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Standalone DeltaV™ PK Controller

DELTAV™

EMERSON™

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Contents

Welcome

This manual provides instructions for installing the PK Controller in a standalone configuration.

Related documentation

- The *PK Controller Hardware Reference* manual contains installation notes, specifications, wiring diagrams, dimensions, and other reference information for the PK Controller hardware components.
- The *DeltaV Power and Grounding* manual contains instructions for properly preparing your site for electrical power and grounding.
- The *Installing Your DeltaV SIS™ Process Safety System Hardware* manual contains information about installing SIS hardware.

Assumptions

It is assumed that you have read the *DeltaV Power and Grounding* manual and have followed the instructions for properly preparing your site for electrical power and grounding before installing your DeltaV system. The *DeltaV Power and Grounding* manual is available from your Emerson representative or sales office. It is also assumed that all installation procedures described in this document are performed by qualified personnel and that the equipment is used only for the purposes described.

CE statement

This manual describes installation and maintenance procedures for products that have been tested to be in compliance with appropriate CE directives. To maintain compliance, these products must be installed and maintained according to the procedures described in this document. Failure to follow the procedures may compromise compliance.

Conventions used in this manual

Notes are used to help you to understand important information.

Warnings are used to describe a critical procedure that must be followed to prevent a safety risk or equipment damage.

Cautions describes a procedure that must be followed to prevent equipment malfunction.

1 Standalone DeltaV PK controller overview

The DeltaV PK controller can be deployed as follows:

- part of the balance-of-plant DeltaV system
- as a standalone unit

The standalone deployment is the focus of this section.

The Standalone DeltaV PK controller provides a control solution for smaller-scale applications such as skid units or small unit operations. It is designed to operate in a standalone fashion, meaning that it runs without requiring a connection to a server, panel HMI, or other typical DCS system elements.

It is configured using the DeltaV PK controller engineering software installed on a laptop or workstation of your choosing (provided it meets the minimum system requirements).

Control of Ethernet devices is made easy with built-in Ethernet ports and native protocols supported by the controller – extra cards are not required.

You can connect to DeltaV IO nodes (CIOC or WIOC) on the DeltaV ACN. You can also connect to and obtain IO from the DeltaV logic solvers.

Up to a total of 16 CIOCs and WIOCs (combined), plus one SZ controller can be configured in the project. The maximum number of remote nodes is the same for all DeltaV PK controller license versions.

The IP addressing that the system assigns to the Standalone DeltaV PK controller and its device network nodes is appropriate for an independent standalone system. However, if you network the multiple Standalone DeltaV PK controllers, IP address conflicts will occur. Therefore, you can modify the IP addresses manually such that all nodes in the network have a different IP address. You must manually track all the IP addresses you assign so that you avoid any conflicts.

Additional interfaces include Modbus TCP and OPC UA.

Note
It is recommended that you use the controller's physical key switch and the DeltaV lock feature to protect your Standalone PK controller from unauthorized access.

Any time after being configured to run in a standalone fashion, the DeltaV PK controller can be merged into a broader DeltaV system. The merging process incorporates the database from the DeltaV PK controller into the DeltaV balance-of-plant database, resulting in a single, native database and system. This process addresses potential conflicts with tags, named sets, and so on, thereby eliminating many of the pains associated with mapping two systems together using communication protocols.

2 Basic steps for getting your Standalone DeltaV PK controller configured

The following procedure outlines the basic steps needed to get your DeltaV PK controller configured.

1. Install the Engineering Station's software.

   a) **Note**
   These steps apply to a physical or virtual Engineering Station.

   Install your Engineering Station from the DeltaV PK DVD (or ISO file). You must be an administrator on the computer to install the software.

   b) Browse to the Autorun folder and double click the Autorun.exe file.

   The installation runs as a wizard.

   c) Select options as appropriate to your installation.

   The installation copies files to your hard drive, creates user accounts and modifies system settings.

   The system will reboot and restart more than once during this process. Each time, log on as the same administrator user.

   d) At the final login (after logging into Windows), you are prompted to log into the DeltaV desktop. Use the same administrator account to do this.

   You will need to set up additional DeltaV accounts in DeltaV User Manager. For example, create any operator accounts that will be logging into the DeltaV local HMI station.

2. Attach the system key, Basic (BM) or Professional (PM), to the Engineering Station.

   If using a virtual machine, you must share the host's USB port with the virtual machine. This is done in the virtual machine's settings.

3. Using DeltaV Explorer on the Engineering Station, download the Engineering Station.

   Note
   The Basic license does not allow for the Event Chronicle or the Sequence of Events (SOE) Collector on the Engineering Station. Therefore, you must disable the Engineering Station's Alarms and Events subsystem before you can download the Engineering Station.

   a. Expand the node in DeltaV Explorer.

   b. Right click the node's **Alarms And Events** subsystem and select **Properties**.

   c. Uncheck the **System SOE Collector** box.

d. Uncheck the **Enabled** box.

e. Click **OK**.

4. Connect the Engineering Station to the Standalone DeltaV PK controller. Port 1 on the controller's IOP is always enabled.
5. Configure the system.
   a) Rename the PK controller placeholder in DeltaV Explorer, if a new name is wanted.
   b) From DeltaV Explorer, enable (or disable) redundant controllers and networks on the decommissioned placeholder for the PK controller. You can only configure these settings on a decommissioned placeholder.
   c) If networking your Standalone DeltaV PK controllers, modify the IP address for the controller's placeholder and its CIOC, WIOC, and SIS Controller placeholders so that you avoid any IP address conflicts.

      Note
      You can only modify the IP addresses on the controller's placeholder and on its CIOC, WIOC, and SIS Controller placeholders, prior to commissioning the controller. You must manually track all the IP addresses you assign so that you avoid any conflicts both on this controller; and, on any other controllers and their devices that are connected either directly or through a switch.

   d) From DeltaV Explorer, commission the controller to the configured placeholder.

      Tip
      The PK controller should be recognized and listed in **System Configuration → Physical Network → Decommissioned Nodes** in the DeltaV Explorer hierarchy.

   e) Run DeltaV PK Controller Administration and create a password for the controller.

      Note
      Best practice is to create a unique password for each controller when you are maintaining multiple projects on the Engineering Station.

   f) Enable the controller's Ethernet ports that you will use and configure the port-to-port communications as appropriate for your needs.
      1. From DeltaV Explorer, select the controller, right click and select **Properties**.
      2. Enable the external Ethernet ports you will use.
      3. Click **Port-to-Port Communications...** button.
      4. Select the appropriate configuration of communications/isolation of ports.

5. Click **OK** on each dialog.

g) Configure the PO1 subsystem on the PK controller.

1. From DeltaV Explorer, with the controller object expanded, right click **PO1** and select **Properties**.
2. On the **General** tab, select **Enabled**.

Tip
If you want to create device network placeholders without affecting the overall integrity of the controller or you want to avoid IP address conflicts while configuring the devices, leave the subsystem disabled until your configuration is ready.

3. Click the **Advanced** tab on the **Properties** dialog.
4. Enter a valid IP address for your Primary and Redundant (if using the secondary network) connections.
5. Select the protocol for this controller's PO1 subsystem.
6. Click **OK**.

h) Create your control strategy.

Using DeltaV Explorer, Control Studio, Recipe Studio and other DeltaV engineering applications, create the logic for this controller. Refer to DeltaV Books Online for a tutorial and for reference information. Refer to the DeltaV application help for information on using the software.

i) Download the controller.

Note
On the download dialog, you have the option to backup the project after the download. This will backup the project to the controller's SD card. Only select this option if your controller has an SD card. The controller must be commissioned and authenticated.

6. Create the local HMI.

Note
The Standalone DeltaV PK controller must be commissioned and authenticated; and, the relevant protocol enabled, before you can communicate with the local HMI panel.

a) For a DeltaV Operator Station, follow these steps.

1. Use DeltaV Explorer to create a placeholder for the DeltaV local HMI as an Operator station in the **Control Network**.
2. Set the properties for that workstation in DeltaV Explorer.
3. Export the workstation configuration. This creates a DevData.cfg file to be used during the installation of DeltaV on the local HMI.

4. Install your DeltaV local HMI station from the DeltaV PK DVD (or ISO file). You must be an administrator on the computer to install the software.
5. Browse to the Autorun folder and double click the Autorun.exe file.
6. Select options as appropriate to your installation. The installation copies files to your hard drive, creates user accounts and modifies system settings.
7. The system will reboot and restart more than once during this process. Each time, log on as the same administrator user.
8. When prompted by Workstation Configuration application, supply the exported DevData.cfg file for your DeltaV local HMI station.
9. At the final login (after logging into Windows), you are prompted to log into the DeltaV desktop. Use the same administrator account to do this, or use one of the operator accounts that you have created.
10. Attach the system key (ST) to the DeltaV local HMI station and copy the license files (*.lia) to the `DeltaV\DvData\Standalone` folder.
11. From the Engineering Station, run DeltaV Explorer and download the DeltaV local HMI station.

b) For a 3rd-party local HMI, follow these steps.

1. Install, configure, and license the computer according to the 3rd-party instructions.
2. Using the Engineering Station, run DeltaV Explorer and enable the protocol (Modbus TCP or OPC UA) on the PK controller. For Modbus TCP, configure the registers as appropriate.
3. Download the controller.

7. Create operator displays.
   a) Run the application for creating operator displays (for example, DeltaV Operate or DeltaV Live). For DeltaV local HMI operator stations, use the Main1366 template.

      Refer to DeltaV Books Online for information on configuring operator displays. Refer to the DeltaV application help for information on using the software.

   b) Download/publish the displays.
8. Create a backup of the DeltaV PK controller's project (if not backed up as part of the download).

   This should be done whenever you are done making changes and before disconnecting the Engineering Station (when using the laptop option).

   You can backup a project to the SD card on the controller or to a drive.

If you re-commissioning the Standalone DeltaV PK controller, you must create a new workstation configuration file (DevData.cfg) and run the Workstation Configuration application on the local DeltaV HMI (supplying the new DevData.cfg file). Without this new configuration file, the local DeltaV HMI cannot communicate with the controller or Engineering Station.

3 The Engineering Station

The Engineering Station (a DeltaV ProfessionalPLUS station) is used to configure the Standalone DeltaV PK controller.

Once the controller is downloaded and running, the Engineering Station is not required for normal operations (with exceptions listed below). The local HMI provides operator control of the unit.

There are two Engineering Station hardware platforms:

- Laptop Engineering Station - Configuration by a laptop-based Engineering Station that is not permanently attached.
- Workstation Engineering Station - Configuration by a permanently attached, usually workstation-based Engineering Station.

Note
When the DeltaV PK controller is part of the DeltaV balance-of-plant system, it is configured using standard DeltaV engineering tools on a ProfessionalPLUS or DeltaV engineering workstation.

Installing the Engineering Station DeltaV software

The Engineering Station can be either a physical computer or a virtual machine. The Engineering Station is a type of DeltaV ProfessionalPLUS station installed specifically and only for use with the Standalone DeltaV PK controller.

On the physical computer, install the Engineering Station using the DeltaV installation media. Follow the prompts to complete the installation.

On the virtual machine, follow the instructions in this manual for creating the virtual environment and starting the virtual machine.

Setting the DeltaV PK controller's Password

The password is set using the DeltaV PK Controller Administration tool after you commission the DeltaV PK controller using DeltaV Explorer.

When interacting with the DeltaV PK controller, the controller must authenticate your connection before access is allowed. Authentication is accomplished using the DeltaV PK controller's password.

Note
Best practice is to create a unique password for each controller when you are maintaining multiple projects on the Engineering Station.

When connecting to the DeltaV PK controller using a laptop Engineering Station, you are required to enter that password. The permanently connected Engineering Station requires authentication only upon reboot or loss of communication with the controller. Additionally, when merging the Standalone DeltaV PK controller to a balance-of-plant DeltaV system, you are also required to enter that password.

Creating a configuration

For a quick tutorial on using the DeltaV software, refer to the *Getting Started with your DeltaV Software* manual.

For detailed information, the DeltaV Books Online is installed on your Engineering Station. Access DeltaV Books Online from the DeltaV applications' menus or the Start menu at **Start → DeltaV Help**.

3.1 The PK Controller Administration overview

The PK Controller Administration application assists you with connecting to and authenticating with the DeltaV PK controller, creating, backing up, comparing and retrieving projects; as well as, managing the controller's password. Additionally, commissioning the controller can be initiated from this application (but is actually performed in DeltaV Explorer).

Start the PK Controller Administration application from the Start menu: **Start → DeltaV Engineering**.

4 The Virtual Engineering Station

4.1 What do I need to run the Virtual Engineering Station?

The Virtual Engineering Station is a VMWare image on the DeltaV USB media. Copy it to the local hard drive from the DeltaV USB media.

Host system requirements

Using the Virtual Engineering Station requires VMWare Workstation Pro or VMWare Player running on a Windows host OS. Emerson recommends Windows 10 or later for the host OS. Additionally, using the Virtual Engineering Station requires the following:

- 16 GB total host system RAM (the Virtual Engineering Station requires 8 GB)
- 64-bit processor
- 200 GB free hard-drive space for the Virtual Engineering Station
- Network adapter with RJ45 jack, such as an internal NIC or a USB-to-Ethernet adapter. Wireless network adapters are not supported.
- USB 2 port for the system identifier. If you are using a USB-to-Ethernet adapter, you need a total of two USB ports on the host system.
- Solid-state drive (recommended)

Logging into the Windows OS of the Virtual Engineering Station

- User name: Emerson
- Password: DeltaVE1

DeltaV prompts you to change the password when you log into the Virtual Engineering Station for the first time. Create a new password then. Do not reuse the default password.

Licensing the Windows OS of the Virtual Engineering Station

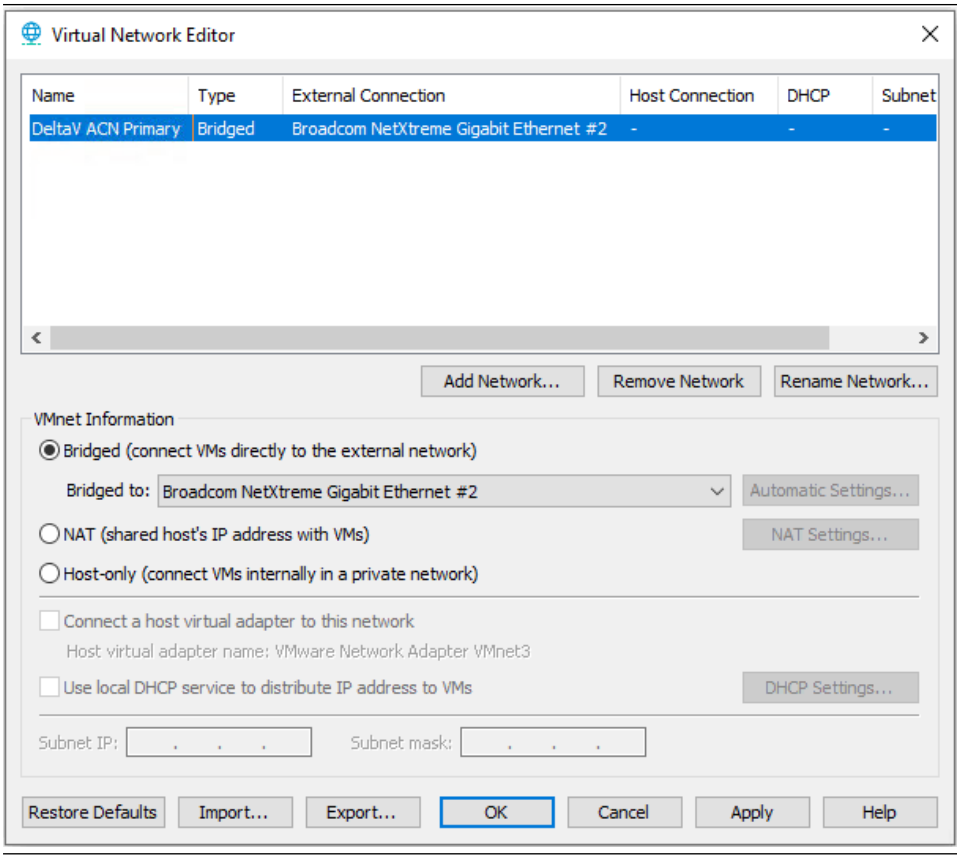
You must license the Windows OS installed in the Virtual Engineering Station. The VMWare image does not include any OS licenses. Refer to microsoft.com for information about licensing the Windows OS installed in the Virtual Engineering Station.

4.2 Configure VMWare virtual networks for DeltaV communications

This section describes how to configure VMWare virtual networks to communicate with the DeltaV control network. In order for the virtual machine to communicate with DeltaV, you *must* associate one VMWare virtual network with the DeltaV Primary ACN and bridge that virtual network to a physical network connection of the host machine.

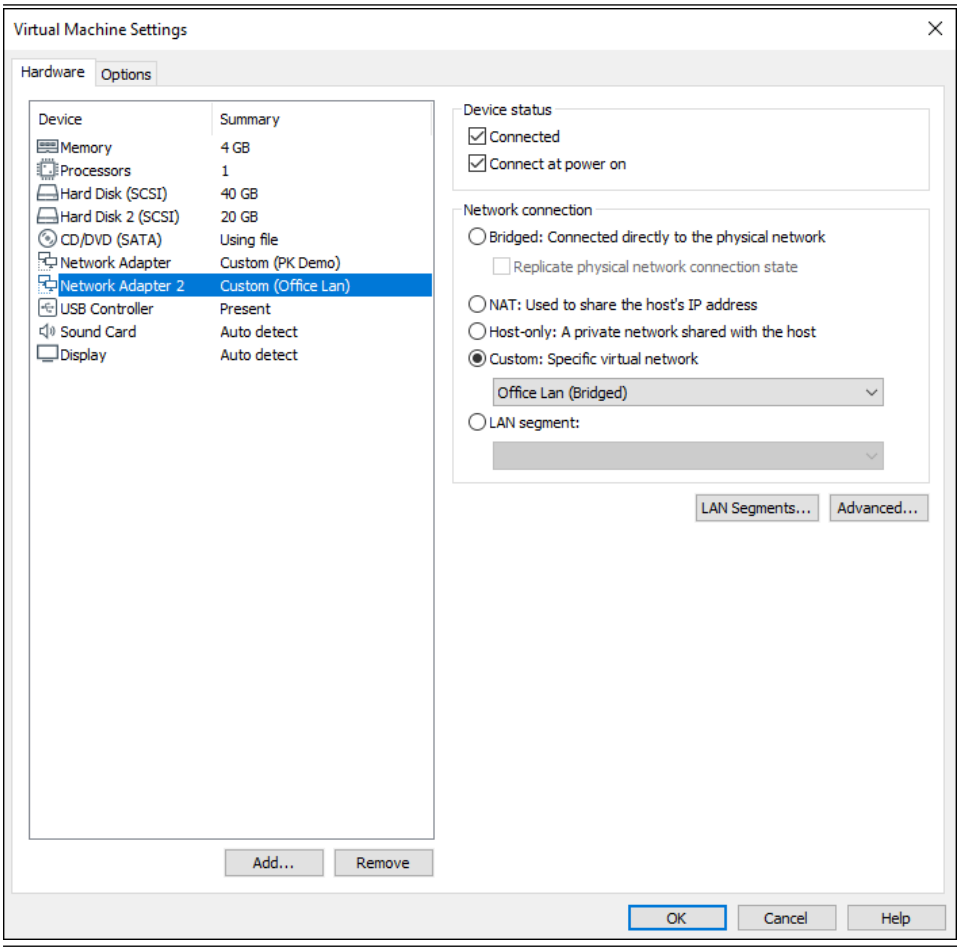
If you have already configured VMWare to use physical of the host machine to communicate with the DeltaV Primary ACN (required) and plant or office LAN (optional), you can skip to the next section.

1. On the host system, go to **Control Panel>Network and Internet>Network Connections** and make a note of the physical network connection(s) you want the virtual machine to use for DeltaV communication. Also make a note of any other network connection you want the virtual machine to use, for example, to communicate with the Internet or the plant or office LAN.
2. Launch VMWare Workstation as an administrator on the host system.
3. Select **Edit>Virtual Network Editor**.
4. In the VMNet Information section of the Virtual Network Editor dialog, select **Bridged**.



5. Use the **Bridge to:** dropdown control to select the physical network connection of the host machine that you want the virtual machine to use for DeltaV communication.
6. Click **Add Network**.
7. On the Add Virtual Network dialog that appears, select one of the VMWare aliases for virtual networks (VMnet*n*) and then click **OK**. Note that VMnet0, VMnet1, and VMnet8 are reserved by VMWare and you cannot bridge physical network connections to those aliases.
8. On the Virtual Network Editor dialog, click **Add Network**.

9. Click **OK**.
10. In the left-hand pane of VMWare Workstation, right-click the new virtual machine and select **Settings**. Make sure the active tab in the right-hand pane of VMWare Workstation displays the name of the new virtual machine.
11. On the Virtual Machine Settings dialog that appears, under the Hardware tab, select the network adapter you want to associate with the virtual network bridged to the physical network connection of DeltaV Primary ACN.
12. In the Device status section, select whether you want the virtual machine to connect to the the virtual network on powerup.
13. In the Network connection section, select **Custom: Specific virtual network** and use the dropdown control to select the virtual network you associated with the DeltaV Primary ACN using the Virtual Network Editor.

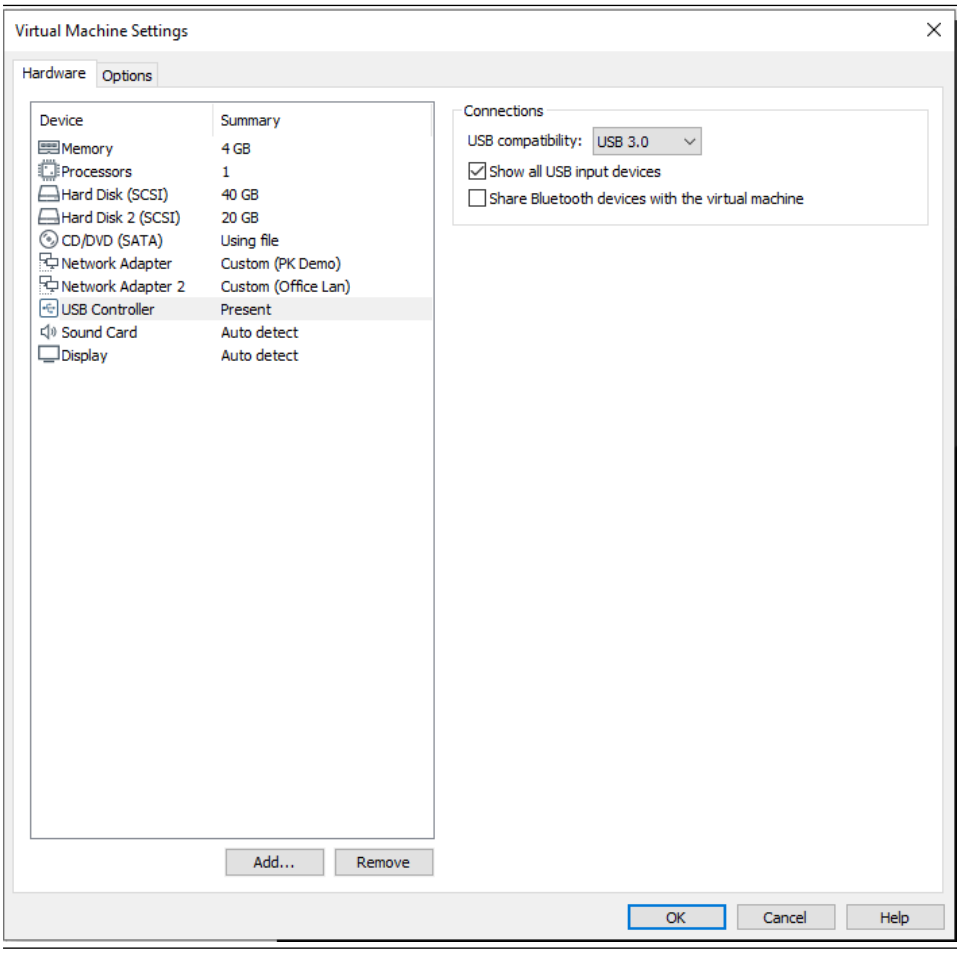


14. If you have associated a second virtual network with an Internet connection or with the plant or office LAN, you can select the second network adapter and edit the settings on this dialog accordingly.
15. Click **OK**.

4.3 Configure USB passthrough for the virtual machine

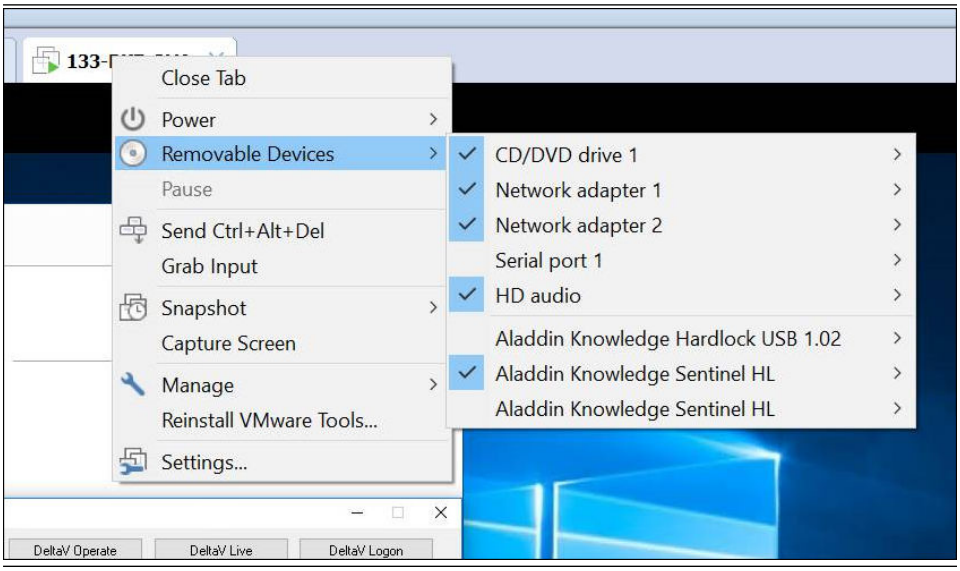
In order to use USB devices with the virtual machine, you must pass those devices through from the USB controller of the host machine to the virtual USB controller of the virtual machine. The virtual machine *must* have access to the USB DeltaV dongle. The virtual machine is shipped with the virtual USB controller configured to recognize the USB controller of the host machine. In this section, you will verify that the virtual USB controller is properly configured and pass through any USB devices you want to use to the virtual machine.

1. Right-click the virtual machine in the left-hand pane of VMWare Workstation and select **Settings**. Alternatively, you can right-click the tab of the virtual machine in the right-hand pane and select **Settings**.
2. On the Virtual Machine Settings dialog that appears, under the Hardware tab, verify that the USB controller is displayed as present.
3. In the Connections section of the dialog, verify that USB compatibility is displayed as USB 2.0 or higher.



4. Make sure the **Show all USB input devices** box is checked.

5. Click **OK**.
6. Right-click the virtual machine in the left-hand pane of VMWare Workstation, or right-click the tab for the virtual machine, and select **Removable devices**. VMWare Workstation displays all USB devices connected to the USB controller that is configured for passthrough to the virtual machine.



7. Check the entries for the DeltaV dongle and any other USB devices you want to use with the virtual machine.

4.4 Log onto the Virtual Engineering Station

1. Launch VMWare Workstation Pro or VMWare Player.
2. Select **File>>Open**.
3. Navigate to the location of the Virtual Engineering Station image on the host machine, select the image, and click **Open**.
4. Select the Virtual Engineering Station and click **Power on this virtual machine**.
5. Click **Okay** on any dialog boxes that appear while the Virtual Engineering Station is starting.
6. Click the full-screen icon to put the Virtual Engineering Station into full-screen mode.
7. Click the Ctrl-Alt-Del icon to proceed with logging onto the Virtual Engineering Station.
8. Log onto the Windows OS of the Virtual Engineering Station.
9. Log onto DeltaV on the Virtual Engineering Station.
10. On the **FlexLock** dialog box, click **Windows Desktop**.
11. Run DeltaV Workstation Configuration on the virtual machine.

5 Local HMI for the Standalone DeltaV PK controller

There are two variations of the local HMI (operator station) for the Standalone DeltaV PK controller: the DeltaV local panel HMI and the 3rd-party local panel HMI.

Note
The Standalone DeltaV PK controller must be commissioned and authenticated; and, the relevant protocol enabled, before you can communicate with the local HMI panel.

DeltaV HMI

The DeltaV HMI option is differentiated by hardware (local panel HMI or local HMI) only. Both hardware platforms are installed as a DeltaV Operator Station and are configured and downloaded using the Engineering Station. Because of utilizing the DeltaV Operator Station installation, The DeltaV HMI can be converted (by running Workstation Configuration and supplying a valid DevData.cfg file) to a licensed DeltaV Operator Station when merged with the DeltaV balance-of-plant system.

DeltaV HMI basic functionality can be expanded with ST scale-up licensing, for example, the DeltaV HMI can serve as the DeltaV Batch Executive and the DeltaV Batch Historian when appropriately licensed.

DeltaV Diagnostics on the Local Panel HMI requires the Engineering Station to be online.

3rd-party local panel HMI

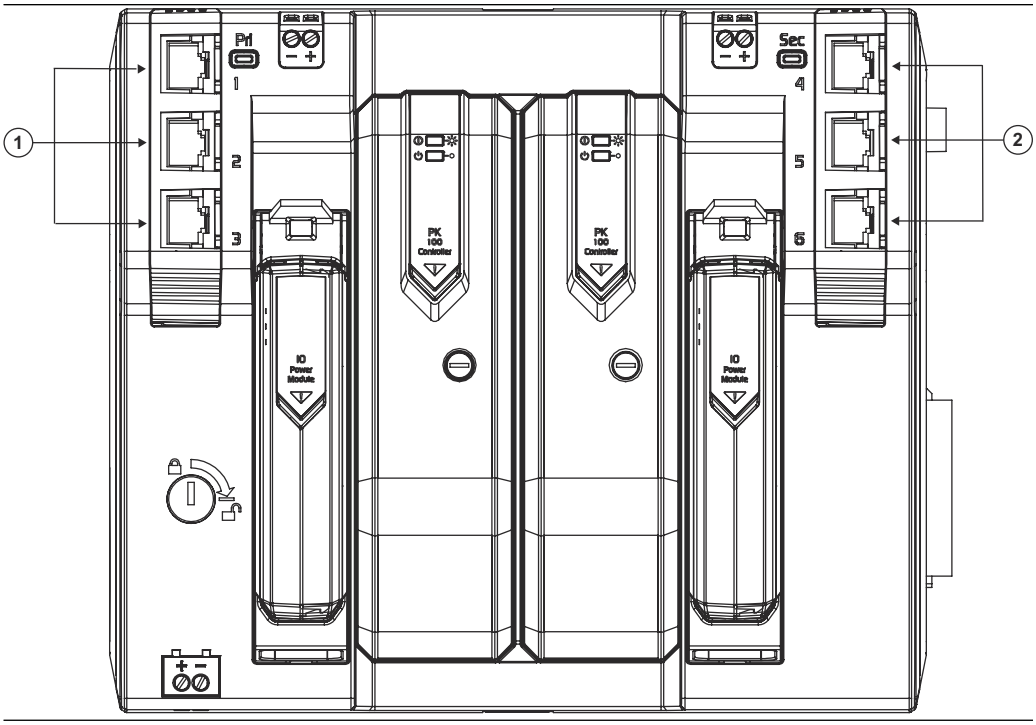
The optional Modbus local panel HMI is not installed with DeltaV nor configured using the Engineering Station. The Engineering Station enables the ModbusTCP communication and maps DeltaV parameters to the registers and coils specified by the 3rd-party HMI software. The 3rd-party software in the local panel makes use of the registers and coils.

3rd-party software in the local panel can also communicate with the PK controller's OPC UA server. Configuration is determined by the 3rd-party software installed on the local panel.

6 Networking and I/O

6.1 I/O Ports overview for the DeltaV PK controller

There are two IOPs on the DeltaV PK controller: a primary (left side) network and a secondary (right side) network. Port 1 (top left) is always enabled and cannot be disabled (allows initial connection between the Engineering Station and the controller). Port 4 (top right) is enabled by default, but can be disabled.



Callout	Description
①	Primary network side. Ethernet ports 1-3. These appear in software as Network Portx.
②	Secondary network side. Ethernet ports 4-6. These appear in software as Network Portx.

You can connect any port on the IOP to an external switch.

Note
The DeltaV Smart Switch is not supported in PK standalone systems.

You cannot bridge the primary and secondary ports.

Simplex network operation mode is accomplished by using the ports on the left side of the DeltaV PK controller.

Redundant networking is accomplished using ports on both the left (primary network) and right (secondary network) sides of the DeltaV PK controller.

The DeltaV PK controller's port 1 is always enabled and therefore is the port you must connect to the first time you configure and commission the controller.

In DeltaV Explorer, configure the controller's PO1 to a valid IP address for your device network. Your controller must be communicating through PO1 using a valid IP address for devices connected to the enabled ports on the controller's IOP (the external Ethernet ports).

Tip
If you want to create device network placeholders without affecting the overall integrity of the controller or you want to avoid IP address conflicts while configuring the devices, leave this port disabled until your configuration is ready.

6.2 Port-to-port communications on the DeltaV PK controller

Port-to-port communication allows communication from one port to be received on another port. Port-to-port communication allows each port in the group to receive communication from all other ports (up to 3 total) in the group. You can only establish port-to-port communication between the ports on the same side of the DeltaV PK controller (1, 2, 3 OR 4, 5, 6).

Conversely, you can elect to isolate the ports so that no one port communicates with any other port.

Refer to the *P-series hardware reference manual* for details on the PK controller hardware.

The default configuration has the **No ports communicate** selection. This means that all ports are isolated (no traffic between any external nodes).

Port-to-port communication does not prohibit communication between any external node connected to one of the ports from communicating with the DeltaV PK controller. This also means that any protocol enabled on the PK controller (server or client) is available on any primary or secondary ports as the protocol (server or client) is configured for primary or secondary connection respectively.

Note
The ports involved in port-to-port communication must be enabled.

Enabling the ports and configuring the port-to-port communication is accomplished using DeltaV Explorer from the PK controller's **Properties** dialog.

Important
Moving which port has which network cable can affect your port-to-port communications. That is, if you are expecting the networks on ports 1 and 2 to communicate, but you move one of the cables to port 3, the communication will physically be broken.

6.3 PK controller device network redundancy

The PK controller supports redundant device network connections through its Ethernet ports on the carrier. With redundant networks, the controller attempts communications with a device on the device's primary address first. If the primary address fails, it attempts communications on the device's secondary address (must be configured to be a redundant network on the device).

You must enable the controller's device network ports through the controller's Properties dialog's General tab.

Redundant device networks require that you configure the primary and secondary device networks to be on separate subnets. Additionally, all devices that are connected to the controller must have IP addresses that match the subnets of the network to which the devices are connected.

Note

Understanding IP addressing and the subnet mask is key to creating separate subnets. The basic rule is that the sum of the IP address and the subnet mask define the subnets.

IPv4 addresses are grouped into 4 octets, where each octet represents a very large binary number. Depending on the subnet mask, you will need to change the appropriate octet to create the different subnets for your primary and secondary device networks.

For example, if the primary device network is 192.168.1.100 with a subnet mask of 255.255.255.0, you must change the **third** octet to create a different secondary subnet (192.168.**2**.101 with a subnet mask of 255.255.255.0).

Contact Emerson support for assistance in designing the device network IP addressing.

6.4 IO for the DeltaV PK controller

The DeltaV PK controller supports the following IO communication:

- Local I/O (connected through the railbus)
- I/O through the IOPs (Ethernet I/O Ports)
- Modbus TCP (through the Device Network)
- Ethernet IP (through the Device Network)

The DeltaV PK controller supports the following I/O:

- M-Series I/O cards (with the exception of M-Series IS I/O cards)
  - Direct connection to 4-wide and 8-wide carriers.
  - Up to 8 carriers (any combination of 4- or 8-wide carriers).
- S-Series I/O cards
  - With an adapter to connect the S-series 8-wide carrier to the PK controller.
  - Up to 8 carriers.
- CHARMs I/O (CIOC and CIOC2)
  - Up to 16 CIOCs (total number of cards combined with WIOCs).
  - Networked through DeltaV ACN - redundant or simplex.

- Wireless I/O
  - Up to 16 WIOCs (total number of cards combined with CIOCs).
  - Networked through DeltaV ACN - redundant or simplex.
- M-series Zone 2 Remote I/O

Note
For the fastest loop execution time, use the supported High Density cards in a simplex configuration. Redundant configuration, Bus cards, increased loading of the railbus all contribute to longer loop execution times.

The supported cards for fast execution (that is, 25ms and 50ms module execution time) are

- DI Card, 32 Ch., High Density, M-series Series 2 Plus
- DI Card, 32 Ch., High Density, Redundant, M-series Series 2 Plus
- DO Card, 32 Ch., High Density, M-series Series 2 Plus
- DO Card, 32 Ch., High Density, Redundant, M-series Series 2 Plus
- DI Card, 32 Ch., High Density, S-series Plus
- DI Card, 32 Ch., High Density, Redundant, S-series Plus
- DO Card, 32 Ch., High Density, S-series Plus
- DO Card, 32 Ch., High Density, Redundant, S-series Plus

6.5 Referencing the IO from devices on the DeltaV PK controller

DeltaV Explorer displays the devices attached to the DeltaV PK controller as both physical and logical devices under the port. The logical devices contain signals that define the specific data items in the devices to be accessed. The device data can be mapped into DeltaV module parameters through the signal DSTs. The port, devices, and signals have configuration properties unique to each protocol.

When connecting devices to the DeltaV PK controller, data from those devices can only be referenced within the controller connected to the device. Device data cannot be externally referenced directly from another controller (or workstation) without going through a module parameter in the DeltaV PK controller.

6.6 Local device network for the DeltaV PK Controller

6.6.1 Modbus TCP on the DeltaV PK controller's local device network

The Modbus TCP interface on the DeltaV PK controller's local device network allows communication to/from Modbus TCP data sources such as drives, motor control centers, analyzers and similar devices.

A Modbus client can read and write data from/to Modbus servers (slave devices). Modbus server devices can be direct Modbus TCP devices or Modbus serial devices under a Modbus TCP gateway.

The **Modbus TCP Port** on the DeltaV PK controller is a Modbus **server** (a slave device). The DeltaV PK controller's **PO1** is a Modbus TCP **client** (master). The two (server and client) ports cannot be switched.

The PO1 subsystem is disabled by default allowing you to configure the local device network without affecting the controller's overall integrity and without creating IP address conflicts during configuration.

Configuring the local device network involves setting a unique IP address and binding it to a physical Ethernet port on the PK controller. Configuration is performed in DeltaV Explorer on the PO1's **Properties** dialog's **Advanced** tab.

Modbus Data Access

The Modbus TCP interface supports the following types of data access using the Modbus TCP protocol:

- Reading input data from Modbus Coils, Discrete Input, Holding Registers, and Input Registers.
- Writing output data to Coils and Holding Registers.
- Input data is read in multiple mode to give the best performance.
- Output data can be written either as single values or as complete blocks.

All reads will be performed periodically and outputs will be sent when they are written at a rate limited by the execution rate of the module writing the outputs.

Only the Modbus TCP standard protocol is supported. The RTU via TCP and RTU via UDP supported by the VIM are not supported in the Standalone DeltaV PK controller.

The logical devices and signals defined under the Modbus device include the information needed to identify the specific Modbus device (for serial devices under a Modbus TCP gateway) and register being accessed.

Modbus Polling Rate

The Modbus TCP polling rate depends directly on the number of physical devices, logical devices, and signals configured. The Modbus interface implementation scans the local device network at rates up to a scan cycle of 50 msec (this is the best possible speed).

6.6.2 EtherNet/IP on the DeltaV PK controller's local device network

The EtherNet/IP (EIP) interface on the DeltaV PK controller allows communication to/from EIP data sources such as PLCs, variable-speed drives, motor control centers (MCCs), analyzers, sub-sea devices, and similar devices communicating EIP. The EIP interface is an EIP I/O scanner reading and writing data from/to EIP I/O adapters and other scanners. Typical ring, star, and linear topologies are supported with the EIP interface network.

EtherNet/IP (EIP) Data Access

The EIP interface supports connections for both implicit and explicit messaging to allow access to the following data in EIP I/O adapter devices:

- Reading and writing real-time I/O data and produced/consumed data - implicit messages (Class 1)
- Reading and writing data - explicit messaging (Class 3)

The logical devices and signals defined under the EIP devices include the information needed to identify which data attribute within an instance (EIP data is grouped within instances of particular object classes) is to be accessed. Implicit I/O data transfers are used with a cyclic trigger to read I/O data.

Poling Rate

Inputs and outputs are cyclic based on the configured Requested Packet Interval (RPI), ranging from 50 msec to 2 seconds.

Configuration Considerations

Redundant PK nodes can impact your configuration planning.

Switchover time is the time it takes for control of devices to pass from one PK to the other in a redundant pair. Switchover time depends on the communication protocol, the number of connected devices (PDTs in the DeltaV hierarchy), and the number of LDTs and signals configured for the connected devices.

Note
When the PK is using either of the supported EtherNet/IP protocols for control, devices must be configured to delay going into fail-safe state after detecting a communication loss. The delay time must be greater than the switchover time for the PK. Otherwise, devices will go into the fail-safe state whenever control passes from one PK to the other in the redundant pair.

7 Servers

7.1 Servers to third-party systems for the DeltaV PK controller

The DeltaV PK controller supports the following servers to communicate with third-party systems:

- Modbus TCP server
- OPC UA server

The controller can communicate to a third-party control system through Modbus TCP with the controller acting as a slave device (Modbus server). The DeltaV PK controller supports both simplex and redundant Modbus communication.

The controller can communicate to third-party OPC UA with the controller acting as an OPC UA server, providing real-time data, alarms and events, and history data to OPC UA clients.

7.2 Modbus Port on the DeltaV PK controller

DeltaV PK controllers can communicate to a third-party control system through Modbus TCP with the controller acting as a slave device (Modbus server). The DeltaV PK controller supports both simplex and redundant Modbus communication.

The DeltaV PK controller can handle both communications (DeltaV and Modbus) simultaneously by using different IP addresses for Modbus communication and selecting different physical ports for each protocol (configured on the **Properties** dialog **Advanced** tab in DeltaV Explorer).

Note
It is important that IP addresses assigned to any device connected either directly or through a switch to any of the ports must be unique. Since IP address verification is done at configuration, if a device is plugged into the network later with an IP address that conflicts with an existing device, it will cause problems on the network due to duplicate IP addresses.

When Modbus is enabled, the primary communications port defaults to any of the left-side physical ports (Primary Network Ports 1-3) of the DeltaV PK controller and the Modbus Server port is set to 502 (and is not configurable).

Redundant server connectivity is accomplished by selecting enabling the secondary port on the Modbus properties dialog. Secondary connection is available on the right-side physical ports (Secondary Network Port 4-6) of the DeltaV PK controller.

Configure the IP address for Modbus TCP through the **Modbus Port Properties** dialog. Set the number of each type of register on the **Data Sets** tab. Define Modbus TCP register mapping on the **Map Registers** or **Register mapping** dialogs.

Enabling the Modbus Port enables one Modbus stack that makes available (to connected clients) the data mapped into a single Modbus register table. When Modbus TCP is selected as the DeltaV PK controller's data server, the Modbus stack serves register Modbus register table on the enabled ports. The number of TCP connections is limited to 8 across the primary and secondary ports.

Note
The DeltaV PK controller's Modbus server is a **Big-Endian** device and the clients must be configured accordingly.

The following table shows the register types and their data types and the number of values and register addresses that can be configured.

Table 7-1: Modbus Port data configuration

Register type	Data type	Description	Number of values	Base register address (read-only and fixed)
coil	Boolean	For discrete output parameter read/ writes	0 to 1000	R1
input status	Boolean	For discrete input and status parameter reads	0 to 1000	R10001
float input	floating point	Floating point for analog input parameter reads	0 to 3000 (in increments of 2)	R30001
integer input	8- or 16-bit unsigned	Integer for integer value input parameter reads	0 to 3999 (restricted by the last register being 39999)	R36001
float holding	floating point	Floating point for analog input parameters read/ writes	0 to 3000 (in increments of 2)	R40001
integer holding	8- or 16-bit unsigned	Integer for integer value input parameters read/ writes	0 to 3999 (restricted by the last register being 49999)	R46001

Note
There is only one data set for each register type and the register offset will always be 0. The data set must be sized large enough to account for all register usage required for that type. The base register address shown in the table above is a read-only field and is the start address of that type.

Writes to integer register mapped to a 32bit integer Module parameter of a value over 16bits is not supported. Use a float register for this module parameter.

You map individual parameters to Modbus port registers from the **Register mapping** and **Map Register** dialogs in DeltaV Explorer. Use Bulk Edit to easily map large numbers of parameters.

8 DeltaV PK Controller and local HMI licensing

8.1 Licenses for the Engineering Station and local DeltaV HMI

There are three components that are licensed on the Standalone DeltaV PK controller; the controller itself (by the number of device signal tags); the Engineering Station; and, the local HMI.

The system key defines what the workstation is (either an Engineering Station or a local DeltaV HMI). Additional licenses define what you can do on that workstation (for example, enabling features of the software). Only the workstations require system keys as described here which are attached to the appropriate workstation's USB port.

The DeltaV PK controller

The DeltaV PK controller is licensed based on the number of device signal tags (DSTs) purchased. You are prevented from downloading more DSTs than the controller is sized for. No other licensing is required. Once commissioned and downloaded, the controller runs independent of any other licenses.

Note
You cannot change a PK controller from one licensed DST amount to another (for example, from a PK100 to a PK300). You must replace the one controller with one that is licensed at the new value.

When the controllers are redundant, both must be replaced and both must have the same DST limit.

DeltaV Engineering Station

The Engineering Station is licensed by the system key that is attached to the Engineering Station. When the Engineering Station is removed, the controller continues to operate having been commissioned and downloaded by the Engineering Station.

There are two classifications of Engineering Station system keys - the Basic and the Professional. Both contain the major version license and, if purchased, the Guardian Support license.

Note
The Basic license does not allow for the Event Chronicle or the Sequence of Events (SOE) Collector on the Engineering Station. Therefore, you must disable the Engineering Station's Alarms and Events subsystem before you can download the Engineering Station.

1. Expand the node in DeltaV Explorer.
2. Right click the node's **Alarms And Events** subsystem and select **Properties**.
3. Uncheck the **System SOE Collector** box.
4. Uncheck the **Enabled** box.

5. Click **OK**.

DeltaV PK SystemID Key Update Tool

The SystemID Key Update tool displays the current expiration, the major version, and CSS licenses of the Engineering Station system identifier. Use this tool in conjunction with an update file to extend the expiration or update the Major Version or CSS license. Run the DeltaV PK SystemID Key Update tool on the Engineering Station. It is located in the `DeltaV\Bin` folder as *PKKeyUpdate.exe*.

Note
Folder access might require elevated permissions to run this application.

Local HMI Workstation

The local HMI is licensed by the system key that is attached to it. This system key remains attached to the HMI station.

There is only one classification of system key for the local HMI - the Standalone HMI (ST).

The local HMI also requires license files (.LIA) that enable the appropriate software features. These files are copied to the `DeltaV\DVData\Standalone` folder.

Note
The standalone system license allows for the Event Chronicle and the Sequence of Events (SOE) Collector on the local DeltaV HMI.

The local HMI licenses (that is, the basic operator station and the multiple monitor licensing) as well as the scale-up licenses are not recognized by a DeltaV balance-of-plant system.

The Standalone License Manager

Local HMI licensing is viewed using the Standalone License Manager. This tool (*DVSTDiag.exe*) is located in the `DeltaV\Bin` folder (folder access might require elevated permissions to run this application).

8.2 Standalone DeltaV PK controller system keys' functionality

The following table defines what each license permits you to do when using the Standalone DeltaV PK controller's Engineering Station and DeltaV local HMI node.

Specific Node and DST counts are not covered in this table. You are limited to the node/DST count of the controller purchased.

It is necessary to download the node with the system key in the USB port and to leave the system key inserted to have all the functionality expected for the inserted system key type. If you change system keys, the functionality of the workstation is affected; for example, if you exchange a PM system key for a BM system key, the Engineering Station now only be able to use the functionality permitted by the BM system key.

Note
These licenses are not compatible when merged with the balance-of-plant DeltaV system.

Function/ Application	Description	Basic System Key (BM)	Professional System Key (PM)	HMI Standalone System Key (ST)
Advanced Unit Management	Allows this feature for the number of units (class-based unit module) licensed. PK100 allows 2 units (in the project) PK300 allows 4 units (in the project) PK750 allows 8 units (in the project) PK1500 allows 12 units (in the project)		X	
Advanced Batch Units	Allows running DeltaV Batch Executive providing batch processing control. The base license allows enabling of the Batch Executive and the Batch Historian. The default base license also includes 2 units (class-based unit modules referenced in operations). Additional scale-up (add-on) licenses are available and can be loaded together, up to 12 units total.			X
Advanced Control	Allows running the following DeltaV Advanced Control applications: • DeltaV InSight Basic (includes DeltaV Tune)		X	
	• DeltaV Predict (limited to 1 manipulated variable)	X	X	
	• DeltaV PredictPro (limited to 1 manipulated variable)	X	X	
	• DeltaV SimulatePro		X	

Function/ Application	Description	Basic System Key (BM)	Professional System Key (PM)	HMI Standalone System Key (ST)
Commission	Allows commissioning of hardware.	X	X	
Configuration Comparison	Allows the comparison between the local configuration on the Engineering Station with the project on the DeltaV PK controller. Comparing is performed using the DeltaV PK Controller Administration application.		X	
Configuration Hiding	Allows the *Hide Internal Structure* feature of Composite Templates, Control Module Classes, Equipment Module Classes, and Phase Classes.		X	
DeltaV Live Configuration	Allows running the DeltaV Live System Management and Graphics Studio applications.		X	
DeltaV Live Operations	Allows running DeltaV Live. Additional add-on license is available for a four monitor configuration.			X
Device Alerts	Allows device alerts for up to 1500 tags.		X	
Download	Allows downloading of nodes.	X	X	
Export	Allows this function in Control Studio and DeltaV Explorer.	X	X	
DeltaV Device Commissioner	Allows running the DeltaV Device Commissioner application. **Note** The I/O Studio application runs with either the Professional or Basic system key.		X	

Function/ Application	Description	Basic System Key (BM)	Professional System Key (PM)	HMI Standalone System Key (ST)
Historical Data Collection on the Engineering Station	Allows historical data collection to be downloaded on the node. The feature can be configured on the Engineering Station without the system key, but cannot be downloaded to the Engineering Station without the system key.		X	
Historical Data Collection on the DeltaV Local HMI	Scale-up (add-on) licenses are available to increase the DST count. This scale-up (add-on) license is not compatible when merged with the balance-of-plant DeltaV system.			X After merging into the balance of plant, the operator station must be licensed using a conventional DeltaV Event Chronicle license to continue using this feature on the operator station. Conversely, the Event Chronicle can be disabled on this workstation.
Loop Tuning	Allows the running of the DeltaV InSight and DeltaV Tune applications. The DeltaV Inspect functions are also enabled, but data is not persisted during project switching.		X	
Retrieve Configuration	Allows the retrieval of items from the DeltaV PK controller's SD card backup into the active project. Retrieving is performed using the DeltaV PK Controller Administration application.	X	X	

Function/ Application	Description	Basic System Key (BM)	Professional System Key (PM)	HMI Standalone System Key (ST)
Save	Allows this function in Control Studio and DeltaV Explorer.	X	X	
Simulation	Allows simulation/testing of control strategy by assigning modules to the Engineering Station. Also allows you to use the DeltaV SimulatePro application, provided the SimulatePro license is also present.		X	
SIS Configuration	Allows the downloading of an SLS1508 or CSLS.		X	

8.3 Update the Engineering Station's system key

This procedure describes how to use the PK SystemID Key Update tool for Standalone DeltaV PK controller systems.

The system key is attached to the Engineering Station's USB port.

The Engineering Station is attached to the Standalone DeltaV PK controller if you intend to commission or download the controller.

The Engineering Station (for a Standalone DeltaV PK controller) is licensed from the attached system key.

Updating the system key is performed using the PK SystemID Key Update tool.

You can also view details about the attached system key without updating it using this tool.

You can only update one system key at a time.

1. Browse to the `DeltaV\Bin` folder.

   Folder access might require elevated permissions to run this application.

2. Right click the *PKKeyUpdate.exe* file and select **Run as administrator**.
3. The PK SystemID Key Update displays current information about the system key (in the **SystemID Key Information** section). The SystemIDs are prefaced with the following:

   - BM - The Basic key
   - PM - The Professional key
   - ST - The Standalone HMI key

   Additionally, the following terms and abbreviations are used

- Major Version - The number designating a major release of the software. For example, the *14* of *v14.3*. The key must be equal to or greater than the currently installed software's major version.
- CSS - The Guardian support licensing.

Note
The software detects DeltaV system identifiers and displays them first. To find the Engineering Station's system key, disconnect other keys on this workstation until the one you want is displayed.

4. Update the system key by clicking the **Browse For Update File** button.
5. Locate the file.
   If a system key matching the update file is found, the system highlights the appropriate update. If the system key does not match any update in the file, you must find the correct update file or find the right system key.
6. Click the **Update The SystemID Key** button.
   When the update completes, the new information is displayed in the **SystemID Key Information** section.
7. To update another system key, disconnect the one currently shown and connect the next key. Repeat the update process.

8.4 View local HMI licenses

This procedure describes how to use the Standalone License Manager to view the local HMI licensing.

You must have the Standalone (ST) system key attached to the local HMI's USB port.

You must have the license files (.LIA) copied into the `DeltaV\DVData\Standalone` folder.

Local HMI licensing is viewed using the Standalone License Manager.

1. Browse to the `DeltaV\Bin` folder.

   Folder access might require elevated permissions to run this application.

2. Right click the *DVSTDiag.exe* file and select **Run as administrator**.
3. The Standalone License Manager displays current information about the system and the licenses.

The Standalone License Manager verifies that the licenses are valid and that all prerequisites are met and then applies the licenses to the workstation.

If the licenses are not valid or if any licensing prerequisites are not met, the licenses are not applied and a red X is shown. You can expand the section for the reason why the license was not applied.

9 Maintaining time synchronization on the Standalone DeltaV PK controller

Maintaining time synchronization on the DeltaV PK controller's network is required. This requires the communication between a time master and a time slave. The time synchronization protocol used for the Standalone DeltaV PK controller is NTP (Network Time Protocol).

The Standalone DeltaV PK controller is, by default, the NTP Time Master for its respective project SKID. All associated DeltaV nodes (operator workstation, CIOC's/WIOC's/SZ) sync with the Standalone DeltaV PK controller automatically.

You can set the controller's time in the PK Controller Administration application to prevent any drift that may happen.

Each Standalone DeltaV PK controller and its associated nodes rely on a request-response method for time synchronization. For each node in the project, NTP has the IP address of the PK controller configured as a time master. The other nodes query the PK's IP address explicitly. This prevents the associated nodes from obtaining time from any other PK controller on the same network. This also means that, for each project skid, all nodes within the project effectively operate as a time island and do not synchronize at all across projects (that is, across PK controllers).

To use a GPS time server for your project, use the appropriate IP addressing (as outlined in Books Online); and, connect the GPS and PK to the appropriate network. The nodes automatically synchronize with the GPS.

The Engineering Station has NTP installed on it. Engineering Stations that are not permanently attached to the PK controller must be in time sync with the PK controller before connecting to it. Set the Engineering Station's time to match the controller's time using normal Windows date and time settings.

10 Terms

DeltaV local panel HMI
A DeltaV-licensed panel computer, local to the DeltaV PK controller. The licensing for this panel computer includes DeltaV Operator Workstation with full span of control. The DeltaV local panel HMI computer can be merged into the balance-of-plant DeltaV system with the DeltaV PK controller. Conventional DeltaV licenses are required once the DeltaV local panel is merged.

IOP (IO Port)
The module on the DeltaV PK controller that houses the Ethernet ports. There are two IOPs on the DeltaV PK controller: primary (left side) and secondary (right side). The secondary is normally used for redundant networks for your IO communication. The IOP can communicate using native DeltaV, Modbus TCP, OPC UA server, and either Modbus or Ethernet IP client protocols.

Merge/ merging
This process takes the database from the Standalone DeltaV PK controller and combines it with the existing balance-of-plant DeltaV database to create one unified database, and places the DeltaV PK controller (and DeltaV local panel HMI if present) as native nodes on the DeltaV network.

The merge process identifies potential tag name conflicts; saves the last configuration on the Standalone DeltaV PK controller; shows the license demand of the standalone system; decommissions the Standalone DeltaV PK controller and commissions it as a node on the DeltaV network.

PK controller engineering software
The tools you use to configure the Standalone DeltaV PK controller. The software applications make it easy to establish communications with a Standalone DeltaV PK controller and to manage project files associated with different controllers. The tools are essentially the same as the DeltaV balance-of-plant engineering tools, with the main limitation being that the DeltaV PK controller engineering software cannot be used to configure controllers other than DeltaV PK controllers; and, it can only configure one DeltaV PK controller per project.

PK controller Engineering Station
When operating in a standalone deployment (not part of a balance-of-plant DeltaV system), the DeltaV PK controller Engineering Station provides all the configuration and management capabilities that a Standalone DeltaV PK controller requires when in standalone deployment. Once the Standalone DeltaV PK controller is merged with the balance-of-plant DeltaV system, the Standalone DeltaV PK controller Engineering Station is no longer used.

Project
When in standalone deployment, the DeltaV PK controller's project contains everything associated with that controller, its attached devices, and the local panel HMI. This includes the logic configuration, graphics files, device configurations, and so on.

There can only be one DeltaV PK controller per project.

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