines

The digital audio data can be recorded either simultaneously with the RT signal, or the RT signal can be recorded first by itself. The opposite case, where an RT signal is to be added to existing digital audio data is not possible.

10.5 Coding the time code track

The format of this track is absolutely identical with the SMPTE/EBU timecode used for analog recorders and video machines. This track can be recorded either with the same head as the data (narrow gap recording) or with a conventional analog head (wide gap recording). These two recordings are electrically not 100% compatible. For this reason the recording mode is flagged in bit 8 of the RT control word. STUDER multichannel machines are designed for narrow gap recording (bit 8 of the RT control word = 1) and are equipped with an erase head for overwriting the deep magnetization of the wide gap recording. The STUDER machines are able to read both recording modes.

10.6 Coding the analog tracks (cue tracks)

The two tracks "analog ch 1" and "analog ch 2" (also referred to as cue 1 and cue 2 tracks) can be recorded either with the same head as the data (narrow gap recording) or with a conventional, separate analog head (wide gap recording). In the first case PDM modulation is required, in the second case a bias is used as in analog recorders. These two recording methods are not compatible. For this reason the recording method is flagged in bit 6 of the RT control word. STUDER multichannel machines are designed for narrow gap recording (bit 6 of the RT control word = 1) and are equipped with an erase head for overwriting the deep magnetization of the wide gap recording. STUDER machines are able to read both recording modes.

10.7 Principal specifications of the DASH multichannel version

General data:

Tape speed:	30 ips = 76,2 cm/sec (at 48 kHz) 27.56 ips = 70.01 cm/sec (at 44.1 kHz)
Tape width:	1/2"
Number of tracks:	52
Number of digital audio tracks:	48 (1 track/channel)
Number of aux tracks:	4 (RT, TC, Cue 1, Cue 2)

Characteristics of the digital audio tracks:

Longitudinal data density:	38.4 kbit/inch for all sampling frequencies (incl. 50% redundance)
Track width:	0.170 mm
Data format:	Data blocks 1 block = 12 audio samples = 0.1905 mm = 288 Bits (incl. 50% redundancy) (corresponds to 0.25 ms at 48 kHz; 0.272 ms at 44.1 kHz) 1 sector = 4 blocks
Coding:	CIC (interleave length 323 blocks)
Channel coding:	HDM-1
HDM-1 run lengths:[11]	between "3" and "9"
HDM-1 wave length:	Between 1.984 and 5.592 μm
HDM-1 frequency:	Between 128 and 384 kHz (at fs = 48 kHz)

Characteristics of the RT track:

Track width:	0.170 mm
Data format:	1 sector = 4 blocks = 64 bits (corresponds to 1 ms at 48 kHz)
Coding:	Biphase
Run lengths[11]**:**	Between "18" and "54"

[11] Run length signifies the time between 2 polarity changes of the head signal in play mode. Run unit "1" is 434 nanoseconds at fs = 48kHz.

Characteristics of the TC track

Track width:	0.330 mm
Data format:	Frames 1 frame = 80 bits
Frame rate:	(24), 25, 29.97, 30 frames/sec.
Coding:	Biphase

Characteristics of the cue tracks (if modulated)

Track width:	0.350 mm (modulated and bias)
Modulation:	PDM
Carrier frequency:	2 * fs
Modulation index:	0.7
Run lengths[12]	For fully modulation: between "3.6" und "20.4" For zero modulation: "12"

[12] Run length refer to the time between 2 polarity changes of the head signal in play mode. Run unit "1" is 434 nanoseconds at fs = 48kHz.

11 Standard Versions

		Order Number
D820-48-½"	Digital tape recorder for 48 tracks	**60.218.20610**
D820-24/24-½"	Digital tape recorder for 24 tracks (upgradable to 48 tracks)	**60.218.20611**
D820-24/48-½"	Digital tape recorder for 24 tracks, equipped with 48-track headblock (upgradable to 48 tracks)	**60.218.20612**
D820 MCH Upgrade Kit 24/24-48	Upgrade Kit for D820-24/24-½" to D820-48	**20.050.820.70**
D820 MCH Upgrade Kit 24/48-48	Upgrade Kit for D820-24/48-½" to D820-48	**20.050.820.71**
	■ Additional Operating Manual (English)	**10.27.xxxx**
	■ Additional Operating Manual (German)	**10.27.xxxx**
	■ Service Manual (German/English)	**10.27.1720**
	■ Additional Schemata and Spare Parts Manual	**10.27.1730**
	■ Wiring List	**10.27.1890**

11.1 Options

		Order Number
Splicing Block	To be installed on the Head Block	**1.862.117.00**

11.2 Accessories

		Order Number
Reels:	NAB metal reel, empty, 1/2" (Ø10.5")	**10.277.000.02**
	NAB metal reel, empty, 1/2" (Ø14")	**10.277.000.03**
Service Tools:	Tool case (basic kit) with soldering iron and demagnetizing choke for 110 V	**20.020.001.20**
	Tool case (basic kit) with soldering iron and demagnetizing choke for 220 V	**20.020.001.21**
	Supplementary tool set D820 MCH, incl. extension boards	**20.020.001.41**
	Extension board, 39-pin, for audio and logic modules	**1.820.799.00**
	Extension board, 64-pin, for logic modules	**1.228.324.81**
	Extension board, 96-pin	**1.228.325.00**
	Extension board, 2x96 pin. Multilayer for PCM electronics	**1.862.669.00**
STUDER Cleaning Kit in Case:	Contains 1 bottle Head Cleaner, 1 bottle Cleaner for anodized parts, Cleaning Towels	**10.496.010.00**
	Head Cleaner, Replacm. Bottle	**10.496.021.00**
	Head Cleaner, 1 litre	**10.496.022.00**
	Cleaner for anodized surfaces, replacm. Bottle	**10.496.025.00**
	Cleaner for anodized surfaces, 1 litre	**10.496.026.00**

11.2.1 Remote Controls

	Order Number
Audio Remote Control D820-48:	**1.328.600.00**
Audio Remote Control D820-24:	**1.328.605.00**
Tape Deck Control D820 MCH incl. Sound Memory Control	**21.328.610.00**
Remote Level Display D820 MCH incl. connecting cable 15 m	**21.328.620.00**
Parallel Audio Interface D820 MCH incl. connecting cable 15 m	**21.328.630.00**
Connecting Cable 0.6 m for REMBUS remotes	**1.862.420.00**
Connecting Cable 15 m for REMBUS remotes	**1.862.421.00**
Connecting Cable 15 m for Remote Level Display	**1.862.422.00**

Remote Stand for Audio Remote Control Tape Deck Control Sound Memory Control		**1.328.191.00**

11.2.2 Mating Connectors to Options and Remote Controls

Note: STUDER Remote Controls are supplied with mating connectors.

Connector to Synchronizer Control Port	25 pole, D-type, male, screw-lock type, key position 8	**20.020.303.37**
Connector to Parallel Tape Deck Remote Control Port	25 pole D-type, male, screw-lock type, key position 24	**20.020.303.16**
Connector to Terminal Port (CPU Board)	25 pole D-type, male screw-lock type, no key	**20.020.303.10**
Connector to ALL OTHER REMOTE CONTROL PORTS	9 pole D-type, male, screw-lock type, no key	**20.020.303.07**
Dummy plug for the unused REMBUS connections	9-Pin, 120 ohm, screw fastened	**1.862.423.00**
Multipin Connector for Analog Audio Input Ports	30 pole, female	**20.020.303.38**
Multipin Connector for Analog Audio Output Ports	30 pole, male	**20.020.303.39**
Connector to SDIF Multichannel Input Port	50 pole D-type, female, screw-lock type, no key	**20.020.303.35**
Connector to SDIF Multichannel Output Port	50 pole D-type, male, screw-lock type, no key	**20.020.303.36**
XLR-Connector Male	3 pole	**54.02.0280**
XLR-Connector Female	3 pole	**54.02.0281**

12 Care Instructions

Daily care is limited to cleaning the sound heads, the capstan shaft, the pinch roller and the tape guiding elements.

Headblock assembly

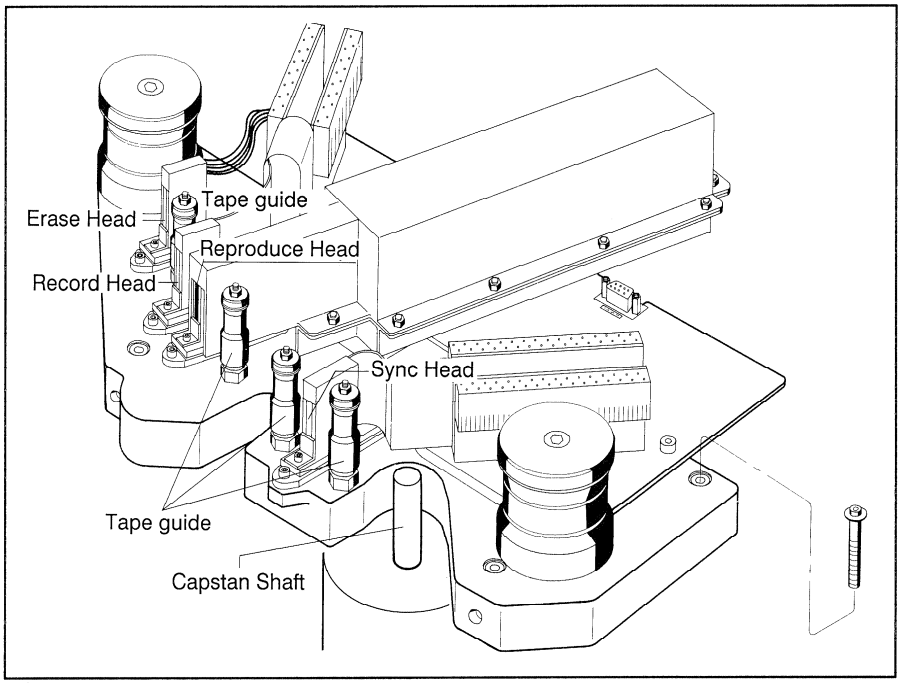
Dust and oxide particles from the tape accumulate principally on the sound heads and tape guides which can cause interruptions (so-called drop-outs) during recording. This is indicated by the CRC ERROR LED on the face of the MAPRO board.
Cleaning should be performed daily, or more frequently if contamination is visible.
For cleaning we recommend the STUDER cleaning set, part number 10.496.010.81. It contains all utensils required for cleaning a tape recorder, including head cleaning fluid and a cleaner for anodized parts.

Procedure:

Moisten a section of the yellow cloth with the cleaning fluid and clean all tape guides and soundheads. Then wipe the cleaned parts with a dry section of the yellow piece of cloth.
Coarse accumulations in the grooves of the reproduce heads can be removed with a small hard brush whose bristles have been shortened to approx. 5 mm (¼").
The capstan shaft normally does not rotate when the tape recorder is switched to play mode. However, a special function is available that puts the capstan motor in motion for cleaning. For this purpose unload the tape and press the PLAY key.

Important:

- When cleaning the capstan make sure that the cleaning fluid does not penetrate the bearing!
- Never use cleaning liquid for anodized parts to clean the soundheads!



Cleaning the headblock assembly

13 Error Messages

The red LED »SYSTEM ERROR« on the display panel flashes as long as an error message is displayed.

Note: Service in this context means that the nearest Studer service center should be contacted.

Display:

```
WARNING:002 BATTERY
   LOW VOLTAGE
```

Recorder: The battery should be replaced soon, otherwise the system parameters may get lost (see warning: 023).

Cause: The power-on self-test has detected a low battery voltage.

Remedy:
- Turn off the machine
- Check the voltage of the battery on the CIF board (behind CPU). If it is less than 2.3 V the battery should be replaced.

Display:

```
ERR:013  CPU->SBC
 CANNOT INIT WR-FIFO
```

Recorder: Tape transport functions are possible but audio functions cannot be executed.

Cause: The write FIFO of the SERBUS controller on the PIF board cannot be initialized.

Remedy:
- Switch the recorder off
- Make sure the PIF board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the PIF and CPU board as well as the FIFO bus must be checked.
- Service

Display:

```
ERR:014  CPU->SBC
 CANNOT INIT RD-FIFO
```

Recorder: Tape transport functions are possible but audio functions cannot be executed.

Cause: The read FIFO of the SERBUS controller on the PIF board cannot be initialized.

Remedy:
- Switch the recorder off
- Make sure the PIF board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the PIF and CPU board as well as the FIFO bus must be checked.
- Service

Display:

```
ERR:015  CPU->SEC
 CANNOT INIT WR-FIFO
```

Recorder: If neither the SMPTE/EBU nor the BINBUS interface are being used, the recorder can be operated normally.

Cause: The write FIFO of the SMPTE/EBUS controller on the PIF board cannot be initialized.

Remedy:

- Switch the recorder off
- Make sure the PIF board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the PIF and CPU board as well as the FIFO bus must be checked.
- Service

Display:

```
ERR:016  CPU->SEC
 CANNOT INIT RD-FIFO
```

Recorder: If neither the SMPTE/EBU nor the BINBUS interface are being used, the recorder can be operated normally.

Cause: The read FIFO of the SMPTE/EBU-BUS controller on the PIF board cannot be initialized.

Remedy:

- Switch the recorder off
- Make sure the PIF board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the PIF and CPU board as well as the FIFO bus must be checked.
- Service

Display:

```
ERR:017  CPU->RBC
 CANNOT INIT WR-FIFO
```

Recorder: Except for the remote control connected to the REMBUS, the machine can be operated normally.

Cause: The write FIFO of the REMBUS controller on the PIF board cannot be initialized.

Remedy:

- Switch the recorder off
- Make sure the PIF board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the PIF and CPU board as well as the FIFO bus must be checked.
- Service

Display:

```
ERR:018  CPU->RBC
 CANNOT INIT RD-FIFO
```

Recorder: Except for the remote control connected to the REMBUS, the machine can be operated normally.

Cause: The read FIFO of the REMBUS controller on the PIF board cannot be initialized.

Remedy:

- Switch the recorder off
- Make sure the PIF board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the PIF and CPU board as well as the FIFO bus must be checked.
- Service

Display:

```
ERR:019  CPU->SSTC
 CANNOT INIT WR-FIFO
```

Recorder: Except for the functions related to the internal synchronizer or time code, the machine can be operated normally.

Cause: The write FIFO of the SYNCHRONIZER & TIMECODE controller on the PIF board cannot be initialized.

Remedy:
- Switch the recorder off
- Make sure the SSTC board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the SSTC board must be checked.
- Service

Display:

```
ERR:020  CPU->SSTC
 CANNOT INIT RD-FIFO
```

Recorder: Except for the functions related to the internal synchronizer or time code, the machine can be operated normally.

Cause: The read FIFO of the SYNCHRONIZER & TIMECODE controller cannot be initialized.

Remedy:
- Switch the recorder off
- Make sure the SSTC board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the SSTC board must be checked.
- Service

Display:

```
ERR:021  CPU->RT
 CANNOT INIT WR-FIFO
```

Recorder: The machine can be operated only with severe restrictions. Recording and reproduction of digital audio tracks may no longer be feasible because the RT code information is missing.

Important! Do not attempt to produce a recording in this condition because the information existing on the tape could be destroyed!

Cause: The write FIFO of the RT controller cannot be initialized.

Remedy:
- Switch the recorder off.
- Make sure the RT board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the RT board must be checked.
- Service

Display:

```
ERR:022  CPU->RT
 CANNOT INIT RD-FIFO
```

Recorder: The machine can be operated only with severe restrictions. Recording and reproduction of digital audio tracks may no longer be feasible because the RT code information is missing.

Important! Do not attempt to produce a recording in this condition because the information existing on the tape could be destroyed!

Cause: The read FIFO of the RT controller cannot be initialized.

Remedy:
- Switch the recorder off.
- Make sure the RT board is installed and correctly seated, replace the fuse if necessary.
- If the fault cannot be remedied, the RT board must be checked.
- Service

Display:

```
WARNING:023  SYSTEM
DEFAULT SETUP LOADED
```

Recorder: The stored system parameters for the tape deck, recording currents, operating states, etc. have been partially or completely lost. The parameters have been replaced with default values. For proper operation of the recorder the parameters for the tape deck, recording and erase currents as well as for other operating states have to be re entered.

Note: With an IBM PC all parameters can be saved on diskette via the TERM interface and subsequently reloaded into the D820 MCH. The program required for this purpose is enclosed in the appendix of this manual.

Cause: The data stored in the static RAM have been corrupted or erased due to low battery voltage or strong electrical interference (e.g. pulling out the CPU board while energized!).

Remedy:
- Switch the recorder off
- Check the battery voltage (min 2.3 V) on the CIF board (behind CPU) and replace the battery, if necessary.
- After power up, the user-specific parameters have to be reentered.

Display:

```
WARNING:024 TDC->CPU
    NO COMMUNICATION
```

Recorder: Switches to STOP

Cause: The CPU is defective, the message on the LC display is generated by the tape deck controller.
The FIFO communication between the CPU and the TAPE DECK controller does not function (possible cause analogous as for ERR: 013/014).

Remedy:
- Switch the recorder off
- Make sure the CPU board is installed and correctly seated.
- Switch the recorder off.
- If the fault cannot be remedied the CPU board must be checked.
- Service.

Display:

```
ERR:025  CPU->SBC
  NO COMMUNICATION
```

Recorder: The machine switches all recording currents and audio outputs off.
The tape deck functions are active but the audio functions cannot be operated.
Recording and playback are not possible.

Cause:
The CPU cannot establish a connection with the SERBUS controller because the later is defective or because the FIFO communication is not operational.
Other possible causes: The write FIFO or the read FIFO of the SERBUS controller on the PIF board cannot be initialized.
The FIFO interface on the CIF board, the FIFO bus, the FIFO interface, or the FIFO on the PIF board may possibly be defective.

Remedy:
- Switch the recorder off
- After a delay of approx. 10 s switch the recorder on again
- If the fault cannot be remedied, check the PIF and the CPU board as well as the FIFO bus (rear panel). (Service)
- Service

Display:

```
ERR:026  CPU->SEC
  NO COMMUNICATION
```

Recorder: If neither the SMPTE/EBU nor the BINBUS interface are used, the recorder can be operated normally.

Cause:

The CPU cannot establish a connection with the SMPTE/EBU BUS controller because the latter is defective or because the FIFO communication is not operational.
Other possible causes: The write FIFO or the read FIFO of the SMPTE/EBU BUS controller on the PIF board cannot be initialized.
The FIFO interface on the CIF board, the FIFO bus, the FIFO interface, or the FIFO on the PIF board may possibly be defective.

Remedy:

- Switch the recorder off
- After a delay of approx. 10 s switch the recorder on again
- If the fault cannot be remedied, check the PIF and the CPU board as well as the FIFO bus.
- Service

Display:

```
ERR:027  CPU->RBC
  NO COMMUNICATION
```

Recorder: Except for the remote control units connected to the REMBUS, the recorder can be operated normally.

Cause:

The CPU cannot establish a connection with the REMBUS controller because the latter is defective or because the FIFO communication is not operational.
Other possible causes: The write FIFO or the read FIFO of the REMBUS controller on the PIF board cannot be initialized.
The FIFO interface on the CIF board, the FIFO bus, the FIFO interface, or the FIFO on the PIF board may possibly be defective.

Remedy:

- Switch the recorder off
- After a delay of approx. 10 s switch the recorder on again
- If the fault cannot be remedied, check the PIF and the CPU board as well as the FIFO bus.
- Service

Display:

```
ERR:028  CPU->SSTC
  NO COMMUNICATION
```

Recorder: Except for the functions related to the internal synchronizer or the time code, the recorder can be operated normally.

Cause: The CPU cannot establish a link with the SYNCHRONIZER & TIMECODE controller because the latter is either not started correctly or has "crashed", or because the FIFO communication does not function.
Other possible causes: The write FIFO or the read FIFO of the SYNCHRONIZER & TIMECODE controller on the PIF board cannot be initialized.
The FIFO interface on the CIF board, the FIFO bus, the FIFO interface, or the FIFO on the SSTC board may possibly be defective.

Remedy:

- Switch the recorder off
- Make sure the SSTC board is installed and correctly seated.
- If the fault cannot be remedied, check the SSTC and the CPU board as well as the FIFO bus.
- Service

Display:

```
ERR:029  CPU->RT
  NO COMMUNICATION
```

Recorder: The machine can only be operated with severe restrictions because recording and reproduction of the digital audio tracks is not possible due to missing RT code information.

Important! Do not attempt to produce a recording in this condition because the information existing on the tape could be destroyed!

Cause: The CPU cannot establish a connection with the RT controller because the latter is defective or because the FIFO communication is not operational.
Other possible causes: The write FIFO or the read FIFO of the RT controller on the PIF board cannot be initialized.
The FIFO interface on the CIF board, the FIFO bus, the FIFO interface, or the FIFO on the RT board may possibly be defective.

Remedy:
- Switch the recorder off
- Make sure the RT board is installed and correctly seated.
- If the fault cannot be remedied, check the RT and the CPU board as well as the FIFO bus.
- Service

Display:

```
WARNING:101  TDC
  UNEXPECTED RESET
```

Recorder: Switches to STOP.

Cause: A fault (strong electrical field, transient line voltage failure) have caused a RESET of the TAPE DECK controller.

Remedy: If this warning appears frequently:
- Check the line voltage
- Check the secondary supply voltages for fluctuations or over/under voltages.
- Service

Display:

```
ERR:102  TDC:EPROM
     CHECKSUM ERROR
```

Recorder: The machine should not be operated.

Cause: EPROM error of the TAPE DECK controller on the PIF board.

Remedy:
- Switch off the recorder.
- Replace the EPROM (TDC software)
- If the fault does not disappear after power up, the PIF board should be checked.
- Service

Display:

```
ERR:103  TDC:RAM
  READ/WRITE ERROR
```

Recorder: The machine should not be operated.

Cause: RAM error or defect in the circuit of the TAPE DECK controller.

Remedy:
- Switch off the recorder (for at least 10 sec.).
- If the fault does not disappear after power-up, the PIF board should be checked.
- Service.

Display:

```
ERR:104  TDC:SSDA
 COMMUNICATION ERROR
```

Recorder: Switches to STOP.

Cause: The tape deck microprocessor is defective.
If the tape deck functions still operate normally, the problem may have been caused by a transient overload of the software. If the message occurs frequently there may be the following causes:

- Tape deck processor not correctly started or "crashed"
- The communication between the TAPE DECK controller and the tape deck microprocessor does not function.

Remedy:

- Switch the recorder off.
- Make sure the boards with the designations "MP-Unit TD CONTROL", "TAPE DECK SERIAL IF" and "CONVERTER RS422/TTL" are installed and correctly seated.
- Switch the recorder on.
- Check the supply voltages of the tape deck.
- Service.

Display:

```
ERR:111  TAPE DECK
   POWER DROP OUT
```

Recorder: Switches to STOP

Cause: Transient (approx. 100ms) line voltage failure.

Remedy: Confirm the event with STORE.
If the recorder cannot be operated normally:

- Switch off the recorder (min. 10 sec.)
- If the fault persists, check the power cable, line voltage, and the tape deck supply voltages.
- Service.

Display:

```
ERR:112  TAPE DECK
  NO SUPPLY VOLTAGE
```

Recorder: Switches to STOP
The tape deck functions are blocked.

Cause: One or more supply voltages for operating the tape deck are missing.

Remedy:

- Check the supply voltages.
- Switch off the recorder.
- Replace defective fuses.
- If the fault cannot be eliminated, the power supply components should be checked.
- Service.

Display:

```
ERR:113  TAPE DECK
  MOTOR SUPPLY LOW
```

Recorder: Switches to STOP.
Cause: Spooling motor supply too low.
Remedy: Wait 10 seconds. If the fault persists:

- Check the tape deck supply voltages.
- Switch off the recorder.
- Replace defective fuse.
- Check the boards with the designation SPOOLING MOTOR DRIVE AMPLIFIER.
- If the fault cannot be remedied, check the power supply units.
- Service.

Display:

```
ERR:114  TAPE DECK
 TACHO SENSOR ERROR
```

Recorder: Switches to STOP.
The tape deck functions are blocked.
Cause: Missing signal from one of the three tacho sensors, the three directions of rotation do not agree, or no tacho signal from the spooling motors with a motor current of >4 A.
Remedy: Switch off recorder.

- Check the flat cable connector to the tacho sensors, and the tacho sensors themselves.
- Verify that the guide rollers and the tacho roller rotate without binding.

Display:

```
ERR:115  TAPE DECK
TAPE TENSION CONTROL
```

Recorder: Switches to STOP.
The tape deck functions are blocked.
Cause: The deviation of the tape tension values has become too large.
Remedy:

- Switch off the recorder.
- Check whether the friction of the tape transport or the guide rollers is too high.
- Service.

Display:

```
ERR:116  TAPE DECK
INCOR RADIUS MEASURE
```

Recorder: Switches to STOP.
Cause: The computed values for pancake radii are outside the valid range.
Tacho sensors possibly defective.
Remedy:

- Switch the recorder with tape threaded to PLAY. The error message normally disappears as soon as a sufficient number of tacho pulses is available for computing the pancake radii.
- Otherwise check the tacho sensors.
- Service.

Display:

```
ERR:117  TAPE DECK
 NO COMM TO CAPSTAN
```

Recorder: Switches to STOP.
The tape deck functions are blocked.

Causes:

- The CAPSTAN controller is defective.
- The communication between the TAPE DECK microprocessor and the CAPSTAN controller is defective.

Remedy:

- Switch off the recorder.
- Make sure the boards with the designations "CAPSTAN CONTROL UNIT" and "CAPSTAN INTERFACE" are installed and correctly seated.
- Service.

Display:

```
ERR:118  TAPE DECK
PINCH ROLLER SLIPPNG
```

Recorder: Switches to STOP.
Cause: Excessive slip of the pinch roller, the speed of the capstan does not agree with the tape speed.

Remedy:

- Clean the capstan shaft, pinch roller, or replace the roller, if necessary.
- Check the pinching force of the roller and adjust, if necessary.
- Service.

Display:

```
ERR:119  TAPE DECK
  INCORRECT INERTIA
```

Recorder: Switches to STOP.
Cause: The last computed rotation moments are unacceptable.
Remedy:

- Check that all tape guide rollers and motors rotate without binding.
- Observe the tape movement through the tape guides to see whether or not the tape is transported gently.
- Service

Display:

```
ERR:120  TAPE DECK
 WRONG REF.FREQUENCY
```

Recorder: Cannot attain the desired tape speed.
Cause:

- When the machine operates with an external reference signal for controlling the tape speed (varispeed), the deviation from the reference frequency is too large.

Remedy: The reference frequency must be corrected correspondingly.

Display:

```
ERR:121  TAPE DECK
 SP-MOTOR TACHO LEFT
```

Recorder: Switches to STOP.
Cause: Left Spooling Motor tacho 1.820.771 reports frequent direction changes or supplies no tacho signal at all.
Remedy: Replace, repair or realign (if possible).

Display:

```
ERR:122  TAPE DECK
SP-MOTOR TACHO RIGHT
```

Recorder: Switches to STOP.
Cause: Right Spooling Motor tacho 1.820.771 reports frequent direction changes or supplies no tacho signal at all.
Remedy: Replace, repair or realign (if possible).

Display:

```
ERR:123  TAPE DECK
MOVE SENSOR HW-ERROR
```

Recorder: Switches to STOP.
Cause: MOVE SENSOR PCB defective or to frequent direction changes detected.
Remedy: Replace, repair or realign (if possible).

Display:

```
ERR:124  TAPE DECK
 MAINS OUT OF RANGE
```

Recorder: Switches to STOP
Cause: The line voltage is outside the operating range for which the D820 MCH has been designed.
Remedy: Check the line voltage, fuses, cable.

Display:

```
ERR:125  TAPE DECK
SP-MOTOR SERVO HW-ER
```

Recorder: Switches to STOP.
Cause: Fault in the analog control circuit of the spooling motors, voltage missing, or current feedback open.
Remedy: Check voltages and signal on the following PCBs:

- Move Sensor 1.820.770
- Sp. Motor Drive Amp. 1.820.875
- Tape Tension Sensors 1.820.772 / 1.820.877

Display:

```
WARNING:201  SBC
  UNEXPECTED RESET
```

Recorder: Switches to STOP.
Cause: A fault (strong electrical field, transient supply voltage drop) causes a RESET of the SERBUS controller.
Remedy: If this warning appears frequently:

- Check the line voltage.
- Check the secondary supply voltages for fluctuations or for over/under voltages.
- Service.

Display:

```
ERR:202  SBC:EPROM
     CHECKSUM ERROR
```

Recorder: The machine should not be operated.
Cause: EPROM error of the SERBUS controller on the PIF board.
Remedy:

- Switch off the recorder.
- Replace the EPROM (SBC software)
- If the fault reoccurs when the machine is powered up, the PIF board must be replaced.
- Service.

Display:

```
ERR:203  SBC:RAM
  READ/WRITE ERROR
```

Recorder: The recorder should not be operated.
Cause: RAM error or defect in the circuitry of the SERBUS controller.
Remedy:
- Switch off the recorder (for at least 10 sec.).
- If the fault reoccurs when the machine is powered up, the PIF board must be replaced.
- Service.

Display:

```
ERR:204  SBC:SERBUS
 INTERFACE/BUS ERROR
```

Recorder: The audio functions are out of order.
Cause: Defective SERBUS (interruption, short circuit, etc.), PORTMASTER chip, or defect in the SERBUS interface on the PIF board.
Remedy:
- Switch off the recorder.
- Make sure all required boards are installed.
- Check the supply voltage on all boards.
- Service.

Display:

```
ERR:205  SBC->DPC
 COMMUNICATION ERROR
```

Recorder: The display panel cannot be operated.
Causes:
- The display panel controller is not started correctly or has "crashed".
- The communication between the SERBUS controller and the display panel does not function correctly.

Remedy: If the fault reappears after the recorder has been switched off (for at least 10 sec.):
- Make sure the display panel is connected and that all boards in the display panel are installed and correctly seated.
- Check the connections to the display panel.
- Check the supply voltage on the display panel.
- Otherwise have the display panel checked.
- Service.

Display:

```
ERR:210  SBC:SERBUS
  TIMEOUT MAPRO #1
```

Recorder: The digital audio channels 1...8 cannot be operated.
Causes:
- MAPRO board of the digital audio group 1 is missing or not correctly seated.
- Wrong PORTMASTER address because the MAPRO boards are installed in the wrong slots or the jumpers on the MAPRO board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the MAPRO board exists, that the jumpers are set correctly, and that the board is installed in the proper slot.
- Check the fuse on the MAPRO board.
- Service.

Display:

```
ERR:211  SBC:SERBUS
  TIMEOUT MAPRO #2
```

Recorder: The digital audio channels 9...16 cannot be operated.

Causes:
- MAPRO board of the digital audio group 2 is missing or not correctly seated.
- Wrong PORTMASTER address because the MAPRO boards are installed in the wrong slots or the jumpers on the MAPRO board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the MAPRO board exists, that the jumpers are set correctly, and that the board is installed in the proper slot.
- Check the fuse on the MAPRO board.
- Service.

Display:

```
ERR:212  SBC:SERBUS
  TIMEOUT MAPRO #3
```

Recorder: The digital audio channels 17...24 cannot be operated.

Causes:
- MAPRO board of the digital audio group 3 is missing or not correctly seated.
- Wrong PORTMASTER address because the MAPRO boards are installed in the wrong slot or the jumpers on the MAPRO board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the MAPRO board exists, that the jumpers are set correctly, and that the board is installed in the proper slot.
- Check the fuse on the MAPRO board.
- Service.

Display:

```
ERR:213  SBC:SERBUS
  TIMEOUT MAPRO #4
```

Recorder: The digital audio channels 25...32 cannot be operated.

Causes:
- MAPRO board of the digital audio group 4 is missing or not correctly seated.
- Wrong PORTMASTER address because the MAPRO boards are installed in the wrong slots or the jumpers on the MAPRO board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the MAPRO board exists, that the jumpers are set correctly, and that the board is installed in the proper slot.
- Check the fuse on the MAPRO board.
- Service.

Display:

```
ERR:214  SBC:SERBUS
  TIMEOUT MAPRO #5
```

Recorder: The digital audio channels 33...40 cannot be operated.

Causes:
- MAPRO board of the digital audio group 5 is missing or not correctly seated.
- Wrong PORTMASTER address because the MAPRO boards are installed in the wrong slots or the jumpers on the MAPRO board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the MAPRO board exists, that the jumpers are set correctly, and that the board is installed in the proper slot.
- Check the fuse on the MAPRO board.
- Service.

Display:

```
ERR:215  SBC:SERBUS
  TIMEOUT MAPRO #6
```

Recorder: The digital audio channels 41...48 cannot be operated.

Causes:
- MAPRO board of the digital audio group 6 is missing or not correctly seated.
- Wrong PORTMASTER address because the MAPRO boards are installed in the wrong slots or the jumpers on the MAPRO board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the MAPRO board exists, that the jumpers are set correctly, and that the board is installed in the proper slot.
- Check the fuse on the MAPRO board.
- Service.

Display:

```
ERR:225  SBC:SERBUS
TIMEOUT SOUND MEMORY
```

Recorder:

The sound memory functions cannot be used.

Cause:

The SOUND MEMORY BOARD is missing or not properly plugged in.

Remedy:
- Switch off the recorder.
- Make sure the SOUND MEMORY BOARD exists and that it is firmly seated.
- Check the fuse of the SOUND MEMORY board.
- Service

Display:

```
ERR:226  SBC:SERBUS
     TIMEOUT I/O #1
```

Recorder: The digital audio channels 1...8 cannot be operated.

Cause:
- The I/O board of the digital audio group 1 is missing or incorrectly installed.
- Wrong PORTMASTER address because the I/O boards are installed in the wrong slots or the jumpers on the I/O board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the I/O board exists, that the jumpers are set correctly and that the board is installed in the proper slot.
- Check the fuse on the I/O board.
- Service.

Display:

```
ERR:227  SBC:SERBUS
   TIMEOUT I/O #2
```

Recorder: The digital audio channels 9...16 cannot be operated.

Cause:
- The I/O board of the digital audio group 2 is missing or incorrectly installed.
- Wrong PORTMASTER address because the I/O boards are installed in the wrong slots or the jumpers on the I/O board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the I/O board exists, that the jumpers are set correctly and that the board is installed in the proper slot.
- Check the fuse on the I/O board.
- Service.

Display:

```
ERR:228  SBC:SERBUS
    TIMEOUT I/O #3
```

Recorder: The digital audio channels 17...24 cannot be operated.

Cause:
- The I/O board of the digital audio group 3 is missing or incorrectly installed.
- Wrong PORTMASTER address because the I/O boards are installed in the wrong slots or the jumpers on the I/O board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the I/O board exists, that the jumpers are set correctly and that the board is installed in the proper slot.
- Check the fuse on the I/O board.
- Service.

Display:

```
ERR:229  SBC:SERBUS
   TIMEOUT I/O #4
```

Recorder: The digital audio channels 25...32 cannot be operated.

Cause:
- The I/O board of the digital audio group 4 is missing or incorrectly installed.
- Wrong PORTMASTER address because the I/O boards are installed in the wrong slots or the jumpers on the I/O board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the I/O board exists, that the jumpers are set correctly and that the board is installed in the proper slot.
- Check the fuse on the I/O board.
- Service.

Display:

```
ERR:230  SBC:SERBUS
    TIMEOUT I/O #5
```

Recorder: The digital audio channels 33...40 cannot be operated.

Cause:
- The I/O board of the digital audio group 5 is missing or incorrectly installed.
- Wrong PORTMASTER address because the I/O boards are installed in the wrong slots or the jumpers on the I/O board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the I/O board exists, that the jumpers are set correctly and that the board is installed in the proper slot.
- Check the fuse on the I/O board.
- Service.

Display:

```
ERR:231  SBC:SERBUS
   TIMEOUT I/O #6
```

Recorder: The digital audio channels 41...48 cannot be operated.

Cause:
- The I/O board of the digital audio group 6 is missing or incorrectly installed.
- Wrong PORTMASTER address because the I/O boards are installed in the wrong slots or the jumpers on the I/O board are set incorrectly (address selection).

Remedy:
- Switch off the recorder.
- Make sure the I/O board exists, that the jumpers are set correctly and that the board is installed proper in the slot.
- Check the fuse on the I/O board.
- Service.

Display:

```
ERR:232  SBC:SERBUS
    TIMEOUT MIO #A
```

Recorder: The digital audio inputs/outputs channels 1...24 cannot be operated.

Causes:
- MASTER I/O A-board is missing or not seated correctly.
- Defective PORTMASTER chip on the MASTER I/O A-board.

Remedy:
- Switch off the recorder.
- Make sure the MASTER I/O A-board is installed and that it is firmly seated.
- Check the fuse on the MASTER I/O A-board.
- Service

Display:

```
ERR:233  SBC:SERBUS
   TIMEOUT MIO #B
```

Recorder: The digital audio inputs/outputs channels 25...48 cannot be operated. Analogous to ERR:232 but applies to channels 25...48 and MASTER I/O B-board.

Causes:
- MASTER I/O B-board is missing or not seated correctly.
- Defective PORTMASTER chip on the MASTER I/O B-board.

Remedy:
- Switch off the recorder.
- Make sure the MASTER I/O B-board is installed and that it is firmly seated.
- Check the fuse on the MASTER I/O B-board.
- Service

Display:

```
ERR:234  SBC:SERBUS
  TIMEOUT PING-PONG
```

Recorder: All digital audio channels are inoperative.

Causes:
- PING-PONG board is missing or not seated correctly.
- Defective PORTMASTER chip on the PING-PONG board.

Remedy:
- Switch off the recorder.
- Make sure the PING-PONG board exists and that it is correctly seated.
- Check the fuse of the PING-PONG board.
- Service.

Display:

```
ERR:235  SBC:SERBUS
    TIMEOUT CLOCK
```

Recorder: The audio and auxiliary tracks can be neither recorded nor reproduced.

Cause:
- CLOCK board defective or not firmly seated.
- Defective PORTMASTER chip on the CLOCK board.

Remedy:
- Switch off the recorder.
- Make sure the CLOCK board is installed and firmly seated.
- Check the fuse on the CLOCK board.
- Service

Display:

```
ERR:236  SBC:SERBUS
        TIMEOUT CUE
```

Recorder: The cue tracks can be neither recorded nor reproduced.

Cause:
- CUE card missing or not seated correctly.
- Defective PORTMASTER chip on the CLOCK board.

Remedy:
- Switch off the recorder.
- Make sure the CUE board is installed and firmly seated.
- Check the fuse on the CUE board.
- Service

Display:

```
ERR:237  SBC:SERBUS
   TIMEOUT AES-IF
```

Recorder: The AES-EBU inputs/outputs do not function correctly.

Cause:
- AES/EBU INTERFACE board missing or not seated correctly.
- Defective PORTMASTER chip.

Remedy:
- Switch off the recorder immediately.
- Make sure the AES/EBU INTERFACE board is installed and firmly seated.
- Check the fuse on the AES/EBU INTERFACE board.
- Service

Display:

```
ERR:238  SBC:SERBUS
  TIMEOUT DP-PANEL
```

Recorder: The audio functions do not operate correctly.

Cause: Defective SERBUS (interruption, short circuit, etc.) PORTMASTER chip or defect in the SERBUS interface on the PIF board.

Remedy:
- Switch off the recorder.
- Make sure all boards are firmly seated.
- Check the supply voltages and fuses on all boards.
- Service

Display:

```
ERR:239  SBC:SERBUS
  TIMEOUT REP-CTRL
```

Recorder: The audio and auxiliary tracks cannot be reproduced. Recording is not possible.

Cause:
- REPRODUCE CONTROLLER board missing or not firmly seated.
- Defective SERBUS connection if ERR:239 and ERR:240 occur simultaneously.
- Defective PORTMASTER chip.

Remedy:
- Switch off the recorder.
- Make sure the REPRODUCE CONTROLLER board is installed and firmly seated.
- Check the supply voltages of the tape deck electronics and the SERBUS connection.
- Service

Display:

```
ERR:240  SBC:SERBUS
  TIMEOUT REC-CTRL
```

Recorder: The record function is inoperative.

Cause:
- RECORD CONTROLLER board missing or not firmly seated.
- Defective or poor SERBUS connection if ERR:239 and ERR:240 occur simultaneously.
- Defective PORTMASTER chip.

Remedy:
- Switch off the recorder.
- Make sure the RECORD CONTROLLER board is installed and firmly seated.
- Check the supply voltages of the tape deck electronics and the SERBUS connection.
- Service

Display:

```
ERR:241  SBC:REC
  WATCHDOG TEST ERR
```

Recorder: The record function is inoperative.

Cause: Fault in the record electronics.

Remedy:
- Switch off the recorder.
- Make sure the boards with the designations "RECORD CONTROLLER", "REC.SUPPLY STABILIZER", "REC/ERASE CURRENT DRIV." and "RECORD CURRENT DRIVER" are installed and firmly seated.
- Also refer to ERR:240

Display:

```
ERR:242      DPC
  UNEXPECTED RESET
```

Recorder: All LEDs and bargraphs of the display panel turn off momentarily.

Cause: A fault (strong electrical field, transient power interruption) has triggered a RESET of the display panel controller.

Remedy:
- Check the line voltage.
- Check the secondary supply voltages for fluctuations or over/under voltage.
- Service.

Display:

```
WARNING:301  SEC
  UNEXPECTED RESET
```

Recorder: If the recorder is linked via the SMPTE/EBU or BINBUS interface with another unit, this link must be reinitialized.

Cause: A fault (strong electrical field, transient line voltage drop) has triggered a RESET of the SMPTE/EBU controller.

Remedy: If this warning appears frequently:
- Check the supply voltage
- Check the secondary supply voltages for fluctuations or over/under voltages.
- Service

Display:

```
ERR:302  SEC:EPROM
     CHECKSUM ERROR
```

Recorder: The SMPTE/EBU or BINBUS interface should not be used.
Cause: EPROM error of the SMPTE/EBU controller on the PIF board.
Remedy:
- Switch off the recorder.
- Replace the EPROM (SEC software).
- If the fault reoccurs after power up, the PIF board should be checked.
- Service

Display:

```
ERR:303  SEC:RAM
  READ/WRITE ERROR
```

Recorder: The SMPTE/EBU or BINBUS interface should not be used.
Cause: EPROM error of the SMPTE/EBU controller on the PIF board.
Remedy:
- Switch off the recorder.
- Replace the EPROM (SEC software).
- If the fault reoccurs after power up, the PIF board should be checked.
- Service

Display:

```
ERR:304  SEC
 SMPTE/EBU BUS ERROR
```

Recorder: The machine cannot be operated via the SMPTE/EBU interface.
Causes:
- Fault on the SMPTE/EBU BUS.
- Incorrect connection to the SMPTE/EBU BUS.
- Wrong SMPTE/EBU BUS address selected.
- Jumper of PIF board set incorrectly.

Remedy: If the fault reoccurs after the machine has been switched off for at least 10 seconds:
- Switch off the recorder.
- Make sure all connections are correctly established.
- Check the jumper positions on the PIF board.
- Check the connected external equipment for possibel faults.
- Otherwise check the PIF board.
- Service.

Display:

```
ERR:305  SEC:BUS-IF
 BAD JUMPER SETTINGS
```

Recorder: Operation with SMPTE/EBU BUS interface not possible.
Cause: Incorrect jumper setting on the PIF board.
Remedy: Correct the jumper settings.

Display:

```
WARNING:401  RBC
  UNEXPECTED RESET
```

Recorder: The communication via the REMBUS has been interrupted briefly. Further operation may possibly be faulty.

Cause: A fault (strong electrical field, transient line voltage drop) has triggered a RESET of the REMBUS controller.

Remedy: If this warning appears frequently:

- Switch off the recorder (for at least 10 sec.)
- Check the supply voltage
- Check the secondary supply voltages for fluctuations or over/under voltages.
- Service

Display:

```
ERR:402  RBC:EPROM
     CHECKSUM ERROR
```

Recorder: Further operation via the REMBUS has to be avoided.

Cause: EPROM error of the REMBUS controller on the PIF board.

Remedy:

- Switch off the recorder.
- Replace the EPROM (RBC software)
- If the fault reoccurs after power up, the PIF board should be checked.
- Service

Display:

```
ERR:403  RBC:RAM
  READ/WRITE ERROR
```

Recorder: Further operation via the REMBUS has to be avoided.

Cause: EPROM error of the REMBUS controller on the PIF board.

Remedy:

- Switch off the recorder.
- Replace the EPROM (RBC software)
- If the fault reoccurs after power up, the PIF board should be checked.
- Service

Display:

```
WARNING:501  SSTC
  UNEXPECTED RESET
```

Recorder: A momentarily active synchronizer operation (LOCK, LOOP, etc.) has been interrupted (STOP).

Cause: A fault (strong electrical field, transient line voltage drop) has triggered a RESET of the SSTC controller.

Remedy: If this warning appears frequently:

- Check the supply voltage
- Check the secondary supply voltages for fluctuations or over/under voltages.
- Service

Display:

```
ERR:502  SSTC:EPROM
     CHECKSUM ERROR
```

Recorder: Further synchronizer operation has to be avoided.
Cause: EPROM error of the SSTC controller on the SSTC board.
Remedy:
- Switch off the recorder.
- Replace the EPROM (SSTC software)
- If the fault reoccurs after power up, the SSTC board should be checked.
- Service

Display:

```
ERR:503  SSTC:RAM
  READ/WRITE ERROR
```

Recorder: Further synchronizer operation has to be avoided.
Cause: EPROM error of the SSTC controller on the SSTC board.
Remedy:
- Switch off the recorder.
- Replace the EPROM (SSTC software)
- If the fault reoccurs after power up, the SSTC board should be checked.
- Service

Display:

```
WARNING:601  RTC
  UNEXPECTED RESET
```

Recorder: (no response)
Cause: A fault (strong electrical field, transient line voltage drop) has triggered a RESET of the RT controller.
Remedy: If this warning appears frequently:
- Check the supply voltage
- Check the secondary supply voltages for fluctuations or over/under voltages.
- Service

Display:

```
ERR:602  RTC:EPROM
     CHECKSUM ERROR
```

Recorder: The machine should not be used for high-quality recording or reproduce operations.
Cause: EPROM error of the RT controller on the RT board.
Remedy:
- Switch off the recorder.
- Replace the EPROM (RT software)
- If the fault reoccurs after power up, the RT board should be checked.
- Service

Display:

```
ERR:603  RTC:RAM
  READ/WRITE ERROR
```

Recorder: The machine should not be used for high-quality recording or reproduce operations.
Cause: EPROM error of the RT controller on the RT board.
Remedy: Switch off the recorder.
- Replace the EPROM (RT software)
- If the fault reoccurs after power up, the RT board should be checked.
- Service

Display:

```
WARNING:800 RT TRACK
  SAMP FREQ MISMATCH
```

Recorder: Recording or reproduction does not occur at the sampling rate recorded on tape.

Cause: The recorder is being operated with an external clock signal (e.g. AES or WORD-clock). The sampling rate of the external clock signal does not conform to the sampling rate which is specified on the RT-track.

Remedy:

- Switch recorder to PLAY with INT CLK.
- Select a sampling rate of the external clock which matches the sampling rate shown on the recorder. The recorder can now again be operated with EXT CLK.

14 INDEX

INDEX