



***JPI, LLC***

***Executive Summary***  
*For*  
***Gas Turbine***  
***Instrumentation***  
*And*  
***Control***  
***Retrofit***

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## Introduction

The HPI turbomachinery control solutions, based on the HPI product line, provide precise automatic governing, sequencing and load control for any engine and its associated load, regardless of manufacturer or application. It has been proven to dramatically increase the start availability, reliability and performance of any train, particularly when compared to old analog relay or hydro-mechanical systems. It has extensive diagnostics and communication facilities allowing easy interfacing to other plant, SCADA or DCS. Now after continual development, HPI's portfolio of GT control platforms has expanded into a range of systems, all of which are safe and cost effective, providing a flexible solution to any turbomachinery and reciprocating engine control application. Control software is not just restricted to the turbine itself other functions such as automatic synchronizing, load sharing and load shedding is available.



HPI's team member experience with the major international oil and gas companies and power utilities throughout the world has established their reputation for providing turbomachinery control systems of the highest quality. Compressor Anti-surge and Load balancing are key features integrated into HPI's control solutions providing improved main control and enhanced performance for these demanding industries. To date, HPI employees have integrated systems fitted to more different types of turbines than any other controls manufacturer. HPI is able to meet the unique requirements of the offshore sector of the oil and gas industry. Complete automation solutions of generators, mechanical drive gas turbines, reciprocating engines, station controls and ESD systems, in all industry sectors, are an integral part of HPI's scope of products and services.

With the experience of designing, manufacturing and supporting so many industrial machinery control systems installed on a vast array of different models of gas & steam turbines, generators, compressors and reciprocating engines, HPI control solutions can satisfy any need. Today, with our team having provided complete SCADA, DCS and Fault Tolerant systems, HPI is at the very forefront of machinery control and monitoring technology as a complete systems integrator and provider of advanced engineered solutions.

**To summarize:**

- HPI's controllers provide a high level of control accuracy and reliability.
- Control/monitoring/protection for GT's and generators uses off the shelf, high speed PLC platforms.
- Maintenance and service knowledge base is no longer an issue.
- Unscheduled outages have decreased as diagnostic capabilities match modern engine systems.

HPI expect to operate the turbine as specified by the OEM without frequent operator intervention. Unplanned shutdowns are not only costly in terms of manpower and possible loss of revenue, but also with regard to the overall life of the turbine. Items to consider for high reliability are:

- State-of-the-art, supportable, digital control hardware and software.
- Control design philosophy.
- Off the shelf high reliability hardware.
- Ease of maintainability, optimizing manpower and maintenance planning.
- Commonality of control systems, i.e., same controls operate many different types of gas turbines.

Modern digital controls are able to play an ever-increasing role in improving turbine efficiency as their reliably and accurately operate the turbine closer to optimum running conditions. Items to consider are:

- Reliable and accurate control.
- Automation of load and transient response.
- Ease of calibration or self-calibration, no control drift.
- Increased monitoring and trending capabilities.
- Increased operating flexibility.

HPI believes customers often need additional capability such as data acquisition or improved man/machine interface. Digital controls are inherently well suited to provide these benefits, and other future enhancements. Effective data acquisition and increased man/machine interface allows operations to be more responsive to rogue conditions. Operators are also better able to assist engineering and management in assessing turbine conditions and planning cost effective maintenance schedules. Items to be considered are:

- Enhanced alarm and trip detail.
- Faster, more accurate access to operating details.
- Hard copy of logs and sequence of events.
- On and off-line trending and operating parameter graphic displays.

The HPI team has developed a program that takes advantage of digital control system implementation on gas turbines, steam turbines and diesel generators. With instrumentation and transducers placed on the engines throughout, there are certain diagnostics that can be performed. The simplest is the calculation of exhaust gas temperature spread. HPI introduces additional software to trend this function so a prediction is generated as to when the spread limit is going to be reached and between which thermocouples, so as to give the user

advanced warning of failure. The user in turn, can then plan a shutdown at the most convenient time, saving the ignominious fate of a blackout condition.

Another example of our 'Healthcare' strategy is that we can predict when a compressor wash is imminent. Also, we can provide an aerothermal analysis, whereby minute by minute calculations of the GT efficiency is generated, providing a tool to detect an any underlying fault building such as cracked or burnt combustion liners, etc. With more instrumentation we can even point more accurately at the actual cause of the fault.

When the data is input into our database, the result is a semi 'expert system' for detecting and predicting problems. If planned maintenance can eliminate a majority of unpredictable shutdowns this will save the user not only money but credibility with its end customers. Our strategy can be further enhanced by implementing after care tactics as well. We believe the modern digital control lends itself to Local Area Network (LAN) and Virtual Private Network (VPN) communication. A seamless integration of these preventative diagnostic programs and Low Cycle Fatigue calculations may be directed to a company wide, Monitor & Diagnostic team. The organized ability to access this intelligence by the fleet overseer will afford customers the opportunity to drastically reduce adverse economic impact due to outages and repair.

We have talked about some of the ways HPI believe it is possible to minimize turn key costs at each engine location. We are convinced a trend towards standardization will not only facilitate the service and maintenance efforts, but the new control system design and build program as well.

Additionally, our projects have taught us the value of using local suppliers for some system elements. We will utilize the local distributors where possible. The end result has proven to greatly enhance response time and customer service, as these vendors are able to more readily recognize the fruits of their labors (\$\$) as they witness their equipment being installed locally.

In the end, diesel and gas/steam turbomachinery control retrofits can result in many benefits. The user will, without question, experience improved monitoring and control, economic savings, enhanced reliability, serviceability and performance

## **HPI CONTROL PACKAGE**

It is evident that the best return on investment for controlling your turbine packages will be obtained by providing a highly reliable, cost-competitive control system. This system will be aimed at providing high start availability, tight control, low maintenance, and 'state-of-the-art, low obsolescence control system components.

HPI is uniquely qualified to provide this particular control system supply. Our position as supplier of microprocessor based, turbine control systems to power generation applications around the world, provides HPI with **unrivaled** access to fuel governing algorithms. It is these very algorithms that are ported into the CPU of the PLC processor, via the commonality of IEC 1131 software standards. HPI recommends the use of Allen Bradleys' *FlexLogix* PLC as this and the more sophisticated *ControLogix* PLC are most suitable for GT control. Using this state of

the art control device, we eliminate the threat of obsolescence, as well as capitalize on recent advances, thus providing a highly integrated solution.



**HPI Dual Redundant ControlLogix Installation**

### **Modern Equipment**

The solution offered is based on the Allen Bradley FlexLogix PLC. HPI is a leading Independent Controls Supplier Company, having successfully developed and implemented this and many other COTS (Commercially available, Off The Shelf) PLC control platform solutions to satisfy retrofit contracts. Currently, the HPI team has implemented over 140 turbomachinery packages operating on the Allen Bradley platform.

### **Remote Control and Supervision**

For most applications, Remote Control can be provided via a Human Machine Interface, located at the client's remote operations and monitoring center, communicating via RS Linx to a centrally located control room of choice. This configuration will allow starting, supervision, diagnostics and automatic unit synchronization as well as sequential start.

As an alternative, a VPN (Virtual Private Network) Internet connection can be used not only for after-hours and remote monitoring by operators, but also to allow system support and troubleshooting by HPI from our Houston office. Via this link system configuration and diagnostics would dramatically reduced lost time thus improving system availability, and providing operational savings.

## **Project Experience and Quality**

HPI are technological leaders in the supply of turbomachinery controls. The company has developed professional project teams with extensive experience in designing, manufacturing, installing and supporting controls identical or similar to that required for your application.

In this proposal we emphasize project management, since we consider this to be crucial to a timely and successful project completion. The project team organization and management that will be offered in any proposal have been proven through many years of providing turbine control retrofits, and are formed of highly qualified personnel who fully understand the demands of this type of project. Selected resumes of company personnel will be provided.

## **After Sales Support**

HPI is committed to providing responsive after-sales service once commissioning has been completed. Our ILS (Integrated Logistic Support) program describes the general range of services provided through HPI's Customer Support Department. Our installation Engineers and Technicians have been trained to also support the Defense and Offshore Industry, applying the same high level standards to all control projects. Support is available from centres in the UK, USA, Canada and Egypt.

## **Conclusion**

The solution that will be offered brings quantitative technical and economic benefits to the operation of your turbines. Availability and reliability are substantially high, while unnecessary maintenance eliminated along with the need for calibration. Commercially available spare parts from Allen Bradley are now standard protocol. Other packages that can be supplied, if they are not part of your current installation plans, are equipment such as complete Power Management Systems, Switchboards and MCC's. We can discuss these optional scope services at your convenience.

We are confident that the HPI solution will prove most satisfactory both immediately and over the long term from the economical and technical standpoints. Our background is comprehensive and unique in the marketplace; our equipment is state of the art and bears recognized quality stamps. We are prepared to provide turbine user's with the most reliable and cost effective control system upgrades for their fleet of combustion gas turbine engines.

Thank you for considering HPI.

Yours Sincerely,



Hal Pontez  
President

