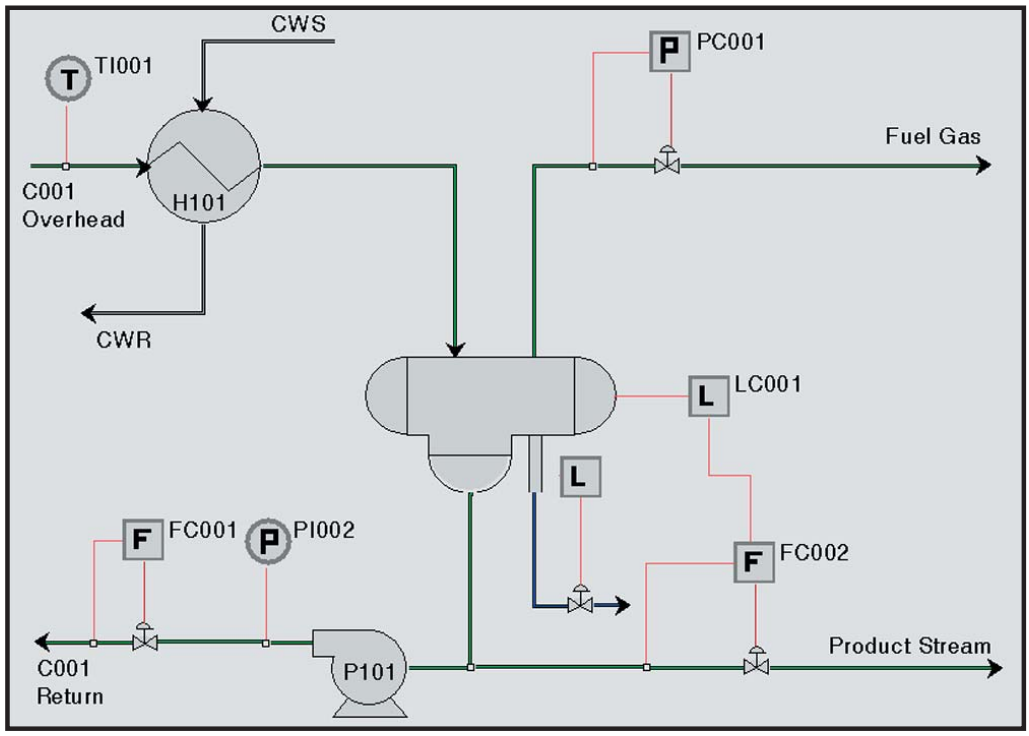
Application Notes

There is no substitute for operating knowledge on a specific process unit. This knowledge is accumulated through years of engineering design, operator training and first-hand operations experience acquired through multiple shifts and generations of personnel. Can this expertise be collected, shared and made available to all staff on-line to improve plant?

With ***rtOp***^{x}™, the ability to take advantage of best operating practices and six sigma methodology is greatly enhanced. Knowledge modeling is the process of capturing this information, digitizing it and using it in real time to enhance operations.

Knowledge Modeling

A simple process layout is shown in the diagram below.



In this example, the plant has experienced an unexpected loss of flow between the discharge of the pump and the downstream process equipment. The loss of flow could be caused by a variety of problems including but not limited to incorrect valve line up, pump failure, valve malfunction or line plugging.

By examining the dynamics of the existing process equipment and instrumentation, it is possible to isolate the potential causes leading to the problem.

For example, if the effect is summarized as follows:

- Predicted PV of FC001 = f(Cv, OP, Delta P) and if Predicted PV of FC001=/ PV of FC001 +/- allowable error and
- If the OP of FC001 > 90.0 (OP is unusually high) and if the PV of PI002 > 60.0 (PV is normal to unusually high indicating pump is running) and
- If the PV of FC002 > 600.0 (PV is above normal) and
- If the OP of FC002 > 80.0 (OP is unusually high)

Then the cause could be reduced to:

1. The block valve(s) associated with FC001 was inadvertently closed.
2. The process line between P101 and the downstream process equipment has an obstruction (such as plugging in a cryogenic process).

Benefits

As the example above demonstrates, it requires a consolidated view of operating conditions to quickly and accurately isolate the problem. A traditional DCS could detect specific problems based on individual alarms. The above situation would generate a number of what would appear as independent alarms to the operator. It is then left to the ability of the operator to quickly process the information, create an action plan, implement the action plan and finally see the result of his/her actions. This ability is diminished by alarm floods, lack of experienced staff and the inability of the operator to be in the right place at the right time to properly deal with the alarm(s). Nexus ***Oz***™ consolidates all of the information collected from all sources, combines the information and generates succinct messages in real time to the correct people so the response is quick, decisive and correct the first time.

Each process unit will exhibit operating characteristics and behaviors, which only the most experienced staff can clearly identify the cause and corresponding effect of unique operating problems. Some of these models are based on rigorous first principles (e.g., use of a thermodynamic database for heat and mass balance calculations), while others are heuristic models (e.g., curve fit relationships of plant variables). All of these models relate the behavior of multiple instruments relative to each other to identify the root cause of a problem. To maximize safety, productivity and profitability, this expertise must deployed to allow the entire plant, all staff members and all shifts, to operate with the working knowledge of the most experienced staff members of an operating unit.