Honeywell Users Group

2019

REVEAL YOUR BEST

Ignace Verhamme
26 September 2019

TURBOMACHINERY CONTROL SOLUTION
Technology Update
Experion PKS Turbomachinery Control Solution

Update:

- Product Update
  - Hardware
  - Software
- API-670 & IEC-61508
- Architecture Summary
- Applications Experion PKS TMCS
- OEM Update
EXPERION PKS TMC HARDWARE
Experion PKS Turbomachinery Control Solution

Product Update:

• C300-50 Controller
• C300-20 Controller

• Series C I/O
  – Utilizes all the standard series C I/O
    ▪ Universal Input / Output Module (UIO-II)
  – Utilizes specialty series C I/O
    ▪ Speed Protection or Surge Prevention Module (SPM)
    ▪ Servo Valve Positioning Module (SVPM)
Experion PKS Turbomachinery Control Solution

Product Update:

SPM Module (R400 or higher)

• Used for three independent purposes –
  – Speed Control, Speed Protection & Anti-Surge Control
• Magnetic Pickup Signals (4 Passive Probes or Active Probes)
• High speed processing of I/O signals (10 ms)
• Automatically detects reverse rotation and missing/deformed teeth
• 2oo3 voting logic for speed, acceleration

<table>
<thead>
<tr>
<th>Module I/O</th>
<th>Quantity</th>
<th>Scan Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>8</td>
<td>10mS</td>
<td>4 – 20 mA (3 wire)</td>
</tr>
<tr>
<td>DI</td>
<td>8</td>
<td>5mS</td>
<td>24V DI channel</td>
</tr>
<tr>
<td>AO</td>
<td>1</td>
<td>10mS</td>
<td>4 – 20 mA (2 wire)</td>
</tr>
<tr>
<td>DO</td>
<td>4</td>
<td>5mS</td>
<td>24V DO channels with dry contact</td>
</tr>
<tr>
<td>Speed</td>
<td>4</td>
<td>2.5mS</td>
<td>Pulse Input to Support 4 Active / Passive probes but it operates any selected 4 at given time</td>
</tr>
<tr>
<td>Speed Vote</td>
<td>1</td>
<td>2.5mS</td>
<td>Used for 2 out 3 logic</td>
</tr>
</tbody>
</table>
## Experion PKS Turbomachinery Control Solution

### Product Update:

**Servo Valve Positioner Module – SVPM (R400 or higher)**

<table>
<thead>
<tr>
<th>Module I/O</th>
<th>Quantity</th>
<th>Scan Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>2</td>
<td>5mS</td>
<td>AI channels are used as alternate position input channels where LVDT / RVDT are not in use</td>
</tr>
<tr>
<td>DI</td>
<td>2</td>
<td>5mS</td>
<td>DI channels are interlock signals for AO drive enable</td>
</tr>
<tr>
<td>AO Servo output</td>
<td>2</td>
<td>2.5mS</td>
<td>AO (bipolar with programmable steps of +/-10mA, +/-20 mA, +/-40 mA, +/-80, +/-160 mA, +/-320 mA. Unipolar range of 0-50mA, 0-300mA &amp; 4-20mA). Update time of 5 ms</td>
</tr>
<tr>
<td>LVDT/ RVDT</td>
<td>2</td>
<td>2.5mS</td>
<td>AC LVDT/RVDT interface to support 1. Programmable excitation up to 8V RMS excitation and max 8 VRMS of feedback 2. 2.5KHz to 3.2KHz of programmable excitation frequency 3. To support A,(A-B),(A-B)/(A+B) modes and 3,4,5 &amp; 6 wiring schemes</td>
</tr>
</tbody>
</table>
Experion PKS Turbomachinery Control Solution

Product Update:

UIO-2 Module (R511 or higher)

- Smaller Footprint
- Extensive Self-Diagnostics
- Temperature Ranges +70 to -40 degrees Celsius.
- Independent configurable I/O channels
- Optionally Redundant
- HART Capable
- DI SOE Capable
- Pulse Capable Up to 10 KHz

<table>
<thead>
<tr>
<th>Module I/O</th>
<th>Quantity</th>
<th>Scan Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UIO</td>
<td>32</td>
<td>10ms</td>
<td>Universal Input s/ Outputs</td>
</tr>
<tr>
<td>AI</td>
<td></td>
<td>10mS</td>
<td>0-20 or 4 – 20 mA</td>
</tr>
<tr>
<td>DI</td>
<td></td>
<td>10mS</td>
<td>24V DI channels (up to 4 channels support pulse counting)</td>
</tr>
<tr>
<td>AO</td>
<td></td>
<td>10mS</td>
<td>0-20 or 4 – 20 mA</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>10mS</td>
<td>24V DO channels (max. 2 amps)</td>
</tr>
</tbody>
</table>
Experion PKS Turbomachinery Control Solution

Product Update:
Universal Process Cabinet (UPC)

- Fiber Optic Media Convertors
- Fiber Optic Termination
- Redundant Power Supply
- Up to 3 Redundant Universal I/O Modules 96 Channels of I/O
- Termination, Disconnects & Optional Conditioning
- Terminations & Disconnects
- 16 Channels of LLAI (option)
- Field Configurable Gland Plate

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Experion PKS Turbomachinery Control Solution
Product Update:
Universal Process Cabinet – Universal Marshalling Option
EXPERION PKS TMC SOFTWARE
Experion PKS Turbomachinery Control Solution

Product Update:

Control Builder

• Provides “single point of build” for Loop, Logic, Device, and Sequences

• ONE Database:
  – Controller
  – HMI
  – Applications
  – All system nodes

• Graphic Editing

• Incremental Edit & Download

• Version Management
High Speed Interlock Block
Experion Control Builder with CAB
Experion PKS Turbomachinery Control Solution

Product Update:

Fast Data Capture

- **NOTE**: this is customized per machine
- Capture events at the controller scan-time (as fast as 50 ms or 20 ms)
- Set Triggers such as surge or even overspeed
- Push data capture to PHD, PI, IP21, etc.
- SOE 1 ms
Turbine/Compressor Operator Graphic
Compressor Map Popup
Experion PKS Turbomachinery Control Solution

Product Overview Update:

API-670 - Electronic Overspeed Protection

**What about API-670?**

- **API-670 3.1.127 Overspeed Detection System (ODS)** - A system that consists of speed sensors, power supplies, output relays, signal processing, and alarm/shutdown/integrity logic. Its function is to continuously measure shaft rotational speed and activate its output relays when an overspeed condition is detected.

- **API-670 3.1.128 Overspeed Protection System** - An electronic ODS and all other components necessary to shut down the machine in the event of an overspeed condition. It may include (but is not limited to) items such as shutdown valves, solenoids, and interposing relays.

- **API-670 intent** – “To achieve a failsafe design utilizing electronic detection, the design must incorporate voting for confirmation, redundancy for reliability, and be configured to trip the turbine if power is lost.”

  **NOTE:** API-670 now states it can be used in SIS applications and that Modbus communications is the standard to interface to process control systems.
Experion PKS Turbomachinery Control Solution
Product Overview Update:
API-670 & IEC-61508 - Surge Detection, & Turbine / Compressor Protection

What about API-670?

- API-670 9 Surge Detection Systems

- API-670 9.1.1 “The function of the surge detection system shall be to detect surges and provide output for use in minimizing the number of surge cycles.”

- API-670 9.1.2 “An electronic surge detection system shall be supplied for axial flow compressors.”

- API-670 9.1.3 “If specified, surge detection shall be supplied on centrifugal compressors.”

- API-670 9.3.1 “Operation of the surge detection system shall be independent of the anti-surge control function”, except as noted in 9.3.2 through 9.3.4. Any failure of the anti-surge control system shall not affect the surge detection. Any components (such as logic solvers and/or input sensors) is therefore essential to help prevent common-point failures.”
Experion PKS Turbomachinery Control Solution

Product Overview Update:
API-670 & IEC-61508 Surge Detection & Compressor Protection
Experion PKS Turbomachinery Control Solution
Product Overview Update:
API-670 & IEC-61508 Overspeed Protection, Surge Detection & Compressor Protection
Experion PKS Turbomachinery Control Solution

Product Overview Update:

API-670 & IEC-61508 Surge Detection & Turbine/Compressor Protection

- S300 Safety Processor
- IO Network Switches HON Approved (MOXA)
- Safety IO Link Network
  - Copper = up to 100M
  - Fiber = up to 100KM
- USIO FTA
  - Universal Safety IO Module
  - Universal Safety IO Redundant IOTA
  - Field Termination Assembly (FTA)
- SDIO FTA
  - Safety Digital IO Module
  - Safety Digital IO Redundant IOTA
  - Field Termination Assembly (FTA)
Experion PKS Turbomachinery Control Solution
Product Overview Update:
API-670 & IEC-61508 Surge Detection & Turbine / Compressor Protection

- Cabinet is Hazloc certified
- Redundant S300 controllers
- Redundant fans (internal circulation)
- 20A Redundant power supplies
- Operating temperature -40 to +70 degrees C

Safety Manager SC Universal Safety Cabinet (USC)

Available Configurations:
S300 w/ 32, 64, or 96 IO configurations:
- 32 SDIO or USIO
- 32 SDIO or USIO + 32 SDIO or USIO
- 32 USIO + 64 SDIO
- 96 SDIO

IO only configurations:
- 32 SDIO or USIO
- 32 SDIO or USIO + 32 SDIO or USIO
- 32 USIO + 64 SDIO
- 96 SDIO
UPDATED SYSTEM ARCHITECTURE

Turbine / Compressor
Experion PKS Turbomachinery Control Solution

Product Update:
Turbine / Compressor System Architecture

Industrial Turbine / Compressor Application
Experion PKS Turbomachinery Control Solution

Product Update:

Turbine / Generator System Architecture

Power Generation Application
APPLICATIONS
TMC and Process
Experion PKS Turbomachinery Control Solution

Product Update:

TMC Applications

• Complete Train Control
  – Steam Turbine Governor Control
  – Gas Turbine Fuel Control
  – Turbine Sequencing
  – Compressor Anti-surge Control
  – Compressor Sequencing
  – Expander Control

• Turbine and Compressor Protection / SIS
Experion PKS Turbomachinery Control Solution

Product Update:

Process Applications

- **Refinery**
  - Wet Gas Compressor
  - Hydrogen Recycle Compressor
  - Alky Refrigeration Compressor
  - Main Air Blower
  - Plant Air Compressor
  - Chiller Compressor

- **Cogeneration**
  - Steam Turbine / Generator
  - Gas Turbine / Generator

- **Gas Plants**
  - Propane Compressor
  - Natural Gas Compressor

- **Ethylene / Olefins**
  - Crack Gas Compressor
  - Refrigeration Compressor

- **Ammonia**
  - Syngas Compressor
  - Refrigeration Compressor
  - Air Compressor
  - Natural Gas Compressor

- **Steel Mills**
  - Main Air Blower

- **Carbon Black**
  - Process Air Compressors

- **Refrigerant**
  - Crude Gas Compressor
  - Chiller Compressor
OEM UPDATE
Turbine / Compressor
Experion PKS Turbomachinery Control Solution

Product Update:
Original Equipment Manufacture – Using Experion

<table>
<thead>
<tr>
<th>APPROVED and USE EXPERION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRESSER-RAND</td>
</tr>
<tr>
<td>DOOSAN</td>
</tr>
<tr>
<td>ŠKODA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Others that have used or in progress!</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELLIOTT GROUP</td>
</tr>
<tr>
<td>KOBELCO</td>
</tr>
<tr>
<td>MITSUBISHI HEAVY INDUSTRIES COMPRESSOR CORPORATION</td>
</tr>
<tr>
<td>Atlas Copco</td>
</tr>
<tr>
<td>MAN</td>
</tr>
<tr>
<td>Ingersoll Rand</td>
</tr>
</tbody>
</table>
UNITS OPERATIONAL TO DATA
Turbine / Compressor
Experion PKS Turbomachinery Control Solution
Product Update:
Units in Operation To Date

North America

• 49 Operational Units to date
• 10 In Engineering Phase
• Others Pending

Vertical Markets

• 46 In refining process applications
• 13 In Chemical process applications (Olefins and others)
Experion PKS Turbomachinery Control Solution
Product Update:
Units in Operation To Date

EMEA
- 47 Operational Units to date
- 2 In Engineering Phase

Vertical Markets
- 22 In Power Generation process applications
- 10 In Refining & Petrochemical process applications
- 17 In Chemical process applications (Olefins and others)
Experion PKS Turbomachinery Control Solution

Product Update:
Units in Operation To Date

Asia Pacific

• 16 Operational Units to date

Vertical Markets

• 10 In Power Generation process applications
• 1 In Refining & Petrochemical process applications
• 5 In Chemical process applications (Olefins and others)
FINAL NOTE

Turbine / Compressor
Experion PKS Turbomachinery Control Solution

Product Update:

Final Note

Listed as a Major Player by Media!

“Major players of this market are Siemens, **Honeywell**, Rockwell Automation, Voith, Elliot Group, Emerson, Stork, and Technics Systems Solution among others.” by Mordor Intelligence Report January 2017
QUESTIONS?