



DoD Lead Automotive Tester

Solid State Recording as Applied to Automotive Testing

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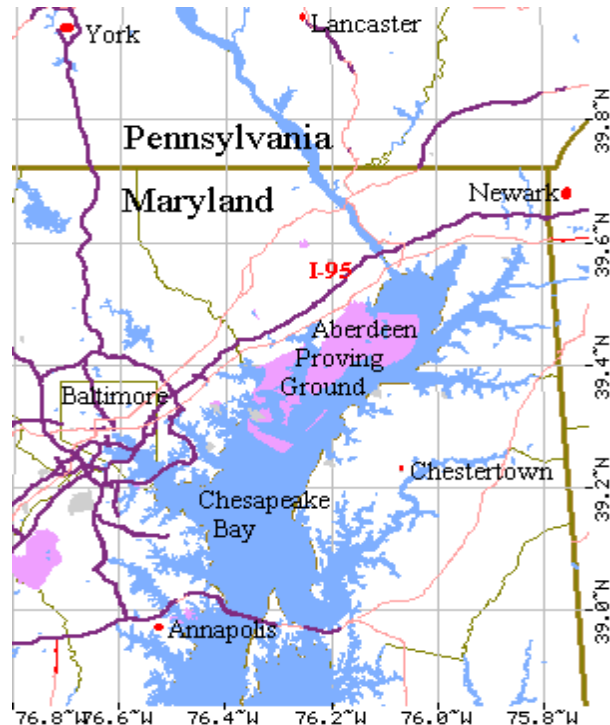
- ◆ What is Aberdeen Test Center
- ◆ Hardware
 - Signal Conditioning System
 - Data Acquisition System
- ◆ Graphical User Interface
- ◆ Automotive Testing
- ◆ The Applications



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ABERDEEN TEST CENTER

LOCATION



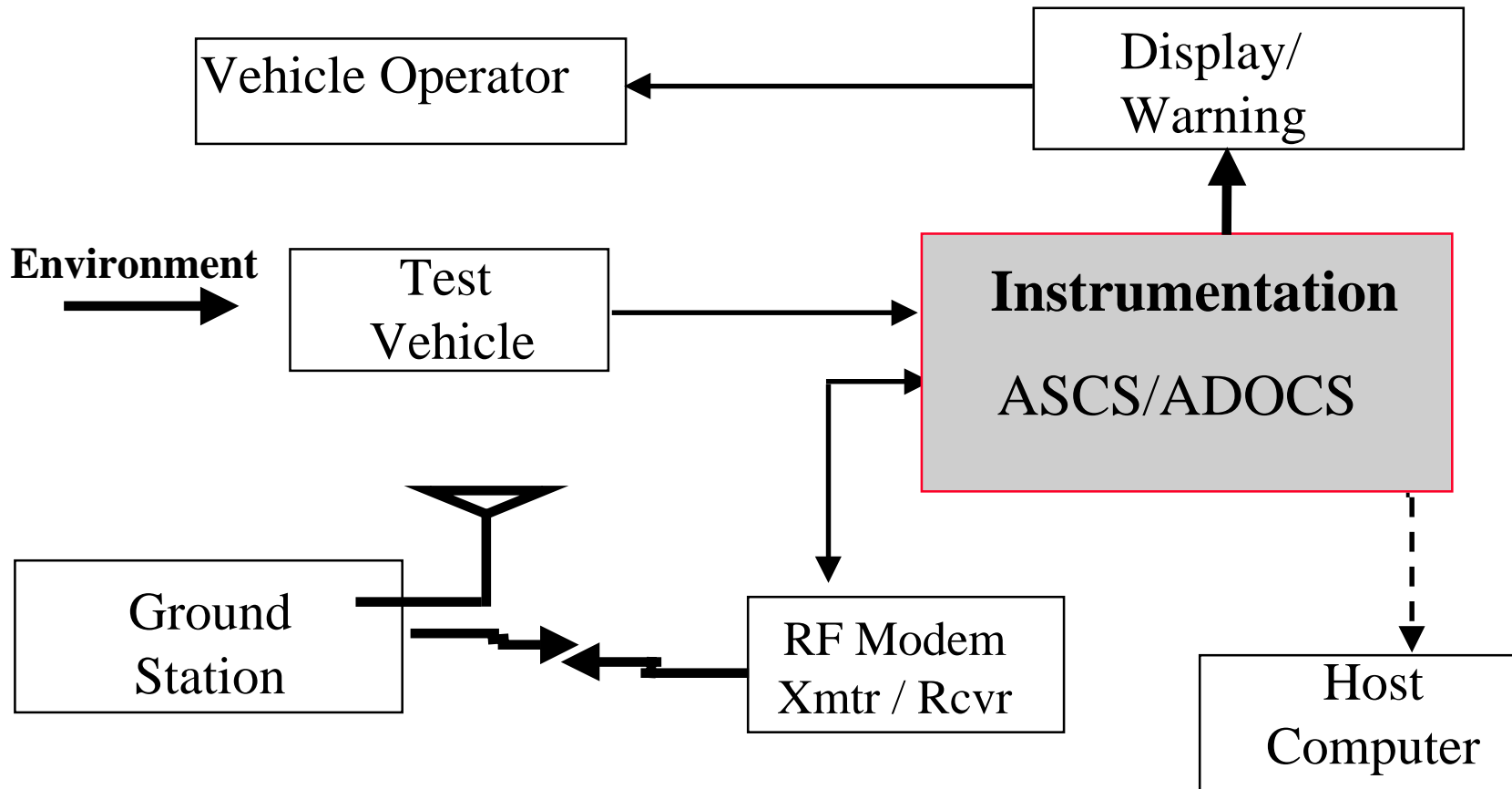
• HISTORY

- First Test 1918
- Automotive Emphasis After WWII
- Standardized Roads
- Accredited Laboratories
- Precision Fabrication
- Ride and Shoot



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Automotive Instrumentation Data Acquisition Philosophy



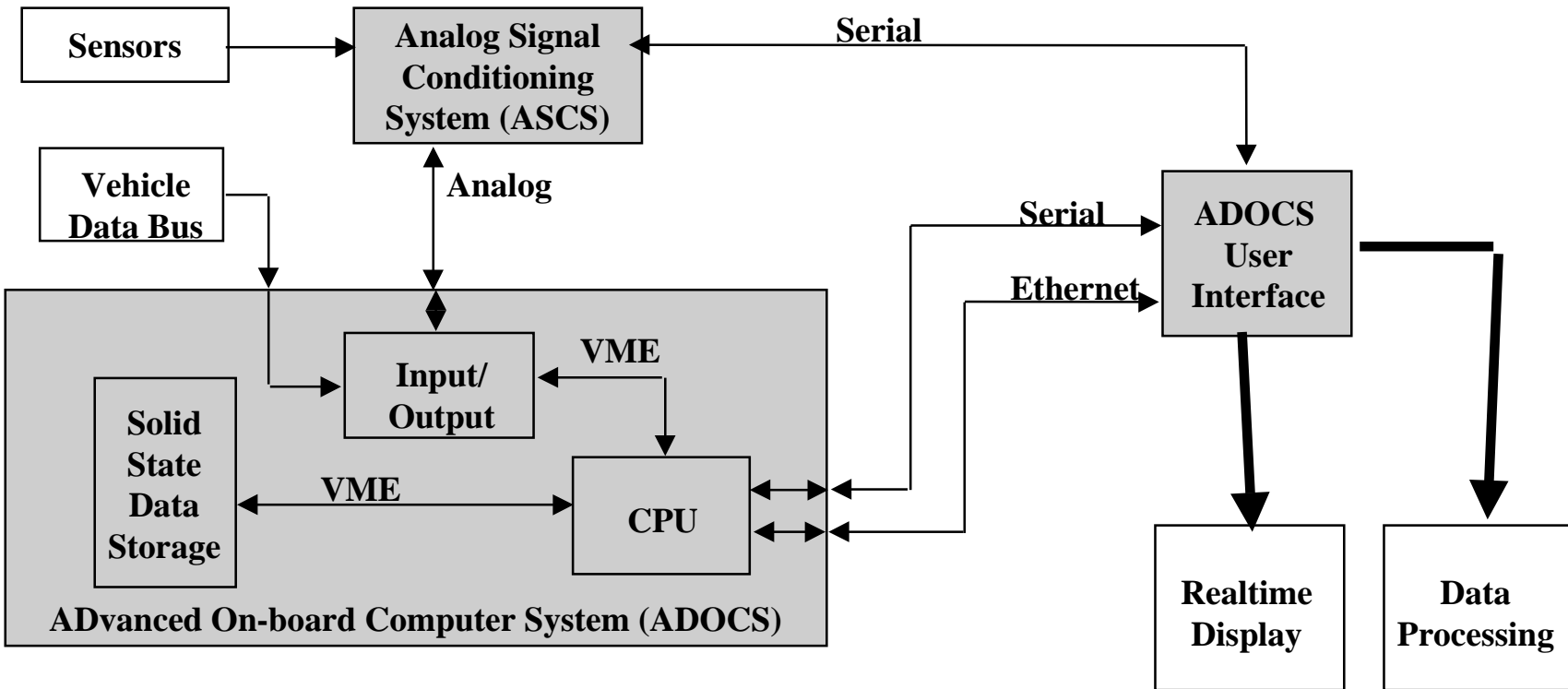


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ADOCS

(ADvanced On-board Computer System)

System Configuration

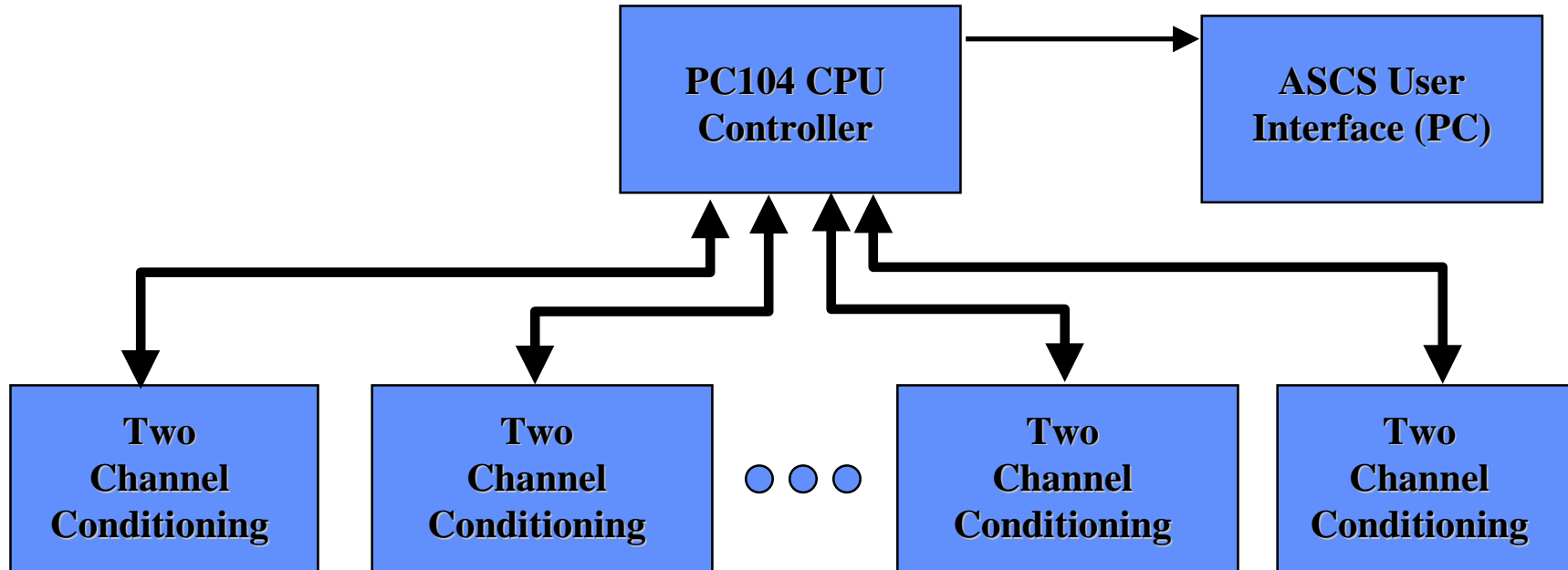




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Analog Signal Conditioning System (ASCS)

ASCS System Architecture





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ASCS CPU Controller

- V20 CPU (8088 based PC clone)
- Flash memory used as disk drive for program and configuration storage
- PC - 104 Bus Architecture

ASCS Signal Conditioning Cards

- 2 Channels per card
- On-board data registers for board type ID and configuration (gain, filter frequencies, etc.)
- Current board types
 - Bridge/High Level
 - Thermocouple (T and K type)
 - Pulse Conditioning



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ASCS

Bridge/High Level Conditioning Card

- ◆ Full, half, or no bridge input
- ◆ Gain from 1/8 to 2048
- ◆ 4 stepped discrete 1 pole RC filter
- ◆ Two 5 pole Butterworth or 5 pole Bessel filter (.1 to 5000 Hz)
- ◆ Programmable voltage calibration for +/- 12 V
- ◆ Selectable excitation voltage: 0 to 10V, +/- 15V, 28V
- ◆ Automatic or manual balance offset 0 to 10V
- ◆ Selectable resistor shunt for calibration
- ◆ Output offset voltage 0 to 10V

Thermal Conditioning Card

- ◆ Accepts T or K type thermocouples
- ◆ Optical isolation of input signal and calibration voltage to 1500V RMS
- ◆ Gains from 1.25mV/°C -160mV/°C
- ◆ 4 stepped discrete 1 pole RC filter
- ◆ Programmable offset of 0 to 10V
- ◆ Calibration voltage from .000010V to .025V in 65356 steps



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ASCS

Pulse Conditioning Board

- 0 to 150V RMS. input signal
- Gain 1/16 to 2500
- Programmable filter 10Hz to 100KHz
- Selectable trigger levels in range +/- 15V
- Optional balance removes DC offset
- Calibration signal 150Hz to 10MHz

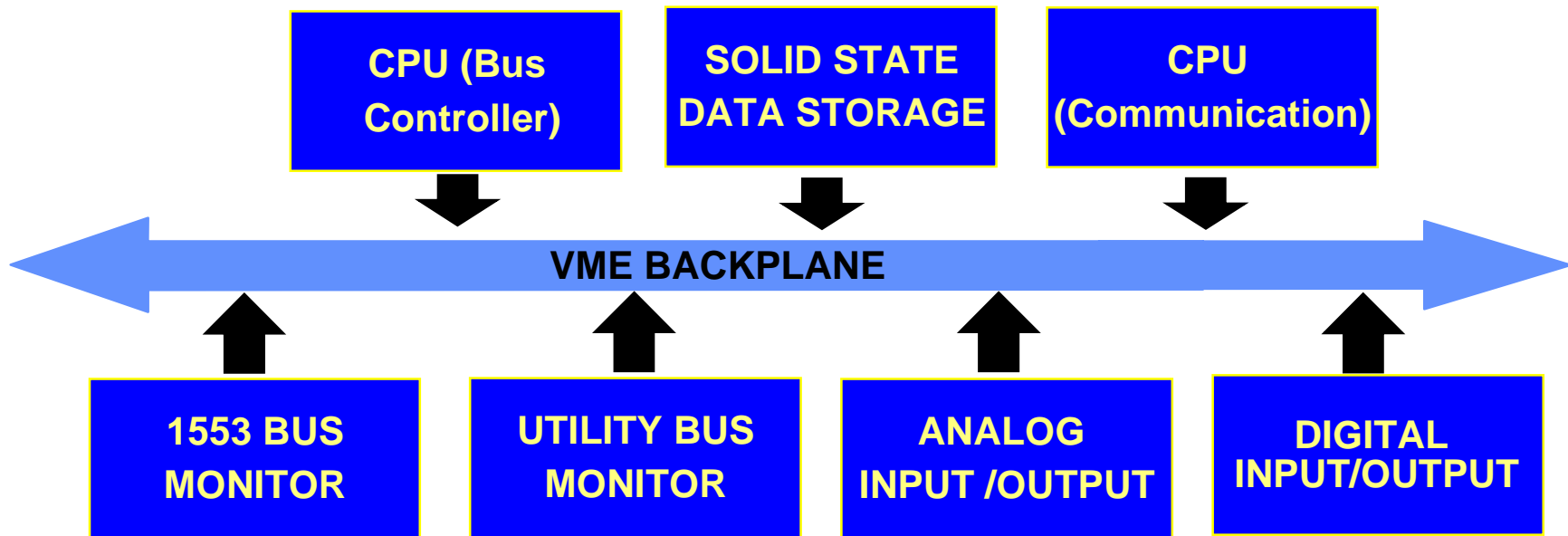


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ADOCS

(ADvanced On-board Computer System)

ADOCS Architecture





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ADOCS Main CPU Primary Functions

- ◆ Controls event processing
- ◆ Performs algorithms
- ◆ Controls PCM
- ◆ Handles all serial communications with Host computer using SLIP protocol
- ◆ Handles communication over ethernet using UDP/IP protocol



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ADOCS Main CPU

Pep Systems VM42:

- ◆ Motorola 68040 CPU @ 33MHz
- ◆ Motorola 68360 co-processor
- ◆ 4 Mbytes of DRAM
- ◆ 1 Mbyte of SRAM
- ◆ 1 Mbyte of Flash EPROM
- ◆ 2 RS232 ports
- ◆ Ethernet port



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ADOCS

Solid State Data Storage



- ◆ Static RAM
 - 8 Mbytes
 - Battery backup
- ◆ ADOCS can have up to 4 cards (32 Mbytes)

Input/Output Modules

- ◆ Industry Packs - Modular , Mezzanine I/O boards
 - IP-Quadrature: pulse train counter
 - IP-1553: 1553 Bus monitor / controller
 - IP-DAC: Digital to Analog converter
 - IP-Opto-interrupter: Opto-isolated digital input board with interrupt capability
 - IP-Synchro: Synchro to digital converter
 - IP-A/D: Analog to digital converter



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ADOCS Graphical User Interface

- ◆ Runs on IBM compatible computer with Windows 95
- ◆ User operations:
 - configure the ADOCS and ASCS
 - examine data in real-time
 - upload recorded data from ADOCS
 - convert data to plots or ASCII file



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ADOCS Configuration Editor

C:\VEPA\VEHICLEX.VEP

General Pulse A/D Events Algos GPS Record D/A View

All Currently Defined Channels (97)

Chan Label	Chan Type
Events	System
BrakeBoxStatus	System
5thWheel_Pulses	Pulse
WheelRevolutio01	Pulse
OptWheel_Pulses	Pulse
RawTemp1	A/D
RawTemp2	A/D
RawTemp3	A/D
RawTemp4	A/D
RawTemp5	A/D
RawTemp6	A/D
RawTemp7	A/D
RawTemp8	A/D
RawTemp9	A/D
RawTemp10	A/D
RawTemp11	A/D
RawTemp12	A/D
RawTemp13	A/D
RawTemp14	A/D
RawTemp15	A/D
RawTemp16	A/D

Minimum Recording Time With Your Configuration & 16 Meg Mem 1889.2 Mins Or 31.5 Hours

Record Rate 1.000000

Record Trigger F5-RecordON/OFF

Units xx

Scale Factor 1.000000

Offset 0.000000

Plot Minimum 1.000000

Plot Maximum 10.000000

XducerModel/SN N/A

CalibrationDate N/A

Save

Save & Exit

Save As ...

Send To ADOCS

Save & Send & Exit

Print

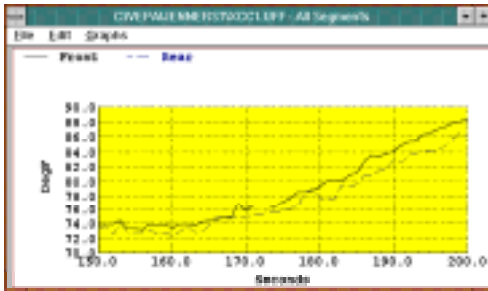
Exit

Help



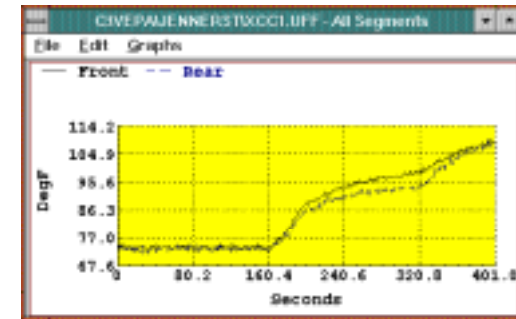
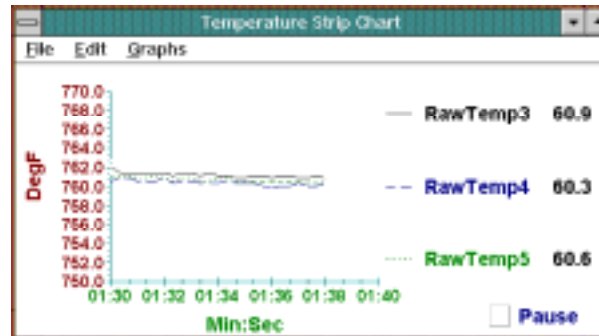
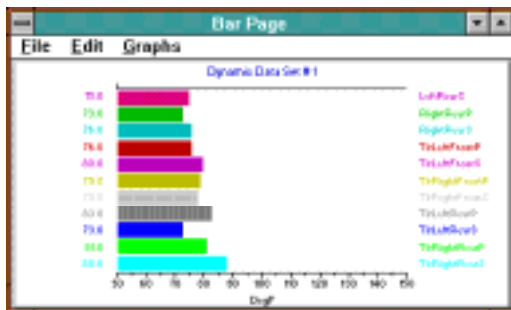
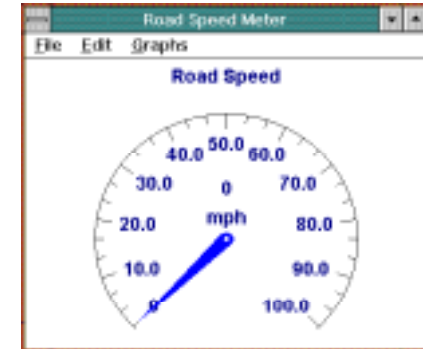
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ADOCS Graphical User Interface Displays



Channels		
RawTemp3	757.41	DegF
RawTemp4	756.35	DegF
RawTemp5	756.88	DegF
RawTemp6	757.95	DegF
RawTemp7	759.01	DegF
RawTemp8	758.21	DegF
RawTemp9	756.35	DegF
RawTemp10	759.81	DegF

Annunciator Panel			
File Edit Graphs			
Dynamic Data Set #1			
LeftRearP	LeftRearS	RightRearP	RightRearS
0	73.00	73.00	75.00
N/A	N/A	N/A	N/A
OK	OK	OK	OK
TiLeftFrontP	TiLeftFrontS	TiRightFrontP	TiRightFrontS
75.00	80.00	78.00	78.00
N/A	N/A	N/A	N/A
OK	HIGH	OK	OK
TiLeftRearP	TiLeftRearS	TiRightRearP	TiRightRearS
83.00	75.00	83.00	89.00
N/A	N/A	N/A	N/A
HIGH	OK	HIGH	HIGH





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Automotive Instrumentation

Sample Test Requirements

Brake Test: Mountain
Endurance Course

Primary Parameters

Brake Pedal Effort

Brake Pedal Position

Deceleration Rate

Brake System Pressure

Brake Shoe Temps

Vehicle Speed

Vehicle Stability Test

Primary Parameters

Vehicle Pitch, Roll
and Yaw Rates

Lateral Acceleration

Steering Wheel
Effort

Steering Wheel
Position

Vehicle Speed



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Solid State Recording as Applied to Automotive Testing

Summary

Embedded System Technology Provides a System with Extensive Versatility in Addition to Being:

- ▶ Rugged
- ▶ Low Power
- ▶ Extensive Remote Control
- ▶ User Friendly Interface

The final product is a common suite of instrumentation tools which satisfy many automotive requirements.