

Diesel Engine Test Cell

CyFlex Overview

A World-Class Test System

CyFlex Test System is a world-class, highly flexible test system currently in use at major engineering facilities in the U.S. and around the world. CyberMetric sells the CyFlex Software, and provides engineering support, application development and training. Demonstrations are available and visits to engineering facilities, that are using the system are possible.

Scaleable

Because of the power and flexibility of the CyFlex Test System, it can be applied in testing and measurement applications that range from small, simple tests managing several parameters, to very large, complex tests involving hundreds of real-time measurements.

Reduced Costs, Greater Productivity

Cost reduction will come from a variety of sources:

- Improved throughput and reduction in testing bottlenecks will compress the development time both reducing costs and supporting on-time delivery to market.
- “Local” hardware systems are reduced saving maintenance and calibration costs.
- Unattended testing requires fewer technicians and/or overtime for weekend testing.
- Empowered users get more done in less time (see notes below).
- With the Enterprise license, the user no longer needs to pay for additional licenses to add test cells.

Improved Test Cell Utilization

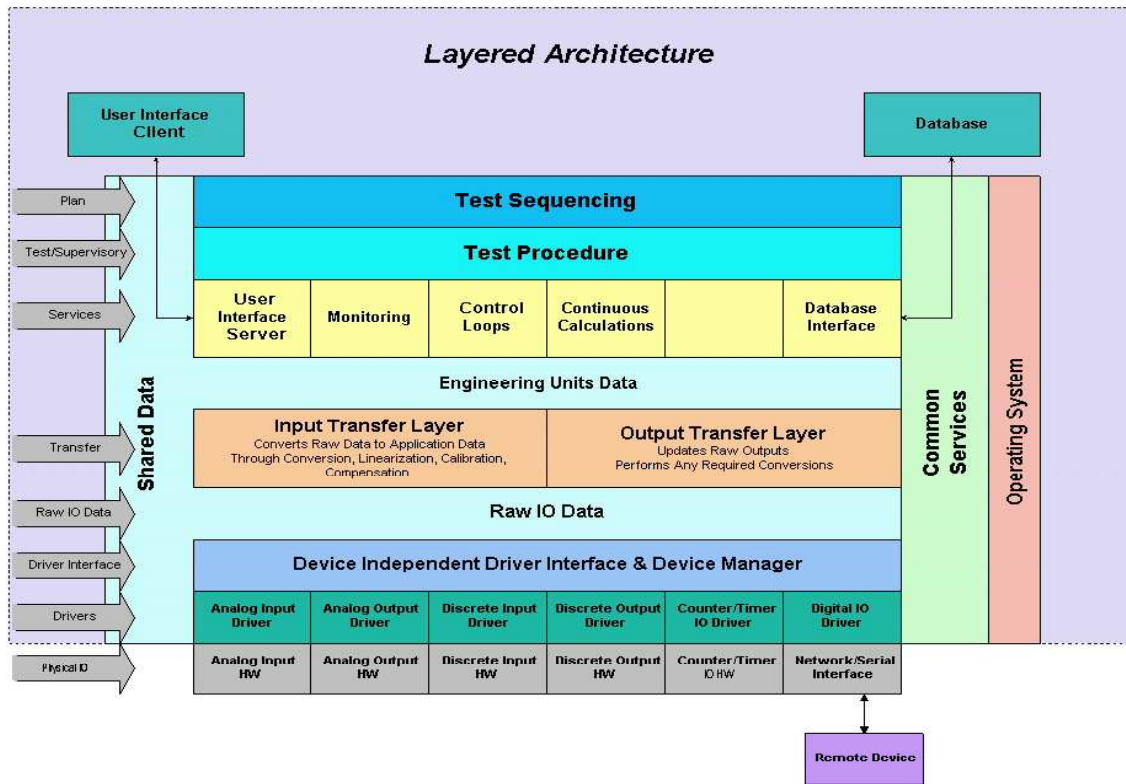
- unattended testing of complex operations means utilization can go to a 2nd and 3rd shift of operation
- event-driven communications means no idle time do to lack of communications

For organizations offering test services, increased revenue and margins will result from:

- Increased test capability, allowing a broader range of services and adding more value.
- Improved resource utilization through automation.
- Increased quality of results, resulting in higher customer satisfaction and repeat business.

Software Strategy & Architecture

1. Empower users
 - User control of functionality
 - + data-driven configurations
 - + test scheduling language
 - + user-defined computations (event driven)
 - Support
 - + on-line manuals & help system
 - + training program
 - + web-based support from CyberMetrix
 - + on-site support for first implementations and configurations
 - + development support from CyberMetrix for applications, device drivers and integration into your existing business systems
 - Event driven communications
 - + pagers
 - + email
 - + automatic data transfers at test completion
 - + remote network access capability for users
2. Organization-wide common approach
 - can be used in engineering and manufacturing
 - engineering units-independence (SI, English)
 - reduces training needs
 - spreads new development costs
3. Highly Integrated Design
 - many traditional hardware functions performed by software
 - reduced hardware complexity
 - unattended operation of complex testing
 - model-based diagnostics enable sophisticated fault detection
4. Networked test systems
 - software upgrades via FTP
 - test monitoring from remote sites (your home)
 - remote consulting & help
5. Modular
 - task-based functions are narrow and specific (low coupling – high cohesion)
6. Layered
 - a logical view / classification of modules with design rules
 - minimize device and operating system dependencies
7. Event-Drive
 - inter-task communications & synchronization mechanism
 - events are both signals and messages
 - tasks remain inactive until an event is received



Hardware Design Philosophy

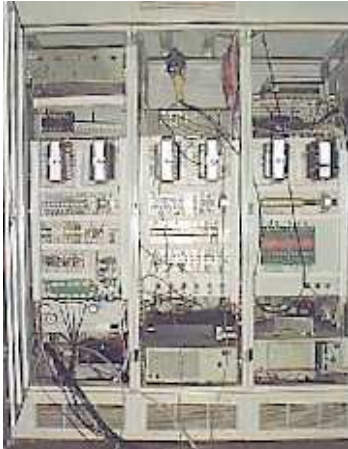
Minimize "local" hardware systems, which require maintenance & calibration

- leverage standard PC technology/cost
- no PID controllers
- no hardware safety control logic (except a watchdog timer)
- minimize signal conditioning
 - strain bridges excited by common power supply
 - no adjustments for pressure or torque measurement
 - thermocouple ice-point compensation and linearization can be done in software
- fuel scale timing, filling, weight lifting functions controlled directly by computer
- minimize "local" display devices
 - rely on the PC monitor for operator display
- minimize "local" controls
 - most controls signal requests to the computer



Engine Test Cell Control Panel

Supported I/O Hardware



Capable of supporting virtually any I/O

Analog Input

- National Instruments FieldPoint
- Metrabyte DAS16 family (DAS16G2, DAS1600)
 - Multiplexers (EXP-16, EXP-GP, ISO-4)
 - Computer Boards CIO-MUX16,
- Metrabus family
- Analog Devices RTI-815
- Computer Boards CIO-AD16JR-AT
- Data Translation 2801
- Hewlett-Packard HP-3852 sub-system
- DGH Serial bus I/O family
- Transition Technology (MTL)
 - Universal AI (25mv to 5v and TC)
 - RTD
 - High Level & 4-20ma
 - Strain Gage
- Datel PCI416 family
- Opto Optomux & SnapIO
- Scanivalve - Ethernet thermocouple module

Analog Output

- National Instruments FieldPoint
- Metrabyte DDA06, DDA15, DAS16, DAS1602
- Computer Boards CIO-DAC08, CIO-DAC16
- Metrabus MAO-8, MAO-12
- Transition Technology (MTL)
- Opto Optomux & SnapIO

Digital I/O (any 8255-based board)

- National Instruments FieldPoint
- Metrabyte PIO-12, PIO-24, PIO-96, PIO-HV
- ICS PCDIO family (PCDIO24-P, etc.)
- Metrabus family (MDI-16, MIO-32, MII-32)
- Transition Technology (MTL)
- Opto Optomux & SnapIO

Counter/Timer (AMD9513-based boards)

- Metrabyte CTM-05
- ICS DCC20/A, DCC5-P
- Computer Boards CI-CTR10, CI-CTR05
- Opto Optomux & SnapIO

CyFlex Platform

Operating System:

- QNX 4.2 (message passing OS)
- Linux port under consideration

Hardware: 386/486/Pentium Intel CPU

- ISA Bus - 11 slots typical
- PCI Bus - 6 slots typical

Language:

- C / C++

Networking

- QNXnet/Arcnet, Ethernet, FDDI, serial
- TCP/IP - Customer's Intranet & Internet
- NFS mounts & TCP/IP connections to Customer's Intranet
- VLAN connection for remote monitoring & specification

Features

Basic I/O transfer/conversion- collection of data & conversion to engineering units

Mass flow - computation of mass flow rates of air and fuel

- air/gas

- continuous fuel

- fuel weighing (scales/load cell)

Performance computation - current engine performance characteristics

User-defined computations - continuous or event-driven evaluations of expressions

Statistical sampling - event-driven statistical evaluation of parameters

Hotkey manager - user definable hotkeys to execute scripts or set events

Data display (multi-page) -user-definable arrangement of 6virtual pages of text data

Waveform Recorder - event-driven collection of time series data for several parameters

Test data logger

- periodic or event-driven sampling of parameters into ASCII tabular form

- automatic transfer of results through ftp, nfs, or local storage

Real-time graphics-graphic simulation of an 8-channel strip chart

Duty cycle collection & analysis-binning algorithm for up to 8 parameters with specified x-y grid

Async device handler- configurable communication mechanism from high level commands,

- used to communicate with intelligent instruments

On/off restriction control-intermittent positioning of a valve to achieve a fixed coefficient at a

- single engine operating point

PID control- single-input, single-output feedback controller

- engine model based feed forward option

PWM control-various methods for generating pulse-width modulated outputs depending on frequency

Limit checking-evaluation of any parameter against a limit

PLC simulation-user-definable response to an event

Engine monitor-manage hour meters and operating range flags

Test scheduler - general purpose, file-driven scheduler of control and data acquisition processes

Engine start - performs engine re-starts with user-definable criteria

Stability evaluation - evaluates multiple criteria to determine stability of an operating point

Data transfer to UNIX/PC-LAN - automatic file transfers through FTP

Calibration utility - GUI for transducer calibration

Pierburg smokemeter (RS232) - management of smokemeter through serial link

AVL smokemeter - management of multiplexed meters

2-D & 3-D modeling - 2d & 3d table interpolations in user-defined expressions

Test cell utilization tracking & reporting

- automatic utilization report generation

Internodal variable & event transfers- real-time transfer of variables from one test system to another - supports use of multiple computers for one application

LabView interface - Interface to LabView tools in NT/'98 environment

Emissions Analyzer - Zero and span algorithms, integrated with test flow. Auto-range control

Real-time turbo surge prediction- tracking of compressor operating point relative to the map surge line to avoid mapping operations under surge

Real-time curve fitting - continuous evaluation of a dataset for smoothness to determine if sufficient data has been collected for optimization processes

Real-time simulation framework

- Simulink-based applications can be integrated into CyFlex environment

- Can be used for vehicle, environment simulation

- Can be used for prototyping control algorithms

Gas Composition and Properties - Real-time computations of gas composition and properties

Emissions and EGR - Real-time computations

Emissions Transient Cycle - Mapping & Cycle validation

Optional Features

History storage/retrieval

- storage of all measured and computed parameters at sampled rate in a compressed format – can be viewed graphically

Test cell utilization tracking & reporting

-graphical displays of facility utilization and current status of test cells

Real-time waveform analysis user-definable real-time extraction of engineering information from collected waveforms.

*Optional features use third party tool that is licensed separately

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