



Control System Asset Management

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Summary

Most large process plants have invested millions in their control systems. Yet it is typical that more than 30% of the system is off-line at any given moment. Getting the best performance from the control system requires a structured approach to control system asset management.

Assets in the control system:

- Instrumentation & Valves
- Distributed Control Systems (DCSs), and other controllers
- Software, Infrastructure, Networks
- Control Strategy, Applications, Configuration, and Process Knowledge

This paper lays out specific plans for establishing a control system asset management program.

Overview

What are Control System Assets?

A control system embodies many different “assets”. Some of these are the traditional, **physical assets**, such as instruments, valves, and DCS Systems. These appear on the accountant’s ledger in black and white.

Less obvious, but critically important, are assets such as the **software, engineering, and configuration** that help the hardware to control the specific process in your plant. In fact, this asset may have cost more than the hardware.

Some companies will refer to people as “their most important asset”. The **skills, knowledge, and specific process experience** of your company personnel is often the “asset” that makes the difference between success and failure.

Finally, in the process industries, we cannot fully distinguish between the control system and the process being controlled. **The process itself**, including its equipment, sequences, and mode of operation, represent a major company asset. As we manage and improve the control system assets, we will also pay close attention to the impact on the performance of the process assets.

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Using this definition, a typical large process plant will have millions of dollars invested in control system assets. When budgeting for a new process plant, automation and control will typically account for between 5% and 15% of the overall project cost.

A mid-sized process plant, costing \$30 million, will have roughly \$3 million invested in its control system assets.

Typical Asset Performance

Now for some bad news: More than 30% of control system assets are being wasted. These assets are not adding value at all for one or more of the following reasons:

- The Control Loop is in Manual
- The Control Valve is Fully Open or Closed.
- The Instrument/Sensor is Faulty or at Limit

Imagine making a \$3 million investment, but only getting the benefits from \$2 million. You have wasted \$1 million. Most process control systems are facing exactly this scenario.

What Asset Management Can Do for You

Asset Management is the practice of getting all your assets to perform at their best, all the time. In the context of control system asset management, the following benefits can be accomplished through the use of an asset management program:

Table 1. Asset Management Results

Performance Metric	Before Control System Asset Management	After Control System Asset Management	Improvement
Service Factor: % of control loops operating in AUTO, valve & sensor not at limit.	>30%	<10%	3X
Control Loop Health: % of control loops exceeding plant-specific key performance indicators.	>10%	<1%	10X
Significant Oscillations: % Loops with significant oscillations, affecting cost & quality.	>20%	<10%	2X



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Control System Assets

Physical Control System Assets

The physical assets of the control system include:

- Instrumentation
- DCS, including controllers, HMI, Historians, etc.
- I/O, wiring, I/P's
- Control Valves, Actuators, Positioners, and VFD's



Depending on the industry and the time specific implementation, these assets alone can be somewhat overwhelming. A typical mid-sized oil refinery, for example, may have over 2,000 control loops, each with a sensor, controller, and valve.

Software & Configuration Assets

If you step back from it for a moment, you will realize that the instruments, controllers, and valves are all worthless unless they are assembled into working control loops. The software, configuration, and programming is a critical asset to the company.

You can estimate the value of this asset by calculating the overall engineering hours (internal and external) that were used to define, design, and commission the project. This often rivals the more obvious hardware cost.



Application & Process Knowledge

Specific knowledge of the process is a very valuable asset. This knowledge is often maintained and passed along by process engineers and control engineers.

Process Assets

The process itself is an asset that cannot be fully separated from the control system. Of course, the process equipment is a separate asset. But that is not what we mean by “the process”.

“The process” includes the specific product flow paths, sequences of operation, target setpoints, ratios, and recipes. The control system manages the process, making it difficult to distinguish between the process itself and the software and configuration discussed above.

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The reason for including the process in this white paper is that control system asset management often leads directly to managing and improving the process itself. More on this later...

Human Resources

In addition to the skills and knowledge of the engineering, maintenance and operations teams, a successful plant will also effectively manage priorities and time for these most critical assets.

One study by the Gartner Group found that in process plants, 50% of maintenance work was not necessary, and 10% was actually harmful. You simply cannot afford to spend 50% of your time working on the *wrong things*.

Control System Asset Management

What is Asset Management?

Asset management is the practice of ensuring that all assets are delivering their best value. At a very high level, this can be measured as RONA, or Return on Net Assets. Asset Management includes tools and practices to keep all assets performing at their best.

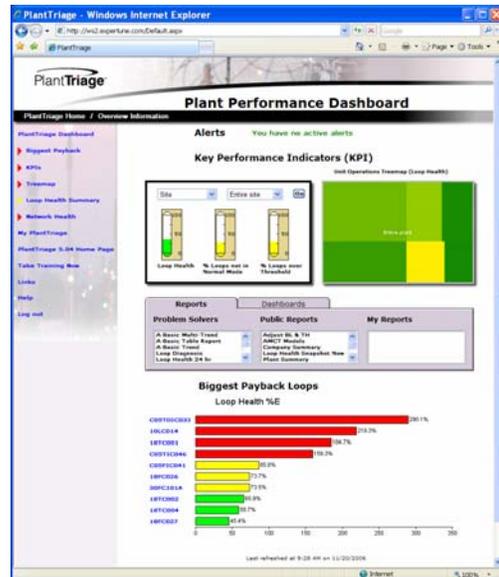
In the past, asset management tended to focus on expected service life, then on diagnosing failures, then on predicting and managing maintenance issues. In the current state of affairs, asset management tools like PlantTriage are also finding system bottlenecks and identifying ways to increase system capability.

Tools + Practices

Success in asset management comes from having the right tools AND the right practices in place. Tools alone do not solve problems. And practices without tools is highly inefficient. Asset management tools, such as diagnostics, performance tracking, and maintenance planning, help in the automatic identification, prioritization, and resolution of asset performance issues.

Diagnostic Tools

A typical process plant may have thousands of assets to manage. In most parts of the world, tracking and managing these assets manually is no longer possible, with so few people in the workforce. Diagnostic tools and software are a basic requirement to identify and diagnose problems.

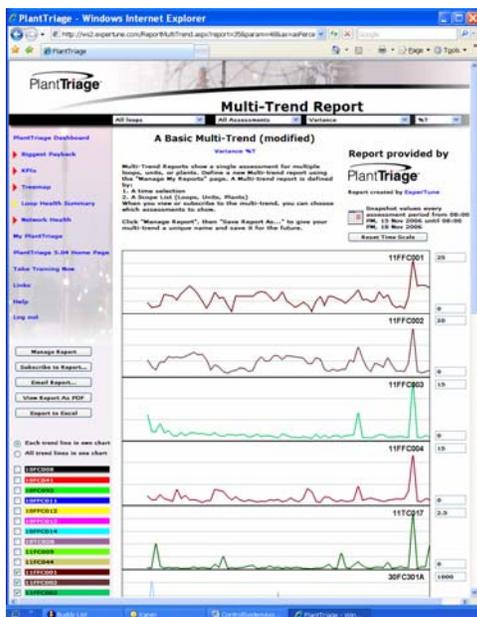


OPC has succeeded in opening up proprietary control systems, so they can share real-time data directly from the DCS and the historian. Today, there is a huge warehouse for process and control data available for diagnostics. At the same time, we now have computers powerful enough to perform computationally-intensive operations. Add the right software, and extremely powerful diagnostics are possible.

The table below provides a few examples of the automated control system diagnostics that are currently available.

Table 2. Examples of Available Diagnostics

Asset Type	Available Diagnostic
Instrument / Sensor / Analyzer	Excessive noise, Communications Issues, Flat-lining, Under-filtered / Over-filtered, Over-spanned, At upper/lower limit.
Controller	Harris index, Oscillating due to tuning, Robustness, Response Time, Inappropriate Use of Derivative, Not in Normal mode
Control valves	Hysteresis, Stiction, Over-sized, Under-sized, Oscillations due to Valve. Excessive Valve Travel.
Process	Interactions, Oscillations due to load, Non-linearity, Energy Use, Cycle Time, Excessive alarming.
Software & Configuration	Sampling too slowly, Service Factor, Communications Errors



Performance Tracking

Measuring raw diagnostics is a huge step in the right direction. But it is not enough. Asset history is an important part of understanding a problem. To accomplish this, diagnostic results should be historized and trended over time. It also helps to normalize the data for comparison. The figure at left contains a multi-trend performance report, clearly showing a recent spike in variance for all loops in Unit Operation 11. Identifying these problems quickly can help to determine the root cause and prevent recurrences.

In addition, most asset management programs involve some sort of maintenance planning or tracking tool. These systems:

- Maintain a database of asset parts and

- repair procedures.
- Allow for detailed documentation of the problem.
 - Maintain a history of cost and effort associated with the asset.

Investigative Tools

Diagnosing problems does not solve the issue. Resolving the issues requires more tools, to investigate and resolve the problem. For example, effective control loop tuning can be accomplished when controller tuning software is included directly within the asset management system. This way, the relevant real-time data can be passed directly into the tuning software.

Benefits of Control System Asset Management



Leveraging People

As companies have downsized, and competition has increased, skilled personnel are being stretched more and more each year. With such limited resources, it is more important than ever that every person stays focused on the most important tasks only, and is able to complete their work efficiently.

With Control System Asset Management in place, automated diagnostics and performance KPIs are automatically prioritized. Furthermore, as asset management tools are integrated more directly, plant personnel can move quickly and efficiently into troubleshooting and issue resolution. Often, issues are identified, prioritized, and reported directly to the user, with drill-down, analysis, and issue resolution available directly from the user's computer desktop.

One example of leveraging people is the use of Active Model Capture Technology. Using this technology, dynamic process models are captured automatically, based on regular control changes by operators. Using Active Model Capture, some users have reported a 5-fold increase in their ability to optimize controller tuning and process dynamic studies.

In the end, asset management software completes much of the routine analysis, diagnostics, and prioritization, freeing up skilled personnel for higher-level tasks.

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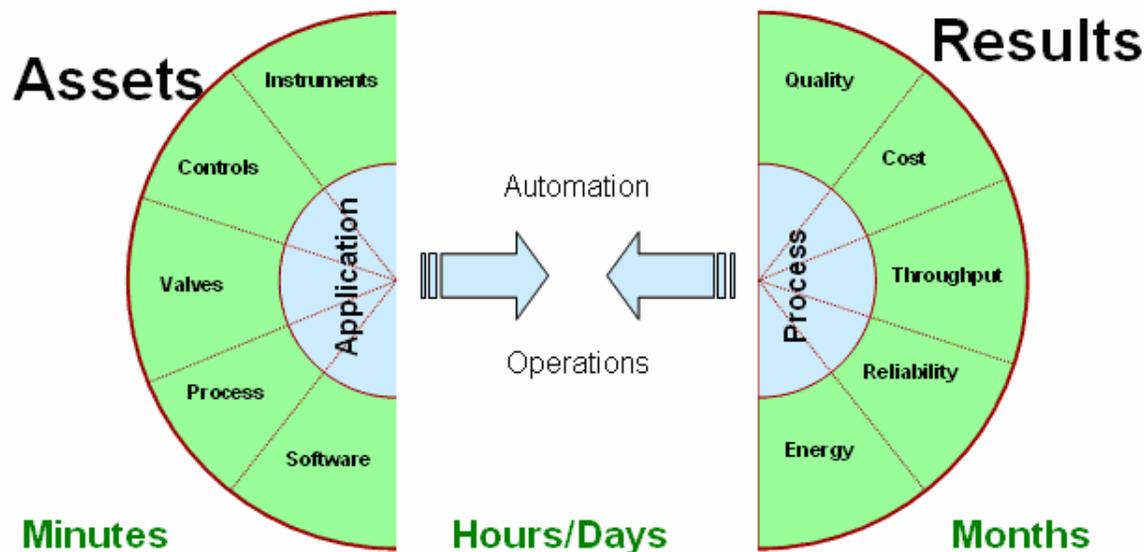
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Maximizing Asset Performance

Most process plants have spent millions on their control systems. And typically, 30% of control loops are not running in their “normal” mode of operation. Many loops are left in MANUAL operation. This effectively disables the function of the control loop, and ensures that those assets are NOT being used to improve performance.



Also, it is typical for 40% of control loops to be oscillating. This oscillation reduces plant efficiency, and increases equipment wear-and-tear. In many cases, plant personnel are simply not aware of the extent of these asset management problems.

One key aspect of Asset Management is that it can be done quickly, based on real-time data. This helps to speed up the response time for operations and automation personnel. As all good control engineers understand, speeding up response time makes the process much easier to control. This delivers bottom-line benefits to the business quickly.

Extending Asset Life

Many control valves are over-worked. That is, they are moving MUCH more often than they need to for good control: In some cases 10 times more valve movement than is required. In some plants, the valve moves so much that the valve/positioner linkage arms are physically worn away. This excessive wear-and-tear leads to premature failure.

Improving Return on Investment

The typical return on investment (ROI) for a control system asset management program is measured in months. Control system asset management leverages maintenance and

engineering personnel, by focusing efforts on the right issues. Because the potential for improvements is so large, the return on investment is typically very fast.

For example, reducing unplanned downtime by even 0.5% is worth millions of dollars for a typical large process plant. The cost of a very large control system asset management system, completely installed, with hardware, services, and training, rarely exceeds \$250,000.

Furthermore, because the asset management system tracks the performance of process assets, there is additional leverage to generate savings.

Conclusions & Recommendations

1. Control system assets are typically under-utilized, with a service factor below 70%.
2. Control System Asset Management tools, such as ExperTune's PlantTriage, have the tools to manage control system assets.
3. Control system asset management provides a fast Return on Investment (ROI), typically paying back the investment within a few months.

Contact ExperTune to estimate the economic benefits that your plant can achieve with PlantTriage™.

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About ExperTune

ExperTune has been improving process performance for over 20 years. With award-winning products, such as the PlantTriage® performance Supervision System, ExperTune has the technology and the expertise that you need to make improvements to your plant.

About the Author

George Buckbee is Director of Product Development at ExperTune. George has over 20 years of practical experience improving process performance in a wide array of process

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industries, George holds a B.S. in Chemical Engineering from Washington University, and an M.S. in Chemical Engineering from the University of California.

About PlantTriage®

PlantTriage is a Plant-Wide Performance Supervision System that optimizes your entire process control system, including instrumentation, controllers, and control valves. Using advanced techniques, such as Active Model Capture Technology, PlantTriage can identify, diagnose, and prioritize improvements to your process.

Glossary

Term	Definition
DCS	Distributed Control System. A centralized process control system that typically provides data collection, operator interface, and control functions.
OPC	OLE for Process Control. An industry-standard method for communication between real-time control systems.
PV	Process Variable. The measured value that is fed to a control loop.
ROI	Return On Investment. A measure of the length of time required to get full payback on a given investment.
RONA	Return on Net Assets
SCADA	Supervisory Control And Data Acquisition.