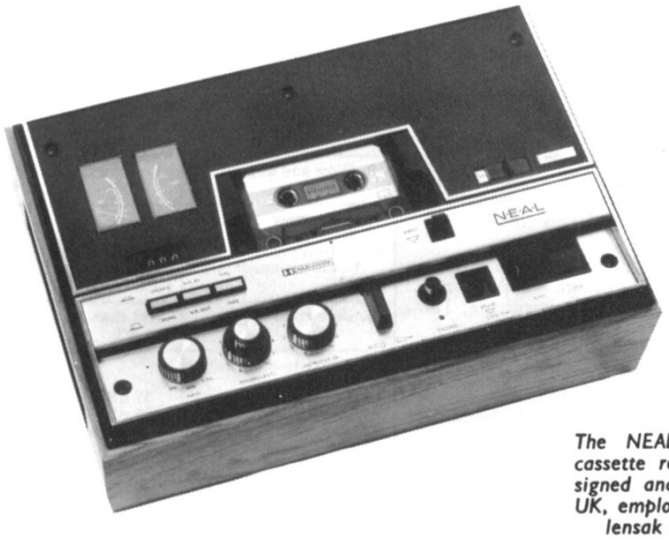
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The NEAL 102 stereo cassette recorder is designed and built in the UK, employing the Wollensak mechanism

NEAL 102 cassette recorder

Price: £189·00 (incl. VAT). Manufactured by North East Audio Ltd., 5 Charlotte Square, Newcastle upon Tyne, NE1 4XF.

WHEN North East Audio Ltd of Newcastle upon Tyne decided to enter the cassette market, they found that the transport mechanism itself would have to be imported. As a result they based their model 102 recorder on the Wollensak deck manufactured in America by the 3M Company. After introducing their own modifications to the mechanism, they then designed their own electronics around it and so produced a top quality mains operated stereo record/playback deck which is intended for use in conjunction with an existing amplifier and loudspeakers. Priced at £189 inclusive of VAT at 8% the NEAL 102 must be regarded as a product for the specialist, and so our technical examination has been conducted along stringent lines without compromise of any kind.

Instead of the usual array of push keys for the tape transport there are only two: one for play and one for stop. Fastwind in either direction is actuated by a lever which must be held in position whilst the winding process continues. This is not such a chore as it might seem to be since the winding speed in either direction is very fast indeed—the fastest we have come across in any cassette mechanism. It is also a great convenience to be able to go straight into fastwind or rewind from play without depressing the stop key first. Mains on/off is controlled by a slider switch and this is linked mechanically to the play key. So long as the machine is connected to the mains power supply, depression of the play key will automatically throw the mains switch to its On position and begin playback. One word of warning in this connection. The capstan and pinchwheel are fully protected against physical damage because, under normal conditions of use, they can never be left together under pressure whilst stationary. The one exception is if the play key should be depressed when the machine is not plugged into a live mains supply socket. Under these conditions the capstan and pinchwheel will remain under pressure with the possible danger of causing indentations in the surface of the pinchwheel so risking deterioration of the wow and flutter performance.

Record is engaged by the depression of a black push-button which is linked to a red pilot light. This control must be actuated in conjunction with the play key and, if one wishes to pre-set levels, it is necessary also to operate the pause lock control. It is not very easy to manipulate the three functions at one and the same time. A row of three push-keys gives choices between mono and stereo operation, Dolby B noise reduction and chromium dioxide or regular tape. Three rotary controls on the front panel are provided for input selection between microphone, DIN input and line input, record level and output level.

It is necessary to explain here that one of the features of the NEAL 102 is the provision of three separate pre-amplifiers for microphone, DIN input and line input. This is a thoroughly professional approach that is rarely adopted by foreign competitors and we are delighted to find that this British manufacturer has had the foresight to use it. Apart from advantages in the improvement of signal-to-noise ratios, this arrangement gives an added bonus in that the line out sockets—a pair of phono connections—deliver a signal at fixed level whereas the 5-pin record/playback socket provides an output that is continuously variable from the output level control on the front panel. This means that there should be no problems at all in matching up the output to the input sensitivity of virtually any amplifier.

We must criticise the mechanical functioning of these three knobs themselves. They do not have quite the feeling of reliability and mechanical efficiency that we have come to associate with some imported recorders; in addition, the record level control consists of a pair of ganged knobs which operate quite independently for left-hand and right-hand channels without any kind of friction interlock. Consequently it is necessary to rotate both knobs together for a smooth fade-up on both channels and this is not particularly easy since the fingers can jam against a protrusion on the upper deck plate. This is an inconvenience which the practised owner would soon learn to overcome, but which is apparent to the reviewer who is able to use the equipment only for a relatively short period of time.

The upper surface of the deck also contains two large record level meters, a 3-digit position finder with its pre-set button and the eject key. On the left-hand side of the machine there is a recessed panel carrying the line input and line output sockets (phono), a 5-pin DIN record/playback socket and jack sockets for headphone output and microphone inputs for left-hand and right-hand channels. The 3-core mains cable exits from the underside of the machine which is fitted with excellent non-scratch, non-slip rubber feet. Overall styling generally could be regarded as somewhat plain and functional, but we do not see this as a disadvantage. It was noted that there is no fly-up lid to the cassette housing and the machine itself is supplied without any form of deck cover. The reason for this is that the NEAL 102 is sold in quantities to professional users where lids are regarded as superfluous to requirements; the manufacturer will supply a cover as an optional extra. Items that are in the price include a cassette of blank tape, a packet of plugs to suit all the various connection sockets and, unusually, a Bib cassette tape head cleaner outfit complete with liquid and cleaning tools. A pity more manufacturers do not follow this excellent practice.

Before beginning our technical investigation, we studied the manufacturer's specification. Unfortunately this has had to be abbreviated for publication in these pages, but the complete version contains a wealth of engineering information that is rarely available from other manufacturers.

We commenced our laboratory examination by reproducing standard calibration tapes manufactured by BASF, the iron oxide to DIN 45513/6 and the chromium dioxide to DIN 45513/7. The measurement of the playback of the tones recorded on these tapes is shown in Fig. 1.

The figures are averages for both channels, there being little channel difference, and the results were substantially the same whether the Dolby noise reduction was switched in or out. As we have explained before, perfection would be indicated by zero measurements; a deviation up or down of 1 dB is very tiny indeed. If we look firstly at the results on iron oxide it will be seen that from 40 Hz to 10,000 Hz the amount of deflection from the perfect straight line is so small as to be negligible. This means that, when we produce any recordings—including commercial pre-recorded tapes—that have been properly prepared on iron oxide tape, the NEAL 102 will, in terms of frequency response, give a standard of reproduction that is just about as close to perfection as humanly possible.

Similarly, when we look at the results from the chromium dioxide calibration cassette, we again find that from 40 Hz to 10,000 Hz the response curve has even smaller variations; it only begins to fall off to −2·5 dB between 10,000 and 12,500 Hz. This too is not just excellent; it is a performance standard that cannot under any conditions be bettered between 125 and 8,000 Hz with what amounts to probably inaudible variations immediately above and below those limits. The fact that there is a loss of response at the very lowest test frequency of 31·5 Hz, which is outside the specification limits, is compensated by a rapid rise to +1 dB at 40 Hz.

To check on the machine's overall response performance we used a TDK SD C45 iron oxide cassette and a TDK C60 chromium dioxide. Again our figures are averages for both channels, and it was noted that there was again little measureable difference when the Dolby noise reduction system was in use. The performance of the 102 as a recorder largely parallels its exemplary results as a playback machine (see Fig. 2). To put these figures into perspective, we would remind readers that a single decibel has been defined as "the smallest audible difference in sound levels".

With such excellent frequency response results, we next proceeded to check on the signal-to-noise ratio of the NEAL 102. Using tape that had been erased within the machine with the record gains closed, it was found that the A weighted noise level using iron oxide tape was approximately 55 dB below reference level; this improved to 63 dB when the Dolby circuit was in operation. The equivalent figures for chromium dioxide were 56·6 and 65 dB. The specification refers to unweighted signal-to-noise ratios, and these we have been able to agree. It is worth mentioning that the machine-only noise (that is without any tape passing the playback head) was measured as some 6 to 7 dB better than when the tape was in motion.

Incidentally, we undertook a special measurement on the level of 50 Hz mains hum and found this to be very, very low indeed—the actual reading was −62 dB with the 50 Hz harmonics of 100 Hz and 150 Hz even lower.

As usual we checked on the distortion content of a signal recorded at reference level. This was found to be exactly 3% on both chromium dioxide and iron oxide tapes. This is precisely the figure that we feel is desirable in top grade equipment of this kind. During the course of this check it was noted that, when switched to either chromium dioxide or iron oxide tape, the internal meters were reading +2 dB when a signal to reference level was being recorded. These meters are described as "peak reading" and this we agree. One of the weaknesses of the specification is that it refers to the electronic time constant as having a 2 millisecond rise time (which is very, very fast indeed) and a 200 millisecond fall time. If a meter is to serve a useful purpose, the needle should rise quickly and fall slowly; unfortunately the mechanical characteristics of the meters in the 102 do not permit the needles to move at anything like the rate at which the electronic circuitry reacts. The practical rise time is in the order of 40 milliseconds for 100% modulation but the delay is indeed suitably slow.

For long term speed stability we checked the playback of a 3,000 Hz tone via an electronic counter and this measured 3008. It can therefore be said that the 102 was running 0·3% fast which is about as close to absolute accuracy as it is possible to get. We were a little concerned at the specified wow and flutter performance which is given as "less than 0·15% RMS DIN weighted". This is an unusual form of measurement and so we checked to the DIN standard using an ME 102B wow and flutter meter. This gave us a reading of 0·08%, thus placing the NEAL 102 firmly amongst the élite few cassette machines capable of achieving such an outstanding performance in this very important respect.

Looking back over the results of our laboratory examination, we can only summarize our our findings by saying that the NEAL 102 cassette recorder is one of the very few machines capable of achieving a standard of performance that could hardly be bettered in any single respect. This is not just a good machine; it is not so long ago since we would have applauded semi-professional open reel equipment costing several hundred pounds if it had measured up as well as this cassette deck. The fact that it is of British design and manufacture—apart from the imported mechanism—increases the pleasure we feel at being able to award this model the top technical accolade.

Engineering figures are only useful in so far as they indicate what one might expect to experience under conditions of practical use. It must never be forgotten that the purpose of a machine is not to produce wonderful measurements but wonderful music. For our recording and listening tests, the NEAL 102 was connected to a Technics SA6000X 4-channel amplifier driving a pair of Bowers & Wilkins DM2 loudspeaker enclosures on the front channels only. The complications of 4-channel operation render it undesirable for use when subjective listening comparisons have to be made. We played back a selection of commercially pre-recorded cassettes, and we made our own recordings originating from 15 ips open reel master tapes and from radio transmissions.

The quality of the music we heard was up to the best we have ever experienced from any cassette deck at any price. It would not be an exaggeration to say that, during the time the NEAL 102 has been in our possession, we have been thrilled and excited by the quality potential of this excellent recorder. It does everything that could be expected of it and more.

DENYS KILLICK.

Note: this review first appeared in our sister publication *Cassettes & Cartridges*.

SPECIFICATION AND TEST RESULTS
NEAL 102 CASSETTE RECORDER

	Maker's Specification	Test Result
1. Tape speed (inches per second)	1⅞	Accurate
2. No. of tracks	4 Stereo/mono	—
3. Wow and flutter (%)	less than 0·15	0·08
4. Frequency response (Hz)		
Iron oxide	35–12,000	See Figs. 1 and 2
Chromium dioxide	35–15,000 (+1,–3 dB)	
5. Distortion (%)	less than 0·1	
6. Signal-to-noise ratio (CrO_2)		(weighted)
Dolby in	57 dB	65 dB
Dolby out	55 dB	56·6 dB
7. Input sensitivity (mV)		
Microphone	0·25	—
High level line	80	—
Low level line	2·25	—
8. Output	110mV fixed 2V controlled	Agreed
9. Dimensions (in.)		—
10. Fast wind time (sec.)	45 for C60 tape	Agreed
11. Equalisation (micro-seconds)		
Iron oxide	120/3180	—
Chromium dioxide	70/3180	—
12. Crosstalk	better than 45 dB	—

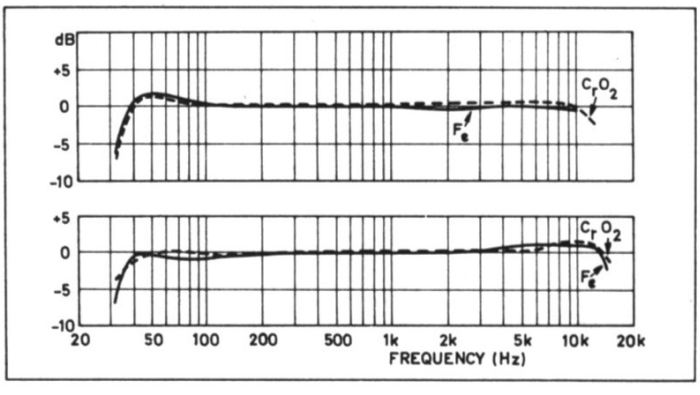


Fig. 1. NEAL 102 frequency response for playback only

Fig. 2. Record/replay frequency response