

APACS to DeltaV System Connectivity

At its introduction, the APACS system presented a novel engineering configuration environment and IO architecture for distributed control system. However, in recent years, special challenges have made APACS maintenance more cumbersome and costly. In this same period, the power of smart digital plan technologies has convincingly been demonstrated. This paper describes APACS-to-DeltaV system transition option that can improve system maintainability and process performance, while advancing the plant toward a digital architecture.



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Introduction

Why might you want to transition from an APACS distributed control system to an Emerson DeltaV system? The APACS maintenance costs are increasing while product enhancements are minimal. Upgrading to the state-of-the-art software and supporting hardware provides easier maintenance, greater flexibility for expansion and enhanced system security and reliability.

Open standards for software reduce the need for pricey custom solutions. The DeltaV system development was based on open technologies. The DeltaV system aims to provide high integrity, high performance process control and ease of integration with information management clients.

A transition from an APACS DCS to the DeltaV system enables you to:

- Incorporate new bus technologies
- Scale up the process control system at your pace
- Improve process optimization
- Lower the device maintenance costs
- Integrate smart device information and diagnostics

How would you connect an APACS DCS and a DeltaV system? The options are console upgrade, advanced controls, and controller and I/O upgrade. Console upgrade makes DeltaV workstations the primary Human Machine Interfaces (HMI) for existing APACS controllers and devices. Controller and I/O upgrade includes an option to connect DeltaV controller I/O directly to the APACS I/O wire terminations. Of course, with controller and I/O upgrade, you will migrate the control and operating configurations to the DeltaV system. Advanced control applications can be implemented in the DeltaV system in an interactive manner with your APACS controllers. This allows you to improve process performance while continuing to use APACS for control and operating. Each connectivity method introduces DeltaV advantages to the APACS user, with minimal upset to normal operations.

The DeltaV Advantage

Digital Bus Technologies

Expanding from traditional I/O to bus-based I/O is easy with DeltaV systems, which integrate CENELEC or IEC-compliant standard device busses. In a single DeltaV controller, you can combine classic or traditional I/O with FOUNDATION fieldbus, Actuator Sensor Interface (AS-i) bus, Profibus DP, and HART device I/O.

The following quotes came from DeltaV customers who implemented beneficial fieldbus installations:

“The unique design of the DeltaV digital automation system simplifies the installation and commissioning process, enabling us to complete the project five months ahead of schedule. The processing capacity reached four milling cubic meters per day at 12:00 on Oct. 25th and all three required operation tests were passed with great success. The quality of the gas is better than the standard of the Grade A specification.”

PetroChina

“Now, the visibility of all our process controls is a thousand times better than what we used to have and due to the PlantWeb architecture and the filler stock prep improvements we made at the same time it was introduced, our up-time in terms of fewer machine sheet breaks, has increased about 40 percent.”

Carustar

“I had a contractor tell me this installation would take at least six months with an ordinary DCS, having to hardwire all the analog instruments. PlantWeb let us do it in about six weeks instead.”

AIPC

Advanced Controls

With the DeltaV system, implementing advanced control strategies is easier than ever. Advanced controls are embedded right in the DeltaV controller, for optimal execution.

“While there are still some geometric process controllers and expert systems running advanced process control algorithms on site, they’re few. Most of the benefits have been transferred into the DeltaV system running, for example, multi-variable control and fuzzy logic.”

INEOS Chlor

“Since the installation of DeltaV Predict our process variability on the lime kiln has been reduced by as much as 90% on key process parameters.”

Cantor

Scalable System Architecture

DeltaV architecture provides the full range of functionality, from single PC – single controller systems to those controlling thousands of I/O points. An initial system could include a single valve and transmitter pair. You could later integrate this valve and transmitter into a plant-wide DeltaV system with no change in hardware. Traditional architectures simply cannot achieve this level of scalability.

“The DeltaV system is much more flexible and friendly than other systems on the market with regard to communication between the user and the process.”

Petroflex

Process Optimization

DeltaV-enhanced automation applications-automatic loop tuning, fuzzy logic and loop variability determination-are included in every system. These efficient tools save time and money while improving loop performance.

For example, DeltaV Tune reduced the loop tuning time from several hours to 10-15 minutes, using the DeltaV Autotuner. The estimated savings for a 1000-loop plant in which loop tuning is verified once per year is:

Savings in time to tune loops = 1000x (1.5 hours) x \$50/hour = \$75,000 per year

“The DeltaV system has given us the flexibility and the response time we need to work with our advanced production models for increasing the mill performance.”

Ispat Inland Steel

“The DeltaV automation system has increased product consistency and has resulted in a longer shelf life. This will increase our geographic market reach.”

Harpon Brewery

Lower Field Device Maintenance Costs

For HART device users, the DeltaV system brings another advantage, the HART Passthrough and Asset Management System (AMS). Combined, these tools allow you to accomplish HART device startup, commissioning and maintenance much faster than with a Handheld 275. The following tables quantify the savings.

Table 1. HART Transmitter commissioning requirements comparison

Activity	Handheld 275 Minutes Required	AMS/DeltaV Minutes Required	Savings*
Configuration	80	16	\$53
Wiring checkout	50	5	\$38
Point checkout	40	10	\$25
Documentation	40	0	\$33
Startup/commissioning savings (per transmitter)		179 minutes	\$149

* Based on \$50/hr

Table 2. HART Transmitter maintenance requirements comparison

Activity	Handheld 275 Minutes Required	AMS/DeltaV Minutes Required	Savings*
Configuration	80	8	\$60
Calibration	50	27	\$19
Documentation	130	4	\$105
Startup/commissioning savings (per transmitter)		221 minutes	\$184

* Based on \$50/hr

For more about how companies got great results with DeltaV, visit www.EasyDeltaV.com

Console Upgrade-First Step toward Digital Plant Architecture

In order to begin your system migration with a cost-effective solution, consider a console upgrade. This solution provides a new engineering and operating environment for future system expansion while extending the use of your existing APACS control strategies and I/O. DeltaV Connect for APACS (DCA) is a great first step toward digital plant architecture.

DCA consists of software for the engineering environment and software for the real-time interface. Data exchange with APACS controllers occurs via the Siemens APACS OPC Device Server software, which installs on the same PC as the real-time interface software. (See Figure 1).

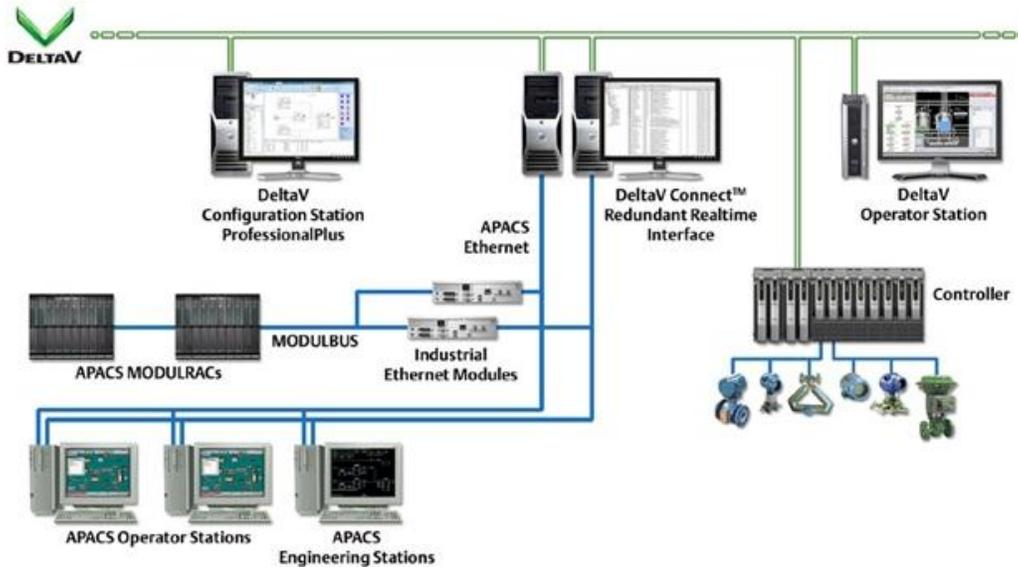


Figure 1. DeltaV Connect for APACS, IEM Simplex Architecture

This solution also works with QUADLOG safety PLCs.

Architecture

The DCA interface connects to the APACS Modibus in the same manner that a Wonderware of MycroAdvantage HMI connects. The physical connection is Ethernet to a Modibus to Ethernet gateway, such as the Industrial Ethernet Module (IEM) from the DeltaV Application station (see Figure 1). The Modibus to Ethernet gateway provides an option to install a small system interface (real-time component and engineering) on the DeltaV ProfessionalPlus Station (see Figure 2).

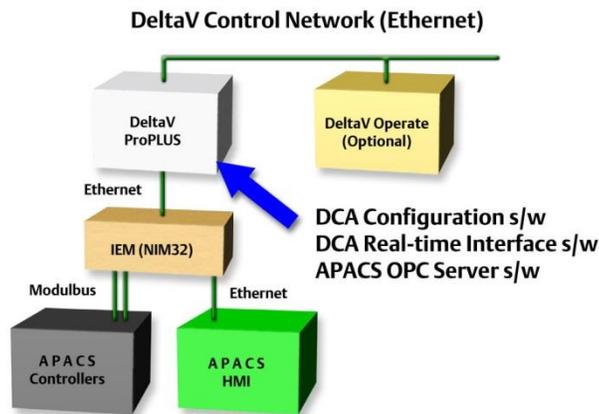


Figure 2. DeltaV Connect for APACS, Small System IEM Architecture Schematic

Display Environment

The DCA interface includes a virtual controller, which brings APACS data into DeltaV tags, also called connect blocks. These tags have DeltaV standard functionality for alarm, history, trend and display on process graphics.

For easier configuration, DeltaV Connect for APACS includes faceplates that correspond to the connect blocks. These faceplates present the same data that you see on the APACS HMIs. Figure 4 shows DeltaV Connect for APACS faceplates appearing on a DeltaV Operator Station.

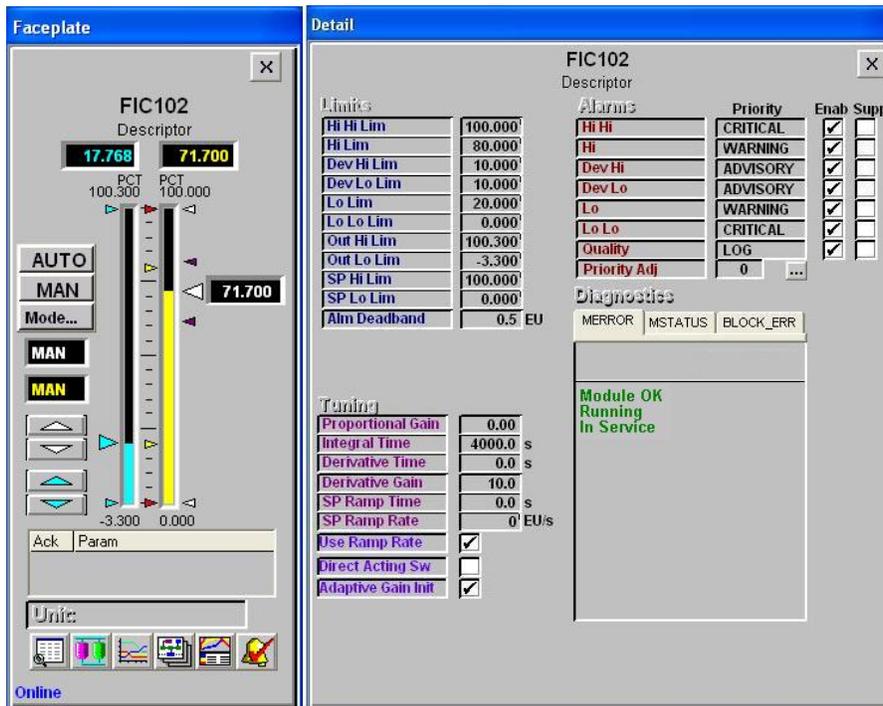


Figure 3 & 4. DeltaV Connect for APACS Single Loop PID Faceplate and Detail Displays

APACS graphics and database conversion services are available for accurate and expedient display reproduction and database generation for the DCA interface. An example converted display is shown in Figure 5.

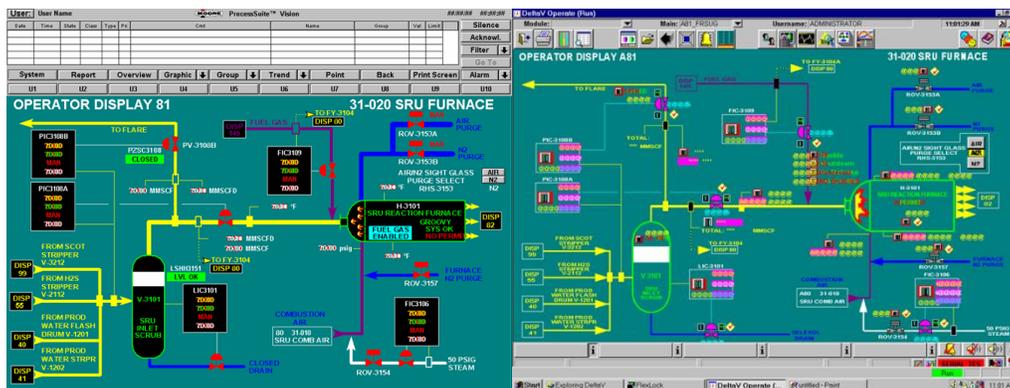


Figure 5. APACS Displays—Original (left) and Converted for DeltaV Operator Station (right)

Benefits of DeltaV Connect for APACS

- Startup is low risk with no downtime
- Configuration is easy, fast and intuitive for APACS user
- Consoles and workstations from both systems can operate side by side
- Operators learn software quickly, with look-alike HMI displays
- Expansions can include the latest bus and smart device technologies
- Field device maintenance is more effective, once operators and maintenance personnel have access to FOUNDATION fieldbus and/or HART Device information from the control system consoles
- Foundation is laid for a future switchover, when moving control from APACS to the DeltaV system. For details, see the Control Configuration and Checkout section on page 13.

To learn more about this product, see the DeltaV Connect for APACS product data sheet at www.EasyDeltaV.com/Solutions/DCS

Controller and I/O Upgrade and Expansion

Whether you need to incorporate digital bus technologies now, or retain conventional field devices, as you migrate control strategies to the DeltaV system, process downtime is a key concern. To enable you maximum flexibility in I/O specification and implementation, Emerson offers FlexConnect®. FlexConnect minimizes process downtime by enabling you to connect DeltaV controller I/O directly to APACS I/O terminations.

Architecture

FlexConnect consists of cables and/or panels that connect APACS I/O to a DeltaV controller. The exact structure varies with the type of system and the type of I/O. An analog input example of FlexConnect for APACS is shown in Figure 6.

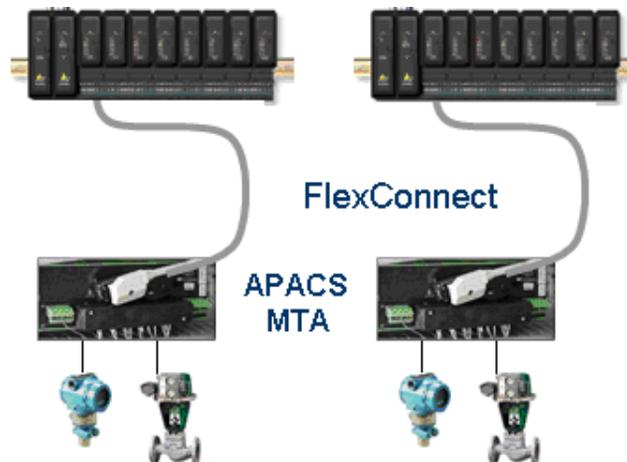


Figure 1. DeltaV FlexConnect Architecture for APACS Analog Inputs

Table 3 lists the types of I/O supported in DeltaV FlexConnect for APACS.

Table 1. APACS marshaled termination assemblies with FlexConnect capability

Model	Description
EAM	16-Channel Analog Input
HFM	16-Channel HART Input/Output
IDM	32-Channel Discrete Input
ODM	32-Channel Discrete Output
SDM	32-Channel Discrete Input/Output
VIM	16-Channel Voltage Input/Output

Phased Implementation

The primary aim of a FlexConnect solution is to minimize process downtime when moving control to the DeltaV system. The existing APACS system continues operating “as is” until all preparations have been completed for the DeltaV system. These preparations include FlexConnect assembly and I/O checkout, control configuration and checkout, operator display configuration and operator training. Each phase has tools that can expedite and help ensure satisfactory results.

FlexConnect Assembly and I/O Checkout

FlexConnect solutions consist of either cable only or panel and cable. Cable-only installations use standard APACS IO cables to the marshaled termination assemblies. Flexconnect panels can be cabinet-mounted or panel-mounted. Cable lengths and mounting options depend on customer preference and available rack space. Once the FlexConnect boards and cables are installed, I/O checkout is the next step.

An I/O simulation tool, Mimic®, provides the capability to thoroughly verify DeltaV I/O configuration. Mimic runs on a workstation, such as the DeltaV Application Station and either (1) connects directly to the DeltaV controller’s I/O carrier, or (2) communicates via OPC to the DeltaV Simulate application.

In case one, above, mimic looks just like DeltaV I/O to the actual controller(s). In case two, mimic looks just like DeltaV I/O to the DeltaV Simulate soft controller. Both methods provide realistic I/O feedback to the control strategy.

Control Configuration and Checkout

For engineering configuration and testing before control hardware arrives, DeltaV Simulate is the best tool to use. DeltaV Simulate provides the standard DeltaV engineering and operating environment (a ProfessionalPlus Station) and runs a soft controller. So, in Simulate, you can completely configure and verify your control strategies for the entire DeltaV system. Later, you can use the same configuration for the installed system.

Configuration checkout requires process simulation. Through OPC, the Simulate soft controller can interact with process simulators such as mimic or HYSYS. Using such applications in combination allows for thorough control system testing-no need to build simulation modules within the configuration. Mimic provides a medium-fidelity process simulation that exchanges data with the DeltaV control modules. HYSYS provides a high-fidelity process model, particularly useful when testing various strategies with a new process.

Operator Display Configuration

Process display configuration is easy on the DeltaV system, with predefined dynamos, such as pumps, valves and motors. These dynamos have data paths to the needed tag values. You simply drag and drop the dynamo and browse for the tag name.

Another option is converting graphics. Emerson Process Management offers conversion services for APACS to DeltaV graphics.

Operator Training

DeltaV Simulate-together with mimic Process Simulator-provides a risk-free training environment. Since the control network is not attached to the Simulate ProfessionalPlus Station, operator changes will not affect plant devices. Your operators can master the DeltaV process interface before bringing controllers and I/O online.

With mimic Process Simulator, the operators will see realistic plant responses. From the mimic Training Manager, a trainer can generate sets of process disturbances or device failures, called “scenarios.” As a scenario runs, the process events, device changes, and operator actions are recorded to an event log, making it easy to document training results.

Benefits

The greatest benefit of FlexConnect is the reduction in process downtime when you are ready for the new system startup. Another compelling FlexConnect benefit is the dramatic wiring cost reduction. Compared to rewiring from devices to new system I/O, on average, the costs drop by 50% and process downtime drops by 75% with FlexConnect.

For an 860-channel APACS system, rewiring can mean >280 hours of lost production. With a FlexConnect solution for the same system, total process downtime would not exceed 62 hours. The calculations for these estimates follow.

Process Downtime Comparison

The following comparison is based on time to install FlexConnect, versus time to rewire the existing panels in the existing cabinets with marshaling termination blocks:

System statistics

- 860 I/O channels
- 62 I/O panels
- Channel distribution:
 - 20% analog inputs
 - 10% analog outputs
 - 45% discrete inputs
 - 25% discrete outputs

Rewiring tasks

- Lift wires from existing termination panels; label as necessary
- Remove old termination panels
- Secure existing wire to new marshaling termination panel (device side)
- Secure new wire to marshaling panel (DeltaV controller side)
- Secure new wire to DeltaV termination block
- (Total of four terminations per wire)

Rewiring time calculation:

- One pair of wire for each I/O channel
- 25 terminations/hour
- Old termination panel removal: 62 panels @ 6 panels/hour
- Total time required > 282 hours

FlexConnect installation tasks

- Mount FlexConnect
- Install cables
- Connect cables

FlexConnect installation time calculation:

- 62 panels @ 1 hour/panel requires 62 hours

For more information about this product, see FlexConnect Solutions for Siemens-Moore APACS product data sheet at www.easydeltav.com/solutions/dcs

DeltaV Advanced Controls

Two powerful DeltaV advanced control applications are supported “standalone”, meaning no DeltaV controller hardware is required, with non-Emerson systems. These are DeltaV Neural, an inferential sensing package, and DeltaV Predict or PredictPro, a model predictive control package that can help manage interactive loops for improved process performance.

Architecture

Two architectures support the use of DeltaV advanced controls with your APACS system.

- (1) DeltaV Neural or Predict can run in a DeltaV Application Station.
- (2) DeltaV Neural or Predict can run in a DeltaV hardware controller.

For either implementation, connection to the APACS MODULBUS network requires DeltaV Connect for APACS or an OPC interface. Another option is to wire directly from the field devices to DeltaV hardware controller I/O.

Benefits

By implementing DeltaV Advanced Control application, you can improve process performance and product quality without major re—work to your existing APACS controls.

More DeltaV advanced control applications, such as Inspect, Fuzzy Logic and Tune are embedded in DeltaV controllers. To learn more about embedded DeltaV Advanced Controls, see www.EasyDeltaV.com/KeyTechnologies/AdvancedControls.

Conclusion

Successfully implementing APACS to DeltaV systems connectivity enables you to:

- Establish a path toward digital plant architecture now
- Pace the transition from older to newer technologies
- Replicate familiar operations displays on the newer consoles
- Save engineering configuration time through use of the conversion tools
- Train operators and verify configuration time through use of conversion tools
- Train operators and verify configuration in a risk-free, offline environment
- Minimize process downtime during a switch of process control IO between systems
- Save existing wiring and avoid costly re-wiring

DeltaV connectivity brings great new possibilities to the APACS user. With smart implementation, the DeltaV system maximizes process potential while minimizing costs of the transition.

Need assistance in selecting the transition solution that best suits your needs? Emerson Process Management offers APACS Migration Consulting services to assist APACS customers in all phases of migration to a DeltaV system. Emerson offers consulting expertise in other areas, including control performance, digital busses and safety systems – review, design and implementation. Contact your local Emerson representative for more information.

To locate a sales office near you, visit our website at:

www.EmersonProcess.com/DeltaV

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