Panasonic Direct-Drive Turntable, Model SP-10

MANUFACTURER'S SPECIFICATIONS

Turntable: Aluminum; die-cast; 12 in. diameter; weight, 6 lbs. **Motor:** 20-pole, 60-slot, ultra-low speed electronic commutator motor, 15 volts, d.c., 85 ma. **Power supply:** A.c., 120 V, 50/60-Hz. **Speeds:** 33⅓ and 45 rpm. **Speed-change method:** Electrical change. **Fine speed control:** Individual adjustment by variable resistor; ±2% adjustment range. **Wow and Flutter:** Less than .03% WRMS. **Rumble:** Better than -60 dB. **Build-up time:** Within ½ rotation at 33⅓ rpm. **Dimensions:** 14'' wide, 14'' deep, 4'' high. **Weight:** 20 lbs. **Suggested Minimum Price:** $299.95, less base, arm, and cover; optional wood base, $34.95; cover, $14.95.

The turntable proper—which is the subject of this profile—is available in the 14-in. square configuration for installation in the purchaser's cabinet or housing, but the one sent to us for testing was mounted already on an attractive walnut-finished base measuring 21⅜ in. long by 16 in. deep by 6¾ in. high over the SME-3009 Series II arm which was also furnished with the turntable. Already installed in the larger base was the turntable, and the cutout was already made for the mounting for the SME arm, and, in fact, the mounting was in place.

This whole structure was suspended on a sub-base just slightly smaller than the top section by means of four large spring mounts, each of which was damped with a sleeve of viscous-coated plastic. These mounts were attached to the base, and the sub-base was then put in place and attached by machine screws.

Thus the turntable chassis, which was firmly attached to the main base, and the main base itself, were very flexibly mounted to the sub base, which rested on the table with its own rubber feet. Truly a well assembled vibration-isolating combination.

The underside of the turntable chassis is a model of neatness. All one sees is the round black motor housing, three rectangular black boxes, and one trapezoidal black box. Several neatly placed cables interconnect these separate black boxes. We succeeded in getting the cover off the motor and the power supply boxes. The trapezoidal box contains some of the electronics as well as the stroboscope-viewing mirror system. The electronics were the two vernier controls for speed adjustment, while the mirrors permit viewing the stroboscope (on the underside of the platter) from the top. All we could see in the power supply box were the transformer case, a large transistor—undoubtedly the "pass" element of the regulated power supply, the ends of a few capacitors, a resistor, a fuse, and a few wiring connections.

Under the motor cover we found the bottom of a printed-circuit board with a hundred or so soldered pads. This cover we replaced quickly. The smallest black box contains three medium-power transistors in the switching-circuit assembly, and some other bits and pieces.

On the top side, with the platter removed, we see the solid rotor frame of the motor which carries the magnet rotor and the position detecting rotor—a toothed wheel, in effect. In addition, the opening for the stroboscope-viewing mirror system and its line-frequency mask which has two positions for the two line frequencies—50 or 60 Hz—and which allows the user to view only one set of stroboscope patterns on the underside of the platter. At the lower left corner of the motor chassis are a rectangular power switch "button" which actuates a push-push switch to turn on the a.c. supply and a small round sliding knob which selects speeds—33⅓ or 45 rpm. At the right front corner is the window through which the stroboscope is viewed, and in front of it are two thumb-wheels for fine adjustment of speeds—one for each. The six-pound platter fits onto the rotor frame, with two red triangles indicating the point at which the platter should be placed for minimum wow and flutter. The instructions imply that this positioning is not particularly important unless extremely critical applications demand the absolute minimum of which this unit is capable. We found, however, that the flutter was noticeably greater with the marks displaced by 180 deg., so all performance measurements were made with the two points aligned. Note that the platter has two large holes to facilitate lifting—a feature we wish *all* removable platters offered, for some are difficult to remove. The center opening is normally covered with an aluminum disc which may be removed for lubrication. The heavy rubber mat covers the opening anyway and provides a ribbed surface for the records.

The underside of the platter carries the two stroboscope pairs, one for each of the two possible line frequencies, and with one ring for 33⅓ and one for 45 at each of the frequencies. The platter also carries the usual drilled holes showing that it had been dynamically balanced.

Motor Operation

Although no complete schematic is furnished, a simplified one is, and by comparison with the schematic of the motor drive system in the RS-275US cassette deck, we are able to offer a brief description of the system. First, there is the oscillator

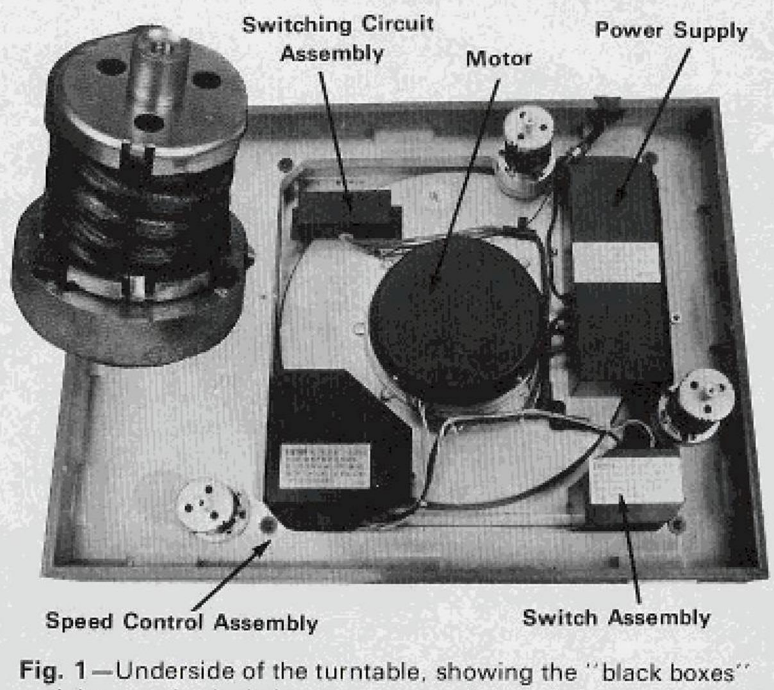


Fig. 1—Underside of the turntable, showing the "black boxes" and the massive isolation mounts consisting of viscous-damped springs. Inset shows one of the isolation mounts.

circuitry which generates a signal of approximately 50 kHz which is fed to three coils of the position-detecting section. As the rotor turns, the coupling between the primary (oscillator-fed) coils and the three secondary coils changes. The signal coupled into the secondary coils is rectified and the resulting position signal is fed to three transistors which switch currents through the three driving armature coils (in the stator) to provide the power to rotate the magnet rotor on which the platter rests. Three speed-generation coils are wound bi-filarly on the drive coils and thus have signals generated in them from the drive coils. These speed-generation coils feed three diodes whose resulting d.c. voltage is compared with a regulated voltage from the power supply, and the differential is fed back to the switching transistors to stabilize the speed to the desired value. Varying the d.c. comparator voltage changes the speed slightly for the vernier controls, or from 33⅓ to 45 or vice versa by action of the speed-change switch. In all, it is a very complicated motor, but it offers the advantage of requiring no high-speed rotor and the necessary speed-reducing mechanism to provide the relatively slow speeds of the platter, and it is obvious that the elimination of rotating elements of, say, 1800 (for the motor) and about 240 for the idler is likely to reduce the possibility of introducing flutter at these frequencies. Furthermore, the elimination of a.c. components of line frequency from the vicinity of the cartridge reduces the possibility of hum pickup. Obviously, the reduction of all rotating elements to the single speed of the platter must be an advantage.

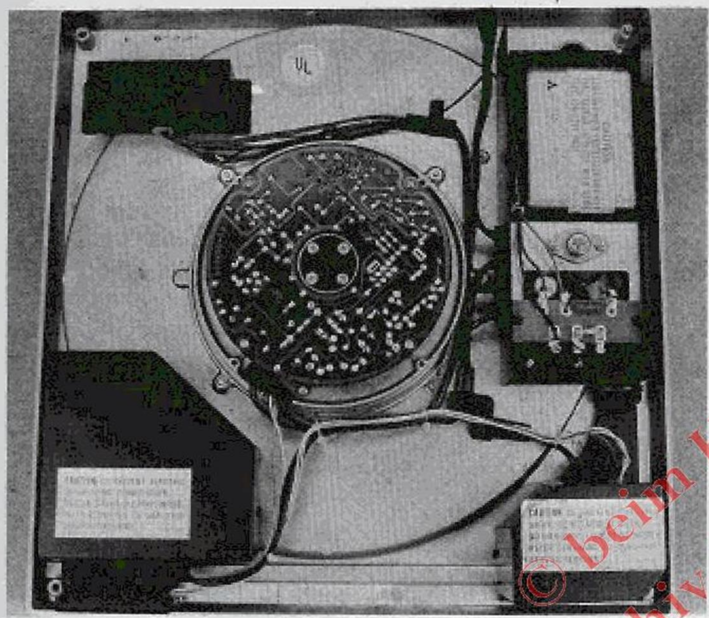


Fig. 2—Underside of the turntable with covers removed from power supply section and the motor. Note caution notices on the other boxes against removing the covers.

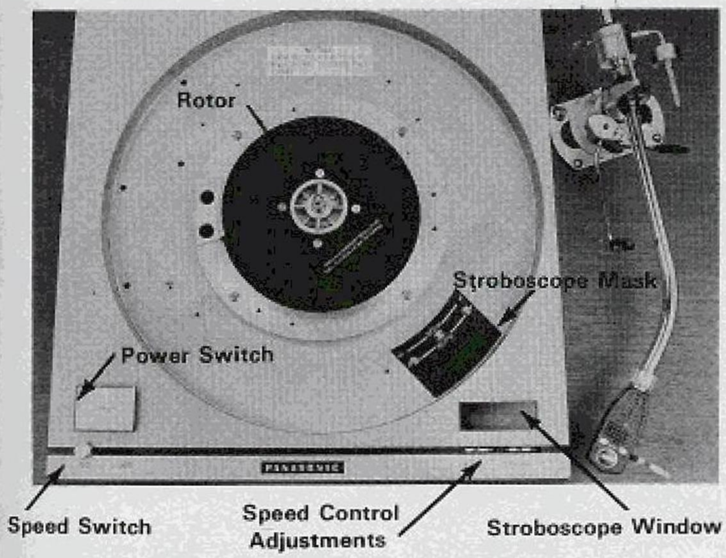


Fig. 3—Turntable with platter removed. Large round section is the magnet rotor—the only moving part of the turntable (when the platter is removed.)

The turntable is provided with a fixed clamp which holds the motor rotor in place—that is, it cannot be removed. In addition, there are three clamps which are used for shipping and which actually hold the rotor stationary. These must be removed, along with a number of other securing screws, all of which are painted blue, and these secure other portions of the mechanism for shipping purposes. Furthermore, there are several more screws which are painted red, and which according to instructions, should not be removed. And in case you select the unit mounted in the cabinet with provision for the SME arm, do not count on being able to play the unit for at least an hour after you get it home—the mounting of the arm is in itself a time-consuming operation. But it is likely to be worth it. Among the many advantages of this type of turntable are the elimination of any intermediate mechanisms between the motor and the platter. Turntable rotation can be stopped at any time without causing any damage—only a slight increase in motor current, which normally results in a power consumption of 0.1 watts. Total power consumption is about 6 watts, which is well under that required by the usual type of turntable.

The d.c. drive motor is not affected by fluctuations in power frequency, although since the neon lamp which illuminates the stroboscope is lighted by the power line directly, any variation in the line frequency will cause an *apparent* speed variation according to the stroboscope. There is *no* speed variation of the platter regardless of the line frequency over a reasonable range, nor of the line voltage over the range from 85 to 135 volts. In other words, as long as the motor is running, the speed will be constant.

Performance

We measured all the usual parameters of turntable performance. Wow, separately measured from flutter, was a low .04 per cent. Flutter measured at .06 per cent, and with the platter displaced 180 deg. from the line-up marks, it was 0.11 per cent. Rumble was just about as low as we could measure—using the NAB method, it was 57 dB below the 1000-Hz 3.54 cm/sec standard for stereo records, which corresponds to the NAB specified velocity of 1.4 cm/sec at 100 Hz to be used as reference for rumble measurements. Note that this 57 dB is the unweighted value. Weighted, the measurement was beyond our capability.

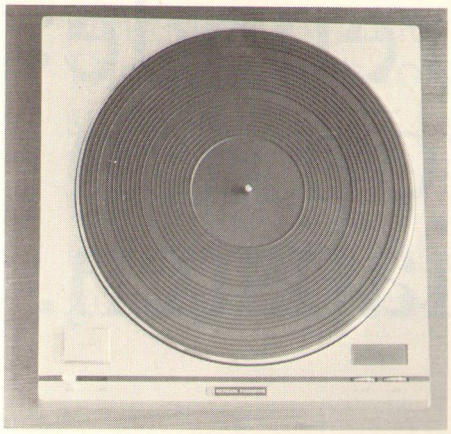
The turntable reached normal speed within ¾ of a revolution when started from a standstill. Holding the platter with power on and then releasing it gave a somewhat quicker response, estimated at about ½ a revolution, and with no fluttering or hunting after reaching normal speed.

Although the figures for wow and flutter are extremely good, it is quite possible that a few hours run-in time would reduce them still further. But, of course, we are talking about very miniscule quantities—we have long lived with the average type of turntable which rarely gets below about .08 in flutter or wow. The Panasonic must therefore be classed very close to the top in turntables—one any of us would be glad to put into our systems. One thing is sure—few of us could possibly have a better one.

C. G. McProud

TEST

National SP-10
Ein Laufwerk mit Direktantrieb



Der Gedanke, ein Laufwerk zu bauen, dessen Motorwelle gleichzeitig den Plattenteller trägt, ist nicht neu. Bisher waren jedoch Plattenspieler nach diesem Konstruktionsprinzip nicht über das Versuchsstadium hinausgekommen. Der SP-10 von National ist das erste Laufwerk mit direktem Antrieb, das serienmäßig produziert wird.
Ähnlich wie bei den einzelnen Bewertungssparten muß auch in dieser Zusammenfassung das Wort „Kritik" ganz klein geschrieben werden, weil es an unserem Testexemplar auch bei strengster Betrachtungsweise praktisch nichts zu kritisieren gab. Von der Präzision der Verarbeitung über die bestechenden Gleichlauf- und Laufruheeigenschaften bis zum optisch nicht mehr erkennbaren Höhenschlag des Plattentellers entsprach alles an ihm den Vorstellungen von einem Laufwerk der absoluten Spitzenklasse. Überdies versprechen Konzeption und Aufbau eine große Lebensdauer bei gleichbleibenden Qualitätsmerkmalen, denn der einzige Punkt, an dem mechanische Abnutzung auftreten kann, ist das an sich gut dimensionierte und geschützte Lager der Motorwelle.

Stratos Tsobanoglou

Konstruktive Merkmale

Laufwerk mit den zwei heute gebräuchlichen Geschwindigkeiten. Die Plattentellerachse und die Motorachse sind identisch, wodurch jegliche Zwischenglieder zur Kraftübertragung entfallen. Der Motor selbst hat einen elektronisch gesteuerten Kollektor – es existieren also keine Bürsten, die auf ihm schleifen und Laufgeräusche verursachen können. Eine umfangreiche Elektronik, versorgt von einem stabilisierten Netzteil, steuert den zwanzigpoligen Gleichstrommotor in allen Funktionen, das heißt, sie besorgt die Geschwindigkeitsumschaltung, die Drehzahlfeinregulierung und hält die Motordrehzahl entsprechend dem voreingestellten Wert konstant. Diese Regelung erfolgt durch Vergleich der in den Positionsdetektorspulen vom Läufer des Positionsdetektors induzierten Spannung mit einer Referenzspannung und hieraus erfolgender Erhöhung oder Absenkung des an den Motor gelangenden Stroms. Um den Motor in Bewegung zu halten, sind übrigens nur 0,1 Watt nötig, dadurch ist das Auftreten von elektromagnetischen Schwingungen praktisch unmöglich gemacht.
Zur optischen Kontrolle der eingestellten Tourenzahl und als Hilfe für deren Feinregulierung dient ein beleuchtetes, sehr exakt arbeitendes Stroboskop mit getrennten Reglern für die zwei Geschwindigkeiten.

Gleichlauf

Zu dem gemessenen vorbildlichen Wert für die Tonhöhenschwankungen sei hinzugefügt, daß er sich nur um ± 0,015% verschlechterte, wenn man nicht nach DIN 45500 bewertet, sondern die Messung linear durchführt. In Anbetracht dieser Tatsache ist es selbstverständlich, daß gehörmäßig wahrnehmbare Gleichlaufschwankungen unter keinen Umständen vom SP-10 verursacht werden können.
Aufgrund der Antriebsart wird ferner die Drehzahlkonstanz von eventuellen Spannungs- oder Frequenzschwankungen im Ortsnetz nicht beeinträchtigt.

Laufruhe

Die erzielten Ergebnisse sind die besten, die bisher in unserem Meßlabor von einem Laufwerk erreicht wurden. Es ist anzunehmen, daß sie die Grenze dessen darstellen, was sich mit der verwendeten Meßschallplatte aufgrund der von ihr produzierten Laufgeräusche herausholen läßt. Sicher ist, daß eventuelle Rumpelgeräusche beim Abspielen von Musikschallplatten mit dem SP-10 allein auf die Oberflächenbeschaffenheit der Platten zurückzuführen sind und nicht auf das Laufwerk.

Drehzahlfeinregulierung

Der gebotene Variationsbereich genügt vollkommen, um die Nenndrehzahlminderung aufzuwiegen, die auch von sehr schweren Plattenbesen (voller Lencoclean) verursacht werden.

TECHNISCHE DATEN

Laufwerk National SP-10

	Herstellerangaben	Messungen
Drehzahlen	33⅓, 45 Upm	
Drehzahlfeinregulierung	± 2%	+ 2,8%, – 2,7%
Plattenteller: Gewicht Durchmesser	2,8 kg 30 cm	
Gleichlaufschwankungen	± 0,03%	± 0,045% (nach DIN 45539)
Drehzahldifferenz zwischen Anfang und Ende einer 30-cm-Platte bei Verwendung eines vollen Lenco-Clean-Röhrchens		0,3%
Rumpel-Fremdspannungsabstand		51 dB (nach DIN 45544)
Rumpel-Geräuschspannungsabstand	70 dB	69 dB (nach DIN 45544)
Abmessungen	35 x 9 x 35 cm (B x H x T)	
Empfohlener Preis einschl. Mwst.	Chassisausführung um 1200,— DM mit Konsole, Haube und Tonarm National EPA-99 1995,— DM	

2

TECHNICS SP-10MK3 TURNTABLE

Manufacturer's Specifications

Drive: Direct.

Motor: Quartz phase-locked control, ultra-low speed, brushless, d.c.

Platter: Copper alloy and aluminum, diecast, 12.6-in. (32-cm) diameter; weight, 22 lbs. (10 kg); moment of inertia, 1.1 ton-cm (1,100 kg-cm).

Speeds: 33.3, 45, and 78.26 rpm.

Pitch Control: Quartz-locked, ±9.9%, in 0.1% steps, at all three speeds.

Starting Torque: 1.2 foot-pounds (16 kg-cm).

Startup Time: 0.25 S to 33⅓ rpm.

Braking Time: 0.3 S from 33⅓ rpm.

Speed Fluctuation Due to Load Torque: 0% within 0.72 foot-pounds (10 kg-cm).

Speed Accuracy: ± 0.001%.

Wow & Flutter: 0.015% wtd. rms (per JIS C5521), ±0.021% wtd. peak (per DIN 45-507, IEC 98A weighted).

Rumble: −92 dB DIN B, −60 dB DIN A (both IEC 98A weighted).

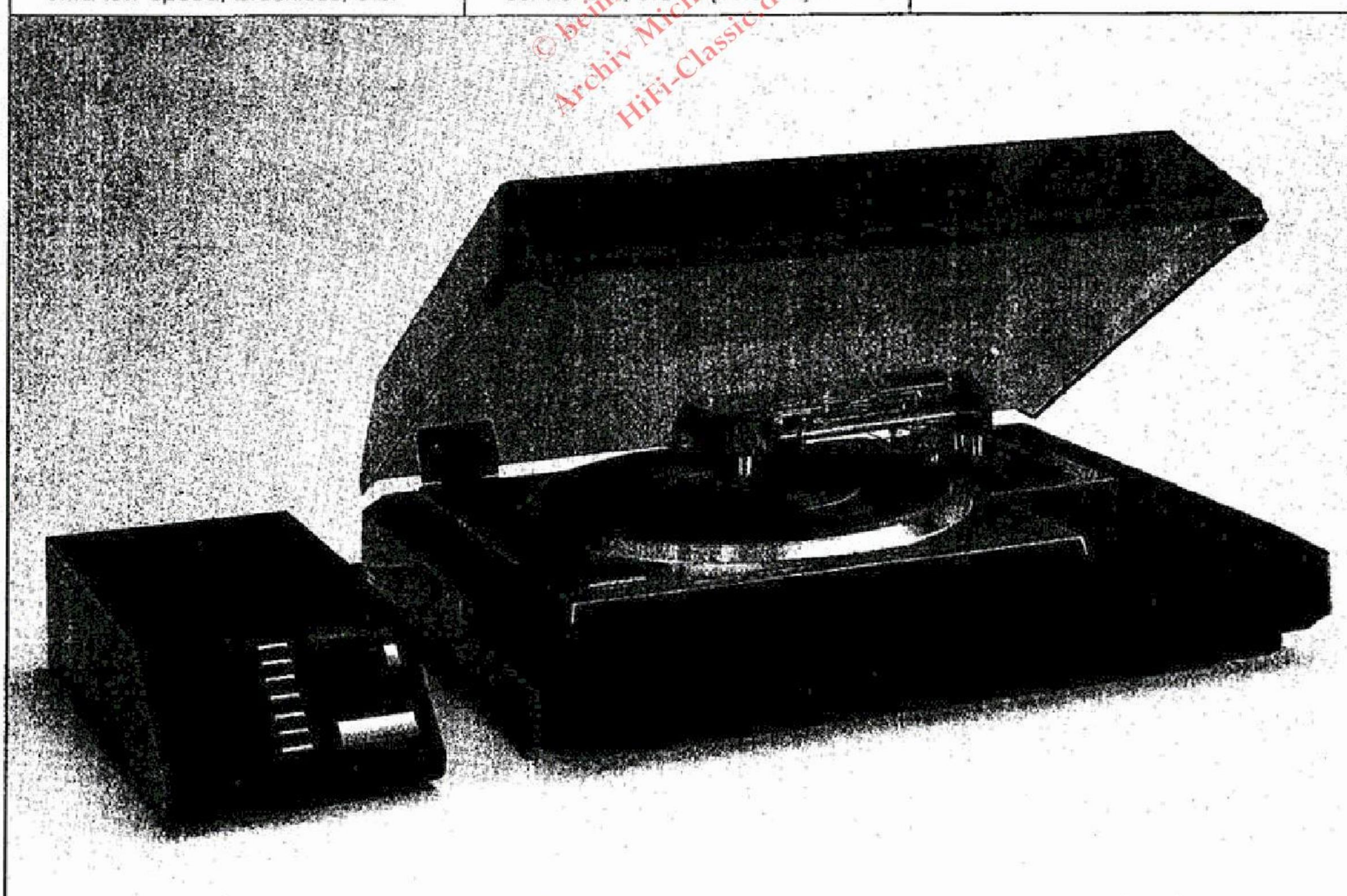
Dimensions: Turntable, 14½ in. (36.9 cm) W × 4-7/16 in. (11.3 cm) H × 14½ in. (36.9 cm) D; power/control unit, 6½ in. (16.6 cm) W × 3-13/16 in. (9.6 cm) H × 16¼ in. (41 cm) D; optional SH-10B5 base, 22 in. (55.9 cm) W × 18 in. (45.7 cm) D × 6¾ in. (17.6 cm) H including dust cover.

Weight: Turntable, 40 lbs. (18 kg); power/control unit, 13.2 lbs. (6 kg); optional SH-10B5 base, 42 lbs. (19.1 kg).

Prices: Turntable and power/control unit, $1,700; SH-10B5 base, $800.

Company Address: One Panasonic Way, Secaucus, N.J. 07094.

For literature, circle No. 91



The SP-10MK3 is produced by Technics, a division of Matsushita Electric Industrial Co. Ltd., the Japanese company which also owns Panasonic and Quasar. Matsushita is a large, vertically integrated company, which means that it manufactures most of the parts used in the products it produces. Technics makes a full line, including receivers, amplifiers, loudspeakers and tape decks.

There has been a debate, over the years, as to the relative merits of direct-drive, belt-drive and quartz-controlled turntables. Technics makes all three types and therefore is in a unique position to make judgments about which is best. For the SP-10MK3, their top turntable, Technics has chosen to use quartz control and direct drive.

Direct drive allows very tight coupling between the motor and turntable platter, and therefore very precise control. To maintain precise motor speed, and thereby take advantage of such tight coupling, Technics uses quartz control. In this, a quartz crystal is used as a very stable control element in a high-frequency oscillator. The oscillator is then used as a reference to control the drive motor's very low rotational speed. (The exact control method can vary from one design to another.) The advantage of such an approach is in the ability to control the speed and to allow it to be changed in a very precise manner.

One very impressive thing about the SP-10MK3 is its weight. It is by far the heaviest turntable that I have ever tested, and I have had to lift some big ones! The immediate problem was to find a wide and stable platform upon which to place the SP-10MK3. Many of the turntables I have seen lately are so large and heavy as to cause the same problems as those "bookshelf" speakers not designed to fit on normal bookshelves. The Technics SP-10MK3 is much too heavy for any bookshelf I have ever seen. The weight of the SP-10MK3 turntable is 40 pounds, the control unit is 13 pounds and the mounting base is 42 pounds, for a total weight of 95 pounds! Technics obviously feels that the way to make a turntable immune to external vibrations is to make it massive. For past reports, I have placed the turntable under test on a special massive platform when I was measuring acoustical and mechanical isolation. With the SP-10MK3, I even made the listening tests with the turntable on this platform.

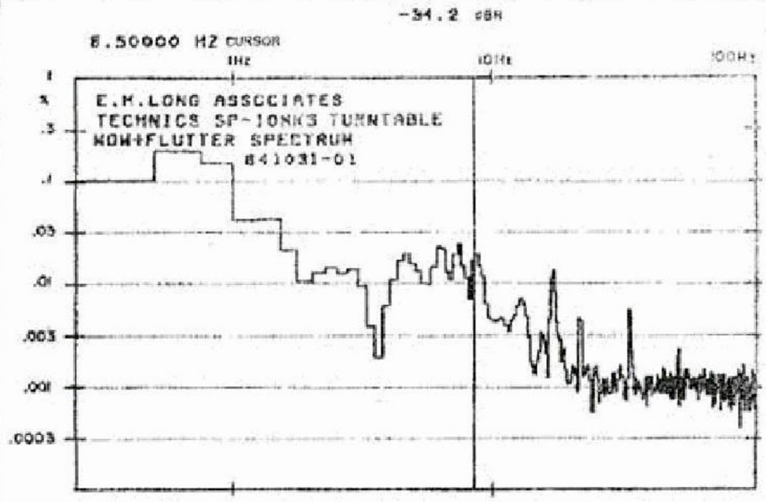


Fig. 1—Wow and flutter spectrum. Note that the vertical percentage scale has been shifted from previous Long turntable reports so that 1% is the maximum level on this scale.

The electronic speed-control unit is also most interesting. There are eight control buttons plus the a.c. power switch and a large display window. Three of the buttons are for selecting the exact speeds; one is the speed lock, three more are for the plus and minus increments and a "clear" switch. The last control button is "Stop-Start." There is a rather large window on the left side of the control unit through which you can see the speed you have selected, and, if you decide to set the speed fast or slow to change pitch, you can see the percentage change in 0.1% increments as you increase or decrease the speed. If you have an interest in 78-rpm records, which I do, you will like the fact that the SP-10MK3 not only has the usual 33.3 and 45 but 78 rpm as well. The electronic speed adjustment will thus allow you to adjust the pitch of the sound to compensate for the old 78-rpm cutting lathes and tape recorders that did not always run at the correct speed.

The optional SH-10B5 turntable base includes a hinged dust cover of smoked gray plastic. The hinges can be adjusted so that the cover can be held open without raising it to its full height. Four feet are mounted on the bottom of the base, and these can be adjusted to level the turntable. The feet include heavy-duty springs which provide some isolation from external shocks. The black and silver styling of the SP-10MK3 is very clean and functional and gives the immediate impression that it is a very solid, professional turntable.

MEASURED DATA

Parameter	Claimed	Measured	Comment
Speeds	33.3 and 45 rpm	+0.19%	Excellent
Speed Stability	±0.001%	±0.17%	Very Good
Wow, DIN Unwtd.		0.21%	Very Good
Wow, DIN Wtd.		0.08%	Excellent
Flutter, DIN Unwtd.		0.12%	Very Good
Flutter, DIN Wtd.		0.02%	Excellent
W & F, DIN Unwtd.		0.28%	Very Good
W & F, DIN Wtd.	0.021%	0.08%	Excellent
Long-Term Drift		0.40%	Good
Rumble, Unwtd.	−60 dB	−68 dB	Excellent
Rumble, Wtd.	−92 dB	−90 dB	Excellent
Suspension Resonance		5.3 Hz	Well Damped

The Technics SP-10MK3 uses quartz control and direct drive to achieve very tight coupling between the motor and platter.

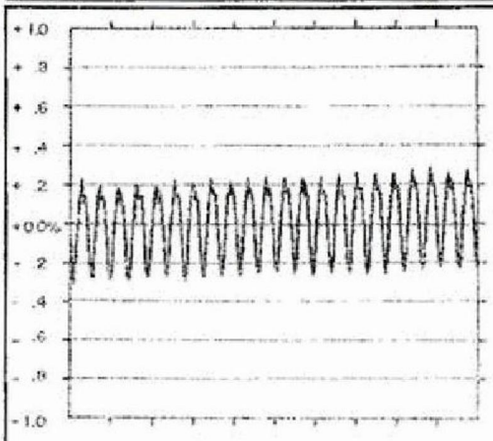


Fig. 2—Speed drift over a 41-S period. The 1.8-S cycle is 5.6 Hz and related to a single revolution at 33.3 rpm. Drift varies between +0.24% and −0.25%.

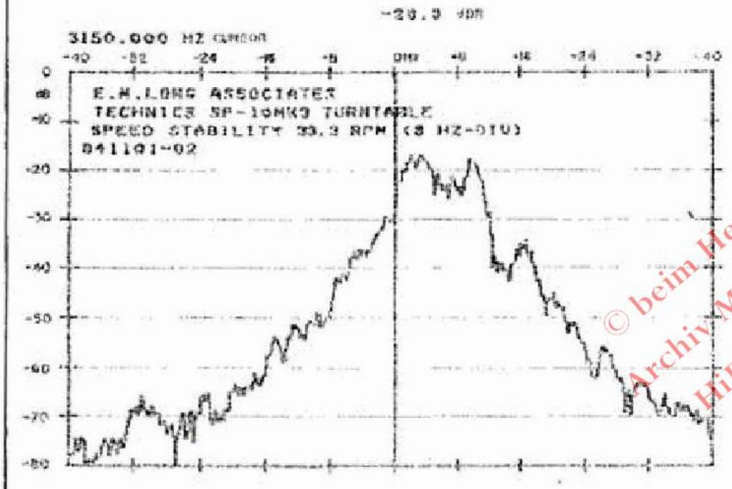


Fig. 3—Speed stability. The 0-Hz reference is to the 3,150-Hz tone on the B & K 2010 test record. Note that speed tends to be fast.

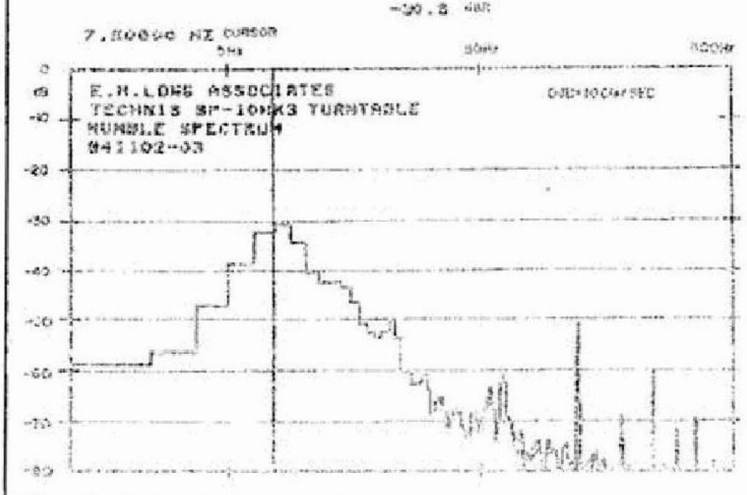


Fig. 4—Rumble spectrum, with main output at the 7.5-Hz tonearm/cartridge resonance.

Features

As mentioned before, the SP-10MK3 uses a direct-drive motor, which means that the motor drives the platter without going through any belts or gears. In the case of the SP-10MK3, the motor *is* part of the platter. The magnetic rotor is mounted on the underside of the platter and is driven by the electric current in the stator coils mounted on the base plate. The platter is made of copper alloy and weighs 22 pounds. Even though it must drive such a heavy turntable, the motor is capable of a starting torque of 16 kg per cm and a moment of inertia of 1.1 ton/sq. cm—quite remarkable. With such torque available, it is no surprise that Technics claims that the platter can reach stable speed within one quarter of a second. By looking at the strobe, I could see that the turntable locked in at 33.3 rpm within one-half turn of the platter. Since the platter makes one complete revolution in 0.56 S at this speed, it appears that the SP-10MK3 meets the specification.

A technique called slip cueing is often used in radio stations to start records exactly. To do this, the record is held stationary while the turntable is rotated. At the desired moment, the record is released, and, since the turntable was already running, the start of the sound can be determined very accurately. The SP-10MK3 can do the same thing *from a standing start*. The stopping time of the turntable is also amazing, considering the mass of the platter, since it comes to a complete halt within 0.3 S after running at 33.3 rpm. The braking is both electrical and mechanical.

The speed can be locked to the standard speeds of 33.3, 45, and 78.26 rpm or it can be adjusted to ±9.9% of each of these speeds in 0.1% increments. The increment is chosen by holding down either the "+" or "−" button on the control unit. Technics includes a chart which will allow you to determine the percentage of change in frequency or the change of pitch in percentage points. As an example, a change of speed from 33.3 rpm by +5.9% will cause a pitch change of a half-tone sharp, and a change of −5.6% will cause a pitch change of a half-tone flat. Adjusting the speed this way allows a recording to be set to the exact pitch originally intended and also allows one to play along in tune with the recording. A "clear" key allows the speed to be reset immediately to the exact rated speed. If you place the control unit next to the turntable, you will need a surface about 29 inches wide and 21 inches deep, and there should be a clearance of about 17 inches above the turntable to allow the cover to be opened.

Mounting a tonearm to the SP-10MK3 is facilitated by the fact that separate mounting platforms are provided with the SH-10B5 mounting base. One of the two that I received had a hole for mounting the Technics EPA-100MK2 tonearm; the other was blank. After the tonearm was fastened to the mounting platform, it was secured to the turntable base by four hex-head bolts. This allows different tonearms to be preset and then changed easily.

Measurements and Listening Tests

As I mentioned earlier, all the measurements and listening tests were conducted with the Technics SP-10MK3 turntable mounted to the SH-10B5 base and with the combination placed on a very heavy and stable platform.

The total weight here is 95 pounds! Technics feels this is the best way to make the table immune to external vibrations.

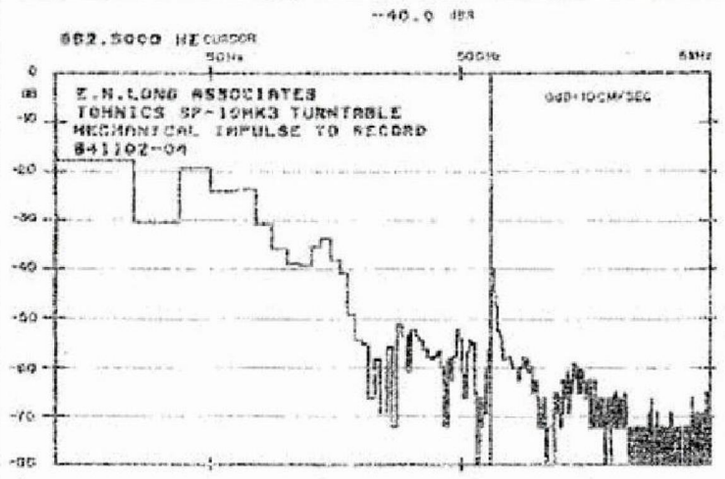


Fig. 5—Spectrum to 5 kHz due to a mechanical impulse applied to the edge of a stationary record with the stylus in a quiet groove. The cursor is at 662.5 Hz, which is the main ringing frequency of the platter and where the output is −40.0 dB below 10 cm/S.

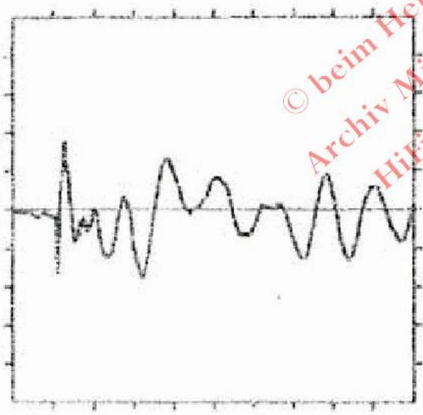


Fig. 6—Output vs. time of the impulse used to obtain the spectrum in Fig. 5. Total period is 0.205 S.

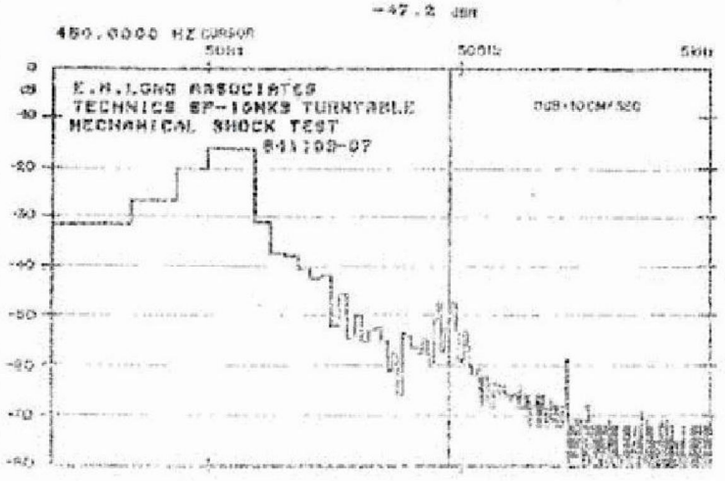


Fig. 7—Spectrum to 5 kHz due to mechanical shock applied to the massive platform upon which the turntable and base rested during tests. Resistance to such shock was very good.

The wow and flutter was measured with a W&F meter and also by recording the component spectrum using the Nicolet 660-2D Fast Fourier Transform (FFT) Analyzer. Figure 1 shows the spectrum of the wow and flutter from the FFT. Most of the components are below 0.03%, and the cursor indicates −34.2 dB, which is 0.02%, at 8.5 Hz. The main component of the wow and flutter spectrum is at about 0.5 Hz. When the record groove is not perfectly centered, the stylus will read the signal at 0.56 Hz, which is the frequency of rotation at 33.3 rpm. This causes the wow modulation seen in Fig. 1, and the accuracy of centering the record has a definite effect upon the amount of wow. The "Measured Data" table shows that the unweighted wow and flutter is 0.28%, while the weighted wow and flutter is only 0.08%. Since the weighting has the effect of reducing the effect of wow and flutter below 20 Hz, this corroborates the data presented in Fig. 1.

The drift in speed over a 40-S period is shown in Fig. 2, a digital storage oscilloscope plot. There is an indication of a little "hunting" by the servo when the speed increases above +0.2%. This might be the reason for the components which appear at frequencies above 10 Hz in Fig. 1. Drift, displayed in Fig. 2, is minor and indicates that overall rotational speed is slightly fast. During the listening sessions, there were no comments regarding the sound that could be directly linked to lack of stability in tone when compared to the reference system. It is rather difficult, however, to be absolutely certain that a record is perfectly centered during listening tests, at least to the degree possible during the technical measurements. I did try a separate experiment to check this. I offset the record slightly on one turntable while I carefully centered a duplicate on the other. When I did this, there was one comment from a panel member about a difference in clarity. I heard a difference also, but I discount my own conclusions to a great extent because I was aware of the test conditions. This might be a clue to explain a phenomenon reported by reputable persons that they have heard an effect upon clarity when the record is rotated to a different position relative to the platter.

Figure 3 shows the spectrum due to playing a recorded 3,150-Hz tone and indicates that the SP-10MK3 is running slightly fast in the 33.3 rpm quartz-locked mode. This is shown as +0.19% in "Measured Data." What this means is that a record which should be exactly 60 minutes when played at 33.3 rpm, will take 59 minutes and 53.2 seconds. This is excellent long-term stability and could be made almost perfect by setting the speed back two clicks to −0.2%. Precise control of speed is very important for timing broadcasts, but it is also handy when copying a record to tape because it can be used to avoid running out of tape at the end of a piece of music. The cyclical variation in speed, shown in Fig. 3, is not the best I have measured, but it is more a function of record eccentricity than of actual speed variations in the turntable itself. Still, the performance here is very good and translates to the ±0.17% shown for speed stability in "Measured Data." The claimed spec of ±0.001% may be a typographical error since it is easy to mix decimal points and percentages. I know, because I tend to fall into this trap myself!

The rumble spectrum is shown in Fig. 4. Most of the

The Technics SP-10MK3 is certainly among the best turntables presently offered by anyone. It's a rugged, heavy-duty unit for daily use.

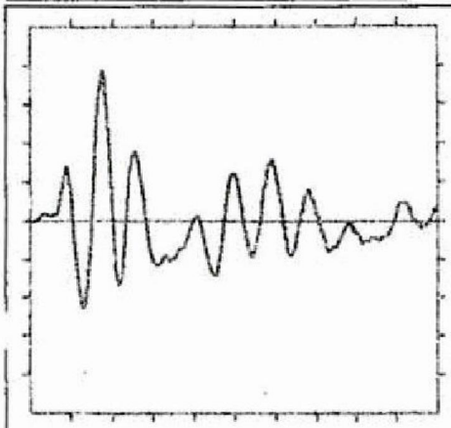


Fig. 8—Output vs. time of the impulse used to obtain the spectrum of Fig. 7. Total period is 0.205 S.

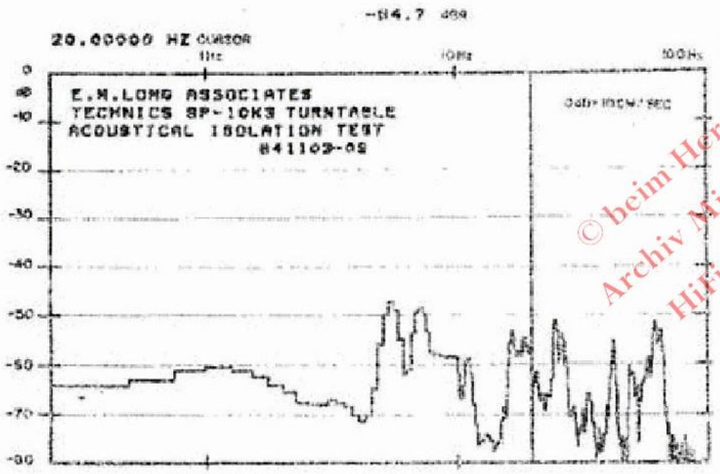
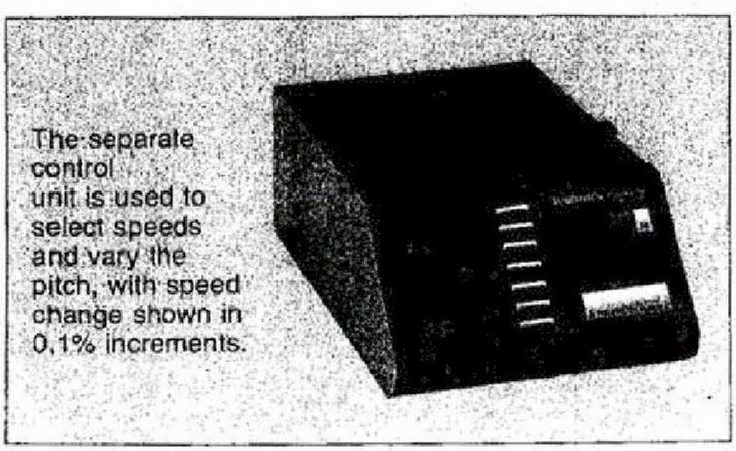


Fig. 9—Spectrum to 100 Hz due to a 100 dB SPL acoustic field at the record surface with the stylus in a quiet groove near the middle of a stationary record. The acoustic isolation is excellent.



The separate control unit is used to select speeds and vary the pitch, with speed change shown in 0.1% increments.

rumble is at the 7.5-Hz tonearm/cartridge resonance frequency. The unweighted and weighted rumble specs are shown in "Measured Data" as being −68 and −90 dB, respectively; Technics claims values of −60 and −92 dB. The rumble is so low that only the most sophisticated equipment and techniques will allow it to be measured with any accuracy, and it has to be rated excellent.

Figure 5 shows the averaged spectrum produced by a series of mechanical impulses. These impulses were applied to the edge of a stationary record while the stylus was resting in a quiet groove near the middle of the record. Figure 6 shows the output versus time caused by one of the mechanical impulses picked up by the stylus. Technics doesn't supply any type of record clamping device, so I didn't use one on the SP-10MK3 for these measurements. During the listening tests, no clamping device was used on either the SP-10MK3 or the reference turntable. The stock platter mat doesn't appear to be anything special, but it is effective in suppressing the ringing of the metal platter at 662.5 Hz. During the listening tests, comments were made about differences in tonal balance between the SP-10MK3 and the reference turntable. It was felt that these differences might be related to differences in the spectrum of the energy in the record. For example, the sound of acoustical guitar seemed a bit fuller from the SP-10MK3, which shows more energy in the range below 200 Hz than the reference turntable.

The isolation of the SP-10MK3 from external shock is indicated by the spectrum shown in Fig. 7. The cursor is at 450 Hz, and the energy rise at this frequency is down −47.2 dB. The greatest amount of energy is concentrated below 100 Hz. The suspension resonance of the SH-10B5 is at 5.3 Hz and very damped, but the great mass of the system can be energized by external shock. Therefore, care was taken during the listening sessions to avoid any mechanical coupling between the loudspeakers and the turntables. Figure 8 shows the output versus time for the mechanical shock which produced the spectrum shown in Fig. 7.

Figure 9 shows the spectrum of the electrical output of the cartridge with the stylus resting in a quiet groove while an acoustical signal produces a level of 100 dB at the surface of the record. This signal is a very slow sweep from 20 to 100 Hz. The system's degree of isolation from this acoustical signal is excellent.

Conclusions

The SP-10MK3 is offered by Technics as being the best turntable that they make; it is certainly among the best turntables presently offered by anyone. If you are in the market for a rugged, heavy-duty turntable which will hold up well in day-after-day use and has broadcast-type professional features, you should check it out. The overall sound quality is only slightly below that of a few top audiophile turntables, and the SP-10MK3 is as good as the best of them with regard to acoustical isolation. In order to achieve this performance, you will have to place the turntable and its base on a very solid platform. The precise control of speed and the ability to change tonearms easily are great features which should interest both musicians and audiophiles.

Edward M. Long