Pilot Plant Monitoring

Applications
Oil companies
Gas companies
Specialty chemical manufacturers

Departments
Research & development

Overview

Pilot plants are small-scale prototypes of large oil or chemical refineries. Research and development engineers use pilot plants to evaluate new refinery designs and develop new refining processes. Usually part of a large company, pilot plants develop technology that is replicated at production facilities within the corporation.

Problem

Volumes in a pilot plant are smaller than for a full scale refinery so greater measurement sensitivity is required. Frequent and rapid setup changes are required to maximize research productivity. Continuous processes require interactive control for real-time process optimization, and batch processes require accurate measurements of process variables such as temperature, flow, pressure, and time to control batch-to-batch variations.

Solution

A VXIbus data acquisition and control system from VXI Technology provides an excellent solution to pilot plant monitoring applications. A graphical programming language for operator interaction, plug-in modules for mixing and matching channel signals, and convenient wiring terminal panels simplify set-up and speed reconfiguration. User programmable algorithms as well as built-in PID algorithms allow for flexibility and ease-of-use. Standard off the shelf computers, peripherals, software, and instrumentation form a cost-effective pilot plant monitoring system. High measurement integrity and flexibility in programming form a better combination than typical solutions offered by programmable logic controllers (PCLs).

Implementation

Temperature

Temperatures at various points in the pilot plant are monitored. Characterizing the processes requires accurate temperature measurements. By improving the process, the quality of the finished product is

increased. Typically, thermocouples are used for temperature measurements because they are more rugged than thermistors.

Flow

The flow rates in various pipes throughout the pilot plant are big factors in the characterization of the process. In combination with levels and temperatures, correct flow ensures that the process is fed with the proper amounts of liquids. Flow meters output either a series of pulses whose frequency is proportional to the flow, a voltage (0- 10 Vdc), or a current (4-20 mA).

Tank level

Tank levels are monitored constantly to characterize process activities. The fluids in tanks in the plant are kept at fairly uniform levels. Some level meters will register on/off (point level) based on whether the fluid is above or below a particular level. Other level meters output a current (4-20 mA) proportional to the level in the tank. The point level type is used to signal when a tank exceeds an upper or lower limit, while the second type emits a continuous level indication.

Pressure

Pressure transducers are used throughout a pilot plant. Their outputs can be current (4-20 mA), small voltages (0-100 mV), or larger voltages (0-10 Vdc). Pressure can vary from a few pounds per square inch (PSI) to 20,000 PSI. In order to obtain the desired results from a process, both temperature and pressure must be within design limits.

Valve position

Algorithms running in the data acquisition and control system monitor analog/digital inputs and control the flow of material either through digital outputs or analog outputs. Watchdog timer modules can assure proper control is maintained by DA&C system such that external shut down valves can be activated in the event of algorithm failure.

Key System Features

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- **VXIbus open architecture**

- **Data Acquisition and Control on a single programmable VXIbus card (VT1419A)**

- **Graphical programming language (Agilent VEE or NI Labview)**

- **Flexibility with deterministic control**

- **Wide choice of inputs/outputs**

- **Built-in control algorithms**

- **Up to 32 user-written "C" code algorithms**

- **65,000 reading FIFO buffer**

- **500 reading Current Value Table (CVT)**

- **All algorithms can write to FIFO/CVT**

- **Data can be time-stamped**

Typical Configuration

Data Acquisition System	Qty
CT-100B VXI 6-Slot Card Cage	1
Firewire VXI Slot 0 Command Module	1
VT1419A Multifunction Measurement & Control Card	1-4
Analog input channels	40-100
Voltage DAC channels	4-12
Counters channels	2-10
Digital input channels	16-48
Digital output channels can control heaters or chillers to change temperature in the process.	24-98