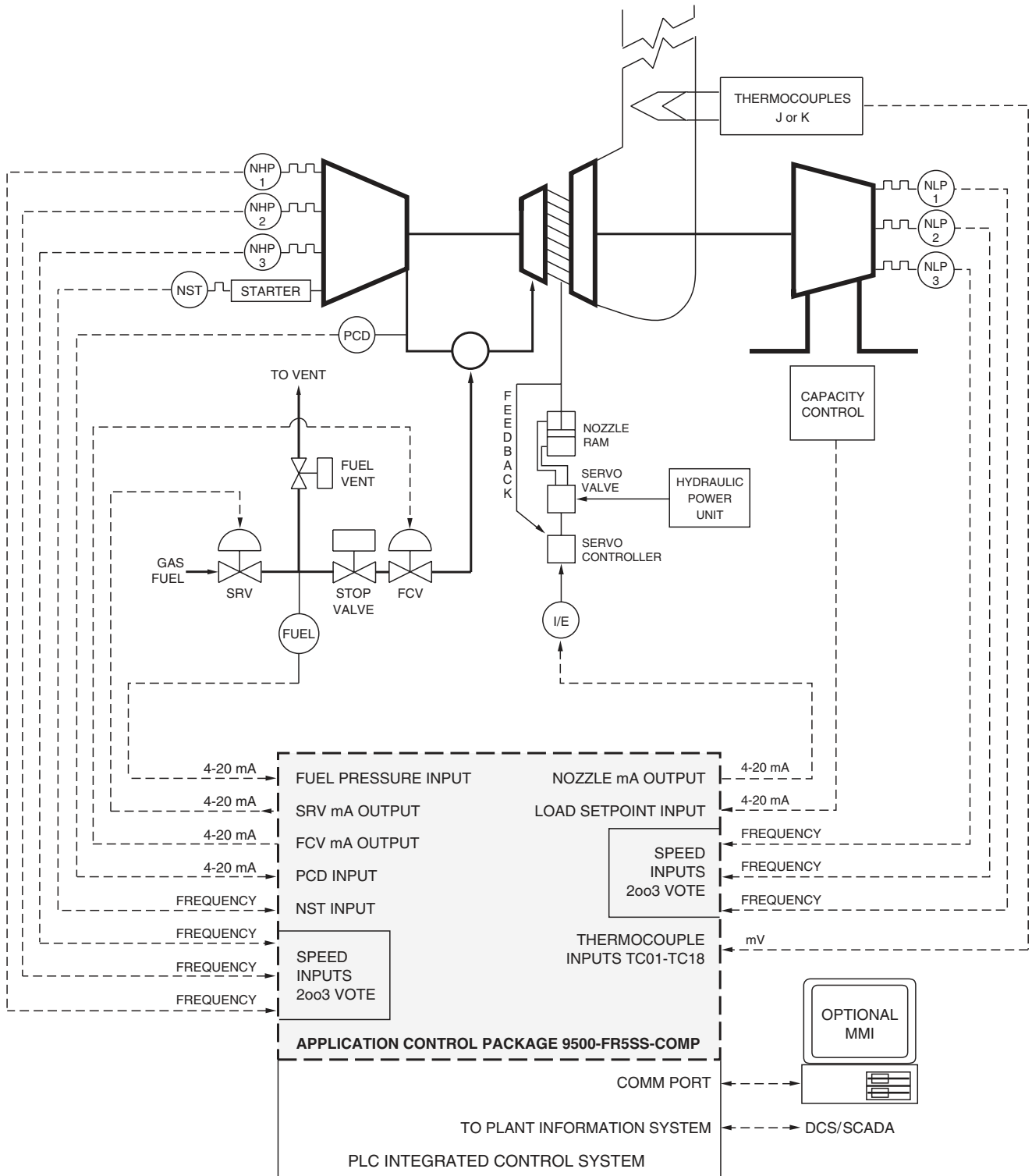# SPLIT SHAFT GAS TURBINE COMPRESSOR DRIVE
APPLICATION CONTROL PACKAGE

PETROTECH

MAY 2012

Simplified schematic showing a Petrotech split shaft gas turbine compressor drive application control package integrated into an advanced integrated control system.

PETROTECH

APPLICATION

The split shaft gas turbine application control package replaces older mechanical/hydraulic/electronic/pneumatic fuel regulators with a modern, reliable application control package which runs on an advanced PLC-based system. The control package for the gas turbine provides fuel control, speed ratio control, and nozzle control based on speed and temperature.

ADVANTAGES

- **Hardware independent system:**

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

- **Fault tolerant:**

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

- **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.

- **Improved fuel regulation:**

  Fast loop sampling rate, combined with modern digital control techniques, improves steady-state setpoint control, and reduces 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.

- **Non-proprietary interfaces:**

  Simple 4-20 mA, RTD, thermocouple, and dry contact I/O allow simple interface to existing sequence/protection logic unit, making low-cost partial upgrades practical, and system troubleshooting simple.

- **Improved operator information with optional MMI:**

  Optional Man-Machine Interface MS Windows-based graphic operator interface displays system status, trending and data logging, which can be used as part of a preventive maintenance program.

SCOPE OF SUPPLY

The application control package for the split shaft gas turbine compressor drive system, includes:

Analog inputs, 4-20 mA:
- Load setpoint (capacity control).
- Compressor discharge pressure (PCD).
- Fuel interstage pressure.

Analog inputs, frequency:
- Three (3) redundant NHP.
- Three (3) redundant NLP.
- One (1) starter speed.

Analog inputs, mV:
- EGT (up to 18 thermocouples).

Analog outputs, 4-20 mA:
- Speed ratio valve position setpoint.
- Fuel control valve position setpoint.
- Nozzle position setpoint

Operating states:
- Firing.
- Warm-up.
- Accelerate.
- Load.
- Upset.

Status, alarms, and shutdowns:
- Fault.
- NHP overspeed alarm.
- NHP underspeed alarm.
- NHP overspeed shutdown.
- Redundant NHP overspeed shutdown.
- $\triangle$NHP alarm
- NLP overspeed alarm.
- NLP underspeed alarm.
- NLP overspeed shutdown.
- Redundant NLP overspeed shutdown.
- $\triangle$NLP alarm
- High EGT alarm.
- High EGT shutdown.
- Rejected thermocouple.
- Too few thermocouples shutdown.
- $\triangle$T alarm
- $\triangle$T shutdown
- Thermocouple spread alarm.
- Thermocouple spread shutdown.
- Turbine maximum limit.
- Turbine minimum limit.
- NHP speed #1.
- NHP speed #2.
- NHP speed #3.
- NHP speed #4.
- NHP speed #5.
- NLP breakaway.

- EGT switch #1.
- Bolt test.
- Manual.
- NLP speed #1.
- NLP speed #2.
- Starter overspeed.
- Starter zero speed.
- High firing fuel pressure shutdown.
- PCD bias active.
- Transmitter failure alarms.
- Transmitter failure shutdowns.
- Output failure shutdowns.
- Control mode.

Controllers/special features:
- NHP controller for fuel valve.
- NHP acceleration controller for fuel valve.
- NLP controller for fuel valve.
- NLP acceleration controller for fuel valve.
- EGT controller for fuel valve.
- EGT rate of rise controller for fuel valve.
- NHP controller for nozzles.
- EGT controller for nozzles.
- Combustion monitoring system.

Ramps:
- Firing (lean lightoff) ramp.
- Start-up ramp.
- Loading ramp.
- NLP cooldown ramp.

Does not include:
- PLC hardware.
- Compressor application control package.
- Gas turbine sequencing and protection discrete logic.
- Compressor sequencing and protection discrete logic.

OPTIONS FOR COMPLETE CONTROL SYSTEM UPGRADE

- Compressor application control package.
- Gas turbine sequencing and protection discrete logic.
- Compressor sequencing and protection discrete logic.
- Communication interface to DCS or SCADA.
- Capacity control application control package.
- PLC hardware.
- Man machine interface unit with Wonderware InTouch® licensed software package.
- Complete custom engineered control panel, factory tested and ready to install.
- Fuel valve system upgrade.
- Nozzle actuator system upgrade or retrofit.
- Thermocouple upgrade.
- Flame sensor upgrade.
- Vibration system upgrade.
- Installation and commissioning.
- Training