

## Fauji Fertilizer Company Retrofit of AEG Kanis Turbine Helps Fauji Fertilizer Company Save Energy, Stabilizes the Fertilizer Production Process and Enhances Steam Management



### Background

Fauji Fertilizer Company (FFC) is a leading fertilizer plant in Pakistan that has been supporting the country's agricultural food production with its fertilizer products since 1982. The company's plant is located in the Rahim Yar Khan area of Pakistan.

Crucial to the production of fertilizer is the availability of Carbon Dioxide (CO<sub>2</sub>) at high pressures and large volumes. A steam turbine driven compressor is used to compress CO<sub>2</sub> gas into a higher pressure for further use in the fertilizer process.

### Challenge

At Fauji Fertilizer an AEG Kanis steam turbine and a Nuovo Pignone CO<sub>2</sub> compressor, rated at 10.7 MW, provided the compression of the CO<sub>2</sub> feed. The steam turbine was using an outdated hydro-mechanical control system to control the turbine speed and turbine extraction pressure.

This control system caused to speed fluctuations of 20 to 40 RPM under steady state conditions, resulting in disturbances to the fertilizer production due to the fluctuating flow of CO<sub>2</sub>.

These speed fluctuations combined with poor efficiency, lack of spare parts and operational difficulties made Fauji Fertilizer decide to upgrade its hydro-mechanical control system to a new electronic solution.

### Solutions

- Woodward 505E digital control system
- Woodward CPC-II actuator
- Woodward Protech G2 SIL-3 overspeed protection system
- Bafco two out of three TMR voting trip block
- Stainless steel local operating panel
- Human Machine Interface (HMI)
- Filters
- MPU's
- Cabinet

### Results

- Reduction of speed fluctuations from 20-40 RPM to only 2-3 RPM
- Easier and more accurate control by system operators
- Increased total system efficiency and steam saving



Fauji had positive experiences with PM Control in the past when PM Control successfully retrofitted a boiler feedwater pump for the company and showed commitment to customer quality during and after that project. This, in combination with the excellent performance of the hardware since the commissioning of the feedwater pump, lead to Fauji's decision to select PM Control's proposal over the competing Compressor Control Corporation (CCC) bid.

### Solution

PM Control proposed the following products for the retrofit:

- Woodward 505E Digital Control System
- Woodward CPC-II Actuator
- Woodward Protech G2 SIL-3 Overspeed Protection System
- Bafco two out of three TMR voting trip block
- Stainless steel local operating panel
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#### Woodward 505E Digital Control System

PM Control supplied a digital control system based on the popular Woodward 505E control system. This field configurable electronic control system can be configured to operate single extraction and/or admission steam turbines of any size. It has menu-driven software to instruct site engineers on programming the control to a specific generator or mechanical drive application. The unique PID structure of the 505E control makes it ideal for applications where it is required to control several steam plant parameters at once, like in the case of Fauji, where parameters such as turbine speed, extraction pressure and load are of key importance.

#### Woodward CPC-II Actuator

Woodward's Current to Pressure Converter (CPC-II) is an electrohydraulic pressure regulating control valve used to position single-acting steam turbine valve servos/actuators. Its superb accuracy and resolution make it ideal for steam turbine valve control and related turbine speed and load control. Its rotating valve technology makes the CPC-II extremely robust in harsh and contaminated oil environments.

In the case of Fauji, Woodward's CPC-II actuators were used to provide a hydraulic pressure command signal to the original AEG Kanis pilot actuators. Fauji preferred to have a circumvent on the manifold to bypass the CPC during flushing. PM Control provided this manifold, while Fauji provided the adapter.

#### Woodward Protech G2 SIL-3 Overspeed Protection System & Bafco Zoo3 Hydraulic Trip Block

The ProTech 203 Overspeed Protection System is a digital overspeed trip device that senses prime mover speed through three magnetic pickups



Control Room



Control Room



Hydraulic Voting Block

(MPUs). It consists of three identical, independent, speed-sensing circuits, which continuously monitor prime mover speed and activate a trip relay when an overspeed condition is detected. The three individual trip relays of the Protech are connected to a two-out-of-three voting Triple Modular Redundant hydraulic trip block. If any of the Protech or trip block modules fail, the systems will still provide the proper protection to machine and personnel.

A custom engineered speed sensing bracket was installed on the turbine to provide individual speed signals to the Woodward 505E control and Woodward Protech protection systems.

### Stainless Steel Local Operating Panel

A stainless steel local operating panel was provided for the operation of the turbine at the turbine deck. This IP 65 rated panel provides the operator with basic control and monitoring information for speed adjustments and overspeed testing of the turbine.

### Human Machine Interface (HMI)

For operation, monitoring and maintenance PM Control supplied a desktop-based HMI. This iFix based HMI solution provides graphical representation of the turbine operation and supports longterm historical trending.

### Implementation & Commissioning

The control system was engineered and assembled at PM Control's workshop in Singapore. After a successful Factory Acceptance Test the system was shipped to Pakistan where local personnel of Fauji installed it.

After a commissioning period of six days Fauji Fertilizer Company happily accepted the system. The Instrumentation Manager of Fauji says: "Woodward CPC-II is a much more superior product compared to similar solutions by its competitors".

### Results

- Reduction of speed fluctuations from 20-40 RPM to only 2-3 RPM
- Easier and more accurate control by system operators
- Increased total system efficiency and steam saving

The new control system has led to a much better control of the turbine speed. Speed fluctuations have been reduced from 20-40 RPM to only 2-3 RPM, resulting in a more constant CO<sub>2</sub> feed from the compressor to the fertilizer production process.

Plant operators are now able to very precisely control the turbine's extraction pressure resulting in better steam management, more operational flexibility and less operator intervention.

The new system increases the total system efficiency resulting in a steam savings of up to 2 to 3 tons per hour. Fauji complimented PM Control for its work on the upgrade: "The Retrofit for the project was done efficiently.



Local Operating Panel



CPC Mounting Bracket



System After Upgrade

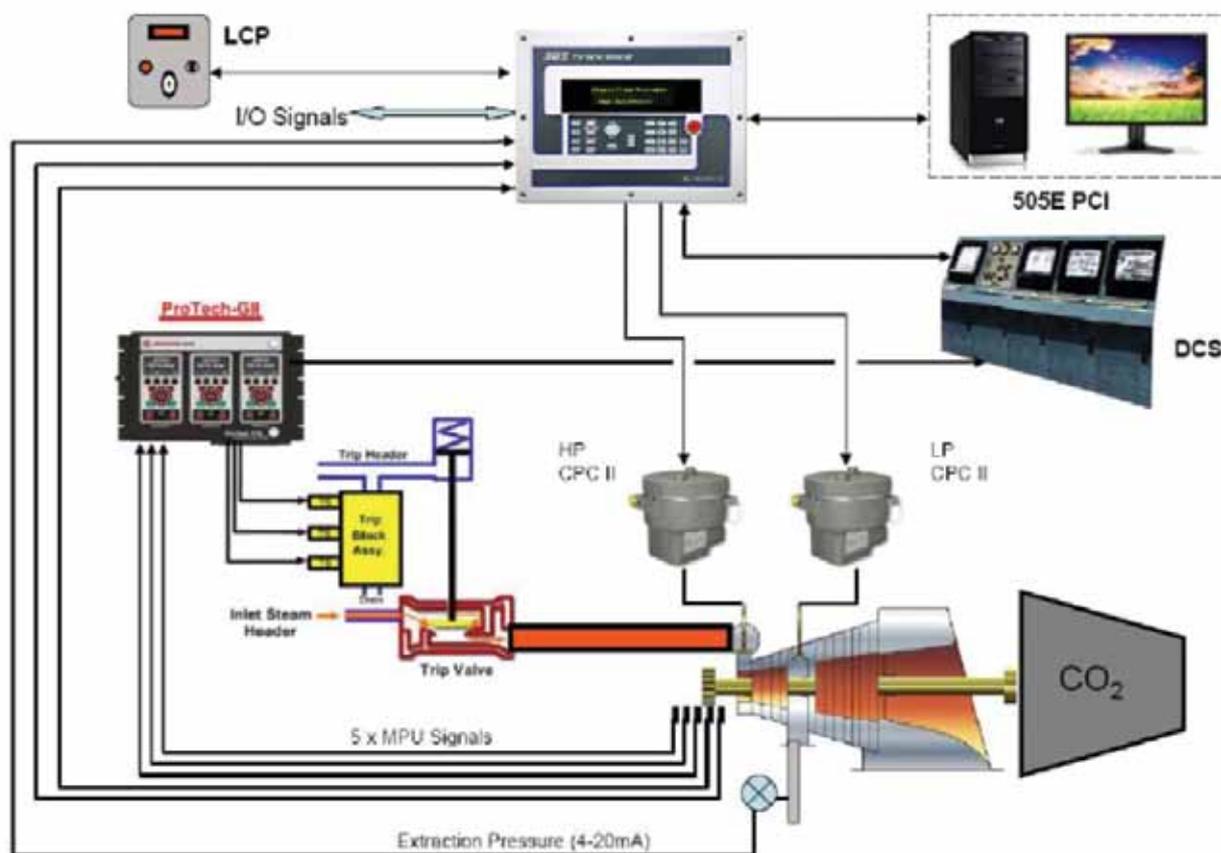
We are especially delighted with the performance of the TMR block. We will definitely consider PM Control and/or Woodward for upcoming projects.”

In the meantime, in 2013 PM Control was already awarded with another turbine control retrofit contract, due to be commissioned mid-2014.

### About PM Control

PM Control delivers energy optimisation solutions that increase efficiency while lowering emissions. Serving the energy, process and transportation markets, PM Control is the appointed distributor and recognized retrofit partner for Woodward Inc., Regional Technical Center for ABB Switzerland and Value Added Reseller for L&S Electric. Through our activities PM Control is having a positive impact on the lives of people across SE Asia, Australasia, India and beyond.

### System Overview



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