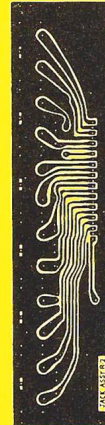
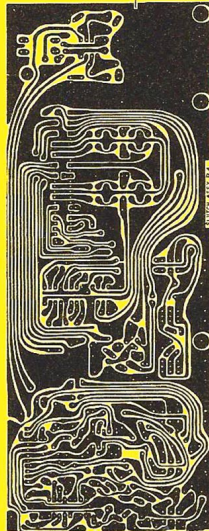
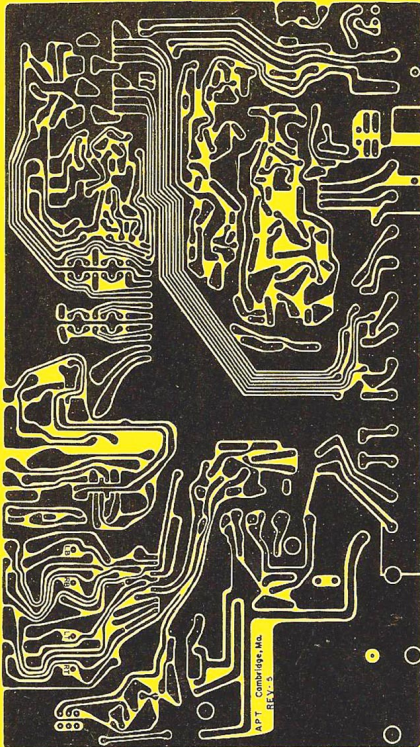


# The Apt/Holman Preamplifier Owner's Manual

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Underwriting organizations require and common sense dictates the following:

WARNING: To prevent fire or shock hazard, do not expose this appliance to rain or moisture.

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### **Introduction**

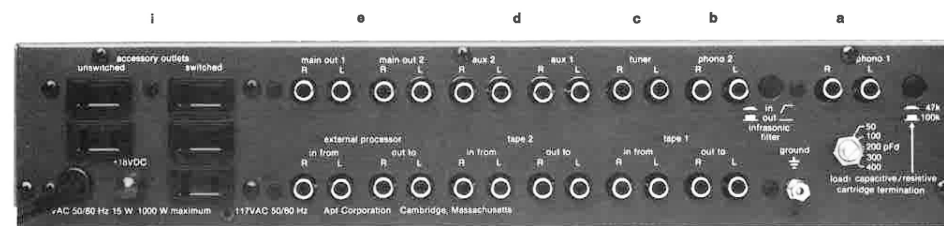
Thank you for purchasing the Apt/Holman Preamplifier. Because the design of this product has evolved from a thorough analysis of how a pre-amplifier should (and should *not*) behave, various aspects of its performance are either subtly or distinctively different from previous pre-amps. We have provided a detailed Owner's Manual to help you fully exploit its capabilities; we hope that you will find it useful. The Manual has been designed to alternate between material of primary importance, and that required for explicit detail.

Please fill in and mail the Owner's Registration Card.



#### Front Panel

- a** program source: Selects input signals, except for tape.
- b** volume: Adjusts level in small increments.
- c** tape 1 and tape 2: Engaging either button enables the output of the corresponding recorder to be heard, regardless of the settings of the Program Source and Dubbing controls. A white indicator appears in each button when it is engaged. If both buttons are pressed, Tape 2 only is heard.
- d** dubbing switches: Controls the copying from tape recorder 1 to tape recorder 2 (dub 1>2) and from recorder 2 to recorder 1 (dub 2>1). A green indicator appears in each button when it is engaged. Avoid engaging both switches simultaneously—see text. The dubbing function is unaffected by the tape monitor switches.
- e** external processor: Permits a signal-processing accessory such as a noise-reduction device or an equalizer to be inserted in the signal path (switch up) or bypassed (switch down).
- f** channel assignment switches: Enables left or right inputs to be assigned to either or both output channels, as follows:
- | Switch: | L>R  | R>L  |                          |
|---------|------|------|--------------------------|
| down    | down | down | normal stereo            |
| up      | down | down | L source to both outputs |
| down    | up   | up   | R source to both outputs |
| up      | up   | up   | stereo reverse           |
- g** balance: Shifts the sound to the left (counter-clockwise) or right (clockwise). Detent at center identifies exactly equal output gains.
- h** mode: Controls the stereo imaging. Detent identifies normal stereo exactly. Rotation toward left (counterclockwise) progressively blends channels together into mono. Rotation toward right (clockwise) cancels mono components and accentuates stereo difference signals. At full clockwise rotation only difference signals are heard.
- i** bass: Controls balance of low frequencies.
- j** bass mode: With switch down (>—), bass control affects mainly deep bass frequencies, with minimal effect on mid-bass. With switch up (>—), bass control affects entire bass range uniformly.
- k** treble: Controls balance of high frequencies.
- l** high filter: With switch down, preamp response rolls off above 40 kHz. With switch up, rolloff starts at 8 kHz to remove distortion and noise from worn recordings.
- m** tone defeat: With switch down, tone controls and high filter circuits operate normally. With switch up, tone and high filter circuits are bypassed.
- n** mute: Engaging the button silences the output of the preamplifier leaving the headphone jack active; a white indicator appears in the button when engaged.
- o** power: Switches on power to the pre-amplifier and to other devices connected to the switched AC outlets on the rear panel. The light emitting diode above the switch lights when power is applied.



#### Rear Panel

- a** phono input 1: Connect input from turntable here. As there is no standard color code for turntable cables, consult the owner's manual applicable to your particular situation for proper left/right connection. Set the input resistance and capacitance as required for the particular arm and cartridge combination with the input resistance and capacitance switches. Refer to the accompanying list of cartridge requirements and tone arm cable capacitances.
- b** phono input 2: Connect input from a second turntable as above. The input resistance is 47 kohms; the input capacitance is 50 picofarads.
- c** tuner: Connect the output of a tuner here. If you have a choice of fixed and variable output levels from your tuner, the variable output level will allow you to match gain with phono.
- d** aux 1 and aux 2: Provide additional high-level inputs for connection to the output of an AM radio, TV tuner, tape player, etc.
- e** main out 1 and main out 2: Provide two sets of output connections. Normally main out 1 will be connected to a power amplifier, while main out 2 will be reserved for a time-delay system, a recorder connection for those times when recording the effect of the tone, mode, and volume controls is desired, or similar uses. Main out 2 has an internal level option which can be used to better match systems with excess sensitivity.
- f** tape 1 out to/in from: Sends signals to and receives signals from one tape machine. The signal sent to the recorder depends on the setting of the dub 2>1 switch; with the button out the input signal to the recorder is the output of the program selector switch, and with the button engaged, the input signal sent to the recorder is the output of tape recorder 2.
- g** tape 2 out to/in from: Sends signals to and receives signals from a second tape machine. The signal sent to the recorder depends on the setting of the dub 1>2 switch; with the button out the input signal to the recorder is the output of the program selector switch, and with the button engaged the input to the recorder is the output of recorder 1.
- h** external processor out to/in from: Allows for a room or speaker equalizer, a compressor-expander, or a similar unit to be inserted in the main signal path. It also may be used for a third recorder.
- i** AC Outlets: Provide switched and unswitched AC for connection of system components. Connect electronic components to the switched outlets. Connect electro-mechanical components, such as turntables and tape recorders, to the unswitched outlets.
- j** +18 VDC jack: Connect *only* the power supply cable of accessories designed for +18 VDC power to this jack.
- k** AC Line Input: Connect the cord to an unswitched source of 120 VAC power.

**Installation and Operation at a Glance**

*Connections for a Typical Installation:*

**Phono 1:** Consult the accompanying list of phonograph cartridge termination requirements and tone arm cable capacitances to find the optimum resistance and capacitance values for the cartridge you are using. On the rear panel, set the resistance and capacitance switches as per the instructions on the accompanying sheet.

Install the turntable on a stable, solid surface to prevent vibration, and at a sufficient distance from the power amplifier to prevent interference from stray hum fields. The Holman preamplifier does not itself produce any measurable stray hum field. The turntable's line cord goes to an unswitched ac outlet on the back of the preamp. The ground wire from the turntable (if any) should be connected to the binding posts labeled ground. As there is no standard color code for turntable cables, consult the owner's manual applicable to your particular situation for proper left/right connection. Without a standard, a guideline is: if the pair contains one red plug, it will correspond to the right channel, and among light colored vs. dark colored pairs, the lighter color will represent the left channel.

**Tuner:** Connect to tuner input. Connect line cord to switched ac outlet.

**First tape recorder:** Connect the tape recorder's inputs to "tape 1 out to," and connect the tape recorder's outputs to "tape 1 in from." Connect line cord to unswitched ac outlet.

**Second tape recorder:** Follow the same procedure as for the first tape machine, only connect to tape 2.

**Power amplifier or powered loudspeakers:** Connect to "main out 1." Connect line cord(s) to switched ac outlets.

*Operation*

**Phonograph:** Set selector switch to phono 1.

**Tuner:** Set selector switch to tuner.

**Tape recorder(s):** There is no selector switch position for tape recorder; rather, for the sake of flexibility, the use of a tape recorder is controlled by the sets of switches marked *tape* and *dub*.

Since it is connected to unswitched ac, the turntable will need to be switched on separately, ensuring that the turntable will run only when actually in use, and guarding against wear and possible damage to moving parts.

Use output level control on tuner to match level with phono.

The tape switches override the selector switch, and the dub switches connect the two tape recorders together. This feature allows for simple switching with maximum utility:

To listen to first recorder: Press tape 1 so that a white disc appears.

To listen to second recorder: Press tape 2.

**Power amplifier:** Connect main out 1 to inputs of power amplifier. Connect line cord to switched ac outlet. Protect speakers from transients, such as setting down a stylus on the record, by using the mute switch.

**Headphones:** All dynamic headphones, regardless of impedance, may be used.

To record onto first recorder from phono, tuner, or aux, engage the record mode of recorder 1. The signal supplied by the program selector switch is always present at the tape recorder input, unless one of the dub switches has been actuated. This means that it is possible, for instance, to copy tapes, or to play a tape for friends, while recording a radio program at the same time—without replugging any cables.

To dub (copy): Press the dub button for the appropriate direction.

### Installation

The location of the Holman preamplifier relative to other components is generally not critical. The unit may be mounted in any orientation. Since this preamp does not radiate a significant external hum field, and is designed to be immune to most externally induced hum or other interference, it may safely be stacked on or adjacent to most other audio components.

(Some power amplifiers, however, may radiate such a strong external hum field that their installation near any other audio components is inadvisable.) The preamp has relatively small power dissipation so that, in general, special provisions for ventilation are unnecessary.

In most installations, of course, the preamp and turntable should be located close to each other in order to keep the phono cables short. Long *phono* signal cables increase the likelihood of hum, radio interference, and frequency-response aberrations due to cable capacitance. The best procedure is to begin by locating the turntable on a stable, vibration-free surface, and then to arrange the preamp and other system components in convenient locations nearby.

Because the front-panel controls on the Holman preamp are more genuinely useful and precise than usually found, they invite more frequent use, making it especially desirable, where possible, that the preamp be located within arm's reach of your usual listening chair.

### AC Convenience Outlets

Five accessory AC power outlets are provided on the rear panel.

If you wish to rack-mount the preamp, a replacement front panel cut to standard EIA rack dimensions is available from your dealer or direct from the factory. Request the number 100 replacement panel.

Devices which are potentially subject to mechanical wear (e.g. turntables, tape decks) should be plugged into the Unswitched outlets. All-electronic components such as FM tuners, equalizers, and power amplifiers can be powered from the Switched outlets, being turned on and off by the preamp's power switch. The Apt preamp is equipped with a heavy-duty AC line cord and a special 1000 watt power switch, permitting practically all stereo power amplifiers to be powered from the switched accessory outlets.

### +18 VDC Outlet

**Caution:** Do not plug audio signal cables into this jack.

This jack, located below the Unswitched AC power outlets, supplies a regulated DC voltage which can be used to power certain accessory devices which are designed for such a supply. The DC current is fed to the jack through a 1000 ohm resistor required by underwriting organizations, so the voltage supplied to an accessory will be reduced by 1 volt for each milliampere of current drawn by the accessory; thus if an accessory draws 3mA, the actual voltage at the jack will be  $18 - 3 = 15$  volts DC.

## Input and Output Connections

### Phono 1 and Phono 2

The sound quality of a phono pickup cartridge is strongly influenced by its frequency response, which in most pickups is, in turn, affected by the phono input impedance.

In the Phono 1 input the resistance and capacitance are independently adjustable in order to allow you easily to select the combination which is optimum for your cartridge. The Phono 2 input is provided with the “standard” input impedance: 47,000 ohms in parallel with 50 picofarads. See the sheets labeled “Phono Input Impedance Matching” which accompany this manual for instructions on setting the input resistance and capacitance.

Connect the left channel of the phono cables to the left input, and the right channel to the right input.

The design of the Holman preamp eliminates the complex impedance interactions which in earlier designs often caused unpredictable response aberrations. The input impedance is a simple combination of resistance and capacitance.

If you are using a single turntable, it should normally be connected to the Phono 1 input. If you use two turntables (or two arms), the one whose cartridge is more load-sensitive should be connected to Phono 1, reserving Phono 2 for cartridges which are optimized for the standard impedance or are insensitive to load impedance.

A modification may be made to the Phono 2 input to accommodate unusual cartridge termination requirements. Contact Apt Corporation for details regarding this modification.

If you are using a moving-coil cartridge with a transformer or an external pre-amplifier, the output of the transformer or pre-preamp may be connected to either phono input.

An optional plug-in pre-amplifier module for moving-coil cartridges is available for installation within the Apt pre-amp. It replaces the standard Phono 2 input circuit and provides for the differing step-up gain and input-impedance requirements of various moving-coil pickups. It also provides compensation for the undamped high-frequency resonance of many moving coil cartridges.

Installation of the optional pre-preamp module in the Phono 2 circuit of the Apt preamplifier, or custom modification of the Phono 2 input impedance to suit special requirements, has no effect on the Phono 1 input. The two phono inputs have independently determined impedance characteristics. Thus Phono 2 can be optimized for a moving-coil or other non-typical cartridge, while the Phono 1 input retains its flexibility to provide the optimum load impedance for any moving-magnet or induced-magnet cartridge.

### Tuner

Plug the signal cables from an FM or AM/FM tuner into these jacks. If your tuner has both “fixed level” and “variable” outlets, in most cases it will be preferable to use the “variable” outputs whose level is controlled by an output-level control on the tuner.

### Aux 1 and Aux 2

Connect to these jacks any “line level” signal sources,

### Main Out 1

Connect cables from these jacks to the input of your power amplifier.

Use that control to adjust the relative volume of the tuner so that you can switch from Phono to Tuner on the preamp without having to substantially alter the setting of the preamp's Volume control.

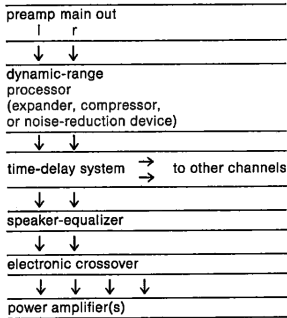
such as an AM tuner, TV audio from an a.c.-line-isolated TV set or TV tuner, the output of a microphone preamplifier, a child's phono with ceramic pickup cartridge, or the output of a play-only tape machine (e.g. an eight-track cartridge player). A normal record/play tape machine is connected to the “tape” inputs and outputs.

If you are using an electronic crossover to bi-amplify or tri-amplify your system, connect cables from the Main Out 1 jacks to the input of the electronic crossover unit, then connect cables from the outputs of the crossover unit to the inputs of the power amplifiers. If you are using a time-delay system whose functions include optional processing of the signals going to the primary (front) loudspeakers, then connect cables from the Main Out 1 jacks of the Apt preamplifier to the main input jacks on the time-delay unit, and the front-output jacks of the time-delay unit will then be connected to the power amplifier input (or to an electronic crossover in the case of a bi-amplified system).

If your loudspeakers require the use of a special accessory equalizer (e.g. Bose 901, E-V interface, etc.), the Main Out 1 signals should be fed to the equalizer, and the output signals from the equalizer should be fed to the power amplifier. But if the Equalizer lacks a bypass switch and you also want to use the power amp to drive electrostatic headphones or speakers not requiring equalization, then the equalizer should be connected to the External Processor jacks, where it can be bypassed at will.

If you are using an octave equalizer, parametric equalizer, or other special purpose equalizer specifically for the purpose of “voicing” the system—i.e., to tailor the speaker/room combination for appropriate response as measured at the listener's chair—this equalizer may be connected to the Main Out 1 jacks, with the equalizer's output feeding the power amplifier input. However, if you are using an equalizer as a highly flexible tone control, to compensate for the varying deficiencies in recordings and broadcasts, then in most systems it is preferable to





connect it to the External Processor jacks (where the equalizer can easily be bypassed when not in use and can be used to improve signals fed to the Headphones jacks and the Main Out 2 jacks as well).

A dynamic-range processor may be connected to the Main Out 1 jacks, if desired. However, if the dynamic processor is not equipped with a bypass switch, it would be preferable to connect the processor to the preamp's External Processor jacks so that it can be bypassed when not in use. The latter connection also enables the dynamically-expanded signal to be heard at the Headphones jack and the Main Out 2 jacks as well.

If you are connecting more than one of these optional components between the preamp and the power amp(s), the following order of components in the signal path is usually preferable. (Deviations from this order are permissible in special circumstances. If four identical speakers which require electronic equalization are used as the front and rear speakers with a time-delay system, for instance, then a single speaker-equalizer could be connected *ahead* of the time-delay unit to provide proper compensation for all four.)

The main outputs of the Apt preamp will drive any load impedance of 5000 ohms or greater, and any capacitance less than 3000 picofarads to 7 Vrms. Thus, if the input impedance of the power amplifier is 50K ohms, the preamp can drive up to ten such power amps at the same time. A combined load impedance of as little as 2K ohms will limit the maximum output to 3 Vrms, still enough voltage to drive all known power amplifiers. If typical audio connecting cable rated at a capacitance of 50 pF per foot is used, the preamp will drive a total of up to 60 feet of such cable in each channel—either in the form of one 60-foot cable or six 10-foot cables. This means that if you are using powered loudspeakers with built-in power amplifiers, or if you choose to place your power amplifier close to the loudspeakers in order to avoid the adverse effects of long speaker-connecting wires, you may safely place the Apt preamp at the far end of the room from the power amps and speakers. Long connecting cables from the Main Out jacks of the Apt preamp will have no adverse effect on the sound.

Apt Corporation offers a pair of appropriate 30-foot cables for installations requiring such length. Request the number 101 cable set.

**Main Out 2**  
The Main Out 2 jacks are electrically identical to the Main Out 1 jacks and are connected in parallel with them.

They may be used for any of the following purposes:

They enable the connection of a second power amplifier, without requiring the use of Y-connecting adapters.

If you are using a time-delay system whose functions do not include processing of the front-speaker signals, connect it to the Main Out 2 jacks; this permits the delayed rear-channel ambience signals to be derived from the front-channel signals without adversely affecting the primary signals themselves. With the time-delay unit connected at the Main Output of the preamp (rather than at the Tape Out or External Processor jacks), the preamplifier's controls—including the Volume, Tone, and Mode controls—become convenient "master" controls affecting the front-speaker and derived rear-speaker signals equally.

The gain of the Apt preamp has been chosen so that with signal sources having normal output level, power amplifiers of typical sensitivity, and loudspeakers of typical efficiency, the system will produce normal loudness levels when the Volume control is set approximately midway in its range. The Volume control range has been chosen to accommodate wide variations in associated equipment and individual listening preferences. However, it may happen that with a high-output program source, an unusually sensitive power amplifier and a very efficient speaker system, a Volume control setting of only 9 o'clock might produce the highest sound levels you wish to hear. Provision has been made in the design of the Main Output 2 circuit for a simple modification which substantially increases the useful range of the Volume control to accommodate this situation, providing increased operating convenience. The modification involves replacing a jumper in each channel with a pair of precision resistors to form a voltage divider; if you desire this change, see your dealer or contact Apt Corporation for details.

Normally tape recorders are connected to the preamp's Tape jacks in order to make direct recordings of the incoming signals without modifications. Thus all of the preamp's controls may be used to adjust the sound to your taste as you hear it, without having any effect on the character of the signal being recorded from the Tape Out jacks. Similarly, accessories connected to the External Processor jacks (e.g. equalizers, noise filters, dynamic range expanders) may be used to alter and improve the sound which you hear, but will not affect the signals being recorded.

### Ground

If your turntable is equipped with a separate grounding wire, it should be connected to this Ground post to minimize hum. Loosen the thumb nut, place the bared wire or spade lug on the post and tighten the thumb nut to fasten it securely.

However, if you *wish* to use the preamplifier's controls and any accessory connected to the External Processor jacks for the purpose of modifying or improving a signal which is to be recorded, simply connect a cable from the Main Out 2 jacks to the "line" inputs of the recorder, disconnecting the cable which normally would run from the preamp's Tape Out jacks to the tape recorder's line inputs.

The majority of audio systems are satisfactorily hum-free without any need for special grounding. However if you do experience a low-level hum or other interference which is not alleviated by repositioning sensitive components, grounding the preamp chassis to a true earth ground may help. Connect a wire from the preamp's ground post to a true ground point located nearby, such as a cold-water pipe, steam radiator, or the third hole in a correctly grounded AC wall socket, absolutely avoiding any possible connection to either of the parallel *hot* blades. Do *not* run separate grounding wires from other system components to earth-ground; to do so would create hum-producing "ground loops." In most cases other system components will be satisfactorily grounded to the preamp through the shields of the audio connecting cables, and a single wire from the preamp Ground post to a true earth ground will satisfactorily ground the entire system.

### Tape 1 and Tape 2

These jacks provide for the recording and playback functions of two tape recorders of any type—open reel, cassette, Elcaset, digital, etc. For recording, connect a cable from the "Out To" Tape 1 jacks to the recorder's line-level inputs; these may be labeled "line in," "aux," or "radio," but *not* "microphone." For playback connect to the preamp's Tape 1 "In From" jacks a cable from the recorder's line-level output jacks; these may be labeled "line out," "main out," "monitor," etc. For a second recorder, repeat this process with the Tape 2 "Out To" and "In From" jacks.

If you are using an outboard tape noise-reduction system (e.g. Dolby B or DBX) with a tape recorder, then the connections from the preamp's Tape jacks will be made to the "amplifier" or "main" input and playback output jacks on the noise-reduction device; the tape recorder will be connected to "tape" input and output jacks on the noise-reduction unit.

Normally a noise-reduction unit is used with only one tape recorder at a time. It is possible to connect two recorders to a single-noise reduction encoder for recording (using Y-connectors at the encoder's "to tape recorder" output jacks, feeding encoded recording signals to the line inputs of both recorders). But for playback

it normally is *not* possible to connect two recorders simultaneously to the inputs of the noise reducer for decoding; typical consequences would include severe distortion, response errors, and decoder mistracking. So if a single noise-reduction unit (connected either to the preamp's Tape 1 or Tape 2 jacks but not on both) is to be used with more than one tape recorder, an external stereo selector switch such as the Switchcraft 668 must be used to select one recorder at a time for playback through noise reduction circuitry.

Many tape machines are equipped with a five-pin DIN connector in addition to standard phono jacks for input/output connections. In such cases it is always preferable to use the phono jack connections for recording and playback through the Apt preamp because they provide better matching in terms of impedances and signal levels. If a recorder is equipped *only* with a DIN connector for signal connections, it is possible to use an adapter cable (with a DIN connector on one end and four phono jacks on the other) to make connections to the preamp; the impedances and signal levels will not be ideally matched, but in most cases it will still be possible to record and play tapes.

The signals fed to the tape recorders from the "Out To" tape jacks are selected by the front-panel program-selector and dubbing switches. They are completely unaffected by the settings of any other front-panel controls. If you wish to use the preamplifier controls (e.g. tone, mode, and high-filter), and any signal-modifying device connected to the External Processor jacks, for the purpose of modifying the signals fed to a tape recorder, the recorder should be disconnected from the Tape jacks and connected to the preamplifier's Main Out 2 jacks instead.

However, under the special circumstances that you wish to dub from one tape machine to the other through an external device such as an equalizer, and without effect from the preamplifier's volume and tone controls, you may connect the external device in the Tape 2 loop, and the tape machines in the Tape 1 loop, and the External Processor loop respectively. Then use the dub function to record from recorder 1 through the external device to recorder 2 by actuating Dub 1>2 and the Tape 2 switches.

**External Processor**

These jacks enable the connection of a broad range of ancillary components which might otherwise use up one of the tape monitor circuits.

Examples include:  
A third tape recorder. (The External Processor loop is functionally identical to a tape-monitor loop except that it does not participate in the Dubbing function, and its input source is affected by the tape 1 and tape 2 monitor switches).

A dynamic noise filter, impulse noise suppressor, or scratch filter.

A dynamic-range expander, compressor, or limiter.

A graphic equalizer or parametric equalizer.

The special equalizer unit supplied for use with some loudspeakers. Alternatively, such a speaker equalizer may be connected at the Main Out jacks, feeding the power amplifier directly, thus leaving the External Processor loop available for another accessory. But if the speaker equalizer lacks a bypass switch, and if you want to switch the power amplifier to drive electrostatic headphones or a second set of speakers not requiring the equalizer, then the speaker equalizer should be connected to the External Processor jacks where it can be engaged or bypassed at will.

For a 4-channel "matrix" decoder or a time-delay ambience-synthesis system, the "front" outputs from the device could be returned to the External Processor "In From" jacks while the "rear" outputs from the device could be fed to a separate amplifier. Note, however, that in most cases it is preferable to connect a time-delay unit to the preamplifier's Main Outputs instead, so that the preamp's Volume and Tone controls can serve as "master" controls governing the sound to all four speakers.

Thus the setting of the "threshold" on a noise filter will not be affected by the preamp's Volume and Tone controls.

**Headphones**

This is the only connecting socket which is located on the front panel of the preamplifier. The "Phones" jack is wired to a separate headphone amplifier circuit within the preamp. The signals fed to the headphone amp are identical to those fed to the Main Output jacks; i.e. they are equally affected by the Volume, Tone, and other controls.

The gain of the headphone amplifier has been adjusted so that, in most installations, the Volume control setting used for comfortable loudspeaker listening will also provide approximately the right volume for headphones.

Unlike the headphone circuits in many tape recorders, which are adequate to drive only 8-ohm headphones, the headphone amplifier in the preamplifier is designed to be equally effective with the many high-quality headphones whose true impedance is from 100 to 2000 ohms. This category includes many models made by Koss, Sennheiser, AKG, Beyer, Yamaha, etc. However the headphone amplifier is *not* designed to drive electrostatic-type headphones; in most cases these must be connected to a power amplifier through an adapter unit supplied with the phones.

The Phones socket is a standard 3-contact ¼" stereo phone jack, accepting normal tip/ring/sleeve plugs. The wiring to the jack is correct for the majority of models: the tip of the plug carries the left-channel signal, the ring contact on the plug carries the right channel, and the sleeve of the plug is the ground or "common" contact. However, in some models of headphones the tip contact is wired to the right channel and the ring contact to the left channel; with these it will simply be necessary to reverse the phones on the head (or, if you prefer, have a technician re-wire the plug on the headphone cable). If you are unsure of the orientation, you can check it with the balance control: when you turn the balance control to the right (clockwise), the sound should go to the right earcup.

If you wish, you may use headphone extension cables, or headphone Y-connectors to drive two headsets simultaneously, with no adverse effect on the preamp. When two headsets are connected together, they should be identical models; connecting two headphones which differ widely in impedance will usually cause a large loss of loudness in the headset having the higher impedance.

Normally when listening to headphones the preamplifier Mute switch should be engaged in order to silence the loudspeakers. This permits the Volume control to be adjusted freely for headphone listening without overdriving the loudspeakers or disturbing neighbors.

The signals fed to the External Processor outlets are selected by the Program Selector and Tape Monitor switches but are unaffected by the preamplifier's other controls.

The Headphone output does not participate in the muting function. Therefore, a transient at turn-on and turn-off is normal.

The Phones socket may also be used as a convenience output (instead of Main Output 2 on the rear panel) to feed signals to an extra tape recorder or other device via an adapter cable (Switchcraft 10FK25, Radio Shack 42-2477, or equivalent). The signals at the Phones jack are, of course, affected by the Volume, Tone, and other preamp controls.

**The Operating Controls/ Rear Panel**

*Resistive Load, Capacitive Load*  
These controls affect the Phono 1 input impedance and are discussed on the accompanying sheets labeled "Phono Input Impedance Matching."

*Infrasonic Filter In/ Out*  
This is a push-button switch. Its normal position is In, with the surface of the button almost flush with the rear panel.

For testing purposes the infrasonic filter may be defeated by pressing and releasing the button so that it clearly protrudes through the panel.

The infrasonic filter is an 18 dB/octave filter with a 15Hz turnover frequency. It maintains a flat frequency response within 0.5 dB down to 20 Hz and then rolls off steeply, down more than 30 dB at 4 Hz. Its purpose is to remove the unwanted infrasonic energy content which is present in the output of most turntables due to normal amounts of record warp, tonearm/ cartridge resonance, and direct-drive motor rumble. This energy, if not stripped off the audio signal by filtering, would tend to overload tape recorders, upset the operating points of power amplifier circuits, waste output power, and drive woofers into large cone excursions producing audible amplitude and frequency intermodulation distortion or, even worse, "bottoming" of the woofer. For these reasons it is recommended that the filter always be left in.

**The Operating Controls/ Chassis—Left Side**

*Phono Balance controls*  
On the left side of the case of the preamplifier are two small access holes. Behind these are controls for trimming the channel balance of the Phono 1 and Phono 2 inputs in order to compensate for the normal 1 to 2 dB errors in channel balance which phono pickups commonly exhibit.

The importance of precise channel balance is often overlooked. Because the subjective limit of perception for differences in loudness is approximately 1 dB, errors in channel balance of that magnitude will not noticeably affect the apparent relative loudness of the two channels, but the stereo imaging of an audio system can be quite noticeably altered by small balance errors. This is particularly true when recordings are played which were made with a minimum number of microphones and which have a natural stereo perspective, with differences in "depth" and hall ambience recorded along with the direct sounds of the instruments and voices. The audibility and character of these differences in depth and ambience depend on precise channel balance and on uniform frequency response in the two channels. The phono balance controls enable you to correct for cartridge balance errors and achieve phono balance to within a very small fraction of a dB without using test equipment. Separate controls are provided for Phono 1 and Phono 2. The procedure is as follows:

Begin by visually examining the installation of the pickup cartridge in the turntable for correct geometric alignment. For example, the body of the pickup should be axially aligned with the tone arm shell (unless it has deliberately been twisted to correct for an offset error in the arm), and, when looked at from the front, the stylus should come straight down from the cartridge body and meet the record surface at a right angle.

Also be sure that any overhang, vertical tracking angle, tracking force, and skating adjustments on the arm have been correctly made.

Then select a monophonic record, or a test record containing monophonic (lateral) cuts. (If neither is available it is possible as a last resort to substitute a stereo recording of a solo vocalist who has been panned into the exact center of the stereo image.) Play the record, adjust the Volume control to a fairly high listening level (use headphones if you prefer), and turn the preamplifier Mode control fully to the right (clockwise), to the L-R position.

Insert a narrow-bladed screwdriver, such as a Jeweller's screwdriver or the small screwdriver commonly supplied for installing phono cartridges, through the appropriate access hole on the left side of the case of the preamplifier. For the Phono 1 input, use the access hole located closer to the rear panel of the preamp; for Phono 2, use the access hole closer to the front of the preamp. In either case, gently insert and rotate the screwdriver until you feel the blade go into the slot in the balance control. Then turn the screwdriver to adjust the control for *minimum* sound output.

Ideally a "null" should be obtained, with the sound vanishing. (If using a stereo record, listen only to the sound of the central soloist.) In practice a perfect null will not be obtained, but a substantial reduction in loudness will occur, and the residual sound may be noticeably distorted due to tracing distortions which are largely masked in normal stereo playback.

That completes the balance adjustment. If you have two turntables, place the record on the other turntable, insert the screwdriver into the other access hole, and adjust the other balance control for minimum L-R output. Then re-set the Mode control to normal stereo.

## The Operating Controls/ Front Panel

The front panel controls are discussed in the order in which a normal input signal encounters them in its passage through the preamplifier. That order is as follows:

Program Selector  
Tape Monitor switches  
Tape Dubbing switches  
External Processor switch  
Channel Assignment switches  
Volume control  
Mode control (stereo image control)  
Balance control  
High filter  
Bass control  
Bass mode switch  
Treble control  
Tone control defeat switch  
Muting relay

### Program Selector

This five-position switch selects the input signal to be heard: phono, tuner, or auxiliary source.

### Tape Monitor and Dubbing Switches

All tape-related functions are handled by a set of four pushbuttons. Two are tape monitor switches and two provide for cross-dubbing between tape recorders.

The two inputs most frequently used in most systems, Phono 1 and Tuner, are placed adjacent to each other on the switch. The design of the selector eliminates any trace of audible crosstalk (leakage of signals from sources other than the selected one). However, crosstalk may appear at an input which has no device connected to it. If for some reason crosstalk into unused inputs is important to you, you may install shorting plugs in them to cancel crosstalk. Shorting plug pairs are available from Apt Corporation: request one number 103 plug pair for each pair required.

Tape 1 and Tape 2 are "monitor" switches. In each, a white disc is visible when the switch is engaged. Engaging either monitor switch connects the output of the corresponding recorder to the preamplifier's circuitry so that the recorder's monitor output will be heard.

The nature of the output signal from a tape recorder depends on the recorder's own controls. When the recorder is in the playback mode, the signal heard is that of the tape being played. When a 2-head recorder is in the "record" mode, its output signal is usually just the incoming source signal after passing through the tape machine's recording level controls and associated electronics. However, if the recorder is a 3-head machine capable of simultaneous recording and playback, then during recording the machine's output signal may be *either* the incoming source signal or the playback of the just-recorded tape, depending on the setting of the *recorder's own* Monitor switch. Finally, two

To hear a tape being played on recorder 1, engage the Tape 1 button.

To hear a tape being played on recorder 2, engage Tape 2.

If Tape 1 and Tape 2 are *both* engaged, only the monitor output from recorder 2 is heard.

additional situations may occur: (1) If a single-pass noise-reduction system is used when recording, the output signal from the tape machine in the recording mode will either be an encoded version of the input source signal, or, the incoming source signal after passing through the noise-reduction system's recording level controls as associated electronics. (2) If a Dolby-encoded FM broadcast is fed to a recorder having an FM Copy function, then the recorder's output may be a decoded version of the broadcast.

Thus a tape monitor switch may serve several additional functions beyond its basic one of permitting the user to hear recorded tapes. But the rules governing the use of the Tape switches are easily summarized.

With Tape 1 engaged the monitor output signal from recorder is heard, regardless of the settings of the Program Selector or dubbing switches.

With Tape 2 engaged the monitor output from recorder 2 is heard, regardless of the settings of the Program Selector or dubbing switches and regardless of whether Tape 1 is also engaged.

As the arrow between the Tape monitor buttons on the front panel indicates, the Tape 2 monitor circuit is "downstream" from the Tape 1 circuit. The Tape 1 button selects either the Program Selector input or the Tape 1 monitor signal and passes it along to the Tape 2 monitor switch. The Tape 2 button then provides another choice: either the input selected by the Tape 1 button, or the Tape 2 monitor input, is sent to the preamplifier circuits. Thus when the Tape 2 button is engaged, only the Tape 2 monitor signal is heard regardless of the position of the Tape 1 monitor switch. Tape 2 must be disengaged in order for the Tape 1 button to be effective.

Assuming that the Dubbing switches are not engaged, the signal which is fed to the inputs of the recorders is that selected by the Program Selector—typically Tuner or Phono. Since the same input signal is fed to the inputs of both recorders, recordings may be made freely on either recorder 1 or 2, or on both simultaneously.

When making a recording, the Tape monitor buttons permit you to compare the quality of the program source to that of the signal processed through the recorder. If the recorder has an output level control, it should be set so that (with normal settings of the machine's Recording Level controls) the sound is equal in loudness

To copy from recorder 1 to recorder 2, engage the Dub 1>2 switch.

To copy from recorder 2 to recorder 1, engage the Dub 2>1 switch.

to the corresponding Tape monitor button engaged and disengaged. This enables meaningful comparisons.

If the recorder has independent recording and playback functions (with 3 heads), the monitor switch enables the quality of the recording to be evaluated as it is being made. Thus, when taping from Tuner or Phono onto recorder 1, the Tape 1 monitor button may freely be pressed to check the quality of the recording, without disturbing the recording process itself. Similarly, when taping on recorder 2, the Tape 2 monitor button may be used at will to monitor the recording as it is made. The purpose of the Tape monitor buttons is solely to select which recorder's output will be *listened to*.

Control for tape *copying* is provided by the Dubbing switches which permit you to copy from either recorder to the other while simultaneously listening to either recorder or another program source chosen by the Program Selector switch. A green disc appears in each dubbing button when it is engaged.

Now, with both Tape monitor switches *disengaged*, you may listen to Phono, Tuner, or an auxiliary program source while the tape copying proceeds. To hear the output of recorder 1 (the source machine), press the Tape 1 button. To hear the monitor output of recorder 2 (the copying machine), press Tape 2. In the case of a three-head tape recorder, the Tape 2 button thus becomes a source vs. tape comparison switch, with the output from the recording machine (Tape 2) heard when the button is in. When the copying is completed, disengage the Dub 1>2 switch.

Now, with both Tape monitor switches *disengaged*, you may listen to Phono, Tuner, or another source while copying proceeds. To check the output of recorder 2 (the source machine), press Tape 2. To hear the output of recorder 1 (the copying machine) engage Tape 1 and disengage Tape 2. The Tape 2 button thus becomes a source vs. tape comparison switch; with the button out, the output is that of tape 1 (the copying machine), and with the button in, the output is from Tape 2 (the source machine). When copying is completed, disengage the Dub 2>1 switch.

Tape recorders always present possibilities for feedback (the output signal returning to the input), resulting in a startling howl. Most such possibilities have been designed out of the tape-processing circuits of the Apt preamplifier, but two remain: If you use microphones to record in the same room with the loudspeakers, activating the corresponding tape monitor switch

**External Processor Switch**  
If you have connected a signal processing accessory (equalizer, noise filter, dynamic processor, etc.) to the External Processor jacks on the rear panel of the preamplifier, raising this toggle switch will insert the processor into the circuit. Lowering the switch will cause the processor to be bypassed.

**Channel Assignment Switches**  
The two switches labeled "L>R" and "R>L" control the channeling of the signals.

will cause the recorded signal to be amplified through the speakers and may be picked up by the mikes, producing a howl. So if you ever record with microphones, use the preamplifier's Mute switch to kill the signal to the power amplifier, and use headphones to monitor the recording.

If you activate *both* Dubbing switches simultaneously and have *both* recorders in the recording mode (or have their own monitor switches set to Source), the signal may chase its tail around the loop through both recorders and immediately set up a loud howl. Of course this situation can never arise in the normal use of the dubbing circuits as described above.

Incidentally, although the Volume control is located between the Program Selector switch and the taping switches on the front panel, that does not mean that the Volume control affects the signals fed to the taping or dubbing circuits. Input signals are selected by the Program Selector and are passed directly through the infrasonic filter to the taping circuits; the selected input or tape monitor signal is routed to the External Processor loop, then to the Volume control and remaining preamplifier circuits.

Thus, for example, if you have a speaker equalizer connected to these jacks, you may insert it in the circuit for normal loudspeaker listening, and bypass it when listening to headphones or to a second set of speakers which do not require equalization.

If you have no equipment connected to the External Processor jacks, or equipment connected but turned off, then raising the External Processor switch will break the signal path, muting the output.

In the normal (down) position of the switches, left-channel input signals go to the left-channel output and right-channel inputs go to the right-channel output.

Raising just the "L>R" switch causes left-channel input signals to appear in both output channels.

Raising just the "R>L" switch causes right-channel input signals to appear in both output channels.

The following table summarizes the assignment of input signals to the output channels of the preamplifier.

Switch	L>R	R>L	
	down	down	normal stereo
	up	down	L source to both outputs
	down	up	R source to both outputs
	up	up	stereo reverse

**Volume**  
The Volume control provides precise adjustment of the gain of the preamp.

**Mode Control**  
The Mode control on the preamplifier adds either in or out-of-phase left and right channel information at the discretion of the user. It is continuously variable, between mono, stereo, and difference (L-R), but is provided with a detented center position that ensures precise stereo operation. In addition, it also allows a unique degree of control over the stereo field—in particular, over the apparent depth of the stereo image.

As the mode control is rotated slightly counter-clockwise (to the left) from stereo, the two channels are partially blended together and the strength of centrally-imaged L+R information in the signal is increased.

When the Mode control is rotated fully counter-clockwise, to the L+R position, the stereo channels are fully blended into mono.

Raising both switches causes the channels to become reversed.

It is a 32-step precision attenuator consisting of thick-film resistors individually trimmed for maximum accuracy. A principal benefit of this design is that the two channels of the Volume control, which are ganged together, track very accurately so that precise channel balance is maintained at all settings of the control. Since the control steps are detented, it is relatively easy to return to a previous setting after a change.

This has several uses:

The variable blend reduces the exaggerated width of the stereo image heard in headphones.

Partial blend also improves the "focus" of solo instruments or voices heard through those loudspeakers which tend to exaggerate spaciousness in some recordings.

Augmentation of L+R information may "bring forward" or strengthen a too-weak or too-distant central soloist.

One useful application of this mode is for cancelling unwanted vertical rumble and distortion in old monophonic recordings.

As the Mode control is rotated slightly clockwise (to the right) from the detented “stereo” position, the monophonic L+R component of the composite signal is decreased and additional out-of-phase L-R difference information is injected.

This partial L-R injection has several uses:

The added L-R information “opens up” the sound field from loudspeakers which are too constricted. In loudspeakers with normally wide imaging, it can make the stereo image appear to be wider than the spacing between the speakers.

Much of the hall ambience information in true stereo recordings is recorded out-of-phase; strengthening of this signal component adds “depth” and “air” to the stereo field. (Of course, this only works when the right information is present in the recording to begin with.)

Many recordings include a closely-microphoned, centrally-imaged soloist who is over-balanced with respect to the other voices or instruments in the recording. With the mode control you can “push back” the central solo until it blends properly with the ensemble.

In some recordings certain instruments or voices have been recorded out-of-phase, either deliberately (for a spacious effect) or accidentally. Experimentation with the mode control can reveal such interesting effects.

In general, it is useful to experiment with small deviations of the Mode control on either side of the detented stereo position, in order to improve the central focusing of the sound field or to open up the breath and depth of the stereo image, depending on the varying requirements of different recordings. Thus the Mode control can add a new dimension of exploratory interest and long-term listening satisfaction to your enjoyment of recordings.

Examples of the use of this control are: for properly balancing soloists with respect to chorus and orchestra, *Messiah* (RCA LSC 6175) use L-R at 2 to 3 o'clock; for balancing a soloist with respect to orchestra, Renata Scotto, *Verismo Arias* (Columbia M33435); and for cancelling a soloist leaving only reverberation and other interesting effects, Fleetwood Mac, *Rumours* (Warner Bros. BSK 3010).

This mode has a variety of uses:

Full clockwise rotation of the Mode control to the L-R position yields a useful test mode, sometimes called the “null” mode—because when the two channels are identical in level and phase, their L-R difference component is zero (null).

In the making of records, monophonic signals yield lateral groove modulations. Out-of-phase signals and all of the channel-difference information responsible for stereo imaging are cut as vertical groove modulations. The L-R mode provides easy identification of out-of-phase signals, vertical rumble, and other accidents in record production. Incidentally, the L-R signal will usually be found to be bass-shy. This is because record cutting systems commonly employ low-frequency blend to minimize the cutting and playback problems which can arise from large vertical modulations.

To determine the amount of stereo separation in any signal source, compare the loudness of the sound in the stereo mode and in the L-R mode. If the loudness is drastically reduced in the L-R mode, then the stereo separation is slight; for example, classical recordings often have strongly shared information in the two channels in order to present a stable image of the orchestra between the loudspeakers. However, if the L-R mode is nearly as loud as the stereo mode, then the stereo separation is large with little “central mono” L+R energy.

In the full null setting of the control (fully clockwise), the difference information (L-R), which is the out-of-phase component of the sound, is presented to the loudspeakers out-of-phase, maintaining the original relationship. For this reason, the output may become “phasy” sounding at the extreme setting of the control, with sound images appearing outside the normal stereo field. This is a natural consequence of the nature of the stereo signal.

When installing a phono cartridge, play a mono record or the L+R lateral band of a test record, and rotate the Mode control from stereo to L-R. If the loudness remains essentially constant rather than dropping nearly to zero, one of the channels is wired out of phase at the turntable or the cartridge coils are not perpendicular to one another.

The L-R mode makes possible a simple procedure for obtaining exact channel balance on each phono input without test instruments (compensating for balance errors in cartridges) as described on page 21).

If rotating the Mode control from stereo to L-R causes a sound to disappear almost completely, then the input signal is monophonic—regardless of claims to the contrary. FM stations, for example, will sometimes be found to be transmitting in mono, even though the transmitter’s stereo