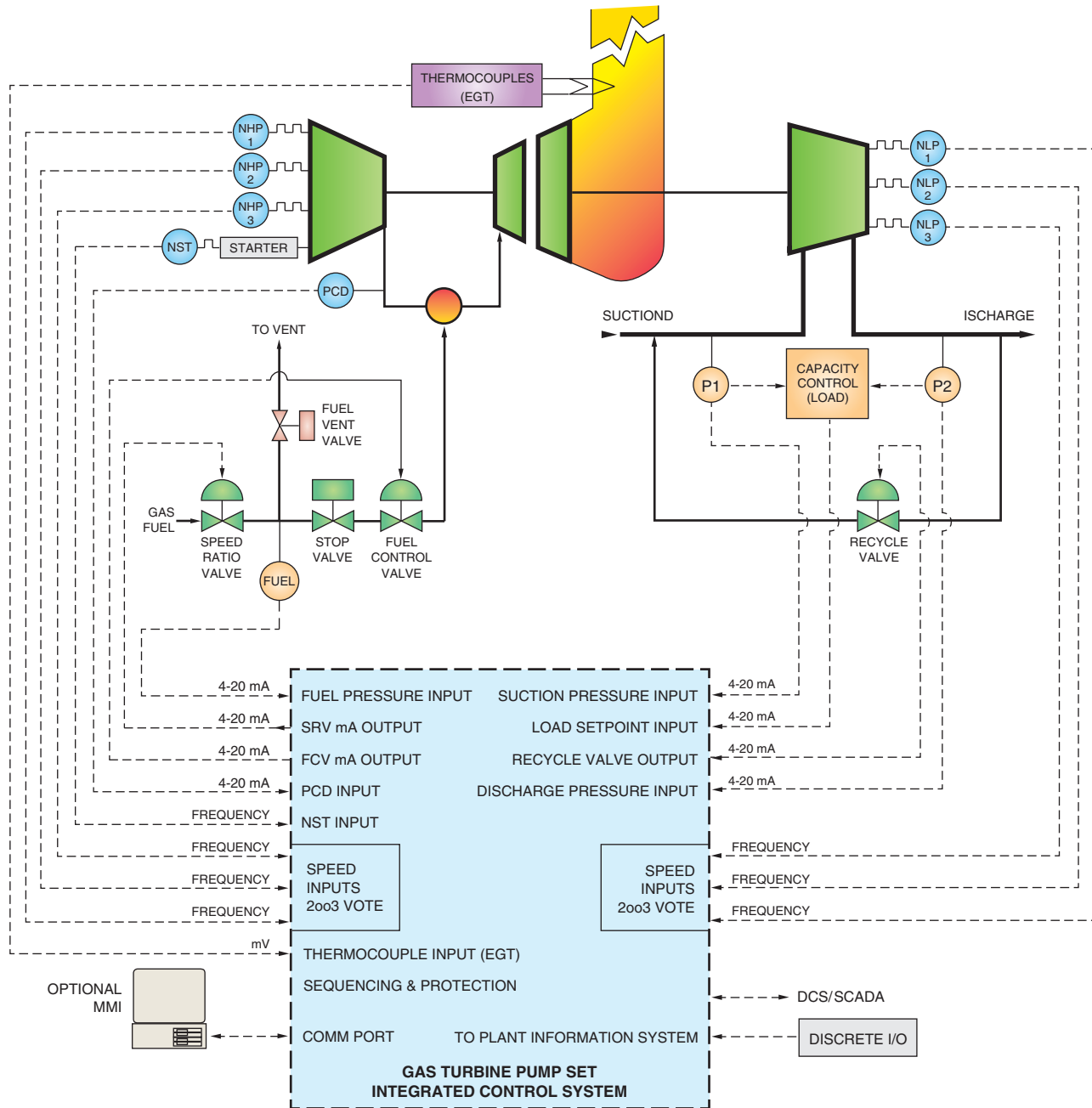


GAS TURBINE PUMP DRIVE INTEGRATED CONTROL SYSTEM



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Simplified schematic showing a Petrotech advanced PLC-based integrated control system for a gas turbine pump set. The system provides turbine fuel control, temperature control, load control, sequencing/ protection, and communication interfaces.

APPLICATION

The Petrotech integrated control system provides cost-effective complete or partial control system retrofits for gas turbine driven pump packages. The system provides replacement controls for outdated electro-hydraulic and analog-electronic controls. The PLC-based system can include turbine and pump sequencing, complete turbine control, pump control, capacity control, DCS interface, and a graphic operator interface for system status, trending, and data logging.

ADVANTAGES

- **Integrated control capability:**

Turbine fuel control, pump 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.

- **Open architecture system:**

Application control package's portability allows customer choice of platform, reducing need for additional spare parts and training expenses. Available PLCs include General Electric 90-70 and 90-30, Siemens/TI, Modicon Quantum, and Allen-Bradley.

- **Fault tolerant:**

Control package is available on fault tolerant controllers for critical control applications.

- **Standard industrial components:**

Non-proprietary, commonly available parts are less costly and more easily serviced by customer's on-site personnel. Much longer time to obsolescence than proprietary systems.

- **Reliability:**

ALL control functions are performed by tested and proven industrial PLC equipment, not by MS-DOS based computer equipment which is not designed to function as a "controller".

- **Simplified interface to DCS or SCADA:**

Communication tasks are handled with a separate, dedicated module in the PLC, increasing data rate and simplifying network installation.

- **Non-proprietary interfaces:**

Interfaces in the form of 4-20 mA, RTD, frequency, thermocouple, and dry contact I/O allow simple integration into existing sequence/protection logic controller, making very low-cost partial control upgrades simple and practical.

- **Improved fuel regulation:**

Fast loop sampling rate, combined with modern digital control techniques improve steady-state setpoint control, and reduce overshoot during transients.

- **Improved start-up reliability:**

Special "lean lightoff" procedure ignites all burners with essentially 100% reliability, and with greatly reduced thermal stress.

- **Improved exhaust temperature monitoring and control:**

Advanced statistical algorithms detect turbine hot/cold spots and automatically reject failed thermocouples.

- **Fail-safe features:**

Redundant overspeeds; open/short monitoring of mA and thermocouples; readback monitoring of outputs, and special self-check features improve safety.



Replacement controls for two Ruston TB4000 gas turbine driven pumps for crude oil pipeline service

- **Improved operator information with graphic interface:**

Industrial workstation graphically displays start-up sequencing, speeds, temperatures, operating points, and alarm/shutdown status. Optional data logging and trending can be used as part of a preventative maintenance program.

- **Simple installation:**

A dimensionally identical replacement of the control panel is possible, saving substantial architectural and installation cost. Control panels can be installed one at a time allowing other units to continue operating.

- **Rugged:**

Control panels can be built Division 2, Nema 4X for installation in harsh local environments.

- **Flexibility:**

The control system package can accommodate many different control strategies based on the customer's need and budget.

CONTROLLERS/SPECIAL FEATURES

The gas turbine application control package includes:

- Firing (soft lightoff) ramp
- Startup controller
- NHP controller
- NHP acceleration controller
- NLP controller
- NLP acceleration controller
- EGT controller
- EGT rate of rise controller
- Combustion monitoring system

The pump application control package includes:

- Suction pressure controller
- Discharge pressure controller



CUSTOMER SELECTABLE COMPONENTS FOR THE CONTROL SYSTEM

Advanced Programmable controller:

- Siemens/TI 505
- Allen-Bradley Series 5, Flex I/O, ControlLogix
- GE Fanuc 90-70 and 90-30
- Modicon Quantum.
- Fault tolerant controllers.

Application control package:

- Petrotech gas turbine control
- Petrotech pump capacity control
- Petrotech sequencing and protection

Vibration Monitor:

- Bently Nevada 3300, 3500, and 2201 (for Allen-Bradley systems only)
- Vibrometer
- Metrix
- Vibrotec
- Customer specified

Man machine interface (MMI) alphanumeric display (low-end) plus panel meters for NHP, NLP, and EGT:

- NEMATRON
- CTI Access 4000
- Allen-Bradley Redi-Panel
- Customer specified

Man machine interface (MMI) package display (high-end):

MMI Hardware:

- Intecolor industrial computer and monitor
- IBM industrial computer and monitor
- Texas Microsystems industrial computer and monitor
- XYCOM industrial computer and monitor
- Nortech industrial computer and monitor
- NEMATRON industrial computer and monitor
- Customer specified

MMI Software:

- WonderWare InTouch®
- Citech®
- Intellution®
- Realflex®
- Customer specified

Critical function redundancy for fail-safe action:

- Customer specified shutdowns in addition to NHP, NLP, EGT, and low lube oil pressure

Communication interface for DCS or SCADA:

- MODBUS
- Ethernet
- Customer specified

Type of control panel enclosure:

- Front plate for existing control enclosure (common for GE gas turbine retrofits)
- Custom fabricated new control enclosure.
- Class I, Division II stainless steel purged panel enclosure for hazardous locations
- Standard Rittal type panel enclosures

AUXILIARY SYSTEMS FOR GAS TURBINE PUMP PACKAGES

The following auxiliary systems and components are also available for complete or partial system upgrades:

- Fuel control valve system upgrade can include replacement of fuel control valve, fuel speed ratio valve upgrade, addition of a fuel vent valve, compressor discharge pressure transmitter, and interstage fuel pressure transmitter.
- Hydraulic servo controls if applicable, such as second stage nozzle controls on a GE Frame 3 gas turbine, or inlet guide vane controls on a GE Frame 5 gas turbine.
- Complete second stage nozzle actuator and hydraulic system retrofit for GE Frame 3, with an increased capacity industrial RAM and servo with accumulator, pumps, and support components integrated into a complete system.
- Speed probe and exciter gear assemblies
- Flame detectors for combustion chambers
- Thermocouple retrofits
- Recycle valve assembly, model Petrotech RVAM
- End elements such as flow, pressure, and temperature transmitters, and flow elements

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