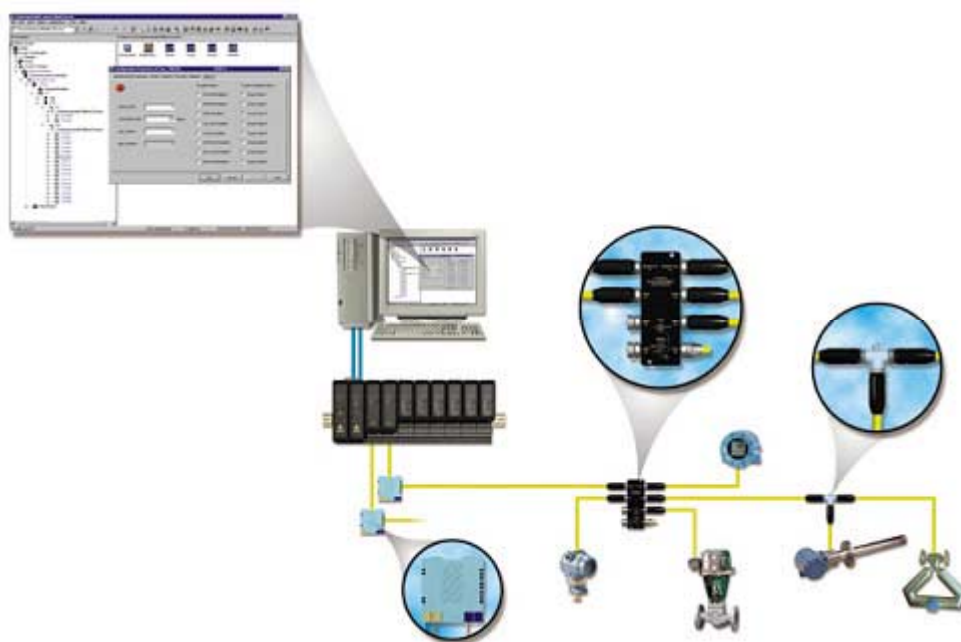




Comparing a DeltaV™ System with FOUNDATION™ Fieldbus to a DCS

This paper illustrates the installation savings associated with a DeltaV system and FOUNDATION fieldbus compared to a traditional DCS.



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Introduction

DeltaV FOUNDATION fieldbus technology is a digital communications network that improves plant performance. Using asset management software (AMS), the DeltaV system extracts information contained in FOUNDATION fieldbus devices and shares this process variable information with the control system. AMS is not part of a traditional DCS system. The DeltaV system with FOUNDATION fieldbus uses the OLE for Process Control (OPC) standard to ensure that configuration, calibration, status, performance, and health of the devices are accessible plant-wide. Predictive maintenance capabilities, improved process control, and increased dissemination of information are benefits not found in a traditional DCS system.

There are substantial hardware installation savings associated with a DeltaV FOUNDATION fieldbus system compared to a traditional DCS installation. An engineering contractor analyzed the results of a FOUNDATION fieldbus installation for an Alaskan North Slope oil producer. For the complete story on this oil producer, see the FOUNDATION fieldbus supplement story entitled "Early Adopters Document Foundation's Potential," in Control Magazine (October 1998).

Table 1. FOUNDATION Fieldbus Installation Savings

Task	Percent decrease
Terminations	75%
Number of I/O cards	93%
Home run wiring	98%
Number of transmitters	28%
Control room instrument panel space	67%

All installations are unique. To get an accurate comparison of a FOUNDATION fieldbus installation and a traditional DCS installation we will compare a 16-device installation using a DeltaV system with FOUNDATION fieldbus and a DCS. We will show how I/O terminations decrease by 75% when DeltaV with FOUNDATION fieldbus technology is used instead of a traditional DCS. We will also show how the number of I/O cards, home run wiring, number of transmitters, and instrument control room panel space decreases substantially when a DeltaV system with FOUNDATION fieldbus is installed instead of a traditional DCS.

I/O Termination Reduction

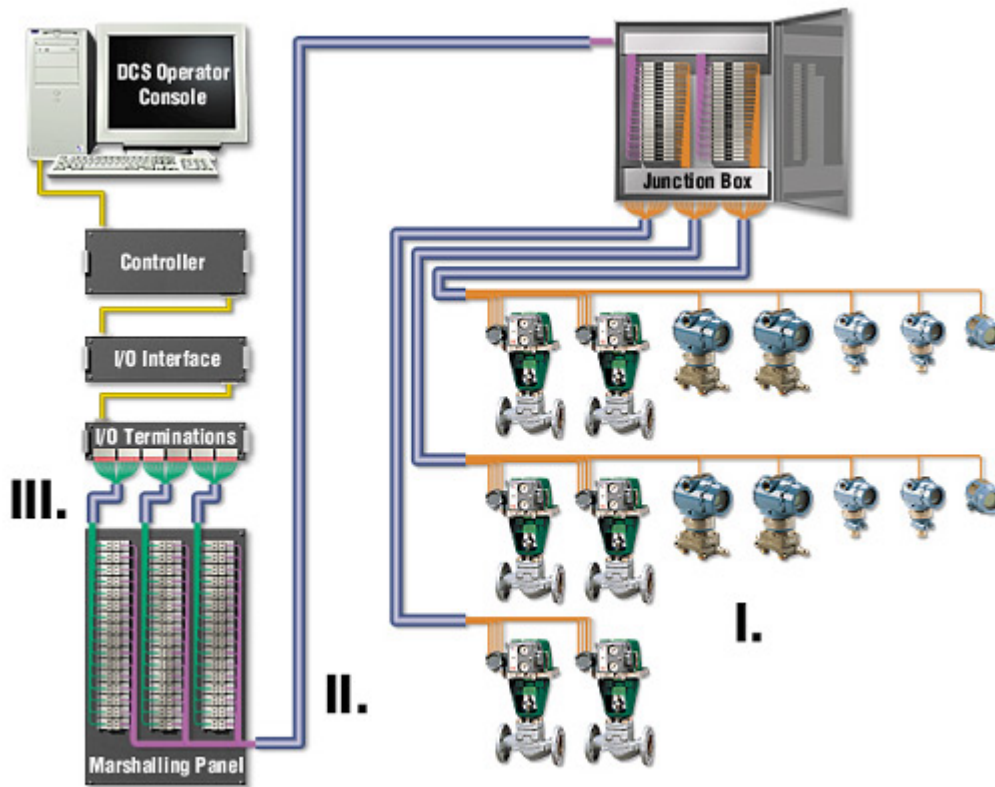
Transmitters and valves are typically connected to a junction box. The wiring from the junction boxes may be connected to a marshalling panel and then to the I/O terminations. For the following example, the maximum number of valves and transmitters that are attached to each junction box is 16. Thus, a maximum of 16 wires can be connected to the junction box at any time with each wire having 3 terminations (twisted pair with shielding). Figures 1 and 2 show a device layout of 6 valves and 10 transmitters. Figure 1 is a traditional DCS layout. Figure 2 is a DeltaV with FOUNDATION fieldbus system layout. For both figures use the Roman numerals I through III to follow the layouts and see the 75% decrease in terminations using the DeltaV system with FOUNDATION fieldbus.

Traditional DCS layout

Sixteen devices require 240 terminations in a traditional DCS layout.

- I. 16 devices to the junction box - 16 wires @ 3 terminals = 48 terminations.
- II. 48 terminations from the junction box to 48 terminations into marshalling panel.
- III. 48 terminations from the marshalling panel to 48 terminations into the I/O cards.

Total of 5 sets of 48 termination points = 240 terminations.





The DeltaV with FOUNDATION fieldbus system layout

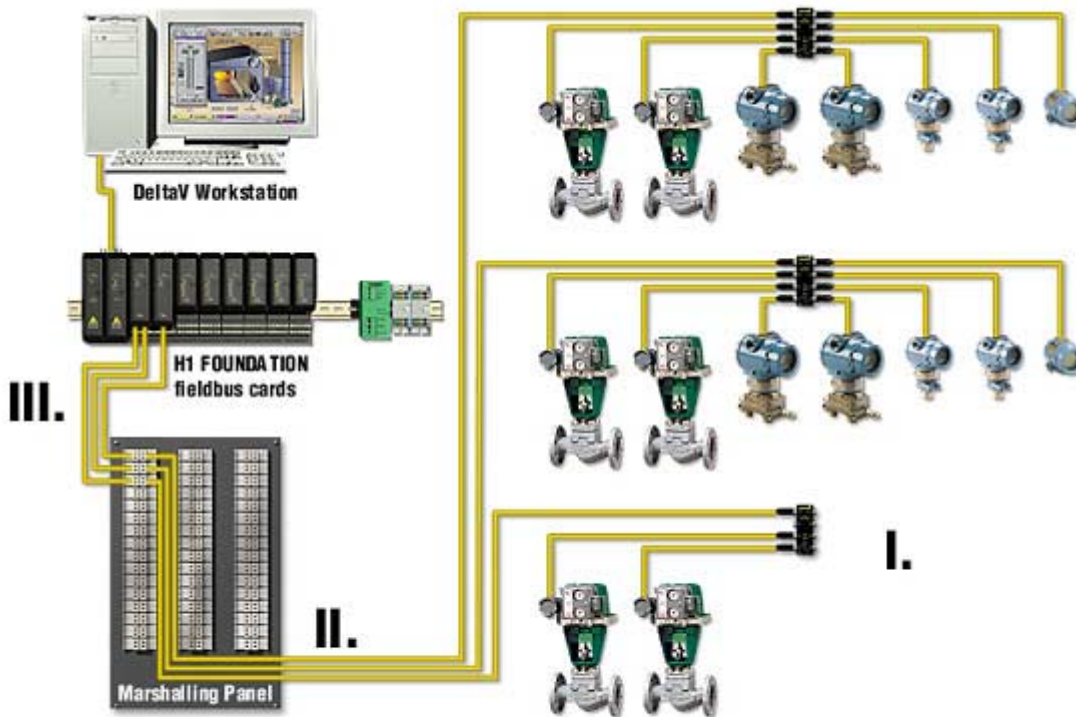
Sixteen devices require 60 terminations in a DeltaV FOUNDATION fieldbus layout.

16 devices to the junction boxes - 16 wires @ 3 terminals = 48 terminations.

3 terminations from the junction boxes to 3 terminations (1 wire) into marshalling panel.

3 terminations (1 wire) from the marshalling panel to 3 terminations in to the I/O terminations.

Total of 48 termination points and 4 wires @ 3 terminations = 60 terminations.



A 75% reduction of terminations is achieved using DeltaV with FOUNDATION fieldbus technology. A greater reduction can be achieved when multi-variable transmitters are used. This is addressed later in this paper.

This 75% decrease in I/O terminations translates into a substantial decrease in FOUNDATION fieldbus installation costs. Table 2 gives a best case and worst case U.S. dollar scenario comparing the traditional DCS 240-termination installation with the DeltaV with FOUNDATION fieldbus 60-termination installation.



Table 2. Traditional DCS vs DeltaV FOUNDATION Fieldbus Termination Installation Costs

\$ Best case/worst case	Traditional DCS 240 termination	DeltaV FOUNDATION fieldbus 60 termination
\$5.00 per termination installation	\$1,200	\$300
\$15.00 per termination installation	\$3,600	\$900

Reduction in Number of I/O Cards

Traditional DCS I/O cards consist of digital input, digital output, and analog input cards. Each card can typically accommodate 8 channels. DeltaV FOUNDATION fieldbus technology uses a fieldbus I/O card. This card accommodates 64 channels. Using the 6 valves and 10-transmitter layout, the following comparisons can be made.

Traditional DCS layout

In our model, one fieldbus on/off valve support the equivalent of 2 discrete outputs, 6 discrete inputs, and 2 analog inputs. One transmitter has 2 analog channels. In a traditional DCS layout a 6 valve configuration will result in 36 digital input signals (DIs), 12 digital output signals (DOs) and 12 analog input signals (AIs). A 10-transmitter configuration will result in 20 AIs. Table 3 states the type and amount of I/O cards needed in a traditional DCS layout. Table 4 states the type and amount of cards needed for the same layout using a DeltaV system with FOUNDATION fieldbus.

Table 3. Traditional DCS I/O Cards

Card type	Amount needed
Digital input	5
Digital output	2
Analog input	4
Total	11

DeltaV with FOUNDATION fieldbus system layout

Using a DeltaV fieldbus I/O card we refer to channels as blocks. One block equals one channel. A total of 80 I/O blocks are needed to accommodate the 16 devices. Consequently, each DeltaV fieldbus card accommodates 64 blocks (channels) compared to 8 channels for a traditional DCS I/O card.

Table 4. DeltaV FOUNDATION fieldbus I/O cards

Card type	Amount needed
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DeltaV fieldbus I/O	2
Total	2

Using a DeltaV system with FOUNDATION fieldbus instead of a traditional DCS, there is an 82% decrease in the number of I/O cards needed in this 16-device layout. At the Alaskan North Slope installation, a 92% decrease in I/O cards was achieved using the DeltaV with FOUNDATION fieldbus. The mix of multi-variable devices impacts the I/O card count.

Reduction in Home Run Wiring

Traditional DCS layout

Refer to figure 1 to see that the sixteen devices require 16 wires from the junction box to the marshalling panel and then 16 wires to the I/O terminations.

DeltaV with FOUNDATION fieldbus system layout

Refer to figure 2 to see that using the DeltaV system with FOUNDATION fieldbus, only one wire is needed from the junction box to the marshalling panel and then to the I/O terminations. Sixteen wires are still needed from the 16 devices to the junction box.

This results in a reduction of 16 wires to 1 wire or 83%. The best case scenario, which would require 16 multi-variable smart devices capable of up to 10 channels per valve, would reduce wiring from 160 wires to 3 wires for a 98% reduction.

At the Alaskan North Slope installation, the field devices were wired so that pressure switches allowed the valve to pass all information back to the DeltaV system on the fieldbus segment. The valve controlled the process and acted as a data concentrator for all signals going back to the DeltaV system. Using this design and technology, a 98% reduction in home run wiring was achieved at the Alaskan North Slope DeltaV with FOUNDATION fieldbus installation.

Reduction in Temperature and Pressure Transmitters

Traditional DCS layout

In a traditional DCS installation, temperature transmitters and pressure transmitters are both needed. There are not any multi-variable transmitters in a traditional DCS.

DeltaV with FOUNDATION fieldbus system layout

Using FOUNDATION fieldbus pressure transmitters with close-coupled mounting, the temperature transmitters are not needed. Each pressure transmitter has an internal process temperature sensor that measures temperature.

Due to location, personal preference, and other factors, not all temperature transmitters will be replaced. However, the DeltaV system with FOUNDATION fieldbus eliminates the need for temperature transmitters by providing multi-variable pressure transmitters with close-coupled mounting. Using these pressure transmitters significantly decreases the need for temperature transmitters.

Reduction in Control Room Panel Space

Compare figures 3 and 4 to see how the DeltaV system with FOUNDATION fieldbus significantly reduces the amount of space needed in the control room. Both figures show I/O cards and power for a 350-field device installation.

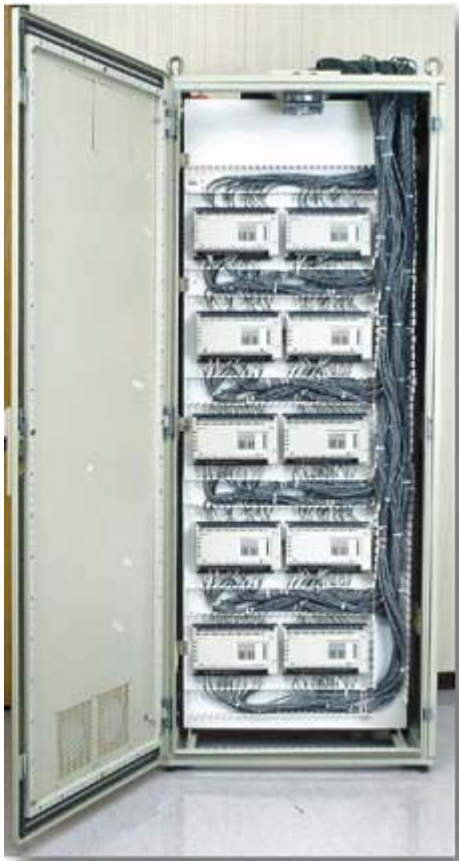


Figure 3. Conventional DCS I/O required panel space



Figure 4. DeltaV with FOUNDATION fieldbus required panel space



Summary

Comparing a traditional DCS installation to a DeltaV system with FOUNDATION fieldbus illustrates that there is a significant decrease in terminations, number of I/O cards required, home run wiring, number of transmitters required, and control room panel space when the DeltaV system with FOUNDATION fieldbus is used. The lead project engineer at the Alaskan North Slope installation stated it best when he said, "we'll have less wire, we'll have less space, we'll have less iron, we'll have less everything on the North Slope." Additionally, the reduction in hardware delivers engineering, installation, and maintenance advantages over a traditional DCS.

At the Alaskan North Slope installation terminations decreased 75% using the DeltaV system with FOUNDATION fieldbus instead of a traditional DCS. In our 16-device installation, a 75% termination reduction was also achieved using the DeltaV system with FOUNDATION fieldbus versus a traditional DCS. This reduction in terminations will increase if DeltaV multi-variable pressure transmitters with close-coupled mounting are used.

A 93% reduction in the number of I/O cards used was realized at the Alaskan North Slope installation. In our 16-device installation an 82% reduction in I/O card use was experienced. Due to the uniqueness of each installation this percent will vary. Based on this data and other DeltaV FOUNDATION fieldbus installation reports, customers can expect to see similar savings.

One of the greatest advantages of the DeltaV system with FOUNDATION fieldbus is its drastic reduction in home run wiring. At the Alaskan North Slope installation, users experienced a 98% reduction in home run wiring compared to traditional DCS wiring. In the 16-device installation an 83% reduction was achieved. Enabling one pair of wires to take the place of 16 reduces installation and ongoing maintenance costs.

The user application dictates the use of multi-variable transmitters. The Alaskan North Slope installation achieved a 28% decrease in transmitter use over a traditional DCS. Applications that can take advantage of multi-variable devices will decrease the number of devices needed and maintenance costs.

The DeltaV system with FOUNDATION fieldbus decreases the number of wires running from the junction box to the marshalling panel and then to the I/O terminations compared to a traditional DCS. Also, the DeltaV fieldbus I/O card provides 56 more channels per card than a traditional DCS I/O card. Fewer wires and more I/O channels decrease control room footprint and panel space. Figures 3 and 4 vividly depict this technological advancement. Control room panel space was decreased by 67% at the Alaskan North Slope installation.

There is an article about the Alaskan North Slope installation in the FOUNDATION fieldbus supplement to Control Magazine (Oct 1998). It is stated in the article that this North Slope FOUNDATION fieldbus installation "resulted in dramatic cost reductions in comparison with traditional distributed control systems." The DeltaV system with FOUNDATION fieldbus is the answer to increased plant performance and decreased cost of ownership.