



A Rockwell Automation Company

El Paso Corporation - Colorado Interstate Gas Air/Fuel Ratio Control

The Client:

El Paso's interstate transmission system spans the nation, border to border and coast to coast. The nationwide pipeline system is consolidated into three regional operations.

The Western Pipeline group consists of El Paso Natural Gas Company and Colorado Interstate Gas Company and is headquartered in Colorado Springs, Colorado.

Colorado Interstate Gas (CIG) is a major transporter of natural gas in the Rocky Mountain region. The Colorado Interstate Gas system is connected to nearly every major supply basin in the Rocky Mountains as well as production areas in the Texas Panhandle, western Oklahoma, western Kansas, and Wyoming.

The Requirement:

The four propane compressors at the Rawlins Gas Plant use Dynalco air/fuel ratio controllers to adjust the engine air intake valve based on fuel gas and air intake pressures. These controllers were obsolete and were no longer working. El Paso wished to replace the Dynalco controllers with a new ControlLogix PLC system using Flex I/O for each unit. The new systems would interface to the Station HMI via the existing Ethernet

network. The control philosophy requires the ability to adjust the air/fuel ratio by controlling the air intake valve and ignition timing offset with a split range reverse acting PID controller which uses direct feedback of engine exhaust oxygen percent. The existing air intake valves and the Altronic ignition timing modules will be reused but new O₂ transmitters need to be installed.

The Design Solution:

Hinz was contracted to upgrade the air/fuel ratio controllers on the four propane compressor units at the Rawlins Gas Plant. Working with El Paso personnel, estimates were prepared which defined the project scope, budget, and implementation plan. The scope of work included:

- Installing a ControlLogix PLC with flex I/O per unit for air/fuel ratio control and for monitoring additional engine parameters.
- Developing logic to Control the air/fuel ratio using the existing air intake valve and Altronic timing module. A split range controller in the PLC using direct feedback of exhaust oxygen percentage controlled the engine airflow first. Then once the intake valve reached its limit the timing was adjusted. The PLC calculated AGA corrected fuel gas flow and engine torque.
- Developing PLC code to monitor the catalytic

converter inlet and outlet temperatures and providing engine shutdown control for high engine torque and high catalytic converter temperatures.

- Preparation of a detailed scope of work for the electrical and mechanical construction contractors' bid documents.
- Preparation of a detailed Functional Requirements Document (FRD) and providing specification sheets for purchase by El Paso of all new equipment required for the project.
- Submission of project tracking documents to include progress reports and budget cost analysis.
- Developing PLC simulation code for software testing and providing for a witnessed software acceptance test.
- Providing commissioning and training services.



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Air/Fuel Ratio

2AFR_O2

RAWLINS GAS PLANT

11:22:23 AM
09/09/1996
DATAD

Air Intake ### % Open	Ignition Timing (deg from TDC)	Shutdown Bypass 5 Min. Remaining	Alarms
PID OVERRIDE	RPM Map Timing ## (-3 to +5)	<input type="checkbox"/> ON/OFF Time Remaining	PLC Battery
O2 Transmitter Alarm	A/F Ratio Offset ## (-8 to 0)	Bypass Off ## Minutes	PLC Minor Fault
O2 Signal Alarm	Engine Timing ## (-3 to +5)	## Seconds	PLC I/O Fault
Tune PID			Shutdowns
BTU ### MBTU/Hr	Engine Speed ### RPM	Catalyst Inlet Temp HH SP ### deg. F	Catalyst Inlet Temp HH
Fuel Flow ## SCFH	Fuel Torque ## PCT	Catalyst Inlet Temperature # deg. F	<input type="button" value="S/D Reset"/>
		Catalyst Outlet Temperature # deg. F	

CIG - GP	11-1A A/F	11-1B A/F	11-1C A/F	11-1D A/F	11-1x Fuel	-	-	RGPWht DATADATA	RPGSiteM
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ACK	TIME IN	TIME LST	NODE	TAGNAME	STATUS	VALUE	DESCRIPTION		
Area	CIG - GP	Login	Logout	Hist Trend	Alarms	Alarm Ack	Sil PC Horn	Sil Alm Horn	Oper Mess

System Specifications:

- (4) ControlLogix 5555 PLCs
- (20) Flex I/O Module Bases
- (4) Flex I/O 8-channel Analog Input Modules
- (4) Flex I/O 4-channel Analog Output Modules
- (4) Flex I/O 16-pt Discrete Input Modules
- (4) Flex I/O 8-pt Relay Output Modules
- (4) Flex I/O 8-channel RTD
- (4) Flex I/O 2-pt Frequency Modules
- (4) Rosemount Oxygen Transmitters for Propane Compressor Exhaust
- (4) Rosemount Smart Differential Pressure Transmitters for Fuel Gas Flow
- (4) Rosemount Smart Gauge Pressure Transmitters for Fuel Gas Flow
- (8) Rosemount Series 0183 Thermocouple Sensor Assemblies for Catalytic Converter Inlet and Outlet Temperatures

For further information or to contact a Hinz office near you, please check our website at:

www.hinz.com