GENERATOR CONTROL

THE MODULAR SOLUTION FOR GENERATORS AND TURBINES IN HYDRO-, STEAM- AND GAS POWER PLANTS
The modular solution for Generators HydroCONTROL, SteamCONTROL, GasCONTROL

- Maximum return on installed investment
- Continuous performance improvements
- Flexible implementations to meet plants needs
- Sustainable competitive advantage

To make sure that power is efficiently converted into electric energy, it is necessary to supervise and control complex operations within the Turbine and Generator.
The modular solution for Generators

Modular solution contains:

**Turbine Control**
- Governor
- Protection and test
- Auxiliary systems
- Automation
- Visualization package
- Interface package

**Generator Control**
- Synchronization
- Automatic Voltage Regulator
- Protection
- Visualization package
- Interface package
The modular solution for Generators
Modular solution
The modular solution for Generators
HydroCONTROL

- DCS
- 3rd. Party controller
- Operation alarm & trends CP400
- Panel front door
- PS501 Engineering Tool
- Operation alarm & trends CP400
- Panel front door
- Ethernet (UDP)

- Control
- Control
- Vibr.
- Temp. measuring
- Pressure measuring
- Pressure measuring
- Control & Protection

- Shaft pos. & Vibr.
- Generator
- Lubrication
- Bearing
- Turbine Water
- Level
- Water
- Oil
- Gen core & cooling
- Oil

- OPEN / CLOSE Loop
- Profibus
- Speed 2
- PLC 1
- PLC GC

- Generator Control
- Synchronizing Prot. AVR
- CP400
- CP400
- CP400
- CP400
- CP400
- CP400
- CP400
- CP400
The modular solution for Generators
SteamCONTROL
The modular solution for Generators
GasCONTROL

- DCS
- 3rd. Party controller
- Operation, alarm & trends CP400
- Panel front door
- PS501
- Engineering Tool PS501
- Operation, alarm & trends CP400
- Panel Front door
- Ethernet (UDP)

Control, Control, Vibr.

Temp measuring, Pressure measuring
control & protection

Generator, Bearing, Oil, level, pressure, Gas Oil, GB & Sync

Open Loop, Profibus, CLOSE Loop

Synchronizing Prot. AVR

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The modular solution for Generators
GeneratorCONTROL with operator and DCS interface

- Panel front door
- PS501 Engineering Tool
- Connection to the field
- Protection Module REG 6xxx
  Hardwired to the interface for operator panel and DCS information
- AVR Unitrol 1010 or 1020
  Hardwired to the interface for operator panel and DCS information
- Synchrotakt 5
  Hardwired to the interface for operator panel and DCS information
- Connection to the field
The modular solution for Generators
HydroCONTROL with operator and DCS interface

- Operation, alarm & trends CP400
- Panel front door
- Engineering Tool PS501
- Operation, alarm & trends CP400
- Panel front door
- PLC by AC500
- Switch
- Connection to the field
- Governor Protection CH 1
  - Auxiliary system
  - Automation
- Protection CH 2
- 3rd. Party DCS
  - Profibus DP
The modular solution for Generators
SteamCONTROL with operator and DCS interface

PLC by AC500

Connection to the field

Connection to the field

Connection to the field

Governor Protection CH 1

Protection CH 2
Auxiliary system
Automation

Panel front door

Operation alarm & trends CP400

Engineering Tool PS501

Panel front door

Operation alarm & trends CP400

Profibus DP

Ethernet
The modular solution for Generators
GasCONTROL with operator and DCS interface

- Operation, alarm & trends
- CP400
- Panel front door

- Engineering Tool PS501
- PS501

- 3rd Party DCS
- Profibus DP

- Connection to the field

- Governor Protection CH 1

- Protection CH 2
  Auxiliary system
  Automation
The modular solution for Generators

Hardware set up

<table>
<thead>
<tr>
<th>Level 1</th>
<th>HydroCONTROL</th>
<th>SteamCONTROL</th>
<th>GasCONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 Protection</td>
<td>PLC1 use from GC</td>
<td>Integration in level 2</td>
<td>Integration in level 2</td>
</tr>
<tr>
<td>Level 3 Auxiliary</td>
<td>Integration in level 1</td>
<td>Integration in level 2</td>
<td>Integration in level 2</td>
</tr>
<tr>
<td>Level 4 Automation/Sequencer</td>
<td>Integration in level 1</td>
<td>Integration in level 2</td>
<td>Integration in level 2</td>
</tr>
</tbody>
</table>
The modular solution for Generators Function Library for HydroCONTROL

<table>
<thead>
<tr>
<th>Level 1 Governor</th>
<th>Controller 1</th>
<th>Controller GC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governor</td>
<td>Governor</td>
<td>Protection CH 2</td>
</tr>
<tr>
<td>Speed, level, load control</td>
<td>Speed, level, load control</td>
<td>In GC Controller</td>
</tr>
<tr>
<td>Operator interface</td>
<td>Operator interface</td>
<td>Over speed and other criteria's</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 2 Protection</th>
<th>Protection CH 1</th>
<th>Protection CH 2</th>
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</thead>
<tbody>
<tr>
<td>Criteria for protection</td>
<td>Criteria for protection</td>
<td>In GC Controller</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 3 Auxiliary</th>
<th>Auxiliary system around the Turbine</th>
<th>Machine protection</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Level 4 Automation/Sequencer</th>
<th>Sequencing for start up and shut down</th>
<th>Various (oil pressure, temperature, vibration, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>The electric generator and transformer protection in GC.</td>
</tr>
</tbody>
</table>

Functions of the machine controller
- Speed controller (startup, load operation, islanding operation)
- Frequency dead band (fixed and dynamic) synchronization
- Set point adjuster for load control
- Protection
- Input for load control by water level switching Local / Remote
- Load shedding and over speed limit / protection Hydro jet diverter
- Controller (turbine) monitoring and self-protection

Machine protection
- Over speed protection
- Self-monitoring machine controller
- Water pressure
- Generator Monitoring (mechanical)
- Various (oil pressure, temperature, vibration, etc.)
The modular solution for Generators Function Library for SteamCONTROL

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Controller 1</th>
<th>Controller 2</th>
<th>Functions of the machine controller</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Protection CH 1</td>
<td>Speed controller (startup, load operation, islanding operation)</td>
</tr>
<tr>
<td></td>
<td>Speed load pressure control</td>
<td>Over speed, oil, steam, Extraction, pressure, vibration</td>
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<td></td>
<td>Operator interface</td>
<td>Protection CH 2</td>
<td>set point adjuster for load control</td>
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<tr>
<td></td>
<td></td>
<td>Over speed, oil, steam, Extraction, pressure, vibration</td>
<td>Input for load control, switching</td>
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<td>Local / Remote, speed limit / protection, limiting, valve control</td>
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<td>(main and extraction with limiters</td>
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<td>of steam pressure (initial extraction) monitoring and self-</td>
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<td>protection</td>
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<td>Self-monitoring machine</td>
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<td>controller steam pressure</td>
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<td>Generator Monitoring, (Various</td>
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<td>transformer in GC.</td>
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The modular solution for Generators
Function Library for GasCONTROL

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<td></td>
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<td></td>
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<td>Oil-gas pressure</td>
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<td></td>
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</table>

Functions of the machine controller
- Open loop and close loop controller
- Close loop take care all the modulating systems
- Open loop take care all the control systems
- Synchronization set point adjuster for load control
- Input for load control, switching Local / Remote, speed limit / protection, limiting, valve control monitoring and self-protection
The modular solution for Generators
Operator interface (Mimic design)
The modular solution for Generators Engineering

Single comprehensive engineering tool to help reduce your engineering time, time to market and cost of ownership

- Comprehensive, pre-built, tested libraries
- Programming, communication, visualization, libraries and drives share common data in one tool
- Effortless debugging, also supported by new multiple watch list
- Easy commissioning: single-point-of-access to machinery drives and PLC keeps setup time to minimum
- Online diagnostics for PLC and drives built-in
- Diagnostics is set up automatically
- Context-sensitive menus adapt automatically to the current task for highest efficiency
The modular solution for Generators

Documentation Base scope

Following documents will be supplied:
- PLC I/O layout drawings
- cabinet layout drawings in extended scope
- wiring diagrams (pin assignment)
- Loop documentation in extended scope
- functional plans of the programmable logic controller
- component descriptions,
- operating and maintenance instructions and manuals
- test protocols
- information on parameters, settings
There are many reasons to upgrade older systems.

An old system means:

- Higher risk of non-process-related trips due to equipment aging. Outdated analog technology requires regular calibration because of drifting parameters, which can cause nuisance tripping or even worse prevent proper tripping.
- Emergency repair, troubleshooting, and spare parts are often more expensive than a retrofit solution. Unexpected long equipment outages are costly.
- Dried out capacitors or potentiometer drift.
- The life time will be extended by another 20 years of trouble free operation.
The modular solution for Generators
Our key competencies for your success - “out of one hand”

**Design and engineering**
Research and development from first concept to the product launch phase for keep the product competitive
Plant-specific basic engineering and preparation of the engineering documentation from experts
Comprehensive service documentation including engineering, quality assurance and operation & maintenance (O & M) documentation from our design department

**Implementation, set up and commissioning**
Installation of new components in the existing cabinet or in a new cabinet by adaptation to the final scope
Field wiring and cabling provided
Testing the functionality of the new components at the plant by our engineers
Adaptation of operational documentation by the engineers on site

**Support and trouble shooting**
Generator / transformer protection
Excitation system
Synchronizing / plant metering
Training and operational support for the new systems
Procurement or replacement of spare parts

**Manufacturing and procurement**
Manufacturing and procurement of components for the Product with supervision of assembly and engineering by our project management
Final witness test in accordance with international standards with our customer
The modular solution for Generators
Service as key component after success installation

Your benefit
Professional life cycle services for your installed products and systems from your country the best after project execution
The modular solution for Generators
Project execution

System for the Charmay Hydro Plant in Switzerland

In this project HydroCONTROL and Generator Control are successfully implemented
The modular solution for Generators

Message

- TURBINE AND GENERATOR CONTROL (WITH PROTECTION, EXCITATION, SYNCHRONIZING / SUPERVISION AT THE SAME LOCATION)
- MAXIMIZES SYNERGIES OF ENGINEERING BETWEEN TURBINE AND GENERATOR CONTROL (WITH PROTECTION, EXCITATION, SYNCHRONIZING, SUPERVISION)
- HIGH DEGREE OF STANDARDIZATION
- ENGINEERING OF YOUR SPECIFIC APPLICATION (WITH SCOPE EXTENSION POSSIBLE)
- SINGLE SOURCE FOR PROJECT EXECUTION
- COMMON COMMISSIONING ACTIVITY FOR THE ENTIRE CABINET (TURBINE AND GENERATOR CONTROL)
- SERVICE SET UP AROUND THE WORLD
- YOUR SYSTEM FOR THE NEXT 20 YEARS
- SAVE TOTAL COSTS
Power and productivity for a better world™