How to Setup the Echo Machine?

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The Beginning...

Inge Edler and Hellmuth Hertz
Echo Machine from 1954
(photo taken in 1977)
Increasing Number of Buttons

How to handle them?

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Principles

1.) Make yourself comfortable!

Dim the light in the room.
Find your preferred scanning position.
Adjust the monitor.

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Monitor Adjustment

brightness / contrast

use all the brightness range the monitor can display

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Monitor Adjustment

brightness / contrast

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Monitor Adjustment

brightness / contrast

Principles

2.) At best, you can see what is there.

Presets

Power, Gain

TGC
Presets

wrong preset

too flat (compression)
too smooth (persistence)

abdominal preset

Presets

right preset

right contrast setting
no temporal smoothing

cardiac preset

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Signal Pathway

power / gain

transmit: output power
receive: gain control

output power given in [dB]

highest: 0.0 dB
50% reduction: -3.0 dB
Signal Pathway

**gain control**

- amplification of the receive signal
- „brightness“
- biggest button on the panel

... does not improve signal to noise ratio!
**Signal Pathway**

... power increase will.

**Power and Gain Effects**

- **Higher gain** leads to a bad image.
- **Higher power** results in a better image.

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Signal Pathway

time gain compensation

depth dependent gain control

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3.) Nothing in life is for free.

Spatial vs. temporal resolution:

- Ultrasound Frequency
- Harmonic Imaging
- Focus
- Depth / Sector Width / Frame Rate
Spatial and Temporal Resolution

depth dependence
- lateral resolution
  - less depth - more beams

frequency dependence
- radial resolution
  - higher frequency - shorter pulses

Radial Resolution

ultrasound frequency
- low frequency
- high frequency

penetration depth
radial resolution
Radial Resolution

ultrasound frequency

low frequency

- good penetration:
  - obese patients
  - deep structures

high frequency

- high resolution
  - normal patients
  - children
  - apical structures
Resolution

focal zone

focus = 12 cm
apex blurred
Resolution

focal zone

focus = 3 cm
apex sharp
basal image
sub-optimal
Resolution

focal zone

dual focus:
focus_1 = 4 cm
focus_2 = 10 cm

trade-off:
frame rate
(78 fps vs. 37 fps)

Principles

4.) Doppler Ultrasound.

Spectral Doppler (PW, CW).
Colour Doppler
Spectral - Doppler

spectrum display: gain settings

Spectral - Doppler

spectrum display: time scale

peak only measurements
time dependent measurements

PHT
Spectral - Doppler

spectrum display: velocity range

Δ 15 mmHg

Δ 3 mmHg

Spectral - Doppler

pulsed wave Doppler: velocity range

limited velocity range or limited depth

aliasing
Spectral - Doppler

**pulsed wave Doppler: velocity range**

adjust:
- base line
- velocity range (PRF)

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**Spectral - Doppler**

**pulsed wave Doppler: high PRF mode**

HPRF - mode
- advantage: higher velocities
- drawback: multiple sample volumes

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Colour - Doppler

colour box size

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Colour - Doppler

gain setting

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Colour - Doppler

velocity range (PRF)

Principles

5.) In case of problems, don't call the technical service. First of all, think!

Requirements:

Know what you want to see.
Know something about ultrasound.
Recognize what's wrong.