

Wireless Power Control for Ford Engine Plant



Eric Marske
Product Manager
ESTEem Wireless Modems

Sam Amaral
South American Sales
Manager
ESTEem Wireless Modems

American auto manufacturers have had a challenging few years with the worldwide economic downturn, but that has not stopped innovations in manufacturing plant efficiency. Ford Motor Company opened a new engine assembly plant in Chihuahua City, Mexico in 2009 for the assembly of their new Super Duty diesel engine. This new plant has focused on operational efficiency in areas that have rarely been considered for automation. In a modern manufacturing plant all cost savings must be considered. Previously lower power consumption systems such as lighting, heating and cooling were rarely considered for automation. Ford has installed an innovative plant-wide Energy Management System for environmental monitoring and control that has provided a lower environmental impact at a great cost savings.

The new Ford diesel engine plant is the second Ford assembly plant in Chihuahua City. This new \$838-million plant was opened in 2009 to assemble Power Stroke diesel engines for Ford's heavy duty line of F-Series® trucks. The plant will assemble the new 6.7-liter Super Stroke V-8 turbocharged diesel engine, code named Scorpion, for the 2011 vehicles. At full capacity the new plant will produce 200,000 engines annually intended for trucks in the North American market.

The Energy Management System (EMS) was designed and integrated by a local engineering firm Proyectos de Ingeniería y Diseño Electrónico y Automatización SA de CV (PROIDEA) in partnership with the local Rockwell Automation® distributor, ABSA del Norte. Rockwell Automation hardware was installed in systems throughout the plant in everything from circuit breakers to automation controllers. When PROIDEA was selecting hardware for the EMS network, Rockwell Automation based control was an obvious choice. The EMS system is divided into three main areas: metering of energy consumption, climate control and lighting control.



Figure 1: Rockwell DeviceNet to Ethernet/IP Converter

The metering of energy consumption is done through a network of Rockwell Automation PowerMonitors which are linked with DeviceNet automation control protocol. The DeviceNet protocol is then converted to TCP/IP based Ethernet protocol (Rockwell's Ethernet/IP) for data collection and display in the overall management system (Figure 1). This energy consumption data is logged by business unit and provided to management for accurate production costing.

The climate control system operates the heating, ventilation and air conditioning (HVAC) control zones located throughout all sections of the plant. The climate system is automated by a network of Rockwell Programmable Automation Controllers (PAC). Both ControlLogix and Flex I/O Ethernet modules link back to the Main Office automatically operating the heating and cooling based upon which areas of the plant are occupied due to production shifts.

The lighting control system uses much the same hardware as the climate control system, allowing common spares between the two networks. Automated lighting control systems have been used at other plant locations in the past, because a manually controlled lighting system is very inefficient and labor intensive. It can take a crew of maintenance personnel several hours to turn on and off the lights in a large production facility. The automated system activates the plant's lighting per shift and can be automated for shutdowns or production changes.

All three systems are linked to a single Human-Machine Interface (HMI) computer station. This computer runs Rockwell Software's FactoryTalk View to display the HMI creating a single user interface to monitor, program and override the entire Energy Management System (Figure 2).

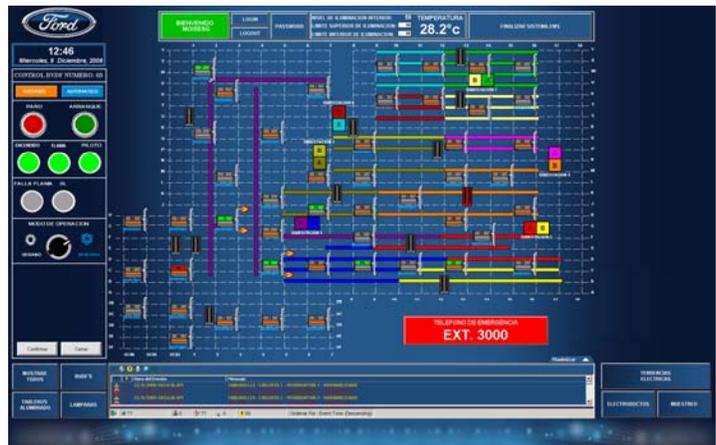


Figure 2: Master HMI Screen

These individual systems communicate on a common Ethernet/IP protocol allowing them to operate as a single network. The challenge is the physical separation of the system components. Spread throughout the large production facility, the Ethernet network had seven remote Ethernet segments. The distance between the segments was greater than the maximum for CAT-5e or CAT-6 cable and would have required a fiber-optic link. At the time of the EMS installation, the new plant was in full startup with testing and adjustments of the production equipment, leaving little time for fiber-optic installation. Because the vast majority of the manufacturing equipment was in place, some of the fiber-optic cable runs would have been blocked by the installed equipment. These two issues drastically increased the cost of fiber-optic installation making that option cost prohibitive.

The local distributor for Rockwell Automation hardware, ABSA del Norte, is also the distributor for ESTEem Wireless Modems in Mexico. ESTEem manufactures a complete line of high speed, wireless Ethernet modems and is a referenced solution partner in Rockwell Automation's Encompass program. ESTEem was able to provide the hardware to cover the long distances between the Ethernet segments while maintaining high data rates.

The ESTEem Model 195Ed was selected for this application. The ESTEem 195Ed operates in the license-free, 900 MHz frequency band with RF data rates to 54 Mbps. Although ESTEem manufactures wireless Ethernet hardware in multiple frequency bands, the 900 MHz frequency was dictated for this project by the Ford plant.

Standard spread spectrum radio modems operating in the 900 MHz band have a much lower data rate and would not have provided the high data required in the Energy Management System.

A clear radio pathway between antennas, called a line of sight (LOS), greatly increases the reliability of a wireless network. To maintain a line of sight for this project, the ESTeem wireless modems were mounted on the roof of the building on the top of the climate control housings (Figure 3). The wireless links were tested for receive signal strength, frequency interference and data rates prior to installation. Once the ESTeem 195Ed's were configured for operation, all six remote Ethernet segments were joined to the Main office to create a single Ethernet network.

The Energy Management System developed for the Ford Motors plant in Chihuahua, Mexico is an excellent example of how automation of smaller facility control systems can have a large energy and cost savings. At the time of this publication, the system has been operating for over a year without a single problem in the wireless network. The wireless Ethernet based control system of Rockwell controllers and ESTeem wireless modems provided a network control solution at a fraction of the cost of fiber-optics in this difficult application. As power costs increase, manufactures must focus on power savings wherever available. Systems like the Energy Management System should become commonplace.



Figure 3: Roof Mounted Antenna

This document is copyrighted by Electronic Systems Technology (EST) dba ESTeem Wireless Modems® with all rights reserved. Under the copyright laws, this document may not be copied, in whole or part, without the written consent of EST. Under the law, copying includes translating into another language. EST, EST logo, and ESTeem are registered trademarks of Electronic Systems Technology, Inc. Simultaneously published in the United States and Canada. All rights reserved. For more information contact: Electronic Systems Technology, Inc., 415 North Quay Street, Kennewick, WA 99336 Ph: (509) 735-9092 Fax: (509) 783-5475