

CONTROL AND PROTECTION TECHNOLOGIES FOR THE WORLD'S BEST COMPRESSORS

Simple | Reliable | Safe | Precise | Proven



TURBOMACHINERY CONTROL EXPERTS
Turbines | Compressors | Safety | Actuation

 **WOODWARD**

WOODWARD COMPRESSOR CONTROL SOLUTIONS

REDUCE PROGRAM AND OPERATIONAL RISK

Through rigorous program execution and validation.

MAXIMIZE UPTIME AND OPERATIONAL PERFORMANCE

Through advanced algorithms, proven platforms, and simulation.

HIGH VALUE

Through integration, standards and services.



FIELD PROVEN

OVER 500 COMPRESSOR CONTROL SYSTEMS INSTALLED

UPSTREAM

- Residue/Export/Sales Gas Compressor
- Acid/Sour Gas Compressor
- Injection Gas Compressor
- Regeneration Gas Compressor

MIDSTREAM

- Gas Pipeline Booster Compressor
- Station Control
- Propane Refrigeration Compressor

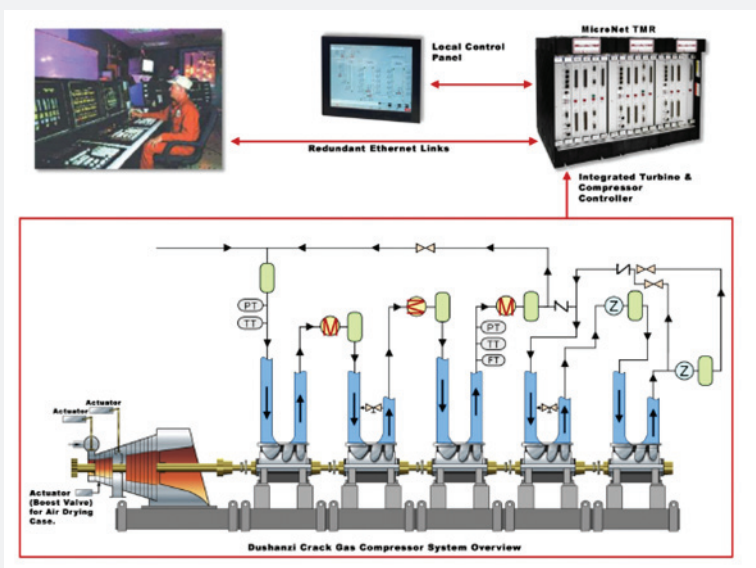
DOWNSTREAM

- Fluid Catalytic Cracker Main Air Blower
- FCCU Complete Power Recovery Train (PRT)
- Wet Gas Compressor
- Hydrogen Recycle and Booster Compressors
- Cracked Gas Compressor
- Ethylene Refrigeration Compressor
- Propylene Refrigeration Compressor
- Propane Refrigeration compressor
- Ammonia Synthesis Gas Compressor
- Ammonia Process Air Compressor
- Ammonia Refrigeration Compressor
- Urea CO₂ Compressor
- Instrument/Plant Air Compressors



INTEGRATED SOLUTION AT DUSHANZI CHEMICAL PLANT

Woodward was selected as the control of choice for all three of Dushanzi's new critical compressor trains (cracked gas, ethylene, and propylene) due to our highly reliable control platforms, advanced compressor protection algorithms, and ability to control very complex applications requiring a high level of integration between multiple control loops. The Woodward MicroNet TMR® control platform met all of Dushanzi's, Linde's, and Siemens' stringent system control, protection, and plant interface requirements.



Dushanzi Cracked Gas Compressor System Overview

MAXIMIZE OPPORTUNITY

MAXIMUM AVAILABILITY

Keep your compressors running without loss of performance or production. Woodward's high-availability Micronet™ control platforms, proven software algorithms, and advanced fallback strategies assure your equipment runs reliably and dependably.

Protect your equipment with outstanding anti-surge control loop response. Woodward's synchronous I/O processing and deterministic execution rates keep anti-surge functions responsive and stable.

Reduce process gas flaring during process disturbances. Woodward's advanced control algorithms minimize recycle valve overshoots.

Increase safety and production by design. Woodward maintains a thorough and rigorous control system design quality process.

KEY BENEFITS

- Superior dynamic performance of surge control and pressure override loops
- Maximized compressor network efficiency through unique load sharing algorithm
- Minimized gas recycling rate, optimum temperature control and prevention of prime mover overload during the startup of a refrigerant compression loop
- Uncompromised compressor safety and high process stability through advanced fallback strategies
- Accurate reproduction of dynamic responses of fast compressor control loops within NetSim™ (turbomachinery control emulation software linked to a plant operator training simulator)

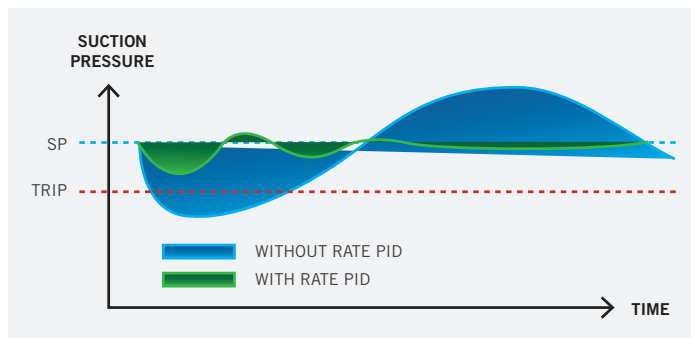
INTEGRATED CONTROL AND PROTECTION

Woodward's Integrated Compressor Control System (ICCS) is a comprehensive and flexible controls package that improves compressor train performance, reliability, and protection by combining control functions into a tightly integrated system. ICCS solutions can include:

- Compressor multi-loop anti-surge valve control and process (performance) control
- Steam turbine, gas turbine, or motor control
- SIL-3 safety
- Quench valve control
- Multiple compressor train control
- Start/stop/loading/unloading
- Shutdown interlocks
- Flare valve control
- Auxiliary and sequencing control

INCREASE PRODUCTION

Woodward's patented rate PID algorithm provides anticipative opening of the anti-surge valve during process upsets to minimize overshoots and allow safe operation with minimal safety margins. Compressor turndown is maximized and higher product yields are achieved.



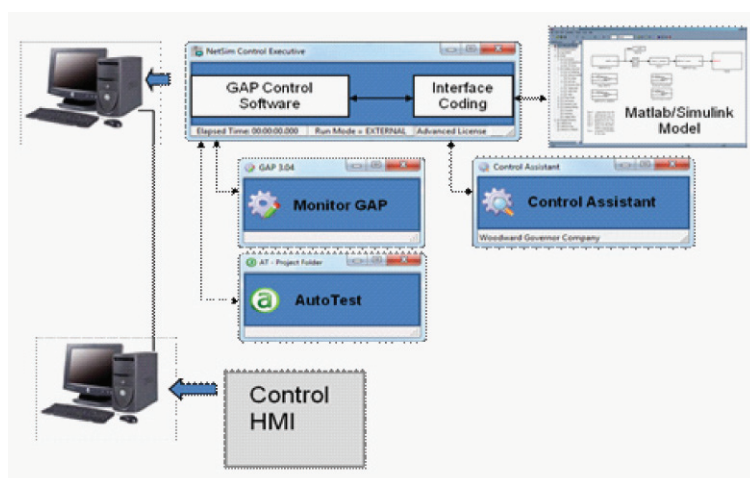
COMPRESSOR - DYNAMIC SIMULATION

Woodward's proven NetSim™ simulation packages provide integrated turbomachinery-specific dynamic modules of the compressor, prime mover and auxiliaries, along with real-time control models that can run on a single computer. This benefits the users in running FEED/ Feasibility/RCA Studies and aids in control system design and testing.

NetSim™ emulates functionality of all system hardware components, accurately reproducing execution timing, I/O synchronization and data protocols.

Power of NetSim™ Compressor Dynamic Simulation Models

- Validate control system design
- Identify compressor process loop bottlenecks
- Shorten commissioning time
- Enable effective troubleshooting
- Simplify DCS integration testing
- Provide hands-on turbomachinery control maintenance experience and training for plant personnel



DEPENDABLE SERVICE

Reliable control systems are more than just hardware and software.

Woodward's stringent product life cycle management process fully meets customers' requirements the first time, every time. The process starts with a thorough review of customer specifications and the compressor/ process data that defines project-specific deliverables and the required testing, including the factory acceptance testing.

Woodward also offers other types of engineering services such as equipment surveys and feasibility evaluations, panel design and procurement, field services, simulation services, commissioning, on-site training, and on-site compressor performance and surge testing.

Finally, Woodward's worldwide network of business partners provides users with the peace of mind that comes with always finding support in a timely, efficient manner.



GLOBAL SUPPORT

Woodward's global support network and our turbomachinery OEM partners provide an extensive range of technical and after-sales support services. This global presence allows us to respond quickly to the needs of our customers anywhere in the world. In today's complex control world, customers have come to recognize our people's expertise beyond the control system and depend on our global teams as critical plant support assets.

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CONTENT

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www.woodward.com/turbine

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