## Shell Refining Company (FOM)

# PM Control Retrofit of Ebara PLCs for Air Compressors Increases Operations Efficiency at Malaysian Shell Plant

Application Bulletin
PMCS-SG-0012


### Background

The Shell Refining Company (Federation of Malaya) Sdn Bhd was formed in 1960 and is a publicly listed company with 49% public participation. It operates with state-of-the-art technology and is the key supplier to Shell's Oil Products' businesses in Malaysia. The company's oil refinery at Port Dickson produces a comprehensive range of petroleum products, most of which are consumed within Malaysia.

In 1999 Shell completed its RM 1.4 billion investment in Malaysia's first Long Residue Catalytic Cracking (LRCC), thereby transforming what was a medium-sized simple refinery into a modern complex refinery capable of processing 125 kbpd (thousand barrels per day). The LRCC quadrupled the refinery's LPG production and doubled its production of motor gasoline. It also enabled the refinery to manufacture propylene, a highly valued feedstock for the petrochemical industry.

At the LRCC process area, there are three three-stage air compressors, K-3470A, K-3470B and K-3470C, which are controlled and surge protected by Ebara Programmable Logic Controllers (PLC's). The K-3470A is driven by a steam turbine with a Woodward UG8 mechanical hydraulic governor, while the K-3470B and the K-3470C are driven by an electric motor. All three air compressors share the same downstream header. Each compressor has a capacity of 50% of the designed plant instrument air demand. This means at any one time two air compressors are used for normal operation and the remaining air compressor is in standby mode.

### Solutions

- Woodward MicroNet Plus
- Woodward UG Actuator
- Speed sensors
- Local operator interface terminal
- Human Machine Interface (HMI)

### Results

- Decreased risk of downtime due to unavailability of spare parts.
- Improved efficiency of the air compressors, preventing frequent venting of the blow-off valves.
- Easier setpoint adjustments for operators.
- Greater visibility of the operation of the three air compressors thanks to a central workstation HMI.

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## Challenge

As the Ebara PLC's for these air compressors were outdated and spare parts were increasingly expensive and difficult to procure, Shell chose to replace these legacy PLC's with Woodward MicroNet Plus digital control systems. Another top priority for Shell was to increase the operational efficiency of the compressors to prevent frequent venting of the blow-off valves which results in a loss of compressed air and an increase of energy consumption.

Shell consulted PM Control, as well as some of its direct competitors, such as Compressor Control Corporation, for the retrofit of the Ebara PLC's. As Shell was looking for a trustworthy supplier that could provide prompt local after-service support the company chose PM Control and its local partner Automation Control Solutions. Moreover, PM Control's proven track record of retrofitting the obsolete control systems of Shell's Main Air Blower and Wetgas compressors and the prompt service response to their after-service calls made PM Control Shell's preferred supplier for the retrofitting job. In October 2011, Shell therefore awarded the project to PM Control.

Location Map

Woodward Micronet Plus

## Solution

PM Control and its local agent Automatic Control Solutions (ACS) supplied, installed and commissioned the following products:

- Woodward MicroNet Plus
- Woodward UG Actuator
- Speed sensors
- Local operator interface terminal
- Human Machine Interface (HMI)

The K-3470A was retrofitted with a Woodward Integrated Turbine Compressor Control (ITCC), replacing the Ebara PLC and Woodward UG8 mechanical hydraulic governor with a Woodward MicroNet Plus and Woodward UG Actuator. The K-3470B and K-3470C were retrofitted with Woodward Integrated Motor Compressor Controls (IMCC), while the PLC's were also replaced with a Woodward MicroNet Plus.

### Woodward MicroNet Plus (for all three compressors)

The Woodward MicroNet Plus is a state-of-the-art, customizable control system that is specifically designed for controlling rotating equipment. It provides operators with a flexible platform to control any prime mover and its associated processes, such as high-speed control, system sequencing, auxiliary system control, surge control, monitoring and alarming and station control.

### Woodward UG Actuator (for K-3470A)

A Woodward UG actuator was used to replace the Woodward UG8 mechanical hydraulic governor on the K-3470A air compressor. The UG Actuator receives a position set point from the MicroNet Plus and provides a proportional opening of the turbine steam valves.

### Woodward Speed Sensor (for K-3470A)

PM Control added new speed sensors to the K-3470A to measure the rotational speed of the turbine. Redundant speed sensors were installed.

### Local Operator Interface Terminal (for all three compressors)

Shell requested a local operator interface terminal for each unit so that

the operator could make set point adjustments. Each air compressor's local operator panel was therefore upgraded with a local operator interface terminal, which was mounted in the local control panel. Besides easier set point adjustments, the local operator interface terminals also provide operators with basic control and monitoring information for speed adjustments and over speed testing of the steam turbine and electric motors. The local operator terminal interface by Schneider Electric is an operator control panel with monochrome display and a keypad.

Shell Refining Company Plant

**Human Machine Interface (HMI, for all three compressors)**
Shell requested a central workstation HMI to monitor and control the air compressors and to provide greater visibility of the operation of the three air compressors. The HMI allows operators easy access to relevant system parameters and enables them to start and stop the system and change operating set points. It has a multiple level login for operators, engineers and system administrators. Other features include alarm and shutdown monitoring and reset. The HMI has real time and historical trending and event logs, which are downloaded onto the computer's hard-drive for system analyzing and troubleshooting.

**Installation & Commissioning**
PM Control worked with Automation Control Solutions Sdn Bhd (ACS) for this retrofit project. ACS provided logistical and site installation support and was the main supplier to Shell.

During installation there was a floating ground in the newly supplied control cabinet. It took the team of ACS and PM Control engineers some time to figure out the cause. The ground interference between DCS and the control cabinet was isolated.

During commissioning it was discovered that the K-3740A turbine speed was unstable. The team quickly zeroed in on a flaw in the design of the speed gear. The existing speed sensor pole piece was larger than the gear tooth profile. The speed gear was therefore redesigned and reinstalled, stabilizing the turbine speed.

Later in the commissioning the blow-off valve, which protects the turbine against surge, did not close properly. The team found that the wrong compressor map had been supplied by the enduser. After reconfiguring the new compressor map the blow off valve worked properly.

## Results

- Decreased risk of downtime due to unavailability of spare parts.
- Improved efficiency of the air compressors, preventing frequent venting of the blow-off valves.
- Easier set point adjustments for operators thanks to a local operator interface terminal.
- Greater process visibility of the operation of the three air compressors thanks to a central workstation HMI.

The project was shipped and successfully commissioned on schedule in December 2013.

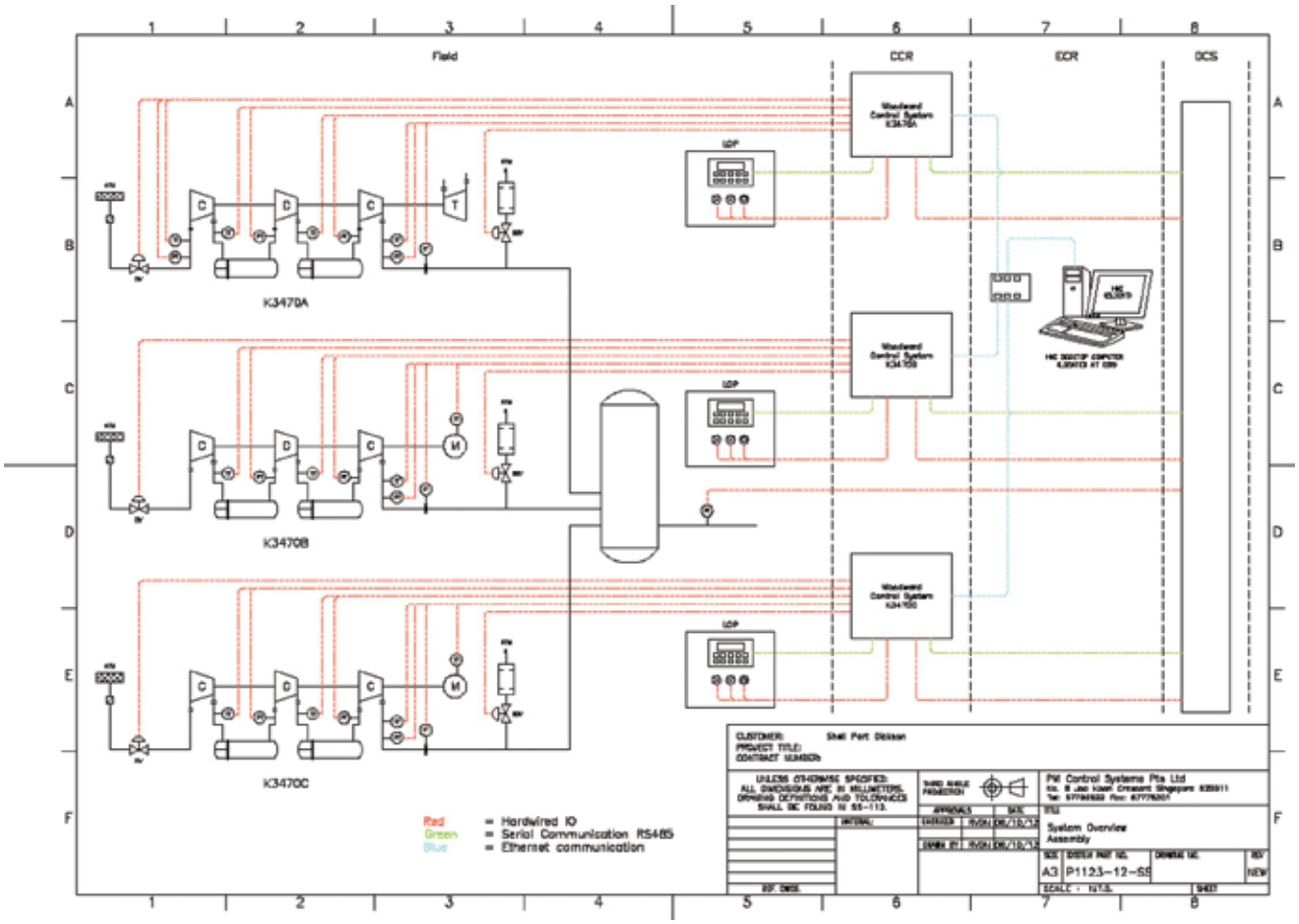
Shell was pleased with the end-result. Mr. Kalsi, Shell's key instrument engineer for this project, says, "The new Woodward MicroNet Plus control

system provided much visibility for me as I can now clearly see how the three air compressors work in difference sequence modes compared to the black box Ebara PLCs. I can also see the efficiency of three air compressors increase with less venting of the blow-off valves."

## 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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