

## DESCRIPTION

## 1.1 GENERAL

Ampex Model AG-440 and AG-445 Magnetic Tape Recorders and Reproducers feature a tape transport capable of handling both 1/4-inch and 1/2-inch tape, and solid-state electronic circuitry constructed on plug-in modules. The AG-440 is a record/reproduce equipment, while the AG-445 is a reproduce-only machine.

Equipment in the AG-440 line is available mounted in Ampex consoles as shown in Fig. 1-1, mounted in portable cases, or unmounted for installation in racks or custom consoles. A basic system consists of one electronic assembly for each channel, a tape transport, and a head assembly.

Each electronic assembly for record/reproduce equipment contains a built-in Sel-Sync\* circuit, which allows recording separate channels at different times while maintaining perfect synchronization. Plug-in accessories, such as microphone preamplifiers, balanced line input transformers, and remote control units are available as optional equipment.

The AG-445, reproduce-only equipment, is available mounted in an Ampex console, or unmounted for rack or custom console installation. Four reproduce-only electronic modules will fit in a tray 3-1/2 inches in height.

\* TM Ampex Corp.



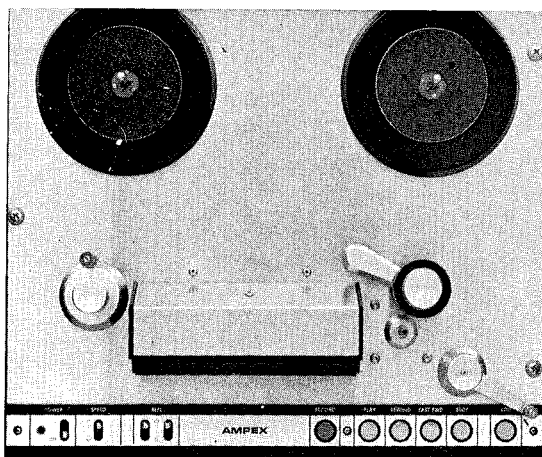
*Fig. 1-1. Ampex Model AG-440, Four Channel, Console Mount*

Insofar as possible, modular construction is used throughout the system. The tape transport is composed of various sub-assemblies, any of which may be removed without unsoldering any connection. Heads plug into receptacles immediately beneath the head housing, and the entire assembly can be easily removed and reinstalled. All relays are of the plug-in type, as is the major portion of the record/reproduce electronic circuitry.

The number of record or reproduce channels which can be accommodated depends on tape width. One or two channels can be utilized with 1/4-inch tape, three or four channels with 1/2-inch tape.

## 1.2 TAPE TRANSPORT

A rigid casting is used as the mounting base for all components of the tape transport. This rigid base makes possible the precise handling of either 1/4-inch or 1/2-inch tape. Supplementing this capability is a quick conversion feature, which allows changing from one width tape to the other in a matter of minutes.



*Fig. 1-2. Tape Transport*

Two tape speeds are available on each transport. Standard speed pairs are 3-3/4 - 7-1/2 inches per second (ips) and 7-1/2 - 15 ips. Speed selection is made at a toggle switch, with electronic equalization automatically switched in accordance with that selection.

Reel switches are provided for each turntable. These are positioned in accordance with

the diameter of the reel hub which is being used. A large NAB hub can be used on one turntable and a small EIA hub on the other.

The transport, as shipped from the factory, will accommodate reels of tape 10-1/2 inches, 8 inches, 7 inches, and 5 inches in diameter. Also, the turntables can be quickly repositioned for use with 11-1/2-inch CCIR reel.

Tape scrape flutter is minimized by the inclusion of a scrape flutter idler, utilizing jeweled bearings, positioned between the record and reproduce head stacks. Mounting facility for a second such idler, which can be ordered as an optional accessory, is provided. The optional idler is mounted to the left of the record head.

A solenoid-controlled tape lifting mechanism automatically removes the tape from contact with the heads during the fast forward or rewind modes. To allow these modes to be used during a cueing operation, manual or electronic override of the tape lifter is possible under local control while electronic override is provided on the optional remote control unit.

Included in a power supply box, mounted to the back of the tape transport, is a plug-in printed circuit card which contains the power supply and master bias and erase oscillator. These circuits are used in conjunction with the record/reproduce electronics. For reproduce-only equipment, the bias oscillator is omitted.

Pushbutton controls are employed to select the mode of operation--play, fast forward, rewind, record, stop, and edit. These switches are mounted on the tape transport control box, positioned adjacent to the head assembly. This control box also contains the receptacles for cables from all other sub-assemblies of the transport, the main fuses, and four plug-in relays (play, rewind, fast forward and edit). Two receptacles allow connection of an optional remote control unit and a precision frequency source; when these accessories are not used the dummy plugs which are provided must be inserted in the receptacles.

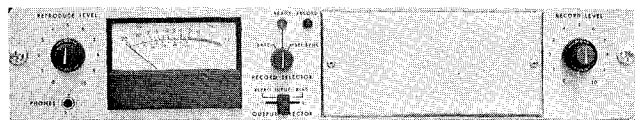
## 1.3 RECORD/REPRODUCE ELECTRONICS

One electronic assembly (see Fig. 1-3) is required for each record/reproduce channel. The assembly consists of an electronic chassis with plug-in printed circuit board modules.

The front panel of the electronic chassis contains all controls and indicators required for the record/reproduce operation. These include

record and reproduce level controls, a three position record selector switch, and a three position output and meter selector switch. Pilot lights indicate that the channel is ready to record and that it is recording. A large meter provides visual monitoring facilities for record, reproduce, and bias levels. The plug-in modules are inserted through an aperture in the front panel, and are guided to printed circuit board receptacles.

Receptacles for interconnecting cables and input/output signal cables are located on the back panel of the electronic chassis, together with an octal socket for accommodating an input accessory or the dummy plug. A line termination switch (which provides correct termination during alignment and maintenance procedures), two alignment controls for the Sel-Sync function, a plug-in relay (record), and a fuse, are also included on this panel.



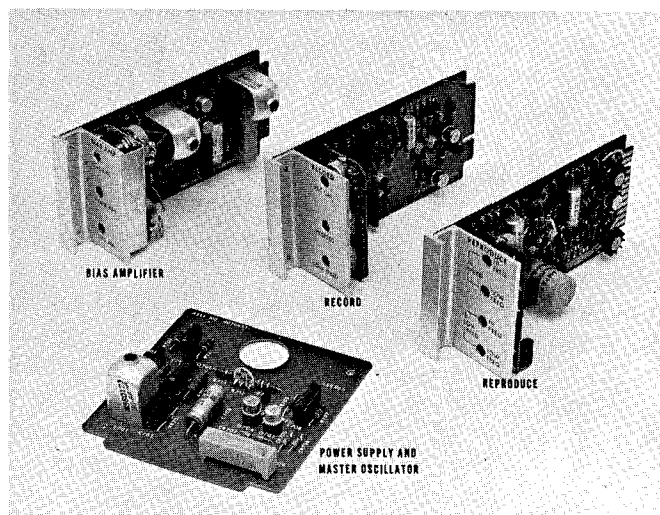
*Fig. 1-3. Record/Reproduce Electronic Assembly*

Supplied with each record/reproduce electronic assembly is a dummy plug and bridging input transformer. The dummy plug is inserted in the accessory socket, on the back panel of the electronics assembly, if an unbalanced line input is used. The bridging transformer is inserted in that socket for a balanced line input; input impedance with the transformer is 20,000 ohms. The equipment is shipped with the dummy plug installed in the socket.

Three plug-in printed circuit boards provide for record, reproduce, and bias amplification. As previously mentioned, these modules are installed through the front panel of the electronic chassis. The record and reproduce modules contain plug-in receptacles for separate equalization printed circuit boards. These equalization boards are mounted at right angles to the main boards, so that alignment controls are available from the front. Equalization is automatically switched, in accordance with the tape speed selected, by a solid state switching circuit.

Internal strapping allows the selection of either a +8 dbm or +4 dbm nominal output level

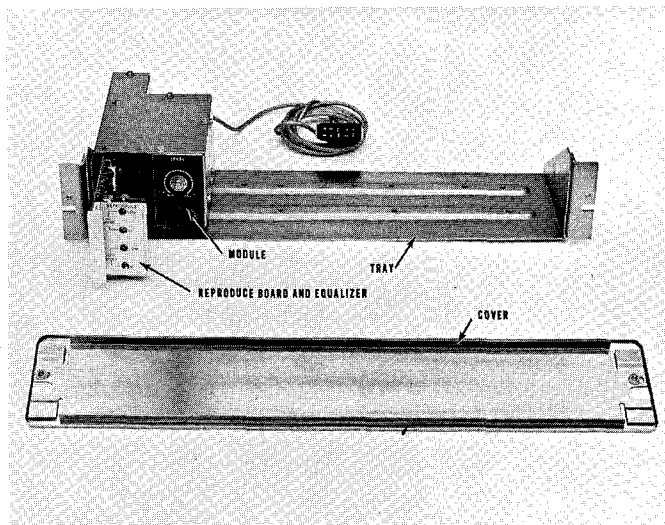
into a 600 ohm line. The equipment is shipped from the factory strapped for a +8 dbm output, but this can be easily changed if necessary.



*Fig. 1-4. Printed Circuit Boards*

#### 1.4 REPRODUCE-ONLY ELECTRONICS

The reproduce-only electronic assemblies are constructed so that up to four reproduce modules will fit in a tray 3 1/2 inches high. That tray can be mounted in a 19-inch rack, or in an Ampex console.



*Fig. 1-5. Reproduce-only Electronic Assembly*

Plug-in reproduce and equalizer printed circuit boards are the same as those used in the record/reproduce equipment. Other required components are mounted on a separate chassis for each electronic channel. The reproduce boards plug into a printed circuit receptacle on that chassis. Complete circuitry required for a reproduce electronic channel is thus provided in each module. As previously noted, up to four modules can be accommodated in the tray.

A screwdriver-operated reproduce level control is provided on the front panel of each module. The back panel contains the reproduce head input receptacle, the line output receptacle, a monitor jack, and a line termination switch (for use during tests and adjustments). A captive power cable, which connects to the electronic power supply box on the tape transport, leaves the module at the back.

## 1.5 HEAD ASSEMBLY

Several head configurations are available. Head housings provide mounting positions for four head stacks; these positions are numbered one through four from left to right when the assembly is viewed from the front. The erase, record, and reproduce head stacks are normally mounted in positions 1, 3, and 4 respectively.

For operation with 1/4-inch magnetic tape, full track heads or two track heads (either normal two track or quarter track) are available. Note that for single channel half track operation, a complete two track head assembly is provided. A special four stack record/reproduce assembly is available which provides two track erase, two track record, quarter track reproduce, and two track reproduce heads; this assembly has a switch which is positioned to connect either the quarter track or two track reproduce heads into the circuit.

For 1/2-inch magnetic tape, three track or four track heads are available. Erase, record, and reproduce stacks are mounted in the normal positions.

Complete head assemblies can be easily changed. In conjunction with the quick conversion feature of the tape transport, this provides a very flexible system, which can be changed in a few minutes from a three or four channel recorder using 1/2-inch tape to a one or two channel recorder using 1/4-inch tape.

Heads for reproduce-only equipment contain only reproduce heads: a dummy post is mounted in the normal erase head position to provide correct tape passage through the assembly. One or two track heads are available for 1/4-inch tape. The two track assembly is provided with both the normal two track head and a 1/4 track head; a switch provides means of selecting the head desired. Three or four track heads are available for 1/2-inch tape operation.

## 1.6 ACCESSORY EQUIPMENT

### 1.6.1 Input Accessories

An octal socket is located on the back panel of each electronic assembly. A dummy plug is provided with each assembly; this plug is inserted in the octal socket when recording from an unbalanced line. If a balanced line or microphone input is to be used, the dummy plug must be replaced with one of the following accessory items.

Also provided for each electronic assembly, is a bridging input transformer (Catalog No. 4580200-01). This transformer provides unity gain, with an input of 20,000 ohms, when a balanced line input is used. It replaces the dummy plug in the accessory socket.

Available as an optional accessory is a matching input transformer (Catalog No. 4580200-02) which provides a gain of approximately 14 db from a balanced line.

Recording directly from a microphone requires the use of a microphone preamplifier (Catalog No. 4010066). This is a two stage solid state preamplifier wired so that when it is inserted in the octal socket the record level control is connected between the two stages. The preamplifier is thereby made a variable gain device, which will accommodate a wide range of professional-quality microphones. This is an optional accessory.

### 1.6.2 Remote Control (Optional)

A desk type remote control unit, Catalog No. 4010080, allows operation of the system from a remote location. The play, record, fast forward, rewind, and stop functions can be pushbutton-controlled from this unit. A sixth pushbutton electrically defeats the tape lifter action in fast-winding modes, so that those modes can be used to quickly cue a tape to the desired spot. Three indicator lights--for ready, tape motion, and record--are provided.

### 1.6.3 Precision Frequency Source

A motor drive amplifier can be plugged into a receptacle on the tape transport control box to provide a precise drive for the capstan motor. The dummy plug (which is provided) can be used as a mating plug for the receptacle by removing the jumper.

If a precision frequency source is not used, the dummy plug (as supplied) must be inserted in the receptacle at the tape transport.

### 1.6.4 Rear Covers, Consoles (Optional)

If covers for the back of console mounted equipment are desired, they are available as optional accessories. Catalog numbers for rear cover sets (1 cover for console base, 1 cover for each electronic assembly) are 4010076-01, 4010076-02, 4010076-03, and 4010076-04 (dash numbers indicate the number of electronic covers in the set).

When ordered separately the rear cover for the console base is Catalog No. 4040982, individual covers for electronic assemblies are Catalog No. 4040984.

### 1.6.5 Scrape Flutter Idler (Optional)

One scrape flutter idler is furnished on the tape transport. A second idler is available as an optional accessory kit under Catalog No.

4010069. All transports have mounting facilities for the second idler. Note that the optional idler is not interchangeable with the one normally supplied, because it is larger.

### 1.6.6 Extender Boards (Optional)

Extender boards are available for the plug-in printed circuit boards (bias amplifier, record, reproduce, and power supply and bias oscillator boards). These extender boards plug into the receptacle inside the housing, the circuit boards then plug into the extender card. Testing of voltages, continuity, etc., during corrective maintenance procedures, can then be performed with the printed circuit boards outside of the housing. Catalog numbers of the extender boards are:

For reproduce board	4020151
For record board	4020152
For bias amplifier board	4020153
For power supply board	4020154

### 1.6.7 CCIR Record Equalizer (Optional)

A CCIR plug-in equalizer, Catalog No. 4020269-03, is available for the record circuit. Note that the standard reproduce equalizer supplied with the equipment has an adjustment range sufficient to allow its use for either NAB or CCIR equalization.

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## 1.7 SPECIFICATIONS

### Tape Width and Channel Configurations

1/4-inch Tape -- 1 or 2 Channels  
1/2-inch Tape -- 3 or 4 Channels

### Tape Speeds Available

Two Speeds:  
3-3/4 and 7-1/2 ips or  
7-1/2 and 15 ips

### Reel Size

5 inch, 7 inch, 10-1/2 inch, EIA or NAB. Adjustable to accept 11-1/2 inch CCIR; CCIR reel adaptors available. Reel switches for each turntable provide proper tension for large or small reel hubs.

### Input

100,000 ohms unbalanced; convertible to 20,000 ohms balanced with plug-in bridging transformer supplied. Will accept line levels from -17 dbm to produce recommended operating level.

### Output

600 ohms balanced or unbalanced, with nominal output levels of +4 dbm or +8 dbm.

Equalization Switched automatically by transport speed selector; solid state switching employed. Equalization circuits on plug-in cards.

Electronics Completely solid state. Plug-in printed circuit boards for record, reproduce, and bias amplifiers. Built-in Sel-Sync (selective synchronization) feature. Power supply and bias oscillator on separate plug-in printed circuit board inserted in power supply box on tape transport.

Overall Frequency Response 15 ips NAB:  $\pm 2$  db 30 Hz to 18,000 Hz  
 7-1/2 ips NAB:  $\pm 2$  db 40 Hz to 10,000 Hz  
                   +2-4 db 30 Hz to 15,000 Hz  
 3-3/4 ips:  $\pm 2$  db 50 Hz to 7,500 Hz

Signal-to-Noise Ratio

<u>Tape Speed</u>	<u>Full Track</u>	<u>Half Track or 2-Track</u>	<u>3-Track</u>	<u>4-Track</u>
15 ips NAB	68 db	60 db	62 db	60 db
7-1/2 ips NAB	68 db	60 db	62 db	60 db
3-3/4 ips (120 micro secs.)	63 db	56 db	----	----

Signal-to-noise is measured from peak record level, which is 6 db above Ampex operating level, to unweighted noise. Noise is measured while erasing a 500 Hz signal which was recorded at peak record level, using a filter to attenuate noise outside of the audio spectrum. 201-type low noise tape, biased for maximum sensitivity at 15 mil wavelength is used.

When noise is measured on an ASA "A" weighted curve, the signal-to-noise ratio is:

<u>Tape Speed</u>	<u>Full Track</u>	<u>Half-Track or 2-Track</u>	<u>3-Track</u>	<u>4-Track</u>
15 ips NAB	70 db	64 db	65 db	64 db
7-1/2 ips NAB	70 db	64 db	65 db	64 db
3-3/4 ips (120 micro secs.)	65 db	58 db	----	----

Bias Oscillator and Power Supply

Power supply box on tape transport contains plug-in bias oscillator and electronic power supply. Nominal bias/erase frequency 150,000 Hz.

Tape Lifters

Tape automatically lifted from heads in fast forward or rewind modes. Manual or electronic override possible during local control, electronic override feature on remote control.

<u>Capstan</u>	Hard chrome plated capstan shaft.
<u>Even-Order Distortion</u>	Second harmonic distortion of a 500 Hz signal recorded at peak record level is less than 0.4%.
<u>Flutter and Wow</u>	15 ips: Maximum 0.08% rms 7-1/2 ips: Maximum 0.1% 3-3/4 ips: Maximum 0.15% rms
	Measured according to ASA Z57.1-1954 measuring all components from 0.5 Hz to 200 Hz.
<u>Start Time</u>	Up to speed in 0.1 second; maximum of 3.5 seconds to reach stable tape motion (within Flutter and Wow specification).
<u>Tape</u>	Specifications based on use of M. M. M. Type 201 Low Noise Tape, or equivalent.
<u>Speed Accuracy</u>	Better than $\pm 0.2\%$ .
<u>Rewind Time</u>	Approximately 1 minute for 2400-foot NAB reel.
<u>Electronic Overload Margin</u>	Record Amplifier -- record level before clipping is at least 28 db above normal operating record level. Distortion less than 1% up to clip level.  Reproduce Amplifier -- output level before clipping is +29 dbm (21 db above normal operating level).
<u>Operating Controls</u>	Input and output level rotary controls, supplied with knob lock.  Record selector -- 3 positions, "Safe", "Ready", "Sel-Sync".  Output and meter selector -- 3 positions, "Reproduce", "Input", "Bias".  Toggle switches for Power, Tape Speed, and Reel(2).  Mode controls -- Pushbutton control of Play, Fast Forward, Rewind, Record, Stop, and Edit. Edit modes available are Stop/Edit, Play/Edit, and Fast-winding/Edit. All modes except Stop/Edit and Play/Edit can be remotely controlled.

Power Requirement

105 to 125 volts, ac, 60 Hz. Equipment for operation with 50 Hz power line frequency available.

Approximate Power Consumption

1 channel system: 2.3 amps

2 channel system: 2.5 amps

3 channel system: 2.7 amps

4 channel system: 2.9 amps

