

Film-Tech

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SERIES 2000

SERIES 4000

SERIES 10000



**ELECTRONIC INTERLOCK
MAGNETIC FILM
RECORDERS and REPRODUCERS
OPERATOR'S MANUAL**

SECTION I
INTRODUCTION

SECTION II
INSTALLATION

SECTION III
OPERATION

SECTION IV
RECORD AND PLAYBACK SYSTEM:
TYPE 69C PLAYBACK AMPLIFIERS AND
TYPE 68C RECORD AMPLIFIERS

SECTION V
AUDIO SYSTEM POWER SUPPLIES

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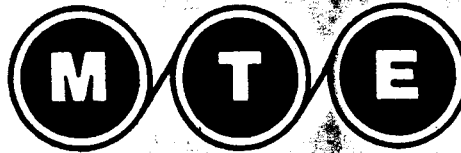
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Cables "Magtech"

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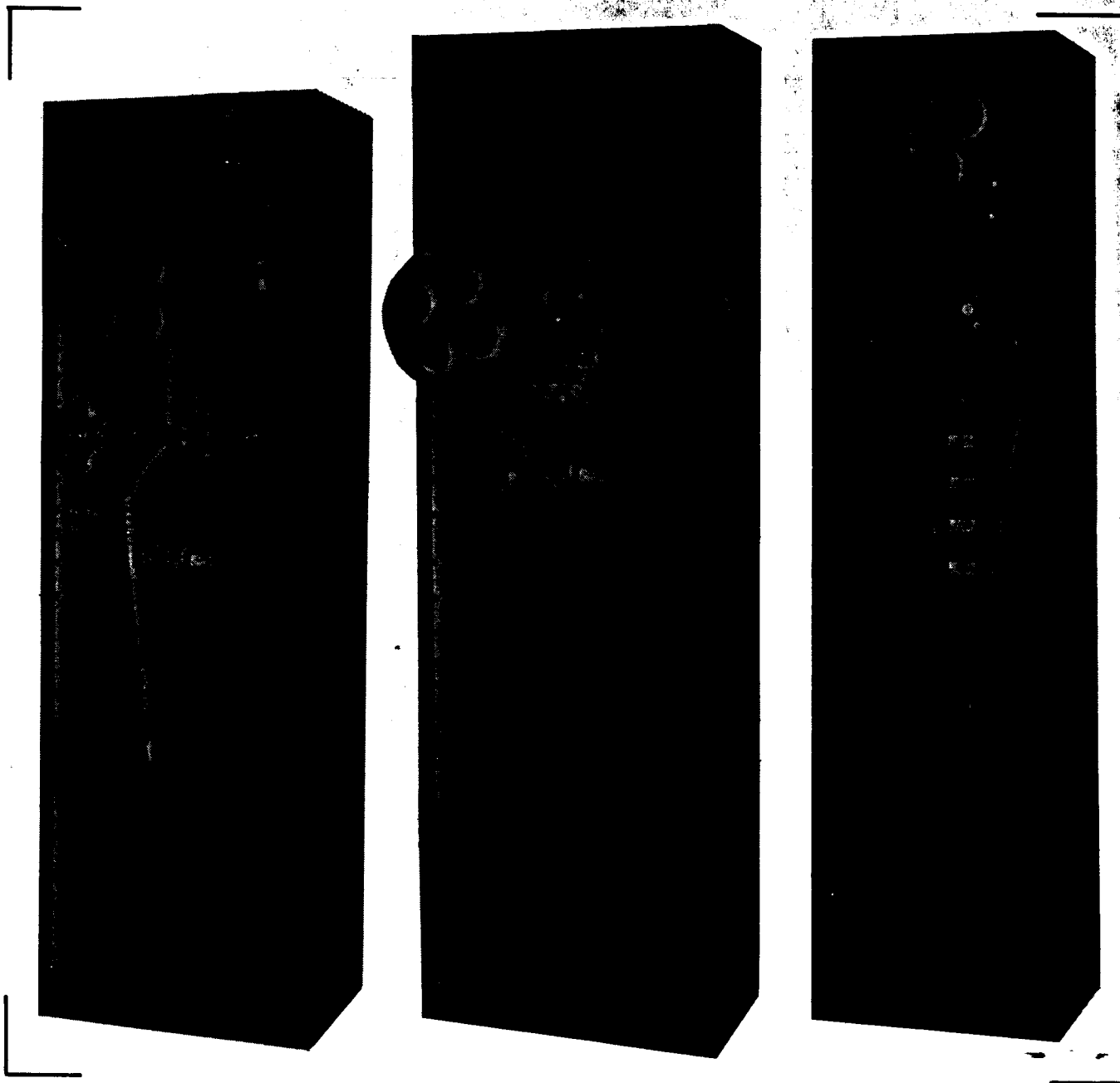
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MTE SERIES 2000, 4000, 10000 RECORDER/REPRODUCER



SERIES 2000

SERIES 4000

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Series 2000, 4000, and 10000 Recorders and Reproducers

Frontispiece

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SECTION I

INTRODUCTION

This manual combines basic instructions for unpacking, installing and operating Series 2000, 4000, and 10000 Electronic Interlock Magnetic Film Recorders and Reproducers. This section provides a brief description of the machines, their functions, available options and accessories, and complete specifications.

DESCRIPTION

Magna-Tech Electronic Interlock Magnetic Film Recorders and Reproducers record and reproduce double-system synchronized sound on sprocketed magnetic film for motion picture and video tape production. In double-system synchronized sound, sound is edited on one or more separate magnetic films which must be in exact synchronism with the corresponding picture. These machines electronically provide exact forward and backward synchronism, or interlock, during mixing, screening, and looping sessions.

Magna-Tech recorders and reproducers are available in many different configurations to meet the various requirements of motion picture and video tape sound studios. Reproducers, or dubbers, are equipped for playback only; recorders have facilities for recording and playback. Thus, a mixing studio may be equipped with a bank of dubbers to play back the various films that make up a composite sound track, and a pick-up recorder to record the mixed sound. All machines may be interlocked to the same picture. When the mix or a part of it has been completed, it may be played back on the recorder in synchronism with the picture using sel-sync playback. Work may be picked up at any point on the sound track. For looping, a recorder may be used together with a projector and the optional looping system to assemble a new dialogue sound track.

Machines in these series are available for 35-mm film, 17.5-mm film, and 16-mm film, and dual-speed machines are available for any combination.

Only the magnetic head assembly need be changed to change film widths on dual-speed machines; sprocket pads simply flip over. Each machine is equipped to run under local control both at 24 frames per second and at 25 frames per second. Plug-in magnetic head assemblies are available for all track configurations up to the number of record and playback amplifiers in the unit. Optical reproducers are available and may be installed in any machine.

These machines may be interlocked with any motion picture projector, recorder, or reproducer equipped with a 10-pulse-per-frame two-phase shaft encoder, to interlock control unit (8LB) or to video tape using SMPTE or EBU time code and synchronizer. In addition, each transport may be synchronized to the drive signal of an adjacent transport. The machine will follow the interlock or drive signal source both forward and backward at any speed up to four times sync speed (twice sync speed for Series 4000; up to eight times sync speed for series 2000 and 10000 equipped with optional servo torque system). Individual films in interlock may be advanced or retarded by a local command at the unit control panel, or by a command from an optional remote control panel or console. Each transport may be operated individually under local control at sync speed and at twice sync speed. Sprocket speed in local operation is crystal-controlled (line or video controlled with optional line/video sync board). Film take-up and tension is controlled by separate torque motors. Maximum reel capacity is 3000 feet (915 meters) [2000 feet (610) meters on Series 4000 machines]. Minimum reel hub diameter for proper performance is 3 inches (7.5 centimeters). All electronics and power supplies required for operation of the unit are installed in the cabinet with the transport.

Each Series 4000 transport is an independent unit arranged horizontally on a single precision-ground aluminum panel. One, two, or three independent Series 4000 transports may be mounted in the same cabinet. Each Series 10000 machine is an independent film transport mounted vertically in a single

MTE SERIES 2000, 4000, 10000 RECORDER/REPRODUCER

cabinet. Each Series 2000 machine consists of two independent film transports, each of which is virtually identical to a single Series 10000 transport, arranged vertically, side-by-side in a single cabinet. All information given in this manual applies separately to each transport of a Series 2000 machine.

Accessory equipment available for use with these machines includes optical shaft encoders for mounting in projectors, recorders, and reproducers; sync generator and studio selector units; interlock distribution amplifiers; magnetic tape resolvers; digital footage counters; video tape synchronizers; looping control systems; and advance-retard units.

Each machine is of modular construction and consists of a heavy-duty cabinet that houses the film transport panel; upper and lower torque motor, or spindle, panels of Series 10000 and 2000 machines; playback amplifiers; control chassis; translator logic; optional record amplifiers; optional digital footage counters; optional optical reproducers; power supplies. The following paragraphs are brief descriptions of each panel and chassis.

FILM TRANSPORT PANEL

The film transport panel carries the sprocket that moves the film past the plug-in magnetic heads located in a dual-flywheel drum and floating idler mechanical flutter filter system. All film-handling components of the transport panel are mounted on the rigid main plate. The sprocket drive motor is resiliently mounted on rigid mounting plates and resiliently coupled to the film sprocket. In Series 4000 machines, the film transport panel also carries the torque motors and reel spindles.

The sprocket drive motor is a slow-speed stepper that runs in step with the output of translator logic. All drive motor and solenoid wiring is connected to two receptacles on the rear. Two sprocket pads, mounted on spring-toggle mechanisms, clamp the film to the sprocket. Dual-speed machines have a stepped sprocket and flip-over pad blocks to accommodate the different film widths. Shaft encoders may be belted to the sprocket shaft to drive optional counters or provide interlock signals to other machines. In Series 10000 recorders, the transport panel has an electronic film counter. On other machines, electronic film counters may be provided on a small, separate panel.

The magnetic head assembly for each transport plugs into a receptacle located between the flywheel drums, and is secured in position by knurled thumb

nuts. Head assemblies are readily interchanged for different film widths and track layouts.

When the film runs faster than the limit selected at the control panel, film tension may be released by a solenoid to prevent unnecessary wear on film and heads. A tape lifter defeat circuit may be provided, if required to block this action. Head assemblies for reproducers may be equipped with playback heads only; head assemblies for recorders include erase heads (optional), record heads, and separate playback heads. Record heads may be used for sel-sync playback if the machine is so equipped.

Earlier model transport panels may be modified, at the factory or in the field, to the electronic drive. The modified transport panel, with its new control chassis, will fit in the same cabinet space but will function exactly like the new units described in this manual. Consult Magna-Tech for more information on modifications to old equipment.

TORQUE MOTORS AND REEL SPINDLES

The reel spindles hold the film supply and take-up reels or hubs. On Series 10000 and 2000 machines, the reel spindles are located on the upper and lower torque motor panels. Supply and take-up spindles are driven by split-phase AC torque motors; an electrolytic capacitor provides the required phase shift. A small panel holds the switches that control the torque motors. The CW/CCW selector switch on this torque motor control panel selects torque direction for A or B wind film supply. Film supply and take-up may be either reels or open hubs and flanges with optional film guides installed. When film is threaded through the sprocket, the sprocket determines film speed; supply and take-up spindles operate as required to maintain film tension. Fast wind and rewind may be accomplished with the film bypassing the sprocket — the torque motors control speed and tension. A continuous loop of film may be threaded on the sprocket without using the spindles. In all modes except loop, the cut-off arm on the transport panel stops the torque motors and applies the spindle brakes if the end of the film is reached or if the film breaks. All parts are mounted to the rigid front panel. All electrical connections are cabled to terminal boards.

PLAYBACK AMPLIFIERS

Playback amplifiers for each channel may be mounted behind the upper torque motor panel of Series 10000 and 2000 machines, or behind the transport panel of Series 4000 machines. Sel-sync

playback amplifiers may be mounted behind the lower torque motor panel or the transport panel. Information required for these playback amplifiers is given in Section IV of this manual.

CONTROL CHASSIS

The control chassis includes the film transport control panel, connectors for rack cabling and connections to other units, and three printed circuit boards that plug into edge connectors on a mother board. These three printed circuit boards provide all control and translation functions required for the operation of the film transport.

The control logic circuit board stores and interprets the commands issued by the control panel switches for local control of film motion. The rate generator and interlock decoder board generates rate and direction signals that are translated into sprocket motion. In local mode the rate signal is crystal-controlled (or line/video controlled with optional sync board installed) and the direction signal is taken from the control panel switches; in interlock mode the rate and direction signals are obtained by decoding the applied interlock or rate and direction signals. The translator logic board translates the rate generator and interlock decoder board outputs into the form required to drive the sprocket motor. Outputs of translator logic are amplified in the main power supply.

The control panel has the POWER switch that controls power to the film transport, up to 12 more illuminated pushbutton switches that control film transport, and a six-position INTERLOCK BUS selector switch. On multi-speed machines, the 24 FPS/25 FPS, 1 × SPEED/2 × SPEED, and 16 MM/35 MM switches select film speed and the appropriate record and playback equalization. The DE-CLUTCH switch releases the sprocket and allows you to move the film by hand. RETARD and ADVANCE switches hold back, or speed up, film running forward at approximately sync speed to adjust framing. The REELS/LOOP switch inhibits reverse motion when running a continuous loop of film. INTERLOCK/LOCAL selects local control or interlock operation. The REV, STOP, and FWD switches are the local motion controls.

All electrical connections are to receptacles on the rear panel of the control chassis. Front-panel indicator lamps operate on 12 volts dc; all other elements in the control chassis require 5 volts dc. These voltages are supplied from, and fused at, the main power supply.

POWER SUPPLIES

All power supplies required for operation of the recorder or reproducer are located near the bottom of the cabinet. These are the main power supply and one or more audio power supplies. In addition, if the machine is to operate from other than 117 volt power, an autotransformer is included to convert the available power line voltage to 117 volts.

The main power supply consists of the power amplifiers for the translator logic outputs that drive the sprocket motor, a transformer and rectifiers that supply all DC for the sprocket control circuits, regulators for the 5 and 12 volts required by the control chassis, and the electronic switches that control sprocket motor power and the tension release solenoid. The AC input and the 5-volt output are separately fused. Two more fuses protect the power amplifier outputs to the sprocket motor.

The audio power supply used in each recorder and reproducer is the playback power supply. It consists of a 1:1 power isolation transformer and a commercial regulated 28-volt DC supply that powers all playback amplifiers and one record amplifier in the machine. One fuse protects the AC input to the transformer. Refer to Section V.

Each recorder with more than one record amplifier is also equipped with a record power supply. A record power supply can supply 28-volt DC power to as many as eight record amplifiers. It consists of a chassis and a commercial, regulated supply. One fuse protects the input to the supply (Section V).

AC input to the main power supply is a permanently attached three-wire line cord; AC inputs to audio power supplies are connected to receptacles accessible from the rear. The playback power supply also has two male receptacles so that AC power may be looped through. All other connections to the main power supply are made through connectors accessible from the rear. Outputs of audio power supplies are available at terminal strips accessible from the rear.

An outlet box containing a line filter and supplied by a 12-foot 3-wire line cord is located in the rack to route AC power for all equipment in the rack.

RECORD AMPLIFIERS

Record amplifiers for each channel may be mounted at the front of the cabinet. Information required for

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these record amplifiers is given in Section IV of this manual.

OPTICAL REPRODUCERS

Optical reproducer panels may be mounted in the cabinet below any Series 4000 transport panel and included in the film path to reproduce any optical sound track.

EQUIPMENT CONFIGURATIONS

Many configurations of these machines are possible; each machine is a modular, custom assembled unit. Single-speed and dual-speed machines are available as pick-up recorders (with erase), recorders without erase, or as reproducers. Any machine may be equipped for up to eight, or even more, audio channels. Plug-in magnetic head assemblies are available for any required track layout. Record and playback amplifiers may be adjusted or equipped for any standard program line level and equalization characteristic. Special circuits may be added to torque motor panels and control

chassis to accommodate projectors with special requirements. Moreover, accessory equipment is available to meet any requirement. Model numbers for basic units are listed in table 1-1.

ACCESSORY EQUIPMENT

A wide range of accessory equipment is available for use in, or in association with, these recorders and reproducers. Some of the more important items are optical shaft encoders, sync generators and studio selectors, interlock distribution amplifiers, remote control units, digital footage counters, video tape interlocks, electronic looping systems, and high-speed projectors. These are briefly described in the following paragraphs.

OPTICAL SHAFT ENCODERS

Optical shaft encoders are installed in projectors, recorders, and reproducers, and time-belted to the sprocket shaft to generate electrical pulses and serve as an interlock source. Installation kits are available to fit any MTE or other manufacturers

Table 1-1. Basic Models

TYPE NUMBER	FILM	SYNC SPEED (FEET PER MINUTE)	DESCRIPTION
MD 4036 MRD 4036 MRDE 4036	16/35mm	36, 90	Reproducer Recorder (no erase) Recorder (with erase)
MD 4036/7 MRD 4036/7 MRDE 4036/7	16/17.5/35mm	36, 45, 90	Reproducer Recorder (no erase) Recorder (with erase)
MD 10036 MR 10036	16/35mm	36, 90	Reproducer Recorder (with erase)
MD 10036/7 MR 10036/7	16/17.5/35mm	36, 45, 90	Reproducer Recorder (with erase)
MD 2036 MRD 2036 MRDE 2036	16/35mm	36, 90	Dual reproducer One side reproducer, other side recorder (no erase) Right side reproducer, left side recorder (with erase)
MD 2036/7 MRD 2036/7 MRDE 2036/7	16/17.5/35mm	36, 45, 90	Dual reproducer One side reproducer, other side recorder (no erase) Right side reproducer, left side recorder (with erase)

NOTE: When erase feature is provided, timing is adjusted to permit pick-up recording. See Section IV.

machine. MTE encoders are fully encased optical non-contact units equipped with a light emitting diode (LED) light source, coding disc, silicon solar cell sensors, and solid-state square-wave output circuits.

TYPE 8LB SYNC GENERATOR AND STUDIO SELECTOR

Interlock control unit type 8LB is a remote unit that may be mounted in a projection room or other appropriate location to control the magnetic film transport. The unit provides control selection of local operation or operation from one of four interlock sources. In local operation, the unit provides 24, 25 or 30 frame-per-second sync speed forward or reverse and selectable high speed forward or reverse signals to the film transport.

INTERLOCK SIGNAL DISTRIBUTION AMPLIFIER

Interlock signal distribution amplifiers with 28 outputs permit the distribution of interlock signals from one (optionally two) interlock source to a number of machines. The amplifier is a self-powered unit containing a plug-in printed circuit amplifier board. All amplification is performed by integrated circuits; isolation resistors isolate each output.

REMOTE RECORD CONTROL UNITS

Remote record control units are panels equipped with individual and master on and off pushbuttons and ready, run, and record indicators for each record amplifier in the recorder.

ADVANCE/RETARD UNIT

The Type 95 advance/retard unit is a remote panel with digital readout that enables you to advance or retard the machine a specific number of frames and automatically return to initial position.

TYPE FTM FILM COUNTER

Magna-Tech Type FTM (Footage, Time, Meters) counter is a microcontroller based, film length/time counter which is built using HCMOS technology for high level of noise immunity and low power requirements. The counter is powered from the recorder/reproducer's 5v power supply or, optionally, from user-supplied +5v source.

The unit measures 6" × 4" × 1⁵/₈" and mounts directly to the transport panel or, optionally, on a

19" × 1³/₄" rack-mount front panel. It has a 6-digit, ⁹/₁₆" high internal LED display for "length.frames" or "minutes.seconds.frames" indication.

With an optional interface board installed FTM counter can be connected via MTE Serial Communication bus to a 6-digit, 4" high underscreen display (9FR) or 6-digit, 1" high table-top display.

The FTM is designed for concurrent count — it maintains information in 4 out of 7 available modes of count in following combinations, selected by internal jumpers:

F/16	—	F/35	—	T/24	—	T/25
F/16	—	F/35	—	T/24	—	T/30
M/16	—	M/35	—	T/24	—	T/25
M/16	—	M/35	—	T/24	—	T/30

Concurrent counting allows the user to switch between information displayed for different modes of count without any risk of loss of counter synchronization. 16/35mm signal, 24/25fps signal and setting of front panel mounted "F/T" (length/time) toggle switch determine for which mode of count the information will be displayed.

When the counter is used in a recorder/reproducer, the count information is supplied to it from the sprocket control circuit in "20 pulse per frame and Direction" format. If the unit is used as a stand-alone, it is modified to accept biphase interlock bus from a shaft encoder or any other source. Different rates of input pulses (1ppf — 64ppf) can be accommodated with the installation of an optional input divider switch.

Following controls and indicators are available on the front panel:

16mm, 35mm, 24fps, 25fps and 30fps LED's — indicate for which format and rate of count the information is currently displayed;

"F/T" toggle switch — selects the mode of display (length or time);

"Reset" pushbutton — resets internal count to 0 for all modes.

TYPE 9F FILM COUNTER

Type 9F digital length/time counter is a computerized unit that counts and displays footage, meters, frames, or time for both 16- and 35-mm

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motion picture film. The counter features a 3/4-inch 6-digit LED display, 16-mm/35-mm speed selection, front panel footage and frame preset, local and remote display hold, automatic reverse sensing and stop information, local and remote reset, and binary-coded decimal (BCD) output. A front-panel switch or external relay closure (change-over) allows selection of one out of two input sources.

An optional self-powered remote display unit (9FR) for mounting under the projection screen, receives serial (RS422) data from the counter and displays the information in 4-inch high digits. Light intensity of the display is adjustable by a front-panel control.

Optional accessories include Time Code Reader/Generator and Serial Communications Interface which allows (when used with 8LB controller) Autolocator functions of 9F to be used.

VIDEO TAPE INTERLOCK

A video tape interlock unit converts video tape SMPTE or EBU time code to standard electronic interlock pulses. The interlock pulses keep magnetic film recorders and reproducers locked in perfect frame-for-frame sync with picture on video tape. The video tape becomes the interlock source.

ELECTRONIC LOOPING SYSTEM

The electronic looping system electronically

provides the functions required for dubbing operations by the looping method, whereby individual segments of the workprint are projected and reprojected while sound is dubbed, without actually cutting the workprint into physical loops. The system provides all control functions required to automatically and repeatedly run a selected segment on the projector and recorder taking full advantage of high speed synchronized reverse for return to the beginning of the segment. In addition, the system controls the audio monitoring as required for rehearse, record, and playback in looping operations. Record is automatically turned on at the beginning of the segment and off at the end as well as during reverse.

HIGH-SPEED PROJECTORS

Magna-Tech high-speed projectors use an electronic film transport system to project motion picture film at sync speed, either 24 or 25 frames per second, and at high speed (without picture) in either direction. Shaft encoders may be provided to generate standard electronic interlock pulses that drive magnetic recorders, reproducers, and digital footage counters. In addition to operation under local control, these projectors may be remotely operated.

SPECIFICATIONS

Specifications for significant parameters and features of these recorders and reproducers are given in table 1-2.

Table 1-2. Series 2000, 4000, 10000 Recorder and Reproducer Specifications

Film Drive System

- Stepping motor sprocket drive
- CMOS integrated circuit logic and control
- Crystal speed control (line and video optional)
- 16-mm, 35-mm speeds, pushbutton selected
- Dual-gauge flip-over sprocket pads (optional on Series 4000)
- Automatic film loop setting
- Local sync speed operation at 24 or 25 frames per second, pushbutton selected
- Local operation at twice sync speed (with automatic equalization changeover)
- Interlock operation
 - Series 4000: Up to twice sync speed with MTE projector
 - Series 2000 and 10000: Up to four times sync speed with MTE projector (Up to eight times optional)
- Drive signal may be looped to synchronize adjacent machines
- Interlock bus selection from four interlock signal sources and two drive signal sources
- Machine can be cued on and off running interlock bus with no interruption to bus
- Sprocket de-clutch for start mark alignment
- Local and remote advance and retard of individual films in interlock
- Film tension released above selected speed to reduce film and head wear (optional)

Table 1-2. Series 2000, 4000, 10000 Recorder and Reproducer Specifications (Continued)

Reel Spindle Drive and Controls

Split-phase torque motors
 Reel-size torque selector
 Switch-selected clockwise or counterclockwise supply spindle rotation
 Capacity
 Series 4000: 2000-foot (610 meters) reels
 Series 2000: 3000-foot (915 meters) reels
 Series 10000: 3000-foot (915 meters) reels
 High-speed wind and rewind outside sprocket
 Automatic stop if film ends or breaks

Rewind Time

400 feet 1/2 minute
 1000 feet 1 minute
 2000 feet 2 minutes

Reproduce Output

Impedance: 600 ohms balanced
 Level: Standard program line, adjustable for +4- and +8-dbm systems

Record Input

Impedance: 15-kilohm bridging
 Level: Standard program line, adjustable for +4- and +8-dbm systems

Flutter

0.06 percent RMS at 90 fpm, unweighted
 0.08 percent RMS at 36 fpm, unweighted

Total Harmonic Distortion

0.5 percent at +16-dbm output level

Signal-to-Noise Ratio

60 dB below peak output

Frequency Response and Equalization

Standard SMPTE or CCIR curves for 16 mm, 35 mm, and 17.5 mm

Plug-In Magnetic Heads

Available in 35 mm, 16 mm, and 17.5 mm

35 mm: 1, 3, 4, 6, 8 and 4-track Cinemascope format; 2 control tracks may be placed outside sprocket holes for 3, 4, and 6 track formats

16 mm: 200-mil edge track
 200-mil center track
 160-mil 2-track EBU
 160-mil 2-track EBU with 1 control track
 90-mil 3-track
 60-mil 4-track
 100-mil release edge track

17.5mm: 200-mil

Table 1-2. Series 2000, 4000, 10000 Recorder and Reproducer Specifications (Continued)

Power

105 to 125 volts AC (117 volts nominal), 50 or 60 Hz
205 to 250 volts AC with optional autotransformer
Series 4000: 4 amperes at 117 volts (each transport)
Series 10000: 6 amperes at 117 volts
Series 2000: 9 amperes at 117 volts

Dimensions and Weight

Series 4000: 83 in. high x 18 in. deep x 27 in. wide
300 pounds (1 transport) (80 pounds extra per additional transport)
24-inch cabinet may house 1, 2, or 3 transports
Series 10000: 83 in. high x 18 in. deep x 22 in. wide
300 pounds
19-inch cabinet
Series 2000: 83 in. high x 18 in. deep x 27 in. wide
350 pounds
24-inch cabinet

SECTION II

INSTALLATION

This section contains information about unpacking and inspection, floor plan requirements, equipment interconnections, accessory installation, initial adjustments, and initial testing.

INSTALLATION PLANNING

In selecting locations for the machines, refer to figure 2-1, outline dimensions, for floor space requirements. Pay special attention to the clear space required behind the cabinet to open the rear door, and to the side clearance required for reel overhang.

Provision must be made for cable connections to the units. Cable entrance may be either through the bottom cutout in the cabinet or through the rear knockouts located below the rear door. If the bottom cutout is to be used, cable ducts must be installed in the floor or a raised platform constructed with cutouts for each machine. If the rear knockouts are used, the machines may be placed on a flat floor if provision is made for safe power control, and audio cable runs in accordance with local electrical codes. Information on power requirements and cabling practices is given in table 1-1, specifications, and under the appropriate headings in this section. Equipment layouts and cabling diagrams should be prepared in consultation with Magna-Tech before the equipment is delivered.

UNPACKING AND INSPECTION

Upon receipt, examine shipping crates for any signs of damage. Unpack the equipment in accordance with the following instructions and inspect for physical damage. Check the equipment against the packing list to verify that all items have been received.

Immediately report any equipment damage or missing items to the transportation company and to Magna-Tech. Be sure to remove all packing materials and install the flywheels as instructed before trying to operate the unit.

UNPACKING INSTRUCTIONS FOR COMPLETE UNITS

When a complete Series 2000, 4000, or 10000 machine is shipped, the entire recorder or reproducer, including all cabinet-mounted optional equipment ordered with the unit, is assembled in the cabinet and interconnected at the factory. Flywheels are removed from the transport to protect the bearings during shipment. Flywheels, additional head assemblies, and items required to complete the installation are in a carton taped securely to the inside of the cabinet. For export, the entire unit is shipped in a float-pack, lying on its back in the crate, with the front panels up.

To unpack cabinet-mounted units, proceed as follows:

WARNING: The recorder or reproducer is a large and heavy unit. Be sure you have enough help to handle the unpacking job without injury or damage. While the unit is sturdy and ruggedly constructed, it consists of precision equipment and can be damaged by careless handling. Be careful.

NOTE: If the unit is not crated, skip to paragraph 12.

1. Place the packing crate in a clear area of floor, near the operating location if possible, with its cover facing up.
2. Cut and remove the steel straps that surround the crate.
3. Use a nail puller to remove the nails that secure the cover on the crate. Remove the cover.
4. The next step is to remove the three two-by-four wooden crosspieces that restrain the unit in the crate. These crosspieces are located across the top, center, and bottom of the unit. Use a nail puller, from outside the crate, to remove the

MTE SERIES 2000, 4000, 10000 RECORDER/REPRODUCER

nails that secure these crosspieces to the sides of the crate. Remove the crosspieces.

5. Carefully turn the crate onto its side.
6. Carefully slide the unit out of the crate; rest the unit, on its side, on the floor.

WARNING: The side panels are held on the cabinet only by gravity. Do not try to lift, move or support the unit by the side panels. Handle the unit only by the main frame.

7. Remove the green formed rubberized horsehair shipping pad from the bottom of the unit. Open, at the bottom, the plastic bag surrounding the unit; fold the bag back to expose the bottom of the cabinet.
8. If the unit is supplied with casters, check to be sure that they are properly seated.
9. Carefully raise the unit to the upright or standing position. If the unit is supplied with casters, be very careful that it does not roll away as you raise it.
10. Cut the filament tape encircling the shipping pad at the center of the unit; remove the two halves of the pad. Remove the remaining shipping pad from the top of the unit.
11. After the unit is safely out of the crate and standing upright with shipping pads removed, lift the plastic bag off the unit.
12. Open the back door of the cabinet. Remove each side panel from the cabinet by lifting it about 3 inches and pulling it away. Set the side panels aside in a safe place.
13. Remove any desiccant packages from the inside of the cabinet (export pack only).
14. Remove all wooden shipping blocks from inside the unit. Most Series 2000, 4000, and 10000 machines are shipped with a block wedged between the side rails near the bottom of the cabinet to protect the transformer of the audio power supply. Pull up one end of the block to remove it; be careful not to damage the cables running up the side rails or the transformer projecting from the power supply.
15. Remove any associated and accessory equip-

ment that has been packed inside the cabinet. When possible, associated and accessory equipment such as shaft encoders, sync generators and studio selectors, distribution amplifiers, remote control units, and advance/retard units ordered with the machine are packed in cartons and secured inside the cabinet for shipment. Cut and remove the filament tape that secures these cartons; remove any packaging material and shipping pads, and remove the cartons from the unit.

16. Remove the carton or cartons that contain the flywheels, additional head assemblies, audio connectors, remote control connectors, Allen Handi-Hex keys, and other installation items from the inside of the cabinet. This carton is usually taped to the bottom left-hand corner of the cabinet (as seen from the rear). Cut and remove the filament tape to release the carton.
17. Inspect the frame, panels, spindles, cut-off arms, idlers, rollers, sprocket, shafts, motors, chassis, printed circuit boards, cables, and other elements for any signs of shipping damage. Check everything against the packing list to be sure you have received and unpacked the entire order. If you discover any shipping damage or missing crates, immediately notify the transportation company that delivered the unit. Also notify Magna-Tech so that replacement parts may be sent without delay. If there is no damage, proceed to the installation instructions.

UNMOUNTED UNITS AND ASSOCIATED EQUIPMENT

Series 2000, 4000, and 10000 transports may be ordered separately for installation in existing cabinets to modernize or enlarge existing units. Unmounted transports and associated equipment, such as control consoles, distribution amplifiers, control panels, and projector shaft encoders, may be crated separately for shipment. To unpack separately crated equipment, first look for special unpacking instructions attached to the crate. In general, the proper procedure is to cut and remove steel straps that surround the crate. Then, use a nail puller to remove the nails that secure the cover on the crate, and remove the cover. Carefully remove packing material and shipping restraints. Carefully remove the equipment from the crate and remove all packing material, shipping blocks, and desiccant packages from the equipment. Check through all

packing material carefully for small items and for instructions and other papers. Check the equipment against the packing list to be sure that you have received and unpacked all items ordered. Inspect the equipment for any signs of shipping damage. If you discover any shipping damage, immediately notify the transportation company and Magna-Tech.

MAGNETIC HEAD ASSEMBLIES

Separate plug-in magnetic head assemblies are supplied with each recorder and reproducer as ordered for each film width and track layout to be run. These assemblies are precision units that are critical to the proper performance of the machines. After unpacking, inspect each magnetic head assembly carefully for shipping damage and store it in a location that is protected from physical danger and magnetic fields, preferably in a magnetically shielded cabinet.

CAUTION: Never check a magnetic head winding with an ohmmeter or continuity tester.

INSTALLATION INSTRUCTIONS FOR COMPLETE UNITS

The entire recorder or reproducer, including all cabinet-mounted optional equipment ordered with the unit, is assembled and interconnected at the factory. Once the unit has been unpacked and inspected, move it to its operating location so that the studio cabling required between units may be installed. Figure 2-1 shows the space required by each unit. While not necessary for normal operation, if the unit is not equipped with wheels the cabinet may be bolted to the floor at the operating location. Use one lag bolt in each corner.

NOTE: If Series 4000 or 10000 machines are to be installed in a row, allowance must be made for reel overhang. If two or more cabinets are to be installed in a row, do not attach side panels between them. Side panels are unnecessary except at the ends of the row, and get in your way when you are installing cables or performing any maintenance tasks.

Adjacent cabinets in a row should be bolted together through the side rails, with side panels removed, to maintain a neat and orderly line-up.

Install the flywheels behind each transport panel before operating the unit.

INTERCONNECTIONS WITHIN THE CABINET

All electrical interconnections within the cabinet are installed at the factory. However, before connecting external power and signal cables, you should check that the internal cables are correctly and securely connected, and are not damaged. Refer to the cabling diagrams, figure 2-2, and check that all cables required by your unit are correctly connected. Check that all plugs are properly seated and locked in their sockets. Check that none of the cables are damaged, pinched, or stretched by mechanical items, or rubbing on moving parts. Because the specific equipment, and the specific connections in your unit, depend on its function and application in your studio, figure 2-2 shows typical and optional connections which may vary. Be sure to determine the correct usage for your installation before changing any connections.

INSTALLATION OF UNMOUNTED UNITS

When transports are ordered separately or returned after modification at the factory, they must be properly installed in your racks or cabinets. Figure 2-1 shows the space required by each transport and its control chassis in a standard rack or cabinet, as well as the space required on each side of the cabinet for reel overhang. When a modified transport is to be reinstalled, the modified transport panel and the new control chassis will occupy the space previously occupied in the rack or cabinet.

When installing two or three Series 4000 transports in a cabinet, the height required for each panel depends on the largest supply and take-up reels to be used. A 1³/₄-inch spacer panel, or an auxiliary unit such as a record amplifier, must be used between Series 4000 transport panels if 2000-foot reel capacity is required.

Install the transport panels and control chassis at the selected locations in the rack or cabinet before installing the flywheels behind each transport panel. Secure the panels to the side rails with 12-24 or 10-32 (depending on side rail drilling) machine screws. Install the new power supply in the bottom of the rack or cabinet. Then, install the cabling required within the rack or cabinet in accordance with figure 2-2 and any special wiring or cabling diagrams supplied.

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NOTES:
 1. ALL DIMENSIONS IN INCHES
 2. SIDE CLEARANCES REQUIRED:

REEL SIZE	SERIES 4000	SERIES 10000	SERIES 2000
1000 FT (1 1/2 DIA.)	1 3/4	0	1 1/4
1200 FT (2 3/4 DIA.)	2 3/8	0	1 7/8
2000 FT (5 DIA.)	3 1/2	0	3
3000 FT (7 DIA.)	—	0	4

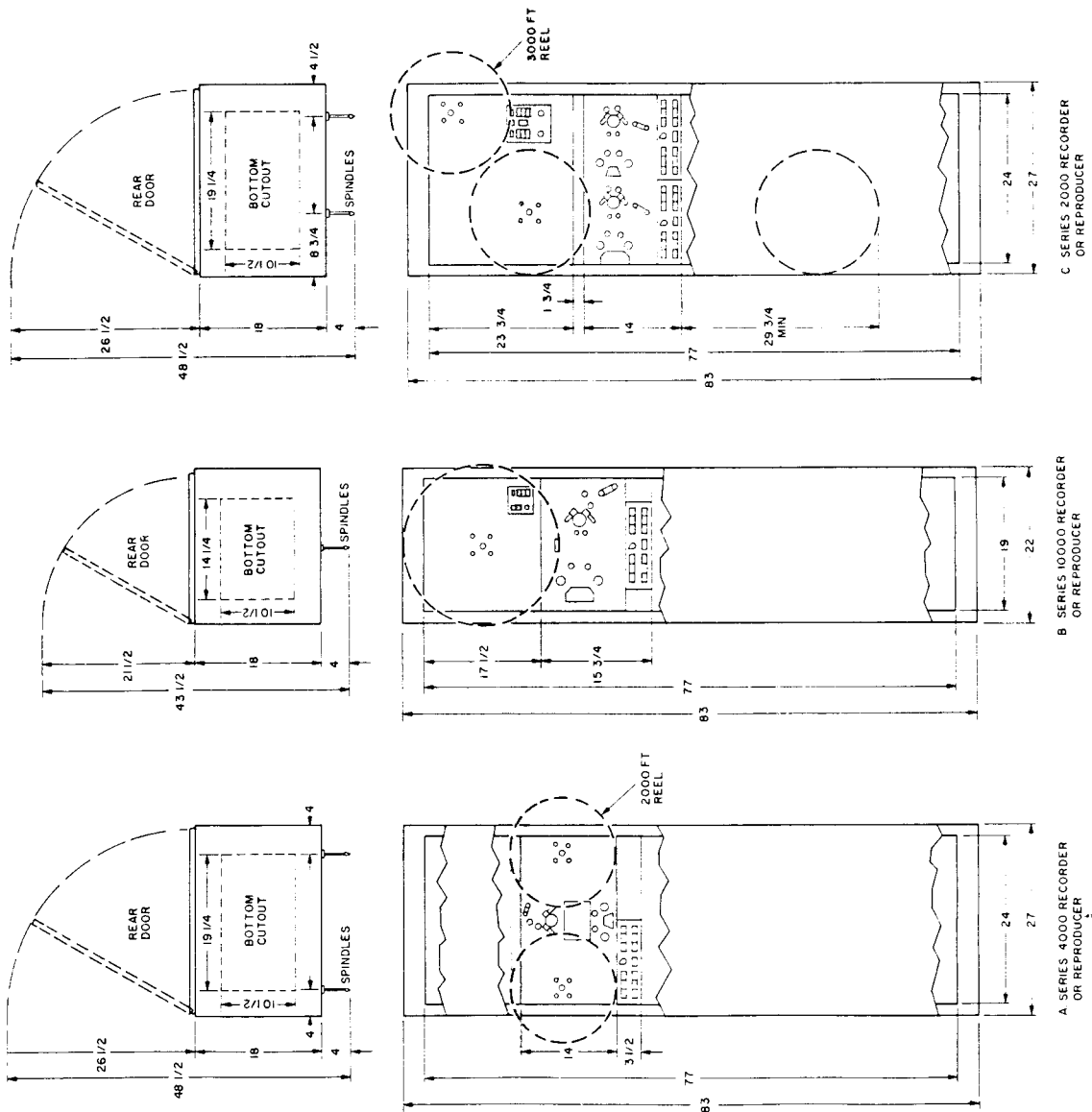


Figure 2-1. Outline Dimensions

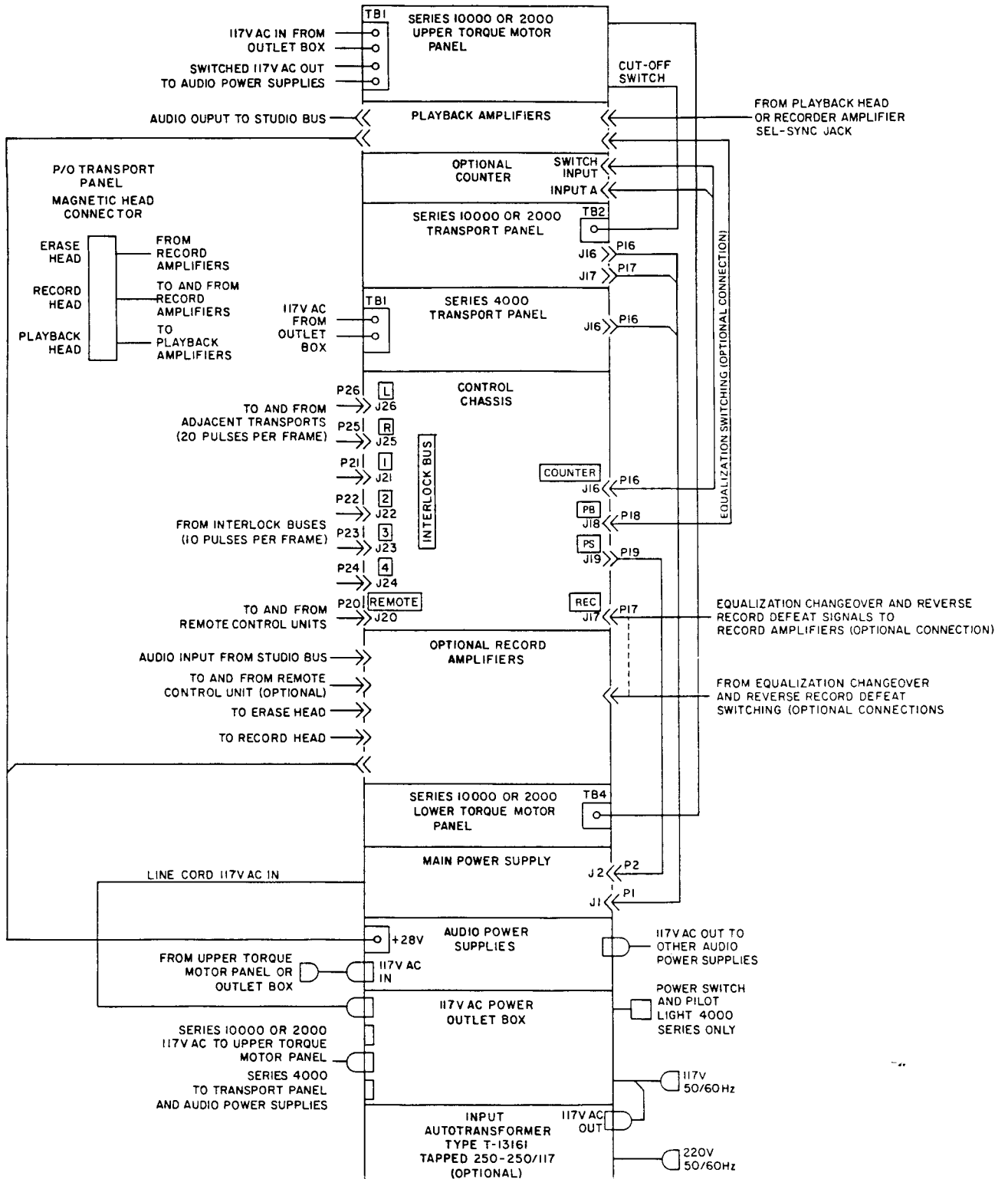


Figure 2-2. Series 2000, 4000, and 10000 Recorder or Reproducer, Internal Cabling Diagram

INSTALLATION OF TRANSPORT PANEL FLYWHEELS

All Series 2000, 4000, and 10000 machines and transport panels are shipped with the flywheels removed from the drum shafts to prevent bearing damage. The flywheels are packed separately and shipped with the unit, usually in a corrugated carton taped inside the bottom left-hand (as seen from the rear) corner of the machine cabinet.

Install a flywheel on each drum shaft before trying to operate the transport. While the flywheels are designed to be interchangeable, flutter will be reduced to a minimum by installing the flywheels on the shafts for which they were balanced. Each flywheel is marked with the serial number and position of the corresponding machine shaft. Shaft positions are marked as seen from the rear of the transport panel.

To install a flywheel, place the flywheel on the shaft, secure the flywheel on the shaft with the Allen-head mounting screw, two flat washers, and self-locking nut. Install the mounting screw with its head nearest the center-punch mark on the end of the flywheel hub. Be careful not to overtighten the mounting screw and nut.

NOTE: Refer to the Technical Reference Manual for exploded view of the flywheel assembly.

INSTALLATION OF ASSOCIATED EQUIPMENT

Install associated equipment such as control consoles, distribution amplifiers, and control panels in their assigned studio locations in accordance with separate installation instructions.

Mount shaft encoders (if applicable) supplied with the equipment on their assigned projectors and couple the timing belts to appropriate projector shafts. Each shaft encoder is supplied with a mounting kit and installation drawing designed for the specific projector model on which it is to be installed. Because the shaft encoder generates 20 pulses per revolution, it must run at 1/2-revolution per frame to provide the 10 pulses per frame required by the interlock bus. Thus, shaft encoder speed is 720 revolutions per minute at 24 frames per second. When adjusting the shaft encoder mounting, be sure that you do not leave excessive slack in the timing belt; excessive slack causes uneven or erratic motion of the shaft encoder and any equipment driven by the resulting interlock signals.

STUDIO CABLING

Install power, control signal, and audio cables in accordance with the block schematics and cabling diagrams supplied for the installation. All cables are to be fabricated in accordance with cable lists given on cabling diagrams. Interlock cables should be 2-pair, foil-shielded, 22-AWG Belden 8723 or equivalent; audio cables should be 2-wire shielded, 20-AWG, rubber-covered Belden 8412 or equivalent. Mating plugs are supplied for all connectors. For pin assignments of control signal connectors refer to the control chassis schematic diagram in the Technical Reference Manual.

Maintain consistent polarity, or phasing, of all audio connections. For all standard 3-pin XLR connectors, pin 1 is the shield connection, pin 2 is the connection for the low side of the balanced line, and pin 3 is the connection for the high side of the balanced line. Terminate the shields at only one end to avoid ground loops.

Be sure to follow standard installation grounding practices regarding the separation of power, signal, audio, and chassis grounds. An earth ground is required for each cabinet; grounding practices should comply with the local electrical code. Always route power and control signal cables as far as possible from audio cables, especially low-level audio cables to avoid hum and noise pick-up.

All output audio connections are balanced low-impedance lines. Inputs are designed for bridging across low-impedance lines; be sure that all input lines are terminated in the proper impedance at the source. Output lines are either 600 or 150 ohms balanced, terminated at source, depending on output transformer strapping; refer to the playback amplifier schematic for output transformer connections. All inputs and outputs are designed for standard +4-dbm program level; amplifier gain must be adjusted for use at other levels; refer to Technical Reference Manual for audio adjustments.

POWER REQUIREMENTS

Each recorder and reproducer requires single-phase ac motor and amplifier power, as listed in table 1-2. The AC line to the amplifier power supply must be free of transients to avoid audible clicks. Special precautions are needed when more than one studio is to operate at the same time. A method of avoiding transients that is often used when problems occur is to install a separate AC line in a separate conduit

from the main distribution panel to provide power for all amplifiers and to permit no other connections to this line. The AC lines to the main power supply of each unit must be adequate, under the local electrical code, for the power requirements given in table 1-2. Refer to figure 2-2 for location and identification of power input connections.

If line voltage at the machine is regularly above 120 volts or below 110 volts, change the connection to the primary taps of main power supply transformer T1. (Refer to Technical Reference Manual.)

Each unit ordered for use with 220-volt mains is supplied with an autotransformer, located at the base of the unit, to accommodate the available power source. Refer to figure 2-2. When connecting the power line, be sure to select the proper autotransformer primary tap to make the transformer output voltage 117 volts. (When connected to 220-volt power, line current requirement is approximately half of 117-volt rating given in table 1-2.)

FINAL CHECK

After all studio cables have been connected, make a final check of the unit before applying power and running a performance test.

1. Check that all moving parts on the torque motor and transport panels move smoothly and freely.
2. Check that all printed circuit boards in the control chassis and in the record and playback amplifiers are firmly seated in their sockets.
3. Check that relays and strapping plugs in the record amplifier are securely seated in their sockets.
4. Check all studio cabling with an ohmmeter for continuity and freedom from short circuits or cross-connections before making final connections. Check power outlets with a voltmeter for correct voltage, polarity, and grounding before connecting the machines.
5. Check that all intra-cabinet and studio cables are connected to the correct connector, and that all plugs are firmly seated and locked in their sockets. Refer to figure 2-2.
6. Check the fuseholders on the upper torque motor panel and main power supply to be sure

that unblown fuses of the correct types and ratings are installed and that the fuseholder knobs are properly seated.

7. Check the fuseholder on each audio power supply (Section V) to be sure that an unblown fuse of the correct type and rating is installed and that the fuseholder knob is properly seated.
 8. Install the side covers on free-standing units, and at the end of each row of units. The back of each side cover has three sheet-metal angles that hook over the side rails of the rack. To install a side panel, fit it into place at the side of the rack but about 3 inches higher than its final position. Then, carefully let it drop into place, making sure that all three angles hook into place over the side rails of the rack.
- CAUTION:** Make sure that each side cover you attach is secure; if it were to fall away it could inflict serious injury.
9. Close and latch the rear door.
 10. Proceed to the initial adjustments (if required) and to the performance tests.

INITIAL ADJUSTMENTS

Unless specifically ordered for other application, each recorder and reproducer is adjusted at the factory as summarized in table 2-1. If your studio requires a different arrangement, make the necessary adjustment in accordance with instructions given in Technical Reference Manual. Before adjusting levels or bias, be sure to learn the operating instructions given in Sections III and run the performance tests.

Table 2-1. Initial Adjustments

ITEM	FACTORY SETTING
Output impedance	600 ohms
Standard program level	
Output	+ 4 dbm
Input	+ 4 dbm
Record level and bias	Adjusted for 3M Type III red oxide film stock

PERFORMANCE TESTS

A test report is included with each unit shipped from the Magna-Tech factory and is a record of final test performance before shipment. Once the unit has been installed, connected to studio cabling, and carefully checked, run the performance tests to be sure that the unit, as installed and connected, is

ready to operate in accordance with specifications. Before beginning the performance tests, be sure to learn the operating instructions for your machine as given in Section III of this manual. Then, do the performance tests as instructed in Technical Reference Manual.

SECTION III

OPERATION

OPERATING CONTROLS

This section shows the location of each Series 2000, 4000, and 10000 magnetic film recorder or reproducer transport operating control and briefly describes its function. See figures 3-1 through 3-5. Operating instructions are presented for each mode of operation available on a typical unit. Because each recorder and each reproducer is, in essence, a custom-assembled unit equipped with only those features and functions required to fulfill its role in the studio, some of your units may not have all the controls shown; some of the operating instructions may not apply to all of your units. For example, idler rollers can only be changed when machine is equipped for 17.5-mm film (/7 option). Where appro-

prate, optional arrangements are discussed so that you may relate the instructions to each of your units. However, you must keep system considerations in mind. In a typical mixing studio, for example, several reproducers, or dubbers, will be running, all interlocked to the same projector or other interlock source, when one recorder is operating.

Each Series 2000 recorder and reproducer includes two independent film transport systems with separate transport control panels. Up to three independent Series 4000 transports may be mounted in the same rack or cabinet with separate transport control panels. Operating instructions apply to each of the independent transport systems.

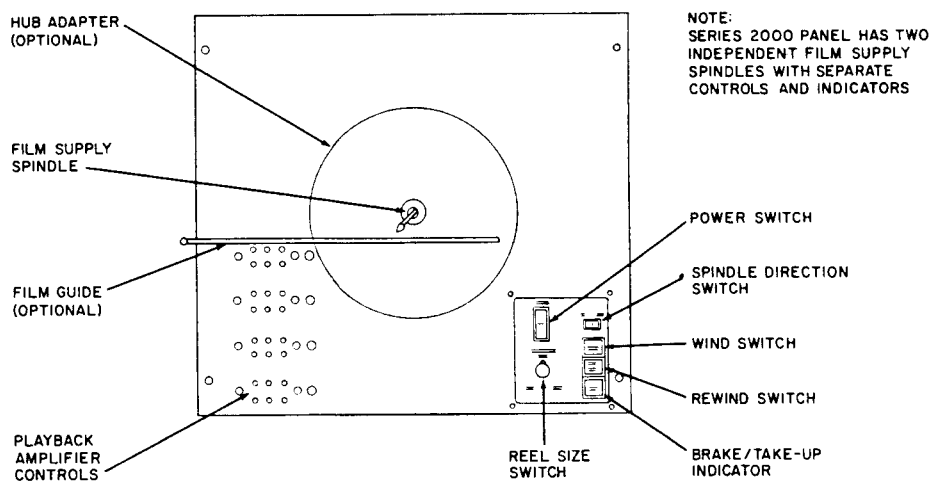


Figure 3-1. Series 2000 and 10000 Upper Torque Motor Panel, Controls and Indicators (Sheet 1 of 2)

NAME	FUNCTION
Film supply spindle	Holds film supply reel or hub; applies torque required for proper film tension and reverse motion. Minimum reel hub or hub diameter for proper operation is 3 inches. Spindle spacers must be used when threading 16-mm or 17.5-mm film on multi-speed machine.
Hub adapter (optional)	Adapts film spindle diameter to open film supply hubs and provides turntable to support film.

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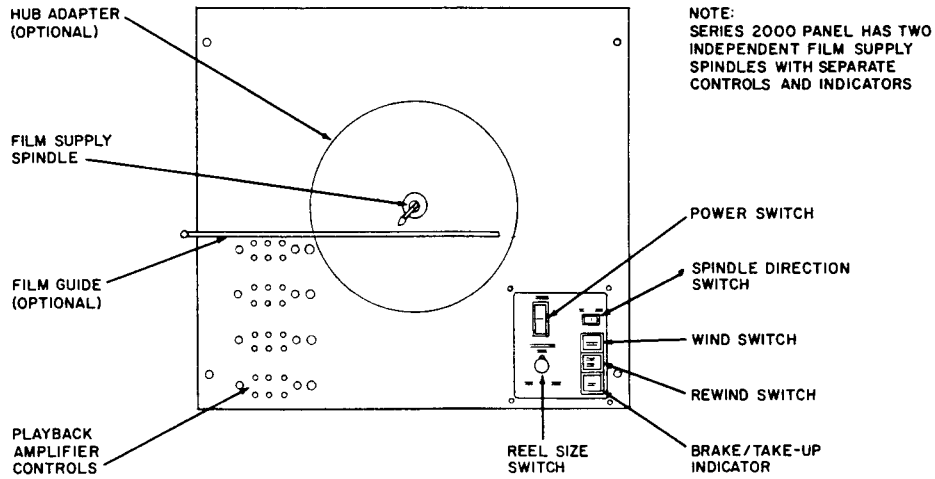


Figure 3-1. Series 2000 and 10000 Upper Torque Motor Panel, Controls and Indicators (Sheet 2 of 2)

NAME	FUNCTION
Film guide (optional)	Controls unwinding and rewinding of film supply on open hubs.
POWER switch	Controls power to upper and lower film spindles. On most machines, also controls playback and record amplifier power.
Spindle direction switch	Selects direction of film supply spindle torque. Set to CCW for B-wind film supply, oxide in, film fed from top of reel; set to CW for A-wind film supply, oxide out, film fed from bottom of reel.
WIND and REWIND switches WIND	Moves film at high speed from upper spindle to lower spindle without going through sprocket.
REWIND	Moves film at high speed from lower spindle to upper spindle without going through sprocket.
	Release brakes by lifting cut-off arm (transport panel) before pressing WIND or REWIND. Switch lights while film is winding or rewinding. Brakes are applied automatically when end of film is reached or if film breaks. To stop wind or rewind before reaching end, pull cut-off arm on transport panel toward film to apply brakes.
	CAUTION: Do not press WIND or REWIND switch when film is threaded through sprocket.
BRAKE/TAKE-UP indicator	BRAKE lights when upper and lower spindle brakes are applied; TAKE-UP lights when power is on and brakes are released.
REEL SIZE control	Selects spindle torque required for film length threaded; set to nearest value.
Playback amplifier controls	See Section IV.

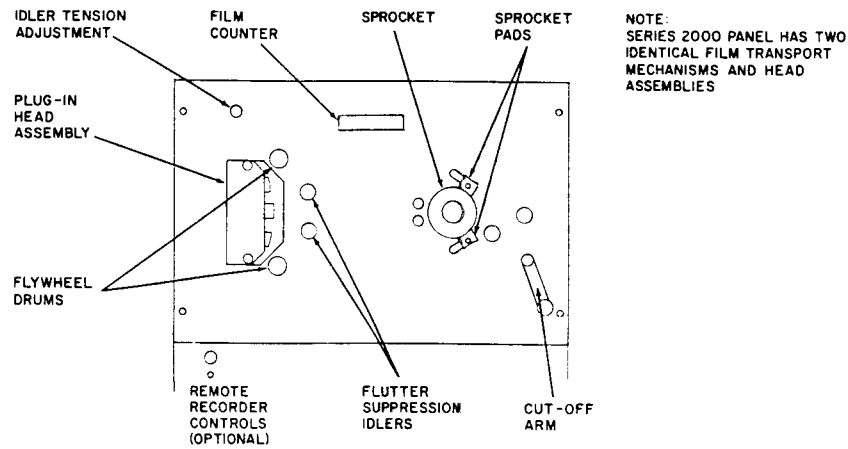
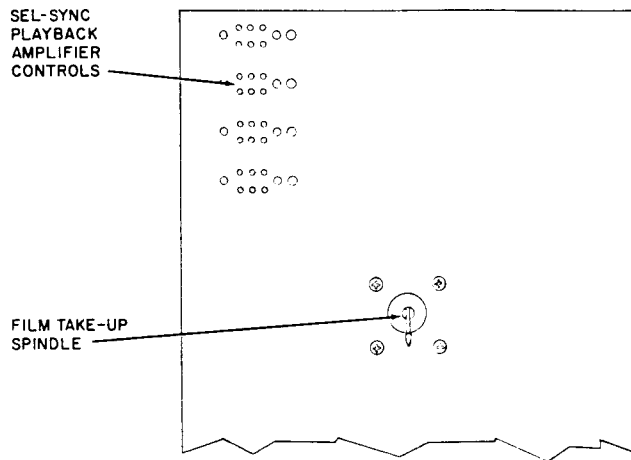


Figure 3-2. Series 2000 and 10000 Transport Panel, Controls and Film Handling Elements

NAME	FUNCTION
Plug-in head assembly	Holds magnetic film heads. Plug in the head assembly required for film width, track locations, and functions. Knurled thumbnuts or knobs at top and bottom secure head assembly to studs on panel.
Fixed idlers	Guide film to sprocket. Change rollers for 17.5-mm film (option /7).
Sprocket	Drives film. De-clutch electronically and turn large knurled knob to move film by hand.
Sprocket pads	Lock film to sprocket. Pivoted on spring toggle arms; lift from sprocket for threading. Lifting the pads locks flutter suppression idlers for automatic loop setting; pull film loop taut and engage sprocket holes before closing sprocket pads. Nylon rollers used on single-speed transports; pad blocks used on multi-speed transports flip over for film width change.
Flywheel drums	Maintain constant film speed through head assembly.
Flutter suppression idlers	Spring-loaded and damped rollers absorb flutter. Locked for threading by lifting sprocket pads; automatically blocked for film tension release during high-speed motion. Change rollers for 17.5-mm film (option /7).
Idler tension adjustment	Controls flutter suppression idler tension. Adjust to make idlers float equally in their slots during sync speed forward operation.
Cut-off arm	Senses end of film. After threading, turn supply and take-up reels to take up slack, then lift cut-off arm to operate switch; switch starts torque motors and releases spindle brakes.
Film counter	Electronic counter registers film footage and frames or elapsed time in minutes, seconds and frames. Press button to reset counter to 0. Switch over the toggle switch to select between length and time display.
Remote recorder controls (optional)	Remote master record on and record off switches for optional record amplifiers. See Section IV. Series 10000 only.

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NOTES:
 SERIES 2000 PANEL HAS TWO
 INDEPENDENT FILM TAKE-UP
 SPINDLES
 SEE FIGURE 3-1, UPPER TORQUE
 MOTOR PANE, FOR OPTIONAL HUB
 ADAPTER AND FILM GUIDE

Figure 3-3. Series 2000 and 10000 Lower Torque Motor Panel, Controls and Film Handling Elements

NAME	FUNCTION
Film take-up spindle	Holds film take-up reel or hub; applies torque required for proper film tension and forward motion. Minimum reel hub or hub diameter for proper operation is 3 inches. Spindle spacers must be used when threading 16-mm or 17.5-mm film on multi-speed machine.
Sel-sync playback amplifier controls	See Section IV.

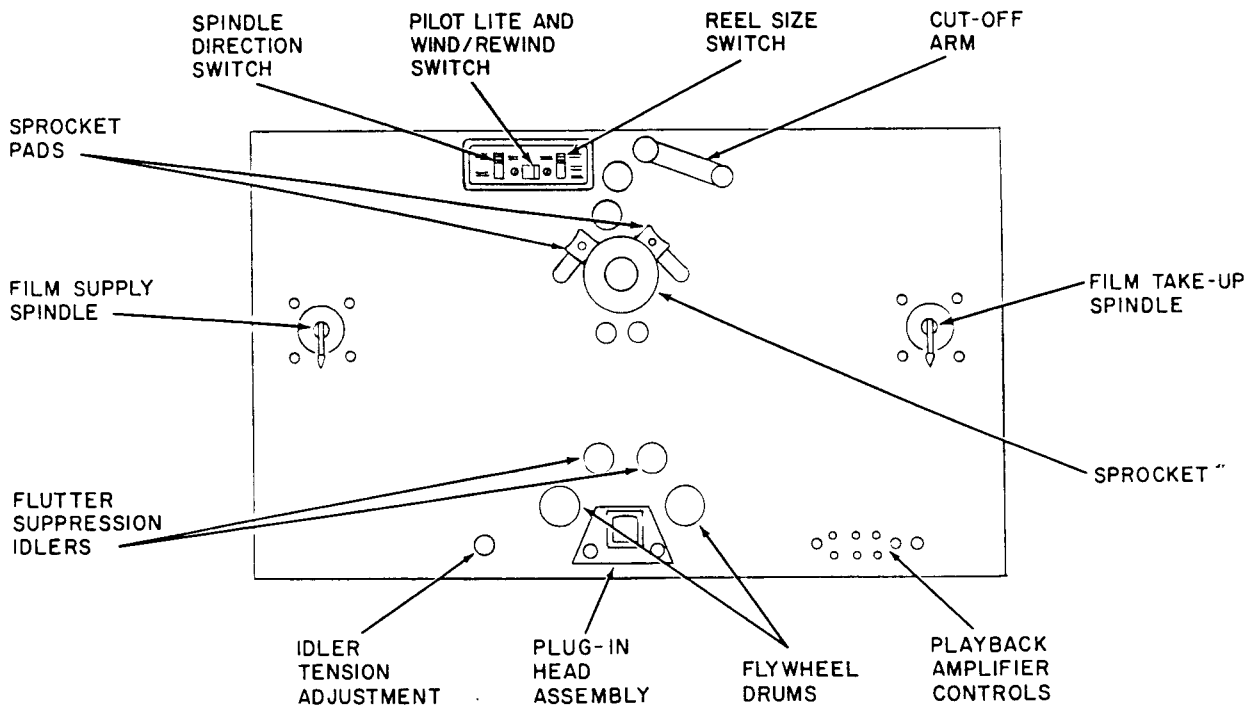


Figure 3-4. Series 4000 Transport Panel, Controls and Film Handling Elements (Sheet 1 of 3)

Figure 3-4. Series 4000 Transport Panel, Controls and Film Handling Elements (Sheet 2 of 3)

NAME	FUNCTION
Film supply spindle	Holds film supply reel; applies torque required for proper film tension and reverse motion. Minimum reel hub diameter for proper operation is 3 inches. Spindle spacers must be used when threading 16-mm or 17.5-mm film on multi-speed machine.
Spindle direction switch	<p>Selects direction of film supply spindle torque. Set to CCW for B-wind film supply, oxide in, film fed from top of reel; set to CW for A-wind film supply, oxide out, film fed from bottom of reel.</p> <p>CAUTION: Do not change switch position with power applied.</p>
Pilot light	Lights when power is on and brakes are released; located in WIND/REWIND switch.
WIND/REWIND switch	<p>WIND position moves film at high speed from left spindle to right spindle without going through sprocket.</p> <p>REWIND position moves film at high speed from right spindle to left spindle without going through sprocket.</p> <p>Release brakes by lifting cut-off arm before setting switch to WIND or REWIND. Brakes are applied automatically when end of film is reached or if film breaks. Return switch to center when film has stopped.</p> <p>To stop wind or rewind before reaching end, set switch to opposite direction; when film stops, set switch to center position.</p> <p>CAUTION: Do not set switch to WIND or REWIND when film is threaded through sprocket.</p>
Reel size switch	Selects spindle torque required for film length threaded; set to nearest value.
Cut-off arm	Senses end of film. After threading, turn supply and take-up reels to take up slack, then lift cut-off arm to operate switch; switch starts torque motors and releases spindle brakes.
Film take-up spindle	Holds film take-up reel; applies torque required for proper film tension and forward motion. Minimum reel hub diameter for proper operation is 3 inches. Spindle spacers must be used when threading 16-mm or 17.5-mm film on multi-speed machine.
Plug-in head assembly	Holds magnetic film heads. Plug in the head assembly required for film width, track locations, and functions. Knurled thumbnuts or knobs secure head assembly to studs on panel.
Fixed idlers	Guide film to sprocket. Change rollers for 17.15-mm film (option /7).
Sprocket	Drives film. De-clutch electronically and turn large knurled knob to move film by hand.
Sprocket pads	Lock film to sprocket. Pivoted on spring-toggle arms; lift from sprocket for threading. Lifting the pads locks flutter suppression idlers for automatic loop setting; pull film loop taut and engage sprocket holes before closing sprocket pads. Change nylon rollers for film width change on multi-speed transports; optional pad blocks simply flip over.
Flywheel drums	Maintain constant film speed through head assembly.

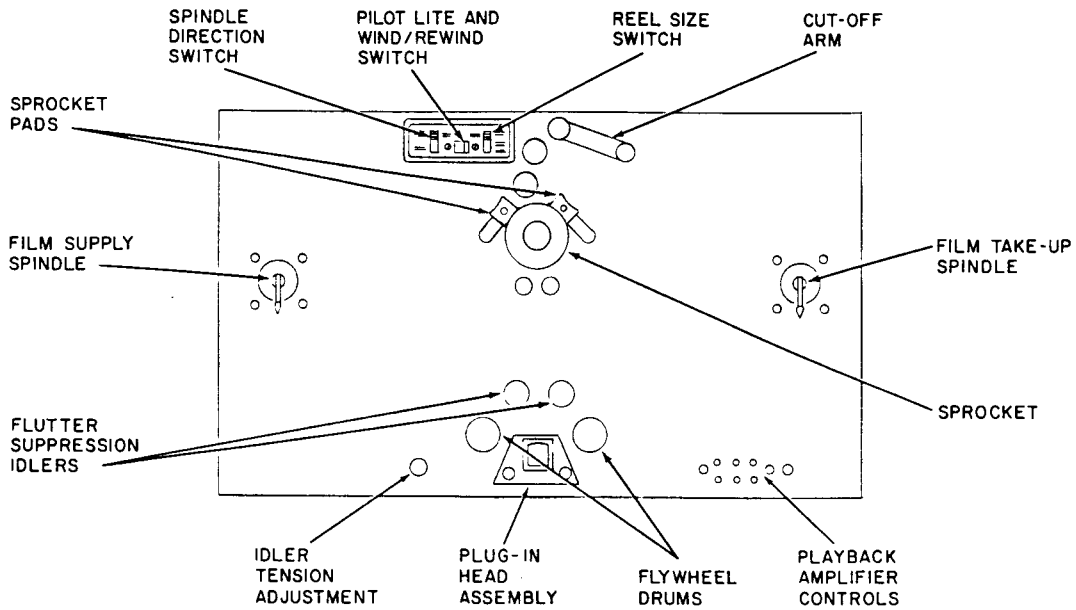


Figure 3-4. Series 4000 Transport Panel, Controls and Film Handling Elements (Sheet 3 of 3)

NAME	FUNCTION
Flutter suppression idlers	Spring-loaded and damped rollers absorb flutter. Locked for threading by lifting sprocket pads. Change rollers for 17.5-mm film (option /7).
Idler tension adjustment	Controls flutter suppression idler tension. Adjust to make idlers float equally in their slots during sync speed forward operation.
Playback amplifier controls	See Section IV.

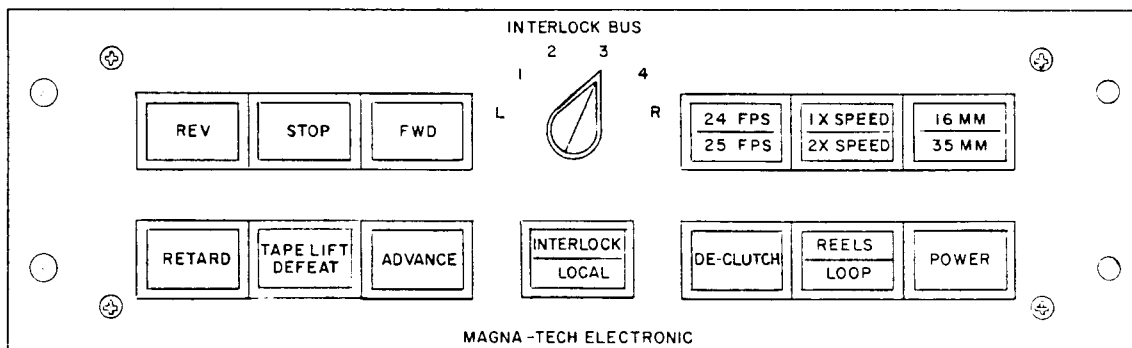


Figure 3-5. Transport Control Panel, Controls and Indicators (Sheet 1 of 3)

NAME	FUNCTION
Local motion controls	Select direction of film motion through sprocket in local mode. Switch lights to indicate motion selected; press another switch to change selection. Speed selected by 24 FPS/25 FPS, 1 × SPEED/2 × SPEED, and 16 MM/35 MM switches. Switches and lights inoperative during interlock.

Figure 3-5. Transport Control Panel, Controls and Indicators (Sheet 2 of 3)

NAME	FUNCTION
Local motion controls (Continued)	Film motion continues until another switch is pressed or film runs out. Film stops if two or three switches are pressed at the same time; motion is then controlled by last switch released.
REV switch (white)	Selects sync or twice-sync speed reverse motion, lower or right-hand spindle to upper or left-hand. Disabled in loop mode.
STOP switch (red)	Cancels forward or reverse motion. If pressed during interlock operation, machine stops and reverts to local mode.
FWD switch (white)	Selects sync or twice-sync speed forward motion, upper or left-hand spindle to lower or right-hand.
INTERLOCK BUS selector switch	Selects one of six sources for interlock operation. L and R positions select left and right adjacent machines as sources; numbered positions select other sources as assigned in your studio. Machine will stop and automatically revert to local mode if bus selection is changed during interlock operation.
24 FPS/25 FPS switch (white/blue)	Selects 24-frame-per-second or 25-frame-per-second film speed. Lights to indicate film speed in use; press switch to change selection. When machine is in local operation, change is deferred until transport is stopped.
1 × SPEED/2 × SPEED switch (white/yellow)	Selects sync or twice-sync film speed for local motion, and for record and reproduce speed limits in interlock operation. Lights to indicate film speed in use; press switch to change selection. When transport is running in local mode, film first stops and then starts up at new speed; when transport is running in interlock mode, change is deferred until transport is stopped. Equalization selected by actual speed.
16 MM/35 MM switch (white/green)	Selects 16-mm or 35-mm film speed and equalization. (With 17.5-mm film: select 16 MM for 45 feet per minute, 35 MM for 90 fpm.) Lights to indicate film speed in use; press switch to change selection. When transport is running in local mode, film first stops and then starts up at new speed; when transport is running in interlock mode, change is deferred until transport is stopped. Remember to change head assembly and spindle spacers when changing film; flip sprocket pads over or change rollers.
POWER switch (green)	Controls power to film transport.
REELS/LOOP switch (green/yellow)	Selects spindle-to-spindle or endless loop film path. Lights to indicate mode selected; press switch to change selection. In loop mode, thread film on transport only, do not engage cut-off arm; reverse motion is disabled.
DE-CLUTCH switch (white)	In local mode, stops and electrically releases sprocket. Hold switch in and turn sprocket to align start mark after threading. If pressed during interlock operation, machine stops and reverts to local mode.

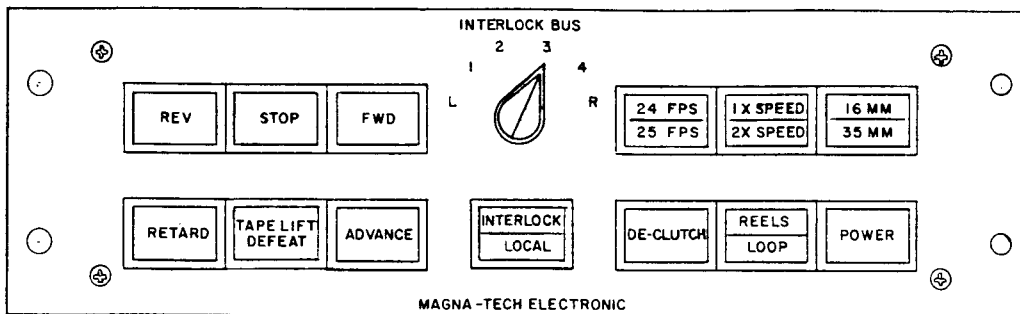


Figure 3-5. Transport Control Panel, Controls and Indicators (Sheet 3 of 3)

NAME	FUNCTION
INTERLOCK/LOCAL switch (green/red)	<p>Selects interlock or local control of sprocket motion.</p> <p>During interlock operation, film motion follows interlock source speed and direction exactly. In local operation, film motion is controlled by local motion controls on this panel.</p> <p>Machine automatically in local mode when power first applied. Switch lights to indicate mode in use; press to change selection. Thread film, release brakes, align start mark, and select interlock bus before selecting interlock operation. Machine automatically stops and reverts to local mode if interlock bus selection changed, DE-CLUTCH switch pressed, or STOP switch pressed during interlock operation. If sprocket is running when interlock is selected, interlock operation will not begin until transport is stopped.</p>
ADVANCE switch (white)	<p>When film is running at approximately sync speed forward, increases film speed 1 frame per second. Switch lights and advance continues as long as control-panel or remote ADVANCE switch is pressed. Primarily used as framing adjust during interlock operation.</p>
RETARD switch (white)	<p>When film is running at approximately sync speed forward, reduces film speed 1 frame per second. Switch lights and retarding action continues as long as control-panel or remote RETARD switch is pressed. Primarily used as framing adjust during interlock operation.</p>
TAPE LIFT INHIBIT switch (optional)	<p>Alternate action switch, inhibits automatic film tension release; allows you to monitor sound while film is running at high speed.</p>
Remote recorder controls (optional)	<p>Remote master record on and record off switches for optional record amplifiers. See Section IV.</p>

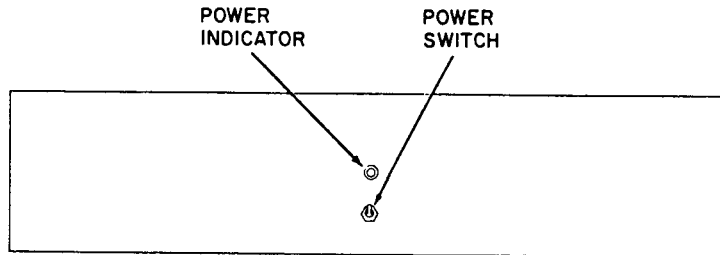


Figure 3-6. Series 4000 Power Switch Panel, Control and Indicator

NAME	FUNCTION
Power switch and indicator	Controls power to reel spindles and transport. On most machines, also controls power to playback and record amplifiers.

OPERATING INSTRUCTIONS

PRELIMINARY PROCEDURES

Before operating the recorder or reproducer, perform the following preliminaries:

1. On upper torque motor panel (figure 3-1) or on power switch panel near bottom of Series 4000 machine (figure 3-6), set POWER switch on. Check that BRAKE indicator, or power indicator, lights.
2. On transport control panel (figure 3-5), set POWER switch on. Check that the following switches light:
 - 24 FPS or 25 FPS
 - 16 MM or 35 MM
 - 1 × SPEED or 2 × SPEED
 - STOP
 - LOCAL
 - REELS or LOOP
3. For 17.5-mm film, remove thumbnuts and change four idler rollers on transport panel (figure 3-2 or 3-4). Secure by replacing thumbnuts.
4. Select the appropriate plug-in magnetic head assembly (figure 3-2 or 3-4). Different head assemblies are provided for different film widths and track formats. To interchange head assemblies, loosen the two knobs that secure the head assembly, or remove the two knurled thumbnuts; unplug the head assembly by pulling it straight out from the transport panel. Plug the appropriate head assembly into the head

connector on the transport panel; tighten the two knobs, or replace the two knurled thumbnuts to secure the head assembly to the panel.

5. Select required film speed at the control panel (figure 3-5). The 24 FPS/25 FPS and 16 MM/ 35 MM switches light to indicate speed selected. (With 17.5-mm film: 16 MM = 45 fpm, 35 MM = 90 fpm.) Press switch once to change your selection.

THREADING FILM ON REELS OR OPEN HUBS

Both the upper and the lower torque motor panels on a Series 2000 or 10000 machine will handle either open film hubs (with optional hub adapters and film guides), or standard film reels. An open hub may be placed on one spindle and a reel on the other. Film capacity is 3000 feet on Series 2000 and 10000. A Series 4000 transport will handle standard film reels up to 2000 feet. Reel spacers are used in placing 16-mm or 17.5-mm film on spindles. Minimum hub diameter is 3 inches. The film supply may be either B-wind (oxide in) or A-wind (oxide out).

1. At the transport control panel (figure 3-5), select reels mode. REELS/LOOP switch lights to show mode selected; press switch once to change your selection.
2. On multi-speed machines, check reel spindles:
 - 16-mm or 17.5-mm film — install reel spacers on each spindle. Install spacer with setscrew first and make sure that its slot engages spindle key.

35-mm film — remove reel spacers from each

spindle and store them carefully.

3. On Series 2000 or 10000 machine, if open film hub is to be used on upper (supply) or lower (take-up) torque motor panel, or on both, install optional hub adapter and film guide (figure 3-1).
4. If standard film reel is to be used on upper (supply) or lower (take-up) torque motor panel, or on both, remove optional hub adapter and film guide if they are in place (figure 3-1).
5. Install supply of film to be recorded or reproduced on supply spindle or hub adapter (figure 3-1 or 3-4). If film supply is B-wind (oxide in), set spindle direction switch to CCW and install film supply to feed from top. If film supply is A-wind (oxide out), set spindle direction switch to CW and install film supply to feed from bottom. Close and latch film guide if used.
6. Set REEL SIZE control to film length you are threading.
7. Install take-up hub or reel on take-up spindle (figure 3-3 or 3-4) or hub adapter.
8. At transport panel (figure 3-2 or 3-4), pivot both sprocket pad arms away from sprocket. On multi-speed machines, flip pad blocks over or change rollers to match film width.
9. Now thread film from supply hub or reel to take-up hub or reel as shown in figure 3-7. Slip film into slots of magnetic head shield to pass heads as shown in threading diagram.
10. Pull film taut around sprocket, flywheel drums, and flutter suppression idlers to set loop. Now engage sprocket holes on sprocket by releasing film slightly to align nearest hole.
11. Pivot sprocket pad arms back into place to hold film on sprocket. Pad arm on take-up side releases flutter suppression idlers to float in their slots.
12. Close and latch lower film guide if used.

CAUTION: Do not operate WIND or REWIND switches while film is threaded through sprocket.

13. Turn supply and take-up reels or hubs to take up slack in outer loops. Lift cut-off arm away from film to release spindle brakes and start

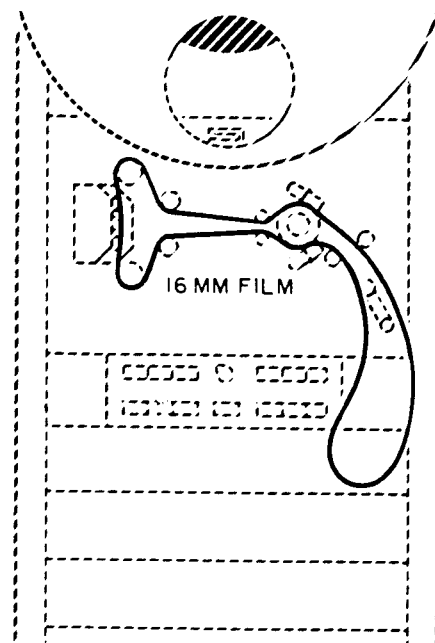
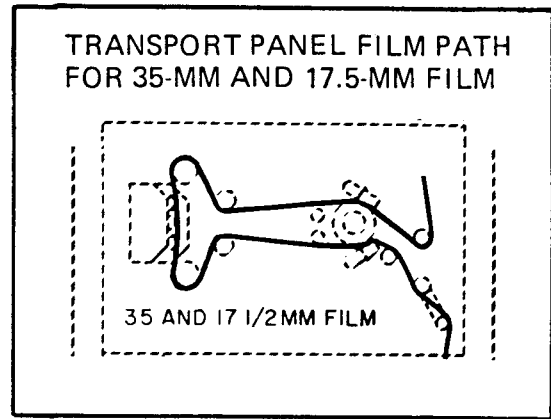
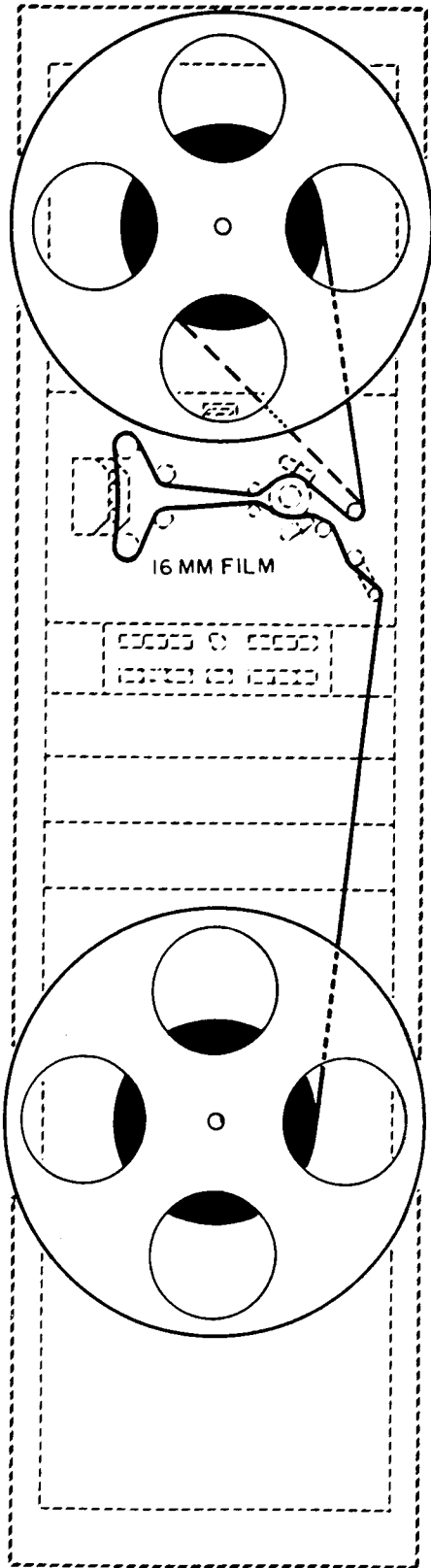
torque motors. On a Series 2000 or 10000 machine, check that BRAKE indicator goes out and TAKE-UP indicator lights. On a Series 4000 machine, check that pilot light in WIND/REWIND switch lights.

14. If start mark on film is nearby, press and hold DE-CLUTCH switch on control panel; turn sprocket by hand to bring the start mark to playback head.

THREADING A CONTINUOUS FILM LOOP

A continuous loop of film may be run under local or interlock control on the transport panel without using the reel spindles. However, on most Series 2000 and 10000 machines, the torque motor panel POWER switch must be on because it controls playback and record amplifier power. The transport will only run forward; if reverse motion is requested, the transport will stop until forward motion is resumed.

1. At transport control panel (figure 3-5), select loop mode. REELS/LOOP switch lights to show mode selected; press switch once to change your selection.
2. At transport panel (figure 3-2 or 3-4) pivot both sprocket pad arms away from sprocket. On multi-speed machines, flip pad blocks over or change rollers to match film width.
3. Now thread loop of film on transport panel as shown in figure 3-7. It's not necessary to open film loop for threading; slip film into slots of magnetic head shield from front to pass heads as shown in threading diagram.
4. Pull film taut around sprocket, flywheel drums, and flutter suppression idlers to set loop, and engage sprocket holes on sprocket by releasing film slightly to align nearest hole.
5. Pivot sprocket pad arms back into place to hold film on sprocket. Pad arm on take-up side releases flutter suppression idlers to float in their slots. Do not engage film in cut-off arm, and do not lift cut-off arm. Lifting cut-off arm would only cause reel spindles to spin needlessly.
6. If start mark on film is nearby, press and hold DE-CLUTCH switch on control panel; turn sprocket by hand to bring start mark to playback head.



CONTINUOUS LOOP

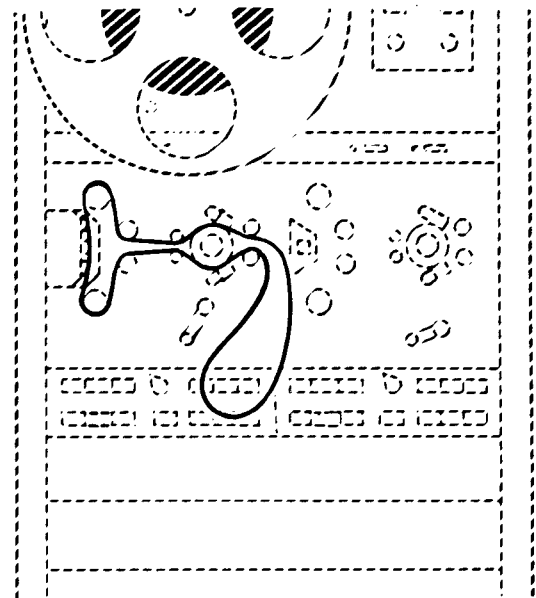
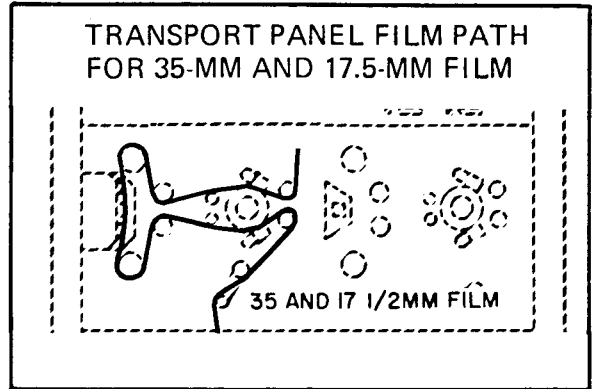
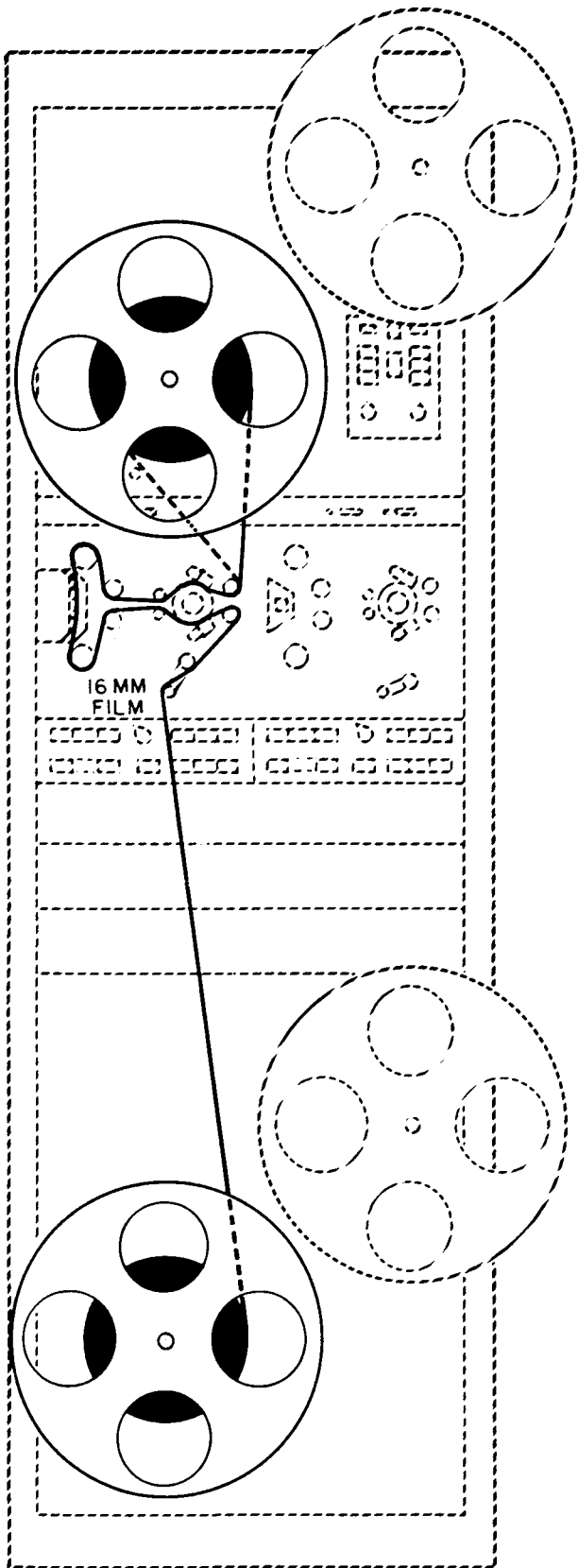
MINIMUM HUB DIAMETER: 3 INCHES

FILM CAPACITY: 3000 FEET

CAUTION: DO NOT PRESS WIND OR REWIND WHEN
FILM IS THREADED THROUGH SPROCKET

SERIES 10000

Figure 3-7. Normal Reels and Continuous Film Loop Threading Diagram (Sheet 1 of 3)



CONTINUOUS LOOP

MINIMUM HUB DIAMETER: 3 INCHES
FILM CAPACITY: 3000 FEET

CAUTION: DO NOT PRESS WIND OR REWIND WHEN
FILM IS THREADED THROUGH SPROCKET

SERIES 2000

Figure 3-7. Normal Reels and Continuous Film Loop Threading Diagram (Sheet 2 of 3)

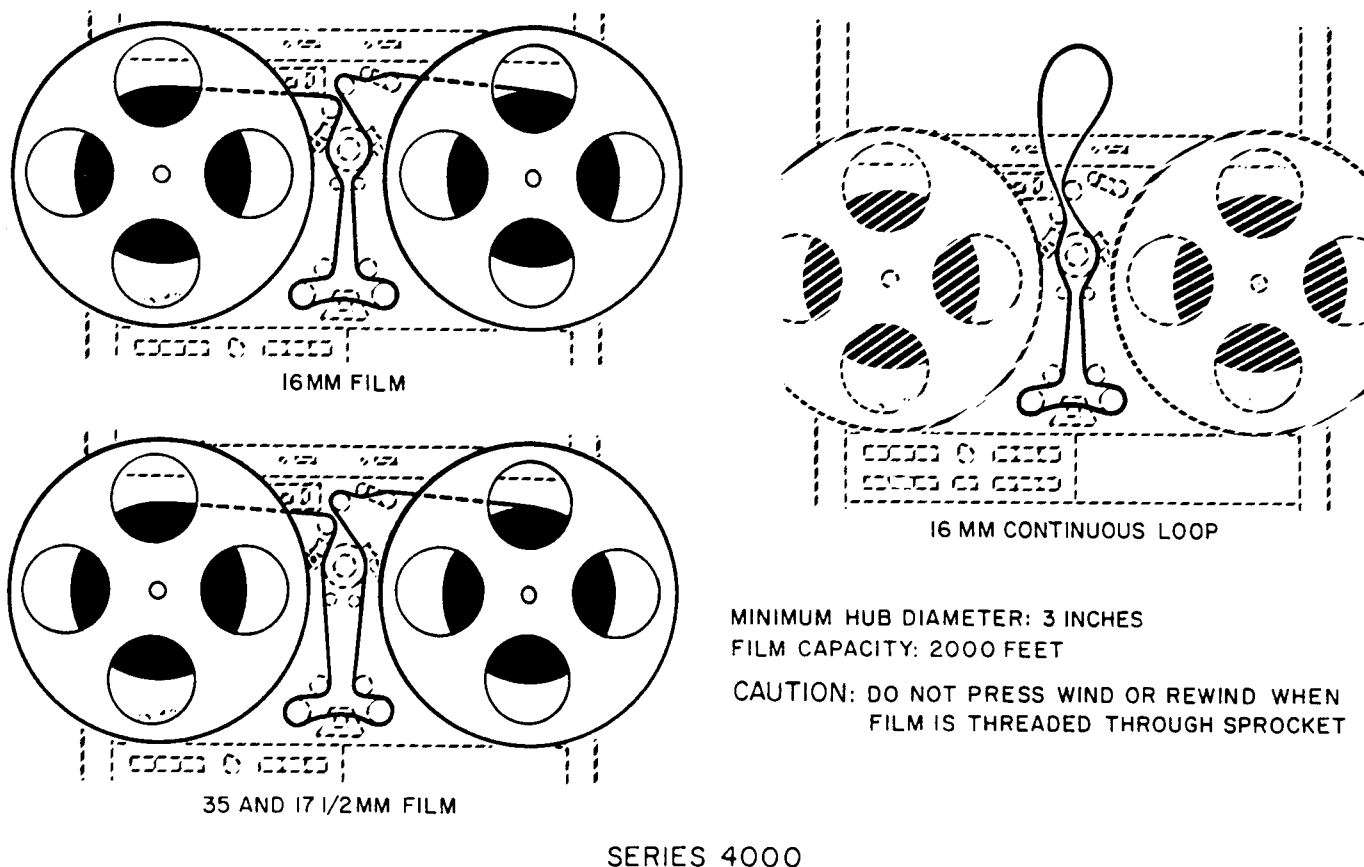


Figure 3-7. Normal Reels and Continuous Film Loop Threading Diagram (Sheet 3 of 3)

LOCAL TRANSPORT OPERATION

Once the preliminaries have been attended to, and the film has been threaded, the transport may be operated by the local motion controls on the transport control panel (figure 3-5) or corresponding controls on a Type 8LB Control Unit or other remote unit.

1. Check that machine is set for local operation. INTERLOCK/LOCAL switch lights to show operating mode; if INTERLOCK is lit, press this switch or STOP switch to return to local.
2. Check that correct film speed has been selected. 24 FPS/25 FPS and 16 MM/35 MM switches light to show selected speed; press switch once to change your selection. (With 17.5-mm film: 16 MM = 45 fpm, 35 MM = 90 fpm.)
3. Check that reels or loop mode has been correctly selected. REELS/LOOP switch lights to show this selection; press switch once to change it.
4. Check that film has been correctly threaded and that DE-CLUTCH switch is dark.
5. For reel-to-reel operation, check that spindle brakes are released. On Series 2000 and 10000 machines, check that BRAKE indicator is dark and that TAKE-UP indicator is lit; on Series 4000 machines, check that pilot light in WIND/REWIND switch is lit. If necessary, lift cut-off arm to release spindle brakes.
6. Select sync or twice sync speed. The 1 × SPEED/2 × SPEED switch lights to show speed selected; press switch once to change it.

CAUTION: Do not operate WIND or REWIND switches when film is threaded through sprocket.

7. To run film forward at selected speed, press FWD switch. Check transport panel (figure 3-2 or 3-4) to see that flutter suppression idlers are floating equally about centers of their slots. If necessary, adjust idler tension to equalize their motions.

NOTE: Forward or reverse motion continues until another switch is pressed or the film runs out. In reels mode, a completed or broken film will automatically apply the spindle brakes.

8. In sync speed forward operation, film speed can be increased or decreased one frame per second by pressing and holding the ADVANCE or RETARD switch.
9. To change to 24-frame-per-second or 25-frame-per-second film speed, press 24 FPS/25 FPS switch once and press STOP switch. When film stops, press FWD again and film will start at new speed.
10. To change to sync or twice sync speed, press $1 \times \text{SPEED}/2 \times \text{SPEED}$ switch once; film will stop automatically and then start at new speed.
11. To run film backwards at selected speed in reels mode, press REV switch. In loop mode, pressing REV switch simply stops transport and cancels forward motion in progress.
12. To move film by hand, press and hold DE-CLUTCH switch; this releases and lets you turn the sprocket. If DE-CLUTCH switch is pressed while film is running under local control, transport will automatically stop and cancel the motion before de-clutching the sprocket.
13. To stop film, press STOP switch.

NOTE: To change film speed or direction, simply press the switch for the speed or direction you need; except for changing to 24-frame-per-second or 25-frame-per-second speed, there is no reason to first press STOP.

INTERLOCK OPERATION

Once the start mark has been lined up in local operation, the transport may be interlocked with any one of four interlock sources or either of two adjacent transports. In reels mode interlock operation, the machine will follow the interlock source exactly, both forward and backward. In loop mode interlock operation, the machine will follow the interlock source only in the forward direction. If the interlock source runs back, the film loop will stop until the interlock source runs forward once again.

1. Prepare the machine as for local operation; review the preliminary, film threading, and local transport operation instructions. Check that film speed has been correctly selected on transport control panel (figure 3-5). In interlock operation, the 16 MM/35 MM switch determines film travel per frame, 24 FRAME/25 FRAME switch determines advance and retard speed, $1 \times \text{SPEED}/2 \times \text{SPEED}$ switch determines record and reproduce speed limits. (With 17.5-mm film: 16 MM = 45 fpm, 35 MM = 90 fpm.)

CAUTION: Do not operate WIND or REWIND switches when film is threaded through sprocket.

2. When brakes have been released, start mark on film has been aligned with playback head, and all is in readiness, set INTERLOCK BUS switch on control panel to select assigned interlock source (1 through 4) or adjacent transport (L or R).
3. Press INTERLOCK/LOCAL switch once to begin interlock operation. Check that LOCAL lamp goes out and that INTERLOCK lights. Also check that FWD, REV, and STOP switches are dark. If film is moving when you press switch, machine will store your request until you stop the film. Film transport is now under total control of interlock source. Local motion switches, FWD and REV, are disabled.
4. When film is running at sync speed forward, check transport panel (figure 3-2 or 3-4) to see that flutter suppression idlers are floating equally about centers of their slots. If necessary, adjust idler tension to equalize their motions.
5. To adjust synchronization between this film and interlock source while running at sync speed forward, hold ADVANCE switch in to increase film

speed by 1 frame per second, or hold RETARD switch in to reduce film speed by 1 frame per second. In many installations, advance and retard may also be accomplished from remote locations.

6. If you change INTERLOCK BUS switch setting, press STOP switch, or press DE-CLUTCH switch while machine is in interlock operation, film will stop and machine will revert to local operation. This is a safety feature to prevent accidental start from a running interlock bus during equipment set-up. To return to interlock, press INTERLOCK/LOCAL switch once after returning film to proper starting position.

NOTE: In reels mode, a completed or broken film will automatically apply the spindle brakes.

7. To return machine to local control, press STOP switch or press INTERLOCK/LOCAL switch once.

PLAYBACK

When the proper head assembly is in place, the machine will play back each track on the film through the playback amplifiers while the film is moving at sync or twice sync speed. When the film is moving more than 3 to 8 frames per second faster than the speed selected by the $1 \times$ SPEED/ $2 \times$ SPEED switch, film tension may be released to separate the film from the magnetic heads and reduce head wear; then, playback cannot occur.

Each recorder and reproducer may be equipped with as many as eight playback amplifiers, and eight sel-sync playback amplifiers, for each transport. Track and head assignments depend on the head assembly in place and the cabling within the unit. Thus, track assignments are determined by the function of the machine in your studio and by the operation you are performing.

For additional information and instructions, refer to Section IV.

RECORDING

When the proper head assembly is in place, machines equipped with optional record amplifiers will record on any track of the film while the film is moving at sync or twice sync speed forward. When the film is moving more than 3 to 8 frames per second faster than the speed selected by the $1 \times$ SPEED/ $2 \times$ SPEED switch, film tension may be

released to separate film from the magnetic heads and reduce head wear; then, recording cannot take place. Moreover, the machine is equipped with a reverse record defeat feature; record amplifier erase and bias are automatically cut off when the film is moving in reverse, more than 3 to 8 frames per second faster than the speed selected by the $1 \times$ SPEED/ $2 \times$ SPEED switch or, in later models, slower than 14 frames per second.

Each recorder may be equipped with as many as eight optional record amplifiers. Track and head assignments depend on the head assembly in place and the cabling within the unit. Thus, track assignments are determined by the function of the machine in your studio and by the operation you are performing.

For additional information and instructions, refer to Section IV.

FAST WINDING AND REWINDING

To simply wind or rewind a reel of film as quickly as possible, the wind or rewind mode may be used with the film threaded from one spindle to the other, bypassing the sprocket.

1. On upper torque motor panel (figure 3-1) or on power switch panel near bottom of Series 4000 machine (figure 3-6), set POWER switch on. Check that BRAKE indicator, or power indicator, lights.
2. On multi-speed machines, check reel spindles: 16-mm or 17.5-mm film — install reel spacers on each spindle. Install spacer with setscrew first and make sure that its slot engages spindle key. 35-mm film-remove reel spacers and store them carefully.
3. On Series 2000 or 10000 machine, if open film hub is to be used on upper (supply) or lower (take-up) torque motor panel, or on both, install optional hub adapter and film guide (figure 3-1).
4. If standard film reel is to be used on upper (supply) or lower (take-up) torque motor panel, or on both, remove optional hub adapter and film guide if they are in place (figure 3-1).

NOTE: If film on supply spindle is B-wind (oxide in), set spindle direction switch to CCW and install film or reel to feed from the top. If film on supply spindle is A-wind

MTE SERIES 2000, 4000, 10000 RECORDER/REPRODUCER

(oxide out), set spindle direction switch to CW and install film or reel from the bottom.

5. Install film to be wound or rewound on one spindle (figure 3-1, 3-3, or 3-4). Close and latch film guide if used.
6. Install take-up hub or reel on other spindle. Close and latch film guide if used.
7. Thread film from supply spindle to take-up spindle as shown in figure 3-8. Do not thread film through heads or over sprocket.
8. Turn supply and take-up reels or hubs to take up slack in both loops. Lift cut-off arm away from film to release spindle brakes and start torque motors. On a Series 2000 or 10000 machine, check that BRAKE indicator goes out and TAKE-UP indicator lights. On a Series 4000 machine, check that pilot light in WIND/REWIND switch lights.

CAUTION: Do not operate WIND or REWIND switches when film is threaded through the sprocket.

9. On Series 2000 or 10000 machine, press WIND switch to move film from upper spindle to lower. Press REWIND switch to move film from lower spindle to upper. Check that switch lights to indicate operation selected.
10. On Series 4000 machine, set WIND/REWIND switch to WIND to move film from left-hand spindle to right. Set switch to REWIND to move film from right-hand spindle to left.

NOTE: When the film is completely wound or rewound to the end, or if the film should break, the torque motors will automatically stop and the brakes will be applied. On Series 4000 machine, return WIND/REWIND switch to center after film has stopped.

11. To stop wind or rewind before reaching the end, pull cut-off arm toward film to stop the motors and apply brakes. On Series 4000 machines, you may also stop wind or rewind by setting WIND/REWIND switch to opposite direction and, when the film stops, setting it to center position.

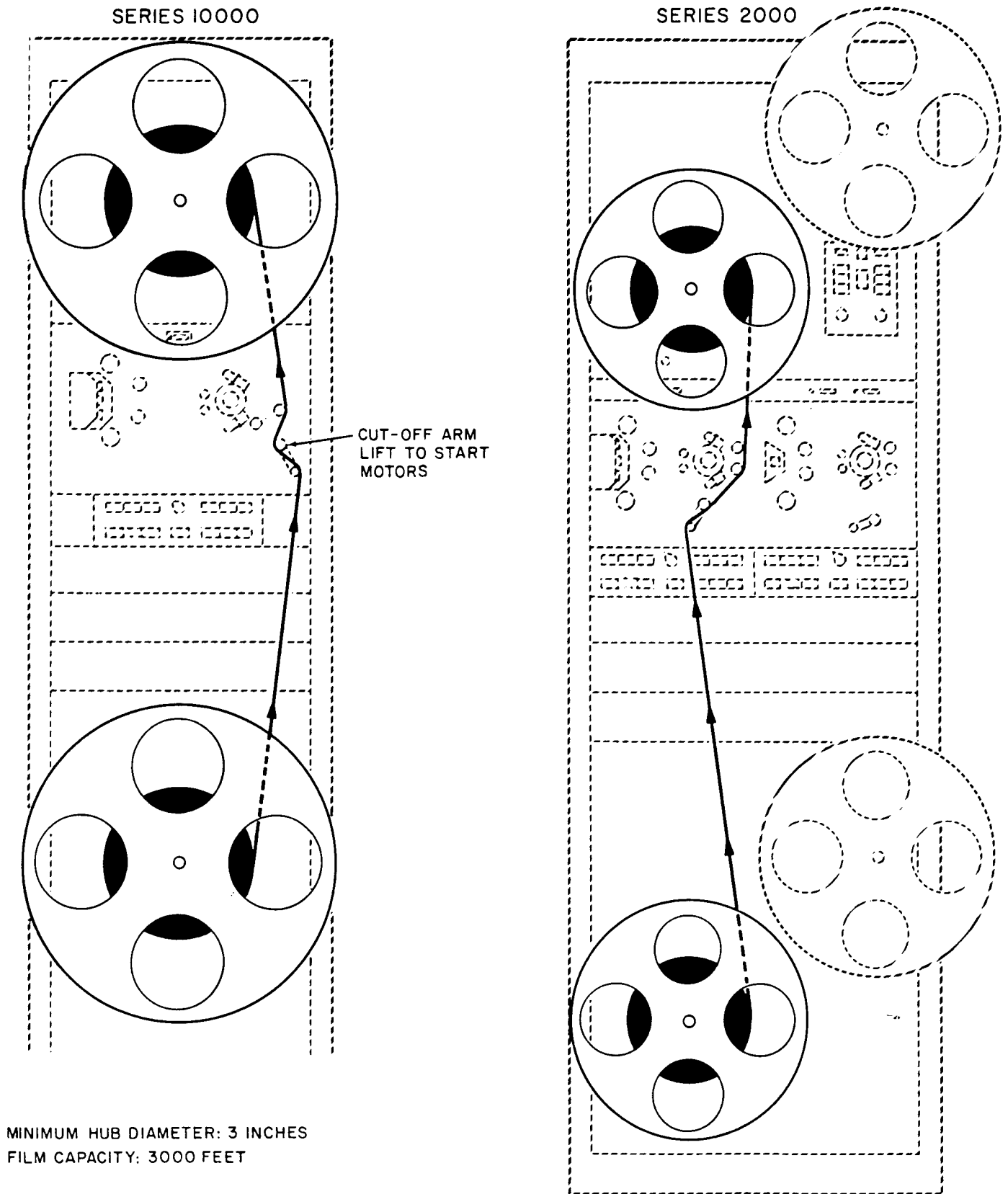


Figure 3-8. Film Wind and Rewind Path (Sheet 1 of 2)

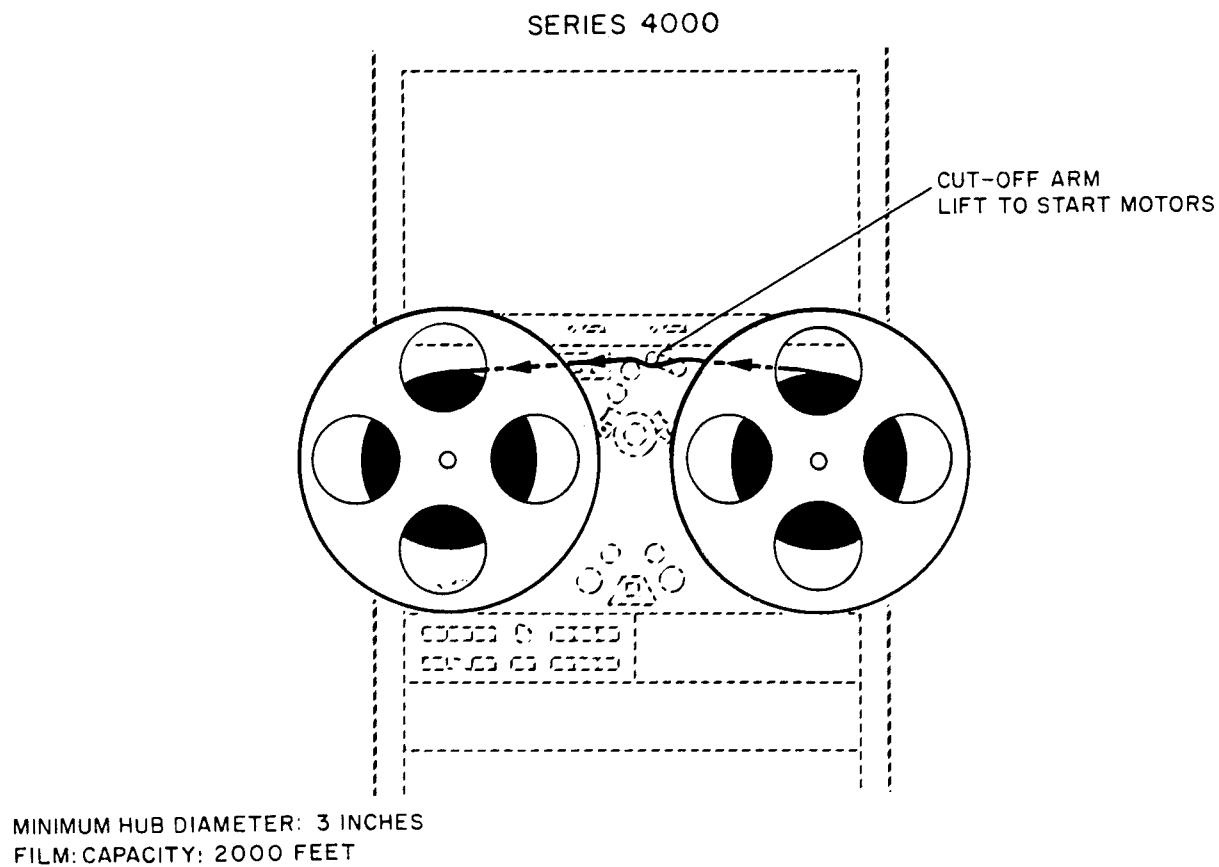


Figure 3-8. Film Wind and Rewind Path (Sheet 2 of 2)

SECTION IV**RECORD AND PLAYBACK SYSTEM:
TYPE 69C PLAYBACK AMPLIFIERS AND TYPE 68C RECORD AMPLIFIERS**

This section provides all information required for installing and operating the record and playback audio systems of Magna-Tech magnetic film recorders and reproducers equipped with Type 69C Playback Amplifiers and Type 68C Record Amplifiers.

DESCRIPTION

Magna-Tech recorders and reproducers are available in many different configurations to meet the various requirements of motion picture and video tape sound studios. Reproducers, or dubbers, are equipped for playback only; recorders have facilities for recording and playback. Thus, a mixing studio may be equipped with a bank of dubbers to play back the various films that make up a composite sound track, and a pick-up recorder to record the mixed sound. All machines may be interlocked to the same picture. When the mix or a part of it has been completed, it may be played back on the recorder in synchronism with the picture using sel-sync playback. Work may be picked up at any point on the sound track.

The audio system of each reproducer is equipped with a Type 69C playback amplifier for each channel to be reproduced. In addition to playback amplifiers, the audio system of each recorder is equipped with a Type 68C record amplifier for each channel to be recorded, and an additional Type 69C playback amplifier for each channel to be played back in sel-sync mode. When the recorder is to be used for electronic looping, a muting circuit is provided to delay recording until erase current has reached full value. Type 69C playback amplifiers and Type 68C record amplifiers are also available separately for installation in existing machines when requirements change.

Magna-Tech film transports use plug-in magnetic head assemblies that are readily interchanged for different film widths and track layouts. Head assemblies for reproducers may be equipped with playback heads only; head assemblies for recorders

include erase heads (optional), record heads, and separate playback heads. Record heads may be used for sel-sync playback if the machine is so equipped. When additional amplifiers are installed, head assemblies for new configurations are readily available.

TYPE 69C PLAYBACK AMPLIFIERS

In most machines, Type 69C playback amplifiers and sel-sync playback amplifiers, if supplied, are mounted behind the torque motor or spindle panels. Each playback amplifier amplifies the output of one playback head. A separate sel-sync playback amplifier is required for each channel to be reproduced in the sel-sync mode, that is, from the record head. This mode is used to avoid the delay caused by film travel from the record head position to the playback head position when playing back a newly recorded track in synchronism with the picture. When not recording, the record head is automatically connected, through the record amplifier, to the sel-sync playback amplifier.

Each Type 69C playback amplifier is equipped with one or two playback equalizers that may be adjusted for any standard equalization used with magnetic film. Equalization changeover of dual-equalization amplifiers is automatic with speed or head assembly change in the transport. Playback amplifiers have high-impedance inputs to match Magna-Tech playback heads; sel-sync playback amplifiers are equipped with matching transformers to accept low-impedance record head signals. Amplifier outputs are low-impedance balanced lines, and are adjusted to standard program level for the studio. The fully solid-state amplifier circuit is constructed on one plug-in circuit board. Gain and equalization are adjusted by front-panel screwdriver controls; a front-panel test output Jack is also provided. A high-gain option is available by changing one resistor on the circuit board. All electrical connections are to receptacles on the sides and rear of the amplifier.

TYPE 68C RECORD AMPLIFIERS

One optional Type 68C record amplifier is required for each track to be recorded. It consists of an electronic chassis designed to mount in a 19-inch rack or cabinet with a front control panel and two plug-in printed circuit boards. All operating controls and indicators, as well as a test input jack, are located on the front panel. The controls and indicators are: RECORD LEVEL adjustment; Input level VU meter; Play/Sync/Bias/Erase VU meter with source selector switch; illuminated REC and OFF pushbuttons; READY/SAFE toggle switch; equalization adjustments; bias current adjustments. The bias circuit board contains the 100-kHz bias and erase oscillator and amplifier, as well as the adjustable erase and record timing circuit. The audio board contains the solid-state audio amplifiers that feed the VU meters and the record head. Each record amplifier is equipped with one or two frequency equalizers, each adjusted for a standard equalization used with magnetic film. Each equalizer is constructed on a high-frequency pre-emphasis switch located on the rear panel. Equalization and erase timing changeover of dual-equalization amplifiers are automatic with speed or head assembly change in most installations. Automatic reverse record defeat turns erase and bias off when film is not running forward at recording speed on the Magna-Tech transport. Erase out timing may be defeated by remote contacts. Record head is automatically connected to SEL-SYNC output when not recording. Equalization and erase timing changeover relay, and record head connection relay, are plug-in elements.

Record amplifiers have high-impedance inputs to bridge across low-impedance balanced standard program level lines; gain is adjustable to match studio standard program level. Output impedance matches Magna-Tech record heads. All electrical connections are to receptacles on the rear panel.

Also on the rear panel are the GAIN and erase TIMING adjustments.

REMOTE RECORD CONTROL UNITS

Remote record control units are optional panels equipped with individual and master on and off pushbuttons and ready, run, and record indicators for each record amplifier in a recorder. These panels are designed for installation at a remote location in the studio. The ready indicator lights when power is applied to the recorder; the run indicator lights when film is running at proper forward speed; and the record indicator lights when the corresponding record amplifier is recording. Thus, recording may be started and stopped on any track or tracks from the remote location. The master on and off pushbuttons start and stop recording on all tracks at the same time. A diode matrix and relay are mounted in the recorder cabinet to channel master commands and reverse record defeat to record amplifiers for all tracks. A small remote record control panel, equipped with master on and off pushbuttons, is designed for mounting at the transport to control all tracks in the unit.

POWER REQUIREMENTS

Each Type 68C record amplifier, and each Type 69C playback amplifier, requires regulated 28-volt DC power. Audio power supplies, which are described in Section V of this manual, are installed in each machine to meet this need. Up to eight playback amplifiers and one record amplifier may be supplied by one playback supply; up to eight additional record amplifiers may be supplied by a record supply.

SPECIFICATIONS

Specifications for significant parameters and features of these record and playback amplifiers are given in table 4-1.

Table 4-1. Record and Playback System Specifications

Type 69C Playback Amplifier

Reproduce Output

Impedance: 600 or 150 ohms balanced

Level: Standard program line, adjustable for +4- and +8-dbm systems

Input: High impedance to match MTE playback heads

Low impedance optional for use in sel-sync

Power Requirement: 28 volts DC, 0.1 ampere

Table 4-1. Record and Playback System Specifications (Continued)

Type 68C Record AmplifierRecord Input

Impedance: 15-kilohm bridging

Level: Standard program line, adjustable for +4- and +8-dbm systems

Output: Low impedance to match MTE record heads

Erase: Optional

Timing: Optional erase and record timing for use in pick-up mixing and electronic looping. Out timing may be defeated from external contacts.

Power Requirement: 28 volts DC, 0.3 ampere

Total Harmonic Distortion:

0.5 percent at +16-dbm output level

Signal-to-Noise Ratio:

70 db below peak output

Frequency Response and Equalization

Standard SMPTE or CCIR curves for 16 mm, 35 mm, and 17.5 mm

Plug-In Magnetic Heads for Magna-Tech Recorders and Reproducers

Available in 35 mm, 16 mm, and 17.5 mm

35 mm: 1, 3, 4, 6, and 4-track Cinemascope format; 2 control tracks may be placed outside sprocket holes for 3- 4- 6 track

16 mm: 200-mil edge track
 200-mil center track
 160-mil 2-track EBU
 160-mil 2-track EBU with 1 control track
 90-mil 3-track
 100-mil release edge track

17.5 mm: 200-mil

Muting CircuitRecord Audio Delay: Adjustable; adjusted to 140 ms $3\frac{1}{2}$ frames for 90-feet-per-minute (35 mm) operation

Operates during electronic looping only

Dimensions and WeightType 69C Playback Amplifier

5 in. wide x $1\frac{3}{4}$ in. high x $11\frac{1}{2}$ in. (maximum) deep
 2 pounds

Type 68C Record Amplifier

19 in. wide x $3\frac{1}{2}$ in. high x $12\frac{1}{2}$ in. deep
 5 pounds

Muting Circuit

5 in. wide x 9 in. high x $2\frac{1}{4}$ in. deep
 3 pounds

INSTALLATION

When ordered with the unit, all cabinet-mounted components of the record and playback system are installed in the recorder or reproducer and interconnected at the factory. Units for remote installation are generally packed in cartons that are taped inside the cabinet for shipping. For export the entire unit is shipped in a float-pack, lying on its back in the crate. For unpacking and installation instructions, refer to Section II of the operator's manual.

UNPACKING ADDITIONAL EQUIPMENT

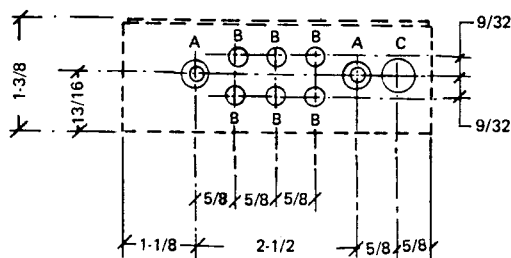
When ordered separately, for installation in or use with existing machines, record and playback system components are carefully packed in suitable cartons or crates for shipment. To unpack crated equipment, first look for special unpacking instructions attached to the crate. In general, the proper procedure is to cut and remove steel straps that surround the crate. Then, use a nail puller to remove the nails that secure the cover on the crate, and remove the cover. Carefully remove packing material and shipping restraints. Carefully remove the equipment from the crate and remove all packing material, shipping blocks, and desiccant packages from the equipment.

Check through all packing material carefully for small items and for instructions and other papers. Check the equipment against the packing list to be sure that you have received and unpacked all items ordered. Inspect the equipment for any signs of shipping damage. If you discover any shipping damage, immediately notify the transportation company and Magna-Tech.

MAGNETIC HEAD ASSEMBLIES

Separate plug-in magnetic head assemblies are supplied as ordered for each film width and track layout to be run. These assemblies are precision units that are critical to the proper performance of the machines. After unpacking, inspect each magnetic head assembly carefully for shipping damage and store it in a location that is protected from physical danger and magnetic fields, preferably in a magnetically shielded cabinet.

CAUTION: Never check a magnetic head winding with an ohmmeter or continuity tester.



ALL DIMENSIONS IN INCHES

HOLE

- A DRILL NO. 11, COUNTERSINK FOR 10-32
- B DRILL 1/4 DIA
- C DRILL 15/32 DIA

Figure 4-1. Type 69C Playback Amplifier, Panel Drilling Dimensions

INSTALLING ADDITIONAL PLAYBACK AMPLIFIERS

In most Magna-Tech recorders and reproducers, Type 69C playback amplifiers are mounted by two screws behind the spindle panels. Refer to your recorder or reproducer Technical Reference Manual and any special drawings supplied for specific locations. Seven holes are required in the panel for amplifier adjustments and test output jack, and two holes are required for the mounting screws. Where these holes have not been provided in advance, drill the panel in accordance with figure 4-1. Then, mount the amplifier behind the panel using the two grey flat-head 10-32 machine screws supplied.

INSTALLING ADDITIONAL RECORD AMPLIFIERS

The Magna-Tech Type 68C record amplifier is designed for mounting by its front panel in a 19-inch rack or cabinet. In machines with 24-inch cabinets, adapter panels are supplied to support the amplifier. Front-panel height requirement is 3½ inches (8.9 cm). Refer to Section II of the Operator's Manual for your recorder or reproducer and any special drawings supplied for cabinet locations. Where blank panels have been used to allow for future expansion, remove the blank panel. In other cases, existing panels must be cut down to make room for the amplifier panel, or separate mounting locations must be arranged. Consult Magna-Tech for specific instructions. Then, mount the amplifier at the front of the cabinet using the mounting screws and adapter panels supplied.

INSTALLING NEW REMOTE CONTROL CIRCUITS

If new remote control circuits are provided, mount the equipment in the cabinet and remote locations using hardware supplied.

INSTALLING MUTING CIRCUIT

If a new muting circuit is supplied for use in electronic looping, attach it to the rear side rail of the cabinet using hardware supplied.

INSTALLING ADDITIONAL AUDIO POWER SUPPLIES

When additional power supplies are required to take care of new amplifiers, refer to Technical Reference Manual and any special drawings supplied.

ELECTRICAL CONNECTIONS FOR ADDITIONAL EQUIPMENT

Install DC power, control signal, and audio cables in accordance with block schematics and cabling diagrams supplied for the installation. For typical connections within the cabinet, refer to the internal cabling diagram in Section II of the instruction manual for your recorder or reproducer. All cables are to be fabricated in accordance with cable lists given on cabling diagrams. Mating plugs are supplied for all connectors. When fabricating audio cables, terminate the shields at only one end to avoid ground loops.

Maintain consistent polarity, or phasing, of all audio connections. For all standard 3-pin XLR connectors, pin 1 is the shield connection, pin 2 is the connection for the low side of the balanced line, and pin 3 is the connection for the high side of the balanced line.

Be sure to follow standard installation grounding practices regarding the separation of power, signal, audio, and chassis grounds. Always route audio cables, especially low-level audio cables, as far as possible from power and control signal cables to avoid hum and noise pick-up.

All input and output audio connections are balanced low-impedance lines. Inputs are designed for bridging across low-impedance lines; be sure that all input lines are terminated in the proper impedance at the source. Output lines are either 600 or 150 ohms balanced, terminated at source, depending on output transformer strapping; refer to

Technical Reference Manual for playback amplifier output transformer connections. All inputs and outputs are designed for standard +4 dbm program level; amplifier gain must be adjusted for use at other levels.

Refer to Technical Reference Manual for location and identification of all connectors for normal studio cabling. Audio input cables are routed to the record amplifiers, audio output cables originate at playback amplifiers and control signal cables connect to the control chassis. Refer to Technical Reference Manual for wiring to record amplifier remote control unit.

FINAL CHECK OF ADDITIONAL EQUIPMENT

After all audio and control cables have been connected, make a final check of the unit before applying power and running a performance test.

1. Check that all printed circuit boards in the record amplifiers and playback amplifiers are firmly seated in their sockets.
2. Check that relays and strapping plugs in the record amplifier are securely seated in their sockets.
3. Check all new cabling with an ohmmeter to be sure that it is correct before making final connections. Check power outlets with a voltmeter to be sure that voltage, polarity, and grounding are correct before connecting the audio power supplies.
4. Check that all new cables are connected to the correct connector, and that all plugs are firmly seated and locked in their sockets.
5. Check the fuseholder on each audio power supply to be sure that an intact fuse of the correct type and rating is installed and that the fuseholder knob is properly seated.
6. Proceed to the initial adjustments (if required) and to the performance tests.

INITIAL ADJUSTMENTS

Unless specifically ordered for other application, each record and playback amplifier is adjusted at the factory as summarized in table 4-2. If your studio requires a different arrangement, make the necessary adjustment in accordance with the

Table 4-2. Initial Adjustments

ITEM	FACTORY SETTING	REFERENCES
Output impedance	600 ohms	Output transformer connections
Standard program level Output	+4dBm	Playback amplifier adjustment
Input	+4 dBm	Record amplifier adjustment
Record level and bias	Adjusted for 3M Type III red oxide film stock	

information referenced in the table. Before adjusting levels or bias, be sure to learn the operating instructions and run the performance tests given in this section.

PERFORMANCE TESTS

A test report is included, as the final page of this manual, with each unit shipped from the Magna-Tech factory and is a record of final test performance before shipment. Once the unit has been installed, connected to studio cabling, and carefully checked, run the performance tests to be sure that the unit, as installed and connected, is ready to operate in accordance with specifications. Before beginning the performance tests, be sure to learn the operating instructions for your machine and for

the record and playback system. Then, do the performance tests as instructed in this section.

OPERATION

Figures 4-2 through 4-4 show the location of each Type 68C record amplifier and Type 69C playback amplifier operating control and briefly describe its function. Recording and playback operating instructions are presented for each mode of operation available on a typical unit. Be sure to review the transport operating instructions given in Section III of the instruction manual for your recorder or reproducer. Moreover, you must keep system considerations in mind. In a typical mixing studio, for example, several machines will be running as reproducers or dubbers while one machine is running as a recorder.

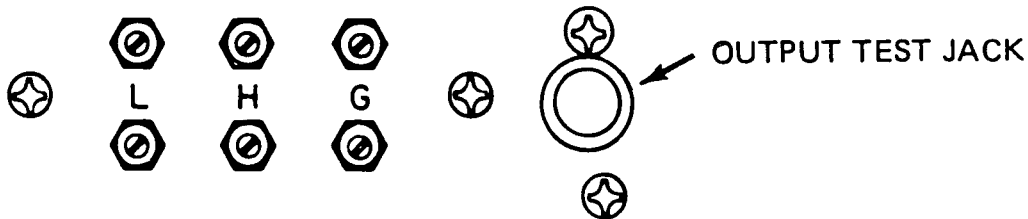


Figure 4-2. Type 69C Playback Amplifier, Controls and Test Connector (Sheet 1 of 2)

NAME	FUNCTION
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NOTE: Dual-equalization playback amplifier is shown; upper row of controls is normally used for 35-mm equalization characteristic, lower row is normally used for 16-mm equalization characteristic. Optional arrangement may provide other pairings. Automatic switchover generally provided.

Single-equalization playback amplifier has only one row of controls.

Also refer to playback amplifier adjustment instructions in this section.

NAME	FUNCTION
L (low frequency) control	Controls low-frequency emphasis characteristic. Adjust to achieve flat low-frequency response when playing corresponding multifrequency test film (6 dB down at 50 Hz for 35-mm Cinemascope).
H (high frequency) control	Controls high-frequency de-emphasis characteristic. Adjust to achieve flat high-frequency response when playing corresponding multifrequency test film.
G (gain) control	Controls output signal level to meet system requirements. Adjust for standard level output (0 VU console meter indication) when playing test film recorded at standard level.
Output test jack	Quarter-inch tip-ring-sleeve telephone jack; provides standard level, balanced to ground output from playback amplifier for monitoring or measuring. Insertion of plug automatically disconnects normal output lines.

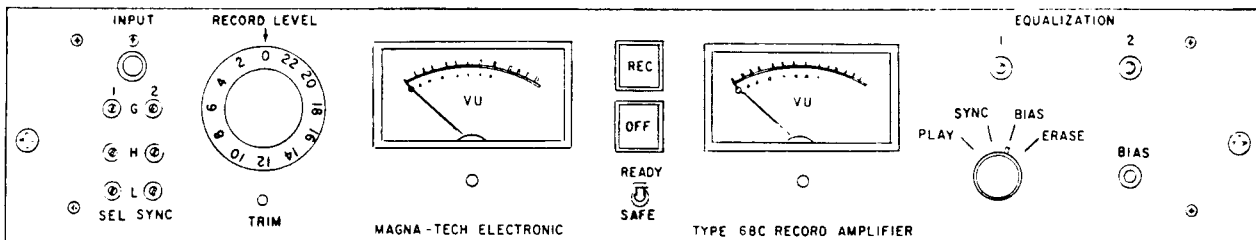


Figure 4-3. Type 68C Record Amplifier, Controls and Indicators (Sheet 1 of 2)

NAME	FUNCTION
Test INPUT jack	Quarter-inch tip-ring-sleeve telephone jack; accepts standard level, balanced to ground test signal input for record amplifier. Insertion of plug automatically disconnects normal input from amplifier.
Dual equalization Sel-Sync amplifier adjustments (optional)	L – low frequency adjustment; H – high frequency adjustment; G – gain control; (row 1 normally used for 35 mm, row 2 for 16 mm equalization).
RECORD LEVEL control	Controls signal level recorded on film; does not affect VU meter indication. Turn clockwise to increase signal level. Correct level depends on recording stock and head assembly in use. Set to position listed in pre-set information for film stock and head assembly to be used.
Input VU meter	Indicates record amplifier input signal level in volume units; not affected by RECORD LEVEL control setting.

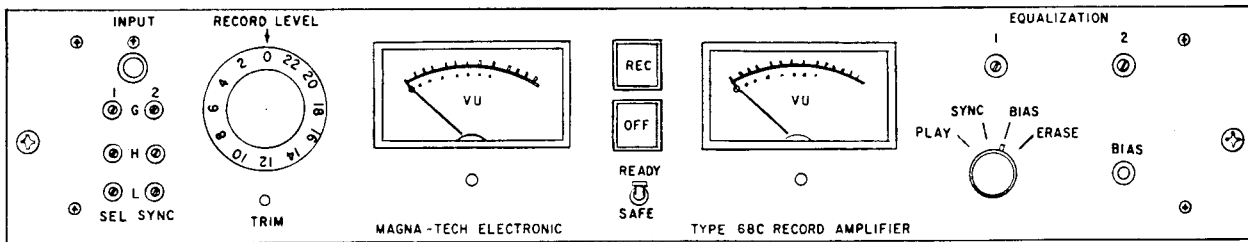


Figure 4-3. Type 68C Record Amplifier, Controls and Indicators (Sheet 2 of 2)

NAME	FUNCTION
Record on and off controls REC switch (red)	Starts recording on film; lights while recording is in progress. Recording may also be started from remote control station. If record amplifier is equipped for pick-up recording, you may start recording at any point without audible interruption provided interlock between previously recorded film and present pick-up insertion has not been broken.
OFF switch (white)	Stops recording on film; lights when recording is not in progress. Recording process may also be stopped from remote control station. If record amplifier is equipped for pick-up recording, you may stop recording at any point without audible interruption provided interlock between previously recorded film and present pick-up insertion has not been broken.
Play/Sync/Bias/Erase VU meter and switch	VU meter indicates the level of the source selected by the switch.
BIAS adjustment	Screwdriver adjustment controls AC bias current during recording. Correct value depends on recording stock and head assembly in use. Adjust for BIAS meter indication listed in pre-set information for film stock and head assembly to be used.
READY/SAFE control	When this toggle switch is in SAFE position, the local and remote REC controls are disabled to prevent accidental recording.
Dual equalization adjustments	Adjusted to provide dual equalization changeover. Normally adjustment 1 is used to 35mm, adjustment 2 for 16mm equalization.

OPERATING INSTRUCTIONS

Before operating the recorder or reproducer, review the transport operating instructions given in Section III of the instruction manual for your machine. When the required head assembly is in place, the film has been correctly threaded, and the transport is driving at the required speed, you may play back or record each track as described in the following instructions.

Playback

When the appropriate head assembly is in place, the recorder or reproducer will play back each

track on the film through the Type 69C playback amplifiers while the film is moving. In many Magna-Tech machines, tape lifters or film tension release mechanisms separate the film from the heads during high-speed, slow-speed, or reverse motion to reduce unnecessary wear. Playback cannot occur when the film is separated from the heads.

Most Magna-Tech machines may be equipped with as many as eight playback amplifiers. Track and head assignments depend on the head assembly in place and the cabling within the unit. Thus, track assignments are determined by the function of the machine in your studio and by the operation you are performing.

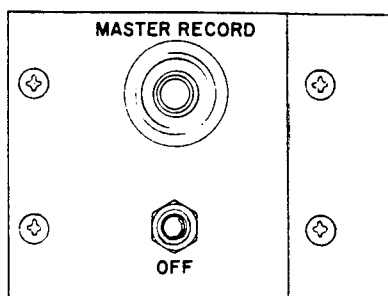


Figure 4-4. Remote Recorder Master Control Panel

NAME	FUNCTION
MASTER RECORD switch	Starts all record amplifiers in the recorder. Red REC switch lights on each record amplifier while recording is in progress.
OFF switch	Stops all record amplifiers in the recorder. White OFF switch lights on each record amplifier when recording is not in progress.

Each Type 69C playback amplifier has one or two rows of equalization and level controls and an output test jack as shown in figure 4-2. Two rows of controls identify a dual-equalization amplifier; one row identifies a single-equalization amplifier. For most dual-equalization units, equalization switch-over is automatic and occurs when film transport speed or the magnetic head assembly is changed.

The output of each playback amplifier can be monitored by plugging into the test output jack. Remember, however, that the normal output audio bus is disconnected from the amplifier when you plug into the test jack. One playback amplifier may be arranged as a local monitor, either speaker or headphone; it may have a switch to change track assignment and a volume control in place of, or in addition to, the level adjustments. Other monitoring arrangements, as well as other audio output arrangements, depend upon the studio patch facilities at your installation.

Recording

When the appropriate head assembly is in place, recorders equipped with one or more Type 68C record amplifiers will record on any track of the film while the film is moving. In many Magna-Tech machines, tape lifters or film tension release mechanisms separate the film from the heads

during high-speed, slow-speed, and reverse motion to reduce unnecessary wear. Recording cannot be accomplished when the film is separated from the heads. Moreover, most recorders are equipped with a reverse record defeat feature; record amplifier erase and bias are automatically cut off when the film is not moving forward at a speed that is within 2 or 3 frames of recording speed. Illuminated record on and off switches are located on the front panel of the record amplifier and on optional remote control units.

Most Magna-Tech recorders may be equipped with as many as eight optional record amplifiers. Track and head assignments depend on the head assembly in place and the cabling within the unit. Thus, track assignments are determined by the function of the machine in your studio and by the operation you are performing.

Each record amplifier may be arranged to erase the track during record; record timing may be arranged for pick-up mixing or for electronic looping. When the amplifier is arranged for pick-up mixing, you can pick up and leave off recording at any point on a previously recorded track without audible disturbance so long as synchronism is maintained. Thus, if the reproducers or dubbers and the recorder are all interlocked, you can run back and repeat any part of the mix. When the amplifier is used for electronic

looping, record off timing is disabled from the looping system. In addition, audio is muted for a brief interval, at the start of every take, until the film is ready to accept new sound. You can begin recording an electronic loop at any point on the film without audible transition if you observe the electronic looping system instructions and allow for the muting period.

Each record amplifier has front-panel record on and off switches, audio level, erase and bias meters, record level, equalization and bias adjustments, and a test input jack as shown in figure 4-3. The input level meter allows you to observe incoming audio bus level in volume units (VU) during recording; the second meter allows you to observe playback or sel-sync output audio level in volume units as well as bias current and erase current during recording. The record level control allows you to adjust the signal level recorded on the film if required by film stock or head assembly characteristics. The jack allows you to patch a test signal into the record amplifier input. Remember, however, that the normal audio bus input is disconnected from the amplifier when you plug into the test jack. Level and bias adjustment instructions are given later in this section.

Depending on the functions required, each record amplifier may be equipped for either one or two equalization characteristics. For most dual-equalization units, equalization switchover is automatic and occurs when film transport speed or the magnetic head assembly is changed. Equalization adjustments are located on the front panel of each record amplifier. The record timing adjustments and erase current adjustment are located on the rear of each record amplifier.

When recording, observe the following points:

1. Check that correct head assembly is in place and that machine is set for required film and speed.
2. Check that film is correctly threaded and start mark lined up.
3. Perform the audio patching and set-up required. Set RECORD LEVEL control to position listed in pre-set information for the film stock and head assembly you are using. Adjust BIAS control to obtain the BIAS meter indication listed in pre-set information for the film stock and head assembly.

Check audio input levels; the VU meter should indicate 0 for most audio peaks.

4. Operate the transport in local or interlock mode as required for the recording to be done. Review the local and interlock operating instructions in Section III.
5. When the film is running forward at the required speed, and reaches the starting point for recording, press the REC switch at the record amplifier for each track to be recorded, or the record ON switches at the remote control unit. At the record amplifiers, check that the record OFF lights go out and that the REC switches light. Remote control units generally have a ready lamp or pilot to show that record amplifiers have power, a run pilot to show that the recorder is running at recording speed forward, and a record pilot for each track.

NOTE: In electronic looping, remember that there is an approximately 3½-frame muting period after recording starts, and before sound can be recorded.

6. When recording, check that the audio level as indicated by the VU meter is within limits, and that bias and erase current (if erase is used), as indicated by the VU meter, are as required for the magnetic head and recording stock in use.
7. If the machine is arranged for reverse recording defeat, recording stops automatically when film motion changes from recording speed forward. At the record amplifier, the REC light goes out and the OFF switch lights; at remote control units, run and record pilots go out. To resume recording when film motion is again recording speed forward, press the REC switch at the record amplifier or the record ON switch at the remote control unit when the starting point for recording is reached. Special instructions apply to operation with an electronic looping control system.
8. To stop recording, press the OFF switch at the record amplifier or the record OFF switch at the remote control unit. Check that the REC light goes out and that the OFF switch lights. At a remote control unit, check that the record pilots for the tracks in question go out.

Sel-Sync Operation

When a recorder with separate playback and record heads is used in recording and mixing operations, there is a time lag or delay between the recorded audio and the reproduced audio occasioned by the time it takes the film to travel from the record head to the playback head. To avoid this lag and achieve absolute synchronism between recorded and reproduced audio, the record amplifier may be arranged for sel-sync operation.

In sel-sync operation, the record head is used both for recording from the record amplifier and then, when recording is stopped, for playback through a separate, or sel-sync, playback amplifier. Audio

patching must route the signal from the sel-sync playback amplifier to the monitor or other destination you have selected.

When you start recording, either by pressing the record amplifier REC switch or by pressing the Record On switch at a remote control unit, the record head is automatically switched to the record amplifier. When you stop recording, the head is automatically switched back to the sel-sync playback amplifier.

Sel-sync operation is generally used to play back a completed recording in synchronism with the picture.

Table 5-1. Audio Power Supplies (Continued)

Record Supply, Lambda LNS-X-28 (used after Oct 1978)

Line regulation: 0.1 percent for input variations from 105-127, 127-105, 210-254, or 254-210 volts AC

Load regulation: 0.1 percent for load variations from no load to full load or full load to no load

Ripple and noise: 1.5 mV rms, 5 mV peak to peak with either positive or negative terminal grounded

Temperature coefficient: Change in output voltage 0.03 percent/deg C

Voltage overshoot: None at turn-on, turn-off, or power failure

Maximum output current: 3.4 amperes at 40 deg C (104 deg F)

Automatic output current limiting: Safe value

Overtemperature protection: Thermal cutout switch with automatic reset

Input: 105-127 or 210-254 volts AC at 47-440 Hz. Maximum input power 200 watts with output loaded to full current rating and input voltage. 127 volts AC, 60 Hz. Standard LNS-X power supplies are factory wired for 105-127 volt input, but can be rewired for 210-254 volt input. Output ratings apply for 57-63 Hz input. For 47-53 Hz or 63-440 Hz input, consult factory.

Record Supply, Lambda LM-C28 (used before Oct 1978)

Line regulation: Less than 0.05 percent plus 4.0 mV for input variations from 105-132 or 132-105 volts AC

Load regulation: Less than 0.03 percent plus 3.0 mV for load variations from zero to full load or full load to zero

Ripple and noise: 1 mV rms; 3 mV peak to peak

Temperature coefficient: Change in output voltage less than 0.03 percent/deg C

Voltage overshoot: None at turn-on, turn-off, or power failure

Maximum output current: 2.3 amperes at 40 deg C (104 deg F)

Automatic output current limiting: 2.53 amperes maximum, decreasing to safe value as load approaches short circuit

Overtemperature protection: Thermal cutout switch with automatic reset

Input: 105-132 volts AC, 45 to 440 Hz, 140 watts (with output loaded to full 40 deg C rating and input voltage 132 volts at 55-65 Hz)

Dimensions and Weight

Playback Power Supply

19 in. wide x 5¼ in. high x 10½ in. deep
15 pounds

Record Power Supply (with Lambda LNS-X-28)

19 in. wide x 5¼ in. high x 6 in. deep
13 pounds

Record Power Supply (with Lambda LM-C28)

19 in. wide x 5¼ in. high x 6 in. deep
15 pounds