

Partial Reference List of

Rotating Machinery Control Systems

Following is a partial list of common rotating machinery for which Petrotech has developed control solutions. Other machinery control systems are available from the extensive library of products developed by Petrotech.

Turbine-Compressor Control Systems

Allison	Pratt & Whitney
Dresser	Rolls-Royce Avon
Fiat	Ruston Series
GE Frame Series	Solar-All Engines
GE LM Series	Westinghouse
Hispano	

Turbine-Generator Control Systems

ABB Stal	Lycoming
Allison	Pratt & Whitney
Dresser	Rolls-Royce
GE Frame Series	Ruston
GE LM Series	Siemens
Kongsberg	Solar

Reciprocating Engine Control Systems

Ariel	Ingersoll-Rand
Chicago Compressor	Rolls-Royce
Clark	Ruston
Cooper-Bessemer	Waukesha
Dresser-Rand	Worthington

Compressor Control Systems Applications

Air Separation	Liquid Extraction
Alkaline Process	LNG
Carbon Monoxide	LPG
Chlorine Process	Maleic Anhydride
CO2 Process	Natural Gas
Coker Gas	Nitric Acid Expansion
Crack Gas	Nitrogen Process
Ethylene	Process Air
FCCU Process	Propane
FCCU Wet Gas	Propylene
Flash Gas Process	Refrigeration
H2S Gas	Residual Gas
HCL	Turbo Expander
Hydrogen/Methane	Waste Gas
Hydrogen Gas	

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Partial Customer Reference List

The following is a partial list of customers that have installed a Petrotech, Inc. Rotating Machinery Control System.

Turbine-Generator Control Systems

AGIP	Nigeria
Alberta Pacific Forest Industries	Canada
Aluminum Bahrain	Bahrain
Arizona Electric Power Company	U.S.A.
City of Springfield Utility	U.S.A.
Consolidated Edison	U.S.A.
DSM Power	Holland
Dyergy	U.S.A.
Ecopetrol	Colombia
Electricity Generating Authority	Thailand
Electroquito	Ecuador
Federal Electricity and Water	Dubai
Houston Light and Power	U.S.A.
Lincoln Electric Utility	U.S.A.
Madison Gas & Electric	U.S.A.
Northern Indiana Public Service	U.S.A.
Northern States Power	U.S.A.
NRG	U.S.A.
Oman Refinery Corporation	Oman
Pennsylvania Power & Light	U.S.A.
Plains Exploration	U.S.A.
Qatar Fertilizer Company	Qatar
Reliant Energy	U.S.A.
Rochester Gas and Electric	U.S.A.
Tractebel	U.S.A.
Union Carbide	U.S.A.

Turbine-Compressor Control Systems

Amoco	Trinidad
Aramco	Saudi Arabia
Arco	Various
BP	USA/China
Chevron Texaco	Various
Columbia Gas & Gulf	U.S.A.
Conoco-Phillips	U.S.A.
Duke Energy	U.S.A.
Enterprise	U.S.A.
Exxon Mobil	Various
Gaz de France	Holland
Gulf South Pipeline	U.S.A.
Kinder Morgan	U.S.A.
National Gas Company	Trinidad
Northern Natural Gas	U.S.A.
Northwest Pipeline	U.S.A.
ONGC	India
PDVSA	Venezuela
PEMEX	Mexico
Petrobras	Brazil
Petrocanada	Canada
Petronas	Malaysia
PDO	Oman
Sempra	U.S.A.
Shell	Various
Williams Energy	U.S.A.



Company Overview



EXPERIENCE • CAPABILITY • EXECUTION

petrotechinc.com



Who We Are

Petrotech, Inc., (Petrotech) supplies control systems and turnkey instrumentation and electrical services (I&E) for a wide variety of turbomachinery assets such as centrifugal and reciprocating compressors, gas and steam turbines, generators and their associated auxiliary systems.

With more than 35 years of experience and over 2,000 installations, Petrotech is a trusted expert in rotating machinery and process control systems.

Our solutions include full turnkey control retrofits, standalone control products and new equipment solutions for turbomachinery systems of all types.

Petrotech facilities include corporate offices in New Orleans, Louisiana and facilities in Houston, Texas and Suffolk, United Kingdom.



Reliable Products and Services

Petrotech works across the energy sector. From power generation for Utilities, IPPs and EPCs to the Oil and Gas, Petrochemical and Mining industries. We help our customers increase reliability, improve efficiency and reduce downtime. Regardless of where in the energy chain Petrotech operates our approach remains the same- we deliver superior customer satisfaction that builds our reputation as the leaders in turbomachinery controls.



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Advantages of the Petrotech

Integrated Control System

Petrotech control systems offer our customers an economical and flexible alternative to OEM supplied control systems. Our ability to provide hardware independent control system solutions enable our customers to standardize their existing installed hardware base, minimize their spare parts inventory and maximize the efficiency of their maintenance and service functions.

Firmware

Petrotech proven-in-use Application Control Packages are derived from well-proven, mature functions that have been implemented in thousands of similar control systems.

Integrated Control Capability

Turbine fuel control, driven equipment control and sequencing/protection are integrated into a single platform. This eliminates the need for additional hardware and communication links, thereby providing a less complicated, more cost-effective solution.

Stand-Alone Control Capability

When budget or project requirements do not require Integrated Control Capability, our stand-alone control solutions utilize the same field proven equipment control algorithms deployed in our integrated systems.

Fault Tolerance

Petrotech also supplies high availability redundant control systems designed to withstand multiple faults or failures without loss of mission.

Critical Function Redundancy Assembly

Even though many of the world-class control systems on the market today have availability in the 99% range, Petrotech includes the Critical Function Redundancy (CFR) assembly to ensure system reliability in the face of unexpected component failures. The CFR assembly provides redundant protection for critical shutdowns, such as redundant over speed, exhaust gas temperature and any other critical protection function and will trip the machine independent of the main PLC control, upon detection of an abnormal operating condition. Our CFR systems provide the first defense against intentional and unintentional cyber-security threats by separating critical functions from the control system communications network.

Cyber Security

There is no single defense against cyber-security threats. Therefore, all Petrotech control systems utilize the cyber security features provided by the control system hardware manufacturer on both the controller level and the control system network level. Petrotech can help you comply with your Critical Infrastructure Protection (CIP) requirement.

Petrotech Support Services

Petrotech provides its customers with a full range of technical support and consulting services. Our experienced support team of control systems specialists and engineers, have years of hands on experience in the industries we serve. Support services include telephone and on-site support, after-market parts, training, turnkey installation and commissioning and the necessary tools, materials and labor to get the job done.

Turnkey Installation

Petrotech offers single vendor turnkey installation services which reduces the risk for the client. This includes all installation labor and materials, while utilizing our personnel or local content as necessary.

Field I & E

Our mobilized Petrotech team provides on-site I&E services. Services include design engineering, I&E construction, control system fabrication, fire and gas safety systems, on-site project management site audits, centralized purchasing and training programs.

Commissioning

During the commissioning process experienced Petrotech engineers and rotating machinery consultants actively participate in initial system start-up and field commissioning activities. This includes loop check responsibilities, Site Acceptance Test execution, system tuning and on-site warranty support.

Field Service

Experienced Petrotech engineers and rotating machinery consultants can be dispatched to address control system operational issues. This can include fault finding, calibration, repair/replace actions, system modification, system updates and programming services. Petrotech's team is available on a call-out and service plan basis.

Technical Consultation

Petrotech offers site surveys and studies of control problems with pre-existing machinery to identify specific problems in process piping or layout that requires correction or mitigation to achieve satisfactory results. Petrotech is also offers an optional Site Support Agreement for remote troubleshooting services via the Internet or a dial-up connection.

Telephone Support

No charge 24x7x365 availability. Customers speak to an experienced Petrotech engineer and rotating machinery consultant.

Training

Petrotech offers training at the beginner, operator, engineer and senior technical management levels for basic machinery control technology, compressor control and gas turbine control. Standard courses are offered at Petrotech's or client's facilities in a classroom setting with all required equipment and simulators.

Petrotech Stand-Alone Products

Petrotech's stand-alone products provide economical solutions to specific turbomachinery functions such as anti-surge, capacity control and steam turbine control solutions. Our stand-alone products are pre-engineered to reduce installation costs and provide comprehensive operator interface functionality to simplify user configuration and monitor operations. Stand-alone products may also be combined with other systems to enhance functionality and provide low-cost configurable solutions. Each of these control products includes the same mature field-proven Petrotech software found in our integrated turbomachinery control solutions.

Em-400 Multi-Body Anti-Surge Compressor Controller

The Em-400 is a multi-body compressor anti-surge controller that incorporates the field-proven Petrotech anti-surge algorithms into a rack mountable package. The Em-400 is user configurable through the built-in color touch screen display. It includes more than 45 configuration and display screens. No additional hardware is needed to configure the Em-400. The user can access key controller parameters, including tuning information, alarm status and live compressor performance maps. The Em-400 controller accommodates up to three compressor bodies.



Em-405 Parallel Compressor Capacity Controller

The Em-405 capacity controller provides a cost effective full featured capacity control solution for up to four parallel compressors typically found in upstream and midstream compressor applications. Designed to interface with the Em-400 or any other 3rd party anti-surge controller, the Em-405 provides an integrated low cost capacity control solution for these systems where a full integrated control system is not desired or required. The Em-405 capacity control system algorithms provide customers the ability to operate their compressors systems without constant operator interaction and provide solutions and strategies to minimize energy consumption.

Em-406 Air Blower Capacity Controller

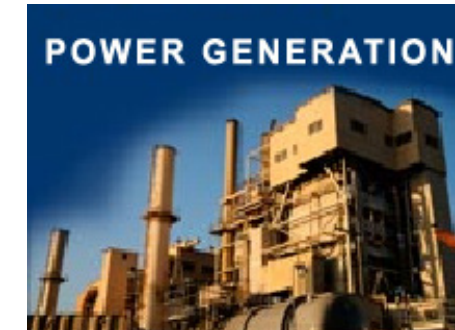
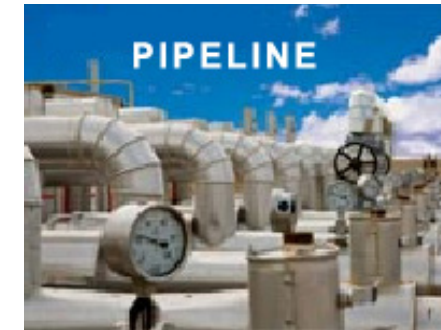
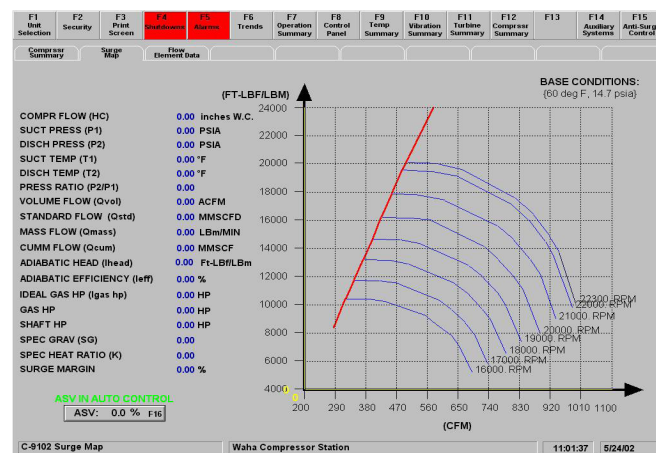
The Em-406 capacity controller provides a cost effective, full featured capacity control solution for up to four parallel axial air blowers. Similar to the Em-405, the Em-406 deploys the similar capacity control strategies utilized in the Em-405 with the addition of strategies designed to efficiently operate axial air compressor systems such as those found in refinery and petrochemical applications.

Em-430 Steam Turbine Controller

The Em-430 steam turbine controller provides a cost effective, full featured steam turbine governor for small to mid-size steam turbines with admission/extraction controls. The Em-430 provides a low cost steam turbine regulation solution for systems where a full integrated control system is not required.

Em-405R Refrigeration Capacity Controller

The Em-405R capacity controller provides a cost effective, full featured capacity control solution for up to four parallel propane refrigerant compressors. Similar to the Em-405, the Em-405R deploys the similar capacity control strategies utilized in the Em-405 with the addition of strategies designed to efficiently operate refrigeration compressors such as quench recycle control.



Solutions for the Energy Sector

At Petrotech, we pride ourselves as being a technology leader in rotating machinery and process control systems, serving the oil and gas, petrochemical and power generation industries. Our control systems are found in the following applications.

- Upstream - Oil & Gas Production**
 Associated Gas, Re-injection, Liquids Stabilization, Driver (EMD/Gas Turbine), Capacity and Load-sharing Controls
- Midstream - Pipeline & Natural Gas Processing**
 Pipeline Booster Compressors (Centrifugal, Reciprocating), Driver (EMD/Gas Turbine/Steam Turbine), NGL Expander/Compressor, Capacity and Load-sharing Controls
- Downstream - Petrochemical & Refining**
 Wet Gas Compressor, FCCU Air Blower, Driver (EMD/Gas Turbine), Capacity and Load-sharing Controls
- Power Generation**
 Standby-Peaking Power (Aero-derivative & Frame Turbines), Driver (EMD/Gas Turbine/ Steam Turbine) Controls, Data Center Stand-by Power
- Instrumentation and Electrical Turnkey**
 Services encompass all industry sectors

Customers look to Petrotech for complete driver control, load control, sequencing, protection and information systems integrated into a control system hardware platform of their choice.



Petrotech Control Systems

Petrotech provides control systems and instrumentation for rotating machinery assets such as compressors, gas and steam turbines, generators, reciprocating engines and associated auxiliary systems and balance of plant automation functions.

In our 35 plus years of experience, we have installed over 2000 state-of-the-art control systems making us a trusted expert in the design, installation and maintenance of rotating machinery and balance of plant control systems.

All Petrotech control systems feature:

- Integrated control capability between the unit subsystems
- Standard industrial components
- Reliability
- Non-Proprietary DCS or SCADA Interface
- Improved start-up and fuel/steam regulation
- Improved operator interface information (HMI)

Gas Turbines

Petrotech supplies cost-effective integrated control system solutions for mechanical and generator turbine drive packages. Our control systems provide replacement controls for outdated electro-hydraulic and analog-electronic controls.

Compressor systems typically include complete gas turbine fuel control system regulation (TFR), compressor control anti-surge controls, turbine and compressor sequencing, capacity control, HMI and DCS interface.

Generator systems typically include complete gas turbine fuel control system regulation (TFR), generator sequencing, isochronous and droop load control, HMI and DCS interface.



Steam Turbines

Petrotech's advanced steam turbine controls for compressor and generator drive applications feature the same integration strategies deployed on gas turbine driven mechanical and electrical drive systems. The steam turbine controls also provide turbine steam flow control, extraction admission flow control, pressure control, sequencing, capacity/load control, DCS interface and a graphic operator interface for the visualization and display of system status, trending and data logging.

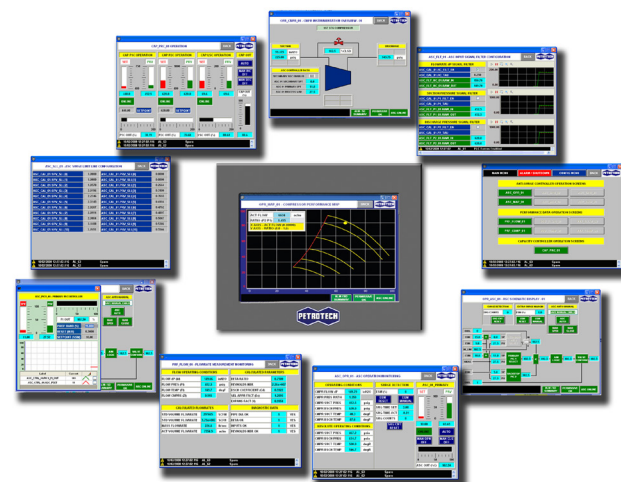
Centrifugal & Axial Compressors

Petrotech provides a complete suite of compressor control solutions, designed to provide the end-user with a wide range of flexible and economical compressor control and protection capabilities.

Over the past three decades, Petrotech has developed numerous compressor anti-surge and capacity control algorithms that can be hosted in many different control systems. Our anti-surge system algorithms provide pressure, temperature and molecular weight correction strategies, adaptive control and anticipation strategies and contingency strategies for transmitter failures. Our capacity control system algorithms provide customers the ability to operate their compressor systems without constant operator interaction and provide solutions and strategies to minimize energy consumption.

Petrotech compressor solutions are classified as:

- ASC – Anti-Surge Control
- CAP – Station Level Capacity Control
- LSC – Multi-compressor Load-sharing or Turndown Control



Petrotech Control Systems



Reciprocating Engines & Compressors

Petrotech also provides economical, flexible, integrated retrofit solutions for reciprocating engine and electric motor driven compressors. Our PLC-based systems can include speed control (governor), torque control, pocket-loader control, air/fuel ratio control, ignition timing set point generation, capacity control, DCS/SCADA interface and a graphic operator interface for the visualization and display of system status, trending and data logging.



Auxiliary Systems

Petrotech specializes in every aspect of controls and instrumentation, including the supply of upgrades and auxiliary systems for turbine and compressor packages. The following auxiliary systems and components are available for complete or partial system upgrades:

- Fuel control valves
- Inlet guide vane control servos
- Interstage nozzle control servos
- Water and steam injection systems
- Speed probe replacement
- Exciter gear assemblies
- Flame detectors for combustion chambers
- Recycle or Anti-Surge control valves

