



Bilgisayarlı Monitorizasyon ve Kayıt Teknikleri

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Konuşma planı

- Bilgisayarlı monitorizasyon için gerekli altyapı
- Sayısal kaydın mantığı
- Bilgisayarlı monitorizasyon için mevcut sistem örnekleri
- MP100 sistemini tanıtmaya
- ACQKnowledge programını tanıtmaya

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Bilgisayarlı monitorizasyon için gerekli altyapı

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Bu sayfa bilinçli olarak boş bırakılmıştır.

Bilgisayarlı monitorizasyon için gerekli altyapı

- Bilgisayar kullanmayı ne kadar biliyoruz?
- Hardware hakkında ne kadar bilgimiz var?
- Ne kadar temel elektronik bilgimiz var?
- Bilgisayarımızı korumayı ne kadar biliyoruz?
- Veri güvenliğimizi sağlamayı ne kadar biliyoruz?
- ...

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Yoksa konuşma burada bitti mi?

Yoksa konuşma burada bitti mi?

HAYIR...

Sayısal kaydın mantığı

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GRASS.
First and Still the Best!



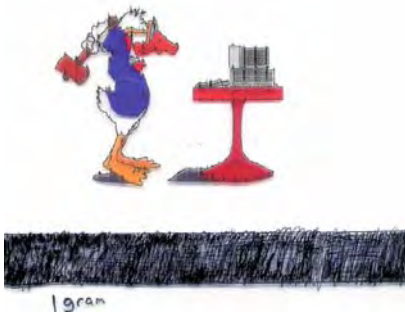
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Elektrofizyolojik sinyallerin özellikleri

| Elektrofizyolojik Sinyal | Genliği (μV) | Frekans Bölgesi (Hz) |
|---|---------------------|----------------------|
| Elektrokardiyogram (EKG) | 1,000 - 2,000 | 0.05 - 1,000 |
| Elektromiyogram (EMG) | | |
| Yüzeysel, iskelet kası (SEMG) | 50 - 5,000 | 2 - 500 |
| Motor birim (MUP) | 100 - 2,000 | 5 - 10,000 |
| Tek-lif (SFEMG) | 1,000 - 10,000 | 500 - 10,000 |
| Elektroensefalogram (EEG) | | |
| Saçlı deriden, yüzeysel (rutin EEG, normal) | 2 - 100 | 0.5 - 70 |
| Uyanılmış Potansiyeller (saçlı deriden, EP) | 0.1 - 30 | 0.5 - 3,000 |
| Hazırık ya da Beklentisi Potansiyelleri (ERP) | 0.1 - 10 | DC - 5 |
| Alan Potansiyelleri (derin elektrota, FP) | 100 - 1,500 | 50 - 2,000 |
| Elektro-okülogram (EOG) | 10 - 5,000 | DC - 100 |
| Elektroretinogram (ERG) | 0.5 - 1,000 | 0.2 - 200 |
| Elektrogastrogram (EGG) | 10 - 100 | 0.01 - 1 |
| Elektroenjogram (ENG) | 5 - 10,000 | 100 - 1,000 |
| Ekstraselüler DC kayımlar | 2 - 2,000 | DC - 5 |
| Ekstraselüler Aksiyon Potansiyeli | 500 - 1,000 | 100 - 2,000 |
| Intraselüler Aksiyon Potansiyeli (AP) | 80,000 - 120,000 | 100 - 3,000 |
| Postsinaptik Potansiyeller (EPSP ve IPSP) | 10 - 50,000 | 1 - 500 |

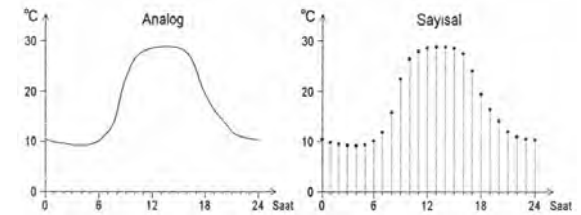
Kaynak: Prof. Dr. Pekcan Ungan 11

Bilgisayarlı kayıt sistemleri...



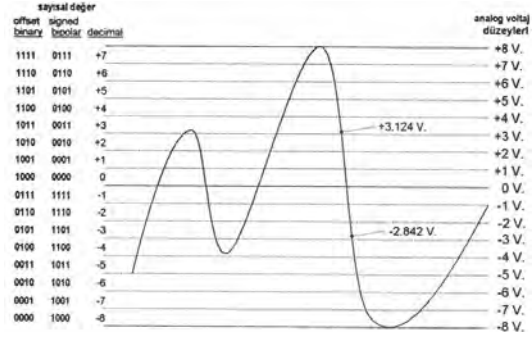
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Analog ve sayısal verilerin karşılaştırılması



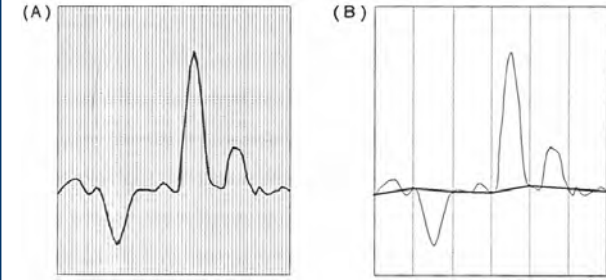
Kaynak: Prof. Dr. Pekcan Ungan 12

Analog verilerin sayısallaştırılması



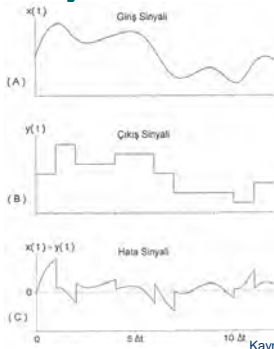
Kaynak: Prof. Dr. Pekcan Ungan 13

Sayısal verilerde örnekleme sıklığı



Kaynak: Prof. Dr. Pekcan Ungan 15

Analog ve sayısal verilerin farklılığı



Kaynak: Prof. Dr. Pekcan Ungan 14

Bilgisayarlı monitorizasyon için mevcut sistem örnekleri

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TDA 97 Transducer Data Acquisition System



TDA 97 Sistem 4 Kanal Transdüser Amplifikatörlerinden oluşmaktadır. Köprü tipi Gerim ve Kan basınç transdüserleri bağlanabilir olup transdüserlerdeki cevap sinyallerini yükseltmek bilgisayarla aktarmaktadır.

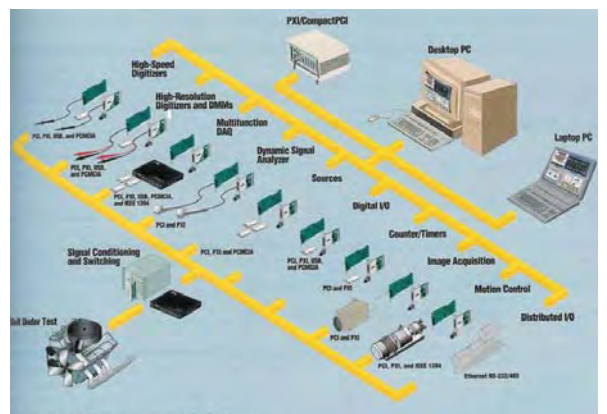
Bilgisayarla On-Line bağlantılı olup analog sinyalleri altyarak POLWIN98 Programı ile koordineli çalışmaktadır. Her marka İzometrik, İzotonik ve Kan basınç transdüserleri özel kablo adaptasyonu ile bağlanabilmektedir.

| | |
|---------------------------|-------------------------|
| Kanal Sayısı: | 4 |
| Giriş Tipi: | Köprü Transdüser |
| Giriş Empedansı: | 50-1000 Ohm |
| Transdüser Üyeleri Akımı: | 20mA Sahit Akım |
| Akım Koruma Çatısı: | Kıymalı |
| Sıfırlama Kaynağı Çatısı: | 24V/Hours |
| Kaçak Arakları: | 1, 2, 5, 10, 20, 40 Tan |
| Filtreler: | Sıklık |
| Değer Kontrol Aralığı: | 930 Kaha 93 İnce |
| Çalışma Voltajı: | 220V 50Hz |

PWS98 Polwin 98 Software



www.commat.com.tr 17



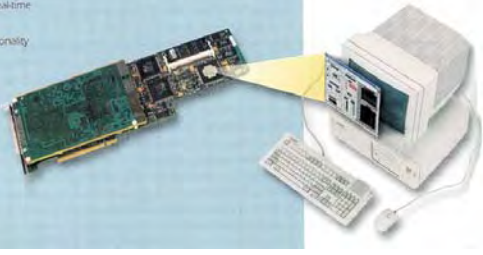
Integrated Measurement Solutions

National Instruments, www.ni.com 19

National Instruments sistemleri

LabVIEW Real-Time


Graphical programming for real-time control and reliability
 Rapid development
 Complete flexibility and functionality
 Reliability of real-time OS
 Integrated libraries for:
 DAQ
 PID Control
 Fuzzy Logic Control
 Numerous add-on tools
 Requires RT Series hardware



National Instruments, www.ni.com 18

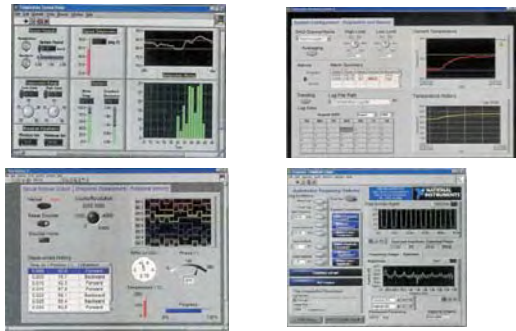
Lowest-Cost Multifunction I/O Board for the IBM PC/XT/AT

PC-LPM-16



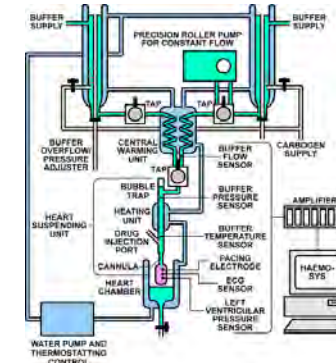
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Labview programı

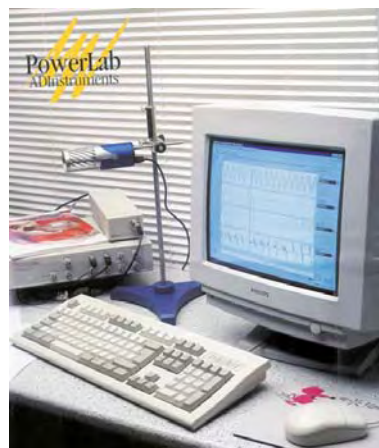


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Haemosys Langendorff düzeneği



<http://quantametrics.com> 23

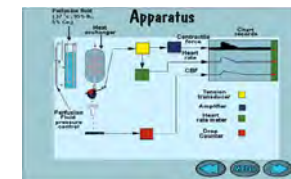


Powerlab sistemleri

www.adinstruments.com 22

Langendorff heart simulation

- A computer simulation of experiments which may be performed on the isolated, perfused mammalian heart written by David Dewhurst and Malachy Doherty.
- This program is highly interactive and simulates experiments, which may be performed on the isolated perfused mammalian heart (Langendorff preparation)...



<http://members.aol.com/Sheffbp/products/langndrf.htm> 24



MP100 Data Acquisition System



www.biopac.com

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MP100 sistemini tanıtma

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Our goal is to provide powerful and distinctive data acquisition systems which do not require technical training or programming knowledge: We want you to concentrate on your research questions instead.

Kaynak: MP100 tanıtım kataloğu 28

16 bit resolution: Able to resolve signal variations with extreme accuracy.

16 analog inputs: Collect data from 1 to 16 different signal sources simultaneously.

16 digital I/O lines: Digital (TTL level) lines are provided for the monitoring and/or outputting of digital (ON/OFF) information.

2 analog outputs: Output can be simultaneous with data collections, allowing stimulus-response measurements.

Isolated external units: Offers a high degree of safety for humans and animals. Removes noise interference.

Double-buffered data transfer: Enables the MP100 to run in the background while you work on something else.

Various trigger modes: Data collection can be synchronized to external events or to a selected channel's predefined threshold level.

Automatically trigger: Control devices from the analog input data.

Several data storage modes:

- High speed burst mode: Data is saved in the MP100's internal memory (16,000 samples max) at rates up to 70,000 samples/second aggregate, then downloaded to the computer.

- Save to computer memory: File size is limited only by computer's available memory.

- Save to disk: File size is limited only by computer's available hard disk space.

High speed burst mode: MP100 storage (data plotted immediately following collection):

1 channel: 70,000 samples/second
16 channels: 5326 samples/second (any computer)

RAM or hard disk storage mode: (data acquired and simultaneously plotted):

1 channel: 11,000 samples/second
16 channels: 1,000 samples/second (Pentium or Power Macintosh)*

TTL: Transistor-transistor logic 29

Analog Inputs

Number of channels: 16
Input voltage range (FSR): $\pm 10V$
A/D resolution (bits): 16
Accuracy (% of FSR): ± 0.003
Input impedance (Ω): 1.0M

Analog Outputs

Number of channels: 2
Output voltage range: $\pm 10V$
D/A resolution (bits): 12
Accuracy (% of FSR): ± 0.02
Output drive current (max): $\pm 5mA$
Output impedance (Ω): 100

Digital I/O

Number of channels: 16
Voltage levels: TTL, CMOS
Maximum drive current: $\pm 20mA$

External Trigger Input

Voltage levels: TTL, CMOS

FSR: Force sensing resistor. CMOS: Complementary metal oxide semiconductor 30

Serial Interface

Transmission rate (bits/sec): 800K
Transmission type (Mac): RS422 direct
Transmission type (PC): RS422 to ISA/PCMCIA
Max serial cable length (meters): 6

Miscellaneous

All biopotential and transducer module isolation is provided by the MP100A.

Leakage current:

Normal Operation: less than $8\mu A$
Single Fault Operation: less than $400\mu A$
Internal buffer (samples): 16,384
Power requirements: 12VDC @ 1amp
(Wall transformer is provided)
Power protection (fused): 2A (fast blow)
Dimensions: 7cm x 29cm x 25cm
Weight: 1.8 Kg.
Compatibility (Mac): System 7 or better
(PC): Windows 3.1 or Windows 95

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BIOPOTENTIAL AMPS

Amplifier type: Differential input
Number of channels: 1
Input impedance: 2 M Ω (differential)
CMII: 1000 M Ω min (50/60 Hz)
CMRR: 110 dB min (50/60 Hz)
CMIV: $\pm 10V$
Notch filter 50/60 Hz: 50dB min rejection
Dimensions: 4cm x 11cm x 19cm

Gain Settings

EEG100B 500; 1,000; 2,000; 5,000
EEG100B 5,000; 10,000; 20,000; 50,000
EMG100B 500; 1,000; 2,000; 5,000
EOG100B 500; 1,000; 2,000; 5,000
ERS100B 5,000; 10,000; 20,000; 50,000

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Upper Frequency Response Selections

| | |
|---------|-----------------|
| ECG100B | 35 or 100 Hz |
| EEG100B | 35 or 100 Hz |
| EMG100B | 500 or 5000 Hz |
| EOG100B | 35 or 100 Hz |
| ERS100B | 3 kHz or 10 kHz |

Lower Frequency Response Selections

| | |
|---------|---------------------|
| ECG100B | 0.05 Hz or 1.0 Hz |
| EEG100B | 0.1, 1.0 Hz |
| EMG100B | 1.0 or 10 or 100 Hz |
| EOG100B | DC or 0.05 Hz |
| ERS100B | 1 or 20 or 100 Hz |

Noise Voltage (Shorted Input)

| | |
|-----------------------|-------------------|
| ECG100B (0.05-35 Hz) | 0.1 μ V (rms) |
| EEG100B (0.1-35 Hz) | 0.1 μ V (rms) |
| EMG100B (10-500 Hz) | 0.2 μ V (rms) |
| EOG100B (0.05-35 Hz) | 0.1 μ V (rms) |
| ERS100B (100-3000 Hz) | 0.5 μ V (rms) |

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DIFFERENTIAL AMP (DA100B)

| | |
|-----------------------|---------------------------------------|
| Amplifier type: | Differential input |
| Number of channels: | 1 |
| Dimensions: | 4cm x 11cm x 19cm |
| Input impedance: | 2 M Ω (differential) |
| CMRR: | 90dB minimum |
| Noise Voltage: | (0.05-10 Hz) 0.11 μ V (rms) |
| Temperature drift: | 0.3 μ V / $^{\circ}$ C |
| Input voltage (max): | \pm 200mV (protected) |
| Voltage reference: | -10 to +10 V max adjustable @ 20mA |
| Gain settings: | 50; 200; 1000; 5000 |
| Upper freq. response: | 10Hz or 300 Hz or 5000 Hz |
| Lower freq. response: | DC or 0.05 |

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TRANSDUCER AMPS

Number of channels: 1
Dimensions: 4cm x 11cm x 19cm

Gain Settings

| | |
|---------|------------------------------|
| GSR100B | 20, 10, 5, 2 μ mhos/Volt |
| PPG100B | 10; 20; 50; 100 |
| RSP100B | 10; 20; 50; 100 |
| SKT100B | 5"; 2"; 1"; 0.5" F/Volt |

Upper Frequency Response:

| | |
|---------|------------|
| GSR100B | 1 or 10 Hz |
| PPG100B | 10 Hz |
| RSP100B | 1 or 10 Hz |
| SKT100B | 1 or 10 Hz |

Lower frequency response selections

| | |
|---------|----------------------|
| GSR100B | DC or 0.05 Hz |
| PPG100B | DC or 0.05 or 0.5 Hz |
| RSP100B | DC or 0.05 or 0.5 Hz |
| SKT100B | DC or 0.05 Hz |

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STIMULATOR MODULE (STM100A)

Dimensions: 4cm x 11cm x 19cm

Stimulator Output

| | |
|--------------------------------|------------------------------|
| Stimulus output voltage: | 20 volts p-p (max) |
| 50 Ω output: | \pm 100mA (3.5mm jack) |
| Ext stimulus output: | \pm 1.0A (1.4" phono jack) |
| Ext stimulus output impedance: | <0.1 Ω |

Stimulator Controls

| | |
|----------------------|--------------------------|
| Input sources: | OUT0, OUT1, PULSE, CH 16 |
| Polarity control: | Manual or digital |
| Attenuation control: | Manual or digital |
| Attenuation range: | 128 dB |
| Indicators: | PULSE, current limit |

Stimulus Waveform Limits

| | |
|--------------------------------|------------------|
| Pulse width: | 10 μ s (min) |
| Pulse resolution: | 1 μ s |
| Biphasic pulse width: | 50 μ s (min) |
| Biphasic pulse resolution: | 25 μ s |
| Arbitrary waveform resolution: | 25 μ s |

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SPECIALTY MODULES

OXY100A

Outputs: SpO₂, Pulse Rate
Pulse Waveform & Module Status
SAO₂ range: 60-100% (specified)
Pulse Rate range: 30-250 BPM
Output range: 0 to 5 volts (analog)
Operation: Dual Wavelengths (660, 940 nm)

CO₂100A

Output: CO₂ Concentration (0-10%)
Output range: 0 to 10 volts (analog)
Response time: 100 ms @ 100 ml/min

O₂100A

Output: O₂ Concentration (0-100%)
Output range: 0 to 10 volts (analog)
Response time: 500 ms @ 100 ml/min

LDF100A

Outputs: Laser Doppler Flow (0-9999 BPU)
Tissue Remittance (0-100%)
Output range: 0 to 10 volts (analog)
Laser Wavelength: 780 nm ± 10nm
Laser Power: 0.5 to 1.0 mW (probe dependent)
Response time: 100 msec

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HOW MUCH DATA CAN I SAVE?

There are no file size constraints in the software. Depending on whether you are saving to your computer's memory or direct to disk, you are limited by how much memory your computer has or by the available space on your hard or floppy disk. To calculate how much disk you will require, use the following equation, then add 5 kbytes to allow for the memory needed to store file information.

$$\text{Memory required (bytes)} = (8C + 2A) \times S \times T$$

C = Number of calculation channels

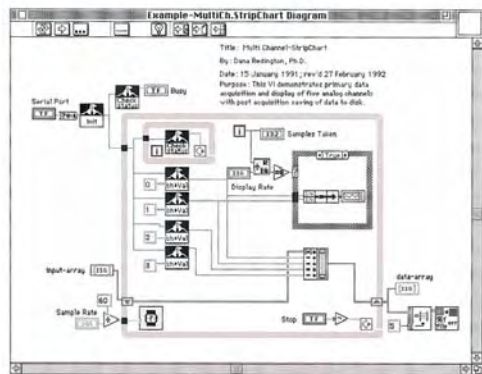
A = Number of analog channels

S = Sample rate (samples/second)

T = Recording time (seconds)

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LABVIEW INTERFACE



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ACQKnowledge programını tanıtma

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