



DeltaV System Ease of Use

This whitepaper presents the results of two usability studies. The first study documents the time it took an independent systems integrator to set up a DeltaV system. The second study compares the time to configure similar elements in a DeltaV scalable process system, an Allen-Bradley/Wonderware PLC system, and a Moore/Wonderware hybrid DCS system.

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Introduction

The world of process control continues to evolve toward a safer, more efficient, more productive environment, thanks to continued improvements in technology. But advances in technology also tend to bring greater complexity to the process and to the equipment running the process—the control system. Incorporating new technology while attempting to simplify the added complexity is a major challenge for today's control systems. Not all systems accomplish this equally well. Choosing the right control system today can mean the difference between being competitive and being out of business tomorrow.

It's not always easy to know which type of control system is best for which application. Programmable Logic Controllers (PLC) traditionally have been the preferred system for discrete and logic-based control of equipment such as conveyors, counters, and finishing systems. Distributed Control Systems (DCS) have likewise been preferred for controlling batch and continuous operations in the wet processing arena. Neither system was an extremely effective choice however, for doing both. That continued to be the case until the introduction of the DeltaV scalable process system.

The DeltaV system was designed from scratch, to be a single solution for the discrete world and the analog world. It was designed as a fully digital replacement for both PLCs and DCSs—one that was easier to use and that had far more capability than either of its predecessors.

This paper presents the results of two usability studies. The first study documents the time it took an independent systems integrator to set up a DeltaV system. The second study compares a key aspect, and major expense, of the overall life cycle cost of a control system—configuration time—for the DeltaV system, a PLC system, and a hybrid DCS.

When the DeltaV system was being designed, one of the goals of the design team was that a person would be able to set up a working DeltaV system in one hour with no prior knowledge of the system. It was assumed that the tester did have experience however, with DCSs and process control applications. *In this first study*, an independent systems integrator was selected to build a very small DeltaV system from scratch. Advanced Systems Integration (ASI) measured and documented the time it took to setup this DeltaV system. While the results were impressive, the target of 1 hour was missed. The exact details of the findings are included later in this report.

In the second study, a DeltaV system was supplied to a 3rd party contractor along with a PLC system and a small, hybrid DCS, both using the same Human Machine Interface (HMI). The objective of the exercise was to compare the configuration time that it took to get each solution to the point where an Operator had full control over a PID loop executing in a controller. An Allen-Bradley SLC500 PLC with a Wonderware HMI was selected as the PLC system and a Moore APACS with Wonderware HMI was chosen as the hybrid DCS.

The results of the test indicated that the DeltaV system was easier to install, operate, and maintain than both the Allen-Bradley and Moore systems. The results of this study, along with testimony from a Uniroyal Chemical instrumentation and control superintendent, will be used throughout this paper to illustrate the fact that using a DeltaV system to run your process is more efficient than either a PLC or a DCS and will save you time and money.



Case 1: Setting Up a DeltaV System—an Out of the Box Experience

Objective: Create a two-node DeltaV system.
Create a PID loop, connect it to the I/O, and download configuration to the controller.
Configure the Operator Interface to include a simple drawing of a valve with a dynamic pressure element linked to it.
Link the pressure element to the PID current value.
Display the current setpoint.
Add a push button to be used for accessing a faceplate that enables full control of the PID loop.

Restrictions: The test engineer was not permitted to call for assistance unless completely stuck. Only supplied documentation was to be used.

Results:

Activity	Time elapsed (min)
Installation & Setup	
✓ Get familiar with documentation and system components	30
✓ Install controller, system power supply, I/O terminal blocks and I/O modules	60
✓ Unpack and setup the workstation	30
✓ Create wiring for Control Network – cut wire to desired length – use crimping tool to attach connectors – make network connections	150
total	270
Configuration	
✓ Define nodes and configure I/O cards	40
✓ Configure a fully functional PID loop	70
✓ Configure a complete HMI for the PID loop	85
total	195

As illustrated in the table, the test revealed a big surprise. The time to create cables was a little over half of the total setup time. This test was disappointing because the target of one hour to set up a DeltaV system had not been achieved. Nonetheless, subtracting the time expended to create cables leaves two hours for setup. This is a very respectable result. Some more comments on this test follow:



- The control strategy implemented using the PID template into the DeltaV system is full functioning. It includes windup protection, modes of operation, and data integrity handling.
- The faceplates created for use in the Operator Interface were all feature-rich. Since the configuration methodology used pre-built faceplates with no extra engineering required, a large return was achieved on a small engineering investment.
- The DeltaV system was designed with a setup software wizard that helped the engineer through the system engineering process. Pushing the Next button on the wizard then took the engineer to a point where the control strategy and graphics were.
- Although the AS-i control engineer commented that she found the cable creation frustrating, given that it was not her area of expertise, her overall experience was positive. She stated in her report, "No problems encountered. I found this very straightforward."



Case 2: Ease of configuration for a DeltaV system, a PLC, and a hybrid DCS

This usability study compared the configuration time that it took to get a DeltaV system, an Allen-Bradley SLC500 PLC with Wonderware HMI, and a Moore APACS with Wonderware HMI to the point where an Operator had full control over a PID loop executing in a controller.

While installing the Wonderware software, unplanned time had to be allocated for identifying software/hardware compatibility issues. For example, the engineer conducting the Study began testing Wonderware 5.0 on Windows NT. Problems arose and an updated version of Wonderware (6.0) had to be shipped to the Study site before actual testing could begin. This problem occurred again when the AB SLC500 configuration software was installed. RSLogix originally sent an old version that is not compatible with Windows NT 4.0. The engineer conducting the test wrote, "After two days of head scratching and being frustrated..." he figured out the compatibility issue. Four days after he began the study, he received the updated software and successfully installed the software packages.

The compatibility issues encountered in this study are not unusual when buying off-the-shelf products from various vendors. The wasted time, stress, and frustration associated with these issues account for lost revenues and disgruntled employees. Emerson Process Management has eliminated this problem by providing customers with the DeltaV system, a complete hardware and software solution. Documented below is the time it took to create four PID loops and four motor control loops with interlocks for the DeltaV system, Allen-Bradley PLC, and Moore APACS DCS.



Development Time Comparisons (min: sec)

Procedure	DeltaV	A-B SLC500 /Wonderware	Moore APACS /Wonderware
Create first PID loop with			
✓ Configuration: Control Studio/PLC/DCS	2:40	12:21	2:43
✓ Display	2:57	8:32	4:55
✓ Alarms	0:29	0:20	0:18
✓ Trends	2:45	2:01	2:02
✓ Instrument and detail display	0:00	75:50	79:54
Create 3 more PID loops with			
✓ Configuration: Control Studio/PLC/DCS	3:01	20:31	3:35
✓ Display	2:07	21:01	5:05
✓ Alarms	0:35	1:35	0:42
✓ Trends	1:56	1:27	0:48
✓ Instrument and detail display	0:00	122:35	1:24
First motor control loop with interlocks			
✓ Configuration: Control Studio/PLC/DCS	5:24	13:31	1:54
✓ Display	2:25	1:40	2:14
✓ Instrument and detail display	0:00	0:00	68:55
3 more motor control loop with interlocks			
✓ Configuration: Control Studio/PLC/DCS	4:57	18:45	4:45
✓ Display	0:29	2:56	1:05
✓ Instrument and detail display	0:00	0:00	1:15



To understand the development time discrepancies between the systems, some of the notes taken during the procedures are included.

It took 2 minutes 40 seconds to create the first PID loop using the DeltaV system. It took 12 minutes 21 seconds to configure the first PID loop in the Wonderware software on the Allen-Bradley PLC. Seven ladder lines had to be configured to implement one PID block and symbol names had to be assigned. Lack of the DeltaV intuitive browse feature and drag and drop capabilities partially account for this 360% increase in control strategy development time.

Creating PID loop displays took up to 914% longer using Wonderware. Using both DeltaV software and Wonderware, the first three data links were copied and pasted three times. In the DeltaV system, the tag names were changed and the procedure completed. The vast increase in development time occurs in Wonderware because nine new tag names had to be defined and mapped with the configuration. Defining, data mapping, and verifying are time intensive jobs.

It must be noted here that using Wonderware, it took 75 minutes 50 seconds and 79 minutes 54 seconds respectively, to create instrument and detail displays for the first PID loop. It took 122 minutes 35 seconds and one minute 24 seconds respectively, to create instrument and detail displays for the next three PID loops. Only a few seconds were needed to perform this procedure with DeltaV software.

Using the DeltaV system, the engineer performing the Usability Study used the default instrument and detail display where 66 fields are defined in instrument and detail pictures. Wonderware has 30 values on its pop up detail window. The study engineer said, "Wonderware doesn't have as much alarm limit control, simulation control and diagnostic capability as compared to the DeltaV software." For the next three PID loops on the PLC, copying, defining, and mapping 90 new tag names made this more than a two hour job using Wonderware.

All DeltaV function blocks contain seventy-five parameters. Allen-Bradley PLCs have some of the same parameters, but not all. The parameters can be built into an Allen-Bradley PLC using time-consuming relay ladder logic. However, when time and efficiency are high priorities, ladder logic and data mapping are not the way to go. Although it took a few less minutes on the Moore/Wonderware system to configure the first motor control loop, the time saved was more than lost while building the first instrument and detail display.



Training, Testing, and Troubleshooting

The complete, pre-installed DeltaV solution gets your process up and running long before a PLC or a DCS system can begin to show results. The Usability Study proves this to be the case. An ongoing study would be required to measure the performance of the DeltaV system and the Allen-Bradley and Moore systems in the areas of training, testing, and troubleshooting. However, Mark Garnett, an instrumentation and control superintendent at Uniroyal Chemical, had this to say about the DeltaV system:

“In our case, training costs were significantly lower—60% lower than if we selected a traditional DCS. We have trained our operators on a number of control systems, so we know how long it takes to get the operators comfortable with normal operation and emergency response. The training was greatly simplified due in large part to the DeltaV system's incorporation of Microsoft technology. Most of our operators were very comfortable with the look and feel of the operator interface from their familiarity with other Microsoft applications.”

The DeltaV system offers system-wide diagnostics for all nodes on the network, including all the I/O devices, all the way to the intelligent HART and FOUNDATION™ fieldbus devices. No configuration or setup work is required to use DeltaV diagnostics. With the Wonderware software, you have to configure the diagnostics you want to use.

The Usability Study made it clear that the DeltaV system's pre-engineered control modules and auto-recognized I/O cards significantly shorten your system development time. There is little need for troubleshooting because the DeltaV *browse* feature only allows you to connect a control strategy to a valid I/O device. Also, the DeltaV system will not allow you to plug in hardware incorrectly. Plain English error messages significantly decrease development and testing time. Unlike the situation with Wonderware, there is no data mapping to be done or dip switches to set in the DeltaV system.

In the August/September 1997 issue of *Start* magazine, Mark Garnett also stated that the DeltaV system cut Uniroyal Chemical's engineering costs by 60%, was 30% less expensive to install, and 60% less expensive to configure than a traditional DCS. He goes on to say that the company meets demand faster and has seen a noticeable improvement in the process.

Refer to the graph in Appendix A for another comparison of a DeltaV system with a PLC and a DCS. This graph shows the results of a third party benchmark conducted for a small project with 15 control loops. Once again, the DeltaV system significantly outperformed a PLC and a hybrid DCS.

Conclusion

You obviously have a choice when choosing a process automation solution. You can buy a DCS, a PLC, or a DeltaV system. If ease of use, efficiency, and cost effectiveness concern you, look to the DeltaV system to diminish your concerns. When you purchase a DeltaV system, you get a Windows-like environment running on an **always-compatible** operating system and state-of-the-art hardware. Our expertise in the process control industry ensures that the DeltaV out-of-the-box solution will out-perform all other control systems. The DeltaV system's ease of use will enable you to become more efficient and effective at your job. The DeltaV system will help you to increase your plant's productivity and decrease run-time costs. Tests prove that it's easier to set up and run your process with a DeltaV system than a PLC or a Hybrid DCS solution. Mark Garnett said it best in the August/September 1997 issue of *Start* magazine. “There have been a lot of companies put off by automating the control and batching process...With (the) DeltaV (system), you can build the system as you go along. It is not that expensive, and the system is easier to use than a traditional DCS.”



DeltaV Hardware

The DeltaV system ships ready to plug and play. The software is currently preinstalled on a Pentium II, 400 MHz processor. The computer has up to 128 MB RAM and 256K cache. DeltaV upgrades its hardware as soon as advances are made in the industry. When you choose DeltaV, you get pre-installed, latest-version software running on state-of-the-art workstations.

The Usability Study makes it clear that compatibility issues arise immediately when using disparate hardware and software. DeltaV reduces this hassle by providing you with an integrated, cost effective process control system.

The DeltaV system is more efficient, cheaper and easier to wire than a PLC. Simply connect the device to a pair of terminals. Then I/O modules can be installed and removed under power, without ever having to disturb the wiring terminations. This elegant design makes installing and maintaining your DeltaV system easy. On the contrary, when exchanging the I/O module on a PLC, often the wiring must be removed, then the I/O module can be replaced, and then rewiring must be done. This is an unnecessary waste of the technician's time.

Another DeltaV design that promotes efficiency and ease of use is the top down power approach. In the DeltaV system, fuses are built into the terminal blocks. And all I/O and terminal blocks have function keys. These keys ensure that the correct I/O card is always plugged into the corresponding terminal block.

DeltaV internal power busses make external cabling to connect system power to controller and I/O interfaces a thing of the past. Also, the modular power structure enables you to simply snap on additional power to the field, controller, and I/O systems as soon as you need it.

PLCs do not work this efficiently. Their design is not modular. There are no built-in power fuses in the terminal blocks. They use external cabling to connect the system power supply to the controller and I/O interfaces. In addition, PLCs need external terminals for power distribution.

DeltaV Software

DeltaV delivers high performance software to meet your needs. The leading edge DeltaV modular software design gives you exactly the functionality you need to run your process efficiently and effectively. From system definition through operations and engineering to overall communications, DeltaV delivers it to you in a user-friendly, graphically rich Windows environment. A few benefits of the DeltaV software are.

- Win98 intuitive user interface and IEC 1131-3 familiar base reduces engineering training.
- Patented auto sensing reduces I/O engineering time—no configuration is necessary.
- FOUNDATION fieldbus devices are also auto-sensed—no configuration is necessary.
- Operator interface is intuitive—operator training is reduced.
- Keying of I/O prevents I/O misplacement and time spent figuring out which modules go where.
- Power pass-through to field devices eliminates extra power wiring panels and associated labor.
- Pre-built control strategies are provided with complete error control conditions so deployment of control strategies is as simple as dragging and dropping—similar to the Microsoft Explorer.
- No mapping of user interface components to controller strategies—part of DeltaV's basic design.
- Intuitive Wizard helps first-time users set up their DeltaV system for the first time through self-paced introduction.
- Comprehensive system diagnostics are provided at the touch of a button.



Appendix A

