STUDER

professional audio equipment

Studer D827 MCH

Digital 24/48 Track Tape Recorder

Operating Instructions

CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN

ATTENTION
RISQUE DE CHOC ELECTRIQUE
NE PAS OUVRIR

ACHTUNG
GEFAHR: ELEKTRISCHER SCHLAG
NICHT ÖFFNEN

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

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

Um die Gefahr eines elektrischen Schlages zu vermeiden, entfernen Sie keine Geräteabdeckungen (oder dessen Rückwand). Überlassen Sie Wartung und Reparatur qualifiziertem Fachpersonal.
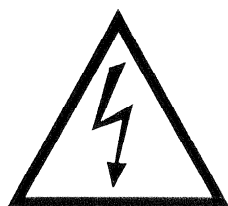
This symbol is intended to alert the user to presence of uninsulated "**dangerous voltage**" within the apparatus that may be of sufficient magnitude to constitute a risk of electric shock to a person.

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

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

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

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

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

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

FIRST AID

(in case of electric shock)

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

WARNING!

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

2. If the person is unconscious:

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

PREMIERS SECOURS

(en cas d'électrocution)

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

- Couper l'interrupteur principal
- Couper le courant

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

ATTENTION!

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

2. En cas de perte de connaissance de la personne électrocutée:
- Controller le pouls
- Si nécessaire, pratiquer la respiration artificielle
- Placer l'accidenté sur le flanc et consulter un médecin.

ERSTE HILFE

(bei Stromunfällen)

1. Bei einem Stromunfall die betroffene Person so rasch wie möglich vom Strom trennen:
- Ausschalten des Gerätes
- Ziehen oder Unterbrechen der Netzzuleitung
- Betroffene Person mit isoliertem Material (Holz, Kunststoff) von der Gefahrenquelle wegstossen

- *Nach einem Stromunfall sollte immer ein Arzt aufgesucht werden.*

ACHTUNG!

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

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

Installation

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.
Untersuchen Sie das Gerät und sein Zubehör auf allfällige Transportschäden.
Ein Gerät, das mechanische Beschädigung aufweist oder in welches Flüssigkeit oder Gegenstände eingedrungen sind, darf nicht ans Netz angeschlossen oder muss sofort durch Ziehen des Netzsteckers vom Netz getrennt werden. Das Öffnen und Instandsetzen des Gerätes darf nur von Fachpersonal unter Einhaltung der geltenden Vorschriften durchgeführt werden.

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

Installation

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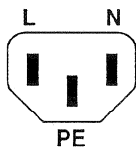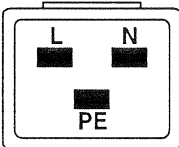
Check the equipment for any transport damage.

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

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

Before connecting the equipment to the AC power outlet, check that the local line voltage matches the equipment rating (voltage, frequency) within the admissible tolerance. The equipment fuses must be rated in accordance with the specifications on the equipment.

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

IEC 320 / C13   IEC 320 / C19

Female plug (IEC320), view from contact side:		
L live; brown	National American Standard:	Black
N neutral; blue		White
PE protective earth; green and yellow		green
Connecteur femelle (IEC320), vue de la face aux contacts:		
L phase; brun	Standard national américain:	Noir
N neutre; bleu		Blanc
PE terre protective; vert et jaune		Vert
Ansicht auf Steckkontakte der Kabel-Gerätesteckdose (IEC320):		
L Phase; braun	USA-Standard:	Schwarz
N Nulleiter; blau		Weiss
PE Schutzleiter; gelb/grün		grün

Zugentlastung für den Netzanschluss

Zum Verankern von Steckverbindungen ohne mechanische Verriegelung (z.B. IEC-Kaltgerätedosen) empfehlen wir die folgende Anordnung:

Mains connector strain relief

For anchoring connectors without a mechanical lock (e.g. IEC mains connectors), we recommend the following arrangement:
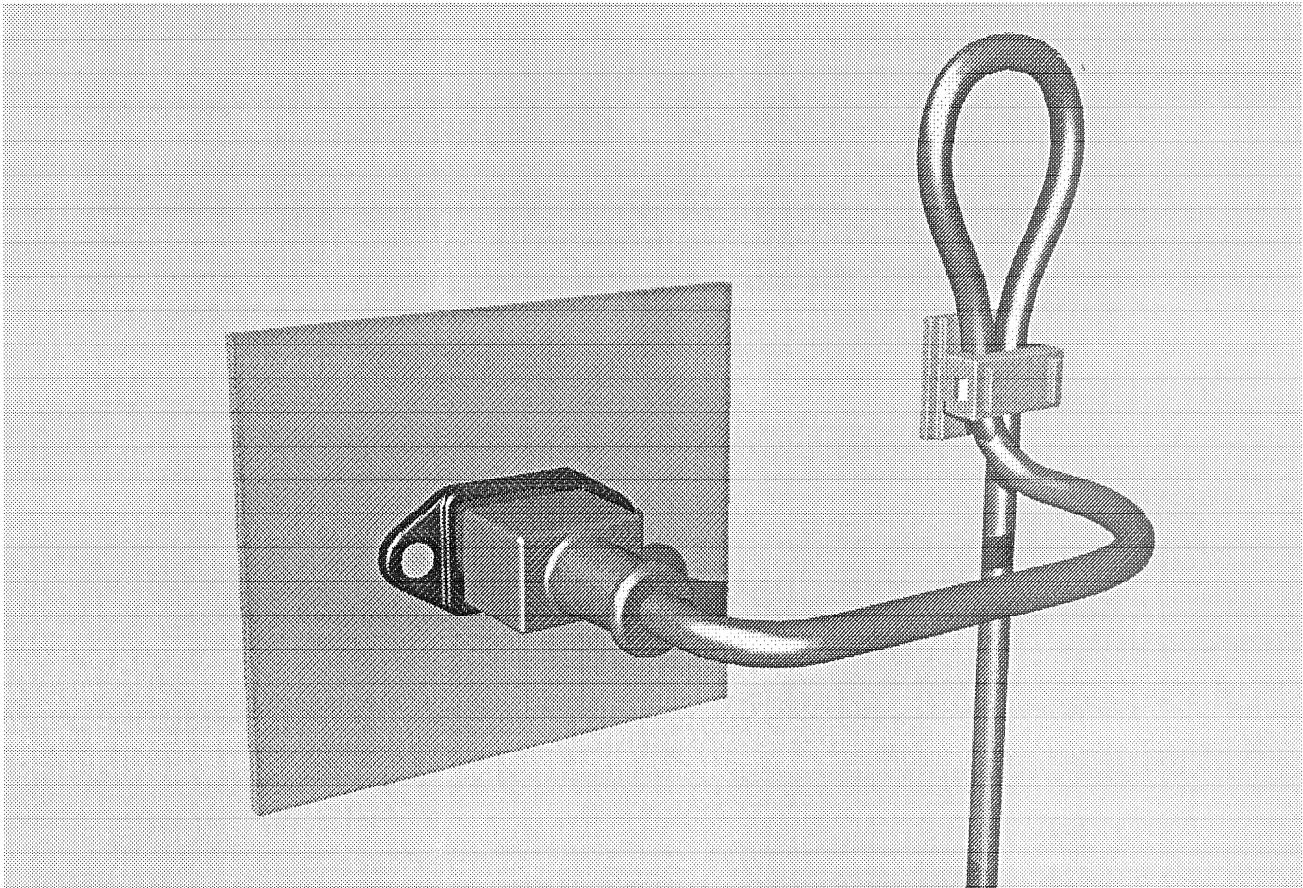
Vorgehen: Der mitgelieferte Kabelhalter ist selbstklebend. Bitte beachten Sie bei der Montage die folgenden Regeln:

1. Der Untergrund muss sauber, trocken und frei von Fett, Öl und anderen Verunreinigungen sein. Temperaturbereich für optimale Verklebung: 20...40° C.

2. Entfernen Sie die Schutzfolie auf der Rückseite des Kabelhalters und bringen sie ihn mit kräftigem Druck an der gewünschten Stelle an. Lassen sie ihn unbelastet so lange wie möglich ruhen – die maximale Klebekraft ist erst nach rund 24 Stunden erreicht.

3. Die Stabilität des Kabelhalters wird erhöht, wenn Sie ihn zusätzlich verschrauben. Zu diesem Zweck liegen ihm eine selbstschneidende Schraube sowie eine M4-Schraube mit Mutter bei.

4. Legen Sie das Kabel gemäss Figur in den Halter ein und pressen Sie die Klemme kräftig auf, bis das Kabel fixiert ist.

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

1. The surface to be adhered to must be clean, dry, and free from grease, oil or other contaminants. Best application temperature range is 20...40° C.

2. Remove the plastic protective backing from the rear side of the clamp and apply it firmly to the surface at the desired position. Allow as much time as possible for curing. The bond continues to develop for as long as 24 hours.

3. For improved stability, the clamp can be fixed with a screw. For this purpose, a self-tapping screw and an M4 bolt and nut are included.

4. Place the cable into the clamp as shown in the illustration above and firmly press down the internal top cover until the cable is fixed.

Lufttemperatur und Feuchtigkeit

Allgemein

Die Betriebstauglichkeit des Gerätes oder Systems ist unter folgenden Umgebungsbedingungen gewährleistet:
EN 60721-3-3, Set IE32, Wert 3K3.
Diese Norm umfasst einen umfassenden Katalog von Parametern; die wichtigsten davon sind: Umgebungstemperatur +5...+40 °C; rel. Luftfeuchtigkeit 5...85% – d.h. weder Kondensation noch Eisbildung; abs. Luftfeuchtigkeit 1...25 g/m³; Temperatur-Änderungsrate < 0,5 °C/min. In den folgenden Abschnitten wird darauf näher eingegangen.
Unter den genannten Bedingungen startet und arbeitet das Gerät oder System problemlos. Ausserhalb dieser Spezifikationen möglicherweise auftretende Probleme sind in den folgenden Abschnitten beschrieben.

Umgebungstemperatur

Geräte und Systeme von Studer sind allgemein für einen Umgebungstemperaturbereich (d.h. Temperatur der eintretenden Kühlluft) von +5...+40 °C ausgelegt. Bei Installation in einem Schrank muss der vorgesehene Luftdurchsatz und dadurch die Konvektionskühlung gewährleistet sein. Folgende Tatsachen sind dabei zu berücksichtigen:
1. Die zulässige Umgebungstemperatur für den Betrieb der Halbleiter-Bauelemente beträgt 0 °C bis +70 °C (commercial temperature range for operation).
2. Der Luftdurchsatz der Anlage muss gewährleisten, dass die austretende Kühlluft ständig kühler ist als 70 °C.
3. Die mittlere Erwärmung der Kühlluft soll 20 K betragen, die maximale Erwärmung an den heissen Komponenten darf somit um weitere 10 K höher liegen.
4. Zum Abführen einer Verlustleistung von 1 kW bei dieser zulässigen mittleren Erwärmung ist eine Luftmenge von 2,65 m³/min notwendig.
Beispiel: Für ein Rack mit einer Leistungsaufnahme $P = 800\ W$ ist eine Kühlluftmenge von $0,8 * 2,65\ m^3/min$ nötig, entsprechend $2,12\ m^3/min$.
5. Soll die Kühlfunktion der Anlage (z.B. auch bei Lüfter-Ausfall oder Bestrahlung durch Spotlampen) überwacht werden, so ist die Temperatur der Abluft unmittelbar oberhalb der Einschübe an mehreren Stellen im Rack zu messen; die Ansprechtemperatur der Sensoren soll 65 bis 70 °C betragen.

Reif und Tau

Das unversiegelte System (Steckerpartien, Halbleiteranschlüsse) verträgt zwar leichte Eisbildung (Reif). Mit blossem Auge sichtbare Betauung führt jedoch bereits zu Funktionsstörungen. In der Praxis kann mit einem zuverlässigen Betrieb der Geräte bereits im Temperaturbereich ab −15 °C gerechnet werden, wenn für die Inbetriebnahme des kalten Systems die folgende allgemeine Regel beachtet wird:
Wird die Luft im System abgekühlt, so steigt ihre relative Feuchtigkeit an. Erreicht diese 100%, kommt es zu Niederschlag, meist in der Grenzschicht zwischen der Luft und einer kühleren Oberfläche, und somit zur Bildung von Eis oder Tau an empfindlichen Systemstellen (Kontakte, IC-Anschlüsse etc.). Ein störungsfreier Betrieb mit interner Betauung, unabhängig von der Temperatur, ist nicht gewährleistet.

Air temperature and humidity

General

Normal operation of the unit or system is warranted under the following ambient conditions defined by:
EN 60721-3-3, set IE32, value 3K3.
This standard consists of an extensive catalogue of parameters, the most important of which are: ambient temperature +5...+40° C, relative humidity 5...85% – i.e. no formation of condensation or ice; absolute humidity 1...25 g/m³; rate of temperature change < 0,5 °C/min. These parameters are dealt with in the following paragraphs.
Under these conditions the unit or system starts and works without any problem. Beyond these specifications, possible problems are described in the following sections.

Ambient temperature

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

1. The admissible ambient temperature range for operation of the semiconductor components is 0 °C to +70 °C (commercial temperature range for operation).
2. The air flow through the installation must provide that the outgoing air is always cooler than 70 °C.
3. Average heat increase of the cooling air shall be 20 K, allowing for an additional maximum 10 K increase at the hot components.
4. In order to dissipate 1 kW with this admissible average heat increase, an air flow of 2,65 m³/min is required.

Example: A rack dissipating $P = 800\ W$ requires an air flow of $0,8 * 2,65\ m^3/min$ which corresponds to $2,12\ m^3/min$.

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

Frost and dew

The unsealed system parts (connector areas and semiconductor pins) allow for a minute formation of ice or frost. However, formation of dew visible with the naked eye will already lead to malfunctions. In practice, reliable operation can be expected in a temperature range above −15 °C, if the following general rule is considered for putting the cold system into operation:

If the air within the system is cooled down, the relative humidity rises. If it reaches 100%, condensation will arise, usually in the boundary layer between the air and a cooler surface, together with formation of ice or dew at sensitive areas of the system (contacts, IC pins, etc.). Once internal condensation occurs, troublefree operation cannot be guaranteed, independent of temperature.

Vor der Inbetriebnahme muss das System auf allfällige interne Betauung oder Eisbildung überprüft werden. Nur bei sehr leichter Eisbildung kann mit direkter Verdunstung (Sublimation) gerechnet werden; andernfalls muss das System im abgeschalteten Zustand gewärmt und getrocknet werden.

Das System ohne feststellbare interne Eisbildung oder Betauung soll möglichst homogen (und somit langsam) mit eigener Wärmeleistung aufgewärmt werden; die Lufttemperatur der Umgebung soll ständig etwas tiefer als diejenige der Systemabluft sein.

Ist es unumgänglich, das abgekühlte System sofort in warmer Umgebungsluft zu betreiben, so muss diese entfeuchtet sein. Die absolute Luftfeuchtigkeit muss dabei so tief sein, dass die relative Feuchtigkeit, bezogen auf die kälteste Oberfläche im System, immer unterhalb 100% bleibt.

Es ist dafür zu sorgen, dass beim Abschalten des Systems die eingeschlossene Luft möglichst trocken ist (d.h. vor dem Abschalten im Winter den Raum mit kalter, trockener Luft belüften und feuchte Gegenstände, z.B. Kleider, entfernen).

Die Zusammenhänge sind im folgenden Klimatogramm ersichtlich. Zum kontrollierten Verfahren gehören Thermometer und Hygrometer sowie ein Thermometer innerhalb des Systems.

Beispiel 1: Ein Ü-Wagen mit einer Innentemperatur von 20 °C und 40% relativer Luftfeuchtigkeit wird am Abend abgeschaltet. Sinkt die Temperatur unter +5 °C, bildet sich Tau oder Eis.

Beispiel 2: Ein Ü-Wagen wird morgens mit 20 °C warmer Luft von 40% relativer Luftfeuchtigkeit aufgewärmt. Auf Teilen, die kälter als +5 °C sind, bildet sich Tau oder Eis.

Before putting into operation, the system must be checked for internal formation of condensation or ice. Only with a minute formation of ice, direct evaporation (sublimation) may be expected; otherwise the system must be heated and dried while switched off.

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

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

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

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

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

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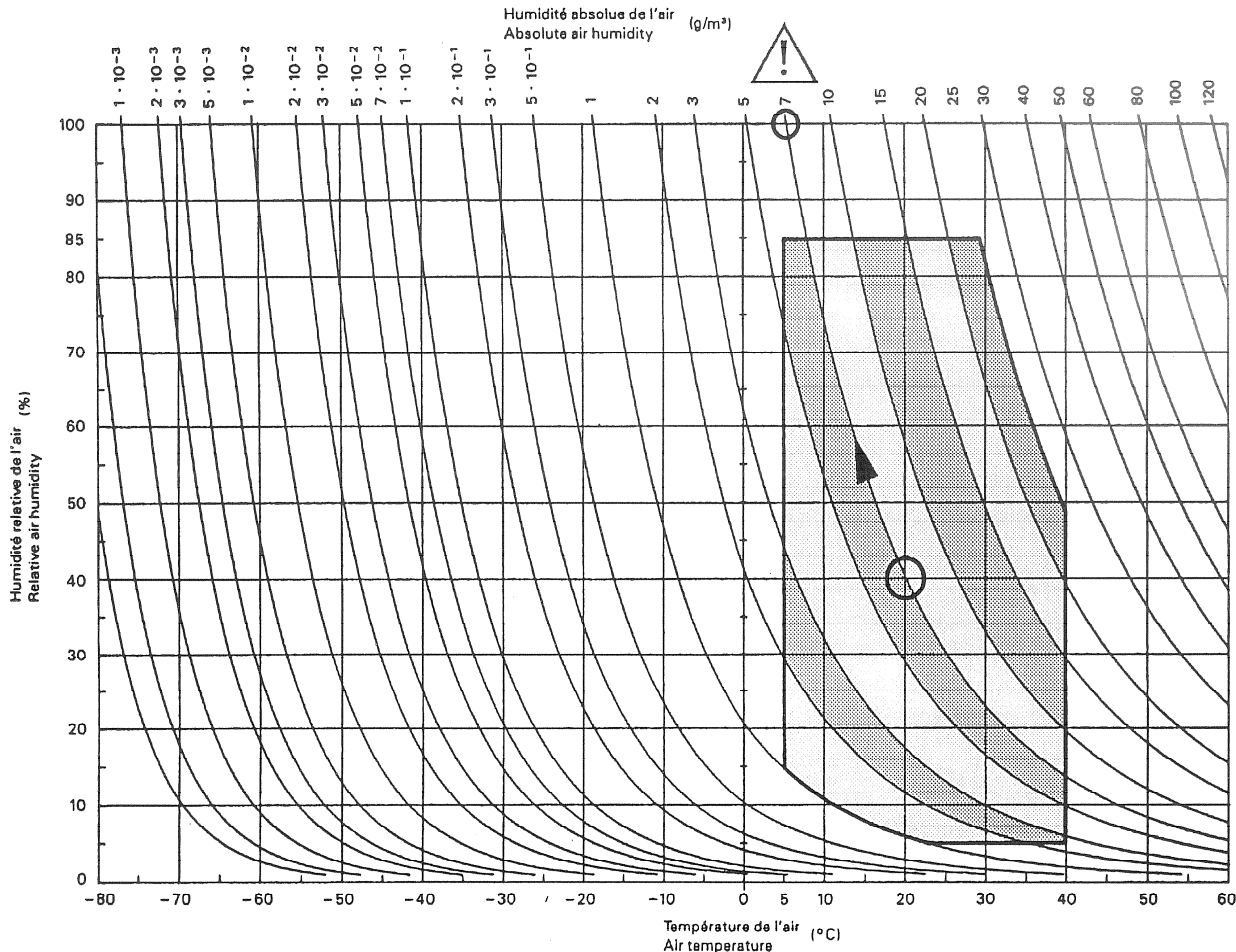

Figure B.3 – Climatogramme pour catégorie 3K3
Climatogram for class 3K3

721-3-3 © CEI:1994

VI

Wartung und Reparatur

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

Bei Wartungsarbeiten am geöffneten, unter Netzspannung stehenden Gerät dürfen blanke Schaltungsteile und metallene Halbleitergehäuse weder direkt noch mit nichtisoliertem Werkzeug berührt werden.
Zusätzliche Gefahren bestehen bei unsachgemässer Handhabung besonderer Komponenten:
- *Explosionsgefahr* bei Lithiumzellen, Elektrolyt-Kondensatoren und Leistungshalbleitern
- *Implosionsgefahr* bei evakuierten Anzeigeeinheiten
- *Strahlungsgefahr* bei Lasereinheiten (nichtionisierend), Bildröhren (ionisierend)
- *Verätzungsgefahr* bei Anzeigeeinheiten (LCD) und Komponenten mit flüssigem Elektrolyt.

Solche Komponenten dürfen nur von ausgebildetem Fachpersonal mit den vorgeschriebenen Schutzmitteln (u.a. Schutzbrille, Handschuhe) gehandhabt werden.

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 if the equipment is disconnected from the power, parts with hazardous charges (e.g. capacitors, picture tubes) must not be touched until they have been properly discharged. Touch hot components (power semiconductors, heat sinks, etc.) only when cooled off.

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

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

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

Elektrostatische Entladung (ESD) bei Wartung und Reparatur

Electrostatic Discharge (ESD) during Maintenance and Repair
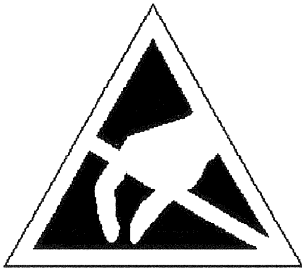
ATTENTION:	Observe precautions for handling devices sensitive to electrostatic discharge!
ATTENTION:	Respecter les précautions d'usage concernant la manipulation de composants sensibles à l'électricité statique!
ACHTUNG:	Vorsichtsmassnahmen bei Handhabung elektrostatisch entladungsgefährdeter Bauelemente beachten!

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

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

Many ICs and semiconductors are sensitive to electrostatic discharge (ESD). The life of components containing such elements can be drastically reduced by improper handling during maintenance and repair work.

Please observe the following rules when handling ESD sensitive components:

- ESD sensitive components should only be stored and transported in the packing material specifically provided for this purpose.
- Unpacked ESD sensitive components should only be handled in ESD protected areas (EPA, e.g. area for field service, repair or service bench) and only be touched by persons who wear a wristlet that is connected to the ground potential of the repair or service bench by a series resistor. The equipment to be repaired or serviced and all tools, aids, as well as electrically semiconducting work, storage and floor mats should also be connected to this ground potential.

- The terminals of ESD sensitive components must not come in uncontrolled contact with electrostatically chargeable (voltage puncture) or metallic surfaces (discharge shock hazard).

- To prevent undefined transient stress of the components and possible damage due to inadmissible voltages or compensation currents, electrical connections should only be established or separated when the equipment is switched off and after any capacitor charges have decayed.

SMD-Bauelemente

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

Bei Studer werden keine handelsüblichen SMD-Teile bewirtschaftet. Für Reparaturen sind die notwendigen Bauteile lokal zu beschaffen. Die Spezifikationen von Spezialbauteilen finden Sie in der Serviceanleitung.

SMD Components

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

Studer does not keep any commercially available SMDs in stock. For repair the corresponding devices should be purchased locally. The specifications of special components can be found in the service manual.

Störstrahlung und Störfestigkeit

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

1. Vom Gerät erzeugte elektromagnetische Strahlung ist soweit begrenzt, dass bestimmungsgemässer Betrieb anderer Geräte und Systeme möglich ist.
2. Das Gerät weist eine angemessene Festigkeit gegen elektromagnetische Störungen auf, so dass sein bestimmungsgemässer Betrieb möglich ist.

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

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

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

Electromagnetic Compatibility

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

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

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

To minimize the probability of electromagnetic interference as far as possible, the following recommendations should be followed:

- Install the equipment in accordance with the operating instructions. Use the supplied accessories.
- In the system and in the vicinity where the equipment is installed, use only components (systems, equipment) that also fulfill the above EMC standards.
- Use a system grounding concept that satisfies the safety requirements (protection class I equipment must be connected with a protective ground conductor) that also takes into consideration the EMC requirements. When deciding between radial, surface or combined grounding, the advantages and disadvantages should be carefully evaluated in each case.
- Use shielded cables where shielding is specified. The connection of the shield to the corresponding connector terminal or housing should have a large surface and be corrosion-proof. Please note that a cable shield connected only single-ended can act as a transmitting or receiving antenna (e.g. with an effective cable length of 5 m, the frequency is above 10 MHz) and that the edges of the digital communication signals cause high-frequency radiation (e.g. LS or HC logic up to 30 MHz).
- Avoid ground loops or reduce their adverse effects by keeping the loop surface as small as possible, and reduce the noise current flowing through the loop by inserting an additional impedance (e.g. common-mode rejection choke).

Class A Equipment - FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residen-

tial area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Caution:
Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment. Also refer to relevant information in this manual.

CE-Konformitätserklärung

Der Hersteller,

Studer Professional Audio AG,
CH-8105 Regensdorf,

erklärt in eigener Verantwortung, dass das Produkt

**Studer D827 MCH, Digitales 24/48-Kanal-Bandgerät,
(ab Serie-Nr. 1072),**

auf das sich diese Erklärung bezieht, entsprechend den Bestimmungen der EU-Richtlinien und Ergänzungen
• Elektromagnetische Verträglichkeit (EMV):
  89/336/EWG + 92/31/EWG + 93/68/EWG
• Niederspannung:
  73/23/EWG + 93/68/EWG
mit den folgenden Normen und normativen Dokumenten übereinstimmt:
• Sicherheit:
  Schutzklasse 1, EN 60065:1993; IEC 65:1985
• EMV:
  EN 50081-1:1992, EN 50082-1:1992.

Regensdorf, 20. November 1995

B. Hochstrasser, Geschäftsleiter

P. Fiala, Leiter QS

CE Declaration of Conformity

The manufacturer,

Studer Professional Audio AG,
CH-8105 Regensdorf,

declares under his sole responsibility that the product

**Studer D827 MCH, digital 24/48 track tape recorder,
(on from serial No. 1072),**

to which this declaration relates, according to following regulations of EU directives and amendments
• Electromagnetic Compatibility (EMC):
  89/336/EEC + 92/31/EEC + 93/68/EEC
• Low Voltage (LVD):
  73/23/EEC + 93/68/EEC
is in conformity with the following standards or other normative documents:
• Safety:
  Class 1, EN 60065:1993; IEC 65:1985
• EMC:
  EN 50081-1:1992, EN 50082-1:1992.

Regensdorf, November 20, 1995

B. Hochstrasser, Managing director

P. Fiala, Manager QA

Contents

1 Getting started

1.1 Utilization for the purpose intended

The D827 MCH is a digital multitrack tape recorder for professional use. It is presumed that the unit is operated only by trained personnel; servicing is reserved to skilled technicians.

The electrical connections may be connected only to the voltages and signals designed in this manual. For flawless operation, only ½" digital tape on precision NAB reels may be used. Make sure to tighten the screw locks in the centers of the NAB adapters for operation.

1.2 Special features of the D827 MCH

With its compact and rugged design, its versatile interfaces and multiple microprocessors, the D827 MCH achieves an exceptionally high level of operational convenience and thus satisfies all requirements of a universal studio tape recorder 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 recorders 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 D827 MCH can reproduce or record any ½" DASH multitrack format.

Reference quality A/D and D/A converters

The optional A/D converters are designed with 18 bits resolution in Delta-Sigma technology. For transferring their superior audio quality without drawbacks to the 16-bit DASH format, the optional Noise-Shaping processor developped by Studer can be installed.

The A/D converters of the D827 MCH are automatically calibrated after every power-on, leading to a unequalled long-term stability of audio performance without periodical recalibrations.

The (optional) precision D/A converters have a resolution of 20 bits and eight times oversampling.

EDR - Extended Digital Resolution

48-track versions of the D827 MCH can be equipped with the EDR option ("Extended Digital Resolution") and can be operated via the digital inputs and outputs as 24-track recorders with a resolution of 24 bits. Thanks to the internal 24-bit signal processing, punch-in and punch-out can be performed with the full resolution.

When using the EDR option the 24-bit data stream of each of the channels is distributed to two tracks; tracks 1 to 24 contain the 16 most significant bits of the data stream of each audio channel so that these tracks can be reproduced without restriction on any standard DASH recorder with the usual 16 bits resolution.

Advanced head technology   The ultra-stable headblock of the D827 MCH is equipped with a thin-film recording head and a ferrite reproduce head. The head arrangement in the sequence "read-after-write" allows for seamless punch-in and punch-out without affecting the data integrity.
An optional second recording head ("New Record Head") is available which in a "write-read-write" arrangement allows for true off-tape monitoring in the NEW RECORD mode.
An additional erase head for the auxiliary tracks ensures full compatibility also with DASH tapes on which the auxiliary tracks have been recorded with bias.
The D827 MCH headblock is shipped with a parameter diskette. With the help of this floppy disk storing the parameters or changing the headblock is possible in less than 30 minutes.

Latest tape deck design   The advanced tape deck control electroncis ensures highest speed without sacrificing the smooth handling of your precious tapes. At 48 kHz sampling rate the tape speed is 76.2 cm/s (30 ips); ½" reels up to 14" (36 cm) dia. allow for a maximum playing time of approx. 60 min (approx. 65 min at 44.1 kHz).

Remote control   Comprehensive remote control facilities have been achieved through a unique bus system for several control units. There are different possibilities of controlling the recorder (even at the same time, if required):
❑ Local operation
❑ Remote control of tape deck and audio channels via the serial REMBUS control
❑ Control of the audio channels from the mixing console via the optional Parallel Audio Interface (PAI)
❑ Operation via the Studer ES protocol (RS422)
❑ Operation via the Parallel Remote interface
❑ Operation via the Synchronizer interface
❑ Entering parameters or settings via the SETUP HANDLER software or the service interface
❑ Additional interface for the connection of an optional Remote Level Display with selectable Peak Hold function.
A separate line voltage supply is no longer necessary for the different remote control units.

High-quality CUE tracks   The DASH format provides four (analog) auxiliary tracks. Two of them are used for Reference (RT) and Timecode (TC) tracks. The CUE1 and CUE2 tracks can be used for recording an analog audio signal (e.g. monitor mix). The PWM recording process (pulse width modulation) developped by Studer ensures the high quality required for this type of application.

"Ping Pong", "Track Bouncing"
Internal routing allows sample-accurate copying from any track to one or more other tracks ("Ping Pong"). Ping Pong mode is controlled with the Channel Remote.
In the "Track Bouncing" mode sample-accurate copies of any number of tracks (up to 48) can be made. Track Bouncing is controlled from the Autolocator or from the Setup Handler software.

Timecode generator   The internal TC generator is coding SMPTE timecode with 24, 25, 29.97 DR, 29.97 ND, 30 DR or 30 ND frames/second and can be synchronized with external code or with the code read from the tape (Jam Sync).
(Counter mode: ND = non drop; DR = drop frame).

Built-in synchronizer

The internal synchronizer supports all functions required for synchronizing the D827 MCH with audio or video machines. The audio-related, sample-accurate synchronization between DASH recorders is based on the Reference Track which means that two (or more) DASH machines can be synchronized ("DASH-Lock"). The extended range of functions includes "Edit Wait", "Edit Lock", "TC Lock", "Automatic Offset Retention" (AOR), "Precision Lock" and "Instant Lock" wich are described later in detail.

Logically arranged display and control panel

For each channel the D827 features a digital 16-segment LED bargraph with PPM characteristics, selectable Peak Hold, and a 60 dB display range. The optional Remote Level Display has the same display range with increased resolution (30 segments per bargraph).

Output with "negative delay"

Signal delay may be caused by external audio processing or mixing. It produces audible phase shift causing sound coloration at the mixdown. However, the D827 MCH allows an exact compensation of 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 two-channel AES/EBU format can be assigned to any two audio channels. The MADI (Multichannel Audio Digital Interface) is available with an electrical (BNC, standard) or an optional optical interface. The optional SDIF interface can be plugged-in whenever it is required.

Vast choice of external clock sources

The D827 MCH can be integrated easily into any type of system. All commonly used video and audio clocks are accepted as an external reference.

DSP for audio signal processing

Each audio channel is equipped with a fast digital signal processor (DSP) for correctly performing crossfades (in the range from 1 to 700 ms) or other signal processing tasks.

SOUND MEMORY option

The D827 MCH can be equipped with a sound memory with a storage capacity of 43.7 track-seconds (or 174.8 track-seconds) at 48 kHz. The storage range can be subdivided for recording and reproduction into four channels of 10.9 s or 43.7 s each. The same memory is used in the Track Slipping mode for audio delay. Depending on the number of channels (max. 24), on sampling rate and on storage capacity the delay time can amount up to 47.554 s and be trimmed in steps of 1 ms.

1.3   Putting into operation

1.3.1   Unpacking and Inspection

The D827 MCH tape recorder is shipped in a special packing which protects the unit against mechanical shock during transit. Care should be exercised when unpacking the unit so that its surfaces do not get marred.

Verify that the content of the packing agrees with the items listed on the enclosed shipping list. Please retain the original packing material because it offers the best protection in case your equipment ever needs to be transported.

Check the condition of the equipment for signs of shipping damage.

⚠ **Particularly check the glass cover of the Local Control Unit for any fissure to avoid danger of personal injuries.**

If there are any signs of shipping damage you should immediately notify the forwarding agent as well as the nearest Studer distributor.

1.3.2   Installation site

Transport

⚠ **The unit may only be moved with the tape deck completely closed and engaged.**

With fork-lift truck: The bottom of the unit is flat except for the castors. The lifting fork can be inserted from the center of any of the unit's sides; we recommend to insert it from the center of the front, because then the operating section is protected and it is within the driver's view.

⚠ **Make sure to drive very carefully - the heavy weight of the D827 MCH might cause the fork-lift truck to tip over.**
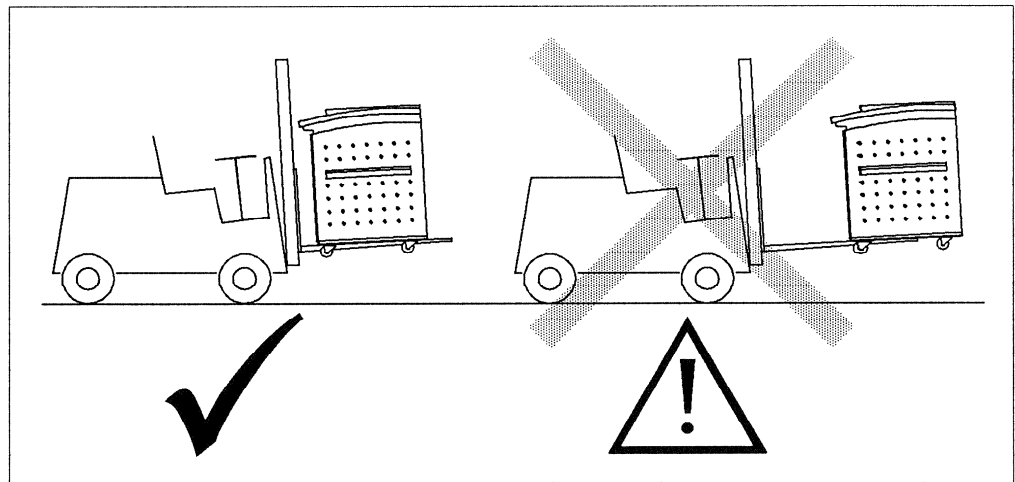
On its castors: For moving across short distances the unit's own castors may be used. For handling, use only the lateral recessed handles.

⚠ **Never abuse any tape deck elements (as headblock, guide rollers, reels or reel adaptors) as a handle!**

Environment

The D827 MCH tape recorder should be installed in a dust-free and adequately ventilated environment. The specifications of the unit are guaranteed for an ambient air temperature range of 5° to 40° C with a relative humidity of 20 to 90 % (non-condensing).

Cooling

The unit should be installed with enough space around the unit for unobstructed cooling. **Heat accumulation can occur particularly when placing the unit in a niche. Whenever the recorder is in operation, the air circulation zone must not be used as a storage area for manuals, etc.**

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

⚠   **The unit may only be operated with all housing covers completely installed and with closed and engaged tape-deck section, in order to prevent personal injuries or interference caused by electromagnetic fields or dust.**

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

1.3.3   Line voltage

⚠   The line voltage is factory-set in the D827 MCH for the corresponding location. **Please verify before putting it into operation that the voltage indicated on the label next to the mains input corresponds to your local line voltage.**

Should the voltage indicated on the label not correspond to your local line voltage it can set by an authorized Studer service technician.

⚠   **Before switching on the first time, please read the sections 2.1.1 and 2.3.2**

1.4   Software versions

This manual describes the software version 2.01 offering the complete range of functions of the D827 MCH.

Displaying the SW version: The SW version is indicated on the LC display for several seconds when pressing the Cursor key ↑. This indication disappears after a short time.

```
┌─────────────────────────┐
│ D827 MCH     SOFTWARE    │
│ V 2.01            ww/yy   │
└─────────────────────────┘
```

2   Operating the D827 MCH
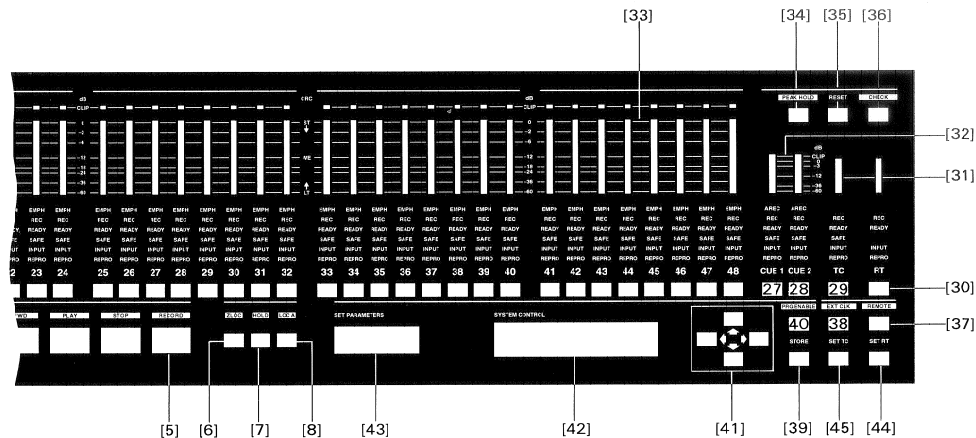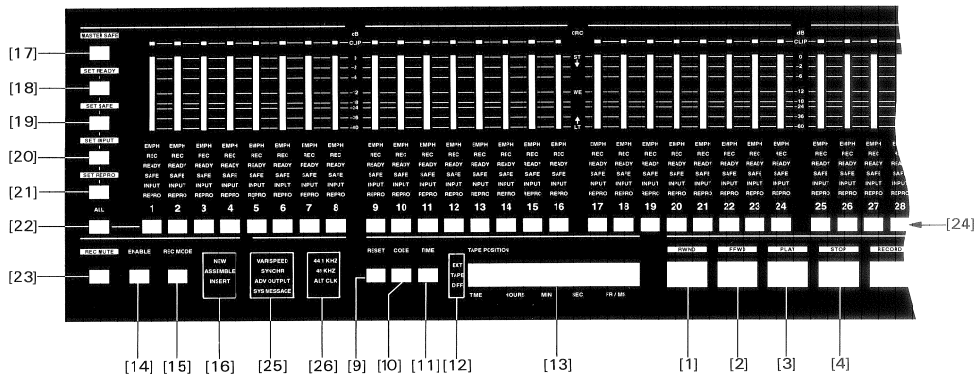
2.1   Controls

2.1.1   Power switch

⚠ **Read Section 2.3.2. before you switch on the machine for the first time.** The power switch is located at the bottom left of the front and is accessible through a cut-out in the gray front cover. After power has been switched on, the previously selected operating state is automatically reestablished, subject to the following exceptions:

❏ The tape recorder is always switched to STOP; if no tape is inserted or the tape is inserted loosely, the STOP lamp flashes.
❏ All channels are switched to SAFE.
❏ Varispeed is switched OFF.

⚠ **The D827 MCH is largely protected against manipulation errors. But to prevent possibly injury when work is performed in the tape reel area, the precautions listed in Section 2.3.2 must be observed. Do not touch any parts of the tape transport mechanism as long as they are still turning.**

⚠ **The operating personnel must be familiar with these precautions. Do not allow untrained persons to touch the machine while it is in operation.**

2.1.2   Controls of the LCU (Local Control Unit)

[1] RWND

Rewind key (ReWiND). RWND lamp starts to flash when a rewind command is given. This lamp is continuously on while the rewind command is being executed.

[2] FFWD

Fast forward key (Fast ForWarD). The FFWD lamp starts to flash when a fast forward command is given. This lamp is continuously on while the fast forward command is being executed.

[3] PLAY

Playback key. The PLAY lamp starts to flash when a PLAY command is given. This lamp is continuously on while the PLAY command is being executed. The flashing can continue for the following reasons:

❏ No RT (Reference Track) exists on the tape. In this case the decimal point next to the format indicator „r" is missing in the TAPE POSITION display.
❏ Machine is still executing a LOC command and PLAY has been preselected.
❏ REHEARSE mode is enabled.

[4] STOP

Cancels all tape deck functions with top priority. Immediately terminates functions such as ZLOC, LOC, REC LOOP and synchronizer LOOP. When this key is pressed and simultaneously the LOC A key is actuated, the previously stored locator tape position (see LOC A) appears on the TAPE POSITION display [13]. A flashing STOP lamp indicates that the tape is being decelerated.

[5] RECORD

Record key. Must be pressed either together with PLAY [3] or can be pressed alone for punch in. (Menu setting: F049 RECORD KEY A or RECORD KEY B). If RECORD continues to flash the machine refuses to execute the command for one of the following reasons:

❏ An attempt to record in NEW RECORD mode has been made but not all audio channels are switched to READY.
❏ An attempt to record in ASSEMBLE RECORD mode has been made but not all audio channels are switched to READY.
❏ An attempt to record in ASSEMBLE RECORD mode has been made but the RT cannot be read. In this case the decimal point next to the format indication „r" in

the TAPE POSITION display is missing. Remedy: Rewind to the end of the last recording.

❏ An attempt has been made to record in INSERT RECORD mode on a new tape or on a tape that has been erased with a bulk eraser (i.e. an unformatted tape).

❏ REHEARSE mode is enabled.

[6] ZLOC

(Locate to Zero); rewinds the tape to tape position 0, based on the time shown in the TAPE POSITION display. If for example, the machine operates in TC display mode (see TIME key) the machine rewinds to the time code address 00:00:00:00.

[7] HOLD

Pressing the HOLD key freezes the value momentarily shown on the TAPE POSITION display [13]. The frozen tape position can be stored as a Locate address A by pressing the LOC A key [8]. The tape position display then continues to operate normally (HOLD lamp off).

If the tape position display has been frozen without storing the reading, press the HOLD key again to restore the TAPE POSITION display to normal indication of the momentary tape position (HOLD lamp off).

[8] LOC A

The LOC A function automatically searches the tape position stored in LOC A. While this key is pressed, the TAPE POSITION display [13] shows the stored LOC A address. This address can be also be displayed without performing the locate function by simultaneously pressing STOP and LOC A. Loading the LOC A memory: Freeze the tape position by pressing the HOLD key, the HOLD lamp is on. Press the LOC A key to save this value in the Locator memory. The tape position display then continues to function normally.

The locator always stores tape positions rather than times. Changeover of the time shown in the TAPE POSITION display [13] (TIME key [11]) or setting the display to zero (RESET key [9]) does not influence the stored tape position (will be recalculated). Please note that all tape positions (except COUNTER) are derived from the absolute time information on the tape, that is, no inaccuracies can occur due to tape slip.

[9] RESET

The RESET key sets the value shown in the TAPE POSITION display [13] to zero. Only the time values COUNTER and LAP COUNTER can be reset; RT and TC are absolute times recorded on the tape.

[10] CODE

The CODE key influences the time indication of RT and TC: Through repetitive pressing of CODE the source of the TC or RT shown on the TAPE POSITION display is switched over. The display [12] provides information on the source:

EXT: An externally supplied TC or RT is displayed.

TAPE: The TC or RT recorded on tape is displayed.

DIFF: The difference between the TC or RT stored on tape and the externally supplied TC or RT is displayed.

[11] TIME

The TIME key selects the time base shown in the TAPE POSITION Display [13]: COUNTER, TC, RT or LAP COUNTER. The currently displayed tape position time is indicated by the first digit of the TAPE POSITION Display [13]:

„t" SMPTE time code; absolute time of the tape or from an external source. Cannot be set to 0 (except when recording the time code track during formatting: see menu, SET TC [45] key).

„r" RT (Reference Track); absolute time. Cannot be set to 0 (except in NEW RECORD mode: see menu, SET RT [44] key).

„L" LAP COUNTER, derived from the RT, but can be set to 0 with the RESET [9] key

„ " COUNTER, derived from the move roller, can be set to 0 with the RESET [9] key. This is the only tape position indication that can have minor deviations (slip between move roller and tape) in case of intensive spooling or many LOC commands.

Behind the absolute time bases (t, r, L) a decimal point is shown if they can be read from tape. If no decimal point is shown behind „r" in PLAY mode, the heads are located on an unformatted tape location, that is, recording is only possible in NEW RECORD or ASSEMBLE RECORD mode.

The TIME [11] key switches between the various times. Please note that when the CODE [10] key is pressed, „t" and „r" can be indicated as read from tape or as supplied by an external source, or as a difference.

In the SET-UP menu (display) there are options for suppressing leading zeros and for setting the number of places after the decimal individually for the running tape (RUN TIME FORMAT) and STOP (S011 to S013). In the TC display mode the frames indication is suppressed only if no places after the decimal are defined.

The DISPLAY [7] key on the Autolocator (see 3.2) toggles between all decimal places and the preset decimal places. This key function can be simulated with the menu setting (S014).

Note: If the NEW RECORD HEAD option (second record head) is not installed, the RT time cannot be displayed during the formatting process (NEW mode). Instead the TAPE POSITION display shows „rt StrIPE" (RT is being striped).

If the optional NEW RECORD HEAD is not installed and the time code is being striped (normally in NEW mode, in special cases also in ASSEMBLE mode) the time code cannot be displayed and „tc StrIPE" appears in the TAPE POSITION display. If in the same situation DIFF (difference between TC or RT from tape and external source) is selected with the CODE [10] key, no time is indicated and the TAPE POSITION display shows dashes: --.--.--.---

[12] EXT / TAPE / DIFF The display provides information on the source of the time information (RT or TC):

EXT: An externally supplied TC or RT is displayed.

TAPE: The TC or RT recorded on tape is displayed.

DIFF: The difference between the TC or RT recorded on tape and the externally supplied TC or RT is displayed. In synchronizer mode the offset is taken into consideration and the difference gradually reduced to zero (SYNC OK).

[13] TAPE POSITION 11-digit seven segment display for the tape position in real time. The following time bases can be displayed: COUNTER, TC, RT or LAP COUNTER. Which of these tape position times is momentarily indicated is shown in the first display digit of the TAPE POSITION display:

„t" SMPTE time code; absolute time from tape or an external source. Cannot be set to zero (except when striping the tape with a time code): See direct access menu, SET TC [45] key).

„r" RT (Reference Track); absolute time. Cannot be set to zero (except in NEW RECORD mode: See direct access menu, SET RT [44] key).

„L" LAP COUNTER, derived from RT, but can be set to zero with the RESET key [9].

„ " COUNTER, derived from the move roller, can be set to zero with the RESET key [9]. This is the only tape position indication that can have minor deviations (slip between move roller and tape) in case of intensive spooling or many LOC commands.

Behind the absolute time bases (t, r, L) a decimal point is shown if they can be read from tape. If no decimal point is shown behind „r" in PLAY mode, the heads are located on an unformatted tape location, that is, recording is only possible in NEW RECORD or ASSEMBLE RECORD mode!

The TIME [11] key switches between the various times. Please note that when the CODE [10] key is pressed, „t" and „r" can be shown as read from tape or as supplied by an external source, or as the difference between these values.

Note: If the optional NEW RECORD HEAD is not installed and the time code is being striped (normally in NEW mode, in special cases also in ASSEMBLE mode) the RT time cannot be displayed and „rt StrIPE" appears in the TAPE POSITION display.

If the NEW RECORD HEAD option is not installed and the time code is being striped, „tc StrIPE" appears in the TAPE POSITION display. If in the same situation DIFF (difference between TC or RT from tape and external source) is selected with the CODE [10] key, no time is indicated and the TAPE POSITION display shows dashes: --.--.--.---
The same applies when recording takes place in ASSEMBLE mode, regardless of whether or not the NEW RECORD HEAD option is installed.

[14] ENABLE

This is the enable key for the REC MODE [15] and REC MUTE [23] function keys. For safety reasons these functions can only be activated when ENABLE is pressed together with one of these function keys.

[15] REC MODE

Switches cyclically between the three possible recording modes: NEW, ASSEMBLE and INSERT. For security reasons this key must be pressed together with the ENABLE key [14]. The recording mode can only be changed over when the tape stands still (STOP) or when no tape is inserted.

[16] REC MODE

Displays the selected RECording mode. The D827 MCH supports the following recording modes: NEW, ASSEMBLE, INSERT.

NEW

A new tape or a tape that has been erased with a bulk eraser must be formatted. In this process the RT (reference track) and the block structure corresponding to the DASH format are written for all audio channels.
In order to format a tape, all audio channels must be set to READY (see SET READY [18] and ALL [22] keys). The machine switches the RT track automatically to READY (status is displayed). The analog auxiliary tracks TC, CUE 1 and CUE 2 can subsequently be recorded at any time. The tape must be formatted without gaps. If the NEW recording mode is interrupted, the subsequent recordings on the unformatted tape section must be recorded in ASSEMBLE mode.
In NEW mode it is, of course, possible to make an audio recording (typically chosen for a live recording). With the optional NEW RECORD HEAD (second record head) true source/tape monitoring (Read-after-Write) is possible. For RT and TC the start time is set in the direct access menues „SET RT" and „SET TC".

Note: If the optional (second) NEW RECORD HEAD is not installed, the RT or TC time cannot be displayed during the formatting. Instead the TAPE POSITION display shows „rt StrIPE" or „tc StrIPE" (RT or TC is initialized).
If in the same situation DIFF (difference between TC or RT from tape and external source) is selected with the CODE [10] key, no time is indicated and the TAPE POSITION display shows dashes: --.--.--.---

ASSEMBLE

ASSEMBLE mode is used for continuing an interrupted NEW mode recording. ASSEMBLE essentially differs from NEW in that RT (and if selected also TC) can be appended to the existing segment without any gap („Jam Sync"). This means that the last part of the previously recorded tape segment must be located before the heads so that the machine is able to continue without any gap. If at the start of the recording the machine is unable to read an RT or if some of the audio channels are no longer READY, the RECORD command is rejected. ASSEMBLE mode is typically chosen for continuing an interrupted live recording.

Note: Since this recording is always made with the standard record head (SYNC-Head), no tape/source monitoring is possible. The reproduce head is located *before* the record head so that crossfading is possible.
As tape/source monitoring is not feasible, the RT time cannot be displayed during the recording operation. Instead „rt StrIPE" or „tc StrIPE" (RT or TC is being striped) appears on the TAPE POSITION display.

If in the same situation DIFF (difference between TC or RT from tape and external source) is selected with the CODE [10] key, no time is indicated and the TAPE POSITION display shows dashes: --.--.--.---

INSERT   Recording in INSERT mode is only possible on a tape that has been fully formatted with NEW or ASSEMBLE. This allows punch in/out to any audio and CUE channels as is normally practiced in everyday studio work.

[17] MASTER SAFE   General RECORD inhibition; switches all audio channels, TC, CUE 1, and CUE 2 as well as RT to SAFE. As long as the MASTER SAFE lamp is on, no channel can be switched to READY. The mounted tape is reliably protected against inadvertent erasure by a RECORD function.

[18]...[21]   SET ... keys: The SET ... keys are preselection keys for the channel selection keys [24] and the ALL [22] key. If for example, SET INPUT is selected, the corresponding channel can be set to INPUT by pressing one of the channel selection keys [24], or by pressing the ALL [22] key all channels can be switched to INPUT. If SET REPRO and SET INPUT (or also SET SAVE and SET READY) are pressed simultaneously, both functions are preselected; with the channel selection keys [24] or the ALL [22] key you can toggle between the two preselected states.

Note: In order to switch all channels to READY, the ALL [22] key must be pressed *together* with the SET READY [18] key.

[18] SET READY   Preselection key; determines the function of the channel keys [24] 1...24 or 1..48, CUE 1 [27], CUE 2 [28] and TC [29]. When one of these channel keys is pressed, the corresponding channel is switched to READY. The channel is enabled for recording and switches to recording mode when the next RECORD command is given. Depending on the selected recording mode the RT track is automatically switched to READY by the machine.

The auxiliary tracks CUE 1 and CUE 2 have two different RECORD READY modes which can be toggled by pressing the channel key when SET READY has been preselected.

READY   When the next RECORD command is given the CUE track switches to RECORD mode.

AREC   (AutoRECord) When the next PLAY command is given the CUE track switches to RECORD mode. In this mode the current stereo mix will always be recorded on the CUE tracks. AREC can only be selected in INSERT RECORD mode.

All audio channels can be switched to READY by pressing the SET READY key together with the ALL [22] key. The status of the auxiliary tracks is not altered by the ALL key.

Note: When the READY RECORD function is programmed (F:048 ON) individual channels can be switched to RECORD while a recording is in progress. If only TC, CUE1 or CUE2 are to be recorded, RECORD INDICATION B (F:031) must be selected.

[19] SET SAFE   Preselection key, determines the function of the channel keys [24] 1...24 or 1...48, CUE 1 [27], CUE 2 [28] and TC [29]. When one of these channel keys is pressed, the corresponding channel is switched to SAFE (recording on this channel is disabled).

All audio channels can be switched to SAFE by pressing the ALL [22] key. The status of the auxiliary tracks is not altered by the ALL key.

[20] SET INPUT   Preselection key, determines the function of the channel keys [24] 1...24 or 1...48, CUE 1 [27], CUE 2 [28] and TC [29].]. When one of these channel keys is pressed, the corresponding channel is switched to INPUT (signal at machine input).
All audio channels can be switched to INPUT by pressing the ALL [22] key. The status of the auxiliary tracks is not altered by the ALL key.

[21] SET REPRO   Preselection key, determines the function of the channel keys [24] 1...24 or 1...48, CUE 1 [27], CUE 2 [28], and TC [29]. When one of these channel keys is pressed, the corresponding channel is switched to REPRO (signal from tape).
All audio channels can be switched to REPO by pressing the ALL [22] key. The status of the auxiliary tracks is not altered by the ALL key.

SET combinations: ❑ SET READY and SET SAFE pressed simultaneously:
Both LEDs are on; the corresponding channel can be toggled between READY and SAFE with the channel keys [24]. When ALL is pressed, all channels are switched to SAFE. When SET READY is pressed while ALL remains pressed, all channels are switched to READY. If the channels are in different states all channels are first switched to SAFE.
❑ SET INPUT and SET REPRO pressed simultaneously:
Both LEDs are on; the channel keys [24] or the ALL key [22] toggles the corresponding channel or all channels between INPUT and REPRO. If the channels are in different states they are first switched to INPUT.
❑ In the AUDIO INPUT submenu four additional channel preselection states are possible. The preconditions are that the machine configuration supports the corresponding state, that PRG ENABLE-LED flashes, that the corresponding picture is on the SYSTEM CONTROL and that the SET PARAMETERS wheel is briefly actuated in either direction. The changeover is performed with the corresponding channel key [24] or ALL [22].
- S001:SDIF INPUT: Selection of the SDIF channels – only with the SDIF option (DIG or ANA; when a channel is in DIG state its INPUT LED is on.
- S041:MADI INPUT: Selection of the MADI channels (DIG or ANA; when a channel is in DIG state its INPUT LED is on).
- S046:ANALOG EMPHASIS: Switches the emphasis and deemphasis filters on and off – only in conjunction with the A/D converter option (ON or OFF; when the filters of a channel are ON the EMPHASIS LED lights up).
- S050:NOISE SHAPING: Switches the Noise Shaper on and off – only in conjunction with the noise shaper option (ON or OFF; when the noise shaper of a channel is ON the INPUT LED lights up).
These four preselection modes can be canceled by quitting the corresponding pictures of the SYSTEM CONTROL display or by pressing another SET ...-key (for example, SET READY) but the settings are preserved in the background (even after the machine has been switched off).
If the channels are not installed the INPUT and REPRO LEDs remain dark.
Of course, these settings can also be established with the SET PARAMETERS wheel and the cursor keys (see [42], SYSTEM CONTROL DISPLAY and 2.2.7, Setup menu).

[22] ALL   The ALL key is used for simultaneously influencing all audio channels (except the auxiliary tracks). When this key is pressed, all audio channels assume the state determined with the preselection keys SET SAFE/INPUT/REPRO. For safety reasons the SET READY preselection key must be pressed together with the ALL key in order to switch all audio channels to READY. The auxiliary tracks CUE 1, CUE 2 and TC are not affected by the ALL command and therefore must be set individually. RT is set automatically by the REC MODE.

[23] REC MUTE   This function is used for recording „digital zero", regardless of which signal is available at the machine input. This function has three levels:
Level 0: REC MUTE off, REC MUTE programming mode off; the REC MUTE lamp is off. This state is achieved by pressing REC MUTE alone when the REC MUTE lamp flashes, or by pressing ENABLE together with REC MUTE when the REC MUTE lamp is continuously on.
Level 1: REC MUTE channel programming; REC MUTE lamp flashes. This state is achieved in all cases by pressing the REC MUTE key alone. The channels for which the REPRO keys are pressed will be disconnected from the input when the next RECORD command is given (REC MUTE function active) and „digital zero" will be recorded. Confirmation: INPUT lamp of the corresponding channel is on.
Level 2: REC MUTE active; REC MUTE lamp is continuously on. This state is achieved by pressing ENABLE together with the REC MUTE key. When the READY lamps of the programmed channels are on, these channels record „digital zero" when a RECORD command is given. Confirmation: the INPUT lamp flashes in input mode.

[24] Channel keys   Multifunction selection keys for channels 1...24 or 1...48. The function is determined by the preselection keys SET READY, SET SAFE, SET INPUT, SET REPRO and REC MUTE. In conjunction with the AUDIO INPUT menu in SET mode the channel key toggles between the analog and the preselected digital input.

Channel status indicators   Six indicator lamps exist for each channel:
REPRO   Lamp is on: The channel output supplies the reproduce signal from tape.
INPUT   Lamp is on: The channel output is connected to the input (monitoring of the input signal).
The INPUT lamp is also used for signaling different preselection modes – see for example, „SET combinations" above.
SAFE   Lamp is on: The channel is protected against recording/erasing.
READY   Green lamp flashes: The channel is preselected for recording and switches to RECORD mode when the next RECORD command is given.
REC   Red lamp flashes: The channel is in RECORD mode.
EMPH   The EMPH lamp indicates different mode-dependent operating states:
❑ For channels that are switched to input from the analog input: *Pre-Emphasis filter active.*
❑ For channels that are switched to input from a digital input: *The emphasis bit is set in the input data stream.*
❑ For channels that are switched to REPRO: *The emphasis bit on the tape is set* (pre-emphasis was used during the RECORD operation); for analog outputs *the de-emphasis filter* is automatically active.

[25] Machine state indictors
VARISPEED   This lamp is on when VARISPEED is set on the Autolocator or when synchronization with TC lock is performed (i.e. the machine follows only the master time code without additional reference).
SYNCHR   This lamp is on in synchronized operation.
ADV OUTPUT   ADVanced OUTPUT mode has been activated via the menu or on the Channel Remote. In the corresponding menu seven fixed values can be defined through which the delays caused by D/A converters or external equipment can be compensated.
SYS MESSAGE   Flashes: The D827 MCH has detected an unexpected operating state. The alphanumeric display [42] supplies plain text information (see Section 12, „Error messages").

[26] SAMPLING FREQUENCY Indicates the sampling frequency read from tape, set in the menu, or detected from an external sync signal (44.1 kHz, 48.0 kHz). When this lamp flashes, VARISPEED mode or PULL DOWN mode is active, or the synchronizer operates in TC-LOCK mode.

In VARISPEED mode the machine clock no longer conforms to the standard frequency. For this reason certain limitations can occur in digital copying, depending on the receiving device.

PULL DOWN allows a reduction of the clock frequency by the drop frame rate for synchronization with video. Instead of 44.1/48 kHz the CLOCK BOARD generates 44.056/47.952 kHz. However, the lamp (now flashing) and the flags still indicate 44.1 or 48 kHz; in this way copying from NTSC video to film and vice versa is possible.

Please note that the D827 MCH is also able to follow a stable external clock that does not correspond to the standard frequencies.

The ALTernative CLOCK lamp indicates that the machine is set to the alternative standard frequency of 44.056 kHz (rather than 44.1 kHz).

[27] CUE 1, [28] CUE 2 Multifunction channel keys for the auxiliary tracks CUE 1 and CUE 2. The function is determined by the preselection keys SET READY, SET SAFE, SET INPUT and SET REPRO. The CUE tracks are not influenced by the ALL function [22] used for the digital audio channels.

The auxiliary tracks CUE 1 and CUE 2 have two different RECORD READY modes that can be toggled by pressing the channel key when SET READY has been activated:

READY Cue track switches to RECORD mode when the next RECORD command is given.

AREC AutoRECord: Cue track switches to RECORD mode when the next PLAY command is given. In this mode the current stereo mix will always be recorded on the CUE tracks. AREC can only be selected in INSERT RECORD mode.

[29] TC Multifunction channel key for the SMPTE time code track. The function is determined by the preselection keys SET READY, SET SAFE, SET INPUT and SET REPRO. The TC track is not affected by the ALL function [22] used for the digital audio channels.

[30] RT Multifunction channel key for the RT track (Reference Track). The RT track is essential for the DASH format and is managed largely automatically by the machine.

With the RT BOARD 1.863.657.20 an INPUT/REPRO changeover is also possible for the RT track.

[31] Level bargraphs For RT and TC track. A level can also be indicated while the tape is stopped (STOP) and the channel is switched to REPRO – depending on the setting of the function T005 „TC OUT REFRESH" in the TC menu (see 2.2.4 and 2.2.6); if this function is active the code is also regenerated while the tape is stopped.

With the RT BOARD 1.863.657.20 the RT track can also be switched to REPRO or INPUT. All LEDs of the level scale are on when signal is available, otherwise they are dark.

[32] Level bargraphs for the analog auxiliary tracks CUE 1 and CUE 2.

[33] Level bargraphs for the digital audio channels. PPM characteristic (Peak Program Meter). Display range 60 dB. Can be changed over to Peak Hold or tape quality indication.

[34] PEAK HOLD

momentary: When this key is pressed once the momentary PEAK HOLD mode is activated. The peak level is indicated for approximately 3 s.

permanent: When the PEAK HOLD key is pressed twice, the peak value indication is frozen indefinitely. In this way the highest peak occurring within a recording can be determined. The peak value indication can be cleared with the RESET [35] key. The PEAK HOLD function can also be used together with the CHECK function in which case the momentary HOLD mode is inactive.

[35] RESET The RESET key clears the peak level indication.

[36] CHECK The CHECK key switches the audio level bargraphs [33] to tape quality indication. The top and bottom LED of the bargraph are continuously on. *Activation of the CHECK function is only useful in PLAY mode.* In all other modes the bargraphs drop to the minimum.

If a tape is not formatted, no proper PLAY state can be achieved; neither quality nor TAPE EMPTY will be indicated (in this condition PLAY flashes, the RT level indicator remains dark for REPRO, and the decimal point behind the „r" in the RT tape counter is missing).

If a tape is partially formatted, TAPE EMPTY can only be detected if PLAY was started on a formatted location.

If a 48-track machine is used to play a tape that has been recorded on a 24-track machine, TYPE EMPTY will be correctly shown for the unformatted tracks 25...48.

From top to bottom all CRC errors of the corresponding tracks averaged across a sliding window of approx. 3.5 s (Short Term). From the bottom to the top they are averaged across a sliding window of approx. 28 s (Long Term).

Interpretation: 1 to 2 LEDs: Excellent conditions
2 to 3 LEDs: Good conditions
3 to 4 LEDs: Tolerable conditions
5 to 6 LEDs: High error rate
WE LED: Interpolations occur.

These LEDs indicate a trend. As long as no WE (Word Error) is indicated the original still exists. The probability that also WE errors occur is high or greater than under good conditions (2 to 3 LEDs) when the CRC error rate is high. If tapes continually produce high error rates it is advisable to make a copy of these tapes. The Short Term indication points to local tape errors. The Long Term indication points to a general problem (for example, contaminated heads or tape guides, scratches running parallel to the tape edge, worn heads). If the error rate is high the heads and the tape guides should be cleaned. For comparison a tape with known error behavior, for example, with excellent conditions, should be mounted in order to determine whether the problem is caused by the tape or the machine.

The Long Term as well as the Short Term CRC peak values as well as the tape empty indication can be frozen with the PEAK HOLD key [10].

Note: During the formatting of a tape the CHECK function is only useful in conjunction with the NEW RECORD HEAD option and NEW RECORD mode. The channels which in this mode simultaneously record in REC MUTE do not give any meaningful CRC indications. A higher error rate may possibly be measured when the tape unthreads at the end of the tape. In this case measurements with PEAK HOLD are not meaningful.

[37] REMOTE The REMOTE key activates the remote control. Via the menu the user can define whether the Local Control Unit should be enabled or disabled when the remote control is active (machine only operable via the remote control).

Note: If an external synchronizer is used REMOTE must be activated so that the external synchronizer can exercise control over the machine.

[38] EXT CLK

The EXT CLK key toggles between the internal and the external clock.
Lamp is on: The machine is synchronized to the external reference defined in the SET-UP menu S017.
Lamp flashes: The external reference has been selected with EXT CLK but no signal corresponding to the one defined in the SET-UP menu is available. This can be caused by the following reasons:
❑ External clock incorrectly defined.
❑ External clock does not exist.
❑ External clock is outside the locking range.
The clock reference is shown in the standard picture of the SYSTEM CONTROL display [42].

[39] STORE

The STORE key alone is used for acknowledging warning and information messages shown on the SYSTEM CONTROL display, when the SYS MESSAGE [25] lamp is on. When the PRG ENABLE key is pressed (lamp flashes), menu items can be selected and programmed with the STORE key (see SYSTEM CONTROL display [42]).

[40] PRG ENABLE

When thePRoGram ENABLE key has been pressed (PRG ENABLE lamp flashes) the STORE key [39] can be used for programming or storing menu items in the SYSTEM CONTROL display (see SYSTEM CONTROL display [42]).

[41] ←, ↑, →, ↓

Cursor keys. The ←/→ keys are used for selecting the parameter shown in the SYSTEM CONTROL display, with the ↑/↓ keys you can navigate through the menu tree (see SYSTEM CONTROL display [42]).

[42] SYSTEM CONTROL display

This alphanumeric display shows warning and information messages in plain text when the SYS MESSAGE [25] lamp is on. If an operating state causes several messages to be generated, these can be retrieved by repetitively pressing the STORE key [39]. This is possible at any time because the messages are canceled only after the cause has disappeared.
Press the ↑ key to read out the software version (important in case of inquiries to the factory or the distributor).
Press the ↓ key to enter into the menu tree. The choices SEARCH and BRANCH are displayed; SEARCH (= searching in alphabetic order) is underscored. To browse through the menu topics press the ↓ again. The → key switches the display mode to BRANCH (now underscored). Press the ↓ key to branch to the desired topic. Press ↓ repetitively to display all available configuration possibilities.
For each configuration possibility the allowed settings are displayed. The currently active setting is shown without flashing, whereas the possible settings are flashing. To switch to a different setting press the STORE key [39]. If the PRG ENABLE [40] function has not be enabled before press the PRG ENABLE key before STORE. The newly selected setting is now shown without flashing whereas the other choices flash. This confirms that the new setting has been stored. If a numeric value needs to be changed, use the SET PARAMETERS setting wheel [43]. The new numeric value flashes and becomes permanent after the STORE key has been pressed. Press the ↑ key to return to the topic or press the ← key to switch back to SEARCH to find another topic. You can quit the menu from any level by simultaneously pressing the ← and → keys.

[43] SET PARAMETERS   Setting wheel for modifying numeric input values in the menu (see SYSTEM
                              CONTROL display [42]).

[44] SET RT   Key for direct access to the Reference Track setup menu which contains param-
                              eters for the operating mode and the start time of the RT generator, and the
                              sampling rate. These values must be defined before a tape is formatted (see NEW
                              RECORD mode [16]). For details: See 2.2.4, „Direct access to the RT and TC
                              settings".

[45] SET TC   Key for direct access to the SMPTE time code setup menu in which the TC source,
                              the TC generator mode, the start time, and the regeneration of the TC are set .
                              These values are normally defined before the tape is formatted (see NEW RECORD
                              mode [16]). For details see: 2.2.4, „Direct access to the RT and TC settings".

2.2   System control display

2.2.1   Purpose

The SYSTEM CONTROL display is an alphanumeric liquid crystal display (LCD) that indicating system status, line level, time code on tape as well as system warnings and error messages.

2.2.2   Menu tree

The menu tree has three main branches:
❏ SET-UP branch
❏ FUNCTIONS branch
❏ ALIGNMENT branch (not visible in normal operation, refer to service manual).
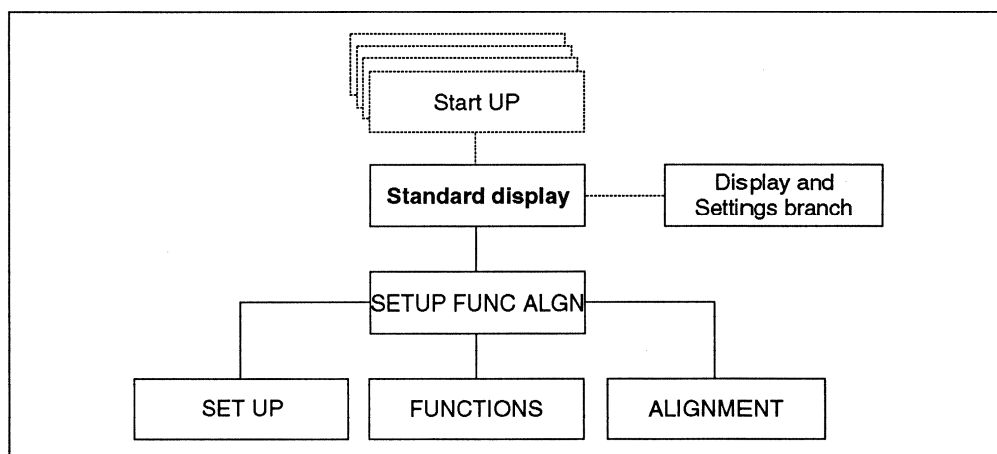
Note: *Flashing values that appear on the LC display are not stored yet.* Press the STORE key to save the value permanently. However, this is only possible if the Program Enable mode is active (i.e. PRG ENABLE lamp is on; can be switched on and off with the PRG ENABLE key [40]).

2.2.3   Entering the menu tree

CURSOR ↑, ↓, ←, →

With the four arrow keys [41] on the LCU you can navigate through the menu tree to the desired setup windows.
If the machine is operating correctly the following **standard picture** is shown:

```
CLK REF: ccccc
TC TAPE: yy.yy Frm/s
```

It provides information on the current clock reference setting and the detected frame rate on the TC track.
Setting ranges: ccccc: INTERNAL, WORD CLOCK, AES/EBU,
                              VIDEO 25..., SQUARE 24..., EXT VARISPD,
                              INT SYNCHR .
                  yy.yy: --.--/24/25/29.97/30 .
                              „--.--" means: Frame rate still unknown or undefined.
The code is detected based on the frame counting sequence or the drop frame flag.

↑   When the ↑ key is pressed, the same information is displayed that is shown for several seconds when the machine is started up.

These information can be skipped by pressing the ↓ key.

These are:

```
┌─────────────────────────┐
│ D827 MCH MULTICHANNEL   │
│ DASH TAPE RECORDER      │
└─────────────────────────┘
```

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

```
┌─────────────────────────┐
│ D827 MCH   SOFTWARE     │
│ V 2.01          ww/yy   │
└─────────────────────────┘
```

Begin of system test. The software version and date are shown.
(ww = week, yy = year)

Important: In case of inquiries to the factory or the dealer the software version and date must be known.

```
┌─────────────────────────┐
│ CONFIGURATION:          │
│ XX CHANNELS             │
└─────────────────────────┘
```

Channel configuration in accordance with the installed MAPRO and I/O boards.
(XX = 24/48 channels)

```
┌─────────────────────────┐
│ ERROR MESSAGE:          │
│ no errors detected      │
└─────────────────────────┘
```

When the D827 MCH is switched on, a system test is performed. If no error is detected the above picture appears, otherwise a plain text error message is displayed.

When an error or a warning (e.g. malfunction, command error, wrong sampling frequency, etc.) is detected during operation, an error message is displayed automatically – the SYS MESSAGE [25] lamp flashes to draw the user's attention to the LC display. Error messages can now be acknowledged or displayed again by pressing the STORE key. If several error messages exist they can be called on the display by repetitively pressing the STORE key (see Section „Error messages").

Starting from the standard picture and depending on the installed machine options, additional information blocks are displayed when the ➔ cursor key is pressed:

```
┌─────────────────────────┐
│ ANALOG PEAK: xx.x dBu   │
│ NOISE SHAPER: ON/OFF    │          (Option)
└─────────────────────────┘
```

or

```
┌─────────────────────────┐
│ DIGITAL I/O ONLY        │
│                         │
└─────────────────────────┘
```

and

```
┌─────────────────────────┐
│ EDR MODE:               │
│ nn BIT / cc CHANNELS    │          (Option)
└─────────────────────────┘
```

Setting ranges: xx.x: 14.0 ... 28.0 dBu
                 ON/OFF: The currently valid setting is not flashing, whereas
                             the possible choice is flashing.
                 nn: 16 or 24 Bits
                 cc: Number of channels

2.2.4   Direct access to the RT and TC setting

The frequently used settings for TC (Time Code) and RT (Reference Track) have been disincorporated from the menu and made accessible directly via the SET RT and SET TC keys. The parameter and configuration settings are established in the same way as in the main menu:

The corresponding direct access menu is activated with the SET RT/SET TC keys. The ESCAPE and BRANCH choices are offered and BRANCH is underscored. Press the ↓ key to access the configuration possibilities.

For each configuration possibility there are different settings. The currently *valid* setting is not flashing whereas the *possible* settings are flashing on the display. To change to a different setting press the STORE key [39]. If the PRG ENABLE [40] function has not been enabled before, press the PRG ENABLE key before STORE.

The newly selected setting is now shown without flashing whereas the other choices flash. This confirms that the new setting has been stored. If a numeric value needs to be changed, use the SET PARAMETERS setting wheel [43]. The new numeric value flashes, and stops flashing after the STORE key has been pressed. With the ↑ key you can page back to the entry point where you can switch to ESCAPE by pressing the ← key.

You can quit the direct access menu completely from any point by simultaneously pressing the ← and → keys.

2.2.5   Settings in the RT direct access menu

When the SET RT key [44] is pressed on the Local Control Unit of the D827 MCH the alphanumeric SYSTEM CONTROL display [42] shows:

```
SET RT FORMAT
escape          branch
```

Press the ↓ key to access the first setting:

```
R001: SAMPLING RATE
      XX.XXX  kHz
```

With the SET PARAMETERS wheel the sampling frequency can be switched between 44.056 kHz, 44.1 kHz and 48 kHz. Before the value can be saved, the store function must be enabled with the PRG ENABLE key (PRG ENABLE lamp flashes). To save the value press the STORE key (the sampling frequency no longer flashes).

Note: In PLAY mode the sampling frequency read from the RT track of the tape overwrites the preset value. If the input is digital, the corresponding sampling frequency is set (44.1 or 48 kHz). 44.056 kHz must be set manually; the ALT CLK-LED lights up together with the 44.1 KHZ LED.

To access the next setup parameter press the ↓ key:

```
R004: PULL DOWN
      ON/OFF
```

In certain synchronizer applications tapes that have been recorded with sampling frequencies of 44.1 or 48 kHz have to be processed with 44.056 or 47.952 kHz. For this purpose set PULL DOWN to ON. The corresponding SAMPLING FREQUENCY LED flashes. The CLOCK BOARD generates a frequency that is reduced by the drop frame rate. The flags for 44.1 kHz or 48 kHz are generated even though the resulting sampling frequency is 44.056 or 47.952 kHz. In this way copying from NTSC Video to Film (and vice versa) is possible.

To access the next setup parameter press the ↓ key:

```
R002: RT GEN MODE
  FRUN/JAMI/JAMT
```

The currently valid setting is shown without flashing, whereas the other two choices are flashing. With the STORE function enabled (PRG ENABLE lamp is on) the STORE key can be pressed (possibly several times) to make one of the settings FRUN/JAMI/JAMT permanent.

FRUN: The RT generator runs freely (Free RUN) based on the machine clock, beginning with the defined starting time, as soon as a recording is started. This setting is only useful in NEW mode in which it is also automatically set by the machine.

JAMI: Alternative possibility for NEW mode: The RT generator synchronizes to the RT signal available at the RT input (JAM to Input). This setting can be selected, for example, for making a 1:1 tape copy from a DASH source machine.

JAMT: The RT generator synchronizes to the RT information on the tape (JAM to Tape). This allows gapless punch-in in ASSEMBLE mode. The machine sets this mode automatically in ASSEMBLE mode.

Notes: When the RT GEN MODE is changed, the RT generator begins at the start address as if a REC command were given.
Since NEW/ASSEMBLE recording mode modifies the RT generator mode, the RECORD mode must be selected first!

To access the next setup parameter press the ↓ key:

```
R003: RT GEN ADDRESS
  HH.MM.SS.FF
```

The position to be modified can be accessed with the ←/→ key and the value changed with the SET PARAMETERS wheel. After the change has been made the corresponding position flashes to indicate that the new value has not been saved yet. When the generator start address corresponds to the desired start time, press the STORE key (PRG ENABLE muss have been activated). The setting range is 00:00:00:00 to 71:59:59:999. Setting the generator start time is only useful in NEW RECORD mode in conjunction with the FRUN generator mode.

If the machine is equipped with an RT BOARD 1.863.657.20 or higher, the ↓ key can be pressed to access the next parameter setting:

```
R005: CTL JAM
  PCM 3324A/PCM 3348
```

If a 1:1 copy of a DASH tape is produced and the master is a Sony DASH machine, correct selection of the machine type is important for sample-accurate copying. If a STUDER machine (D820 or D827) is used as the master, this setting is not relevant.

2.2.6   Settings in the TC direct access menu

When the SET TC key is pressed on the D827 MCH Local Control Unit the alphanumeric SYSTEM CONTROL display shows:

```
SET TC GENERATOR
escape        branch
```

Press the ↓ key to access the first parameter setting:

```
T001: TC INPUT SOURCE
      INT GEN/EXTERN
```

The current setting is shown without flashing whereas the other choice flashes. With the STORE function enabled (PRG ENABLE lamp is on) the STORE key can be pressed (possibly several times) to make the INT GEN or EXTERN setting permanent.

INT GEN   The SMPTE time code is produced by the built-in generator. This code is automatically in synchronism with the machine clock.

EXTERN   The internal generator is switched off, the time code is supplied from an external source.

Important: **Make sure that the external time code source is synchronized with the same clock reference as the D827 MCH.**

If the external time code source runs independently of the machine clock reference and if this time code is used for formatting the tape, the recorded SMPTE TC after a while drifts away by a few frames from the word clock of the machine. In a studio where the equipment is coupled to an in-house clock source, such an incorrectly striped tape will cause the machines to compensate this difference which leads to periodic resynchronization and corresponding audio mutes.

To access the next setup parameter press the ↓ key:

```
T002: INT TC GEN MODE
      FRUN/JAMI/JAMT
```

The current setting is shown without flashing whereas the two other choices flash. With the STORE function enabled (PRG ENABLE lamp is on) the STORE key can be pressed (possibly several times) to make one of the settings FRUN/JAMI/JAMT permanent.

FRUN: The TC generator runs freely (Free RUN) based on the machine clock, beginning with the set starting time, as soon as a recording is started. This is the usual setting for formatting a new tape.

JAMI: The TC generator time is determined by the TC signal available at the TC input (JAM to Input). This setting can be selected, for example, for making a 1:1 tape copy from a DASH source machine.

The offered time code sets not only the time but also the TC GEN RATE. After the internal generator has been synchronized, the signal from the TC input is no longer used. The generator runs in synchronism with the machine clock.

JAMT: The TC generator synchronizes to the TC information on the tape (JAM to Tape). This allows gapless punch-in in ASSEMBLE mode. However the TC GEN RATE set in menu T003 is used.

Of course, the internal generator is always synchronized with the machine clock of the D827 MCH.

Please note that in contrast to the RT no automatic recording mode dependent settings are made by the machine because the time code can be striped also after the tape has been formatted.

To access the next setup parameter press the ⬇ key:

```
T003: INT TC GEN RATE
XX FRAMES/s
```

With the SET PARAMETERS wheel the SMPTE TC format can be selected. The following choices are available:

Typical application	TC format [fr/s]	Frame frequ. [fr/s]	Frame counter	Recommended sampling rate [kHz]
Film	24	24	24	44.1 / 48
Video (PAL/SECAM)	25	25	25	44.1 / 48
Video NTSC colour	29.97DR (drop frame)	29.97	30DR	44.056 / 47.952
Film post prod. w. NTSC video work copy	29.97ND (non drop) *)	29.97	30ND	44.056 / 47.952
Film / video B&W / CD mastering / HDTV	30ND (non drop)	30	30ND	44.1 / 48
Film production for video NTSC	30DR (drop frame) *)	30	30DR	44.1 / 48

*) Special application

If the store function has not been enabled yet this must be done now by pressing the PRG ENABLE key (PRG ENABLE lamp is on). To save the value press the STORE key (selected TC format no longer flashes).

To access the next setup parameter press the ⬇ key:

```
T004: INT TC GEN ADDR
HH.MM.SS.FF
```

The position to be modified can be accessed with the ⬅/➡ key and the value changed with the SET PARAMETERS wheel. After the change has been made the corresponding position flashes to indicate that the new value has not been saved yet. When the generator start address corresponds to the desired start time, press the STORE key (PRG ENABLE must have been activated). The setting range is 00:00:00:00 to 23:59:59:29. Setting the generator start time is only useful in FRUN generator mode.

To access the next setup parameter press the ⬇ key:

```
T005: TC OUT REFRESH
ENABLE/DISABLE
```

The D827 MCH is equipped with an independent time code regenerator that produces valid time code in any machine state. When the tape is spooled and does not contact the tape so that it cannot be read, or if the tape moves too slowly (deceleration or standstill), the regenerator reconstructs the time code automatically from the move pulse information. When the regenerator is switched on, the TC level indicator on the Local Control Unit indicates a TC signal also when the tape stands still.
With the store function enabled (PRG ENABLE lamp is on) the STORE key can be pressed (possibly several times) to make one of the ENABLE/DISABLE settings (switched on or off) permanent.
When an external synchronizer is used the utilization of the regenerator is *not* recommended (i.e. TC OUT REFRESH DISABLE).

2.2.7 SET-UP menu

Menu / Cursor

The SET-UP menu shows configuration setting topics in alphabetic order.
To navigate through the menu use the LCU cursor keys ↓, ←, →, and ↑.
If the cursor (shown as an underscore) is positioned under „**search**" pressing the ↓ key advances to the next topic.
To establish a setting choose „**branch**" and press the ↓ key to access a parameter.

Starting from the standard picture press the ↓ key to get to the menu selection. The procedure to access the SET-UP menu is as follows:

```
S005: LIBR WIND SPEED
       8.0 m/s
```

```
SET-UP    FUNC
(escape = ←+→)
      ↓
     ←
SET-UP    FUNC
(escape = ←+→)
      ↓
     ↓
SET: <section>
 search    branch
   ↓        ↓
  ↓        ↓
        S002: <function name>
        . . . .<parameter>
              ↓
             ↓
        S018: <function name>
            <parameter>

SET: <section>
 search    branch
   ↓        ↓
  ↓        ↓
```
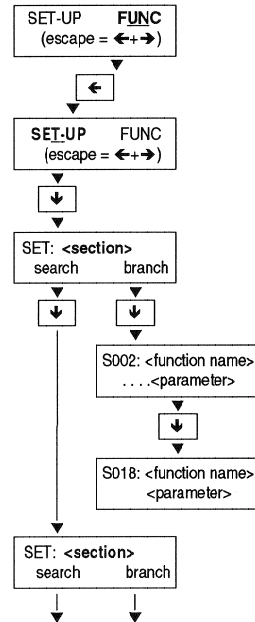
Changing the settings

The parameters are set with the SET PARAMETERS wheel and saved with the STORE key if the store function has been enabled with the PRG ENABLE key (PRG ENABLE lamp flashes). As long as the set value has not been stored yet it is shown in flashing mode.

Note:

As long as the STORE key is pressed, the values selected with the SET PARAMETERS wheel are continually stored. The value at which the STORE key is released is the one that is saved.

Example: Set Library Wind (spooling speed for library tapes) to 8 m/s

SYSTEM CONTROL-Display:

Procedure:

❏ Switch machine to STOP

❏ Press the following sequence of keys:
↓, ←, 4 x ↓, →, ↓

❏ Set the desired spooling speed (8 m/s) with the SET PARAMETERS wheel.
❏ Enable the STORE function by pressing the PRG ENABLE key (PRG ENABLE lamp flashes).
❏ Press STORE to save the set value.
❏ Press ← and → simultaneously to quit this menu branch or press ↓ to advance to the next setting.

SET-UP

PRESS ⬇ then ⬅ ➝
```
SETUP      FUNC
(escape = ⬅ + ➝)
```

```
SET:AUDIO INPUT
search        branch
```

```
S002:DIGITAL INPUT
...... ASSIGNED
```
NONE, SDIF, MADI, AES/EBU
S001 S041 S018

```
S018:2 CH 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

★
```
S046:Analog EMPHASIS
CH:...      SET:...
```
CH: 1...48/ALL
SET: ON/OFF

★
```
S050:NOISE SHAPING
CH:...      SET:...
```
CH: 1...48/ALL
SET: ON/OFF

```
SET:AUDIO OUTPUT
search        branch
```

```
S019:2 CH 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: DIG I/O, 15, 23, 31,
A/D-D/A, 47, (54),
(53 in EDR Mode)

```
SET:CROSSFADE TIME
search        branch
```

```
S004:16 BIT X-FADE
PUNCH IN/OUT: ... ms
```
1, 5, 10, 20, 50, 100, 200, 700
(REM. KEYS: X-FADE / TRIM±

★
```
S064:EDR X-FADE
PUNCH IN/OUT: ... ms
```
PUNCH: IN/OUT, IN, OUT
1, 2, 5, 10, 15, 20, 30, 50, 70,
100, 200, 400, 700, 1000,
2000, 5000.

```
SET:DECK
search        branch
```

```
S005:LIBR WIND SPEED
... m/s
```
0.1 ... 15.0

```
S006:MAX WIND SPEED
... m/s
```
0.1 ... 15.0

★ **with option only!**

```
SET:DISPLAY
search        branch
```
hh.mm.ss.xxx
h.mm.ss.xxx
mm.ss.xxx
m.ss.xxx

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

```
S012:RUN TIME FORMAT
hh.mm.ss.xxx
```
hh.mm.ss.xxx
hh.mm.ss.xx
hh.mm.ss.x
hh.mm.ss

```
S013:STOP TIME FORMAT
hh.mm.ss.xxx
```

```
S014:STOP TIME RESOL
DISP:FULL/PROGRAMMED
```
(REMOTE KEY: DISPLAY)

★
```
SET:EDR MODE
search        branch
```

★
```
S060:
EDR MODE      ON/OFF
```

```
SET:EXT CLOCK REF
search        branch
```

```
S017:EXT CLOCK REF
.................
```
WORD CLOCK, AES/EBU,
VIDEO 25Frm/s,
VIDEO 29,97Frm/s,
VIDEO 30Frm/s,
SQUARE 24Hz, 25Hz, 50Hz,
59,94Hz, 60Hz

```
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 ... 28.0

★
```
S023:OUTP CLIP LEVEL
CH:...    SET:....dBu
```
CH: ALL, 1 ... 48
SET: 14.0 ... 28.0

```
SET:LOCATOR
search        branch
```

```
S024:ROLLBACK TIME
... sec
```
1 ... 59
(REM. KEYS: RECALL+ROLLBACK,
TRIM±)

```
SET:SYNCHRONIZER
search        branch
```

```
S029:INT MOVE PULSES
.... p/s
```
1024, 64, 32

```
S030:EXT MOVE PULSES
.... p/s
```
0.000 ... 9999.999

```
S031:PARK OFFSET
ss.xxx
```
-59.999 ... 59.999

★ **with option only!**

SET-UP description

SET:AUDIO INPUT

```
S002: DIGITAL INPUT
XXXXXXX   assigned
```

X: NONE (= Analog IN)
   MADI
   SDIF *
   AES/EBU

Changeover of the input source between the analog inputs (NONE) and the digital input formats MADI (48CH), SDIF (48CH) or AES/EBU (2CH). For each digital format you can select between digital and analog input. Different digital formats cannot be used simultaneously. It is also possible to configure a digital format and to simultaneously feed individual channels with an analog signal.

After an input source has been selected with the SET PARAMETERS wheel, press the STORE key (after this function has been enabled with PRG ENABLE). If „assign" flashes on the display, all channels of this format are set to „ANALOG" or „OFF". Press STORE again so that the corresponding channel selection menu appears. (For explanation see under S001:SDIF INPUT, S018:2 CH AES INPUT, S041:MADI INPUT).

* Option: This line does not appear if this option is not installed!

Source selection procedure:

1) **DIGITAL INPUT** menu (S002): Select digital/analog source signal.
2) For digital formats press STORE again and in the displayed field **choose the channels** that should record a digital signal.
3) For an external CLOCK REFERENCE set the **desired format** of the external reference (SETUP menu S017).
4) Set **CLOCK REFERENCE INT/EXT** to „EXT" (EXT CLOCK key or menu F013).

Notes: When the DIGITAL IN key is active on the Channel Remote control you can switch between analog and digital input with the INPUT/REPRO key (INPUT LED: ON). If the 24-Bit EDR mode is active, the machine switches all digital inputs to MADI unless AES/EBU has been selected. The selection window S041:MADI INPUT does not appear. When you switch back to 16-bit mode the previously stored MADI input source assignment is reestablished.

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

CH A/B: 1..48, OFF

Specifies the tracks to which channels A and B of the AES/EBU interface are assigned. If the digital format AES/EBU has been set (see S002), the digital audio channels of an AES/EBU input channel are automatically set to DIGITAL INPUT. It is not possible to assign both AES/EBU channels to the same audio track. The channel assignment can also be performed on the channel remote control when the DIGITAL IN key is enabled, by selecting the corresponding channel via the INPUT/REPRO key. The first of the two selected channels corresponds to CH A (left), the second corresponds to CH B (right). ALL REPRO sets all inputs to ANALOG IN when DIGITAL IN is active.

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

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

With this menu you can configure all tracks in case that „SDIF" has been selected for DIGITAL INPUT (S002), *provided the machine is equipped with the SDIF option; otherwise this menu is not displayed.* Different digital input formats cannot be recorded simultaneously. Combining a digital input format with analog inputs, however, is allowed and can be defined in this track selection menu.

Examples:

CH: ALL	SET: SDIF	All channels set to SDIF input.
CH: ALL	SET: ANALOG	All channels set to analog input, no SDIF input selected.
CH: ALL	SET: ANA/NULL	All channels set to analog input, no SDIF input selected, not all converter cards inserted.
CH: ALL	SET: INDIV	Some channels set to analog input, and some channels set to SDIF input.

Channel assignment: A) With the remote control (Channel Remote): With selected SDIF format (assigned) and active DIGITAL IN key you can switch between analog and digital input (INPUT LED: ON) with the INPUT/REPRO key of the corresponding channel.
When DIGITAL IN is active, ALL REPRO switches all inputs to ANALOG IN.

B) On the LCU (Local Control Unit) of the machine: In menu S001 under „CH:" first choose an individual track (1...48) or all (ALL) tracks and then determine the signal source (ANALOG/SDIF). Save each setting with STORE (after this function has been enabled with PRG ENABLE). „SET: INDIVIDUAL" means that not all channel settings are identical.

If all tracks are set to ANALOG the message „assign" flashes in the DIGITAL INPUT menu when SDIF is selected. „assigned" is shown if the digital format has been set for at least one track.

For SDIF signals CLOCK REFERENCE must be set to EXTERNAL (F013 or LCU key EXT CLOCK) and WORD CLOCK (S017). With other synchronization clock sources errors are possible on the SDIF input.

If no SDIF interface (MIO board) is installed in the machine, the SDIF format cannot be selected. If a 48-channel machine is equipped with only one MIO board, either channels 1...24 or 25...48 can be operated with SDIF, depending on the slot in which the MIO board has been installed. ALL sets all channels equipped with an SDIF interface to SDIF; if only one MIO board is used in a 48-channel machine, 24 channels remain in ANALOG mode.

If analog input channels are selected for which no A/D converter is installed, NULL is shown in the SET display. „Digital zero" will be recorded on such channels. The setting ALL:ANALOG sets all channels equipped with an A/D converter to analog input.

```
┌─────────────────────────┐
│ S041: MADI INPUT        │
│  CH: ...    SET: .. ..   │
└─────────────────────────┘
```

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

This menu is used for configuring the tracks for MADI signals.
Different digital input formats cannot be recorded at the same time but the combination of MADI channels with analog inputs is allowed.

Channel assignment: A) With Channel Remote: With selected (assigned) MADI format and active DIGITAL IN key you can switch between analog and digital input (INPUT LED: ON) with the INPUT/REPRO key of the corresponding channel. When DIGITAL IN is active ALL REPRO sets all inputs to ANALOG IN.

B) On the LCU (Local Control Unit) of the machine: In menu S041 under „CH:" first choose an individual track (1...48) or all (ALL) tracks and then determine the signal source (ANALOG/MADI). Save each setting with STORE (after this function has been enabled with PRG ENABLE). „SET: INDIVIDUAL" means that not all channel settings are identical.

At least one track must be set to MADI, otherwise the message „assign" flashes in menu S002.

The MADI channels are always recorded on the audio tracks having the same number. No other assignment of channels or tracks in possible.

For MADI signals CLOCK REFERENCE is to be selected, depending on the environment.

If analog input channels are selected for which no A/D converter is installed, NULL appears in the SET display which means that „digital zero" will be recorded on such channels. ALL sets all channels equipped with an A/D converter to ANALOG.

Examples:

CH: ALL	SET: MADI	All channels set to MADI.
CH: ALL	SET: ANALOG	All channels set to analog input, no MADI input selected.
CH: ALL	SET: ANA/NULL	All channels set to analog input, no MADI input selected, not all converter cards inserted.
CH: ALL	SET: INDIV	Some channels set to analog input, and some channels set to MADI input.

```
┌─────────────────────────┐
│ S046: Analog EMPHASIS    │  *
│ CH: . .       SET: . .   │
└─────────────────────────┘
CH: 1..48/ALL
SET: ON, OFF
```

In this field the emphasis filters of channels equipped with A/D boards can be switched individually or collectively. When the EMPHASIS key is enabled, the emphasis of the corresponding channel can be switched on or off with the INPUT/ REPRO key of the corresponding channel.
* Option; this menu does not appear if no A/D converter is installed!

```
┌─────────────────────────┐
│ S050: NOISE SHAPING      │  *
│ CH: . .       SET: . .   │
└─────────────────────────┘
CH: 1..48/ALL
SET: ON, OFF
```

In this field the noise shapers of channels equipped with A/D boards can be switched individually or collectively. If the noise shapers are switched off, bits 17 and 18 of the converter are not taken into consideration, but a dither noise is added to the 16th bit. Without optional NOISE SHAPER BOARD the bits 17 and 18 are truncated. For optimum utilization of the high converter quality the ON setting should be used as standard if NOISE SHAPER BOARDS are installed.
* Option; this menu does not appear if no noise shapers are installed!

SET: AUDIO OUTPUT

```
┌─────────────────────────┐
│ S019: 2CH AES OUTPUT     │
│ CH A: . .     CH B: . .  │
└─────────────────────────┘
CH A/B: 1..48
```

All analog and digital output signals are available simultaneously, regardless of the selected signal source.
Specifies the audio tracks that are assigned to channels A and B of the AES/EBU output. The output channel assignment can also be made with the Channel Remote control when the AES OUT key is enabled (press SET and DIGITAL IN for this purpose). The channels are selected with the INPUT/REPRO key of the corresponding channel. The first of the two selected channels corresponds to CH A of the AES/EBU format (left), the second corresponds to channel B (right). In contrast to the AES/EBU input one track can be distributed on the output to both AES/EBU channels. The REPRO LEDs confirm the change of the outputs. If only one REPRO LED is on, the same audio track is used for both channels (A and B) of the AES/EBU output.

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

CH: ALL, 1..48
SAMP: see table ☛

Set the „negative" delay for the ADVANCED OUTPUT mode (see F001). The negative delay can be set in 7 steps as a number of samples. Depending on the sampling frequency this results in a slightly different negative delay (see table). In EDR mode slightly different values apply than in 16-bit mode; in EDR mode the values *cannot* be set individually for each channel but only in common.

Neg. delay [Samples]	48.0 kHz	44.1 kHz	44.056 kHz
	Compensation time [µs]		
DIG I/O	0	0	0
15	312.5	340.1	340.5
23	479.2	521.5	522.1
31	645.8	702.9	703.6
AD/DA (16 bit mode)	0 for analog I/O	0 for analog I/O	0 for analog I/O
39 (EDR mode)	812.5	884.4	885.2
47	979.2	1065.8	1066.8
54 (16 bit mode)	1125.0	1224.5	1225.7
53 (EDR mode)	1104.2	1201.8	1203.0

SET:CROSSFADE TIME

S004: **16 BIT X-FADE**
PUNCH-IN/OUT: .... ms

PUNCH: IN/OUT, IN, OUT
see table ☛

The crossfade time can be set in 8 steps. Operation is also possible via the remote control (Autolocator). The fade-in and fade-out times can be different. The setting is preserved when the machine is switched off.

Displayed cross-fade time [ms]	Exact cross-fade time [ms]		
	48.0 kHz	44.1 kHz	44.056 kHz
1	1.0	1.1	1.1
5	5.0	5.4	5.4
10	10.0	10.9	10.9
20	20.0	21.8	21.8
50	49.0	53.3	53.4
100	98.0	106.7	106.8
200	171.0	186.1	186.3
700	683.0	743.4	744.1

S064: **EDR X-FADE** *
PUNCH-IN/OUT: .... ms

PUNCH: IN/OUT, IN, OUT
see table ☛

In EDR mode the crossfade time can be set in 16 steps. It is inversely proportional to the sampling frequency that is used. For setting the crossfade time(s) the same rules apply as above under „16 BIT X-FADE".
* Option; this menu does not appear if the EDR option is not installed!

Displayed cross-fade time [ms]	Exact cross-fade time [ms]		
	48.0 kHz	44.1 kHz	44.056 kHz
1	1.0	1.1	1.1
2	2.0	2.2	2.2
5	5.0	5.4	5.4
10	10.0	10.9	10,9
15	15.0	16.3	16.3
20	20.0	21.8	21.8
30	30.0	32.7	32.7
50	50.0	54.4	54.5
70	70.0	76.2	76.3
100	100.0	108.8	109.0
200	200.0	217.7	217.9
400	400.0	435.4	435.8
700	700.0	761.9	762.7
1000	1000	1088.4	1089.5
2000	2000	2176.9	2179.0
5000	5000	5442.2	5447.6

SET:DECK

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

0,1..15,0

Specifies the maximum spooling speed for library tapes when the LIB WIND key has been enabled (Autolocator or F020). The value for the library wind speed cannot be greater than the maximum spooling speed (which is defined in S006: MAX WIND SPEED).

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

5,0..15,0

Specifies the maximum spooling speed in all spooling modes (LIBR WIND OFF, see F020).

SET:DISPLAY

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

Specifies the number of leading zeros on the TAPE POSITION display.

Format	Example 1	Example 2	Example 3
hh.mm.ss.xxx	00.00.00.000	06.57.39.245	-00.00.02.768
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 digits on the TAPE POSITION display while the tape is running (see also S013: STOP TIME FORMAT).

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

Specifies the number of trailing digits on the TAPE POSITION DISPLAY when the tape is stopped.

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

| S014: **STOP TIME RESOL** |
| DISP:FULL/PROGRAMMED |

Changeover between the resolutions PROGRAMMED with S013:STOP TIME FORMAT and the FULL resolution of the counter; default: PROGRAMMED. This function can also be operated with the remote control (Autolocator).

SET:EDR MODE

| S060: | ＊ |
| **EDR MODE:** ON/OFF |

Switches the EDR mode on and off.
＊ Option; this menu does not appear if not MADI24 board is installed!

SET:EXT CLOCK REF

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

see table ☞

Specifies the external clock source for synchronizing the digital audio signal. The clock reference set in this menu is used if CLOCK REFERENCE has been switched to EXTERNAL (F013 or EXT CLK key).

EXT CLOCK REFERENCE	VARISPEED	SAMPLING RATE SELECTION
WORD CLOCK	impossible*	impossible (auto)**
AES/EBU	impossible*	impossible (auto)**
VIDEO 25 Frm/s	possible	possible
VIDEO 29.97 Frm/s	possible	possible
VIDEO 30 Frm/s	possible	possible
SQUARE 24 Hz	possible	possible
SQUARE 25 Hz	possible	possible
SQUARE 50 Hz	possible	possible
SQUARE 59.97 Hz	possible	possible
SQUARE 60 Hz	possible	possible

*) Recorder follows a fixed or variable clock
**) Setting at fs = 44.056 kHz must be made manually

SET:LEVELS

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

1/2: 14,0...24,0

Recommendation:

Specifies simultaneously the input and output clip level of the CUE tracks.
Inputs: An input signal with clip level results in peak level recording on the tape.
Outputs: Peak level recording on the tape supplies an output level with clip level.
Factory setting: +20.0 dBu.

Set the same level as for INP CLIP LEVEL.

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

CH: ALL, 1...48
SET: 14,0...28,0

Recommendation:

Specifies the clip level of the analog inputs for digital audio tracks.
An input signal with this level produces (digital) peak level recording (0 dB).
Factory setting: +20.0 dBu.
When ALL is chosen, INDIVidual means that not all tracks are set to identical levels.
* Option; this menu does not appear if no A/D converters are installed!
Set all channels to the same level, approx. 10 dB higher than studio level.

Examples:

CH: 15	SET: -	No A/D converter equipped for the selected channel.
CH: ALL	SET: 24.0 dBu	All channels set to the same level, all A/D converters are inserted.
CH: ALL	SET: 14.0 dBu/-	Not all A/D converters are inserted, all channels with A/D converters are set to the same level.
CH: ALL	SET: INDIV/-	Not all A/D converters are inserted, all channels with A/D converters are set to different levels.

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

CH: ALL, 1...48
SET: 14,0...28,0

Recommendation:

Specifies the peak level of the analog outputs for digital audio tracks.
(Digital) peak level recording (0 dB) supplies an analog reproduce signal with this level.
Factory setting: +20.0 dBu.
If not all tracks are set to the same level, the display shows a channel selection of CH: ALL, SET: INDIV. (Examples analogous to the above table).
If the machine is not equipped with D/A converters, the settings in menu S023 cannot be made.
* Option; this menu does not appear if no D/A converters are installed!
Set all channels to the same value as INP CLIP LEVEL.

SET:LOCATOR

| S024: ROLLBACK TIME |
| ... sec |

1 ... 59

SET:SYNCHRONIZER

| S029: INT MOVE PULSES |
| .... p/s |

1024, 64, 32

Set ROLLBACK time. The tape deck rewinds by the amount specified by the ROLLBACK time and subsequently activates the operating mode defined in function F045: STOP, PLAY, or RECORD. The ROLLBACK time can be displayed by simultaneously pressing STOP and ROLLBACK (on remote).
With RECALL and ROLLBACK the displayed value can be loaded into the AUX REGISTER and subsequently varied with TRIM±.
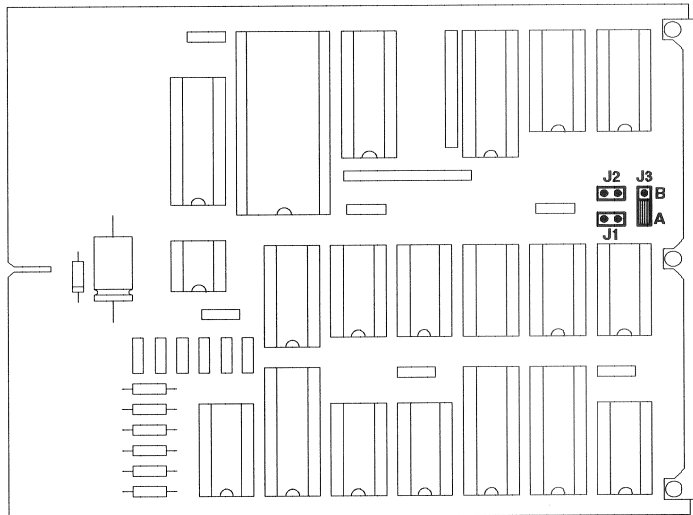
Specifies the number of MOVE PULSES per second that are generated by the tape counter circuit. This parameter must correspond to the jumper setting on the TAPE DECK COUNTER/TIMER PCB 1.820.823.

Note: Jumper in position J3A: 1024 pulse/s at 48 kHz (default)
Jumpers in position J3B and J1: 64 pulse/s at 48 kHz
Jumpers in position J3B and J2: 32 pulse/s at 48 kHz.

| S030: EXT MOVE PULSES |
| .... p/s |

1.0 ... 9999.999

| S031: PARK OFFSET |
| ss.xxx sec |

-59.999 ... 59.999

Specifies the number of MOVE pulses per second that the external master machine generates in SYNCHRONIZER mode. The MOVE pulses are supplied by the internal synchronizer as a substitute for missing TIMECODE or RT signals when these are unavailable during the spooling phases.

Specifies the PARK OFFSET. When the D827 MCH is coupled via the internal synchronizer and the master is switched to STOP, it parks *before* the master by this amount, or *after* the master when a negative PARK OFFSET is entered. The latter is useful if the D827 operating in slave mode accelerates faster from STOP to PLAY than the master, and the PLAY command of the master is transmitted via the Master Tallies connection to the D827.
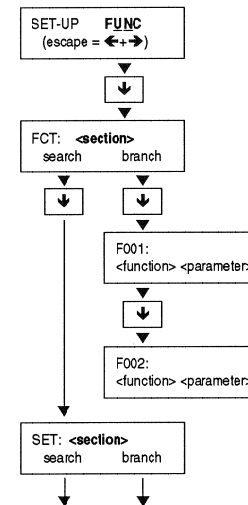
2.2.8   FUNCTIONS menu

The FUNCTIONS menu contains alphabetically arranged areas (in the graphic further below referred to as „Section"). The following FUNCTIONS menu settings can also be established directly with the control keys:

REMOTE	LCU	Key	MENU
*		ADV OUTPUT	F001: ADV OUTPUT
	*	EXT CLK	F013: CLOCK REF
*		LIB WIND	F020: LIBRARY WIND
*	*	CODE	F032: CODE
*	*	TIME	F034: TIME
*		FR MS	F035: Frames/ms
*		PAI	F052: PAR AUDIO IF
*		AOR	F062: AOR
*		TC LOCK	F064: TC LOCK

Menu operation

With the LCU **cursor keys** ↓, ←, → and ↑ you can navigate the cursor through the menu tree. If the cursor (shown as an underscore) is positioned under „search" the ↓ key advances to the next section. To establish a setting press → to „branch" and the ↓ key to access the individual functions.

Changing a setting

The procedure for setting parameters in the FUNCTIONS menu differs from the Set-up menu: All parameters are visible on the display. The current active value is shown without flashing, the inactive values are flashing.
Before a new setting can be saved the STORE key must be enabled with PRG ENABLE (PRG ENABLE lamp flashes).
Press STORE repeatedly until the desired setting is reached. The last setting at which the STORE key was released is automatically stored.

Current values

| The active parameters are shown without flashing. |
| **Flashing values** are **inactive.** |

FUNCTIONS

PRESS ⬇ ➝ SETUP   FUNC (escape = ⬅ + ➝)

FCT : AUDIO — search   branch

F001: ADV OUTPUT: ON/OFF   (REMOTE KEY: ADV OUT)

F002: AUTO INPUT: A/B   A: all channels to INPUT / B: READY channels to INPUT

FCT : AUX TRACKS — search   branch

F010: CUE1 REPRO: ANA/PDM

F011: CUE2 REPRO: ANA/PDM

F012: ERASE HEAD: ON/OFF

FCT : CHECK ENABLE — search   branch

F080: CHECK ENABLE: ON/OFF

FCT : CLOCK REFERENCE — search   branch

F013: CLOCK REF: INT/EXT   (LCU KEY: EXT CLK)

FCT : DECK — search   branch

F020: LIBRARY WIND: ON/OFF   (REMOTE KEY: LIB WIND)

F021: TAPE: A/B   A: Ampex, BASF / B: 3M, Sony

F029: TAPE GUARD: ON/OFF

F030: TAPE GUARD MODE: A/B   A: reduced / B: STOP

FCT : DISPLAY — search   branch

F032: CODE: EXT/TAPE/DIFF   (LCU + REMOTE KEY: CODE)

F034: TIME: T/TC/RT/L   (LCU + REMOTE KEY: TIME)

F035: Frames / ms: (REMOTE KEY: FR MS)

FCT : LOCATOR — search   branch

F037: LOC ST: PLY/REC/STP

F045: ROLLB: PLY/REC/STP

FCT : RECORD — search   branch

F048: READY RECORD: ON/OFF

F049: RECORD KEY: A/B   A: PLAY + REC / B: REC key only

F050: REFRESH: ON/OFF

F051: REC INDICATION: A/B   A: 1 or more CH in REC / B: 0 or more CH in REC

FCT : REMOTE — search   branch

F052: PAR AUDIO IF: ON/OFF   (REMOTE KEY: PAI)

F054: REMOTE MODE: A/B   A: REM or LOC / B: REM + LOC

FCT : SYNCHRONIZER — search   branch

F060: REFERENCE: TC/RT

F062: AOR: ON/OFF   (REMOTE KEY: AOR)

F063: SYNCHR: INT/EXT

F064: TC LOCK: ON/OFF   (REMOTE KEY: TC LOCK)

F065: PRECISE LOCK: ON/OFF   ON: Sample-accurate but higher lock-up time / OFF: Accuracy ≤10 ms (typ. ±1 ms), short lock-up tim

F068: SLOW LOCK: ON/OFF

FCT : VARISPEED — search   branch

F071: VARI DISP: %/HT/IPS

Description of the FUNCTIONS

FCT: AUDIO

F001:
ADV OUTPUT: ON/OFF

Remote-Taste **ADV OUTPUT**

Switches the machine to ADVANCED OUTPUT mode. This changeover is only possible in STOP condition.

ON: ADVANCED OUTPUT mode is switched on.
This operating mode is used if tracks recorded on tape are to be processed by external equipment and subsequently written back in synchronism to the tape.
In ADVANCED OUTPUT mode the audio signals are output with a „negative delay" (i.e. earlier) and can thus compensate the delay of an external unit (for example, a digital mixing console or an effect processor). Different compensation times can be selected in S003.

OFF: Normal operation, compensation of external delay inactive (default).

F002:
AUTO INPUT: A/B

AUTO INPUT switches all digital audio channels to INPUT when the machine does not operate in PLAY mode. AUTO INPUT has two modes that can be selected with this function:

A: AUTO INPUT MODE A switches *all channels* to input.
B: AUTO INPUT MODE B switches *only those channels to input that are in READY state.*

FCT: AUX TRACKS

F010:
CUE1 REPRO: ANA/PDM

F011:
CUE2 REPRO: ANA/PDM

The D827 MCH uses PWM (pulse width modulation) for recording the analog CUE tracks, rather than the obsolete analog recording with bias. For reproducing DASH tapes that have been recorded on first generation DASH machines, the CUE reproduce electronics must be switched to the corresponding recording type.

ANA: For reproducing CUE tracks recorded in analog mode.
PDM: For reproducing CUE tracks recorded with PWM (default).

F012:
ERASE HEAD: ON/OFF

In NEW RECORD and ASSEMBLE RECORD mode the erase head for the AUX tracks is always switched on. When INSERT RECORD is activated the erase head is normally switched off. If necessary the erase head can also be activated in INSERT RECORD mode (erasing obsolete analog recordings).

ON: The erase head is enabled in INSERT RECORD mode.
OFF: The erase head is disabled in INSERT RECORD mode (default).

FCT: CHECK ENABLE

F080:
CHECK ENABLE: ON/OFF

With the CHECK key on the LCU the level bargraph of the D827 MCH can be switched to tape quality display mode. The setting CHECK ENABLE: OFF disables the CHECK key if this function is not wanted.
In tape quality display mode the top and bottom LED of the bargraph are continuously on. The bargraph is to be read as follows: From top to bottom all CRC errors of the corresponding tracks averaged across a sliding window of approx. 3.5 s (Short Term). From the bottom to the top they are averaged across a sliding window of approx. 28 s (Long Term). In this way tape locations with elevated CRC rate can be systematically discovered. The CRC sums on both display sections are scaled in such a way that 3 LEDs (two, plus the one that is continuously on) represent a good quality. The LED in the middle of the level bargraph has a special meaning: It indicates a Word Error (interpolation). The red CLIP indicator above the level bargraph signals an unformatted tape location (Tape Empty).
The precondition for this is, however, that PLAY has been started on a formatted area of the tape. Please note also that all CRC indications in Tape Empty condition are meaningless.
The Long Term and Short Term CRC peak values as well as the Tape Empty indication can be frozen with the PEAK HOLD key [10].

Note: The CHECK function does not supply a meaningful result for channels that have been switched to REC MUTE.

FCT:CLOCK REFERENCE

| F013: |
| CLOCK REF: INT/EXT |

LCU key **EXT CLK**

The D827 MCH can be operated either with the internal clock (quartz reference) or with an external clock (for example, AES/EBU interface, word clock of a digital audio source, video, or square wave).
See also S017: EXT CLOCK REF.

INT: Switches the tape machine to INTERNAL CLOCK (default).
EXT: Switches the tape machine to EXTERNAL CLOCK.

FCT:DECK

| F020: |
| LIBRARY WIND: ON/OFF |

Remote key **LIB WIND**

LIBRARY WIND (reduced spooling speed for library tapes) can be used in conjunction with any spooling function (for example, rewind, fast forward). Through this function the spooling speed is reduced to a specific value between 0.1 m/s and the spooling speed selected with MAX WIND SPEED.
See also: LIBR WIND SPEED (S005), MAX WIND SPEED (S006).

ON: Spooling with reduced speed.
OFF: Spooling with maximum speed (default), adjustable (function S006).

| F021: |
| TAPE: A/B |

The D827 MCH can store the head parameters for two different tape types, designated as TAPE A and TAPE B.

A: Selects tape type A (default). Factory setting for:
• *AMPEX 467* or *BASF 931*
B: Selects tape type B. Factory setting for:
• *Fuji Film D-½ series, Scotch 3M 275LE* or *Sony D-½ series*

| F029: |
| TAPE GUARD: ON/OFF |

TAPE GUARD prevents unthreading of the tape at full spooling speed. Mode A/B determines whether deceleration or stopping should occur before the end of the tape is reached.

ON: Reduces the spooling speed or stops the spooling operation (depending on the TAPE GUARD MODE; F030), shortly before the tape unthreads (default).
OFF: The tape is neither decelerated nor stopped before it unthreads.

| F030: |
| TAPE GUARD MODE: A/B |

TAPE GUARD MODE selects the type of TAPE GUARD function. See F029.

A: Reduces the spooling speed at the end of the tape (default).
B: Stops the spooling operation just before the end of the tape is reached.

FCT:DISPLAY

| F032: |
| CODE: EXT/TAPE/DIFF |

LCU and
Remote key **CODE**

Code switches the signal source for TC and RT. See also F034, TIME.

EXT: The EXTERNAL *MASTER* TAPE TIME is displayed.
TAPE: The *SLAVE* (LOCAL) TAPE TIME of the D827 MCH is displayed. If display mode „t" (real time counter) or „L" (relative counter) is selected (TIME or F034 key), the CODE setting is set automatically to SLAVE.
DIFF: The *difference* between the EXTERNAL MASTER TIME and the SLAVE TAPE TIME is displayed.

| F034: |
| TIME: T/TC/RT/L |

LCU and
Remote key **TIME**

Switches the time display mode.

T: The real time tape counter is displayed (derived from MOVE pulses).
TC: The time code (TC) is displayed.
RT: The time recorded on the REFERENCE TRACK (RT) is displayed.
L: The relative tape timer (LAP) is displayed (derived from the RT track on the tape).

| F035: |
| Frames / ms |

Remote key **FR/MS**

Switches the TC display from milliseconds to frames. The display parameters in the SET-UP menus S012 (Run Time Format) and S013 (Stop Time Format) determine the number of trailing digits.

Frames: Frame display mode (max. 2 digits)
ms: Millisecond display mode (max. 3 digits)

FCT:LOCATOR

F037:
LOC ST: PLY/REC/STP

LOC START mode changeover. After the LOC START command the machine spools to the tape location at which the last PLAY command was given and then activates PLAY, RECORD or STOP, depending on the programmed LOC START mode.

PLY: PLAY is activated after the ROLLBACK.
REC: RECORD is activated after the ROLLBACK.
STP: STOP is activated after the ROLLBACK (default).

F045:
ROLLB: PLY/REC/STP

ROLLBACK mode changeover. With the ROLLBACK command the tape is wound backward by a programmable amount of time.
After that, the machine spools to the tape location at which the last PLAY command was given and then activates PLAY, RECORD or STOP, depending on the programmed ROLLBACK mode (for setting the ROLLBACK time: see S024).

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

FCT:RECORD

F048:
READY RECORD:ON/OFF

For audio and AUX tracks the READY RECORD function allows punch-in of specific channels by pressing the corresponding READY key, provided the machine is already in RECORD mode (RECORD lamp is on).

ON: Changeover of a track from SAFE to READY while a recording is in progress causes immediate RECORD activation for this track.
OFF: If audio tracks are switched from SAFE to READY while a recording is in progress, they remain ready and punch-in is preselected. The punch-in of these channels occurs simultaneously when the RECORD key is pressed.

F049:
RECORD KEY: A/B

The RECORD KEY function determines the keys through which a machine is switched from PLAY to record.

A: Two switch to RECORD during PLAY or for switching additional channels to RECORD during a recording, the PLAY and RECORD keys must be pressed **together** (default).
B: If the machine operates in PLAY mode, RECORD can be activated by pressing the RECORD key **alone** (i.e. PLAY does not have to be pressed again).

F050:
REFRESH: ON/OFF

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

ON: Activates the REFRESH function. In this recording mode the data stored on tape are read and rewritten after the CRC errors have been corrected.
OFF: Disables the REFRESH function, normal RECORD mode (default).

F051:
REC INDICATION: A/B

Normally a tape machine can be switched to RECORD only if at least one digital audio channel is in READY condition. With RECORD INDICATION B a recording can also be started if no channel has been switched to READY, for example, for FOLLOW RECORD commands, etc.

A: At least one digital audio channel must be in READY condition before the tape machine can be switched to record.
B: The tape machine can be switched to RECORD even if all digital audio channels are set to SAFE (default). This setting is useful in conjunction with READY RECORD ON (F048). Of course the drop-in occurs only for channels that are in READY condition; the machine does not leave the RECORD mode if at certain times no channel is in READY condition.
Note: If only TC, CUE1 or CUE2 is to be recorded „REC INDICATION: B" must be selected.

FCT:REMOTE

F052:
PAR AUDIO IF: ON/OFF

Remote-Taste **PAI**

To avoid operating conflicts when a PARALLEL AUDIO INTERFACE is used, the channel selection keys on the LCU and on the CHANNEL REMOTE are disabled.
ON: The PARALLEL AUDIO interface is enabled. The keys of the CHANNEL REMOTE and the LCU are disabled.
OFF: The PARALLEL AUDIO interface is disabled. The keys on the CHANNEL REMOTE and on the LCU are enabled (default).

F054:
REMOTE MODE: A/B

REMOTE MODE specifies whether the LOCAL Control Unit (LCU) is enabled when the remote controls are active.
A: If a remote control is active the LCU is disabled. The REMOTE key on the LCU, however, is always enabled.
B: If a remote control is active the LCU keys can still be used (default).

FCT:SYNCHRONIZER

F060:
REFERENCE: TC/RT

Changeover of the REFERENCE signal of the internal synchronizer.
This changeover is not allowed during a LOCK operation.
TC: The synchronization is based on the MASTER TIME CODE signal supplied by an external source and on the SLAVE (LOCAL) TIME CODE signal (default).
RT: The synchronization is based on the MASTER REFERENCE TRACK signal supplied by another DASH machine and on the SLAVE (LOCAL) REFERENCE TRACK signal. This mode allows sample accurate synchronization of the machines.

F062:
AOR: ON/OFF

Remote-Taste **AOR**

AOR (AUTOMATIC OFFSET RETENTION) automatically adds time code jumps to the separate SYNCHRONIZER OFFSET REGISTER:
ON: AOR switched on.
OFF: AOR switched off. The separate SYNCHRONIZER OFFSET REGISTER is not active (default).

F063:
SYNCHR: INT/EXT

SYNCHR: Changeover between synchronization with the *internal* synchronizer and the *external* unit.
This changeover is not allowed during a LOCK operation.
INT: Activates the internal synchronizer. All functions that depend on internal synchronization (for example, LOCK, INST LOCK, EDIT WAIT, EDIT LOCK) are enabled. External synchronization is switched off (default), the lamps NO MASTER CODE and NO SLAVE CODE are on and the synchronizer port does not accept all commands.
EXT: Activates the external synchronization if REMOTE is active (REMOTE lamp is on). the internal synchronizer and all functions depending on it (for example, LOCK, INST LOCK, EDIT WAIT, EDIT LOCK) are disabled.

F064:
TC LOCK: ON/OFF

Remote-Taste **TC LOCK**

TC LOCK can be used for synchronizing the D827 MCH with an analog tape machine that does not support a clock reference but supplies only a TC signal.
ON: The D827 MCH does not synchronize to an external clock signal but is controlled by the time code of the master. The audio quality of the output signals can deteriorate because the clock of the converters includes the time code jitter of the master machine. See SLOW LOCK F068. As the digital clock is generated by the synchronizer in this mode, the digital output is of limited use.
OFF: When the time code difference between the master and the slave has been reduced to zero, a clock reference is activated (S017/F013) (default). At this point the D827 MCH is in stable and frame accurate synchronism with the master. This mode should be selected for interconnected digital system operation.

The TC LOCK function has an influence also when an external synchronizer is used.
ON: From the capstan control frequency of the external synchronizer (approx. 9.6 kHz) the machine clock is generated among other signals; in this way audio signals become audible more quickly. During the „TC Chase" phase the digital audio signals are not coupled with the external clock and therefore of only limited use.

OFF: The machine clock and consequently also the clock of the digital outputs is in synchronism with the external clock reference. The digital outputs can be used without limitation. The capstan control frequency is used only for controlling the capstan. In this mode the external synchronizer can switch the machine correctly to the external clock frequency.

F065:
PRECISE LOCK: ON/OFF

Switches PRECISION LOCK on/off. If PRECISION LOCK is on (default) the D827 MCH synchronizes exactly to the master machine. When this function is disabled the synchronization occurs much faster but with reduced accuracy. The accuracy is better than 10 ms, typically ±1 ms. This function is advantageous for synchronization with pictures.

F068:
SLOW LOCK: ON/OFF

The SLOW LOCK function makes the chase inaudible when synchronizing with the internal synchronizer. It is only active if TC LOCK = ON.

ON: SLOW LOCK MODE: The TC jumps caused by tape editing are eliminated slowly so that they become inaudible. This function can only be activated in TC LOCK mode. In this mode the digital clock is generated by the synchronizer which means that the digital output signals are only of limited use.

OFF: Normal mode. The chase by the synchronizer is performed quickly. Due to the resulting wow and flutter the audio outputs may be temporarily muted.

FCT: VARISPEED

F071:
VARI DISP: %/HT/IPS

Changeover of the varispeed display mode:

%: The varispeed deviation is entered and shown in percent of the nominal tape speed.

HT: The varispeed deviation is entered and shown as semitones.

IPS: The varispeed deviation is entered and shown as absolute tape speed in inches per second (ips).

2.2.9   ALIGNMENT menu

In the alignment menu the machine operation parameters can be set. These settings require the expertise of a service technician because calibrations are involved in the following area:
- ❏ Tape deck
- ❏ Equalizer
- ❏ Erase current
- ❏ Record current

Programming lock: The settings of the alignment menu are protected against unintentional manipulation through a special key sequence.
When the programming lock is active (default) the alignment menu does not appear on the display. A detailed description of this menu can be found in the service manual.

2.3   Operation

2.3.1   Power-on sequence

⚠️ During the power-on sequence, that is, while the processors is being initialized, random key and indicator lamps can turn on. During this time the RECORD function is electronically inhibited and there is no danger to your valuable tapes. **To prevent bodily injury do not thread a tape during this time (approx. 5 s)!**

SYSTEM CONTROL display   The SYSTEM CONTROL display consecutively shows the following equipment related data for a few seconds; they can be recalled at any time by pressing the ↑ key. With the ↓ key the display sequence can be accelerated.

```
D827 MCH MULTICHANNEL
DASH TAPE RECORDER
```

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

```
D827 MCH      SOFTWARE
V X.X              ww/yy
```

Begin of the system test with indication of the software version and index (X.X) and release date (ww = week, yy = year).

Important: Always specify the software release date in any inquiries to your dealer!
↓

```
CONFIGURATION:
XX CHANNELS
```

Channel configuration in accordance with the installed MAPRO and K/O boards. (XX = 8 / 16 / 24 / 32 / 40 / 48 channels)
↓

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

If an error is detected an error message number and plain text explanation is output, see Section 13.
↓

Standard picture
```
CLK REF: ccccccccccc
TC TAPE: ff.ff Frm/s
```

CLK REF provides information on the currently set clock reference (ccccccccccc = INTERNAL, WORD CLOCK, AES/EBU, VIDEO 25..., SQUARE 24..., EXT VARI-SPD, INT SYNCHR); TC TAPE specifies the frame rate detected from the TC track (ff.ff = 24/25/29,97/30). For the „29.97" indication the drop frame flag of the recorded time code is relevant.

Monitoring of the operating voltage, fuses

Below the LCU (Local Control Unit) there is a white unlocking knob that releases the hinged tape deck. After this knob has been pressed, the tape deck can be lifted with both hands up to the self-latching stop position.

Caution: **Never open the tape deck while the machine is running (for example, spooling mode)! The high rotational speeds of the reels and the resulting centrifugal forces can damage the tape, reels and tape deck and cause bodily injury!**

Only trained service technicians are authorized to perform any manipulations inside the machine. Fuses may only be replaced with units of the same rating.

Although the raised tape deck is latched in the top position, the machine must not be shifted or transported when the tape deck is opened!
To unlatch the raised tape deck, lift it with both hands and carefully lower it to the horizontal position. Then press it down lightly so that it engages with an audible click.

On the right-hand side of the machine frame there is a circuit board with 6 green control LEDs for the tape deck supply voltages. The corresponding voltages are labeled on the LED board.
On the rear machine frame there are 8 fuses of which 5 are equipped with a pilot lamp. The corresponding circuits are labeled on the machine frame.
When the front panel is unhooked the electronics rack containing the voltage regulators become accessible. These three units which are encapsulated in aluminum housings have one pilot LED each that signals the correct functioning.
An additional set of fuses is located above the power inlet and is accessible from the outside.

To prevent bodily injury and interference by electromagnetic fields or dust, the machine may only be operated when the housing covers are completely installed and the tape deck is locked in the normal operating position.

2.3.2   Threading the tape

⚠ The D827 MCH is largely protected against manipulation errors. But when working in the area of the tape reels the precautions specified in Section 2.3.1 must be observed in order to prevent injuries. Do not touch any parts of the tape deck before the tape is fully stopped.

⚠ All operators who work on the machine must be familiar with these precautions. Do not allow untrained persons to touch the machine while it is operating.

Mounting the reels

⚠ To prevent bodily injury do not mount a reel during the initialization phase of the machine (for approx. 5 s after power on)!
Make sure that the reels are firmly seated on the reel adapters. Tighten the twist lock in the center of the adapter.

Threading the tape

⚠ To prevent bodily injury do not thread the tape during the initialization phase of the machine (for approx. 5 s after power on)!
Thread the tape as shown in the following diagram:
Place the leading edge of the tape 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 tape is loaded into the operating position.
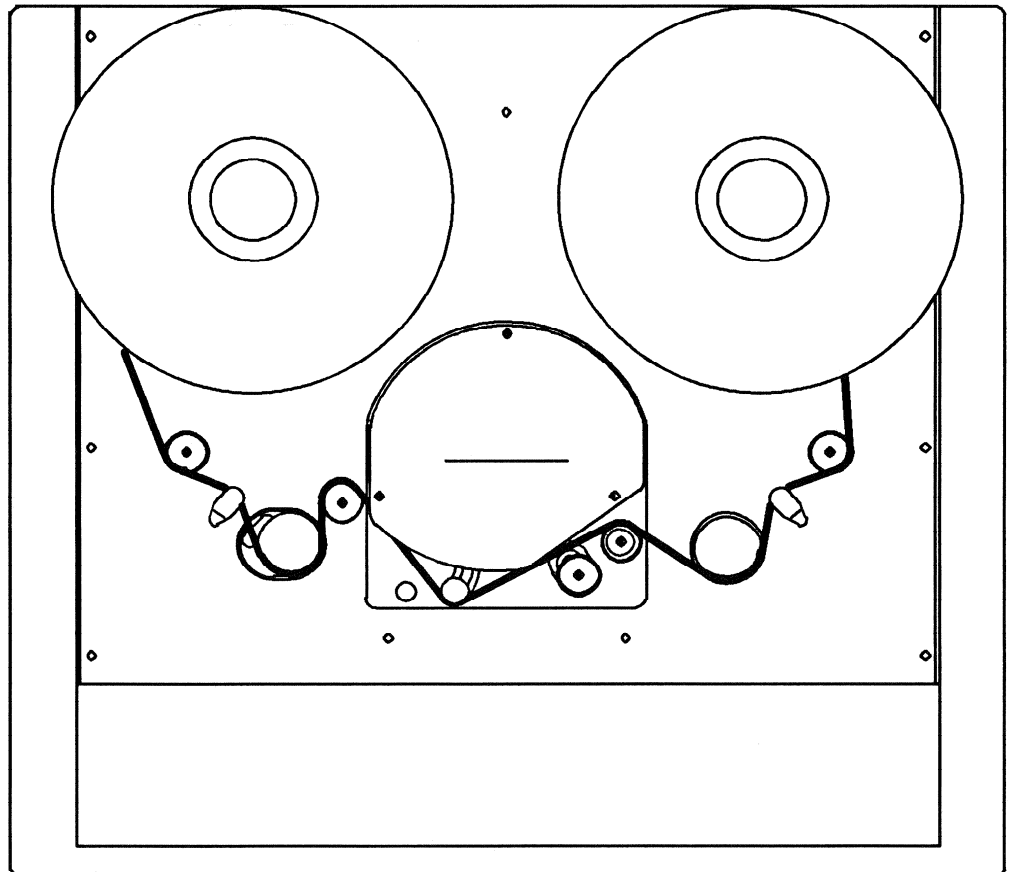
Determining the pancake inertia

For optimum adaptation of the tape deck control the inertia of the pancakes is included as a control parameter. For determining this value the tape must be spooled in either direction for a few seconds after the tape has been inserted or the machine is switched on again.

2.3.3   Setting the tape counter display mode

TIME   By pressing the TIME key (or with F034 in the functions menu) the tape display can be switched between the following display modes:
❑ Tape counter in real time. The counter can be set to zero at the beginning of the tape by pressing the RESET key.
❑ Time code (TC)
❑ Reference track (RT)
❑ Elapsed playing time (LAP). The LAP counter is a second counter that does not influence the tape counter.

The Locator addresses are not changed when the time counter display mode is changed over.

If the TC or RT display mode is selected, the CODE key status determines whether the code from tape (SLAVE), from the external source (MASTER), or the difference (DIFF) between the master and slave are displayed.

A corresponding letter L (LAP), t (TC) or r (RT), or no letter (tape counter) on the left-hand side of the display identifies the display mode.

| TIME | HOURS | MIN | SEC | FR / MS |

LAP tape counter   The LAP counter can be set to zero at any position of the tape. In this way the exact playing time of a recorded segment can be determined without having to calculate the difference between the start and stop time.

| TIME | HOURS | MIN | SEC | FR / MS |

CODE   The CODE key (LCU and AUTOLOCATOR) cyclically switches between **TAPE** (Code from tape), **EXT** (external code) and **DIFF** (difference between external code and the code from tape on master and slave). Yellow LEDs at the left-hand side of the display identify the current display mode.
The same setting can be made in the functions menu DISPLAY / CODE (F032).

When pressing TIME to switch over to the tape counter or to LAP counter, CODE is automatically changed over to SLAVE.

Note: The information on the tape counter display is derived from the signals supplied by the move roller which means that minor deviations can occur due to tape slip when intensive spooling or many LOC commands are performed. All other times are derived from the absolute time information on the tape and are therefore always accurate regardless of the operation.

2.3.4   Setting the input and output levels

For each channel equipped with an A/D or D/A converter the audio levels can be individually set between +14.0 and +28.0 dBu (up to +24 dBu for the CUE tracks). These settings are software controlled and are described in the SET-UP menu (see Section 2.2.7). The following levels can be set:

❑ CUE CLIP LEVEL
❑ INPUT CLIP LEVEL
❑ OUTPUT PEAK LEVEL

The setting depends on two factors:
❑ The studio level and
❑ The magnitude of the desired headroom.

Example: The studio level is nominally +4 dBu, in addition a headroom of 10 dB is desired. The desired clip level of +14 dBu is obtained by adding the two values.

Headroom In an analog tape recording the tape becomes saturated if the recording level is too high. The harmonic distortions increase audibly but the transition to the distortion range is gradual and the tolerance range is large.
The situation is different for digital recordings. There is no transition range between full level and distortion. When full level is reached there are no further digital level values, the 16 bits are exhausted. The result is a sudden jump from the range with minimal distortion to usually audible distortions.
The „tolerance range" available in analog production mode must in practice be replaced by a sufficiently large headroom.
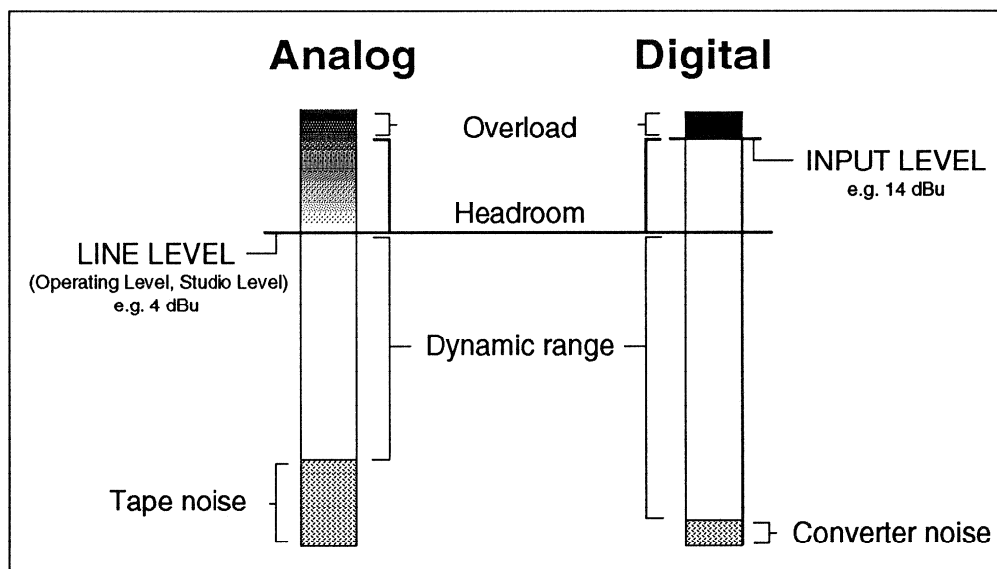
Level comparison between analog and digital recording

2.3.5   Source selection of the audio inputs

The D827 MCH can work with the following audio signals:
❏ Analog audio signals via the 30-pin connector (option)
❏ Two-channel AES/EBU digital audio signal via the XLR connectors
❏ Digital audio signal in MADI format
❏ Digital audio signals in SDIF format via the 50-pin D-connector (option).
A combination of analog and digital inputs is allowed but different digital input formats cannot be mixed.

The audio mode is established in the SET-UP menu according to Section 2.2.7.
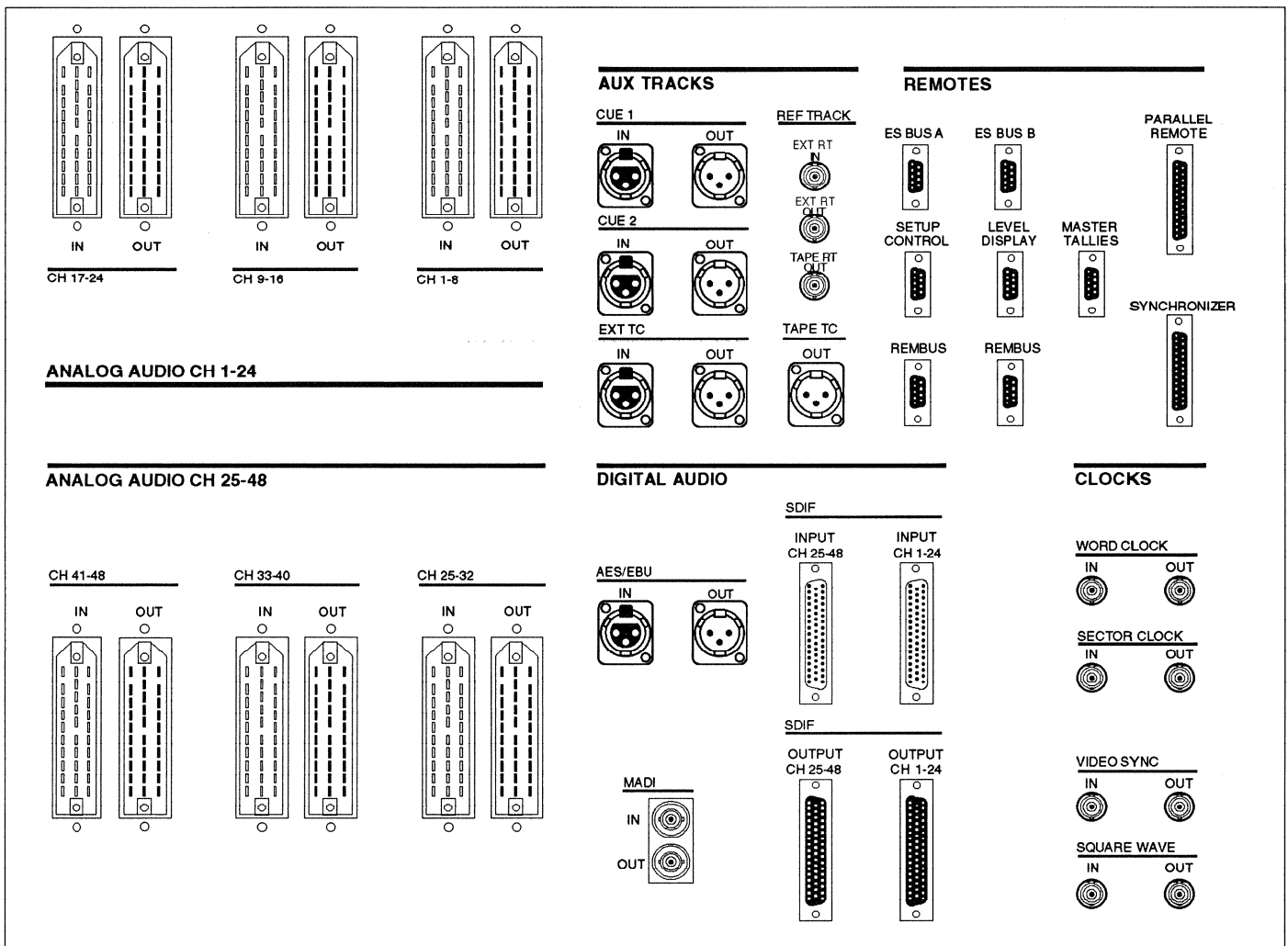
Connector panel of the D827 MCH

2.3.6   Setting the sampling frequency

The D827 MCH can work with sampling frequencies of 48 kHz, 44.1 kHz or 44.056 kHz. The sampling frequency of each tape must be defined at the time it is formatted in NEW RECORD mode because this information is recorded on the reference track (RT).

The setting is made with the LCU key SET RT [44], as described in Section 2.2.5. When a formatted tape is played, the D827 MCH automatically selects the correct sampling frequency based on the RT information.

For certain synchronizer applications, tapes that have been recorded with a sampling frequency of 44.1 or 38 kHz have to be played back with 44.056 or 47.952 kHz. For this purpose switch R004:PULL DOWN to ON. The corresponding SAMPLING FREQUENCY LED flashes.

If a tape is formatted with the function R004:PULL DOWN ON, the RT track is recorded with the 44.1 kHz or 48 kHz information and the machine operates with a sampling frequency of 44.056 or 47.952 kHz. The corresponding SAMPLING FREQUENCY LED flashes.

2.3.7   Choosing the clock source

The D827 MCH can operate with its own, internal clock source or an external clock reference. The EXT CLK key is located on the Local Control Unit. In the SET-UP menu EXT CLOCK REF (S017) the format of the external clock reference must be defined. 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

2.3.8   Varispeed

With the built-in varispeed control the tape speed can be varied from the nominal speed by up to ±12,5%.

Display modes   When varispeed is switched on, the tape speed deviation is shown in the VARISPEED display of the tape deck remote control (autolocator). Three display modes are available in the FUNCTIONS menu VARI DISP (F071):
❑ Speed deviation in percent (%)
❑ Speed deviation in semitones (HT)
❑ Actual speed in inches per second (ips)

SET VARISPEED   The deviation from the nominal speed can be set on the remote control. When the SET VARISPEED key is pressed, the varispeed display shows the deviation in percent, semitones, or ips. The deviation can be varied with the TRIM± keys. The set value remains stored after the SET function has been terminated.

VARISPEED ON / OFF   To change over from nominal tape speed to varispeed, press the VARISPEED ON key on the remote control (Autolocator); the VARISPEED lamp and the sampling frequency display flash.

Ext. Sync.: If one of the two external word clock sources or AES/EBU is used for synchronization, the varispeed setting is ignored. In this case the machine follows the external clock source (and also its deviation from the nominal frequency within the range of approx. 38 to 54 kHz). If the sampling frequency of the clock source does not correspond to the recorded sampling frequency, the error message „WARNING: 800 RT TRACK – SAMP FREQ MISMATCH" appears on the system control display.

If one of the two other external clock sources (video and square wave) is used for synchronization, the varispeed control can be used. The resulting sampling frequency is based on the external reference and the speed deviation set with the varispeed control.

2.3.9 Advanced Output

If a signal is to be reproduced, externally processed and synchronously re-recorded, the signal transit time must be compensated. On tracks with the advanced output function enabled, the output signals are available earlier. The Advanced Output mode can be configured individually for each track. In EDR mode (24 bits) all tracks are configured jointly. Advanced Output is only available in INSERT RECORD mode.
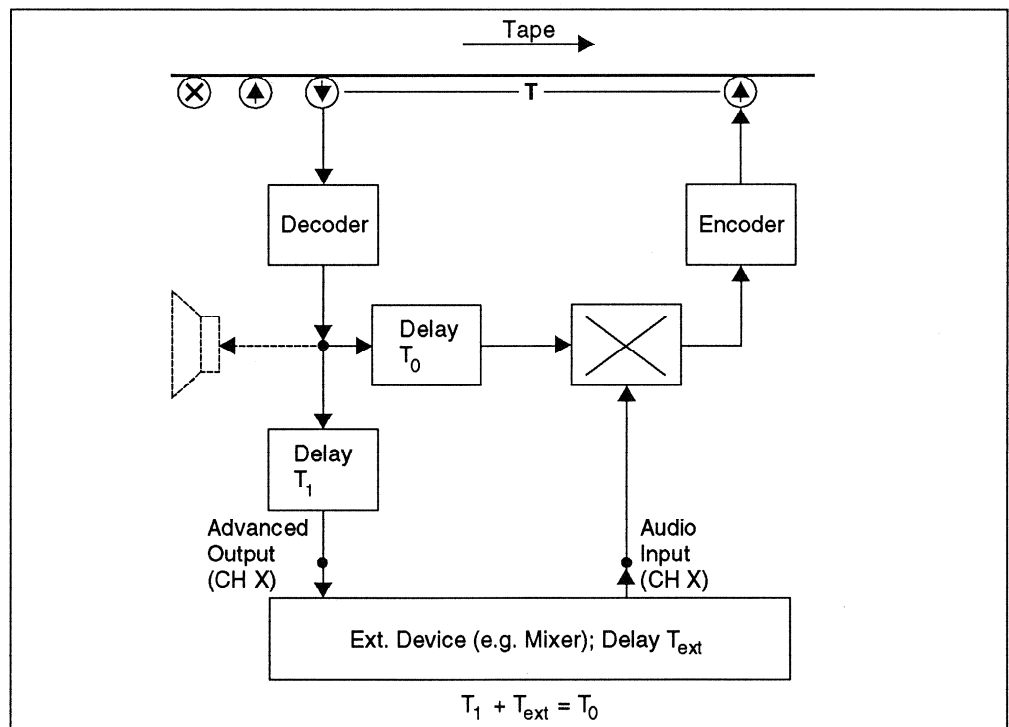
Principle: D827 MCH in INSERT REC MODE + ADVANCED OUTPUT

Neg. delay [Samples]	48.0 kHz	44.1 kHz	44.056 kHz
	Compensation time [µs]		
DIG I/O	0	0	0
15	312.5	340.1	340.5
23	479.2	521.5	522.1
31	645.8	702.9	703.6
AD/DA (16 bit mode)	0 for analog I/O	0 for analog I/O	0 for analog I/O
39 (EDR mode)	812.5	884.4	885.2
47	979.2	1065.8	1066.8
54 (16 bit mode)	1125.0	1224.5	1225.7
53 (EDR mode)	1104.2	1201.8	1203.0

The external delay must be set as a compensation time in the SET AUDIO OUTPUT / ADV. OUTPUT DELAY (S003) menu.

The „DIG I/O" setting compensates for the digital inputs and outputs. The delay time through the analog inputs and outputs of the D827 MCH is compensated with the „A/D-D/A" setting.

ADVANCED OUTPUT The ADVANCED OUTPUT mode is switched on and off with the ADV OUT key on the CHANNEL REMOTE (or F001 function). The signals of all channels that have been configured in the S003 menu with a number of samples will be output early by the amount of this compensation time.

2.3.10 Playback

The PLAY key is used for starting the playback. The PLAY lamp is on.

If PLAY is pressed while a recording is in progress, the machine switches to PLAY without interruption and the RECORD mode is canceled.

If PLAY is pressed in spooling mode, the machine decelerates the tape, the PLAY key flashes until the PLAY command is executed. From PLAY mode it is possible to switch directly to spooling mode or a locator function; when the locator address is reached the machine switches back to PLAY.

When the machine is operated in REHEARSE mode, the PLAY key flashes when it is pressed. The PLAY key also flashes if no RT information is read from tape.

2.3.11 Spooling

The fast FFWD key (Fast ForWarD) and the RWND key (ReWiND) activate the spooling mode in the corresponding direction. The spooling speed can be changed in the SET-UP menu DECK / MAX WIND SPEED (S006) between 0,5 m/s and 15 m/s in steps of 0.1 m.

Cancellation: By pressing either STOP, PLAY, REC+PLAY or LOC.

Tape deck functions can be selected directly, that is, it is not necessary to press STOP first. From spooling mode PLAY or RECORD mode can be activated directly. In this case the preselected key flashes until the corresponding tape speed has been reached and the desired function is executed.

Library Wind To prevent damage to the tape edges on irregular pancakes, the spooling speed should be reduced for creating library pancakes. The library wind speed can be defined in the SET-UP menu DECK / LIBR WIND SPEED (S005) between 0.1 m/s and the maximum spooling speed defined in the SET-UP menu DECK / MAX WIND SPEED (S006) (max. 15 m/s) in steps of 0.1 m/s. The recommended LIB WIND speed is **5 m/s**.

Library Wind is switched on and off with the LIB WIND key on the Channel Remote or in the function menu DECK / LIBRARY WIND (F020).

2.3.12 Stop

STOP has the highest priority and interrupts all other modes such as playback, recording, spooling and locator functions.

The tape tension control is always active. When the tape stands still, that is, in STOP mode you can shuttle it with one hand in either direction.

When the recording mode is canceled with STOP the machine stops only after the punch-out operation has been completed.

2.3.13   Editing, tape cutting

With the D827 MCH a tape can also be edited physically by cutting. In contrast to the editing of analog tapes certain restrictions apply with respect to the distance between edit points. Careful work is essential if muting of the signal is to be avoided. Within the edit area, system induced interpolation occurs.
For this reason tapes should only be edited in audio pauses or electronically rather than physically.

Cueing   During manual cueing the digital tracks cannot be read directly. For this reason a mixdown or a suitable audio track must be copied to one of the CUE tracks. Two CUE tracks are available (see also 2.4.6).

Searching a tape location   ❑ Search the approximate tape location with the spooling functions or PLAY and press STOP.
❑ Search the exact edit point with the autolocator or by manually turning one of the two spindles.

Marking and cutting   ❑ Very carefully mark the back of the tape located in front of the reproduce head with a grease pen – *the reproduce head is sensitive to mechanical stress and contamination.*
❑ Place the marked tape location with the shining oxide coating facing downward into the splicing block (accessory, part No. 1.820.110.12) in such a way that the tape can be cut in the groove by means of a razor blade. For digital multichannel tape use *only* the groove that is *perpendicular to the tape edge!*

Splicing the tape   ❑ Butt the two tape edges to be spliced without a gap and without overlap and join them with adhesive tape.

2.3.14   Locator

The locator installed in the D827 MCH supports the following operating modes:

Z LOC   **Zero Locator**: When the locator key is pressed, the tape spools to the **zero position** which depends on the currently selected display mode: real time tape counter, time code (t), RT (r) or LAP counter (L).

LOC A   A tape address can be stored in the locator and searched in spooling mode by pressing the LOC A key in (LOC A exists only on the LCU of the machine).

The locator function can be canceled by pressing one of the spooling keys (FFWD/ RWND) or STOP, ZERO LOC or LOC START.

Storing a locator address   ❑ Freeze the momentary tape position by pressing the HOLD key. Then press LOC A to store this position and to re-enable the tape counter.

Displaying a locator address   There are two ways of displaying a locator address:
❑ Press the STOP key together with the corresponding LOC key.
❑ When the LOC function has been activated the locator address is shown on the display for as long as the corresponding LOC key is pressed.

PLAY or REC preselection: When PLAY is pressed once during a locator function (ZERO LOC, LOC START, LOC A) or when PLAY is pressed together with REC, the tape machine switches automatically to PLAY or RECORD when the corresponding tape location is reached. If PLAY is pressed a second time during a search function of the locator, the search is canceled and the machine switches to PLAY as soon as the machine has decelerated to the nominal tape speed.
All locator addresses remain stored when the tape machine is switched off.

2.3.15   EDR – Extended Digital Resolution (option)

Operation with 24-bit resolution is available if the 48-track D827 MCH is equipped with software version 2.0 or higher and with the optional MADI24 board.

Two tracks each are used for recording the 24 bits of one audio channel. The 16 high-order bits (MSB) of the 24 channels are recorded on the first 24 tracks and can be reproduced by any DASH machine in 16 bit audio quality. The 8 remaining low-order bits (LSB) of the 24 channels are recorded on tracks 25...48. This signal behaves like noise at approx. -50 dB. The internal signal processors assemble these signals during playback in such a way that 24 bit resolution is achieved also in crossfade areas.

For channel manipulations (except sound memory, ping-pong, etc.) only 24 channels are available in EDR mode. In alignment mode (see 2.2.9 and Service manual) the equalizations and record current are still accessible for all 48 digital audio tracks.

Activation   The EDR mode is activated in menu S060:EDR MODE ON/OFF with the STORE key.

Display   The selected RECORD mode is shown on the SYSTEM CONTROL display.

Behavior in EDR mode   When 24-bit mode is active the D827 MCH behaves like a 24-channel machine. All keys of channels 25...48 are inhibited; the level and channel status indicators, except REC and READY, remain dark. Only in CHECK mode are the bargraphs active for all tracks.

For the Advanced Output Delay time and crossfade times separate registers exist which can be set independently of those for the 16-bit mode.

Limitations   ❑ The ADVANCED OUTPUT DELAY times of all tracks are identical.
❑ SDIF or analog inputs and outputs cannot be used; in menu S002:DIGITAL INPUT you cannot select NONE and SDIF. Only the digital MADI and AES/EBU inputs and outputs are available.
❑ The MADI input configuration cannot be selected in EDR mode, the S041:MADI INPUT menu is suppressed.
❑ If MADI or SDIF sources were configured (DIGITAL IN LED flashes) in 16-bit mode on the CHANNEL REMOTE with the INPUT/REPRO keys, these are reset when the 24-bit mode is activated.

2.4   Recording

Recording with a digital multitrack machine requires certain preparations. These are discussed in this Section and first listed as a summary. Also the three recording modes and their applications are described.

Presettings: **Formatting** a new tape (or a tape erased with a bulk eraser):
1) **Setting the recording mode**
   (Press ENABLE and RECORD MODE; select NEW RECORD).
2) Preparing the reference track recording (RT):
   Selecting the sampling frequency
   (key SET RT -> Menu SET: RT FORMAT / R001: SAMPLING RATE)
   Setting the operating mode of the RT generator
   (key SET RT -> menu SET: RT FORMAT / R002: RT GEN MODE, R003: RT GEN ADDRESS)
3) **Setting the external CLOCK REFERENCE**
   (key EXT CLOCK; menu SET: EXT CLOCK REF)
4) **Selecting the audio input sources** for all tracks
   (Menu SET: AUDIO INPUT);
   For analog sources the peak level may possibly have to be set
   (Menu SET: LEVELS / S022: INP CLIP LEVEL).
5) Preparing the time code recording (TC):
   Select TC source (internal/external)
   (key SET TC -> Menu SET: TC GENERATOR / T001: TC INPUT SOURCE)
   Setting the operating mode of the TC generator
   (key SET TC -> Menu SET: TC GENERATOR / T002: INT TC GEN MODE, T003: INT TC GEN RATE, T004: INT TC GEN ADDR).
6) **Track preselection**
   (keys SAFE / READY; for NEW and ASSEMBLE RECORD modes *all* digital audio channels must be switched to READY).

RECORD settings: The FUNCTIONS menu offers under FCT: RECORD certain settings that influence the behavior in RECORD mode. (See 2.2.8)
❑ **F:048 READY RECORD ON** Allows changeover of individual tracks from PLAY to RECORD with the aid of the corresponding READY key only.
❑ **F:049 RECORD KEY** Determines whether the punch-in from PLAY requires pressing of the RECORD key only (RECORD MODE B) or simultaneous pressing of RECORD + PLAY (RECORD MODE A).
❑ **F:051 RECORD INDICATION ON** Determines whether a record feedback (RECORD lamp on) is given also when all tracks are switched to SAFE (MODE B – this is required if only the AUX tracks are to be recorded).

The tape machine switches to RECORD when **RECORD and PLAY** are pressed together. If RECORD and PLAY are pressed in spooling mode, the machine decelerates the tape. The RECORD function is preselected and the RECORD and PLAY lamps flash.
The RECORD mode is activated as soon as the tape reaches the nominal speed; the two keys are now continuously illuminated. From RECORD mode it is possible to switch directly to spooling mode or to a locator function.

MASTER SAFE: The MASTER SAFE function is a top priority record inhibition. All READY commands are ignored while MASTER SAFE is active and the mounted tape is protected from being overwritten inadvertently.

2.4.1   Tape formatting and first time recording

For a tape that has never been used before on a multichannel DASH machine the *REFERENCE TRACK* (RT) and the digital audio tracks must first be recorded from the beginning to the end of the tape in *NEW RECORD* mode (see below). At the same time also audio signals can be recorded. The reference track is required for sectoring the audio data and defines the data distribution on the tape.
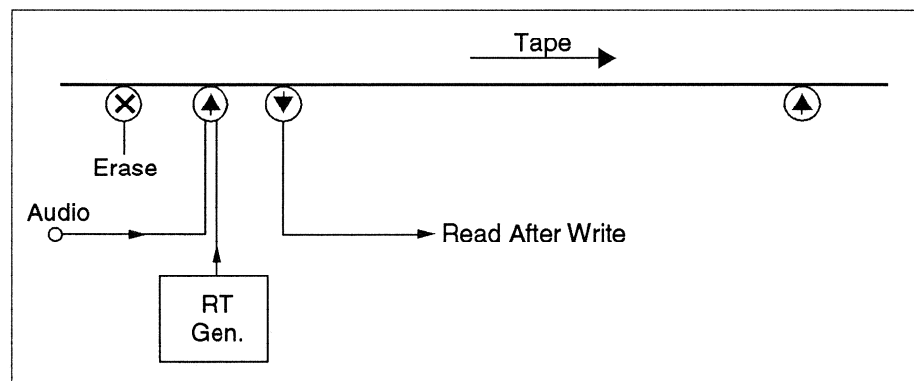
2.4.2   New record mode

Purpose   The NEW RECORD mode is used for virgin tapes or for reformatting previously recorded tapes. *All 48 or 24 audio channels must be switched to READY for this function!*
When NEW RECORD is activated the RT address begins automatically with the time set in the RT generator (R003: RT GEN ADDRESS), if RT GEN MODE (R002) set to FRUN (free running). Digital audio signals existing on the tape are irretrievably destroyed by formatting.
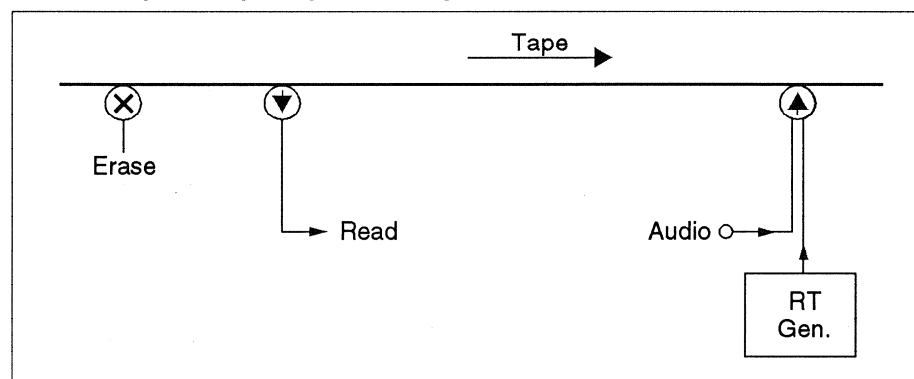
Principle: D827 MCH, NEW RECORD without *New Record Head* option

Principle: D827 MCH, NEW RECORD with *New Record Head* option

Activation   The NEW RECORD mode can only be activated when the machine is switched to STOP. Hold down the ENABLE key while simultaneously selecting the NEW RECORD mode by pressing the REC MODE key.
If the optional NEW RECORD HEAD is installed, the machine works with the additional record head. It records RT and audio signals at the same time. This head arrangement allows READ AFTER WRITE. The tape can be monitored during the recording (source/tape) by using the REPRO keys.

Auxiliary tracks   The auxiliary tracks CUE 1, CUE 2 and TC do not have to be recorded, but if this is desired they must be switched to READY before the RECORD command is given. The reference track (RT) is automatically switched to READY in NEW and AS-SEMBLE RECORD modes.

TC generator   The procedure for setting the internal TC generator is described in Section 2.4.7. If an external TC generator is used make sure that the generator is synchronized with the same clock reference (for example, video) as the D827 MCH. If the internal TC generator is used this synchronization is performed automatically by the D827 MCH.

Display in NEW RECORD mode without New Record Head:

RT display mode: **r rt S t r I PE**

TC display mode: **t t c S t r I PE** (only if TC is written)

DIFF display mode: **r** -- . -- . -- . --- $^{h\ \ m\ \ s\ \ FR}$ (RT)

DIFF display mode: **t** -- . -- . -- . --- (TC, if TC is written)

2.4.3   Assemble record mode

Purpose   This mode is used for recording on a tape that has not been formatted to the end. As in NEW RECORD mode all channels must be switched to READY. Since the SYNC record head is used, READ AFTER WRITE is not possible. When the machine is switched to RECORD the reference track is appended without a gap as if recorded without interruption. For this reason the punch-in must occur within an existing recording.
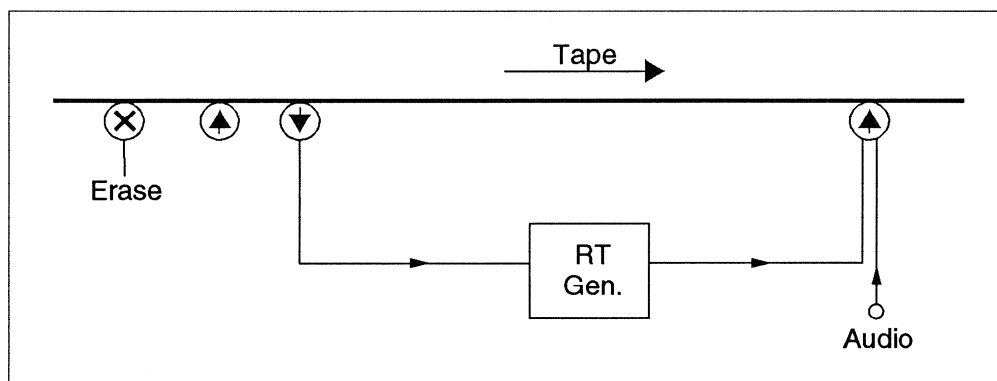
Activation   As in NEW RECORD mode, the machine must be switched to STOP. While holding down the ENABLE key also press the REC MODE key to select ASSEM-BLE mode. *All digital audio channels must be switched to READY.* For this purpose press READY ENABLE together with the ALL key. If also the TC and CUE tracks are to be recorded they must be switched to READY with their SAFE/READY keys before. The RT is automatically switched to READY; for this purpose RT GEN MODE (RT002 in the RT menu) is automatically set to JAMI (= JAM to Input).

Punch-in   The setting of the internal generator is described in Section 2.4.7. Before the machine is switched to RECORD it must be able to read the RT information. Please observe the **RT** level indication on the display panel – the punch-in must occur in a location where valid RT information still exists.

Note: If also the TC needs to be appended without gap, select „Jam to tape" (JAMT) in the TC menu T002:INT TC GEN MODE. The correct INT TC GEN RATE is to be set in menu T003.

2.4.4   Insert record mode

This is the standard recording mode and is comparable with the recording mode of an analog tape machine. Changeover to INSERT RECORD is only possible from the STOP state. While holding down the ENABLE key also press the REC MODE key to select the INSERT mode.

Important: **Completely formatted tapes must be used in this mode!**

The SYNC record head is used for recording the audio signal. Since the SYNC record head is located behind the reproduce head, no source/tape monitoring (read after write) is possible. For this reason the outputs of all channels operating in RECORD mode are switched internally by the D827 MCH to their inputs; the monitored signal corresponds to the recorded signal (exception: in ADVANCED OUTPUT ON – see 2.3.9 – the reproduce signal from tape is always heard).
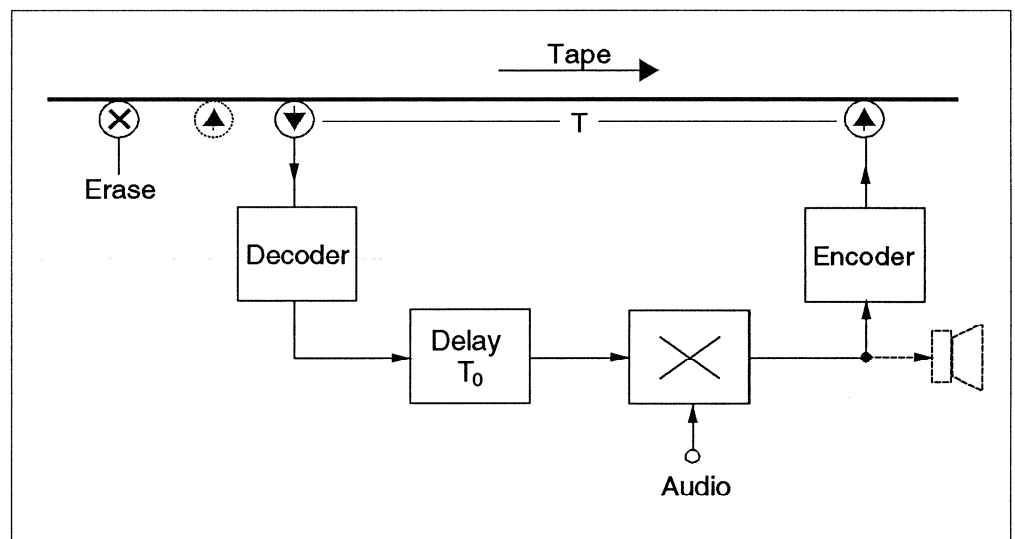
In INSERT RECORD mode the RT information is not overwritten, and all tracks with the exception of RT can be *individually switched to SAFE/READY*.

2.4.5   Record Mute

REC MUTE can be used for recording a digital „zero" signal in any recording mode. Any number of tracks can be included in a mute configuration.

Important: **For channels that are switched to REC MUTE the CHECK function does not supply a meaningful result.**

Determining the MUTE tracks The REC MUTE key recalls the REC MUTE configuration („programming mode"). The REC MUTE LED flashes and the INPUT LEDs identify the tracks that have been preselected for MUTE. REC MUTE is individually preselected for each channel with the INPUT-/REPRO keys.
On the LCU (Local Control Unit): The ALL key enables/disables REC MUTE for all tracks.
On the CHANNEL REMOTE: The ALL INPUT key enables REC MUTE for all tracks whereas ALL REPRO disables REC MUTE for all tracks.
To terminate the programming mode press the REC MUTE key.

MUTE activation While holding down the ENABLE key also press the RECORD MUTE. The RECORD MUTE LED is now permanently on. A digital „zero" signal will be recorded on all previously selected tracks (switched to READY) when the next RECORD command is given.
If the output signal is switched to INPUT in RECORD MUTE mode the INPUT LED of this track flashes. The input signal is looped through to the output but it is not recorded. In the REPRO setting the output is muted but the level bargraphs remain active for level adjustment.
This function can be used for Spot Erase of unwanted data by means of punch in and punch out. For greater accuracy an automatic punch-in and punch-out can be programmed with the autolocator.

2.4.6 Recording the CUE tracks

CUE recording The two CUE tracks can be used for searching a cue point on the tape. On the D827 MCH the cue tracks are recorded in PWM technique. Other manufacturers used analog bias. For playback of such tapes the demodulation can be switched over in the menus F010 and F011 from PWM to ANALOG.

Note: For recording the CUE tracks only, RECORD INDICATION B (F051) must be selected.

Connectors, levels The Input and output signals of the CUE tracks are available as balanced analog signals on the corresponding XLR connectors. The levels of these connectors (same level for input and output) is set in the menu S021 (CUE CLIP LEVEL). Our recommendation is to set the same level as for the analog inputs and outputs.

Channel status The status of the CUE tracks is changed over with the corresponding preselection keys (SET READY, SET SAFE, SET INPUT and SET REPRO) together with the channels selection keys CUE 1 and CUE 2. If SET READY and INSERT RECORD mode are selected, the channel selection key can be used to switch from READY to AREC (AUTO RECORD).

SAFE/READY These settings behave the same as for an audio channel.

AREC AUTO RECORD: Characteristical is that the CUE tracks are switched to RECORD also in PLAY mode. In this way the current mix can be recorded on the CUE tracks during each playback.
AUTO RECORD is available only in INSERT RECORD mode.

REC The red LED which is continuously on indicates that the corresponding cue track is in RECORD mode.
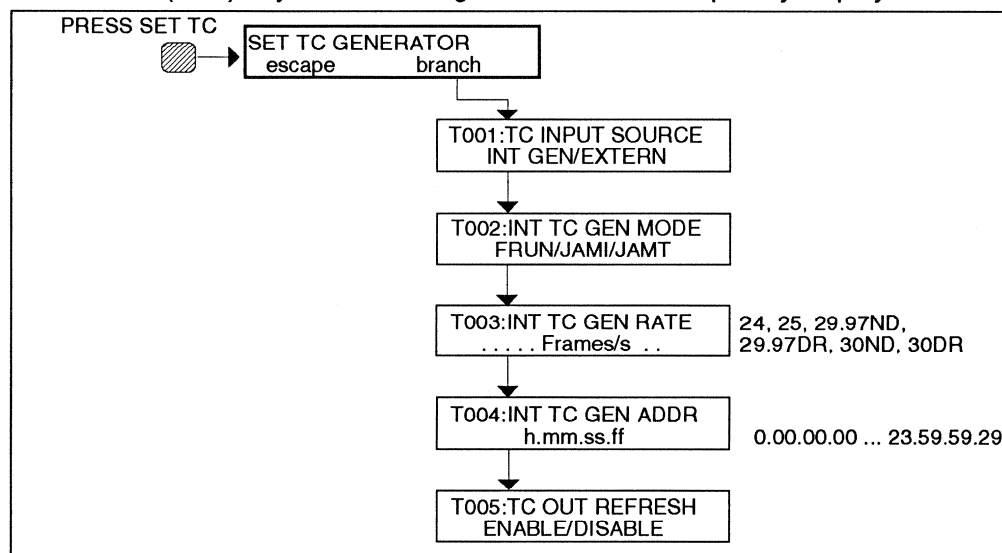
2.4.7   Recording the time code track

In the DASH format the time code (TC) is recorded on a dedicated track, independently of the audio, cue and RT tracks. The TC is supplied by the internal TC generator or an external source. The corresponding changeover is made in the TC direct access menu (see 2.2.6) with the function T001:

❏ The default setting is the internal TC generator (the INT GEN indication in the system control display is permanently on).

❏ Changeover to the external generator (the EXTERN indication in the system control display is permanently on) by pressing the STORE key after the PROG ENABLE LED has been switched to flashing with the PRG ENABLE key.

Note: For recording the TC source only, RECORD INDICATION B (F051) is required.

Internal TC generator

SET TC GENERATOR   A specific address, operating mode, and frame rate can be entered by pressing the SET TC (LCU) key. The following choices are subsequently displayed:

```
PRESS SET TC
   ▨ ──▶  ┌─────────────────────────┐
          │ SET TC GENERATOR        │
          │  escape        branch   │
          └─────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────┐
              │ T001:TC INPUT SOURCE    │
              │      INT GEN/EXTERN     │
              └─────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────┐
              │ T002:INT TC GEN MODE    │
              │      FRUN/JAMI/JAMT     │
              └─────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────┐     24, 25, 29.97ND,
              │ T003:INT TC GEN RATE    │     29.97DR, 30ND, 30DR
              │      . . . . . Frames/s . .  │
              └─────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────┐
              │ T004:INT TC GEN ADDR    │     0.00.00.00 ... 23.59.59.29
              │      h.mm.ss.ff         │
              └─────────────────────────┘
                            │
                            ▼
              ┌─────────────────────────┐
              │ T005:TC OUT REFRESH     │
              │      ENABLE/DISABLE     │
              └─────────────────────────┘
```

T002: INT TC GEN MODE   The internal TC generator (T001: TC INPUT SOURCE INT GEN) starts in FRUN mode (= Free RUN) at the preprogrammed address (T004: INT TC GEN ADDR) when the RECORD command is given.

In **JAMI** mode (= JAM to Input) an external time code is briefly read at the start of the recording, synchronously regenerated and recorded. In this way a poor time code can be regenerated; the frame rate is matched to this external code.

JAMT mode (= JAM to Tape) continues the TC on the tape without gap and is consequently needed in ASSEMBLE and INSERT RECORD modes (inhibited in NEW RECORD mode).

All JAM modes must be able to read code (TC or RT) before code can be written. In JAM mode the frame rate of the TC generator must be matched to the one of the source. The frame rate can be set to 30 (non-drop or drop frame), 29.97 (non-drop or drop frame), 25 or 24 frames/s.

T003: INT TC GEN RATE   With the SET PARAMETERS wheel the corresponding TC generator rate can be selected. It is coupled with the sampling frequency.

T004: INT TC GEN ADDR   After you have entered the address with the cursor keys ← and → and the SET PARAMETERS wheel, press the STORE key. The generator starts each recording with this preset time. The TC generator continues to run also after the recording is canceled. At the beginning of the next recording the generator jumps back to the start address and begins with this value.

The output of the internal TC generator is available on the TAPE TC OUT [1] connector on the rear panel if the TC track is switched to INPUT. If the TC track is switched to REPRO the TC from tape is available at this socket.

[2]　　　[3]　　　[1]
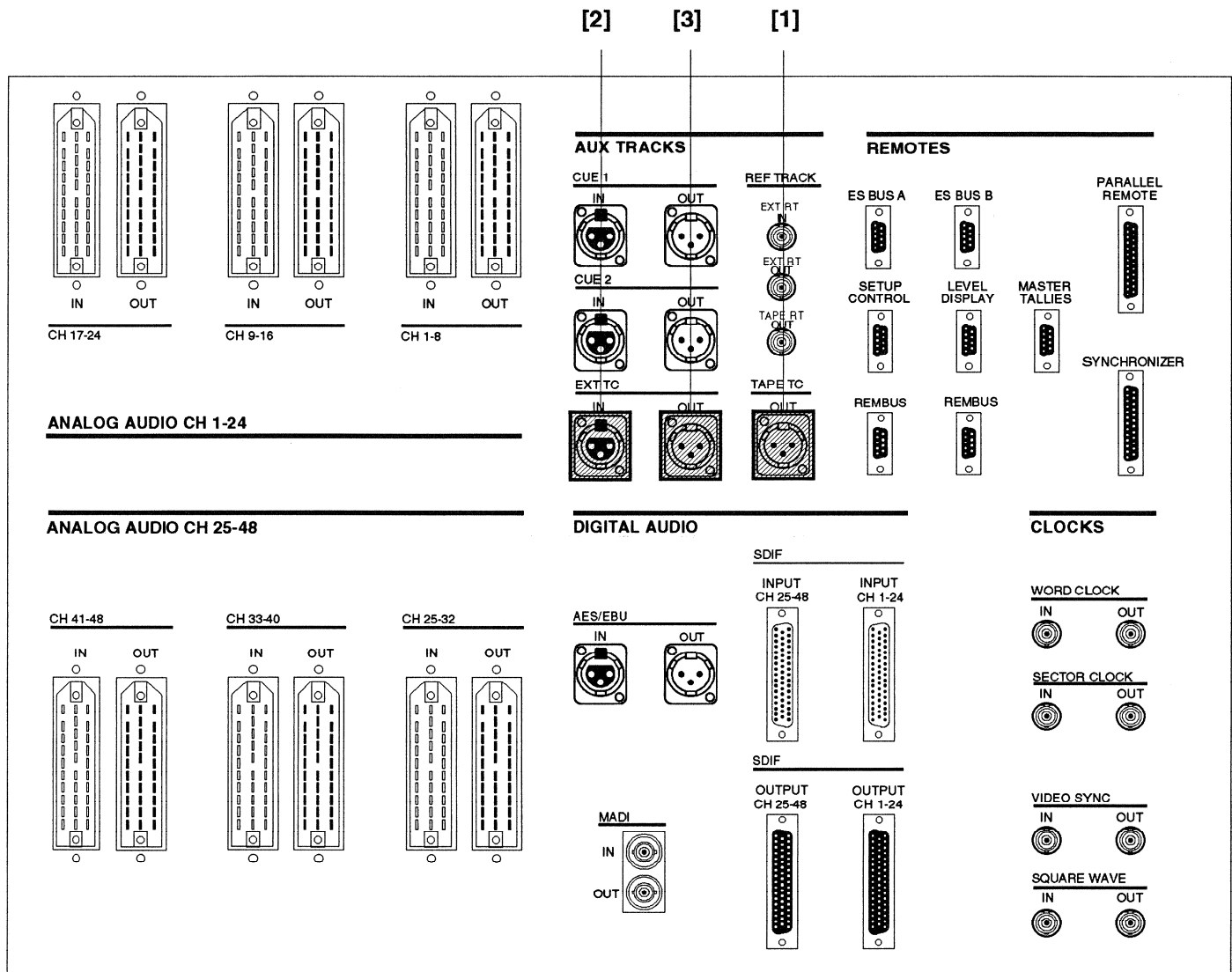
Connector arrangement TC IN/OUT

T005: TC OUT REFRESH	DISABLE: The TC is read in correct time relationship with the audio signal from tape (for external synchronizer). ENABLE: The TC is regenerated via a separate TC generator in correct time relationship with the audio signal. This TC is now free of drop-outs and has regenerated edges. TC is also available in STOP and (interpolated) in spooling mode (normal operation).

TC recording from an external source

Note:	When an external TC generator is used, make sure that the generator and the machine are coupled through a *common* clock source (for example, video). In the TC direct access menu under T001:TC INPUT SOURCE you can switch to an external TC source: *EXTERN* is continuously on. An external TC signal can be input at the XLR socket EXT TC IN [2] on the rear panel. This signal is looped through to the XLR connector EXT TC OUT [3].

2.5   Synchronizing with the internal synchronizer

Synchronizer built in   For synchronizing the D827 MCH with audio or video machines the internal synchronizer supplies all necessary functions. Reference to the TC or RT as a time reference is possible. The audio related and sample accurate synchronization between DASH machines is based on the reference track – this is the most accurate way of synchronizing two DASH machines.

2.5.1   Synchronization and integration in other systems

In many applications the digital tape machine is not an autonomous device connected to a mixing console but part of a complex system with an editor or controller, a number of different audio units and video machines.

To achieve a functional system three interfaces must be correctly matched:
❏ *External clock reference signal* (clock source), S017 (EXT CLOCK REF)
❏ *Audio input signal*, setup menu S002 (AUDIO INPUT) and S001 (SDIF-INPUT), S018 (2CH AES INPUT), S041 (MADI INPUT)
❏ *Connected control signals* (Master Tallies, etc.)

2.5.2   Interface for synchronization signals

Clocks   The internal generator derives the clock reference of the D827 MCH from a quartz oscillator. It can be synchronized also to an external clock source (for example, Composite Video signal, Word Clock, AES/EBU).

An external reference is only required for synchronizing digital equipment. If two digital units are to be coupled with the digital audio data transfer, or if rigid, frame-accurate synchronization with a video system is needed, the corresponding reference must be selected.

LOCK   The synchronization initiated with the LOCK command proceeds as follows:

1.   The difference between the desired position specified by an external time code source and the actual time code on the tape is calculated. With the spooling motors and the capstan motor the difference is gradually reduced to nearly zero. During this time the audio signals from the tape are muted.

2.   When synchronism has been achieved the tape machine switches to the selected clock source. Muting of the audio signals from the tape is canceled.

Note: If an external TC generator is used, make sure that the generator and the machine are coupled to a *common* clock source (for example, Video).

RT synchronization   *If the master machine is also a D827 MCH,* RT/RT synchronization can be selected. In this case the RT signals rather than the SMPTE/EBU time codes are used; this synchronization provides sample-accurate resolution.

TC LOCK   *If the master machine does not offer a clock reference* (e.g. analog master recorder) or if no common clock source exists, the „TC LOCK" mode can be selected. In this case the machine never switches to an external clock source but remains always under control of the external time code. Since the internal clock is derived from the TC afflicted with jitter, the internal clock inherits this jitter. This can impair the audio quality.

Note: In TC LOCK mode also the sampling frequency varies slightly which means that the digital output is generally of limited use.

In such a case the DASH machine is preferably used as the master and its clock stability used for synchronizing the analog machine.

Clock sources   The following external clock sources are possible:
- ❏ *Word Clock* (square-wave signal with a frequency of either 48 / 44.1 / 44.056 kHz or derived from the AES/EBU signal).
- ❏ *Video Clock* (Composite Video/Composite Sync signal with 25 / 29.97 / 30 frames/sec.).
- ❏ *Square wave* (square-wave signal with 24 / 25 / 50 / 59,94 / 60 Hz).

Video synchronization   The D827 MCH is equipped with a *time code generator* that can be coupled to an external *Video-Sync signal* (if available). If EXT CLOCK REF (S017) is selected as one of the video formats, the output time code is synchronized during playback in such a way that it is phase-locked to the incoming video clock without frame edge synchronization.

2.5.3   Operation with the internal synchronizer

Setting the PARK OFFSET for internal synchronizer mode:

When the master switches to STOP in synchronizer mode, the slave parks before or after the master by the amount specified with PARK OFFSET. By optimizing the PARK OFFSET setting (menu S031:PARK OFFSET) the time for achieving lock-up can be minimized.

The optimum PARK OFFSET depends on different factors (type of master, PLAY and STOP Master Tallies, TC OUTPUT REFRESH etc.). For this reason approximate values are specified here that can be used as the starting point for individual optimization.

Master	Slave	Master Tallies	PARK OFFSET setting
D827 MCH, SW 1.0	D827 MCH, SW 2.0	Move Clock, DIR, PLAY, RECORD	–0.200 s
D827 MCH, SW 1.0	D827 MCH, SW 2.0, TC SYNC	not used	+1.300 s (Default)
D827 MCH, SW 1.0	D827 MCH, SW 2.0, RT SYNC	not used	+0.600 s
D827 MCH, SW 2.0	D827 MCH, SW 2.0	Move Clock, DIR, PLAY, RECORD	+0.100 s
D827 MCH, SW 2.0	D827 MCH, SW 2.0, TC SYNC	not used	+1.300 s (Default)
D827 MCH, SW 2.0	D827 MCH, SW 2.0, RT SYNC	not used	+0.400 s
D820 MCH	D827 MCH, SW 2.0	Move Clock, DIR, PLAY, RECORD	–0.400 s
D820 MCH	D827 MCH, SW 2.0, TC SYNC	not used	+1.300 s (Default)
D820 MCH	D827 MCH, SW 2.0, RT SYNC	not used	+1.000 s
Sony PCM 3348	D827 MCH, SW 2.0	PLAY, RECORD	+0.400 s
Sony PCM 3348	D827 MCH, SW 2.0, TC SYNC	not used	+1.300 s (Default)
Sony PCM 3348	D827 MCH, SW 2.0, RT SYNC	not used	+0.600 s
Sony PCM 3324	D827 MCH, SW 2.0	PLAY, RECORD	+0.300 s
Sony PCM 3324	D827 MCH, SW 2.0, TC SYNC	not used	+1.300 s (Default)
Sony PCM 3324	D827 MCH, SW 2.0, RT SYNC	not used	+0.600 s

Additional Notes: If the slave (D827 MCH) receives neither STOP nor PLAY Tally from the master, the PARK OFFSET should be selected in such a way that master achieves the nominal PLAY speed approx. 500 ms before the stopped slave.

If the PLAY Tally is connected from the master to the slave (D827 MCH), the PARK OFFSET should be selected in such a way that after the start of the master the difference is minimal at the time the slave achieves nominal PLAY speed.

If STOP and PLAY Tally are connected from the master to the slave (D827 MCH), the PARK OFFSET should be optimized for two criteria:
- Minimum lock-up time; after the start of the master the difference should be minimal when the slave achieves nominal PLAY speed.
- Immediate STOP of the slave after the STOP of the master; if the master stops in locked condition the PARK OFFSET should be selected in such a way that the slave stops exactly at the right location.

PRECISION LOCK The internal synchronizer distinguishes between PRECISION LOCK *ON* (high synchronization accuracy; sample accurate for RT, possibly also for TC) and PRECISION LOCK *OFF* (for fast synchronization; a small error – typ. ±1...4 ms, max. ±10 ms – intentionally accepted).

In PRECISION LOCK *OFF* the synchronous state is achieved much faster in the following LOCK modes:
- With TC synchronization: LOCK, INST LOCK, EDIT WAIT and EDIT LOCK (if TC LOCK is switched off), as well as ES bus absolute video lock mode.
- With RT synchronization: LOCK, INST LOCK, EDIT WAIT and EDIT LOCK.

In all other LOCK modes the activation of PRECISION LOCK influences neither the speed nor the accuracy.

PRECISION LOCK *OFF* can also be used if the sync window must be larger, e.g. for Master TC with fluctuations.

Sample accurate synchronization

of two D827 MCH is reliably achievable if the MAPROs of the two machines are in the same Recording mode – SYNC REC, that is, ASSEMBLE or INSERT RECORD, or NEW RECORD without optional NEW RECORD HEAD). If one of the machines is equipped with the optional NEW RECORD HEAD, the following tables should be consulted. In this case a D820 MCH behaves like a D827 MCH equipped with NEW RECORD HEAD and MAPRO 1.863.652.20 .

Summary: If the master and the slave machine are in ASSEMBLE or INSERT mode, no offset exists. An offset can occur only in connection with the optional NEW RECORD HEAD and only in the combinations shown in the following table.

For a 1:1 back-up the master machine must operate in ASSEMBLE RECORD mode (with ADVANCED OUTPUT:ON and ADV OUTP DELAY:DIG I/O), and the slave machine in NEW RECORD mode – see Section 3.8 of the Set-up Guide. In this way *no time offset* occurs in RECORD mode.

The following tables specify which offset occurs as a function of the MAPRO configuration *if the Master and Slave are in PLAY mode* and different Recording modes are used. The following table specifies in which column of the four subsequent tables the offset can be found for each specific case.

MASTER MAPROs	SLAVE MAPROs	Table column
1.863.652.20	1.863.652.20	1
1.863.655.20	1.863.660.20	2
1.863.660.20	1.863.652.20	3
1.863.652.20	1.863.660.20	4

Audio offset, if neither the master nor the slave are equipped with the NEW REC HEAD:

REC MODE MASTER	REC MODE SLAVE	1 [samples]	2 [samples]	3 [samples]	4 [samples]
NEW	NEW	0	0	0	0
NEW	ASS	0	0	0	0
NEW	INS	0	0	0	0
ASS	NEW	0	0	0	0
ASS	ASS	0	0	0	0
ASS	INS	0	0	0	0
INS	NEW	0	0	0	0
INS	ASS	0	0	0	0
INS	INS	0	0	0	0

An audio offset >0 signifies that the slave's audio signal is leading with respect to the master's.

Audio offset, if only the master is equipped with the NEW REC HEAD:

REC MODE MASTER	REC MODE SLAVE	1 [samples]	2 [samples]	3 [samples]	4 [samples]
NEW	NEW	−67	−67	−127	−127
NEW	ASS	−67	−67	−127	−127
NEW	INS	−67	−67	−127	−127
ASS	NEW	0	0	0	0
ASS	ASS	0	0	0	0
ASS	INS	0	0	0	0
INS	NEW	0	0	0	0
INS	ASS	0	0	0	0
INS	INS	0	0	0	0

An audio offset >0 signifies that the slave's audio signal is leading with respect to the master's.

Audio offset, if only the slave is equipped with the NEW REC HEAD:

REC MODE MASTER	REC MODE SLAVE	1 [samples]	2 [samples]	3 [samples]	4 [samples]
NEW	NEW	67	127	67	127
NEW	ASS	0	0	0	0
NEW	INS	0	0	0	0
ASS	NEW	67	127	67	127
ASS	ASS	0	0	0	0
ASS	INS	0	0	0	0
INS	NEW	67	127	67	127
INS	ASS	0	0	0	0
INS	INS	0	0	0	0

An audio offset >0 signifies that the slave's audio signal is leading with respect to the master's.

Audio offset, if master and slave are equipped with the NEW REC HEAD:

REC MODE MASTER	REC MODE SLAVE	1 [samples]	2 [samples]	3 [samples]	4 [samples]
NEW	NEW	0	0	0	0
NEW	ASS	−67	−67	−127	−127
NEW	INS	−67	−67	−127	−127
ASS	NEW	67	127	67	127
ASS	ASS	0	0	0	0
ASS	INS	0	0	0	0
INS	NEW	67	127	67	127
INS	ASS	0	0	0	0
INS	INS	0	0	0	0

An audio offset >0 signifies that the slave's audio signal is leading with respect to the master's.

Cloning and DASH lock with Sony DASH recorder as player or master

Cloning: The alignment between the RT and audio at the SDIF input/output of the D827 MCH has been optimized for cloning (1:1 copy) and DASH lock with the Sony DASH recorders PCM-3348, PCM-3324A (modified) or PCM-3324S as player or master. For creating a true 1:1 copy of a digital tape the D827 MCH must be operated in NEW RECORD mode, the Sony player must be forced into Block Phase 0/0 (the LEDs „M" and „L" on the CTL board must be off). In addition the following settings must be made (see also Section 3.9 of the Set-up Guide):

Sony Player	Sony ADV. OUTPUT MODE	Sony ADV. OUTPUT DELAY	Studer ADV. OUTPUT MODE	Studer ADV. OUTPUT DELAY	Studer CTL JAM
PCM-3348	ON	47	--	--	PCM-3348
PCM-3324A	--	--	--	--	PCM-3324A

DASH Lock: The D827 MCH must operate in ASSEMBLE or INSERT RECORD mode – see Section 4.4 of the Set-up Guide. The following settings are necessary for achieving correct allocation of RT to audio at the SDIF input of both machines:

Sony Player	Sony ADV. OUTPUT MODE	Sony ADV. OUTPUT DELAY	Studer ADV. OUTPUT MODE	Studer ADV. OUTPUT DELAY	Studer CTL JAM
PCM-3348	ON	14	ON	15	--
PCM-3324A	--	--	ON	DIG I/O	--

If the master is a PCM-3324A, the audio samples of the D827 MCH are delayed by one sample.

Formatting during a 96-channel synchronous recording

Synchronous formatting of two tapes on two D827 MCH machines with simultaneous recording of up to 96 tracks is possible with the new RT board (1.863.657) by means of INPUT/REPRO changeover.

Settings:

	Master	Slave
RECORD MODE	NEW	NEW
RT GEN. MODE	FRUN	JAMI
RT OUTPUT MODE	INPUT	any
TC INPUT SOURCE	INT GEN	EXT
INT TC GEN. MODE	FRUN	any
TC OUT REFRESH	ON	any
TC OUTPUT MODE	INPUT	any
CLOCK REF.	INT	EXT
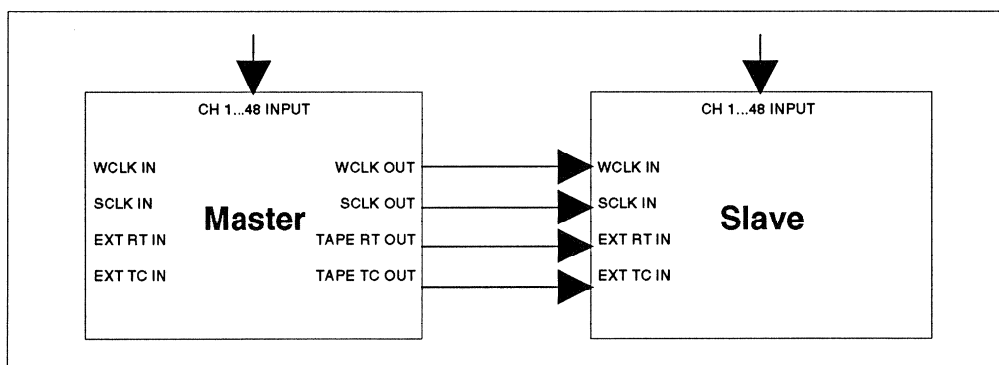
2.6   AES/EBU interface

2.6.1   Selecting a suitable signal source

The D827 MCH can be connected to another digital audio device (for example, CD player) via the 2-channel AES/EBU interface, provided this device is also equipped with an AES/EBU output.

The AES/EBU input circuit of the D827 MCH accepts all conventional implementations. The professional format is supported actively, but also the consumer format (SPDIF) can be read.

The connectors for the AES/EBU interface are located on the rear panel. One XLR connector for input [1] and one for output [2] are available.
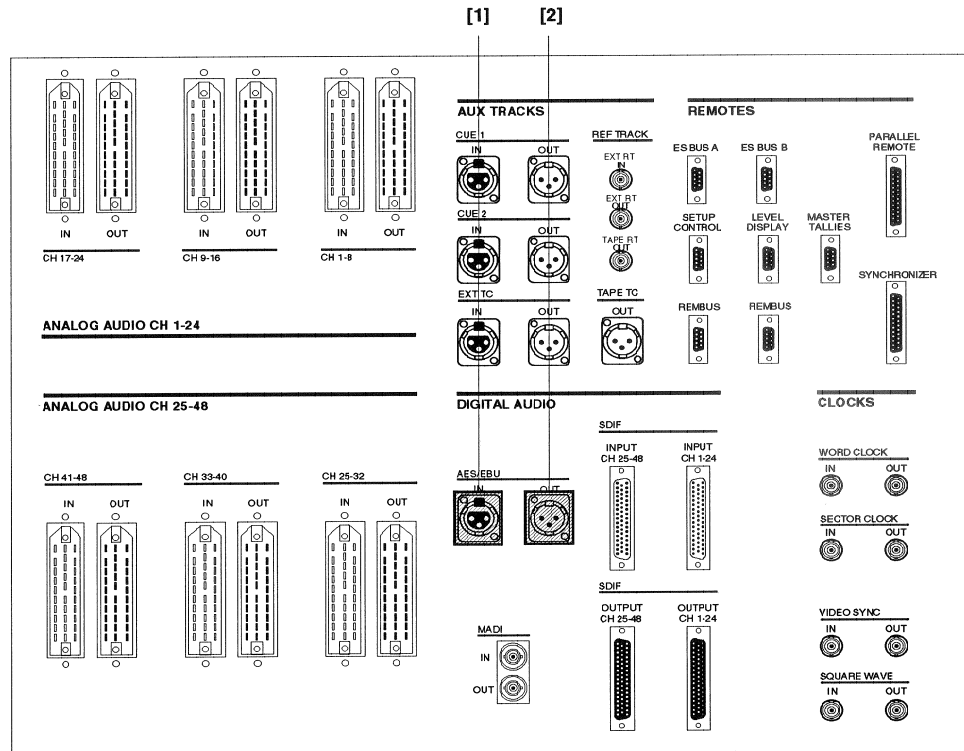
Connector arrangement AES/EBU In-Out

2.6.2   Channel assignment of the AES/EBU outputs

The input and output channels are selected in the set-up menu under SET:AUDIO INPUT and SET:AUDIO OUTPUT (S018 and S019). Detailed information on the set-up menu can be found in Section 2.2.7; see also Section 3.4 of the Set-up Guide.

When both input channels are assigned to the digital format AES/EBU, they are switched automatically to DIGITAL INPUT whereas all other channels are switched to ANALOG INPUT. The existing DIGITAL INPUT configuration remains stored and is reestablished as soon as DIGITAL INPUT (S002) is switched back to SDIF or MADI. It is possible to assign both outputs (but not the inputs) to the same channel.

Note: When an AES/EBU is assigned the machine must be synchronized to this clock source. For this reason the clock reference *AES/EBU* must be selected in the set-up menu S017. On the LCU (Local Control Unit) EXT CLK [38] must be activated.

3 Operation of the remote controls

3.1 Channel Remote (Audio remote control)
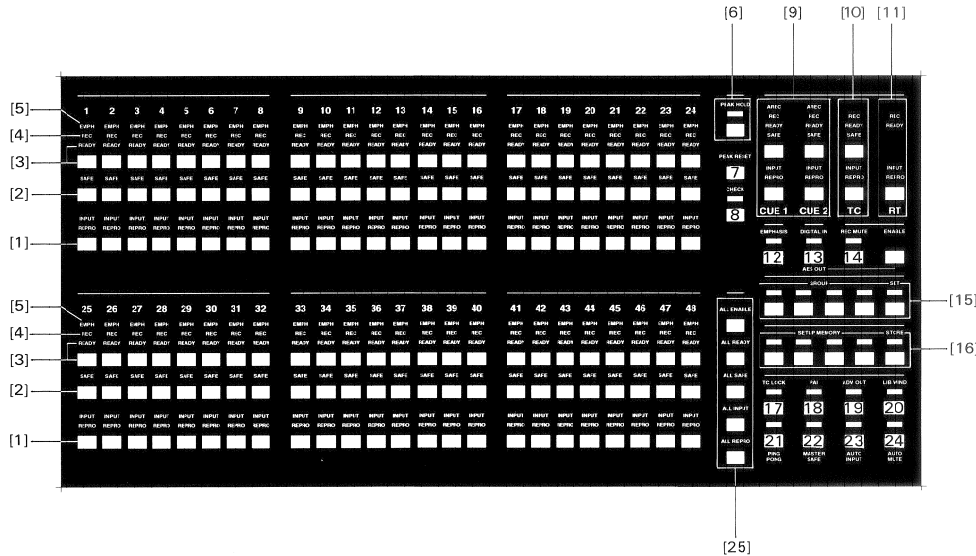
⚠ **Remote control cables may be connected and disconnected only when all units involved have been switched off.**

The remote control is powered via the remote control cable. Connection: See Section 4.

The tape machine can be operated with the remote control only when the REMOTE function on the LCU is on.

Lamp check: Hold down the ALL ENABLE key and in addition press the CHECK key. Press any key to cancel the lamp check mode.

3.1.1 Operator controls

[1] INPUT / REPRO   Keys for switching the output signals of the individual channels between INPUT and REPRO (from tape). The selected mode is confirmed with the INPUT or REPRO lamp.

[2] SAFE   Keys for activating the record inhibition of the individual channels. The SAFE lamp is on when recording on the corresponding channel is inhibited.

[3] READY   Keys for switching the individual channels to ready mode. The flashing READY lamp signals that the corresponding channel will switch to record mode when the next RECORD command is given.

Note: With F048:READY RECORD ON also groups of channels can be switched to record mode via ALL READY.

[4] REC   The red REC lamp is on for all channels that are switched to record mode.

[5] EMPH   The EMPH lamp shows various states depending on the operating mode:
❑ Channels that are switched to input from analog source: *Pre-Emphasis filter active.*
❑ Channels that are switched to input from a digital source: *Emphasis bit in data stream set.*
❑ Channels that are switched to REPRO: *Emphasis bit set* (i.e. pre-emphasis was used during the recording). At the analog outputs the *de-emphasis filter is automatically active;* on the digital outputs the *emphasis bit is set in the output data stream.*

[6] PEAK HOLD   When this key is pressed once the momentary PEAK HOLD mode is activated. The peak level is frozen for approx. 3 s by the top LED of the level indicator. When the PEAK HOLD key is pressed twice, the peak value over an unlimited period of time is shown. In this way the peak level occurring within an entire recording can be determined. Peak level indication is canceled with the PEAK RESET key [7]. PEAK HOLD can also be used in conjunction with the CHECK function in which case the momentary PEAK HOLD mode is not applicable.

[7] PEAK RESET   The PEAK RESET key is used for resetting the peak level indication.

[8] CHECK   The CHECK key switches the audio level indication (on the LCU and/or on the Remote Level Display) to tape quality display mode. The top and bottom LEDs of the level bargraphs are continually on. *Activation of the CHECK function is only useful in PLAY mode.* In all other tape deck states the minimum value is shown.
If a tape is not formatted, no PLAY condition can be established; neither quality nor TAPE EMPTY indication is possible (the PLAY lamp flashes, the RT level indication in REPRO remains dark, and on the RT tape counter the decimal point is missing behind the „r").
If a tape is partially formatted, TAPE EMPTY can only be detected if play was started in a formatted location.
If a tape recorded on a 24-track machine is reproduced on a 48-track machine, TAPE EMPTY is correctly indicated for the unformatted tracks 25...48.
From the top to bottom all CRC errors of the corresponding tracks are averaged and displayed across a sliding time window of approx. 3.5 s (Short Term). From the bottom to the top they are averaged and displayed across a sliding time window of approx. 28 s (Long Term).

Interpretation: 1 to 2 LEDs: Very good conditions
2 to 3 LEDs: Good conditions
3 to 4 LEDs: Tolerable conditions
5 to 6 LEDs: High error rate
WE LED: Interpolations occur.

These LEDs indicate a trend. As long as no WE (Word Error) is indicated the original still exists. The probability that also WE errors occur is high or greater than under good conditions (2 to 3 LEDs) when the CRC error rate is high. If tapes continually produce high error rates it is advisable to make a copy of these tapes. The Short Term indication points to local tape errors. The Long Term indication points to a general problem (for example, contaminated heads or tape guides, scratches running parallel to the tape edge, worn heads). If the error rate is high the heads and the tape guides should be cleaned. For comparison a tape with known error behavior, for example, with excellent conditions, should be mounted in order to determine whether the problem is caused by the tape or the machine. The Long Term as well as the Short Term CRC peak values as well as the tape empty indication can be frozen with the PEAK HOLD key [6].

Note: During the formatting of a tape the CHECK function is only useful in conjunction with the NEW RECORD HEAD option and NEW RECORD mode. The channels which in this mode simultaneously record in REC MUTE do not give any meaningful CRC indications. A higher error rate may possibly be measured when the tape unthreads at the end of the tape. In this case measurements with PEAK HOLD are not meaningful.

[9] CUE1, CUE2

CUE tracks 1 and 2 are switched to SAFE, READY or AREC with one changeover key each. The current mode is indicated by the corresponding lamp. In the READY status the channels are ready for recording the analog input signals available on the connectors CUE 1 IN or CUE 2 IN. When recording is in progress the red REC lamp is on.

AREC AUTO RECORD: The CUE tracks switch to record when a PLAY command is given. In this way an (external) mixdown of channels from tape can be recorded to the CUE tracks.
Channel Remote MkII is additionally equipped with one INPUT/REPRO key each for the two CUE tracks.

[10] TC

SAFE/READY changeover for the time code track.

Note: For recording CUE or TC tracks alone (without Audio) F051:RECORD INDICATION B is required.
Channel Remote MkII is additionally equipped with an INPUT/REPRO key for the time code track.

[11] RT

The lamps indicate whether the RT track (Reference Track) is switched to READY (green) or to record (REC; red). SAFE/READY preselection for the RT track is made by choosing the REC MODE:
❑ NEW REC: RT track to READY
❑ ASSEMBLE REC: RT track to READY
❑ INSERT REC: RT track to SAFE.
Channel Remote MkII is additionally equipped with an INPUT/REPRO key for the RT track. The prerequisite for INPUT/REPRO changeover of the RT track is an RT BOARD 1.863.657.20 or newer.
Actuation of the RT key switches the RT output to the input or to the signal from tape.

INPUT When the RT track is switched to INPUT the internal RT generator is connected to the output. When the changeover to INPUT occurs the RT generator is automatically started in the selected mode (FRUN/JAMI/JAMT). In this way it is possible to use the generator signal also for additional machines.

REPRO The RT signal from tape is connected to the output also when the machine is switched to record (Exception: NEW RECORD without New Record Head option).

[12] EMPHASIS

Operation together with REPRO keys.

Activates/deactivates the pre-emphasis filters (only for channels equipped with A/D converters, which are switched to analog input).

While EMPHASIS is held down press the REPRO keys to activate/deactivate the pre-emphasis filters in the analog input of one or several channels (the EMPH lamps on the LCU and Channel Remote of the corresponding channel are on when emphasis is active).

ALL INPUT activates the emphasis for all channels equipped with A/D converters that are switched to Analog Input. ALL REPRO deactivates the emphasis of all channels.

[13] DIGITAL IN / AES OUT

Influences the digital input configuration (AES/EBU, SDIF, or MADI input channels).

The DIGITAL IN key has no effect if the current configuration is programmed toNONE, or to MADI in EDR mode.

If AES/EBU is selected as the digital source no more than two channels are indicated (INPUT LED) in the DIGITAL IN configuration. The first of the two selected channels corresponds to CH A of the AES/EBU format (left), the second one corresponds to CH B (right).

If MADI or SDIF is selected as the digital source and DIGITAL IN is active, the corresponding channel can be switched between analog and digital input with the INPUT/REPRO key of the corresponding channel. ALL REPRO sets *all* inputs to analog, ALL INPUT sets them to digital.

The AES/EBU output channels are assigned on the channel remote control with active AES OUT key (DIGITAL IN and ENABLE together) and the INPUT/REPRO key of the desired audio track. The first of the two selected channels corresponds to CH A of the AES/EBU format (left), the second one corresponds to CH B (right). In contrast to the AES/EBU input the output of a track can be assigned to both AES/EBU channels. The REPRO LEDs confirm the change of the outputs. If only one REPRO LED is active the same audio track is used for both channels (A and B) of the AES/EBU output.

[14] REC MUTE

REC MUTE can be used for recording a digital „zero" signal in any recording mode. Any tracks can be grouped into a mute configuration.

Important: The CHECK function does not supply a meaningful result for channels that are switched to REC MUTE.

Determining the MUTE tracks

The REC MUTE configuration („programming mode") is activated with the REC MUTE key. The REC MUTE LED flashes and the INPUT LEDs indicate the tracks that have been preselected for MUTE. With the INPUT/REPRO keys REC MUTE can be preselected for the individual channels.

On the LCU (Local Control Unit): The ALL key controls REC MUTE for all tracks.

On the CHANNEL REMOTE: The ALL INPUT key activates REC MUTE for all tracks, whereas ALL REPRO deactivates REC MUTE for all tracks.

To quit the programming mode press the REC MUTE key.

MUTE activation

While the ENABLE key is held down press the RECORD MUTE key. The RECORD MUTE LED is now continually on. When the next RECORD command is given a digital „zero" signal is recorded on those tracks that have been switched to READY.

When the output signal is switched to INPUT in RECORD MUTE mode, the INPUT LED of this track flashes. The input signal is connected to the output but it is not recorded. In the REPRO setting the output remains muted, but the level bargraphs remain active for setting the levels.

This function can be used for erasing (Spot Erase) unwanted data by means of punch in and punch out. For greater accuracy an automatic punch-in and punch-out can be programmed with the autolocator.

[15] GROUP

With the SET and GROUP 1...4 keys several channels can be combined into a group. The status of all channels of a group can be switched jointly with the corresponding group key and one of the ALL keys (ALL READY, ALL SAFE, ALL INP, or ALL REP). The tracks that are not included in the group are not affected.

Forming a group:

The group formation is started and ended by pressing the SET key.

1. The SET key activates the SET mode for defining the group. If any other SET mode is still active (Record Mute, Memory, Ping-Pong, Track Slipping, Track Bouncing) that mode is terminated.
   ❏ SET lamp is on.
   ❏ INPUT/REPRO lamps are dark.

2. Assign the working group to one of the keys GROUP 1...4.
   ❏ GROUP lamp is on, SET lamp flashes.
   ❏ The INPUT lamps of the channels already included in the group are on.

3. Any number of channels can be included in or removed from this group by pressing the corresponding INPUT/REPRO keys.
   ❏ The channels assigned to this group are identified by the INPUT lamps.

4. To terminate the SET mode press the SET key.
   ❏ SET lamp is off.
   ❏ GROUP lamp is off.
   ❏ The INPUT/REPRO lamps revert to their normal status.

Switching a group

The GROUP key must be pressed together with one of the ALL keys. Depending on the ALL key all channels of this group are switched either to SAFE, READY, INPUT or REPRO. With F048: READY RECORD ON punch-in of channels by group is possible via ALL READY (see 2.2.8).

[16] SETUP MEMORY

Four memory locations are available for storing four different channel states.

Storing the setup

The current status of all 24 or 48 channels (SAFE/READY, INPUT/REPRO) can be transferred into one of the four memories:
   ❏ Activate the store function by pressing the STORE key – the STORE lamp flashes.
   ❏ Determine the memory in which the setup is to be stored: Press one of the SETUP MEMORY 1...4 keys – the STORE lamp turns off.
The status of all channels is now stored.

Recalling a setup

Press one of the SETUP MEMORY 1...4 keys: all channels immediately assume the previously saved status. The set-up is preserved also when the machine is switched off.

[17] TC LOCK

Function for synchronizing the D827 MCH with an analog tape machine that does not support a clock reference but supplies only a TC signal. The quality of the audio signals can deteriorate because the clock of the A/D and D/A converters includes the time code jitter of the analog master.

ON: Lamp on; the D827 MCH does not synchronize to an external clock signal but is controlled by the TC of the master. The SLOW LOCK (F068) can be activated in this mode.

OFF: Lamp off; after successful synchronization to the master TC, switch-over to an external clock reference takes place, if one is selected. In this case the synchronization is as stable as the clock.

Note: In TC LOCK mode the clock frequency may be slightly off; operating the machine under this condition in a digital environment is only of limited usefulness. See also 2.2.8, TC LOCK, F064.

[18] PAI   When a PARALLEL AUDIO INTERFACE (PAI) is used the local channel function keys of the D827 MCH must be inhibited; press the REMOTE key on the LCU; the REMOTE lamp is illuminated.
ON: Lamp is on; the PAI interface is activated, the channel function keys on the LCU and on the Channel Remote are partially inhibited.
OFF: Lamp dark; PAI inhibited, the channel function keys on the LCU *and* on the Channel Remote are active.

[19] ADV OUT   Function for compensating the delay of external components when a signal must be reproduced, processed and re-record in synchronism. See 2.3.9 .
ON: Lamp on; the audio signals are output earlier by the number of samples defined for each channel (in the SET AUDIO OUTPUT/ADV OUTPUT DELAY (S003) menu).
OFF: Lamp dark; function inactive.

[20] LIB WIND   Reduced spooling speed for producing library pancakes. Can be varied in the SETUP menu DECK/LIBR WIND SPEED (S005) between 0.1 m/s and the maximum spooling speed in steps of 0.1 m/s. Recommended LIB WIND speed: **5 m/s.**
ON: Lamp on; spooling is performed with the reduced speed.
OFF: Lamp dark; spooling is performed with the maximum speed which can be varied in the SETUP menu DECK/MAX WIND SPEED (S006) between 0.1 m/s and 15 m/s in steps of 0.1 m/s.

[21] PING-PONG   Digital copying of an individual audio channel to one or several other channels via internal connections. This function is not available in NEW REC mode.
  1. Activate the function by pressing the PING-PONG key:
     ❏ The PING-PONG lamp flashes.
     ❏ The INPUT/REPRO lamps switch off or indicate a previously stored PING-PONG configuration.
  2. Choose the source channel with one of the INPUT/REPRO keys:
     ❏ The REPRO lamp of the selected channel turns on.
  3. Choose one or several destination channels with the INPUT/REPRO keys:
     ❏ The INPUT lamps of the selected channels are on.
  4. Activate the function by pressing the PING-PONG key:
     ❏ The PING-PONG lamp is on.
     ❏ The INPUT/REPRO lamps revert to their normal status. READY is automatically selected for the corresponding record channels.
     ❏ The programmed channel assignment is active.
  5. To terminate the PING-PONG mode press the PING-PONG key again:
     ❏ The PING-PONG lamp turns off.

[22] MASTER SAFE   General record inhibition.
ON: Lamp on; recording not possible. All channels (Audio, CUE 1/2, TC, RT) are switched to SAFE.
OFF: Lamp off; recording is possible.

[23] AUTO INPUT   **ON:** Lamp on; the digital audio channels are automatically switched to INPUT as soon as the machine no longer operates in PLAY mode.
OFF: When AUTO INPUT is switched off the lamp is dark.
Note: AUTO INPUT can be operated in two modes (A and B): In mode A all channels are switched, on the more commonly used mode B only the channels in READY status are switched to INPUT. Channels that were already in the INPUT status retain in this status even when PLAY is activated.
(Setting in FUNCTIONS/AUDIO/F002 menu: AUTO INPUT A/B).

[24] AUTO MUTE   **ON:** Lamp on; the audio outputs of the CUE tracks are muted when PLAY is terminated.
OFF: Lamp is dark; the audio outputs of the CUE tracks remain always active.

[25] ALL keys:

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

ALL SAFE inhibits recording on all audio channels.

ALL INP connects the signal available at the audio channel inputs to the corresponding audio outputs.

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

ALL ENABLE Enable must be used together with ALL READY.

3.2 Autolocator (Tape deck remote control)

The proven autolocator concept of the analog tape machines has been largely integrated in the control panel, together with a few enhancements.

The enhancements essentially relate to:

❑ Time indication, Locate, Loop functions not just on the basis of move pulses but also on the basis of TC and RT.

❑ Operation of the internal synchronizer integrated

❑ Setting of RECORD MODE and CROSSFADE time

❑ Connection to the D827 MCH via Rembus. Also the audio remote controls are operated on this bus (Channel Remote and Parallel Audio Interface).
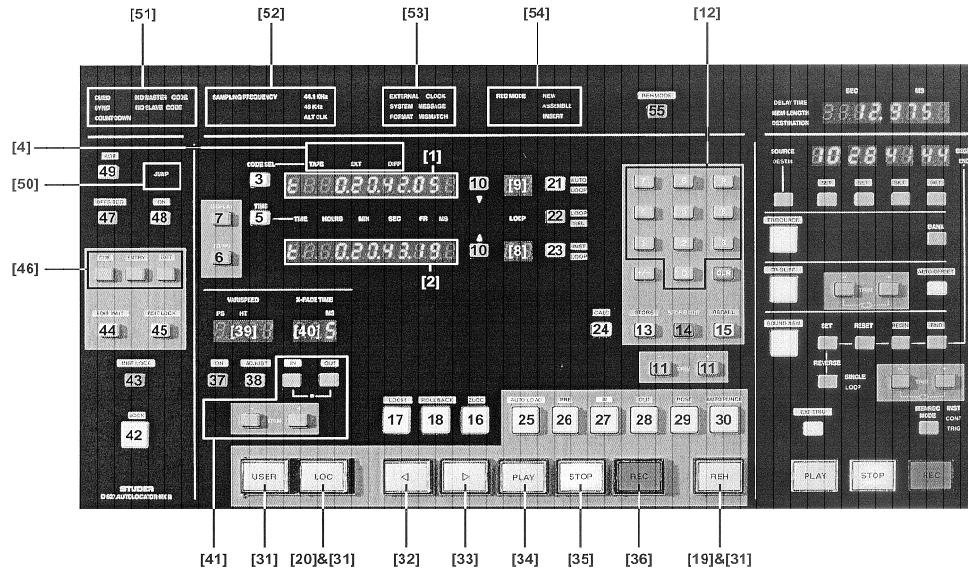
⚠ **Remote control cables may be connected and disconnected only when all units involved have been switched off.**

The remote control is powered via the remote control cable. Connection: See Section 4.

The machine can only be operated with the remote control when the REMOTE lamp is illuminated on the LCU.

Lamp check: While holding down the STOP key also press the REH MODE key. Press any key to terminate the check mode.

3.2.1 Operator controls

[1] TAPE POSITION

Displays the tape position in real time, corresponds to the display on the LCU. The following time bases can be displayed: COUNTER, TC, RT or LAP COUNTER. Which of these tape position times are momentarily indicated is identified by the first position of the TAPE POSITION display:

„t"   SMPTE time code; absolute time from tape or an external source. Cannot be set by the user (except when the time code is striped: see direct access menu, SET TC key on the LCU).

„r"   RT (Reference Track); absolute time from tape or external source. Cannot be set by the user (except in NEW RECORD mode: see direct access menu, SET RT key on the LCU).

„L"   LAP COUNTER, derived from RT, but can be set with the COPY ↑ key [10] to the value contained in the AUX-Register [2]. The AUX register must have the same time base („L").

„ "   COUNTER, derived from the move roller, can be set with the COPY ↑ key [10] to the value contained in the AUX register [2]. This is the only tape position indication that can have minor deviations (slip between move roller and tape) due to intensive spooling or many LOC commands. The AUX register must have the same time base („L").

For the absolute time bases a decimal point is shown when they can be read from tape. If the decimal point is missing behind „r" or „t" in play mode the machine is on an unformatted tape location.

Changeover between the different times: TIME key [5].

Please note that „t" and „r" can be displayed from tape, from an external source, or as a difference by means of the CODE key [3].

In the SET-UP menu (S011 to S013) it is possible to suppress the leading zeros and to define the number of decimal positions individually for the running tape (RUN TIME FORMAT) and STOP (STOP TIME FORMAT). In the TC indication format the TC DISPLAY FR MS changeover [6] has no effect if no decimal positions have been defined.

[2] AUX REGISTER

The AUXiliary REGISTER is used for displaying and setting the following values:

❑ LOCator addresses (110 address can be stored)

❑ The corresponding destination address in LOOP mode. During the playback of a loop, for example, the AUX register shows the loop end time; when this time is reached the machine rewinds and AUX shows the loop start time.

❑ Register contents such as CUE, OFFSET, PUNCH-IN/OUT, PRE ROLL, POST ROLL, [RECALL] ROLLBACK, OFFS REG (Synchronizer).

Register values stored in the AUX register can be modified with the TRIM± [11] keys. The magnitude of the trim steps (1 ms to 1 s) depends on the actual display resolution (DISPLAY [7] key or menu S013).

With the COPY ↓/↑ keys [10] the content of the TAPE POSITION display [1] and the current time indication format are transferred into the AUX [2] display, or written back if the format is the same.

With the numeric keys 0...9 [12] you can write any value into the AUX register. The displayed time base depends on the setting made with the TIME key [5] as shown in the TAPE POSITION display.

Note: If the AUX register does not accept any input from the numeric keypad, one of the above register functions (CUE, OFFSET, etc.) has been selected (lamp above the corresponding key is on). When the corresponding key is pressed the lamp turns off and the AUX register is enabled.

[3] CODE SEL

The CODE key relates to the RT and TC time indication: By repeatedly pressing the CODE key the source of the TC or RT shown on the TAPE POSITION display is switched over between EXT/TAPE and DIFF.

[4] EXT / TAPE / DIFF The display provides information on the source of the time information (RT or TC):
EXT: An externally supplied TC or RT is displayed.
TAPE: The TC or RT recorded on tape is displayed.
DIFF: The difference between the TC or RT recorded on tape and the TC or RT fed by an external source is displayed.

[5] TIME Pressing the TIME key chooses the time base to be shown in the TAPE POSITION display [1]: COUNTER, TC, RT, or LAP COUNTER. Which of these tape position times is momentarily displayed is shown in the first position of the TAPE POSITION display [1].

[6] FR MS (TC Display) The FR/MS key relates only to the SMPTE time code and allows changeover of the decimal positions from frames to milliseconds.

[7] DISPLAY Changeover between the programmed and maximum resolution for the STOP TIME format. Access to this function is possible via the S014:STOP TIME RESOL menu.

[8] LOOP (LocMem/LoopBeg) Here the addresses (00...99, –0...–9) of the CUE memories are displayed. The AUX register [2] shows the corresponding memory content (tape position) together with the time base. When a loop is to be programmed, the AUX register in conjunction with the LOOP SEL function [22] shows the start address of the loop. While the loop is being executed the register alternatingly shows the start and the end addresses.

[9] LOOP (LocMem/LoopEnd) When a loop is programmed, the register shows in conjunction with the LOOP SEL function [22] the end address of the loop.

[10] ▼/▲ Copy Press the ▼ copy key to transfer a tape position (TAPE POSITION display) into the AUX register. The value can subsequently be saved with the STORE key [13] into one of the 110 locator memories.
The ▲ copy key can only be used in conjunction with a LAP or COUNTER tape position: It is used for setting the TAPE POSITION display (LAP or COUNTER time base) to the value that has been written into the AUX register with the numeric keys 0...9 [12].

[11] TRIM± The TRIM± keys (fine adjustment) influences the last position shown in the AUX register, the „+" key increments and the „–" key decrements the value by one. The size of the TRIM steps can be varied with the DISPLAY [7] key. In conjunction with the CALC [24] key the TRIM± keys determine the function of the operator (addition/ subtraction).

[12] Numeric keys 0...9 Numeric keypad for entering values into the AUX register.

[13] STORE The STORE key saves the content of the AUX register (tape position, shown in one of the four time bases) into one of the 110 memories:
1. Press the STORE key, the STORE lamp shows that the store function has been preselected.
2. With the numeric keys [12] enter the two-digit memory no. (leading zero or sign for single digit numbers).
3. The STORE lamp turns off, the AUX register content is saved.

The AUX register values to be saved can be entered as follows:
❏ Enter a tape position with the numeric keys [12]. The time base shown in the AUX register [2] is applicable (can be changed over with the TIME [5] key and copied into the AUX register with the ▼ copy key [10]).
❏ With the ▼ copy key [10] the tape address shown in the TAPE POSITION display can be transferred into the AUX register independently of the current operating mode so that it can subsequently be used as a LOC address.

[14] STORE CUE

With the STORE CUE key tape positions can be stored „on-the-fly" (during PLAY, ◁, ▷ or STOP) into consecutive memory numbers, beginning with the selected memory number.

Example: Different CUE points are to be set „by ear". The memories beginning with no. 20 are free and shall be used.

1. Press the RECALL key, the RECALL lamp shows that memory recall has been preselected.
2. With the numeric keys enter „1", „9", the LOC MEM display [8] shows memory no. 19.
3. Start the tape in PLAY mode.
4. When the STORE CUE key is pressed the first time the momentary tape position is stored in memory no. 20 as a function of the time base shown in the TAPE POSITION display (RT, TC, COUNTER or LAP).
5. Each successive actuation of the STORE CUE key causes the momentary tape position to be stored in the next higher memory no. (21 etc.).

[15] RECALL

The D827 Autolocator is equipped with 110 tape position memories which can be used as locator addresses or LOOP start and stop addresses. These tape positions can be accessed with the RECALL key under memory numbers –0...–9 and 0...99:

❑ Press the RECALL key, RECALL lamp turns on.
❑ With the numeric keypad enter the 2-digit memory number (for single-digit numbers: with leading zero or sign).
❑ In the LOC MEM/LOOP BEG display [8] the memory number is shown whereas in the AUX [2] register the corresponding tape position and its time base (COUNTER, RT, TC or LAP) is shown.

Note: Tape positions rather than times are stored. In the case of TC and RT the time and the corresponding tape position are identical; if the LAP or COUNTER time is modified or set to zero during the production, the locator and LOOP points stored under these time bases are converted which means that the correct tape positions are always preserved.

Fast method for the LOC function [20]: The RECALL key can be circumvented but the tape position of the locator point will be only displayed in the AUX register while the locate function is in progress. See paragraph „[20] LOC, Fast method".

[16] ZLOC

(LOCate to Zero); rewinds the tape to the tape position 0 as defined by the time base shown in the TAPE POSITION display. If the machine is in TC display mode, for example (see TIME key), the beginning of the tape must have been striped with the SMPTE time code 00:00:00:00 for a successful ZLOC.

[17] LOC ST

(LOCate to STart); the machine continually „remembers" the tape position with the last transition from STOP to PLAY. When the LOC ST key is pressed the machine spools to this position. Depending on the configuration set in the menu (F037: LOC ST PLY/REC/STP) the machine switches either to STOP, PLAY or REC when this position is reached. During the positioning to the last transit point from STOP to PLAY the machine displays the function (STOP, PLAY, REC) that has been preselected in the menu; the corresponding lamp flashes.

The stored tape position of the last transition from STOP to PLAY can be shown on the TAPE POSITION display by holding down the STOP key and pressing the LOC ST key.

[18] ROLLBACK

When the ROLLBACK key is pressed the machine rewinds by the amount defined in the ROLLBACK register. The stored ROLLBACK value (in seconds) can be made visible in the AUX register with the key sequence RECALL – ROLLBACK and varied with the TRIM± keys [11] within the range of 1 to 59 s. This change can also be made in the set-up menu S024 (SET:LOCATOR).

[19] REH / USR 2

Combination key. The default function is REHearse Record, the lettering REH lights up; *however, if a key sequence (macro) is programmed (see USR 1...3 [31]) the programmed key sequence rather than the REH function is executed. In this case the lettering USR 2 lights up.*

REHearse Record corresponds to the behavior of the REC key in REHEARSE mode, with the following differences:

❑ When a simulated punch-in is executed in REHearse mode, the PLAY and the REH lamps are continuously on (not flashing).

❑ Immediately after a completed REHearse punch-in/out sequence a real RECORD punch-in/out can be initiated by pressing the REC key (and vice versa).

❑ While REHearse Record is active the status of the REH MODE lamp [55] does not change.

[20] LOC / USR 3

Combination key. The default function is LOC, the lettering LOC lights up; *however, if a key sequence (macro) is programmed (see USR 1...3 [31]), the programmed key sequence rather than the LOC function is executed. In this case the lettering USR 3 lights up.*

When the LOC key is pressed the machine searches the tape position specified in the AUX register [2]. A tape position can be written into the AUX register as follows:

❑ Enter the tape position with the numeric keys [12]. The time base displayed in the AUX register [2] is applicable.

❑ In any operating status the ▼ copy key [10] can be used for transferring the tape position momentarily shown in the TAPE POSITION display into the AUX register so that it can later be used as a LOC position. This position can subsequently be searched by pressing the LOC key, or it can be saved in one of the 110 locator memories by pressing the STORE [13] key (memory no. entered with the numeric keys [12]). Fast method: See paragraph „[14] STORE CUE".

❑ With the RECALL [15] key and the two-digit memory no. (−9...99, entered with the numeric keys [12]) a tape position can be transferred from one of the 110 locator memories into the AUX register; when the LOC key is pressed the tape will be positioned at that address. The tape position is displayed in the AUX register with the same time base under which it has been stored (regardless of the time base currently shown in the TAPE POSITION display).

Fast method for recalling a tape position from the locator memory: If a *one- or two-digit number* is entered with the numeric keys, it will appear in the AUX register. When the LOC key is pressed the input is not interpreted as a tape position but as a locator memory no.: The AUX register [2] shows the destination address while the machine is spooling to this position.

When the destination position is reached the AUX register reverts to the original content.

Notes: If the AUX register does not respond to the input with the numeric keys, it may possibly be occupied with the indication of a register function (CUE, OFFSET, etc.). To free the AUX register press the same key again.

If desired, ROLLBACK [18] or PLAY [34] can be preselected immediately after the locator command.

[21] AUTO LOOP performs a loop whose beginning and end have been defined with the LOOP SEL [22] key.
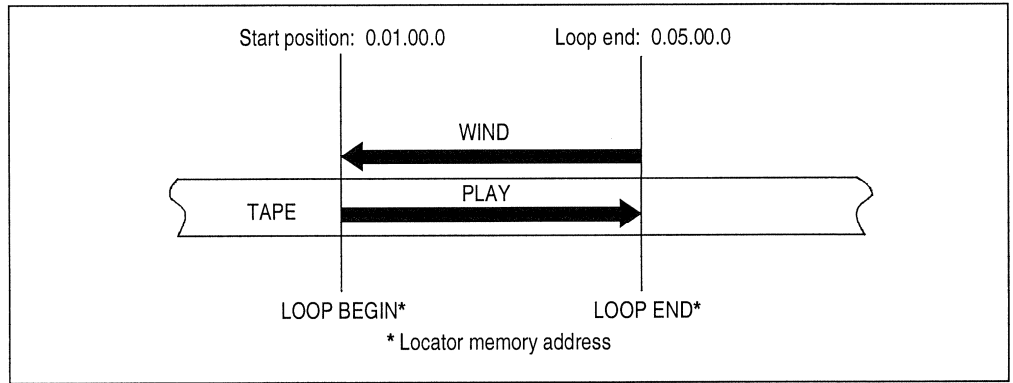

[22] LOOP SEL This function is used for defining a loop. It selects two memory addresses in which the begin and end position of the loop are stored. When the LOOP SEL key is pressed (LOOP SEL lamp is on) the LOOP BEG [8] display shows the memory no. in which the begin position of the loop is stored, and the LOOP END display [9] contains the memory no. in which the end position of the loop is stored. In addition the AUX display shows the tape position of the loop begin. To execute the loop, press the AUTO LOOP key.
The first address is always the start address; make sure that this time is smaller than the one of the end address.

[23] INST LOOP This function is used for quick programming and execution of a loop. The loop begin is always the content of the AUX register (value entered with numeric keys, or current tape position loaded with the ▼ copy key [10]). Pressing the INST LOOP key defines the loop end, and the loop is started immediately.
When loop mode is active the AUX register always shows the destination position: during PLAY mode it is the end of the loop, during REWIND mode the start of the loop.
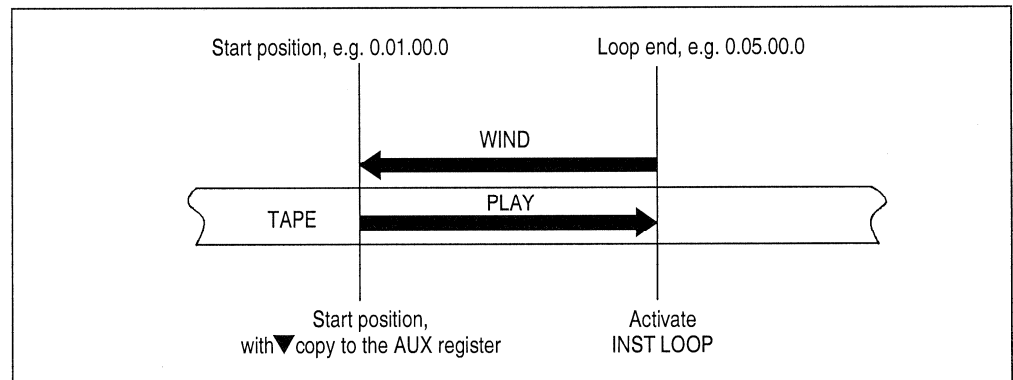
[24] CALC The CALC key activates the built-in calculator function. Any values can be added to or subtracted from the AUX register content.

Example 1: The TAPE POSITION display shows the TC tape position 1:25:30:345. The tape shall be rewound by exactly 17 seconds (AUX – 17 s).
1. Press the ▼ copy key to copy the tape position into the AUX register.
2. Press the CALC key; the CALC lamp shows that the calculator function has been enabled.
3. With the numeric keys enter 17 s (1, 7[, 0, 0, 0]).

4. Press the TRIM– key; the AUX register shows a value that has been reduced by 17 seconds: 1:25:13:345

5. Press the LOC key; the machine rewinds by 17 s.

Notes: Instead of positioning directly with the LOC key, the calculated AUX register content can be saved in one of the 110 locator memories (STORE [13] key). For adding a value press the TRIM+ key.

Example 2: The value stored in memory no. 8 shall be added to the content of the AUX register (AUX + R08):

1. Press the CALC key.
2. Press the RECALL key; with the numeric keys recall memory no. 8 (0, 8).
3. Press the TRIM+ key.

Example 3: The content of memory no. 50 shall be subtracted from the content of memory no. 33 (R33 – R50).

1. Press the RECALL key.
2. With the numeric keys enter the memory no. 33 (3, 3).
3. Press the CALC key.
4. Press the RECALL key.
5. With the numeric key enter the memory no. 50 (5, 0).
6. Press the TRIM– key.

Calculator operations are applicable to all values that can be displayed in the AUX registers such as PUNCH IN/OUT, CUE, ENTRY, EXIT, etc.

[25] AUTO LOAD

With this function the machine remembers the subsequent punch-in and punch-out point so that the punch-in and punch-out can be repeated at exactly the same point when further tests are made. The AUTO LOAD lamp signals that the function has been enabled. When a drop-in occurs during playback (by pressing REC and PLAY or REC only, depending on the programming) or by pressing REH / USR 2, and a subsequent punch-out is initiated (by pressing PLAY or another tape deck function such as ◁, ▷, STOP), the punch-in point is stored in the IN register [27], the punch-out point in the OUT register [28]. The corresponding tape position can be displayed in the AUX [2] register by pressing the IN and OUT register key, and can be fine-adjusted with the TRIM± [11] keys. Automatic repetition of the punch-in/out sequence can be initiated with AUTO PUNCH as often as desired.
AUTO LOAD is activated automatically each time the machine is switched on.
The punch-in/out initiated by a AUTO PUNCH [30] changes neither the input nor the output registers.
This function can also be operated in REH MODE [55].

[26] PRE (-roll)

The PRE register contains a time from 1 to 99 s and relates exclusively to the automatic punch-in/out. The machine parks at an address that is located before the programmed punch-in by the preroll distance and therefore allows monitoring of the tape before the machine switches to record. When the PRE key is pressed the register contents (number of seconds) is shown in the AUX register and can be varied with the TRIM± keys [11].

[27] (Punch) IN

The IN register contains the tape position at which the machine switches to record in automatic punch-in/out mode (activated with the AUTO PUNCH [30] key). When the AUTO LOAD [25] or REH [19] function is active this tape position is loaded into the IN register while the tape is running by pressing the REC key (or REC and PLAY, depending on the programming). The punch-in tape position can be displayed in the AUX register [2] by pressing the IN key and fine-adjusted with the TRIM± [11] keys. The IN register can also be loaded in the inactive status (IN off) by writing the desired tape position with the numeric keys into the AUX register (or by recalling it from a LOC memory) and pressing the key sequence STORE, IN.

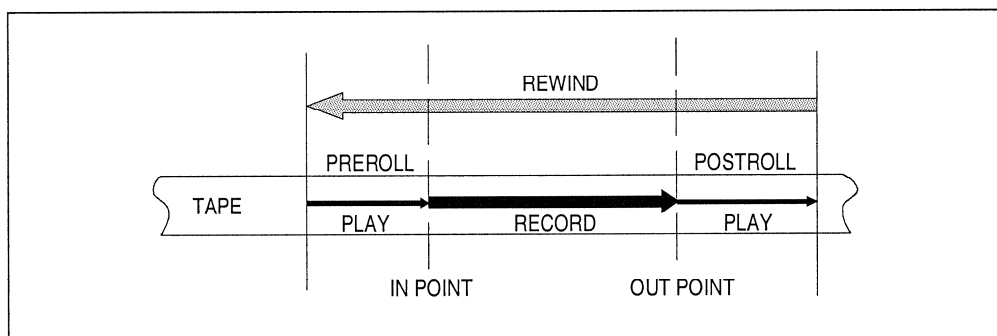**[28]** (Punch) **OUT**

The OUT register contains the tape position at which the machine punches out of play in automatic punch-in/out mode (activated with the AUTO PUNCH [30] key). When the AUTO LOAD function [25] is active this tape position is loaded into the OUT register while the tape is running by pressing the PLAY key (punch out). The punch-out tape position can be displayed in the AUX register [2] by pressing the OUT key and fine-adjusted with the TRIM± [11] keys. The OUT register can also be loaded in the inactive status (OUT off) by writing the desired tape position with the numeric keys into the AUX register (or by recalling it from a LOC memory) and by pressing the key sequence STORE, OUT.

[29] POST (roll)

The POST register contains a time from 1 to 99 s and relates exclusively to the automatic punch-in/out. After the automatic punch-out the machine switches to play for the defined post roll time before it stops. When the POST key is pressed, the register contents (number of seconds) is displayed in the AUX register and can be varied with the TRIM± keys [11].

[30] AUTO PUNCH

enables an automatic record loop whose punch-in point is defined in the IN register [27], the punch-out point in the OUT register [28]. The PRE [26] and POST [29] registers contain the duration in seconds during which tape monitoring is possible before the punch-in and after the punch out. When the AUTO PUNCH key is pressed the flashing AUTO PUNCH lamp shows that the function is enabled. The automatic loop is started by activating a record function (tape deck command keys REC or REH with PLAY, or REC or REH alone, depending on the menu setting of the machine).
This function can also be executed in REH MODE [55].

The automatic sequence comprises:
❑ Monitoring from tape (PRE ROLL time),
❑ Punch-in (at PUNCH IN tape position),
❑ Punch-out (at PUNCH OUT tape position),
❑ Monitoring from tape (POST ROLL time),
❑ Rewind to the start (including PRE ROLL time),
❑ Maintaining the ready status for next test.
If the recording is successful the ready status can be canceled by pressing the AUTO PUNCH key or one of the tape command keys ◁, ▷ or STOP (AUTO PUNCH lamp turns off).
Note: During the automatic sequence the AUX register shows the destination position: During PRE ROLL this is the PUNCH IN point (IN lamp on), during the recording this is the PUNCH OUT point (OUT lamp off), during the POST ROLL this is the loop end point (OUT position plus POST ROLL time).

[31] USR 1...3

Any sequence of up to 10 key depressions (a "macro") can be stored and recalled under these three keys. With the USR functions it is possible to initiate frequently used work sequences comprising many individual operations with the push of a single button. *Two of the USR keys (USR 2 and USR 3) have default functions that are active when no macros are programmed to these keys. This is indicated by the illuminated lettering of the corresponding key.*

Programming a keying sequence:

❏ Press the STORE [13] key and USR 1...3. The AUX register indicates the number of key sequences that have already been programmed with "STEPS xx". If any key sequence has been programmed, the corresponding lamp is illuminated. The STORE lamp flashes to signal that the programming mode has been activated. If nothing is to be changed press STORE again to terminate the programming mode.

❏ To cancel an existing key sequence press the CLEAR key in the numeric keypad [12] together with one of the USR 1...3 keys. Any other key depressing in programming mode (STORE lamp flashes) is appended as an additional step to the previously programmed key sequence.

To terminate the programming operation press the STORE key again (STORE lamp off).

When one of the USR 1...3 keys is pressed the programmed key sequence is automatically executed.

[32] ◁

Rewind key. ◁ flashes to signal that rewind has been commanded. During the execution of this command this lamp is continuously on.

[33] ▷

Fast forward key. ▷ flashes to signal that fast forward has been commanded. During the execution of this command this lamp is continuously on.

[34] PLAY

Playback key. PLAY flashes to signal the playback has been commanded. During the execution of this command this lamp is continuously on. If the lamp continues to flash the possible reasons are:

❏ No RT (Reference Track) on the tape. In this case the decimal point on the TIME display is missing.

❏ The machine is still executing a LOC command and PLAY has been preselected.

❏ REHEARSE mode is switched on.

[35] STOP

Cancels each tape deck function with top priority. Immediately terminates functions such as ZLOC, LOC, AUTO PUNCH and synchronizer LOOP. While the tape is being decelerated the STOP lamp flashes.

[36] REC

Record key; must be pressed either together with PLAY [34] or can be used alone for punch-in from play mode (menu setting: F049 REC KEY A or REC KEY B). If the REC lamp remains dark the machine refuses to execute the record command for one of the following reasons:

❏ An attempt is made to record in NEW RECORD mode but not all audio channels are switched to READY.

❏ An attempt is made to record in ASSEMBLE RECORD mode but not all audio channels are switched to READY.

❏ An attempt is made to record in ASSEMBLE RECORD mode but the RT cannot be read (decimal point in the TIME display missing). Remedy: Rewind to the end of the last recording.

❏ An attempt is made to switch to record mode with RECORD INDICATION A (F051) but no audio channels are switched to READY.

Note: A flashing REC lamp signals a recording in REHEARSE mode (see REH MODE [55]).

[37] ON (VARISPEED) | Switches from nominal speed to the value defined with ADJUST (VARISPEED) [38]. Please note that the sampling frequency changes inevitably with the change in the play speed. The connected equipment may possibly no longer be able to process the signals available at the digital outputs if the deviation is too large. Varispeed cannot be used in conjunction with synchronization to AES/EBU or Word Clock (EXT CLK).

[38] ADJUST (VARISPEED) | With this function a speed can be defined (for playback *and* recording) that varies from the nominal tape speed. The VARISPEED display [39] shows these deviations in % or semi-tones, or the actual tape speed in ips is shown (depending on the programming in the FUNCTIONS menu F071). Varispeed can be adjusted with the TRIM –/+ keys [41].

[39] VARISPEED | Display for variable tape speed. When varispeed is active or being set (ON VARISPEED or ADJUST VARISPEED), either the current deviation in % or semi-tones, or the actual tape speed is shown in ips (depending on the setting in the FUNCTIONS menu F071). Depending on the setting also the IPS, HT or % lamp above the display is on (see also 2.3.8).

[40] X-FADE TIME | Display for indicating the crossfade time(s) set with IN and OUT [41] in milliseconds (ms); in EDR mode (with option) crossfade times up to 5000 ms can be set; if the time is 1000 ms or larger a decimal point is shown after the seconds digit.

[41] IN/OUT, TRIM –/+ | The crossfade time of audio from tape to the signal to be recorded at punch-in/out can be set in eight (EDR mode: 16) steps. The values range from 1 ms (hard punch-in/out) to 700 ms (soft transition); EDR mode: 1 ms...5 s. The crossfade times can be set individually for 16-bit mode and EDR mode and are preserved when the mode is changed over.
The IN and OUT times can be different, see also 2.2.7 .

IN   When the IN key is pressed the X-FADE TIME display shows the crossfade time for the punch-in operation. The IN lamp above the key is on; the „MS" lamp above the display is on and indicates the selected unit of time. The value can be adjusted with the TRIM –/+ keys below.
When the IN key is pressed while the OUT key is still held down, the X-FADE TIME display shows the crossfade time for the punch-in operation. If the punch-in time is *different* from the punch-out time, the displayed punch-in time *flashes.* The IN and OUT lamps above the keys are on. The punch-in time can be varied with the TRIM –/+ keys located below *and simultaneously copied to the punch-out time.* Since both times are now identical, the displayed punch-in time no longer flashes.

OUT   When the OUT key is pressed the X-FADE TIME display shows the crossfade time for the punch-out operation. The OUT lamp above the key is on; the „MS" lamp above the display is on and indicates the selected unit of time. The value can be adjusted with the TRIM –/+ keys below.
When the OUT key is pressed while the IN key is still held down, the X-FADE TIME display shows the crossfade time for the punch-out operation. If the punch-out time is *different* from the punch-in time, the displayed punch-out time *flashes.* The IN and OUT lamps above the keys are on. The punch-out time can be varied with the TRIM –/+ keys located below *and simultaneously copied to the punch-in time.* Since both times are now identical the displayed punch-out time no longer flashes.

[42] LOCK

When the LOCK key is pressed the D827 MCH is coupled to an external master time reference. The master time reference can be the SMPTE time code (for example, synchronization with video) or the RT (DASH LOCK method for coupling DASH multichannel machines). When the master machine is in STOP condition and the LOCK key of the D827 MCH is pressed (LOCK lamp on) the D827 MCH spools to the last read master position, parks slightly behind this position (distance can be optimized in the SET-UP menu: S031:PARK OFFSET) and waits in ready mode. When the master starts, the D827 MCH chases the master (SYNC flashes, audio still muted). As soon as the D827 MCH has caught up with the master it automatically locks to the external clock reference (the master reference alone is not stable enough for full audio quality). The SYNC lamp is on, audio is reproduced.

Note: If no correct synchronized operation is possible check that the correct synchronizer reference is set (in menu F060:REFERENCE).
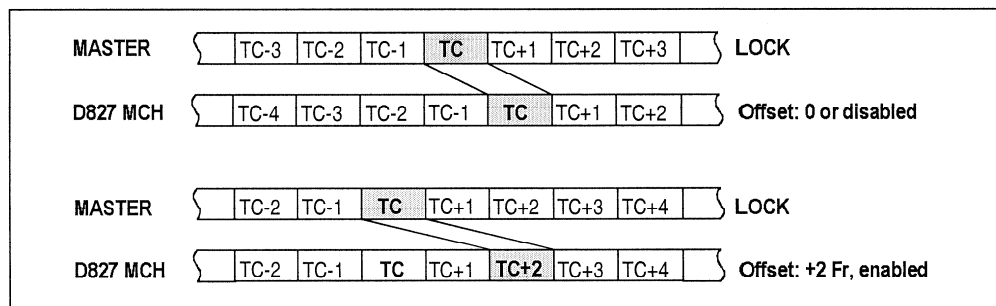
Conditions **for synchronization with SMPTE time code** (see also 2.5 as well as the examples in Section 4 of the Set-up Guide):

❑ The tape to be used must have been striped with one of the SMPTE time code formats. The recorded time code can be monitored on the TAPE POSITION display by switching to TAPE (display [4]) with the CODE SEL [3] key.
For successful synchronization the format of the recorded time code does *not* necessarily have to agree with the format of the incoming master time code! Master time code jumps can be processed without interference with the synchronous operation by pressing the AOR [49] key.

❑ Valid master time code must be available at the machine input. The incoming master time code can be monitored on the TAPE POSITION display by switching to EXT (display [4]) with the CODE SEL key [3]. The difference between the master time code and the slave code from tape is shown when DIFF has been selected with the CODE SEL key [3]. Master time code jumps can be processed without interfering with the synchronous operation by activating the automatic offset retention (AOR [49] key).

❑ For synchronous operation with full audio quality, an external clock reference must be defined and be available at the machine. In the SET-UP menu a number of choices are available (S017: EXT CLOCK REF). For locking the D827 MCH to the external clock reference the EXT CLK key on the LCU must be pressed (EXTERNAL CLOCK [53] lamp on).

❑ In the FUNCTIONS menu the internal synchronizer must be enabled (F063), set to TC synchronization (F060), and TC LOCK disabled (F064).

Special case: There is an emergency mode for cases in which the external clock cannot be used, and synchronization to the SMPTE time code is needed (even though this method is inaccurate for digital recordings). This emergency mode is activated with the TC LOCK function (key on the Channel Remote or FUNCTIONS menu setting F064). Doing without external clock reference results in higher jitter values and has the following consequences:

❏ Reduced audio quality.
❏ Equipment with very tight specifications may possibly be unable to process the signals of the digital audio outputs.

The TC LOCK emergency mode is always required:

❏ for synchronization with an analog tape machine operating as the master.
❏ if the time code on the tape was inadvertently striped on the tape without any reference to the sampling frequency. This error cannot occur when TC is striped on the tape with the aid of the built-in generator of the D827 MCH. But if a free-running TC generator is used, that is, if it does not have the same clock reference (Video, AES/EBU or Word Clock) as the D827 MCH, time deviation (jitter) occurs between the sampling frequency and the recorded TC.

The *SLOW LOCK* function (menu F068) can be used in this TC LOCK mode; if TC jumps occur, follow-up is performed without audible effect.

Conditions for DASH LOCK (see also Sections 4.3.4 and 4.4 in the Set-up Guide):

❏ Both the slave and the master must be DASH multichannel machines.
❏ RT (or SECTOR CLOCK) and a clock reference (AES/EBU or Word Clock) as well as the MASTER TALLIES must be connected between the machines.
❏ In the FUNCTIONS menu of the slave machine F060:REFERENCE must be set to RT and F063:SYNCHR to INT.
❏ In the SET-UP menu of the slave machine AES or Word Clock must be selected in S017:EXT CLOCK REF in accordance with the clock reference being used.
❏ To ensure that the slave machine follows the external clock reference the EXT CLK key on the LCU must be pressed (EXTERNAL CLOCK [53] lamp on).

[43] INST LOCK

This function is identical with LOCK [42], except that the momentary time code difference between master and D827 MCH is written into the synchronizer offset register; the two machines are synchronized with this offset, the existing offset is overwritten with the new value.

| MASTER		TC-3	TC-2	TC-1	TC	TC+1	TC+2	TC+3		INST LOCK
D827 MCH		TC-1	TC	TC+1	TC+2	TC+3	TC+4	TC+5		Offset Reg = +2 Fr Offset Enabled
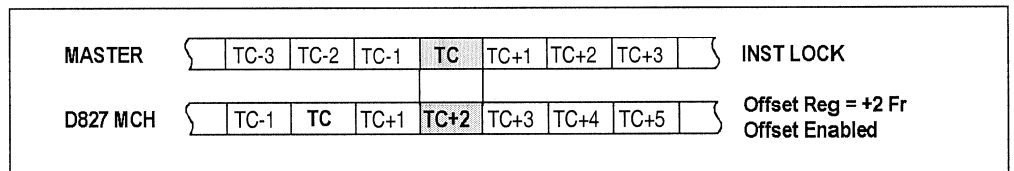
[44] EDIT WAIT

Allows the execution of a preprogrammed sequence. This function is comparable to AUTO PUNCH [30] except that the time base is referring to the master. The slave machine stops at the park point and waits for the master. As soon as the latter reaches the park point of the slave the slave is started and synchronized.

Punch-in and punch-out is possible for programmed ENTRY and EXIT points.

Restrictions: ❏ ENTRY and EXIT points must be at least 50 ms apart; as a rule 5 s are adequate, or a reasonable starting point for own tests, respectively.
❏ Both points must be defined in the same time format, otherwise no punch-in/out takes place. In this case the display shows „no Punch".
❏ If the slave is not yet synchronized when the ENTRY point is reached, no punch-in takes place.

Synchronous operation is maintained until it is terminated for any reason (for example, master switches to STOP). At this point the slave rewinds to the park point and waits for the next EDIT sequence.
This function can be used when the master performs a programmed loop.
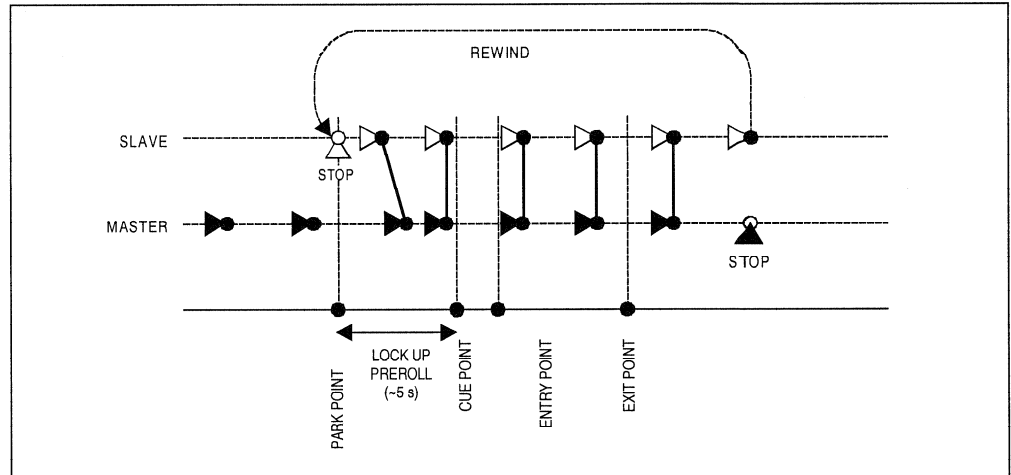
EDIT WAIT command: Pressing EDIT WAIT causes the slave to position itself at the park point. The EDIT WAIT lamp remains on while this function is active. The function can be canceled at any time by pressing this key again or by pressing one of the tape transport command keys (except PLAY and PLAY+REC), or by selecting a different synchronizer function.

Determining the CUE/ENTRY/EXIT points:

For EDIT WAIT and EDIT LOCK (see below) three parameters must be defined: CUE point, ENTRY point and EXIT point. All three addresses must be in the same format (TC or RT). All three parameters are entered in the same manner:

❏ Load the address into the AUX register (enter it with the numeric keys, or copy it from the TAPE POSITION DISPLAY, or recall it from the LOCATOR memory). As the master time is relevant, the recommend procedure is to press CODE SEL [3] in order to activate the EXT display [4], that is, the master code, and to load the master time via the AUX register into the CUE, ENTRY or EXIT register [46] by pressing ▼ copy [10] at the desired location.
This function is suitable if two machines are used for electronic editing (achievable accuracy: 1 ms).

❏ To store the address: Press STORE and subsequently CUE, ENTRY or EXIT [46].

Modifying CUE/ENTRY/EXIT points:

❏ Press the CUE, ENTRY or EXIT [46] key. The address is displayed in the AUX register and can be varied with the TRIM± keys. Whatever is shown in the AUX register is automatically stored.

❏ An address can be completely cleared with the key sequence CLEAR, STORE and subsequently either CUE, ENTRY or EXIT.

❏ To quit this mode press the corresponding CUE, ENTRY or EXIT key, respectively; the corresponding lamp turns off.
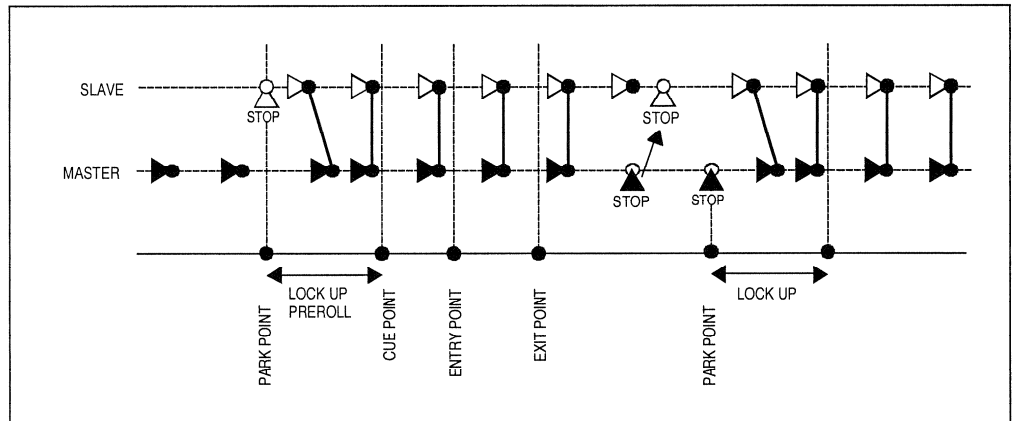
[45] EDIT LOCK

Same as EDIT WAIT [44], except that the slave follows the master also when the latter quits the synchronized mode. In this case the EDIT LOCK lamp turns off because the new status corresponds to the LOCK mode.
Determining and modifying CUE, ENTRY and EXIT points: same as EDIT WAIT [44].

EDIT LOCK command: Pressing the EDIT LOCK key activates the EDIT LOCK mode on the slave and causes the slave to position at the park point. The EDIT LOCK lamp remains on for as long as this mode is active. It is terminated in the same way as the EDIT WAIT function.
The tape is not reparked at the CUE point until a new EDIT LOCK command is given.

[46] CUE / ENTRY / EXIT

For displaying and defining CUE, punch-in, and punch-out points (see EDIT WAIT [44] and EDIT LOCK [45]).

[47] OFFS REG

For displaying or modifying the offset register content.
There are two ways of modifying or entering the register content:
- ❏ Enter the offset with the numeric keys [12] into the AUX register (values of −12:00:00:000 to 12:00:00:000 are accepted; if values greater than 12 h are entered the largest integer multiple of 24 h is automatically subtracted. Save the value by pressing STORE and OFFS REG or:
- ❏ Press the OFFS REG key, the current value is shown in the AUX register. This value can be modified with the TRIM± keys. The modified value is automatically stored.

To quit the OFFSET EDIT mode press the OFFS REG key again.

[48] ON

Key for activating and deactivating the synchronizer offset. Offset active is the normal situation, i.e. the default value after the machine has been switched on. When a LOCK command is given and OFFSET is deactivated, synchronization takes place with OFFSET = 0. The old value remains stored in the OFFSET register.

[49] AOR

Automatic Offset Retention; when this function is active (lamp on) jumps in the master or slave time code are added in LOCK mode to an additional offset that is hidden to the user. When a code jump occurs the slave does not start to chase the master but remains in LOCK. As soon as the machine is stopped or rewound this cumulative offset is reset without changing the normal offset register content.

[50] (Code) JUMP

The JUMP lamp is on when a master code jump is detected.

[51] EDIT mode indicators When the EDIT WAIT or EDIT LOCK key is pressed the corresponding operation is started. The slave machine status is indicated by the following LEDs:

CUED - flashes while the slave is being positioned at the park point;
- is on when the slave is positioned at the park point and waits for the master.

SYNC - flashes when the slave waits or is not synchronized yet;
- is on when the slave runs in synchronism with the master.

COUNT DOWN flashes when the master is within five seconds before the park point of the slave.
NO MASTER CODE is on if the slave does not receive any master time code (external TC or RT).
NO SLAVE CODE is on if the slave cannot read any time code (TC or RT) from tape.

Note: When EDIT WAIT or EDIT LOCK is activated the AUX register shows the park position. When synchronization starts the entry point is displayed and during the recording the exit point is displayed. These time indications are related to the master code.

[52] SAMPLING FREQUENCY Specifies the sampling frequency (44.1 kHz/48 kHz) as set in the menu, read from tape, or from an external source. If this indicator flashes either VARISPEED or the PULL DOWN mode (R004, see 2.2.5) is active. The synchronizer can cause varispeed if TC LOCK (F064, see 2.7.8) is selected.
Please note that the D827 MCH is able to follow a stable external clock even if it does not correspond to the standard frequencies.
When the ALTernative CLOCK lamp is on this means that the machine works with the alternative standard frequency: 44.056 kHz rather than 44.1 kHz.

[53] EXTERNAL CLOCK Lamp on: The machine is synchronized to an external reference defined in the SET-UP menu S017.
Lamp flashing: The external reference has been selected with the LCU key EXT CLK, but no clock signal conforming to the menu setting is available at the machine input.

SYSTEM MESSAGE Lamp on: The D827 MCH has detected an unexpected operating status. The SYSTEM CONTROL DISPLAY on the LCU provides information in plain text (see Section 12, „Error messages").

FORMAT MISMATCH If an AES/EBU or Word Clock signal is used as the external reference, the signal available at the machine also defines a specific sampling frequency. If the sampling frequency with which the tape has been formatted and recorded is not in agreement with the external reference, the D827 MCH follows the external reference and must consequently replay the tape with a speed that differs from the nominal speed. In this operating status the FORMAT MISMATCH lamp is on.

[54] REC MODE Indicates the selected recording mode. The D827 MCH supports the following recording modes: NEW, ASSEMBLE, INSERT.

NEW A new tape or a tape that has been erased with a bulk eraser must be formatted. In this process the reference track (RT) and the block structure applicable to the DASH format are written in all audio channels.
For formatting, all audio channels must be set to READY. The machine switches the RT track automatically to READY (lamp on). The analog auxiliary tracks TC, CUE 1 and CUE 2 can subsequently be recorded at any time. A tape must be formatted without gap. If a recording is interrupted in NEW RECord mode, subsequent recordings on the unformatted part of the tape must be added in ASSEMBLE mode.
Of course, audio can be recorded already in NEW mode (this is the typical procedure for live recordings). When the optional NEW RECORD HEAD (second record head) is installed, true tape/source monitoring (read after write) is possible. The start time of the RT and TC is set in the direct access menus „SET RT" and „SET TC".

Note: If the optional NEW RECORD HEAD (second record head) is not installed, the RT or TC time cannot be displayed during the formatting process (NEW mode).

Instead the TAPE POSITION display shows „rt StrIPE" or „tc StrIPE" (RT or TC are being striped).
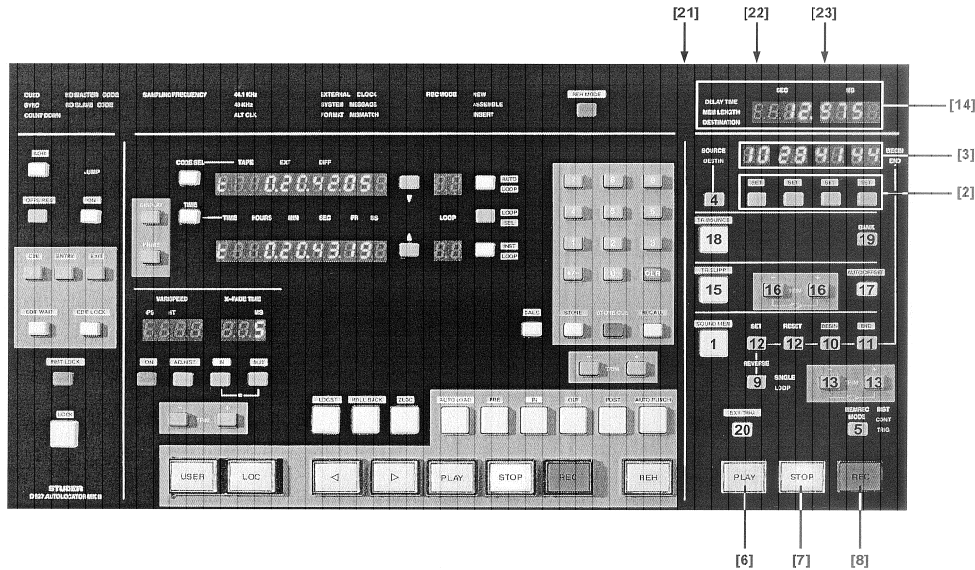If in the same situation DIFF (difference between TC/RT from tape and external source) is selected with the CODE key [3], no time is indicated, the TAPE POSITION display contains dashes: --.--.--.--

ASSEMBLE The ASSEMBLE mode is used for continuing an interrupted NEW recording. ASSEMBLE differs from NEW in that the RT (and optionally the TC) is appended to the existing part without any gap („Jam Sync"). For this reason the last recorded section of the tape must be located before the heads so that the machine is able to append the continuation without gap. If the machine is unable to read an RT or if not all audio channels are switched to READY when the recording is started, the machine does not switch to record mode. The ASSEMBLE mode is typically used for continuing an interrupted live recording.

Note: As this recording is always made with the normal record head (SYNC head), source/tape monitoring is not feasible. The reproduce head is located *before* the record head which means that crossfading is possible.
Since source/tape monitoring is not possible, the RT cannot be displayed in record mode. Instead the TAPE POSITION display shows „rt StrIPE" or „tc StrIPE" (RT or TC is being striped).
If in the same situation DIFF (difference between TC/RT from tape and external source) is selected with the CODE key [3], no time is indicated, the TAPE POSITION display contains dashes: --.--.--.--

INSERT Recording in INSERT mode is only possible on a tape that has been completely formatted in NEW or ASSEMBLE mode. It allows punch-in/out of any audio and CUE channels as is required in everyday studio work.

[55] REH MODE REHearsal MODE. When the REH MODE function is enabled (REH MODE lamp on) a recording can be simulated. This function is used for rehearsing accurate punch-in/out by ear without altering the existing recording on the tape (see also: „Automatic punch-in" under AUTO LOAD [25], REC LOOP [30], REH/USR 2 key [19]).

3.3   Sound Memory (Optional audio memory)


3.3.1   Operator controls

[1] SOUND MEM	First key depression: Selects the Sound Memory set mode; the SOUND MEMORY lamp flashes. The source and destination tracks can be selected with SET [2] and SOURCE/DESTIN [4]. Second key depression: Activates the Sound Memory; the SOUND MEMORY lamp is continually on. For additional operating steps: see 3.3.3. Third key depression: Deactivates the Sound Memory mode, the SOUND MEMORY lamp is off.
[2] SET	Four keys for selecting (together with the numeric keys or the INPUT/REPRO keys of the Channel Remote) SOURCE and DESTINation tracks in Sound Memory and Track Bouncing mode.
[3] SOURCE/DESTIN Display	Displays for indicating SOURCE or DESTINation tracks in the Sound Memory and Track Bouncing modes in conjunction with SOURCE/DESTIN [4] and SET [2].
[4] SOURCE/DESTIN	Changeover of SOURCE or DESTINation tracks in the Sound Memory and Track Bouncing modes in conjunction with SET [2].

[5] MEMREC MODE	Selection of the three MEMory RECord modes INST, CONT or TRIG (see 3.3.3).
[6] PLAY (Memory)	Playback of the Sound Memory content.
[7] STOP (Memory)	Stop the playback of the Sound Memory content.
[8] REC (Memory)	Recording with the Sound Memory, either from tape (source track switched to REPRO) or from an analog or digital input (source track switched to INPUT). To terminate the recording: press MEM STOP [7]. Depending on MEMREC MODE the recording is terminated automatically when the Sound Memory is full.
[9] SINGLE LOOP	Either repetitive replay from the Sound Memory (LOOP) or one-time replay of the memory content (SINGLE). The active mode is indicated by a flashing LOOP or SINGLE LED. When this key is pressed together with the SET key, the memory content is replayed in the reverse direction (REVERSE MEMPLAY MODE).
[10] BEGIN, [11] END	This function is used for monitoring the first three seconds (BEGIN) or the last three seconds (END) of the Sound Memory. The corresponding LED is on. Alternative: MEMPLAY replays the complete memory content. The MEM LENGTH display shows the start or stop time. When the BEGIN or END LED is on you can shift the start or endpoint within the memory by means of the TRIM >/< keys [13]; in most cases only the start point is important because the end point is determined with PUNCH OUT [28].
[12] SET / RESET	Sets the start or end point of the memory playback. The SET and RESET keys respond independently of the current monitoring mode – MEM PLAY, BEGIN PLAY (BEGIN LED on), or END PLAY (END LED on). Determining the start point „on the fly": Play back the memory (MEM PLAY, BEGIN PLAY, END PLAY); while holding down the SET key press BEGIN or END in the desired location. The Sound Memory playback starts automatically for a new determination of the start or end point.
[13] TRIM –/+	Shifts the start or end point of the memory playback (press TRIM>/< while BEGIN [10] or END [11] is light). When the TRIM key is held down the TRIM speed increases continually (from 4 ms/s to 100 ms/s after approx. 5 s). If the second TRIM key is pressed in addition to the first TRIM key, the TRIM key increases to 2 s/s after a short delay (TRIM <</>>).
[14] DELAY TIME / MEMORY LENGTH / DESTINATION	In Track Slipping set mode the maximum delay time is displayed; in Sound Memory set mode, the maximum memory length (depends on memory size, number of channels, and sampling frequency – max. 43 s or 174 s) is displayed. In Track Slipping mode the current delay is displayed whereas in Sound Memory mode the current loop time is displayed. In Track Bouncing mode the number of the current TRACK BANK is displayed (1...12); see 3.3.5 .

[15] TR SLIPP

First key depression: Activates the Track Slipping set mode, the TR SLIPP lamp flashes. Select the source and destination tracks (tracks 1...12 or 1...24) with the INPUT/REPRO keys on the CHANNEL REMOTE. The DELAY TIME/MEM LENGTH display [14] shows the maximum delay.

Second key depression: Activates the Track Slipping function, the TR SLIPP lamp is continually on. For additional operating steps: see Section 3.3.4. The DELAY TIME/MEM LENGTH display [14] shows the current delay. This setting is saved when the machine is switched off.

Third key depression: Deactivates the Track Slipping mode, the TR SLIPP lamp is off.

[16] TRIM –/+

Fine-adjustment of the delay in Track Slipping mode; the delay is shown in the DELAY TIME/MEMORY LENGTH display [14].

When the TRIM key is held down the TRIM speed increases continually (from 4 ms/s to 100 ms/s after approx. 5 s). If the second TRIM key is pressed in addition to the first TRIM key, the TRIM speed increases to 2 s/s after a short delay (TRIM <</>>).

[17] AUTO OFFSET

When AUTO OFFSET is activated the track slipping delay is automatically added to the content of the synchronizer offset register; the machine runs in synchronism with the delayed signal.

[18] TR BOUNCE

First key depression: Activates the Track Bouncing set mode, the TR BOUNCE lamp flashes. Select the source and destination tracks with SET [2], SOURCE/DESTIN [4], and BANK [19].

Second key depression: Activates the Track Bouncing function, the TR BOUNCE lamp is continually on. For additional operating steps: see 3.3.5.

Third key depression: Deactivates the Track Bouncing mode, the TR BOUNCE lamp is dark.

[19] BANK

Selects the track BANK (1...12) in Track Bouncing set mode; the track BANK is shown in the DELAY TIME/MEM LENGTH display [14]. With each depression of the BANK key the value in the display is incremented by one; if the BANK key is held down, the TRIM –/+ keys [16] can be used for „paging" up or down.

[20] EXT TRIG

Enables starting the sound memory by an external AC signal connected to the 6.3 mm EXT TRIG jack socket [21] at the rear side of the unit, e.g. by a kick drum sound. Required trigger level (threshold): –25 dBu.

[21] EXT TRIG connector

Input connector for the EXT TRIG signal, see [20].

[22] Setup Handler conn.

Connector for a direct link to the Setup Handler; requires optional parameter backup software 21.863.995.00 for McIntosh computers.

[23] Loop Through conn.

Same as [22], but with inverted gender.

3.3.2   Function overview

The D827 MCH can be equipped with an optional Sound Memory board on which the digital audio signal of 43 (Option No. 20.863.558.00) or 174 „channel seconds" (20.863.559.00) can be stored with a sampling frequency of 48 kHz.
This sound memory supports the following basic functions:

Sound Memory   Filling the memory with data, editing of the begin and end points, reading out the memory, inserting the data into the tape, see 3.3.3 .
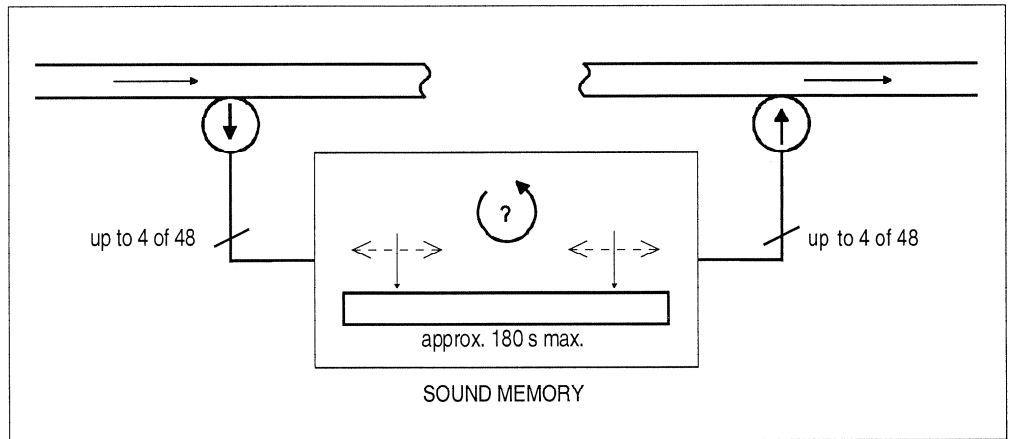
Track Slipping   Copying and delaying of up to 12 or 24 tracks (for 24 or 48 channel machines) with an adjustable delay, see 3.3.4 .
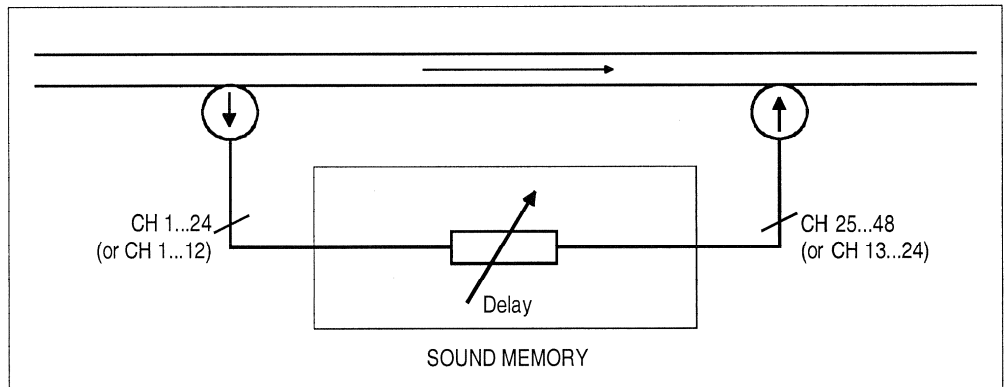
Track Bouncing   Sample accurate, simultaneous copying of max. 48 tracks to any other tracks, see 3.3.5 (this function is possible without Sound Memory board, too).
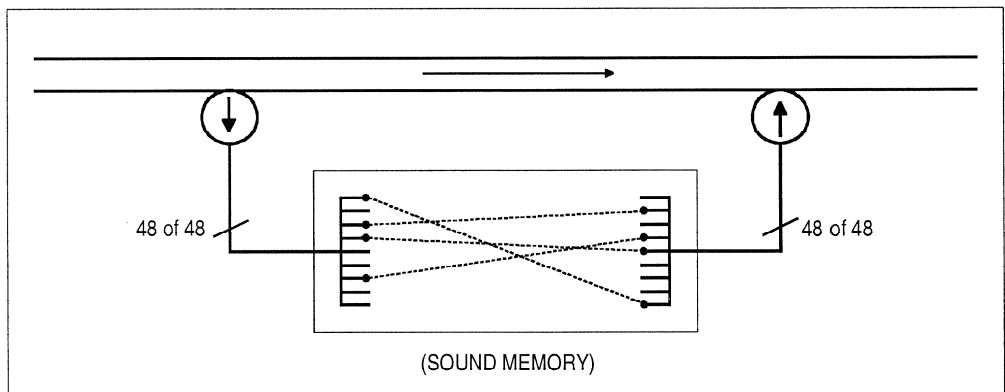
3.3.3   Sound Memory mode

Notes: The audio memory can only be activated from the Autolocator, and only when the D827 MCH operates in INSERT RECORD mode.
If the optional Sound Memory board is not installed no configuration or operating commands for the sound memory are accepted.

Activation

Activate the set mode for defining the source and destination tracks by pressing the SOUND MEM [1] key. The corresponding yellow lamp flashes, the maximum memory length is shown in the DELAY TIME/MEM LENGTH display [14].

Assigning the source track: If the SOURCE lamp is off, press the SOURCE/DESTIN key [4] once – the SOURCE lamp comes on.
Press the SET key [2] below the first (leftmost) numeric display [3]; the first register is activated. Its display flashes.
Select the desired track – either by entering the two-digit number on the numeric keypad, or by pressing the corresponding INPUT/REPRO key. The number of the selected source track flashes in the display.

Assigning the destination track:
Press the SOURCE/DESTIN key, the DESTIN lamp is on.
The first register is already activated from the preceding assignment of the source track.
Select the desired track – either by entering the two-digit number of the numeric keypad, or by pressing the corresponding INPUT/REPRO key. The number of the selected destination track flashes in the display.

2nd to 4th Registers: The procedure for the four registers is identical. The source and destination track assignment is preserved also when the machine is switched off.

Canceling: In set mode you can cancel the track assignment of all four registers by pressing CLR together with SOUND MEM. CLR alone cancels only the assignment made with SET.

Quitting the set mode: To quit the set mode press the SOUND MEM key [1]; the SOUND MEM lamp is continuously on.

Maximum memory length: It is determined by the number of channels, the capacity of the memory chips installed on the Sound Memory board, and the sampling frequency; it can be read out in the DELAY TIME/MEM LENGTH display [14].

	Memory length at 48 kHz sampling rate	
No. of selected channels	**20.863.558.00**	**20.863.559.00**
1 channel	43.691 s	174.763 s
2 channels	21.845 s	87.381 s
3 channels	14.564 s	58.254 s
4 channels	10.923 s	43.691 s

Memory recording (MEMREC)

MEMREC MODE	By pressing the MEMREC MODE key [5] the following memory functions can be selected:
INST	The memory recording function is started by pressing the REC (memory) key [8] and stops when the memory is full or when the STOP (memory) key [7] is pressed.
CONT	The memory recording function is started by pressing the REC (memory) key [8]. If a memory overflow occurs the oldest data are overwritten, that is, the memory contains always the newest data. To cancel the memory recording function press the MEM STOP key [7].
TRIG	The audio memory is switched to ready when the REC (memory) key [8] is pressed and the REC (memory) lamp flashes. To start (trigger) the memory recording function press the MEM STOP key [7]; the MEMREC lamp is continuously on. Since the memory is always running „in the background" it contains already 0.5 s of data before the trigger point. The remaining procedure is the same as for INST.
MEMREC	Start the tape in play mode; when the desired position is reached activate the memory recording function by pressing the REC (memory) key [8]; the REC (memory) lamp flashes; or: Switch the desired channels to INPUT if the input signal is to be stored. Start the memory recording by pressing the REC (memory) key [8]; the REC (memory) lamp flashes.

Memory play (MEMPLAY)

MEMPLAY MODE	This key switches between LOOP and SINGLE memory play mode.
LOOP:	The memory content is replayed in an endless loop.
SINGLE:	The memory content is replayed once.
REVERSE SINGLE LOOP	If the SINGLE LOOP key is pressed together with the SET key the memory content is replayed in the reverse direction; the LOOP or SINGLE lamp flashes.
MEM PLAY	Activates the replay of the audio memory. The destination channels are automatically switched to input.
Note:	While MEM PLAY is active the other analog and digital audio inputs are inhibited as destination channels.

Copying the memory content to tape

Start copying	The desired destination tracks have already been defined in Set mode (see „Activation" further above), but they can be changed at any time. Switch the destination tracks to READY and start the machine in record mode. The audio memory switches automatically to MEM PLAY and the stored audio data are copied to the tape.
LOOP active	The copying process is not stopped automatically until the machine quits the record mode; if MEM STOP [7] is pressed, the copying stops, but the machine continues recording.
SINGLE active	The copying process stops when the end of the audio memory is reached; the machine terminates the record mode automatically (punch-out).

Determining start and end of an audio memory recording

BEGIN When the BEGIN [10] key is pressed a 3 second loop is played beginning at the current start marker. The start marker can be readjusted with the TRIM</> keys [13] during the recording.
MEM STOP [7] interrupts the loop.
MEM PLAY [6] replays the memory content beginning at the new starting point.

END When the END [11] key is pressed a loop beginning 3 seconds before the end marker is played. The end marker can be readjusted with the TRIM</> keys [13] during the playback.
MEM STOP [7] interrupts the loop.
MEM PLAY [6] replays the memory content up to the new end point.

Notes: The start and end points can also be defined „on the fly" during playback. Hold down the SET [12] key and set the desired marker with the BEGIN [10] or END [11] keys. The determination of the marker is independent of the monitoring mode – PLAY (memory), BEGIN PLAY (BEGIN LED on), END PLAY (END LED on).
When RESET [12] is pressed together with BEGIN or END the begin or end point is reset to the absolute begin or end point of the audio memory. The existing audio data are preserved.
When the TRIM key is held down the TRIM speed increases continuously (from 4 ms/s to 100 ms/s after approx. 5 s). If the second TRIM key is pressed in addition to the first TRIM key the TRIM speed increases to 2 s/s after a brief delay (TRIM <</>>).

Quitting the audio memory mode

Press the SOUND MEM key [1]. This terminates the Sound Memory mode and the lamp turns off. Another mode can now be activated.

3.3.4   TRACK SLIPPING

Notes: **Track Slipping can only be activated when the D827 MCH operates in INSERT RECORD mode.**
If the optional Sound Memory board is not installed, neither Track Slipping configuration nor operation are possible.
❏ Up to eight user-defined channels from the channels 1...12 *(D827-24)*, or up to 24 channels from the channels 1...24 *(D827-48)* can be simultaneously copied and delayed.
❏ *D827-24:* the delayed version of channel 1 is copied to channel 13 (channel 2 to 14,..., channel 12 to channel 24).
D827-48: The delayed version of channel 1 is copied to channel 25, channel 2 to channel 26,..., channel 24 to channel 48).
❏ The DELAY TIME is identical for all selected channels. The maximum delay depends on the number of selected channels, the sampling frequency, and the installed Sound Memory option (20.863.558.00 or 20.863.559.00); it is shown in the DELAY TIME/MEM LENGTH display [14].
❏ Track slipping is not possible in NEW RECORD mode.

Activation

Press the TR SLIPP [15] key to activate the Set mode. The TR SLIPP lamp flashes.

Selecting the source/destination tracks:

Press the INPUT/REPRO key of the channel to be delayed (1...8 or 1...24). The REPRO lamp of the source channel and the INPUT lamp of the automatically assigned destination channel are on.
The Display [14] shows the maximum delay time; it depends on the number of activated channels and the capacity of the Sound Memory board.
The entire track slipping configuration can be cleared in Set mode by pressing CLR together with TR SLIPP.
To quit the Set mode press the TR SLIPP key [15] again; the TR SLIPP lamp is continuously on. The source and destination track assignment is preserved when the machine is switched off.

Notes: All destination tracks are automatically switched to READY and the source and destination tracks to REPRO.
Track Slipping can also be used for direct delay of audio channels without recording them – for example for delaying the signal from an accent microphone. The destination channels are switched to INPUT and the analog or digital output signal can be transmitted to the mixing console.

Max. delay time The maximum achievable delay time depends on the number of channels.
The delay time is shown in the TIME display [14]. The desired delay can be fine-adjusted (±1 ms) with the TRIM –/+ keys [16].
When the TRIM key is held down the TRIM speed increased continuously (from 4 ms/s to 100 ms/s after approx. 5 s). If the second TRIM key is pressed in addition to the first TRIM key the TRIM speed increases after a brief delay to 2 s/s (TRIM <</>>).

AUTO OFFSET When AUTO OFFSET [17] is active the programmed track slipping delay is automatically added to the synchronizer offset register; the machine operates in synchronism with the delayed signal.

Quitting the track slipping mode

Press TR SLIPP key [15] to terminate the Track Slipping mode. The TR SLIPP lamp is off.

3.3.5   TRACK BOUNCING

Note: Also track bouncing is only possible in INSERT RECORD.

Activation

Press the TR BOUNCE key [18] to activate the Set mode. The yellow LED flashes. All 48 destination tracks can be selected in groups of four (called „track BANKs"); the DELAY TIME/MEMORY LENGTH display shows the current track BANK (1...12) of the destination tracks. By pressing the BANK [19] key you can „page" through all 12 track BANKs. If the BANK key is held down continuously you can also page up or down with the TRIM –/+ keys [16].

Assigning the source and destination tracks:

A: „Paging" through the track BANK:
❏   With the BANK key select the desired track BANK (destination tracks) – its number is shown in the DELAY TIME/MEMORY LENGTH display; the SOURCE lamp is on.
❏   Press the SET key [2] of the desired destination channel. You can define the destination track with the numeric keys or an INPUT/REPRO key of the Channel Remote. The number of the corresponding track appears on the display [3].
❏   Assign additional tracks in the same manner.

B: Direct access to the destination channel (fast method):
❏   Press the SOURCE/DESTIN [4] key until the DESTIN lamp is on.
❏   Define a destination track with an INPUT/REPRO key of the Channel Remote or with the numeric keys. The corresponding SET key is selected and ready for entering the source track (SOURCE lamp on).
❏   Define a source track with an INPUT/REPRO key of the Channel Remote or with the numeric keys.
❏   Repeat the procedure for assigning additional tracks.

The selected destination tracks are automatically switched to READY; all source and destination tracks are switched to REPRO.

To cancel the source and destination track assignment press the SET [2] key and CLEAR. This is confirmed on the display [3] with „- -".
The entire track bouncing configuration can be canceled in Set mode by pressing CLEAR together with TR BOUNCE.

To quit the Set mode press the TR BOUNCE key again; the TR BOUNCE lamp is continuously on. The source and destination track assignment is preserved when the machine is switched off.

Quitting the Track Bouncing mode

Press the TR BOUNCE key again to quit the track bouncing mode; the TR BOUNCE lamp is off. You can now activate another operating mode.

3.4   Remote level display (option)

The Remote Level Display can be positioned away from the tape machine – for example, at the mixing console, if the machine is installed in a different room. The display facilities are the same as on the LCU of the machine, but the bargraph display is longer and consequently has a higher display resolution.
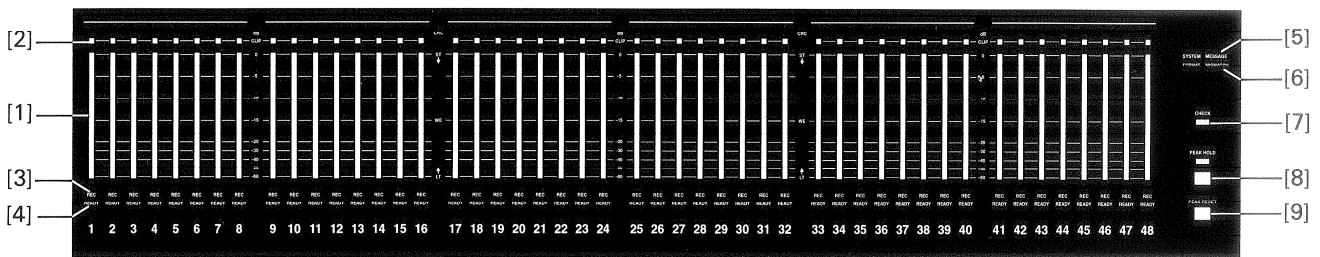
⚠ **Remote cables may be connected and disconnected only when all units involved have been switched off.**

The remote level display is powered via the remote cable. Connection: See Section 4.

[1] Bargraph scale

The scale is subdivided into two areas with different resolution:
0...–20 dB; each LED corresponds to 1 dB; the top three LEDs have a different color.
–20...–60 dB; each LED corresponds to 5 dB.

[2] Examples:

     0 dB: The peak value of the signal is within the range of 0...–0.9 dB.
    –30 dB: The peak value of the signal is within the range of –30...–34.9 dB.
    –35 dB: The peak value of the signal is within the range of–35...–39.9 dB.

[2] CLIP

The A/D converter is overloaded. This indicator is always active when the analog inputs operate in INPUT mode; in REPRO mode it is only active during RECORD.

[3] REC

Record indicator (red LED)

[4] READY

Record ready indicator (green LED)

[5] SYSTEM MESSAGE

This indicator flashes to signal faults and errors in the power supply, tape deck, electronics, etc. A corresponding message appears on the system control display of the machine.

[6] FORMAT MISMATCH

This indicator flashes when the machine is operated with an external clock reference whose frequency does not agree with the sampling frequency of the recorded tape. In addition and error messages appears on the system control display of the machine.

[7] CHECK

The CHECK key switches the audio level display [33] to tape quality mode. The top and bottom LEDs of the level bargraphs are continuously on. *Activation of the CHECK function is only useful in PLAY mode.* In all other tape deck states the level indication on the bargraphs drops to the minimum.

If a tape is not formatted no proper PLAY status can be achieved, neither quality or TAPE EMPTY indication is possible (in this case the PLAY lamp flashes, the RT level indication in REPRO remains dark, and the decimal point behind the „r" on the RT tape counter display is missing).

On partially formatted tapes TAPE EMPTY can only be detected if playback was started in a formatted location.

If a 48-track machine is used for replaying a tape that has been recorded on a 24-track machine, TAPE EMPTY is correctly shown for the (unformatted) tracks 25...48.

From top to bottom all CRC errors of the corresponding tracks averaged across a sliding window of approx. 3.5 s (Short Term). From the bottom to the top they are averaged across a sliding window of approx. 28 s (Long Term). In this way tape locations with elevated CRC rate can be systematically discovered. The CRC sums on both display sections are scaled in such a way that 6 LEDs (5, plus the one that is continuously on) represent a good quality. The LED in the middle of the level bargraph has a special meaning: It indicates a Word Error (interpolation). The red CLIP indicator above the level bargraph signals an unformatted tape location (Tape Empty), i.e. a new tape or a tape having been erased with a bulk eraser. *The precondition for this is, however, that PLAY has been started on a formatted area of the tape. Please note also that all CRC indications in Tape Empty condition are meaningless.*

The long-term as well as the short-term CRC peak values and the Tape Empty indication can be frozen with the PEAK HOLD [10] key.

See also 2.1.2; the resolution of the Remote Level Display is twice as high as the one on the LCU.

[8] PEAK HOLD

Local function for the Remote Level Display; has no effect on the level display on the Local Control Unit (LCU) of the machine!

MOMENTARY   **PEAK HOLD pressed once:** Activates the momentary PEAK HOLD function. The peak level is held for approx. 3 s and then reset, but any upward deviation will be indicated immediately.

In CHECK mode (CRC test) pressing PEAK HOLD once already initiates a permanent HOLD function, the peak values remain stored until they are reset with the PEAK RESET key or the CHECK function is deactivated by pressing PEAK HOLD a second time.

PERMANENT   **PEAK HOLD pressed twice:** Activates the permanent PEAK HOLD function. The peak level is held and shown as an individual dot. The display is updated only when higher values occur. To reset the display press PEAK RESET.

In CHECK mode (CRC test) pressing PEAK HOLD once already initiates a permanent HOLD function, the peak values remain stored until they are reset with the PEAK RESET key or the CHECK function is deactivated by pressing PEAK HOLD a second time.

Note: PEAK HOLD can also be selected either on the Channel Remote or on the LCU; in this case it influences the level indication on the LCU as well as on the Remote Level Display.

[9] PEAK RESET

Local function for the Remote Level Display without effect on the level indication on the Local Control Unit (LCU) of the machine!

Resets the stored PEAK HOLD value.

Note: PEAK RESET can also be selected on the Channel Remote or on the LCU; in these cases it influences the level indication on the LCU as well as on the Remote Level Display.

4   Connecting remote controls

⚠ **Remote control connections may be established and disconnected only if all concerned units are switched off.**

4.1   REMBUS remote controls

Audio and tape deck remote controls (CHANNEL REMOTE and AUTOLOCATOR) as well as the Parallel Audio Interface (PAI) can be connected to the recorder's serial remote bus called "REMBUS" - but only one remote of the same type *at the same time (e.g. not two AUTOLOCATORs).*
If only one remote control is used, the following connection suggests itself:
One of the two REMBUS terminals of the recorder is connected to one of the two REMBUS terminals of the remote control by the REMBUS cable 1.862.421.00 (15 m long).

If more than one remote control is to be connected, basically the following two possibilities are available:

Configuration 1   Suited if all remotes (F1 to F3) are located in close proximity:
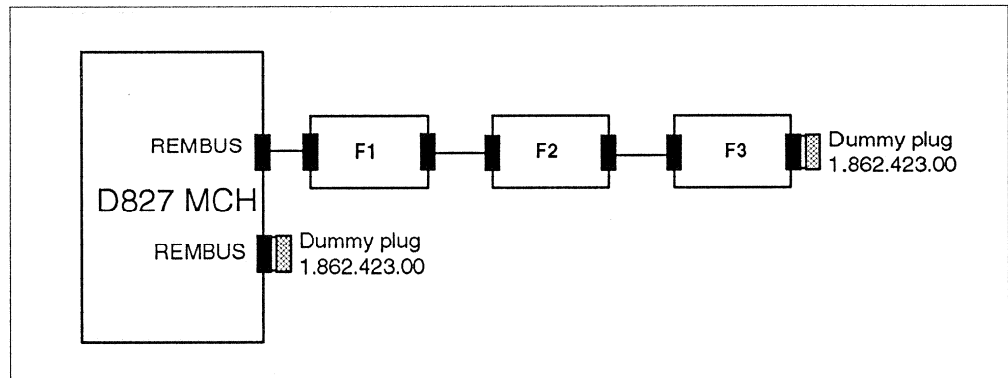
Configuration 2   Suited if one of the remoes (F3 in the example) is located much nearer to the recorder than to the remaining remotes:
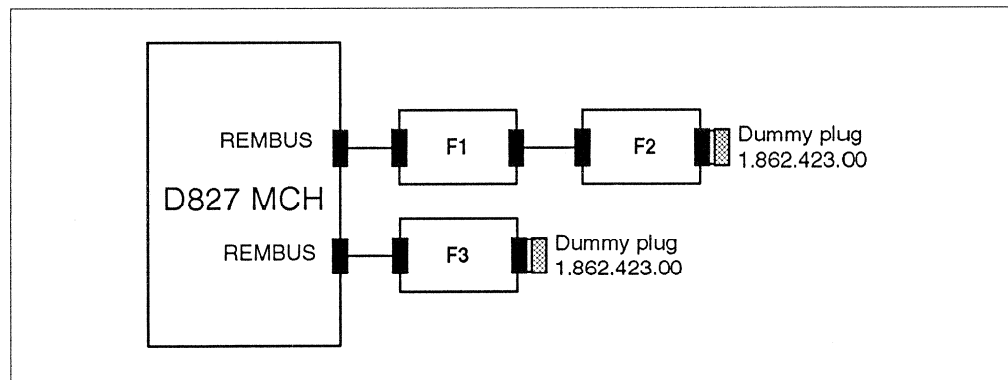
⚠ **Unused REMBUS terminals, as well at the recorder as at the remotes, must be terminated by a dummy plug (1.862.423.00), even if only one single remote is used!**

If required, longer remote cables (>15 m) can be used - please contact your Studer representative.

4.2   Parallel Audio Interface (PAI)

General The Parallel Audio Interface (19", 3 U) converts the serial REMBUS remote format of the D827 MCH to a parallel format and vice versa. This allows that every Audio, Cue, and TC track as well as selected special functions can be controlled from the mixing console. It is connected to the D827 MCH at the REMBUS terminal (9-pin, D-type). For the connection to the mixing console, parallel control lines in up to seven groups of one 50-pin and an optional 9-pin D-type connector are provided. Each of these groups consist of:

❏ 6 Audio groups for the control lines of 8 digital audio channels each
❏ 1 Master group for the control lines of the two Cue tracks and the TC track, plus special functions.

Control lines Connections whose signal name starts with "S-" are used as control inputs (from the mixing console to the recorder). Connections whose signal name starts with "B-" are used as acknowledgement outputs (from the recorder to the mixing console). If a pin is labelled "not used", it is not connected or undefined - these pins must not be used.

Control lines per audio group

50-pin D-type connector (Main lines for 8 digital audio channels)
8   INPUT/REPRO control inputs (switch closed = REPRO)
8   SAFE/READY control inputs (switch closed = READY)
8   INPUT acknowledgement outputs
8   REPRO acknowledgement outputs
8   RECORD acknowledgement outputs
8   READY acknowledgement outputs

9-pin D-type connector (Optional lines for 8 digital audio channels)
8   SAFE acknowledgement outputs

### Control lines of the master group

50-pin D-type connector (Main lines for the 3 Aux channels - CUE 1, CUE 2, TC - and special functions)
3   INPUT/REPRO control inputs (switch closed = REPRO)
3   SAFE/READY control inputs (switch closed = READY)
1   ALL INPUT control input
1   ALL REPRO control input
1   ALL READY control input
1   ALL SAFE control input
1   MASTER SAFE control input
1   REHEARSE control input
1   RECORD MUTE control input
1   AUTO INPUT control input
1   AUTO MUTE control input
3   INPUT acknowledgement outputs
3   REPRO acknowledgement outputs
3   RECORD acknowledgement outputs
3   READY acknowledgement outputs
3   SAFE acknowledgement outputs
1   ALL INPUT acknowledgement output
1   ALL REPRO acknowledgement output
1   ALL READY acknowledgement output
1   ALL SAFE acknowledgement output
14 Spare lines ("not used")

9-pin D-type connector (Optional lines for special functions)
1 MASTER SAFE acknowledgement output
1 REHEARSE acknowledgement output
1 RECORD MUTE acknowledgement output
1 AUTO INPUT acknowledgement output
1 AUTO MUTE acknowledgement output
3 Spare lines ("not used")

4.2.1   Pin assignments

50-pin D-type connector
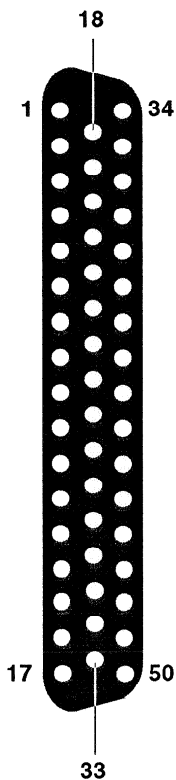
D	Audio 1-8	Audio 9-16	Audio 17-24	Audio 25-32	Audio 33-40	Audio 41-48	Master
01	DGND	DGND	DGND	DGND	DGND	DGND	DGND
02	S-REP-01	S-REP-09	S-REP-17	S-REP-25	S-REP-33	S-REP-41	S-REP-CUE1
03	S-REP-04	S-REP-12	S-REP-20	S-REP-28	S-REP-36	S-REP-44	S-REA-CUE2
04	S-REA-01	S-REA-09	S-REA-17	S-REA-33	S-REA-33	S-REA-41	S-ALL-REA
05	S-REA-02	S-REA-10	S-REA-18	S-REA-26	S-REA-34	S-REA-42	S-ALL-SAF
06	S-REA-05	S-REA-13	S-REA-21	S-REA-29	S-REA-37	S-REA-45	S-REHEARSE
07	B-RCD-01	B-RCD-09	B-RCD-17	B-RCD-25	B-RCD-33	B-RCD-41	not used
08	B-RCD-03	B-RCD-11	B-RCD-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	not used
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	not used
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	not used
16	B-REA-03	B-REA-11	B-REA-19	B-REA-27	B-REA-35	B-REA-43	B-ALL-SAF
17	B-REA-06	B-REA-14	B-REA-22	B-REA-30	B-REA-38	B-REA-46	not used
18	S-REP-02	S-REP-10	S-REP-18	S-REP-26	S-REP-34	S-REP-42	S-REA-CUE1
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	not used
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-MAST-SAF
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	not used
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	not used
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	B-REP-46	B-INP-TC
31	B-REA-02	B-REA-10	B-REA-18	B-REA-26	B-REA-34	B-REA-42	B-ALL-REA
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	not used
34	S-REP-03	S-REP-11	S-REP-19	S-REP-27	S-REP-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-RECMUTE
37	S-REA-04	S-REA-12	S-REA-20	S-REA-28	S-REA-36	S-REA-44	S-ALL-REP
38	S-REA-07	S-REA-15	S-REA-23	S-REA-31	S-REA-39	S-REA-47	S-AUTOINP
39	S-REA-08	S-REA-16	S-REA-24	S-REA-32	S-REA-40	S-REA-48	S-AUTOMUTE
40	B-RCD-05	B-RCD-13	B-RCD-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	not used
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	not used
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	not used
47	B-REP-08	B-REP-16	B-REP-24	B-REP-32	B-REP-40	B-REP-48	not used
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	not used
50	VCC	VCC	VCC	VCC	VCC	VCC	VCC

9-pin D-type connector
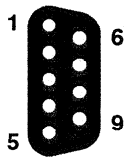
| D	Audio 1-8	Audio 9-16	Audio 17-24	Audio 25-32	Audio 33-40	Audio 41-48	Master
01	DGND	DGND	DGND	DGND	DGND	DGND	DGND
02	B-SAF-01	B-SAF-09	B-SAF-17	B-SAF-25	B-SAF-33	B-SAF-41	not used
03	B-SAF-03	B-SAF-11	B-SAF-19	B-SAF-27	B-SAF-35	B-SAF-43	B-REHEARSE
04	B-SAF-05	B-SAF-13	B-SAF-21	B-SAF-29	B-SAF-37	B-SAF-45	not used
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	not used
07	B-SAF-04	B-SAF-12	B-SAF-20	B-SAF-28	B-SAF-36	B-SAF-44	B-MAST-SAF
08	B-SAF-06	B-SAF-14	B-SAF-22	B-SAF-30	B-SAF-38	B-SAF-46	B-RECMUTE
09	B-SAF-08	B-SAF-16	B-SAF-24	B-SAF-32	B-SAF-40	B-SAF-48	B-AUTOMUTE

4.2.2   Control signal input, acknowledgement output
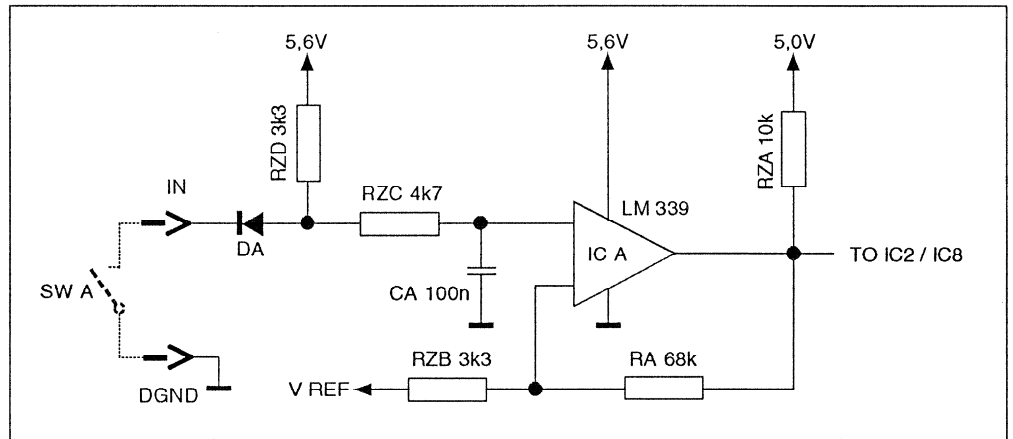
Control input: Signals "S-.."
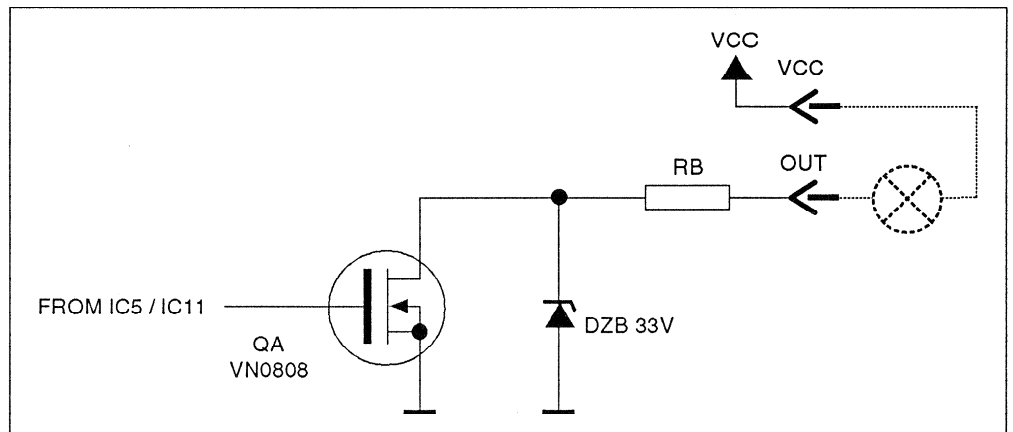
Acknowledgement output: Signals "B-.."

4.2.3   Configuration of the Parallel Audio Interface

1.328.631.20
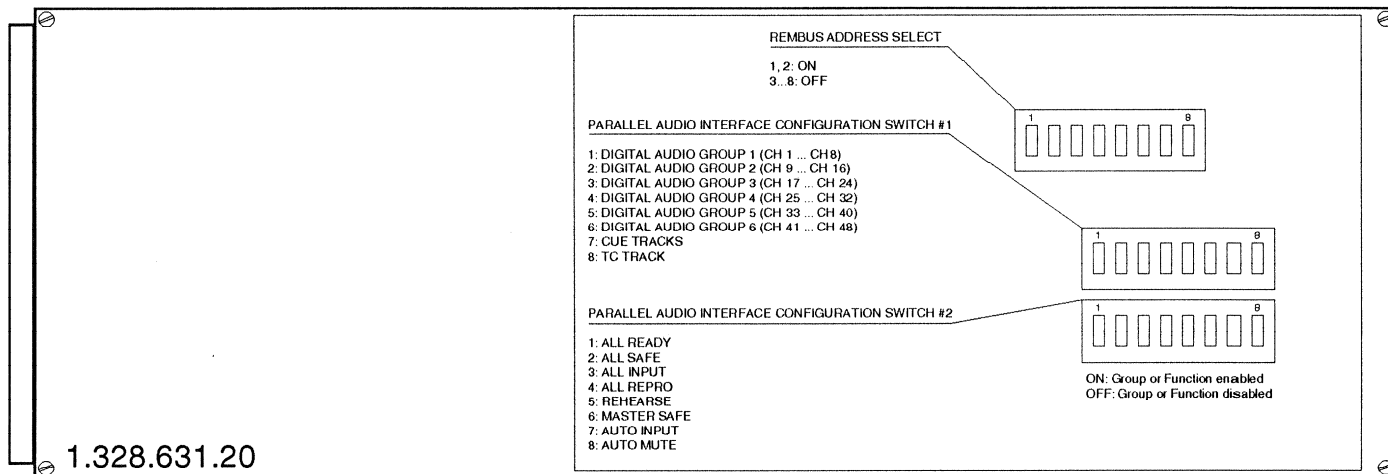
Switch No. 0:   REMBUS address selection
1, 2: ON
3...8: OFF

Switch No. 1:   Parallel Audio Interface configuration switch No. 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 No. 2:   Parallel Audio Interface configuration switch No. 2
1: All Ready
2: All Safe
3: All Input
4: All Repro
5: Rehearse
6: Master Safe
7: Auto Input
8: Auto Mute

Set the corresponding DIL switch to ON to activate a function of the PAI. In this case the selected function on the Local Control Unit (LCU) and on the Autolocator will be de-activated.

Note: If only the READY function is used by the mixing console, connect all S-REP-XX inputs or the S-ALLREP input to DGND in order to switch the recorder to REPRO.

4.3   SETUP CONTROL - computer connection for SET-UP HANDLER
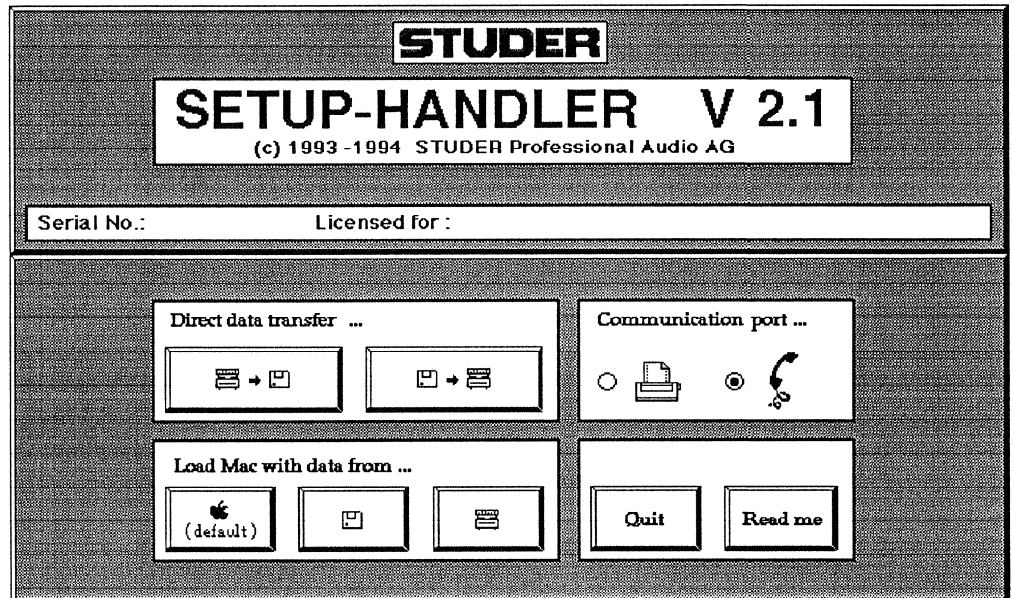
The SET-UP HANDLER is a program written for McIntosh computers which was primarily developped for the back-up of user-defined settings and for restoring them into the recorder. Besides, it is a convenient tool for performing settings of the recorder (i.e. the complete range of SETUP and FUNCTIONS - refer to the corresponding sections above).
This utility is available as an accessory.

Important: The Set-up Handler is not meant as an online user interface but as an extension for easily and comfortably restoring settings (e.g. in order to have individual presets for different users without the need of working through all menues each time the user changes).
Basic practice in using McIntosh computers is presumed.

Specifications of the McIntosh computer for using the SET-UP HANDLER, V 2.1:
- ❏ Operating system 7.1 or higher
- ❏ free hard disk memory: approx. 5 MBytes (Compact Stack)
- ❏ free RAM space: approx. 2 MBytes
- ❏ For optimum convenience a Powerbook 145 or better is recommended.

Important: Before connecting the computer with or separating it from the D827 MCH, both units should be switched off (a special cable, Order-No. 41.001.804.22, is shipped together with the software).

Installation: Installation instructions are shipped together with the software; the file format is different for 24 or 48 track recorders. Detailed information is included in the installation instructions. The program diskette contains an additional README file with current information.

Information on the special cable and the connector pin assignment: See section 6.8.5.

5   Technical Specifications (Subject to change as technological progress may warrant)

Momentarily available tapes:	The specifications can be guaranteed until further notice only with the following tape types: ❑ Ampex 467 (Tape A) ❑ BASF 931 (Tape A) ❑ Fuji Film D-1/2 Series (Tape B) ❑ Scotch 3M 27516 (Tape B) ❑ SONY D-½ Series (Tape B)
Maximum cable lengths:	The total length of remote control cables must not exceed 100 m.
Recording format:	**DASH-F**

No. of tracks:

	Digital audio tracks:	D827-48	**48 tracks**
		D827-24	**24 tracks**
		(upgradeable to 48 tracks)	
	Aux tracks:	D827 MCH	**Reference track** **Time code track** **2 CUE tracks**

Sampling rate:	**48 kHz / 44.1 kHz / 44.056 kHz** (selectable)
Tape speed:	**76.2 cm/s** (30 ips) at f_s = 48 kHz
Variable tape speed:	**± 12.5 %**
Recording time:	**approx. 60 min** (reel dia. 35.6 cm, 2680 m) at f_s = 48 kHz **approx. 65 min** (reel dia. 35.6 cm, 2680 m) at f_s = 44.1 kHz
Winding time:	**approx. 3 min** (reel dia. 35.6 cm, 2680 m)
Quantization:	**16 bits,** linear
Frequency response:	**20 Hz...20 kHz,** ±0.3 dB [1]
THD + N:	**< -90 dB** (-30 dBFS, emphasis off) **< -96 dB** (-30 dBFS, emphasis on) [1]
Channel separation:	**> 88 dB** [1]
Dynamic range:	**> 93 dB** (emphasis off) **> 97 dB** (emphasis on) [1]
Emphasis:	**50 µs / 15 µs** (selectable for each analog input individually) [2]
TC generator:	**SMPTE standard** 24 / 25 / 29.97D / 29.97ND / 30D / 30ND frames/s
Analog inputs:	**Digital audio tracks:** [2] transformer-balanced, impedance >10 kΩ; input level: **+14...+28 dBu** (steps of 0.1 dB) **CUE tracks:** transformer-balanced, impedance >10 kΩ; input level: **+14...+24 dBu** (steps of 0.1 dB)

Analog outputs:	**Digital audio tracks:** electronically balanced, impedance < 50 Ω; output level: **+14...+28 dBu** (steps of 0.1 dB)		[2]
	CUE tracks: electronically balanced, impedance < 50 Ω; output level: **+14...+24 dBu** (steps of 0.1 dB)		
Digital inputs:	**AES/EBU** **MADI** **SDIF-2**	XLR, 3-pin female, 110 Ω BNC, 75 Ω D-Sub, 50-pin male	[2]
Digital outputs:	**AES/EBU** **MADI** **SDIF-2**	XLR, 3-pin male, 110 Ω BNC, 75 Ω D-Sub, 50-pin female	[2]
Clock inputs:	**Word Clock** **Sector Clock** **Video Sync** **Square-wave**	TTL level, BNC, 75 Ω TTL level, BNC, 75 Ω looped-through, BNC, 75 Ω looped-through, BNC, 75 Ω	
Clock outputs:	**Word Clock** **Sector Clock**	TTL level, BNC, 75 Ω TTL level, BNC, 75 Ω	
Additional inputs:	**Timecode** (SMPTE-TC) **Reference track**	looped-through, XLR, 3-pin female TTL level, BNC, 75 Ω	
Additional outputs:	**Timecode** (SMPTE-TC) **Reference track**	XLR, 3-pin male TTL level, BNC, 75 Ω	
Control inputs:	**REMBUS**	looped-through, balanced, Studer standard (for Autolocator, Channel Remote, and Parallel Audio Interface)	
	Rem. Level Display	balanced, Studer standard	
	SETUP CONTROL	balanced (for Setup Handler and service)	
	ES-BUS	looped-through, balanced	
	Parallel Remote and Synchronizer		
	Master Tallies	(signalling inputs)	
	Terminal	unbalanced (for service)	

Operating mains voltage:	**115 V,** range 90...127 V, 50/60 Hz	
	230 V, range 180...254 V, 50/60 Hz	
Power consumption:	**800 W** (48 CH, all options, PLAY)	
	1500 W (peak)	
Safety and EMC:	Safety standards	EN 60065 / 1993
		IEC 65 / 1985
	EMC standards	EN 50081-1 / 1992
		EN 50082-1 / 1992
Ambient temperature:	**+5 °C...+40 °C**	
Relative humidity:	**20%...90%** (non-condensing)	
Dimensions:	**880 × 1000 × 800 mm** (W × H × D - refer to 5.1)	
Weight:	**approx. 240...260 kg** (depending on options)	

[1]) Test conditions: A/D-D/A, 20 Hz...20 kHz, f_s = 48 kHz
[2]) Optionally available

5.1   Dimensions (in mm)
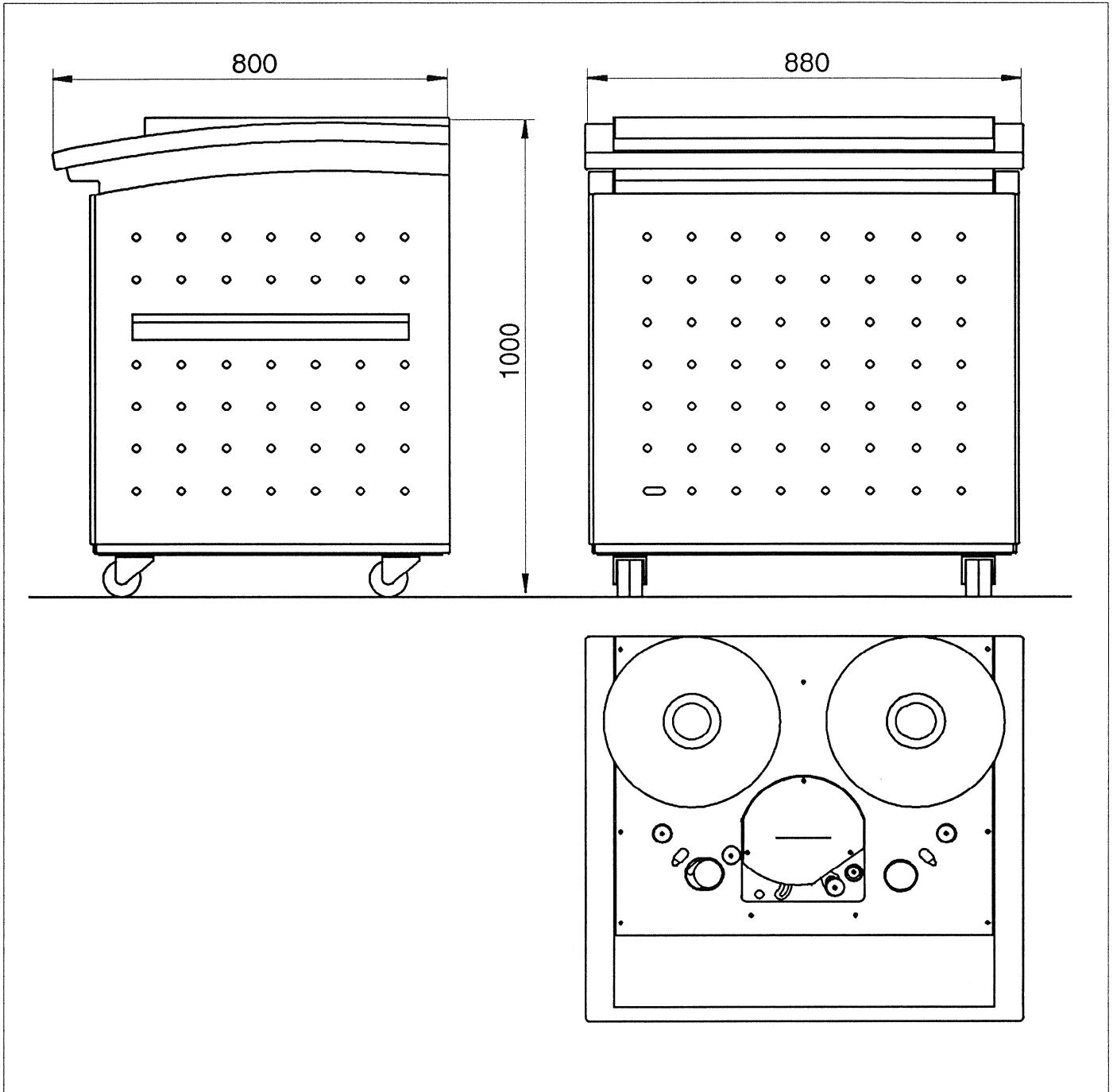
6   Connectors and pin assignments
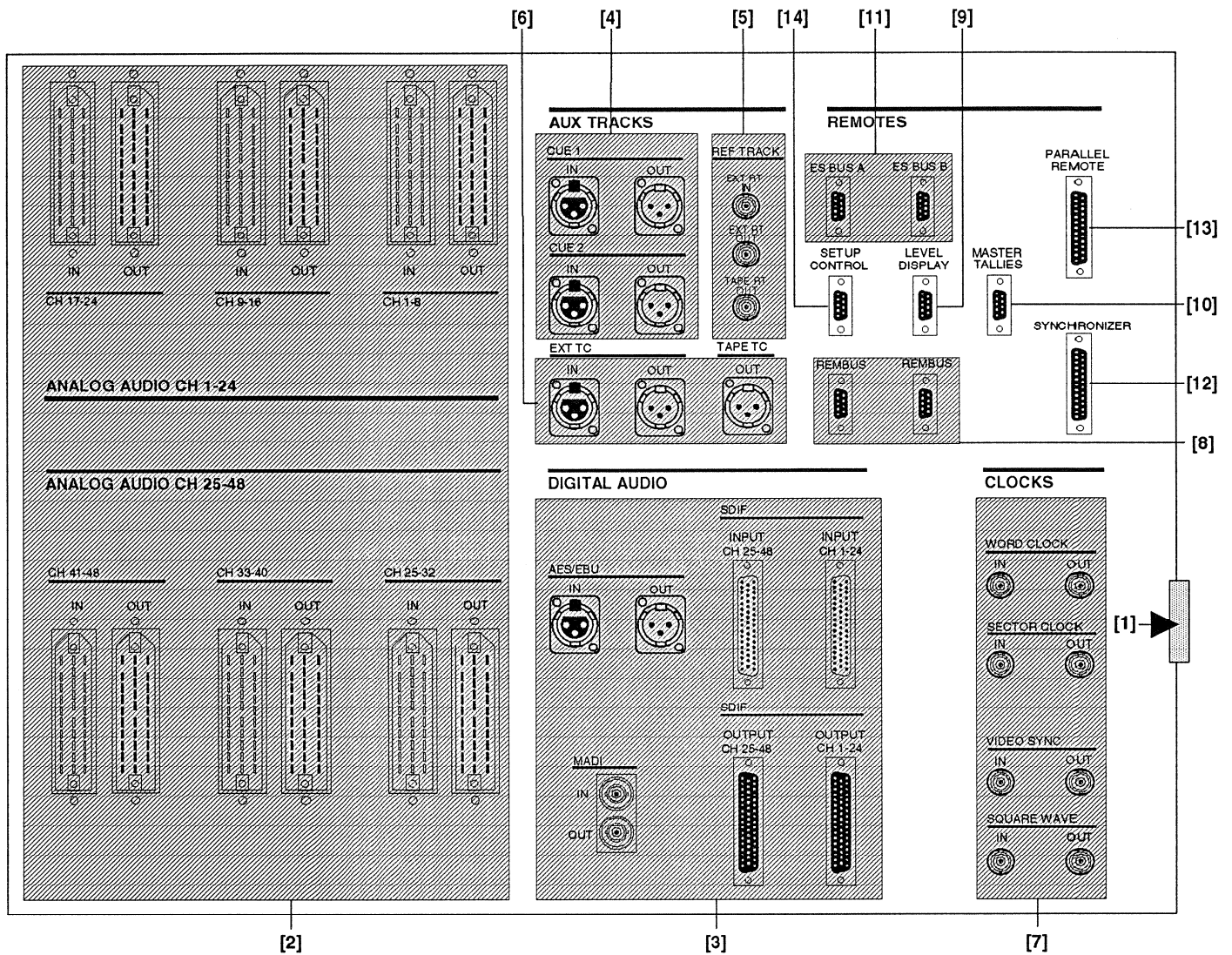
[1]   Mains input, refer to 6.1

[2]   Analog audio IN/OUT, refer to 6.2

[3]   Digital audio IN/OUT, refer to 6.3

[4]   Auxiliary tracks, refer to 6.4

[5]   Reference track, refer to 6.5

[6]   Timecode, refer to 6.4 und 6.6

[7]   Clock signals, refer to 6.7

[8]   REMBUS, refer to 6.8.1

[9]   Remote level display, refer to 6.8.2

[10]   Master Tallies input, refer to 6.8.3

[11]   ES bus, refer to 6.8.4

[12]   Synchronizer, refer to 6.8.6

[13]   Parallel Remote, refer to 6.8.7

[14]   Setup Control (computer connection), refer to 6.8.5

6.1   Mains input
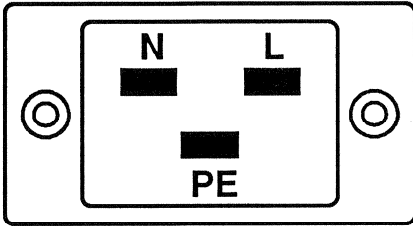
IEC 320 / C20

L = Live
PE = Protective Earth
N = Neutral

6.2   Analog audio inputs and outputs (option)

Valid for all inputs: Balanced and floating (with transformer)
input impedance >10 kΩ (f: 20 Hz...20 kHz), max. level 28 dBu.

Valid for all outputs: Electronically balanced
output impedance <50 Ω (f: 20 Hz...20 kHz), output level for floating load max. 28 dBu, for unbalanced load max. 26.5 dBu.

CH 1-8 IN   **Inputs for channels 1 through 8**
Pin assignment (IEC 130.6, 30-pin, female):
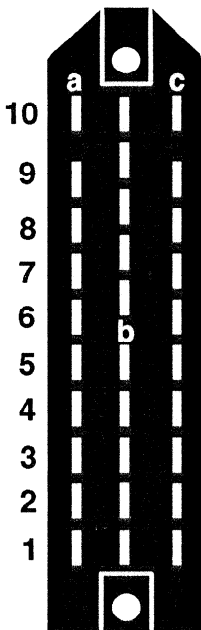
Pin	Signal name	Description
1a	CO_AIN01	Channel 1 (+)
1b	COIAIN01	Channel 1 (-)
1c	GND	Ground
2a	CO_AIN02	Channel 2 (+)
2b	COIAIN02	Channel 2 (-)
2c	GND	Ground
3a	CO_AIN03	Channel 3 (+)
3b	COIAIN03	Channel 3 (-)
3c	GND	Ground
4a	CO_AIN04	Channel 4 (+)
4b	COIAIN04	Channel 4 (-)
4c	GND	Ground
5a	CO_AIN05	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	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

CH 9-16 IN

Inputs for channels 9 through 16
Pin assignment (IEC 130.6, 30-pin, female):
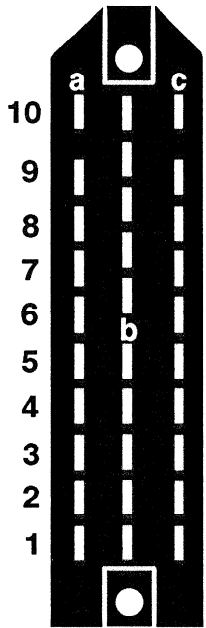
Pin	Signal name	Description
1a	CO_AIN09	Channel 9 (+)
1b	COIAIN09	Channel 9 (-)
1c	GND	Ground
2a	CO_AIN10	Channel 10 (+)
2b	COIAIN10	Channel 10 (-)
2c	GND	Ground
3a	CO_AIN11	Channel 11 (+)
3b	COIAIN11	Channel 11 (-)
3c	GND	Ground
4a	CO_AIN12	Channel 12 (+)
4b	COIAIN12	Channel 12 (-)
4c	GND	Ground
5a	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	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

CH 17-24 IN

Inputs for channels 17 through 24
Pin assignment (IEC 130.6, 30-pin, female):
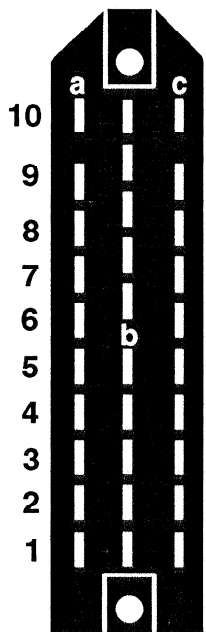
Pin	Signal name	Description
1a	CO_AIN17	Channel 17 (+)
1b	COIAIN17	Channel 17 (-)
1c	GND	Ground
2a	CO_AIN18	Channel 18 (+)
2b	COIAIN18	Channel 18 (-)
2c	GND	Ground
3a	CO_AIN19	Channel 19 (+)
3b	COIAIN19	Channel 19 (-)
3c	GND	Ground
4a	CO_AIN20	Channel 20 (+)
4b	COIAIN20	Channel 20 (-)
4c	GND	Ground
5a	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	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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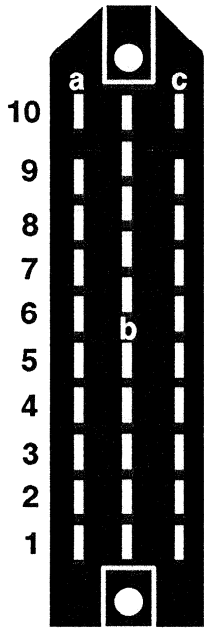
Inputs for channels 25 through 32
Pin assignment (IEC 130.6, 30-pin, female):

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	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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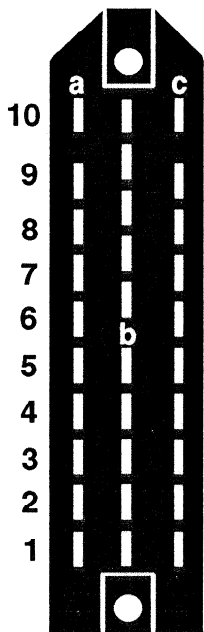
Inputs for channels 33 through 40
Pin assignment (IEC 130.6, 30-pin, female):

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	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

CH 41-48 IN

Inputs for channels 41 through 48
Pin assignment (IEC 130.6, 30-pin, female):
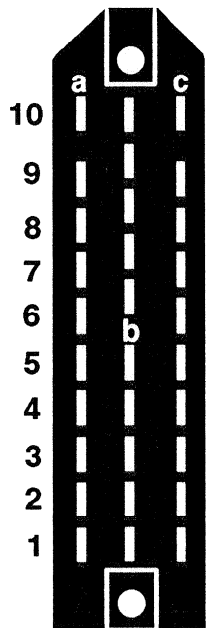
Pin	Signal name	Description
1a	CO_AIN41	Channel 41 (+)
1b	COIAIN41	Channel 41 (-)
1c	GND	Ground
2a	CO_AIN42	Channel 42 (+)
2b	COIAIN42	Channel 42 (-)
2c	GND	Ground
3a	CO_AIN43	Channel 43 (+)
3b	COIAIN43	Channel 43 (-)
3c	GND	Ground
4a	CO_AIN44	Channel 44 (+)
4b	COIAIN44	Channel 44 (-)
4c	GND	Ground
5a	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	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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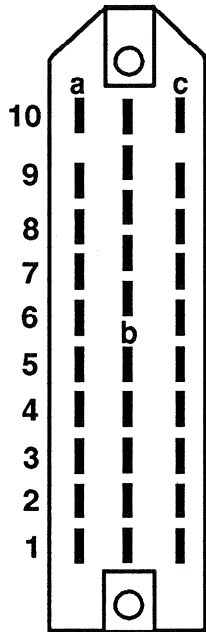
Outputs for channels 1 through 8
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	DA_OUT01	Channel 1 (+)
1b	DAIOUT01	Channel 1 (-)
1c	GND	Ground
2a	DA_OUT02	Channel 2 (+)
2b	DAIOUT02	Channel 2 (-)
2c	GND	Ground
3a	DA_OUT03	Channel 3 (+)
3b	DAIOUT03	Channel 3 (-)
3c	GND	Ground
4a	DA_OUT04	Channel 4 (+)
4b	DAIOUT04	Channel 4 (-)
4c	GND	Ground
5a	DA_OUT05	Channel 5 (+)
5b	DAIOUT05	Channel 5 (-)
5c	GND	Ground
6a	DA_OUT06	Channel 6 (+)
6b	DAIOUT06	Channel 6 (-)
6c	GND	Ground
7a	DA_OUT07	Channel 7 (+)
7b	DAIOUT07	Channel 7 (-)
7c	GND	Ground
8a	DA_OUT08	Channel 8 (+)
8b	DAIOUT08	Channel 8 (-)
8c	GND	Ground
9a	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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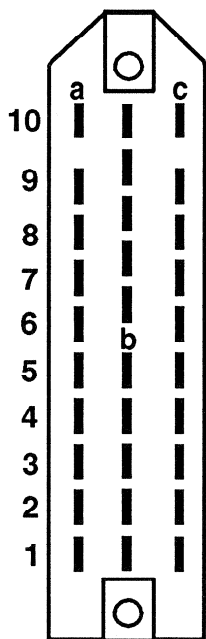
Outputs for channels 9 through 16
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	DA_OUT09	Channel 9 (+)
1b	DAIOUT09	Channel 9 (-)
1c	GND	Ground
2a	DA_OUT10	Channel 10 (+)
2b	DAIOUT10	Channel 10 (-)
2c	GND	Ground
3a	DA_OUT11	Channel 11 (+)
3b	DAIOUT11	Channel 11 (-)
3c	GND	Ground
4a	DA_OUT12	Channel 12 (+)
4b	DAIOUT12	Channel 12 (-)
4c	GND	Ground
5a	DA_OUT13	Channel 13 (+)
5b	DAIOUT13	Channel 13 (-)
5c	GND	Ground
6a	DA_OUT14	Channel 14 (+)
6b	DAIOUT14	Channel 14 (-)
6c	GND	Ground
7a	DA_OUT15	Channel 15 (+)
7b	DAIOUT15	Channel 15 (-)
7c	GND	Ground
8a	DA_OUT16	Channel 16 (+)
8b	DAIOUT16	Channel 16 (-)
8c	GND	Ground
9a	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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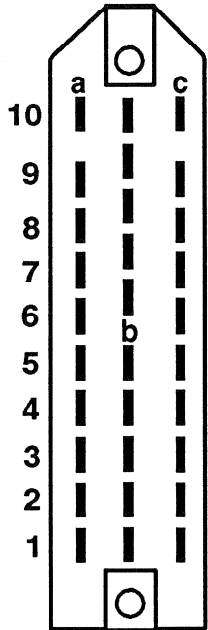
Outputs for channels 17 through 24
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	DA_OUT17	Channel 17 (+)
1b	DAIOUT17	Channel 17 (-)
1c	GND	Ground
2a	DA_OUT18	Channel 18 (+)
2b	DAIOUT18	Channel 18 (-)
2c	GND	Ground
3a	DA_OUT19	Channel 19 (+)
3b	DAIOUT19	Channel 19 (-)
3c	GND	Ground
4a	DA_OUT20	Channel 20 (+)
4b	DAIOUT20	Channel 20 (-)
4c	GND	Ground
5a	DA_OUT21	Channel 21 (+)
5b	DAIOUT21	Channel 21 (-)
5c	GND	Ground
6a	DA_OUT22	Channel 22 (+)
6b	DAIOUT22	Channel 22 (-)
6c	GND	Ground
7a	DA_OUT23	Channel 23 (+)
7b	DAIOUT23	Channel 23 (-)
7c	GND	Ground
8a	DA_OUT24	Channel 24 (+)
8b	DAIOUT24	Channel 24 (-)
8c	GND	Ground
9a	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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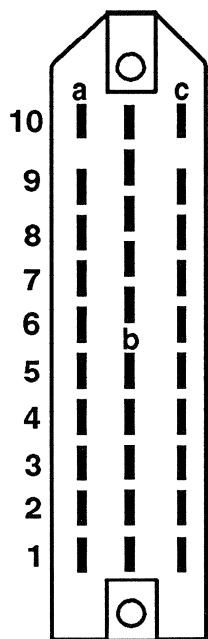
Outputs for channels 25 through 32
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	DA_OUT25	Channel 25 (+)
1b	DAIOUT25	Channel 25 (-)
1c	GND	Ground
2a	DA_OUT26	Channel 26 (+)
2b	DAIOUT26	Channel 26 (-)
2c	GND	Ground
3a	DA_OUT27	Channel 27 (+)
3b	DAIOUT27	Channel 27 (-)
3c	GND	Ground
4a	DA_OUT28	Channel 28 (+)
4b	DAIOUT28	Channel 28 (-)
4c	GND	Ground
5a	DA_OUT29	Channel 29 (+)
5b	DAIOUT29	Channel 29 (-)
5c	GND	Ground
6a	DA_OUT30	Channel 30 (+)
6b	DAIOUT30	Channel 30 (-)
6c	GND	Ground
7a	DA_OUT31	Channel 31 (+)
7b	DAIOUT31	Channel 31 (-)
7c	GND	Ground
8a	DA_OUT32	Channel 32 (+)
8b	DAIOUT32	Channel 32 (-)
8c	GND	Ground
9a	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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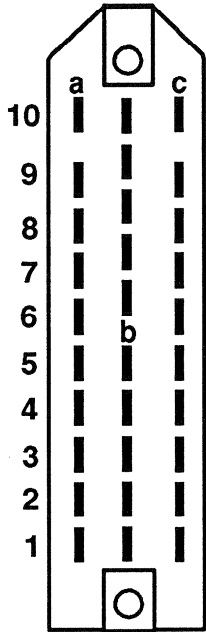
Outputs for channels 33 through 40
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	DA_OUT33	Channel 33 (+)
1b	DAIOUT33	Channel 33 (-)
1c	GND	Ground
2a	DA_OUT34	Channel 34 (+)
2b	DAIOUT34	Channel 34 (-)
2c	GND	Ground
3a	DA_OUT35	Channel 35 (+)
3b	DAIOUT35	Channel 35 (-)
3c	GND	Ground
4a	DA_OUT36	Channel 36 (+)
4b	DAIOUT36	Channel 36 (-)
4c	GND	Ground
5a	DA_OUT37	Channel 37 (+)
5b	DAIOUT37	Channel 37 (-)
5c	GND	Ground
6a	DA_OUT38	Channel 38 (+)
6b	DAIOUT38	Channel 38 (-)
6c	GND	Ground
7a	DA_OUT39	Channel 39 (+)
7b	DAIOUT39	Channel 39 (-)
7c	GND	Ground
8a	DA_OUT40	Channel 40 (+)
8b	DAIOUT40	Channel 40 (-)
8c	GND	Ground
9a	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

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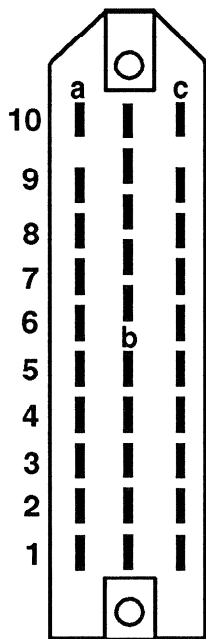
Outputs for channels 41 through 48
Pin assignment (IEC 130.6, 30-pin, male):

Pin	Signal name	Description
1a	DA_OUT41	Channel 41 (+)
1b	DAIOUT41	Channel 41 (-)
1c	GND	Ground
2a	DA_OUT42	Channel 42 (+)
2b	DAIOUT42	Channel 42 (-)
2c	GND	Ground
3a	DA_OUT43	Channel 43 (+)
3b	DAIOUT43	Channel 43 (-)
3c	GND	Ground
4a	DA_OUT44	Channel 44 (+)
4b	DAIOUT44	Channel 44 (-)
4c	GND	Ground
5a	DA_OUT45	Channel 45 (+)
5b	DAIOUT45	Channel 45 (-)
5c	GND	Ground
6a	DA_OUT46	Channel 46 (+)
6b	DAIOUT46	Channel 46 (-)
6c	GND	Ground
7a	DA_OUT47	Channel 47 (+)
7b	DAIOUT47	Channel 47 (-)
7c	GND	Ground
8a	DA_OUT48	Channel 48 (+)
8b	DAIOUT48	Channel 48 (-)
8c	GND	Ground
9a	---	not assigned
9b	---	not assigned
9c	GND	Ground
10a	---	not assigned
10b	---	not assigned
10c	GND	Ground

6.3   Digital audio

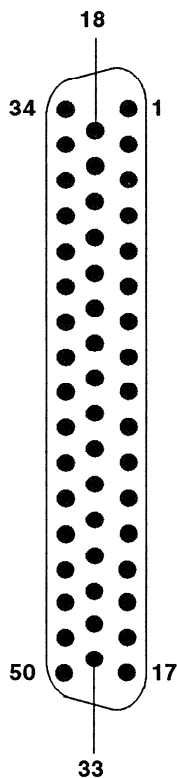**SDIF (option)**   ❏ All signals: RS422 (220 Ω)

CH 1-24 IN   **Inputs for channels 1 through 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	---	not assigned
50	---	not assigned

SDIF (option)

CH 25-48 IN

Inputs for channels 25 through 48
Pin assignment (Sub-D, 50-pin, male):
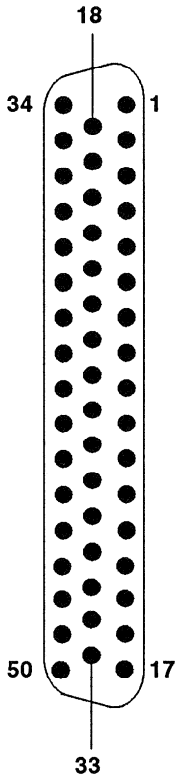
Pin	Signal name	Description
01	CO_ID01B	Channel 25 (-)
02	CO_D01B	Channel 25 (+)
03	CO_ID02B	Channel 26 (-)
04	CO_D02B	Channel 26 (+)
05	CO_ID03B	Channel 27 (-)
06	CO_D03B	Channel 27 (+)
07	CO_ID04B	Channel 28 (-)
08	CO_D04B	Channel 28 (+)
09	CO_ID05B	Channel 29 (-)
10	CO_D05B	Channel 29 (+)
11	CO_ID06B	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	---	not assigned
50	---	not assigned

SDIF (option)

CH 1-24 OUT

18

1 □ 34

17 □ 50

33

Outputs for channels 1 through 24
Pin assignment (Sub-D, 50-pin, female):
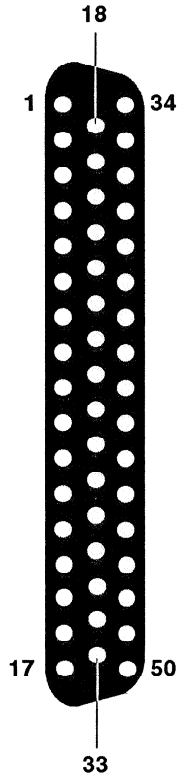
Pin	Signal name	Description
01	MI_ID01A	Channel 1 (-)
02	MI_D01A	Channel 1 (+)
03	MI_ID02A	Channel 2 (-)
04	MI_D02A	Channel 2 (+)
05	MI_ID03A	Channel 3 (-)
06	MI_D03A	Channel 3 (+)
07	MI_ID04A	Channel 4 (-)
08	MI_D04A	Channel 4 (+)
09	MI_ID05A	Channel 5 (-)
10	MI_D05A	Channel 5 (+)
11	MI_ID06A	Channel 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	---	not assigned
50	---	not assigned

SDIF (option)

CH 25-48 OUT

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

18

1 ○ 34

17 ○ 50

33
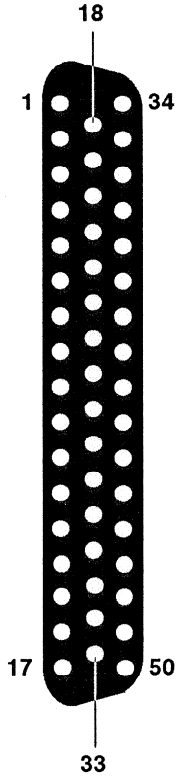
Pin	Signal name	Description
01	MI_ID01B	Channel 25 (-)
02	MI_D01B	Channel 25 (+)
03	MI_ID02B	Channel 26 (-)
04	MI_D02B	Channel 26 (+)
05	MI_ID03B	Channel 27 (-)
06	MI_D03B	Channel 27 (+)
07	MI_ID04B	Channel 28 (-)
08	MI_D04B	Channel 28 (+)
09	MI_ID05B	Channel 29 (-)
10	MI_D05B	Channel 29 (+)
11	MI_ID06B	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	---	not assigned
50	---	not assigned

AES/EBU IN
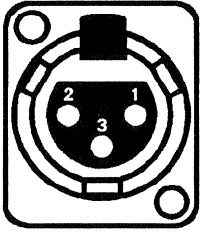
Input
Pin assignment (XLR, 3-pin, female, 110 Ω):

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

AES/EBU OUT
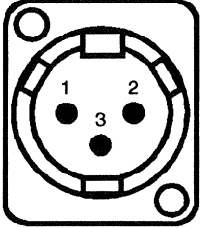
Output
Pin assignment (XLR, 3-pin, male, 110 Ω):

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

MADI IN
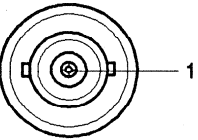
Input
Pin assignment (BNC, 75 Ω):

Pin	Signal name	Description
01	MADI_IN	MADI Input signal
	GND	Ground

MADI OUT
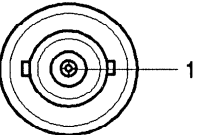
Output
Pin assignment (BNC, 75 Ω):

Pin	Signal name	Description
01	MADI_OUT	MADI Output signal
	GND	Ground

6.4   Auxiliary tracks

TC OUT
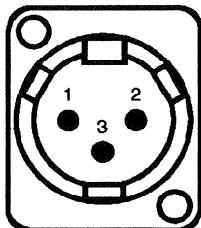
Output for internal Time Code
Pin assignment (XLR, 3-pin, male):

Pin	Signal name	Description
01	GND	Ground
02	SS_TCOUT	Output +
03	SSITCOUT	Output -
	SHELL	Chassis
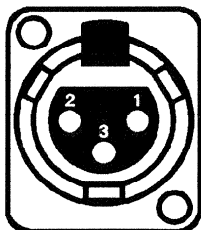
CUE 1 IN

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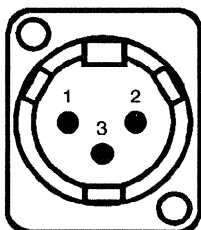
Output (left channel)
Pin assignment (XLR, 3-pin, male):

Pin	Signal name	Description
01	GND	Ground
02	CU_OUT1	Output +
03	CU_IOUT1	Output -
	SHELL	Chassis
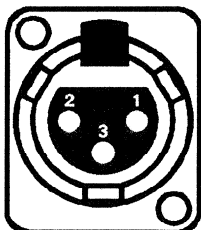
CUE 2 IN

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

Pin	Signal name	Description
01	GND	Ground
02	CO_CUE2	Input +
03	CO_ICUE2	Input -
	SHELL	Chassis

CUE 2 OUT
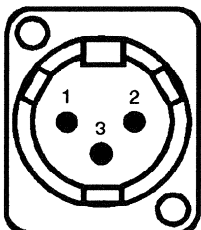
Output (right channel)
Pin assignment (XLR, 3-pin, male):

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

6.5   Reference track

EXT. RT IN

Input for Reference Track signal (RT)
Pin assignment (BNC, 75 Ω):
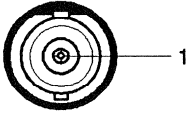
Pin	Signal name	Description
01	CO_RTIN GND	Input RT Signal (TTL level) Ground

EXT. RT OUT

Output for Reference Track signal (looped through)
Pin assignment (BNC, 75 Ω):
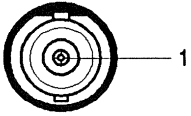
Pin	Signal name	Description
01	CO_RTOUT GND	Output RT Signal (TTL level) Ground

TAPE RT OUT

Output für Reference Track signal
Pin assignment (BNC, 75 Ω):
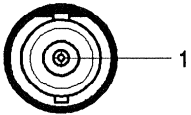
Pin	Signal name	Description
01	RT_RTOUT GND	Tape RT Signal (TTL level) Ground

6.6   External Time Code

EXT. TC IN

Input for external Time Code
Pin assignment (XLR, 3-pin, female):
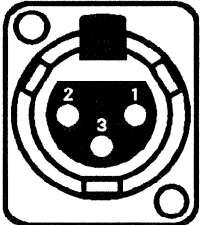
Pin	Signal name	Description
01 02 03	GND CO_TCIN CO_ITCIN SHELL	Ground Input + Input - Chassis

EXT. TC OUT

Output for external Time Code (looped through)
Pin assignment (XLR, 3-pin, male):
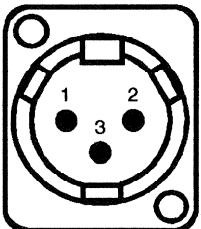
Pin	Signal name	Description
01 02 03	GND CO_TCIN CO_ITCIN SHELL	Ground Input + (looped from EXT. TC IN) Input - (looped from EXT. TC IN) Chassis

6.7   Clock signals

WORD CLOCK IN
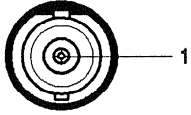
Input
Pin assignment (BNC, 75 Ω or 1 kΩ, jumper-selectable on CLOCK BOARD):

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

WORD CLOCK OUT
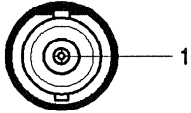
Output
Pin assignment (BNC, 75 Ω):

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

SECTOR CLOCK IN
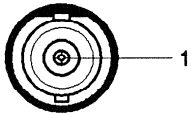
Input
Pin assignment (BNC, 75 Ω or 1 kΩ, jumper-selectable on CLOCK BOARD):

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

SECTOR CLOCK OUT
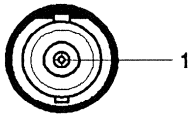
Output
Pin assignment (BNC, 75 Ω):

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

VIDEO SYNC IN
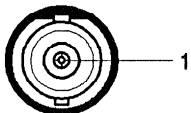
Input
Pin assignment (BNC, 75 Ω or 1 kΩ, jumper-selectable on CLOCK BOARD):

Pin	Signal name	Description
01	CO_CV CO_CVGND	Composite Video Input (video level) Ground

VIDEO SYNC OUT
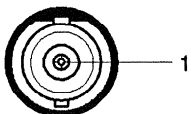
Output
Pin assignment (BNC, 75 Ω):

Pin	Signal name	Description
01	CO_CV CO_CVGND	looped from Video Input Signal Ground

SQUARE WAVE IN
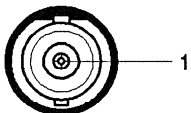
Input
Pin assignment (BNC, 75 Ω or 1 kΩ, jumper-selectable on CLOCK BOARD):

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

SQUARE WAVE OUT
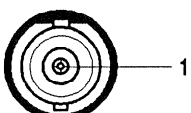
Output
Pin assignment (BNC, 75 Ω):

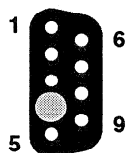| Pin	Signal name	Description
01	CO_SW CO_SWGND	looped from Square Wave Input signal Ground

6.8   Remote control connectors

6.8.1   REMBUS

Two terminals connected in parallel (RS422).
Pin assignment (Sub-D, 9-pin, female):

Pin	Signalname	Description
01	PI_RCLK	Clock line +
02	PI_RRXD	Receive data line +
03	PI_RTXD	Transmit data line +
04	PI_RES1	Coding (protection)
05	OSTABIN	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)

Connect only by special cable 1.862.420.00 / 1.820.421.00
Do not connect or disconnect in operation - danger of damages.

6.8.2   Remote Level Display

On this RS422 output a Remote Level Display can be connected.
Pin assignment (Sub-D, 9-pin, female):
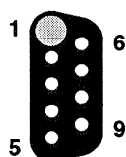
Pin	Signal name	Description
01		Key
02	PI_ECLK	Clock +
03	PI_EDAT	Data +
04	PI_ETPH	Transmission phase +
05	OSTABIN	Ground
06	PI_IECLK	Clock -
07	PI_IEDAT	Data -
08	PI_IETPH	Transmission phase -
09	STABINZ	Remote supply voltage (+30 V...+60 V)

Connect only by special cable 1.862.422.00
Do not connect or disconnect in operation - danger of damages.

6.8.3   Master Tallies input

Pin assignment (Sub-D, 9-pin, female):
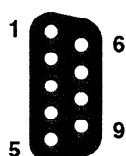
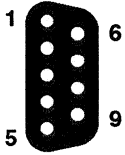| Pin	Signal name	Description
01	GND	Ground
02	CO_TSTOP +	STOP
03	CO_MOVE1 *	MOVE reference signal 1 (CLK)
04	CO_TPLAY +	PLAY
05	GND	Ground
06	CO_TFREC +	FOLLOW RECORD
07		
08	CO_TREC	RECORD
09	CO_MOVE2 *	MOVE reference signal 2 (DIR)

     *   Input (TTL level)
     +   switch input, LOW level activates the command.
Note: Master Tallies cable to Sony PCM 3324A/3348 (3 m): 1.023.781.00

6.8.4   ES bus

Two terminals for ES bus connected in parallel (RS422).
Pin assignment (Sub-D, 9-pin, female):

Pin	Signal name	Description
01	PI_EBUFG	Frame ground
02	PI_EBUTB	Transmit (bal: RS422-LO / unbal: RS232C)
03	PI_EBURA	Receive (bal: RS422-HI)
04	PI_EBURC	Receive (bal: RS422-Common -> 0,0 V)
05	---	
06	PI_EBUTC	Transmit (bal: RS422-Common -> 0,0 V)
07	PI_EBUTA	Transmit (bal: RS422-HI)
08	PI_EBURB	Receive (bal: RS422-LO / unbal: RS232C)
09	PI_EBUFG	Frame ground

6.8.5   Setup Control

Terminal for connecting a McIntosh computer for Setup control.
Pin assignment (Sub-D, 9-pin, female / Mini-DIN, 8-pin, male):
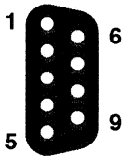
D827 MCH		McIntosh	
Sub-D, 9-pin fem., Pin	Description	Description	Mini-DIN 8-pin male, Pin
1	Frame GND	Shell	Shell
2	Receive A	Transmit A	5
3	Transmit B	Receive B	6
4	Transmit Common	Transmit Common	4
5	n.c.	n.c.	1, 2, 7
6	Receive Common	Transmit Common	4
7	Receive B	Transmit B	8
8	Transmit A	Receive A	3
9	Frame GND	Shell	Shell

A mating cable (3 m long) is supplied together with the Setup-Handler software package (Order No. 21.863.995.00).

Note: Should this terminal accept no commands, the switch on the MASTER CPU card (located behind the "TERM" connector) is in the wrong position. It must be set to the position towards the rear panel of the recorder in order to activate the SETUP CONTROL terminal.

6.8.6   Synchronizer

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

Pin	Signal name		Description
01	+0.0		Ground
02	BR-REW	*	Acknowledgement RWND
03	BR-FORW	*	Acknowledgement FFWD
04	BR-VRSPD	*	Acknowledgement VARISPEED (if active, alternatingly HIGH and LOW)
05	SR-VRSPD	+	Control input VARISPEED command
06	SR-REHSL	+	Control input REHEARSAL command
07	OR-MVCLK	*	Output for TAPE MOVE CLOCK signal (1024 / 64 pulses/s at 48 kHz, corresponding to jumper position on Tape Deck Counter/Timer 1.820.823.00; 50% duty cycle)
08	KEY		Key
09	BR-REC	*	Acknowledgement RECORD
10	OR-MVDIR	*	Output for TAPE DIRECTION signal (rewind = LOW, forward = HIGH)
11	OR-CMCLK	*	Output for CAPSTAN MOTOR MOVE CLOCK signal (4800 pulses/s at 48 kHz)
12	OR-SYENB		Output for SYNCHRONIZER ENABLE signal (LOW if tape loaded and recorder ready; HIGH if tape is not stretched)
13	IR-REFEX		Input for external Capstan PLL reference signal (9.6 kHz corresponds to 30 ips and 48 kHz sampling rate; TTL level recommended. Max. input voltage +30 V)
14	+0.0		Ground
15	BR-PLAY	*	Acknowledgement PLAY
16	BR-STOP	*	Acknowledgement STOP
17	SR-LIFT	+	Control input LIFTER command
18	SR-MUTE	+	Control input MUTE command (no effect on TC channel)
19	SR-REC	+	Control input RECORD command
20	SR-REW	+	Control input RWND command
21	SR-FORW	+	Control input FFWD command
22	SR-PLAY	+	Control input PLAY command
23	SR-STOP	+	Control input STOP command
24			n.c.
25	+24.0		Supply output +24 V (max. 300 mA)

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

+   Control input, low level activates the command. Internal pull-up resistor 4.7 kΩ to +24 V supply, max. high input level = +30 V. Logic levels: low: 0...+4 V; high: +7.5...+30 V.

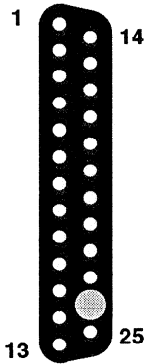|	Order No.:
Connector complete	20.020.303.15
Connector housing, 25-pin	54.13.7022
Connector, 25-pin, with key	10.217.001.05

6.8.7 Parallel Remote

To this 25-pin Sub-D socket a parallel remote can be connected allowing for the following control possibilities:
❏ Remote control of the tape deck functions with acknowledgement (FFWD, RWND, PLAY, STOP, and RECORD)
❏ RESET TIMER (reset of the tape counter)
❏ ZERO LOC (automatic positioning to tape address 0.00.00.0)
❏ LOC START (automatic positioning to the tape address at wich the last PLAY command was entered)
❏ LIFTER (activating the tape lifter during fast wind mode as long as the key is pressed)
❏ VARISPEED (variable tape speed).

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

Pin	Signal name		Description
01	+0.0		Ground
02	BR-REW	*	Acknowledgement RWND
03	BR-FORW	*	Acknowledgement FFWD
04	BR-VRSPD	*	Acknowledgement VARISPEED (if active, alternatingly HIGH and LOW)
05	SR-VRSPD	+	Control input VARISPEED command
06	SR-FADRY	+	(no function)
07	BR-LOCST	*	Acknowledgement LOC START
08	BR-FADRY	*	Acknowledgement FADER START READY
09	BR-REC	*	Acknowledgement RECORD
10	SR-RESET	+	Control input RESET TIMER command
11	FAD1		(no function)
12	FAD2		(no function)
13	IR-REFEX		Input for external Capstan PLL reference signal (9.6 kHz corresponds to 30 ips and 48 kHz sampling rate; TTL level recommended. Max. input voltage +30 V)
14	SR-0LOC	+	Control input ZERO LOC command
15	BR-PLAY	*	Acknowledgement PLAY
16	BR-STOP	*	Acknowledgement STOP
17	SR-LIFT	+	Control input LIFTER command
18	SR-LOCST	+	Control input LOC START command
19	SR-REC	+	Control input RECORD command
20	SR-REW	+	Control input RWND command
21	SR-FORW	+	Control input FFWD command
22	SR-PLAY	+	Control input PLAY command
23	SR-STOP	+	Control input STOP command
24	KEY		Key
25	+24.0		Supply output +24 V (max. 300 mA)

* Open-collector output, active low. No internal pull-up resistor, max. high level = +30 V. Max. current 200 mA, internal current limiting resistor 22 Ω.
+ Control input, low level activates the command. Internal pull-up resistor 4.7 kΩ to +24 V supply, max. high input level = +30 V. Logic levels: low: 0...+4 V; high: +7.5...+30 V.
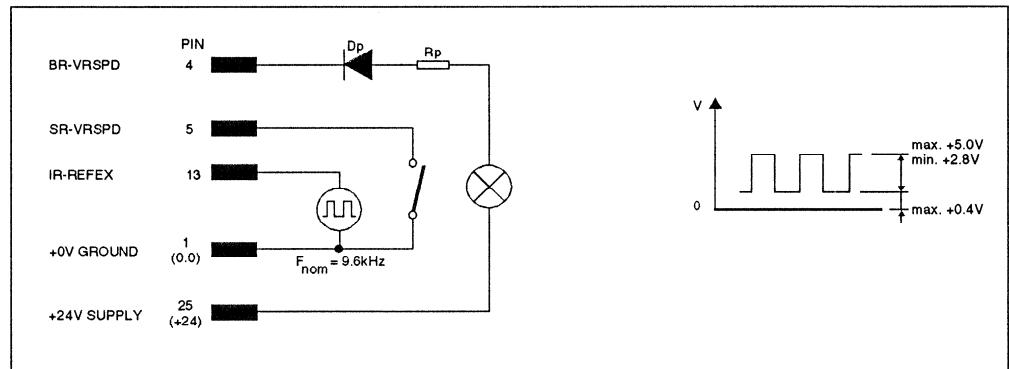
	Order No.:
Connector complete	20.020.303.16
Connector housing, 25-pin	54.13.7022
Connector, 25-pin, with key	10.217.001.06

Remote diagram:

FUNCTION	PIN
VARISPEED	5
FADER ST. READY	6
RESET TIMER	10
ZERO LOC	14
LIFTER	17
LOC START	18
RECORD	19
REWIND (<)	20
FORWARD (>)	21
PLAY	22
STOP	23

1
(0.0)

25
(24V)

INTERNAL SUPPLY

EXTERNAL SUPPLY
24V STUDIO (max. 28V)

FUNCTION	PIN
REWIND (<)	2
FORWARD (>)	3
VARISPEED	4
LOC START	7
FADER ST. READY	8
RECORD	9
PLAY	15
STOP	16

$I_{max.} = 0.3A$

Rp = OVERLOAD PROTECTION
Dp = POLARITY PROTECTION

$V_{SAT.} = 0.7V$

Varispeed diagram:

BR-VRSPD   PIN 4

SR-VRSPD   5

IR-REFEX   13

+0V GROUND   1 (0.0)

+24V SUPPLY   25 (+24)

$F_{nom} = 9.6kHz$

max. +5.0V
min. +2.8V

max. +0.4V

Caution If incandescent bulbs are used for the acknowledgments, their inrush current must not exceed 300 mA.

7   Test interface, copying the recorder parameters (backup)

The 25-pin Sub-D connector "TERM" is located behind the front cover of the recorder, on the MASTER CPU card. Behind this connector there is a slide switch. If the slider is set towards the rear of the recorder, the SETUP CONTROL connector is active, otherwise the "TERM" test interface is active. At this RS232C interface, a terminal or a PC with a terminal emulator can be connected, allowing for a range of test, control and monitoring functions as well as copying and storing the recorder parameters.

Important: ⚠   Before connecting or disconnecting the PC to/from the D827 MCH with the special cable according to the table below, both units should be switched off.
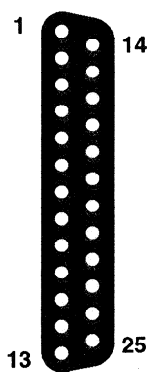
D827 MCH ("TERM")		PC (RS232 Port)	
Sub-D, 25-pin f Pin	Signal name	Signal name	Sub-D, 9-pin m Pin
02	TX (Transmit)	RX (Receive)	03
03	RX (Receive)	TX (Transmit)	02
07	0,0 V (Ground)	0,0 V (Ground)	05

For the hardware handshake the following connections have to be made on the PC side: Pins 7 and 8, as well as pins 1, 4 and 6. All other pins are not used.

Data format:

Baud	Data	Stop	Parity
9600	8	1	no

Parameters diskette   The D827 MCH is shipped with a 3½" diskette (1.863.996.21) on which the recorder parameters as tape tensions, erase current etc. are stored.

After a data loss - e.g. after having installed a software update - all settings can be reloaded via the "TERM" test interface.

Tools   For transferring data the following tools are required:
❏ 1 IBM-compatible PC with:
    3½" floppy disk drive and
    RS232 port
❏ 1 connecting cable (pin assignment according to the table above).

Data transfer   Detailed explanations on how to proceed are contained in the "README.DOC" file on the diskette.

Note: On the diskette the original factory settings are stored. After having changed the recorder parameters, it is highly recommended to store the new data (in a new file) on the diskette, too, in order to have also the modified parameters as a backup.

8   Location of the jumpers

8.1   Clock Board MkII 1.862.667.xx

Setting possibilities: Input impedance of the video, sector clock, word clock, and square wave inputs; polarity of the video sync pulse.
All jumper positions and functions are labelled on the Clock Board MkII 1.862.667.xx.

8.2   Tape Deck Counter Timer Board 1.820.823.xx

Jumper position:	Description:
J3A	1024 Hz square wave signal at 48 kHz (factory setting)
J1+J3B	64 Hz square wave signal at 48 kHz
J2+J3B	32 Hz square wave signal at 48 kHz

Important: Modify the internal move pulse setting (SETUP: SYNCHRONIZER, S029) according to the jumper position.
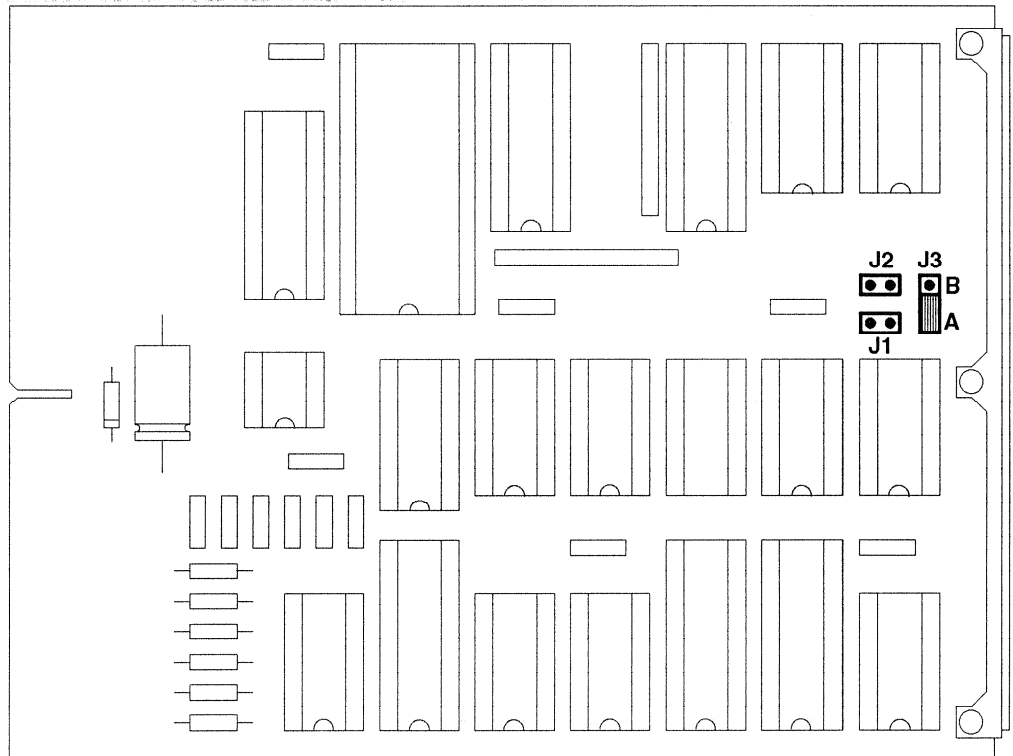
9   The DASH format

The DASH (Digital Audio Stationary Head) format describes a tape recording method based on an agreement between different manufacturers of digital tape recorders. The objective is to ensure full compatibility of tapes recorded on units of different brands.

9.1   DASH versions

"Version" is meant here not within the sense of a release (as usual with software products) but is an exactly defined variant of the format described by the collective term "DASH".

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, ¼" and ½" tapes can be recorded.

The following tables provide information on the various DASH versions:

	Tape speed		
	fast	medium	slow
Tracks per channel:	1	2	4
Sampling frequency 48 kHz	76.2 cm/s 30 ips	38.1 cm/s 15 ips	19.05 cm/s 7.5 ips
Sampling frequency 44.1 kHz	70.01 cm/s 27.56 ips	35.00 cm/s 13.78 ips	17.5 cm/s 6.89 ips

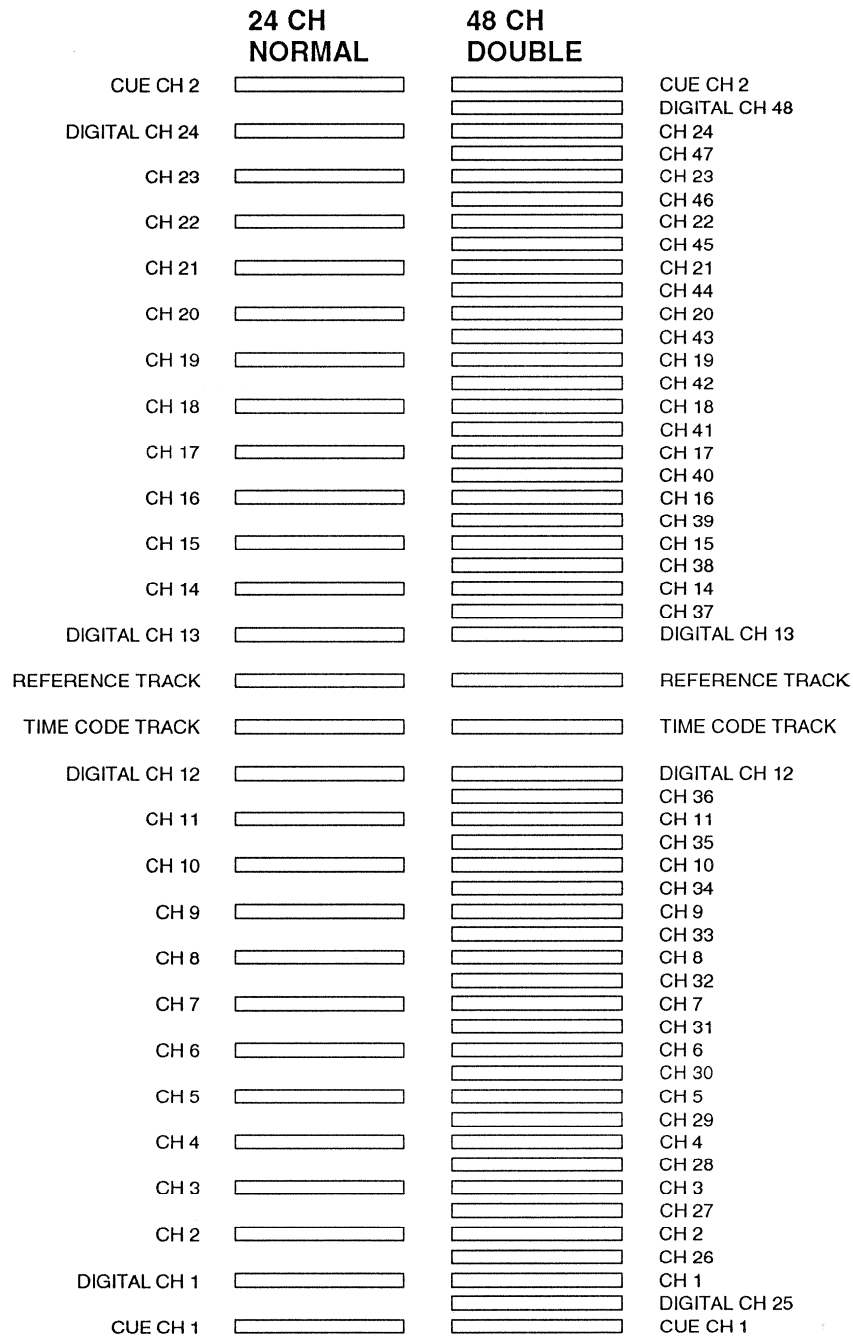| Tape width		¼"		½"	
Recording density		**Normal**	Double	**Normal**	**Double**
No. of digital audio tracks		**8**	16	**24**	**48**
Number of digital audio channels	fast	**8**	16	**24**	**48**
	medium	**4 / 2¹)**	8	**12**	**24**
	slow	**2**	4 / 2¹)	**6**	**12**
Number of auxiliary tracks		4	4	4	4
¹) Twin-DASH - every signal is recorded twice for improved data security					

Although the DASH format offers a multitude of possibilities, only three versions have been implemented in practice (**bold** entries in the above table).

DASH multichannel (as in D827 MCH):

Tape speed:	**30 ips** (76.2 cm/s), fast
Tape width:	½"
Normal density:	**24 channels** (1 track/channel)
Double density:	**48 channels** (1 track/channel)

9.2   Track layout for DASH 24 and 48 channel recorders

24 CH NORMAL	48 CH DOUBLE
CUE CH 2	CUE CH 2
	DIGITAL CH 48
DIGITAL CH 24	CH 24
	CH 47
CH 23	CH 23
	CH 46
CH 22	CH 22
	CH 45
CH 21	CH 21
	CH 44
CH 20	CH 20
	CH 43
CH 19	CH 19
	CH 42
CH 18	CH 18
	CH 41
CH 17	CH 17
	CH 40
CH 16	CH 16
	CH 39
CH 15	CH 15
	CH 38
CH 14	CH 14
	CH 37
DIGITAL CH 13	DIGITAL CH 13
REFERENCE TRACK	REFERENCE TRACK
TIME CODE TRACK	TIME CODE TRACK
DIGITAL CH 12	DIGITAL CH 12
	CH 36
CH 11	CH 11
	CH 35
CH 10	CH 10
	CH 34
CH 9	CH 9
	CH 33
CH 8	CH 8
	CH 32
CH 7	CH 7
	CH 31
CH 6	CH 6
	CH 30
CH 5	CH 5
	CH 29
CH 4	CH 4
	CH 28
CH 3	CH 3
	CH 27
CH 2	CH 2
	CH 26
DIGITAL CH 1	CH 1
	DIGITAL CH 25
CUE CH 1	CUE CH 1

This diagram shows that on a 48-channel recorder a 24-channel tape can be played back (or recorded) without setup change because the channels 1 to 24 are in the same locations for either number of channels.

9.3   Coding the digital audio data

Block structure

Each data track is coded individually and consists of so-called blocks. A block is the smallest detectable unit on the tape and comprises 192 bits of digital audio information (12 sampling values of 16 bits each) plus 96 bits of 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 wether 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 of the tape.

Interleaving of information

A data block is constructed from digital audio sampling values that are not adjacent but far apart. In addition, the parities belonging 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 only 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 be restored 100% in the DASH format, provided that 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, avoiding long sequences of zeroes ore ones as well as fast polarity changes (zero-one-zero or one-zero-one), so that DC-like signals as well as very high change frequencies are eliminated. The spectral characteristics of the heads and the tape can so be optimally exploited.

In 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.

9.4   Coding the Reference Track (RT)

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 word. These bits are biphase-mark coded before they are transmitted to the record electronics. The control word contains important system information and has the following format:

Bit no.	Designation	STUDER 48 CH	STUDER 24 CH	Condition
15	Twin-DASH ID	0	0	
14 - 12	Sampling frequency	001 010 100	001 010 100	fs = 48 kHz fs = 44.1 kHz fs = 44.056 kHz
11 - 9	Format ID	100	000	
8 - 6	Aux tracks ID	101	101	
5 - 0	Spare	000000	000000	

The Reference Track is used for the following purposes:
- Capstan 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 (tape position display, locator, etc.)
- Sample-accurate synchronization of two (or more) DASH recorders.

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.*

9.5   Coding the time code track (TC)

The format of this track is absolutely identical with the SMPTE/EBU time code 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 recording methods are not 100% compatible; for this reason the recording mode is flagged in bit no. 8 of the RT control word. Studer multichannel DASH recorders can read both recording modes but are designed for narrow gap recording (bit no. 8 of the RT control word = 1). They are equipped with an additional erase head for overwriting the deep magnetization of the wide gap recording.

9.6   Coding the analog tracks (Cue tracks)

The two analog tracks (CUE 1, CUE 2) can be recorded either with the same head as the digital audio data ("narrow gap recording"), or with a conventional, separate analog head ("wide gap recording"). In the first case PWM is required, in the second case bias is used as in analog tape recorders. These two recording methods are not compatible. For this reason the recording mode is flagged in bit no. 6 of the RT control word. Studer multichannel DASH recorders can read both recording modes but are designed for narrow gap recording (bit no. 6 of the RT control word = 1). They are equipped with an additional erase head for overwriting the deep magnetization of the wide gap recording.

9.7   Basic specifications of the DASH multichannel version

General data: E/143

Tape speed	30 ips = 76.2 cm/s (at 48 kHz),
	27.56 ips = 70.01 cm/s (at 44.1 kHz)
Tape width	½" = 12.7 mm
No. of tracks	52
No. of digital audio tracks	48 (1 per digital audio channel)
No. 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 rates (incl. 50% redundancy)
Track width	0.17 mm
Data format	Length of a data block: 0.1905 mm
	1 block = 12 audio samples = 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 [1])	between "3" and "9"
HDM-1 wavelength	between 1.984 and 5.592 μm
HDM-1 frequency	between 128 and 384 kHz (at f_s = 48 kHz)

Characteristics of the RT track

Track width	0.17 mm
Data format	1 sector = 4 blocks = 64 bits (corresponds to 1 ms at 48 kHz)
Coding	Biphase
Run lengths [1])	between "18" and "54"

Characteristics of the TC track

Track width	0.33 mm
Data format	1 frame = 80 bits
Frame rate	(24) / 25 / 29.97 / 30 frames/s
Coding	Biphase

Characteristics of the CUE tracks (if modulated)

Track width	0.35 mm (modulated and bias)
Modulation	PWM
Carrier frequency	2 × f_s
Modulation index	0.7
Run lengths [1])	Full modulation: between "3.6" and "20.4"
	Zero modulation: "12"

[1]) "Run length" signifies the time between two polarity changes of the head signal in PLAY mode. Run unit "1" is 434 ns at f_s = 48 kHz.

10   Versions, options, accessories   Order No.

10.1   Ordering information   Order No.

D827-48-½"	Digital tape recorder for 48 tracks (basic version)	**60.218.20620**
D827-24/24-½"	Digital tape recorder for 24 tracks (basic version), (upgradeable to 48 tracks)	**60.218.20621**
D827-24/48-½"	Digital tape recorder for 24 tracks (basic version), equipped with 48-track head block (upgradeable to 48 tracks)	**60.218.20622**
D827 MCH Upgrade kit 24/24-48	Conversion kit for upgrading a D827-24/24-½" to D827-48-½"	**on request**
D827 MCH Upgrade kit 24/48-48	Conversion kit for upgrading a D827-24/48-½" to D827-48-½"	**on request**

10.2   Remote controls (options)   Order No.

Note: Studer remote controls are shipped with mating connector(s).

Channel Remote D827-48		**1.328.700.00**
Channel Remote D827-24		**1.328.705.00**
Autolocator (Tape Deck Remote) D827 MCH incl. Sound Memory control		**1.328.710.00**
Setup-Handler	MacIntosh application software for parameter backup incl. connecting cable 3 m	**21.863.995.00**
Remote Level Display D827-48 incl. connecting cable 15 m		**21.328.730.00**
Remote Level Display D827-24 incl. connecting cable 15 m		**21.328.735.00**
Parallel Audio Interface D827 MCH/D820 MCH incl. connecting cable 15 m		**21.328.630.00**
REMBUS connecting cable 15 m for REMBUS remote controls		**1.862.420.00**
REMBUS connecting cable 15 m for REMBUS remote controls		**1.862.421.00**
SERBUS connecting cable 15 m for Remote Level Display		**1.862.422.00**
Remote stand	for Channel Remote, Autolocator incl. Sound Memory control	**1.328.192.00**

10.3   Options   Order No.

D827 MCH A/D 8CH	A/D converter, for 8 channels	20.863.552.00
D827 MCH Noise Shaper	Noise Shaper option for A/D converter, for 8 channels	20.863.553.00
D827 MCH D/A 8CH	D/A converter, for 8 channels	20.863.554.00
D827 MCH SDIF-2-Interface 24CH SDIF-2 multichannel interface, for 24 channels		20.863.555.00
New Record head 48CH	New Record head, for off-tape monitoring, for D827-48 and D827-24/48	20.863.556.00
New Record head 24CH	New Record head, for off-tape monitoring, for D827-24/24	20.863.556.00
Sound Memory 45 s	RAM memory for editing, total storage length 45 s, splittable to 4 channels	20.863.558.00
Sound Memory 180 s	RAM memory for editing, total storage length 180 s, splittable to 4 channels	20.863.559.00
19" Rack mounting brackets	for installing 19" racks up to 3 U to the rear panel	20.863.560.00
MADI Optical Front End	Optical interface for MADI, cable length up to 2000 m	20.863.564.00
EDR Option	System expansion for digital 24-bit recording and reproduction on 24 channels; standard format (16 bits/48 channels) selectable.	21.863.666.20

10.4   Accessories   Order No.

Manuals	Additional operating instructions (German)	10.27.3590
	Additional operating instructions (English)	10.27.3600
	Set-up Guide (short-form operating instructions; English only)	10.27.3621
	Service instructions (German/English)	10.27.3680
	Diagrams and spare parts	10.27.3670
Service tools	Tool case, basic kit, with soldering iron and demagnetizing choke 115 V	20.020.001.10
	Tool case, basic kit, with soldering iron and demagnetizing choke 230 V	20.020.001.11
	Tool kit	20.020.001.12
	Supplementary tool set D827 MCH, incl. extension boards	20.020.001.45
	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, containing 1 bottle head cleaner, 1 bottle cleaner for anodized parts, lintless towels, buckskin towel	10.496.010.82
	Soundhead cleaning stick, 1 pce.	15.066.001.00
	Head cleaner, replacement bottle	10.496.021.00
	Cleaner for anodized parts, replacement bottle	10.496.025.00
	Splicing block	1.820.110.12

Connector for Synchronizer port   20.020.303.15
        Sub-D, 25-pin, m, screw-lock type

Connector for Parallel Remote port   20.020.303.16
        Sub-D, 25-pin, m, screw-lock type

Connector for TERM test port (CPU Board)   20.020.303.10
        Sub-D, 25-pin, m, screw-lock type

Connector for all other remote ports   20.020.303.07
        Sub-D, 9-pin, m, screw-lock type

Dummy plug for unused REMBUS ports   1.862.423.00
        Sub-D, 9-pin, 120 Ω, m, screw-lock type

Dummy plug for unused ES-BUS ports (1 pce is sufficient)   1.862.424.00
        Sub-D, 9-pin, shorting, m, screw-lock type

Multipin connector for analog audio inputs   20.020.303.39
        IEC 130.6, 30 pin, m

Multipin connector for analog audio outputs   20.020.303.38
        IEC 130.6, 30 pin, f

Multipin connector for SDIF multichannel input   20.020.303.35
        Sub-D, 50-pin, f, screw-lock type

Multipin connector for SDIF multichannel output   20.020.303.36
        Sub-D, 50 pin, m, screw-lock type

XLR-Connector, male   3-pin   54.02.0280

XLR-Connector, female   3-pin   54.02.0281

11   Daily care

The daily care is limited to cleaning the sound heads, the capstan shaft, the pinch roller, and the tape guide elements.

Dust and oxide particles form the magnetic coating of the tape accumulate on the sound heads and tape guides leading to drop-outs during recording. This is indicated by the CHECK display or by the CRC ERROR LED at the front of the MAPRO card.

Cleaning should be performed daily or more frequently, if contamination is visible. For cleaning we recommend the **Studer Cleaning Set, Order No. 10.496.010.82.** It contains utensils required for cleaning, as sound head cleaner, and cleaner for anodized parts. Use of the **sound head cleaning sticks 15.066.001.00** is recommended.

Procedure: Moisten a sound head cleaning stick with the sound head cleaning fluid and *very carefully* clean the sound heads and all tape guides.

The capstan shaft usually stops when the recorder is not switched to PLAY mode. There exists a special function to activate the capstan motor for cleaning; for this purpose, unload the tape and press the PLAY key.

Caution: ❏ **When cleaning the capstan shaft make sure that by no means the cleaning fluid penetrates the capstan bearing!**
    ❏ **Never use the cleaner for anodized parts to clean the sound heads!**

Erase head

Tape guide

New Rec head (option)

Reproduce head

Sync head

Tape guides

Capstan shaft
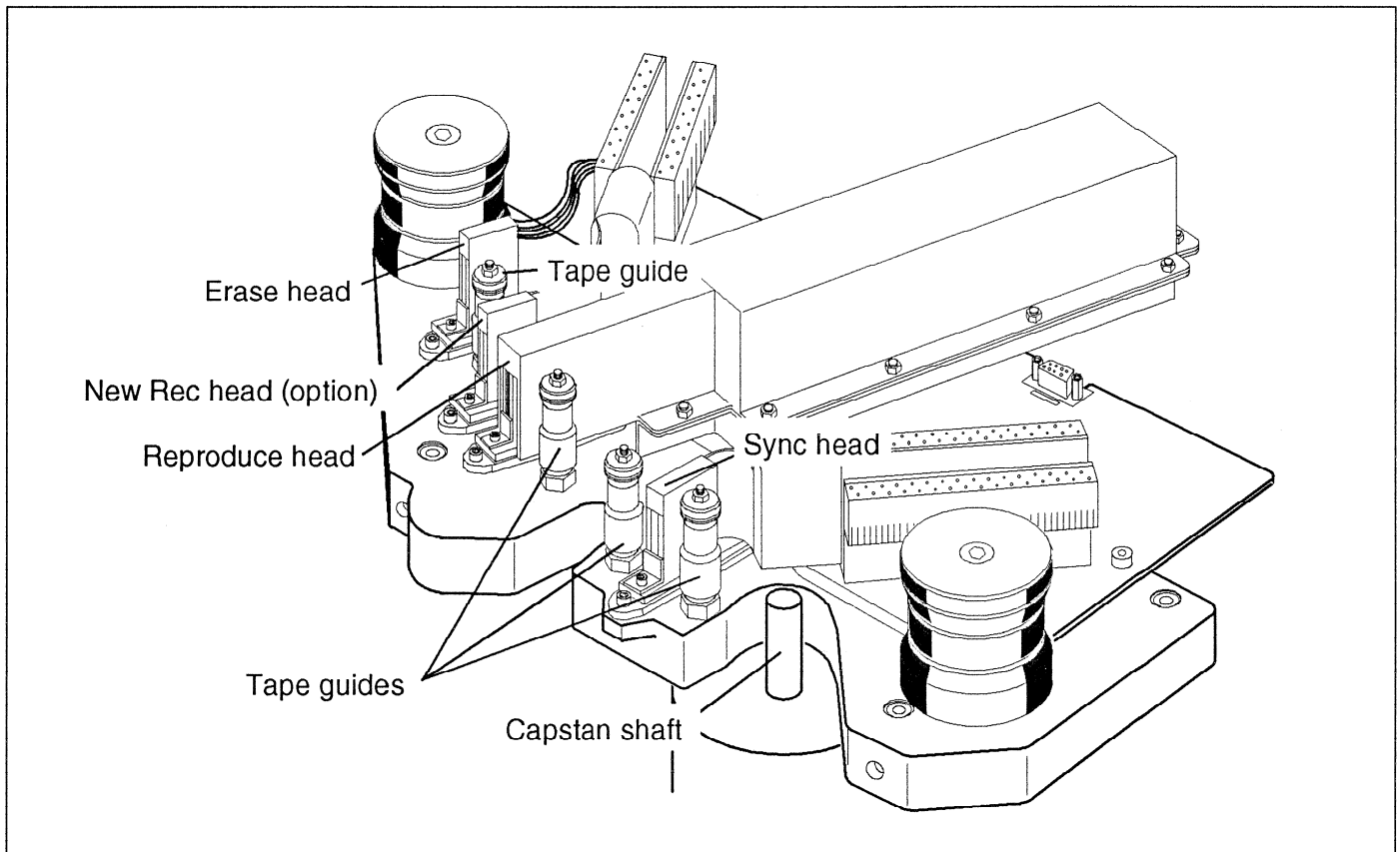
12   Error messages / warnings

General   Even in the most sophisticated electromechanical devices errors cannot be completely excluded. To have your tape recorder ready for operation again as fast as possible in such a case, its software contains a comprehensive error detection routine; the major part of all possible faults is detected by the unit automatically and will be displayed in the System Control Display. The red SYS MESSAGE lamp on the Local Control Unit and the red SYSTEM MESSAGE lamp on the Autolocator (if used) indicate that an error message is displayed.

Should an error message be displayed, first note its error number (ERR:xxx). Exact indications are helpful for locating the fault and reducing repair time. Because several error messages with similar text exist, the use of the error number is easier and clearer.

Should several error messages appear at the same time, they can be scrolled by pressing the STORE key on the LCU.

Error hierarchy   We distinguish three error types and corresponding error messages:

Category 1 errors: These errors prevent normal operation of the unit; primarily these are hardware errors or errors presenting a danger for an existing recording (unintentional erasing). The accompanying error message can only be deleted by switching the recorder off and on again. If the message appears again, the fault has to be repaired; if not, the unit can be normally operated again.

Caution: **Should a category 1 error message appear, switch the recorder off and, after at least 10 s on again; if the message remains, switch off again and call your nearest Studer service center or your trained technician.**

The unit must by no means be opened by untrained persons in order to exclude the danger of a hazard.

Category 2 errors and warnings:

Errors of this category can adversely affect the operation of the recorder, however, reduced operation is possible. The corresponding error message remains on the display for your information even if the error cause should no more exist. The message can be deleted by pressing the STORE key on the Local Control Unit. If the fault remains, the message is displayed again. Apart from that, the unit can be operated.

For definitively remedying the fault, call your nearest Studer service center or your trained technician.

The unit must by no means be opened by untrained persons in order to exclude the danger of a hazard.

Category 3 errors and warnings:

Errors of the third category can also adversely affect the operation of the recorder. The error message disappears automatically when the error cause disappears. If the System Control Display is used for other purposes, the error message can be deleted by pressing the STORE key; the error cause, however, might remain.

RESET: A complete reset of the recorder is only guaranteed if it is switched off for at least 5...10 s; the reset buttons on single modules only produce local resets.

Message:

> WARNING: 002 BATTERY
> LOW VOLTAGE

Recorder: Battery must be replaced soon; otherwise the system parameters could be lost (also refer to Warning: 023).

Cause: Battery voltage was too low at power on.

Remedy: ❏ **Call service; work to be performed by the technician:**
- Check the voltage of the battery on the CIF card behind the CPU (min. 2.3 V).
- Replace the battery.

Message:

> ERR: 013 CPU->SBC
> CANNOT INIT WR-FIFO

Recorder: Tape deck functions can be used, but audio functions cannot be performed, however.

Cause: The write-FIFO of the SERBUS controller on the PIF card cannot be initialized.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the PIF card is present and if it is correctly inserted; check the fuse and replace it, if necessary.
- If the fault is still present, the PIF and CPU cards have to be checked as well as the FIFO bus.

Message:

> ERR: 014 CPU->SBC
> CANNOT INIT RD-FIFO

Recorder: Tape deck functions can be used, but audio functions cannot be performed, however.

Cause: The read-FIFO of the SERBUS controller on the PIF card cannot be initialized.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the PIF card is present and if it is correctly inserted; check the fuse and replace it, if necessary.
- If the fault is still present, the PIF and CPU cards have to be checked as well as the FIFO bus.

Message:

> ERR: 015 CPU->SEC
> CANNOT INIT WR-FIFO

Recorder: If the ES bus interface is not required, the recorder can be used normally.

Cause: The write-FIFO of the ES bus controller on the PIF card cannot be initialized.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the PIF card is present and if it is correctly inserted; check the fuse and replace it, if necessary.
- If the fault is still present, the PIF and CPU cards have to be checked as well as the FIFO bus.

Message:

> ERR: 016   CPU->SEC
> CANNOT INIT   RD-FIFO

Recorder: If the ES bus interface is not required, the recorder can be used normally.
Cause: The read-FIFO of the ES bus controller on the PIF card cannot be initialized.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                ❏ **Call service; work to be performed by the technician:**
                - Check if the PIF card is present and if it is correctly inserted; check the fuse and
                   replace it, if necessary.
                - If the fault is still present, the PIF and CPU cards have to be checked as well as
                   the FIFO bus.

Message:

> ERR: 017   CPU->RBC
> CANNOT INIT   WR-FIFO

Recorder: The recorder can be operated normally except for the remote control units
                connected to the REMBUS.
Cause: The write-FIFO of the REMBUS controller on the PIF card cannot be initialized.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                ❏ **Call service; work to be performed by the technician:**
                - Check if the PIF card is present and if it is correctly inserted; check the fuse and
                   replace it, if necessary.
                - If the fault is still present, the PIF and CPU cards have to be checked as well as
                   the FIFO bus.

Message:

> ERR: 018   CPU->RBC
> CANNOT INIT   RD-FIFO

Recorder: The recorder can be operated normally except for the remote control units
                connected to the REMBUS.
Cause: The read-FIFO of the REMBUS controller on the PIF card cannot be initialized.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                ❏ **Call service; work to be performed by the technician:**
                - Check if the PIF card is present and if it is correctly inserted; check the fuse and
                   replace it, if necessary.
                - If the fault is still present, the PIF and CPU cards have to be checked as well as
                   the FIFO bus.

Message:

```
ERR: 019    CPU->SSTC
CANNOT  INIT  WR-FIFO
```

Recorder: The recorder can be used normally except for the functions concerning the internal synchronizer and the timecode.

Cause: The write-FIFO of the SYNCHRONIZER & TIMECODE controller cannot be initialized.

Remedy:
❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Check if the SSTC card is present and if it is correctly inserted; check the fuse and replace it, if necessary.
- If the fault is still present, the SSTC card has to be checked.

Message:

```
ERR: 020    CPU->SSTC
CANNOT  INIT  RD-FIFO
```

Recorder: The recorder can be used normally except for the functions concerning the internal synchronizer and the timecode.

Cause: The read-FIFO of the SYNCHRONIZER & TIMECODE controller cannot be initialized.

Remedy:
❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Check if the SSTC card is present and if it is correctly inserted; check the fuse and replace it, if necessary.
- If the fault is still present, the SSTC card has to be checked.

Message:

```
ERR: 021    CPU->RT
CANNOT  INIT  WR-FIFO
```

Recorder: The recorder can only be operated with restrictions, because recording or playback of the digital audio tracks may not be possible because of missing RT information.

Caution: **Never perform a recording in this state because an already existing recording might be destroyed.**

Cause: The write-FIFO of the RT controller cannot be initialized.

Remedy:
❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Check if the RT card is present and if it is correctly inserted.
- If the fault is still present, the RT card has to be checked.

Message:

```
ERR: 022    CPU->RT
CANNOT INIT  RD-FIFO
```

Recorder: **Recorder:**
The recorder can only be operated with restrictions, because recording or playback of the digital audio tracks may not be possible because of missing RT information.

Caution: **Never perform a recording in this state because an already existing recording might be destroyed.**

Cause: The read-FIFO of the RT controller cannot be initialized.

Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

⚠️   ❑ **Call service; work to be performed by the technician:**
- Check if the RT card is present and if it is correctly inserted.
- If the fault is still present, the RT card has to be checked.

Message:

```
WARNING: 023   SYSTEM
DEFAULT SETUP  LOADED
```

Recorder: The stored parameters for tape deck, recording and erase currents, operating states etc. have been partially or completely lost; the parameters have been replaced by the default values. For troublefree operation of the recorder the tape deck, recording and erase currents and other operating states must be entered again.

Note: With an IBM PC all parameters can be stored to a floppy disk and entered into the D827 MCH again via the test interface "TERM" (on CPU 1.863.655; a floppy disk with the recorder-specific parameters is shipped together with the recorder).

Cause: The data stored in the static RAM have been completely or partially modified or erased because of low battery voltage or a heavy electrical interference (e.g. when pulling out the CPU card during operation).

Remedy: ⚠️   ❑ Switch recorder off.
                       ❑ **Call service; work to be performed by the technician:**
- Check the voltage of the battery on the CIF card behind the CPU (min. 2.3 V); replace the battery if necessary.
- After power-on the recorder-specific parameters have to be set or entered from the floppy disk again.

Message:

```
WARNING: 024   TDC->CPU
NO COMMUNICATION
```

Recorder: Goes to STOP.
                       The recorder cannot be operated.

Cause: Malfunction of the CPU; the message on the LC display is produced by the tape deck controller. The FIFO communication between the CPU and the tape deck controller is disturbed (possible cause: as ERR: 013/014).

Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

⚠️   ❑ **Call service; work to be performed by the technician:**
- Check if the CPU card is present and inserted correctly.
- Switch recorder on.
- If the error remains, the CPU card has to be checked.

Message:

```
ERR: 025    CPU->SBC
     NO COMMUNICATION
```

Recorder: The recorder mutes all recording currents and audio outputs.
Tape deck functions are active, audio functions cannot be operated.
Recording and reproduction not possible.

Cause: The CPU cannot communicate with the SERBUS controller because of a mal-
function of the latter, or because the FIFO communication is disturbed.
Other possible cause: The write- or the read-FIFO of the SERBUS controller on the
PIF card cannot initialized.
Possibly malfunction of the FIFO interface on the CIF card, or of the FIFO bus,
FIFO interface or damaged FIFO on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
-    Check PIF and CPU card and the FIFO bus (back panel).

Message:

```
ERR: 026    CPU->SEC
     NO COMMUNICATION
```

Recorder: If the ES bus interface is not to be used, the recorder can be operated normally.
Cause: The CPU cannot communicate with the ES bus controller because of a malfunction
of the latter, or because the FIFO communication is disturbed.
Other possible cause: The write- or the read-FIFO of the ES bus controller on the
PIF card cannot initialized.
Possibly malfunction of the FIFO interface on the CIF card, or of the FIFO bus,
FIFO interface or damaged FIFO on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
-    Check PIF and CPU card and the FIFO bus (back panel).

Message:

```
ERR: 027    CPU->RBC
     NO COMMUNICATION
```

Recorder: The recorder can normally be operated except for the remote units connected to
the REMBUS.

Cause: The CPU cannot communicate with the REMBUS controller because of a mal-
function of the latter, or because the FIFO communication is disturbed.
Other possible cause: The write- or the read-FIFO of the REMBUS controller on
the PIF card cannot initialized.
Possibly malfunction of the FIFO interface on the CIF card, or of the FIFO bus,
FIFO interface or damaged FIFO on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
-    Check PIF and CPU card and the FIFO bus (back panel).

Message:

```
ERR: 028      CPU->SSTC
NO COMMUNICATION
```

Recorder: The recorder can normally be operated except for the functions concerning the internal synchronizer or the time code.

Cause: The CPU cannot communicate with the SYNCHRONIZER & TIMECODE controller because of a malfunction of the latter, or because the FIFO communication is disturbed.

Other possible cause: The write- or the read-FIFO of the SYNCHRONIZER & TIMECODE controller on the PIF card cannot initialized.

Possibly malfunction of the FIFO interface on the CIF card, or of the FIFO bus, FIFO interface or damaged FIFO on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

❏ **Call service; work to be performed by the technician:**
- Check if the SSTC card is present and if it is correctly inserted.
- If the fault is still present, the SSTC and CPU cards have to be checked.

Message:

```
ERR: 029      CPU->RT
NO COMMUNICATION
```

Recorder: The recorder can only be operated with restrictions, because recording or playback of the digital audio tracks may not be possible because of missing RT information.

Caution: **Never perform a recording in this state because an already existing recording might be destroyed.**

Cause: The CPU cannot communicate with the RT controller because of a malfunction of the latter, or because the FIFO communication is disturbed.

Other possible cause: The write- or the read-FIFO of the RT controller on the PIF card cannot initialized.

Possibly malfunction of the FIFO interface on the CIF card, or of the FIFO bus, FIFO interface or damaged FIFO on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

❏ **Call service; work to be performed by the technician:**
- Check if the RT card is present and if it is correctly inserted.
- If the fault is still present, the RT and CPU cards have to be checked.

Message:

```
WARNING: 101      TDC
UNEXPECTED  RESET
```

Recorder: Switches to STOP.

Cause: An interference (strong electrical field, short mains dropout) caused a reset of the Tape Deck controller.

Remedy: Should this message appear frequently:

❏ **Call service; work to be performed by the technician:**
- Check the line voltage.
- Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

> ERR: 102   TDC: EPROM
>   CHECKSUM ERROR

Recorder: **The recorder should not be operated.**

Cause: EPROM error of the Tape Deck controller on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

❏ **Call service; work to be performed by the technician:**
- Replace EPROM (TDC software).
- If the error remains after power-on, the PIF card has to be checked.

Message:

> ERR: 103   TDC: RAM
>   READ/WRITE ERROR

Recorder: **The recorder should not be operated.**

Cause: RAM error or an error in the Tape Deck controller circuit.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

❏ **Call service; work to be performed by the technician:**
- Check the PIF card.

Message:

> ERR: 104   TDC:SSDA
>   COMMUNICATION ERROR

Recorder: Goes to STOP.

Tape deck functions cannot be operated.

Cause: Should the tape deck functions still operate normally the cause may have been a short overload condition. Otherwise the following causes are possible:

❏ Malfunction of the tape deck microprocessor.

❏ Communication between Tape Deck Controller and the Tape Deck Microprocessor is disturbed.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:

❏ **Call service; work to be performed by the technician:**
- Check if the cards labelled "MP-Unit TD CONTROL", "TAPE DECK SERIAL IF", and "CONVERTER RS422 / TTL" are present and correctly inserted.
- Check the tape deck supply voltages.

Message:

> ERR: 111   TAPE DECK
>   POWER DROP OUT

Recorder: Goes to STOP.

Cause: Short power drop out of approx. 100 ms.

Remedy: Confirm with STORE.

If the recorder cannot be operated normally:

❏ **Call service; work to be performed by the technician:**
- Check mains cable, mains voltage, and tape deck supply voltages.

Message:

```
ERR: 112    TAPE  DECK
   NO  SUPPLY  VOLTAGE
```

Recorder: Goes to STOP.
                    Tape deck functions are blocked.
Cause: One or more of the tape deck supply voltages are missing.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
                      10 s and on again. If the message still remains:
                    ❑ **Call service; work to be performed by the technician:**
                    - Check the tape deck supply voltages.
                    - Switch recorder off.
                    - Replace blown fuses.
                    - If the error remains, the power supply units must be checked.

Message:

```
ERR: 114    TAPE  DECK
TACHO  SENSOR  ERROR
```

Recorder: Goes to STOP.
                    Tape deck functions are blocked.
Cause: Signal of one of the three Tacho Sensors is missing; the sense of rotation of the
                    three Tacho Sensors are different; or no tacho signal of a spooling motor while the
                    motor current exceeds 4 A.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
                      10 s and on again. If the message still remains:
                    ❑ **Call service; work to be performed by the technician:**
                    - Check the flat cable connectors to the Tacho Sensors and the Tacho Sensors
                      themselves.
                    - Check if the guide rollers and the tacho roller rotate freely.

Message:

```
ERR: 115    TAPE  DECK
TAPE  TENSION  CONTROL
```

Recorder: Goes to STOP.
                    Tape deck functions are blocked.
Cause: Deviation of the tape tension values is too large.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
                      10 s and on again. If the message still remains:
                    ❑ **Call service; work to be performed by the technician:**
                    - Check the tape deck and the guide rollers for excess friction.

Message:

```
ERR: 116    TAPE  DECK
INCOR  RADIUS  MEASURE
```

Recorder: Goes to STOP.
Cause: The computed values for the pancake diameters exceed the acceptable range.
                    Tacho Sensoren possibly faulty.
Remedy: ❑ Switch recorder with loaded tape to PLAY.
                    ❑ Usually the error message disappears if a sufficient amount of tacho pulsis is
                      available for computing the pancake diameters; if not:
                    ❑ **Call service; work to be performed by the technician:**
                    - Check the Tacho Sensors.

Message:

```
ERR: 117    TAPE  DECK
NO COMM TO CAPSTAN
```

Recorder: Goes to STOP.

Tape deck functions are blocked.

Causes:
- ❏ Malfunction of the Capstan Controller.
- ❏ No communication between TAPE DECK microprocessor and the Capstan Controller.

Remedy:
- ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❏ **Call service; work to be performed by the technician:**
- - Check if the cards labelled "CAPSTAN CONTROL UNIT" and "CAPSTAN INTERFACE" are present and correctly inserted.

Message:

```
ERR: 118   TAPE  DECK
PINCH ROLLER  SLIPPNG
```

Recorder: Goes to STOP.

Cause: Excess slip of the pinch roller; capstan speed deviates of the tape speed.

Remedy:
- ❏ Clean the capstan shaft, clean the pinch roller, replace if necessary.
- ❏ **Call service; work to be performed by the technician:**
- - Check the pinch roller force, adjust if necessary.
- - Check the tape tensions.

Message:

```
ERR: 119    TAPE  DECK
INCORRECT  INERTIA
```

Recorder: Goes to STOP.

Cause: The last computed torque values are not acceptable.

Remedy:
- ❏ Check for excess friction of guide rollers and motors.
- ❏ Check the tape movement through the tape guides to find out if it is gently enough.
- ❏ **Call service.**

Message:

```
ERR: 120    TAPE  DECK
WRONG REF. FREQUENCY
```

Recorder: Nominal tape speed cannot be reached.

Cause: If operating with an external reference signal for varispeed control the deviation of the reference frequency is too large.

Remedy:
- ❏ Adjust the reference signal.

Message:

```
ERR: 121    TAPE  DECK
SP-MOTOR TACHO   LEFT
```

Recorder: Goes to STOP.
Cause: The left Spooling Motor Tacho 1.820.771 detects too many direction changes or
                    supplies no tacho signal
Remedy: ❏ **Call service; work to be performed by the technician:**
                    -   Repair, adjust or replace.

Message:

```
ERR: 122   TAPE DECK
SP-MOTOR TACHO RIGHT
```

Recorder: Goes to STOP.
Cause: The right Spooling Motor Tacho 1.820.771 detects too many direction changes or
                    supplies no tacho signal
Remedy: ❏ **Call service; work to be performed by the technician:**
                    -   Repair, adjust or replace.

Message:

```
ERR: 123
MOVE SENSOR HW-ERROR
```

Recorder: Goes to STOP.
Cause: MOVE SENSOR PCB faulty or detects too many direction changes.
Remedy: ❏ **Call service; work to be performed by the technician:**
                    -   Repair, adjust or replace.

Message:

```
ERR: 124    TAPE  DECK
 MAINS OUT OF  RANGE
```

Recorder: Goes to STOP.
Cause: Mains voltage is out of the range necessary for operation of the D827
Remedy: ❏ **Call service; work to be performed by the technician:**
                    -   Check mains voltage, fuses, cables.

Message:

```
ERR: 125    TAPE   DECK
SP-MOTOR  SERVO  HW-ER
```

Recorder: Goes to STOP.
Cause: Error in the analog spooling motor control circuit, missing supply voltage, or current
                    feedback loops open.
Remedy: ❏ **Call service; work to be performed by the technician:**
                    -   Check voltages and signals on the following boards:
                        - Move Sensor 1.820.770
                        - Sp. Motor Drive Amp. 1.863.875
                        - Tape Tension Sensors 1.863.772

Message:

> WARNING: 201   SBC
>   UNEXPECTED   RESET

Recorder: Switches to STOP.
Cause: An interference (strong electrical field, short mains dropout) caused a reset of the SERBUS controller.
Remedy: Should this message appear frequently:
                       ❏ **Call service; work to be performed by the technician:**
                       -   Check the line voltage.
                       -   Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

> ERR: 202   SBC: EPROM
>   CHECKSUM ERROR

Recorder: **The recorder should not be operated.**
Cause: EPROM error of the SERBUS controller on the PIF card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
                       ❏ **Call service; work to be performed by the technician:**
                       -   Replace EPROM (SBC software).
                       -   If the error remains after power-on, the PIF card has to be checked.

Message:

> ERR: 203   SBC: RAM
>   READ/WRITE ERROR

Recorder: **The recorder should not be operated.**
Cause: RAM error or an error in the SERBUS controller circuit.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
                       ❏ **Call service; work to be performed by the technician:**
                       -   Check the PIF card.

Message:

> ERR: 204   SBC: SERBUS
>   INTERFACE/BUS   ERROR

Recorder: No audio functions.
Cause: Faulty SERBUS (interruption, short, etc.), faulty PORT MASTER chip or a fault in the SERBUS interface on the PIF card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
                       ❏ **Call service; work to be performed by the technician:**
                       -   Check if all cards are inserted properly.
                       -   Check supply voltages and fuses on all cards.

Message:

> ERR: 210   SBC: SERBUS
> TIMEOUT MAPRO #1

Recorder: Digital audio channels No. 1...8 cannot be operated.
Causes: ❑ MAPRO card of the digital audio group No. 1 is missing or not correctly inserted.
                  ❑ Incorrect PORT MASTER address due to confounded MAPRO cards or incorrectly set jumpers (address selection) on the MAPRO card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
                  ❑ **Call service; work to be performed by the technician:**
                  - Check if the MAPRO card is present, if the jumpers are correctly set, and if the MAPRO card is correctly inserted.
                  - Check the fuse on the MAPRO card.

Message:

> ERR: 211   SBC: SERBUS
> TIMEOUT MAPRO #2

Recorder: Digital audio channels No. 9...16 cannot be operated.
Causes: ❑ MAPRO card of the digital audio group No. 2 is missing or not correctly inserted.
                  ❑ Incorrect PORT MASTER address due to confounded MAPRO cards or incorrectly set jumpers (address selection) on the MAPRO card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
                  ❑ **Call service; work to be performed by the technician:**
                  - Check if the MAPRO card is present, if the jumpers are correctly set, and if the MAPRO card is correctly inserted.
                  - Check the fuse on the MAPRO card.

Message:

> ERR: 212   SBC: SERBUS
> TIMEOUT MAPRO #3

Recorder: Digital audio channels No. 17...24 cannot be operated.
Causes: ❑ MAPRO card of the digital audio group No. 3 is missing or not correctly inserted.
                  ❑ Incorrect PORT MASTER address due to confounded MAPRO cards or incorrectly set jumpers (address selection) on the MAPRO card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
                  ❑ **Call service; work to be performed by the technician:**
                  - Check if the MAPRO card is present, if the jumpers are correctly set, and if the MAPRO card is correctly inserted.
                  - Check the fuse on the MAPRO card.

Message:

> ERR: 213   SBC: SERBUS
>   TIMEOUT MAPRO #4

Recorder: Digital audio channels No. 25...32 cannot be operated.
Causes:
❏ MAPRO card of the digital audio group No. 4 is missing or not correctly inserted.
❏ Incorrect PORT MASTER address due to confounded MAPRO cards or incorrectly set jumpers (address selection) on the MAPRO card.

Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the MAPRO card is present, if the jumpers are correctly set, and if the MAPRO card is correctly inserted.
- Check the fuse on the MAPRO card.

Message:

> ERR: 214   SBC: SERBUS
>   TIMEOUT MAPRO #5

Recorder: Digital audio channels No. 33...40 cannot be operated.
Causes:
❏ MAPRO card of the digital audio group No. 5 is missing or not correctly inserted.
❏ Incorrect PORT MASTER address due to confounded MAPRO cards or incorrectly set jumpers (address selection) on the MAPRO card.

Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the MAPRO card is present, if the jumpers are correctly set, and if the MAPRO card is correctly inserted.
- Check the fuse on the MAPRO card.

Message:

> ERR: 215   SBC: SERBUS
>   TIMEOUT MAPRO #6

Recorder: Digital audio channels No. 41...48 cannot be operated.
Causes:
❏ MAPRO card of the digital audio group No. 6 is missing or not correctly inserted.
❏ Incorrect PORT MASTER address due to confounded MAPRO cards or incorrectly set jumpers (address selection) on the MAPRO card.

Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the MAPRO card is present, if the jumpers are correctly set, and if the MAPRO card is correctly inserted.
- Check the fuse on the MAPRO card.

Message:

> ERR: 225   SBC: SERBUS
> TIMEOUT SOUND MEMORY

Recorder: SOUND MEMORY functions cannot be used.
Cause: SOUND MEMORY card is missing or not correctly inserted.
Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the SOUND MEMORY card is present and correctly set
- Check the fuse on the SOUND MEMORY card.

Message:

```
ERR: 226    SBC: SERBUS
      TIMEOUT  I/O   #1
```

Recorder: Digital audio channels No. 1...8 cannot be operated.
Causes:
- ❏ I/O card of the digital audio group No. 1 is missing or not correctly inserted.
- ❏ Incorrect PORT MASTER address due to confounded I/O cards or incorrectly set jumpers (address selection) on the I/O card.

Remedy:
- ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❏ **Call service; work to be performed by the technician:**
- - Check if the I/O card is present, if the jumpers are correctly set, and if the I/O card is correctly inserted.
- - Check the fuse on the I/O card.

Message:

```
ERR: 227    SBC: SERBUS
      TIMEOUT  I/O   #2
```

Recorder: Digital audio channels No. 9...16 cannot be operated.
Causes:
- ❏ I/O card of the digital audio group No. 2 is missing or not correctly inserted.
- ❏ Incorrect PORT MASTER address due to confounded I/O cards or incorrectly set jumpers (address selection) on the I/O card.

Remedy:
- ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❏ **Call service; work to be performed by the technician:**
- - Check if the I/O card is present, if the jumpers are correctly set, and if the I/O card is correctly inserted.
- - Check the fuse on the I/O card.

Message:

```
ERR: 228    SBC: SERBUS
      TIMEOUT  I/O   #3
```

Recorder: Digital audio channels No. 17...24 cannot be operated.
Causes:
- ❏ I/O card of the digital audio group No. 3 is missing or not correctly inserted.
- ❏ Incorrect PORT MASTER address due to confounded I/O cards or incorrectly set jumpers (address selection) on the I/O card.

Remedy:
- ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❏ **Call service; work to be performed by the technician:**
- - Check if the I/O card is present, if the jumpers are correctly set, and if the I/O card is correctly inserted.
- - Check the fuse on the I/O card.

Message:

```
ERR: 229    SBC: SERBUS
      TIMEOUT  I/O   #4
```

Recorder: Digital audio channels No. 25...32 cannot be operated.
Causes:
- ❏ I/O card of the digital audio group No. 4 is missing or not correctly inserted.
- ❏ Incorrect PORT MASTER address due to confounded I/O cards or incorrectly set jumpers (address selection) on the I/O card.

Remedy:
- ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❏ **Call service; work to be performed by the technician:**
- - Check if the I/O card is present, if the jumpers are correctly set, and if the I/O card is correctly inserted.
- - Check the fuse on the I/O card.

Message:

```
ERR: 230    SBC: SERBUS
       TIMEOUT  I/O   #5
```

Recorder:Recorder: Digital audio channels No. 33...40 cannot be operated.
Causes: ❏ I/O card of the digital audio group No. 5 is missing or not correctly inserted.
                         ❏ Incorrect PORT MASTER address due to confounded I/O cards or incorrectly
                           set jumpers (address selection) on the I/O card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                           10 s and on again. If the message still remains:
                         ❏ **Call service; work to be performed by the technician:**
                         - Check if the I/O card is present, if the jumpers are correctly set, and if the I/O
                            card is correctly inserted.
                         - Check the fuse on the I/O card.

Message:

```
ERR: 231    SBC: SERBUS
       TIMEOUT  I/O   #6
```

Recorder: Digital audio channels No. 41...48 cannot be operated.
Causes: ❏ I/O card of the digital audio group No. 6 is missing or not correctly inserted.
                         ❏ Incorrect PORT MASTER address due to confounded I/O cards or incorrectly
                           set jumpers (address selection) on the I/O card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                           10 s and on again. If the message still remains:
                         ❏ **Call service; work to be performed by the technician:**
                         - Check if the I/O card is present, if the jumpers are correctly set, and if the I/O
                            card is correctly inserted.
                         - Check the fuse on the I/O card.

Message:

```
ERR: 232   SBC: SERBUS
       TIMEOUT MIO   #A
```

Recorder: The digital audio SDIF inputs and outputs of the channels 1...24 cannot be
                         operated.
Causes: ❏ MASTER I/O A card is missing or not correctly inserted.
                         ❏ Defective PORT MASTER chip on the MASTER I/O A card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                           10 s and on again. If the message still remains:
                         ❏ **Call service; work to be performed by the technician:**
                         - Check if the MASTER I/O A card is missing or correctly inserted.
                         - Check the fuse on the MASTER I/O A card.

Message:

```
ERR: 233    SBC: SERBUS
       TIMEOUT  MIO  #B
```

Recorder: The digital audio SDIF inputs and outputs of the channels 25...48 cannot be
                         operated.
Causes: ❏ MASTER I/O B card is missing or not correctly inserted.
                         ❏ Defective PORT MASTER chip on the MASTER I/O B card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                           10 s and on again. If the message still remains:
                         ❏ **Call service; work to be performed by the technician:**
                         - Check if the MASTER I/O B card is missing or correctly inserted.
                         - Check the fuse on the MASTER I/O B card.

Message:

```
ERR: 234    SBC: SERBUS
    TIMEOUT  PING-PONG
```

Recorder: Any of the digital audio channels can be operated.
Causes: ❏ PING-PONG card is missing or not correctly inserted.
                  ❏ Defective PORT MASTER chip on the PING-PONG card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                  ❏ **Call service; work to be performed by the technician:**
                  - Check if the PING-PONG card is present and correctly inserted.
                  - Check the fuse on the PING-PONG card.

Message:

```
ERR: 235    SBC: SERBUS
    TIMEOUT  CLOCK
```

Recorder: Audio and auxiliary tracks cannot be recorded or reproduced.
Causes: ❏ CLOCK card is missing or not correctly inserted.
                  ❏ Defective PORT MASTER chip on the CLOCK card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                  ❏ **Call service; work to be performed by the technician:**
                  - Check if the CLOCK card is present and correctly inserted.
                  - Check the fuse on the CLOCK card.

Message:

```
ERR: 236    SBC: SERBUS
    TIMEOUT  CUE
```

Recorder: CUE tracks cannot be recorded or reproduced
Causes: ❏ CUE card is missing or not correctly inserted.
                  ❏ Defective PORT MASTER chip on the CUE card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                  ❏ **Call service; work to be performed by the technician:**
                  - Check if the CUE card is present and correctly inserted.
                  - Check the fuse on the CUE card.

Message:

```
ERR: 237    SBC: SERBUS
    TIMEOUT  AES-IF
```

Recorder: AES/EBU inputs and outputs do not work.
Causes: ❏ AES/EBU INTERFACE card is missing or not correctly inserted.
                  ❏ Defective PORT MASTER chip on the AES/EBU INTERFACE card.
Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for
                  10 s and on again. If the message still remains:
                  ❏ **Call service; work to be performed by the technician:**
                  - Check if the AES/EBU INTERFACE card is present and correctly inserted.
                  - Check the fuse on the AES/EBU INTERFACE card.

Message:

```
ERR: 238    SBC: SERBUS
     TIMEOUT  DP-PANEL
```

Recorder: No audio functions.
Cause: Faulty SERBUS (interruption, short, etc.), faulty PORT MASTER chip or a fault in the SERBUS interface on the PIF card.
Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if all cards are inserted properly.
- Check supply voltages and fuses on all cards.
- Replace PORT MASTER chip.

Message:

```
ERR: 239    SBC: SERBUS
     TIMEOUT  REP-CTRL
```

Recorder: Audio and auxiliary tracks cannot be recorded, and possibly not reproduced.
Causes:
❏ REPRODUCE CONTROLLER card is missing or not correctly inserted.
❏ If ERR: 239 and ERR: 240 are present simultaneously, defective or bad SERBUS connection.
❏ Defective PORT MASTER chip.
Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the REPRODUCE CONTROLLER card is present and correctly inserted.
- Check supply voltages of the tape deck electronics, check SERBUS connections.

Message:

```
ERR: 240    SBC: SERBUS
     TIMEOUT  REC-CTRL
```

Recorder: No recording.
Causes:
❏ RECORD CONTROLLER card is missing or not correctly inserted.
❏ If ERR: 239 and ERR: 240 are present simultaneously, defective or bad SERBUS connection.
❏ Defective PORT MASTER chip.
Remedy:
❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Check if the RECORD CONTROLLER card is present and correctly inserted.
- Check supply voltages of the tape deck electronics, check SERBUS connections.

Message:

```
ERR: 241      SBC: REC
   WATCHDOG  TEST ERR
```

Recorder: No recording after the start of the recorder.
Cause: Fault in the recording electronics.
Remedy:
- ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❑ **Call service; work to be performed by the technician:**
- - Check if the cards labelled "RECORD CONTROLLER", "REC. CURRENT SUPPLY", "ERASE CURRENT DRIVER" and "RECORD CURRENT DRIVER" are present and correctly inserted.
- ❑ Check supply voltages of the "REC. CURRENT SUPPLY" card (red LED).
- ❑ Check the jumpers on the "RECORD CONTROLLER" card, change from SAFE to NORM.
- ❑ Also refer to ERR: 240.

Message:

```
ERR: 242         LCU
   UNEXPECTED  RESET
```

Recorder: All lamps and bargraphs of the Local Control Unit (LCU) are dark for a short time.
Cause: An interference (strong electrical field, short mains dropout) caused a reset of the Display Panel Controller.
Remedy: Should this message appear frequently:
- ❑ **Call service; work to be performed by the technician:**
- - Check the line voltage.
- - Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

```
ERR: 243   LCU: EPROM
   CHECKSUM ERROR
```

Recorder: **The recorder should not be operated.**
Cause: EPROM error of the LCU Controller on the LCU Processor card.
Remedy:
- ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❑ **Call service; work to be performed by the technician:**
- - Replace EPROM (LCU software).
- - If the error is still present after switching on, the LCU Processor card must be checked.

Message:

```
ERR: 244      LCU: RAM
   READ/WRITE  ERROR
```

Recorder: **The recorder should not be operated.**
Cause: RAM error or a fault in the LCU Controller circuit.
Remedy:
- ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
- ❑ **Call service; work to be performed by the technician:**
- - If the error is still present after switching on, the LCU Processor card must be checked.

Message:

```
WARNING: 301    SEC
     UNEXPECTED  RESET
```

Recorder: If the recorder is connected via the ES Bus interface with an other unit, this communication might have to be initialized again.

Cause: An interference (strong electrical field, short mains dropout) caused a reset of the ES Bus controller.

Remedy: Should this message appear frequently:
❏ **Call service; work to be performed by the technician:**
- Check the line voltage.
- Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

```
ERR: 302    SEC: EPROM
     CHECKSUM  ERROR
```

Recorder: The ES Bus interface should not be used.

Cause: EPROM error of the ES Bus controller on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Replace EPROM (SEC software).
- If the error is still present after switching on, the PIF card must be checked.

Message:

```
ERR: 303    SEC: RAM
     READ/WRITE  ERROR
```

Recorder: The ES Bus interface should not be used.

Cause: EPROM error of the ES Bus controller on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Replace EPROM (SEC software).
- If the error is still present after switching on, the PIF card must be checked.

Message:

```
ERR: 305    SEC: BUS-IF
     BAD JUMPER  SETTINGS
```

Recorder: Operation with the ES Bus interface impossible.

Cause: Wrong jumper setting on the PIF card.

Remedy: ❏ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❏ **Call service; work to be performed by the technician:**
- Correct jumper setting.

Message:

> WARNING: 401   RBC
> UNEXPECTED RESET

Recorder: Short interruption of the REMBUS communication. Further operation might be
                        disturbed.
Cause: An interference (strong electrical field, short mains dropout) caused a reset of the
                        REMBUS controller.
Remedy: Should this message appear frequently:
⚠   ❑ **Call service; work to be performed by the technician:**
                        -   Check the line voltage.
                        -   Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

> ERR: 402   RBC: EPROM
> CHECKSUM ERROR

Recorder: The REMBUS should not be used.
Cause: EPROM error of the REMBUS Controller on the PIF card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
                           10 s and on again. If the message still remains:
⚠   ❑ **Call service; work to be performed by the technician:**
                        -   Replace EPROM (RBC software).
                        -   If the error is still present after switching on, the PIF card must be checked.

Message:

> ERR: 403   RBC: RAM
> READ/WRITE   ERROR

Recorder: The REMBUS should not be used.
Cause: EPROM error of the REMBUS Controller on the PIF card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
                           10 s and on again. If the message still remains:
⚠   ❑ **Call service; work to be performed by the technician:**
                        -   Replace EPROM (RBC software).
                        -   If the error is still present after switching on, the PIF card must be checked.

Message:

> WARNING: 501   SSTC
> UNEXPECTED RESET

Recorder: A synchronizer operation (LOCK, LOOP, etc.) was interrupted (STOP).
Cause: An interference (strong electrical field, short mains dropout) caused a reset of the
                        SSTC controller.
Remedy: Should this message appear frequently:
⚠   ❑ **Call service; work to be performed by the technician:**
                        -   Check the line voltage.
                        -   Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

```
ERR: 502    SSTC: EPROM
       CHECKSUM  ERROR
```

Recorder: Refrain from synchronizer operations.
Cause: EPROM error of the SSTC Controller on the SSTC card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Replace EPROM (SSTC software).
- If the error is still present after switching on, the SSTC card must be checked.

Message:

```
ERR: 503    SSTC: RAM
      READ/WRITE  ERROR
```

Recorder: Refrain from synchronizer operations.
Cause: EPROM error of the SSTC Controller on the SSTC card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Replace EPROM (SSTC software).
- If the error is still present after switching on, the SSTC card must be checked.

Message:

```
WARNING: 601    RTC
      UNEXPECTED  RESET
```

Recorder: Goes from NEW REC mode to STOP.
Cause: An interference (strong electrical field, short mains dropout) caused a reset of the
RT controller.
Remedy: Should this message appear frequently:
❑ **Call service; work to be performed by the technician:**
- Check the line voltage.
- Check the secondary supply voltages for fluctuations or too high/too low values.

Message:

```
ERR: 602    RTC: EPROM
       CHECKSUM  ERROR
```

Recorder: **The recorder should not be used for recording.**
Cause: EPROM error of the RT Controller on the RT card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for
10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Replace EPROM (RT software).
- If the error is still present after switching on, the RT card must be checked.

Message:	ERR: 603 RTC: RAM READ/WRITE ERROR

Recorder: **The recorder should not be used for recording.**
Cause: EPROM error of the RT Controller on the RT card.
Remedy: ❑ Confirm the message with STORE; should it remain: Switch recorder off for 10 s and on again. If the message still remains:
❑ **Call service; work to be performed by the technician:**
- Replace EPROM (RT software).
- If the error is still present after switching on, the RT card must be checked.

Message:	WARNING: 800 RT TRACK SAMP FREQ MISMATCH

Recorder: Recording and reproduction is not processed with the sampling rate recorded on the tape.
Cause: Recorder is operated with an external clock signal (e.g. AES/EBU or Word Clock). The sampling rate of the external clock signal does not correspond with the sampling rate specified in the RT track.
The tape was not formatted completely with the same sampling rate.
Remedy: ❑ Switch recorder to PLAY with INT CLK.
❑ Select the sampling rate of the external clock signal corresponding with the sampling rate displayed on the recorder; now, the recorder can be operated with EXT CLK again.

13   Technical glossary

Advanced Output   A "negative delay" mode provided to compensate either for external delays in post-production (e.g. digital effect units) or to compensate for I/O interfacing when sample-accurate copying from one machine to another is desired (e.g. for clone copies of tapes).

Advance Record   Sony naming for *New Record* Mode.

A/D   The A/D converters used in the D827 MCH are 18 bit sigma-delta converters with 64 times oversampling.

AES   Audio Engineering Society.

AES/EBU   Colloquial for the two-channel digital audio interface, defined by *AES* and *EBU*. Standards name: AES-3. Self-clocking transmission of 2 channels with an audio word length of up to 24 bits. Balanced transmission for up to 100 m distance.

AES-11   Synchronization standard for digital audio applications, uses *AES/EBU*-like signals for clock synchronization.

Assemble Record Mode Recording mode used when *New Record* Mode has been left before the end of the tape. Allows gapless assembling of *Reference Track* and *Timecode* information (jam-to-tape information). All digital audio tracks are simultaneously overwritten.

Chase Synchronizer   Implemented as standard in the D827 MCH. Allows locking to *Timecode* or *RT* references. The D827 MCH synchronizer is based on the Studer TLS4000 MkII and does not only allow standard chase, but has also edit capabilities for pre-programmable punch-in/-out sequences in synchronized environments.

Confidence Playback   Terminology used when true tape read-after-write is provided. The record head has to be followed by a playback head.
Can only be selected in *New Record* Mode if the D827 MCH is equipped with the additional, optional *New Record Head.*
In New Rec Mode all audio tracks, including *Reference Track*, are recorded simultaneously.

CRCC   Abbreviation for Cyclic Redundancy Check Code. Stands for a polynomical calculation of a checksum across the audio information, e.g. on the tape. Delivers a quality criterion and is usually averaged across a dedicated number of blocks of audio data. Is also basis of the channel-individual read-back quality display (CHECK function) on the D827 MCH.

CTL   Sony naming for the Control Track output containing the RT information in the Sony dialect. The Studer D827 can read and process RT as well as CTL if equipped with the RT card 1.863.657.20 (e.g. for DASH LOCK).

D/A   The high-quality, low distortion D/A converters used in the D827 are 20 bits and eight times oversampling.

DASH   Abbreviation for Digital Audio Stationary Head. Several versions defined, e.g. Twin DASH, DASH-F ("F" for fast, i.e. 30 ips) etc. Refer to section 9.
The D827 MCH conforms to the DASH-F, single and double density standard. It is compatible to 24-track (single density) and 48-track (double density) DASH recorders as the Studer D820 MCH, Sony PCM-3324/A, Sony PCM-3324S, Sony PCM-3348, and Tascam DA-800-24.

DASH-Lock	Application where two or more DASH tape recorders are linked via *Reference Track* for sample-accurate lock ("DASH-lock").
Dither	Digital signal processing technique usually used to manipulate the least significant bit of a digital audio word to overcome digital artifacts, e.g. after truncation. Adds noise but colours this noise towards the white spectrum for less acoustical disturbance.
EBU	European Broadcasting Union.
EDR	Abbreviation for "Extended Digital Resolution" which stands for a unique Studer feature. EDR allows storing of 24 digital audio channels of 24 bit audio data on a 48-channel DASH recorder. Two 16 bit digital audio tracks are used to store the 24 bit word. The internal 24 bit signal processing provides for full punch-in and punch-out capabilities together with full media format compatibility to a 24-channel standard DASH recording. 24 bit tapes can be played back with standard 16 bit performance on any *DASH-F*-conforming multitrack tape recorder. Can be retrofitted to any D827-48 and makes 24 tracks available with 24 bit resolution or alternatively all 48 tracks with standard 16 bit performance. Can only be used with *MADI* and *AES/EBU* input signals and is therefore an ideal recording technique to match today's digital mixing console outputs.
ES Bus	Serial tape deck control bus for control or synchronization systems. Specified by the *EBU*. Allows also serial track arming.
Insert Record Mode	Recording mode using pre-striped tape. Recording of individual tracks is possible. Usual standard way of operation with DASH recorders.
MADI	Abbreviation for Multichannel Audio Digital Interface, also known as AES-10 standard. Allows interconnection of two devices to transmit up to 56 channels of digital audio (max. word length 24 bits) with a single coaxial cable or via *optical link*. Standard interface to digital mixing consoles like the Studer D940 or the Neve Capricorn.
Master Tallies	Tape transport status information (Stop, Play, Record, move pulses) of the master machine, connected to the slave synchronizer, in order to speed up synchronization and to allow for synchronous punch-in/-out (Follow Record).
Move Pulses	Clock signal provided by tape machines to interpolate time information (e.g. *Timecode*) during Wind and Stop, when no code can be read off tape. Speeds up synchronization.
New Record Mode	During New Record the tape is striped ("formatted") with the *Reference Track* and usually with the *Timecode* track as well. All digital audio tracks are overwritten (with or without a new recording).
New Record Head	Optional. When installed, allows for *confidence playback* in New Record mode.
Noise Shaping	Digital signal processing technique to overcome problems when truncating higher bit-length words to words with less bits, e.g. when truncating 18 bit A/D-output to DASH-dictated 16 bit recording word length. Moves the noise generated with *dither* algorithms towards higher frequency regions where the human ear is less sensitive. Noise Shaping does not touch the original audio information. Noise Shaping leads to better sonic performance than allowed by the actual stored word length in the frequency range where the human ear is most perceptive.

Optical Front End   Can be provided as an option for the *MADI* interface. Allows interconnection of two MADI devices over a distance of up to 2000 m by a fiber optic cable.

PAI   Abbreviation for Parallel Audio Interface. Remote interface allowing interconnection of parallel channel status control outputs of mixing consoles to the *REMBUS* of the D827 MCH.

Ping-Pong   See *Track Bouncing.*

PWM   Abbreviation for Pulse Width Modulation. Technique used for recording the analog Cue Tracks. First-generation *DASH* machines like the Sony PCM-3324 used bias recording. Recordings performed with both techniques can be read and overwritten by the D827 MCH.

Reference Track (RT)   *DASH* defined control track recorded on tape during *New Record* mode. Holds address information to reproduce the block-structured audio data. Contains also information about used sampling rate, DASH format etc. This track information is also used as a reference for *DASH-lock.*

Refresh   Special recording mode implemented in Studer DASH tape recorders. Allows internal 1:1 re-recording ("refreshing") of digital audio tracks after error correction to maintain maximum reliability.

REMBUS   Abbreviation for REmote Multimaster BUS. Allows interconnection of D827 MCH remote units (Autolocator, Audio Remote, Sound Memory Controller and *PAI*). Connects also the power supply from the recorder to the remotes; therefor mains connection of the remote units is unnecessary.

SDIF   Abbreviation for Sony Digital InterFace. Digital transmission format for digital audio, outdated today. As this is an old de-facto industry standard, it is available as an option for the D827 MCH.
                           Transmission format not recommended for longer distances. Allows for transmission of 16 bit audio (Standard allows for 20 bits).
                           Two standards are common: 2-channel transmission, unbalanced, on 75 Ω cable (used e.g. in Sony PCM-1630 devices), or multichannel transmission on balanced lines with RS485 characteristics.

Setup Handler   The Setup Handler is a specific Studer tool. It is delivered as an application program for Apple MacIntosh computers and allows for an on-screen display of all user parameters of the D827 MCH. It also allows to back-up all parameters on a floppy disk. This substantially decreases the setup time of the machine when resuming a session, because also parameters very time-consuming to be restored (as the 110 CUE addresses) can be simply downloaded from the diskette to the machine.
                           The Setup Handler also allows for the storage of user production memos like the track sheet.

Sound Memory   This is a unique Studer feature. The Sound Memory is a Random Access Memory (32 or 128 Mbits) available as an option. It allows for the storage of up to 180 track-seconds which can be splitted up to max. 4 tracks. Digital audio data can be stored either from the tape or from an analog or digital input into the memory and edited to be re-inserted at any other location on the tape, or output on any analog or digital output. Various recording and playback modes are provided.

TC Regenerate   The D827 MCH regenerates the off-tape *Timecode* at the output, if selected in the menu. This overcomes drop-out problems. Timecode is also interpolated during Wind or Stop when no code can be read from the tape. This makes move-pulse connection e.g. to a synchronizer for TC interpolation unnecessary.

Timecode (TC)   Standard format for recording time information to allow synchronization of several devices.
If timecode is used for synchronization in digital environments, clock-referenced recording of TC is mandatory.

Track Bouncing   Facility for sample-accurate copies of digital audio tracks to other tracks in the digital domain. It is used to re-organize the track order on tape or to copy tracks for further post-processing. The D827 MCH provides three modes:
❑ Ping-Pong: copy one track to several other tracks
❑ Track Bouncing (with Autolocator): up to 48 source tracks to max. 48 destination tracks
❑ Track Bouncing (with Setup Handler): up to 48 source tracks to max. 48 destination tracks.

Track Slipping   *Sound Memory* mode which allows for copying up to 24 tracks (8 tracks with the D827-24) at the same time with an adjustable delay. This allows e.g. for proper time alignment of instruments in multitrack recordings or, in another example, for time compensation in poly-microphony recordings or time-shifting of voices in film post production.

14   Index