The Optonica RP7100 — a new concept in turntable convenience

The microprocessor now brings to turntable technology the same automatic track-finding feature as has recently been introduced in several cassette decks. Louis Challis reviews the Optonica RP7100 turntable.

Louis Challis

THE ADVENT of the microprocessor and its acceptance by the electronics industry is now already well understood by most audiophiles. Cassette and tape recorders, timers, and various types of remote controls already make full and effective use of their potential. However, one area where they have been slow in penetrating has been in the field of record players.

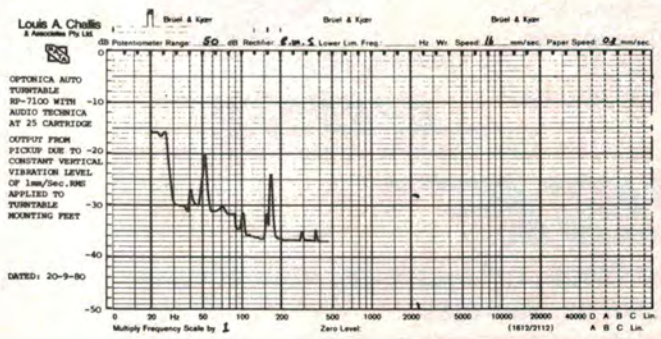
Optonica were amongst the first to use microprocessors with their APSS in the RT7100 and RT9100 electronic tape recorders. With the ground thus broken, it is not surprising that the same concept should be used in the form of the APLD (auto programme locating device) in the RP7100 turntable. The APLD system is designed to locate one out of up to seven tracks on a record and to skip over those tracks which precede it. The basic idea is that the record player should be able to select a given track on a record and play that track without the need for the user to manually cue the tone arm to find it.

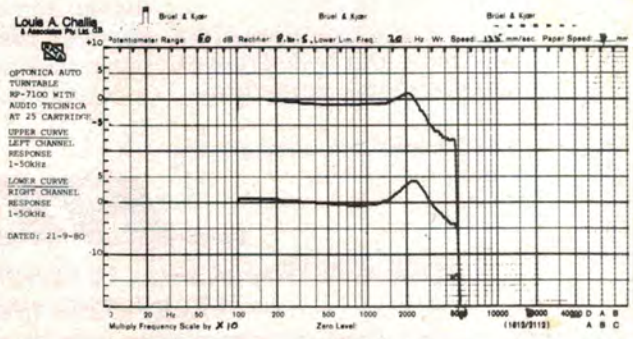
The concept of electronic searching for a programme on a cassette tape is now well accepted; using the breaks between individual tracks in recording it is possible to look for the lack of any recorded signal or alternatively to insert an infrasonic tone on the tape which is then detected by special circuitry. Obviously with records one cannot emulate this process and so Optonica came up with an entirely different approach. It seemed illogical to use the stylus and cartridge as the detection mechanism and the logical solution was to incorporate an optical system which scans the record and in doing so finds the plain sections between individual tracks.

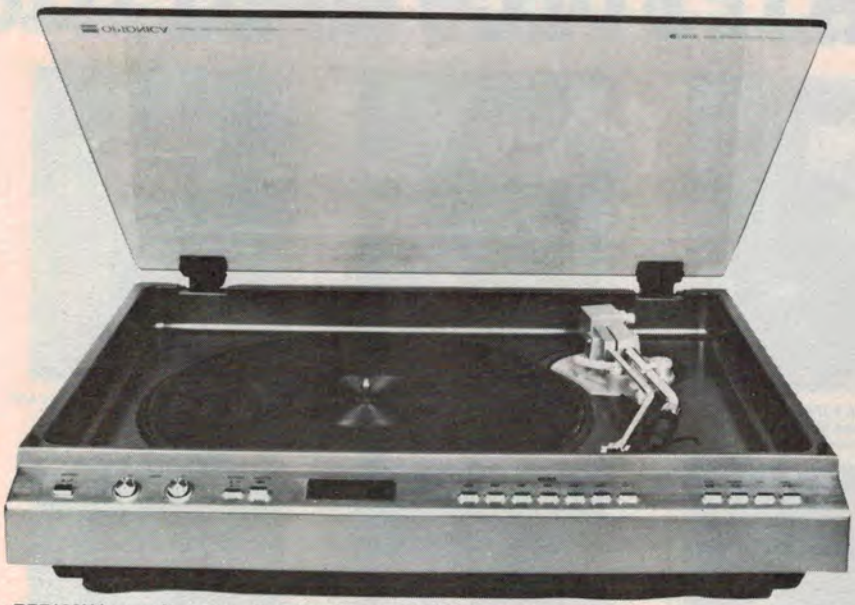
In order not to further compromise the tone arm's performance this scanning is achieved through the use of a completely separate arm from the normal tone arm. This is positioned parallel to the tone arm but is longer and somewhat different in its general appearance. It is arranged so that an infrared photosensor is positioned at its end in line with the stylus assembly of the normal tone arm. On detecting either the lead-in track or any specified track nominated, the APLD device lowers the tone arm in the correct position.

The RP7100H stereo turntable has a somewhat unfamiliar appearance. The first significant difference is the use of a glass top instead of the conventional acrylic or polycarbonate cover incorporated by most other record players. This sheet of glass has significant mass and consequently requires fairly solid spring-loaded hinges. The sheet of glass is flat, whilst the base and plinth of the turntable are moulded into a well-like structure in which the turntable and tone arm are recessed. This plinth is fairly lightly constructed, being an injection-moulded plastic structure designed for ease of fabrication and automatic production.

The front of the turntable features a sloping, brushed satin aluminium escutcheon plate on which all the controls are laid out in a linear array. These are from left to right: the power switch, two knurled rotary knobs for setting the fine pitch of the record player drive at 33 and at 45 rpm, a speed selector switch (with up setting of 33 and down setting of 45), and a quartz crystal, phase-locked loop on/off circuit control switch. When activated this either locks the motor drive circuit on to the internal crystal-







The RP7100H has a glass top rather than the conventional acrylic or polycarbonate covers. All controls are accessible with the lid down.

controlled circuit or allows the user to vary the speed with the two controls. At the front centre of the turntable is a large stroboscope window with which the speed stability of the platter in the variable speed mode can be assessed. On the right hand side of the escutcheon and immediately in front of the tone arm assembly are seven numbered push buttons. By selecting one of these the required track on a record may be selected.

On the right hand side of the plinth are four push buttons. The first of these is a "cueing" button by which the tone arm may be automatically lifted off the record. By pressing the switch a second time the tone arm will be lowered to return to the same place on the record.

Adjacent to this is the "repeat" button, which if pressed whilst a record is playing allows the record to play automatically a second time from the beginning. If the repeat button is simultaneously pressed with the play button at the start of play, then the record plays through repeatedly. To cancel the replay function it is necessary to press the "cut" button, which will terminate the sequence.

The last and most important control is the "play" button, which lifts the tone arm and places it on the first lead-in groove of the record. The tone arm is equipped with a conventional rectangular balance weight, providing adjustment in the range of 0.25 to 3 g. This is supplemented by an anti-skate adjustment which also covers the same range of adjustment. The tracking weight is normally left to the recommendation of the cartridge manufacturer. For our evaluation the Optonica distributors chose an Audio-Technica AT25 cartridge, which is Audio Technica's top-of-the-line moving magnet unit.

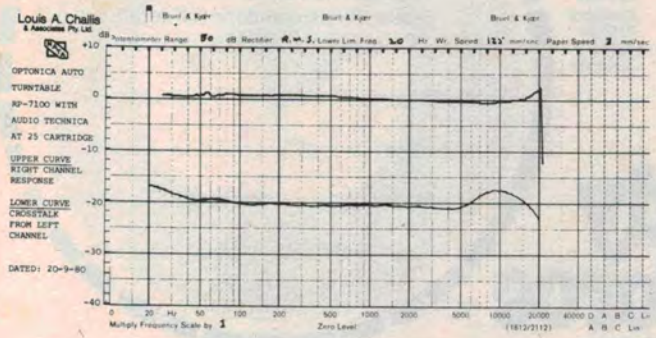
Optonica's design philosophy is in general terms very different to that of the other record player manufacturers on the market. They have designed this unit to provide the simplest possible usage with the minimum number of possible system adjustments. This is achieved through the use of their activated controls, which perform tasks other record players cannot do.

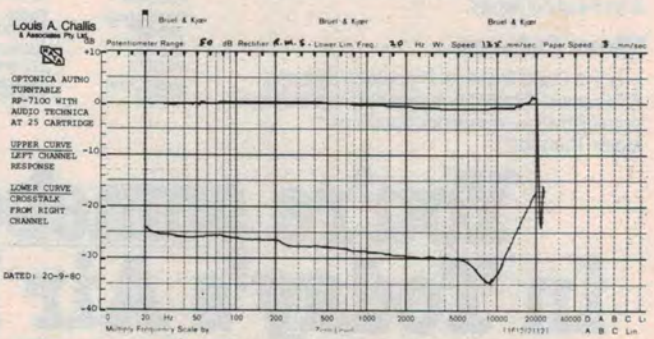
To minimise the feedback problem on what is already a very lightly constructed turntable plinth, they have combined rubber with coil springs in the adjustable isolators to reduce feedback from the supporting structure on which the turntable may be resting. To allow the user freedom of selection in terms of both cartridge and head shell, they have provided a very light and simple universal head shell assembly into which the user-selected cartridge may be screwed.

On test

The objective testing of this particular record player was a pleasant task. The AT25 cartridge that was provided with the unit for its evaluation provided truly impeccable performance. It has a particularly flat frequency response from 20 Hz to 19 kHz, with a slight rise in response at 20 kHz. The cartridge channel separation was typically 20 dB right across the spectrum for the right channel and typically better than 25 dB for the left channel. Based on our previous evaluation of our test records, the frequency response is most probably much flatter than indicated by our level recordings.

More significantly, the tracking ability of the cartridge was quite exceptional, with the cartridge faithfully tracking at all levels on the Shure test record TTR103 with a tracking ▶





THE RP-7100 ELECTRONICS

The quartz locked motor system of the RP-7100 is built around a frequency generator, comprising a 160-pole magnet and a multigap head having 80 pairs of pole teeth and coils, connected to the motor, which generates a 44.44 Hz sine wave signal when the motor is rotating at 33⅓ rpm and a 60 Hz sine wave signal when the motor is rotating at 45 rpm.

The signal from the generator is fed to an operational amplifier and then to an astable circuit which produces a rectangular waveform of 50% duty cycle. This frequency is compared with a reference frequency generated from a crystal oscillator in the following way.

The crystal oscillator frequency of 9.3312 MHz is divided first by four and then by 972. The resulting frequency is then divided by either 27 (for 33⅓ rpm) or by 20 (for 45 rpm) and finally by a factor of two to produce the reference frequency of either 44.44 Hz or 60 Hz.

The operation of the direct drive motor circuit with its Hall Effect commutating devices is well illustrated in Figure 1. The outputs of each of two Hall Effect cells (marked HE) are fed to the inputs of operational amplifiers. The output of each operational amplifier drives a pair of complementary transistors which in turn control the current in the motor drive coils. The Hall cells detect the position of the rotor magnets and cause the currents in the motor drive coils to be phased accordingly. In addition, the voltage applied across the Hall cells is controlled by the servo phase control circuits and alters the switching times of the motor drive coil current so that the motor rotates at the desired speed.

The automatic programme locate device (APLD) is carried on an arm separate from the tone arm, as shown in Figure 2, so that it does not alter the stylus force. This device utilises the difference in the reflection factor for infra-red radiation of sound modulated grooves and unmodulated grooves to detect the spaces between parts of the recorded material. When using the RP-7100, the user can push any APLD button, from one to seven, to select, for example, any song on a record.

The circuitry of the APLD sensor is shown in Figure 3. When the sensor reaches an unmodulated groove, positive-going pulses of some 20 to 40 mV in amplitude appear at the collector of the sensor device. This is amplified to a level of 1 V to 3 V by the operational amplifier whose output is at B. The second amplifier shapes the pulses into square waves of 7 V amplitude at point C, after which they are differentiated by C221 and R264 to form sharp pulses, which are used to trigger the monostable circuit of Q215 and Q216. The output pulses from this circuit are of constant amplitude and duration and are fed to the logic circuitry of this record player.

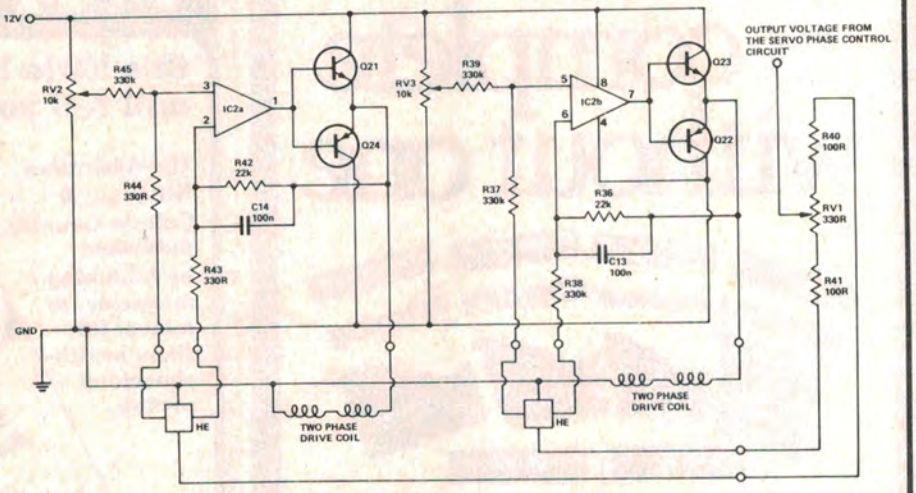


Figure 1. **Basic circuit of the motor drive system which employs Hall Effect sensors (HE) to detect motor speed.**

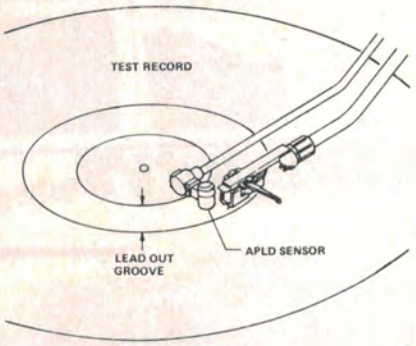


Figure 2. **The APLD sensor system employs infra-red light reflection to detect the difference between the modulated grooves and unmodulated between-track grooves. The sensor is mounted on the separate arm adjacent to the tone arm.**

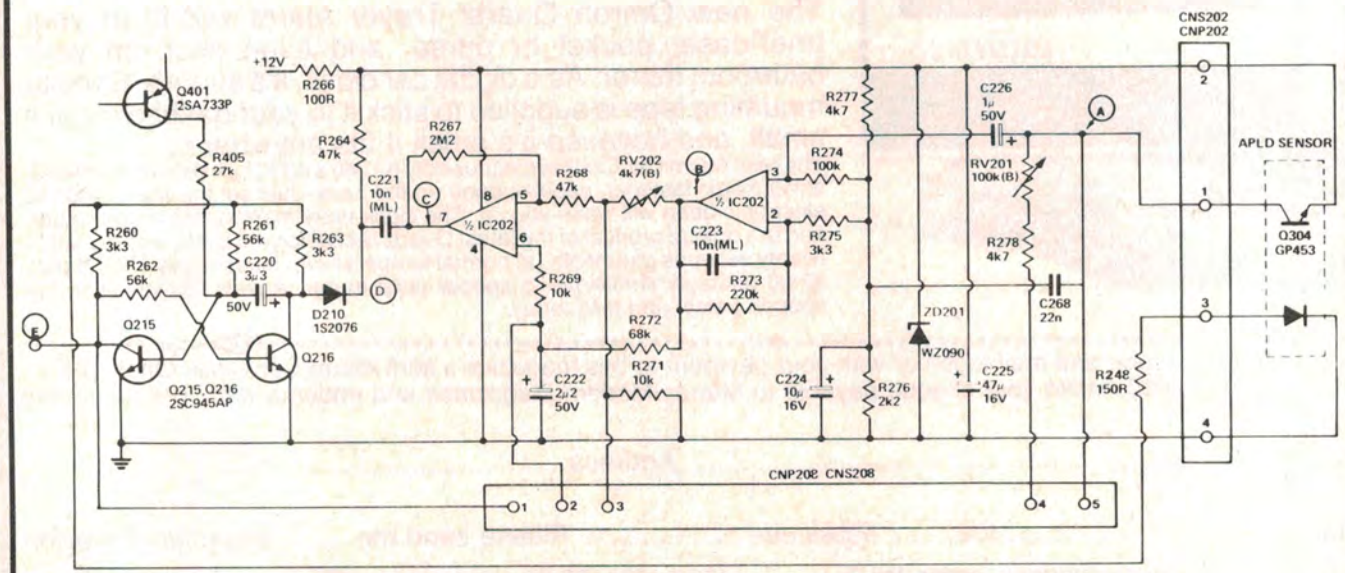


Figure 3. **Basic circuitry of the APLD sensor system.**

mass of 1¼ g. The cartridge was still achieving very acceptable levels of intermodulation distortion at 30 cm/sec tracking velocity — but so much for the cartridge.

We evaluated the tone arm resonance, which occurs at approximately 6 Hz with a fairly sharp "Q" and a trace of jitter which I suspect was due to mechanical interaction with the adjacent photo-optical arm. The actual resonance frequency occurs at a lower frequency than the latest theory would dictate; this could result in some nasty problems if one were to try to play a moderately warped record. Optonica, however, do not recommend playing badly warped records with this unit and are careful to highlight this in their handbook. The shaker test of the complete turntable showed up the effects of using a lightly constructed plastic plinth with low mass and low damping.

The plinth exhibits a number of significant resonances between 20 and 26 Hz as well as at 52 Hz and at 150 Hz. The light construction of the plinth is however compensated for in part by the efficacy of the spring and rubber mounting feet and by the added mass of the glass top. The other features of the unit including the wow and flutter are acceptable and the speed stability is excellent.

The subjective evaluation of this unit was particularly interesting. This is one of the first of a new breed of record players designed for the person who wishes to be able to play his or her records in the most flexible manner possible and with the least complication. I noted that whilst the Auto Programme Locate Device worked well on the whole, on some records it cued into the second groove rather than at the very start of the recording as intended.

The ability of the player to be able to cue to any track on the record is a positive and distinct advantage for any user, and provided this is achieved without compromising the other important operational parameters, then the results justify the means. With any cartridge offering the characteristics and attributes of the AT25, the results are worth the trouble, and it becomes possible to identify the functional and design factors which could be improved in subsequent generations of this record player.

It is clear that the RP7100H has lost some of the ruggedness and technical panache as a result of the incorporation of the APLD function. Nevertheless, it could be said that the differences between this record player and conventional manually operated record players are analogous to the differences between a manual transmission car and automatic transmission car. Obviously both camps have their adherents, and judging by the number of automatic cars on the road, many people gladly sacrifice some areas of performance in favour of ease of operation and labour-saving.

My own impression of the RP7100 stereo turntable is that it offers a reasonable technical performance which is compensated for by its excellent flexibility and almost faultless practical performance. Fitted with a high quality cartridge, and tracking at close to the upper limit recommended by the manufacturer, it will perform well and satisfy most residential uses. Given the benefit of a heavier plinth and/or located in a vibration-free area it would perform even better. ●

Dimension: *108 mm high x 480 mm wide x 384 mm deep*
Weight: *9 kg*
Manufactured by: *Sharp Corporation, Osaka, Japan*
Price: *$499*

The Sharp-Optonica RP-7100H turntable is distributed by Sharp Corporation of Australia, 64 Seville St, Fairfield NSW.

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF
OPTONICA AUTO TURNTABLE - TYPE RP-7100
SERIAL NO. 2050304, FITTED WITH AUDIO TECHNICA
AT 25 CARTRIDGE

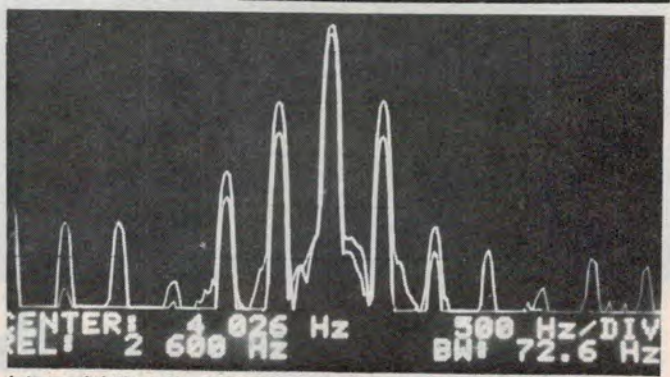
WOW & FLUTTER:	Wow:	0.6% peak to peak
	Flutter:	0.04% Weighted R.M.S.
		0.1% Unweighted R.M.S.
RUMBLE:		-69 dB weighted
		-37 dB Unweighted
SENSITIVITY:	Right Channel:	1.4mV/cm/sec.
	Left Channel:	1.4mV/cm/sec.
	Channel Difference:	0dB
FREQUENCY RESPONSE:		20Hz to 30kHz

CROSSTALK:	100Hz	1kHz	6.3kHz
Left into Right:	21dB	20.5dB	19dB
Right into Left:	26dB	29.0dB	30dB

TONE ARM RESONANCE: 5.5Hz (see attached graph)

TOTAL HARMONIC DISTORTION: (2.24cm/sec. @ 1kHz)		100Hz	1kHz	6.3kHz
	Right	1.1%	1.0%	6.0%
	Left	0.5%	0.9%	6.3%

TRACKABILITY: (Using Shure Disc.TTR103, 400 and 4000Hz) disc) Tracks all levels satisfactorily at 1.4 grams. Photo shows distortion components (including those of) at two highest levels (24 and 30 cm/sec).



Intermodulation distortion of the AT25 cartridge fitted to the RP7100H turntable. Taken with a 4 kHz signal, scale: 500 Hz per div., top trace taken at tracking velocity of 30 cm/sec, bottom at 23.8 cm/sec. Result is quite good.