Modular Extensible I/O System

Power Plant Training Simulator Upgrades and Services
Modular Extensible I/O System
Stanley Chan, Corys Thunder

Nuclear Industry Leader in Simulator Upgrades and Services
Introduction

Modular I/O, in the context of training simulators, will focus on the ease of how different components of an I/O system can be integrated. Properties such as physical packaging and connectivity, software configurability are important features.

Extensible is a design principle that is a measure of how easy a system is to extend its functionality, not to be confused with the expandable.
Topics

- CAN Standard
- What is Modular and Extensible I/O?
- Where is Modular and Extensible I/O used?
- Why use Modular and Extensible I/O?
CAN Standard

Controller Area Network, is a bus standard designed in 1986 to allow microcontrollers and devices to communicate with each other without a host computer. Originally designed for the automotive industry but now used in other areas such as Medical Equipment and Industrial control.
CAN Standard

- Uses a broadcast serial bus methodology where all modules
  - Are active in all bus activity and see all messages and locally choose to filter the messages.
  - Perform automatic error detection and fault containment.
  - Force automatic retransmit of an erroneous message.
  - Acknowledge a correct message reception.

Performance:
- Data rates up to 1 Mb/s.
- Maximum bus length of 5000m
- Simple 2-wire transmission medium.
What is Modular and Extensible I/O?

Modular Components

- Communication (CAN + Ethernet)
- Analog Input (Current + Voltage modes)
- Analog Output (Current + Voltage modes)
- Digital Input/Output (Source, Sink, TTL)
- Synchroscope Controllers
- Multiplexed devices (DRPI displays)
- Servo controllers (Pneumatic meters)
What is Modular and Extensible I/O?

**Modular Packaging**
- Low density 16/32 points, self-contained 35mm DIN mount.
What is Modular and Extensible I/O?

Card/Rack Packaging

- Low density 4/16 points, 19 inch - 3U, surface mount components, Euro-din connectors.
What is Modular and Extensible I/O?

Card/Rack Packaging
- High density 128 points, 19 inch - 6U, surface mount components, Euro-din connectors.
What is Modular and Extensible I/O?

- Rack Packaging
  - Communications controller, Status panel
Where is Modular and Extensible I/O used?

- **Small I/O Count < 20**
  - I&C experiments, new controllers, recorders

- **Medium I/O Count < 200**
  - Paperless recorder upgrades (Honeywell, Yokogawa)
  - Control Systems integration (DFW, DEHC)
  - Auxiliary panels (EDG, Rad monitors)
  - STAR Trainers
  - Train and Bus simulators

- **High I/O Counts > 10000**
  - New simulators
  - Upgrades
Communications

Simulators communicate with Modular I/O Controller using standard Ethernet sockets.

Modular I/O Controller communicates with I/O components using CAN Bus.
Where is Modular and Extensible I/O used?

- Extensibility is achieved by using a standardized communication protocol such as CAN and Ethernet.
- All I/O components have standard 9-pin Sub-D connectors to allow daisy-chaining.
- Extremely flexible configuration enables to use the most cost effective I/O component to meet space/density, and quantity requirements.
High Density 6U Rack
Medium Density Modules
Paperless Recorders

1 – Analog Output

12/24 – Analog Output
Synchroscopes
ULD V &V Tester
Train Simulators
Why use Modular and Extensible I/O

- Use the same communications protocol for I&C, Small stand-alone projects, Custom devices, and Simulator Control Panels.
- Systems that are heterogeneous in physical packaging and density can be seamlessly integrated together using standard serial cables, all configuration is via a simple three table MS Access database.
- Most cost effective solution when different density and I/O count solutions must be integrated together.
- This makes going from Testing on the bench to live on the panels a non-event.
Questions?