

Installing TotalControl

**Includes installation instructions for
Design Studio and Building Services Version 4.5.3.15**

TotalControl 4.0.4.0 and later will not support any edition of SQL Server 2005. Review Service Bulletin SB180410 if this applies to an existing system that will use or upgrade SQL Server 2005.

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About this manual

This publication is an installation manual for all of the components of TotalControl. Review this material in its entirety before installing any of the TotalControl programs.

This manual covers installation for both TotalControl Design Studio and Building Services. Sections in this manual include the following topics:

- Information you need to gather before you begin installing TotalControl.
- Requirements and specifications for the computers on which TotalControl will run.
- Installing TotalControl at a new location or job site.
- Upgrading existing TotalControl sites.
- Customizing the installation of TotalControl.
- Starting Design Studio.
- Uninstalling selected components of TotalControl.
- Appendix material and overview of TotalControl and other useful information.
- A glossary of terms used with TotalControl.

What you need to know

This manual assumes your familiarity with the following:

- Your computer and the Windows operating system.
- The principles of the building automation systems that will be managed with TotalControl.

In addition to the material presented in this user's guide, review and have available the following reference material.

- The user's guides for each device in the system.
- A sequence of operation for each piece of equipment in the site.
- Detailed plans and drawings for the building automation system.
- Information about the Local Area Network (LAN) including routers, switches, and network firewalls.

Conventions used

Some of the text in this publication uses special formatting to indicate emphasis or keystrokes. The text conventions are as follows:

Menu and dialog items	Highlights items in the TotalControl interface, including buttons, dialog names, menus, and commands in menus.
<code>Control Basic</code>	Highlights text that can be used in Control Basic programming.
<code>File names</code>	Highlights names of files and extensions.
<i>Italics</i>	Indicates a book or section title, a Control Basic keyword, mnemonic, or a value.
KEY NAMES	Indicates a specific key on the keyboard such as SHIFT or ENTER .

If you encounter difficulty

If you experience difficulty with TotalControl, KMC Controls, Inc. provides the following assistance.

Printed version of help An Adobe Acrobat version of TotalControl help is available from the KMC Controls website. The PDF document is identical to the online help, but it is formatted to print as a reference manual.

The KMC Controls web site Navigate to the support section on the KMC controls web site for the latest information for TotalControl and other KMC Controls products.

www.kmccontrols.com

KMC technical support Our distribution partners have unlimited and free access to our team of Technical Support representatives. We provide coast-to-coast and toll-free support from 8:00 AM Eastern Time to 5:00 PM Pacific Time.

Toll-Free Technical Support: (866) 303-4562

Section 1: Read this first

This section covers preparations that you will need to make before you begin installing TotalControl.

Before you install TotalControl, you will need to perform some prerequisite tasks.

- Be familiar with the concepts and parts of a TotalControl managed site. See [An overview of TotalControl on page 43](#).
- Gather system information. See [Things you will need on page 9](#).
- Determine your computer requirements. See [Choose a deployment option on page 10](#).
- Set up the computers as describe in [Setting up computers on page 15](#).

About the installer

Beginning with TotalControl version 3.0, the installer includes significant improvements to the installation process.

- You no longer have to stop or uninstall any component of TotalControl before upgrading to the new version.
- Microsoft.NET framework and Internet Information Services (IIS) are installed automatically.
- If SQL Server Express is the chosen database server, it will be installed automatically.

Things you will need

To install TotalControl, you will need the following items and information:

- Detailed plans and drawings for the building automation system.
- Information about the LAN including routers, switches and firewalls.
- Installation files from the Downloads area in the Partner Portal on the KMC Controls web site.
- The name or IP address of the server on which TotalControl will be installed or is installed.

Choose a deployment option

Before you begin installing TotalControl, make a decision on the following issues:

- Computer selection
- Hosting the SQL database
- Web Portal access
- License keys

Computer selection

TotalControl can run from a single computer or can be deployed to run on several computers. Various deployment options are discussed in the section [An overview of TotalControl on page 43](#).

Determine a database host computer

TotalControl requires a SQL database server. The server can be any of the following:

- SQL Server Express edition will be installed with TotalControl if no other SQL Server is designated. This database should be used on systems with no more than 300 controllers.
- Use an existing edition of Microsoft SQL Server that is operated by the IT department. This is the preferred method if SQL Server Express is not used.
- A new, dedicated installation of Microsoft SQL Server.

See the topic [Computer requirements on page 12](#) for the SQL server specifications.

Plan for operator web pages and kiosk connections

The exact number of concurrent web connections to the computer running the TotalControl web components is limited both by the operating system of the computer on which the web components are installed and site licensing.

In summary:

- Every concurrent operator connection to the Web Portal requires two web connections.
- A connection from a kiosk requires one web connection.
- Each concurrent operator connection to the Web Portal and kiosk connection requires a license.

The number of concurrent connections for each type of operating system is listed in the table [Concurrent web connections on page 10](#).

Table 1–1 Concurrent web connections

Operating system	Concurrent web connections
Windows 10	20
Windows 11	20
Windows Server	Unlimited, but may require an upgrade from Microsoft

See the related topic [About the custom components on page 29](#).

Licensing

Several of the components of TotalControl require a hardware license key for activation.

- Small sites operating from one computer require a key for the licensed components of Building Services.
- For larger systems, a license key or access to a key on a computer running the license service is required for each computer on a site that is running a component of Building Services that requires a license.

The license for Design Studio can be added to any key at the site. Typically, the license is added to a key that will be plugged into a USB port on the computer on which Design Studio will run.



Tip: Once TotalControl is installed, the Hard License key can be converted to a license file. See [Converting a USB hardware license to a soft license key on page 85](#).

Computer requirements

Computers running TotalControl must meet the minimum hardware and operating system requirements listed in the tables in this topic. Review these requirements before installing TotalControl.

TotalControl Building Services and Design Studio will run on either 32-bit or 64-bit versions of Windows. The components of TotalControl can be installed on hot-swappable or replicated servers as long as the servers meet the minimum operating system requirements for TotalControl.

See also the topic [SQL server requirements on page 14](#).

Table 1–2 Windows 11 computer requirements

Component	Requirements
Operating system	Windows 11 Professional
Processor	Two or more cores, 64-bit
Trusted Platform Module (TPM)	Yes
Processor speed	2 GHz or faster
RAM	4 gigabyte (GB)
Graphics adapter	DirectX 12 or greater graphics processor

Table 1–3 Windows 10 computer requirements

Component	Requirements
Operating system	Windows 10 Professional
Processor	Two or more cores, 32- or 64-bit
Trusted Platform Module (TPM)	No
Processor speed	2 GHz or faster
RAM	2 gigabyte (GB) for 32-bit or 64-bit
Graphics adapter	DirectX 9 or greater graphics processor

Table 1–4 Windows Server 2022 computer requirements

Component	Requirements
Windows Server 2022	Windows 11 operating system
Processor	Two or more cores

Table 1–4 Windows Server 2022 computer requirements (continued)

Component	Requirements
Trusted Platform Module (TPM)	Yes
Processor speed	2 GHz or faster
RAM	16 GB or greater

Table 1–5 Windows Server 2019, Windows Server 2016 computer requirements

Component	Requirements
Windows Server 2019, 2016	Windows 10 operating system
Processor speed	Two or more cores
Trusted Platform Module (TPM)	No
Processor speed	2 GHz or faster
RAM	16 GB or greater

Table 1–6 Windows 10 Computer platform requirements

Component	Recommended	Minimum
Hard disk space	500 GB 100 GB free	80 GB 60 GB free
Monitor	1920 x 768 or higher	SVGA 1024 x 768
Network connection	100BaseT Ethernet	10BaseT Ethernet (Design Studio only)
Internet connection	High speed (3 Mbps minimum)	
USB	USB port dedicated to hardware key	

SQL server requirements

TotalControl Building Services store data in a Structured Query Language (SQL) database. Microsoft SQL Server Express*, a lightweight version of the Microsoft SQL Server family, is included with Building Services. KMC Controls recommends upgrading to a Microsoft SQL Server Workgroup, Standard, or Enterprise edition on sites with more than 300 controllers.

See also the topic [Computer requirements on page 12](#).

Table 1–7 SQL server requirements

Recommended	Minimum
Microsoft SQL Server 2022	SQL Server 2016**
Microsoft SQL Server 2019	
Microsoft SQL Server 2017	
Microsoft SQL Server 2014*	

*Microsoft SQL Server 2014 Express is installed for Windows 7 and older.

**Microsoft SQL Server 2016 Express is installed for Windows 8 and newer.

Browser requirements

The TotalControl Web Portal is compatible with the following HTML5 browsers.

- Firefox version 71.0 or later
- Google Chrome version 78.0 or later
- Internet Explorer version 11 or later
- Microsoft Edge Chromium version 80.0 or later

Other browser requirements.

- If Adobe Flash is enabled, Adobe Flash Player version 11 is required. Enabling Flash is a local option and not required to use the Web Portal.
- The recommended monitor resolution is 1280 x 1024 pixels or larger. The minimum recommended resolution is 1024 x 768.
- The Web Portal does not require Java applets or custom ActiveX controls.

Setting up computers

Computers hosting TotalControl must meet the requirements listed in the section [Computer requirements on page 12](#). Before installing a program on any TotalControl computer, verify the computer name, passwords and privileges, and sleep and hibernation modes.

In summary:

- Place the computers in a secure location.
- Connect each to the local area network.
- KMC Controls recommends that you operate each computer hosting one of the services from an uninterruptible power source.

Computer names

Assign names to the computers that consist of only numbers and letters.

Assign names to the computers that consist of only numbers and letters.



Caution: If the computer that hosts IIS is assigned a name using characters other than numbers or letters, the Web Portal will not work correctly. Use only numbers or letters when naming computers on which a component of TotalControl will operate.

Passwords and privileges

Have available a user name and password for each computer on which a component of TotalControl will be installed. The installing technician must have Windows administrator privileges.

Sleep and hibernation modes

To avoid corrupting the hardware license key, change the power settings for the computer. To change the power settings for your version of Windows, do the following:

- 1 Use the Help function in Windows to search for “power” or “power management”.
- 2 Choose the Help topic for changing or setting up a power scheme.
- 3 In the power scheme, change the computer power settings to disable hibernation and set the sleep mode to “never”.

Set up and configure the BACnet internetwork

The BACnet internetwork¹ consists of BACnet devices and usually one or more routers. The devices and routers should be configured before installing TotalControl. See Application Note 0404A, *Planning BACnet Networks*.

In summary:

- BACnet network protocol, network numbers, and UDP port assignments are configured in a BACnet router such as a BAC-5051(A)E or BAC-5050 router. The routing functions in a BAC-A1616BC Building Controller may also be used.
- BACnet device instance numbers are assigned to individual controllers. The exact method will depend upon the manufacture and type of controller. The method will be described in the installation manual for the controller.
- The TotalControl BACnet PDS must be installed on a computer with network access to either a BACnet IP or BACnet Ethernet network.

See the related topics [About the custom components on page 29](#) and [Configuring the Cimetrix BACstac driver on page 67](#).

¹A BACnet internetwork can be as simple as a single network but is usually two or more BACnet networks connected by routers. The BACnet protocol permits up to 65,534 interconnected networks in an internetwork. Internetworks may contain similar or dissimilar physical types such as Ethernet, IP or MS/TP.

Set up and configure KMD controllers and networks

The components that make up the KMC Digital¹ (KMD) network are configured with the Hardware Configuration Manager (HCM), a software tool that is free to KMC partner organizations.

KMD Tier 1 network connections

- A KMD Tier 1 network consists of at least one KMD-5205, KMD-5210, or KMD-5270 Tier 1 controller.
- The computer on which the KMD PDS will be installed must have network access to a KMD Tier 1 controller.
- Each controller must have an address assigned to it with the HCM.
- Tier 1 controllers must also have IP addresses, gateway, and subnetwork information configured with the HCM.



Note: For best operation, install or upgrade KMD-5210 LAN controllers with firmware 4.0.0.22 or later.

Tier 2 network connections

- The computer on which the KMD PDS will be installed must have physical access to the Tier 2 network.
- The computer must also include a serial port or USB-to-serial adapter.
- Each controller must have an address assigned to it with HCM.

See the related topic [About the custom components on page 29](#).

Download new installation files

The latest TotalControl installation files are distributed in a single `.zip` file. The file is available to our partners at the following web site:

partners.kmccontrols.com.

All of the files for TotalControl Building Services and Design Studio are included in the `.zip` file. The same `.zip` file is used for both new installations and site upgrades.

Once the file is downloaded, temporarily disable any security features that might block the installation. Extract the contents and save the extracted folder in a convenient location.

¹KMDigital is a proprietary line of digital building automation controllers manufactured by KMC Controls, Inc. The controllers are either Tier 1 or Tier 2 controllers. Tier 1 controllers connect directly to a LAN through Ethernet; Tier 2 controllers connect to each other and Tier 1 controllers on an EIA-485 network. KMDigital is often abbreviated as KMD.

Section 2: Installing a new job site

This section is the procedure for installing a new version of TotalControl on a single computer.

This section applies only to new installations of TotalControl. For upgrading an existing installation, see [Upgrading an existing job site on page 23](#).

About new installations

There are several configurations and deployment possibilities for installing TotalControl. This section covers a typical new installation on a single computer. During installation, the following items will be installed on the computer.

- Microsoft.NET framework
- Microsoft Internet Information Services (IIS)
- Microsoft SQL Server Express (optional)
- Cimetrics BACstac BACnet driver
- System Monitor Engine Service
- BACnet PDS (requires a license)
- KMD PDS (requires a license)
- OPC PDS (requires a license)
- Protocol Gateway Service (requires a license)
- Trend Service
- Notification Service
- License Service
- TotalControl Service Control Panel
- Design Studio (requires a license)
- TotalControl Web Portal components
- TotalControl utilities

During installation, the installing technician can choose to use an SQL database server on a computer other than the computer on which TotalControl is being installed. Typically, this is a database server that is managed by an IT department. When using another database server, SQL Server Express is not installed.

Before you install

Before you begin to install the software, perform the following tasks or gather the following information:

- Have available the information listed in [Things you will need on page 9](#).
- An installation file from the [KMC Controls partners](#) web site.
- If you are using a SQL database on a computer other than the computer on which you are installing TotalControl, you will need the database name and password.
- A user name and password for the computer on which you are installing TotalControl. The user must have Windows administrator privileges.
- Choose a name and administrator's password for the site.
- A hardware license key or keys for the installed services and Design Studio.

Choosing the Typical, Custom, or Restore options

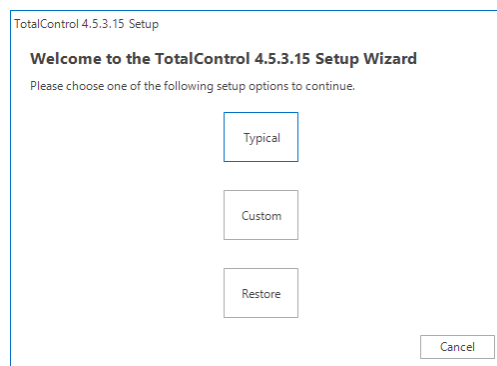
When the installation procedure begins, you will have the following three choices:

- Choosing **Typical** installs all of the TotalControl components. This procedure starts in the topic [Begin installing TotalControl on page 20](#)
- If you choose **Custom**, you will have the option to install only selected components. See the topic [Custom installations on page 27](#) before continuing.
- Use the **Restore** option only with a site backup file. See the topic [Installing from a backup file on page 33](#) before continuing.

Begin installing TotalControl

You will need the latest TotalControl installation files for this procedure. See the topic [Download new installation files on page 17](#) before starting.

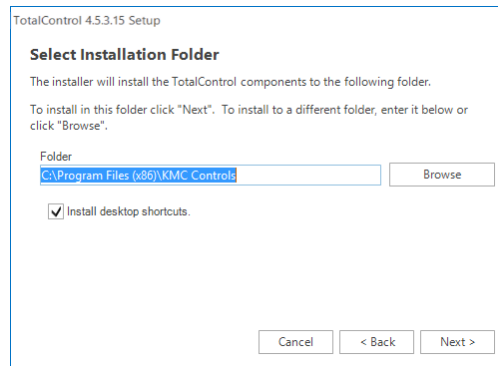
- 1 Open the extracted installation folder and double-click the **Setup** icon.
- 2 When the **Welcome to the TotalControl... Setup Wizard** opens, click **Typical**.



3 Select the **Create Site** dialog box.

- 4 Enter the name of the job site in **New Site Name** using only letters, numbers, or the underscore (_) for the site name. Spaces, punctuation, or special characters will cause problems when using the Web Portal.
- 5 Enter a password in both **Site Admin Password** and **Retype Site Admin Password**. This is the master password for the job site. This password will be used with the user name *admin* to open Design Studio. Record this password on the worksheet in [Worksheet for site data on page 55](#).
- 6 If the site will use SQL Server Express, the server name is the name of the computer on which you are performing the installation. If you are using another server, such as a server managed by the IT department, do one of the following:
 - Enter the name of the server in **Server Name or IP Address**. The name of the server is supplied by the database server administrator. Using the name is the recommended method to identify the server.
 - Enter the IP address of the server in **Server Name or IP Address**.
- 7 Enter the named instance of the database server in **SQL Named Instance**.
 - For SQL Server Express, the named instance is **SQLEXPRESS**.
 - For other database servers, use either **<default>** or obtain the named instance from the server administrator.
- 8 Select the **Use Windows Authentication** check box unless instructed by the IT department or the database server administrator. When selected, the current Windows user information is used and the Database Username and Database Password fields are unavailable.

- 9 Click the button under **Test Connection**. This creates an SQL database connection to the defined server.
 - If the connection is successful as shown in the Connection Details box, click **Next**.
 - If the connection fails as shown in the Connection Details box, click **See Details** for more information. Correct the problem(s) described and then repeat the test.
- 10 Select a folder in which TotalControl will be installed. KMC Controls recommends installing TotalControl in the default location. Click **Next>** when ready.



- 11 Once installation begins, additional interaction may be required for any of the following items:
 - To acknowledge an end-user license agreement.
 - To grant permission in a security dialog to continue installation.
 - To locate Windows files to install IIS.

After installation

After installation, you will need to configure the BACstac driver and the Notification service.

BACstac driver configuration For new installations that connect to a BACnet internetwork, the BACstac BACnet driver is installed with the following configuration:

- The BACnet IP protocol
- Network 1
- UDP port 47808 (Hexadecimal BAC0)

To change the BACnet network configuration, see the following topics.

- [Configuring BACstac for BACnet IP on page 68](#)
- [Configure BACstac for Ethernet 8802.3 on page 72](#)

Notification service (email) Before TotalControl will send operator email messages, the Notification service must be configured with the credentials for an SMTP email server. See the topic [Configuring TotalControl for an email server on page 81](#) in the section [The Service Control Panel](#).

Section 3: Upgrading an existing job site

Existing installations of TotalControl are upgraded from the same installation flash drive as the one used to install a new site. This section describes how to upgrade an existing site.

This section applies only to upgrading an existing TotalControl job site. For installing a new job site, see the topic [Installing a new job site on page 19](#).

Applicable versions

TotalControl version 4.0.x.x can be used to upgrade versions 2.0 and later. For versions earlier than 2.0, contact customer service or technical support before upgrading a site. Contact information is in the section [If you encounter difficulty on page 8](#).

Before you begin the upgrade

Before you begin the upgrade, perform the following tasks or gather the following information.

- Have available the information listed in the topic [Things you will need on page 9](#).
- The name of the SQL database server on which the site database is located.
- An installation file from the KMC Controls web site.
- A user name and password for the computer on which you are installing TotalControl. The user must have Windows administrator privileges.
- The site name and administrator's password for the site.
- A hardware license key or keys for the installed services and Design Studio.

Updating hardware license keys

Hardware license keys issued for previous versions may not work with upgrade versions. The first two numbers of the version in the key must be the same as the version of TotalControl to which you are upgrading.

In summary:

- Update the site key *before* upgrading a site.
- Contact customer service at KMC Controls, Inc. for authorization to update an existing site key.
- Existing site keys can be updated over the Internet. If Internet access is not available at the site, a technician key—a key with a red tag—can be used to keep the site operational while updating the site key at a location where Internet access is available. A technician key will operate the site for 72 hours and then the key will have to be removed and reinserted for an additional 72 hours of operation.

Choosing the typical, custom, or restore options

When the installation procedure begins, you will have the following three choices.

- Choosing **Typical** installs all of the TotalControl components. See the topic [Installing a new job site on page 19](#)
- If you choose **Custom**, you will have the option to select which TotalControl components to install. See the topic [Custom installations on page 27](#) before continuing.
- Use the **Restore** option only with a site backup file. See the topic [Installing from a backup file on page 33](#) before continuing.

About the upgrade

This upgrade adds several new features and corrects some problems found in previous versions of TotalControl. The following is a list of some major changes to this version of the installer.

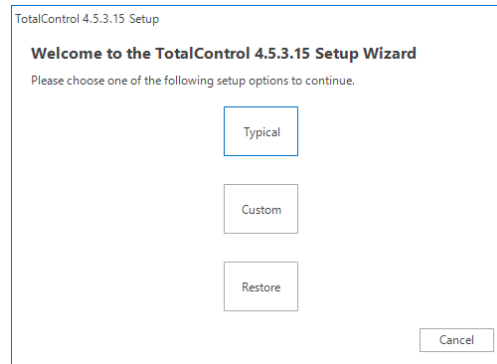
- If required, the correct version of Microsoft.NET framework¹ will be installed on your computer.
- If required, the Cimetrics BACstac driver will be upgraded to the latest version.
- The individual building services no longer have to be stopped and uninstalled. This is handled entirely by the installing program.
- If—during installation—you choose the Typical option, all of the components will be installed on the computer.
- See *Technical Bulletin TB0309A, TotalControl Release Notes* for details on improvements and bug fixes in this version.

¹The Microsoft .NET Framework is a component of the Microsoft Windows operating system. It provides a large body of pre-coded solutions to common program requirements, and manages the execution of programs written specifically for the framework. The framework is intended to make it easier to develop computer applications and to reduce the vulnerability of applications and computers to security threats.

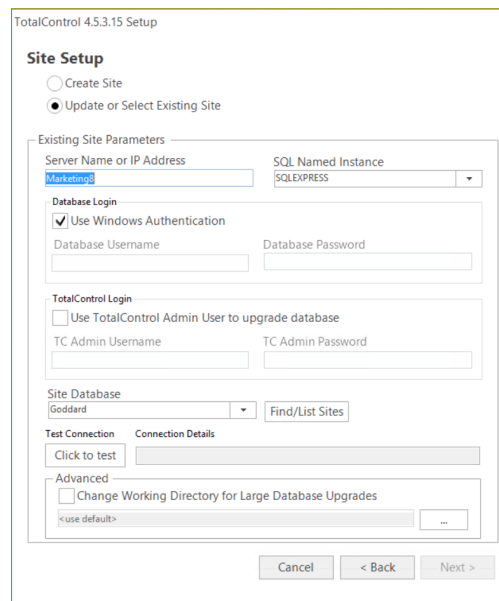
Upgrade the site

You will need the latest TotalControl installation files for this procedure. See the topic [Download new installation files on page 17](#) before starting.

- 1 Open the extracted installation folder and double-click the **Setup** icon.
- 2 When the **Welcome to the TotalControl Setup Wizard** opens, click **Typical**.

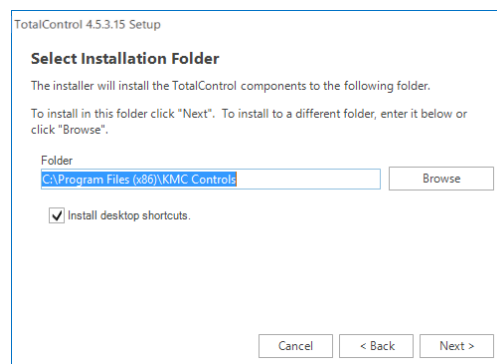


- 3 Select **Update or Select Existing Site**.



- 4 If the site will use SQL Server Express, the server name is the name of the computer on which you are performing the installation. If you are using another server, such as a server managed by the IT department, do one of the following:
 - Enter the computer name of the server. The name of the server is supplied by the database server administrator. Using the name is the recommended method to identify the server.
 - Enter the IP address of the server.
- 5 Enter the named instance of the database server in **SQL Named Instance**.
 - For SQL Server Express, the named instance is **SQLEXPRESS**.
 - For other database servers, use either **<default>** or obtain the named instance from the server administrator.

- 6 Log in using one of the following methods.
 - The **Use Windows Authentication** check box (selected by default). This method uses the current Windows user credentials. The Database Username and Database Password fields are unavailable.
 - Use the Database Username and Database Password by clearing the check box. Use this method if instructed by the IT department or database server administrator to use these credentials for the SQL database.
 - Select the **TotalControl Login** check box to use the TotalControl Admin credentials. When selected, the Windows user and Database login fields are unavailable.
- 7 Clear the **Working Directory for Large Database Upgrade** check box unless moving a large database.
- 8 Click the button under **Test Connection**.
 - If the connection is a success as shown in the Connection Details box, click **Next**.
 - If the connection fails as shown in the Connection Details box, click **See Details** for more information. Correct the problem(s) described and then repeat the test.
- 9 Select a folder in which TotalControl will be installed. KMC Controls recommends installing TotalControl in the default location. Click **Next** when ready.



- 10 Once installation begins, interaction may be required to grant permission in a security dialog.

After installation

After installation, verify that the Cimetrics BACstac driver has the correct protocol settings. Also, remove any unneeded protocol entries from the driver. To change or verify the BACnet network configuration, see the following topics.

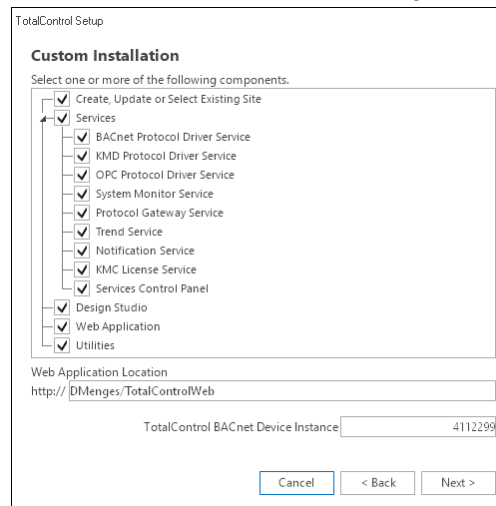
- [Configuring BACstac for BACnet IP on page 68](#)
- [Configure BACstac for Ethernet 8802.3 on page 72](#)

Section 4: Custom installations

During installation, individual components of TotalControl can be selected for a custom installation. This section describes each of those components.

Choosing the Custom option when installing TotalControl offers the installing technician the choice of which of the TotalControl components to add to a single computer. The components are selected in *TotalControl Components dialog*.

Illustration 4–1 TotalControl Components dialog



Once the components are selected, the installer program verifies that the computer has all the required operating system components and then proceeds with the installation as if it were a typical installation.

Installing with the custom option

TotalControl 4.0 installation files are distributed in a .zip file available from the Downloads section of our web site at partners.kmcccontrols.com. All of the files for TotalControl Building Services and Design Studio are included in the .zip file. Once the file is downloaded, extract the contents and save them in a convenient location.

Use of the TotalControl custom installation option is the same for both installing a new site and upgrading an existing site. These procedures are covered in other sections.

- [Installing a new job site on page 19](#)
- [Upgrading an existing job site on page 23](#)

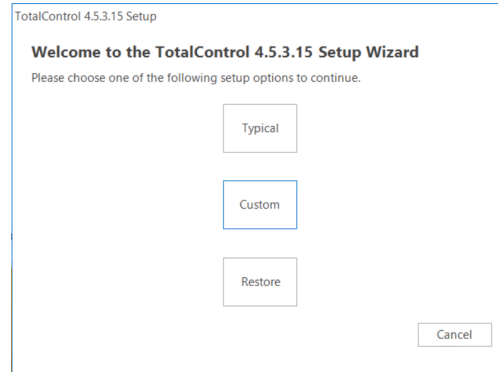


Note: Repeat the Custom installation process for every computer in the site on which a component of TotalControl is installed.

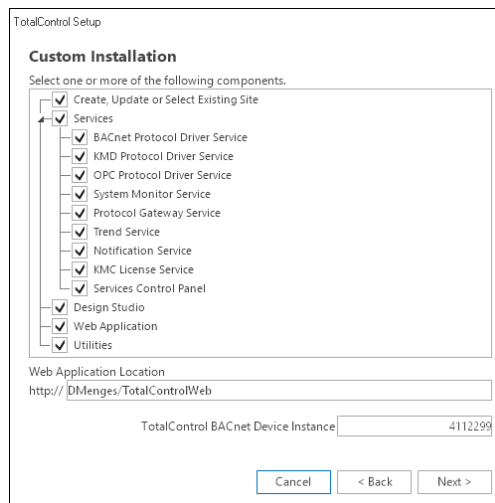
To use the Custom option during installation, do the following.

- 1 Open the extracted folder and double-click the **Setup** icon.

- 2 In the TotalControl opening dialog, click **Install TotalControl**.
- 3 When the **Welcome to the TotalControl Setup Wizard** opens, click **Custom**.



- 4 If needed, change the device instance number of the BACnet PDS in the Custom Installation dialog.
- 5 If the Web Portal will use a URL other than the default, enter the URL in Web Application Location. The default URL is `http://computerID/TotalControlWeb`.
- 6 Select the required components to install and then click **Next**.



- 7 Continue with either of the following procedures.
 - If installing a new job site, proceed with the step [Select the Create Site dialog box. on page 21](#).
 - If you are upgrading an existing site, proceed with the step [Upgrade the site on page 25](#).

Shortcuts for custom installations

There are several shortcuts that you may choose from the Components dialog. To use a shortcut command, right-click anywhere on the Components dialog and then choose one of the following shortcuts:

- **Select All** selects all component check boxes.
- **Clear All** clears all component check boxes.
- **Select Typical BACnet Site** selects all components except the KMD PDS and OPC PDS.
- **Select Typical KMD Site** selects all components except the BACnet PDS and the OPC PDS.
- **Select Typical OPC site** selects all components except the KMD PDS and the BACnet PDS.

About the custom components

Each of the components that can be selected during a custom installation is described in the following topics.

Create, Update or Choose a Site When selected, this option controls the installation for the TotalControl database configuration.

- During a new installation, you will have the choice to install SQL Server Express or supply the name of another SQL server.
- For an update, the installer migrates the existing database to a new format.

BACnet Protocol Driver Service When the BACnet PDS is installed, the Cimetrics BACstac driver is also installed on the same computer. The Cimetrics BACstac driver connects the TotalControl BACnet Protocol Driver Service to the BACnet internetwork. See [Configuring the Cimetrics BACstac driver on page 67](#) for additional details on the BACstac driver.

Device instance The BACstac driver is a BACnet device and is required to have a device instance number.

- For new installations, the installing program assigns a random number as the BACnet instance number. After installation, use Design Studio to locate this number in the Network Manager list under the BACnet service. Record the device instance on the worksheet located in the appendix [Worksheet for site data on page 55](#).
- When the BACstac driver is upgraded, the installing program preserves the existing instance number. However, the device instance can be changed in the Component Selection dialog during installation.

BACnet internetwork configuration The BACnet internet work connection will vary depending upon whether the installation was new or an upgrade. For new installations, the driver is configured as follows:

- The BACnet IP protocol
- Network 1
- UDP port 47808 (Hexadecimal BAC0)
- These settings can be change by following the procedures in the section [Configuring the Cimetrics BACstac driver on page 67](#).
- When upgrading an existing site, the installer preserves the original BACstac network settings.



Note: Each BACnet PDS must be licensed before it can be activated.

KMD Protocol Driver Service The KMC PDS must be installed on a computer that has network access to a KMD Tier 1 controller. No information about the KMD network is required at the time the service is installed. You will need the IP network address of one of the KMD Tier 1 controllers when you add the KMD network to the site database with TotalControl Design Studio.



Note: For best operation, install or upgrade KMD-5210 LAN controllers with firmware 4.0.0.22 or later.



Note: The KMD PDS must be licensed before it can be activated.

OPC Protocol Driver Service The OPC PDS must be installed on a computer that has access to one or more OPC servers. If the OPC PDS is not installed on the same computer as the OPC server, either DCOM must be enabled on the OPC server or a third-party DCOM tunneling program must be installed. No information about the OPC network is required at the time the OPC PDS is installed. You will need the name of the OPC server when you add an OPC network to the site database with TotalControl Design Studio.



Note: The OPC PDS must be licensed before it is active.

System Monitor Service Selecting the System Monitor Service installs the System Monitor Engine. The System Monitor Engine (SME) coordinates the movement of data among the other services, Design Studio, and the web components.



Note: The computer on which the system monitor engine is running requires a hardware license key for any additional licensed web seats.

Protocol Gateway Service The Protocol Gateway Service transfers values between different types of TotalControl supported BAS protocols with one or more defined processes. The processes are set up with the Protocol Gateway Manager in Design Studio. The Protocol Gateway Service is typically installed on the same computer as the System Monitor Engine (SME). It does not require information during installation.



Note: The Protocol Gateway Service requires a license before it is active. This license is required to use timed overrides in the Web Portal. If you do not have a license, contact KMC Customer Service.

Trend Service The Trend service manages data collected by controllers for storage in the site database and for display by either Design Studio or the Web Portal. It does not require a license.

Notification Service The Notification service performs alarm management for operator notifications and displays alarms in both Design Studio and the Web Portal. It also sends e-mail messages to key operators. After the Notification service is installed the e-mail service must be configured as described in the topic [Configuring TotalControl for an email server on page 81](#). The Notification service does not require a license.

License Service The license service provides a method to activate a licensed component from a hardware key on a remote computer. The most common use for the service is in installations where a licensed component is operating on a server without a USB port or when Design Studio is operated through a Remote Desktop Connection.

Service Control Panel When selected, the Service Control Panel icon will be added to the Windows notification area. See [The Service Control Panel on page 75](#).

Design Studio This is the master operator software with which you can build browser-based operator pages, configure controllers, manage the database, and set up security, trends, schedules, and alarms.



Note: Design Studio requires a license in order to be activated.

Web Application The web application components serve the TotalControl operator Web Portal and kiosk pages to an Internet browser. The Web Application must be installed only on a computer hosting the Internet Information Service (IIS). The installer will automatically install IIS when Web Application is selected. Record the name of the computer under [Web Portal data on page 57](#) on the worksheet in the Appendix [Worksheet for site data on page 55](#).



Caution: Use only numbers or letters when naming computers on which a component of TotalControl will operate. If the computer that hosts IIS is assigned a name using characters other than numbers or letters, the Web Portal will not work correctly.



Note: The computer on which the system monitor engine is running, not the computer serving web pages, requires a hardware license key for any additional licensed web seats and kiosk computers.

Section 5: Installing from a backup file

During installation, TotalControl can be installed using the settings and data from a backup file. This section describes how to use a backup file to either restore a site or to create a new site from the data and settings in a backup file.

A controls technician can use the Restore command in Design Studio to make a backup file as a source for configuration settings when installing TotalControl. When using the Restore command, the technician can do the following:

- Create a new site with the configuration settings and data from a backup file. This is typically used to set up a site on a computer at one location—such as in a workshop—and then transfer settings and data to the computer at the final site location.
- Restore site configuration and data after a computer malfunction.

Backup files are created only with Design Studio. There are two types of backup files.

- A site backup file contains site configuration settings and data in one compressed file. The file may then be taken to another computer to transfer settings and data.
- A scheduled backup file contains only data from the site SQL database. This file is typically created to automatically save operational and performance data on a regular basis.

Before you install

Restoring from a backup file may require changing settings in the Restore TotalControl Components dialog. Review the following information before starting the installation.

Establish a database or database connection

When restoring or installing from a backup file, a connection to an SQL server must be established.

- Installing an instance of SQL Server Express is the default for the TotalControl installation program. If no other server is designated and SQL Server Express is already on the computer, the installation program will recognize the installed version and use that version to host the site database.
- All components installed at the same time will point to the server designated by Server Instance and SQL Named Instance in the Restore TotalControl Components dialog box.
- If the site is to use an existing SQL server, such as one operated by the IT department, a connection to the server must be designated in the Restore TotalControl Components dialog box.
- If components of the TotalControl are to be installed on more than one computer, the same server instance and SQL named instance must be entered every time a component is installed.

Changing configuration settings for services

During installation, settings for some components can be selected and changed. Typically, these changes include network ports, addresses, or timing settings. The changes are made from the component list at the bottom of the Restore TotalControl Components dialog box.

Restoring to a single computer

When restoring all of the components of a site to a single computer, select all of the services in the list at the bottom of the Restore TotalControl Components dialog box.

Either allow SQL Server Express to be automatically installed or designate an existing server. See [Establish a database or database connection on page 34](#).

Restoring to multiple computers

When installing the components and services for a TotalControl site on more than one computer, the site database must be established as a first step. The database used for the site can be a new version of SQL Server Express, an existing version of SQL Server Express, or a link to an existing SQL database. During installation, do one of the following:

- Allow SQL Server Express to be automatically installed. This must be done on the first computer on which a component of TotalControl is installed.
- Designate an existing server such as one managed by an IT department.
- When installing components on subsequent computers, designate the same SQL server.

Renaming the site

The Site Name text box holds the name of the site from the backup file. This can be changed to rename the site. If the site is renamed, it must have the same name for every installed component.

Installing a new site from a backup file

This is an advanced procedure. Before installing from a backup file, review the information in [Before you install on page 34](#).

Using the TotalControl restore option during installation is similar to using the custom option. However, instead of installing the components of TotalControl with default settings, TotalControl is installed with configuration settings from a backup file.

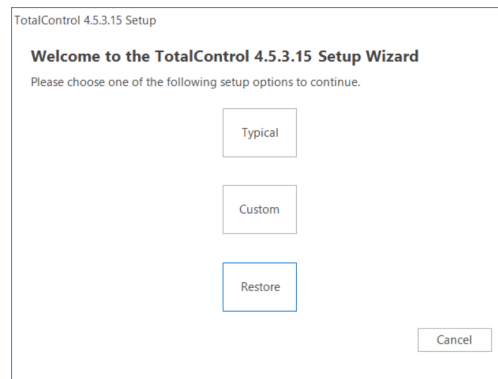
You will need the following items to install TotalControl from a backup file.

- A backup file created with Design Studio. Site backup files contain configuration settings for the TotalControl services as well as data from the SQL database.
- Detailed plans and drawings for the building automation system.
- Information about the LAN. This includes routers, switches and firewalls.
- A hardware license key for each computer on which a licensed component will be installed.
- The installation file available from the Downloads area in the Partner Portal on the KMC Controls web site. See the topic [Download new installation files on page 17](#) before starting.

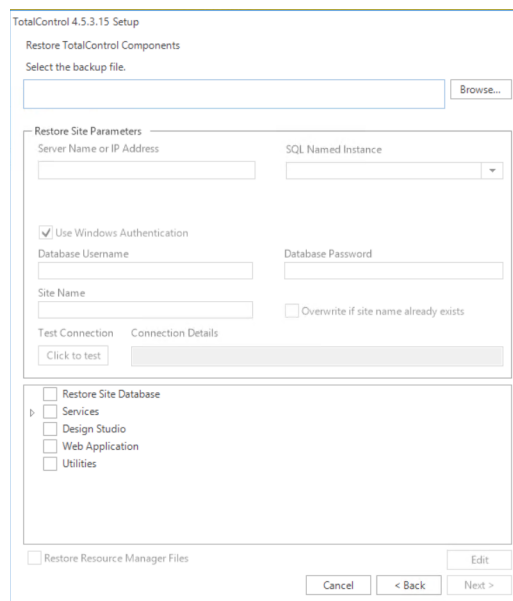
To install from a backup file:

- 1 Open the extracted installation folder.
- 2 Double-click the **Setup** icon.
- 3 In the TotalControl opening dialog, click **Install TotalControl**.

4 When the **Welcome to the TotalControl Setup Wizard** opens, click **Restore**.



5 The **Restore TotalControl Components** dialog box opens. Use this dialog to make changes to the settings for the restored site.



6 If the site will be using SQL Server Express, the server name is the name of the computer on which you are performing the installation and is automatically filled in. If you are using another server, such as a server managed by the IT department, do one of the following.

- Enter the name of the server in **Server Instance**. The name of the server is supplied by the database server administrator. Using the name is the recommended method to identify the server.
- Enter the IP address of the server in **Server Instance**.

7 Enter the named instance of the database server in **SQL Named Instance**.

- For SQL Server Express, the named instance is **SQLEXPRESS**.
- For other database servers, use either **<default>** or obtain the named instance from the server administrator.

8 Select the **Use Windows Authentication** check box unless instructed by the IT department or the database server administrator.

- 9** In the list of components at the bottom of the dialog, select the check boxes for the components to be installed. If a component is to be installed on another computer, clear the check box.
- 10** To rename the site when it is installed, change the name in **Site Name**. Use only letters, numbers or the underscore (_) for the site name. Spaces, punctuation, or special characters will cause problems when using the Web Portal.
- 11** To change the settings for a selected component—for example, a device instance or port number—do the following:
 - a. Select the item in the list and then click **Edit**.
 - b. When the Edit Configuration dialog opens, select an item to change.
 - c. Make changes and then click **OK**.
- 12** Click the button under **Test Connection**. If the connection attempt is successful as shown in the Connection Details box, click **Next**. If Next is not available, click **See Details** for more information. Correct any problem(s) and then repeat the test.
- 13** Once installation begins, additional interaction may be required for either of the following items.
 - To grant permission to continue in a security dialog.
 - To locate Windows files to install IIS.

Section 6: Using Design Studio

Design Studio is the master operator software for a TotalControl managed site. The following topics briefly cover the first steps of using Design Studio to open a job site.

Design Studio is a software configuration tool that a controls technician can use to build browser-based operator pages, configure controllers, manage the database, and set up security, trends, schedules, and alarms.

Starting Design Studio

The program starts the same as other Windows applications.

To start Design Studio, do the following:

- 1 Insert a valid hardware key or verify that a hardware key is inserted into a USB port.
- 2 Click **Start** and then point to **KMC Controls**, and then **TotalControl Design Studio**.

When Design Studio starts and it has previously been set up to open an existing site, the **Open Site** dialog will open.

- If you are connecting to the site listed at the top of the dialog, enter a user name and password and then click **OK**.
- If you are not connecting to the site, click **Cancel**.

Using Design Studio without connecting to site

Without connecting to a job site, you may use Design Studio to prepare graphic pages, write Control Basic files, or configure controller template files. The work performed while not connected to a site is stored on a local or network computer drive. The prepared files can be transferred to the site when Design Studio connects to the site.

See the following help topics in Design Studio for additional information:

- To edit Control Basic programs, see the section *Control Basic and Code Editor*.
- For creating graphics for the user interface, see the topic *Graphics Designer*.
- To prepare templates, *Under Design Studio Basics*, see *About Resource Manager*.

Connecting to a site

To connect to an existing site or to create a new site, under the help topic *Design Studio Basics*, see *Connecting to job sites with Design Studio*. The help topics will cover the following:

- Opening an existing job site
- Adding an existing job site to the Site Explorer list
- Creating a new site.

You will need also the following information:


- The address of the computer hosting the site SQL database. This is either an IP address or a URL.
- If you are establishing a new site, you will need also the user name and password for the SQL database administrator.
- The site name and an *Admin* or *TCadmin* user name and password for the site.

Section 7: Uninstalling components of TotalControl

This section explains how to remove a component of TotalControl that is no longer needed.

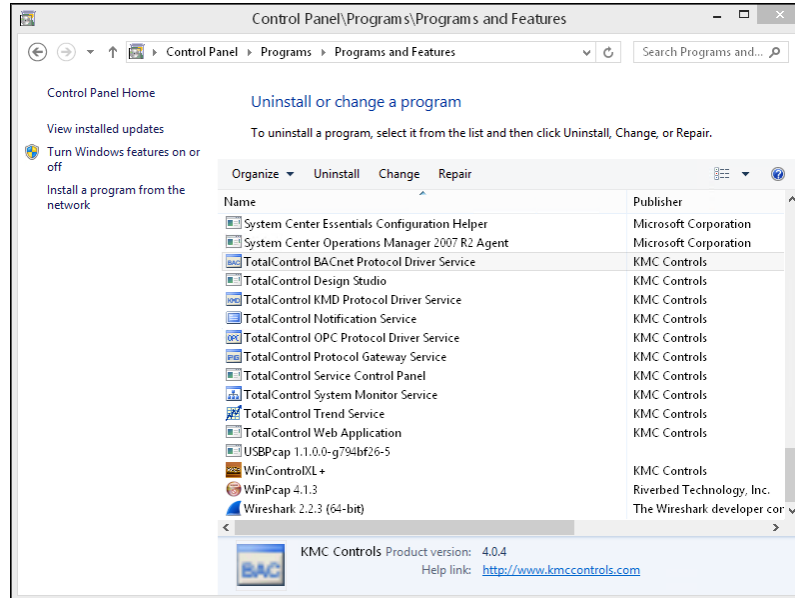
Components of TotalControl may need to be removed from the computer on which they were installed because they were installed erroneously or are no longer needed. They do not need to be uninstalled before installing a new version of TotalControl.

To uninstall any component of TotalControl, do the following:

- 1 If you are uninstalling Design Studio, continue at Step 3.
- 2 Stop the service from the Service Control Panel by doing the following:
 - a. Locate the Service Control Panel icon  in the notification area.
 - b. Double-click the icon. The Service Control Panel dialog opens.
 - c. Click a service icon or select the row for the service.
 - d. Click **Stop Service**.
 - e. Click the Minimize button (—) when finished.
- 3 Click **Start>Settings>Control Panel** and then choose **Add or Remove Programs**.
- 4 Scroll to the TotalControl programs in the **Currently installed programs** list. See the illustration [Installed TotalControl programs on page 42](#) for a list of the programs.
- 5 Choose a TotalControl program and then click **Remove**.
- 6 When removal of the program is finished, repeat for all other unneeded or unwanted TotalControl programs in the list.
- 7 When all programs on the computer are removed, restart the computer.

- 8 Repeat this procedure for each computer on which a TotalControl building service or program is installed.

Illustration 7–1 Installed TotalControl programs



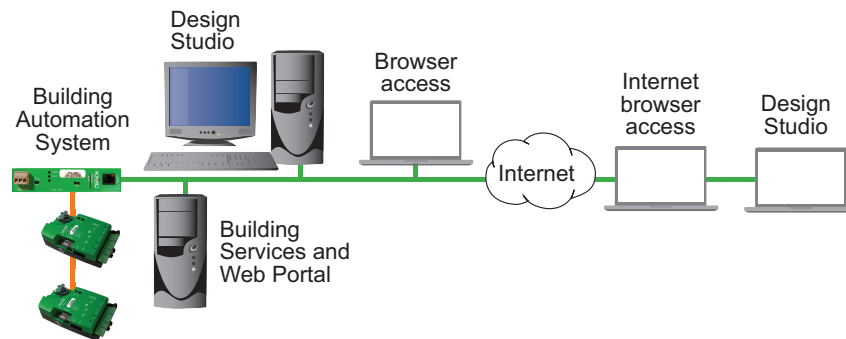
Appendix A: An overview of TotalControl

Topics in this section outline the major components and features of TotalControl, several deployment possibilities and computer requirements for a TotalControl managed building automation system.

TotalControl is a software approach to providing Internet-based facilities management for a building automation system. Built on the Microsoft .NET framework, TotalControl is a flexible solution that provides multiple deployment possibilities to match the size of the building automation system, the protocols in use, and customer requirements for operator access. Regardless of size or complexity, all TotalControl systems are built around the same core components.

- *The TotalControl Web Portal* and an Internet browser provide intranet or Internet access to the building automation system.
- The components of *TotalControl Building Services* collect, store, and move data between the controllers and the web components.
- *TotalControl Design Studio* is the configuration tool used to set up the system and build the operator interface, which can then be viewed from an Internet browser.

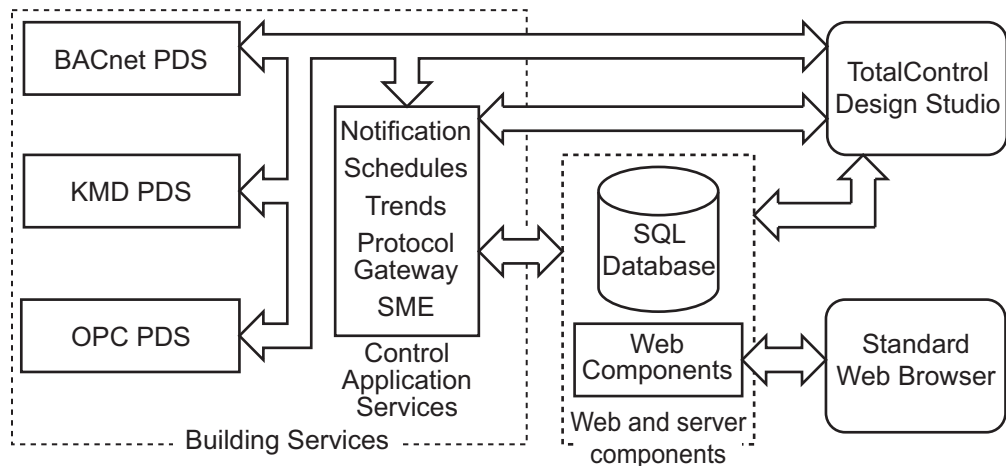
Illustration A–1 Typical TotalControl system



TotalControl Building Services

TotalControl Building Services collect and manage information from the controllers in a building automation system. They run in the background of one or more computers connected to the building automation system network. Once configured with Design Studio, the bundle of programs in Building Services provides the data to route alarms, manage schedules and display historical trend data for either Design Studio or the TotalControl Web Portal. The major components of the building services are the Protocol Driver service (PDS), the Control Application Services (CAS) and the web and server components.

Illustration A-2 TotalControl core components



Protocol Driver Service

A Protocol Driver Service (PDS) is the link between a building automation system and other TotalControl services. When data is required from a controller, the PDS retrieves the data, forwards it to the requesting service and, depending upon the type of data, caches it for future use. Each supported protocol requires a corresponding PDS and network connection. The PDS is one of the licensed components of TotalControl Building Services.

Control Application Services

The control application services perform key functions to monitor, display and manipulate data from the building automation services. These services include:

- Notification of alarms and events
- Schedule management
- Trend data collection
- Exchanging data between protocols with Protocol Gateway service.
- Data management among the components of TotalControl by the Service Monitor Engine (SME).

Web and server components

The web and server components are distributed with TotalControl Building Services, but may be installed on a computer separate from the computer running the Control Application Services. Regardless of where the web and server components are running, they provide two functions:

- Store data, graphic pages, and web pages in an SQL database.
- Serve web pages and building automation system data to the TotalControl Web Portal.

Web components The web components are a combination of a web server and the TotalControl Web Portal components.

- Internet Information Services (IIS) distributed with the Windows operating system fills the web server function for a TotalControl managed site.
- The TotalControl Web Portal components—through a combination of custom graphic pages stored in the database and trend, schedule, alarm, and administration modules—provide complete access to a site. Once configured with Design Studio, authorized operators need only an Internet browser for site management.

SQL server components TotalControl is a database managed system and requires a Structured Query Language (SQL) database server to store both system data and graphic pages. The size and type of database server depends upon the complexity of the building automation system.

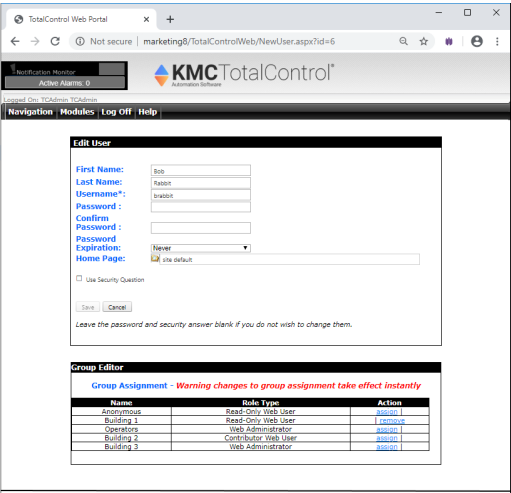
- Systems with 300 controllers or fewer can operate with Microsoft SQL Server Express, which is distributed with Building Services.
- For systems with more than 300 controllers, use a SQL Server Workgroups, Standard, or Enterprise edition.
- Other factors, such as collecting over 1,000 trend logs, may also require the use of the Workgroups, Standard, or Enterprise edition of SQL Server as the site database.

When a service retrieves data from a controller through the appropriate PDS, the data may also be stored in the database. Each of the services can then query the database for information.

The TotalControl Web Portal

Operators view and manage the key functions of a building automation system using a standard Internet browser connected to web pages constructed in Design Studio. These pages are stored and served to web browsers from the computer or computers hosting the SQL database and Microsoft web components.

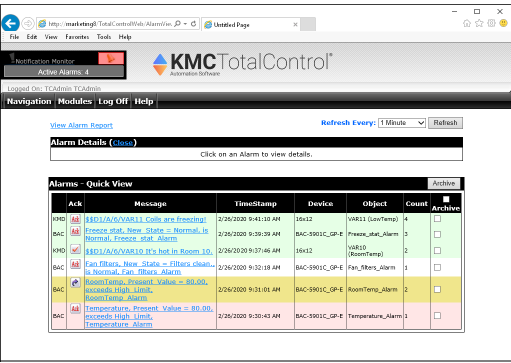
Illustration A–3 TotalControl Web Portal



Alarm viewer and manager

Notification of alarms and events are managed, viewed, and acknowledged with the Alarm Tools module. Programs within each device monitor a condition. When a value moves beyond normal parameters, a notification event is created that the TotalControl notification service processes as an alarm.

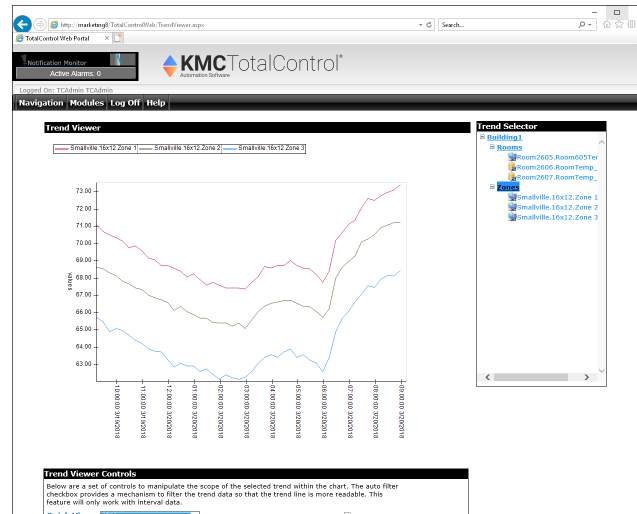
Illustration A–4 Alarm management



Trend management

The trend viewer and configuration modules retrieve historical data for viewing trend logs, managing trend log configuration, and exporting trend log data.

Illustration A–5 Historical data displayed in a trend log



TotalControl manages three types of trend logs:

- Controller trend logs are sets of historical data collected and stored only within the memory of an individual controller.
- Database trend logs are controller trend logs that TotalControl has retrieved from a controller and then stored in the site database.
- A PC trend log is a polling process performed by the TotalControl trend service.

Web administration

Authorized operators use the web administration module to add or remove operators and assign operator permissions to various parts of the site.

Illustration A–6 Operators are granted access through web administration

The screenshot shows the KMC TotalControl Web Administration interface. The main area displays a table of users. The table has columns for 'Users', 'Name', and 'Action'. The 'Users' column lists several names, and the 'Name' column shows their full names. The 'Action' column contains links to 'Edit' and 'Delete' for each user.

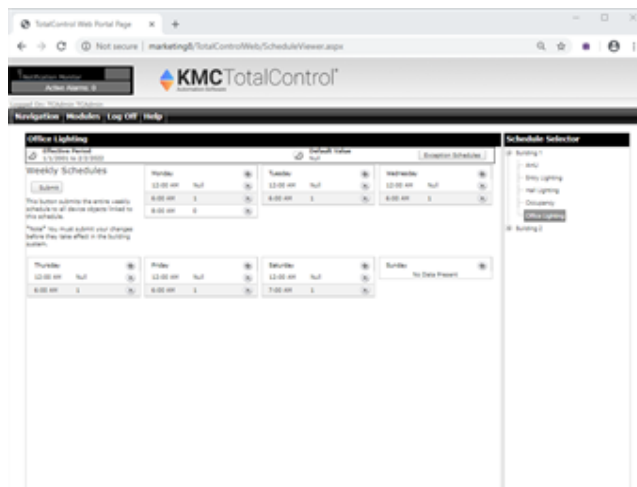
Users	Name	Action
Smith	Andy Smith	Edit Delete
Miller	Bob Miller	Edit Delete
Cynder	Chuck Cynder	Edit Delete
Brown	Dave Brown	Edit Delete
Johnson	Eric Johnson	Edit Delete
Jones	Frank Jones	Edit Delete

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Schedule management

The schedule management module configures weekly and annual schedules to control recurring events.

Illustration A–7 Schedule module



The kiosk display

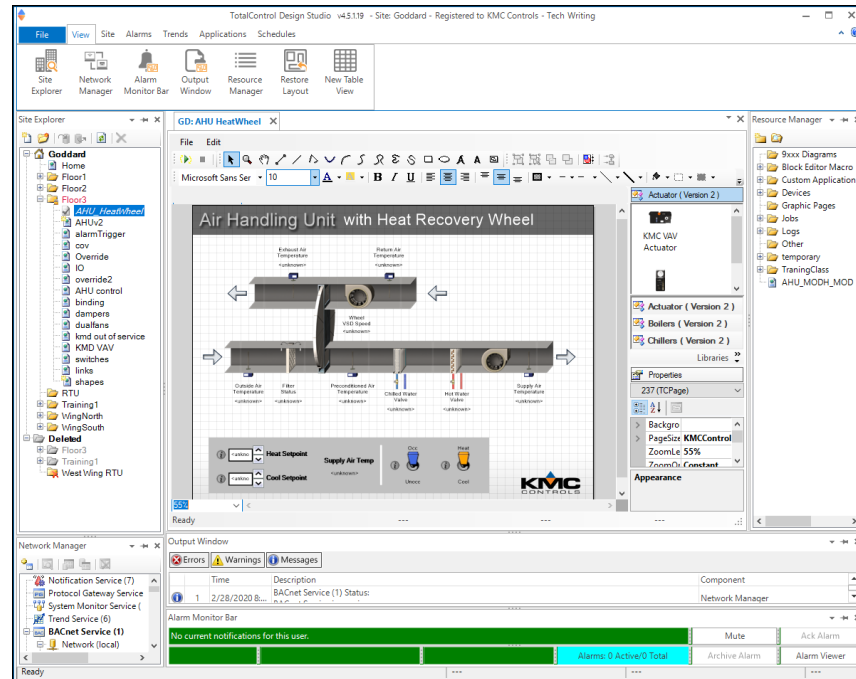
A kiosk is a computer that automatically displays only selected graphic pages from the Web Portal. A controls technician or engineer sets up the kiosk computer using Design Studio.

- Each kiosk can have a unique set of graphic pages that will display as a slide show. The slide show automatically starts when a web browser opens the Web Portal from the kiosk computer.
- Each kiosk requires a license added to building services. The designated kiosk computer does not require a license or special browser plug-in.
- Operators cannot log on to the Web Portal from a kiosk computer.

TotalControl Design Studio

Design Studio is the master operator software with which you can build browser-based operator pages, configure controllers, manage the database, and set up security, trends, schedules, and alarms. Once the graphic pages are constructed and the site is configured, Design Studio is not required for daily operation.

Illustration A–8 TotalControl Design Studio



Graphics Designer Use Graphic Designer to assemble graphic pages from either the included graphics library or imported graphic files. Once a page is constructed, it is stored in the database and then published for viewing with a standard web browser.

Network Manager All networks, devices, objects, points, and properties are managed through the Network Manager. The complete job site is displayed in a list that can be expanded to manipulate a specific point or property or collapsed to view only networks, devices, or controllers.

Site Explorer Site Explorer manages the graphics pages in the TotalControl database. Versions of the graphics pages are controlled by checking the pages out of the database for editing. While a page is checked out, it cannot be edited by other operators.

Resource Manager Resource Manager displays and manages a list of local files. Through the Resource Manager, these local files can be edited without connecting to a site. Files in Resource Manager can also be used to restore a backup configuration to networks, controllers, points, and objects.

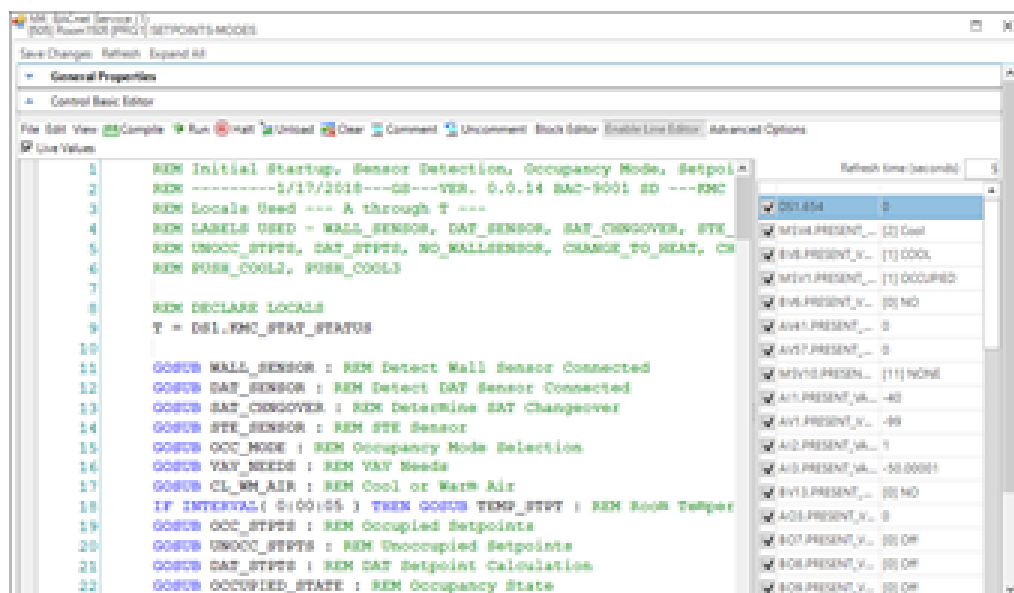
Security Manager A TotalControl administrator assigns permissions and passwords to authorized operators with the Security Manager.

Protocol Gateway Manager The Protocol Gateway Manager is the Design Studio tool that operators use to configure the Protocol Gateway service. The Protocol Gateway service monitors data in one or more points or objects and then transfers that value to another point

or object. The transfer interval can be set for a range from every few seconds to once a month.

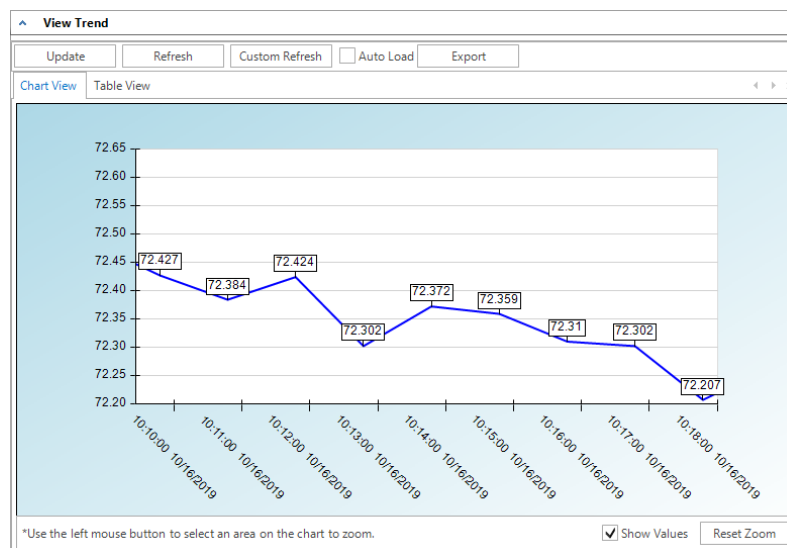
Code Editor Control Basic programs in KMC controllers are edited, compiled and sent to controllers with the Code Editor.

Illustration A–9 Control Basic listed in the TotalControl Code Editor



Trends With Design Studio, you can set up controller, database, and PC trends. Controller trends can be viewed with Design Studio.

Illustration A–10 BACnet controller trend in Design Studio



Alarm management With Design Studio you can set up alarms to notify key operators of critical events. Notification includes custom messages in e-mail text.

Deployment options

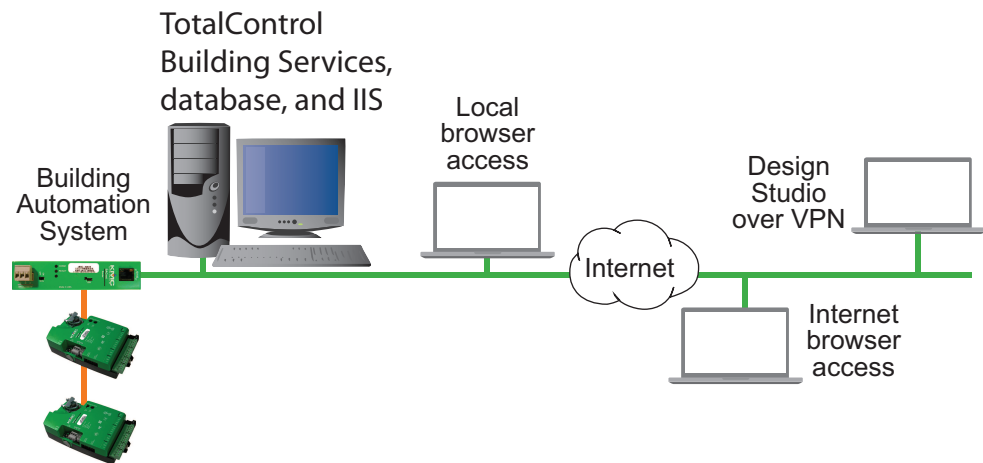
While all TotalControl core components are required for a complete system, they may be located on separate computers. This provides a path for both upgrade and expansion of a building automation system. Three typical computer systems are discussed on following pages.

- [Single computer deployment](#)
- [Distributed systems](#)
- [Enterprise system](#)

Single computer deployment

The single-computer system is the simplest deployment of the TotalControl system. This system is suitable for small systems with minimum resources.

Illustration A–11 TotalControl single computer system



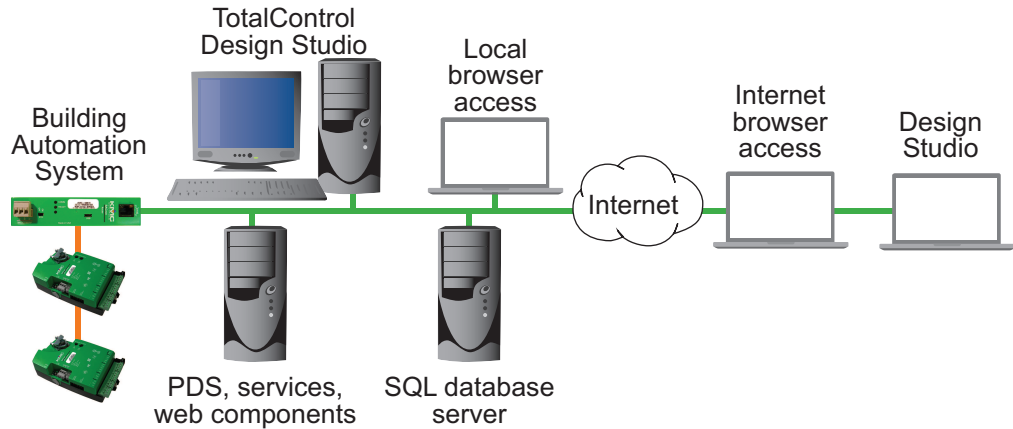
In a single-computer system:

- All licensed components for TotalControl Building Services are installed and operate on a single computer. This is the only computer that requires a hardware license key for TotalControl Building Services to operate.
- The computer serves the web pages created by TotalControl Design Studio in addition to managing the interface to the schedule, alarm, trend, and administration web modules.
- The system uses Microsoft SQL Server Express distributed with TotalControl Building Services.
- Graphic pages were created with Design Studio by the system installers. Design Studio was used also to configure controllers. It is not a required to be a permanent part of the finished site.
- If needed, a master operator can connect Design Studio to the TotalControl managed site over a virtual private network (VPN).

Distributed systems

Medium-sized building automation systems may require spreading TotalControl components across two or more computers. The distributed system is similar to the single-computer system except that a separate computer hosts the SQL database. In addition, Design Studio is included as a master operator workstation.

Illustration A–12 Distributed system

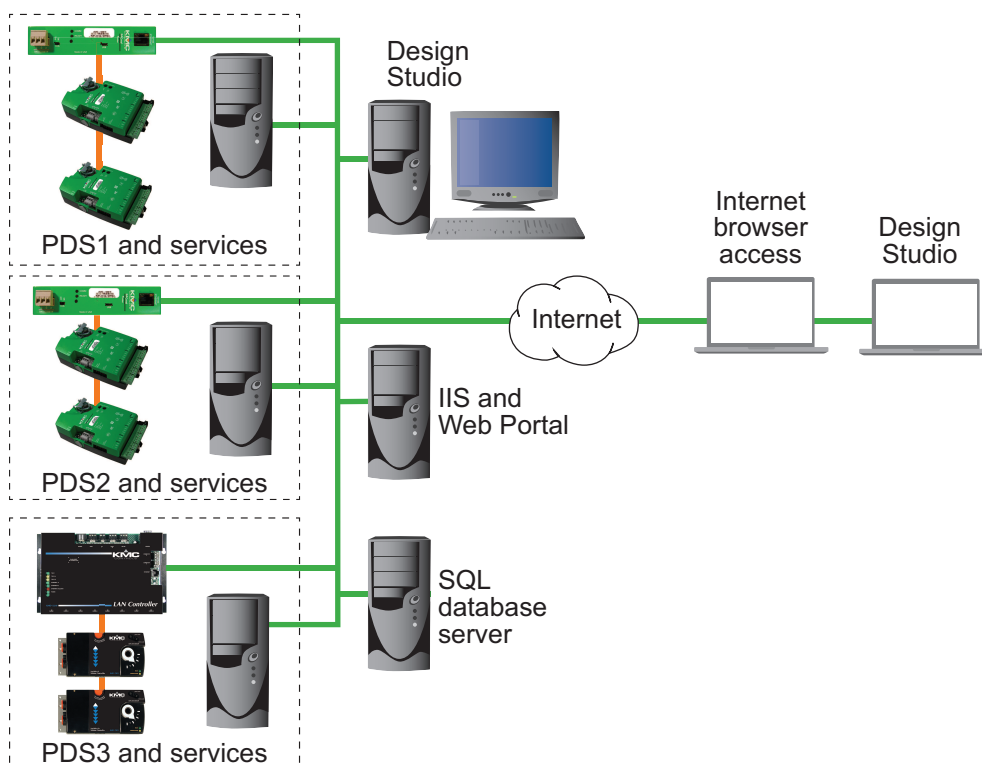


In a distributed system:

- The TotalControl Design Studio is an on-site part of the system. The system engineer uses this workstation for administrative functions and to build graphic pages. To prevent unauthorized modifications, system engineers can remove the license key when they are not using Design Studio.
- All TotalControl services are running on one computer and a second computer hosts the SQL database. The building services computer also operates IIS and serves the web pages created with TotalControl Design Studio. The computer on which the components of Building Services are running requires a hardware key.
- Depending upon the size of the system, the distributed system could use Microsoft SQL Server Express distributed with TotalControl or a dedicated SQL server running on one of the Windows Server operating systems.

Enterprise system

Use enterprise deployment for large installations that include multiple buildings, protocols, and locations.

Illustration A-13 Enterprise system

In an enterprise system:

- TotalControl Design Studio is part of the system. The system engineer uses Design Studio for administrative functions and to build graphic pages. As with the distributed system, Design Studio computer requires a hardware license key.
- Each building automation system connects to its own computer running the PDS appropriate for the protocol and the TotalControl services for that building's automation system. Each computer operating a PDS requires a hardware license key.
- A central computer operates the SQL database; a second computer operates IIS. The web pages created with TotalControl Design Studio are hosted and served by IIS from this computer.

Appendix B: Worksheet for site data

Use the space below to record setup information about the job site. Safeguard this sheet as it includes operator names and passwords.

TotalControl site data

Use the following space to record the customer and site information.

Customer Name				
Contact at Site/Phone#				
TotalControl Version				
Installation Date				
Reference Documents				
Type of Site (circle)	Single	Distributed	Enterprise	
Services (circle)	BACnet PDS	KMD PDS	OPC PDS	Design Studio
	Notification Svc.	Trend Svc.	Web Portal	Integration Svc.

Host computer user name and passwords

Host Computer for Single Site or SQL Database	
Computer Password	
URL	
IP Address	
TotalControl Site Name	
TC Site Admin Password	
Type of Server*	SQL Express (default)
Name of Server*	Default is same as site name
SQL Named Instance*	SQL Express (default)

* Provided or approved by the IT department.

BACnet PDS

See also [About the custom components on page 29](#).

Host Computer Information		BACnet System Details			
URL	IP Address	BACnet Protocol	Device Instance	BACnet Network Number	BACnet Port Number
		<input type="checkbox"/> BBMD <input type="checkbox"/> Foreign Device <input type="checkbox"/> Normal IP Device <input type="checkbox"/> 8802.3			
		<input type="checkbox"/> BBMD <input type="checkbox"/> Foreign Device <input type="checkbox"/> Normal IP Device <input type="checkbox"/> 8802.3			
		<input type="checkbox"/> BBMD <input type="checkbox"/> Foreign Device <input type="checkbox"/> Normal IP Device <input type="checkbox"/> 8802.3			
		<input type="checkbox"/> BBMD <input type="checkbox"/> Foreign Device <input type="checkbox"/> Normal IP Device <input type="checkbox"/> 8802.3			

KMD PDS

See details in the topic [About the custom components on page 29](#).

Host Computer Information		KMDigital System Details		
URL	IP Address	System Name	Tier 1 Controller IP	Controller Number

OPC data

See details in the topic [About the custom components on page 29](#).

Host Computer Information		OPC Server ID	
URL	IP Address	Name	IP

Notification service

See details in the topic [About the custom components on page 29](#).

Host Computer Information		E-Mail Information				
URL	IP Address	SMTP Server	User Account	Domain Name	Account Password	Reply Address

Trend service data

See details in the topic [About the custom components on page 29](#).

Host Computer Information	
URL	IP Address

Web Portal data

See details in the topic [About the custom components on page 29](#).

Host Computer Information		
URL	IP Address	External URL

Appendix C: Communication ports and BAS networks

This topic focuses on Information Technology issues related to your Building Automation System (BAS).

A Building Automation System (BAS) consists of a network of hardware devices that communicate using one or more TotalControl supported protocols. Software applications provide an interface between the user and these devices for monitor and control of the building environment. The devices and software perform most functions without manual intervention. They also collect trends of monitored sensor and equipment status, and will send alarm messages as needed.

Microsoft IIS and SQL servers, as well as TotalControl Building Services, may be distributed on a number of computers, though they are typically installed on the same computer. SQL Express edition is distributed with TotalControl, but any SQL edition is usable.

Topics in the remainder of this section cover the following information:

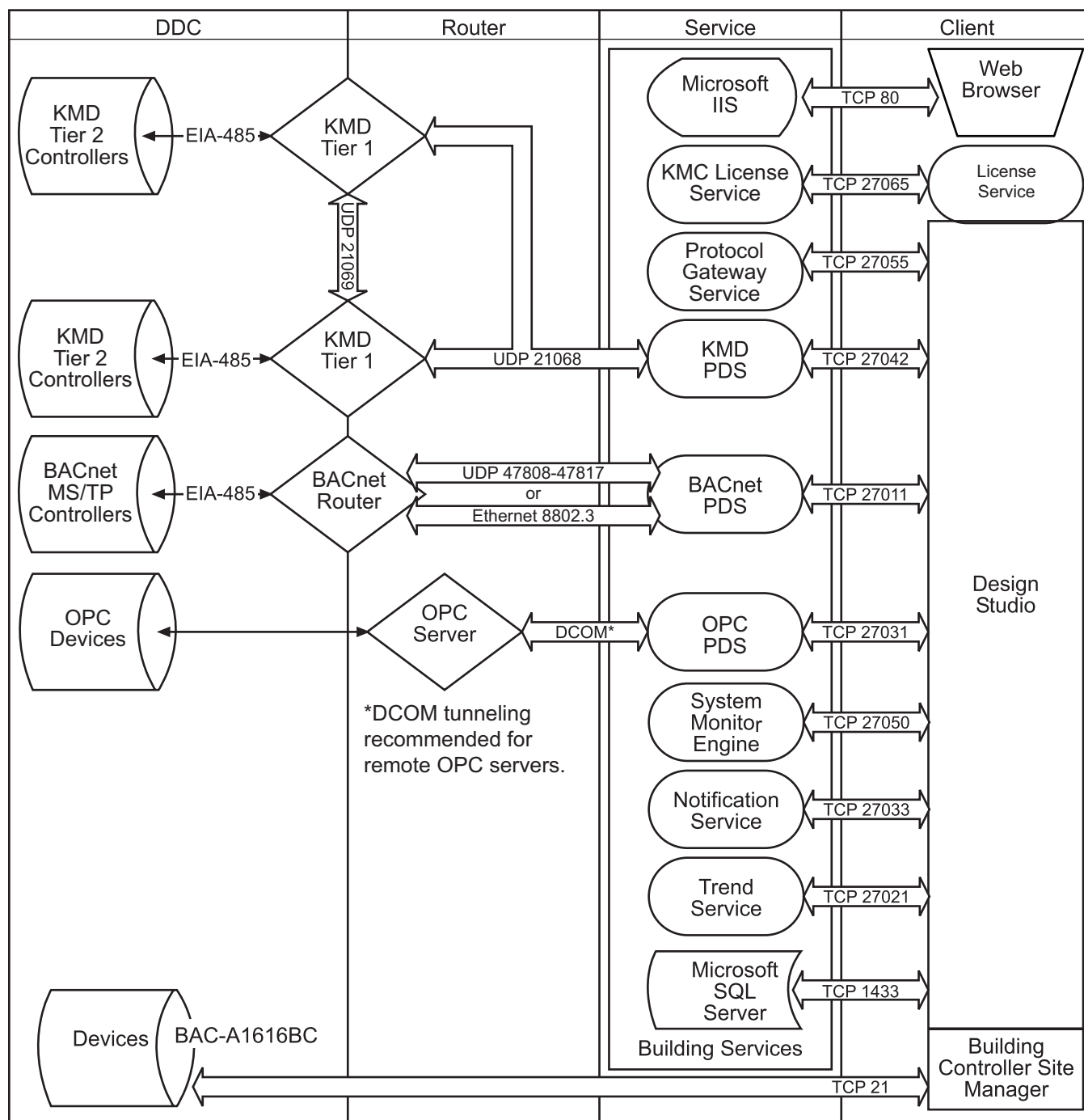
- [Firewalls and ports on page 59](#)
- [Remote access on page 61](#)
- [BACnet controllers and networks on page 62](#)
- [KMD controllers and networks on page 63](#)

Firewalls and ports

Because a Microsoft Windows or Microsoft Server operating system has an inherent firewall, exceptions must be added to the firewall to allow communication through the firewall ports. The TotalControl installer adds exceptions to the Windows firewall for its own services. Other ports, such as those for IIS, SQL and BACnet traffic, must be manually added to the firewall. If other firewalls—such as with network IP routers— are in the path between elements, exceptions for the ports must also be added to the firewall. Client-server communications between Building Services are not shown in the following table and diagram.

Table C–1 TCP/UDP Ports

Device / Application	Purpose	Port	Location
KMC License service	Active licensed components	TCP 27065	Anywhere
Building Controller Site Manager	Technician configuration tool	TCP 21	Anywhere
KMD Protocol Driver Service (PDS)	KMD BAS server	TCP 27042	Site
KMD Tier 1 controllers	KMD traffic router	UDP 21068	Site
KMD Tier 1 controllers	KMD traffic router between Tier 1 controllers	UDP 21069	Site
OPC Protocol Driver Service (PDS)	OPC server	TCP 27031	Site
BACnet Protocol Driver Service (PDS)	BACnet BAS server	TCP 27011	Site
BACnet routers	BACnet traffic router	Typical range is 47808-47812	Site
BAC-5050 & BAC-1616	Router configuration	TCP 21070	Site
System Monitor Engine	BAS server	TCP 27050	Site
Notification service	BAS server	TCP 27033	Site
Trend Service	BAS server	TCP 27021	Site
Protocol Gateway service	BAS server	TCP 27055	Site
MS IIS Web Server		TCP 80	Site
MS SQL Dbase server		TCP 1433, 1434	Site
Design Studio	Client (Technician configuration tool)	Communicates with services, IIS & SQL	Anywhere
Web browser	Client (End User)	Communicates with IIS	Anywhere

Illustration C-1 Communication ports for TotalControl

Remote access

If remote access to the building automation system is required, we recommend setting up a VPN account for your authorized installer. This provides a secure, remote access for TotalControl. We also recommend that remote connectivity—either by Microsoft's remote console or Virtual Network Computing (VNC)—be set up temporarily on the computer until installation of TotalControl and communication with devices has been verified. This will enable technical service personnel to identify problems.

BACnet controllers and networks

The KMC Controls BACnet products in a Building Automation System (BAS) conform to the BACnet communications standard (www.bacnet.org) for monitor and control functions, services, devices, and software applications. The issues discussed are:

- Broadcast domains and traffic tunneling schemes in BACnet
- Network traffic loading

BACnet controllers are installed throughout the building to control building equipment and monitor environmental and system status. The controllers from KMC Controls use BACnet MS/TP (EIA-485 physical layer) for communication. Gateways, called BACnet routers in the standard, transfer traffic along EIA-485 and Ethernet cabling between DDCs and the BACnet Protocol Driver Service.

BACnet networks, broadcast domains and tunneling

The BACnet standard specifies networking schemes that may be used at OSI Layers 1-4. Several physical layers are supported, mainly EIA-485 and IEEE 8802.3. For IEEE 8802.3, BACnet traffic is transported either at the Link layer, called "BACnet over Ethernet", or at the Network/Transport layers, called "BACnet over IP", as follows:

- BACnet/Ethernet uses an LSAP of 0x82 in the LLC sub layer to identify BACnet traffic.
- BACnet/IP uses UDP ports to identify BACnet service traffic. The default port is 47808 (0xBAC0).

Every device within the system has peer-to-peer communications with all other devices, routed through BACnet routers. BACnet networks are defined as follows:

- An Ethernet segment
- An IP broadcast domain, defined by a UDP port
- An EIA-485 network
- A one-to-one unicast tunnel between two routers, defined by a UDP port. This is referred to as the PAD method.
- A many-to-one unicast tunnel between routers and a single router configured as a broadcast manager, defined by a UDP port. This is the BACnet Broadcast Management Device (BBMD) and foreign device method.

BBMDs and Packet Assembler and Disassembler (PAD) routers are used to cross IT subnetwork boundaries. PAD routers carry broadcast and unicast messages between devices. In the BBMD method, only broadcast messages are tunneled between the many foreign devices and the BBMD. The BBMD informs all of its registered foreign devices of the entire set of foreign devices so that foreign devices will route unicast messages directly to other foreign devices. Thus, if a BBMD fails, this will stop the flow of broadcast—and eventually all—BACnet traffic within the BBMD's registered foreign devices.

The following are some defining features of BACnet routers:

- BACnet routers are really gateways.
- BACnet routers do not route Layer 3 (IP) traffic; they route BACnet traffic at all appropriate layers.
- BBMD traffic passing through a firewall to the Internet requires a public IP address. Network address translation is supported for BACnet routers that comply with Addendum O to BACnet Standard 135-2010 or Annex J of BACnet Standard 135-2012.

The Cimetrix BACstac driver—part of the BACnet Protocol Driver Service for TotalControl—may be configured to route traffic as either a BBMD or foreign device. Typically, a BBMD is used for permanent installations. A foreign device connection is only recommended for a temporary connection such as a technician's service tool.

Bandwidth and traffic loading

BACnet traffic mainly consists of periodic requests for sensor and equipment status. The periodicity can be minutes, even hours, and messages are very small. A site of 100,000 sq. ft. may typically have system-wide traffic on the LAN on the order of a few tens of packets a second to a few kilobytes a second.

Web traffic per client is also minimal. Typically, only a few hundred kilobytes are necessary to present a page in the Web Portal and to initialize a Flash movie or HTML 5 animation, and then a few kilobytes every 30 seconds thereafter.

Other applications and TotalControl on a single computer

For a system in which BACnet traffic is transported over BACnet/IP, BACstage and may not operate through the same Ethernet network interface card (NIC) while using the same UDP port. To simultaneously use other applications, each application must be assigned its own network and UDP port; a matching UDP port and network must be configured on the internetwork within a BACnet router.

KMD controllers and networks

Only the Tier 1 KMD series¹ of controllers are directly connected to the Ethernet LAN. Tier 2 controllers are connected to Tier 1 controllers with EIA-485 networking. All controllers use points of data (such as an input from a sensor) to perform their control function(s).

¹KMDigital is a proprietary line of digital building automation controllers manufactured by KMC Controls, Inc. The controllers are either Tier 1 or Tier 2 controllers. Tier 1 controllers connect directly to a LAN through Ethernet; Tier 2 controllers connect to each other and Tier 1 controllers on an EIA-485 network. KMDigital is often abbreviated as KMD.

Bandwidth issues

In general terms, KMD controllers take only a minutely small portion of available Ethernet bandwidth. Some bandwidth usage is fixed, other usage is dynamic, and still other usage is user-defined.

Fixed bandwidth Each controller is set to send and receive data only every 20 to 30 seconds. This traffic probably accounts for no more than 6 kilobytes at peak while at most times it is idle.

Dynamic Dynamic usage refers to alarm conditions. These exceptions occur rarely, even in large and complex automation systems. In addition, each alarm will account for only up to several hundred bytes or so of bandwidth.

User defined User-defined traffic is more unpredictable. Users can set up TotalControl to access controllers and perform any number of tasks. Again, even at peak, this traffic accounts for only a small percentage of available Ethernet traffic bandwidth.

While not meant to be definitive or comprehensive, the following formula can provide a general calculation for controller-to-controller bandwidth.

max. bandwidth per controller =

3000 bytes X (number of Tier 1 controllers in system – 1) every 25 seconds

This formula does not account for dynamic or user-defined traffic.

Summary of KMD network use

- A Network Status UDP packet—UDP datagrams of 40 bytes—is sent every 23 seconds to each Ethernet connected controller in the system.
- A Network Points packet—a UDP datagram from 0 to 528 bytes—is sent every 24 seconds to each Ethernet connected controller in the system.
- Alarms—UDP datagrams of up to 1400 bytes—are sent to each Ethernet connected controller as they occur. Multiple alarms will be concatenated into one message. These same packets are then directed to the KMD PDS or operator workstation that is both logged in and set up to receive such alarms.
- Operator requests—UDP datagrams of 24 bytes—are directed to specific controllers. Replies can be up to 1400 bytes.
- Operator sends can be a UDP datagram of up to 1400 bytes; controllers acknowledge with a 15-byte UDP datagram.
- The building operator determines and controls the frequency of activity. Operator workstation refresh rates can be set as often as once per second. In addition, multiple windows may be open simultaneously. Only those windows that are in Update mode (as opposed to View mode), generate network traffic. However, workstations can also be programmed to maintain historical files known as trend logs. Workstation settings determine the number of trend logs and the frequency of updates. Trend log packets (UDP datagrams) are 1400 bytes.
- Packets transmitted on the same Ethernet sub-network are fragmented at the Maximum Transmission Unit (MTU) size set at the controller level not related to the

LAN MTU size. Default size is 1500 bytes.

- Routers and gateways have a tendency to drop KMD controllers from routing tables. To keep the controllers in the tables, Tier 1 controllers ping routers and gateways every 2 minutes.

Network protocols supported

- Internet Protocol (IP) over Ethernet
- Internet Control Message Protocol (ICMP)
- Universal Datagram Protocol (UDP)
- Address Resolution Protocol (ARP)
- BACnet-licensed KMD models (MS/TP, Ethernet 8802.3)
- Proprietary protocol (encapsulated in UDP)

Broadcasting on KMD networks

- In the traditional sense of the word, KMC controllers do not perform any broadcasting functions.
- Address Resolution Protocol (ARP) messages are used whenever a given Tier 1 controller needs to determine the MAC address of other controllers. This broadcast ARP is of no consequence to the other devices on the Ethernet LAN.
- We generally recommend that Tier 1 controllers are designated as broadcast servers in our facility management software. However, this traffic exists only from controller to controller.
- All UDP transmissions are directed (no broadcasts).

Appendix D: Configuring the Cimetrix BACstac driver

Topics in this section cover the configuration of BACstac for BACnet IP or BACnet Ethernet networks.

The Cimetrix BACstac driver is included in the installation of the BACnet Protocol Driver Service (PDS). The BACstac driver is a software service that connects the local BACnet network to the BACnet PDS.

- Prerequisite system information and requirements are covered in the topic [Before you begin on page 67](#).
- Configuring the driver for the correct BACnet protocol
 - [Configuring BACstac for BACnet IP on page 68](#).
 - [Configure BACstac for Ethernet 8802.3 on page 72](#).
- If needed, removal procedures are covered in the topic [Remove previous versions of the BACstac driver on page 73](#).

Before you begin

The Cimetrix BACstac driver is included in the installation of the TotalControl BACnet PDS is installed. To configure the BACstac driver for connection to a BACnet internetwork, you will need the following information.

- For BACnet IP networks—a local BACnet network number and UDP port number for the local network.
- For foreign device registration—the IP address and UDP port number of a remote BBMD.
- For BACnet Ethernet 8802.3—the local BACnet Ethernet network number.

Network number Network numbers are assigned by BACnet routers or devices with a routing function. The network number in BACstac must match the network number set by the router.

Routing protocol The routing protocol is established by a router or a device with a routing function. By using Cimetrix BACstac as a driver, TotalControl supports the following BACnet routing protocols.

- BACnet IP (Internet protocol)
- BACnet IP foreign device
- BACnet IP BACnet Broadcast Management Device (BBMD)
- BACnet Ethernet-8802.3

The routing protocol must match the BACnet protocol of the local BACnet network.

UDP Port The UDP Port number is assigned by a BACnet router or a device with a routing function. Each BACnet IP network must be assigned a UDP Port. The port number in BACstac must match the port number set by the router.

Related topics

- [Configuring BACstac for BACnet IP on page 68](#)
- [Configure BACstac for Ethernet 8802.3 on page 72](#)
- [Remove previous versions of the BACstac driver on page 73](#)

Configuring BACstac for BACnet IP

The BACstac driver is automatically installed when the TotalControl PDS is installed. For instructions to install the BACstac driver, see the topic [Custom installations on page 27](#). However, the driver must be configured to match the type of BACnet network to which the computer is connected.



Caution: If the computer running BACstac includes a firewall, the port selected in **UDP Port** must be opened in the firewall. If the port is not opened, BACnet devices cannot be seen in the Network Manager list and data cannot be transferred from the device to the the TotalControl BACnet PDS.

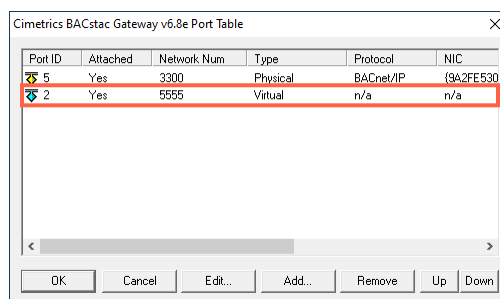
Configure the computer as a BACnet IP device

To configure the computer as a BACnet IP device, the computer must meet one of the following conditions:

- It must be connected to the same IP subnetwork as one of the BACnet IP networks.
- It must be configured as a BACnet Broadcast Management Device (BBMD) that is part of the BACnet internetwork. This is the recommended practice if no other means to send and receive BACnet broadcast messages is available.
- It must be registered as a foreign device to a BBMD. This is not recommend for permanent installations.

All three types of IP routing protocols require entries under the **Port** tab. To configure the computer as an IP device, do the following:

- 1 Choose **Start**, **Cimetrics**, and then **Configure BACstac**. The Port Table dialog opens.
- 2 If there are any unneeded entries in the port table, select them and then click **Remove**.



Remove unneeded connections.

- 3 Click **Add** and then choose **BACnet/IP**.
- 4 Enter the configuration for the following in the BACnet/IP dialog:
 - Port ID
 - Network number
 - UDP Port

- 5 From **Adapter**, select the physical network adapter that will connect to a LAN.
- 6 If required, perform either of the following additional configurations:
 - [Configure BACstac as a BBMD on page 71](#)
 - [Register as a foreign device on page 70](#)
- 7 Click **OK** to finish and save the configuration.

Port ID Enter any non-zero number.

Network number Enter the BACnet IP network number from the BACnet system plans. The network number must match the network number for the BACnet IP network to which the computer is connected. BACnet IP network numbers are configured in routers or devices with routing functions.

IP Address This lists the IP addresses of the Network Interface Cards (NIC) installed in the computer. Select the address for the NIC in use.

Subnet Mask The IP subnetwork to which the computer hosting the PDS is connected.

UDP Port Enter the UDP port number from the BACnet system plans. The UDP port number must match the port number for the BACnet IP network to which the computer connected. UDP port numbers are typically 47808 to 47817 (0xBAC0 to 0xBAC9 in hexadecimal notation).

Register as a foreign device

The computer can register as a foreign device to a BACnet Broadcast Management device (BBMD). Foreign device registration to a BBMD is a technique for crossing IP subnetwork boundaries with BACnet broadcast messages.



Note: Registering as a foreign device is not recommended for permanent connections. Instead, configure BACstac as a BBMD.

To configure the computer as a foreign device, do the following:

- 1 [Configure the computer as a BACnet IP device on page 68](#)
- 2 Click the **Foreign Device** tab.

The screenshot shows the 'BACnet/IP Port Properties' dialog box with the 'Foreign Device' tab selected. The 'Foreign Device' checkbox is checked. Under the 'Remote BBMD' section, the 'IP Address' is set to '10.110.6.5' and the 'UDP Port' is set to '47808'. The 'Time To Live, sec' is set to '1800'. The dialog has 'OK' and 'Cancel' buttons at the bottom.

- 3 Enter the configuration for the following properties:
 - IP Address of the remote BBMD
 - UDP Port of the remote BBMD
 - A value for Time To Live
- 4 Close all dialog boxes when finished.

IP Address Enter the IP address of the remote BBMD. If network address translation (NAT) is used between the PDS computer and the BBMD, contact the network system administrator for the correct public IP address.

UDP Port Enter the UDP Port of the BBMD to which BACstac is registering as a foreign device.

Time To Live Sets the interval at which the driver sends a registration message to the BBMD with which it is registered.

If the BBMD does not receive a registration message within the Time To Live period plus 30 seconds, the BBMD removes the device from its foreign device table and will not send broadcast messages to the device.

- The valid time range is 1 to 65535 seconds.
- If the entry is zero (0), the registration is forever.
- The default value is 1880 seconds.

Configure BACstac as a BBMD

A BACnet Broadcast Management Device (BBMD) facilitates BACnet broadcast messages across IP subnetworks. When configuring the driver as a BBMD, observe the following rules.

- Configure only one BBMD with the same port number for a single IP subnetwork.
- Assign the same BACnet network number to all BBMDs on the internetwork.
- The BBMD can accept registration from foreign devices or perform BBMD-to-BBMD routing.



Note: To use BACstac as a permanent BBMD, the computer must remain connected to the internetwork and running at all times. Typically, a BBMD is not used on a computer that is used only as a service tool.

To configure the PDS computer as a BBMD, do the following:

- 1 Start with the procedure [Configure the computer as a BACnet IP device on page 68](#).
- 2 Click the **BBMD** tab.

BACnet/IP Port Properties

Port BBMD Foreign Device

☒ BACnet Broadcast Management Device

Broadcast Distribution Table

☒ Two-Hop Forwarding

IP Address	UDP Port	Subnet Mask
10.110.6.3	47809	255.255.255.255

Add Remove

Foreign Device Table

☒ Enable Max FDT Entries: 0

NAT Global Address

☐ Enable

IP Address: UDP Port:

OK Cancel

- 3 Select the **BACnet Broadcast Management Device** check box.

4 Enter the configuration for the following:

- Broadcast Distribution Table
- Two-Hop Forwarding
- Foreign Device Table
- Max FDT Entries

5 Close all dialog boxes when finished.

Broadcast Distribution Table The broadcast distribution table is a list of all BBMDs in the internetwork. The table includes the IP address, UDP port number, and IP subnet mask of each BBMD. Use **Add** or **Remove** to edit the table.

Two-Hop Forwarding Always select the **Two-Hop Forwarding** check box.

Foreign Device Table Select the *Enable* check box to enable foreign devices to register with the BBMD. The maximum number of devices is limited by the value in **Max FDT Entries**.

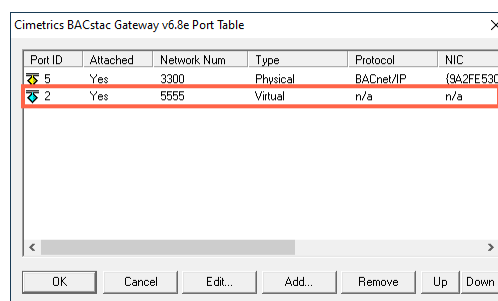
Max FDT Entries Sets the maximum number of foreign devices that can register at one time. The value for **MAX FDT Entries** is 1 to 128.

NAT Global Address When using network address translation and port address translation (NAT and PAT), enter the public IP and port number. NAT and PAT are used when the BBMD needs to be accessible from the Internet. The IT department provides the IP address and UDP Port number.

Configure BACstac for Ethernet 8802.3

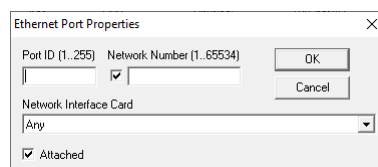
The BACstac driver is automatically installed when the TotalControl BACnet PDS is installed. For instructions to install the BACstac driver, see the topic [Custom installations on page 27](#). However, the driver must be configured to match the type of BACnet network to which the computer is connected.

- 1** Choose **Start, Cimetrics**, and then **Configure BACstac**. The **Cimetrics Port Table** dialog opens.
- 2** If there are any unneeded entries in the port table, select them and then click **Remove**.



Remove unneeded connections.

- 3** Choose **Add** and then select **Ethernet**.



- 4 In the Ethernet Port Properties dialog, enter the configuration for **Port ID**, **Network Number**, and **Attached**.
- 5 From **Network Interface Card**, select the physical network adapter that will connect to a LAN.
- 6 Close all dialog boxes when finished.

Port ID Enter any non-zero number.

Network number Enter the local BACnet 8802.3 network number from the BACnet system plans. The network number must match the network number for the BACnet Ethernet network to which the computer is connected.

Attached Always select this option.

Remove previous versions of the BACstac driver

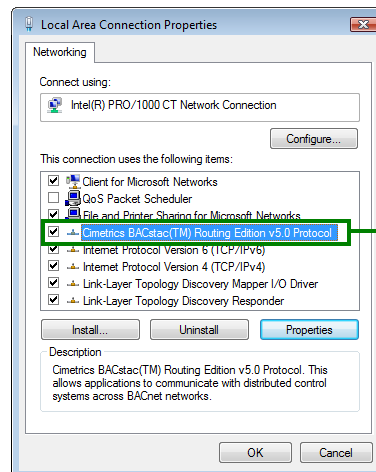
TotalControl may require an old version of the Cimetrics BACstac driver to be removed before a new version is installed. This is usually required only on computers that were running programs other than TotalControl or if a problem occurs during installation.



Note: This procedure applies only to BACstac versions earlier than 6.0. Version 6.0 and later are removed using the Windows Control Panel program.

To remove an old version of BACstac, do the following:

- 1 Choose **Start>Settings>Network Connections** and then **Local Area Connections**. The Local Area Network Dialog opens.



Remove any previous version of Cimetrics BACstac.

- 2 Click **Properties**.
- 3 Scroll through the list of connection items.
- 4 If you find *any* version of **BACstac (TM) Routing Edition**, select it and then click **Uninstall**.

Appendix E: The Service Control Panel

The topics in this section describe how to use the TotalControl Service Control Panel to change or configure properties of TotalControl Building services.

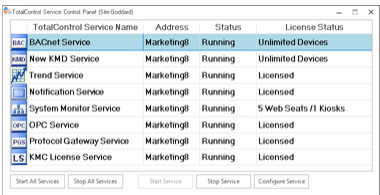
The TotalControl Service Control Panel is part of the TotalControl installation. From any Service Control Panel in a TotalControl managed site, a controls technician can do the following:

- Verify that all of the services in a site are running and which—if any—are not running correctly.
- View the license status of each service including the number of web seats and kiosks.
- Start or stop any of the building services.
- Designate the computer on which a remote license key is installed.
- Configure the notification service for an email server.

Topics covered in this section

- [Opening the Service Control Panel on page 76](#)
- [Starting and stopping TotalControl services on page 76](#)
- [Configuring a service on page 77](#)
- [Restarting the BACstac driver on page 78](#)
- [Configuring a service for a remote hardware license key on page 79](#)
- [Configuring the License Manager service on page 80](#)
- [Configuring TotalControl for an email server on page 81](#)

Illustration E–1 TotalControl Service Control Panel






TotalControl Service Name	Address	Status	License Status
BACnet Service	Marketing8	Running	Unlimited Devices
New KMD Service	Marketing8	Running	Unlimited Devices
Trend Service	Marketing8	Running	Licensed
Notification Service	Marketing8	Running	Licensed
System Monitor Service	Marketing8	Running	5 Web Seats / 1 Kiosks
OPC Service	Marketing8	Running	Licensed
Protocol Gateway Service	Marketing8	Running	Licensed
KMC License Service	Marketing8	Running	Licensed

Start All Services Stop All Services Start Service Stop Service Configure Service

Opening the Service Control Panel




To open the TotalControl Service Control Panel, double-click the icon in the Windows notification area. The exact icon shape will depend upon the status of the services. See the table [Service Control Panel status icons on page 76](#) for a list of icons.

Table E–1 Service Control Panel status icons

Icon	Description
	All services are running.
	One or more services are not responding or are unlicensed.
	One or more services have stopped.

Each installed service is represented by an icon in the Services Control Panel. The icon corresponds to the status of the service. See the table [Service Control Panel service icons](#) for a description of the icon status.

Table E–2 Service Control Panel service icons

Icon	Status
	Service is fully functional.
	Service is not responding or is unlicensed.
	Service has stopped.

Related topics

- [Starting and stopping TotalControl services on page 76](#)
- [Configuring a service on page 77](#)
- [Configuring a service for a remote hardware license key on page 79](#)
- [Configuring the License Manager service on page 80](#)
- [Configuring TotalControl for an email server on page 81](#)

Starting and stopping TotalControl services

All TotalControl services start automatically when the computer on which they are installed starts. Starting and stopping a service from the Service Control Panel is usually needed only for system diagnostics.

To start or stop a service from the Service Control Panel, do the following:

- 1 Locate the Service Control Panel icon  in the Windows notification area.
- 2 Double-click the icon. The Service Control Panel dialog opens.

- 3 Click a service icon or select the row for the service.
- 4 As available, click either **Stop Service** or **Start Service** at the bottom of the dialog.
- 5 Click the Minimize button (–) when finished.

You may also do the following to start or stop a service:

- Stop or start a service by right-clicking the service icon or service row and then choosing **Start Service** or **Stop Service** from the shortcut menu.
- Simultaneously start or stop all services by clicking **Start All Services** or **Stop All Services**.


Related topics

- [Opening the Service Control Panel on page 76](#)
- [Configuring a service on page 77](#)
- [Configuring a service for a remote hardware license key on page 79](#)
- [Configuring the License Manager service on page 80](#)
- [Configuring TotalControl for an email server on page 81](#)

Configuring a service

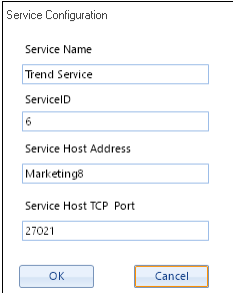
Some properties for TotalControl Building Services can be changed from the Service Control Panel.

To configure a service, do the following:

- 1 Locate the Service Control Panel icon  in the Windows notification area.
- 2 Double-click the icon. The Service Control Panel dialog opens.
- 3 Click a service icon or anywhere on the row for the service.
- 4 Click **Configure Service**.
- 5 Make changes to the service and then click **OK**.
- 6 Click the Minimize button (–) when finished.

You may also right-click a service icon or anywhere on the row for the service and then choose **Configure Service** from the shortcut menu to open the Service Configuration dialog.

Illustration E–2 Service Configuration dialog



The Service Configuration dialog box contains the following fields and buttons:

- Service Name:** Trend Service
- ServiceID:** 6
- Service Host Address:** Marketing8
- Service Host TCP Port:** 27021
- Buttons:** OK and Cancel

Properties of the Configure Service dialogs

Service Name A descriptive label of the service. The set of characters used in Service Name is restricted to printable characters.

Service ID Service ID is assigned by TotalControl and cannot be changed.

Service Host Address This is the address of the computer on which the SQL service is running. The preferred entry is the name of the computer; the IP address may also be used.

Service Host TCP Port This port is used by TotalControl building services.



Related topics

- [Opening the Service Control Panel on page 76](#)
- [Starting and stopping TotalControl services on page 76](#)
- [Configuring a service for a remote hardware license key on page 79](#)
- [Configuring the License Manager service on page 80](#)
- [Configuring TotalControl for an email server on page 81](#)

Restarting the BACstac driver

For various reasons, the BACstac BACnet driver may need to be restarted after computer maintenance or upgrade. The driver can be restarted from the Service Control Panel.

To restart the BACstac driver from the Service Control Panel, do the following.

- 1 Locate the Service Control Panel icon  in the notification area.
- 2 Double-click the icon. The Service Control Panel dialog opens.
- 3 Right-click the BACnet service icon  or anywhere on the row for the service and choose **Restart BACnet Service** from the shortcut menu.
- 4 Click the Minimize button (–) when finished.

Configuring a service for a remote hardware license key

Licensed components of TotalControl require activation from a license stored in a hardware license key. This license key is usually plugged into a USB port on the computer on which the application is operating.

If a USB port is not available or the hardware key must be plugged into a computer other than the one on which the service is running, use the license key server component of Building Services. This service provides access to a valid hardware license key on another computer on the same network.

To configure a service to use a remote hardware license key, do the following:


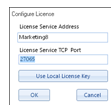
- 1 Locate the Service Control Panel icon  in the notification area.
- 2 Double-click the icon. The Service Control Panel dialog opens.
- 3 Right-click the service icon or anywhere on the row for the service and then choose **Configure License** from the shortcut menu.
- 4 Make changes to the service and then click **OK**.
- 5 Click the Minimize button (–) when finished.

Illustration E–3 Configure License dialog



Properties of the Configure License dialog

License Service Address Enter either the IP address or the name of the computer on which the license key server is running and the key that holds the license for the service installed.

License Service TCP Port This is a network port through which the license service connects to computers running a TotalControl service that requires a license. See [Communication ports and BAS networks on page 59](#) for a description of all ports used by TotalControl.



Note: The entry in License Service TCP Port must match the entry in Service Host TCP port used by the license server. See [Configuring the License Manager service on page 80](#).

Use Local License Key Click **Use Local License Key** to change the location of the hardware key from a remote computer to the computer on which the service is running.

Related topics

- [Opening the Service Control Panel on page 76](#)
- [Starting and stopping TotalControl services on page 76](#)
- [Configuring a service on page 77](#)
- [Configuring the License Manager service on page 80](#)

- [Configuring TotalControl for an email server on page 81](#)

Configuring the License Manager service

The TotalControl License Manager service provides a method to license a service from a computer other than the computer on which the service is running. The computer on which the License Manager Service is running hosts the USB license key. The service can then enable one or more TotalControl services running on other computers that require a license.

To configure the License Manager, do the following:



- 1 Locate the Service Control Panel icon  in the notification area.
- 2 Double-click the icon. The Service Control Panel dialog opens.
- 3 Right-click the License Manager icon  or anywhere on the row for the service.
- 4 Choose **Configure Service** from the shortcut menu.
- 5 Make changes to the service.
- 6 When finished, click **OK**.
- 7 Click the Minimize button (–) when finished.

Illustration E–4 License Manager configuration dialog



Properties of the License Manager Service Configuration dialog

Service Name A descriptive label of the service. The set of characters used in Service Name is restricted to printable characters.

Service ID Service ID is assigned by TotalControl and cannot be changed.

Service Host Address This is the address of the computer on which the SQL service is running. The preferred entry is the name of the computer; the IP address may also be used.

Service Host TCP Port This is a network port through which the license service connects to computers running a TotalControl service that requires a license. See [Communication ports and BAS networks on page 59](#).



Note: The entry in Service Host TCP Port must match the entry in License Service TCP Port used by all other services using the License Manager service. See [Configuring a service for a remote hardware license key on page 79](#).

Related topics

- [Opening the Service Control Panel on page 76](#)
- [Starting and stopping TotalControl services on page 76](#)
- [Configuring a service on page 77](#)
- [Configuring a service for a remote hardware license key on page 79](#)

- [Configuring TotalControl for an email server on page 81](#)



Configuring TotalControl for an email server

To send email messages to an operator, the Notification service must be configured with the credentials for an email server. The credentials are supplied by the IT department or the email server administrator.



Note: Some virus detection programs will block TotalControl from sending email messages because the messages are interpreted as spam email. You may need to disable email protection in the virus detection program or enter TotalControl as an exception.

To add or change email credentials after installation for the Notification Service, do the following:

- 1 Locate the Service Control Panel icon  in the Windows notification area.
- 2 Double-click the icon. The Service Control Panel opens.
- 3 Right-click the Notification Service icon .
- 4 From the shortcut menu, choose **Configure Email Server**.
- 5 In the properties dialog box, enter the account credentials.
- 6 Click **OK** or **Cancel** when finished.
- 7 Click the Minimize button (–) when finished.

The account credentials supplied by the server administrator include the following:

Outgoing Mail Settings

Server Type The name of the outgoing mail server.

Server Address The address of the outgoing mail server. The address may take the form of a URL (e.g., bigbuilding.com) or an IP address (e.g., 192.0.2.0).

Secure Select this box if messages requires a secure connection.

Port Typically, this is TCP port 25. The IT department can verify this or supply the correct value.

Email A user account name (e.g., TCalarms).

Password This is a third-party application code generated by the email service provider. Refer to your email service provider's instructions for generating and managing third-party application passwords.

Return Address (Address the Email will be FROM) The reply address that is included as part of the message (e.g., maintenance@bigbuilding.com).

Use login Email Select this box if the return address will be the same as the log-in email address.

To Address (For testing) Type the recipient address (e.g., superTech@bigbuilding.com) for an outgoing test message. This address is used only to test the connection to the email server.

Test Connection Click **Test Connection** to send a test message to the email recipient in **To Address (For testing)**.

Illustration E–5 Email Settings tab

The screenshot shows the 'Email Settings' tab with the following fields and options:

- Outgoing Mail Settings**
 - Server Type: Other (dropdown)
 - Server Address: smtp.kmcccontrols.com
 - Secure: ☒
 - Port: 587
 - Email: @kmcccontrols.com
 - Password: [masked]
- Return Address (Address the Email will be FROM): @gmail.com
- ☐ Use login Email
- To Address (For testing): example@example.com
- Test Connection button

Illustration E–6 Email properties dialog

The screenshot shows the 'Email Settings' tab within the 'TotalControl Notification Service' dialog box. The fields and options are:

- Outgoing Mail Settings**
 - Server Type: Other (dropdown)
 - Server Address: [empty]
 - Secure: ☐
 - Port: 25
 - Email: [empty]
 - Password: [empty]
- Return Address (Address the Email will be FROM): [empty]
- ☐ Use login Email
- To Address (For testing): example@example.com
- Test Connection button
- OK button
- Cancel button

Related topics

- [Starting and stopping TotalControl services on page 76](#)

- [*Configuring a service on page 77*](#)
- [*Configuring a service for a remote hardware license key on page 79*](#)
- [*Configuring the License Manager service on page 80*](#)

Appendix F: Converting a USB hardware license to a soft license key

This section covers the procedure to convert the license in a USB license key to a soft license key.



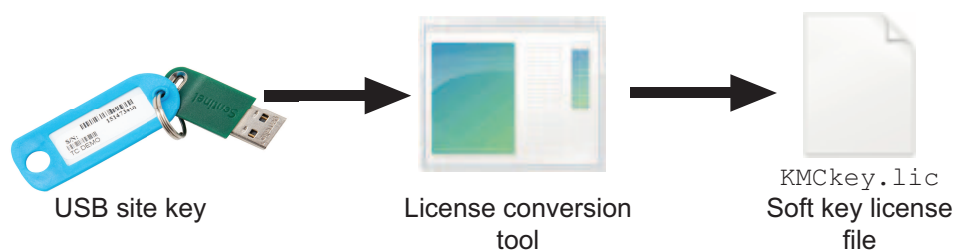
Caution: These instructions are for TotalControl and KMC Connect keys only. WinControl XL Plus and BACstage do not support a soft key license. As of March 31, 2020, KMC Controls does not support WinControl XL Plus and BACstage.

TotalControl version 1.8 and later requires a USB hardware license key, part number HW-KEY. However, some installations cannot use a physical license key for the following reasons.

- TotalControl is installed on a virtual machine that does not have permanent access to a physical USB port.
- The local security policy does not permit USB devices of any kind.
- The Virtual Machines on which TotalControl is running are not capable of mapping physical USB ports.

For these or other reasons, it may be necessary to convert a license from a Hard Key license to a Soft Key license. The result of this process is that components of TotalControl are licensed using a license file stored on the computer instead of a USB hard key license.

Illustration F–1 License conversion process



Before you begin

Read all of the instructions in this section before starting the conversion process.
Converting a license key from a Hard Key to a Soft Key is irreversible. Be absolutely sure
Soft Key conversion is necessary before converting the license.



Caution: Read, understand, and follow exactly all procedures for converting to a Soft Key license. Failure to correctly follow procedures can result in permanent damage to your license key and require the purchase of a replacement license.

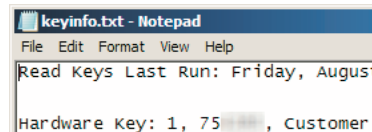
License type compatibility

Only Customer license keys—also referred to as Site keys—may be converted to a soft key. This type of license key can be identified by the blue ID tag physically attached to it, or, using the ReadKeys application, by the serial number followed by “Customer”.

Illustration F-2 Identifying customer key



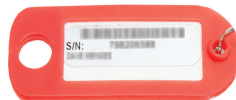
Customer key tag
(Blue)



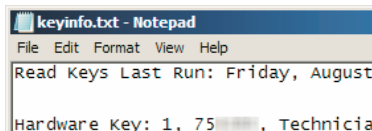
Customer key ReadKey report

Technician keys are not supported for conversion to a soft key. This type of license key can be identified by the red ID tag physically attached to it, or, using the ReadKeys application, by the serial number followed by "Technician".

Illustration F-3 Identifying technician key



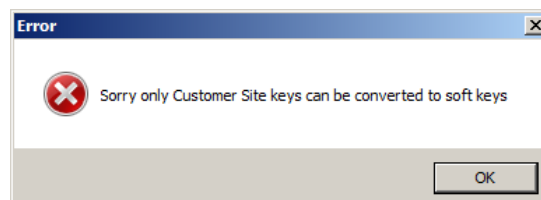
Technician key tag
(Red)



Technician key ReadKey report

If a user runs the license conversion tool with a Technician key attached, the tool will report an error and not allow the conversion to continue. If conversion is attempted, the conversion tool will close and the Technician key will remain unchanged.

Illustration F-4 Technician key conversion failure dialog

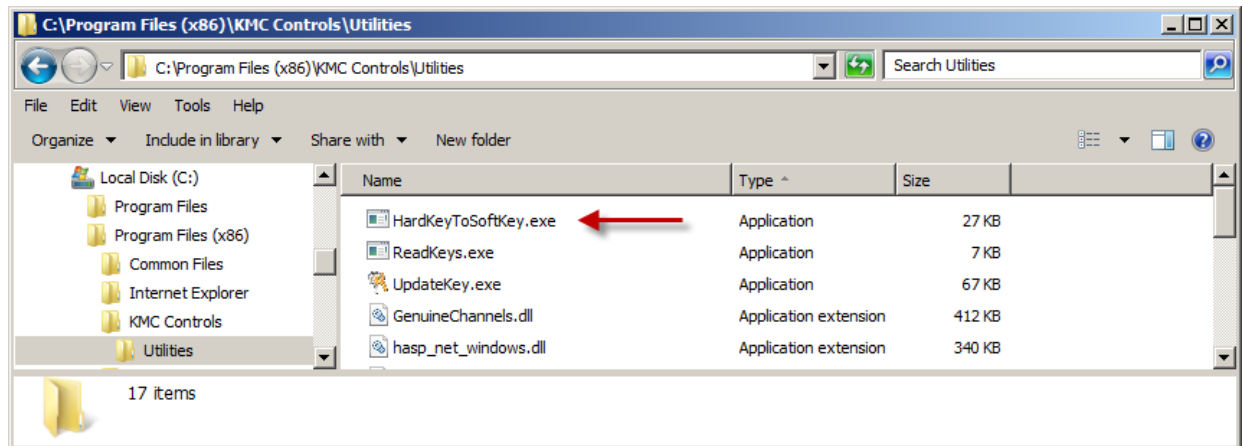


Locate the License Conversion Tool

The License Conversion Tool, `HardKeyToSoftKey.exe` is installed by default within the Utilities folder with `ReadKeys.exe` and `UpdateKey.exe`. However, to prevent accidental use, it is not provided as a shortcut in the Windows Start Menu. Depending on which version of Windows you are running, the program is located at one of the following locations.

- For 32-bit (x86) versions of Windows, the location of the license conversion tool is:
`C:\Program Files\
KMC Controls\Utilities\HardKeyToSoftKey.exe`
- For 64-bit (x64) versions of Windows, the location of the license conversion tool is:
`C:\Program Files (x86)\
KMC Controls\Utilities\HardKeyToSoftKey.exe`

Illustration F–5 Figure 7 - 64-bit file location example



Methods of license conversion

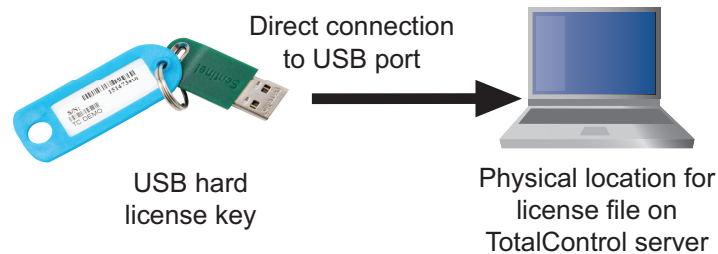
Converting a license from a Hard Key License to a Soft Key License requires access to the Hard Key License by either physical direct access or IP network access.

- Use the Direct Access method when you can plug the USB license key directly into the TotalControl server. Follow the instructions in the topic [Direct access conversion method on page 88](#).
- Use the Network Access method when you cannot plug a USB license key directly into a TotalControl server. Follow the instructions in the topic [Network access conversion method on page 90](#).

Direct access conversion method

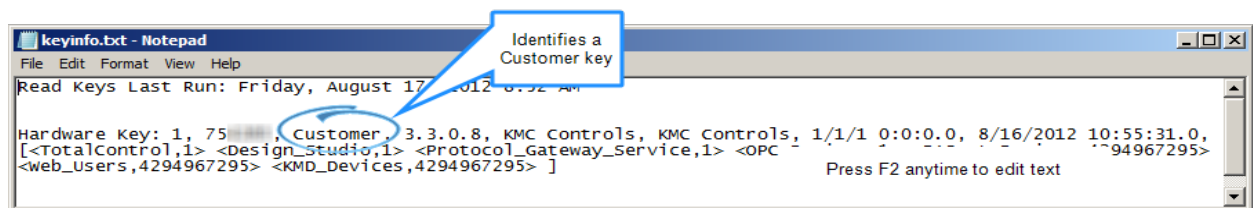
The instructions in this topic cover converting from a Hard Key to Soft Key license by the direct access method. This method requires that you plug the USB license key directly into the TotalControl server on which you will convert the license. If the key cannot be plugged directly into the TotalControl server, follow the instructions in the topic [Network access conversion method on page 90](#).

Illustration F-6 Direct Access Conversion Topology



To convert a license with the direct access method, do the following:

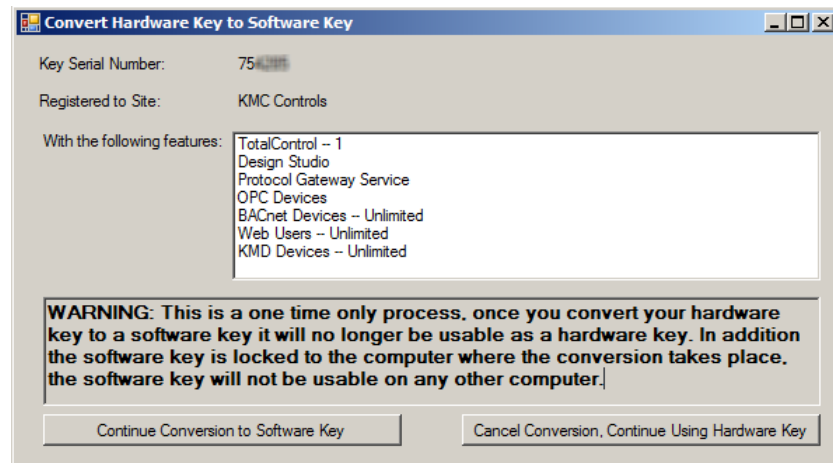
- 1 Plug the USB Customer Key into the TotalControl server.
- 2 Use the ReadKeys utility to verify that it is a Customer key.



3 Run the Hard Key-to-Soft Key license conversion tool.

After the tool reads the license key information, a confirmation dialog opens that requires you to verify the license serial number, site name, and license features that you are about to convert.

- If the information presented is correct, then click **Continue Conversion to Software Key**.
- If it is not correct, or you are not sure, click **Cancel Conversion** and verify the correct Hard Key is attached to the Temporary License Server computer by returning to Step 1.



Caution: This is the last opportunity to cancel the conversion before it becomes permanent!

When you click **Continue**, the license conversion tool will generate a unique fingerprint of the computer and move the license data from the Hard Key license to a Soft Key license file located on the computer's hard drive under the TotalControl working directory. After this process is complete, the Hard Key is marked as invalid and no longer contains any license data.

4 Disconnect the USB Hard Key License.

If the license conversion was successful, the confirmation dialog will close and you will not see any further prompts. Disconnect the USB Hard Key License from the computer at this time and store it in a safe location since it still contains the license serial number information.

- 5 Make a backup of the Soft Key License file in case the hard drive contents are lost or become unrecoverable. Because the USB Hard Key License becomes invalid after the license conversion is complete, if the Soft Key License file is lost, it will require the purchase of an entirely new replacement license.

If using Windows XP or Windows Server 2003, the location of the Soft Key license file is:

```
C:\Documents and Settings\All Users\Application
Data\KMC Controls\TotalControl\KMCKey.lic
```

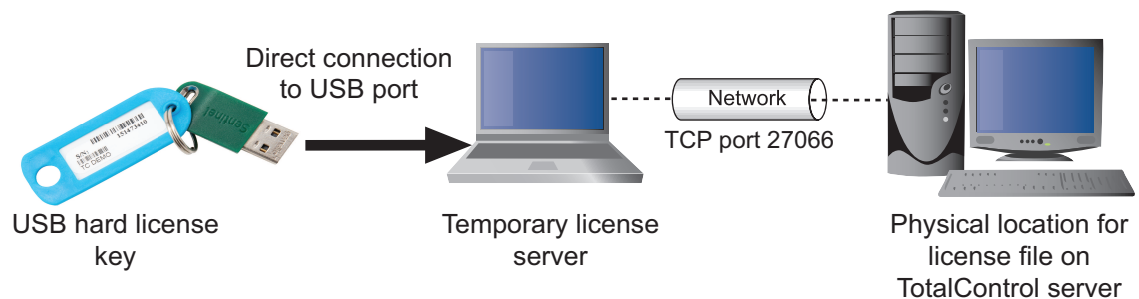
If using Windows 7 or Windows Server 2008, the location of the Soft Key license file is:

```
C:\ProgramData\KMC Controls\TotalControl\KMCKey.lic.
```

Network access conversion method

Use the Network Access method when you cannot plug a USB license key directly into a TotalControl server. If the key can be plugged directly into the TotalControl server, use the procedure [Direct access conversion method on page 88](#).

Illustration F–7 Network Access Conversion Topology



The IP Network Access method requires the use of a physical temporary license server to provide access to the USB Hard License key. The Temporary License server requires the following software components to be installed:

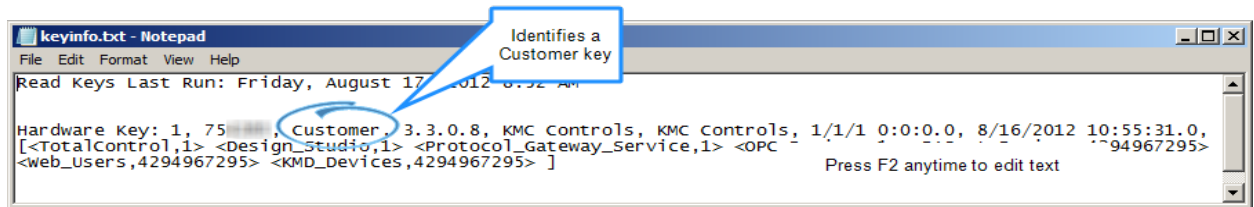
- Sentinel HASP Run-time Driver
- TotalControl License Server service
- TotalControl Utilities (ReadKeys and UpdateKey)

The IP Network Access method to convert to a Soft Key license consists of two parts.

- 1 Set up a temporary license server computer.
- 2 Convert the Hard Key license to a Soft Key license.

Step-1: Set up the temporary license server computer

- 1 Plug the USB Customer Key into the temporary license server.
- 2 Use the ReadKeys utility to verify that it is a Customer key.

Illustration F-8 ReadKeys example

- 3 Open a Command Prompt window from the Windows Start Menu and run the command `ipconfig/all`. Make note of the Host Name and/or IP Address as identified in , [Network access conversion method](#).

There may be multiple IP addresses listed in this report. If you are not sure of which IP address to use, contact your IT administrator. In this example document, the Temporary License Server computer will be identified as 192.168.89.128.

```

C:\>ipconfig/all

Windows IP Configuration

Host Name . . . . . : user-PC
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : localdomain

Ethernet adapter Local Area Connection:

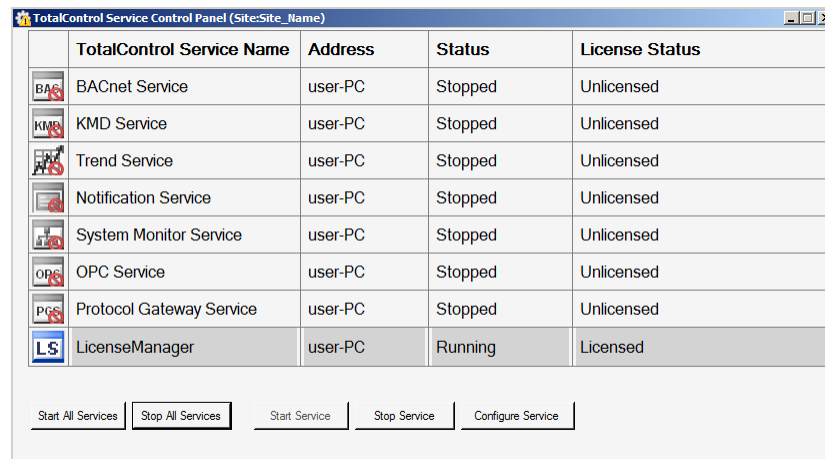
Connection-specific DNS Suffix . : localdomain
Description . . . . . : Intel(R) PRO/1000 MT Network Connection
Physical Address. . . . . : 00-0C-29-1E-CB-8A
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IPv4 Address. . . . . : 192.168.89.128(Preferred)
Subnet Mask . . . . . : 255.255.255.0

```

- 4 Verify that the TotalControl License Service is running. It is very important that no other licensed TotalControl services, such as the BACnet Protocol Driver Service or Design Studio, are running on the Temporary License Server computer. If these other licensed components are running at the time of the license conversion, it may cause the conversion to fail.

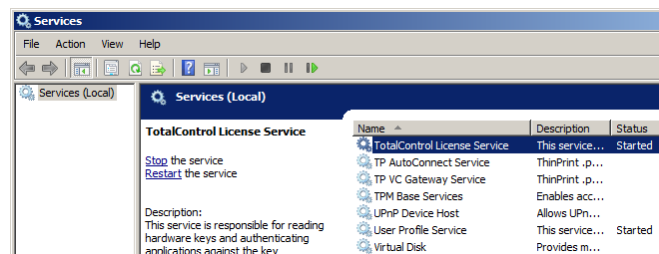
If a partial or complete installation of TotalControl Building Services is present, verify service status by opening the TotalControl Service Control Panel as shown in the [Illustration F–9, TotalControl Service Control Panel](#). The TotalControl License Service appears as LicenseManager in the TotalControl Service Name column.

Illustration F–9 TotalControl Service Control Panel



If no other TotalControl components are installed, verify TotalControl License Service status by opening the Windows Services Control Panel as shown in [Illustration F–8, ReadKeys example](#).

Illustration F–10 Windows Services Control Panel



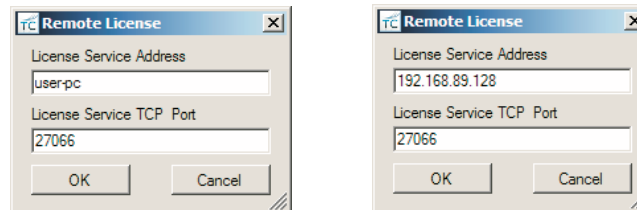
Step-2: Convert the license

You must have access to either the physical or virtual TotalControl server to run the License Conversion Tool. See the topic [Locate the License Conversion Tool on page 87](#).

1 Start the License Conversion tool.

When the license conversion tool starts, it will first scan the local computer for a directly connected license key. This will take a few seconds to time out. Once the license key is detected, a dialog box will open and require you to enter the Host Name or IP Address of the Temporary License Server computer. The TCP port number should remain as the default of 27065 except for advanced installations. When complete, click **OK**.

Illustration F–11 Address examples



Host name example

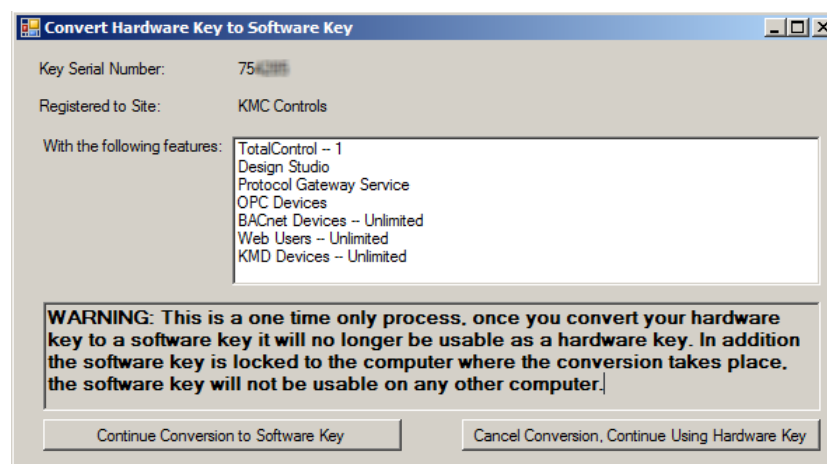
IP address example

- 2 Once the conversion tool successfully finds the specified remote license service, a confirmation dialog opens that requires you to verify the license serial number, site name, and license features you are about to convert.
 - If the information presented is correct, then click **Continue Conversion to Software Key**.
 - If the information is incorrect, or you are not sure, click **Cancel Conversion** and verify that the correct Hard Key license is attached to the Temporary License Server computer.



Caution: This is the last opportunity to cancel the conversion before it becomes permanent!

Illustration F–12 Conversion confirmation form example



3 Disconnect the USB Hard Key License and make a backup of the Soft Key license file.

If the license conversion was successful, the confirmation form will close and there will be no further prompts. Remove the USB Hard Key license from the computer at this time and store it in a safe location since it still contains the license serial number information.

4 Make a backup of the Soft Key license file in case the hard drive contents are lost and/or become unrecoverable.

Because the USB Hard Key License becomes invalid after the license conversion is complete, if the Soft Key license file is lost, an entirely new replacement license will need to be purchased.

If using Windows XP or Windows Server 2003, the location of the Soft Key license file is:

C:\Documents and Settings\All Users\Application Data\KMC Controls\TotalControl\KMCkey.lic

If using Windows 7 or Windows Server 2008, the location of the Soft Key license file is:

C:\ProgramData\KMC Controls\TotalControl\KMCkey.lic

Reference

The following information may be helpful when converting a license.

Using the ReadKeys program with Soft Key licenses

Both the Hard Key and Soft Key licenses will behave the same except for the requirement of the physical USB key and port and a minor detail in the ReadKeys report. In the report, a Hard Key license is described as *Hardware Key*, a Soft Key license is described as *Software Key*. Both before and after examples of the conversion of a ReadKeys report are shown in the following illustrations.

Illustration F–13 Hard Key license before conversion

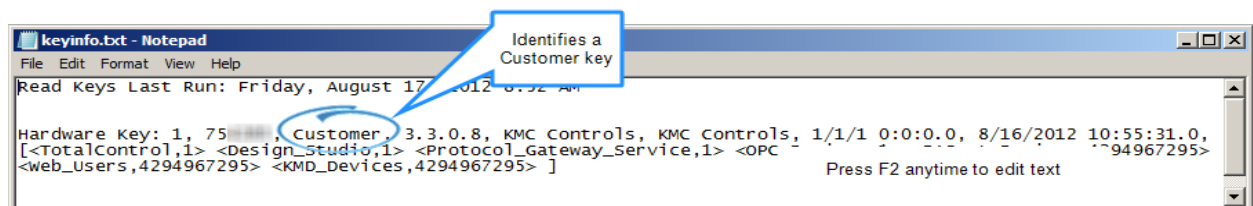
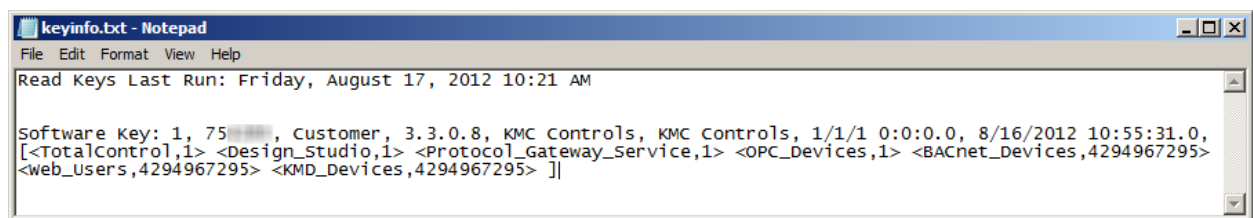


Illustration F–14 Soft Key license file after conversion



Upgrading Soft License Keys with UpdateKey

When a major version software upgrade is performed—for example upgrading from version 3.2 to version 3.3—Soft License keys will behave the same as Hard License keys when running the UpdateKey utility. The same upgrade procedure remains in place when the user contacts KMC Customer Service to request the version upgrade, then runs UpdateKey to retrieve the new license data from KMC.

Computer hardware failure, Soft Key license encryption, and hardware fingerprints

As mentioned in the instructions section, the license conversion tool creates a fingerprint of the computer during the conversion process. This fingerprint is encrypted into the license file and permanently pairs the Soft Key to the computer. If the Soft Key license file is copied to another computer, it will not be recognized or function in any manner.

This encrypted fingerprint is multi-faceted, but does not include any characteristics of the hard disk drive on which it is installed. This design allows for partial or complete hard disk drive failures that may include:

- Partial drive content failure requiring a user to restore the drive from a backup.
- Complete drive content failure requiring a user to format the drive and install a new instance of Microsoft Windows.
- Complete drive hardware failure requiring a user to replace a physical hard disk drive.

All of the above examples allow the user to restore a backup or copy of the Soft Key license file to the TotalControl server on which it was created without having to purchase a new license.

KMC Technical Support and Customer Service representatives do not have any details of the hardware fingerprint encryption outside of what is provided in this document. Any specifics regarding the hardware fingerprinting and encryption will not be discussed with customers as it is considered a trade secret.

Virtual machine installations

For installations on virtual machine environments, such as VMware, be cautious of upgrades to the virtual machine host software. Performing major upgrades to VMware ESX or ESXi host software may change the hardware fingerprint of virtual machines. This will invalidate TotalControl Soft Key license encryptions. Any planned upgrades to VM host software should first be tested and validated as compatible with existing TotalControl Soft Key licenses before committing the change or upgrade as permanent.

Troubleshooting

The following information and procedures may help with problems encountered when converting a license.

Unable to locate the Soft Key license file

The TotalControl working folder is a subfolder that Windows hides by default.

To access the TotalControl working folder in Windows XP or Windows Server 2003, you may use the following addresses that resolve to the same location:

```
C:\Documents and Settings\All Users\Application Data\KMC  
Controls\TotalControl\%ALLUSERSPROFILE%\Application  
Data\KMC Controls\TotalControl\
```

If using Windows 7 or Windows Server 2008, the working folder locations are:

```
C:\Program Data\KMC Controls\TotalControl\%PROGRAMDATA%\KMC  
Controls\TotalControl\
```

The license conversion tool fails to contact the temporary license server

The most common causes of the license conversion tool failing to contact the Temporary License server computer (also known as a Remote License server) are:

- The lack of a valid network path
- The Windows Firewall blocking communications.

The easiest way to verify a path between the TotalControl server and a Temporary License server is to use the Wireshark capture tool. This requires installing and starting Wireshark on both computers, enabling filtering for TCP port 27066, then following the appropriate license conversion procedure until the license conversion tool attempts to contact the Temporary License server and times out. If no filtered packets appear on the Temporary License server Wireshark graphical user interface (GUI), then verify the network path is valid and reattempt the procedure.

Lost or unrecoverable Soft Key licenses

If a Soft Key license is lost and a backup file was not made after the license was converted, an entirely new license must be purchased to replace it. KMC Controls will not issue credit, attempt repairs, or assist with data recovery of lost or damaged Soft Key licenses.

KMC Controls is not responsible for lost or unrecoverable Soft Key license files because of operator errors such as:

- Deleting license key files.
- Corrupted configurations due to changing the system clock.
- License failure because of moving a TotalControl installation.
- Failure to maintain backup files.
- Converting a key with a WinControl or BACstage license.

Appendix G: Glossary

A

Administrator

Users in the Administrator group are the only users with access to Design Studio. Operators are granted Administrator status by the Admin user in the Admin group.

alarms

Audible or visual messages indicating that a value is out of range or an abnormal condition is present. KMC digital and BACnet controllers both generate alarm messages.

analog

Analog describes any fluctuating, evolving, or continually changing process. Examples of analog units are temperatures, setpoints, humidity, volts, and amperes.

APDU

Application Layer Protocol Data Unit. An APDU is the significant data in a network packet.

ASHRAE

The American Society of Heating, Refrigerating and Air-Conditioning Engineers. Founded in 1894, it is an international organization with the mission of advancing heating, ventilation, air conditioning, and refrigeration.

ASP.NET

Software that provides the services necessary for developers to build web applications.

B

BACnet

Building Automation Control Network. A data communications protocol for building automation systems. Developed and maintained by ASHRAE, it is an American National Standards Institute standard designated ASHRAE/ANSI 135. BACnet defines how information is exchanged between vendors.

BACnet broadcast

A message that is intended to be received by a group of devices on an internetwork. There are three types of BACnet broadcasts: Global Broadcast - All devices on the internetwork get the message. Remote Broadcast - All the devices on a remote network get the message. Local Broadcast - All of the devices on the local network receive the message.

BACnet broadcast management device (BBMD)

A special type of routing device that is used in BACnet/IP networks to distribute broadcast messages across multiple IP subnetworks.

BACnet device

Any device, real or virtual, that supports digital communication using the BACnet protocol. Examples of devices are operator terminals, routers, unitary controllers, etc.

baud

Pronounced bawd, it is a reference to the speed at which a modem or other serial device can transmit data. In KMC networks, it is the speed at which a Tier 2 or BACnet MS/TP network operates. The term is named after J.M.E. Baudot, the inventor of the Baudot telegraph code.

C**client**

In networked systems, an application or device acting as a requestor or consumer of data. A client requests a server device for data resident in the server.

conformance class

Conformance classes describe the capabilities of a BACnet device for communicating data and interoperating with other BACnet devices. A device's Protocol Implementation Conformance Statement (PICS) details its conformance class.

Control Basic

A program embedded in KMC controllers that interprets a set of instructions. Control Basic programs are either written by the installer or embedded in the controller by the manufacturer.

controller

A device that changes its output based on a sensed condition.

D**database**

A collection of information stored in related tables of data and definitions of data objects. The data within a database can be accessed and manipulated with a computer program.

DCOM

Distributed Component Object Model (DCOM) is a set of Microsoft program interfaces in which client program objects can request services from server program objects on other computers in a network.

device instance

A number that uniquely identifies the device on the internetwork. The device instance number is determined by the BACnet system designer. Valid instance numbers range from 0 to 4,194,303 and are assigned to the device during configuration. It is by reference to the device instance number that data is exchanged between BACnet devices.

Trend log–device

A Device Trend Log is a controller trend log that has been retrieved from a device and then stored in the site database.

digital

Any electronic technology that generates, stores, and processes data in terms of two states: positive and non-positive. Positive is expressed or represented by the number 1 and non-positive by the number 0. Valid units for digital points in KMC controllers include Off/On, Closed/Open, 1 / 0, and Unoccupied/Occupied.

direct digital control

A microprocessor based device or network of devices to control a system or process. The DDC device operates digitally and converts digital information into analog signals which control HVAC equipment such as hot water valves, heat pumps or air control devices.

directly connected network

A BACnet network that is accessible from a router without messages being relayed through an intervening router. A PTP connection is to a directly connected network if the PTP connection is currently active and no intervening router is used.

E**end-of-line**

A set of switches, jumpers, or resistors that indicates the controller is the last physical panel at the end of a network cable. This is not the same as the software Last Panel setting for KMD series controllers.

enthalpy

Enthalpy is a measure of the heat content within a sample of air and is expressed in BTUs per pound or as joules per kilogram of dry air. It is used to determine the amount of outside air to add for best economy.

Ethernet

Ethernet is a widely-installed local area network (LAN) technology specified by the IEEE standard, IEEE 802.3. Original versions of the Ethernet LAN used coaxial cables and were referred to as “thicknet” or “thinnet”. Newer versions (10baseT and 100baseT) connect with unshielded twisted pairs of wires in a cable. Ethernet operates also on fiber optics and as a wireless LAN.

F**firewall**

A security mechanism, or combination of mechanisms, designed to prevent unauthorized or unwanted communications between sections of a computer network. Firewalls are usually both software and hardware based.

flash memory

A special type of EEPROM (electrically erasable programmable read-only memory) that can be erased and reprogrammed in blocks instead of one byte at a time. Flash memory

gets its name because the microchip is organized so that a section of memory cells is erased in a single action, or “flash.” Flash memory is non-volatile, meaning that it retains its data after the power is removed.

frame

A frame (or packet) is piece of a message transmitted over a packet-switching network. One of the key features of a packet is that it contains the destination address in addition to the data.

G

gateway

A device that connects two or more different communication protocols so that information can be passed from devices on one network to the other. Gateways are similar to human language translators. A BACnet gateway uses BACnet as a common language on one side and some non-BACnet (usually proprietary) communication scheme on the other side.

H

half-router

In BACnet, a device that can participate as one partner in a point-to-point (PTP) connection. Two half-routers form an active PTP connection and act as a single router.

hub

A common connection point for nodes on a network. Hubs connect segments of a LAN and contain multiple ports. When a packet (message) arrives at one port, it is copied to all other ports.

I

I-Am service

The I-Am service is used to respond to Who-Is service requests. However, the I-Am service request may be issued at any time. It does not need to be preceded by the receipt of a Who-Is service request. A device may be programmed to broadcast an I-Am service request when it powers up. The network address is derived either from the MAC address associated with the I-Am service request, if the device issuing the request is on the local network, or from the BACnet network header (NPCI) if the device is on a remote network.

internetwork

A BACnet internetwork can be as simple as a single network but is usually two or more BACnet networks connected by routers. The BACnet protocol permits up to 65,534 interconnected networks in an internetwork. Internetworks may contain similar or dissimilar physical types such as Ethernet, IP or MS/TP.

IP address

Short for Internet Protocol address, it is the address of a computer or other network device on a network using the IP protocol. The number 10.1.1.2 is an example of a typical IP address. The IP address is usually assigned by the network administrator.

K**KMDigital**

KMDigital is a proprietary line of digital building automation controllers manufactured by KMC Controls, Inc. The controllers are either Tier 1 or Tier 2 controllers. Tier 1 controllers connect directly to a LAN through Ethernet; Tier 2 controllers connect to each other and Tier 1 controllers on an EIA-485 network. KMDigital is often abbreviated as KMD.

L**last panel**

The highest numbered panel on a KMD network. A controller assigned as the last panel will pass the token back to the lowest numbered panel when it is done talking on the network. Last Panel is not the same as end-of-line termination.

local area network

A collection of interconnected equipment that can share data, applications, and resources. It may include computers, printers, data storage devices and industrial controllers and machines. A LAN device can send and receive signals from all other devices in the network. Networks use protocols, or rules, to exchange information through a single shared connection. These protocols prevent collisions of data caused by simultaneous transmission between two or more computers.

local network

The network to which a BACnet device is directly connected.

M**MAC address**

The MAC address uniquely identifies a device on its network. Each network type—Ethernet 802.3, IP or MS/TP—has its own MAC addressing scheme.

main panel

See Tier 1 controller.

master and slave devices

MS/TP devices come in two varieties: Slave devices are suited for the lowest-cost implementations but they lack the capability to initiate requests; they can only reply to messages from other devices. Master devices are able to initiate requests, but they must also be able to negotiate for a time slot in which to make their requests. This adds some processing and memory requirements to the Master device which can result in higher cost than the slave.

Microsoft.NET Framework

The Microsoft .NET Framework is a component of the Microsoft Windows operating system. It provides a large body of pre-coded solutions to common program requirements, and manages the execution of programs written specifically for the framework. The framework is intended to make it easier to develop computer

applications and to reduce the vulnerability of applications and computers to security threats.

Modbus

A protocol developed to establish master-slave/client-server communication between industrial devices. Modbus devices communicate over a serial network in a master/slave (request/response) type relationship using one of two transmission modes: ASCII (American Standard Code for Information Interchange) mode or RTU (Remote Terminal Unit) mode.

MS/TP

The MS/TP (master slave/token passing) protocol is unique to BACnet and is implemented using the EIA-485 signaling standard. This is a shielded, twisted-pair LAN operating at speeds from 9600 to 115,200 baud.

N

Near Field Communication (NFC)

A method of short-range, wireless communication that enables smartphones and other devices to transmit and receive data even with unpowered target devices.

Network Manager

Network Manager is the user interface for navigating through the control system. It displays a hierarchical view of the physical layout of the control system including networks, devices, controllers, objects, and properties.

network number

A number from 1 to 65,534 that identifies specific BACnet network. It is assigned by the BACnet system designer at the time a router is initialized for network operation.

network segment

An electrically separate section of a network. In the Ethernet communications protocol, bridges, hubs, switches, and repeaters connect multiple physical segments into one logical segment. Broadcast messages can be received by all devices within a logical segment. In BACnet MS/TP or KMD Tier 2 networks, segments are connected with a repeater.

node

A device such as a computer or a controller on a network that is capable of communicating with other network devices.

O

object

Objects are the means by which a BACnet device represents information that can be observed or changed. The object may represent a physical point such as an input or output or a logical grouping of data such as a PID loop, schedule, or variable. Objects have a set of properties and a group of functions that can be applied to them.

OPC

OPC is the original name for OLE for Process Control, an open standards specification developed in 1996 by an industrial automation industry task force. The standard specifies the communication of real-time plant data among control devices from different manufacturers. OPC servers provide a method for many different software packages to access data from a process control device, such as a PLC or DCS.

P

packet

A packet (or frame) is piece of a message transmitted over a packet-switching network. One of the key features of a packet is that it contains the destination address in addition to the data.

PAD router

A BACnet IP PAD (Packet Assembler and Disassembler) is a special type of router that connects two BACnet IP network segments that are separated by at least one IP-only router. The PAD router monitors network traffic for BACnet messages addressed to the other subnet and repackages the message so that it can pass through IP routers, in effect forming a “tunnel” between the two network segments. A companion PAD router unpacks and retransmits the message on the remote BACnet network.

peer-to-peer communications

The controllers in a network hierarchy which are considered to be at the same level. There are no host or master controllers. Each controller is at the same level as its peers.

PID controller

A Proportional Integral Derivative loop is an algorithm built into each controller that calculates a value between 0 and 100 percent. The output of the loop can then be used to control the position of an actuator. The output value is based on the sensed value and the required setpoint.

point-to-point

In BACnet, point-to-point is a method of data transmission to provide serial communications between two BACnet devices. Typically, it is used for remote and roaming access to BACnet systems, dial-up communications over modems, or a portable computer connection to a controller. PTP is based on the EIA-232 direct point-to-point connection or via dial-up telephone modems.

port

An interface on a computer, either physical or logical, to which you can connect a device. Examples of physical ports are connections for disk drives, display screens, keyboards, networks, etc. Ports may also be logical connection on networks. For example, port 80 is used for HTTP traffic.

priority array

BACnet devices use the priority array to control Present Value in certain objects. The array consists of a table with 16 slots arranged in descending priority order. Values

written to higher priority slots in the table override those of lower priority. The value in the highest priority slot transfers to the present value property.

properties

Properties are used to read information from objects or write information to objects. Each BACnet object is provided with a standard set of properties that describes the object and its current status. Certain properties of an object may be required, while others may be optional.

protocol

A definition or rules of communication for a computer network. A formal set of conventions governing the format and relative timing of message exchange between two communications terminals.

Protocol Driver Service

A Protocol Driver Service (PDS) is the link between a building automation system and other services. When data is required from a controller, the PDS retrieves the data, forwards it to the requesting service and, depending upon the type of data, caches it for future use. Each supported protocol requires a corresponding PDS and network connection. The PDS is one of the licensed components of Building Services.

Protocol Implementation Conformance Statement

A Protocol Implementation Conformance Statement (PICS) is a document issued by a manufacturer that specifies exactly which portions of the BACnet Standard a device actually implements.

R

remote network

Pertaining to devices or nodes on a network different than the referenced device.

repeater

A network device used to regenerate analog or digital signals distorted by transmission loss. A repeater cannot do the intelligent routing performed by bridges and routers.

routers, BACnet

BACnet routers connect different types of BACnet networks. The KMC Controls BAC-5051(A)E routers link BACnet 8802-3, BACnet IP, and MS/TP networks.

RSSI

Received Signal Strength Indication (RSSI) is the relative received signal strength in a wireless environment, in arbitrary units. It is an indication of the power level being received by the receiving device. Because RSSI is represented in a negative form, the closer the value is to 0, the stronger the received signal.

S

scan

The process that Control Basic uses to read the state of points or properties. The period required for the processor to perform all of its instructions and programs.

server

In networked computer systems, an application or device acting as a provider of data, responding to a request from a client. A server can refer to hardware optimized to perform server functions or software such as an SQL server.

services

BACnet services control the transfer of information between BACnet devices. Examples of services include scheduled commands and alarms between BACnet devices. BACnet defines 26 standard services. Some services read or write properties of objects in the receiving device. Others convey notification of alarms or other special events, others read and write files, and so on. The services provided by a BACnet device are generally described by the device's PIC statement.

setpoint

The desired temperature of a space.

SQL

An abbreviation for Structured Query Language. SQL is an industry standard query language for requesting and manipulating information from a database. When referring to Structured Query Language as SQL, it is pronounced as its constituent letters. When referring to the product or the server that is running the product, SQL is pronounced "sequel."

subnet

A subdivision of an IP network. Each subnet has its own unique network ID.

subnet mask

Short for subnetwork mask, a subnet mask is method of dividing a network of IP addresses into groups. It enables the recipient of IP packets to distinguish the network ID and host ID portions of the IP address. A common example of a subnet mask used is 255.255.255.0. Subnet masks are assigned by the network administrator.

switch

A special type of network hub that forwards packets to the appropriate port based on the packet's address. A switch may also be referred to as a switching hub.

system

All of the components that combine to control a building. This may include controllers, repeaters, modems, and computers.

T**Tier 1 controller**

An upper level controller in the KMC digital network hierarchy. The Tier 1 controller can have one or more Tier 2 networks connected to it. A Tier 1 controller may also have ports for connection to computers, a network, buffered modem communications, a dedicated system printer and an OEM equipment interface. The Tier 1 controller has many other advantages for large networks such as large areas of memory for system groups, Control Basic programs, schedules, and passwords. Tier 1 controllers have additional

commands and statements available to allow complex programs to be easily written. Also referred to as a LAN controller, MultiNet or main panel.

Tier 2 controller

A KMC controller with built-in peer-to-peer, EIA-485 network communications. Also referred to as a Subnet controller or sub-panel.

token

A special network message that circulates around a token ring network. Only the device that has the token can transmit data on the token ring network. BACnet MS/TP and the KMD protocol are both token passing protocols.

Trend log-controller

Controller trend logs are sets of historical data collected and stored only within the memory of an individual controller.

Trend log-PC

A PC Trend Log is a polling process that is performed by a trend service. At regular intervals, the value of a property or point is sampled by the trend service and then stored in the site database.

trend logs

Trend logs are a record of the value of a point or property as measured by a building automation device or controller.

U

UDP/IP

An abbreviation for User Datagram Protocol and Internet Protocol, a connectionless protocol that, like TCP, runs on top of IP networks. Unlike TCP/IP, UDP/IP provides very few error recovery services, offering instead a direct way to send and receive datagrams over an IP network. It is used primarily for broadcasting messages over a network.

Universal Serial Bus (USB)

An external bus standard that supports data transfer rates of 12 Mbps. A single USB port can be used to connect up to 127 peripheral devices such as mice, modems and keyboards.

V

variables

Virtual points in the KMD protocol that can represent temperatures, setpoints, offsets, multipliers, or digital values.

W

want-point

Points that are being requested from the network. A list of want-points is created in each panel when a point in another panel is referenced in a Control Basic program, system group, or trend log.

Web Administrator

Web Administrators typically have access to all or major portions of the TotalControl Web Portal.

Who-Is service

The Who-Is service message is sent by a BACnet device to determine the device object identifiers and network addresses for all devices on the network, or to determine the network address of a specific device whose device object identifier is known, but whose address is not.

wide area network (WAN)

A geographically widespread network, usually comprising one or more LANs. WANs are often connected through the Internet, leased lines, satellite, or microwave communications.

X**XML**

The Extensible Markup Language (XML) is a standard for marking up documents and data. It facilitates the sharing of data among diverse systems and programs that are often operating on different computer platforms.

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