German Ultrasound Museum

Collection of Devices, last update June 2016

No. **001** description: **Echoencephalography**

type of device: A-Mode producer/distributor : Krautkrämer/Siemens

development: 1959-1960

frequency: 2 MHz time of production: since 1961

A-Mode-system with oscilloscope for determining time delay and amplitude of an echo. Modification of the ultrasonic testing device Krautkrämer USIP 10 by Siemens Co for brain scans. Oldest echoencephalography system in Germany (here with additional calibrator and camera). 36 x 23 x 56 cm
Origin: Mann, Mainz.

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No. 002 **description:** Ophalmography

type of device: A-Mode **producer/distributor:** Krautkrämer/Siemens

development: 1959-1961

frequency: 4-15 MHz **time of production:** since 1961

A-Mode-system with oscilloscope for determining time delay and amplitude of the echo.
Modification of the ultrasonic testing device USIP 10 from Krautkrämer by Siemens Co.
for use in Ophthalmology. 36 x 23 x 56 cm
Origin: Mann, Mainz.

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No. 003 **description:** Echocardiography

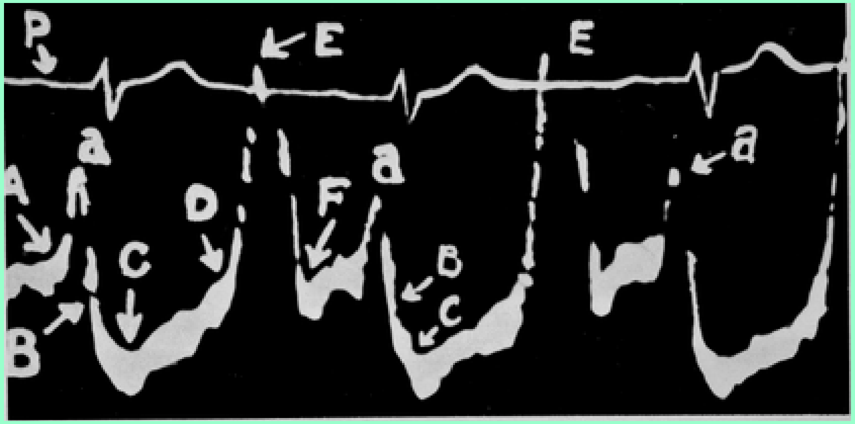
type of device: A-Mode **producer/distributor:** Krautkrämer/Siemens

development: 1959-1960

frequency: 2-5 MHz **time of production:** since 1961

A-Mode-system with oscilloscope for determining time delay and amplitude of the echo.
TM – display by auxiliary unit.
Modification of an ultrasonic testing device USIP 10 from Krautkrämer by Siemens Co.
For use in cardiology.
36 x 23 x 56 cm

Special version of oldest German echoencephalography-device converted for Cardiography. - The very first TM-system, however, was an echo material-machine from Siemens Co. modified by Hertz and Edler (Lund) for TM.



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No. **011** description: **Material testing**

type of device: A-Mode producer/distributor: Krautkrämer
development:

frequency: 0.5-10 MHz time of production: since 1960

Material-testing device type USIP 10 from Krautkrämer Co., Cologne.
This original device was later modified for medical diagnostics (Encephalography, Cardiography, Ophthalmography) in collaboration with Siemens Co.
(bound by contract).

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No. 012 **description:** # Material testing

type of device: A-Mode **producer/distributor:** Krautkrämer
development:

frequency: 2 MHz **time of production:** since 1968

Portable battery-powered non-destructive testing device of Krautkrämer Co., Cologne.
Further modifications for medical applications were planned.
Only a small number of these devices were ever tested.

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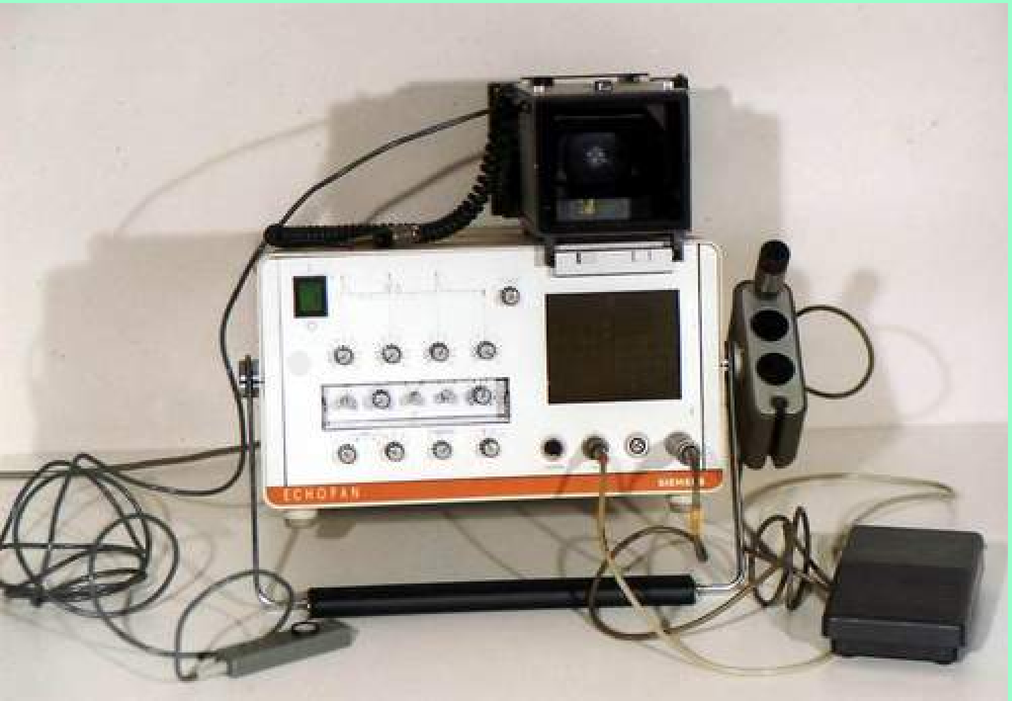
No. 004 **description:** Echopan

type of device: A-Mode **producer/distributor:** Siemens AG, Erlangen

development: 1973-1974

frequency: 2-5 MHz **time of production:** since 1974

Echoencephalography system with 2 channels for simultaneous bilateral echography of the skull. Used in Neurology (for identifying tumors or atrophy) and in Traumatology (hemorrhages). Equipped for calibration and compensation of depth; filters, camera.



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No. **005** description: **Echopan KS**

type of device: A-Mode producer/distributor: Siemens AG, Erlangen

development: 1973-1974

frequency: 2-5 MHz time of production: since 1974

A-Mode with M-Mode display via storage oscillograph und UV-recorder with glass-fiber optics.
Developed for cardiological examinations.
Later supplemented with mechanical sector-scanner for B-Mode display.
30 x 50 x 60 cm

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No. 006 **description:** Echogerät Serie 1000

type of device: A-Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1955-1958

frequency: 1-14 MHz **time of production:** 1958-1965

This A-Mode device of the 1000 series, a tube model, was one of the first devices developed for non-destructive material testing. Starting in 1960 it was increasingly used for medical purposes; first in Ophthalmology und Neurology (Traumatology), and later in Obstetrics. Analysis of time delay and amplitude of the echo.

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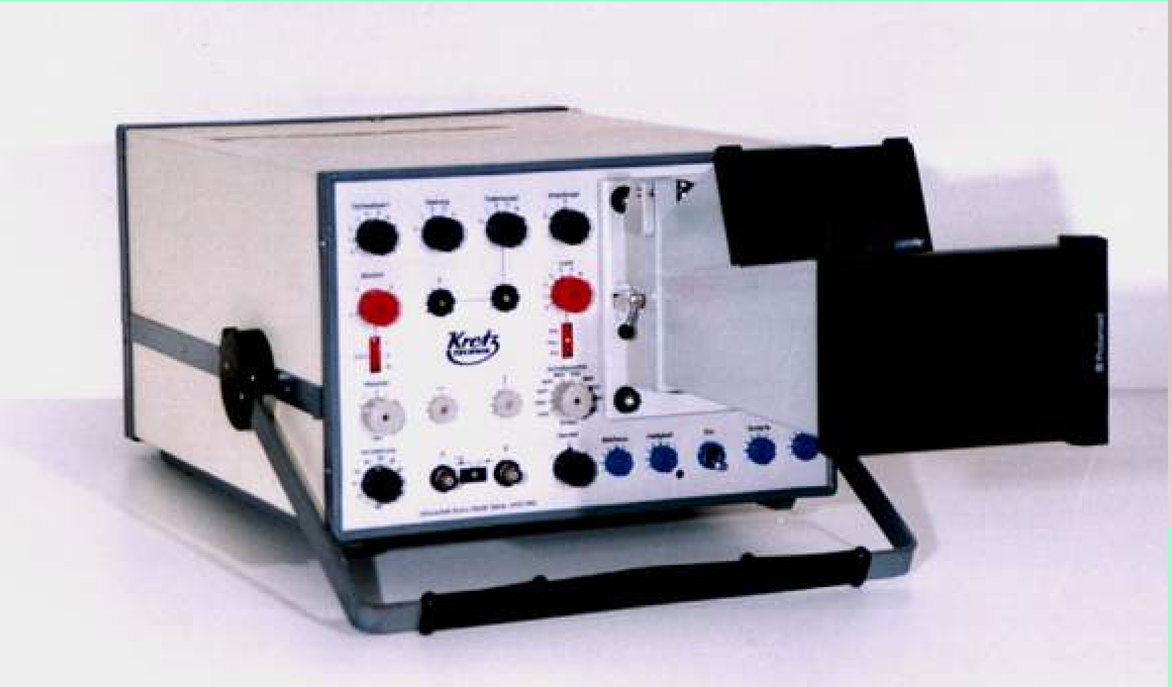
No. 007 **description:** 4100 MGB

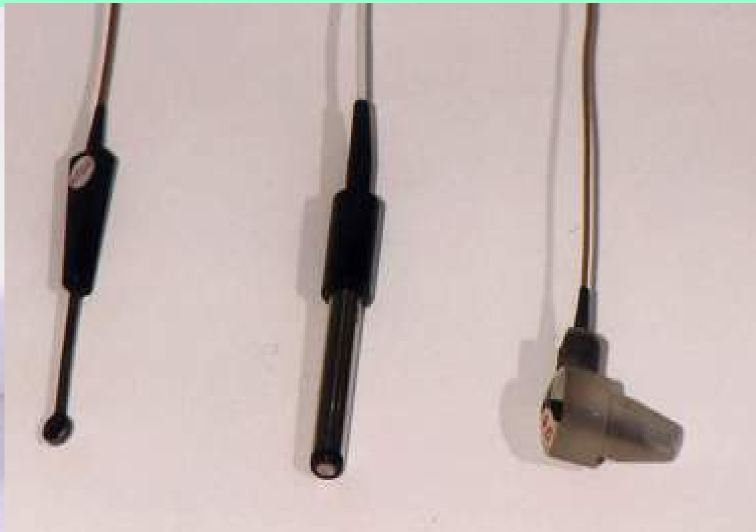
type of device: A-Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1966-1968

frequency: 0.5-15 MHz **time of production:** 1968-1978

Two-channel system, time-mark channel, compensation of depth, magnifier, quartz stabilized time scale. This modernized device was fully transistorized.
Used for abdominal and obstetrical diagnostics (including a vaginal probe!). This device was also part of Compound-scan systems. Similar devices were used for echoencephalography, ophthalmography – and also for material testing.





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No. 008 **description: Echoencephalograph 4200 ME**

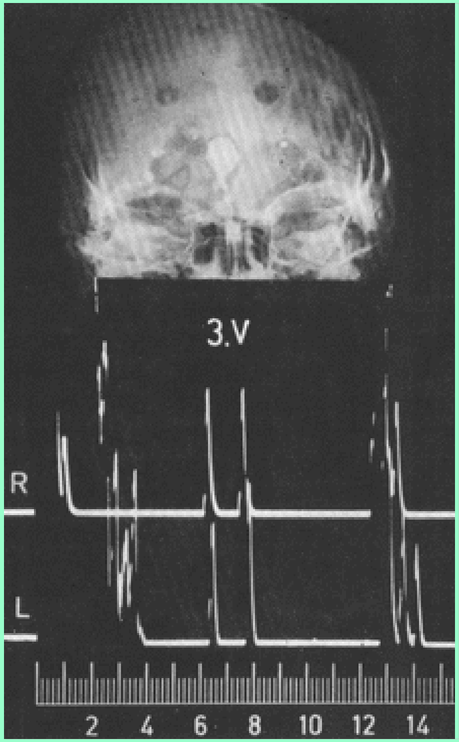
type of device: A-Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1972-1973

frequency: 0.5-4 MHz **time of production:** 1973-1985

A-Mode-Encephalograph with separate channels for simultaneous bilateral echo investigations. Visual documentation of the screen by retractable camera.
Fully transistorized system.

Echoencephalogram: Diameter of the 3rd ventricle. Figure: Schiefer, Erlangen)



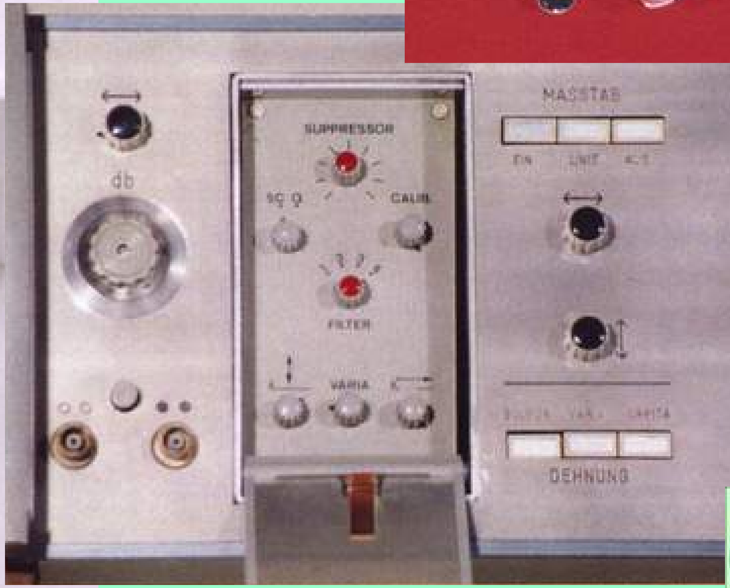
No. 009 **description:** Echoophthalmograph 7200 MA

type of device: A-Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1969-1971

frequency: 6-15 MHz **time of production:** 1971-1985

A-Mode-ophthalmograph, integrated quartz oscillator, calibration, frequency filter.
Horizontal resolution 0.3 µsec/mm.
Equipped for standardized examinations – according to Ossoinig.
Origin: Kretztechnik, Zipf.



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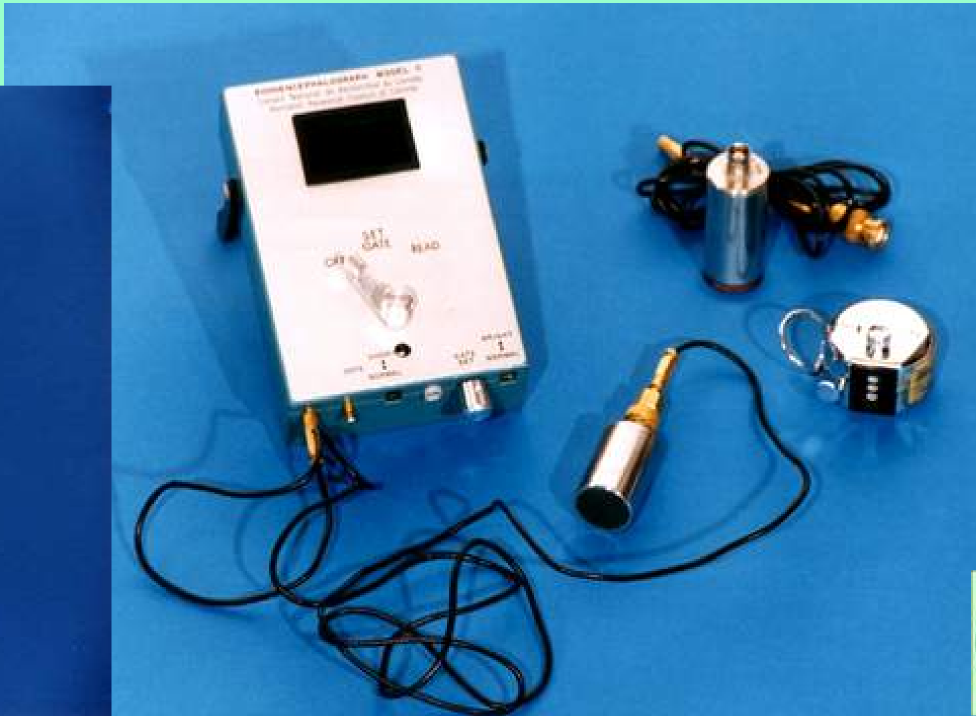
No. 010 **description:** Echoencephalograph Model C

type of device: A-Mode **producer:** Radio & Electrical Lab., Canada

development: 1965

frequency: 3 MHz **time of production:** 1965

A-Mode device, pocket sized, 14 x 10 x 4 cm.
Probably custom-made for H. R. Müller, Basel.
A numerical display (digits) can be switched to either echo amplitude or to time-delay of the echo.
Origin: H. R. Müller, Basel



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No. **050** description: **Materialprüfgerät 9020**

type of device: A-Mode producer/distributor: Funkwerk Erfurt

development: 1956-1957

frequency: 1-6 MHz time of production: since 1958

A-Mode device, one channel.
The GDR started development of material testing devices (type 608 was a precursor of this device) in 1951. This type 9020 was first used for medical diagnostics (Obstetrics and Traumatology).
Origin: Institute for Medical Physics und Biophysics, Halle University.

with interchangeable probes

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No. 051 **description:** Sonovisor 1

type of device: A-Mode **producer/distributor:** Carl Zeiss Jena

development: 1956

frequency: 2-5 MHz **time of production:** 1957-1958

A-Mode device, later converted to B-Mode, or Schwingschnittverfahren („swinging sections“). Originally developed for material testing. Later used for medical purposes with an add-on linear probe of about 5 MHz, sliding on circular rails. Mechanical vertical spacing. Control of synchronized image points

by magnetic encoder. Water-coupling for the transducer (B-Mode add-on not present here).

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No. **052** description: **Sonovisor 2**

type of device: A-Mode and mechanical B-Mode

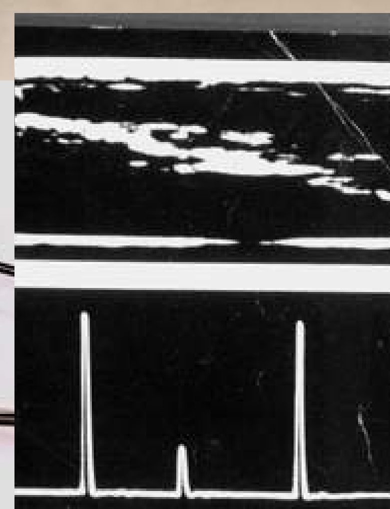
producer/distributor: Carl Zeiss Jena

development: 1957-1958

frequency: 2-5 MHz

time of production: 1958-1959

A- and B-Mode device, the so-called Schwingschnittverfahren („swinging sections“).
Further development of Sonovisor 1. Partly transistorized.
Scanner with no metal coupling disc. Still portable at 25 kg.



Material testing:

Fault in metal bar.

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No. 054 **description:** Echogerät GA 10

type of device: A-Mode **producer/distributor:** VEB Ultraschalltechnik Halle

development: 1967-1968

frequency: 1-6 MHz **time of production:** 1968-1971

Belongs to series A 10. Modules slide in and can be interchanged, enabling multifunctional use.
Introduced as GA with 1-6 MHz probes for Obstetrics and Gynecology.
Also available: EA 10 for Traumatology, OA 10 for Ophthalmology and KA 10 for Cardiology.
2 channels; EA version 3 includes a calibrated scale and threshold regulation.
Origin: R. Millner, U. Cobet Halle

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No. 054 z **description:** Echogeraet GA 10

type of device: A-Mode TM-Mode **producer/distributor:** VEB Ultraschalltechnik Halle

development: 1967-1968

frequency: 10-12 MHz **time of production:** 1968-1971

Modules slide in and can easily be interchanged.
With an added module this device could be used for an echo-glottographia, for example.
Movements were recorded in M-Mode (TM-Mode) with a high sampling rate; transducer frequency 10-12 MHz.

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No. 055 **description:** **Echogerät GA 10,** **older version**

type of device: A-Mode **producer/distributor:** VEB Ultraschalltechnik Halle

development: 1966-1968

frequency: 1-6 MHz **time of production:** 1968-1971

Older version of the A 10 series. Developed at the Ultrasound Department, Institute of Medical Physics (later: Applied Biophysics), Halle University and at the Research Institute M. v. Ardenne, Dresden.
Production of the pilot series by Strobl company, Berlin, later by VEB Ultraschalltechnik Halle.

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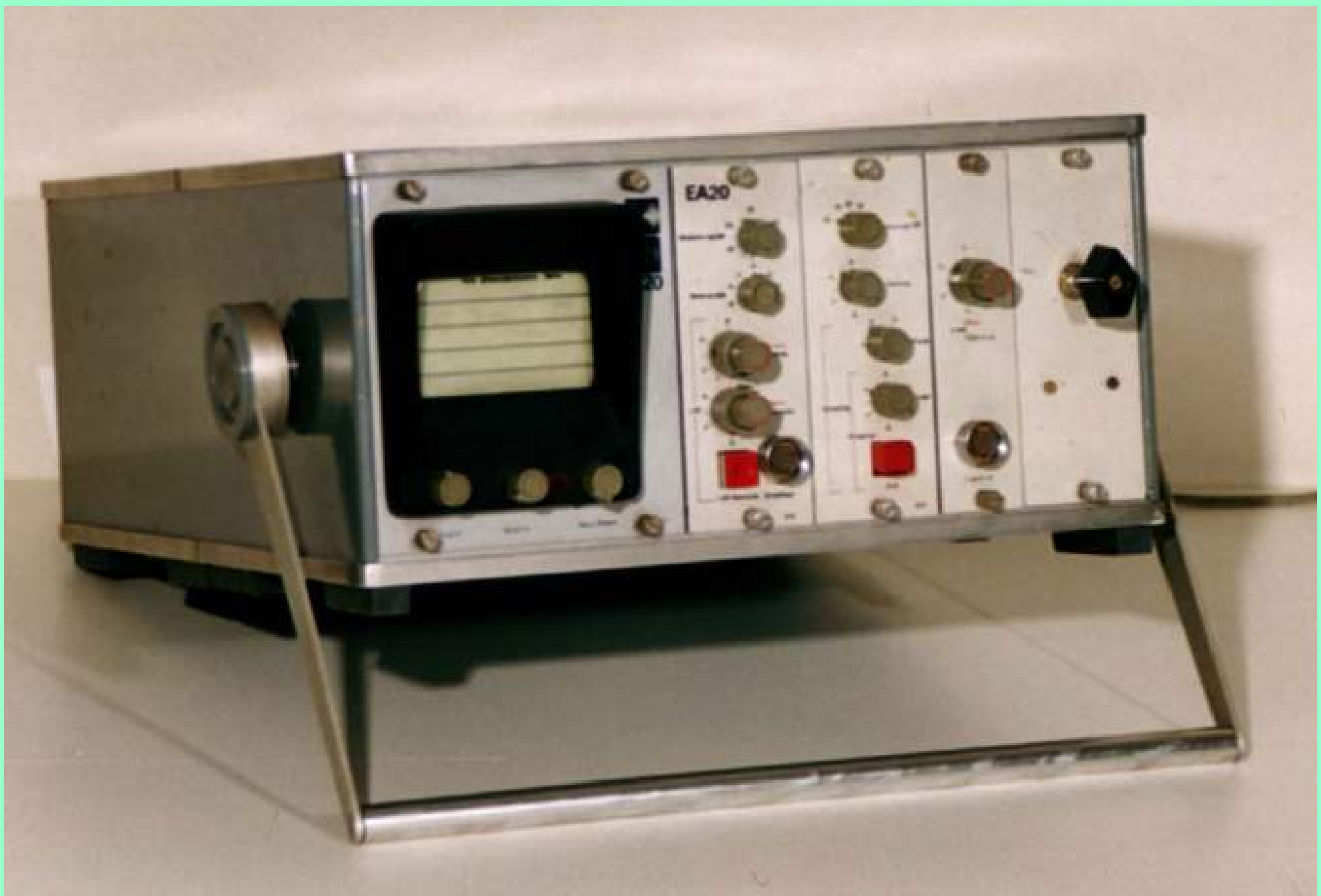
No. 056 **description:** Echogerät EA 20

type of device: A-Mode **producer/distributor:** VEB Ultraschalltechnik Halle

development: 1970

frequency: 1-4 MHz **time of production:** 1970-1980

Improved version of the A 10 series with magnifier, compensation of depth and auto-determination of the midlinee echo.



No. **057** **description:** **Echoencephalograph T**

type of device: A-Mode **producer/distributor:** Krautkrämer/Siemens

development: ??

frequency: ?? **time of production:** ??

Origin: R. Soldner, Erlangen

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German Ultrasound Museum

Collection of Devices, last update June 2016

No. 113 **description:** Echoview 80 L

type of device: Compound **producer/distributor:** Picker Int. Inc., USA

development: approx. 1970

frequency: 1-7.5 MHz **time of production:** 1974-1979

Digital compound-scanner, built 1974. Real time (Linear Array 3.5 and 5 MHz) as an option.
Displaying A-Mode, B-Mode und TM-scan.
Origin: H.-J. Schultz, Picker International

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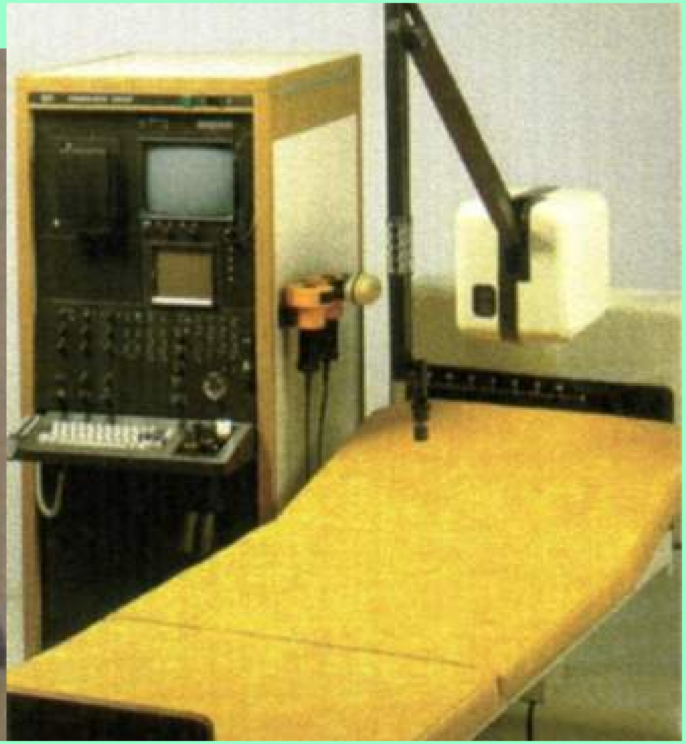
No. 114 **description:** Combison 202

type of device: Compound **producer/distributor:** Kretztrechnik AG, Zipf

development: 1978-1979

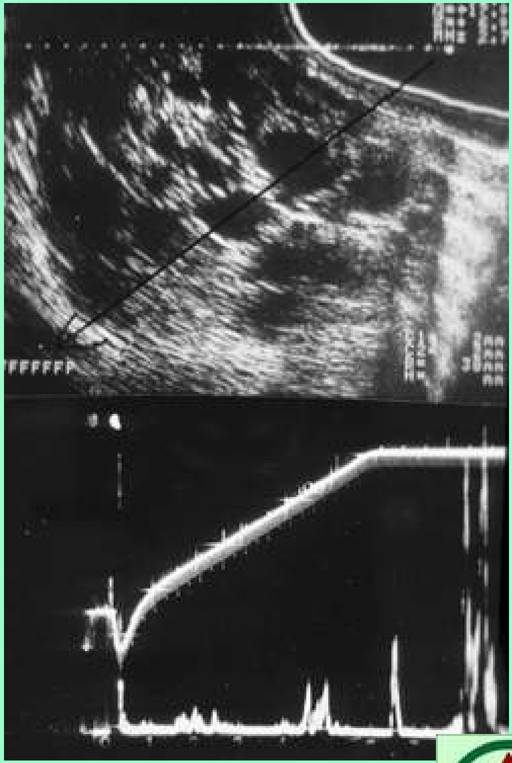
frequency: 2 and 5 MHz **time of production:** 1979-1983

Compound-Scanner, A- and B-Mode. Digital frame storage, grayscale-technique, automatic image evaluation (histogram).
The improved type 202 R offered additional real-time technique (mechanical sector) for transcutaneous, transrectal und intravesical applications.



cystic liver
B-Scan

A -Mode



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No. 114 SK **description:** Combison 202

type of device: Compound **producer/distributor:** Kretztrechnik AG, Zipf

development: 1978-1979

frequency: **time of production:** 1979-1983

Compound scanner

Scan-arm with localizer for a compound system (Combison 202 Kretz) necessary for manual B-Scans.

During the scan procedure information about the position and the direction of the transducer is gathered. These data are captured as analog electrical signals via mechanically-linked potentiometers and are simultaneously processed in the ultrasonic system.

The accuracy of the data collected in this way substantially determines the precision and the quality of the ultrasound images.

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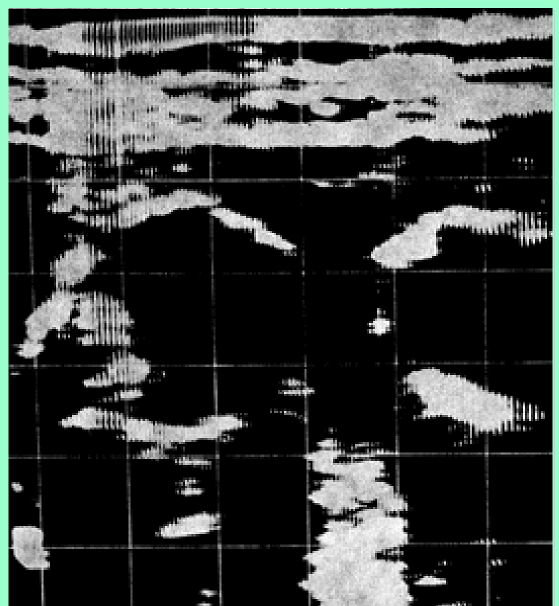
No. 115 **description:** **Vidoson 635**

type of device: mechan. Sector B-Mode **producer/distributor:** Siemens AG, Erlangen

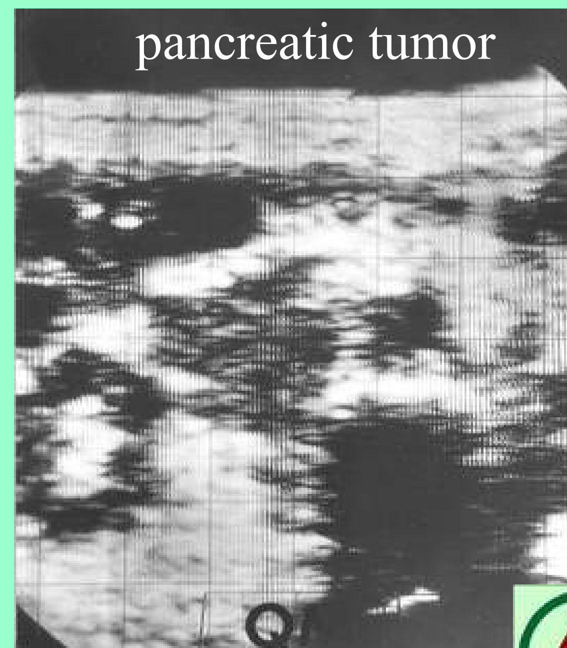
development: 1961-1965

frequency: 2.5 MHz **time of production:** 1965-1975

Mechanical real-time B-Mode system (15 frames/sec) with water coupling.
Adjustable section plane, gray-scale display.
Originally developed for mamma-sonography, first used instead in Obstetrics by Holländer, later in abdominal diagnostics by Rettenmaier.
Origin: Rücker, Roderbirken



twins
fig. Holländer, 1968



pancreatic tumor

No. **115 z** description: **Vidoson 635**

type of device: mechan. Sector B-Mode

producer/distributor: Siemens AG, Erlangen

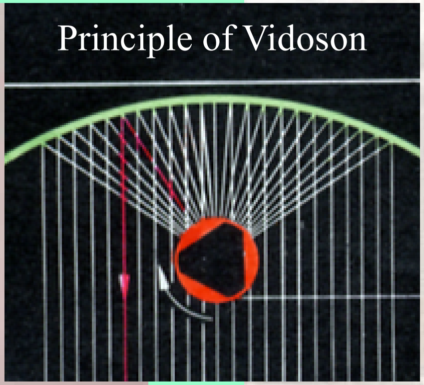
development: 1961-1965

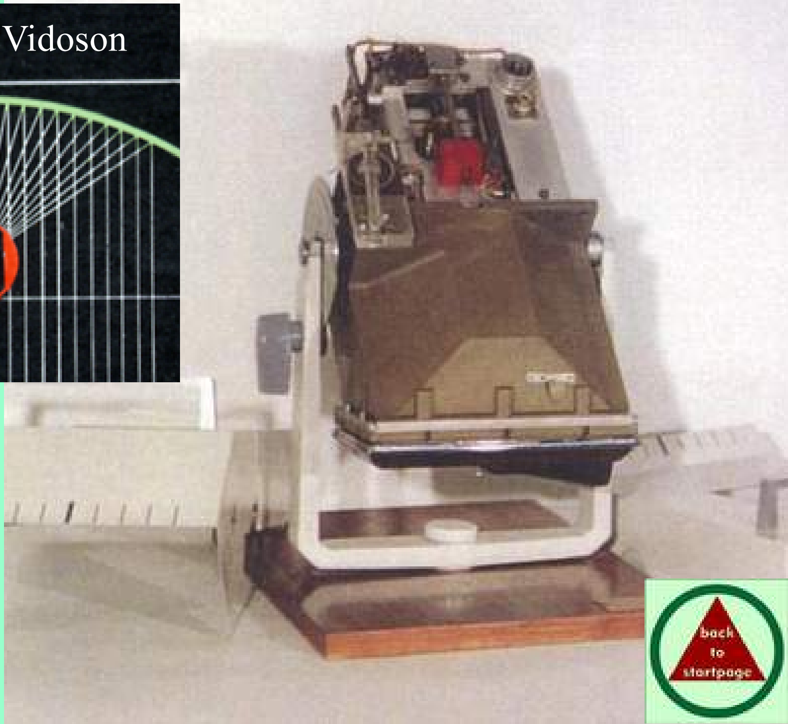
frequency: 2.5 MHz

time of production: 1965-1975

Mechanical real-time B-Mode system (15 frames/sec) with water coupling.
Adjustable section plane, gray-scale display.
(The ultrasonic impulses of a rotating transducer are first reflected by a parabolic mirror,

then beamed parallel towards the body.)
Origin: Lutz, Bayreuth





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No. 115 SK 1 | description: Vidoson 635

type of device: mechan. Sector B-Mode | producer/distributor: Siemens AG, Erlangen

development: 1961-1965

frequency: 2.5 MHz | time of production: 1965-1975

Mechanical linear sector scanner

Scanner unit of the first real-time ultrasound system (Vidoson 635).

Three successively activated ultrasonic transmitters rotate in the focal plane of a parabolic reflector.

This reflector transforms the original sector scan to a (linear) parallel scan. The reason for this unorthodox solution: The constant rotation of the transducers is – contrary to repetitive longitudinal motions - not subject to inertial force. Therefore scanning time and frame rate are not limited, as they would be in case of longitudinal motions of the transducer.

The longitudinal axis of the rotating transducers can be shifted. In this way the section plane can be varied up to 3.5 cm without moving the complete scanning unit which is connected to the patient‘s skin. This method was intended to facilitate ultrasonic mamma inspections.

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No. 115 SK 2 description: Vidoson 735

type of device: mechan. Sector B-Mode producer/distributor: Siemens AG, Erlangen

frequency: 3.5 MHz time of production: 1978-1980

Transducer for mechanical linear scanner (Vidoson 735)

Rotating transducer mount with three identical periodically-activated transmitters for the Vidoson 735 series.
The elliptic shape of the transducer is a consequence of the opto-acoustical characteristics of the corresponding parabolic reflector.

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No. 117 **description:** ATL Mark III

type of device: B-Mode (with optional Doppler mode) **producer/distributor:** Advanced Technology Labs.

development: before 1975

frequency: 3.5 and 5 MHz **time of production:** 1975

Mechanical B-scan with A- and M-Mode, sector-scanner. Pw-Doppler unit optional, 3.5 and 5 MHz. Programs for measuring; video documentation.
Used mainly for abdominal, cardiological, and vascular applications.

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No. 118 **description:** Combison 100

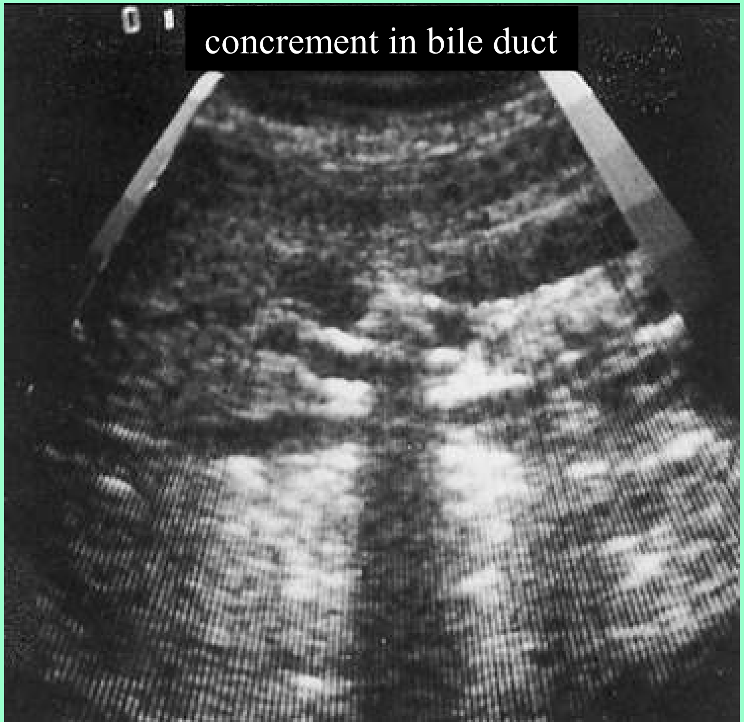
type of device: B-Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1976 – 1978

frequency: 2.5 – 4 MHz **time of production:** 1978 – 1983

Real-time sector scanner. 5, later 3 rotating elements. Omnidirectional measuring possible. Additional monitor.

Transrectal and intravesical transducers. Used in Obstetrics/Gynecology, Internal Medicine and Urology. Origin: Frentzel-Beyme, Berlin



concrement in bile duct

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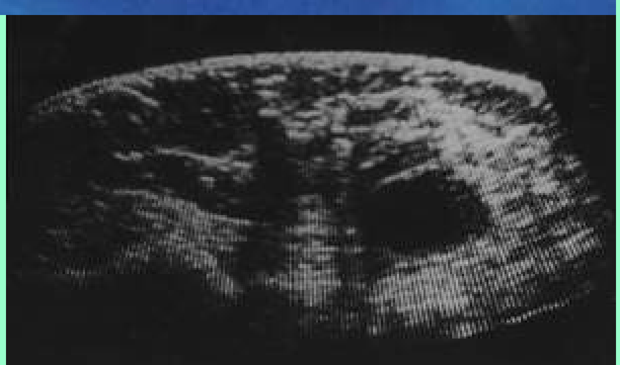
No. 118 z **description: Combison 100**

type of device: B – Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1976 - 1978

frequency: 2.5 - 4 MHz **time of production:** 1978 - 1983

Real-time sector scanner. Automated mamma scanner:
For imaging the scanner circled the mamma within a water bath – driven by an additional engine. These images were then assembled with the help of a computer, similar to computerized tomography in radiology.



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No. **118 SK** description: **Combison 100**

type of device: B-Mode producer/distributor: Kretztechnik AG, Zipf

frequency: 3.5 MHz time of production: 1976 – 1979

Mechanical Sector Scanner

Mechanical sector scanner for Combison 100 with 5 identical rotating transducers (fix-focus).
The transducer pointing to the connecting window was activated by a magnetic strip fixed at the cover.
The accompanying switches, which were also activated by magnets, can be seen between the transducers.

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No. 120 **description:** Combison 1320-5

type of device: B-Mode **producer/distributor:** Kretztechnik AG, Zipf

development: 1983/1984

frequency: 3.5 and 7 MHz **time of production:** 1984-1993

Mechanical sector scanner and electronic multi-array scanner. Intracavitary probes. Digital scan-converter for gray-scale storage. Software: coordinated operation, picture processing, gauging. Integrated instant-camera documentation. Spectral-Doppler as an option. Used for abdomen, obstetrics, transrectal, vaginal and intravesical.

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No. 121 **description:** Sonoline 3000

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development:

frequency: 3 and 5 MHz **time of production:** 1985

Real-time sector-scanner with switch from 3 to 5 MHz. Storage function.

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No. **121 SK** description: **Sonoline 3000**

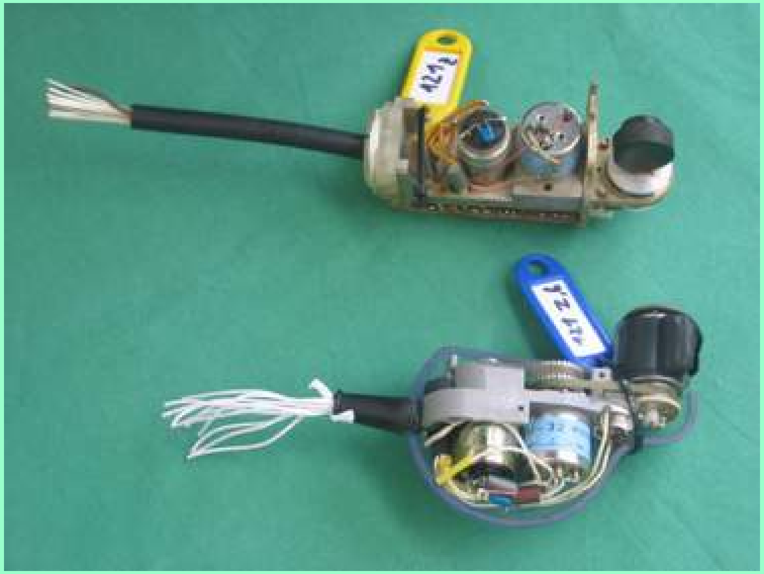
type of device: B-Mode producer/distributor: Siemens AG Erlangen

development:

frequency: 5 MHz time of production: 1978-1980

Sector Scanner

Prototype of a mechanical sector scanner with two identical transducers mounted on a rotating support.



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No. 122 **description:** B-Mode System SB 30

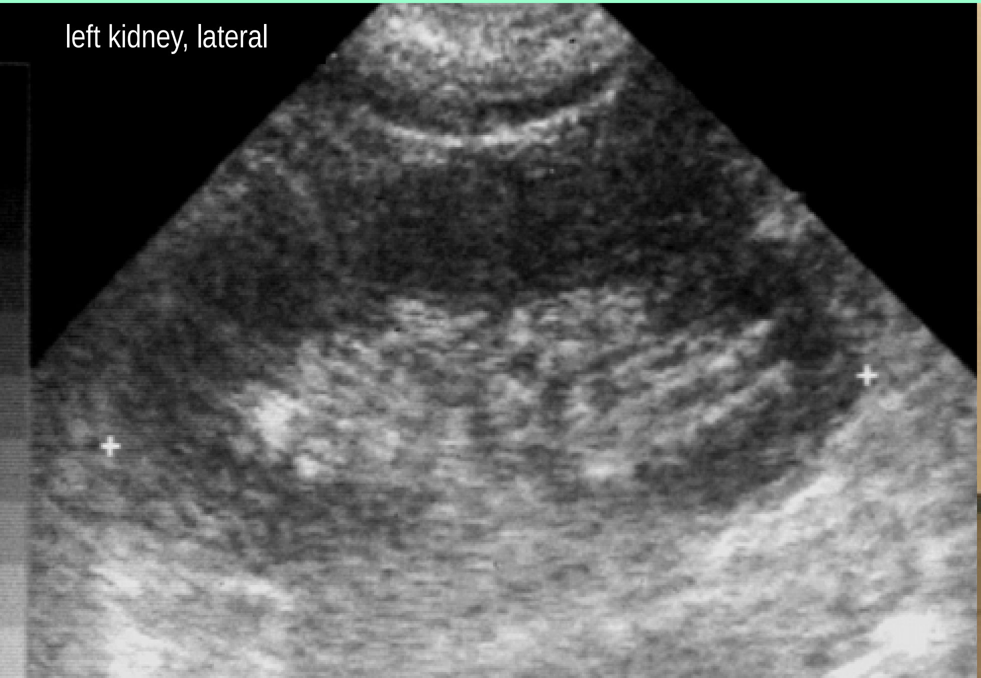
type of device: B-Mode **producer/distributor:** VEB Ultraschalltechnik Halle

development: ?

frequency: 2 and 5 MHz **time of production:** 1979

Ultrasound system with 2 rotating scanners, 2 und 5 MHz. 16 levels gray scale, variable TGC, gauging marks. This system was meant to cover the demands for B-mode devices in the German Democratic Republic (GDR), as devices from Western manufacturers could not be imported. However, because of inadequate technology (lack of electronic components), this system was not able to meet international quality standards.

Origin: Institute for Biophysics, Halle



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No. 123 **description:** Mechanical Sector Scanner

type of device: B-Mode **producer/distributor:** Halle???

development: ?

frequency: ? **time of production:**

Mechanical Sector Scanner

Mechanical sector scanner with 4 identical transducer elements on a rotating disc to be placed directly on the skin. This may have been the transducer for the concept of a compound system with semi-automatic scanning – similar to the system of Jan Donald, Glasgow.

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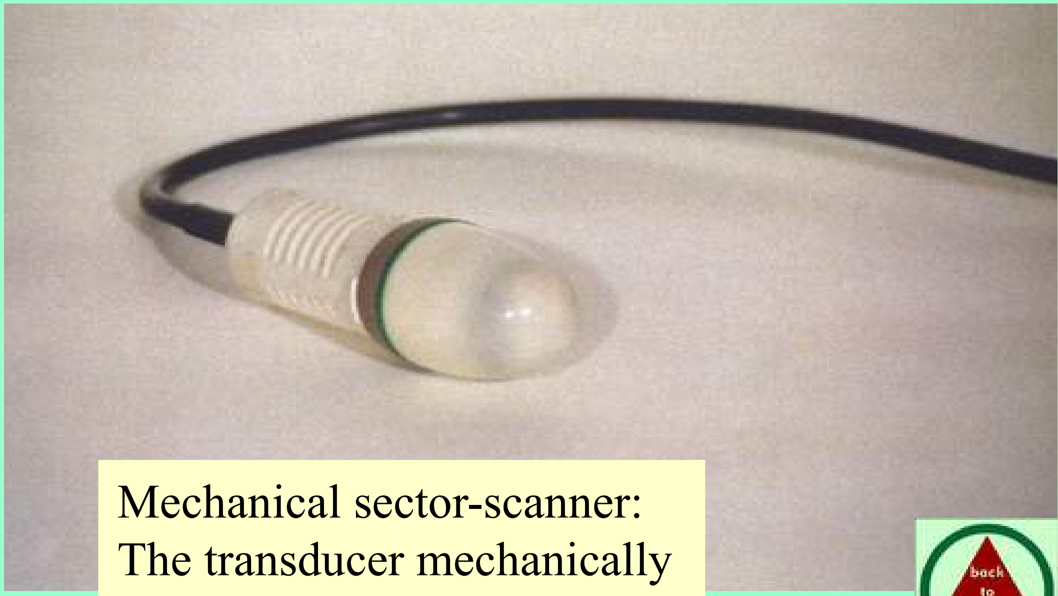
No. 119 **description:** **Sonoline SX**

type of device: B-, M-Mode Doppler **producer/distributor:** Siemens AG, Erlangen

development: 1982/1983

frequency: 3.5 and 5 MHz **time of production:** beginning 1983

B-Mode device, mechanical sector-scanner with 3.5 and 5 MHz. Also M-Mode and Doppler-Mode. Zoom. Measurements of distance and volume, calculation of delivery date.
This scanner was developed parallel to the linear-scanner Sonoline LX with identical components as part of the „Sonoline“ series.
With a size of only 30 x 24 x 40 cm it was a small, portable scanner-unit for universal use.



Mechanical sector-scanner:
The transducer mechanically "wobbeles" to and fro.

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No. 119 SK **description:** **Sonoline SX**

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development:

frequency: 3.5; 5 MHz **time of production:** 1982-1984

Sector Scanner

Sample mechanical sector scanner probes with varying ultrasound frequencies, each with three identical transducers on a rotating support.
(With guidance for puncture tubes.)

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No. **124** **description:** **ADR 2130**

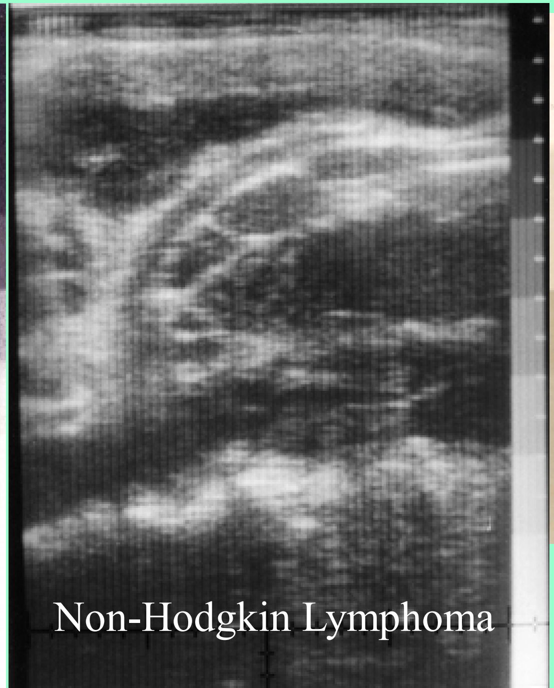
type of device: B-Mode **producer/distributor:** ADR/Kranzbühler & Sohn

development: 1969-1971

frequency: 1-7.5 MHz **time of production:** beginning 1971

Real-time B-Mode device, linear multi-element array probe with 64 single elements.
10 gray scales, 20-40 frames/sec. , 50-120 lines. Freeze frame. Electronic caliper.
This scanner was developed by ADR in Phoenix, Arizona, and very successfully distributed by Kretz, later by Kranzbühler. Used mainly in Obstetrics and Internal Medicine.


14th week/gestation


Non-Hodgkin Lymphoma

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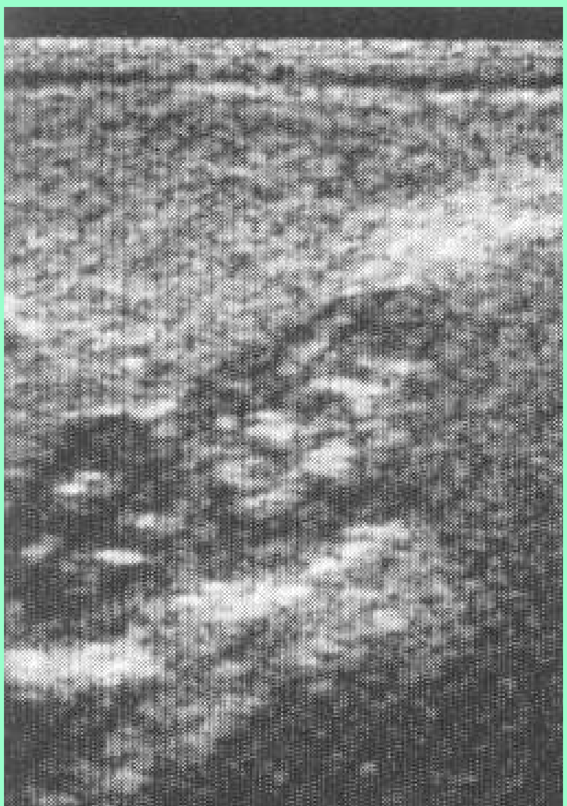
No. 125 **description:** Sonolayer SAL – 20 A

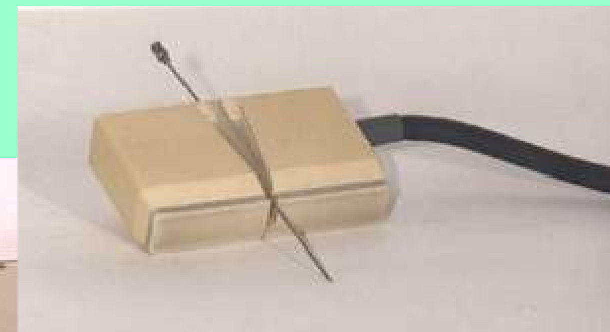
type of device: B-Mode **producer/distributor:** Toshiba, Tokyo

development: 1977-1979

frequency: 2.4 and 3.5 MHz **time of production:** beginning 1979

B – mode, real time. Linear-scanner with electronic focusing. 8 gray scales.
No storage of the screen images possible. Alphanumerical keys for patient's data. Biopsy probe.





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No. 127 **description:** **Multison 400**

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development: c. 1975

frequency: 2.5 and 3.5 MHz **time of production:** beginning 1977

B-mode, real time, linear array technique.
30 frames/s with 2.5 MHz,
40 frames/s with 3.5 MHz.
Electronic caliper.
Origin: Dr. F. Lorenz, Berlin

Array not yet with dynamic focusing, only one transformation layer. Already with micro divisions, however. The assembly was essentially aligned for separate modules. Image quality not satisfactory with 2.5 MHz

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No. **127 SK** description: **Multison 400**

type of device: B-Mode producer/distributor: Siemens AG, Erlangen

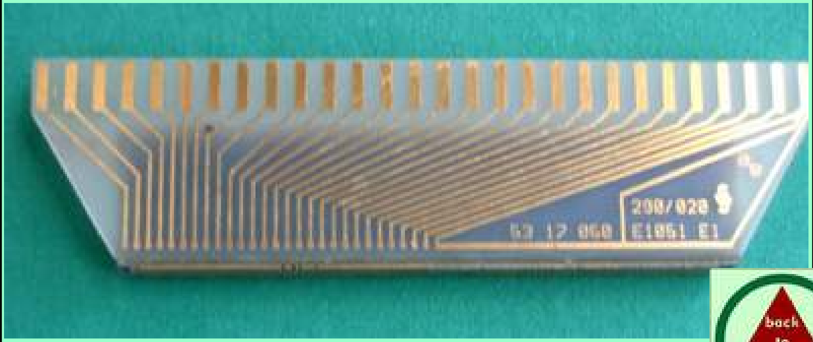
development:

frequency: 2.5 MHz time of production: beginning 1975

Linear Array

First generation linear array, not yet with dynamic focusing, with only one transformation layer, however already with micro divisions.
The assembly was essentially aligned for separate modules.

Image quality not satisfactory.



No. 128 **description:** # Imager 1000

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development:

frequency: 2.5 and 3.5 MHz **time of production:** beginning 1977

Early linear array system, fix focus in transmitting and receiving.
No dynamic focusing yet.
Only two frequencies: 2.5 and 3.5 MHz.

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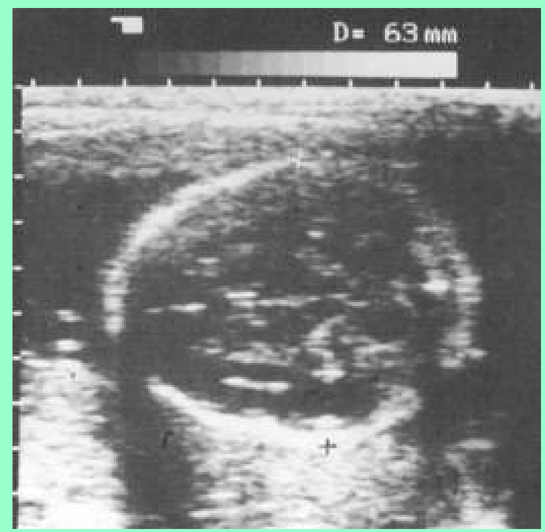
No. 129 **description: Imager Serie 2000**

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development: 1979/1980

frequency: 3.5 and 7 MHz **time of production:** 1980-1985

Real-time B-mode, 3.5 and 7 MHz.
Electronic focusing, microprocessor controlled. Alphanumerical input of patient’s data.
Electronic measuring auf distances.
Mainly used for Obstetrics and Gynecology, also for abdominal diagnostics.



Fetal skull, 24th week of pregnancy
(Holländer)

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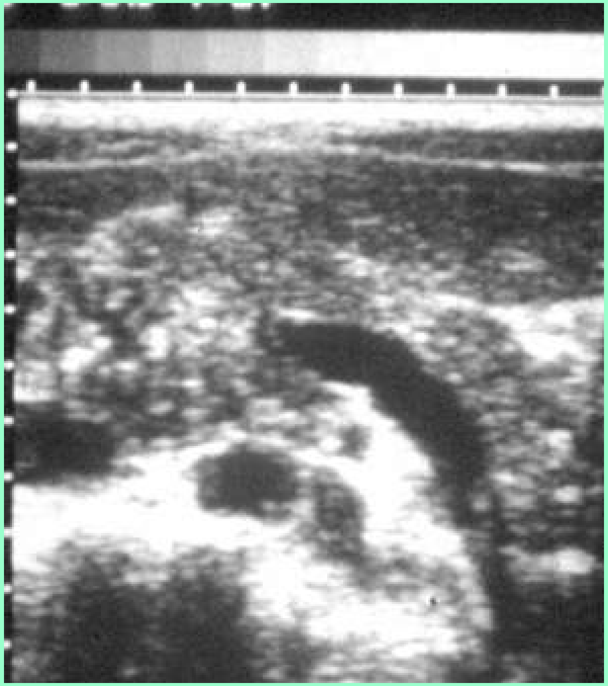
No. 130 **description:** Imager 2380

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development: 1978/80

frequency: 2.5 and 3.5 MHz **time of production:** since 1980

Real Time B-Mode, 2.5 and 3.5 MHz.
Dynamic focusing (receiver). Electronic multi-caliper for measuring distance, circumference, area and volume. Storage of measurements.



chronic calcified pancreatitis

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No. **131** **description:** **Sonoline 1000**

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development:

frequency: 3 and 4 MHz **time of production:** 1983

Portable real-time system, linear array, 3 and 4 MHz. Dynamic focusing, zooming, caliper for measuring distance, circumference, area, volume, time and biometrical data. Mainly in use for Obstetrics.

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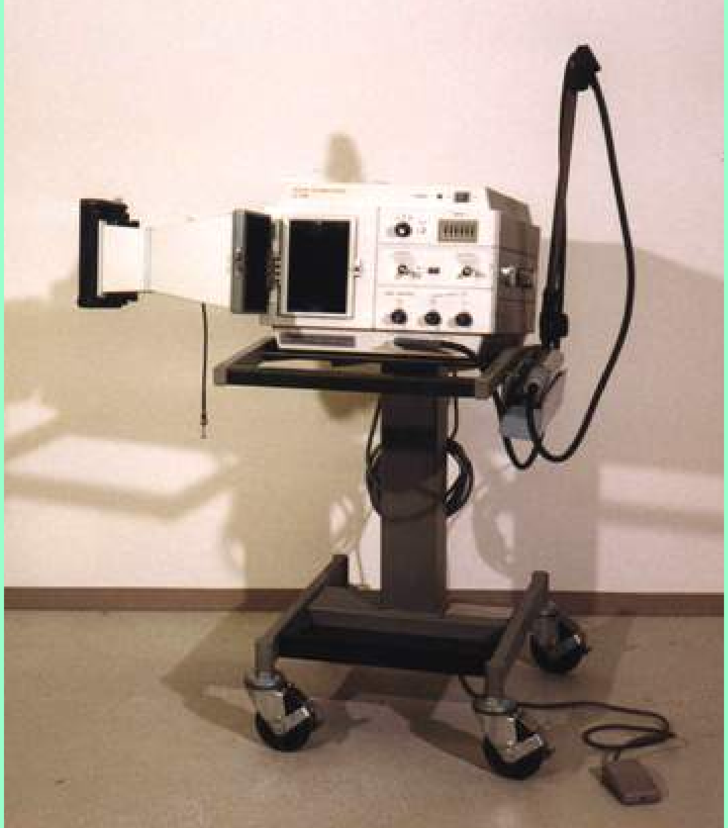
No. 133 description: **Linear Scanner LS 1500**

type of device: B-Mode producer/distributor: Picker Int., USA

development: 1979

frequency: 3 and 5 MHz time of production: since 1979

Real Time B – Mode, linear array, 3 and 5 MHz
Display on X – Y monitor. Storage.



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No. 134 **description:** Axiscan 5 A

type of device: B-Mode **producer/distributor:** Roche / Kontron

development:

frequency: 2 MHz **time of production:** 1976 - 1981

Real-time B – Mode, linear array, 2 MHz. Portable. 64 elements, 8 of them active for one line of the image. Mainly in use for Obstetrics.

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No. 135 **description:** Kontron Sigma 20

type of device: B-Mode **producer/distributor:** Kontron Instruments

development:

frequency: 3.5 and 5 MHz **time of production:**

Real-time B-Mode, linear phased array. Also TM-Mode.

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No. 141 **description:** CS 9200

type of device: B-Mode **producer/distributor:** Hitachi/Picker

development:

frequency: 3.5 - 7.5 MHz **time of production:** 1990-1995

B-mode system with curved and linear array probes; here with 3.5 MHz curved array for appications in Internal Medicine.
Origin: Klinikum Ibbenbueren

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German Ultrasound Museum

Collection (Last Update June 2013)

- From material-testing to A-Scan
- B-Scan:
    - Compound scanner
    - Mechanical real-time devices
    - Electronic real-time devices

- Special developments
- Doppler-systems
- Other objects
- Cut transducers without apparatuses

No. 136 description: **Diasonics RA1**

type of device: B-Mode / Doppler

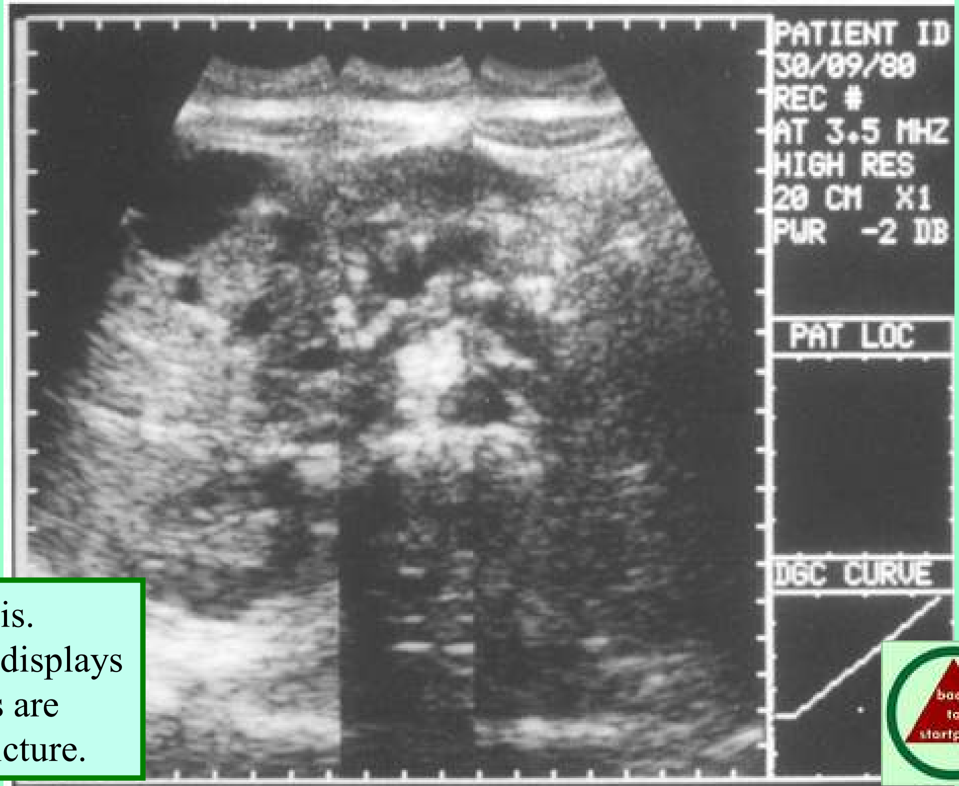
producer/distributor: Diasonics/Siemens AG

development: 1978 -1980

frequency: 2 - 7.5 MHz

time of production: since 1980

Real-time B-Mode. Mechanical sector scanner. The probe for „small parts“ is coupled with a pw-Doppler-probe (see No.136 SK1). Documentation by instant camera.
In the 3.5 MHz probe three sector scanners are synchronized for a wide field of view (136 SK2). A special scanner arm enables automatic positioning. The RA1 was the first „high end“ system.



Chronic pancreatitis.
This cross section displays how 3 sector scans are joined to form 1 picture.

No. **136 SK1** description: **RA1 Small –Parts Probe**

type of device: B-Mode Doppler

producer/distributor: Diasonics/Siemens AG

development:

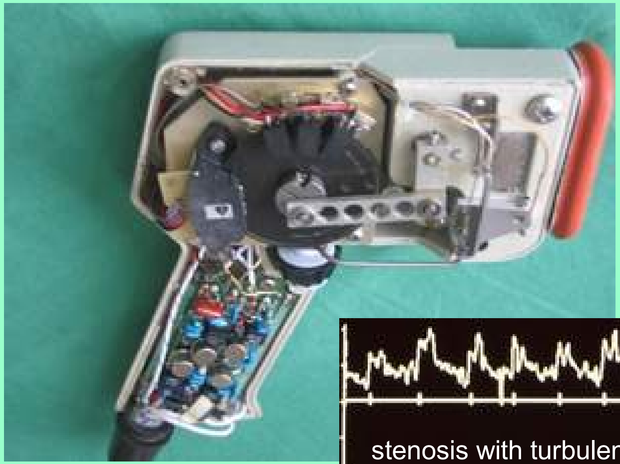
frequency: 7.5 / 2 MHz

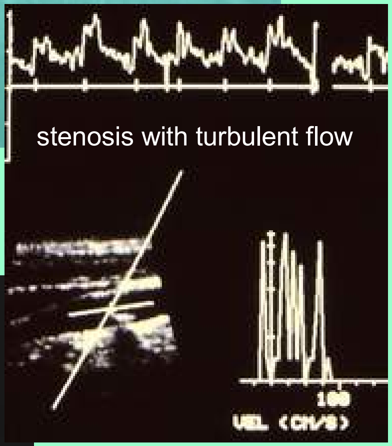
time of production: 1978-1980

"Small-Parts" Duplex Probe

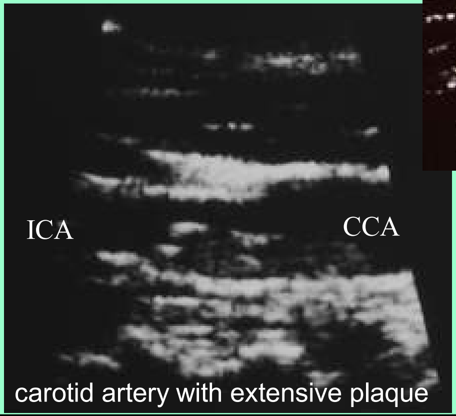
Mechanical sector scanner (wobbler) with high resolution; separate pw-Doppler. Both probes are joined in one oil-filled case.
Position, size and angle of the Doppler sample volume can be adjusted within the field of view of the B-Mode probe.
Crude spectral display.

Frequencies: 7.5 MHz B-Mode
2.0 MHz Doppler Mode





stenosis with turbulent flow



carotid artery with extensive plaque

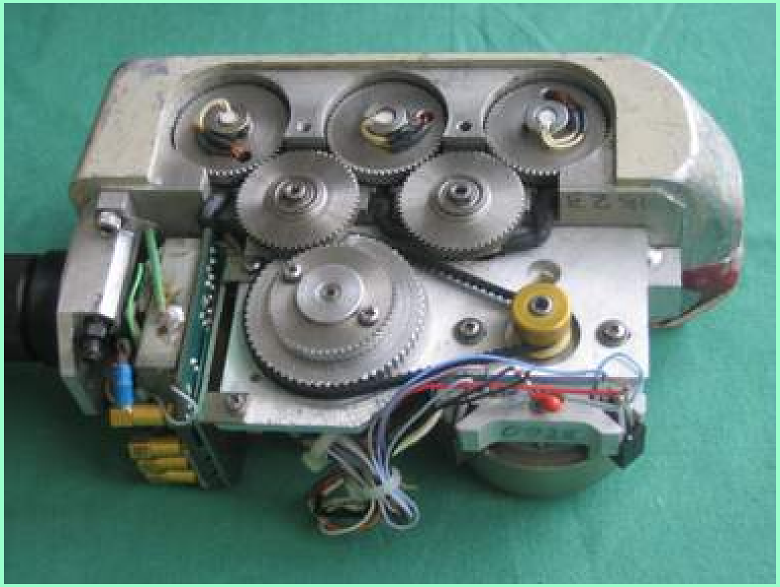
No. **136 SK 2** description: **RA1 Mehrfachsonde**

type of device: B-Mode producer/distributor: Diasonics/Siemens AG

development:

frequency: 3.5 MHz time of production: 1978-1980

Mechanical multi transducer system
Three synchronously rotating transducers for displaying larger body surfaces.
Each transducer displays a pre-defined part of the sectional plane. The transducers are alternately activated.
The whole picture is displayed by combining the three separate scans (see No. 136).
Relatively low frame rate.



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No. 137 **description:** Color Doppler SSD 880

type of device: B-Mode, Color-Doppler **producer/distributor:** Aloka Co, Tokyo

development: 1980-1985

frequency: **time of production:** 1985-1992

Real-time B-Mode, phased array technique with integrated color-Doppler (Color Coded Duplex). First system with integrated combination of A-Mode, TM-Mode, B-Mode, Doppler-Mode (cw- pw- and directional color Doppler).

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No. 138 **description:** Sonoline 8000

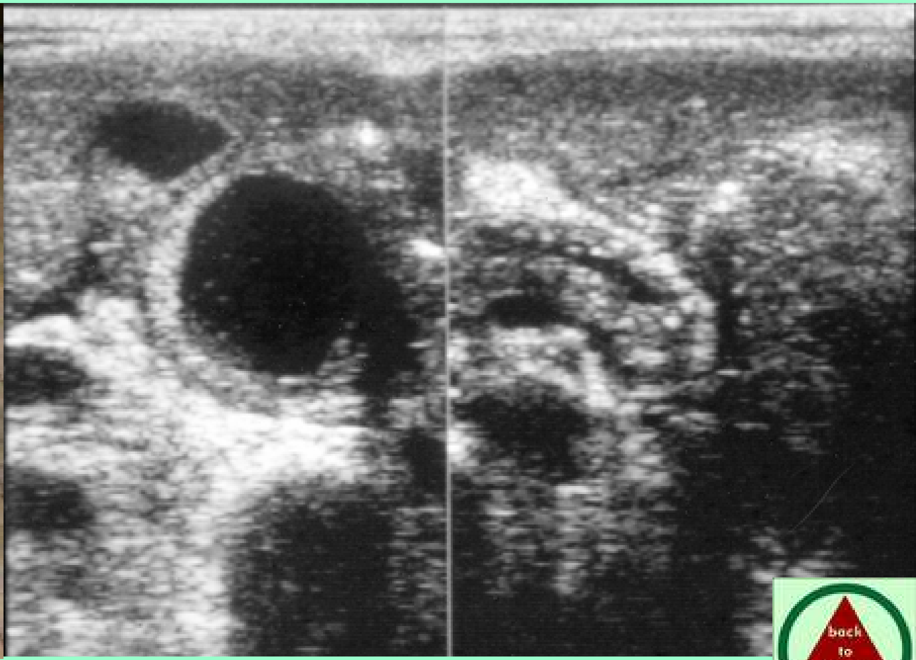
type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

development: 1979-1982

frequency: 2.5-7.5 MHz **time of production:** 1982-1985

Real-time B-Mode, linear array technique. Dynamic focusing (transmitter and receiver). First fully digitalized ultrasound device.

pancreas pseudo-cyst / chronic pancreatitis



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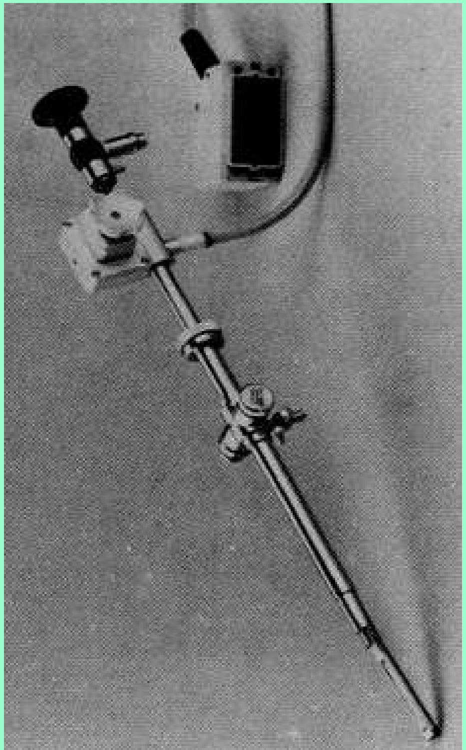
No. **138 Z 1** description: **Ultrasound Laparascope UM 2 for Sonoline 8000**

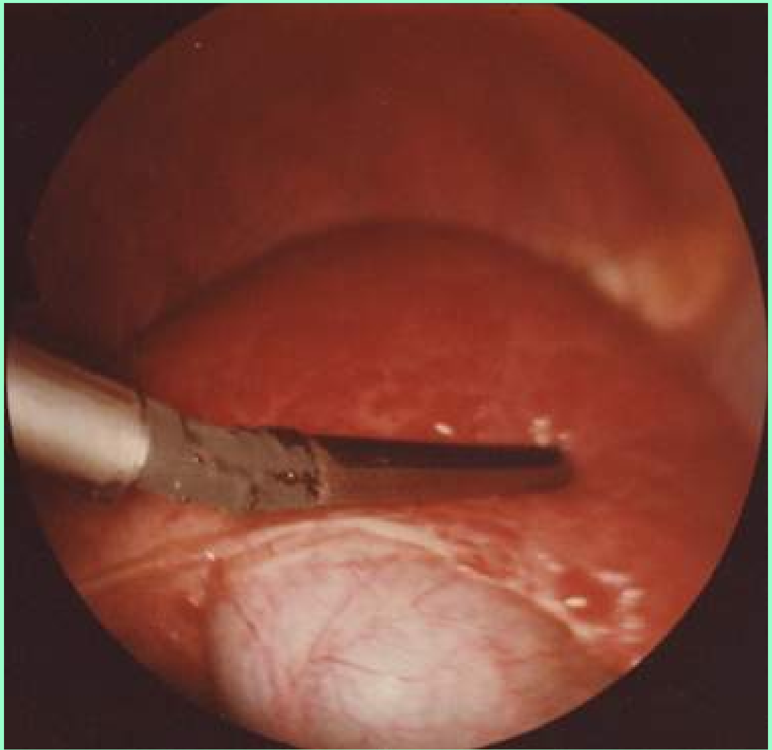
type of device: B-Mode, producer/distributor: Siemens AG, Erlangen

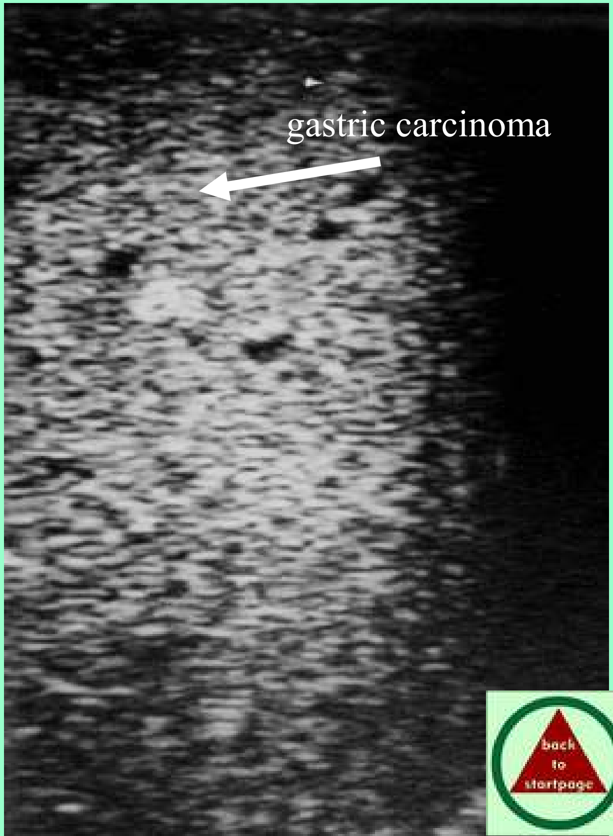
development: since 1982

frequency: 7.5 MHz time of production: prototype 1983

Linear array for laparoscopy with 96 single elements. Sterilization possible with cold gas. Dynamic focusing by digital signal processing in 16 channels. Each element is connected to the Sonoline 8000 by a separate coaxial cable. This intricate requirement was not easy to fulfill, especially the connection between the flexible array and the fixed laparoscopic tube.







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No. 138 Z 2 **description:** Laparascope for Sonoline 80

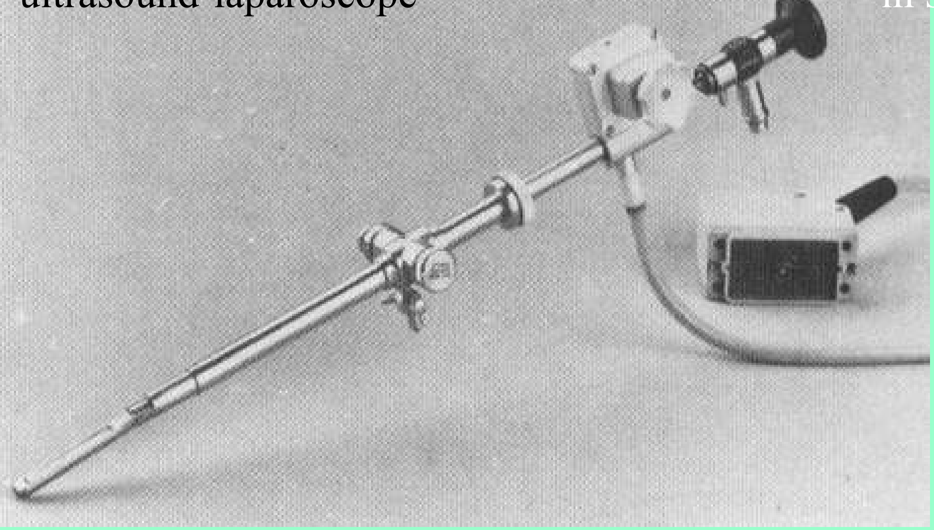
type of device: Linear Array **producer/distributor:** Siemens AG, Erlangen

development: 1982

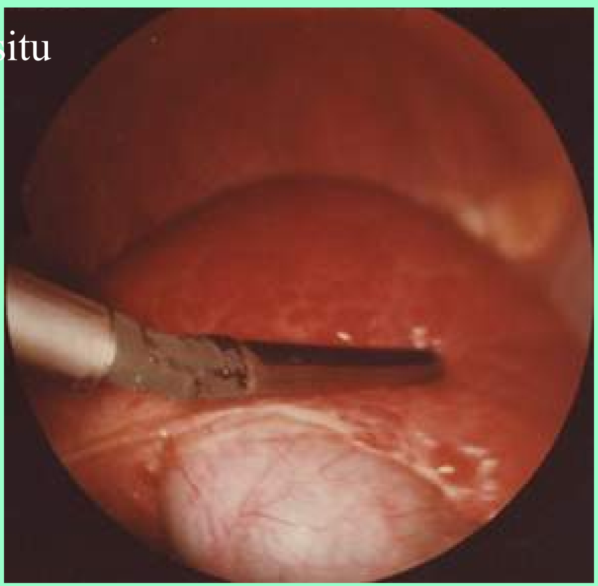
frequency: 7.5 MHz **time of production:** prototype

Ultrasound transducer at the end of a 30 cm long probe, which can be inserted through the 10 mm wide tube of a customary optical laparoscope. The linear transducer has an active length of 35 mm. It is maneuverable in the ultrasound plane from -10° to +45°. Dynamic focusing by digital signal processing in 16 channels. Sterilization possible with cold gas.
Each of the 96 single elements is connected to the Sonoline 8000 by a separate coaxial cable. This intricate requirement was not easy to fulfill, especially the connection between the flexible array and the fixed laparoscopic tube.

ultrasound-laparoscope



in situ



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No. 138 SK 1 **description:** Sonoline 8000

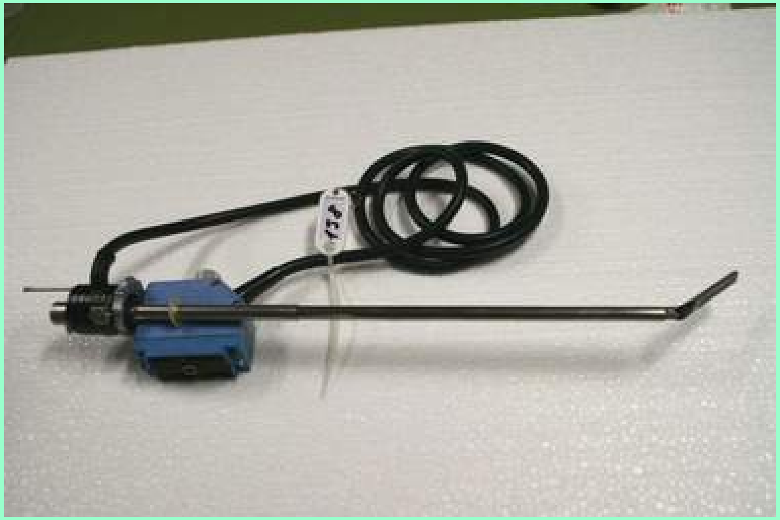
type of device: B-Mode, **producer/distributor:** Siemens AG, Erlangen

development: 1982-1983

frequency: 7.5 MHz **time of production:** 1983-1985

Linear Array

Linear array for laparoscopy with 96 single elements. Sterilization possible with cold gas. Dynamic focusing by digital signal processing in 16 channels. Each element is connected to the Sonoline 8000 by a separate coaxial cable. This intricate requirement was not easy to fulfill, especially the connection between the flexible array and the fixed laparoscopic tube.



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No. 138 SK 1 description: Sonoline 8000

type of device: B-Mode, producer/distributor: Siemens AG, Erlangen

development:

frequency: 5 MHz time of production: 1979 - 1982

Linear Array

Linear array, 5 MHz, with 128 single elements. First system with completely digitalized signal processing including beam forming.

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No. 139 **description:** Combison 330 Voluson

type of device: B-Mode, 3D-Imaging, Colorflow Doppler

producer/distributor: Kretztechnik, Zipf

development: 1986

frequency: 3.5-7.5 MHz

time of production: since 1989

B-Mode with mechanical sector, linear und curved array technique. Volume calculation with color-coded images. **First 3-dimensional ultrasound system** with surface view, translucent display and volume calculation. Various special probes, e.g. for intracavitary applications, spectral- and color Doppler.

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No. 140 **description:** ATL Ultramark 9 HDI

type of device: B-Mode, M-, TM-Mode, Colorflow Doppler

producer/distributor: Advanced Technology Labs.

development:

frequency: 2 - 10 MHz

time of production: 1988-1992

At that time ATL's top ultrasonic device, and with 565 lbs (256,3 kg) very impressive. For use in Obstetrics, Gynecology, Urology, Cardiology, small parts, vascular lab, Neurology.
Probes with phased, annular, linear and curved arrays; also mechanical sector, TEE, vaginal endo-probes, intraoperative probes. B-mode triggering by ECG optional.
Our system is equipped with a linear probe of 5-7 MHz and a sector probe of 2-3 MHz including software for intracranial investigations. M-mode also works in color.
Separate monitors for black-and-white and for colored displays.
Software-controlled multi-function switches at a touch-sensitive gas-discharge plasma display.
Independent steering of B-Mode display, colorflow-Doppler and cw-Doppler.
Frame rate up to 156/s, depending on depth and angle.

Origin: Klinikum Ibbenbueren

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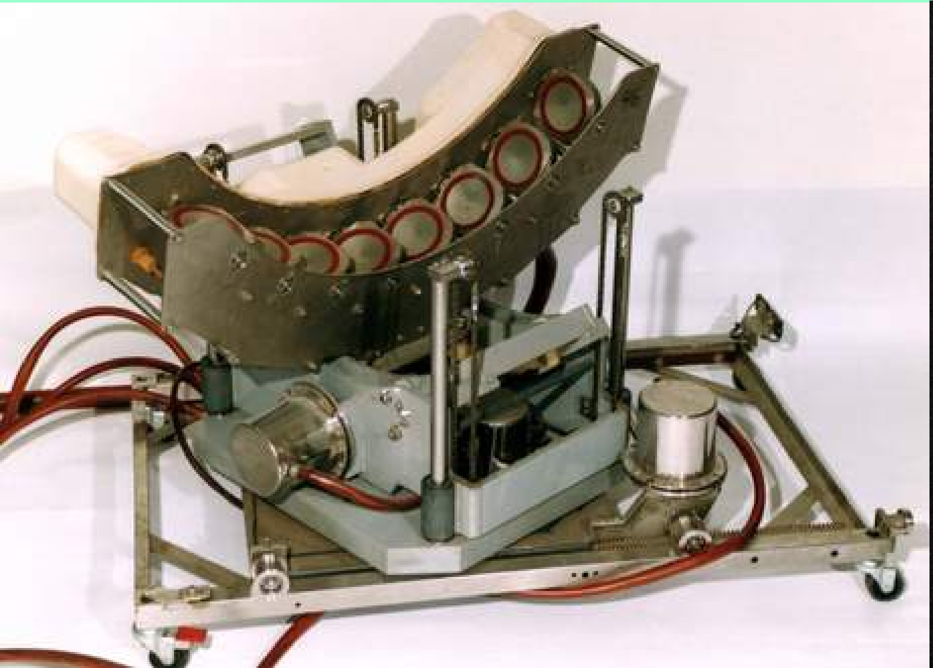
No. 142 **description:** Octoson

type of device: B-Mode **producer/distributor:** Ausonics, Sydney

development: 1978

frequency: 3 MHz **time of production:** since 1978

Very complex Compound system, simultaneous mechanical scanning by 8 large statically focused transducers within a water tank. Connection to patient by means of a large plastic examining surface upon which the patient lies. Originally designed for gynecological use, the Octoson was later modified for mamma inspections.



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German Ultrasound Museum

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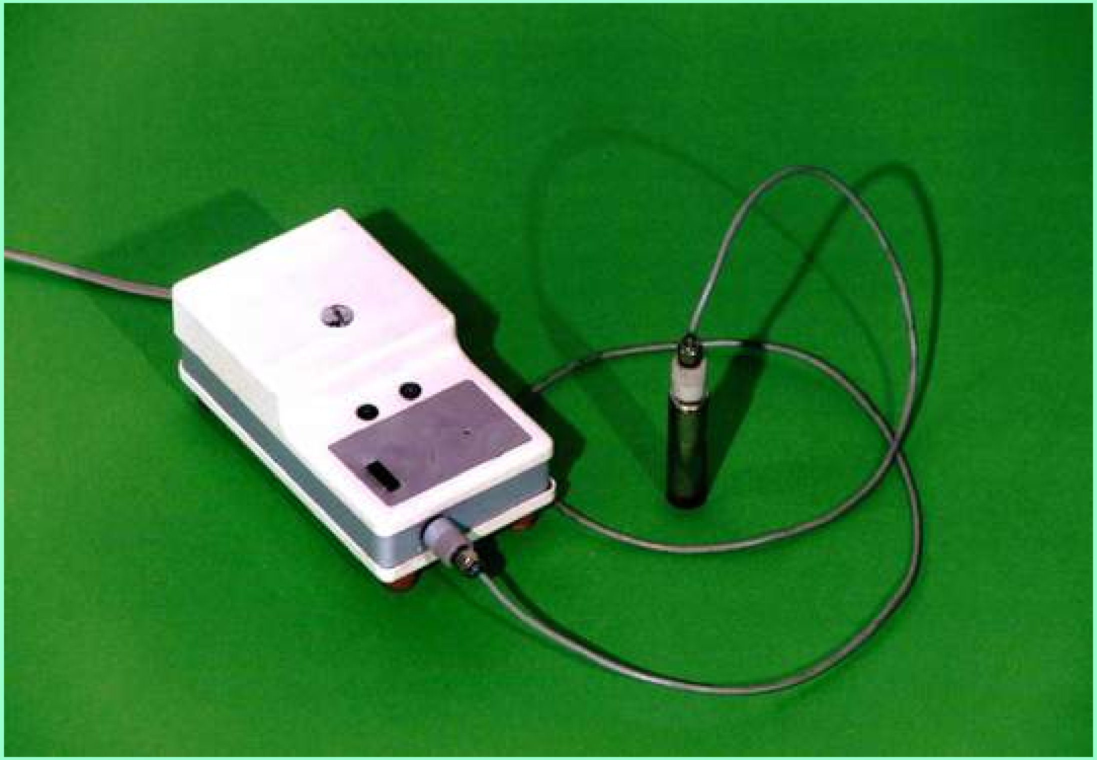
No. **140** description: **ENT - Detector**

type of device: Echo Detector producer/distributor: VEB Ultraschalltechnik, Halle

development: 1978

frequency: 4 MHz time of production: since 1979

Echo-Detector, pocket-size.
This device showed the existence (pathological finding) or none-existence of the echo of the back wall of the maxillary sinus via either a red or a green LED.



No. 141 **description:** MiniVisor

type of device: Echo Detector **producer/distributor:** Organon Teknika Corp.

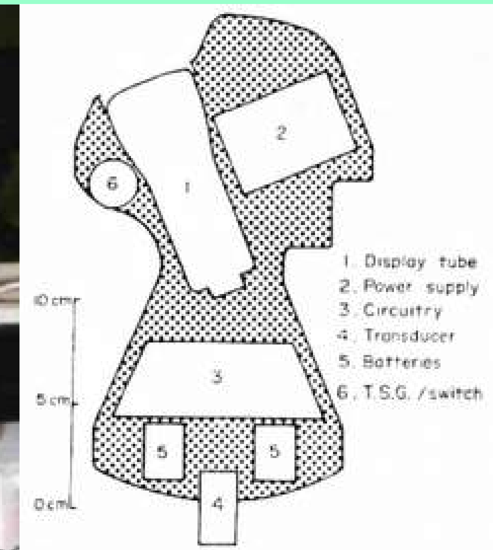
development:

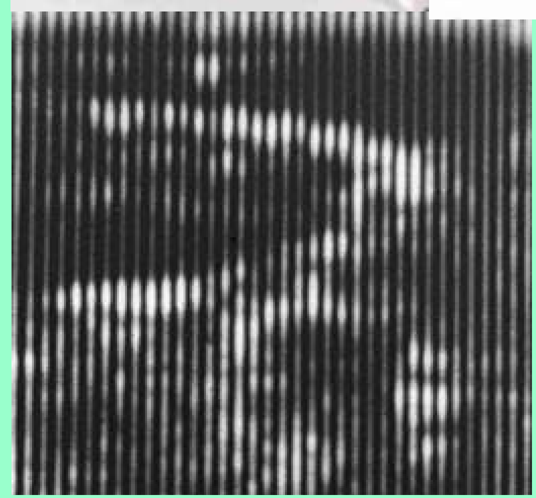
frequency: 3.12 MHz **time of production:** 1979

Portable Ultrasound Scanner

Battery-powered scanner with integrated linear-array. Contrary to customary array systems with many elements, of which several were activated simultaneously during one sounding period, this array had only 20 elements of which just 1 at a time was activated – similar to the Eye-Scanner (system Buschmann / Kretz) with 12 single elements.

At that time smallest scanner, 1,5 kg, c. 26 x 16 x 16 cm. Display only 33 x 43 mm. Just 1 switch for modulating amplification.





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No. **054 z** **description:** **Device for Bone Scanning**

type of device: A-Mode **producer/distributor:** Institute for Biophysics, Halle

development: 1968

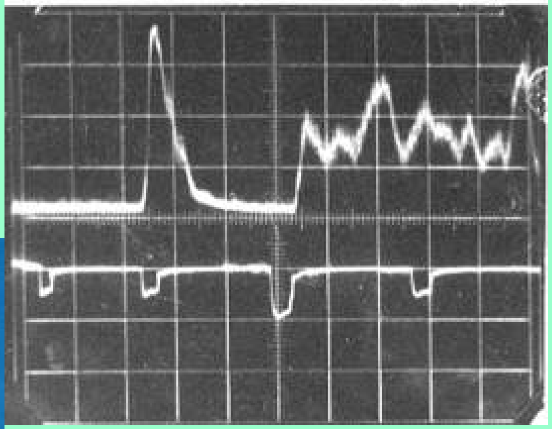
frequency: 2.5 to 7.5 MHz **time of production:** 1968

Scanner to be connected to the A-Mode device series GA 10 for measuring the speed and the attenuation of sound at the tibia in vertical and in oblique direction.

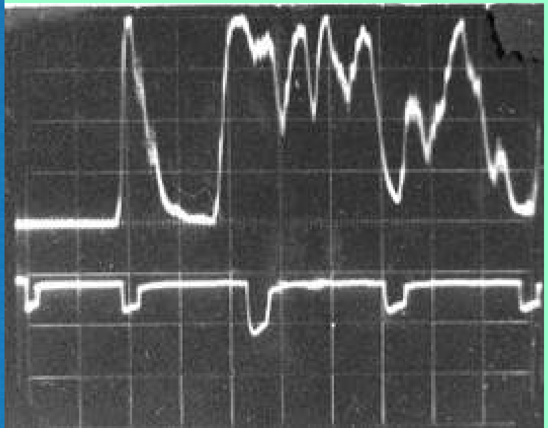
Model II

See device No 54 GA 10

Origin: R. Millner, Halle



normal



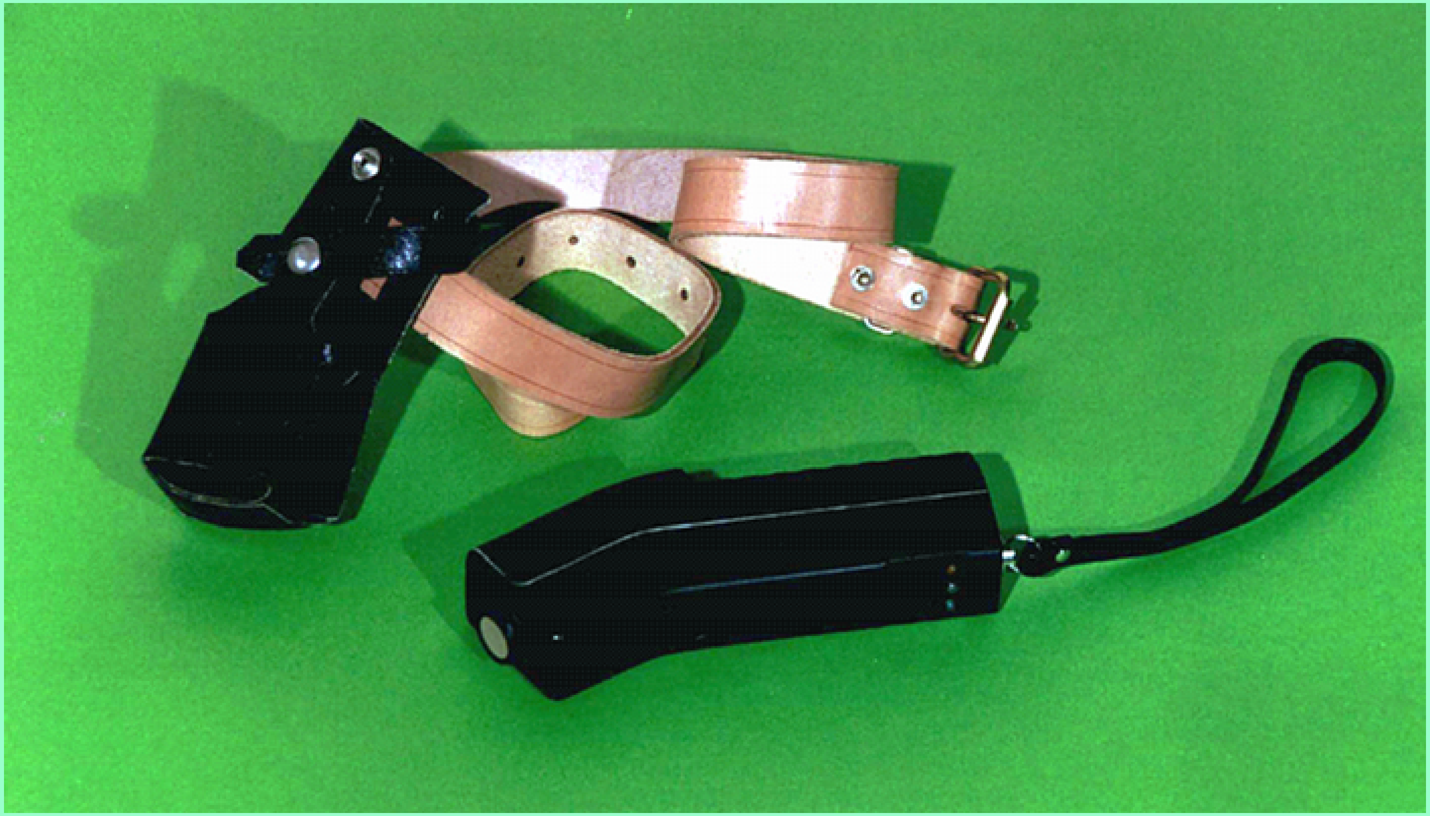
osteoporosis

No. 144 **description:** Gestation detector TuR-TD 20S

type of device: Doppler **producer/distributor:** VEB Transformatoren und Röhrenwerk Dresden

frequency: 2 MHz **time of production:** 1979

Portable Doppler system for the detection of gestation.
Also used in human medicine on an experimental basis.



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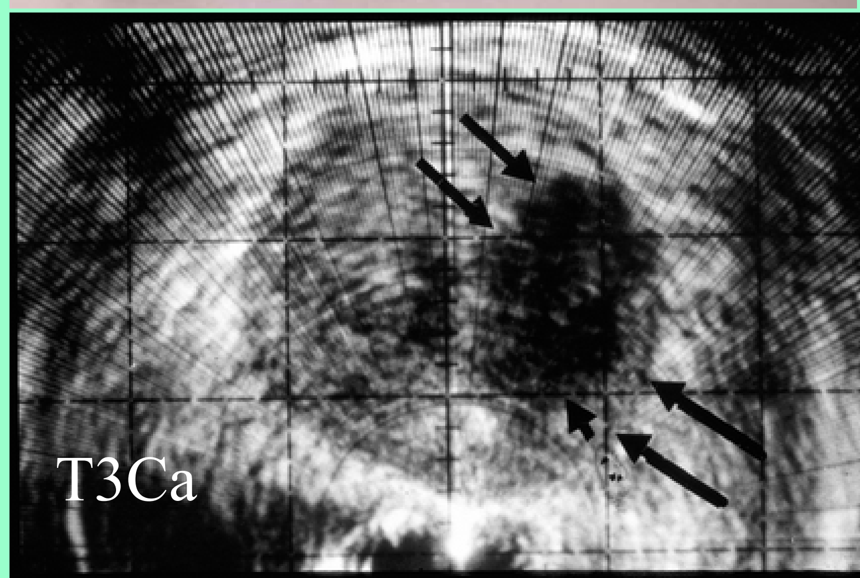
No. **145** **description:** **Trans Rectal Scanner 9526**

type of device: B-Mode **producer/distributor:** Brüel & Kjaer, DK

development: 1978 -1979

frequency: 3.5 MHz **time of production:** 1979

B-Mode, mechanically rotating scanner, exclusively for transrectal use.
Coupling by a water-filled standoff.
Origin: B. Frentzel-Beyme, Berlin



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No. 146 **description: Ultrasonic Endoscopic Probe UM 2**

type of device: 360° Sector Scanner **producer/distributor:** Aloka/Olympus

development: since 1981

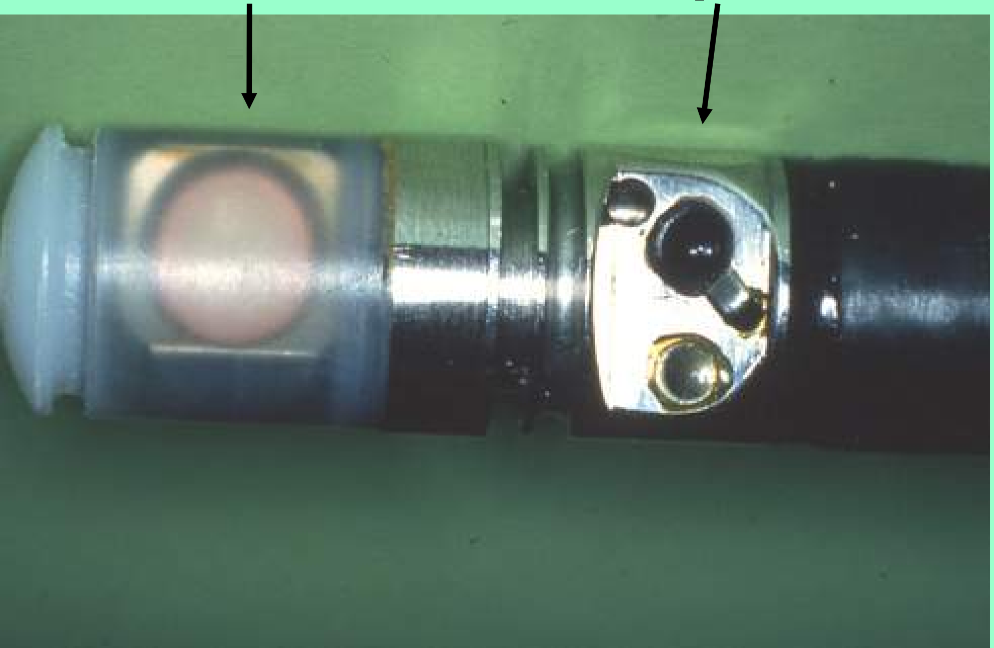
frequency: 7.5 MHz **time of production:**

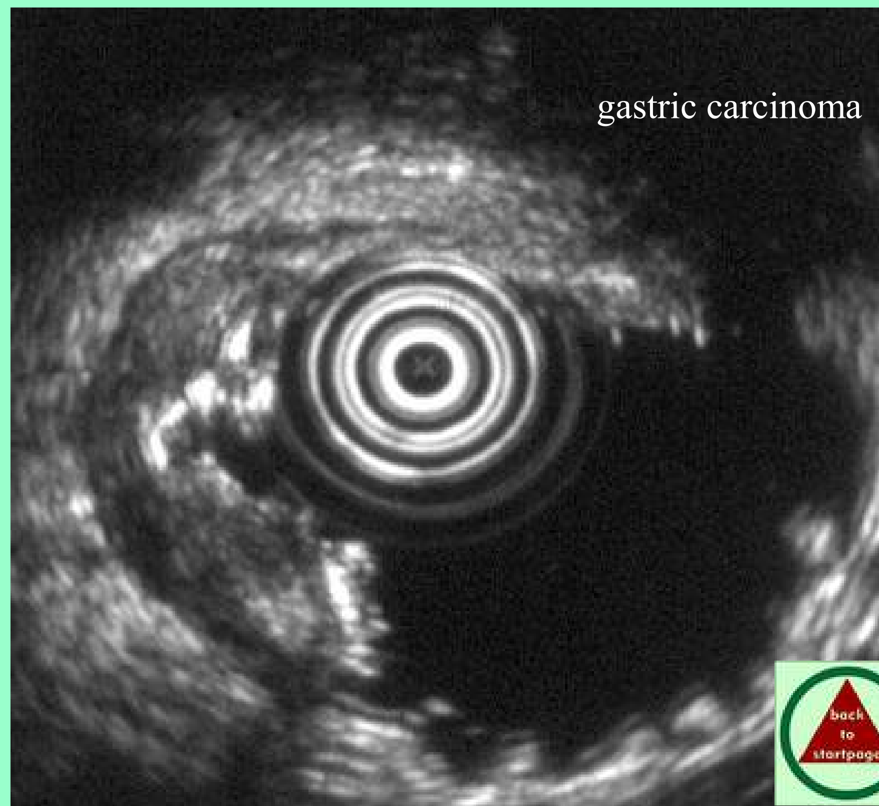
Mechanical 360° sector-scanner at the tip of a gastroscope with oblique optics for viewing. Originally developed for the inspection of organs next to the stomach, such as the pancreas; mostly used for the evaluation of the walls of the esophagus and the stomach - complementary to optical endoscopy.

See also No. 138, Sonoline 8000.

ultrasound transducer

optics





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No. **157** description: **Focoscanner**

type of device: A-, B-, and C-Mode

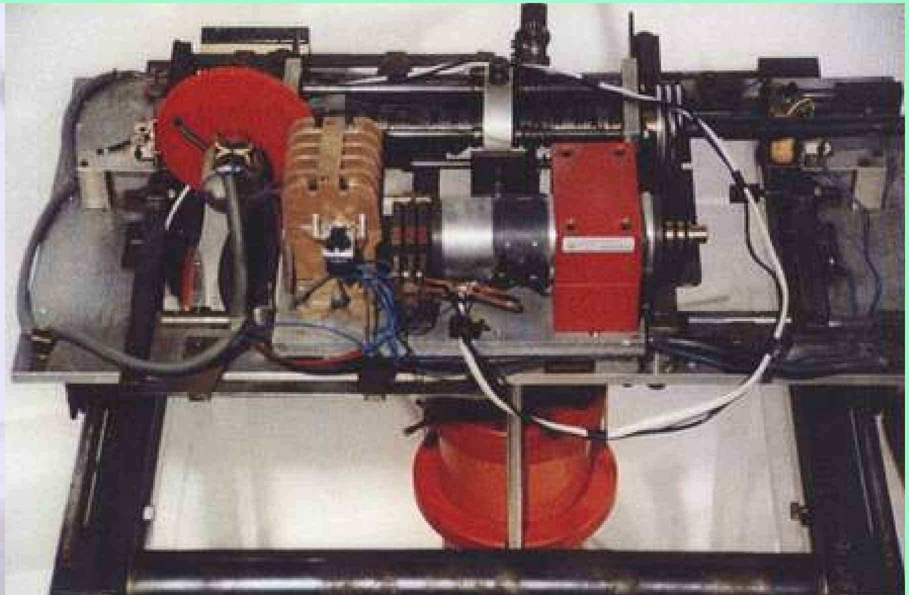
producer/distributor: Instit. M. von Ardenne, Dresden

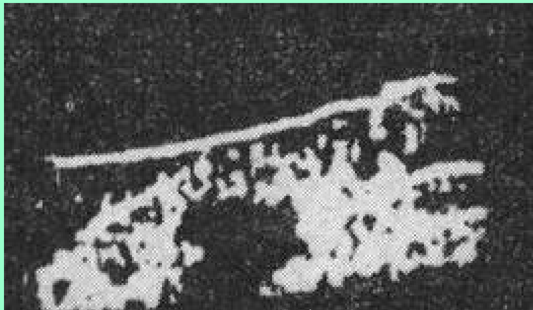
development: 1959/60

frequency: 3 MHz

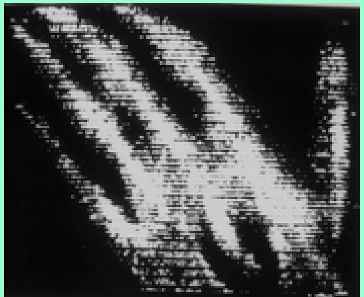
time of production: 1960

A-, B- and C-system. The plane scanned is at right angle to sound propagation (C-plane). The transducer is moved in one line by a spindle. Line break by cograils.
For sound generation a virtual punctiform sonic source is generated in the level of the object by a lens and this performs the scanning procedure.
All echoes are depicted in the same focal intensity. Scanning time about 30 sec.
If a stone was localized, a fragmentation could be tried, as the maximum power output was 400 Watts. - Experimental device without clinical application.





breast cancer



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No. 160 description: Sonoline SI 1200

type of device: B-Mode, producer/distributor: Siemens AG, Erlangen

development:

frequency: 2.5-3 MHz time of production:

Phased array device specially constructed for cardiological diagnostics.
To minimize electronic layout, the focusing is done by 2 x 48 channels with alternating transmission cycles.
Color-coding of blood-flow (duplex mode).

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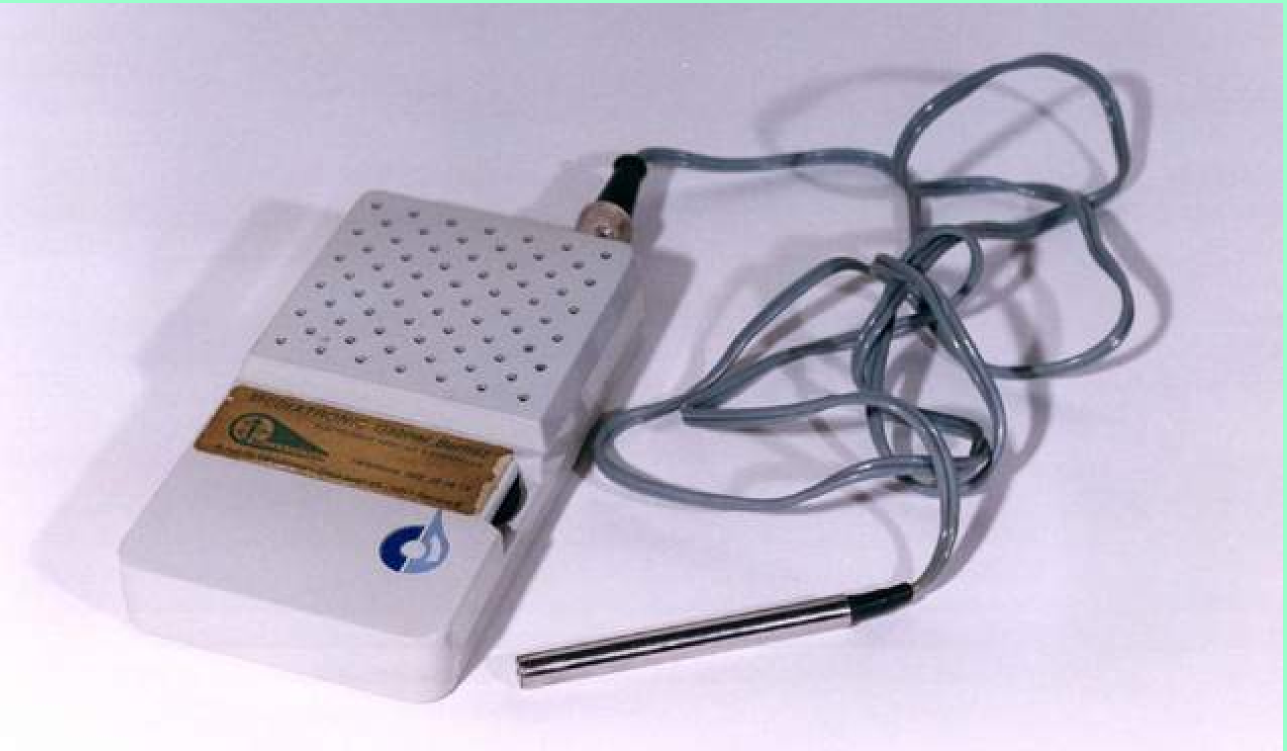
No. 260 **description:** **Pocket Doppler**

type of device: cw-Doppler **producer/distributor:** Mediatronics, Geneva

development: 1967

frequency: 8 MHz **time of production:** since 1968

Cw-pocket Doppler, 8 MHz
Simple yet highly-sensitive non-directional device.
First investigations of the fronto-orbital arteries, so called indirect Doppler sonography.
Origin: R. Müller, Basel



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No. 261 **description:** Fetal Puls Monitor FM 2

type of device: cw-Doppler **producer/distributor:** Sonicaid/Kranzbühler

development: 1968

frequency: 1.5 MHz **time of production:** 1968-1971

Cw–Doppler system with multiple elements transducer 1.5 MHz.
Integrated thermal recorder.
First device for continuous monitoring of fetal heartbeats.
Origin: Kranzbühler, Solingen.

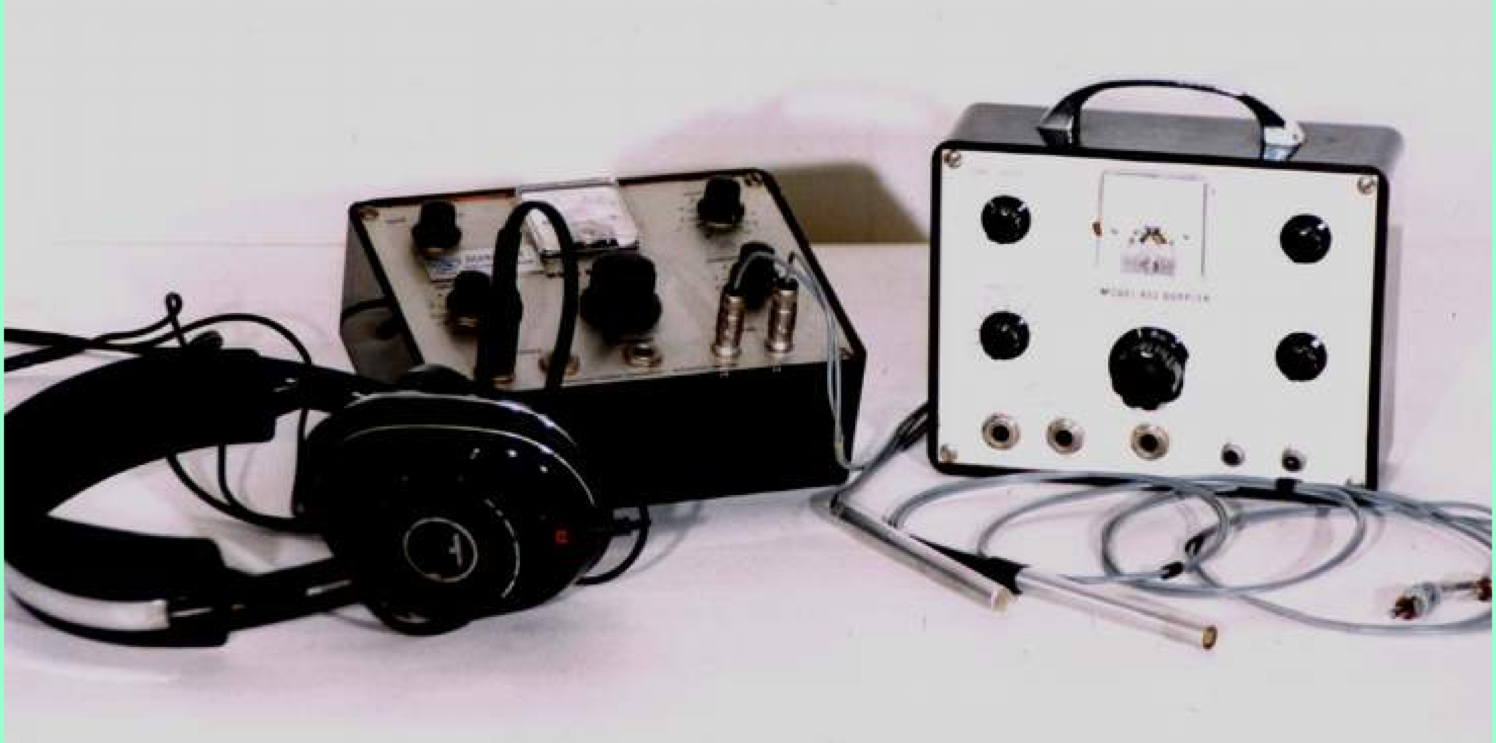
No. 262 **description:** **Parks Model 802**

type of device: cw-Doppler **producer/distributor:** Parks Electronics, USA

development: 1966-1968

frequency: 5 MHz **time of production:** since 1968

Cw-pocket Doppler system, non-directional, 5 MHz.
Used for first recordings of intracardial flow (Seipel)
Origin: L. Seipel, Tübingen.



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No. 263 **description:** Parks Model 806

type of device: cw-Doppler **producer/distributor:** Parks Electronics, USA

development: 1969

frequency: 5 MHz **time of production:** 1969 - 1970

Bidirectional Doppler system, 5 MHz. Direction of blood flow is indicated by 2 separate gauges and by 2-chanel acoustics. Outlet for printer.
Model 806 was the first bidirectional model by Parks, soon to be replaced by Model 906.
Origin: R. M. Schütz, Lübeck.

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No. 264 description: **Parks Model 906**

type of device: cw-Doppler producer/distributor: Parks Electronics, USA

development: 1970

frequency: 5, 10 MHz time of production: 1970

Two frequency bidirectional cw-Doppler system, 5 and 10 MHz.
Flow direction is indicated by two gauges as well as acoustically.
Outlet for printer. Replacement of Model 806.
Origin: R. M. Schütz, Lübeck.

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No. 265 **description:** DUD 02

type of device: cw-Doppler **producer/distributor:** Delalande Electronique, F

development: 1969

frequency: 4 MHz **time of production:** since 1970

Cw-Doppler with directional information, 4 MHz.
Zero-crossing-technique displays sum of frequency shift. External recorder.
With a pivot arm and an EDM, this system was deployed for „Doppler-angiography“.
Origin: B. Widder, Ulm

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No. **266** **description:** **DUD 400**

type of device: cw-Doppler **producer/distributor:** Delalande Electronique, F

development: 1970-1972

frequency: 4 MHz **time of production:** since 1972

Cw-Doppler, 4 MHz.
Bidirectional system with integrated thermal printer; connections to external printer, EKG. Wall filter 10, 30 and 100 Hz. Display of averaged Vi and Vm.
Origin: I. Neuerburg-Heusler, Engelskirchen.

No. 267 **description:** UDOP 1

type of device: cw-Doppler **producer/distributor:** Popp Elektronik, Halle

development: 1960-1970

frequency: 2 MHz **time of production:** 1970-1980

Cw-Doppler for fetal monitoring, 2 MHz.
Acoustic information of fetal cardiac actions. First Doppler system in the GDR.
The picture [left] displays a picoskope or oscilloscope used for optical visualization of the signal.
Origin: A. Millner, Halle

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No. 268 **description:** UDOP 2

type of device: cw-Doppler **producer/distributor:** VEB US-Technik, Halle

development: 1968-1969

frequency: 2 MHz **time of production:** 1969-1975

Cw-Doppler system with acoustical information for monitoring of fetal heart actions, 2 MHz. Similar to UDOP 1, but further improved by addition of signal filters and outputs for tape recorder and printer for continuous monitoring.
Origin: R. Millner, Halle

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No. **269** description: **UBD 2**

type of device: cw-Doppler producer/distributor: Instit. for Biophysics, Halle

development: 1974-1976

frequency: 2-10 MHz time of production: 1976-1980

Cw-Doppler system, bidirectional, 2-10 MHz.
Acoustical output, sockets for printer and PC.
System for the center of a vascular Doppler lab, intended for registering flow and volumes, and for determining flow indices, spectral distribution and power.
Origin: U. Cobet, Halle.

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No. 270 **description:** **FD 410**

type of device: cw-Doppler **producer/distributor:** VEB US-Technik, Halle

development: 1975

frequency: 4 MHz **time of production:** since 1977

Cw-Doppler system for fetal monitoring, 4 MHz. Sockets for printer and tape recorder.
Used for continuous monitoring with special probes.
Also deployed for blood flow monitoring (unidirectional).
Origin: R. Millner, Halle

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No. 271 **description:** FD 410 revised version

type of device: cw-Doppler **producer/distributor:** VEB US-Technik, Halle

development: 1977

frequency: 4 MHz **time of production:** 1978-1985

Fetal pulse detector, revised version, 4 MHz
Also deployed for blood flow monitoring (unidirectional).
Origin: R. Millner, Halle.

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No. 272 **description:** **Eucoton S**

type of device: cw-Doppler **producer/distributor:** Siemens AG, Erlangen

development:

frequency: 3-4 MHz **time of production:** 1970

Simple cw-Doppler system for monitoring of fetal cardiac actions, 3-4 MHz.

No. 273 **description:** MDG 2

type of device: cw-Doppler **producer/distributor:** Kretztechnik, Zipf

development: 1969

frequency: 2 MHz **time of production:** since 1970

Cw-Doppler system for monitoring of fetal heart actions, 2 MHz.
Interchangeable probes; sockets for headsets and tape recorder.

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No. 274 **description:** Minivason 9

type of device: cw-Doppler **producer/distributor:** Kretztechnik, Zipf

development: 1972-1973

frequency: 6-8 MHz **time of production:** 1973-1979

Cw-Doppler system, pocket size, battery-powered.
Small loudspeaker, socket for headset, replaceable probe.
This sturdy device – an enhanced version of the „Minifeton“ (No. 278) - was mainly used in out-patient care, also in accidents.

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No. 276 description: TC 2-64

type of device: pw-Doppler producer/distributor: EME, Überlingen

development: 1982

frequency: 2 MHz time of production: since 1983

Pw-Doppler system, 2 MHz, developed by Eden Medizinische Elektronik Überlingen in cooperation with Neurosurgeon Rune Aaslid. First commercially available Doppler system for recording of transcranial (intracranial) blood flow by pulsed Doppler (TCD). Also first to include a 64-point spectral display of the Doppler-signal after fast Fourier transformation (FFT) in the same device. TCD monitoring with the probe fitted to the skull by an elastic strap.– Type TC2-64B was also equipped with 4 and 8 MHz probes for peripheral vascular examinations.

Origin: R. M. Schütz, Lübeck.

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No. 278 **description:** Minifeton

type of device: cw-Doppler **producer/distributor:** Kretztechnik, Zipf

development: 1969

frequency: 2 MHz **time of production:** 1970-1979

Cw-Doppler system for detection and monitoring of fetal heart beats, 2 MHz.
2 models: a) simple pocked Doppler device with acoustical output. b) later sized as an ordinary probe but equipped with remarkable functions: Automatic battery charging in a mount, acoustical output either by stethoscope or via a FM-transmitter by a standard radio.

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No. 279 description: **Doppler 762**

type of device: cw-Doppler producer/distributor: Kranzbühler

development:

frequency: 4 and 8 MHz time of production: since 1977

Cw-Doppler system with frequency filter, calibration and integrated printer. Connects to "frequency analyzer 8106" for spectral analysis (FFT).

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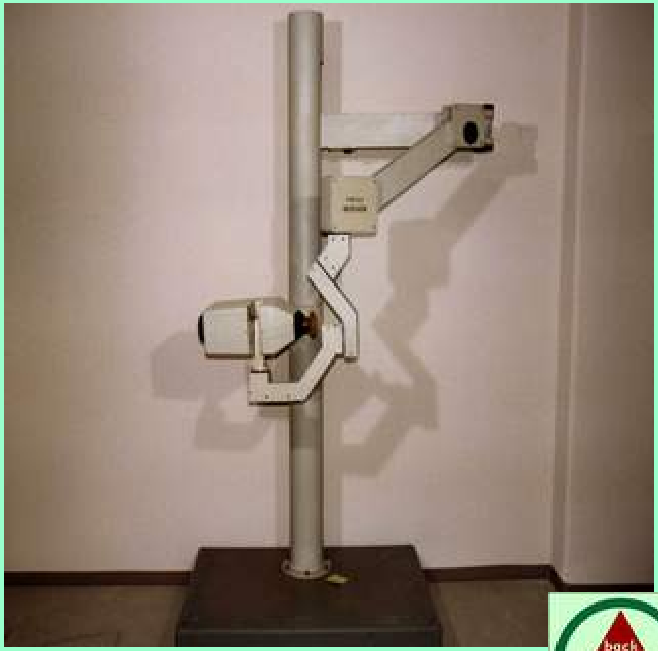
No. 280 **description: Microview**

type of device: Doppler-, B-Mode **producer/distributor:** Picker

development:

frequency: 10 MHz **time of production:** since 1978

Microview Duplex. Mechanical linear scanner with high resolution for small parts-scanning, including Doppler sonography for superficial blood vessels.
The constructional design of the scanner allowed coupling without pressure.
Origin: H. J. Schulz, Hamburg



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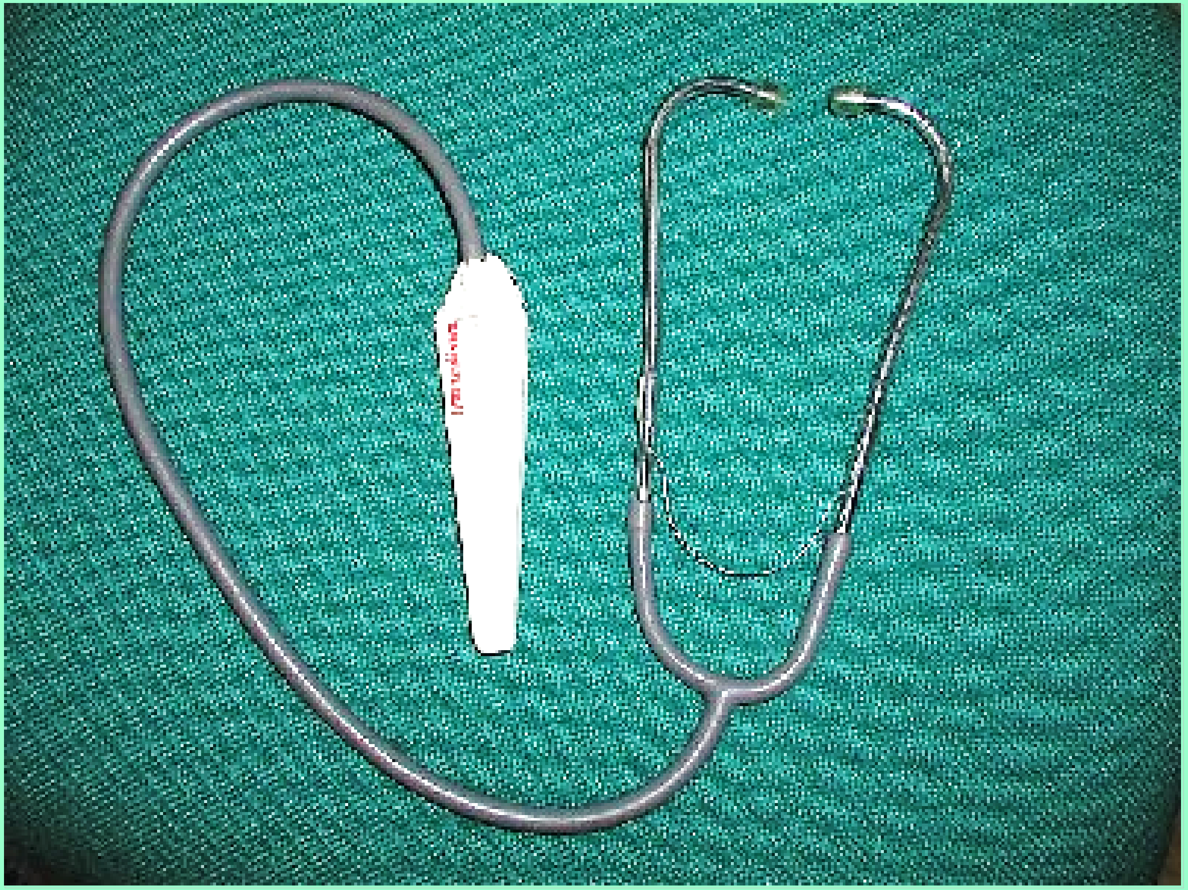
No. 281 description: **Doppler-Stethoscope**

type of device: cw-Doppler producer/distributor: Kranzbühler

development:

frequency: ?? time of production: ???

Doppler – System



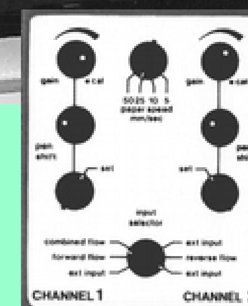
No. **282** description: **Vasoflo 2**

type of device: **cw-Doppler** producer/distributor: **Sonicaid Ltd.**

development:

frequency: **2, 4 and 8 MHz** time of production: **1983-1988**

Bidirectional cw-Doppler System with three frequencies for vascular and for cardiological examinations. Battery/mains operation.
Outphaser separation of forward and reverse flow. This separate flow can be displayed by printer on thermo-sensitive paper, by LEDs and on a none-fade digital memory scope. Acoustical output via integrated loudspeaker or headset (two channel).
Calibration pulses and zero run at the end of every recording.
Origin: Klinikum Ibbenbueren



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Collection of Devices, last update June 2016

No. 346 **description:** # Measuring track in oil bath (new)

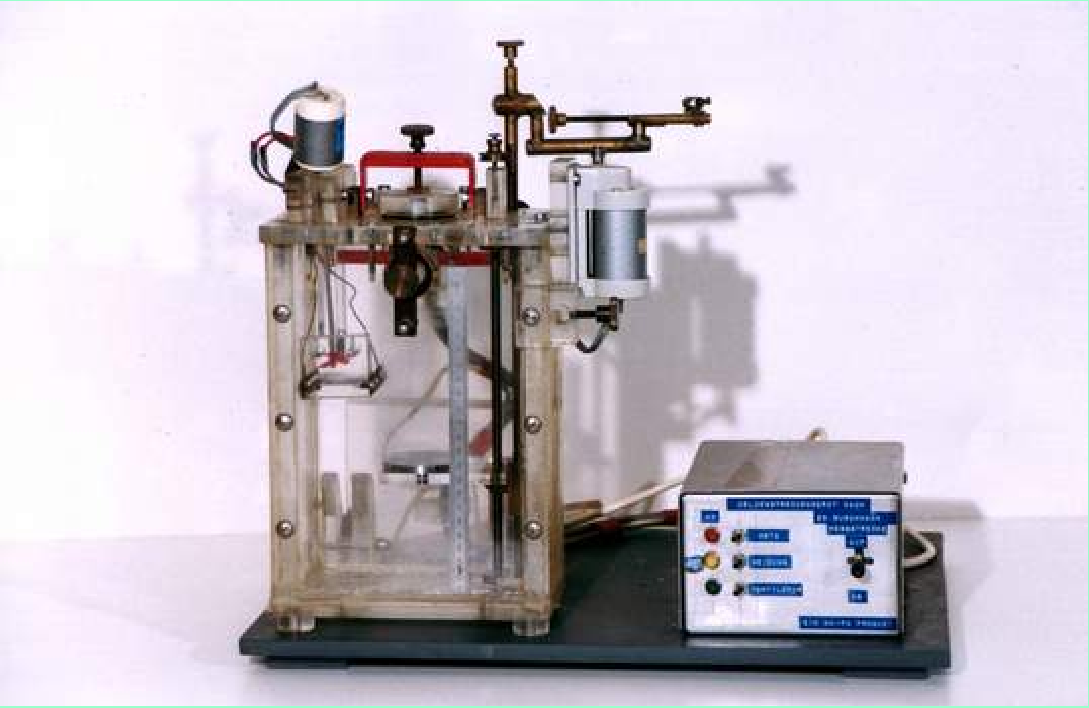
type of device: Accessory **producer/distributor:** Dept. of Ophthalmology, Würzburg University

development:

frequency: **time of production:** 1985

This measuring system was developed by Buschmann in the Ophthalmology department of the Charité Berlin, 1966. Our device was built 1985 in Würzburg for determining the sensitivity of the transducer.

Origin: W. Buschmann, Würzburg.



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No. 346 description: **Measuring track in oil bath (old)**

type of device: Accessory

producer/distributor: ??

development: ??

frequency:

time of production: ??

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No. 365 **description:** Uni Quatro

type of device: Multiformat camera for documentation **producer/distributor:**

development:

frequency: **time of production:** since c. 1981

Early in the 1980s the Uni Quatro was introduced in (West) Germany. Before that, for documentation only Polaroid pictures could be shot (1 shot ≙1 € or 1.4 $) - or negatives on 35 mm films (later correlation used to be somewhat difficult).
The Uni Quatro documented on radiographic film - 4 frames, initially. Therefore it was first deployed in Radiology and later in other medical disciplines.
As the camera improved, one could choose between 8, 4, 2 or just 1 frame per sheet.

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No. 380 **description:** **Acoustic pressure scale**

type of device: **producer/distributor:** VEB Transformatoren- und Röhrenwerk, Dresden

development:

frequency: **time of production:** 1960

Acoustic pressure scale for determining the acoustic power for therapy (> 9.1 Watts).
The power or intensity is specified in Watts per square centimeter.
Origin: R. Millner, Halle

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No. 390 SK

description: Sonocur plus

type of device: B-Mode

producer/distributor: Siemens AG, Erlangen

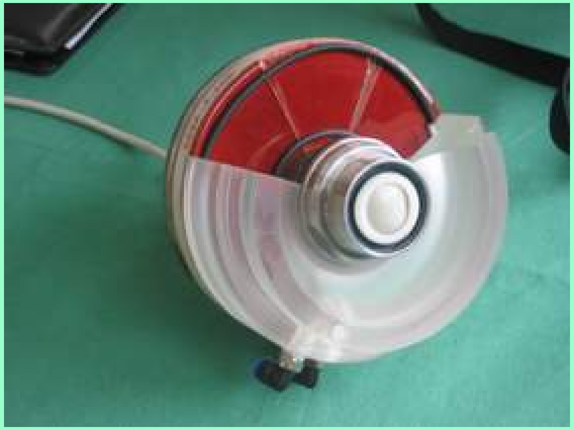
development:

frequency: ??

time of production: 1984

Shock wave generator + Sector scanner

US-therapy + B-scan. Combination of a shock wave generator for therapeutic use (here for pain treatment) with a mechanical sector scanner displaying the body surface being treated.
The initially plane shock wave is focused on the zone to be treated by a polystyrene lens - patient coupling by a water-filled standoff.



No. 391 description: Sterling

type of device: B-Mode producer/distributor: Philips

development:

frequency: ?? time of production: 1990 - 1993

B-Mode-Device

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No. 481 SK

description:

type of device: B-Mode

producer/distributor:

development:

frequency:

time of production:

Array transducer

Example of adaptation layers

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No. 482 SK

description:

type of device: B-Mode

producer/distributor:

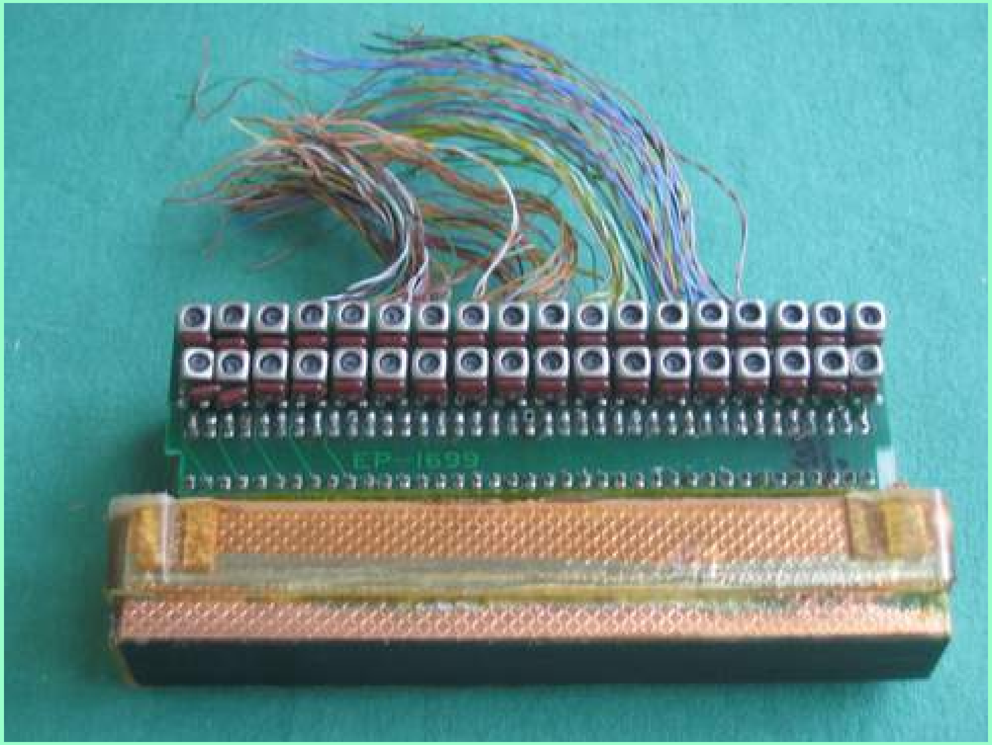
development:

frequency:

time of production:

Array transducer

Example of wiring



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No. 483 SK

description: Accuson transducer

type of device: B-Mode

producer/distributor: Accuson/Siemens AG

development:

frequency: 4 MHz

time of production: 1995

Phased Array Transducer

Transducer of an electronic sector scanner (phased array) with 128 single elements. Each element is connected to the ultrasonic device by an individual coaxial cable with a diameter of about 0.6 mm,
and each element is triggered by a separate cable.

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No. 484 SK

description: Phased array

type of device: B-Mode

producer/distributor: Siemens AG

development:

frequency: 3.5 + 5 MHz

time of production: 1984

Phased array scanner

Acoustical parts for transducers of an electronic sector scanner (phased array) with 64 single elements.
Each element is connected to the ultrasonic device by an individual coaxial cable and is triggered by a separate cable.

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No. 485 SK **description:** Curved Array

type of device: B-Mode **producer/distributor:** Accuson/Siemens AG

development:

frequency: 7.5 MHz **time of production:** 1998

Curved Array (vaginal probe)

Endoprobe for vaginal diagnostics.
Curved array with 128 single elements and a 90° angle of view.
Fixed image plane.
Guide slot for visually controlled punctures.

No. **486 SK**

type of device: B-Mode

frequency: ??

description:

producer/distributor:

development:

time of production:

Mechanical sector scanner for teeth

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No. **487 SK** description: **Endoprobe**

type of device: B-Mode producer/distributor development: Siemens AG, Erlangen

frequency: 5-7.5 MHz time of production: 1989-1990

Endoprobe (rectal probe)

Mechanical sector transducer
for endosonography. Designated
especially for transrectal scanning.
The mechanical drive makes it possible
to choose the location of the sectional
plane.

No. 488 SK

description: Sector Scanner

type of device: B-Mode

producer/distributor: IVUS/Siemens AG

frequency: 20 MHz

time of production: 1984-1986

Sector scanner

Mechanical sector scanner for intravasal sonography. The ultrasound transducer (20 MHz) is fixed to the tip of the catheter. A rotating tilted mirror provides a 360° scan. This mirror is driven by a guide wire at the entrance of the catheter. Catheter is built for single use only.

No. **490 SK**

description: **Curved Array**

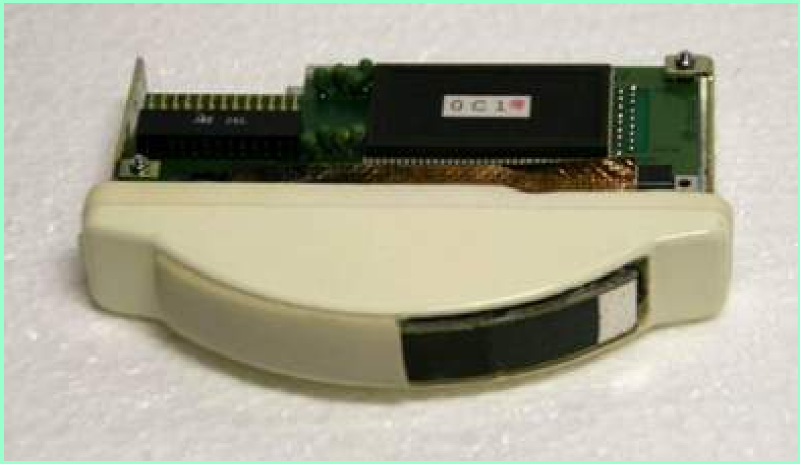
type of device: B-Mode

producer/distributor: Picker

frequency: 5 MHz

time of production: 1983-1985

Curved Array
Curved arrays are a variety of linear arrays. They only differ in the way the transducer elements are aligned. The same technology is applied in both cases.
In linear arrays – as the name implies – the elements are arranged in a straight line, while in curved arrays this line is curved along a more or less rounded arc. The image format of the curved array thus resembles a ring segment.
Curved arrays have the advantage – depending on the field of application – of combining the characteristics of both a sector scanner (small connecting area) and a linear array (large field of view).



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No. **491 SK**

description: **Endoprobe**

type of device: B-Mode

producer/distributor: Matsushita/Siemens

frequency: 5-7.5 MHz

time of production: 1985-1988

Endoprobe (vaginal probe)

Mechanical sector scanner for endosonography, especially designed for vaginal examinations.

No. 492 SK **description:** Multiline Array

type of device: B-Mode **producer/distributor:** Siemens AG, Erlangen

frequency: 3.5 MHz **time of production:** 1981

Prototype of a the very first multiline array. By subdividing an array system into several parallel and separately-activated array lines, a dynamic focusing perpendicular to the direction of the scanning is possible (annular array) – unlike the array transducers with just one line of arrays which are still common today. In theory this method should have great diagnostic advantages. The high technological and electronic complexity of the method hasn't found wide-spread use in ultrasound equipment.

No. 493 SK

description: Linear Array

type of device: B-Mode

producer/distributor: Matsushita/Siemens

frequency: 5 MHz

time of production: 1985

Linear Array

Example of the delicate architecture of a linear array structure. Here each single circuit-relevant element is again mechanically subdivided, in order to suppress unwanted oscillations. For attenuation the ceramic elements are embedded at the back in a supporting cushion to prevent resonances.

Furthermore, two transformational layers with different wave impedance are visible. They are necessary to adapt the acoustical impedance of the ceramic elements to biological tissues. This adaptation leads not only to better sound transmission; it also leads to an enlargement of the usable ultrasound frequencies and thus to better image quality. The top layer is formed by a so-called silicon lens, which not only protects the arrays but also helps focus the ultrasound beam at a right angle to the scan direction, contributing to better image quality.

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- Cut transducers without apparatuses
- **Therapy devices**
-

No. 300 **description:** Impulsaphon M33 GILe

type of device: Therapy Device **producer/distributor:** Ultraschall-Gerätebau Dr. Born GmbH, Frankfurt/M (D)

developed by:

frequency: 1000 kHz **time of production:** beginning 1951

Ultrasonic therapy device for the known indications e.g. in general medicine, rheumatology and dermatology. Handheld applicator connected to console by cable. Coupling of the applicator to the external skin with coupling fluid.
(Exhibit serial no. 1011) *Origin: H.G. Trier, Bonn*

Fig. left: Original product advertisement for the transducer of this device from 1955 .

(from: Zschr. Ultraschall in Medizin u. Grenzgebieten, Vol. 8, no. 1, March 1955, Ed. K. H. Woeber, Bonn).

Fig. right: Console: Connecting load 100 VA, time switch, controller W/ cm² in 4 steps from 0 - 3 W/cm². Impulse- and continuous operation, controller for switch options (ratio ON/OFF) in 4 steps (1/20, 1/10, 1/5, continuous operation). Tuning controller for the applicator with indicating instrument, control of coupling. Nominal frequency 1000 kHz; max. acoustic power 15 W, emitting surface of the applicator 5 cm², average power density 3W/ cm².
FTZ check no. B 019-52. Type-certified PTB V-U 009/53.

No. 301 **description: Piezo PUK 143**

type of device: Therapy Device **producer/distributor:** Piezo-Werk H. EVERTZ Stockdorf (D)

developed by:

frequency: 1000 kHz **time of production:** beginning 1950

Portable set with handle for ultrasonic therapy e.g. in general medicine, rheumatology and dermatology. Hand-held angled applicator, at which tubes of various shape and size for treatment are attached that can be sterilized. Detachable plug connection of cable to console. Features: time switch, 2 controllers for „dosage" und „tuning" with pointer instrument up to 5 W of ultrasonic power. *(Exhibit console no. 4456) Origin: H.G. Trier, Bonn*

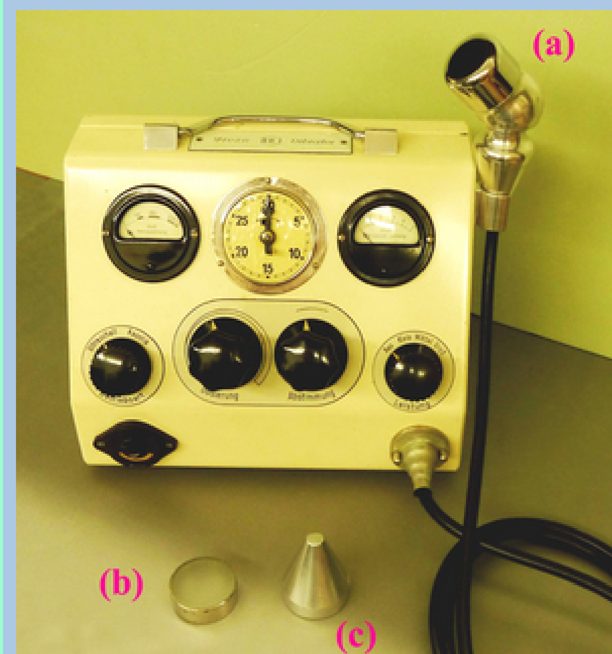


Fig. left: Console for 110/150/220/250 V, AC. (a) angled applicator. (b) and (c)attachable tubes (left below: Plug for cauterization add-on).

Fig right: Original product advertisement from 1952. (From: *Der Ultraschall in der Medizin Vol. 4, advertising section, ed. K.H. Woeber, Bonn, Hirzel-Verlag, Stuttgart 1952.).*

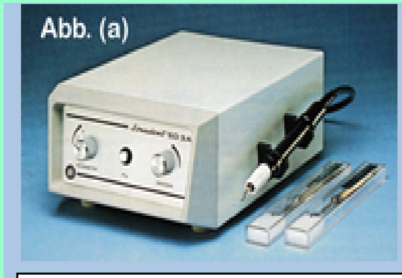
No. **304** description: **Sonadent SD 3A**

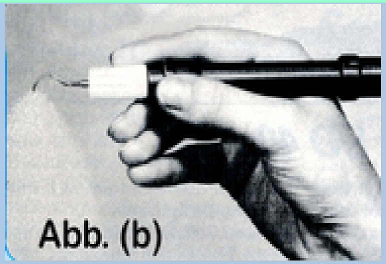
type of device: Ultrasonic Descaler producer/distributor: BANDELIN electronic (West-) Berlin (D)

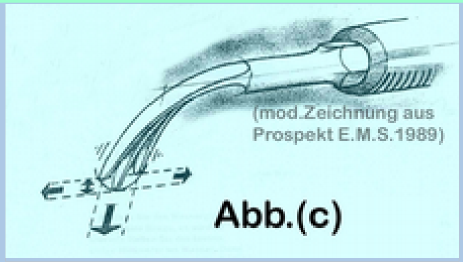
developed by: Bandelin, ca. 1970

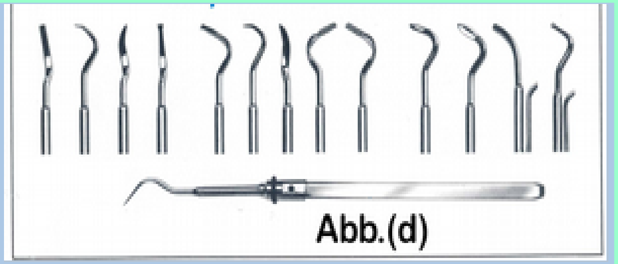
frequency: 18-60 kHz time of production: since 1970

At the beginning of the 1960 ultrasound was introduced to dental and oral medicine. In addition to applications in conservative dentistry, periodontology, prosthodontics and orthodontics the removal of plaques /tartar at the tooth neck plays an important role. The ultrasonic „Dental Descaler“ is composed of an ultrasound generator, a handpiece and of various applicators, which may be attached to the handpiece.
In the ultrasonic range of 18-60 kHz a cleansing effect is achieved at the tooth as well as periodontally by scraping and shearing while touching the dental plaques with the applicator, and also by cavitation within the sound fields and by an abrasive effect of the removed calculus particle.
Numerous instruments and manufacturers and versions, e.g. the exhibit. *Origin: H.G. Trier, Bonn*

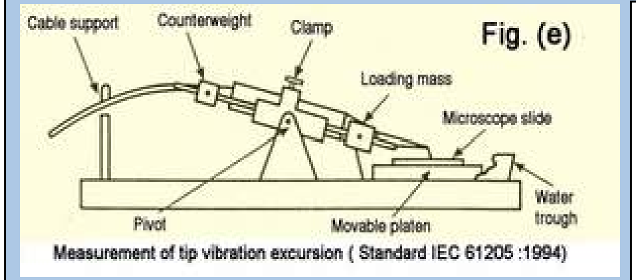








These devices utilize magnetostrictive or piezo-electrical oscillators driven in resonance or frequency-controlled in cw- or pulse-mode. By changing the oscillating applicators (tips or inserts of the instruments - fig. a, b and d) different properties are achieved. Depending on the shape longitudinal, lateral and elliptical oscillations of the tip occur (fig. c). As heat can arise, leading to pain and nerve damage within the tooth, cooling with rinsing liquid orally is necessary. The rinsing system is coupled to the handpiece.



Numerous publications of the method, e.g.:
GOLDMAN , H.M.1961; BALAMUTH, L.1967
SPRANGER 1970, WALMSLEY 1984..

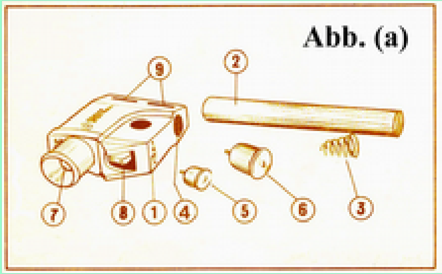
Similar systems emerged as further developments for invasive operations in surgery and neurosurgery (**ultrasonic aspirator**) and for ophthalmology (**phacoemulsification)**, partly by the same manufacturers. In order to ensure effectiveness and safety, a declaration of ultrasound performance characteristics was established (first standard IEC 1205:1993 and ISO; test procedure e.g. fig. (e)).

No. 302 **description: DAISONIC NSY-62**

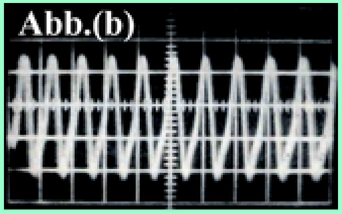
type of device: US Therapy Device **producer/distributor:** Dainiti Sogyo Co. Tokyo (Japan)

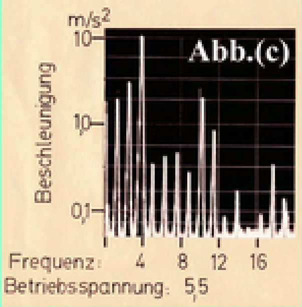
developed by: Y. Yamamoto, Tokyo, 1961

Handheld device for so called low frequency ultrasound therapy of the eye. The bell-shaped metal applicator is coupled to the closed eyelid by gel. According to clinical studies in Japan with series of treatments (e.g. 20 sessions lasting 10 minutes every 1-3 days) as described by YAMAMOTO and OTSUKA 1963 and later, successful treatments of several eye-diseases and of myopia were reported, e.g. by stimulating the blood circulation in the eye. *Origin: H.G. Trier, Bonn*



A non-linear electro-acoustical converter generates cw-oscillations in the "lower ultrasound range". According to manufacturer at 6 V DC power output 280 mW ± 10% (electr.) or 100 mW/cm² (acoust.) at the end of the applicator.
Fig. (a) Device setup: (1) Plug of power supply (2) Handle of battery (3) Battery-spring (4) Aperture for battery handle (5) and (6) applicator Ø 20 mm or 30 mm (7) Screw thread for applicator (8) Switch ON/OFFs (9) Aperture for carrying strap.
Abb. (b) Cw-oscillation
Abb. (c) Solid-borne sound measurement with acceleration sensor at the applicator (PTB Braunschweig, 1966).
Abb. (d) Newspaper articles of 1964-66
Abb. (e) Outpatient department of a Tokyo hospital.





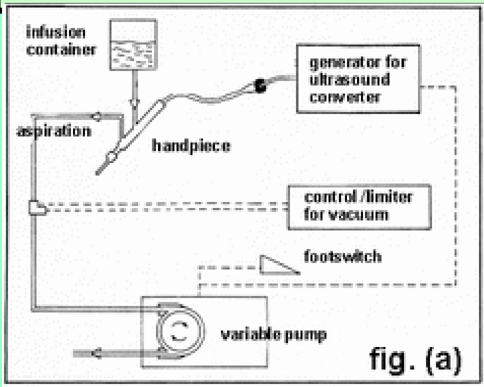
Publications : In **Japan** numerous publications of YAMAMOTO et al., at first J. Clin. Ophthal.17:295-10,1963. In **Germany**: TRIER: Ultrasonics in Ophthalmology, Symp. Münster 1966, 45-53 (Karger 1967).

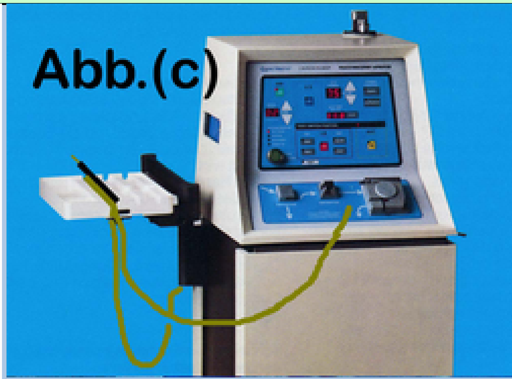
No. 305 **description: Cavitron KELMAN Emulsifier**

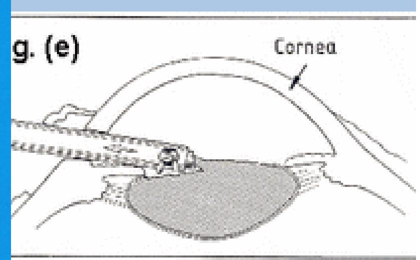
type of device: Phacoemulsifier **producer/distributor:** Cooper Vision Irvine, CA (USA)

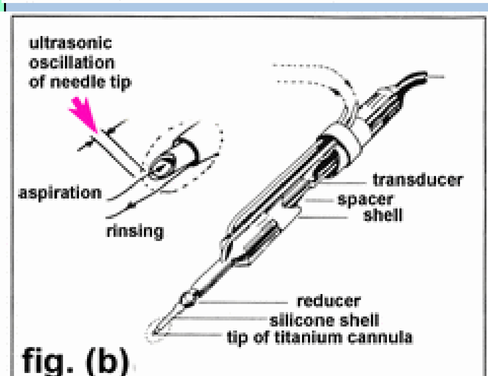
developed by: C. Kelman, since 1965

About 1968 KELMAN established the liquefaction of the eye lens by ultrasound (phacoemulsification). Up to now this became the standard procedure for cataract surgery worldwide. The clouded tissue within the lens capsule is disintegrated and emulsified by the ultrasonic oscillations of a Titanium cannula inserted into the eye, and then aspirated. The ultrasound system and the rinsing-and aspiration-systems are both integrated in one handpiece and one device console. Numerous models and manufacturers.









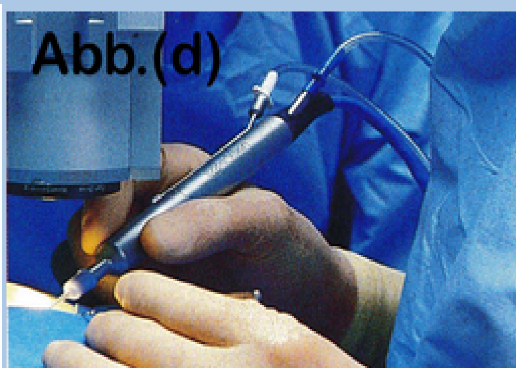


Fig. (a) system layout
Fig. (b) handpiece, structure
Fig. (c, d) CAVITRON Kelman type 9000 (hoses schematic)
Fig. (e) implementation at eye lens.

Among the publications :
KELMAN, C.: Amer. J. Ophthal. 67, 464-477 (1969).
TRIER, HG.: Medizintechnik 104, 216-221 (1984)

Sound Field Data of the CAVITRON KELMAN-Device Type 1970(*)
in water , after Kelman (1969)

frequency	40 kHz
wavelength	37 mm
oscillation amplitude	0,38 µm
needle speed	9,55 m/s (max)
needle acceleration	2,42 x 10^6 m/s² (max)
ultrasound intensity at needle tip	25 W/cm²
emitting surface of needle	0,00135 cm²
ultrasound power	0,034 W(max)

(*) magnetostrictive ultrasound generation (devices by other manufacturers can be piezoelectrical)

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- **Ophthalmologic devices**

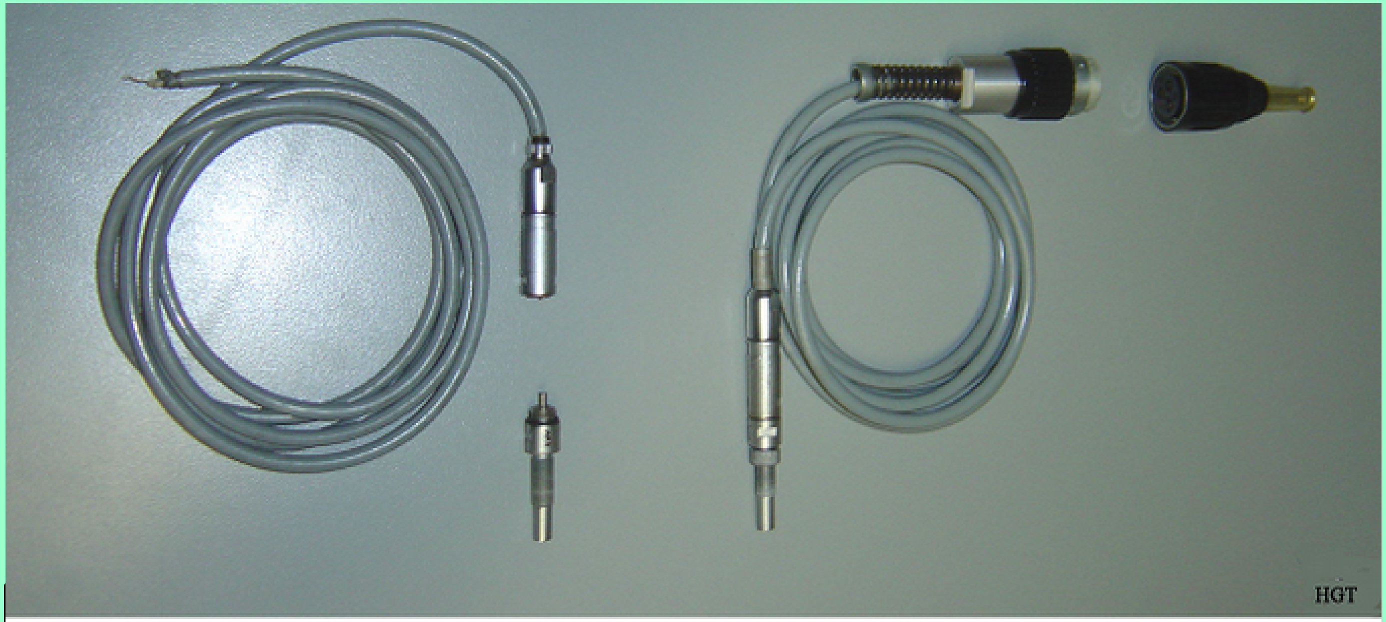
No. 320 description: **Technique of US Probes**

type of device: A-mode producer/distributor: Siemens-Krautkrämer, D

development: before 1960

frequency: 6 MHz time of production: since 1960

In the 1960ies A-mode probes like these were used for nondestructive material testing (KRAUTKRÄMER). Medical diagnostic devices were only derivates and re-named Echo-Encephalograph or Echo-Ophthalmograph or Echo-Cardiograph (SIEMENS–KRAUTKRÄMER)
Origin: HG. Trier, Bonn.



Aufbau eines A-mode-Schallkopfs
(SIEMENS-KRAUTKRÄMER, um 1960):

Connectors to device („large TUCHEL") and cables are HF-shielded. The probe consists of the connector body (with electrical matching) and the replaceable but locked watertight screwed piezoelectic part.
Here: Type AK6, 6 MHz, for ophthalmological examinations.

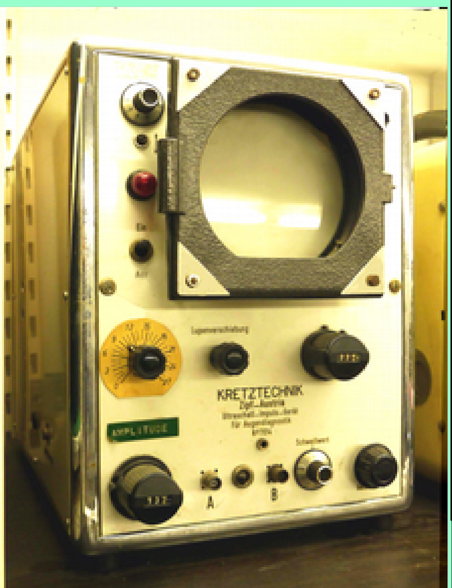
No. 303 **description:** **Echodevice Series 7000**

type of device: A-mode **producer/distributor:** Kretztechnik AG, Zipf, A

developed by: Bernhard Gerstner and C. Kretz

frequency: 1-14 MHz **time of production:** 1963

Tube device, developed for Ophthalmology from Type 1000. Precise transient time measurement by electronic marker and Wendel-potentiometer . Enhanced echo sensitivity. This ultrasonic type was the beginning of broader A-mode-tissue diagnostics in Ophthalmology, followed by numerous publications in the 1960ies and 1970ies. Options: Test object and interferometer for distance calibration of the oscilloscope trace ; test device for penetration depth in oil (W. BUSCHMANN) to determine the all-over performance.
Probes 6-12 MHz (round, flat stalked, spoonlike; Ultrasonolux according to BUSCHMANN). *Origin: HG. Trier, Bonn*



Device type 7000 was equipped with one echo trace, switchable from A- to B-mode presentation of the echos. Photo-adapter for 35 mm negative-film

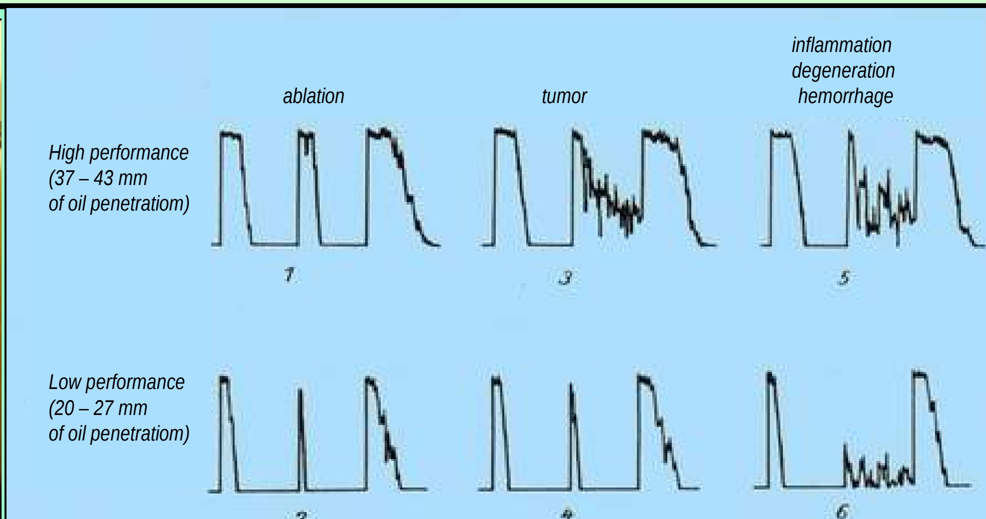
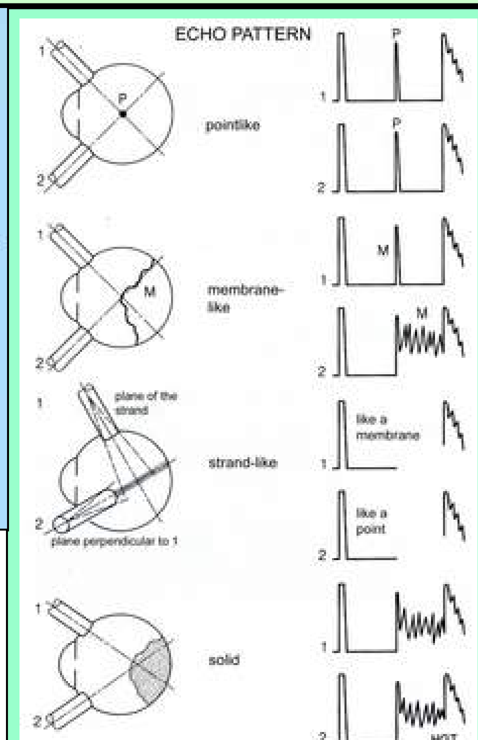


Fig. above: "Scheme of the typical echogram changes depending on the performance " (S.T.E.V., according to BUSCHMANN 1966).
Echo performance was calibrated in (mm) of oily penetration.

Fig. right: A-mode diagnostics at the eyeball with typical findings (schematically, modified according K.C.OSSOINIG)



No. 319

description: **10-elements-array probe with switch device UZGL**

type of device: B-mode array **producer/distributor:** Kretztechnik AG, Zipf, A

developed by: Bernhard and Kretz

frequency: 6-8 MHz **time of production:** 1964

Worldwide first commercial multielement array-probe for 2-dimensional scans, developed by KRETZ together with W. BUSCHMANN, Charité (DDR). Electronic wiring in a common cable via multiconductor plug, leading to the switch device type UZGL, which in turn is connected with the basic device Kretz 7000 or 7900 S. For transmitting and receiving the 10 elements are activated successively by UZGL, a numeric indicator tube showing the runs. Because of a high frame rate the 10 scanner lines are visible simultaneously on the screen. As the array assembly was too demanding for that time, only three specimen were produced, only one of which is preserved. *Origin: H. G. Trier, Bonn*.

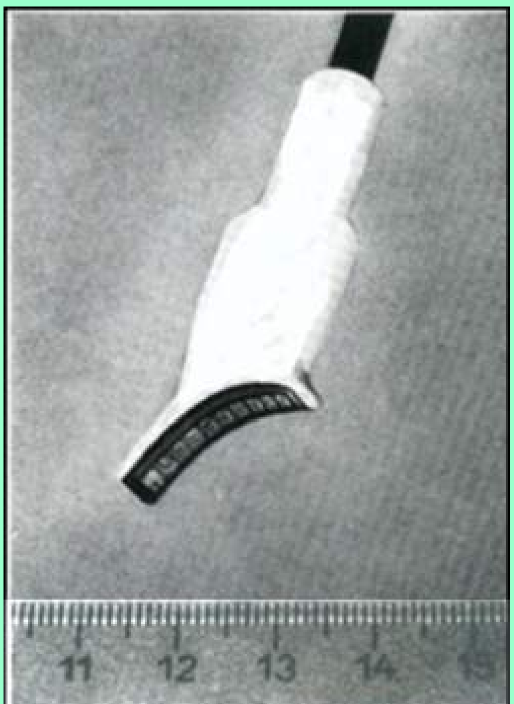
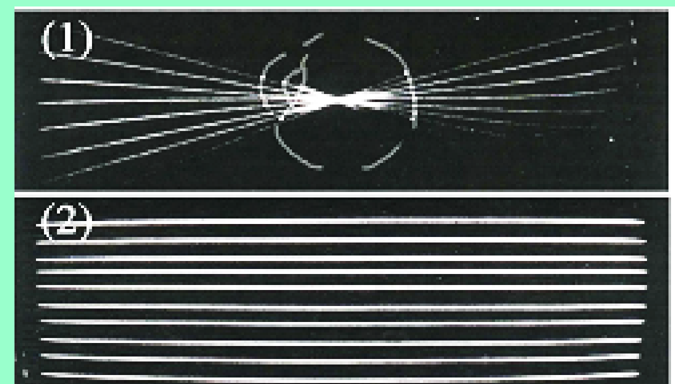


Fig. left: Array with 10 elements for 2-dimensional scans (from: *BUSCHMANN,:Einführung in die ophthal.Ultraschalldiagnostik .VEB Thieme, Leipzig 1966).*

Fig. below: Electronic switch device type UZGL



Designated scanning deflections at the cathode ray tube, for KRETZ concave array :
(1) **Intersecting**, here schematically from an array position which displays typical interfaces of the eyeball.
(2) **Parallel lines,** with selectable line spacing.
The lines are only visible with a high level of brightness at the screen.. *(mod. after BUSCHMANN, Ultrasonics 3, 1965).*

No. 311 **description: Echo-Gerät (device) 7900 S Series**

type of device: A-, B, M-mode **producer/distributor:** Kretztechnik AG, Zipf

developed by:

frequency: 4-12 MHz **time of production:** beginning 1966

(a) Console: Two modules are inserted in the TEKTRONIX basis, thereby especially in use for Ophthalmology. A-mode, linear B-mode (manually or engine-driven), M-mode. The screen has 3 operating modes „no storage“ with grey scale, „storage“ (bistabile storage), and „erase storage”. Adjustable gain controls for transmitter and receiver. Electronical scaling. Distance calibration depending on sound velocity. M-mode with variable sweep. Single element probes with 4 -12 MHz. Options: eyeball mask that can be filled with water; screen mounts for 35 mm or for Polaroid cameras; chair (exhibit serial-No. 7906). *Origin: H.G.Trier, Bonn.*

(b) Attachable B-mode mechanics fixed to wall for manual or engine driven linear scanning.

Origin: TIMUG eV, Bonn (W. Haigis, Würzburg).

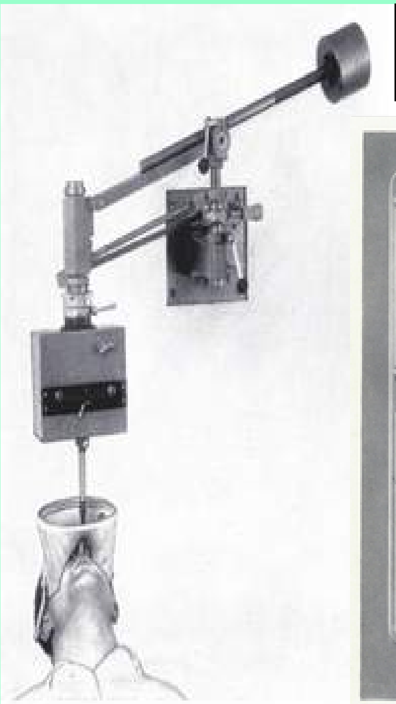


Photo credits: Devices. KRETZTECHNIK. Findings : H.G. TRIER and F. SAYEGH, Bonn.

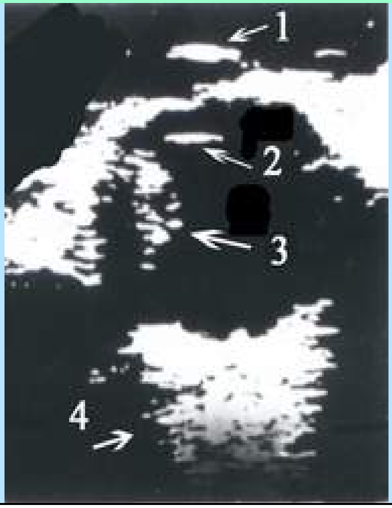


Fig. above: Immersion-B-Mode image of an eyeball:
1. Cornea 2. Lens
3. Tumour (melanoma of the ciliary body)
4. Orbital tissue

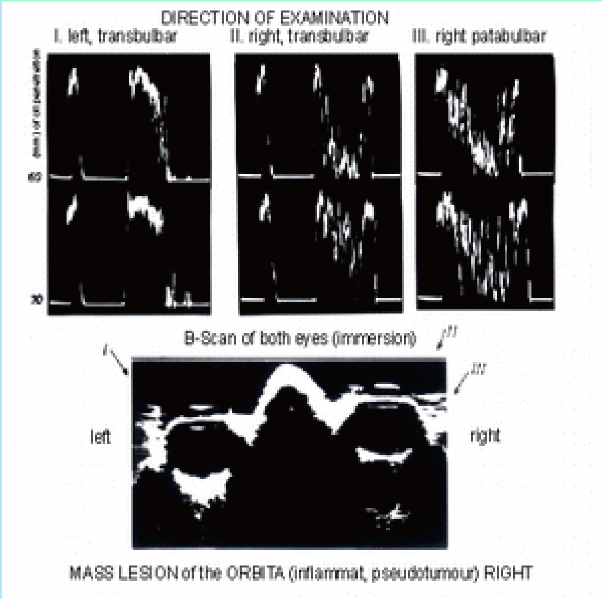


Fig. above: Immersion-B-Mode image of both eyes and orbits

No. 307 **description:** Material Testing Device Echoskop MPT-10

type of device: A-Mode **producer/distributor:** Lehfeldt GmbH

developed by: Dr. W. Lehfeldt, 1965

frequency: 0,5 - 4 MHz **time of production:** beginning 1966

Material testing device with plug-in boards and printed circuits, all transistors. Used for through-transmission-technique and echo methods. Scale expansion. Optional electronic scale for transit time, depth gain control. Variable power for transmission and receiving / variable pulse repetition frequency. The MPT-10 was the precursor of models type 4100, 4200, 7100, 7200 by KLN and KRETZ for medical purposes.
Origin: GEFAU eV, Duisburg/Berlin.

No. 312 **description:** Impulse Echo-Device

Serie 7100 MA

type of device: A-mode **producer/distributor:** Kretztechnik, Zipf (A)

development: Kretz-Lehfeldt (KLN)

frequency: 4 - 15 MHz **time of production:** since 1970

Developed for medical purposes, especially for Ophthalmology, <u>succeeding the LEHFELDT Echoskop MPT-10</u>. Plug-in boards and printed circuits, all transistors. Scale expansion. Optional electronic scale with quartz control for transit time. Adjustable sound velocity in distance scales. Depth gain control. Variable power for transmission, receiver gain control calibrated range of 80 dB; variable pulse repetition frequency. Display of HF-mode or A-mode by variable filter and threshold levels. *Origin: H.G. Trier, Bonn*.

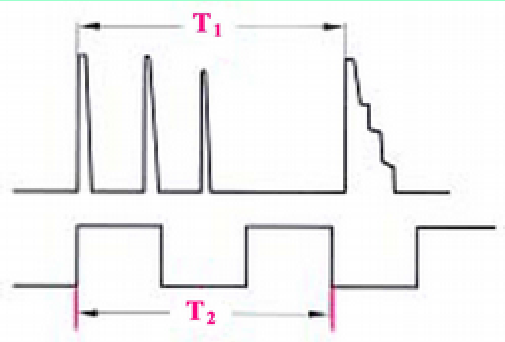


Figure above: Displaying in identical distension the echogram (T_1, here the eyeball axially) and the transit time (internal quartz-scale T_2= 30µs). **Therefore an external transit-time calibration is not necessary**

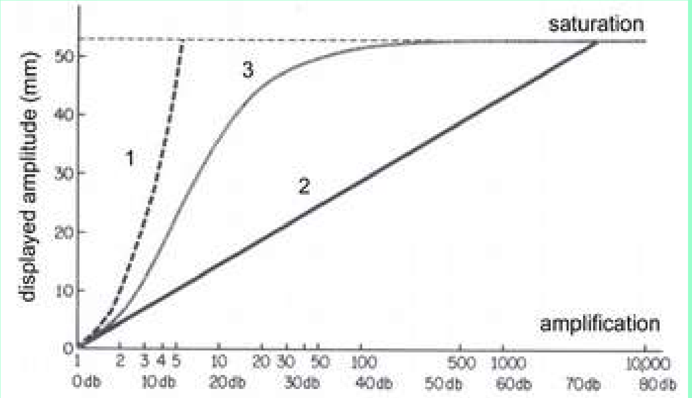


Fig. above: Differences in the amplifier characteristics, exemplified by KRETZ A-Mode-devices
1= linear characteristic e.g.. KRETZ Typ 7000
2= log. characteristic e.g.. KRETZ Typ 7100 MA
3 = special characteristic e.g. KRETZ Typ 7200 MA

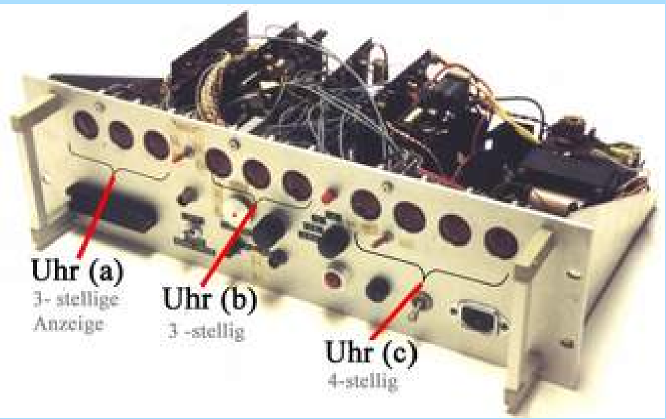
No. 306 **description: Device for Automatic Runtime Determination**

type of device: E.R.A. **producer/distributor:**

development: H. G. Trier and co-workers
Instit. f. med. Optics, Munich Univers.

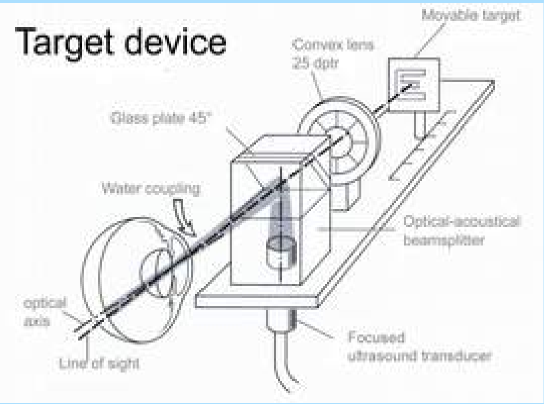
frequency: 8 - 14 MHz **time of production:** Prototype 1968/69

a) Prototype of an electronic runtime analyser (ERA) for ultrasonic biometrics of the eye. It was a designated add-on for A-mode devices with transducers and served for **simultaneous** precise measurement of the 3 sections of the optical axis of the eye (anterior chamber depth / lens thickness / vitreous body length), by scanning only once; for physiological und optical studies. Device is composed of 3 interval counters at 100 MHz, with NIXIE tubes . TTL-logics, data output via interface with paper tape puncher. Time resolution 10 ns or 15 µm in the eye respectively. Actual resolution - depending on probe - below 0.1 mm; output 8 to 25 measurements/s. b) Accessories: Optoacoustical target device for controlling the viewing direction (line of sight) and the change of accommodation during the measurement.
Origin: H. G. Trier and TIMUG eV, Bonn.



Participating in the development (DFG-project TRIER 89/1) were: A. HAMMERLA and F. SCHRIEVER, Munich; R. REUTER and R. D. LEPPER, Bonn. In West Germany (FRG) further development progressed in several steps to the new category of **„Devices for automatic electronic runtime analysis"** (ERA) for ophthalmology, with numerous company products. In the FRG special minimum requirements for these devices (E.L.M.) had to be fulfilled for quality control since 1985.

Precursors for precision oculometry were the approaches 1966-68 in USA by GIGLIO, COLEMAN and CARLIN.



Ultrasonic biometry of the eye with E.R.A.was easy and precise. Since about 1975 it was a crucial prerequisite for calculating intraocular lens implants for cataract surgery. Worldwide it became the most common application of ultrasound in Ophthalmology, in West Germany we had 300,000 to 500,000 examinations every year. For about 30 years this biometrical ultrasound procedure was unrivalled until about 2005, when optical biometry using contactless laser-optical measurements was introduced alternatively. .

No. 309 **description: GBS Computerized System for Ultrasound Biometry of the Eye**

type of device: Runtime Device **producer/distributor:** Grieshaber AG (CH)

development: R. D. Lepper, H. G. Trier (Bonn)

frequency: 10 MHz **time of production:** 1979 - 1986

Electronic runtime analyser (ERA) for ultrasonic biometrics of the eye enabling simultaneous measurements of the 3 axial segments. Manually guided probe, coupled to the eye by immersion. The examiner may adjust 3 to 4 measuring windows (gates) at the A-mode screen, triggering a series of automatic runtime measurements. Automatic evaluation of the signal quality in respect to alignment und stability, automatic calculation of every segment length with its specific sound velocity.. Readings on mean and variance of the measurement series. After input of the optical values automatic calculations of the dioptre strength of the artificial implant lens for the eye in respect to correct refraction and image size for cataract surgery (IOL-software after GERNET, later LEPPER and HAIGIS). The system was composed of a GBS-console with transducer, a Commodore V64 computer with floppy disk drive, keyboard, printer and GBS-software. Findings with GBS-ultrasound systems later served for calibration of alternative laser optical measuring procedures for optical biometry of the eye (HAIGIS for Carl ZEISS AG.). *Origin: TIMUG eV, Bonn*

Work station for biometry of the eye with GBS-console (front), A-mode transducer, Commodore V64 computer, printer.

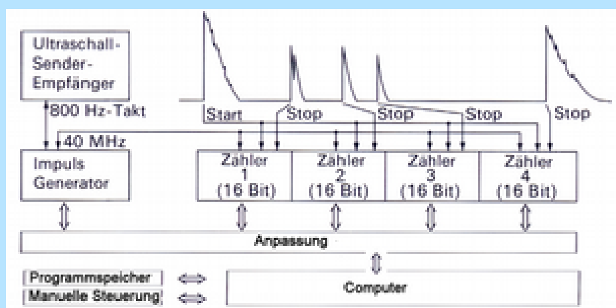
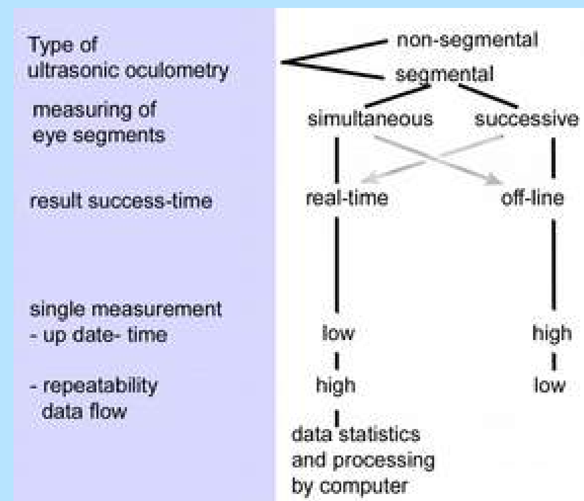


Fig. above:
Composition of GRIESHABER GBS.

Characteristic: Simultaneous segmental real-time measurement, fast data flow, data statistics (mean , variance) with quality evaluation



Key features for assessment of devices for biometry of the eye (oculometry) *(HG. Trier)*

No. 314/15 **description:** **Ocular Sonograph**

type of device: Compound **producer/distributor:** **USI, Toronto (CDN)**

development:

frequency: 6 – 20 MHz **time of production:** 1977

A-, B- and M-mode. 3 slide-in modules 19" including 2 screens, support for manual compound B-mechanics (with linear and angular potentiometers) for examinations of eyeball and orbit / neck / thyroid / small parts / skin, all immersed. Focused transducers 6-20 MHz . Receiver amplifier calibrated in decibels, 2 screens for (i) visual display (ii) of grey-scale stored images via scan converter. (Comment: Commercial remake of OPHTHALMOSCAN type 200, SONOMETRICS, New York, USA).
Origin: TIMUG eV, Bonn / U. Fries , Univ.-Augenklinik Frankfurt)

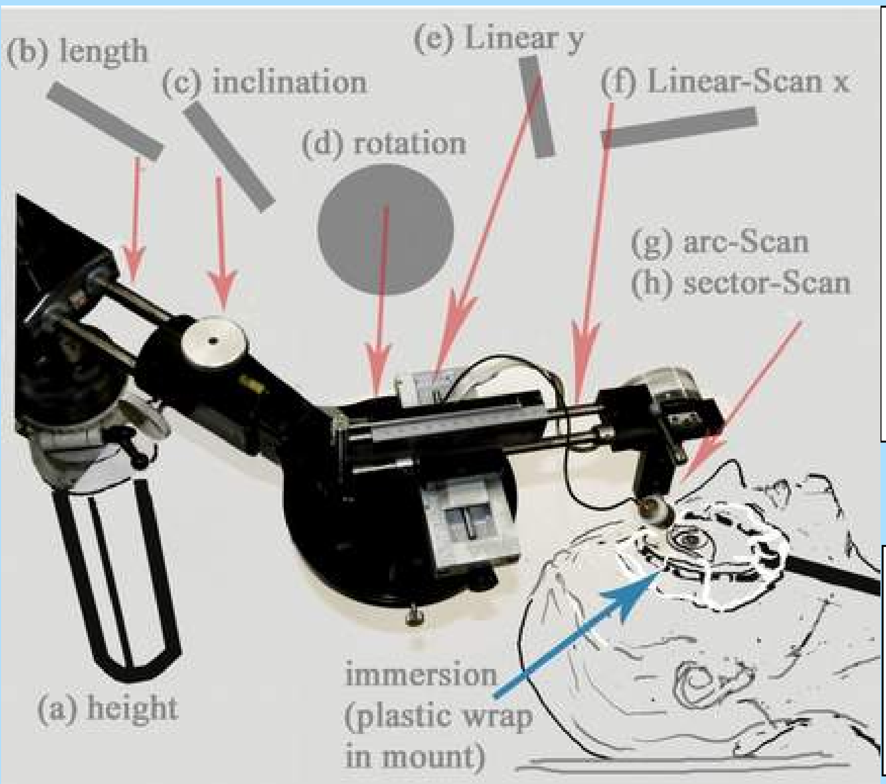


Fig. right: ***Essential features***:
Lower module: Transmitter, preamplifier, preadjustment of display; M-mode adjustment.
Middle module: Scan-converter with storage tube.
Upper module: Grey-scale screen (non storing). Selection of transducer frequency, of RF/video and sound velocity, Amplification up to 100 dB, filter, runtime calibration (quartz), scaling.

Fig. left: ***Application of the compound-scan mechanics at the eye, with immersion coupling.*** A membrane within a circular mount is filled with physiological saline solution. Immersed into this liquid is the transducer, which can be guided manually as linear scan (f), arc scan (g), sector scan (h) or combined as compound scan.
For changing the section plane and the focal plane of the transducer, various adjustment options are available at the mount (a to e). *(Schematic illustration, HGT* ***).***

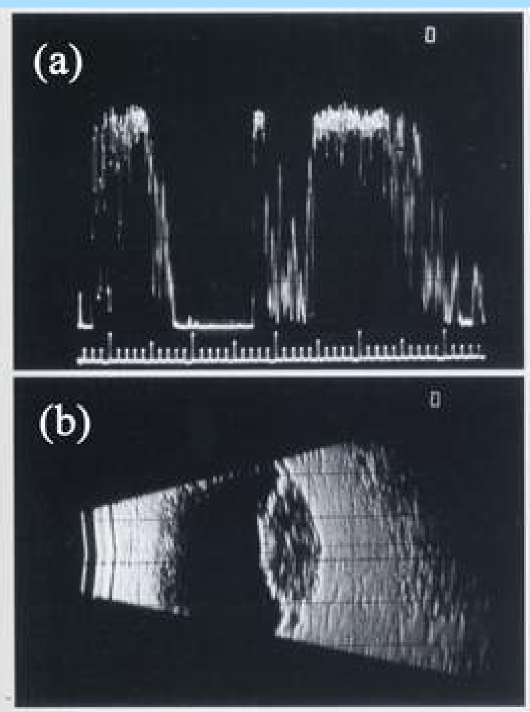
No. 308 **description: Ocuscan 400**

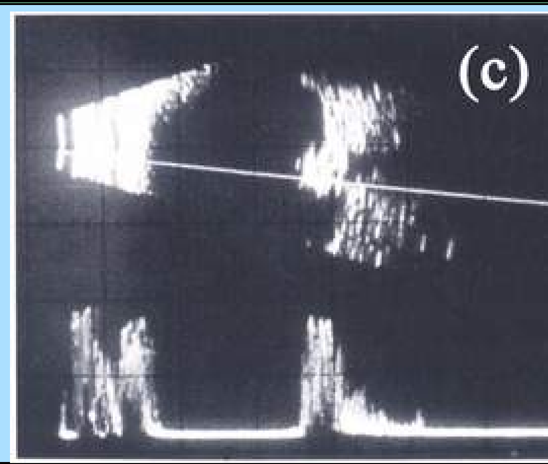
type of device: Real-time A- / B-Mode / Biometry **producer/distributor:** Sonometrics Inc. (USA)

development: L. Katz

frequency: 4 – 12 MHz **time of production:** 1978 - 1982

Electro-mechanical sector scanner (20 frames/s) with single probe 8-10 MHz in a case with acoustic window, coupling at closed eyelid. Display switchable from A-mode or RF (standing probe) to real-time B-mode or to combination of B with vector A; scanning angle can be switched to 25° or 40°. Control unit for amplification, TGC and scaling. Polaroid adapter with foot switch. Option : Module for Biometry. with one electronic gate, numerical display of distance at the selected sound velocity. *Provenienz : TIMUG e.V., Bonn*





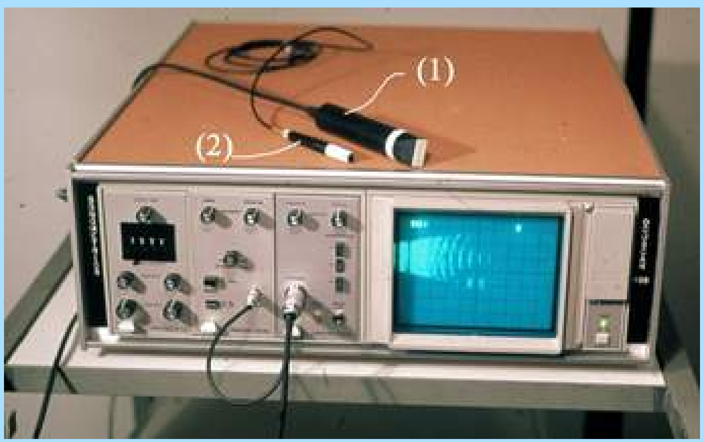


Fig. right: OCUSCAN 400 with 2 probes: (#1) for contact-B- und A-mode. (#2) separate A-mode probe for biometry.

Fig. (a) (b) (c): Polaroid images with contact-probe (1): (a) A-mode with <u>standing</u> probe
(b) Sector B-mode ; both (a) and (b) showing a tumour in the eyeball
(c) Simultaneous B- and Vector-A display with moving probe (vector-blanking in preselected video image-line, 1 per frame, at 20 frames /s).

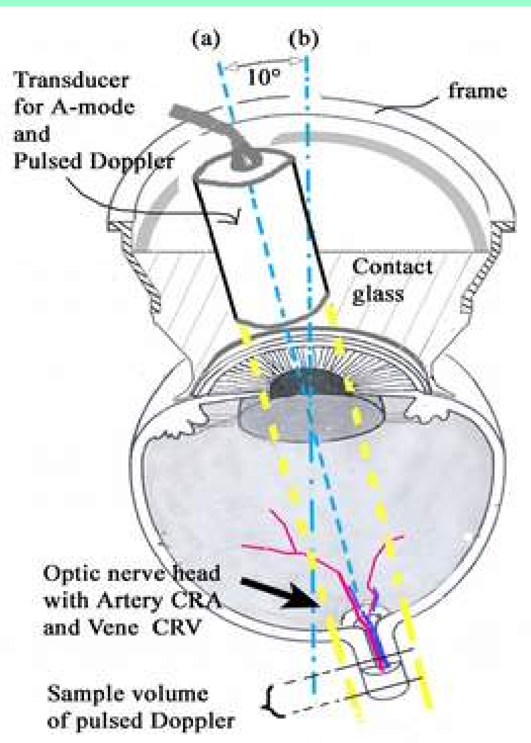
No. 310 **description:** **DRG Retina Doppler**

type of device: Pulsed Doppler / A-Mode **producer/distributor:** TOMEY, Erlangen / SONOTECHNIK

development: Fortune Optical/TIMUG eV, 1996-97

frequency: 10 MHz **time of production:** 1998

A contact glass with an integrated probe for pulsed Doppler and A-mode is placed on the eyeball. In order to measure the blood-flow in the central artery of the eye or in the ophthalmic artery, the sample volume of the probe is automatically directed - aided by A-mode biometry - to the rear of the eyeball, at the entrance of the optic nerve. The Doppler-signal is documented by a one-channel printer. Doppler-calibration with Doppler-simulator DS 81. *Origin: H.G. Trier, Bonn*



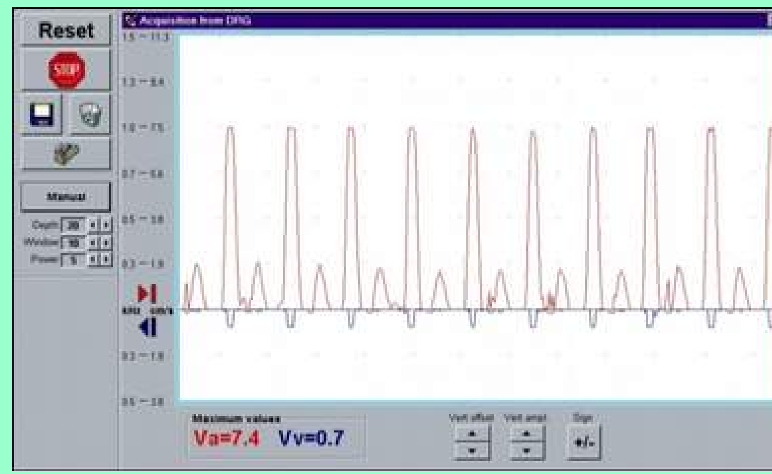


Fig. middle (both): **DRG work place**. Characteristics of the pulsed Doppler probe in the contact glass: 10 MHz, piezo-Ø 4 mm, Doppler sample-volume size variable axially 1-10 mm, laterally fixed at 1 mm (-6dB). The sample volume is automatically placed at a depth of 20-30 mm, according to the length of the eyeball, as recorded by A-mode scan of the same probe. Angle of probe to eye axis = 10° (OBERMAIER). Comprehensive evaluation of the central retinal arteries (CRA) included supplementary CW-Doppler examinations of the extra- and intracranial carotid flow. ***Fig. left:*** **Transducer with contact glass:** Schematic illustration. ***Fig. right***: DRG-graph displaying systolic Doppler-shift of 1 kHz corresponding to a velocity of 7,4 cm/s.

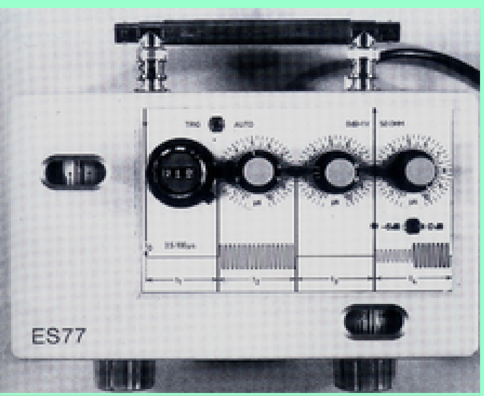
No. 316 **description:** # Echosimulator ES77

type of device: Test signal generator for A-/B-/M-Mode **producer/distributor:** RUCK Ophthal. Systeme GmbH

development: R. Reuter (workgroup H.G. Trier), Bonn

frequency: Pseudoechos 5-15 MHz **time of production:** since 1977

In order to objectively define the quality of signals and images and thus to trace and to localise potential malfunction, basically two different tools are necessary: (i) test bodies (phantoms) for integral assessment of the combination transducer /console, and (ii) electronic test signals for separate components. As a testing device for the second category the working group and test laboratory of H.G.TRIER at the university of Bonn, Germany, developed a series of echo-simulators since 1976-77. Type ES 77 was developed for single channel A-, B- and M-mode systems, combining important practical testing parameters, for which otherwise several measurement instruments would be necessary for test operations. Therefore it was suitable for quality control of device manufacturers, distributors and operators. *Origin: TIMUG eV, Bonn*.



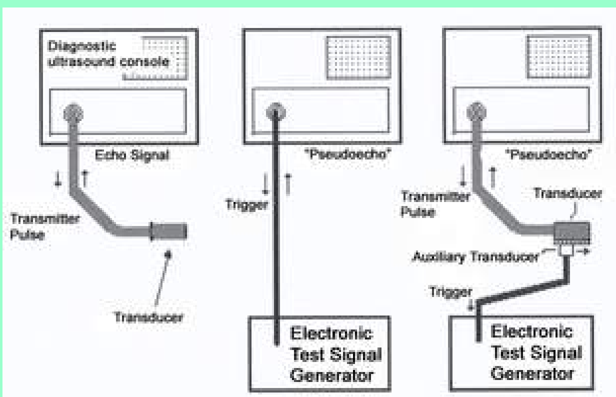
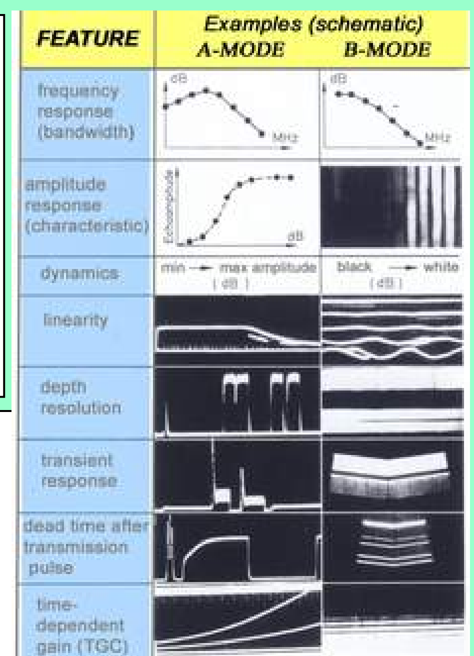


Fig. left: Device ES77 and implementation of electronic test signals (schematic)

Chart right: Acquisition of various device characteristics in A- and B-mode with ECHOSIMULATOR



The transducer plug of the console is fed with a signal sequence, the parameters of which can be continuously altered by the investigator (carrier frequency 5-15 MHz, the amplitude can be lowered up to -100 dB; referred to 1 V_{SS} at 50 Ohm source resistance, temporal distance from transmitted pulse and signal duration). The pseudoechos can be fed freely or triggered by the transmitted pulse. The principle of this test method was incorporated in technical standards for quality control of pulsed echo-scanners in all respective disciplines (DIN EN 6 1391-2 // IEC 61391-2:2010: "Measuring the maximum penetration and the local dynamic range"; part on direct electr. testing procedures). Application: distributors and users of devices. Further developments of the ES 77, which was built with analogue components was a PC-supported version (with W. HAIGIS) and the device SONOGEN with digital architecture (Aachen/ Jülich university of applied sciences). *Origin: TIMUG eV, Bonn.*

No. 317 **description:** **Echosimulator ES 81B/Q**

type of device: Test signal generator for biometry of the eye **producer/distributor:** RUCK Ophthal. Systeme GmbH

development: R. Reuter (workgroup H.G. Trier), Bonn

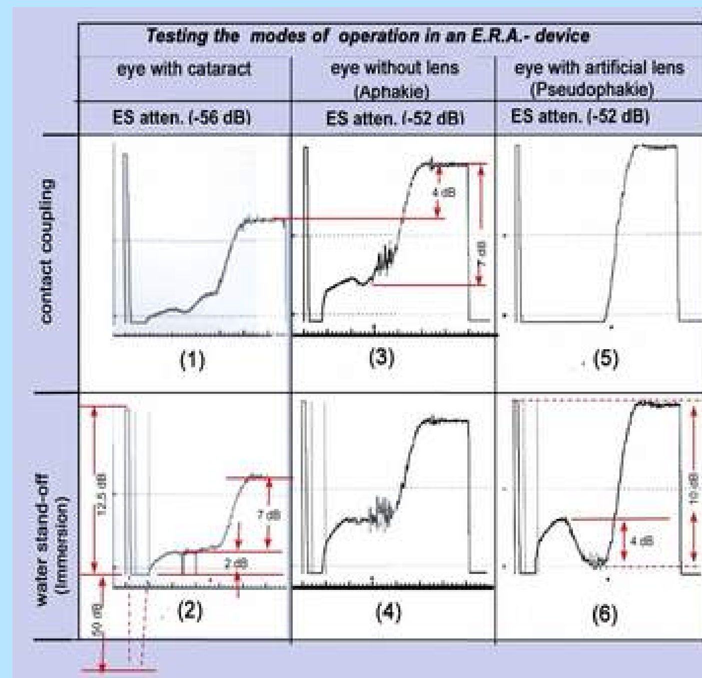
frequency: Pseudoechos 6 - 10 MHz **time of production:** since 1981

Both testing devices permitted the analysis and calibration of device functions in ultrasonic biometry of the eye, especially in automatic runtime measuring (ERA). The electronic test signal is injected in the plug thus replacing the transducer. The signal corresponds to the typical echo chain within the eye axis and has got the correct phase relations of the transient, i.e. also the typical phase jumps occuring at the interfaces of the eye due to varying acoustical impedance. Runtimes between individual signals and within the coupling layers rare adjustable. Type ES 81B is battery powered; Type ES81Q with quartz stabilizers. *Origin: TIMUG eV, Bonn.*

Fig. left above: ECHOSIMULATOR type 81B battery powered.

Fig. Left below: Type ES 81Q with quartz stabilization.

Fig. right: With ECHOSIMULATOR determined characteristics of an ultrasonic biometry device (ERA) for ophthalmology. In this case the input of simulated echoes of same amplitude is amplified and displayed differently, depending on the operating mode. Illustrations (1)-(6) reveal the types of runtime-dependent amplifications, inherent to this device (TGC characteristics). Thus electronic test signals clarify device properties hidden to the operator but decisive fur the accuracy of the ultrasonic biometry.

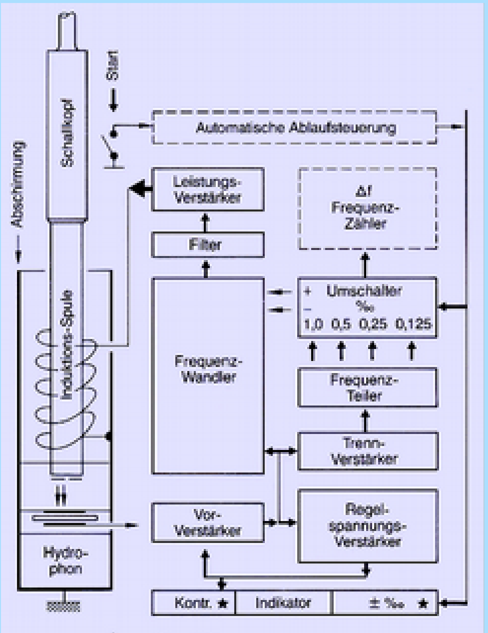


No. 318 description: **Doppler-Simulator DS 81**

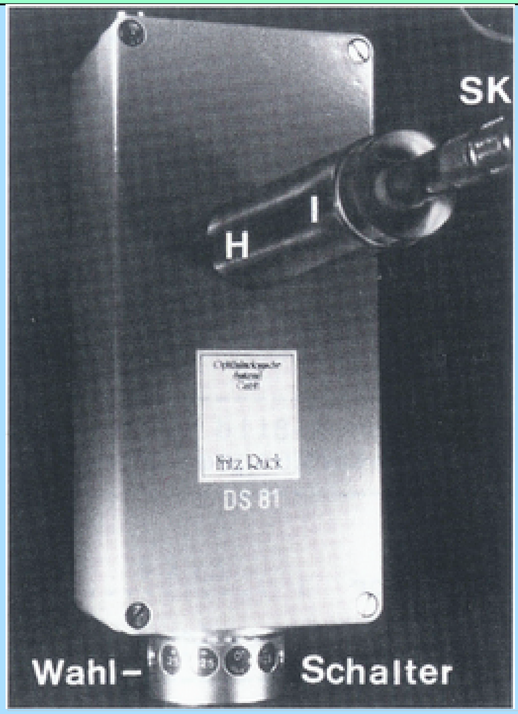
type of device: Doppler-Simulator **producer/distributor:** RUCK Ophthalmol. Systeme GmbH

development: R. Reuter (workgroup H.G. Trier), Bonn

Simulator for calibration and quality control of cw-ultrasound Doppler systems. Utilization without interfering with the Doppler device by sliding its transducer into the guiding tube, in which a hydrophone is installed. The real frequency of the transducer is now determined by this hydrophone or directly electronically. From this real frequency the simulator derives a series of test frequencies (Doppler shifts of ± 0.125/ 0.25/ 0.5/ and 1.0 ‰), feeding them automatically to the transducer or to its supply cable via induction coil in the guiding tube. These discrete frequencies correlate to linear flow. The Doppler shift displayed by this specimen (at screen or printout) is compared by the examiner with the nominal values.
Application: Distributors and operators of cw-Doppler devices with or without spectral analysis, uni- and bidirectional probes, handheld probes, probes with area scanning (angiogram-scanner, flow mapping). *Origin: TIMUG eV, Bonn.*



Doppler-Simulator DS 81
Blockschaltbild (R.Reuter)



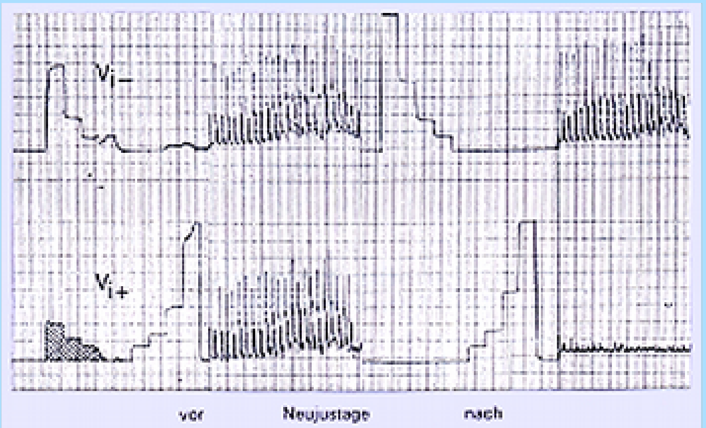


Fig. left: At the bottom of the device there is a selector switch for Doppler-shift. **SK**=transducer in the guiding tube with hydrophone **H** and induction coil **I**.
Fig. above: ***Application example of a directional Doppler device***
Crosstalk of channel (V i-) in (V i+) , amplitude error in both channels. Left side before, right side after readjustment (now perfect function). Reference steps 0.125 - 1.0 ‰ of simulator DS81.