



# Hani Energy Catalog

## Introduction

HANI ENERGY Company started its activity in the field of industrial automation in 2000. In the early years, along with other industrial projects, we also worked in the field of power plants and related industries. After six years, the company decided to expand its specialized activities in the field of the power plant and oil and gas industry services to become an expert in the power industry. Since then, we successfully provided our retrofit service to more than 3000MW (by early 2020) power generation units in power generation and oil and gas industries.

The fields of activity and expert teams of our company is divided into the following categories:

- ◆ Control and protection systems of gas power plant units and gas turbines.
- ◆ Control and protection systems of steam and combined cycle power plant units.
- ◆ Generator excitation and protection systems.
- ◆ Special industrial automation projects.



By adopting a successful research and development strategy, we deployed many projects to the best of customer satisfaction and achieved relevant technical expertise of these industries.

We created technical teams with a scientific approach to provide high-quality service.

Our goal is to become a prominent player in the power plant retrofit industry in a global scale. We have put forward this goal based on our mature technology which has been tested on more than 3000MW power generation units and our competitive price which stems in our agility and advanced technology.

 [www.hanienergy.com](http://www.hanienergy.com)

 [info@hanienergy.com](mailto:info@hanienergy.com)

 +41 78 638 07 09

## Fields Of Activity

### Gas turbine control unit

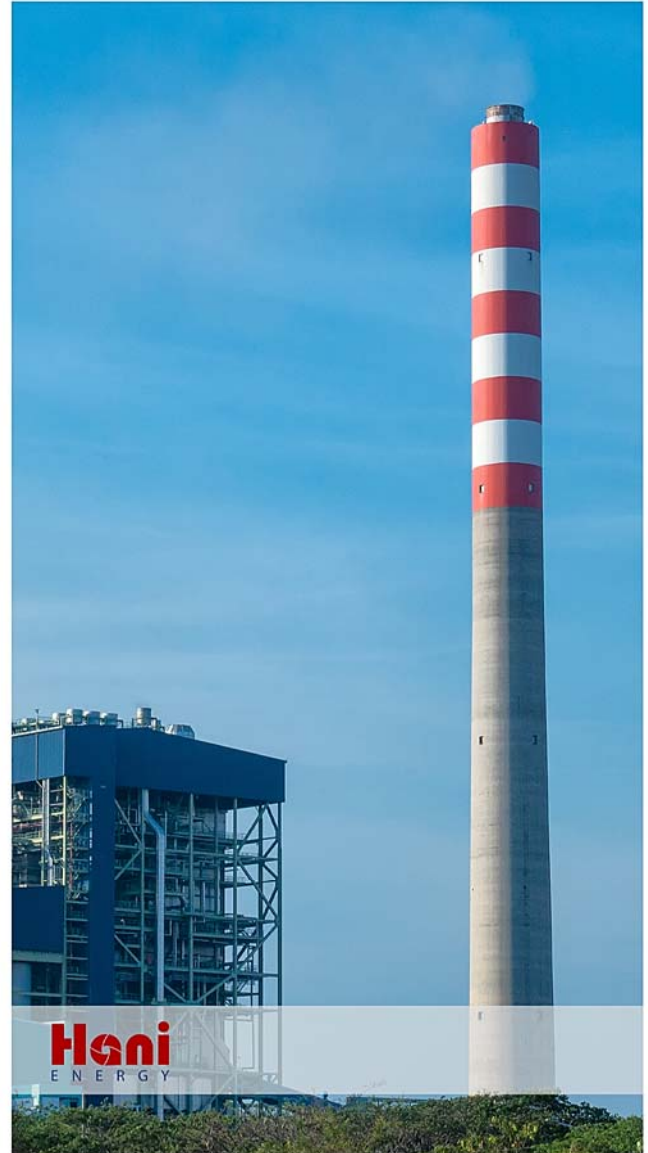
After years of studying the DCS control systems of gas turbines and by reviewing and modelling the GE 5001 and 5002 control and protection systems and optimizing them, the company was able to develop its comprehensive control and protection system called Gtech (stands for "Gas turbine control technology") in November 2011. Gtech is compatible with many types of turbines such as Hitachi, BBC, Siemens, etc.

The Gtech includes comprehensive turbine control and protection system, which was first planned for gas units and specially designed for GE turbines 5001 and 5002, and then has been adapted and optimized for using in other kinds of turbines (Hitachi, BBC, Siemens, etc.). These products can be extended to other gas turbines, regardless of their applications as turbo generator, turbo-compressor and turbo-pump. This comprehensive technology has been developed by studying different types of turbines and adapting the initial designs for a wide range of customers with different turbine types and a variety of applications.

### Optimization of turbine controllers

Based on our technical proficiency, one of the services which HANI ENERGY Company provides is the performance test and inspection of the turbine controller. After examining each controller and its performance coefficients, optimization is applied to the turbine, which reduces the costs of O&M (operation and maintenance) in the mechanical unit.

First, we audit and investigate the turbine controller's working flow pattern in different operating modes and conditions of the turbine. Next, we examine all controller components one by one, and finally, the coefficients and their overall performance will be reviewed. This can have a significant impact on the optimization of the turbine performance and reduction in the O&M (operation and maintenance) cost of the mechanical unit.



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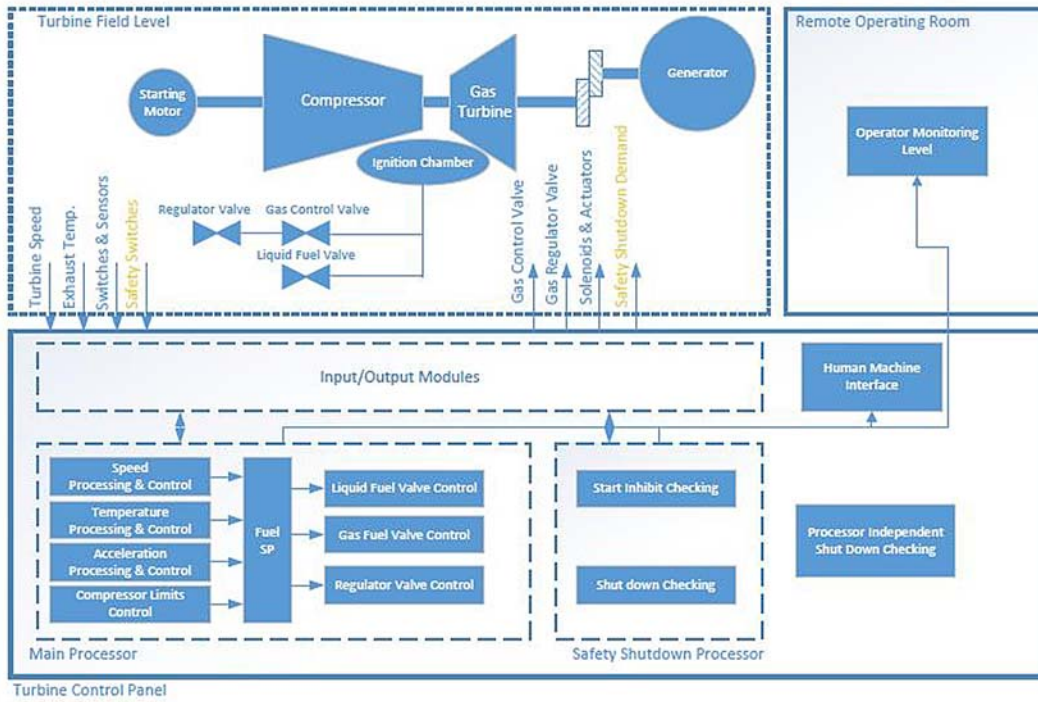


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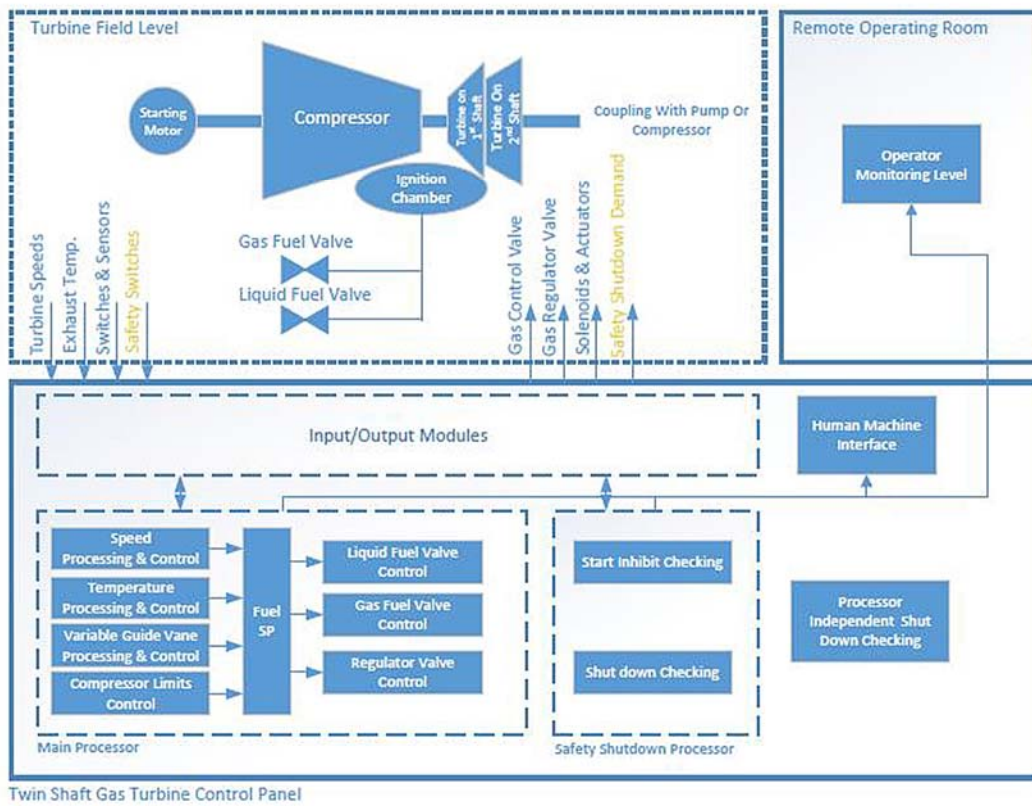


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The block diagram of this product for turbo-generator systems is as follows:



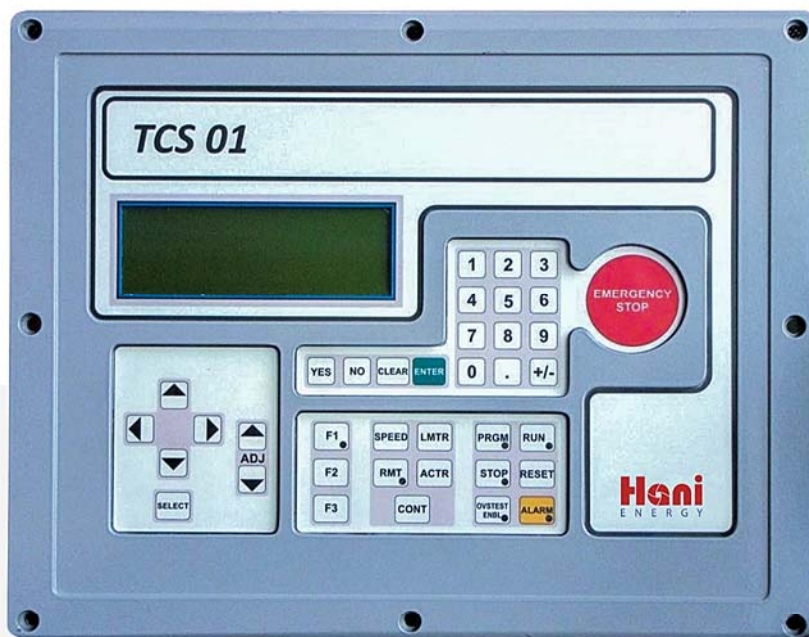
Also, the product diagram for turbo-pump and turbo compressor systems (with two shafts) is as follows:



## Control and protection of steam and combined units

By increasing of Gtech capabilities, we extend the scope of this turbine controller to a variety of steam turbines, including the LMZ Russian turbine generators. To obtain control technology for steam units, HANI ENERGY performed numerous research projects in steam plants that cover a wide range of processes. The following processes in a steam plant are among the main units included in our controllers:

- ◆ Turbine control of steam units
- ◆ Control of fuel cycle, air and vacuum (fuel, tail and suction)
- ◆ drum level control with three-parameter algorithms
- ◆ Superheat Steam Temperature Control (ABZ)
- ◆ Burner Controls (Complete BMS Cycle Includes Logic and Control)
- ◆ Condenser level control
- ◆ Injectors control
- ◆ Control of the cooling cycle
- ◆ Control of full cycle of water and steam and related tanks
- ◆ Increase the safety and reliability of the unit by implementing 2 of 3 logic.



The simpler product of this family is named Gtech 401, as an alternative to every electronic governor controller, to install and control small steam turbines on turbo steam pumps, etc.

## Generator Excitation Systems

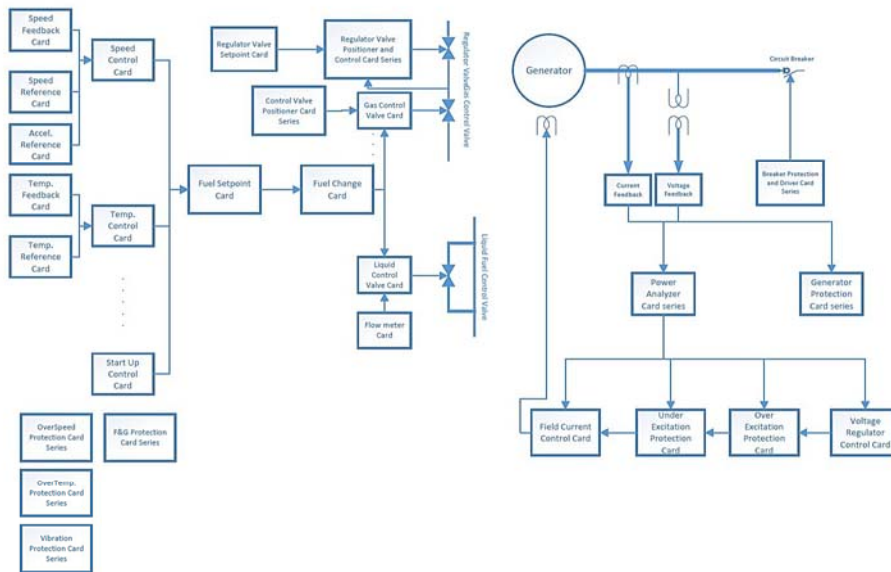
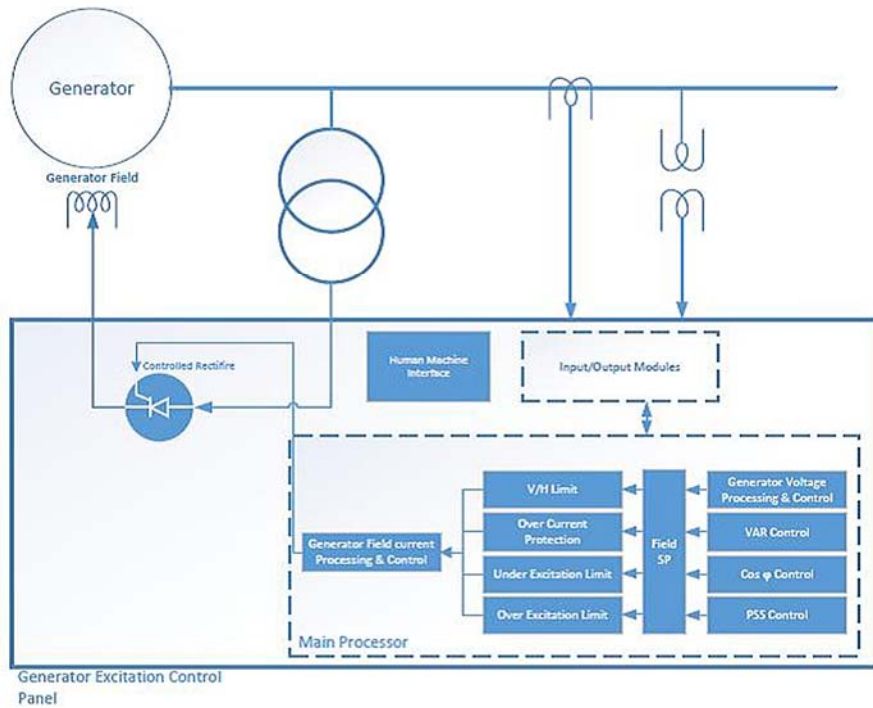
Hani Energy company has nearly two decades of experience developing various electronic cards, excitation system components, and cards. We have recently developed a complete excitation control and protection system for generators. The design and implementation of all power electronic parts and control parts of the system and its implementation as a DCS system are parts of our technical capabilities in this field.



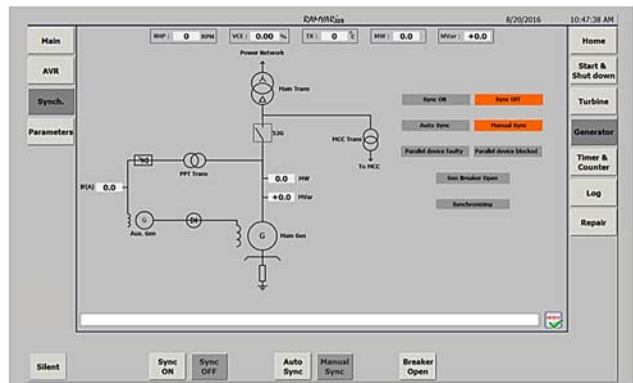
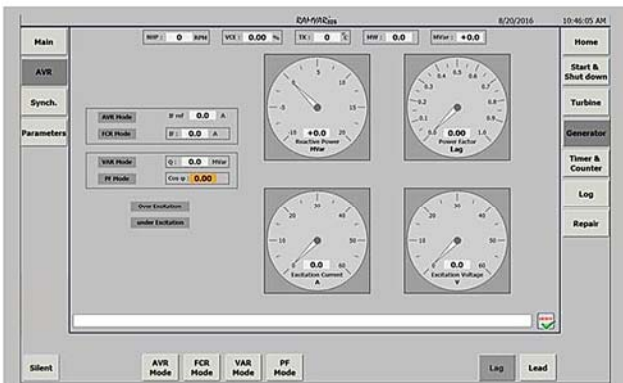
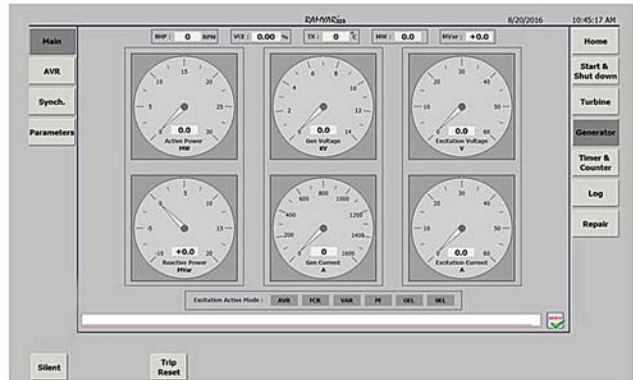
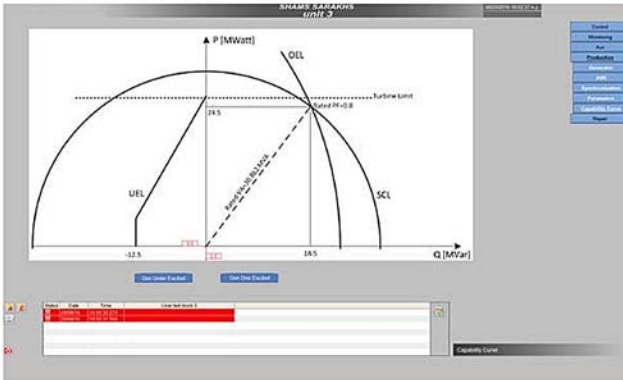
The most important features of this system include the followings:

- ◆ Configuration of Siemens hardware and software-based controls, based on PCS7 300 and 400 class.
- ◆ The high processing speed of control loops (less than two milliseconds).
- ◆ Ability to implement the system through hot redundancy in the control, power, and cooling systems.
- ◆ Reduction of generator losses by placing its working point at the nominal working point that results in better generator efficiency.
- ◆ Ability to communicate with the proxy bus network and industrial Ethernet network.
- ◆ The ability to change the excitation system's power from the dynamic to the static mode and the removal of the middle power generators.
- ◆ Full control over the generator by various control modes.
- ◆ Voltage control in automatic mode or AVR (automatic voltage regulator).
- ◆ FCR (Field Current Regulator) flow control.
- ◆ Reactive power control and generator power factor in PF (power factor).
- ◆ Transmission without mutants between control modes.
- ◆ Reactive flow regulator and the ability to determine the line drupe or reactive power drill.
- ◆ Soft power generator startup voltage to prevent sudden spin on triggering.
- ◆ Contains UEL (under excitation limiter), OEL (overexcitation limiter), limiting stator current limiter (SCL), and limiting volts per Hz (V/Hz).
- ◆ Displaying the generator's work point in the generator's power generation curve on the HMI.
- ◆ Design of the power sector in two ways to increase the speed of the De-excitation.
- ◆ Monitoring the position of rotating diodes in the system of dynamic stimulation and the state of the thyristors in the static excitation system.

The use of this system will reduce the cost of repairing and maintenance and long-term after-sales service. The block diagram of this product is as follows:



Several examples of the monitoring page of the excitation system implemented in recent projects have shown in the following figures:





## Over Speed Protection System

Ryan's advanced over-speed protection system is designed to display and protect the instantaneous speed of rotating equipment. This system has a modular structure that ultimately facilitates the transportation, installation, and supply of spare parts. The most important features of this system are:

- ◆ It has three independent speed protection modules
- ◆ Ability to receive input from three independent sensors in each module
- ◆ Ability to configure two out of three algorithms at the level of each module
- ◆ Ability to configure two out of three algorithms for all three modules
- ◆ Ability to configure two trip methods of two of the three cards with two independent voters simultaneously
- ◆ Availability is very high
- ◆ Compatible with a variety of magnetic pickup sensors, proximity, and Hall effect
- ◆ Ability to detect sensor error
- ◆ Possibility of latching trip
- ◆ Easy user interfaces for setting parameters (Oraspid setpoint, hysteresis definition, etc.)
- ◆ Show speed online
- ◆ Periodic validation operation in each module
- ◆ Design based on IEC61508, SIL3 standard
- ◆ 4-20mA analog output proportional to speed (optional)
- ◆ Possibility of communication through Profibus
- ◆ Repeater signal for monitoring use
- ◆ Response time <15msec in the occurrence of Oraspid
- ◆ Measurement accuracy of 1Hz at 20KHz



### Design and production of electronic cards

We have been designing and manufacturing a variety of electronic cards for more than two decades. So far, we have provided more than hundreds of different types of cards to power plants, refineries, and other industrial centers like modern electronic breaker drivers, steam turbine control, steam boilers control, etc.

Many cards have been ordered for retrofit purposes and we have redesigned the technology to increase the reliability of the cards. The following steps are taking place in our card design section for any new retrofit card to have the same functionality higher reliability.




- ◆ Studying the layout's accuracy with the card in cases where the card's layout is available and otherwise extraction of the card layout even for multi-layer boards.
- ◆ Studying and analyzing card function and card design in simulation software and comparing the results of analysis and simulation.
- ◆ Designing a new card and comparing its performance with the old card.
- ◆ Performing relevant functional and non-functional tests on the new card, such as environmental tests according to IEC60068, other cold tests required in the laboratory, and hot tests on units.


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 [info@hanienergy.com](mailto:info@hanienergy.com)

 +41 78 638 07 09

 Chemin des Noutes 17,  
1023 Crissier Switzerland

 +41 78 638 07 09  
 +41 76 421 29 71

 [www.hanienergy.com](http://www.hanienergy.com)  
 [info@hanienergy.com](mailto:info@hanienergy.com)