



## 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!**



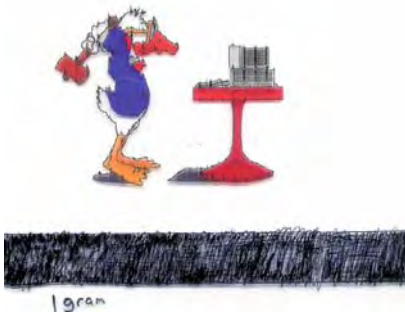
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## Elektrofizyolojik sinyallerin özellikleri

Elektrofizyolojik Sinyal	Genliği ( $\mu V$ )	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
Elektroentorogram (ENG)	5 - 10,000	100 - 1,000
Ekstraselüler DC kayımları	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

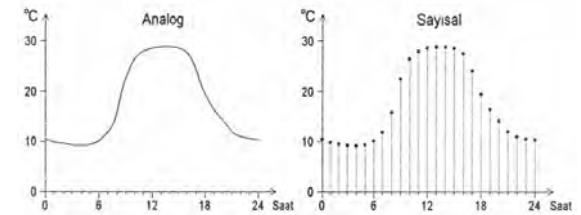
Kaynak: Prof. Dr. Pekcan Ungan 11

Bilgisayarlı kayıt sistemleri...



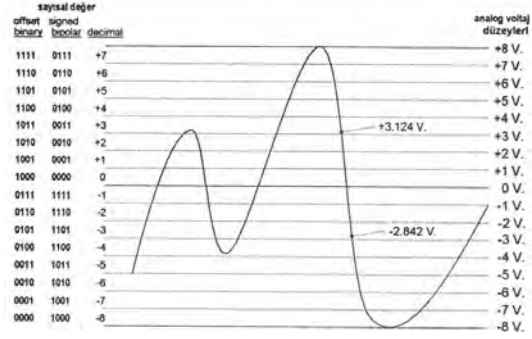
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## Analog ve sayısal verilerin karşılaştırılması



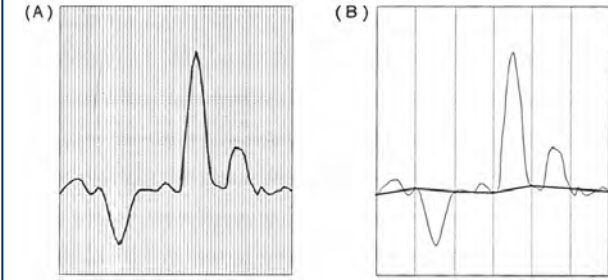
Kaynak: Prof. Dr. Pekcan Ungan 12

## Analog verilerin sayısallaştırılması



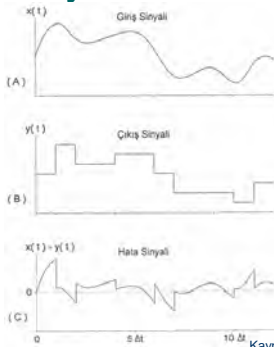
Kaynak: Prof. Dr. Pekcan Ungan 13

## 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 basıncı transdüserleri bağlanabilir olup transdüserlerdeki cevap sinyallerini yükseltmek bilgisayar aktarmaktadır.

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

Kanal Sayısı :	4
Giriş Tipi :	Köprü Transdüser
Giriş Empedansı :	50-1000 Ohm
Transdüser Üyeni Akımı :	20mA Sahit Akım
Akım Koruma Çatısı :	Kıymalı
Safılaşma Kayma Oranı :	20V/Hours
Kaçanç Aralıkları :	1, 2, 5, 10, 20, 40 Tan
Filtreler :	Sıklık
Değer Kontrol Aralığı :	950 Kaha 95 İnce
Çalışma Voltajı :	220V 50Hz

### PWS98 Polwin 98 Software



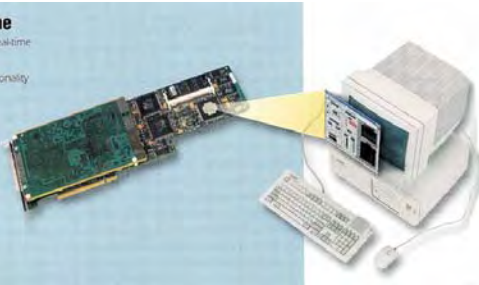
www.commat.com.tr

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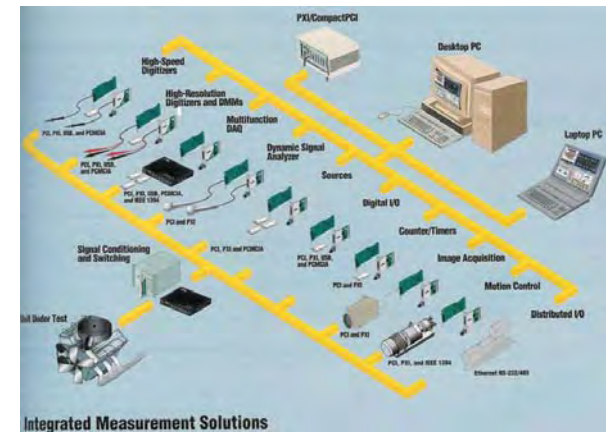
## National Instruments sistemleri

### 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

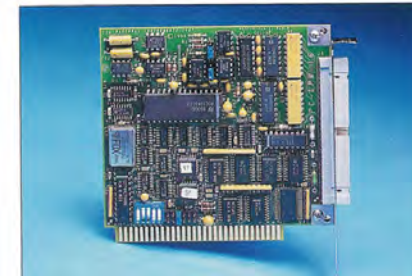


Integrated Measurement Solutions

National Instruments, www.ni.com 19

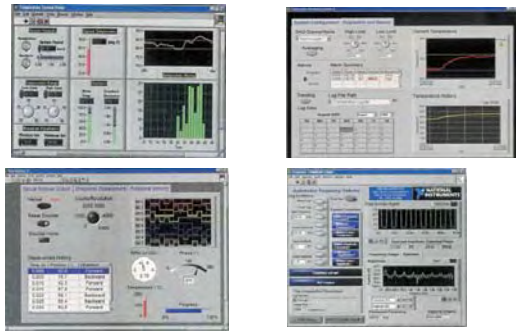
## Lowest-Cost Multifunction I/O Board for the IBM PC/XT/AT

PC-LPM-16



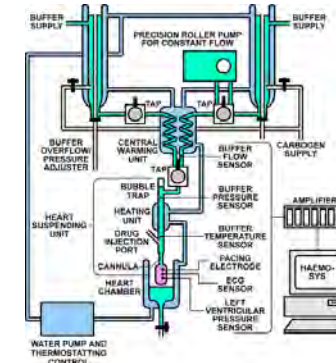
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## Labview programı

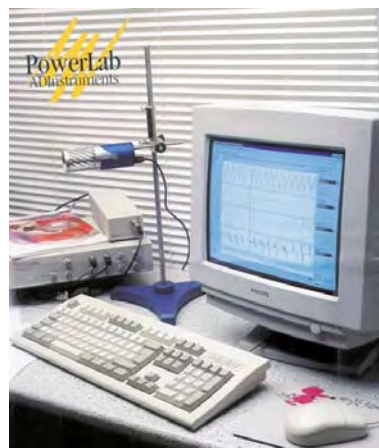


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## Haemosys Langendorff düzeneği



<http://quantametrics.com> 23

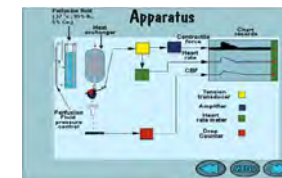


## Powerlab sistemleri

[www.adinstruments.com](http://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](http://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):  $\pm 0.003$   
Input impedance ( $\Omega$ ): 1.0M

**Analog Outputs**

Number of channels: 2  
Output voltage range:  $\pm 10V$   
D/A resolution (bits): 12  
Accuracy (% of FSR):  $\pm 0.02$   
Output drive current (max):  $\pm 5mA$   
Output impedance ( $\Omega$ ): 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 $\Omega$  (differential)  
CMII: 1000 M $\Omega$  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**

ECG100B 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 $\mu$ V (rms)
EEG100B (0.1-35 Hz)	0.1 $\mu$ V (rms)
EMG100B (10-500 Hz)	0.2 $\mu$ V (rms)
EOG100B (0.05-35 Hz)	0.1 $\mu$ V (rms)
ERS100B (100-3000 Hz)	0.5 $\mu$ 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 $\Omega$ (differential)
CMRR:	90dB minimum
Noise Voltage:	(0.05-10 Hz) 0.11 $\mu$ V (rms)
Temperature drift:	0.3 $\mu$ 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 $\mu$ 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 $\Omega$ output:	$\pm$ 100mA (3.5mm jack)
Ext stimulus output:	$\pm$ 1.0A (1.4" phono jack)
Ext stimulus output impedance:	<0.1 $\Omega$

#### 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 $\mu$ s (min)
Pulse resolution:	1 $\mu$ s
Biphasic pulse width:	50 $\mu$ s (min)
Biphasic pulse resolution:	25 $\mu$ s
Arbitrary waveform resolution:	25 $\mu$ s

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### SPECIALTY MODULES

#### OXY100A

Outputs: SpO<sub>2</sub>, Pulse Rate  
Pulse Waveform & Module Status  
SAO<sub>2</sub> range: 60-100% (specified)  
Pulse Rate range: 30-250 BPM  
Output range: 0 to 5 volts (analog)  
Operation: Dual Wavelengths (660, 940 nm)

#### CO<sub>2</sub>100A

Output: CO<sub>2</sub> Concentration (0-10%)  
Output range: 0 to 10 volts (analog)  
Response time: 100 ms @ 100 ml/min

#### O<sub>2</sub>100A

Output: O<sub>2</sub> 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

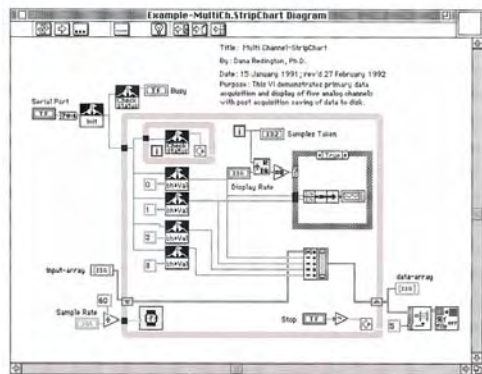
A = Number of analog channels

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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