

Equipment Profiles

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**Panasonic RS-736US
Stereo Tape Deck**

MANUFACTURER'S SPECIFICATIONS

Speeds: 15, 7½, and 3¾ ips. **Reel Size:** 7 in. max. **Motor:** 4-pole hysteresis sync. **Frequency Response:** 20-32,000 Hz at 15 ips, (30-25,000 Hz $\pm$ 3 dB); 20-28,000 Hz at 7½ ips, (30-23,000 Hz $\pm$ 3 dB); 20-15,000 Hz at 3¾ ips. **Wow and Flutter:** Below 0.09% at 15 ips; below 0.09% at 7½ ips; below 0.13% at 3¾ ips. **Signal-to-Noise Ratio:** 53 dB or more. **Input Sensitivity:** Microphone, 0.3 mV; Phono-1 (ceramic or crystal), 100 mV; Phono-2 (mag), 2 mV; Aux-1, 30 mV; Aux-2, 100 mV. **Outputs:** (fixed) 1.0 V; (variable) 0 to 1.0 V. **Headphone Output:** 55 mV across 8 ohms. **Dimensions:** 17 in. W., 18½ in. H., 8½ in. D. (upright position). **Weight:** 33 lbs. **Price:** \$329.95.

As the average recordist becomes more proficient in his hobby, he is likely to want to try some "professional" assignments in which he plans to end up with some commercially produced phonograph records, and for this purpose, he will want to use a higher speed than is usually available on the average recorder. The Panasonic RS-736US will answer his desires for the higher speed—15 inches per second. At the same time it provides the usual 7½ ips which he will use for his not quite so important work, as well as the economical 3¾ ips

NOTE: Due to last minute space considerations, the review of the Revox A-77 Dolby had to be held over until next month.

which he is likely to use for recording the spoken word or possibly for casual programs recorded off the air. And in all these speeds, this machine will give him adequate service, as well as the sort of flexibility he needs for his various activities.

When we speak of flexibility, we are referring to the many uses to which this deck can be put, since it provides a wide range of inputs—two pairs of PHONO inputs, two pairs for AUX (all of which are phono jacks), and two standard phone jacks for MICROPHONE inputs. In addition there are two pairs of phono jacks for outputs—one pair with a fixed output and one variable, and controllable from the front panel with separate slide controls for each channel. Since the machine has three stereo heads, you can monitor while recording from either source or tape so you can determine during the process if you are actually getting anything on the tape, as well as comparing the quality of the two. You can make sound-on-sound recordings monophonically, enabling you to create a quartet, for example, from a single performer. You can add to, record a "language-lab" procedure in which the instructor records on one channel while the student listens to the playback of this channel and then records his own reply on the other. All these facilities are simplified by the provision of separate level controls for most of the inputs. While these level-set controls are ganged to operate on both channels at once, you still have separate recording level controls for each channel. It is a very flexible machine.

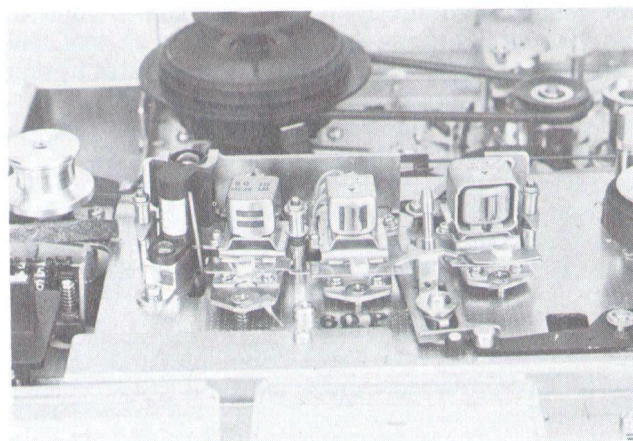


Fig. 1—Close-up of the head assembly. Heads are of hot-pressed ferrite material for long wear.

Physically, the RS-736US has the usual two reel hubs across the top of the panel, with the speed control knob between them at the very top of the panel. At the left center is the left tension lever around which the tape is passed before passing the guide roller. For ease in threading, the tension level locks its maximum counterclockwise position, giving easy access to the guide roller. The head cover is just to the right of the guide roller, and its upper part covers the wiring to the heads and accommodates the power indicating pilot light. The lower two-

thirds of the head cover hinges upward to make threading as easy as possible, as well as to give access to the heads for cleaning. The tape next passes the capstan and the large idler roller, thence past the right tension arm and upward to the takeup reel. Underneath the idler or pinch roller is a small lever which serves to disable the retracting mechanism when winding rapidly to cue the sound to aid in locating the desired portion of the tape.

The pinch roller is removable, and to change from 7½ ips to 15, it is replaced with a smaller one, and at the same time the small capstan screw is replaced with a large screw which holds the larger capstan sleeve. Thus the two lower speeds are selected by the knob on the panel, using the small capstan screw and the large pinch roller, while the selector switch remains in the 7½-15 position and the screw and roller are changed for the highest speed. This is a method that has been in use on U.S.-made machines for perhaps 20 years, and it is effective and serviceable. Next to the right is the function lever which controls tape motion.

The lower third of the front panel is given over to the amplifier and its controls. In the upper portion are the two 4-in. meters, flanked by the two recording-level slide controls—one for each channel. Next come the two slide controls for output level—again one for each channel—followed by the two monitor switches which select between SOURCE and OFF-THE-TAPE monitoring—one for each channel. Next is the NFD switch—which actuates the noise-level control that reduces highs during the absence of a sufficiently high level of sound in the output. This is followed by the tape selector switch, which should be actuated whenever low-noise tape is being used. It serves to decrease high-frequency equalization slightly.

Along the lower section of the panel a number of jacks and controls are located. First there is the three-circuit headphone jack which is fed from a transistor stage through a transformer to feed the usual low-impedance stereo headphones. Next are the two microphone input jacks. The next item is a knob which actuates a switch that selects inputs from MICROPHONE, PHONO 1, and PHONO 2. This is followed by an input level-set control for the selected source of the preceding switch. The next two knobs control, respectively, AUX 1 and AUX 2 input levels. These controls all operate on both channels with dual controls, but individual channel level control can be handled by separate recording-level controls—one for each channel. The next knob controls the equalization required for the three tape speeds, both for record and playback.

Next is the level control for the specialized functions—sound-on-sound and echo. This is followed by three switches which control these functions—first is the SOUND-ON-SOUND switch, then a switch which selects whether you are recording from right to left or left to right, and finally there is the echo switch with its ON and OFF positions.

The two recording levers are on the upper panel just to the left of the head cover and under the guide roller. In addition, separate indicator lights are illuminated when any of the three specialized function controls are turned from the OFF position.

For aid in locating the actual gaps on the recording, erase, and playback heads, their positions are marked on their shield for easy readability.

On the right side of the cabinet in the lower portion is another panel on which are mounted the two PHONO-1 (ceramic or crystal) input jacks, the two PHONO-2 (magnetic) input jacks, the two pairs of AUX jacks—low level and high level—and the two pairs of OUTPUT jacks—fixed and variable. Then there is a five-terminal DIN receptacle for connection to receivers and amplifiers similarly equipped to provide both record out and playback in connections, a ground terminal, and two convenience outlets—one switched and one unswitched. The power cord also enters at this panel.



Fig. 2—Connection panel located on the lower right side of the cabinet.

Circuit Description

The unit contains two separate amplifiers for each channel—one for recording and one for playback. The record amplifiers employ six transistors each. The first two provide the pre-amplification for microphone and Phono-2 for magnetic pickups, and the required equalization is furnished by feedback around these two transistors in the preamp section. The low-level AUX input connects directly to the input of the following stage, while the high-level AUX-2 input feeds through a resistor to one of the specialty controls.

The remaining four stages serve to provide further amplification, with the last stage being equalized for recording at the three speeds, using resonant circuits across the emitter resistor. The output of this last stage feeds the record head directly, with controllable bias voltage being furnished through a capacitor and a variable resistor.

The playback amplifiers each have seven transistors, with playback equalization for the three speeds around the first two stages, monitoring selection between the preamp section and the next stage. The ensuing three stages provide the necessary gain to feed the output lines, with the remaining two used to drive the headphone amplifier and the metering circuit.

The NFD noise suppressor circuit utilizes two additional transistors to which are fed the outputs of the two playback amplifiers, and then, in turn, furnish a d.c. voltage which causes the high frequency response of the amplifiers to be reduced, thus reducing the apparent noise. One additional transistor serves as a voltage regulator to supply a constant source to the amplifiers, and two more are employed as the bias/erase oscillator. (For a basic schematic of Panasonic's NFD circuit, see Fig. 1 of H.W. Hellyer's article in this issue.)

Performance

We tried out the machine in all its functions and found that it performed just as described. Measurements on all the possibilities would take up more space than is available, so only the most important response curves are shown. As to details, bias/erase frequency was measured at 187 kHz, which is well above average. Most measurements were made at 7½ ips, with the exception of the frequency responses at all three speeds. Distortion was found to be 0.4% at 10 dB below indicated zero level, increasing to 0.8% at zero, and rising to 3% at an indicated level of +8 dB. Fast forward and rewind times for 1200 feet of tape were 2 minutes and 40 seconds. Wow checked out at 0.05 per cent at 15 ips, 0.08 at 7½, and 0.11 at 3½; flutter at the three speeds was measured at 0.08, 0.1, and 0.14 respectively. Signal-to-noise ratio was a comfortable 55 dB below the 3% distortion point, and with the NFD noise suppressor in operation the S/N was increased by 6 dB.

Fig. 3 shows the response from a standard tape for playback response, along with a comparison of the phono equalization

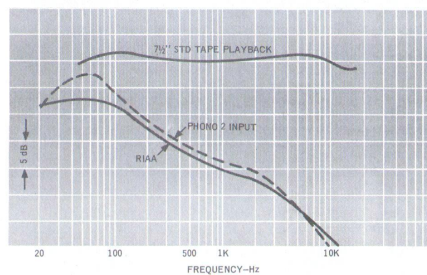


Fig. 3—Comparison between RIAA curve and that of the PHONO-2 input shown in the lower section. Upper curve is playback from a standard tape at 7½ ips.

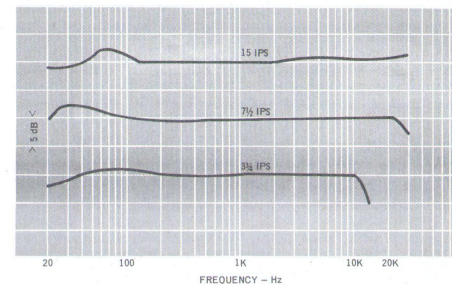


Fig. 4—Frequency response at the three speeds of the machine.

provided in the PHONO-2 position (magnetic pickups) with the standard RIAA curve. Note that they are with ± 2 dB throughout the range.

The frequency response curves in Fig. 4 were made from the Bruel & Kjaer sweep record QR-2009, which extends from 20 to 20,000 Hz. The output of a Stanton 681EE cartridge was equalized to within 1 dB of the RIAA curve over the entire range and fed to the AUX-2 input. The output was then recorded on a graphic recorder. For the phono equalization curve of Fig. 3, the cartridge was fed directly into the PHONO-2 input of the Panasonic, and the output similarly recorded.

To sum up, the machine is easy to handle, and with the exception of a slight loosening of the tape tension when the machine is stopped after fast winding, no problems were encountered. It is a handsome machine, and it is certain to provide all the flexibility the average user could imagine.

C. G. McProud

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Technics by Panasonic Quadraphonic Tape Recorder
Model RS-740US



Manufacturer's Specifications
Tracks: 4, quadraphonic. **Speeds:** 3 1/2 and 7 1/2 ips. **Frequency Response:** 30 to 23,000 Hz at 7 1/2 ips; 30 to 20,000 $\pm$ 3 dB. **Wow and Flutter:** Less than 0.1% at 7 1/2 ips; less than 0.13% at 3 1/2 ips. **Inputs:** Mic, -65 dB (4 circuits) 5k to 20k ohms impedance; line, -30 dB, 220k ohms impedance. **Output:** Line, 10,000 ohms impedance; headphones, 8 ohms. **Dimensions:** 16 1/4 in. W. x 15 1/4 in. H. x 8 in. D. **Price:** \$449.95.

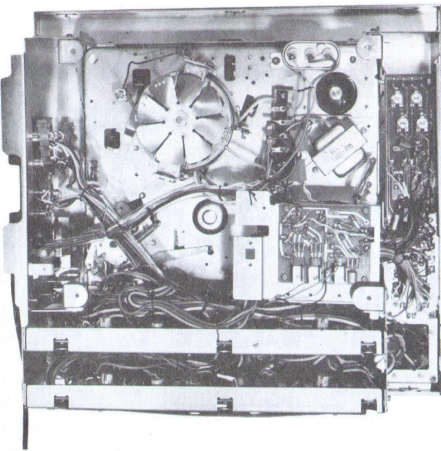


Fig. 1—Showing the underneath view.

The RS-740US is a quadraphonic tape deck having a good all-round performance for its modest price of \$449.95. It is one of the first products to be designated Technics by Panasonic, a name designating top quality equipment for the audio-ophile. The first thing that strikes the eye is the neat row of six knobs at the bottom. Reading from the left, the first pair are dual-concentric types controlling the input signal. The next pair are also dual concentric and they control the output. The third pair are labelled "separation," and they can blend the front and rear channels. If both are turned to maximum, then the front and back pairs form a double two-channel. To the right are two headphone sockets, and at the extreme left are four microphone input sockets. Above these are the record switches and the usual digital counter. To the right of the meters are the tape selector and the equalizer switches. The tape selector enables either normal or low-noise tape to be used, and the equalizer switch has to be used in conjunction with the two-position speed selector switch which is located at the top, between the two reels.

The large knob above the tape selector is the function lever and it controls the playback, record, fast-forward, reverse, pause, and stop functions. To the right is the push button ON/OFF switch. In a recess on the right hand side of the machine is a panel on which the input and output sockets (including DIN) are located. Also on this panel are output sockets for 'scope monitoring. Figure 1 shows the view underneath, and the head assembly is seen in Fig. 2. A single motor is used—a four-pole induction type.

Circuit Details

The basic design is fairly straightforward, with four record and four playback amplifiers. The basic circuit for a playback amplifier is shown in Fig. 3. R₁ forms a d.c. stabilizing loop between the emitter of T₁ to the base of T₁. The capacitor C₄ prevents a.c. feedback. The network VR₁, VR₂, C₁, C₂, and R₂ form a frequency-selective, negative-feedback loop for equalization. The next two stages, T₃ and T₄, both have current feedback in the emitter circuit (C₅ is only 0.01 μ F), and the line and scope outputs are taken from the collector of T₁. T₅ is an emitter-follower feeding the VU meter and headphone transformer.

A total of 36 transistors are used—plus two in the push-pull bias oscillator and another in the stabilized power supply.

Measurements

Figure 4 shows the record replay response at 7 1/2 ips; the upper solid-line curve was taken at -20 VU and the broken line shows the response at 0 VU. Response at 3 1/2 ips is shown at

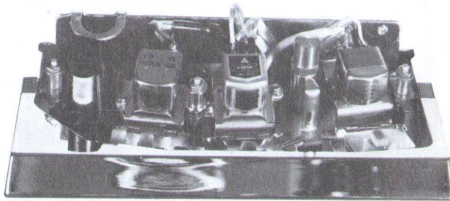


Fig. 2—Head assembly.

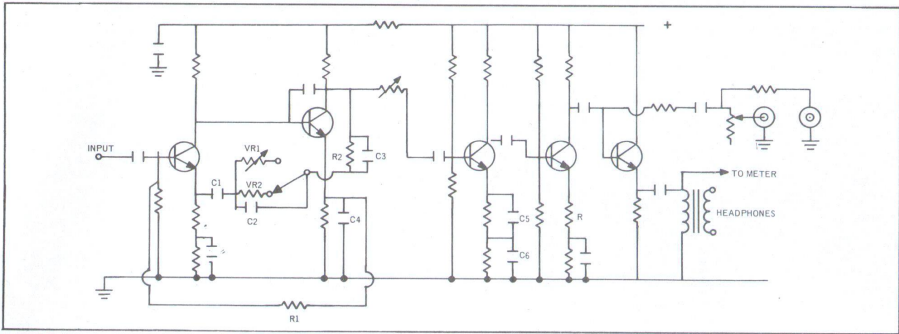


Fig. 3—Basic circuit of a playback amplifier.

B for both levels. It will be seen that the 3 dB point is at 24 kHz at 7 1/2 ips and 13 kHz for 3 1/2 ips—very creditable. The response from a standard playback tape is given in Fig. 5. Distortion at 0 VU measured 0.8% at 1 kHz and increased to 1.4% at +3 dB, as can be seen from Fig. 6. THD versus frequency is shown in Fig. 7. Signal-to-noise ratio measured 59 dB referred to 0 VU or 63.5 dB referred to the 3% distortion figure. Incidentally, the tape used for these tests was Maxell UD, but similar results were achieved with TDK SD and BASF 35. Wow and flutter is specified as less than 0.10% at 7 1/2 ips. Our measurements came very close with 0.12% at 7 1/2 ips and 0.14% at 3 1/2 ips. Input sensitivity was 27 mV for 0 VU and the output was 500 mV.

Listening Tests

For our tests we used the 740 with a Technics by Panasonic SA 6800X four-channel receiver and four EPI 100s. We found the deck easy to use, and the controls were smooth and positive. The monitoring facility is, of course, almost essential for the serious recording enthusiast, as is the provision for low-noise tapes. In fact, the reason why the overall results were better than the specifications might be due to the use of these tapes. Be that as it may, a distortion of less than 1% at 0 VU with a frequency response only 3 dB down at 24 kHz compares very favorably with machines costing much more. And the 740 is a four-channel deck into the bargain! Quadraphonic sound is an exciting field for the enthusiast—there are all kinds of recording methods to be tried: spaced mics, co-axial, omnidirectional, cardioid, and so on. And, don't forget, you can play your ordinary two-channel tapes on the 740 as well.

G. W. T.

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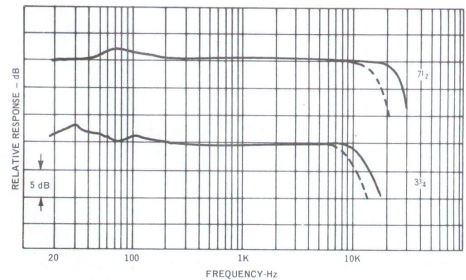


Fig. 4—Record-playback response at 7 1/2 and 3 1/2 ips.

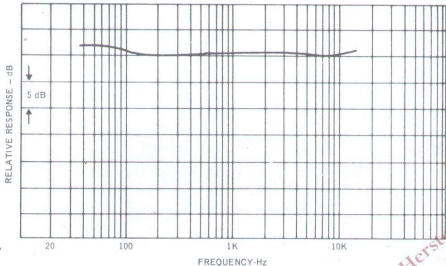


Fig. 5—Response from standard playback tape.

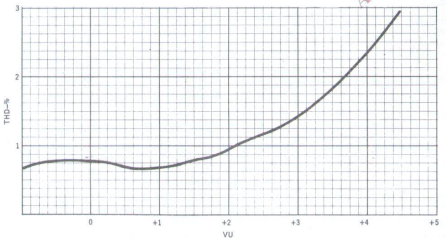


Fig. 6—Distortion at 1 kHz.

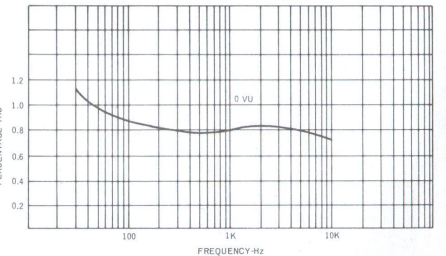


Fig. 7—THD versus frequency.

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Archiv Michael Otto

Panasonic Model RS-761S Stereo Tape Recorder

MANUFACTURER'S SPECIFICATIONS—Four-tracks. Record-playback system. Tape speeds: $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ ips. Frequency Response: 30-18,000 Hz at $7\frac{1}{2}$, 30-13,000 at $3\frac{3}{4}$, 30-16,000 at $1\frac{7}{8}$. Signal-to-Noise Ratio: more than 52 dB. A.C. Bias: 50 kHz. Weight: approx. 22 lbs. Dimensions: $17\frac{5}{16} \times 6\frac{1}{2} \times 11\frac{1}{4}$ in. Speakers: Two $8\frac{1}{2} \times 5\frac{1}{2} \times 11$ in. enclosures. Price, with speakers, microphones, connecting cables: \$269.95.

Every time we encounter a new tape recorder, it's like a new ball game—they are similar in many respects, but vastly different in detail. The RS-761S is a tape recording *system*, in that it includes everything one needs to start recording immediately—microphones, speakers, etc.

The unit is a three-speed, 7-in. reel-to-reel machine, designed for four-track stereo recording, four- or two-track stereo playback, and four tracks of mono recording and playback. The small speaker systems, each of which contains a $6\frac{1}{2}$ -in. woofer and $2\frac{3}{8}$ -in. tweeter, have provisions for wall mounting.

Equipment Profiles (continued)



Fig. 1—The Panasonic RS-761S Stereo Tape Recorder System.

The panel of the recorder proper—the amplifier panel occupies the $3\frac{1}{2}$ -in. at the right of the recorder chassis—has the usual supply and take-up spindles, with the speed selector between them and a 4-digit counter at the lower left. The control section is fitted with two record-level meters which also indicate during playback, and two record-level controls at the left. Below these are two pushbuttons for the record function. These buttons are covered by a plastic slide which helps to prevent unauthorized or inadvertent operation. To the right is the transport and head section, and below this is the pair of microphone jacks, using the miniature phone plugs. A push-on, push-off power switch is next, and farthest right is the control lever. The rest position of the function lever is STOP; one position to the left is REWIND and one position to the right is PLAY. Next to the right is the PAUSE position, and farthest right is the FAST FORWARD position. The pause position between fast forward and play practically eliminates any possibility of breaking the tape in switching from F.F. to PLAY.

The unit employs one motor, with a stepped motor pulley providing the speed changes, and idlers between the motor shaft and the reel-spindle turntables. All of the action is mechanically controlled by a series of levers and wires. The head shields, on which

are mounted the pressure pads, are raised automatically when the control lever is placed at PLAY, hinging outward when the lever is in any other position.

The amplifier section, mounted at the right of the deck, has a three-position slide switch at the top. In the center position, the machine is in the stereo mode, and at either right or left positions feeds the speakers from either right or left channels—desirable when playing monophonically recorded material. Progressing downward are the treble control, bass control, volume control, balance control, and a headphone jack.

On the rear is a panel which offers access to the auxiliary inputs, line-out phono jacks (high impedance), and two miniature phone jacks for the speaker connections. The power cord also enters the unit from this panel.

Circuitry

The Panasonic RS-761S employs a total of 19 germanium pnp transistors and six diodes in its electronic circuitry.

The amplifier consists of the bass boost control, followed by a transistor stage, with its output going to the speaker switch which selects the source channel for the monitor signal. This is followed by the treble control, the driver transistor stage, transformer-coupled to the two-transistor output

stage, which is a single-ended push-pull configuration, with the output being taken from the intermediate point, going first to the headphone jack which cuts off the following speakers when the usual three-circuit plug is inserted. The balance control is a 20k pot connected from the bases of the driver stages, with its arm grounded.

The bias/erase oscillator uses two more transistors in a balanced oscillator which feeds a 50-kHz signal to the erase heads from a tap on the secondary of the oscillator coil, and bias voltage from the entire coil through adjustable trimmers. When only one channel is being recorded, a load resistor is switched into the circuit to simulate the unused head.

D.c. is supplied to the low-level stages through a regulating transistor, while the full rectified output voltage is fed to the audio amplifier sections. A pilot light, which illuminates the record-level meters, is fed from a tap on the secondary of the power transformer.

Switching from play to record is done entirely by the push buttons used to select the channel on which recording is to be done, while separate switches short out the audio signal to the amplifier when the machine is stopped or in either of the fast-wind positions. In addition, the line outputs are shorted out during recording. A tape-sensing switch shuts off the drive motor when the end of the tape passes through the head assembly.

Performance

In operation, the Panasonic gives a good account of itself. Its one-knob function control and vertical stacking of amplifier controls simplifies operation.

It has a comparatively low hum-and-noise figure of 49 dB below the 3% distortion point when measured according to NAB standards at $7\frac{1}{2}$ ips. At $3\frac{3}{4}$ ips, S/N is 50 dB, and at $1\frac{7}{8}$ ips it is 47. Wow and flutter measure 0.13% at $7\frac{1}{2}$, 0.17% at $3\frac{3}{4}$, and 0.25% at $1\frac{7}{8}$.

The record-level meters are calibrated at a zero which is 10 dB below the 3% distortion point, and the output at the overload point is 3 volts at the line output and 1 watt at the speaker jacks—enough for a reasonably loud signal with the speakers furnished. To reach the meter zero in recording, a signal of 0.14 V is required at the line inputs, and only 0.25 mV at the microphone jacks. One great convenience is the fact that the meters operate in the

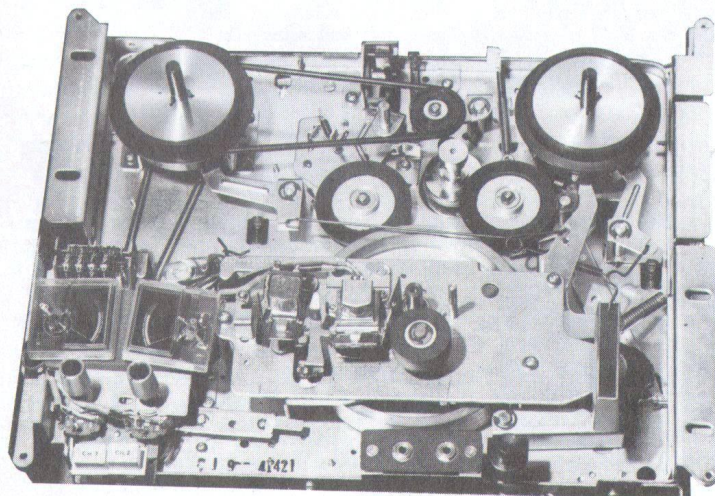


Fig. 2—View of the mechanism of the Panasonic RS-761S with the front panel removed.

Equipment Profiles (continued)

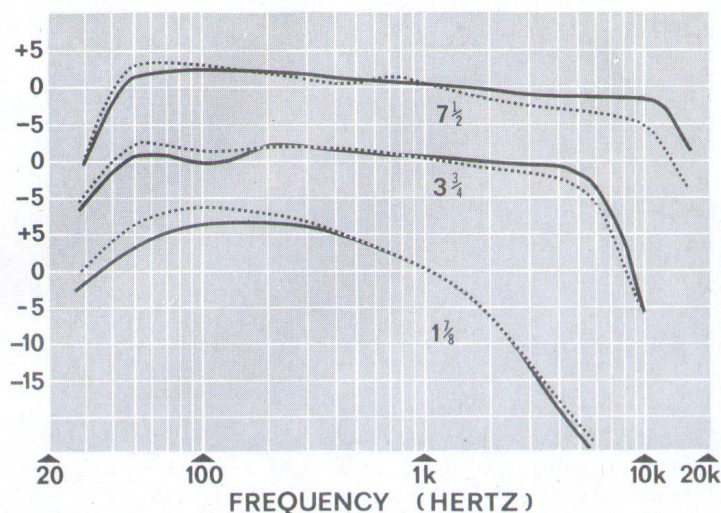


Fig. 3—Record/play curves for the Panasonic RS-761S Tape Recorder.

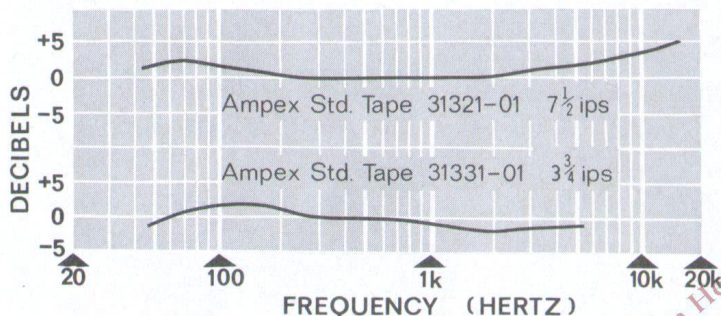


Fig. 4—Playback response from Ampex Standard Tapes.

playback mode as well as when recording.

The electrical signal output from a standard frequency tape shows the response to be within ± 3 dB from 40 to 15,000 Hz at $7\frac{1}{2}$ ips, and ± 2 dB from 40 to 5000 at $3\frac{3}{4}$ —these frequencies being the limits of our standard tapes.

With signals recorded at a constant input level and played back, the response was within ± 5 dB from 40 to 16,000 Hz at $7\frac{1}{2}$ on the left channel, and within ± 7 dB on the right channel. At $3\frac{3}{4}$ ips, the response measured ± 5 dB from 30 to 8000 Hz, with the two channels differing by not more than 2 dB. At $1\frac{1}{8}$, response was within ± 5 dB from 30 to 2200 Hz. The manufacturer's specs do not indicate any tolerances, unfortunately, so our measurements cannot be compared. These figures are respectable for a complete system in the RS-761S's price category, however.

Tone-control action was relatively gentle, providing very little bass boost and about 8 dB of cut at the low end, and about 3 dB of boost and 10 dB of cut at the high end. While these tone-control figures do not sound very impressive, it is surprising how effective they are with the system's speakers. (Tone-control circuits were modified in early production to meet the follow-

ing specifications, according to the manufacturer. Bass, ± 10 dB at 100 Hz; Treble, $+10$, -15 dB at 10 kHz. —Ed.)

Rewind time clocked 2:58 for a 1200-ft. reel of tape, while fast forward required 3:25 for the same reel. These figures are slower than normal for machines in this general category. The 50-kHz bias frequency is lower than generally used for modern tape recorders; if it appears on the tape it might show up on a stereo recording from a tuner as a 12-kHz squeal.

Crosstalk between channels measured slightly better than 40 dB at 1000 Hz, and about 34 dB at 10 kHz, which is good. Distortion measured below 3% at the speaker jacks up to 1 W output, rising to 5% at 3 W. An output of 1 W provided an adequate listening level with the system's highly efficient speakers.

In summation, the Panasonic RS-761S is a handsome machine, with dark wood, chrome, and black employed tastefully in both the recorder and the loudspeakers. The machine is easy to thread, and easy to operate, with a transport that handles tape gently. Panasonic's RS-761S certainly offers one a nice, complete tape package at \$269.95.

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