Figure 2.1A.

Measurement points

Depolarization wave front

Reference point at a far distance

$V_{\text{bipolar}} = V_{E_1} - V_{E_2}$
<table>
<thead>
<tr>
<th>Channel #</th>
<th>Channel Name</th>
<th>Record</th>
<th>Color</th>
<th>Group</th>
<th>Voltage Range</th>
<th>Low Cutoff</th>
<th>High Cutoff</th>
<th>Notch Filter</th>
<th>Can Stim</th>
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<td></td>
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<td>BARD</td>
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<td>30.0 Hz</td>
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</table>

Figure 2.1B.
Figure 2.2A.
Figure 2.2B.
Figure 2.3A.
Figure 2.3B.
Figure 2.3C.
Figure 2.3D.
Figure 2.3E.
Figure 2.3F.
Figure 2.4A.
Figure 2.4B.
Figure 2.5A.
Figure 2.5B.
Figure 2.6A.
Figure 2.6B.
Figure 2.6C.
Figure 2.6D.
Figure 2.6E.
Figure 2.6F.
Figure 2.7A.
Figure 2.7B.

Bipole Pin 75-76
2 mm apart

Bipole Pin 75-78
9 mm apart

Bipole Pin 75-80
16 mm apart
$0.6\cos(2\pi120t) + 1.7\cos(2\pi50t)$

$x(t)$

Figure 2.8A.
\[ x(t) = 1 \cos(2\pi 20t) + 2 \cos(2\pi 13t) \]

\textbf{Figure 2.8B.}
0.6\cos(2\pi 120t) + 1.7\cos(2\pi 50t) + 1\cos(2\pi 20t) + 2\cos(2\pi 13t) = x(t)

Figure 2.8C.
**Mathematical description in time domain**

- \(2\cos(2\pi 13t)\)
- \(1.7\cos(2\pi 50t)\)
- \(1\cos(2\pi 20t)\)
- \(0.6\cos(2\pi 120t)\)

**Figure 2.8D.**
Analog pre-amplifier
Highpass and Lowpass filters
Gain

Figure 2.9A.
Figure 2.9B.
Noise

High signal-to-noise ratio (SNR)

Low SNR

Very Low SNR

High signal-to-noise ratio (SNR)

Figure 2.10A.
Figure 2.10B.
Figure 2.10C.
Figure 2.10D.

60 Hz notch filter off

60 Hz notch filter on
Figure 2.11A.
Figure 2.11B.
Figure 2.11C.
Figure 2.11D.
All frequencies below 80 Hz are multiplied by 1, so they remain as they are.

All frequencies above 80 Hz are multiplied by 0, so they are eliminated.

Figure 2.12A.
Figure 2.12B.
Figure 2.12C.
corner frequency (100 Hz)

Figure 2.12D
Figure 2.13A

Original electrogram

“noise” is gone

Filtered electrogram

high-frequency peaks attenuated and slurred

Time →
Raw Data

30-250 Hz filter

high frequency: little change

lower frequency: inversion of morphology!

Phase delay

Time →

Figure 2.13B
Figure 2.13C
Figure 2.13D

- Noise-free data
- Data with 60-Hz Noise
- Notch Filter
- Adaptive Filter

Time →
Figure 2.14B.
Figure 2.14C
Figure 2.14D
Filter: 1-100 Hz

Figure 2.15A
Figure 2.15B

Filter: 0.05-100 Hz
Figure 2.16A
Figure 2.17A.
Figure 2.17B.
Figure 2.18A
Figure 2.18B
Figure 2.19A.
Noise on ECG

ECG generated by Stimulator

Figure 2.19C
Figure 2.19D

60 Hz notch filter off

60 Hz notch filter on
Figure 2.20A

Foot end of x-ray table

CARTO Patient-Interface Unit (PIU)

Bard Pin Box

Head end of x-ray table
Figure 2.20B.
All cables stay above floor!
AC power supply of CARTO-3 PIU

Figure 2.21A
Figure 2.21B
X-ray system NOT turned on

Figure 2.23A.

mG = milli Gauss
X-ray system turned on

>100 mG

8 mG

6.9 mG

18 mG

mG = milli Gauss

Figure 2.23B.
Figure 2.24A. Tri-field meter

- **iv bump**: 5-6 mGauss
- **Zoll defibrillator**: 6-8 mGauss

The tri-field meter reads 60 mGauss and 0 mGauss.
Figure 2.24B.
Figure 2.25A
Figure 2.25B

60 Hz Filter Off

Adaptive Filter On

MAP

p

d

60 Hz Filter Off

Adaptive Filter On
Figure 2.25C
Figure 2.25D
Figure 2.26B.

Wilson’s Central Terminal
Figure 2.26D.
Figure 2.27B.
Figure 2.28A.
Figure 2.28B.
Figure 2.29A.
Figure 2.29B.
Figure 2.30A.
Figure 2.30B.

HBp: pin 12, 14

- I
- II
- V₁
- RAA

HBₚ

HB₃
(11,12)

HB₂
(9,10)

HB₅
(7, 8)

HBp: pin 12, 13

- I
- II
- V₁
- RAA

HBₚ

HB₃
(11,12)

HB₂
(9,10)

HB₅
(7, 8)
Figure 2.31A.
Figure 2.31B.
Figure 2.32A.
Figure 2.32B.

MAP_d: Pin 1, 3  MAP_p: Pin 2, 4
Figure 2.33