



PROJECT OVERVIEW : EXTRACTION / ADMISSION STEAM TURBINE **CS7477**

Extraction / Admission Steam Turbine Generator

TYPE OF FACILITY

Paper Mill

TYPE OF PLANT

Prime Power Generation
Utility Paralleled in Droop Base Load

PRIME MOVER

GE Steam Turbine Generator
Single Extraction / Admission
Inlet Pressure: 1500 psig
Admission/Extraction Press: 600 psig
28.7 MW, 13.8 kV @ 3600 RPM

CONTROL TECHNOLOGIES

Woodward Micronet

Steam Turbine Digital Control System for speed control (governing), admission / extraction control, turbine protection, and monitoring. Micronet features redundant power supplies and CPUs.

Woodward ProTech GII

Independent Over-speed Protection Device with two-out-of-three voting

Solenoid Trip Assembly

Triple-Modular Redundant (TMR) turbine trip assembly

Woodward DSLC-2

Generator Synchronizer and Load Control

Woodward UMT

MW Load Transducer

HMI System

Dual touch-screen terminals in the plant control room and control cabinet door for monitoring and control of the system including remote access.



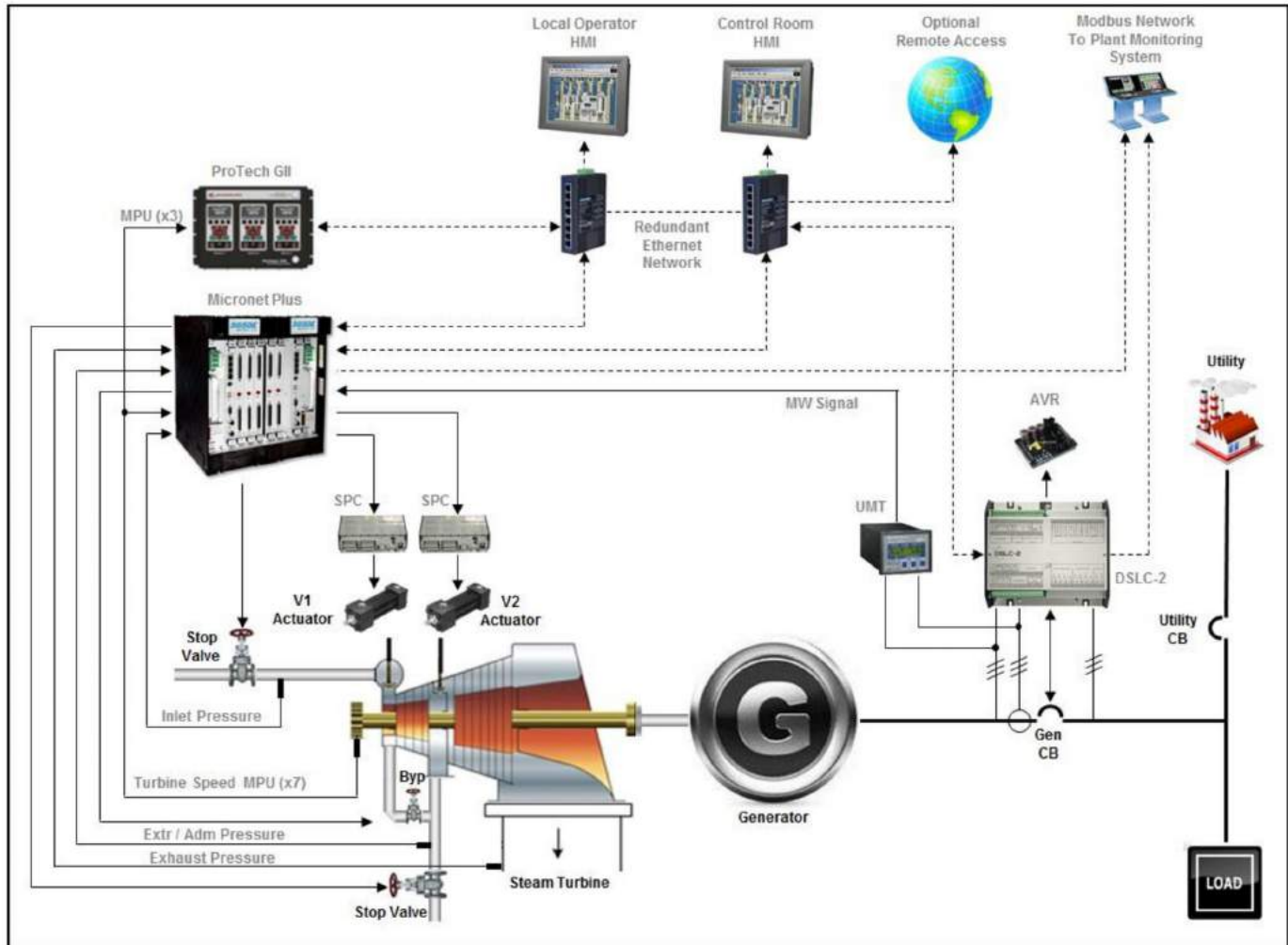
PROJECT OVERVIEW

GCS has supplied a turbine-generator control, monitoring, and actuation system for a large paper mill. The plant utilizes multiple turbines including this General Electric package rated for 28.7 MW @ 3600 RPM. The plant is run in parallel to the local utility in a droop base load mode.

The control system features the Micronet Digital Turbine Control Platform with custom application software performing functions including automatic turbine start and stop sequencing, speed control, admission/extraction control, and turbine protection. The Micronet hardware includes redundant power supplies and CPUs. In the event of a power supply or CPU failure, the control will automatically transfer control to the secondary CPU or power supply in a bump-less fashion enabling the turbine to continue to run until the appropriate module can be replaced. The system also includes an electronic over-speed protection device completely independent from the Micronet. This device utilizes three independent speed probes that trip the turbine only when two out of the three modules agree (2-out-of-3 voting). Similar to the Micronet hardware, the modules in this device can be changed while the turbine is on-line. GCS has included an automatic synchronizer with the system and packaged the controls in a single free-standing control cabinet.

Central monitoring and control is performed via a custom HMI system featuring dual touch-screen terminals. The HMIs provide the operator with complete system control including starting and stopping of the turbine, synchronization, inlet steam valve control, and admission / extraction valve control.





CONTROL SYSTEM FEATURES

Control System Cabinet

- Single Freestanding Enclosure (36"Wx36"Lx84"H)
- Door Mounted Touch-Screen HMI
- Redundant AC Power Supply Feeds
- Redundant DC Power Supplies
- Dedicated Hardwired Safety Trip System

Turbine Control: Woodward Micronet System

- Speed Control / Governing
- Automatic Start / Stop Sequencing
- Extraction / Admission Control (V2 Valve)
- Process Limiting
- Manual Valve Limiter Adjustment
- Critical Speed Range Avoidance
- Protection and Alarm Handling
- Ethernet Network to HMI System
- Redundant Power Supplies and CPUs
- Hot-Swapping of Modules with Turbine On-Line

Over Speed Protection: Woodward ProTech GII

- Protection Independent to Micronet System
- Two-out-of-Three Voting – Three Separate MPUs
- Hot-Swapping of Modules with Turbine On-Line
- Modbus over Ethernet Network to HMI System

Generator Synchronization: Woodward DSLC-2

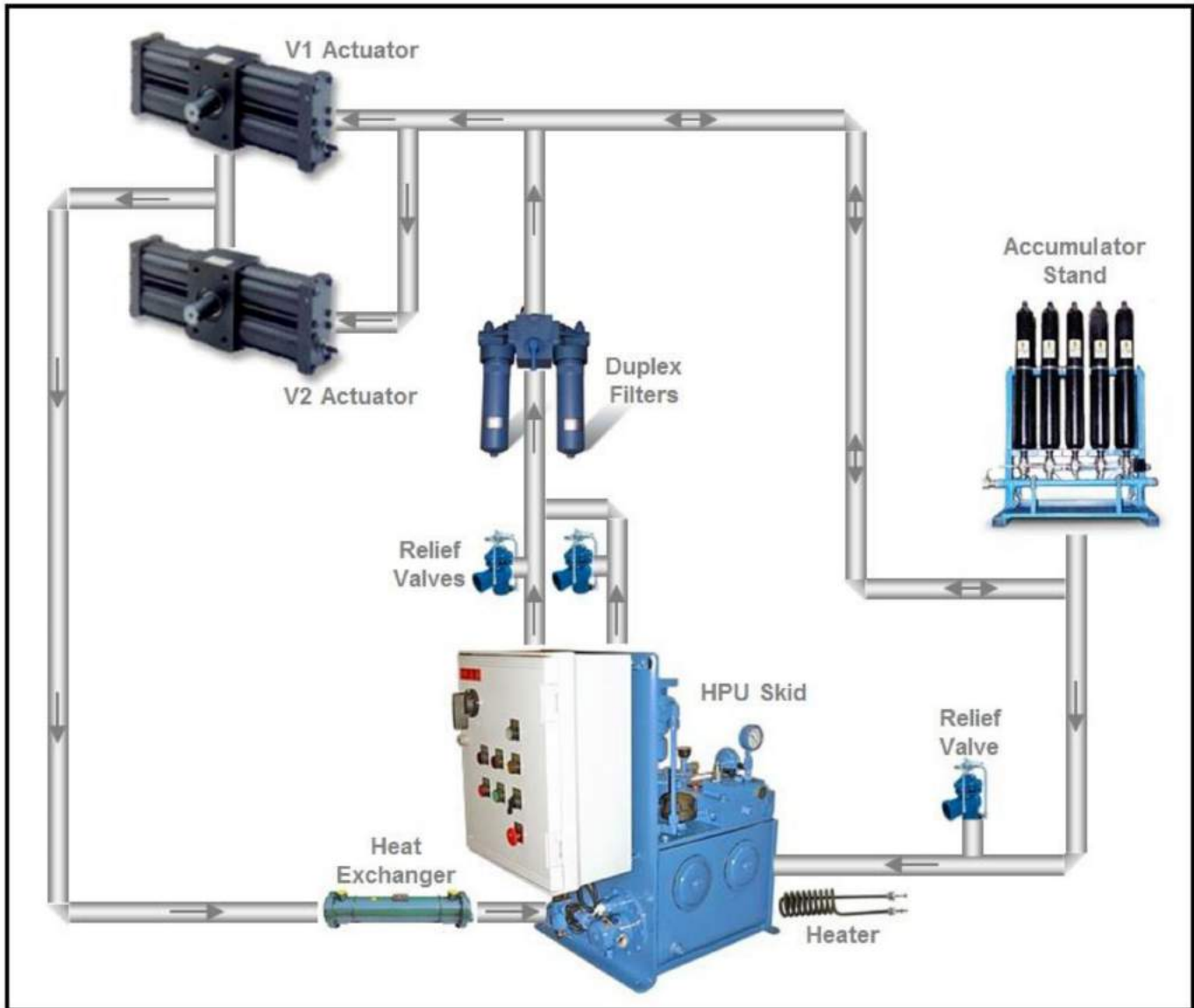
- Dead Bus Control or Live Bus Synchronizing
- Interface to Automatic Voltage Regulators
- Ethernet Network to HMI System

HMI / SCADA System

- Control Room Mounted Touch-Screen HMI
- Second HMI Mounted in Control Cabinet Door
- Redundant Ethernet Communication Network
- System Monitoring and Control
- Control System Integration
- Alarm Handling and Performance Data Trending
- Multiple User Access Levels
- Available Remote Access via the Internet

HYDRAULIC ACTUATION SYSTEM

In addition to the control system, GCS has also supplied a new hydraulic actuation system for this turbine. This system includes a hydraulic power unit (HPU) skid, accumulator stand, rotary actuators for both V1 and V2, and accessories.



ACTUATION SYSTEM FEATURES

Duplex Hydraulic Power Unit (HPU)

- Dual 7 ½ HP Pumps Rated at 5 GPM & 1500 psig
- Pressure Switching for Lead/Backup Arrangement
- Thermostat Operated Heater
- Oil to Water Heat Exchanger (Cooler)

Accumulator Stand

- Four 15 Gal Gas Bottles with One 4 Gal Booster
- Pre-charged to 1000 psig
- Full 4 Gal of Oil Available to Operate the Actuators

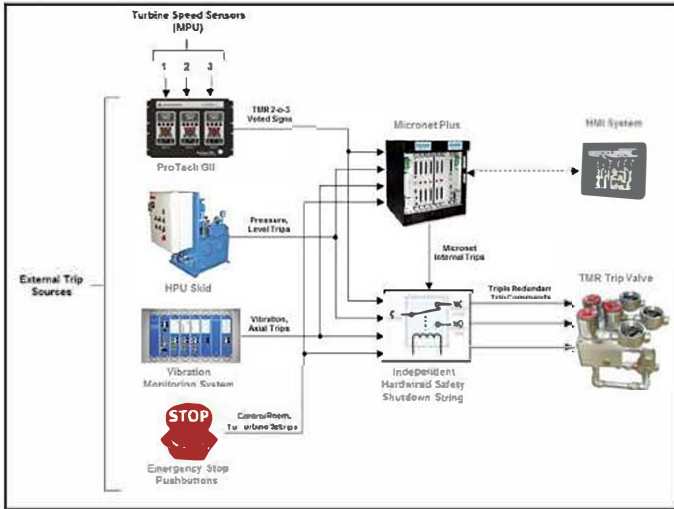
Hydraulic Rotary Actuators: *Parker HTR150*

- Dual Rotary Actuators for Turbine Valves V1 & V2
- Voice Coil Servo Valves
- Directly Coupled to Turbine Camshafts
- Integral LVDT Feedback Devices
- Full 360 Degree Stroke
- Full 100% Rotation in Less Than One Second

System Accessories

- Duplex Hydraulic Oil Filters
- Oil to Water Heat Exchanger
- Pressure Relief Valves

TRIPLE MODULAR REDUNDANT (TMR) SAFETY TRIP SYSTEM



Control System Safety Features

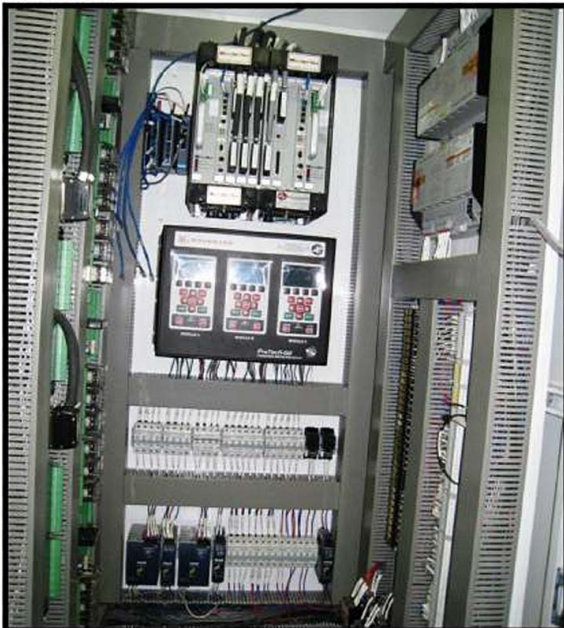
- Hardwired Relay Shutdown System Integrated into Control Cabinet
- Heavy-Duty Industrial Grade Trip Relays
- Triple Redundant Signals to Turbine Trip Valve
- Independent ProTech 2-o-3 Overspeed Protection
- IEC61508 SIL-3 Certified
- API670 & API612 Compliant
- Micronet Integrated Internal Turbine Protection
- Interface to HMI System for Alarm and Shutdown Reporting Including First-Out Detection

TMR Trip Valve

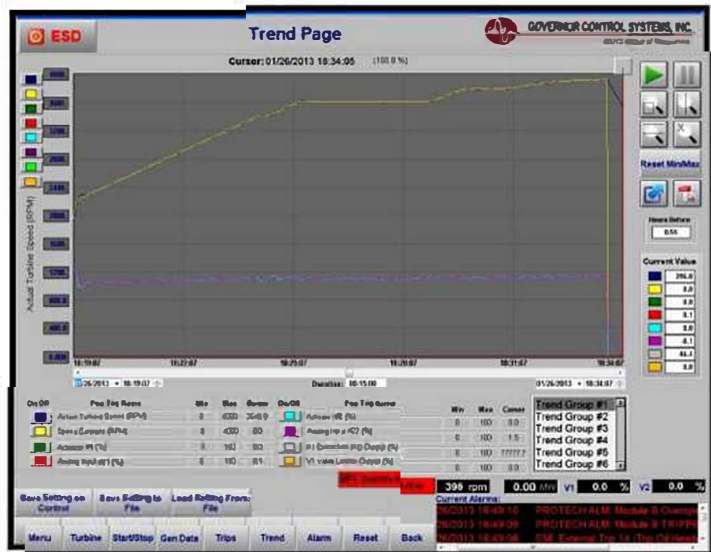
- Triple Independent Solenoids Integrated On-Valve
- 2 out of 3 Voted Design
- 24 Vdc Solenoids (110/220 Vac Available)
- 50 – 300 psi Operating Pressure

POST INSTALLATION PHOTOS

Cabinet :



HMI Screen : Micronet Overspeed Test



As a part of the MSHS group of companies, GCS offers comprehensive control system support, from engine and turbine systems integration to turnkey project management for a broad range of marine, power generation and industrial projects. GCS engineers have experience with control system retrofits in all of these industries and aftermarket applications. Learn more at GOVCONSYS.COM.

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