# THE DIASONOGRAPH STORY.

Tony Whittingham

## APPENDIX

Sections *A* - *K* of this appendix contains copies of Diasonograph and related sales brochures and leaflets

Section *L* contains a list of the locations of archived Diasonographs in the UK

*A. Nuclear Enterprises Ltd. Bulletin No. 327- Diasonograph NE4101. February 1970.*

*B. Nuclear Enterprises Ltd. Bulletin No. 64 - New Diasonograph NE4102 Diagnostic Ultrasonic Scanner. September 1972.*

*C. Nuclear Enterprises Ltd. Bulletin No. 88 - New Diasonograph NE4200 with Greyscale Storage Display. July 1976.*

*D. Nuclear Enterprises Ltd. Bulletin No. 434 - Ultrasonic Greyscale Facilities. Edinburgh. April 1975.*

*E. Nuclear Enterprises Ltd. Bulletin No. 90 - NE4104G Greyscale Storage Display Accessory for NE4102 Diasonograph Systems, July 1976.*

*F. EMI Medical Ltd. Bulletin No. 112 - EMISONIC 4200. October 1977.*

*G. EMI Medical Ltd. Bulletin No. 116 - EMISONIC 4201. January 1978.*

*H. Fischer Ultrasound Ltd. 4200S Console. High Resolution Imaging Combined with Maximum Operating Convenience.*

*I. Fischer Ultrasound Ltd. Articulated Scan Arm.*

*J. Fischer Ultrasound Ltd. MARTI.*

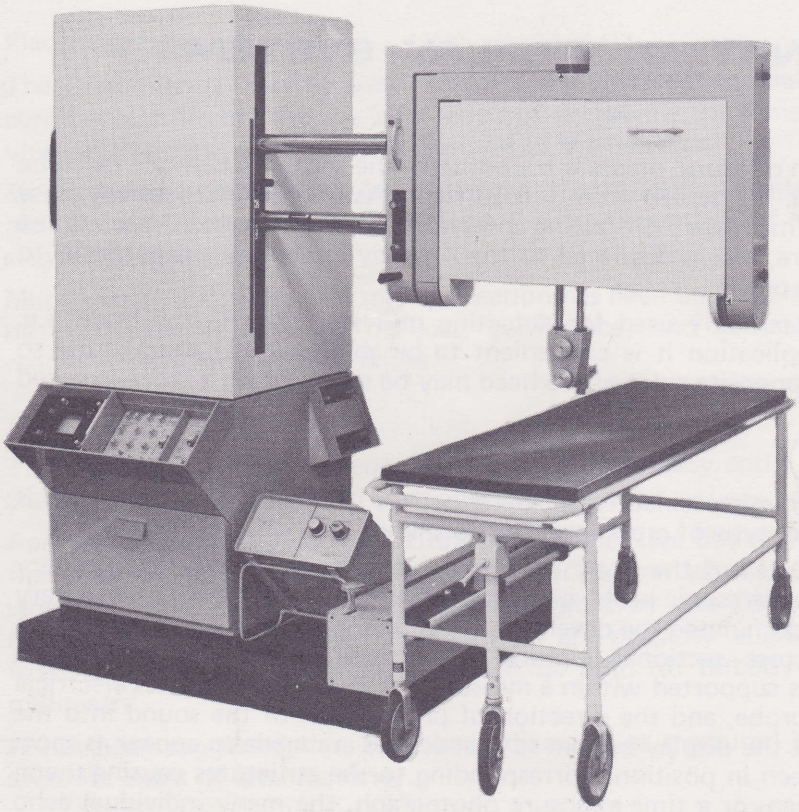
*K. Fischer Ultrasound Ltd. LINUS.*

*L. Locations of archived Diasonographs in the UK.*

*A*

*Nuclear Enterprises Ltd. Bulletin No. 327- Diasonograph NE4101.*
*February 1970.*

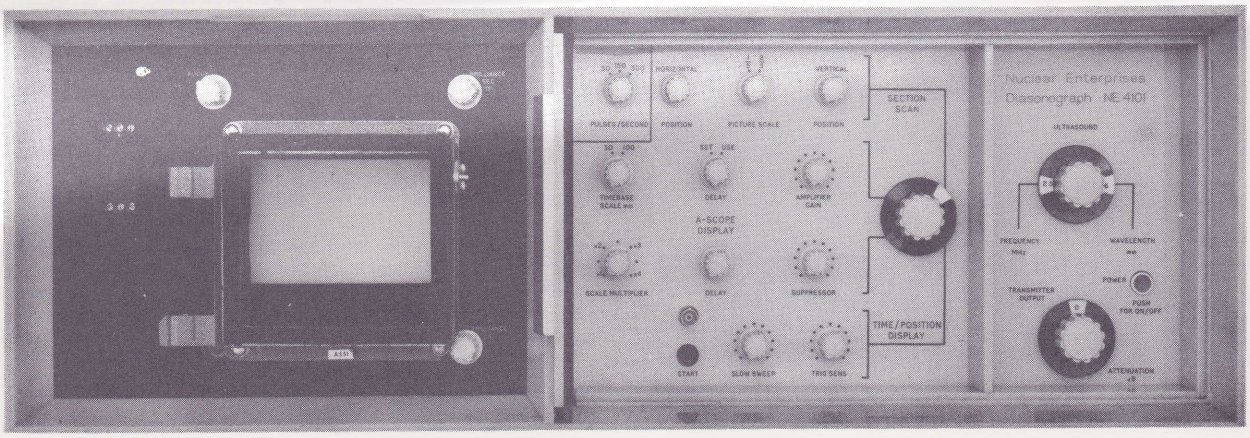
# DIASONOGRAPH
## NE 4101



for
ROUTINE
CLINICAL
DIAGNOSIS
in
Obstetrics
and
Gynaecology
and
for
RESEARCH
in
General
Medicine

The Diasonograph is a multi-purpose system for the investigation of soft-tissue structures in the body by pulsed ultrasonic waves. The operating principle is basically the same as that of underwater echo sounding or 'sonar'. However, the sound waves used have a much higher frequency, corresponding to a wavelength in tissues of 1 mm or less.

The ultrasound is emitted in short pulses, and echoes are detected from discontinuities in the tissues through which the sound pulses pass. Since the velocity of sound in soft tissue is known to be approximately the same from one tissue type to another, the elapsed time between transmission of a sound pulse and reception of the echo gives a measure of the distance of the tissue structure from the transmitting and receiving probe.




*The Control Panel of the Diasonograph*

## THREE ALTERNATIVE DISPLAY SYSTEMS

### A–Scope Display

Just before each of a rapid succession of sound pulses is transmitted, the spot of a cathode ray tube is made to start moving rapidly over the screen from left to right. As echoes are received, these cause vertical deflections of this 'time base', producing a series of vertical 'spikes'. Each spike represents a separate echoing structure, and is displaced to the right by a distance proportional to the distance of the structure from the probe.

This is the type of display most commonly used for detecting mid-line shifts in the brain, i.e. "echoencephalography". For this application it is convenient to be able to invert the picture, so that comparative echo patterns from opposite sides of the head may be recorded on a twice-exposed photograph of the screen.

### Cross–sectional Display

(Note: Cross–sectional display is sometimes incorrectly described as 'B–scope' display, which is more properly a certain, rather limited, type of cross–sectional display).

Echo patterns received from most sites of the body are rather complex, and may change very rapidly with small movements of the ultrasonic probe or of the patient. Interpretation is often very difficult, if not impossible. This has stimulated the development of pictorial display systems, which present the echo information as a cross–sectional 'picture' of the tissues being examined. In the Diasonograph, the ultrasonic probe is supported within a measuring frame. This generates electrical signals defining the position of the probe, and the direction of propagation of the sound into the body. These electrical signals control the display system so that echoes are made to appear as spots of light on the cathode ray tube screen in positions corresponding to the structures causing them. By the use of a long-persistence screen, or a time-exposure photograph, the many individual echo patterns produced as the probe is moved round the body surface, can be summated to yield a cross–sectional picture of the soft tissue structures being investigated.

By this means it is possible, for example, to visualise the gestation sac only a few weeks after conception, to locate the placenta and define its precise margins with a great deal of confidence, and to carry out many other diagnostic investigations on soft tissues which have no counterpart in conventional radiological, or isotopic techniques.

### Time/Position Display

Many soft tissue structures of the body move, for example, with the heartbeat, or with respiration. In some instances the form of this movement has diagnostic significance.

The best-known examples are possibly the movement pattern of the mitral valve as an index of the severity of rheumatic heart disease, and the separation and synchronous movement of the pericardium and myocardium which reveals the presence and degree of pericardial effusion.

The Time/Position display system utilises the horizontal timebase of the A–scope system and presents the echo signals as bright spots on this line, rather than as deflection 'spikes'. At the touch of a button, the whole trace moves, relatively slowly, from the bottom to the top of the screen. Echoes from stationary structures thus trace out straight vertical lines, while structures which are moving trace out the pattern of the movement in great detail.

The speed of the slow vertical sweep is adjustable over wide limits, enabling the operator to choose a speed best suited to the time scale of the phenomenon he is investigating.

# APPLICATIONS

### A Summary

Without doubt the principal routine clinical applications of the Diasonograph lie in the obstetric field, though the practical significance of the instrument in gynaecology, and the investigation of the liver, spleen, and renal disorders, should not be overlooked. The following is only a brief summary of the main applications which have already been extensively investigated.

## OBSTETRIC APPLICATIONS

### Early Pregnancy

Positive confirmation of pregnancy from six weeks amenorrhoea onwards, diagnosis of extra-uterine pregnancy, multiple pregnancy, blighted ovum, level of nidation, and incomplete abortion.

Positive diagnosis of hydatidiform mole, and, more significantly, exclusion of this possibility in cases of threatened abortion.

### Placentography

The Diasonograph may be used to locate the placenta, and define its margins with a high degree of confidence from around the 28th week of pregnancy. In some cases it may be possible to observe unusual thickness, or other abnormalities of the placenta.

Much earlier in pregnancy, 14–16 weeks, the approximate placental site may be identified, but a positive location and the firm exclusion, or confirmation, of placenta praevia should await a later stage of pregnancy.

Much clinical experience of this application has been built up, and the ultrasonic method appears to be preferable on grounds of cost, confidence, and general convenience to either soft-tissue radiography or isotope techniques.

### Fetal Cephalometry

The fetal head is readily recognised by ultrasonography and a refinement of the technique permits the accurate measurement of the bi-parietal diameter.

For this purpose, the NE 4131 Ultrasonic Caliper (see Bulletin No. 284) is used in conjunction with the Diasonograph. The bi-parietal diameter is first identified by cross–sectional scanning, after which the two bright marker spots generated by the Caliper are superimposed on the display of the echo pattern. When the markers are properly aligned with the entry and exit echoes from the fetal head, the diameter can be read off directly to an accuracy of better than one millimetre.

It has been suggested that fetal head diameter as measured in this manner, is a very reliable and accurate index of fetal maturity.

### General Obstetric Applications

Determination of fetal presentation in the obese patient or otherwise difficult situation. Diagnosis of hydramnios, anencephaly and hydrocephaly. Investigation of multiple pregnancy and the determination of the relative sizes of the fetal heads. Avoidance of the placenta in amniocentesis. Investigation of all cases of antepartum haemorrhage. Determining co-existence of pregnancy and pelvic tumour.

## GYNAECOLOGICAL APPLICATIONS

Diagnosis of ovarian cyst, and determination of whether unilocular or multilocular. Differential diagnosis of ovarian cyst, fibroid, and other pelvic tumours. Differentiation of different types of ascites. Study and management of retention of urine.

## GENERAL MEDICAL APPLICATIONS

Investigation of hepatic tumours, and hepatomegaly. Investigation of splenomegaly. Demonstration of hydronephrosis, and diagnosis of polycystic disease. Abdominal abcesses and hematomata. Demonstration of abdominal aortic aneurysm by cross–sectional scanning and time/position display. Demonstration of Pericardial effusion and mitral stenosis by time/position display. A–scope "echoencephalography".

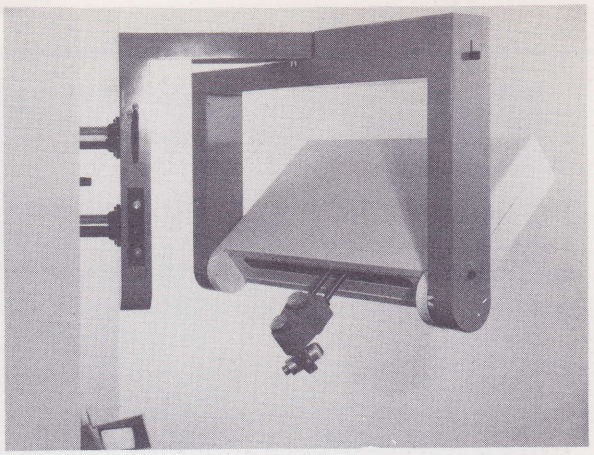
## MECHANICAL FACILITIES

In many applications the diagnostic information can only be obtained if the plane of the cross-sectional scan passes through a particular small region. Also there are instances when the inclination of this plane relative to the tissue structures is critical.

A unique and very important feature of the Diasonograph is the extreme degree of freedom of adjustment of the measuring frame — and hence the cross-section examined — relative to the patient. This is achieved by the combination of three linear, and two angular movements. The whole measuring frame can be rotated about a vertical pivot from the transverse to the longitudal direction, and may be locked in position at 5° steps. Further the plane of the scan may be tilted out of the vertical, and also locked at 5° steps (see illustration).

Calibrated scales are provided for each of these five degrees of freedom of adjustment, so that the position of any particular scan may be recorded and repeated.

It is this convenience and stability of this freedom of adjustment of the plane of the scan which accounts for much of the versatility and clinical utility of the Diasonograph.



# SPECIFICATION

### Dimensions

| | |
|---|---|
| Overall Height | : 202cm (79.5in) |
| Maximum width without couch | : 108cm (42.5in) |
| Overall Length of measuring frame assembly and supporting guide tubes | : 233cm (91.7in) |
| Height of couch top | : 76cm (30.0in) |
| Width of couch top | : 59cm (22.0in) |
| Overall Length of couch | : 198cm (78.0in) |
| Gross weight, inclusive of packing for transit by air | : Approx 800kg (1760lb) |

### Power Requirements

Suitable for use on ac mains of 50 or 60Hz. (Frequency and operating voltage should be specified at time of ordering). Power consumption approx 600 watts.

### Photographic Recording

An NE 4135 camera is supplied as part of the Diasonograph system. This has an object/image ratio of 1:0.7. The camera uses Polaroid type 107 film packs which give 8 exposures 83 x 108mm (3.25in x 4.25in).

### Ultrasonic Probes

3 special focussed probes are provided as part of the Diasonograph system. These operate at 1.5MHz (NE 4161), 2.5MHz (NE 4162) and 5MHz (NE 4163). In addition, hand-held, non-focussed "low-noise" single transducer probes are available at extra cost.

### Recommended Operating Frequencies

For most abdominal work, 1.5MHz and 2.5MHz will be found to give best results. 5MHz may be used for experimental investigations but its use is generally confined to the examination of tissue structures close to the skin surface.

### Transmitting System

The electrical input to the transducer does not exceed 0.001 joules per pulse.

A stepped attenuator on the output of the transmitting system provides 0-45dB attenuation in nominal 5dB steps.

### CROSS-SECTIONAL DISPLAY ("Section Scan")

The picture scale, as measured on a finished print from the NE 4135 camera may be selected as $\frac{1}{5}$ or $\frac{2}{5}$ of full size.

The measuring frame allows the transducer freedom of measured movement within a rectangle 50 x 25cm (20 x 10in approx). The transducer may be rotated through $\pm 100^{\circ}$ from the medial position.

The display system will follow any scanning pattern chosen by the operator, though the most useful type of scan is usually the "compound sector scan" described in the literature.

A long-persistance cathode ray tube is provided for visual monitoring. This reproduces exactly the information on the photographed display, but the 'afterglow' effect enables the operator to carry out a systematic visual search for particular sections which contain data of diagnostic significance.

Special circuits are incorporated in the Diasonograph which enable echo signals of widely-differing amplitudes to be recorded on the same display. The signal processing circuits also decrease the apparent pulse length, thus improving the resolving power of the equipment, and preventing small signals following closely on larger ones from being lost.

### A-SCOPE DISPLAY

Time base ranges are 30mm and 100mm nominal, in soft tissue for full-scale range, with a continuously adjustable range multiplier from X1 to X5. The start of the timebase may be delayed relative to the instant of transmission of the sound pulse enabling the operator to study in detail the echo pattern obtained from a small region some distance from the body surface. A delay "Set/Use" switch enable the operator to pre-select the region to be examined.

The A-scope display is normally arranged to occupy half the available screen height, and may be inverted by the function selector switch.

### TIME/POSITION DISPLAY

The slow-speed vertical timebase is initiated by a push button, or an external signal, and causes the horizontal, intensity-modulated, trace to move at an adjustable speed from the bottom to the top of the screen.

### SWEPT GAIN SYSTEM

A swept gain system is incorporated which compensates both for the sensitivity-versus-range characteristics of the probes in use, and also for the progressive weakening of echo signals from tissue structures remote from the probe.

Not all applications require the same swept gain conditions and for the convenience of the user, four separate sets of pre-set swept gain controls are provided. These are selectable by a four-position switch. As supplied from the factory, the four positions give progressively increasing degrees of swept gain compensation. However, a user may modify these settings as he sees fit for his particular clinical or research applications.



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Nuclear Enterprises Inc., 935 Terminal Way, San Carlos, California 94070, U.S.A. Tel: 415-593-1455

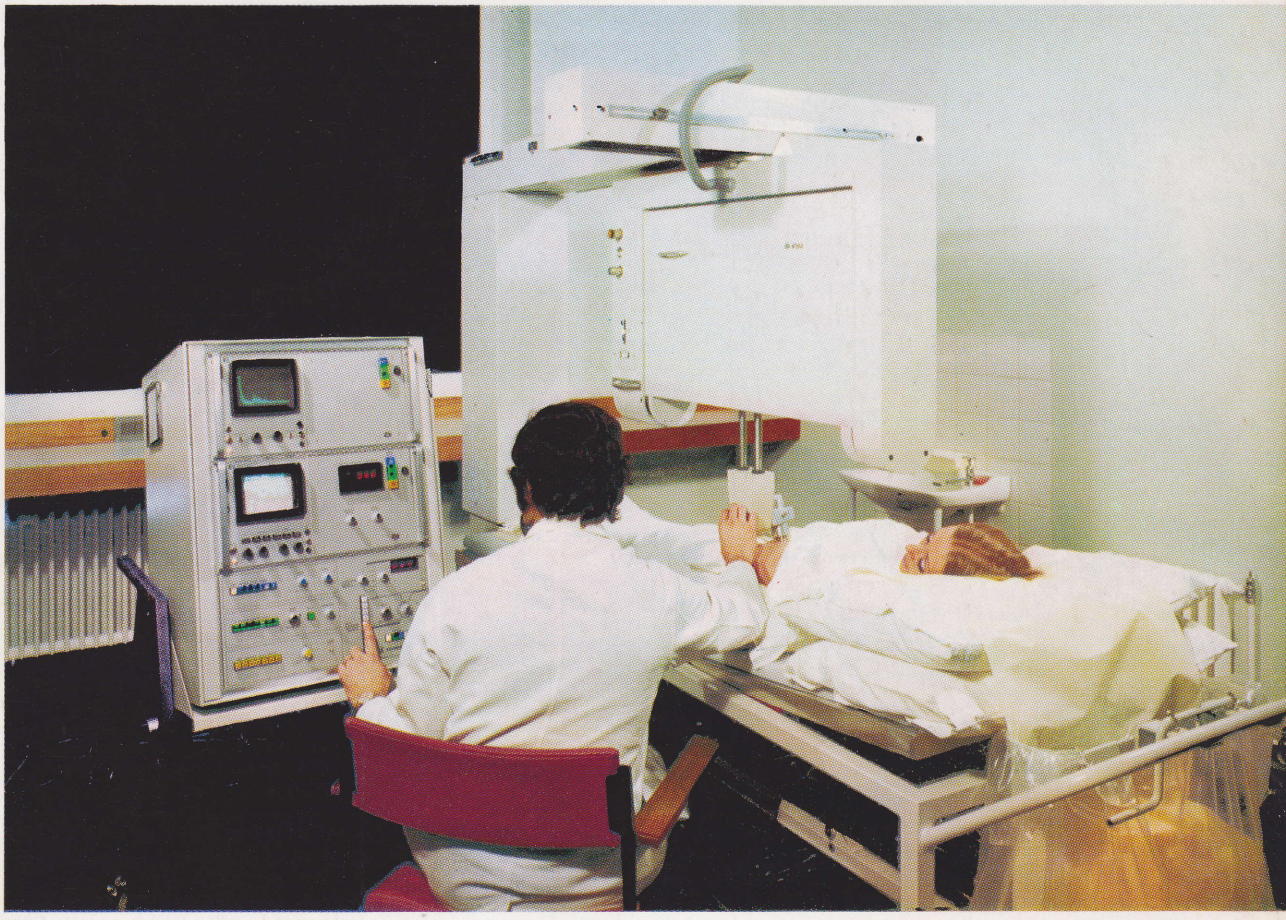
*B*

*Nuclear Enterprises Ltd. Bulletin No. 64 - New Diasonograph NE4102 Diagnostic Ultrasonic Scanner. September 1972.*

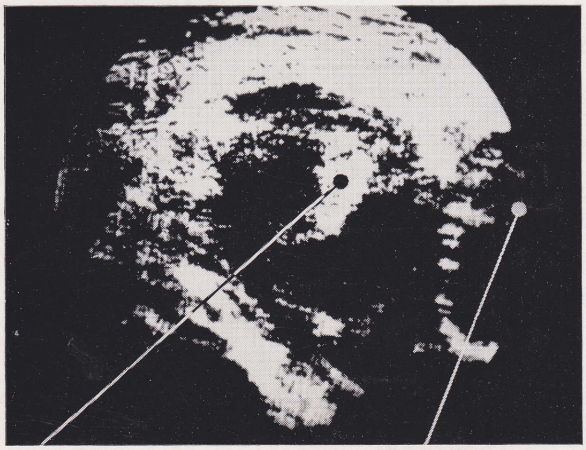
# NEW

# DIASONOGRAPH

## NE 4102 Diagnostic Ultrasonic Scanner



Diasonograph NE 4102 in operation at Queen Mother's Hospital, Glasgow



FOETUS BLADDER

Longitudinal cross-sectional picture of nine week old foetus (Courtesy Queen Mother's Hospital, Glasgow)

- ★ Very high resolution combined with fine control, for detailed examination of small structures
- ★ Twin cathode-ray tube displays for simultaneous search and identification of structures
- ★ Wide choice of scan planes, simply selected and extremely stable
- ★ A-scan, Cross-sectional and Time/Position Displays
- ★ Integrated circuitry, for high electrical stability, accuracy, and extreme reliability
- ★ Caliper System with large-scale direct digital readout
- ★ Compact and flexible, permitting considerable freedom in patient examination
- ★ Designed for a single operator
- ★ Wide range of Obstetric, Gynaecological and General Medical applications
- ★ Lowest possible ultrasonic output

# DIAGNOSIS BY ULTRASOUND

The new Diasonograph NE 4102 has been developed and evaluated by groups of workers whose involvement in diagnostic ultrasonic scanning equipments extends over the past twenty years. Typical of the thought and expertise designed into the NE 4102 are the methods used to ensure that the ultrasonic power output is reduced to the lowest possible level. Firstly, for fixed pulse rate applications the number of pulses transmitted per second is held at 600. Some equipments use pulse repetition rates up to three or four times higher than this. Secondly, during searches, a unique velocity controlled pulse repetition system ensures that transmission only takes place whilst scanning is being carried out and at a rate controlled by the speed of scanning. Thirdly, the sensitivity of the equipment is controlled by reducing the transmitted power rather than using high power and reducing the gain of the system.

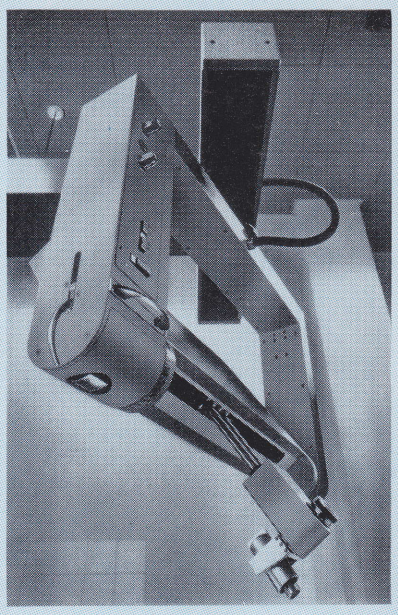
Some features can be considered traditional. The NE 4102 measuring system has long been shown to have exceptional freedom of positioning of the scanning plane, whilst maintaining extremely tight control of the chosen scanning plane. The one-to-one measuring system directly coupled to the scanning probe has unequalled measuring accuracy which contributes to the outstanding ability of the NE 4102 to find and resolve structures smaller than hitherto possible.

Very comprehensive display facilities and a wide choice of operating modes enable the new Diasonograph to cover a wide field of applications. The controls are simple. Colour coding is used to indicate function, and illumination to indicate choice (see specifications p. 6).

Most investigations carried out by ultrasound come within three main groups:

1. Accurate measurement of structural dimensions in vivo, e.g. Foetal Cephalometry—*A-scan*
2. Visualisation of a structure, e.g. Placental Localisation—*Section Scan*
3. Visualisation of moving structure, e.g. Mitral Valve Investigation—*Time/Position Scan*

It is often necessary to observe in two modes simultaneously, as in Foetal Cephalometry. With the new Diasonograph, accurate measurements can be made on the A-scan Display of echoes identified on the Section Scan Display.



Positioning of the scanning plane is achieved with push-button controlled magnetic locks (Courtesy Design Magazine and Philip Sayer)

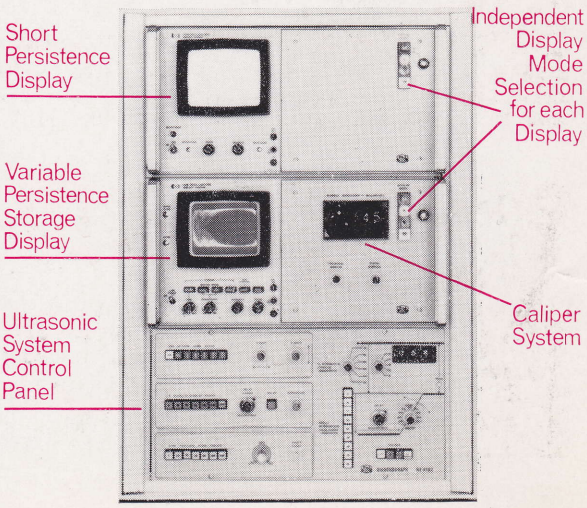
## PRINCIPLE OF OPERATION

The technique for investigations of soft tissue structures in the body by pulsed ultrasonic waves is basically the same as that employed in underwater echo-sounding or sonar. However, the sound waves used have a much higher frequency, corresponding to a wavelength in tissue of 1mm or less. The ultrasound is emitted in short pulses, and echoes are detected from discontinuities in the tissues through which the sound pulses pass. Since the velocity of sound in soft tissues is known to be approximately the same from one tissue type to another, the elapsed time between transmission of a sound pulse and reception of the echo gives a measure of the distance of the tissue structure from the transmitting and receiving probe.

## Display Systems

The NE 4102 has two display oscilloscopes which are interchangeable. Display of section scan, A-scan or time/position scan may be presented independently on either of the two units (see illustration right).

The upper display unit consists of a short persistence oscilloscope. The lower incorporates a variable persistence oscilloscope and Caliper System, which uses a large scale illuminated digital readout. This layout permits unobscured viewing of both displays and digital readout while the caliper settings are being adjusted. This is the standard arrangement but it can be modified to suit individual requirements. For specification details see page 6.




Electronics console of UE 4102

# THREE ALTERNATIV

## A-Scan Display

A-scan display is most commonly used for detecting mid-line shifts in the brain (echo-encephalography). For this application it is convenient to be able to invert the picture so that comparative echo patterns from opposite sides of the head may be recorded on a twice-exposed photograph of the short persistence screen, or on the variable persistence oscilloscope.
When the echo comparison is not required, the full screen is used to make accurate location of the caliper markers easier.

Just before each of a rapid succession of sound pulses is transmitted, the spot of a cathode-ray tube is made to start moving rapidly across the screen from left to right. As echoes are received, the time base is deflected producing a series of vertical 'spikes'. Each spike represents a separate echoing structure.

## Cross-sectional Display

With the new Diasonograph's cross-sectional display facility, it is now possible to visualise the gestation sac only a few weeks after conception. The placenta can be located and its precise margins defined with a great deal of confidence. Many other diagnostic investigations on soft tissues, which have no counterpart in conventional radiological or radioisotope techniques, can be carried out.
Formerly, because of the complex nature of the echo patterns received from most sites on the body, and lack of stability of probe positioning on the patient, interpretation of results was very difficult, if not impossible. Now, cross-sectional pictorial display is combined with the very high system resolution of the new Diasonograph and an extremely accurate and stable measuring frame. Consequently, the pictures of small structures obtained with the NE 4102 are exceptionally detailed.

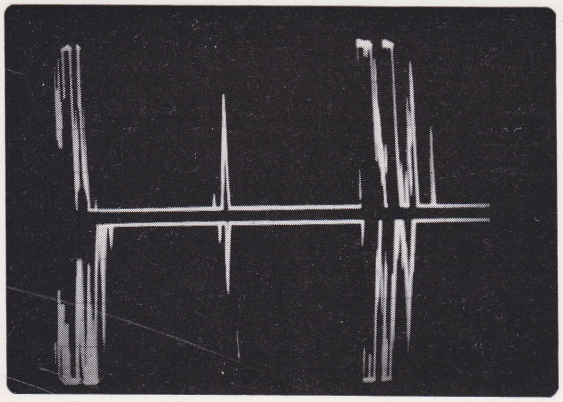
In the new Diasonograph, the ultrasonic probe, supported within a measuring frame, generates electrical signals defining the position of the probe and the direction of propagation of the sound into the body. These electrical signals control the display system so that echoes are made to appear as spots of light on the cathode-ray tube screen in positions corresponding to the structures causing them. By the use of a long-persistence screen, or a time-exposure photograph, the many individual echo patterns produced as the probe is moved round the body surface, can be integrated to yield a cross-sectional picture of the soft tissue structures under investigation.

## Time/Position Display

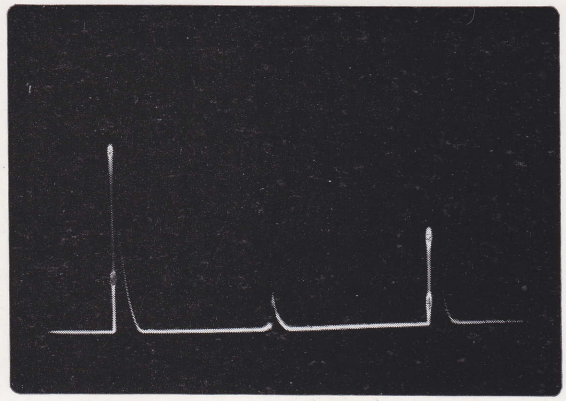
Many soft tissue structures of the body move, for example with the heartbeat, or with respiration. The form of this movement can have diagnostic significance. For example, the movement pattern of the mitral valve gives an indication of the severity of rheumatic heart disease, and the separation and synchronous movement of the pericardium and myocardium can reveal the presence and degree of pericardial effusion.
In the Time/Position display mode, the pattern of movement of the structure under examination is shown. The vertical sweep velocity is adjustable over wide limits permitting the operator to select conditions best suited to the particular investigation.

The Time/Position display system uses the horizontal timebase of the A-scan system and presents the echo signals as bright spots on this line, rather than deflection 'spikes'. The whole trace can be made to move relatively slowly from the bottom to the top of the screen. Echoes from stationary structures trace out straight vertical lines, while structures which are moving trace out the pattern of their movement.

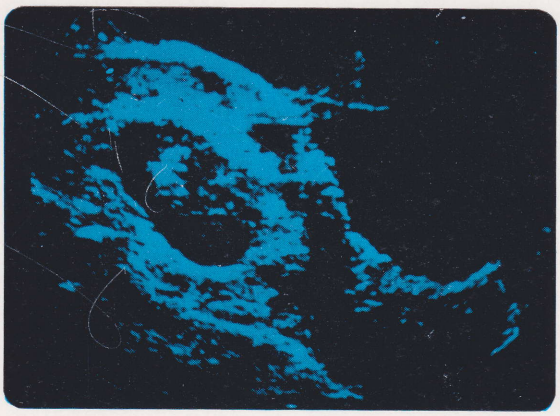
# 'E DISPLAY MODES



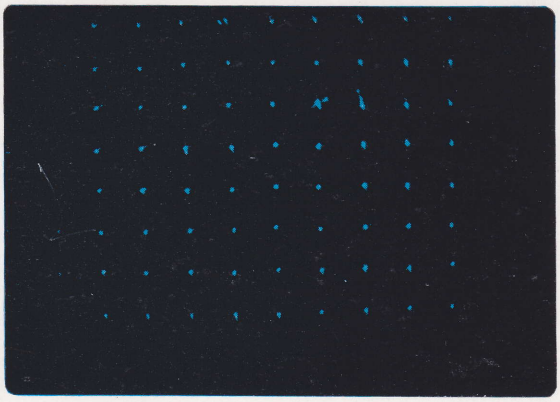
Echoencephalography Trace



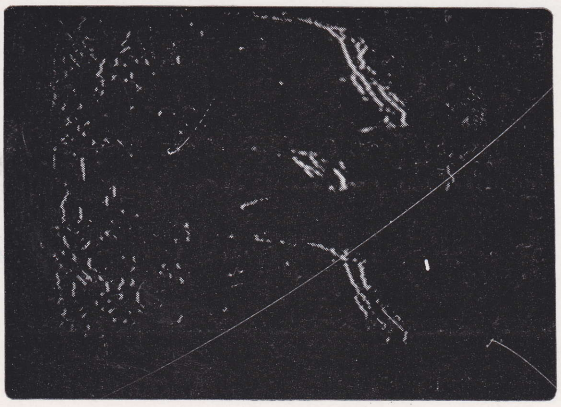
Foetal Cephalometry Trace



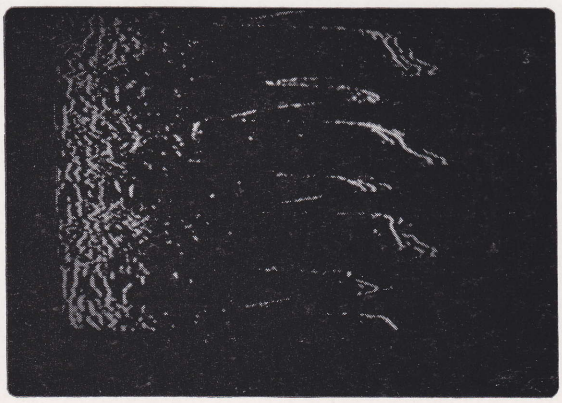
Longitudinal cross-section of an early gestation sac (Courtesy Queen Mother's Hospital, Glasgow)



Cross-sectional picture of a matrix of wires spaced at 0.5in (12.7mm) intervals in a water tank



Time Position Trace showing the movement of a mitral valve



Time Position Trace of identical mitral valve showing larger number of heartbeats

# WIDE RANGE OF APPLICATIONS

## Obstetric Applications

**Positive confirmation of pregnancy** from six weeks amenorrhoea onwards, diagnosis of extra-uterine pregnancy, multiple pregnancy, blighted ovum, level of nidation and incomplete abortion.

**Positive diagnosis of hydatidiform mole,** and, perhaps more important, exclusion of this possibility in cases of threatened abortion.

**Placentography**

The Diasonograph may be used to locate the placenta and to define its margins with a high degree of confidence from around the 28th week of pregnancy. In some cases it may be possible to observe unusual thickness, or other abnormalities of the placenta.
Much earlier in pregnancy, 14-16 weeks, the approximate placental site may be identified, but the positive location and the exclusion or confirmation of placenta praevia should await a later stage of pregnancy.
Much clinical experience of this application has been built up, and the ultrasonic method is often preferred on grounds of cost, confidence, safety, and convenience to either soft-tissue radiography or radio-isotope techniques.

**Foetal Cephalometry**

The foetal head is readily recognised by ultrasonography and a refinement of the technique permits the accurate measurement of the bi-parietal diameter. The bi-parietal diameter is first identified by cross-sectional scanning, after which the two bright marker spots generated by the Caliper are superimposed on the display of the echo pattern. When the markers are properly aligned with the entry and exit echoes from the foetal head, the diameter can be read off directly to an accuracy of better than one millimetre. It has been suggested that the measurement of foetal head diameter obtained in this manner, is a very reliable and accurate index of foetal maturity.

**General Obstetric Applications**

Foetal presentation may be determined in the obese patient and in otherwise difficult situations. Diagnosis of hydramnios, anencephaly and hydrocephaly may also be made. Other applications include the investigation of multiple pregnancy and the determination of the relative sizes of the foetal heads, the avoidance of the placenta in amniocentesis, investigation of all cases of antepartum haemorrhage, and determining the co-existence of pregnancy and pelvic tumour.

## Gynaecological Applications

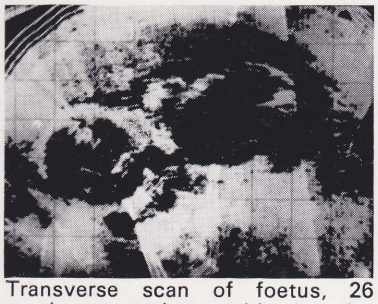
Diagnosis of ovarian cyst, and determination of whether unilocular or multilocular. Differential diagnosis of ovarian cyst, fibroid, and other pelvic tumours. Differentiation of different types of ascites. Study and management of retention of urine.

## General Medical Applications

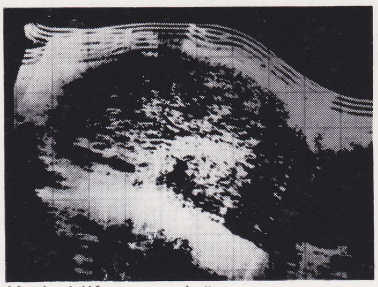
Investigation of hepatic tumours, and hepatomegaly. Investigation of splenomegaly. Demonstration of hydronephrosis, and diagnosis of polycystic disease, abdominal abcesses and hematomata. Demonstration of abdominal aortic aneurysm by cross-sectional scanning and time/position display. Demonstration of pericardial effusion and mitral stenosis by time/position display. A-scan 'echoencephalography'.

## TYPICAL RESULTS

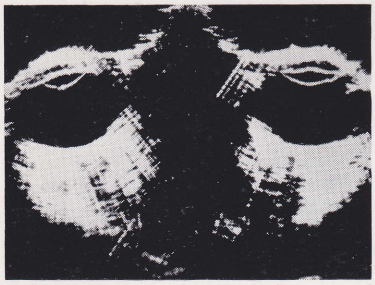
Transverse scan of foetal head at 36 weeks gestation*



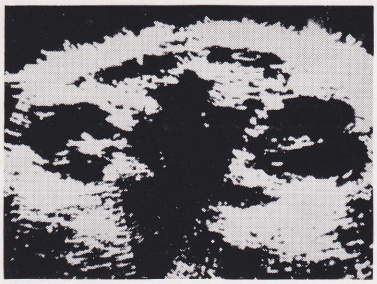
Transverse scan of foetus, 26 weeks gestation, with anterior placenta*



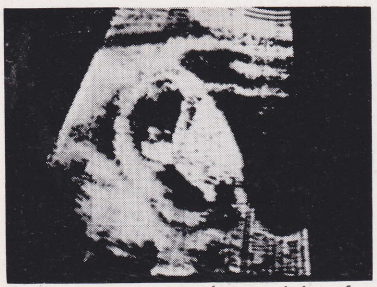
Hydatidiform mole*



Cross-sectional scan of normal eyes†



Cross-section of infant kidneys†



Early pregnancy (see right for enlarged picture of gestation sac)†

Life-size picture of embryo†


References

*S. Campbell, J. Obstetrics and Gynaecology of Brit. Com.*, **75**, *p. 568, 1968.*
*I. Donald and U. Abdulla, J. Obstetrics and Gynaecology of Brit. Com.*, **75**, *p. 993, 1968.*
*P. Morley and E. Barnett, Brit. J. Radiology*, **43**, *p. 602, 1970.*
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*E. A. Lyons et al, Brit. Med. J., p. 2689, 1972.*
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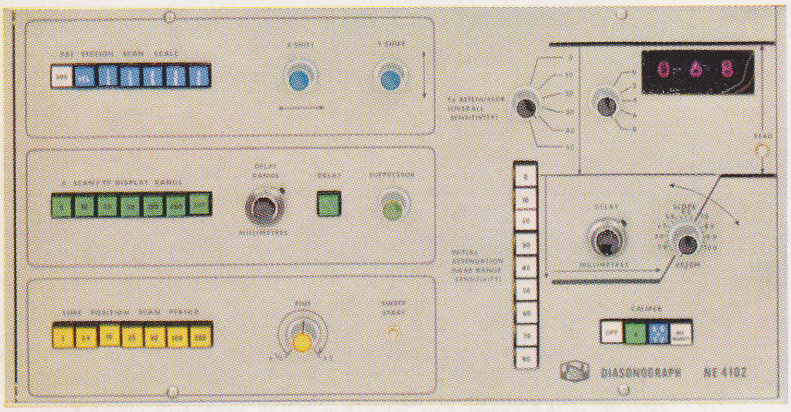
*R. A. Underhill et al, Brit. Med. J., p. 3736, 1971.*
*S. Campbell and C. J. Dewhurst, Lancet, p. 1002, 1971.*
*I. Donald et al, J. Obstetrics and Gynaecology of Brit. Com.*, **79**, *p. 304, 1972.*
*Investigations into Possible Chromosome Damaging Effects of Ultrasound, Brit. J. Radiology*, **45**, *p. 319, 1972.*


* Courtesy St Bartholomew's Hospital, London
† Courtesy Queen Mother's Hospital, Glasgow

# NE 4102 SPECIFICATION

Two cathode-ray tube display units are provided, one with a short persistence cathode-ray tube, and the other with a variable persistence storage type tube. The short persistence tube is most useful for the photographic recording of section scans, where the optimum system resolution is required, or for foetal cephalometry with the Caliper. The variable persistence tube is most valuable when 'searching' during a section scan, since it is possible to vary the fade on the tube, and having located the required place of scan, to store the required picture. Photographs of the stored picture may be taken if required. A-scan, cross-section or time/position display may be set up independently on either display unit.

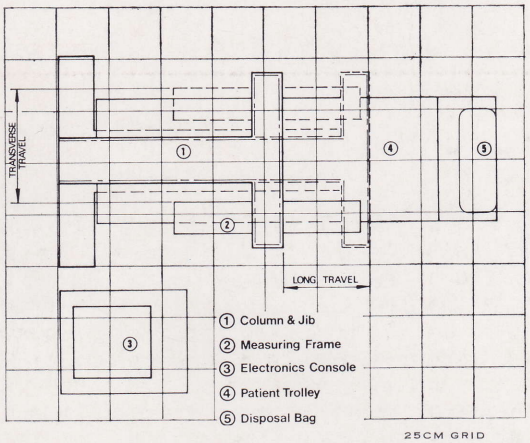
Operating controls are distributed in ergonomic groupings to assist operators without specialised knowledge of physics or electronics. Operating controls are calibrated in cm (or mm) in tissue where appropriate (see Control Panel below).

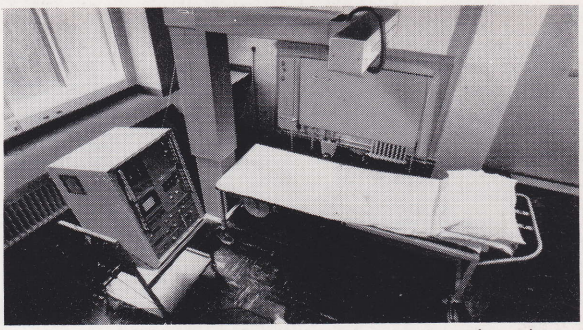



| | |
|---|---|
| **Operating Frequencies** | 0.5, 1.5, 2.5, 5 and 10 MHz |
| **Energy** | Maximum available ultrasonic intensity is a function of the probe in use. Using the standard range of probes the following figures are typical. |
| **Normal Mean Acoustic Power** | 1.5MHz – 0.70 microwatt<br>2.5MHz – 6.92 microwatt<br>5.0MHz – 84.0 microwatt |
| **Maximum Available Mean Acoustic Power** | 1.5MHz – 7.0 milliwatt<br>2.5MHz – 6.92 milliwatt<br>5.0MHz – 2.7 milliwatt |
| | **Note** Maximum operating sensitivity of the equipment is controlled by adjustment of the output power. |

| | |
|---|---|
| **Transmitter Pulse Repetition Rate** | (a) Fixed PRF 600 pulses/second<br>(b) Velocity Controlled PRF (Section Scan only) 60 to 1000 pulses/second |
| **Sensitivity Control by Transmitter Attenuator** | 0 to 50db in 10db steps<br>+ 0 to 8db in 2db steps |
| **Swept Gain** | Initial reduction:<br>0 to 80db in 10db steps<br>Initial delay:<br>0 to 25cm continuously variable<br>Slope:<br>1.5 to 7.5db/cm continuously variable |
| **Picture Scales (Cross-Section only)** | 1/5, 2/5, 3/5, 4/5, or 5/5 of full scale |
| **Scanned Area (Cross-Section only)** measuring frame in vertical position | Horizontal:<br>20in (500mm) nominal<br>Vertical:<br>10in (250mm) nominal<br>Probe rotation: ±100° from vertical in the plane of scan |
| **Cross-Section Display** | Intensity modulation of compound scan pattern on a 7.5 x 9.9cm display area. |
| **A-Scan Display** | A-scan display occupying half or whole available screen height. (Selected by preset switch.) Inversion by panel switch to enable accurate photographic comparison to be made between two successive echo patterns. |
| **A-Scan Range** | 5, 10, 20, 50, 100, 200 and 500mm switched steps. |
| **A-Scan Delay** | 0 to 500mm continuously variable<br>A delay set/use switch allows the operator to preselect the region to be examined. |
| **Time/Position Display** | Intensity modulation of horizontal sweep. |
| **Vertical Sweep (Time/position Display only)** | Single vertical sweeps triggered by push button.<br>Sweep speed continuously variable between x ½ and x 2 of the following switched ranges:<br>1, 2.5, 10, 25, 50, 100, 250mm/second |
| **Horizontal Range and Delay (Time/position Display)** | A-scan controls operative. |

## Plan of Layout



In the new Diasonograph, maximum use has been made of floor space without any sacrifice in the facility of selecting the more difficult scanning planes. The construction of the scanning system and the control cabinet affords considerable **freedom of choice in the layout** of the examination room. Total system weight is 650kg. (Photo courtesy Design Magazine and Philip Sayer)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Bulletin No. 64
September 1972

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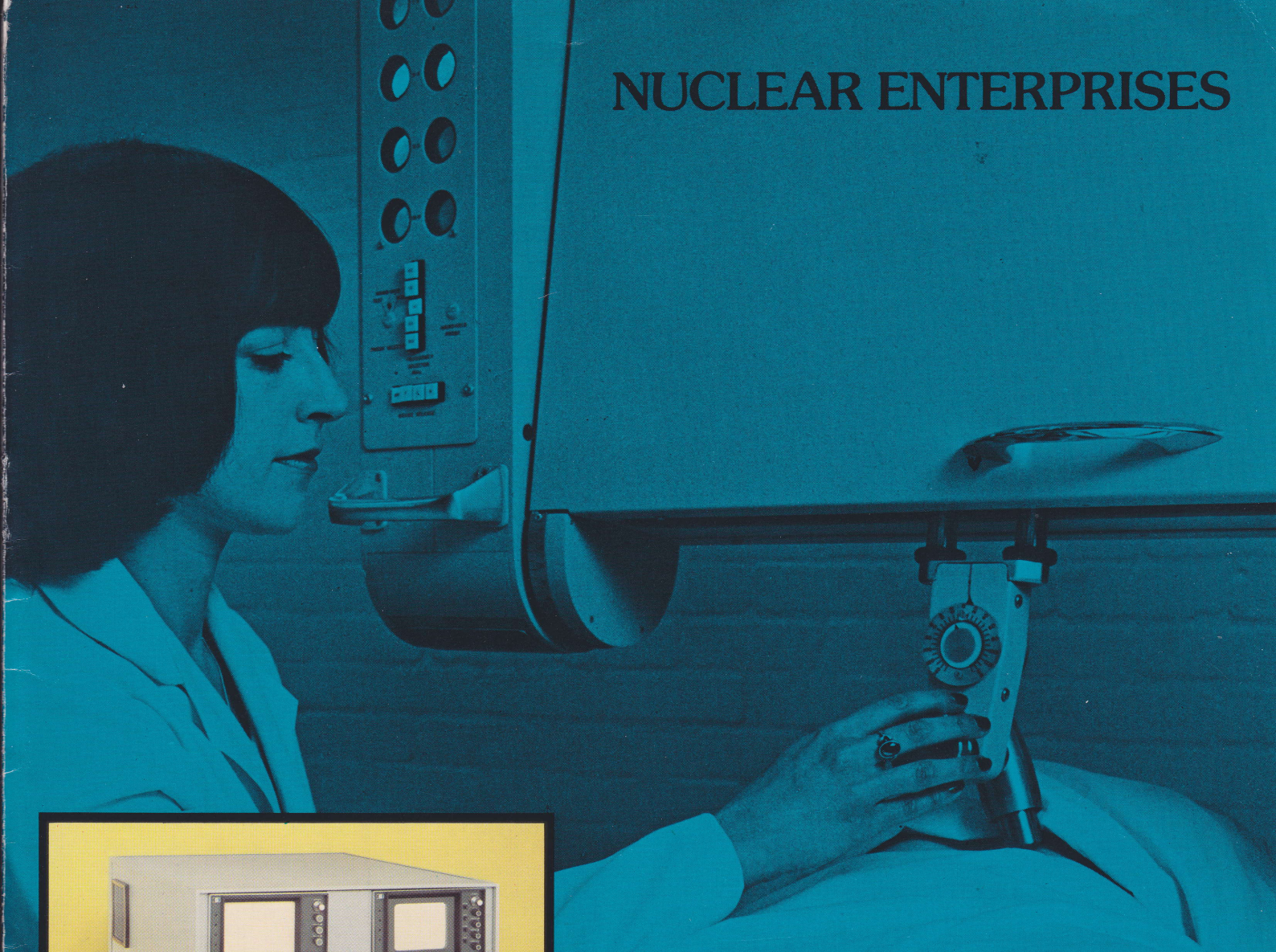
*Nuclear Enterprises Ltd. Bulletin No. 88 - New Diasonograph NE4200 with Greyscale Storage Display. July 1976.*

NUCLEAR ENTERPRISES



# New NE4200 Diasonograph

with Greyscale Storage Display

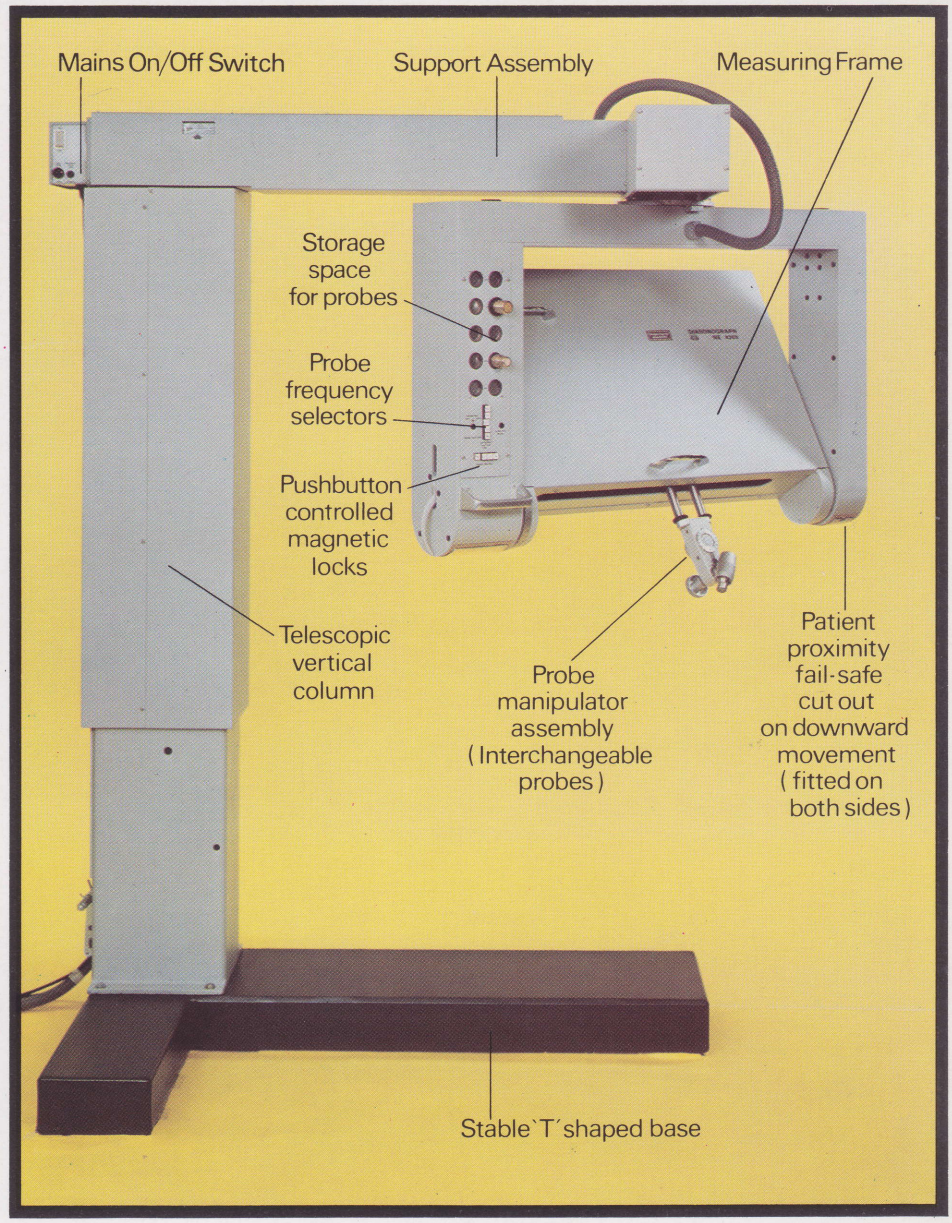
# New NE4200 Diasonograph with Greyscale Storage Display

The NE 4200 Diasonograph is the latest addition to the world-leading range of diagnostic ultrasonic scanners developed by Nuclear Enterprises over the past ten years. It has full greyscale capability with colour option for expansion of greyscale, and maintains the high standard of resolution and the same outstanding operational capability as the Award-winning NE 4102 Diasonograph now in use in hospitals in over forty countries. Improved control console facilities are a major feature of the new scanner which operates with the exceptionally stable scanning system and a wide choice of accessories.

The basic Control Console (opposite) now includes improved display oscilloscopes and the following facilities are provided as standard: display of swept gain waveform; calibrated intensity controls for oscilloscopes; and amplifier processing mode selection. Careful ergonomic grouping and colour coding of pushbutton controls ensure simplicity of operation. The recording facilities offered include: photographs (Polaroid, 70mm film), hard copy, strip chart and video.

The Nuclear Enterprises policy of seeking equipment evaluation from groups of workers with widespread experience in the field of medical ultrasound continues and the new NE 4200 is designed to meet individual requirements as fully and as simply as possible. The system can be supplied complete with the NE 4204G Greyscale Storage Display and NE 4103C Cardiac Module (as illustrated on the front cover); with either facility or in its basic form. Nuclear Enterprises Ultrasonic Division will gladly advise on selection.

# Scanning Assembly with exceptional Measuring Accuracy

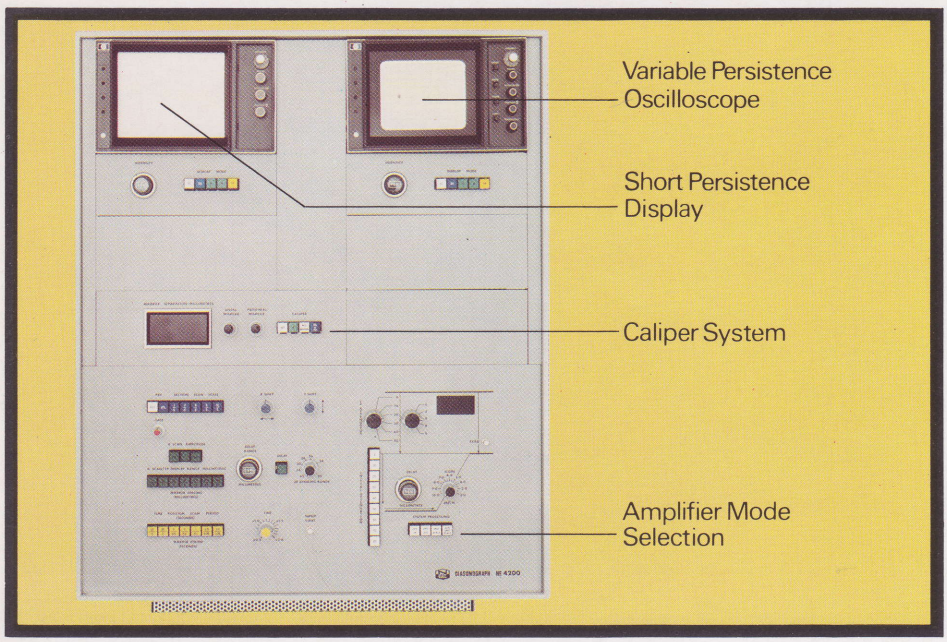



*Measuring System*

The NE 4200 measuring system affords an operator exceptional freedom in positioning the scanning frame and allows the chosen scanning plane to be easily maintained and reproduced. The one-to-one measuring system coupled to the scanning probe has unequalled measuring accuracy, and all movements are calibrated. Rapid changing from longitudinal to transverse scanning is another important facility offered by the 4200 measuring system.

The NE 4162 2.5MHz focused probe is supplied as standard with the system but a wide choice of interchangeable bayonet fitting probes for different applications is available. These probes may be exchanged without switching off the equipment, and changed from one side of the assembly to the other to suit the examination. The probe may be locked at a specific angle within its travel both for calibration and operational requirements as when it is used with an NE 4167 Biopsy Probe. Optional facilities for locking the X and Y movements are also available.

# New Improved Control Console




*Basic Control Console*

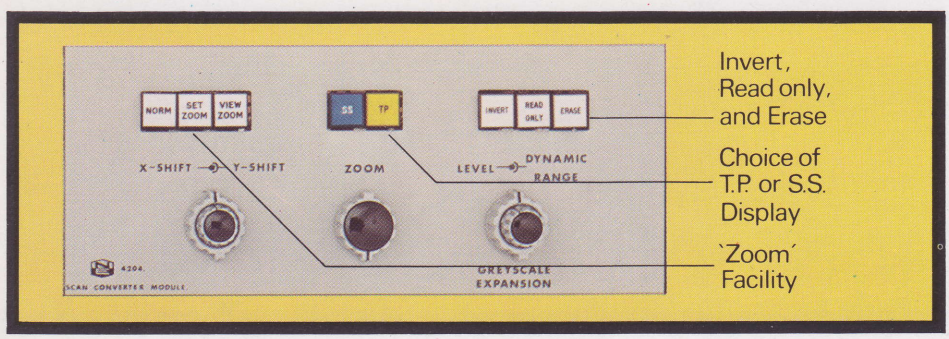
Two recently introduced high performance cathode ray display units are now included in the trolley-mounted electronics console. One is a short persistence HP 1332 and the other is a variable persistence/storage HP 1335, with foot-operated erase switch. A caliper device, a calibrated swept gain display, calibrated oscilloscope intensity controls and amplifier processing mode selection are now standard facilities in the electronic system. The controls on the console are simple. Colour coding is used to indicate function and illumination to indicate choice.

The very comprehensive display facilities with the wide choice of operating modes enables the Diasonograph to cover a wide field of applications. It is possible to display section-scans (B mode), A scan, inverted A scan, time-position scan (M mode) and "open shutter" greyscale scans, including those from the storage greyscale unit, independently on each cathode ray tube display.

Accurate measurements of structural dimensions *in vivo* are possible with the caliper system which has a large scale illuminated digital readout. The caliper pips can be displayed simultaneously on all modes.

The basic NE 4200 Diasonograph has a maximum dynamic range of 40dB, which may be reduced to 22dB by the panel control. The operator may vary the appearance of the scan he wishes to observe by using the combination of the dynamic range control and the amplifier mode selection. "Non-Greyscale" gives a non-greyscale picture ideal for producing outline-type scans of important structures. "Greyscale" operates with two types of signal processing ,"Diff In" and "Diff Out" which provide a scan with a range of grey tones. The incorporation of the NE 4204G Greyscale Storage Display described below allows the complete range of grey tones to be observed.

# Integral NE4204G Greyscale Storage Display




*Greyscale Storage Display*

The NE 4204G Greyscale Storage Display offers the clinician the benefits of conventional storage tubes and, at the same time, a picture on the video monitor with the full range of grey tones. This can enormously simplify the obtaining and interpreting of pictures of more complex structures.

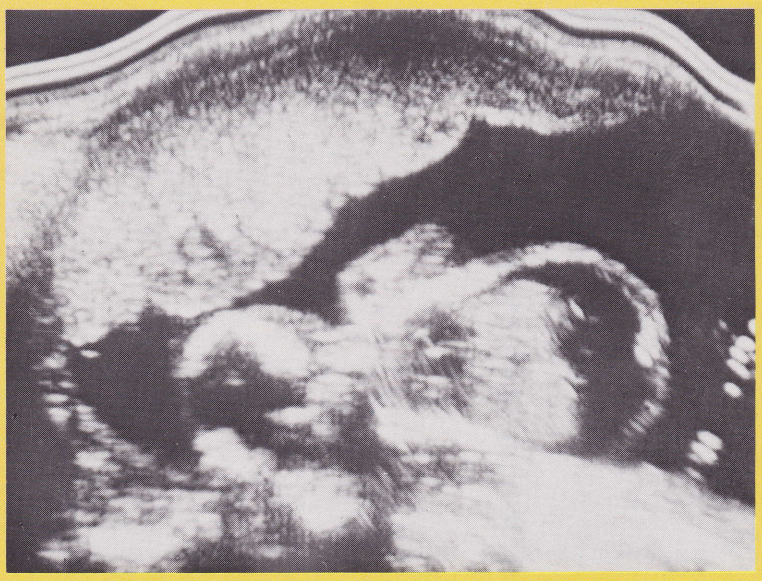
With the NE 4204G it is possible to achieve almost complete freedom from the overwriting effects which can seriously degrade a compound scan result. The user may, without writing out the picture, "compound" a scan in order to collect as much clinically useful information as possible. This significantly improves quality and simplifies diagnosis in some types of examination.

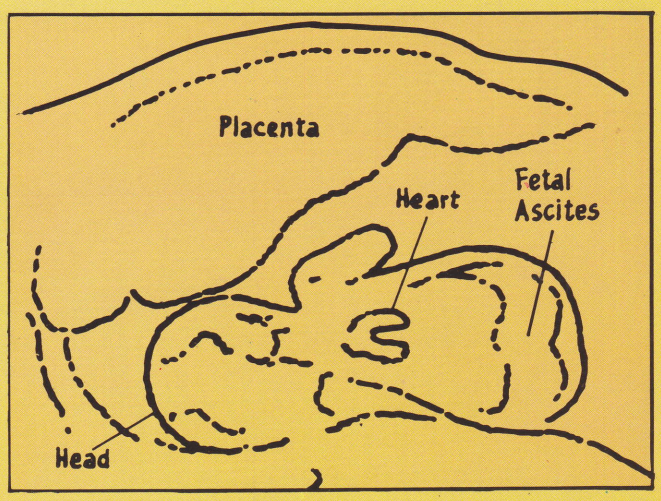
A ten step wedge greyscale may be displayed on the screen for standardisation of the greyscale displays and thereby optimum discrimination of the tissue under examination is obtained.

The NE 4204G time share, read/write facility allows the operator to see the build-up of a picture during the scanning process. Any area of interest may be preselected and with the use of the zoom control switched to cover the total screen width. A magnification 4 × life size is possible without significant loss of resolution. Time-position and Section Scans may be displayed. Permanent records may be obtained by conventional Polaroid photography or by the addition of a hard copy unit. Alternatively, 70mm film recordings can be made.

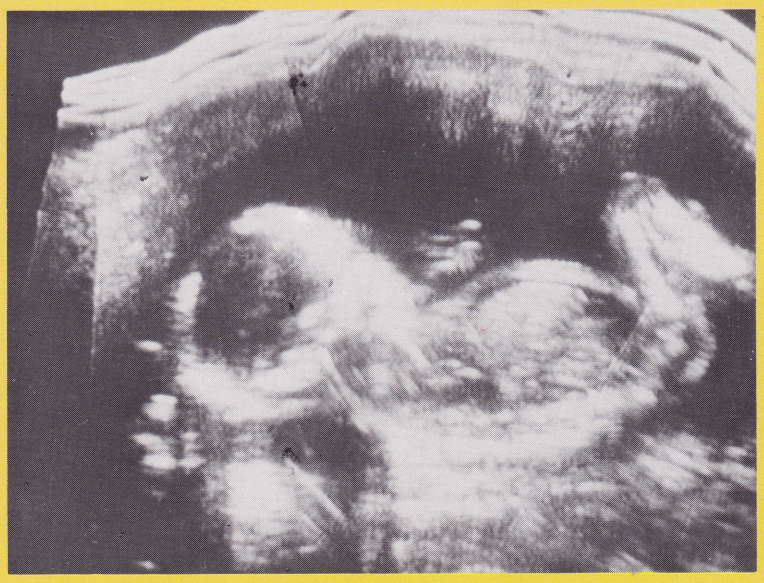
As electronic signals are now available in standard TV form, slave or remote TV monitors may be used for display and video tape recorders employed to store and replay information. Thus monitors may be sited in lecture theatres or in consulting rooms.

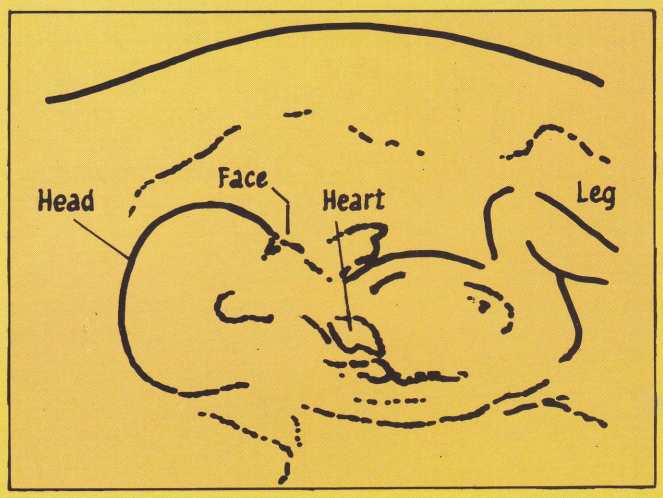
# Typical Greyscale Results



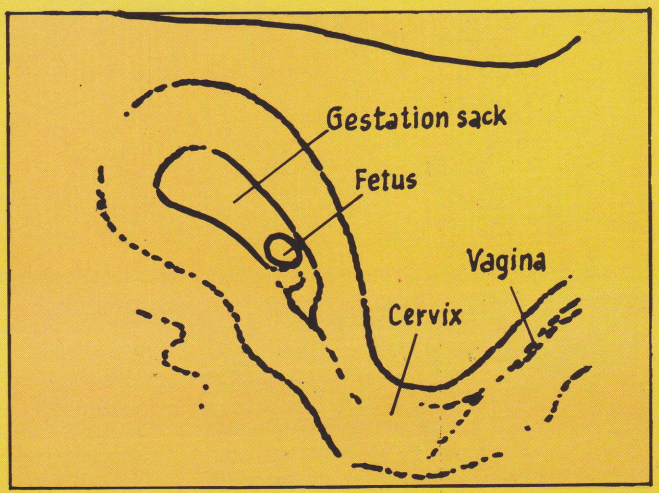



*Fetus at 22 weeks with marked ascites due to severe Rhesus iso-immunisation.*






*Fetus at 24 weeks.*

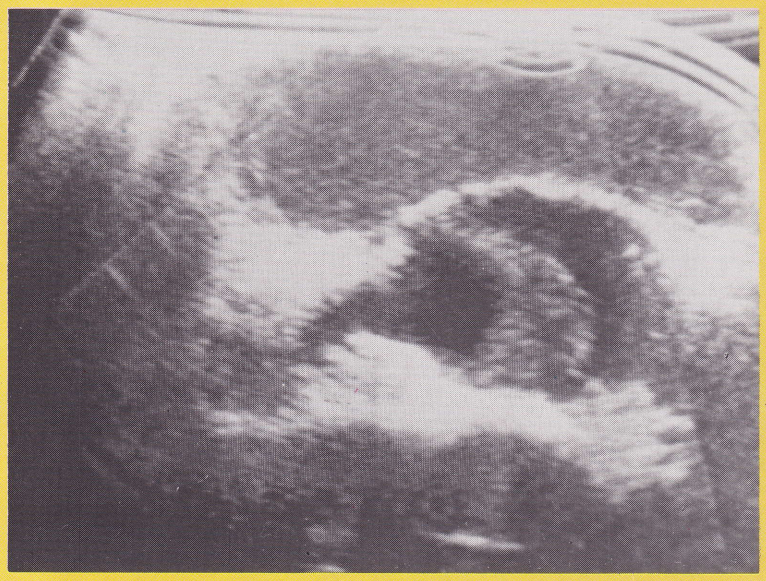


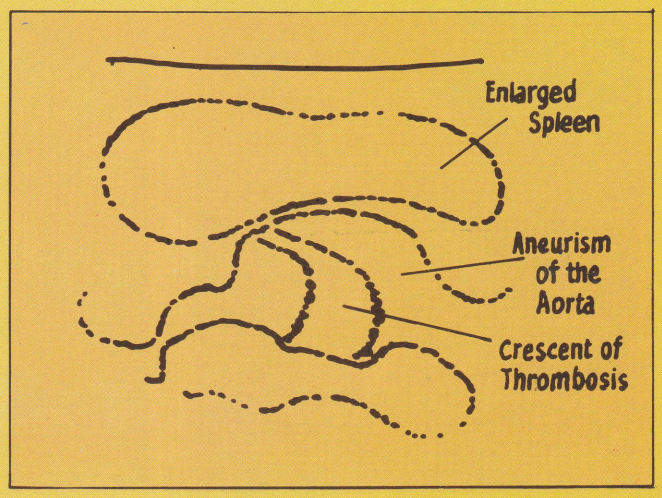

*Longitudinal scan of 9 week pregnancy.*

*Illustrations on this page courtesy Queen Mother's Hospital, Glasgow*

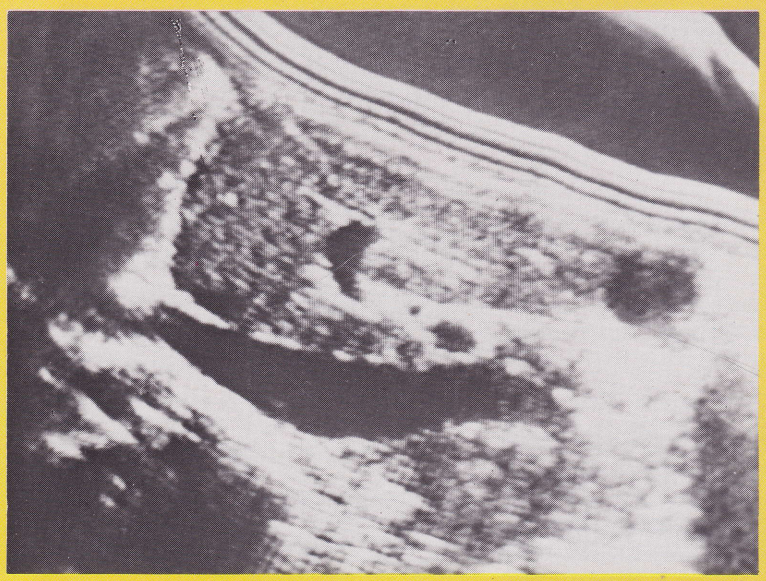
***Applications in :***

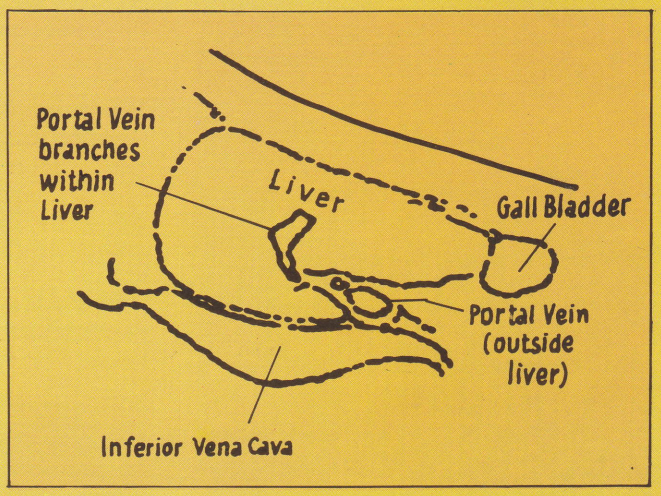
* **Obstetrics**
* **Gynaecology**
* **Abdominal and Pelvic Pathology**
* **Cardiology**
* **Ophthalmology**
* **Oncology**



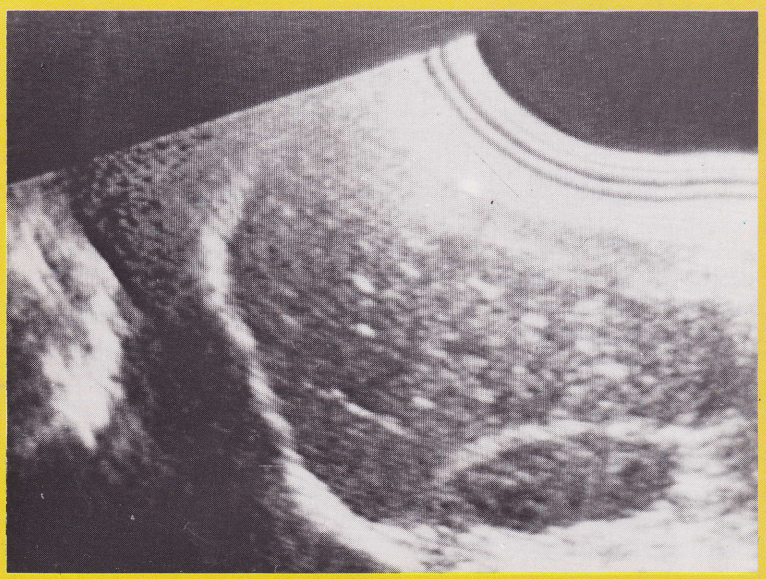


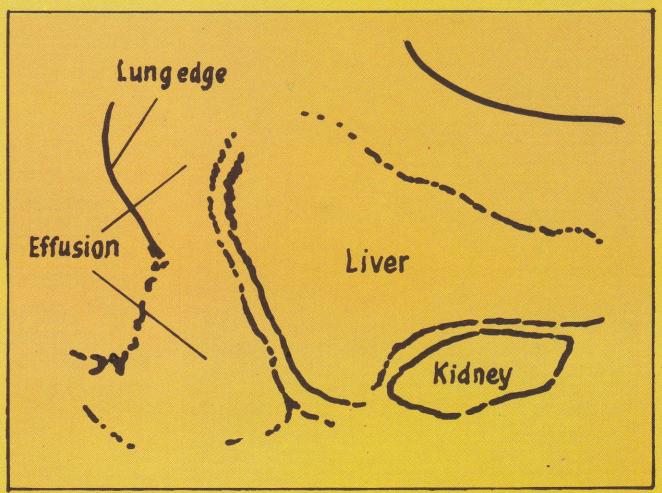

*Longitudinal scan—spleen and aorta. Clinically unsuspected aneurism of the aorta behind the enlarged spleen. A crescent of thrombosis present is in the aneurism.*






*Longitudinal scan—liver. Shows inferior vena cava and portal vein.*



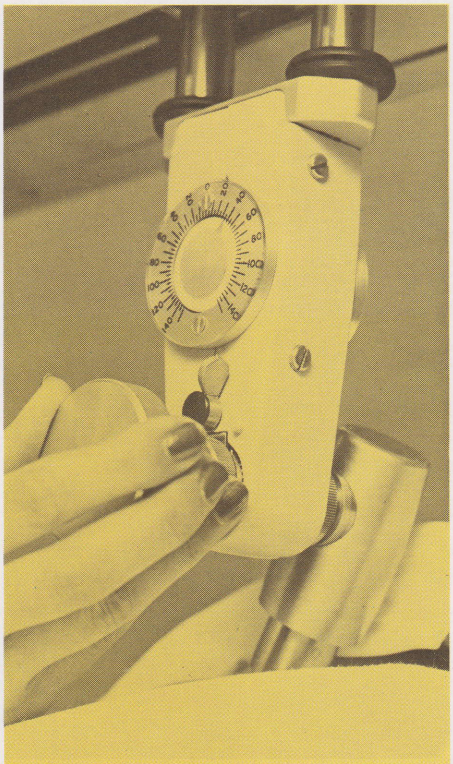



*Longitudinal scan—liver and right kidney. A large pleural effusion is present above the diaphragm.*

*Illustrations on this page courtesy Northwick Park Hospital, Harrow*

For Application Notes, (available on request) see p. 8.

# Accessories



The ultrasonic power output in all Nuclear Enterprises scanners is reduced to the lowest possible level. The sensitivity of the equipment is controlled by reducing the transmitted power rather than using high power and reducing the gain of the system. For fixed pulse rate applications the pulse repetition frequency is held at 600. During searches a unique velocity controlled pulse repetition system ensures that transmission only takes place while scanning is being carried out at a rate controlled by the speed of scanning.

**1**
NE 4211 Patient Trolley with paper sheet dispenser and facility for raising or lowering the patient's head to allow adjustment of posture for comfort and/or ease of investigation.

**2**
NE 4161 1.5MHz focused bayonet fitting probe.

**3**
NE 4166 5MHz non-focused bayonet fitting probe.

**4**
NE 4155 2.5MHz hand held probe (cardiology).

**5**
NE 4167 Biopsy probe—especially useful for amniocentesis 2.5MHz.

**6**
NE 4141 Water Bath for immersion scanning techniques.

**7**
NE 4110 Echo Generator for system calibration checks.

**8**
Shackman Super Seven Camera with Polaroid or 70mm film backs.

**9**
NE 4210 Remote Photographic facility for use with the NE 4204G Greyscale Storage Display comprises a 6in (152 mm) TV monitor with hinged adaptor to accept a Polaroid or 70mm camera. This TV monitor can be used as a remote viewing monitor and may be placed away from the main ultrasonic scanning area.

**10**
NE 4204C Colour Conversion Unit is all that is required to upgrade a greyscale storage display to full colour capability. It comprises a special 20in (508mm) colour TV display monitor and additional circuitry. The addition of a colour "window" to the greyscale picture allows much simpler differentiation between adjacent grey shades and this makes examination of fairly homogeneous structures such as livers more easily visualised.

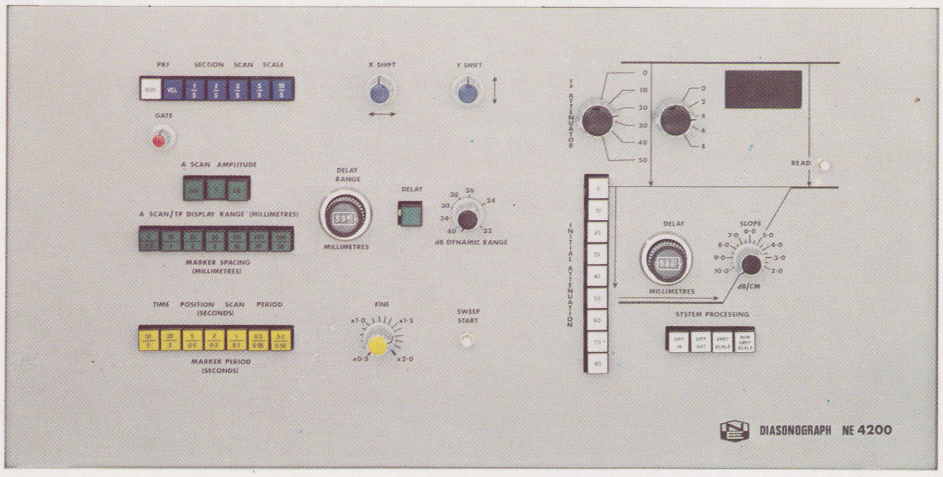
**11**
NE 4108 Video Cartridge Recorder is basically a PAL Colour $\frac{1}{2}$ in (12.7mm) magnetic tape recorder. It is specially modified to suit the particular requirements of recording scans from the greyscale/colour storage display. Operation is extremely simple, all major operations being pushbutton. The standard $\frac{1}{2}$ in (12.7mm) cartridge tapes supplied have a playing time of 36 minutes and it is possible to produce a simultaneous audio recording using the dubbing facility.

**12**
NE 4106 Hard Copy Unit produces high quality paper copies of the greyscale information stored on the NE 4204G Greyscale Storage Display video monitors. The copies are large ($8\frac{1}{2}$ in $\times$ 11 in or 216mm $\times$ 279mm), and are produced quickly (approximately 12 seconds).

**13**
NE 4103C Cardiac Module extends the use of Diasonograph systems in the field of cardiology. This module allows simultaneous presentation of Time-Position Scan, ECG and PCG traces. In addition, the display of ECG triggered cross-section scans of moving structures is possible. The pulse repetition rate is raised to 1,800 pulses per second and synchronisation of the Time-Position Scan from the ECG waveform can be achieved.

**14**
NE 4105 Fibre Optic Recording Oscilloscope provides a flexible, non-integrating display-record facility. In addition to continuous chart recording (m-mode) conventionally used in cardiological investigation, the NE 4105 can provide permanent hard copy records of section scans, time-position scans and A scans. All NE 4200 series Diasonographs are manufactured with a fibre optic recorder interface socket.

# Specifications




*Control Panel*

## NE4200 Specification

Operating controls are distributed in ergonomic groupings to assist operators without specialised knowledge of physics or electronics. Controls are calibrated in cm (or mm) in tissue where appropriate (see Control Panel above).

**Sensitivity Control by Transmitter Attenuator:**
0 to 50dB in 10dB steps
+0 to 8dB in 2dB steps

**Swept Gain (Depth Compensation):** Initial reduction: 0 to 80dB in 10dB steps
Initial Delay: 0 to 25cm continuously variable.
Slope: 1.5 to 10.5dB/cm continuously variable.

**Picture Scales: (short persistence, variable persistence and scan converter displays)—Section Scan only:** 1/5, 2/5, 3/5, 4/5, 5/5 of full-scale.
Scanned Area: Horizontal: 500mm nominal
Vertical: 250mm nominal
Probe rotation: ±135° from vertical in the plane of scan.

**A-Scan Display:** Occupies half or whole of screen (preset switch selection). Inversion of ½ scale by panel switch to enable accurate photographic comparison to be made between two successive echo patterns. Swept-gain characteristic can be superimposed on the A-scan display (selected by pushbutton control).

**A-Scan Range:** 5, 10, 20, 50, 100, 200, 500mm switched steps.

**A-Scan Delay:** 0 to 500mm continuously variable. A delay set/use switch allows the operator to preselect the region to be examined.

**Time-Position Display:** Intensity modulation of horizontal sweep.

**Vertical Sweep (Time-Position only):** Single vertical sweeps triggered by push button. Scan period continuously variable between ×0.5 and ×2 of the following ranges:—
50, 20, 5, 2, 1, 0.5, 0.2 in seconds.

**Horizontal Range (Time-Position Display):** 5, 10, 20, 50, 100, 200, 500mm switched steps (same control as A-Scan range).

**Operating Frequencies:**
0.5, 1.5, 2.5, 5, 10MHz.

**Energy:** Maximum available ultrasonic intensity is a function of the probe in use. Using the standard range of probes, the following figures are typical.
Normal mean
Acoustic Power: 1.5MHz 0.70 microwatt
2.5MHz 6.92 microwatt
5MHz 84.0 microwatt
Maximum Available Mean Acoustic Power: 1.5MHz 7.0 milliwatt
2.5MHz 6.92 milliwatt
5MHz 2.7 milliwatt
NOTE: Maximum operating sensitivity of the equipment is controlled by adjustment of the output power.

**Transmitter Pulse Repetition Rate:**
(a) Fixed 600 pulses/second.
(b) Velocity controlled (section scan only) 0 to 1800 pulses/second.
(c) With cardiac facility (time position scan) 1800 pulses/second.
(d) Triggered section scan with cardiac facility 10 to 100 pulses/cardiac cycle.

**Horizontal Delay (Time-Position Display):**
0 to 500mm continuously variable (same control as A-Scan range).

**Dynamic Range of Echoes:** 22 to 40dB continuously variable.

**Ultrasonic caliper:** Marker separation 0 to 199.9mm in 0.1mm steps over entire A-Scan range.

**Power requirements:** 100 to 120/200 to 240V ac, 50/60Hz 800VA.

## NE4204G Greyscale Storage Display Specification

**Description:** High resolution unit for storage and display of video and graphic information.
**Storage Medium:** Princeton Electronic Products PEP 400R Scan Conversion and Image Storage Unit.

**Resolution:** 1350* to 2100**
*TV lines per diameter at 50% depth of modulation.
**TV lines per diameter limiting resolution.

**Output:** Television 1V video signal with composite synch.
625 lines, 50 fields or 525 lines, 60 fields.

**Display Unit:** Electrohome 28cm monochrome monitor.

**Front Panel Controls:**
**(Continuously variable)**
"Zoom"—magnifies the image being viewed.
"X"—controls horizontal position of the area being magnified by zoom.
"Y"—controls vertical position of the area being magnified by zoom.

**Pushbutton switch selection:**
"Norm"—normal full-size viewing of the image.
"Set Zoom"—normal full-size image with "region of interest" superimposed—this is a rectangular box defining the area to be covered by the zoom. Its position and size are controlled by the X, Y and "Zoom" controls.
"View Zoom"—enlarges area within "region of interest" to fill the screen.
"Invert"—changes the displayed picture from positive to negative. Used for making positive pictures on negative film.
"Read only"—stops the writing of images on the storage unit when the probe is moved.
"Erase"—clears screen for the next scan.
"SS"—selects section scan picture storage.
"TP"—selects time-position scan picture storage.

**Preset Controls on the Storage Unit:**
"Read"—Preset control for optimisation of image read from the silicon storage target.
"Focus"—Focus of image read from the storage target.

**Rear Panel Outputs/Inputs:**
"Video Out"—1V composite synch video signal for TV monitor or video tape recorder. BNC 750hm socket.
"Video In"—1V composite synch video input for colour processing.
"Colour TV"—Multiway connector for colour TV monitor for NE 4204C.

**Dynamic Range of system with NE 4200:** 36dB.

**Greyscales Displayed:** 10.

**Power Requirements:**
100 to 120/220 to 240V ac, 50/60Hz, 200VA.

The following Application Notes are available on request:

1. Ophthalmic Ultrasonography—G. R. Sutherland FRCP(E), FFR. Southern General Hospital, Glasgow.
2 & 3. Obstetric Ultrasonography—Hugh P. Robinson MRCOG. Queen Mother's Hospital, Glasgow.
4. Echocardiography—D. A. R. Robertson FRCR. Southern General Hospital, Glasgow.
5. Ultrasonic Scanning of the Abdomen—Patricia Morley MB, DMRD, and Ellis Barnett FRCP, FRCR. Western Infirmary, Glasgow.
6 & 7. Short Case Notes on Abdominal Scanning—Hylton B. Meire MB, BS, DObst RCOG, FRCR. Northwick Park Hospital, Harrow.

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*(A member of the Oxley Printing Group Ltd.)*


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* Registered Office. Registration No. 31256, Scotland.

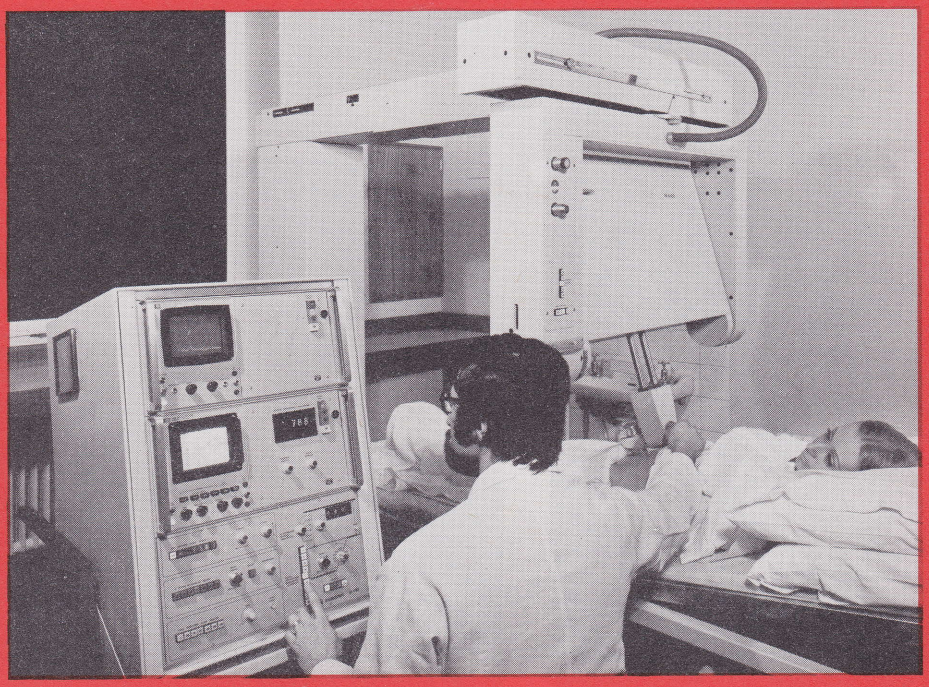

*Bulletin No 88 July 1976*

*D*

*Nuclear Enterprises Ltd. Bulletin No. 434 - Ultrasonic Greyscale Facilities. Edinburgh. April 1975.*

DIAGNOSIS BY ULTRASOUND

# GREYSCALE FACILITIES



with
DIASONOGRAPHS
NE 4102 & 4102A

Nuclear Enterprises Limited

# ULTRASONIC

**Interest is becoming very widespread in the application of greyscale techniques. A summary of equipment available for Storage Display and details of the capability of Nuclear Enterprises standard scanners in this field are given below. For full information please contact the Ultrasonic Sales Department, Tel: 031-443 4060.**

## NEW GREYSCALE STORAGE DISPLAY

The new NE 4104 Greyscale Storage Display offers the clinician the benefits of conventional storage tubes and, at the same time, a picture on the screen with the full range of grey shading. This can enormously simplify the obtaining and the interpretating of pictures of more complex structures. (The four pictures on this page are printed by kind permission of the Queen Mother's Hospital, Glasgow).

### Easier Operation and Improved Picture Quality

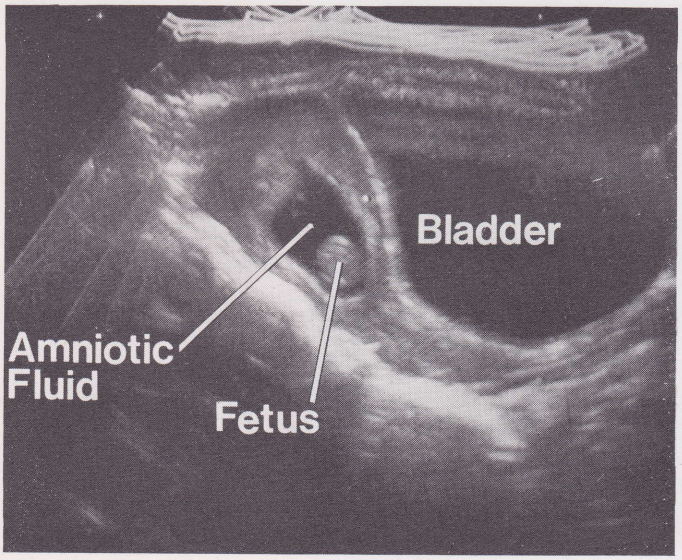
With the NE 4104 it is possible to achieve almost complete freedom from the overwriting effects which ruin many potentially good pictures obtained with conventional (non-storage) greyscale techniques. The user is encouraged to 'compound' every scan in order to collect as much clinically useful information as possible. This automatically improves quality and simplifies diagnosis.

Ten discernible shades of grey may be displayed on the screen for optimum discrimination of tissues under examination. In addition, special dynamic range compression and contrast enhancement circuitry allow the echo emplitudes of interest to be spread across the grey range of display.

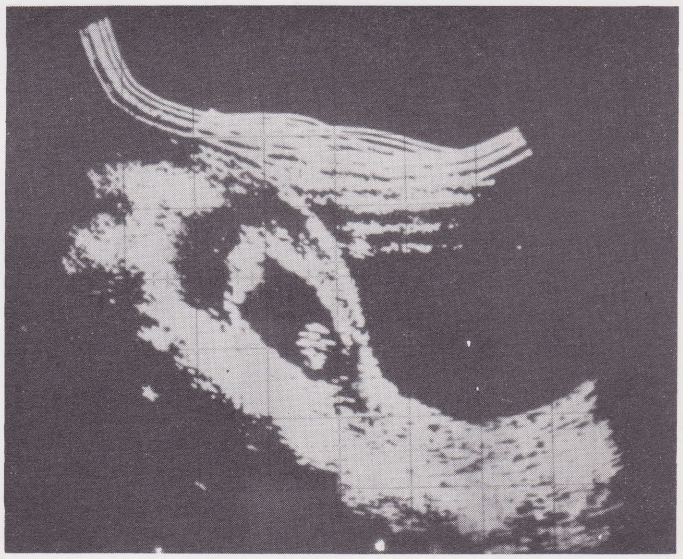
### Display and Record Facilities Increased

The NE 4104 time share, store/view facility allows the operator to see the build-up of a picture during the scanning process. Any area of interest can be selected and magnified to cover the screen and a maximum overall magnification 4x life size is possible without significant loss of resolution. TP and Section-scans may be displayed, and, with Diasonograph NE 4102B only, up to 4 section scans may be stored and viewed. Permanent records may be obtained by conventional Polaroid photography or by the addition of a hard copy unit.

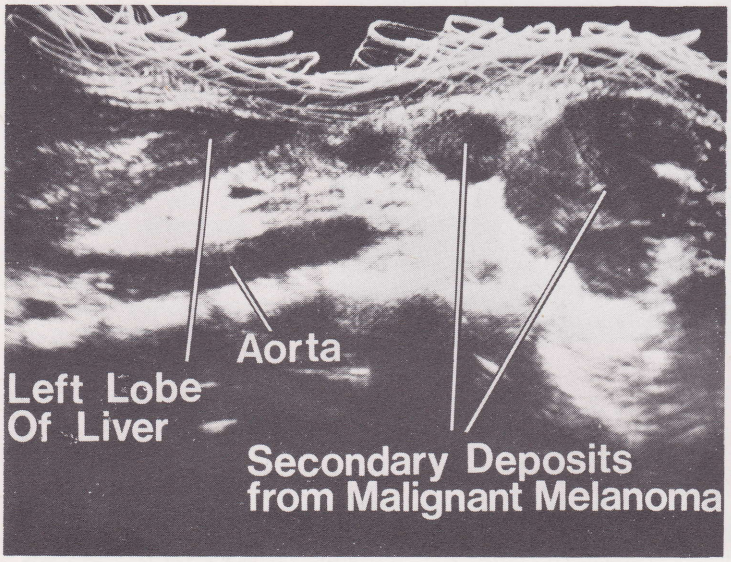
As electronic signals are now available in standard TV form, slave or remote TV monitors may be used for display and video tape recorders employed to store and replay information. Thus monitors may be sited in lecture theatres or in consulting rooms.



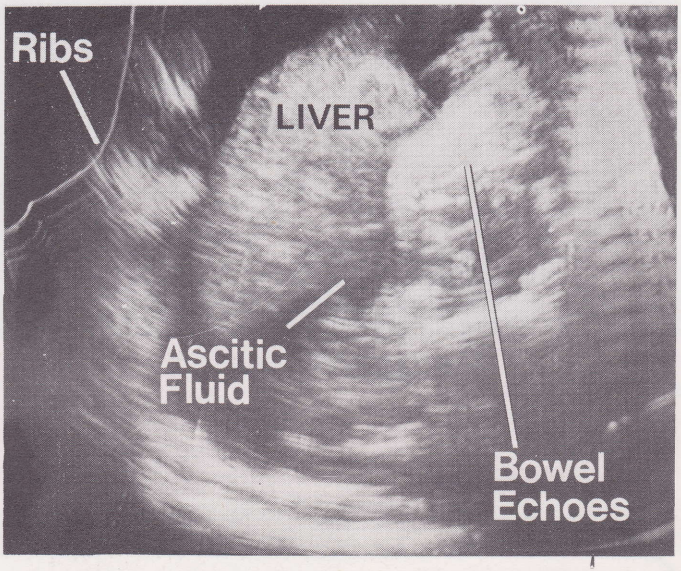

LONGITUDINAL SECTION OF EARLY PREGNANCY



LONGITUDINAL SECTION OF EARLY PREGNANCY (NO GREYSCALING)




LONGITUDINAL SCAN OF ABDOMEN




HIGH TRANSVERSE SCAN

# CS - GREYSCALE FACILITIES

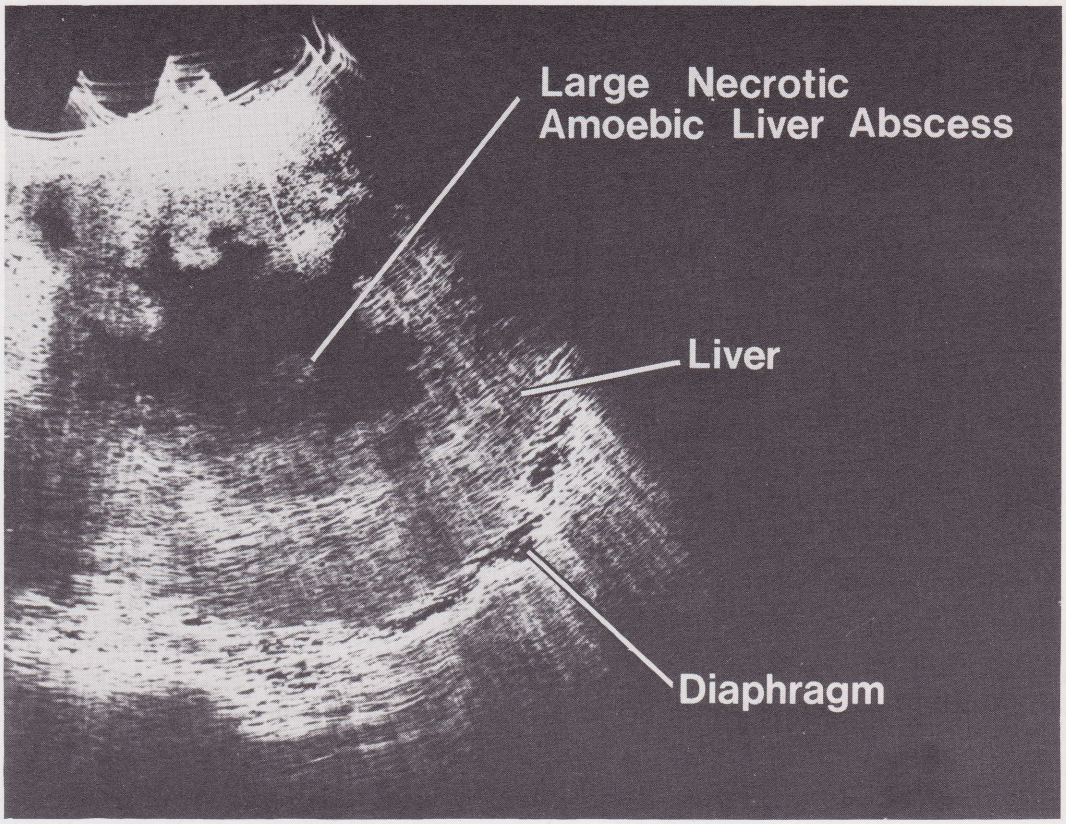
## GREYSCALE CAPABILITY OF STANDARD EQUIPMENTS

### NE 4102 and NE 4102A Diasonographs

All Nuclear Enterprises scanners can be used to produce greyscale pictures by time exposure photography of the non-storage display. The technique can also be used on the variable persistence display when this is switched to the non-store (conventional) mode. However, signal processing on the NE 4102 and NE 4102A includes differentiation for resolution enhancement which reduces greyscale contrast. Nuclear Enterprises can now supply a Modification Kit which permits non differentiated signals to be used and ensures maximum greyscale contrast for applications where greyscale is the most important picture characteristic.

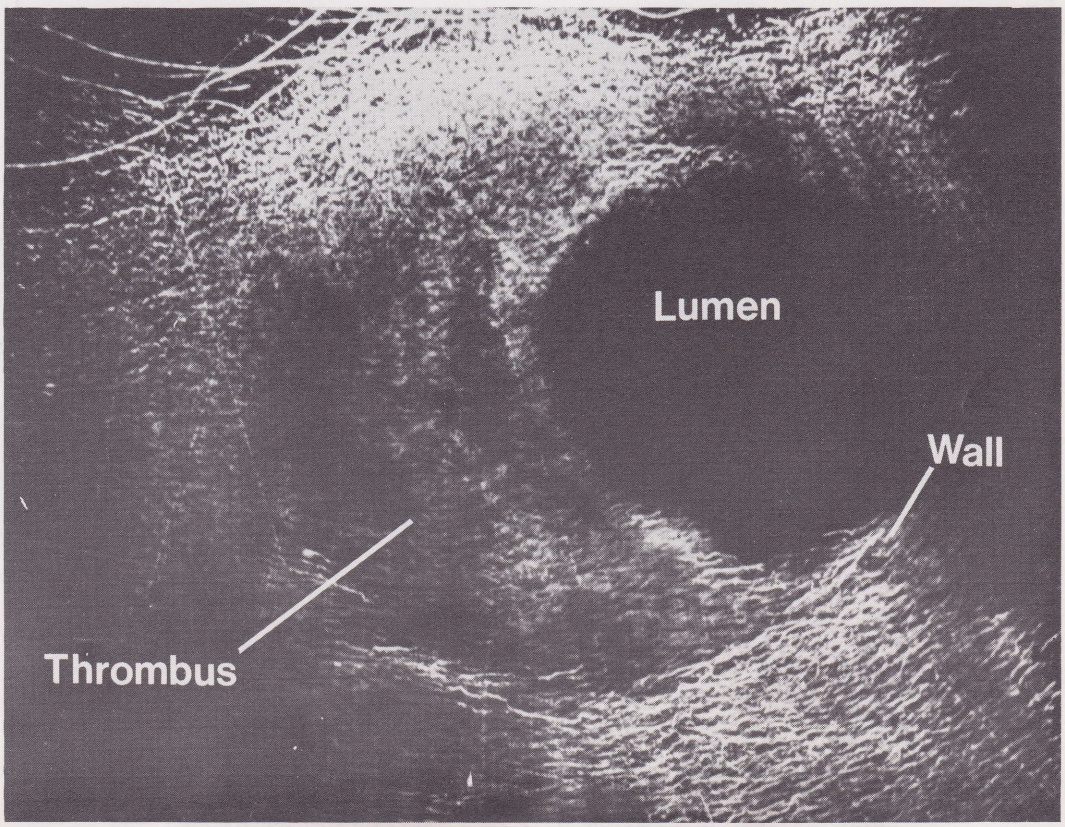
The Kit is easily incorporated in all equipments and, when the standard NE 4102 has been modified, two signal processing modes are available. The first mode "Differentiation," is suitable for high resolution greyscale visualisation. The second Mode, "Non - Differentiation", emphasises greyscale, but compromises boundary resolution or "sharpness" of the displayed result.

N.B. All the greyscale conditions specified above for the modified standard NE 4102 (or NE 4102A) are automatically included in the NE 4102B, so no modification is required for NE 4102B. The four pictures on pages 3 and 4 were taken with the




LARGE NECROTIC AMOEBIC LIVER ABSCESS

TRANSVERSE SCAN. LARGE ABDOMINAL AORTIC ANEURISM



NE 4102B and are printed by kind permission of Dr. D. A. R. Robertson, Dept. of Radiology, Southern General Hospital, Glasgow and Dr. R. Railton, Dept. of Clinical Physics and Bio-Engineering, Glasgow.

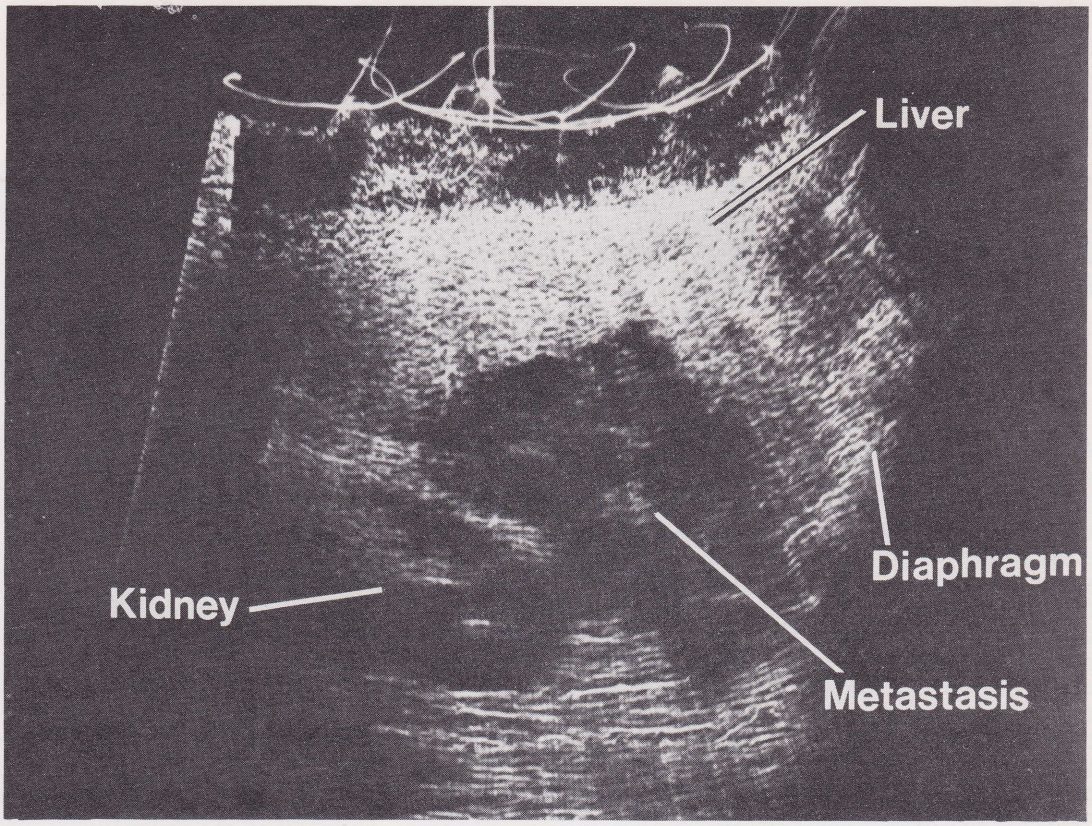
## NE 4105 Fibre Optic Recording Oscilloscope

The NE 4105 can be fitted to the NE 4121 Diasonoscope and to all the NE 4102 Series Diasonographs to provide permanent records at comparatively low cost. The differentiated and non-differentiated signal processing option is a standard facility in this unit. The NE 4105 reproduces up to five grey tones unequivocally and, in the section scan mode, considerable over scanning without deterioration of picture quality is possible.

Records of single frame time position scans, A-scans, and continuous time position scans for long term observation of moving structures, can also be obtained with the NE 4105.

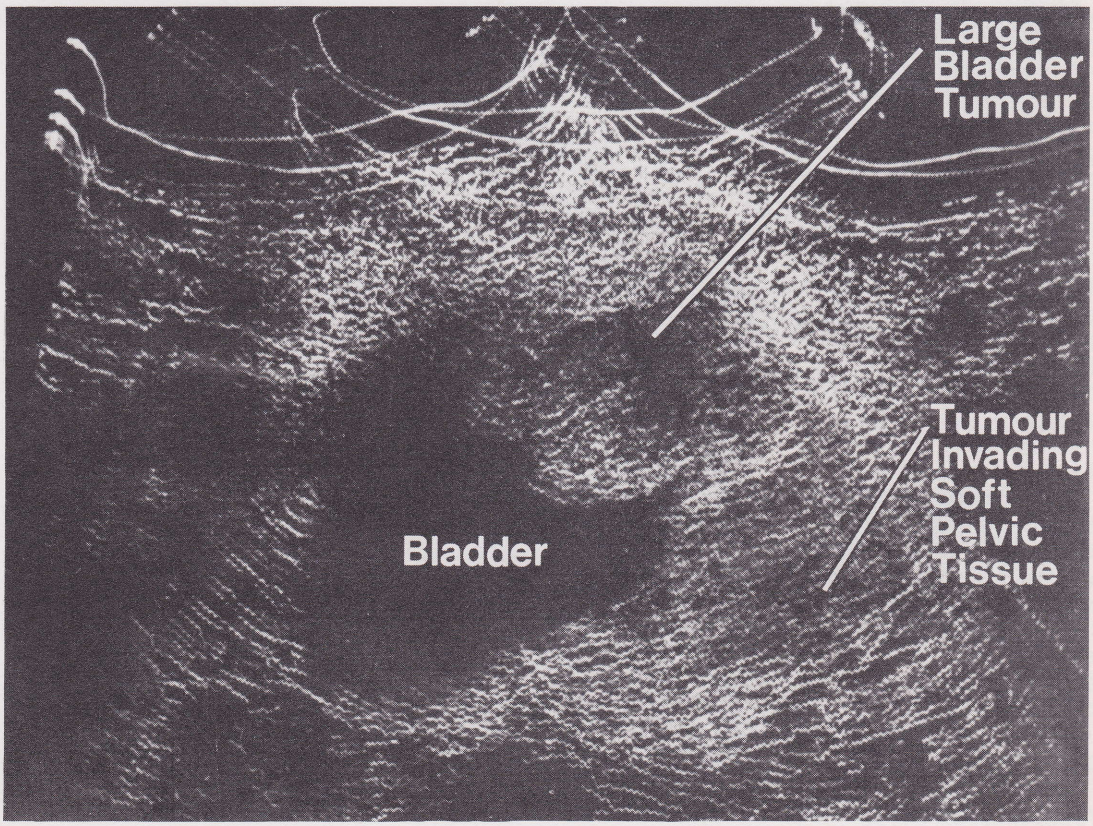
## NE 4107 Greyscale Calibration Unit

The NE 4107 provides a calibration signal into the input of the receiver amplifier, and a drive waveform to the swept gain unit. This enables a thorough check to be made of the performance of all critical elements affecting the greyscale performance — not merely as individual elements but as a complete system.




**LONG SCAN. LARGE METASTASIS IN RIGHT LOBE LIVER**

**TRANSVERSE SCAN, BLADDER. TUMOUR: INTRA-LUMINAL PLUS EXTRA-VESCICAL SPREAD**





# Nuclear Enterprises Limited

Bulletin No. 434
April 1975

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* Registered Office Registration No. 31256 Scotland

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*Nuclear Enterprises Ltd. Bulletin No. 90 - NE4104G Greyscale Storage Display Accessory for NE4102 Diasonograph Systems, July 1976.*

DIAGNOSIS BY ULTRASOUND

# NE4104G GREYSCALE STORAGE DISPLAY ACCESSORY FOR NE4102 DIASONOGRAPH SYSTEMS

**HIGH DEFINITION LARGE SCREEN NON-INTEGRATING GREYSCALE STORAGE DISPLAY CAPABILITY**

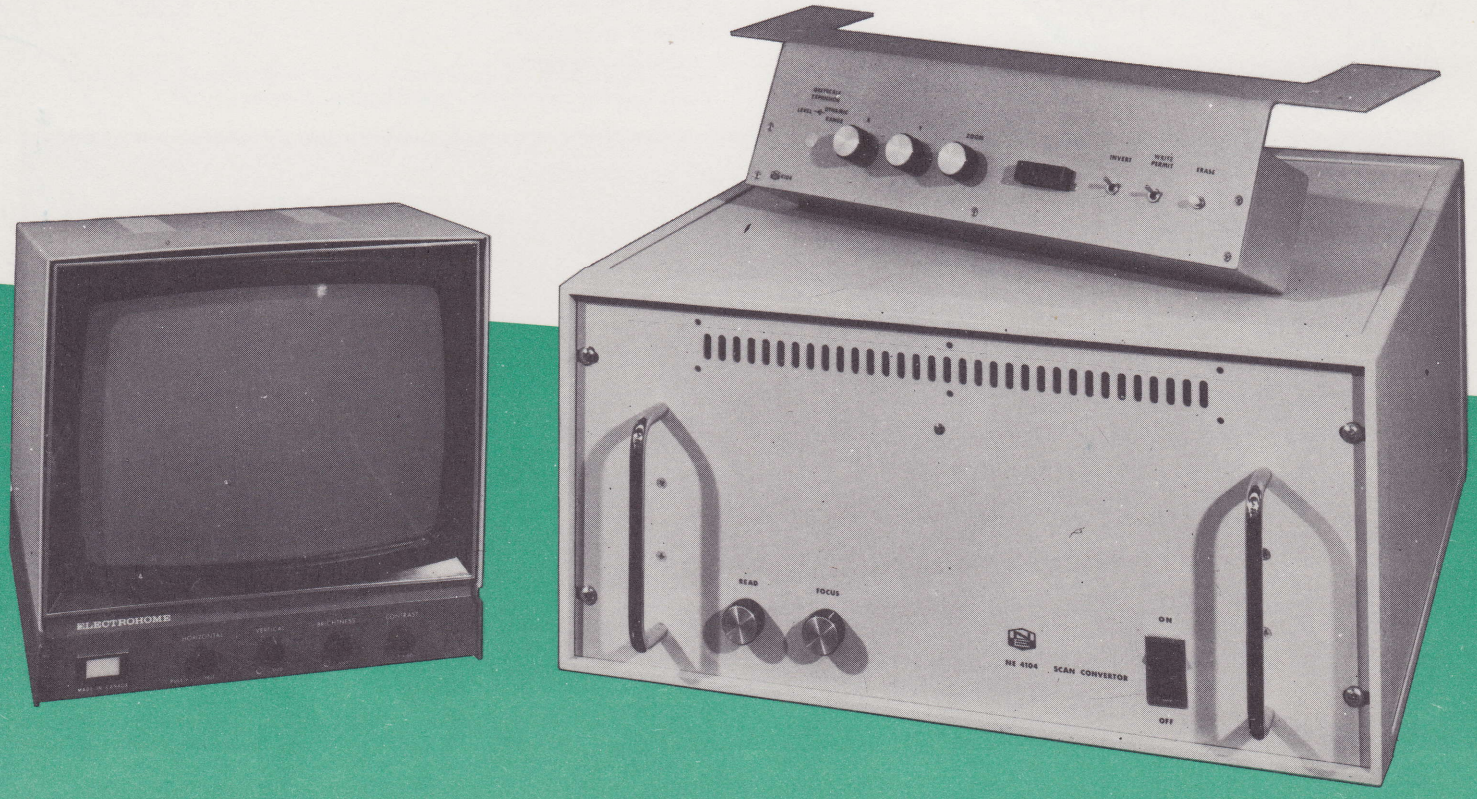
The NE 4104G has been designed for use with the NE 4102, NE 4102A and NE 4102B Diasonographs. The unit is supplied in its own cabinet which fits on the trolley below the main electronics console together with the necessary interfacing circuitry and display unit.

The NE 4104G Greyscale Storage Display offers Diasonograph users the benefits of conventional storage tubes and, at the same time, a picture on the TV monitor screen with the full range of grey shading. This can enormously simplify the obtaining and the interpreting of pictures of more complex structures.

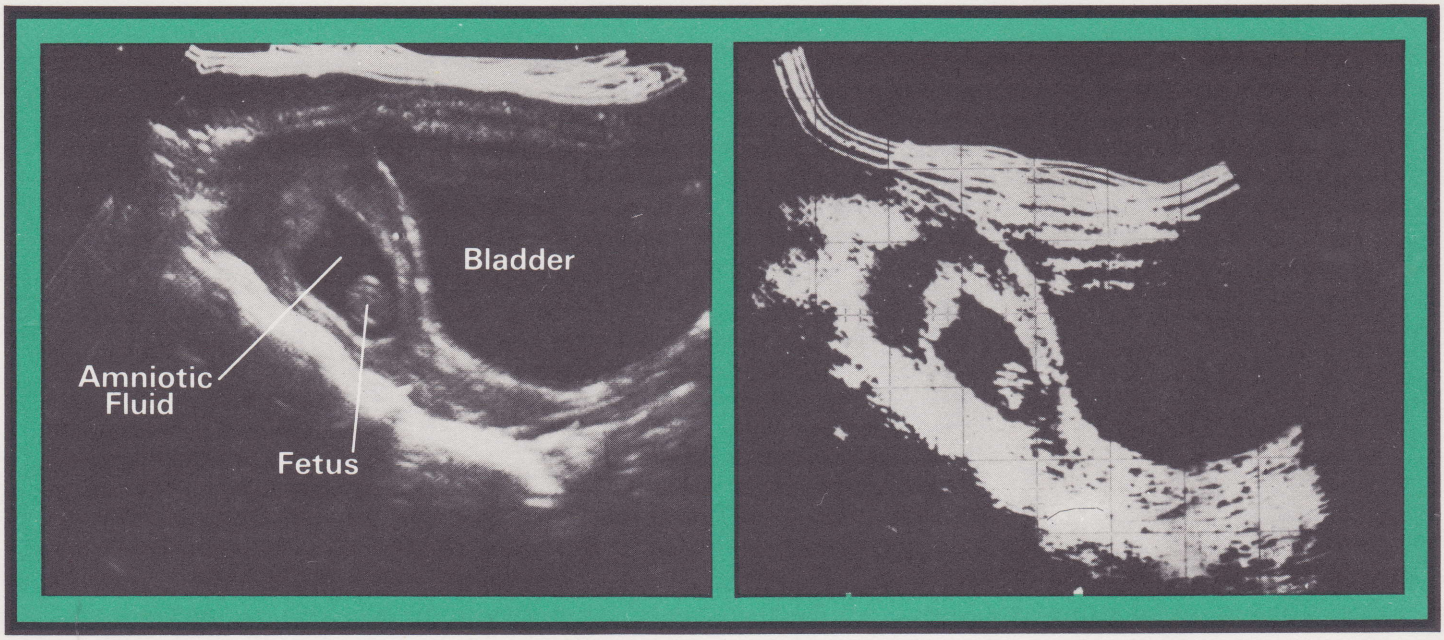
## Easier Operation and Improved Picture Quality

With the NE 4104G it is possible to achieve almost complete freedom from the overwriting effects which spoil many potentially good pictures obtained with conventional (non-storage) greyscale techniques. The user may, without writing out the picture, 'compound' a scan in order to collect as much clinically useful information as possible. This significantly improves quality and simplifies diagnosis in some types of examination.

Ten discernible shades of grey may be displayed on the screen for optimum discrimination of tissues under examination. In addition, special dynamic range compression and contrast enhancement circuitry allow the echo amplitudes of interest to be spread across the grey range of display.



# Typical Results




*Top left: Longitudinal section of early pregnancy*

*Top right: Longitudinal section of early pregnancy — no greyscaling*

*Courtesy Queen Mother's Hospital, Glasgow*

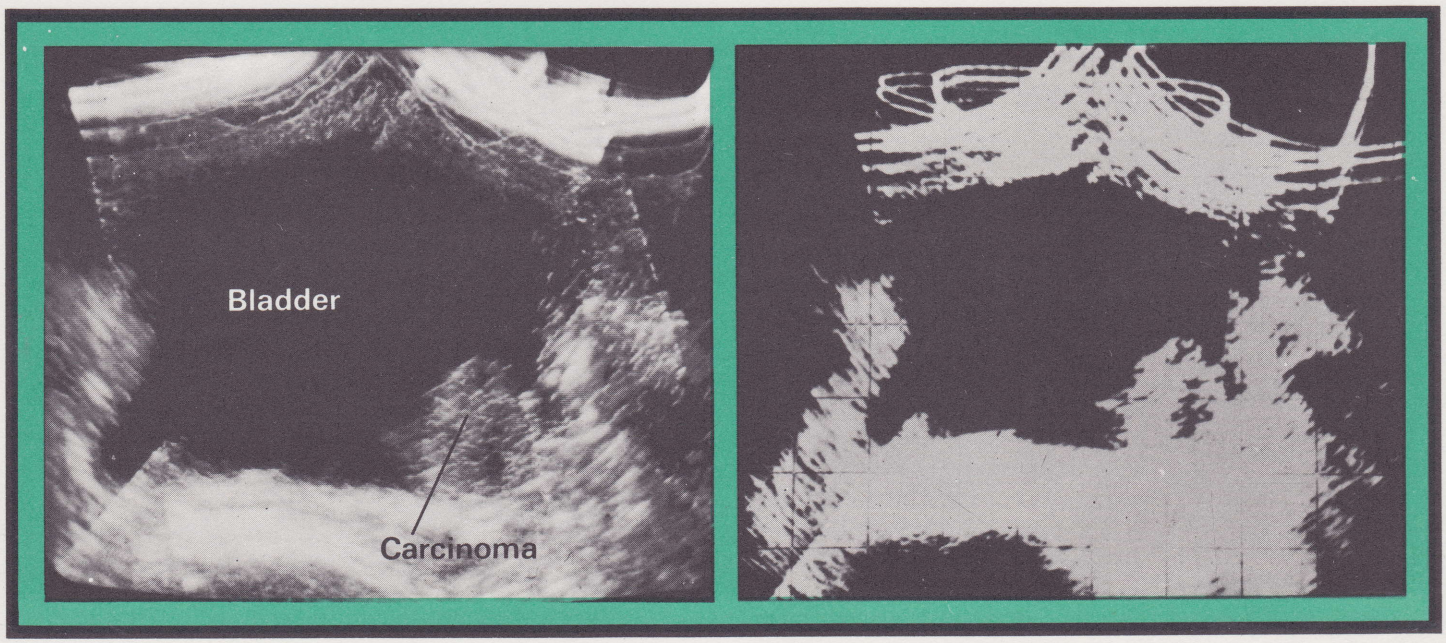
**Display and Record Facilities Increased**

The NE 4104G time share, read/write facility allows the operator to see the build-up of a picture during the scanning process. Any area of interest can be selected and magnified to cover the total screen width. A maximum overall magnification 4× life size is possible without significant loss of resolution. TP and section scans may be displayed and, with Diasonograph NE 4102B only, up to 4 section scans may be stored and viewed. Permanent records may be obtained by conventional Polaroid photography or by the addition of a hard copy unit.

As electronic signals are now available in standard TV form, slave or remote TV monitors may be used for display, and video tape recorders employed to store and relay information. Thus monitors may be sited in lecture theatres or in consulting rooms.

*Bottom left: Transverse section of a female bladder with a left posterior carcinoma*

*Bottom right: Same study as shown left but without greyscaling. Both results courtesy Northwick Park Hospital, Harrow*



# Technical Description

The NE 4104G Greyscale Storage Display has been designed to give greyscale pictures from Diasonographs. The heart of the system is the scan converter tube which stores the image. The stored picture cannot, however, be viewed directly but is electronically processed so that it is in the format of a standard television video waveform and is viewed on standard TV monitors.

The image is stored on a silicon chip or target within the scan converter. The principle of operation is for the target to be charged to a high voltage. The signals, which drive the display tubes on a Diasonograph, are used to discharge the voltage on this target, and thus the pattern of charge remaining on the target is the same as the pattern on a storage oscilloscope tube. The target is scanned by a beam of electrons, the scanning being in the same pattern as on a TV screen. The number of electrons in the scanning beam is determined by the charge on the target where the beam is aimed, and since the movement of electrons is an electric current then these current changes can be used to present the information on the target as a TV type signal. The *scanning* format of the Diasonograph has been *converted* to a TV picture.

The greyscale capability of the scan converter is due to its non-integrating method of writing the information on the target. On the standard oscillographic display the intensity is an additive process so that several small echoes received from one point scanned from various positions are displayed with the same intensity as one large echo from one point.

The charged silicon target of the scan converter is a non-integrating or non additive process. Several repeated echoes from the same point do not cause over-writing. The 4104G does not only consist of the scan conversion circuits. It is possible to enlarge the image on the target by a zoom facility, the area of the zoom being defined by the 'region of interest' or 'new zoom' circuits. The TV signal can also be inverted to give a negative picture, and this facility is particularly useful for recording results on negative film. The scan conversion process is also carried out in such a way that the target can be scanned and the image viewed at the same time as information is being written on to the target.

Interfacing is supplied to enable the signals to be derived from the Diasonograph in a suitable manner for scan conversion and the TV monitor picture to be displayed (and photographed) on one of the Diasonograph's display tubes.

# Accessories

**1** NE 4210 Remote Photographic facility for use with the NE 4104G Greyscale Storage Display comprises a 6 inch TV monitor with hinged adaptor to accept a Polaroid or 70mm camera. This TV monitor can be used as a remote viewing monitor and may be placed away from the main ultrasonic scanning area.

**2** NE 4108 Video Cartridge Recorder is basically a PAL Colour ½ inch recorder. It is specially modified to suit the particular requirements of recording scans from the greyscale display. Operation is extremely simple, all major operations being pushbutton. The standard ½ inch cartridge tapes supplied have a playing time of 36 minutes and it is possible to produce a simultaneous audio recording using the dubbing facility.

**3** NE 4106 Hard Copy Unit produces high quality paper copies of the greyscale information stored on the NE 4104G Greyscale Storage Display video monitors. The copies are large, 216×279mm (8½×11in), and they are produced quickly (approximately 12 seconds).

# NE4104G Specification

**Description:** High resolution unit for storage and display of video and graphic information.

**Storage Medium:** Princeton Electronic Products PEP 500R Scan Conversion and Image Storage Unit.

**Resolution:** 1350* to 2100**
*TV lines per diameter at 50% depth of modulation
**TV lines per diameter limiting resolution

**Output:** Television 1V video signal with composite synch. 625 lines, 50 fields or 525 lines, 60 fields.

**Display Unit:** Electrohome 28cm monochrome monitor.

**Front Panel Controls:** Continuously variable.
'Zoom'—Control to magnify the image being viewed.
'X'—Controls the horizontal position of the area being magnified by the zoom.
'Y'—Controls the vertical position of the area being magnified by the zoom.

**Pushbutton switch selection:**
'Norm'— Normal full-size viewing of the image.
'Set Zoom'—Normal full-size image with 'region of interest' superimposed—this is a rectangular box defining the area to be covered by the zoom. Its position and size are controlled by the X, Y and 'zoom' controls.
'View Zoom'—Enlarges area within 'region of interest' to fill the screen.

**Toggle Switches:**
'Invert'—Changes the displayed picture from positive to negative. Used for making positive pictures on negative film.
'Write permit'—Enables the circuitry to write images on the storage unit when the probe is moved.
'Erase'—Clears the screen for the next scan.

**Preset Controls on the Storage Unit**
'Read'—Preset control for optimisation of the image read from the silicon storage target.

**continued overleaf**

# NE4104G Specification (contd)

'Forms'—Focus of image read from the storage target.

**Rear Panel Outputs/Inputs**
'Footswitch erase'—For remote erase facility. Multiway.
'Video Tape'—1V composite synch video signal for video tape recorder. BNC 75ohm socket.
'TV Monitor'—1V composite synch video signal for TV monitor. BNC 75ohm socket.
'Graph'—Multiway connector to Diasonograph.
'Front Panel'—Multiway connector to front control panel.
'Colour TV'—Multiway connector for colour TV monitor for NE 4104C.
'Mains Input'—Mains power supply.

**Dynamic Range** of system with NE 4102 36dB

**Greyscales Displayed** 10.

**Power Requirements**
220 to 240V, 50Hz
or 110 to 120V, 60Hz } 200VA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*Bulletin No. 90 July 1976*

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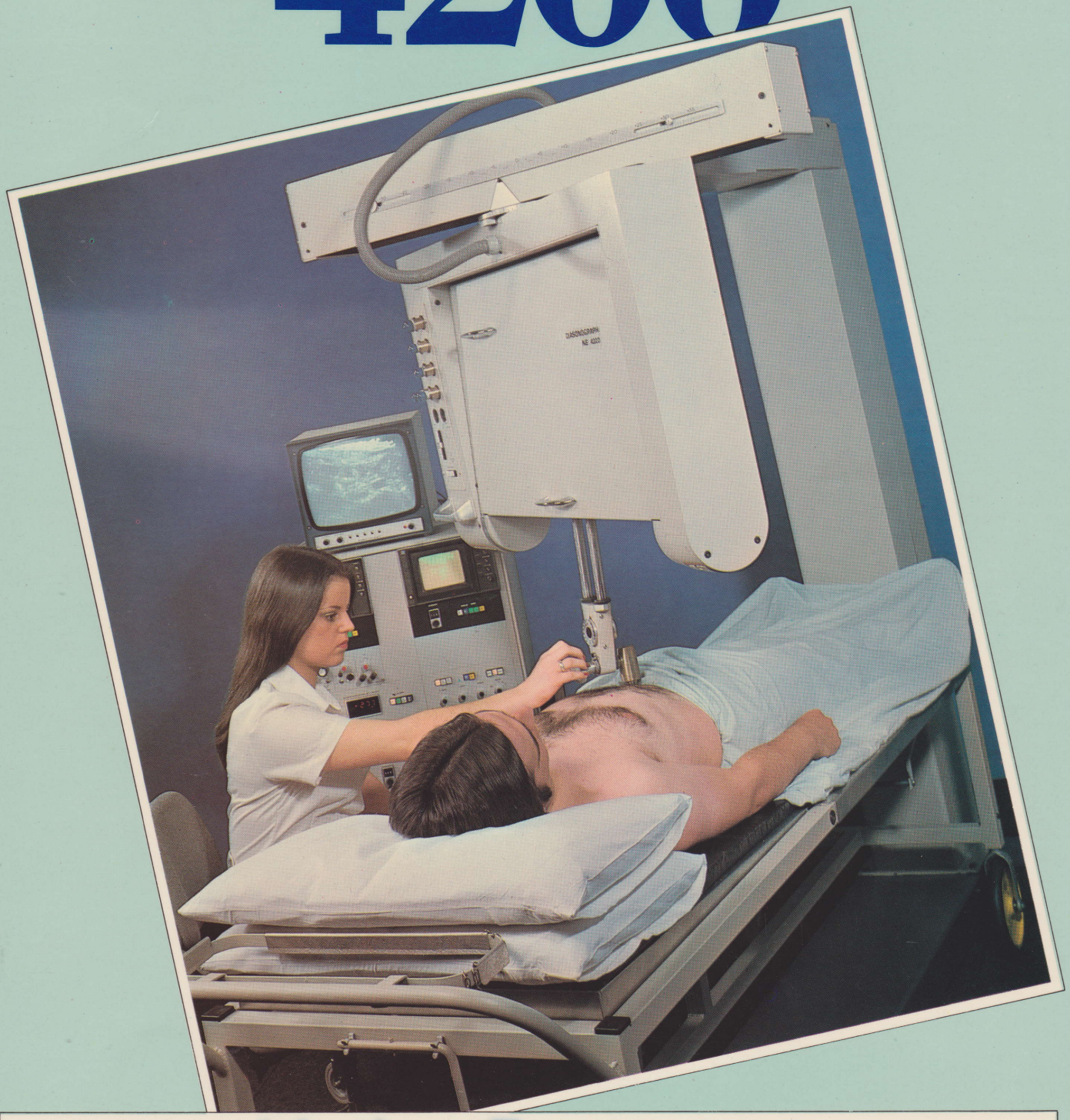
*EMI Medical Ltd. Bulletin No. 112 - EMISONIC 4200. October 1977.*

# EMISONIC 4200



Nuclear Enterprises

EMISONIC 4200
(Formerly Nuclear Enterprises Diasonograph 4200)

Following the merger of Nuclear Enterprises with EMI in October, 1976, Nuclear Enterprises is now a full member of the EMI Group of Companies, world leaders in medical imaging systems.

Nuclear Enterprises pioneered the design and manufacture of advanced Ultrasound Scanners, which have been internationally acknowledged as setting performance standards in this field.

The combined research, development and manufacturing resources now provide a new, and expanded range of advanced Ultrasound Systems. This new range is being marketed under the 'EMISONIC' trade name through Nuclear Enterprises/ EMI Medical and their associated subsidiaries and representatives.

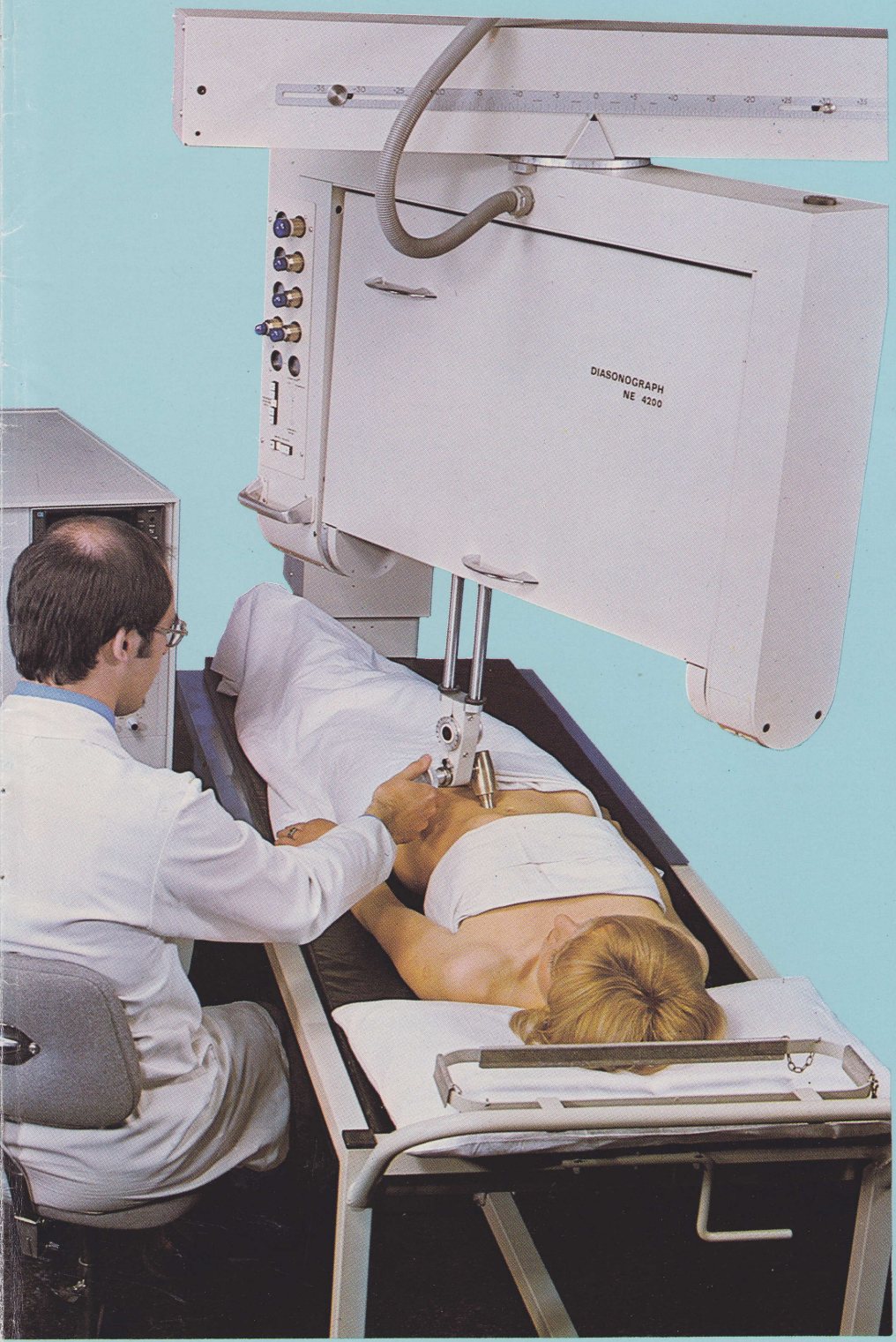
The EMISONIC Ultrasound range of equipment is supported worldwide, in all overseas markets, by specialised teams in marketing, installation and after-sales service.

# EMISONIC 4200 with Greyscale Storage Display.

The EMISONIC 4200 is the latest addition to the world-leading range of diagnostic pulse echo, ultrasonic scanners developed by Nuclear Enterprises over the past ten years. It has full greyscale capability and provides a high standard of resolution, outstanding operational capability and reliability. The 4200 single transducer contact scanner incorporates as standard, facilities for displaying A-scan, Cross-Section (B-scan) and Time-Position (M Mode) scans. These facilities enable a comprehensive diagnostic service to be provided in the fields of obstetrics, gynaecology, general abdominal examinations of soft tissue structures, neurology, ophthalmology, endocrinology, gastroenterology and cardiology.

The basic Control Console includes well established high quality displays and the following facilities are provided as standard: display of swept gain waveform; calibrated intensity controls for displays; and amplifier processing mode selection. Careful ergonomic grouping and colour coding of pushbutton controls ensure simplicity of operation. The recording facilities offered include: photographs (Polaroid, 70mm film, X-ray film), strip chart and video.

The 4200 is designed to meet individual clinical requirements as fully and as simply as possible. The system is supplied complete with the 4205G Greyscale Storage Display and the 4103C Cardiac Module is an optional facility. The 4200 can be supplied in its basic form without storage greyscale if required.



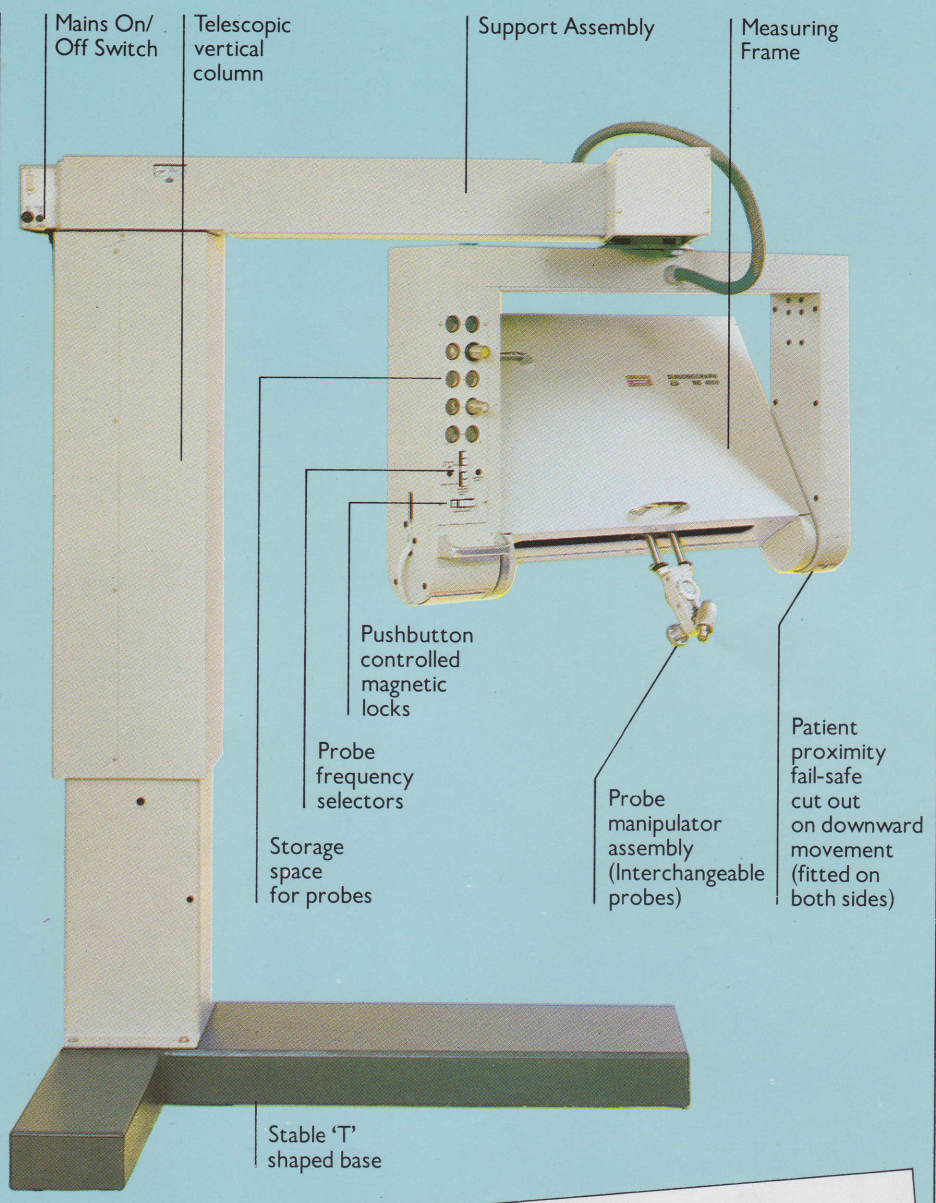
# Scanning Assembly with exceptional measuring accuracy.

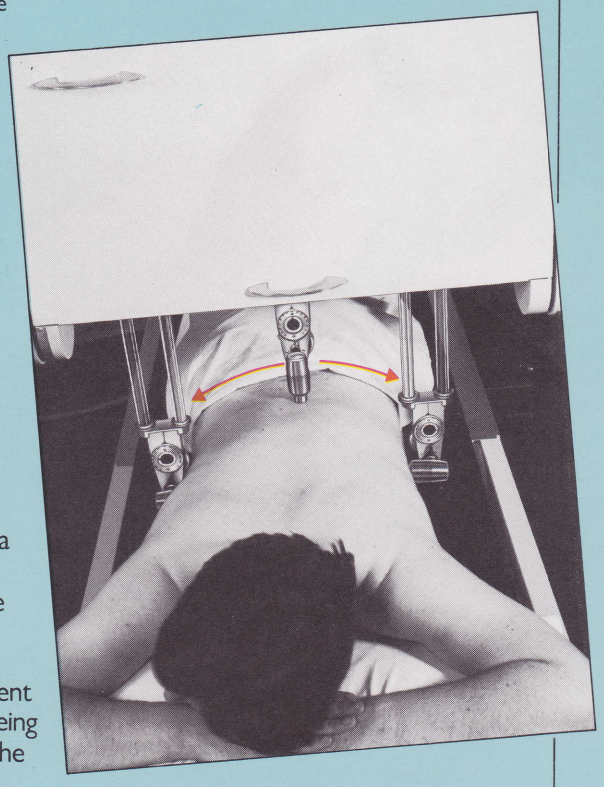
The 4200 measuring system affords an operator maximum freedom in positioning the scanning frame and allows the chosen scanning plane to be easily maintained and reproduced. The one-to-one measuring system coupled to the scanning probe has unequalled measuring accuracy, and all movements are calibrated. Rapid changing from longitudinal to transverse scanning is another important facility offered by the 4200 measuring system.

The 4238 2.5MHz long internal focus probe is supplied as standard with the system but a wide choice of interchangeable bayonet fitting probes for different applications is available. These probes may be exchanged without switching off the equipment, and changed from one side of the assembly to the other to suit the examination. The probe may be locked at a specific angle within its travel both for calibration and operational requirements as when it is used with a 4167 Biopsy Probe.

The **unique probe frequency selection** controls enable the operator to match the amplifier tuning to the transducer being used – thus optimising information production for a particular examination. **1.5MHz, 2.5MHz, 3.5MHz, 5.0MHz and 10MHz optimised frequency tuning is available as standard.**

**Patient proximity detectors are provided to ensure that no hazard to a patient occurs** from accidental lowering of the measuring frame or probe.

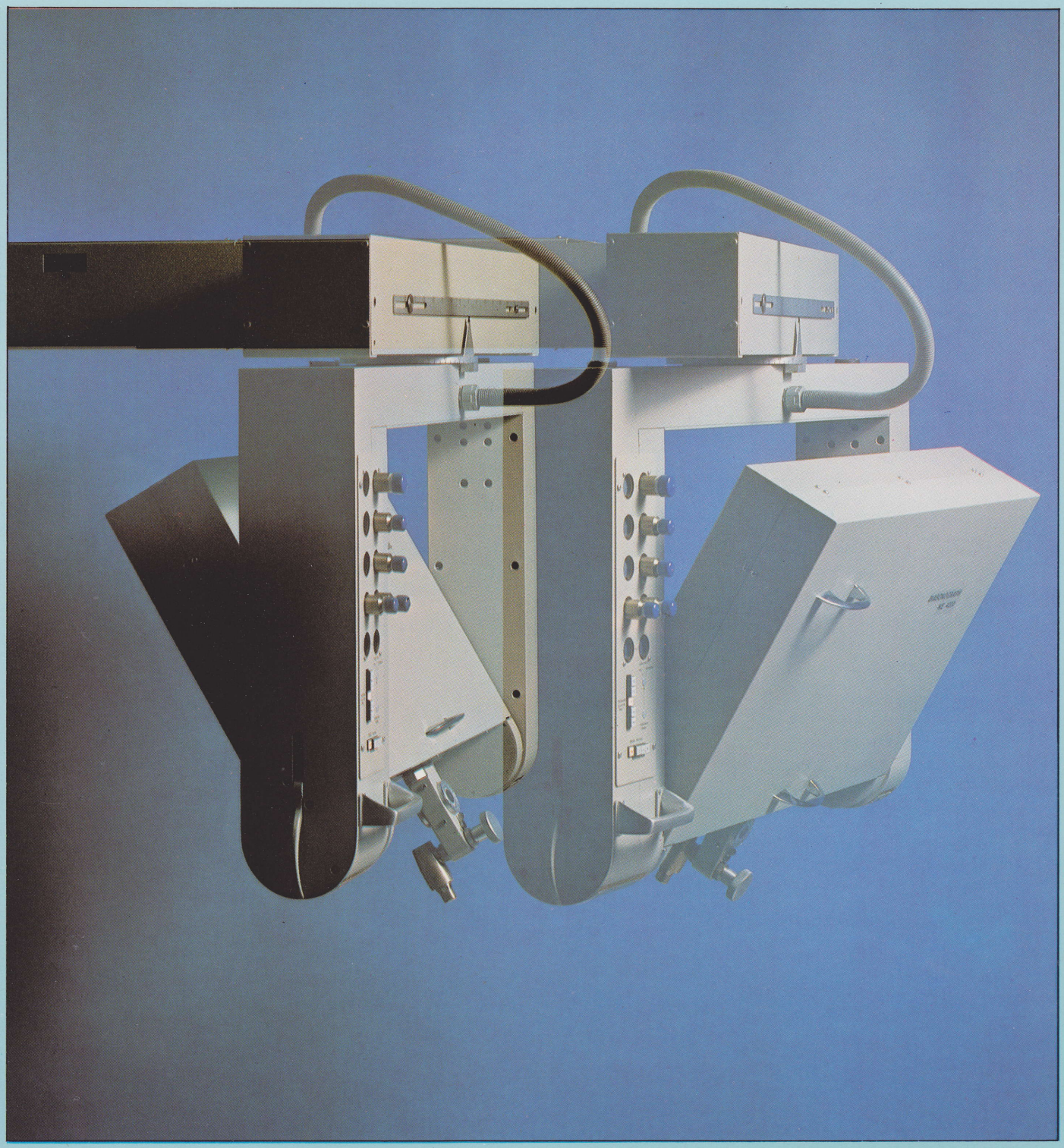


The ultrasonic power output in all Nuclear Enterprises scanners is reduced to the lowest possible level in order to minimise the dose energy to the patient, whilst maximising the use of it. The sensitivity of the equipment is controlled by reducing the transmitted power rather than using high power and reducing the gain of the system.

For most routine investigations a pulse repetition frequency of 600 pulses per second is used. A unique selectable velocity controlled pulse repetition system ensures that ultrasound transmission to the patient only takes place whilst scanning is being carried out at a rate controlled by the speed of scanning.

The transmitter output power and attenuation controls are accurately calibrated in decibels (dB).



An essential requirement for an ultrasonic scanning system is that the cross-sectional plane of interest in the patient is reproduced accurately and reliably. **The exceptional freedom of positioning of the 4200 measuring system allows the operator to change the plane of scan rapidly and minimises user fatigue.**

The majority of clinical investigations require a series of scans to be taken both transversely and longitudinally. Rapid interchangeability between planes is an important facility offered by the 4200. This is especially significant in busy clinics where the patient throughput is high.

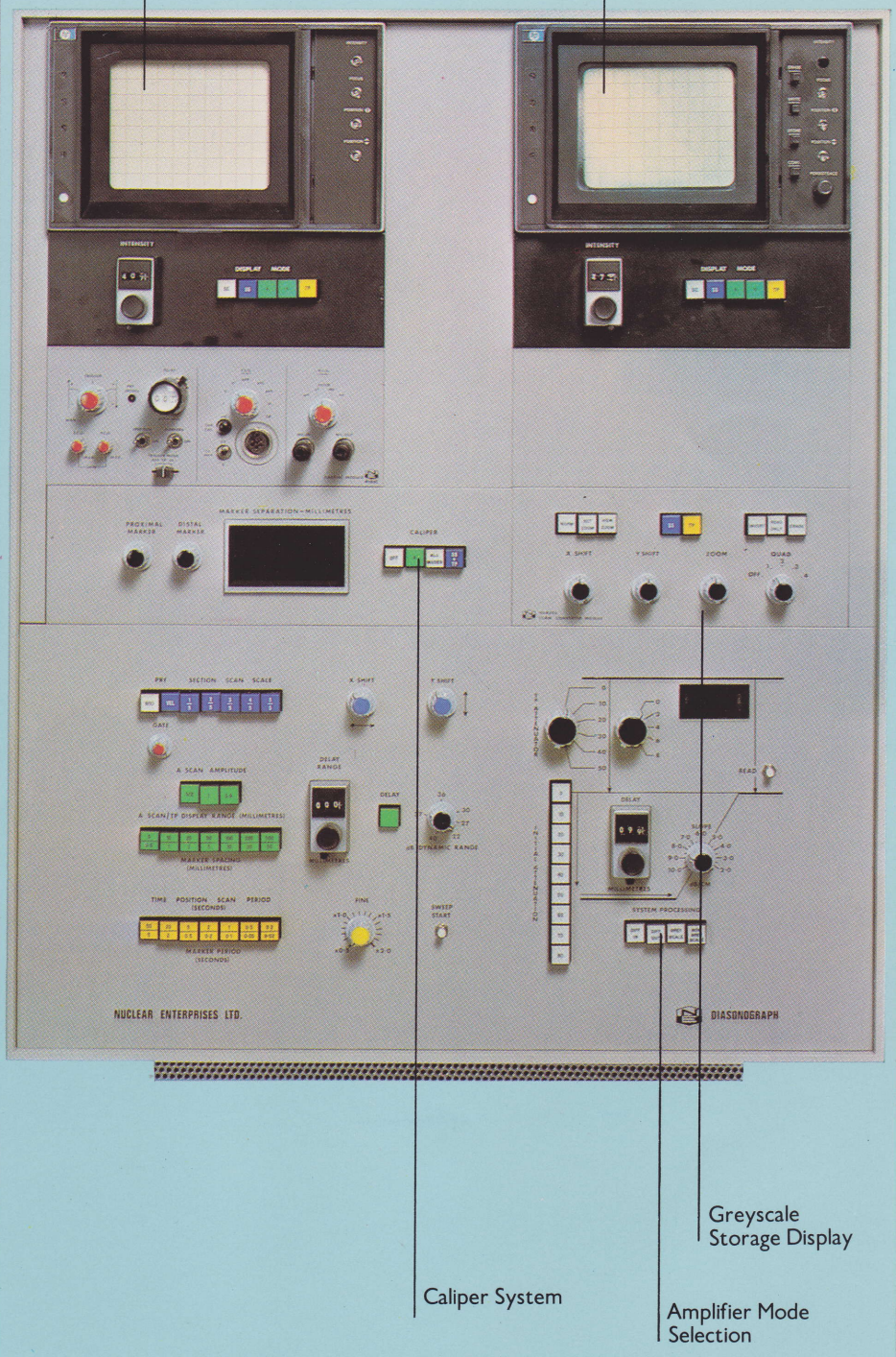
# Control Console.

Two high performance display units are included as standard in the trolley-mounted electronics console. One is a short persistence HP 1333 and the other is a variable persistence/storage HP 1335, with foot-operated erase switch. A caliper device, a calibrated swept gain display, calibrated oscilloscope intensity controls, and amplifier processing mode selection are standard facilities in the electronics system. **The controls on the console are simple.** Colour coding is used to indicate function and illumination to indicate choice.

The comprehensive display facilities with the **wide choice of operating modes enables the 4200 to cover a wide range of applications.** It is possible to display section-scans (B-mode), A-scan, inverted A-scan, time-position scan (M-mode), and "open shutter" greyscale scans, including those from the storage greyscale unit, independently on each display.

**Accurate measurements to ± 0.1mm of structural dimensions in vivo are possible with the caliper system.** This has a large scale illuminated digital readout. The "bright-up" caliper pips can be displayed simultaneously on all modes.

The basic 4200 has a maximum dynamic range of 40dB, which may be reduced to 22dB allowing maximum grey tone range to be obtained of echoes of very similar amplitude arising from relatively homogeneous tissues.



# 4205G Greyscale Storage Display.

The 4205G Greyscale Storage Display allows the clinician to obtain high resolution greyscale scans, which are viewed and stored on the (300mm) TV monitor.

In greyscale scanning the grey level intensity is determined by the amplitude of the echo. A large echo is recorded as peak white, a low-level as very dark grey and intermediate strength echoes at the appropriate grey scale range. High quality scans showing the full range of greytones simplify the visualisation and interpretation of complex structures. Examination times are minimised and confident diagnoses can be made.

A feature of the 4205G is that it is possible to achieve almost complete freedom from overwriting effects which can seriously degrade a compound scan. The user may, without writing out the picture, "compound" a scan in order to collect as much clinically useful information as possible.

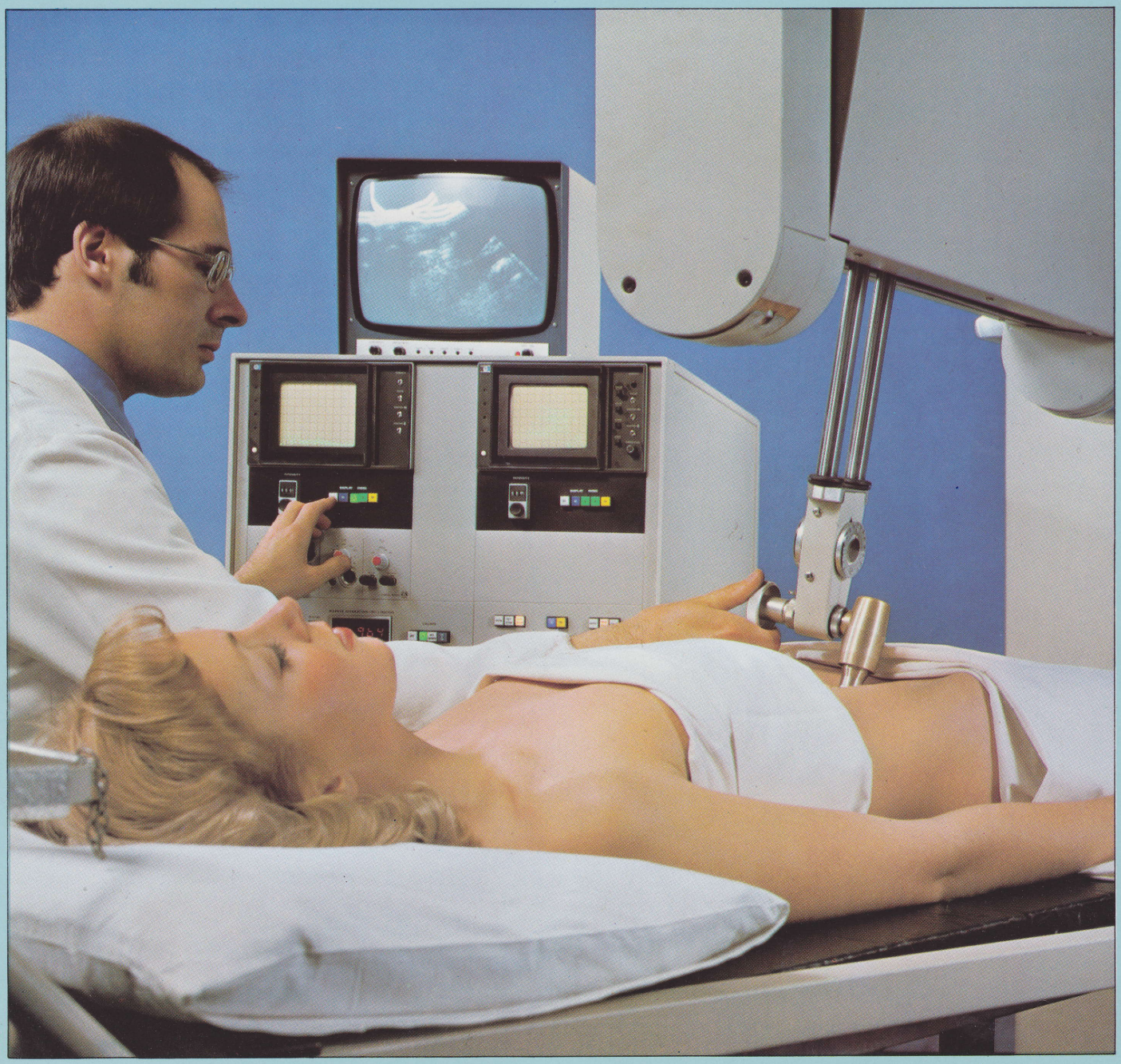
The quad option allows four scans to be viewed simultaneously on the monitor. Each of these scans may be erased independently or viewed at full screen size.

The 4205G time share, read/write facility allows the operator to see the build-up of a picture during the scanning process. Any area of interest may be preselected and, with the use of the zoom control, switched to cover the total area. A magnification 4×life size is possible without significant loss of resolution.

Time-Position and Section Scans may be displayed. By depressing the 'SC' button on the mode selection panel, the stored greyscale picture can be transferred to either console display for photography.

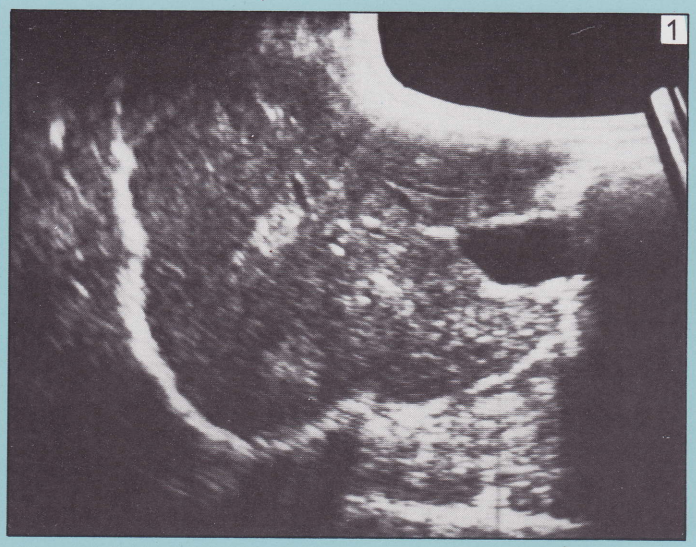
Selection of the "invert" pushbutton changes the displayed picture from positive to negative to facilitate negative film photography.

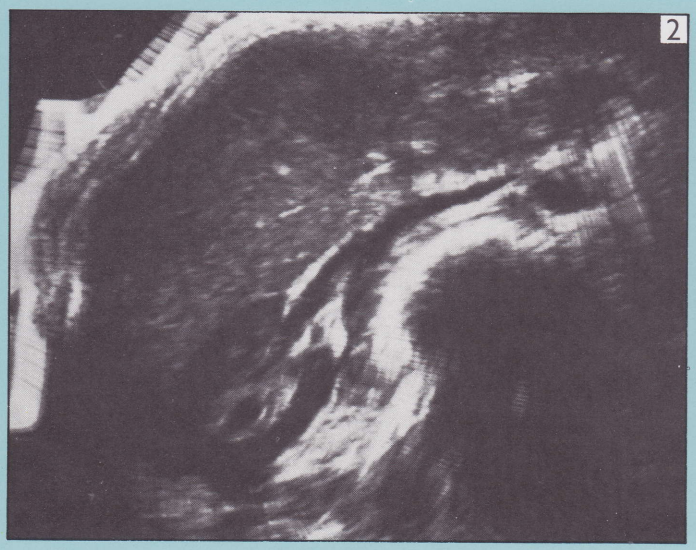
Permanent records may be obtained by conventional Polaroid photography. Alternatively, 70mm or X-ray film recordings can be made. As electronic signals are now available in standard TV form, slave or remote TV monitors may be used for display, and video tape recorders employed to store and replay information. Thus video monitors may be sited in lecture theatres or in consulting rooms.



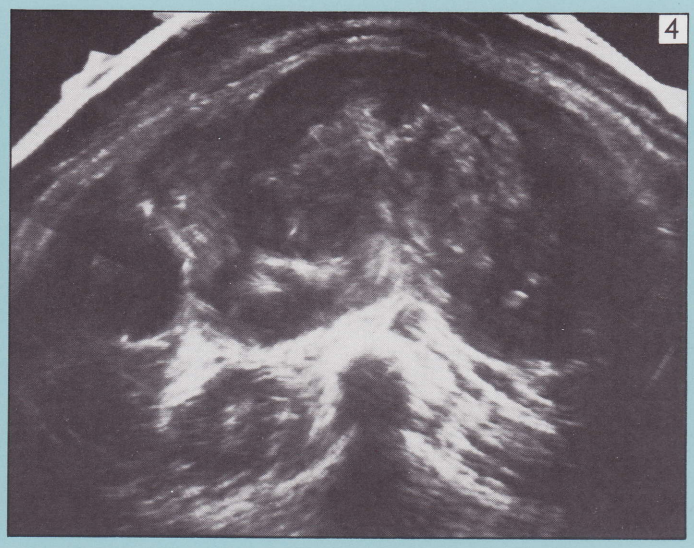
# Clinical results.

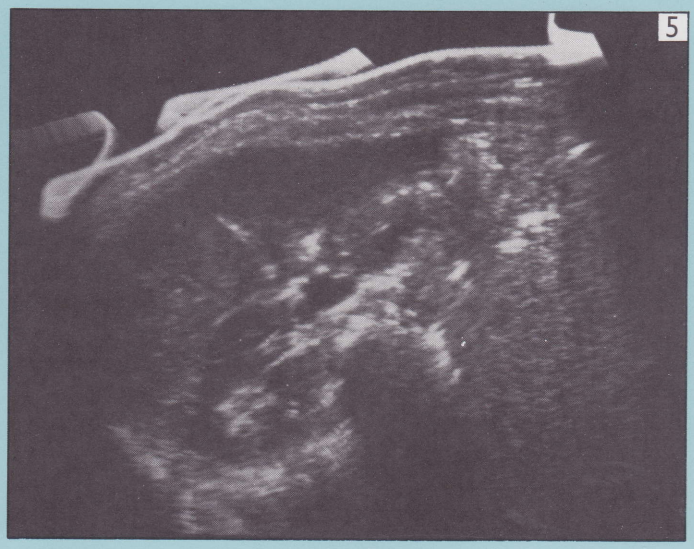
All result photographs on these pages are reproduced by courtesy of the Clinical Research Centre and Northwick Park Hospital, Harrow, Middlesex.

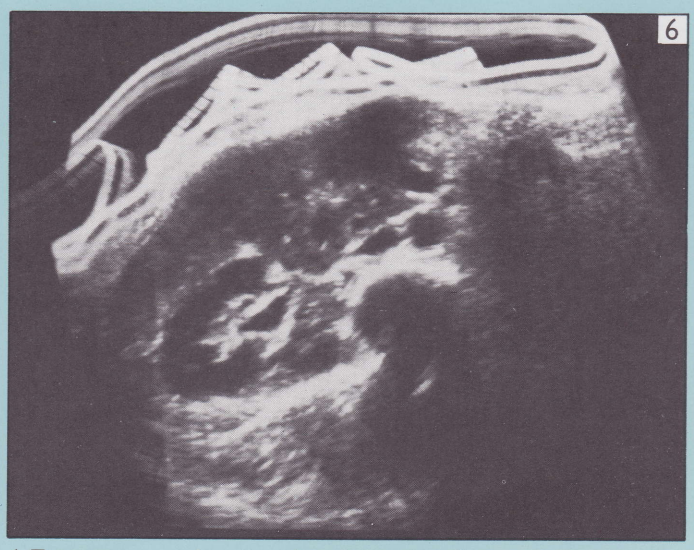






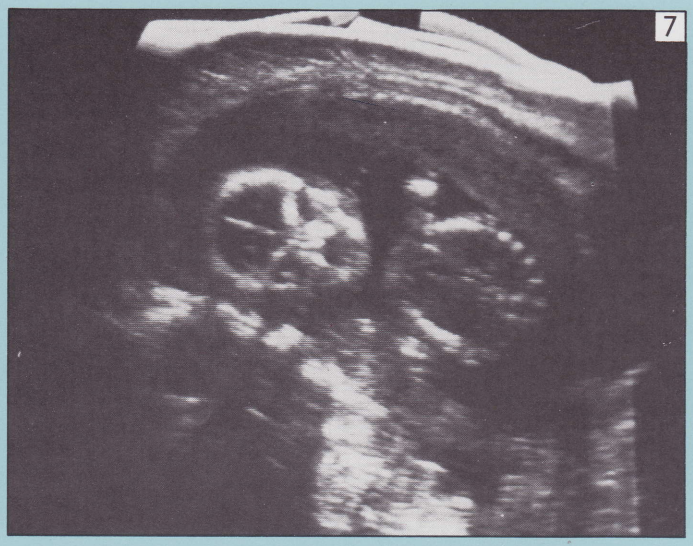



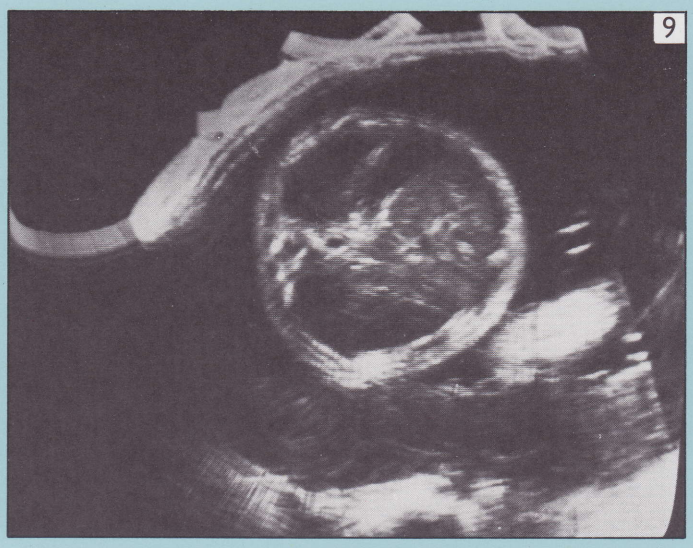



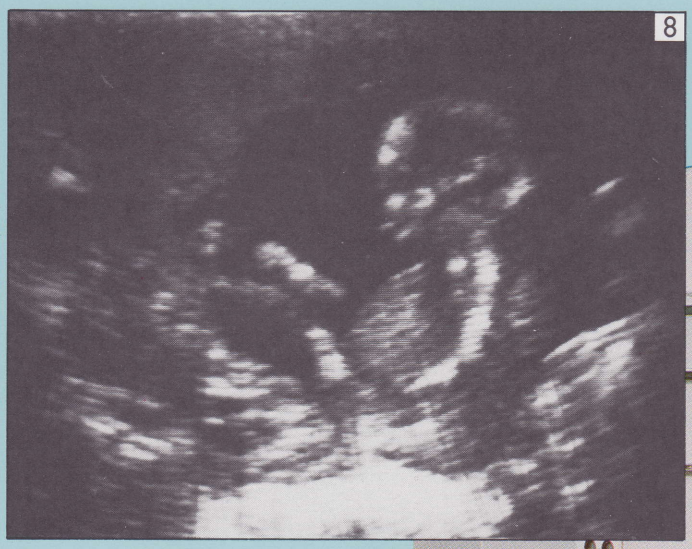

1. Longitudinal scan of right lobe of liver with metastases.
2. Transverse scan showing normal kidney and renal vein.
3. Transverse scan showing pelvis of kidney.

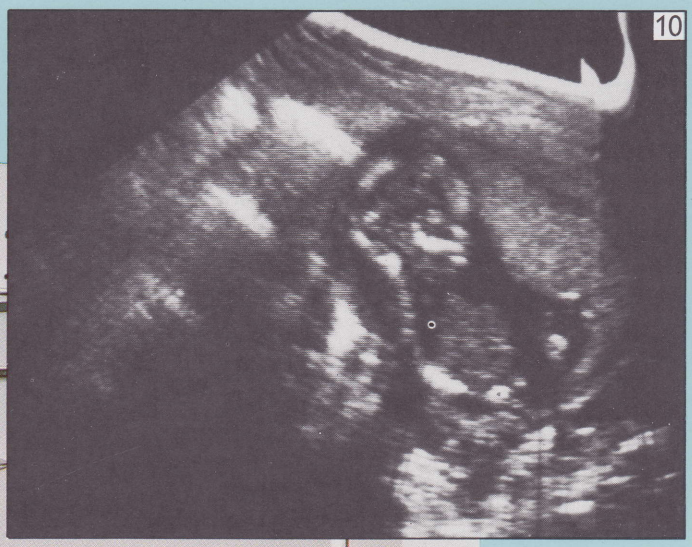
4. Transverse scan showing enlarged pancreas of patient with acute pancreatic necrosis.
5. Transverse scan showing head and body of normal pancreas.
6. Transverse scan showing slightly enlarged head of pancreas with dilated ducts within the head.

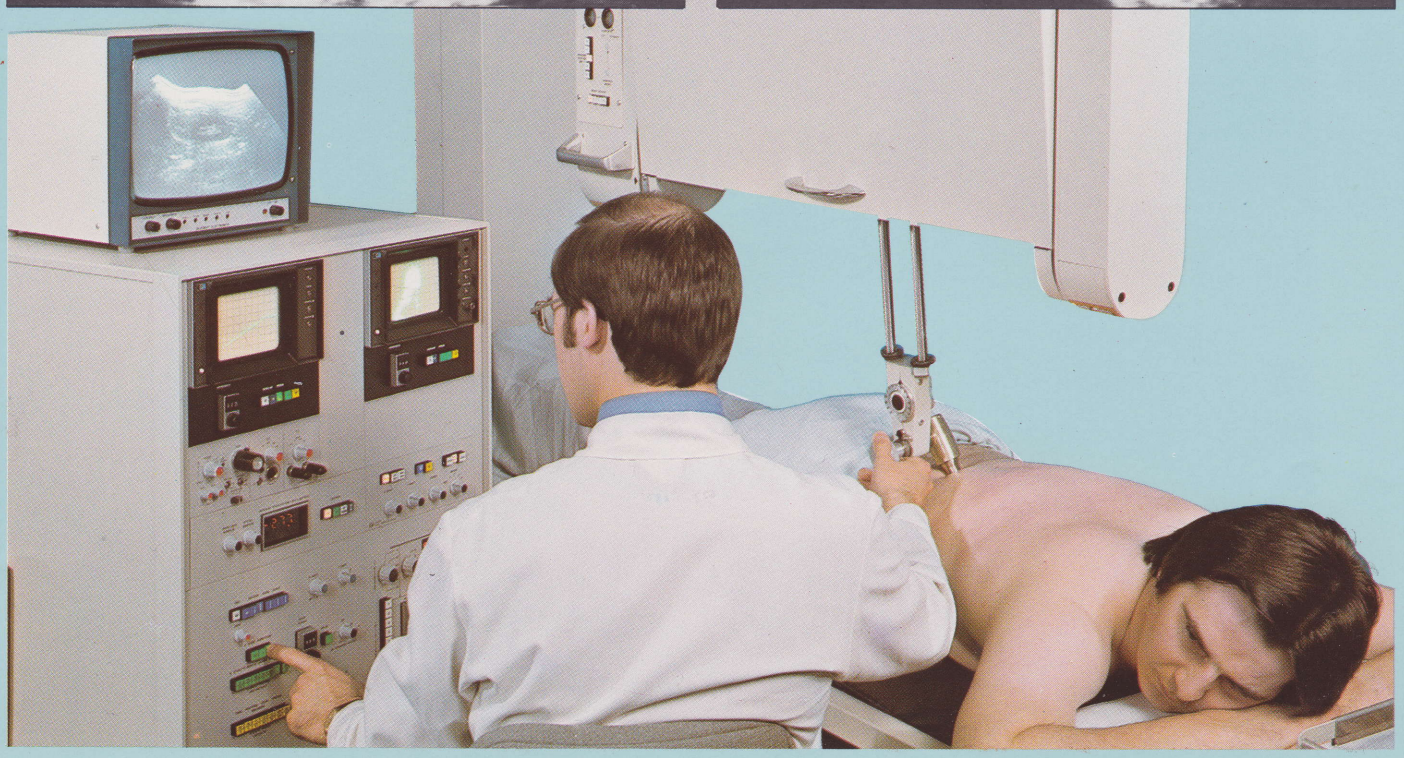
7. Longitudinal scan (anterior view) of fetus showing both orbits.
8. Longitudinal scan of fetus at 14 weeks.
9. Cross section of fetal abdomen at 36 weeks.
10. Longitudinal scan of fetus at 13 weeks showing detail of face.



# Accessories.

1. 4211 Patient Trolley with paper sheet dispenser and facility for raising or lowering the patient's head to allow adjustment of posture for comfort and/or ease of investigation.
2. 4141 Specially designed Water Bath for immersion scanning techniques.
3. 4110 Echo Generator for system calibration checks.
4. 4126 Calibration Jig for system registration checks.
5. 4210 Photographic Facility for use with the 4205G Greyscale Storage Display comprising a 6 inch (152mm) TV monitor, hinged camera adaptor and a Shackman Super Seven Polaroid Camera. This TV monitor can be used as a remote viewing monitor and may be placed away from the main scanning area.
6. 4232 Shackman Super Seven Polaroid Camera as used in the 4210 except that it is supplied with an AS20 adaptor allowing photographs to be taken from the HP 1335 and HP 1333 oscilloscopes.
7. 4235 70mm Linhof Film Holder and M4 International Module for the Shackman Super Seven Camera as an alternative to the Polaroid Back.
8. 4143 Multi-Format X-ray Film Holder for the Shackman Super Seven Camera giving six photographs, each 63×78mm, on one sheet of 203×254mm X-ray film. (Bulletin No. 103.)
9. 4108 Video Cartridge Recorder is basically a PAL Colour half inch (12.7mm) magnetic tape recorder. It is specially modified for recording high resolution scans from the 4205G Greyscale Storage Display. Operation is extremely simple, all major controls being operated by pushbuttons. The standard half inch (12.7mm) cartridge tapes supplied have a playing time of 36 minutes and it is possible to produce a simultaneous audio recording using the dubbing facility. (Bulletin No. 99.)
10. 4103C Cardiac Module extends the use of 4200 systems in the field of cardiology. This module allows simultaneous presentation of the Time-Position Scan (M-mode) ECG and PCG traces. In addition, the display of ECG triggered cross-section scans of moving structures is possible. The pulse repetition rate is raised to 1,200 pulses per second and synchronisation of the Time-Position Scan from the ECG waveform can be achieved. (Bulletin No. 95.)
11. 4105 Fibre Optic Recording Oscilloscope provides a flexible, non-integrating display-record facility. In addition to continuous chart recording (M-mode) conventionally used in cardiological investigation, the 4105 can provide permanent hard copy records of section scans, time-position scans (M-mode) and A scans. All 4200 systems are manufactured with a fibre optic recorder interface socket. Details of other recorders available on request. (Bulletin No. 91.)
12. 4144 Video Character Generator enables the operator to type information onto the greyscale scan displayed on the video monitor. Patient details, date and areas of anatomical interest may be marked and recorded. This facility is of particular importance if negative film recording methods are used. (Bulletin No. 101.)

# Ultrasonic Transducers.

A 2.5MHz flat faced, 13mm diameter, long internal focus probe is supplied as standard with every 4200 system. This is suitable for most routine diagnostic imaging. However, large improvements in resolution and lesion detection can be expected in a limited area of interest by selection of a specialised transducer from the wide range available for both scanning and hand-held applications.

Each transducer is marked with a reference number, frequency, diameter and focal length. Metal-based bayonet fitting transducers ensure good grounding and freedom from external electrical interference.

Full details of the complete range are available on request. The following list details some of the most commonly used transducers.

## Recommended Scanning Transducers

| | | | |
|---|---|---|---|
| 1. | 4238 | Long Internal Focus Bayonet Fitting Probe 2.5MHz, 13mm active element diameter. | Supplied as standard |
| 2. | 4310 | Non-focused Bayonet Fitting Probe. 1.5MHz, 19mm active element diameter. Good angular resolution in far range. | Deep penetration, obese patients posterior placenta |
| 3. | 4311 | Long Internal Focus Bayonet Fitting Probe. 1.5MHz, 19mm active element diameter. Angular resolution improved in mid range. | |
| 4. | 4325 | Non-focused Bayonet Fitting Probe. 2.5MHz, 13mm active element diameter. Optimum angular resolution in far range | General purpose liver and kidney, and obstetric applications. |
| 5. | 4323 | Long Internal Focus Bayonet Fitting Probe. 2.5MHz, 19mm active element diameter. | |
| 6. | 4383 | Medium Internal Focus Bayonet Fitting Probe. 3.5MHz, 13mm active element diameter. Lower penetration, high angular and range resolution in mid range. | Pancreas, thyroid, breast and scanning of older children. |
| 7. | 4388 | Long Internal Focus Bayonet Fitting Probe. 3.5MHz 19mm active element diameter. High angular and range resolution at mid range. | |
| 8. | 4351 | Non-focused Bayonet Fitting Probe. 5.0MHz, 13mm active element diameter. High range resolution penetration limited. | Paediatric, ophthalmology and thyroid. |
| 9. | 4354 | Long Internal Focus Bayonet Fitting Probe. 5.0MHz, 13mm active element diameter. Improved angular resolution in mid range. | |
| 10. | 4167 | 2.5MHz Biopsy Probe with a central aperture allowing use of needles up to 1.96mm in in diameter. | Designed primarily for amniocentesis but also useful for cyst aspiration. |
| 11. | 4364 | Long Internal Focus Probe. 1.5MHz, 19mm active element diameter. | Echoencephalography |
| 12. | 4367 | Medium Internal Focus Probe. 2.5MHz, 13mm active element diameter. | General purpose cardiac |
| 13. | 4394 | Medium Internal Focus Probe. 3.5MHz, 13mm active element diameter. | Adult and paediatric cardiac |
| 14. | 4343 | Non-focused Probe. 5.0MHz, 13mm active element diameter. | Neonate and paediatric cardiac |
| 15. | 4340 | Non-focused Probe. 5.0MHz, 6mm active element diameter. | Ophthalmic |
| 16. | | Aspiration/Biopsy Transducer. Non-focused, 2.5MHz, 13mm active element diameter with 2.4mm central aperture (aperture accommodates 14 gauge aspiration or biopsy needle). | |

# EMISONIC 4200 Specification.

Operating controls are distributed in ergonomic groupings to assist operators without specialised knowledge of physics or electronics. Controls are calibrated in tissue where appropriate (see Control Panel right).

**Sensitivity Control by Transmitter Attenuator:**
0 to −50dB in 10dB steps, +0 to −8dB in 2dB steps

**Swept Gain** (Depth Compensation): Initial reduction:
0 to 80dB in 10dB steps
Initial Delay: 0 to 250mm continuously variable.
Slope: 1.5 to 10.5dB/cm continuously variable.

**Picture Scales:** Section Scan only:
1/5, 2/5, 3/5, 4/5, 5/5 of full-scale.
Scanned Area:
Horizontal: 500mm nominal
Vertical: 250mm nominal
Probe Rotation: ±135° from vertical in the plane of scan.

**A-Scan Display:**
Half screen or whole screen or Swept Gain. Inverted V on half or whole screen.

**A-Scan Range:** 5,10, 20, 50, 100, 200, 500mm switched steps.

**A-Scan Delay:** 0 to 500mm continuously variable. A delay set/use switch allows the operator to preselect the region to be examined.

**Time-Position Display:** Intensity modulation of horizontal sweep.

**Vertical Sweep (Time-Position only):**
Single vertical sweeps triggered by push button. Scan period continuously variable between ×0.5 and ×2 of the following ranges:–
50, 20, 5, 2, 1, 0.5, 0.2 in seconds.
Horizontal Range (Time-Position Display): 5, 10, 20, 50, 100, 200, 500mm switched steps (same control as A-Scan range).

**Operating Frequencies:** 1.5, 2.5, 3.5, 5.0, 10MHz

**Energy:** Maximum available ultrasonic intensity is a function of the probe in use. Using the standard range of probes, the following figures are typical.
Normal Mean
Acoustic Power: 1.5MHz 0.70 microwatt
2.5MHz 6.92 microwatt
5MHz 84.0 microwatt
Maximum Available Mean Acoustic
Power: 1.5MHz 7.0 milliwatt
2.5MHz 6.92 milliwatt
5MHz 2.7 milliwatt

**NOTE:** Maximum operating sensitivity of the equipment is controlled by adjustment of the output power.

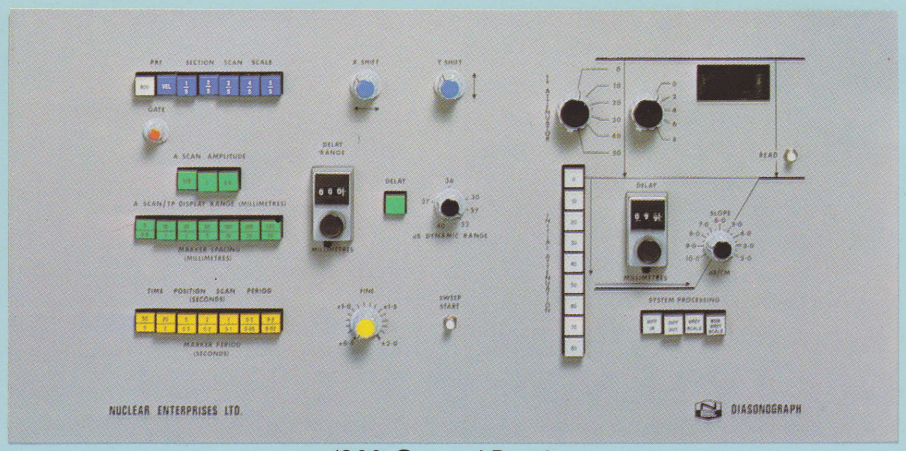
**Transmitter Pulse Repetition Rate:**
(a) Fixed 600 pulses/second.
(b) Velocity controlled (section scan only) 0 to 1800 pulses/second.
(c) With cardiac facility (time position scan) 1200 pulses/second.
(d) Triggered section scan with cardiac facility 10 to 100 pulses/cardiac cycle.

**Horizontal Delay** (Time-Position Display):
0 to 500mm continuously variable (same control as A-Scan range).

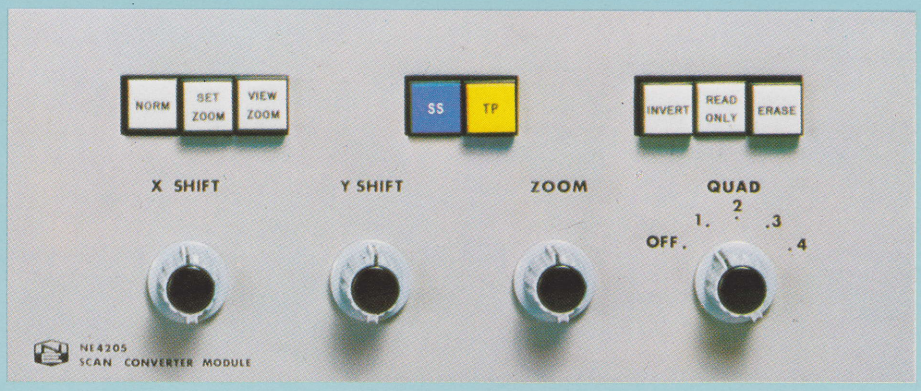
**Dynamic Range of Echoes:** 40 to 22dB continuously variable.

**Ultrasonic Caliper:** Marker separation 0 to 199.9mm in 0.1mm steps over entire A-Scan range.

**Power Requirements:** 100 to 120/200 to 240V ac. 50/60Hz 800VA.




4200 Control Panel




4205G Control Panel


# 4205G Greyscale Storage Display Specification.

**Description:** High resolution unit for storage and display of video and graphic information.

**Storage Medium:** Princeton Electronic Products Scan Conversion and Image Storage Unit. (Special Version).

**Resolution:** 1350* to 2100**
* TV lines per diameter at 50% depth of modulation.
** TV lines per diameter limiting resolution.

**Output:** Television IV video signal with composite synch.
625 lines, 50 fields or 525 lines, 60 fields.

**Display Unit:** 300mm monochrome monitor.

**Front Panel Controls:**
(Continuously variable)
"Zoom"–magnifies the image being viewed.
"X"–controls horizontal position of the area being magnified by zoom.
"Y"– controls vertical position of the area being magnified by zoom.

**Pushbutton switch selection:**
"Norm"–normal full-size viewing of the image.
"Set-Zoom"–normal full-size image with "region of interest" superimposed. This is a rectangular box defining the area to be covered by the zoom. Its position and size are controlled by the X, Y and "Zoom" controls.
"View Zoom"–enlarges area within "region of interest" to fill the screen.
"Invert"–changes the displayed picture from positive to negative. Used for making positive pictures on negative film.
"Read only"–stops the writing of images on the storage unit when the probe is moved.
"Erase"–clears the screen for the next scan.
"SS"–selects section scan picture storage.
"TP"–selects time-position scan picture storage.
"Quad Option"–allows 4 scans to be viewed simultaneously and erased independently.

**Rear Panel Outputs/Inputs:** "Video Out 1 and 2" –Two independent IV composite synch video signals for TV monitor or video tape recorders.

**Dynamic Range of system with 4205G** 36dB

**Greyscales Displayed:** 10

# Space saving

The ergonomic design of the EMISONIC 4200 system ensures maximum use of the available floor space and affords considerable freedom of choice in the layout of the examination room.

**Control Console Cabinet:**

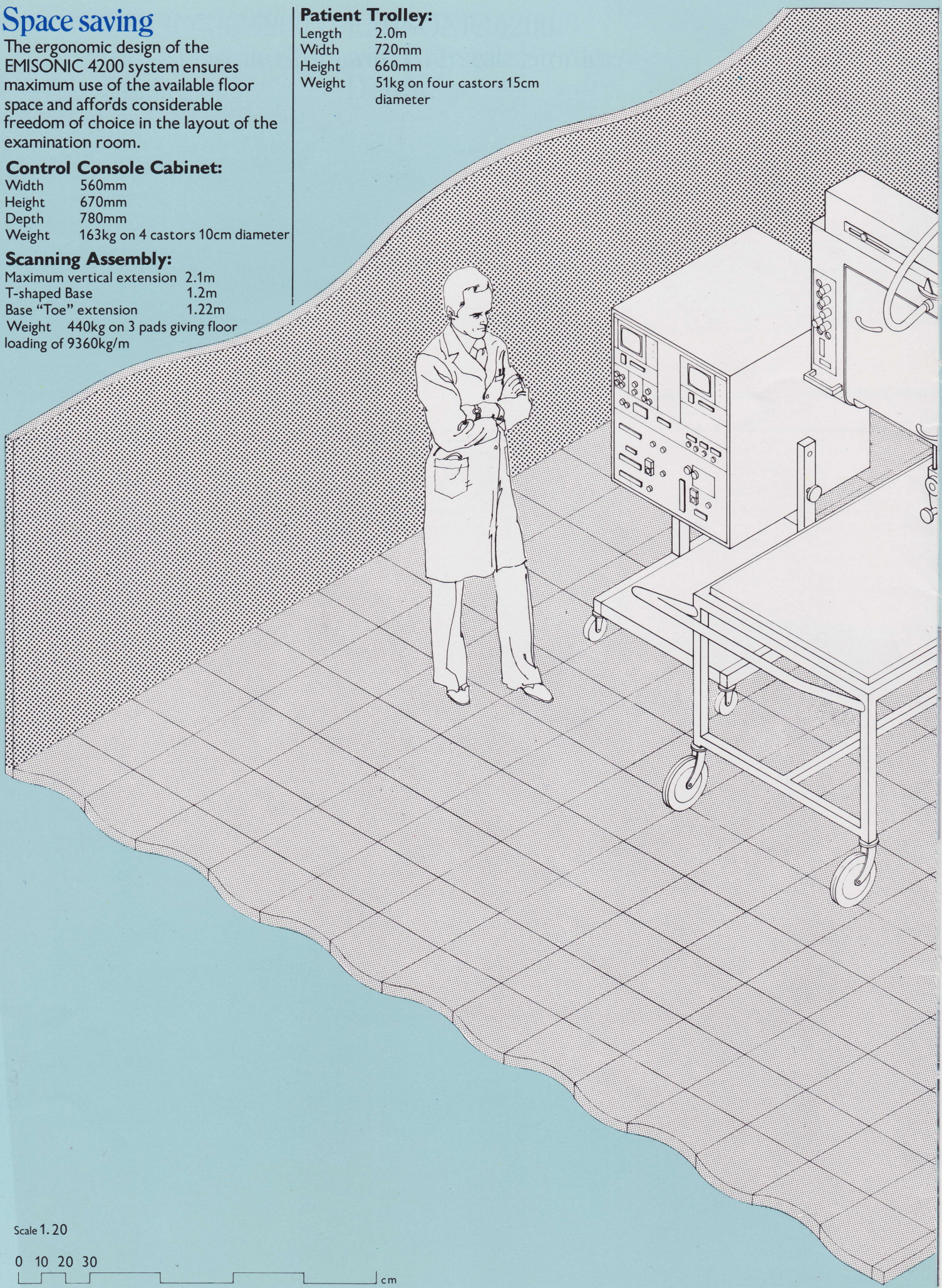
| | |
|---|---|
| Width | 560mm |
| Height | 670mm |
| Depth | 780mm |
| Weight | 163kg on 4 castors 10cm diameter |

**Scanning Assembly:**

| | |
|---|---|
| Maximum vertical extension | 2.1m |
| T-shaped Base | 1.2m |
| Base "Toe" extension | 1.22m |
| Weight | 440kg on 3 pads giving floor loading of 9360kg/m |

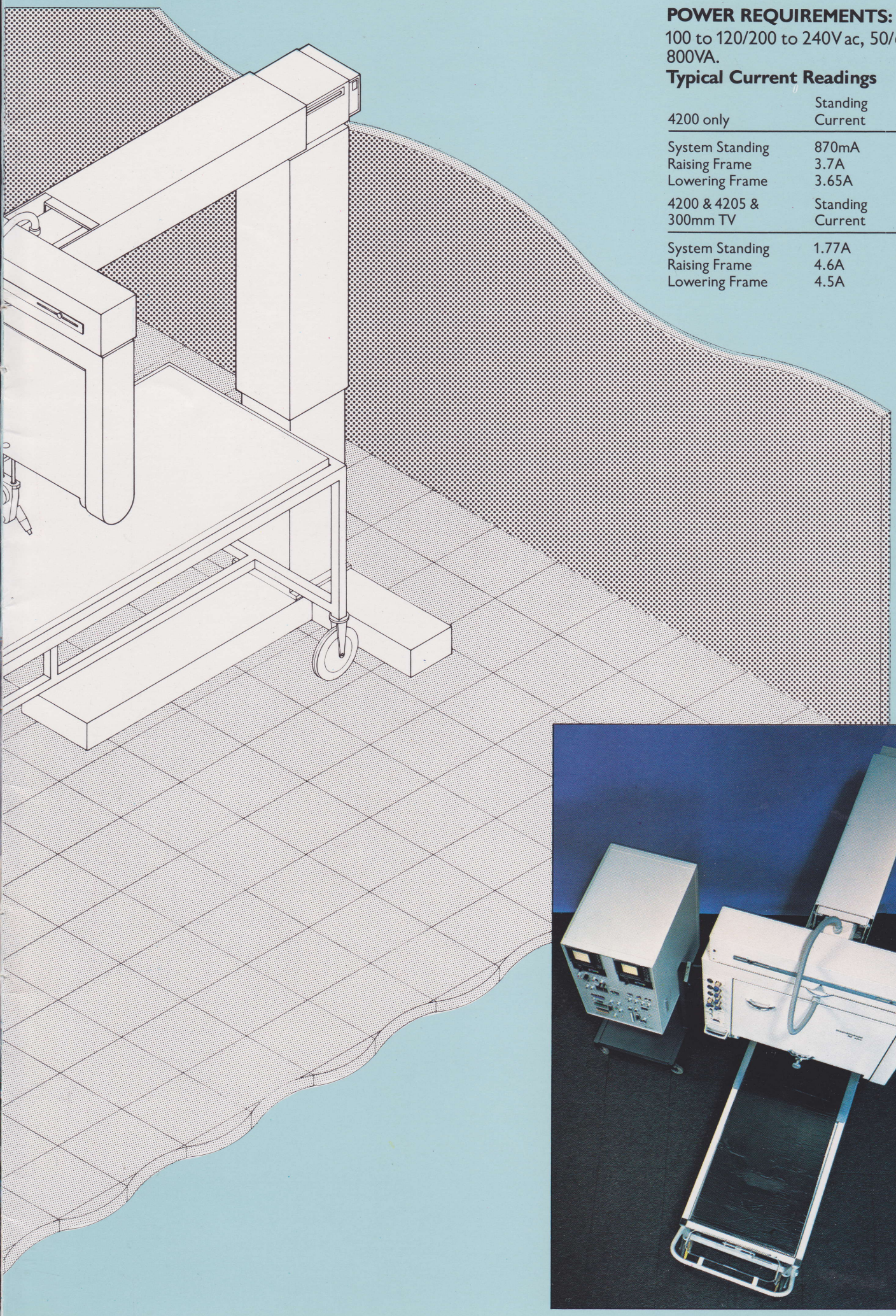
**Patient Trolley:**

| | |
|---|---|
| Length | 2.0m |
| Width | 720mm |
| Height | 660mm |
| Weight | 51kg on four castors 15cm diameter |



Scale 1.20

0 10 20 30 cm



## POWER REQUIREMENTS:

100 to 120/200 to 240V ac, 50/60Hz, 800VA.

### Typical Current Readings

| 4200 only | Standing Current | Initial Surge |
|---|---|---|
| System Standing | 870mA | |
| Raising Frame | 3.7A | 4.2A |
| Lowering Frame | 3.65A | 4.2A |
| **4200 & 4205 & 300mm TV** | **Standing Current** | **Initial Surge** |
| System Standing | 1.77A | |
| Raising Frame | 4.6A | 6A |
| Lowering Frame | 4.5A | 5A |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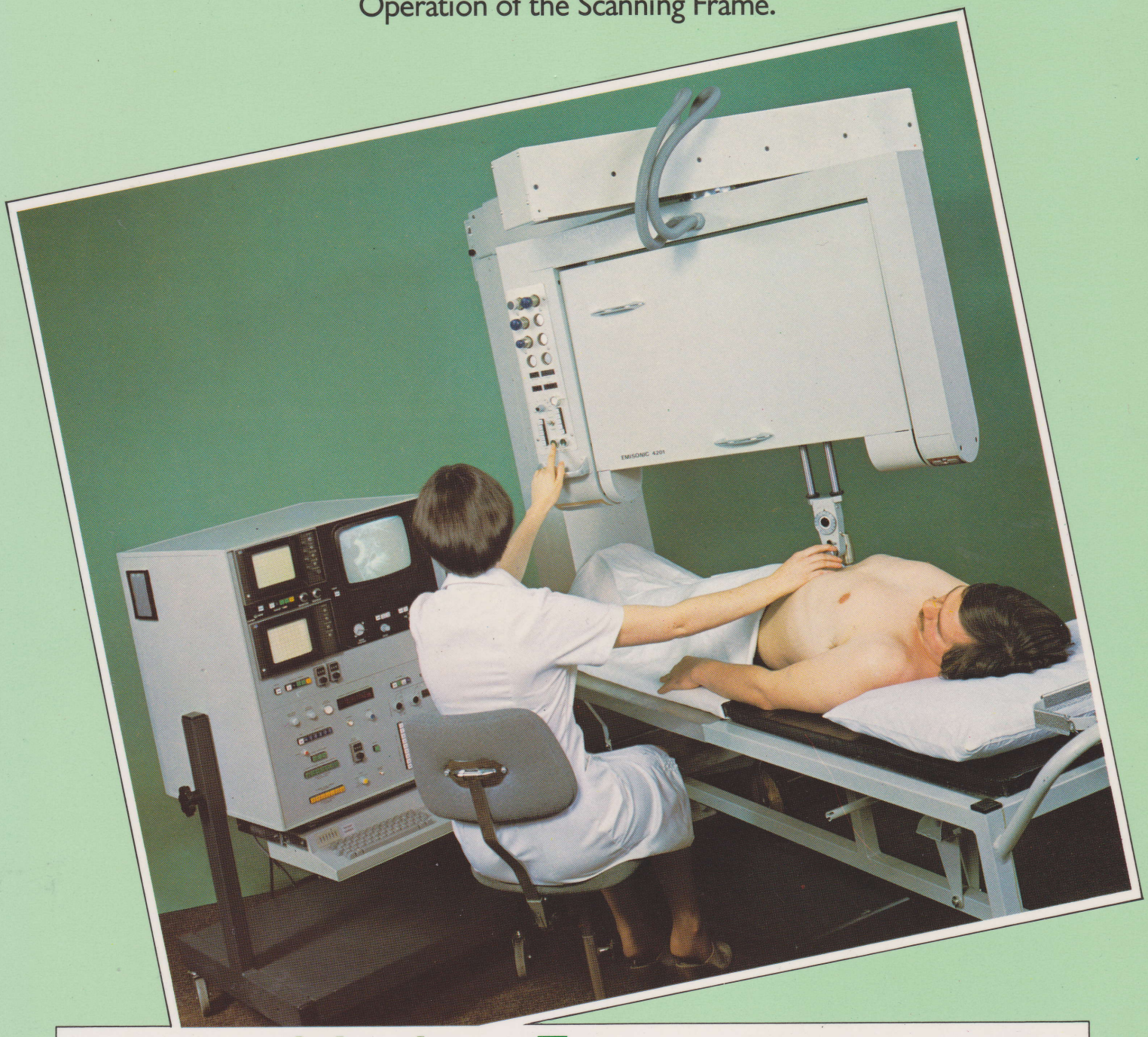
*G*

*EMI Medical Ltd. Bulletin No. 116 - EMISONIC 4201. January 1978.*

# EMISONIC 4201

A Compact Ultrasound Scanner with Automatic Entry of Scanning Parameters and Motorised Operation of the Scanning Frame.




Nuclear Enterprises

# EMISONIC 4201

The EMISONIC 4201 extends the EMISONIC Range of Ultrasound Scanners. In addition to providing the high clinical performance and reliability of the EMISONIC 4200, the 4201 provides a number of supplementary feature benefits.

**Compact 3-Display Control Console**

This incorporates an 'A' MODE DISPLAY for TGC curve and depth recognition, a video greyscale PHOTOGRAPHIC DISPLAY and a large screen VIEWING DISPLAY. The viewing display and the photographic display have the capability of independent video invert, which allows the operator to view the scans in one format and simultaneously take photographs of the clinical scans in another.

**Automatic Patient Data Entry with Unique Data Security Interlocks**

Patient details and scanning parameters are entered automatically into viewing and display monitors. Special interlock circuitry ensures complete protection of patient data.

**Motorised or Manual Operation of the Scanning Frame**

Operator fatigue is minimised by the use of the motorised drive of the scanning frame between scans.

**Incremental Power Assisted Drive with 2mm to 40mm Range**

Precisely separated parallel scans in increments of 2mm, 5mm, 10mm, 20mm, 30mm or 40mm can be activated by finger tip controls in either the longitudinal or transverse direction. In addition, accurate digital readout of the scanning frame position is displayed on the scanning frame control panel for convenient viewing.

**Unique Resolution Enhancement Facility**

This allows clinical details and information on the high resolution greyscale storage display to be maximised.

**Pushbutton Auto-Centering of Image**

Plus an independent 'Y' position control.

**Simultaneous Viewing 'A' Scan and TGC Waveforms**

**Electronic Joy Stick Control of Region of Interest Box**

Subsequent depression of the 'view zoom' magnifies this region to full screen size.

**Pushbutton Tuned Amplifier Frequency Selection**

1.5, 2.5, 3.5, 5.0 and 10MHz operation.

**Keyboard Control of Alpha-Numeric Data**

Information in addition to that automatically displayed on the scan may be added using the manual keyboard. If required, the digital reading of the caliper separation may also be incorporated into the data displayed by simple pushbutton operation.

**High Resolution Transducers**

Two specially selected transducers are provided as standard. One 2.5MHz 19mm diameter long internal focus 4323 and one 3.5MHz 19mm diameter long internal focus 4388. A standard range of transducers and optional accessories is available with all EMISONIC systems.

**Adjunctive Real-Time Option Available**

Request details of the EMISONIC Spinner System (Bulletin No 118)

**EMISONIC Range**

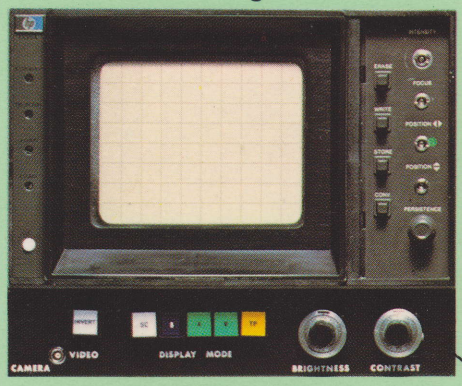
Following the merger of Nuclear Enterprises with EMI in October 1976, Nuclear Enterprises is now a full member of the EMI Group of Companies, world leaders in medical imaging systems.

Nuclear Enterprises pioneered the design and manufacture of advanced Diasonograph Ultrasound Scanners, which have been internationally acknowledged as setting standards in this field.

The combined research, development and manufacturing resources now provide a new, and expanded range of advanced Ultrasound Systems. This new range is being marketed under the 'EMISONIC' trade name through Nuclear Enterprises, EMI Medical and their associated subsidiaries and representatives.

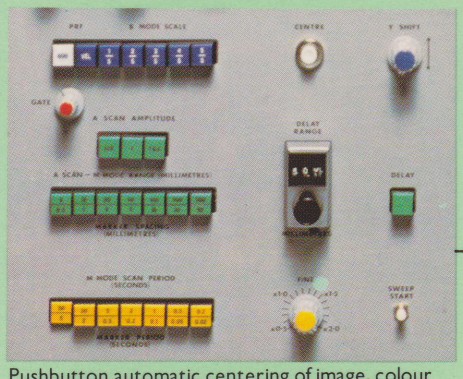
The EMISONIC Ultrasound range of equipment is supported world-wide, in all overseas markets, by specialised teams in marketing, installation and after-sales service.

The EMISONIC 4201 has been designed with the needs of the clinician in mind. Minimum patient discomfort and trauma, high patient throughput, trouble free system operation and high resolution clinical data provided by the 4201 make a major contribution to a sophisticated ultrasound scanning service.

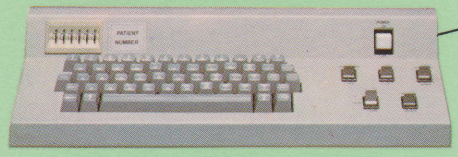



High definition photographic display.

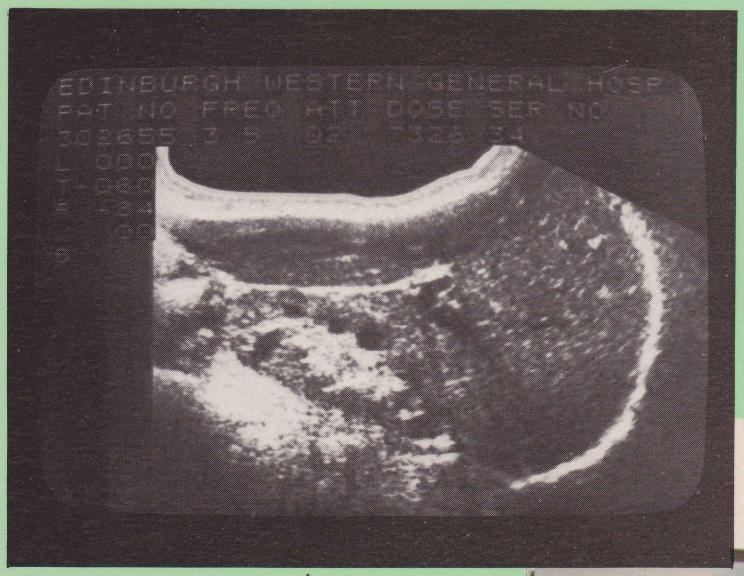
0.1% accurate digital caliper. Pushbutton readout onto display.



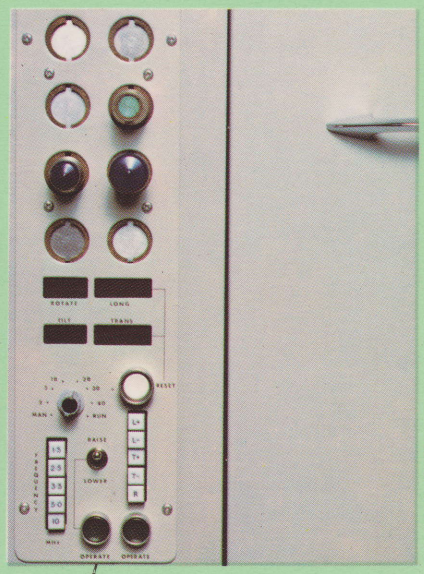
Pushbutton automatic centering of image, colour coded controls of 'B' Scan, 'A' Scan and 'M' mode operations.



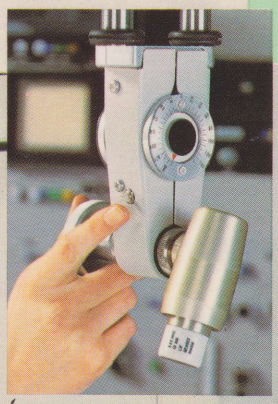
Keyboard entry of patient data to displays.




Automatically recorded scan data on clinical record.



Probe storage– digital read-out of scanning frame position and angulation–stepping motor control– tuned amplifier frequency selector.



Finger tip two-directional control of stepping motor.

# EMISONIC 4201 Condensed Specification

The EMISONIC 4200 specification (see Bulletin 112) is also applicable to the EMISONIC 4201. In addition, EMISONIC 4201 includes the following features:

**Motorised Movement of Scanning Frame Assembly (3 Modes)**

| | |
|---|---|
| Manual: | Functions as EMISONIC 4200 |
| Step: | Selectable in 2mm, 5mm, 10mm, 20mm, 30mm or 40mm discrete steps. Actuation is by pushbutton on scanning frame control panel or by probe assembly pushbuttons. Direction of travel preselected for L+, L−, T+, T−. (L = Longitudinal, T = Transverse.) |
| Run: | Continuous motorised movement along L ± or T ± axes dependent on axis selected. Actuation as for Step. |

**Alpha Numeric Data Displayed on Scanning Frame**

The position of the scanning plane with reference to a predetermined anatomical landmark is shown continuously on a digital display (±1mm accuracy). The angles of tilt and rotation of the scanning plane are also displayed.

**Keyboard Data Entry:** 2 pages of display available

Page 1: Automatic Fixed Data Entry

The following protected and interlocked alpha numeric data can be displayed on all monitors.

| | |
|---|---|
| Title | Preprogrammed to customer's requirements, e.g. hospital name |
| Patient Number | PAT NO +6 digits |
| Frequency | FREQ +2 digits with decimal point as selected on scanning frame. |
| Attenuation | ATT +2 digits as selected on electronic console transmitter setting. |
| Dose | DOSE +4 digits ×100. This count is the number of transmitter pulses received by the patient. »» Indicates a dose of greater than $10^6$ pulses. The internal dose counter is reset when the PAT NO is changed. |
| Scan Serial Number | SER NO +2 digits. Option 1: Updates by one for each combination of photograph and storage greyscale erase. Option 2: Updates by one for every storage greyscale erase. Options 1 and 2 are switch selectable; on both SER NO is automatically reset to 0 when PAT NO is changed. |
| Longitudinal Movement | 'L' 3 digits with sign, either + or −. Units mm. |
| Transverse Movement | 'T' 3 digits with sign, either + or −. Units mm. |
| Rotational Movement | 'R' 2 digits with sign, either + or −. Units degrees. |
| Tilt Movement | / 2 digits with sign, either + or −. Units degrees. |
| Marker Separation | 'B' 4 digits with decimal point. Entered onto display by depressing "ENTER READING" pushbutton on console front panel. May be updated at any time. |
| Interlock | If any of the above parameters, with the exception of marker separation, are changed during a scan further writing of the picture will be prevented, thus ensuring integrity of alpha numeric data. |

Manual Alpha Numeric Data Entry

Data may be entered in the free area of the display by use of the video character generator keyboard.

Page 2. Unrestricted Data Entry

No interlock arrangements. Data may be entered as required by use of the video character generator keyboard.


**Nuclear Enterprises Limited**
* Sighthill, Edinburgh EH11 4EY Scotland
Telephone 031-443 4060
Cables: Nuclear, Edinburgh Telex 72333
*Registered office. Registration No 31256 Scotland.

**North America**
EMI Medical Inc.
3605 Woodhead Drive,
Northbrook, Illinois 60062
Telephone (312) 291 4444
Telex 289450



Bulletin No. 116
January 1978


A member of the EMI group
International Leaders in music, electronics and leisure.


Design Forth Studios Edinburgh. Photography Inglis Stevens Edinburgh. Printed in England by the Oxley Printing Group Ltd

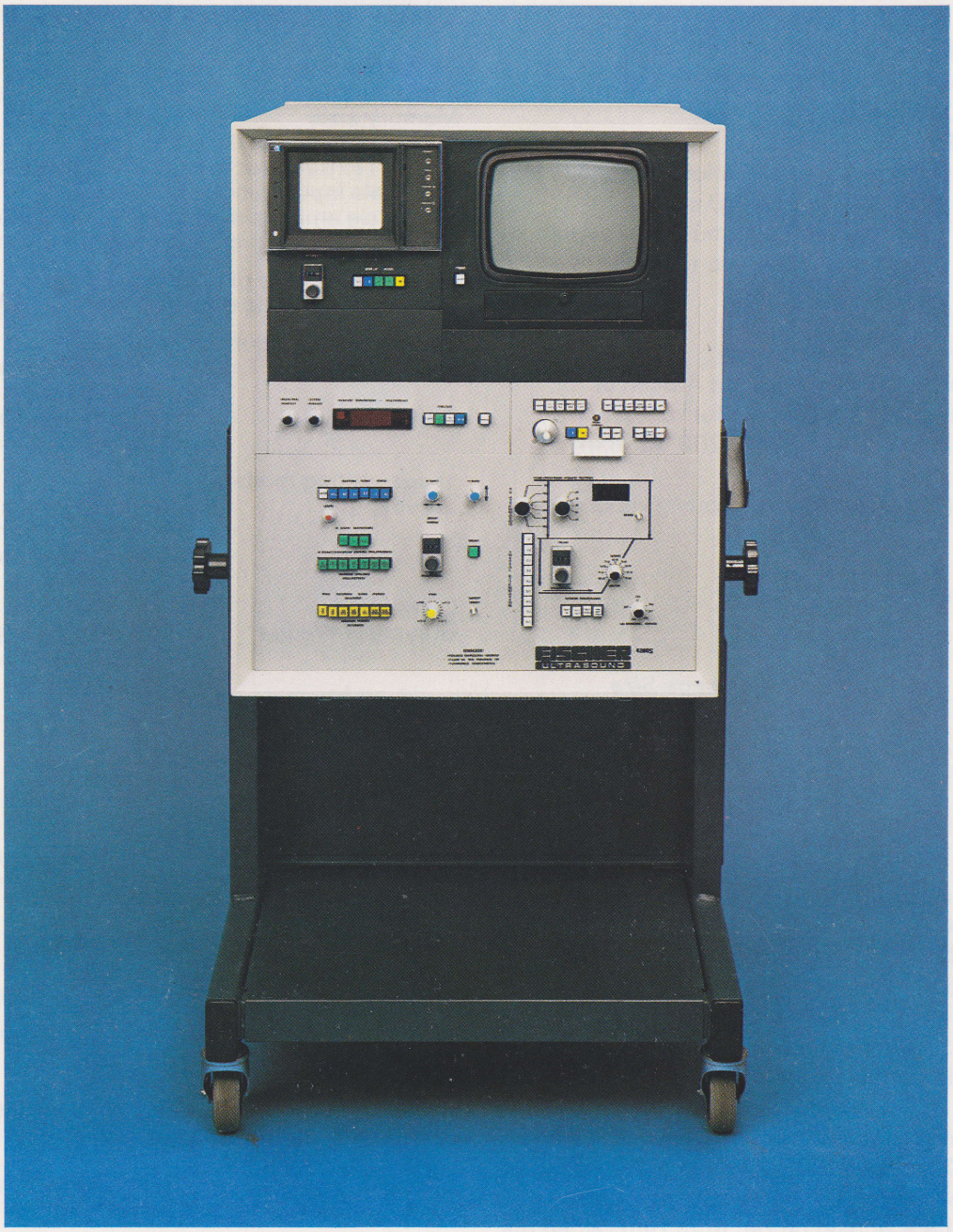
*H*

*Fischer Ultrasound Ltd. 4200S Console. High Resolution Imaging Combined with Maximum Operating Convenience*

# FISCHER ULTRASOUND

## 4200S CONSOLE

### HIGH RESOLUTION IMAGING COMBINED WITH MAXIMUM OPERATING CONVENIENCE



One of the comprehensive range of modular diagnostic ultrasound units designed by Fischer Ultrasound to meet individual clinical requirements as simply and cost effectively as is possible.

Connected with the appropriate probes or scanning arms, A mode, M mode and B mode (real time with the addition of the 4260 module) high resolution images can be displayed in greyscale and manipulated using the Digital Memory.

The 4200S console which has been designed for standing or seated operation is mounted on a wheeled trolley and in addition to incorporating a Digital Memory Matrix of over 1 million bits, features high quality displays and an ultrasonic caliper facility. Careful ergonomic grouping and colour coding of push button controls ensure simplicity of operation.

**FISCHER ULTRASOUND LTD.**

Bankhead Crossway South, Edinburgh EH11 4EY, Scotland Telephone 031-443 4166 Telex 727045 Fischr G

## TECHNICAL DATA

**Displays**
Hewlett Packard 1333A short persistence display unit.
(White phosphor 1332A optional)
9-inch monochrome TV monitor.

**Dynamic Range of Echoes**
40 to 22dB continuously variable. Dynamic range of system not less than 36 dB

**Operating Frequencies**
2.5, 3.5, 5, 7.5, 10MHz and Wide Band.

**Operating Controls**
Sensitivity controlled by transmitter attenuator.
0 to −50 dB in 10 dB steps
0 to −8 dB in 2 dB steps
Swept gain (TGC time gain compensation) controlled by

| | |
|---|---|
| Initial attenuation | 0 to 80 dB in 10 dB steps |
| Initial delay | 0 to 250mm continuously variable |
| Slope | 1.5 to 10 dB/cm continuously variable |

**A Mode**
Displayed on short persistence display.
Displays available are A Scan, Inverted A Scan or superimposed A Scan and TGC waveform.

| | |
|---|---|
| A Scan ranges: | 5, 10, 20, 50, 100, 200 500mm switched ranges |
| A Scan delay: | 0 to 500mm continuously variable |

**B Mode**
Displayed on both displays.

**Scanned Area**

| *Range Selected* | *Image Size* | |
|---|---|---|
| 10cm | 10cm (X axis) | 8cm (Y axis) |
| 20cm | 20cm ,, | 16cm ,, |
| 30cm | 30cm ,, | 24cm ,, |
| 40cm | 40cm ,, | 32cm ,, |

**M Mode**
Scrolling on both displays.
3 ranges 100, 200 and 500mm selected on console.
7 speeds 0.5, 0.8, 1.0, 1.5, 1.8, 3 and 5 seconds, selected on console.
Marker dots written every 0.5 sec along X axis and every 1cm along Y axis. (Each dot has a black and white area to enable identification of markers for all picture grey levels.)

**Transmitter Pulse Repetition Rate**
a) Fixed PRF is 800 pulses per second
b) Variable rate 'Velocity'. Proportional to the rate of movement of the scanning probe, from zero (when the probe is stationary) to a maximum of 800 pulses/second.

**Ultrasonic Caliper**
Caliper separation: 0 to 199.0mm may be displayed independently along vector on short persistence display on A Mode, B Mode or M Mode displays.

| | |
|---|---|
| System velocity<br>Caliper velocity<br>Caliper separation | May be displayed digitally on a panel meter, selected by a rotational control in cabinet access door on the right hand side of the console. |

Omnidirectional caliper with digital readout may be displayed on B Mode displays utilising the Digital Memory. Two moveable reference crosses positioned by joystick control. Marker crosses separated by 1cm marker dots. Digital readout accuracy ±1mm on all ranges.

**Digital Memory**

| | |
|---|---|
| Image matrix size: | 512 × 512 pixels |
| Memory size: | 1,048,576 bits |
| Number of grey levels: | 16 |

Tissue Texture Processing—four operator-selectable greyscale input transfer curves.
Greyscale emphasis—four operator-selectable post storage (display) grey level enhancement programmes.

Live Vector: Line of dots separated by 1cm (displayed along direction of ultrasound vector)

Image magnification:

| | |
|---|---|
| Read Zoom | 2 × area to be magnified is selected by a moveable box cursor. |
| Write Magnify | 2 × and 4 × area to be rescanned is selected by a moveable box cursor. |

Image writing modes:

| | |
|---|---|
| Survey | Overwrite in which the most recent pixel data is written into the memory while simultaneously erasing old data. |
| Compound | Peak writing mode. |
| Greyscale Wedge | 16-level reference greyscale on left hand side of image. |

**Dimensions**
Width: 68cm
Height: 129cm
Depth: 84cm

**Power Requirements**

| | |
|---|---|
| Voltage | 240 V +5%−10% 100 V +5%−10%<br>220 V +5%−10% 120 V +5%−10% |
| Frequency | 47 to 63Hz |
| Power | 800 VA |

## Options for use with 4200S Consoles

| | |
|---|---|
| 8200 | Flexible Articulated B Scan Arm |
| OR | |
| 4200 | Rectilinear B Scan Frame |
| 4260 | Real Time Sector Scan Facilities |
| | Photographic and Alphanumeric Data Entry Systems |
| | Fischer's range of probes developed to suit specific applications |

**For further information on the above and other Fischer Ultrasound products please contact your local Fischer representative or write directly to:**


# FISCHER ULTRASOUND

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**FISCHER ULTRASOUND U.S.A.**
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SCHILLER PARK, ILLINOIS 60176
PHONE: 312-671-7966
TELEX: 433-0258 HGFI UI

*I*

*Fischer Ultrasound Ltd. Articulated Scan Arm*

# FISCHER ULTRASOUND

## ARTICULATED SCAN ARM

## ACCURATE — EASY TO USE

- Offers smooth, simple and repeatable positioning of the transducer for high resolution scanning.
- Readily adjusted for transverse, sagittal and oblique scanning, improving the efficiency of scanning procedures.
- Ease of movement and finger-touch controls minimise operator fatigue.
- Provides consistently accurate measurement capability.
- Compatible with Fischer B-scanner console range.

**FISCHER ULTRASOUND LTD.**

Bankhead Crossway South, Edinburgh EH11 4EY, Scotland Telephone 031-443 4166 Telex 727045 Fischr G

**Readily interchangeable frequency encoded bayonet fitting transducers.**

**Microprocessor control of traverse movements and angular detection.**

**Display of positional information and operational frequency.**

**Electrically activated locks secure stability.**

**Flexible range of movements allows scanning of sitting, standing or prone patients.**

**Accurate scan registration through the use of precision electronics.**

**A.I.U.M. phantom registration accuracy better than ±1mm.**

**Rigidity for maintenance of a precise scanning plane.**

**Motor drive assistance allows accurate scan plane positioning in selected increments.**

**Controls are optimally located for range of movements required during a scanning procedure.**

## SPECIFICATION

Position accuracy of transducer ±1mm.
Absolute accuracy of scan arm position readout ±1mm.
Probe angulation ±170°.
Scan arm tilt ±110°.
Scan arm rotation ±360°.
Traverse movement ±20cm from central position.
Vertical movement available 120cm.
The diameter of a semicircle capable of being scanned by the arm is 70cm.
Preset Automatic Traverse—2, 5, 10, 20, 30 or 40mm steps (accuracy ±0.3mm).
All electrical locks are controlled from a single 3-position switch. The following movements may be activated—Column rotation, Traverse Box rotation, Horizontal slide and Scan arm tilt.
Transducers can be changed with or without power on.

| | | |
|---|---|---|
| Height | 234cm | |
| Base width | 100cm | |
| Base depth | 95cm | |
| Electrical requirements | Voltage | 240V±10% 120V±10%<br>220V±10% 110V±10% |
| | Frequency | 40 to 63Hz |
| | Power | 200 VA maximum |


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*J*

*Fischer Ultrasound Ltd. MARTI*

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MARTI

# FISCHER ULTRASOUND

# MARTI

**MARTI** is a compact and transportable real time sector scanner. Advanced digital scan conversion techniques combined with rotating transducer technology provide a solution to real time imaging problems in Radiology, Obstetrics and Internal Medicine.

**MARTI** provides A-mode, B-mode real time sector scan and M-mode facilities in a single unit. A variable image frame rate is available for optimum visualisation of rapidly or slowly moving structures. The high resolution real time images are displayed with 64 greylevels and may be frozen without loss of resolution for detailed viewing and recording. Pre and Post storage image processing makes it possible to improve delineation of subtle tissue differences.

Complete patient identification, dual electronic calipers, automatic Area, Perimeter, BPD and CRL computation are standard. All measured data appears alphanumerically on the monitor screen. Permanent recording may be made on Polaroid film, multiformat imagers or video tape recorders.

**"Freeze" Of Images**
Two methods of obtaining a static image are available to allow detailed study or permanent recordings. "Frame freeze" provides instantaneous freezing of real time images. "Frame grab" allows frozen images to be obtained at low rotational speeds which ensures the highest possible resolution of the stored image.

**Advanced Digital Scan Converter**
The large capacity digital memory allows greyscale B-mode sector scan images with 64 greylevels to be stored and displayed.

**TV Compatibility**
Outputs are available for direct interfacing to remote monitors, multiformat imagers and video recorders.

### Pre and Post Data Storage Processing

The greyscale emphasis of the image may be allocated both prior to obtaining a stored scan and after the image has been stored. Four different functions are available for both pre and post processing.

### Automatic TGC

Time gain compensation (TGC) may be manually adjusted in a conventional manner or the new automatic optimisation feature may be selected.

### Scale Change and Zoom

The size of the scanned image may be varied and areas of interest magnified ×2 for detailed examination.

### Reverse Polarity Image

A simple rotational control provides black on white or white on black presentation.

### Touch Sensitive Keyboard

Provides full alphanumeric patient identification. Time, date and operating frequency are automatically displayed.

### Mechanical Rotating Transducer Probe

Four transducers are mounted on a rotating drum housed within the real time probe. The small patient contact area allows access through small acoustic windows eg. intercostal spaces. The probes are vibration free and patient discomfort is minimal.

### Electronic Calipers

Two simultaneous measurements of distance may be made using the dual caliper markers. These markers may be moved in all directions over the image (either B-mode sector or M-mode).

### Area/Perimeter

In additional to linear measurements, Area and Perimeter measurements may be made. Alphanumeric readout of the measured data appears on the display.

### Automatic Display of Gestational Period

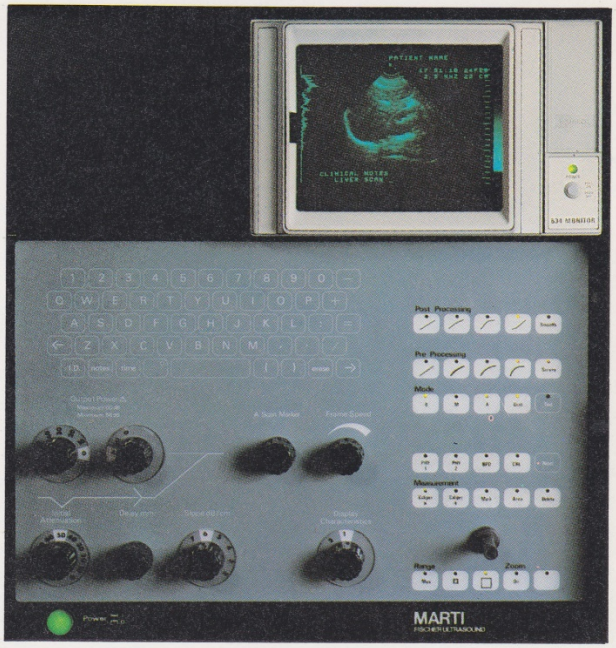
Following either a crown rump length (CRL) or biparietal diameter (BPD) measurement, a display in weeks and days of the gestational period may be obtained.

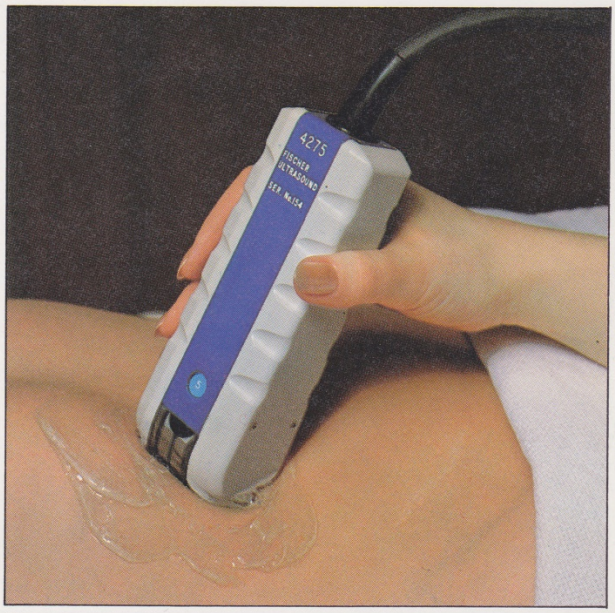
### Display

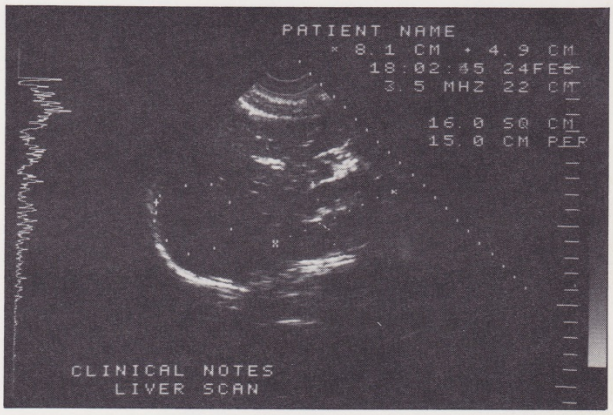
**A-mode.** When selected a bright marker line appears which can be steered within the 90° sector. The A-mode along this vector is shown on the left hand side of the display.

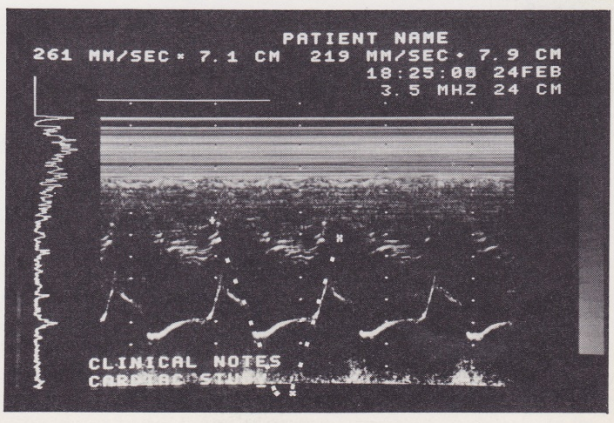
**B-mode sector.** 90° sector scan images are displayed with 64 greylevels on the high brightness white phospher display.

**M-mode.** Selection displays an M-mode which scrolls horizontally across the screen. This may be frozen by use of the footswitch. The electronic calipers may be used to provide depth and slope information. In M-mode the rotation of the transducers within the probe is stopped and the probe can be used in the conventional manner to provide M-mode information.



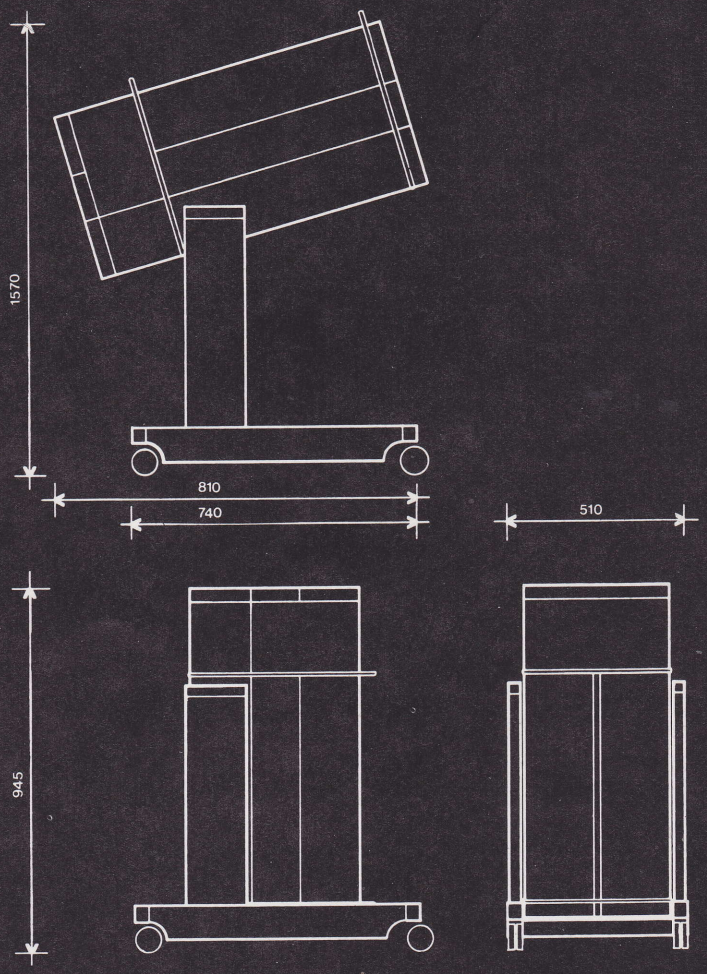
# SYSTEM SPECIFICATIONS

| | |
|---|---|
| Sector Display: | 90° sector image, 64 greylevel wedge, A-mode, A-mode marker, range scale marks and alphanumeric annotation on high brightness, white phospher TV raster display. |
| Rotating Probe: | 3.5 MHz (standard) other frequencies available on request. |
| Operating Modes: | A-mode, B-mode sector or M-mode. |
| Digital Memory: | 480 pixels × 640 pixels × 6 bits, Scan Converter.<br>64 greylevels displayed on B-mode.<br>M-mode 400 pixels × 640 pixels × 4 bits.<br>16 greylevels displayed on M-mode. |
| Frame Rate: | Variable. Maximum 24 frames/sec. Minimum 6 frames/sec. |
| Maximum Depth of Scan: | 24 cm from apex. |
| Display Ranges: | 8cm, 10cm, 15cm, 22cm, 24cm, plus Zoom × 2. |
| Dynamic Range: | 40dB. |
| Sensitivity Control: | By transmitter attenuator 0 to -50dB in 10dB steps. 0 to -8 dB in 2 dB steps. |
| Time Gain Compensation: | Initial gain 0 to 80 dB in 10 dB steps. Initial delay 0 to 250mm continuously variable. |
| Pre-processing: | 4 selectable modes. |
| Post-processing: | 4 selectable modes. |
| Omnidirectional Electronic Calipers: | Distance — between any two points on the image in B and M-modes. Dual calipers allow two independent measurements of distance. Readout in cms. |
| M-mode Markers: | Markers at ½ sec apart in time and 1 cm apart in depth. |
| Alphanumeric Keyboard: | Touch sensitive keyboard allows entry of: — 1 line of 20 characters for patient identification. 1 line of 18 characters plus 1 line of 16 characters for patient notes. |
| Recording: | Polaroid photography standard.<br>Options: —<br>Multiformat camera, video tape recorder. |

| Computation Facilities: | | |
|---|---|---|
| | Area | Automatic readout in sq. cms. |
| | Perimeter | Automatic readout in cms. |
| | Slope: (for each caliper selected) | Automatic readout on M-mode in mm/sec |
| | Depth: (for each caliper selected) | Automatic readout on M-mode in cm. |
| | Crown Rump Length (CRL) | Display of gestation period in weeks and days. |
| | Biparietal Diameter (BPD) | Display of gestation period in weeks and days. |

| | |
|---|---|
| Mains Voltage: | 240V +5% -10% 120V +5% -10%<br>220V +5% -10% 110V +5% -10% |
| Power: | 400VA |
| Net Weight: | 90kg |

# DIMENSIONS Units mm




Fischer Ultrasound is the Fischer Imaging Corporation company specialising in Diagnostic Ultrasound.

An extensive range of Ultrasound scanners have been developed and assembled at our Edinburgh, Scotland headquarters by experts in this technology.

If needed, rapid service assistance can be provided by fully trained engineers to ensure the optimum performance of your system.

For further information on MARTI and other Fischer Ultrasound products please contact your local Fischer respresentative or write directly to Fischer Ultrasound.


# FISCHER ULTRASOUND

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Printed in Scotland 1982

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*Fischer Ultrasound Ltd. LINUS*

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# LINUS

# FISCHER ULTRASOUND

# LINUS

The LINUS real time system is a compact, portable linear array from Fischer Ultrasound. In the Fischer tradition Linus's image quality maintains the highest standards. Simplicity of operation, portability, reliability are all featured in an economical package.

Advanced ultrasound technology provides high quality real time images by means of electronic and lens focusing. The lightweight transducer is easy to position and an image reversal facility helps to maintain correct anatomical orientation.

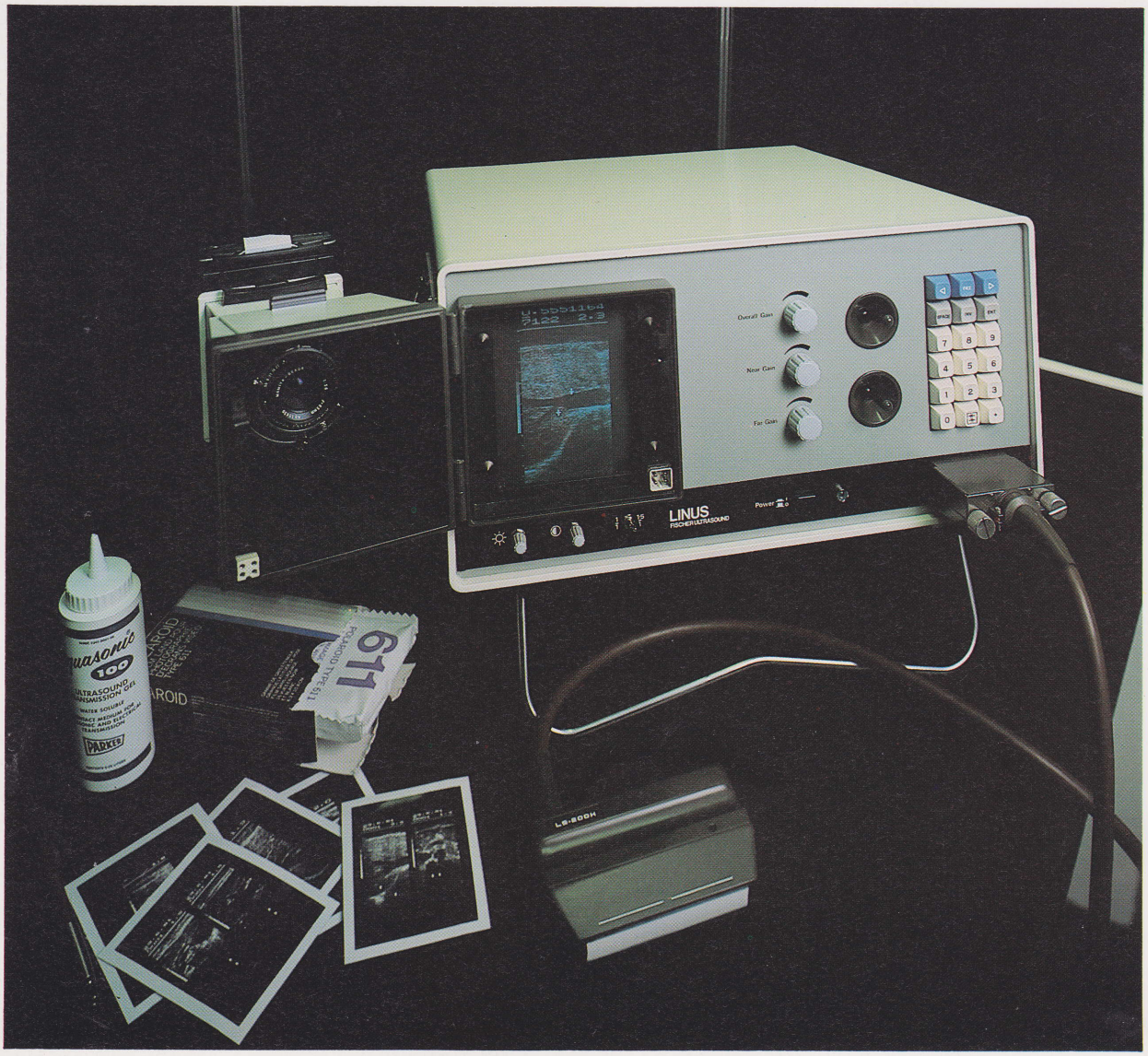
The freeze frame facility enables dynamic images to be frozen for photography. One ¾ scale or two ½ scale images may be photographed with the Polaroid camera. Brightness and focus are automatically adjusted. A greyscale wedge is displayed on the CRT.

Numeric keys are available for patient identification and date. Omnidirectional calipers with digital readout allow accurate measurements to be made.

Simple three control Time Gain Compensation (TGC) and adjustable scale size of ½ or ¾, allows the operator to adjust the field of view to suit the examination.

Optional transducers, camera and display systems are available for expanded capability.

LINUS has the in-built flexibility to guarantee a system with continuing viability for further applications.



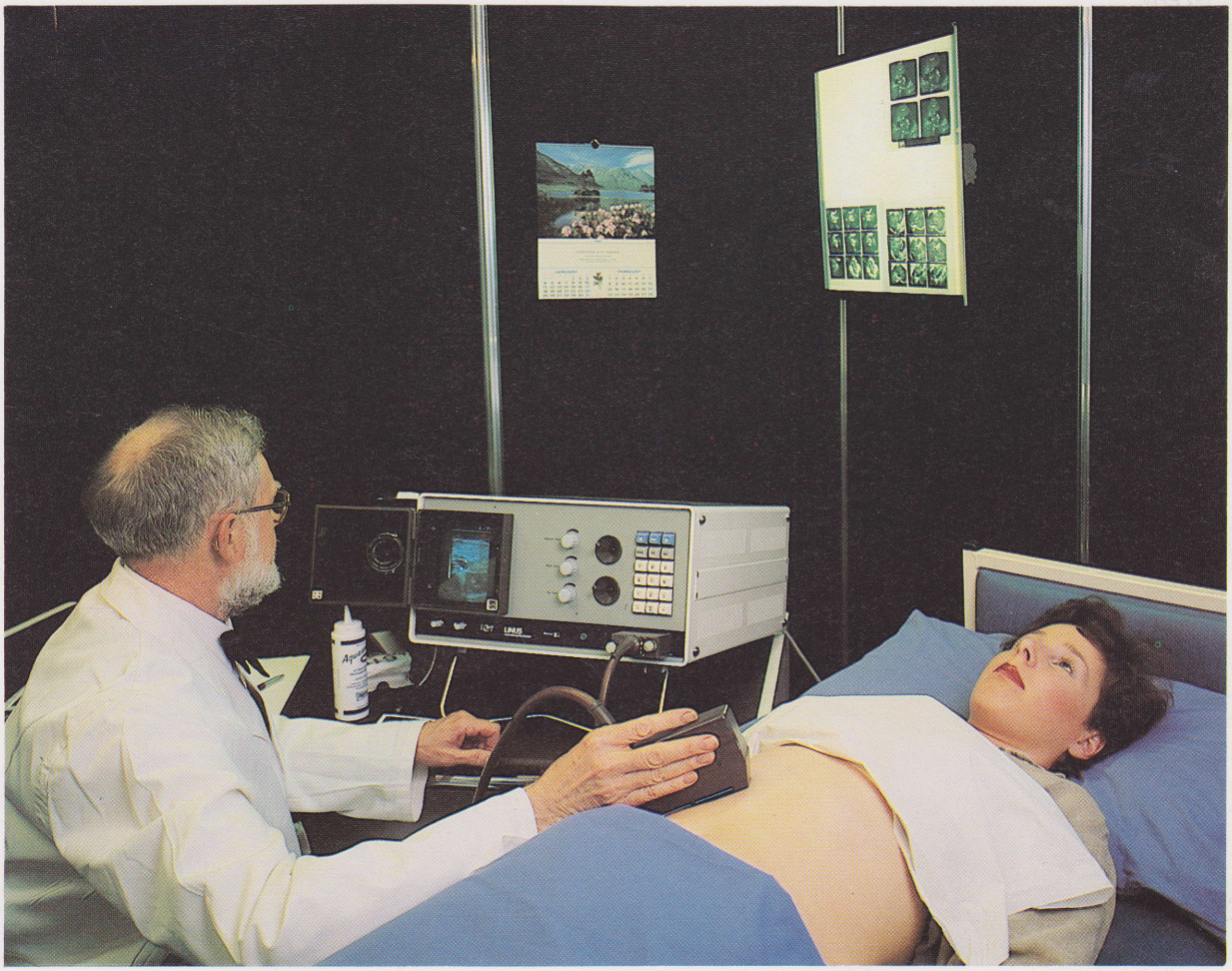

LINUS – A COMPACT PORTABLE UNIT


Clear, simple control unit with CRT display

The lightweight transducer

High quality real time images may be frozen for photography

## FISCHER ULTRASOUND



**LINUS – HIGH PERFORMANCE YOU CAN DEPEND ON**

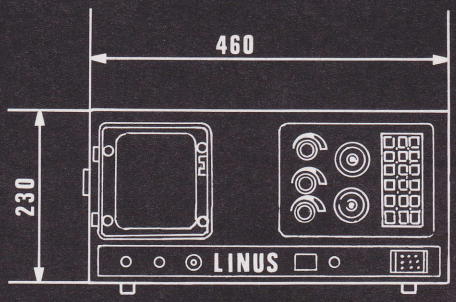
# SYSTEM SPECIFICATIONS

| | |
|---|---|
| General Scanning method: | Linear electronic scanning with electronic focusing and lens focusing |
| Frequency: | 2.25, 3.5, 5 MHz |
| Focal length: | 50 mm approx. |
| Field of View: | 85 mm wide, 20 mm deep (with standard 3.5 MHz Transducer) |
| Dynamic Range: | 40 dB |
| Number of scanning lines: | 114 |
| Frame Rate: | 24 per second |
| TGC: | Near Gain 0 to –50 dB<br>Far Gain 0 to 30 dB<br>Overall Gain 0 to ± 40 dB |
| Grey Scale: | 8 Shades of Grey, Grey Bar Display |
| Caliper: | Dual joystick control<br>3 Integer display including one decimal unit<br>Accuracy of ±0.1 cm, ±1 mm |
| Annotation: | 13 digit display numerals 0 to 9, decimal point and space. |
| Power: | Input power – 100V, 117V, 220V, 240V, AC±10%; 200V A.<br>Input frequency: 50 or 60 Hz |
| Environment: | Ambient operating temperature 15°C to 35°C |
| Weight: | Transducer 330 gm, Main Unit 25 Kg. |

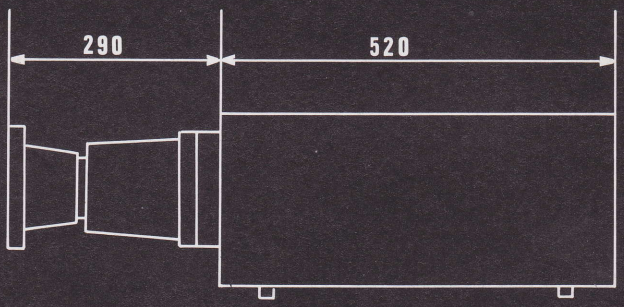
# STANDARD CONFIGURATION

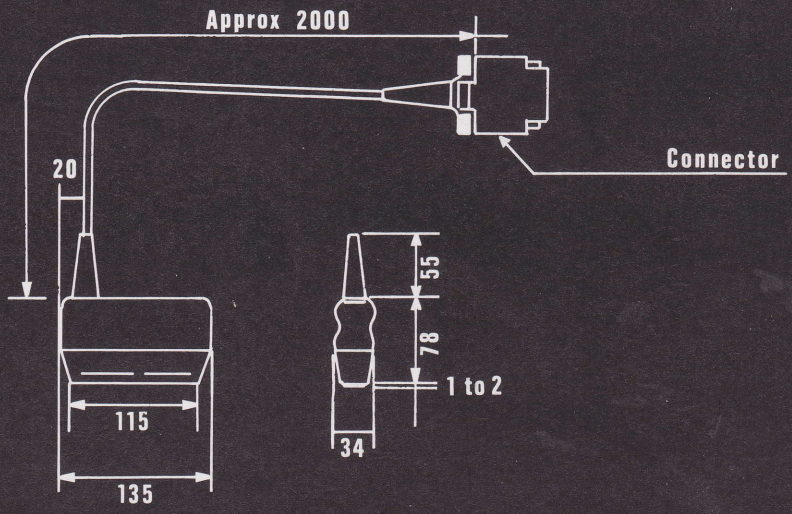
Main Unit incorporating 8 inch display, 3.5 MHz transducer and Polaroid camera.

# DIMENSIONS Units mm




## Main Unit




## Standard 3.5 MHz Transducer

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TELEX: 433-0258 HGFI UI

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*Locations of archived Diasonographs in the UK*

| Date, approx | Location | Equipment | Origin | Manufacturer |
|---|---|---|---|---|
| c. 1957 | Hunterian Museum Glasgow | The first contact scanner | Queen Mother's Hospital Glasgow | Operational prototype |
| c. 1960 | Glasgow Museums Resource Centre | The first automatic contact scanner | Queen Mother's Hospital Glasgow | Operational prototype |
| c. 1965 | Science Museum store | Diasonograph | Queen Charlotte's Hospital London | Nuclear Enterprises Ltd |
| c. 1970 | Glasgow Museums Resource Centre | Diasonograph | Queen Mother's Hospital Glasgow | Nuclear Enterprises Ltd |
| c. 1972 | Glasgow Museums Resource Centre | NE 4102 | Queen Mother's Hospital Glasgow | Nuclear Enterprises Ltd |
| c. 1980 | National Museum of Scotland Edinburgh | NE4200 | Newcastle General Hospital | Nuclear Enterprises Ltd |
| c. 1986 | Science Museum store | NE4200S | Hillingdon Hospital, London | Fischer Ultrasound |
| c. 1989 | Science Museum display | Emisonic 4264 "spinner" | Queen Charlotte's Hospital | Nuclear Enterprises/EMI |

*List compiled by Francis Duck*