DigiVis 500

Getting Started

Version 1.0 SP1

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About This Book

Use of Warning, Caution, Information, and Tip Icons

This publication includes **Warning**, **Caution**, and **Information** where appropriate to point out safety related or other important information. It also includes **Tip** to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

Electrical warning icon indicates the presence of a hazard which could result in *electrical shock.*

Warning icon indicates the presence of a hazard which could result in *personal injury.*

Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in *corruption of software or damage to equipment/property.*

Information icon alerts the reader to pertinent facts and conditions.

Tip icon indicates advice on, for example, how to design your project or how to use a certain function

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Typographic Conventions

All text entries, shortcuts, prompts, system messages, menu items, screen elements etc. comply with the Microsoft Windows conventions.

Terminology

You will find a complete and comprehensive glossary at the end of the Engineering Manual, DigiVis 500 Graphics Builder. This glossary contains terms and abbreviations that are unique to ABB or have a usage or definition that is different from standard industry usage. Please make yourself familiar with this glossary.

Related Documentation

The following list gives an overview of the documentation relating to the DigiVis 500 system.

Title	Number
Engineering Manual, DigiVis 500 Graphics Builder	2PAA104345R0201
Engineering Manual, Security Lock	2PAA104348R0201
Operators Manual, DigiVis 500 Operations	2PAA104346R0201

The manuals listed above are for the DigiVis 500 system only. These manuals should be supplemented by the AC500 related documentation (PS501 CD, Documentation).

Section 1 DigiVis 500 Installation

General Notes

Recommended PC Equipment

DigiVis 500 Graphics Builder

Hard disk for installation	500 MB free disk space
Hard disk for operation	10 GB free disk space
Operating System	Microsoft Windows XP Professional, SP3 Windows 7 Professional SP1, 32-bit
CPU Speed	≥ 2 GHz
RAM	1 GB
Ethernet card with supp. Interface	BNC/AUI/TP

Windows 7 Professional SP1, 32-bit OS is referred to as Windows 7 throughout the user manual.

DigiVis 500 Operations

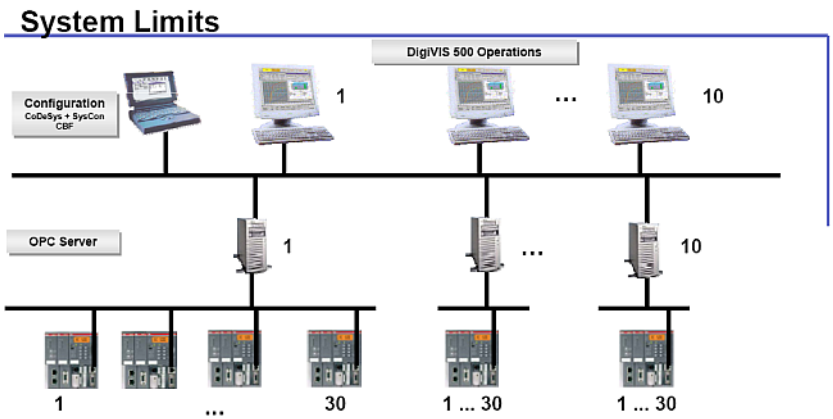
Hard disk for installation	500 MB free disk space
Hard disk for operation	≥ 2 GB free disk space
Recommended for archiving	≥ 80 GB (depending on configuration)
Operating System	Microsoft Windows XP Professional, SP3, 32-bit, en Windows 7 Professional SP1, 32-bit, en
Speed	≥ 2 GHz
RAM	3 GB
Graphics card for dual monitor	Matrox Millenium P690 Nvidia NVS295
Multi-display Fiber-Optic Remote Graphics Unit	Matrox Extio F1400
Ethernet card with supp. Interface	BNC/AUI/TP

The above-mentioned specifications for PC equipment are recommendations only. They were selected to guarantee a fluent workflow and have good response time. Depending on the size of your project you might experience good behavior also with a less powerful PC.

The proper and error-free operation of DigiVis 500 can be guaranteed only if DigiVis 500 applications are the only ones installed on the PC.

DigiVis 500 System Limits

The DigiVis 500 System has the following configuration limits:



One AC500 HA pair counts as 2 Controllers. In that case one OPC server connects to 15 AC500HA pairs only

System Limits.bmp

- Max. of 10 DigiVis 500 Operator stations
- Max. of 10 OPC Servers can be used.
- Each OPC Server can be connected to 30 AC 500 Controllers

In case of AC500 High availability controller, each OPC Server can be connected to 15 AC500 HA pairs.

Mixed systems with Windows XP and Windows 7

It is possible to combine PCs with Windows XP and PCs with Windows 7 Operating System in a DigiVis 500 system. With this, an update from Windows XP to Windows 7 must not be done in one step but can be done one after the other.

Product Options

For DigiVis 500 you need a hardkey and an authorization key. These will enable you to work with those functions and features of DigiVis 500 Graphics Builder and/or DigiVis 500 Operations that was ordered.

The new authorization key should be entered as follows:

> Start > All Programs > ABB Industrial IT > DigiVis500 > Configure.

Select the tree item
> General settings > Authorization key installation

Hardkey

DigiVis 500 products are protected by means of the hardkey and an associated authorization key, which activates only those packages and functionalities for which official orders have been processed.

The following are the versions of the hardkey:

- DigiVis 500 Graphics Builder
- DigiVis 500 Operations
- Combination (DigiVis 500 Graphics Builder and DigiVis Operations)

If you start the DigiVis 500 software without the hardkey, a demo version will run for 100 days.

You will only be put into demo mode if there is no hardkey installed on the PC during installation.

In case of a hardkey failure, the software will enter an emergency mode which, just like the demo mode expires after 100 days. As long as the hardkey is replaced within these 100 days, the rights conferred by the license will remain in effect.

Similarly, if the hardkey is unplugged after startup the software will go into emergency mode.

First Installation of the DigiVis 500 Software

Checklist for Installation

- ☐ Do you have a current authorization key file (only required for Production Mode?
  If not please contact your local ABB sales office.
  See Authorization Key Installation on page 57.
- ☐ Is the **hardkey** plugged in at the USB port?
- ☐ Has the Windows Operating System been **fully installed**, including the Service Pack?
  See Windows XP Installation on page 16.
- ☐ Windows 7 only:
  Is the User Account Control disabled?
  See Windows 7 User Account Control Settings on page 17.
- ☐ Is the Windows Firewall configured? See Firewall Configuration on page 31.
- ☐ Is the Screen saver deactivated? See Disable Screen Saver on page 34.
- ☐ DigiVis operator stations only:
  Is the theme and screen resolution set?
  See Starting the ABB OPC Tunnel on page 62.
- ☐ DigiVis operator stations only:
  Is the Windows Taskbar Configuration appropriate?
  See Starting the ABB OPC Tunnel on page 62.
- ☐ Is TCP/IP protocol installed as network protocol? Have the **IP addresses** been entered? Has the file “hosts” been correctly edited?
  See Network and IP Address Settings on page 18
- ☐ Is the size of the **virtual memory** defined (1 GByte)?
  See Virtual Memory Size on page 29.

- ☐ The required user accounts for production mode will be created during the installation of the DigiVis 500 software.
- ☐ Is the automatic update of the Windows Operating Systems disabled?
  See Disable Automatic Updates on page 30.
- ☐ Is the project directory <DigiVis 500_Installation_Folder>\proj excluded from virus checking?
  See Configure the Antivirus Program on page 30.
- ☐ Is there a Freelance 800F version installed on the system? If yes, uninstall the same before installing DigiVis 500.
- ☐ Is there a previous version of DigiVis 500 installed on the system? If yes, the setup Uninstall the same and then installs the new version.
- ☐ Is the monitor resolution for the DigiVis 500 Operations station set to 1280 x 1024?

Windows XP Installation

Check to be sure that the Windows Operating System and the required Service Pack for Windows is installed. For detailed information on required service packs please refer to the release notes, which are available on the setup CD. The Service Packs are available free of charge from Microsoft Corporation (also on the internet at http://www.microsoft.com).

For Installation of DigiVis 500 Operations: Windows XP Taskbar Configuration

When you start DigiVis 500 Operations the Windows Start button is shown in gray without text. There is no minimize button in DigiVis 500 Operations. This behavior has been implemented because of security concerns. The DigiVis 500 operations user cannot switch to other applications. Only those applications that have been started before the start of DigiVis 500 Operations can be reached by the DigiVis 500 Operations user by pressing the ALT+TAB keys.

The windows Operating System can be reached from the DigiVis 500 Operations menu (Options / System / Operating System) after entering a password. With this action the Windows start button is enabled and is displayed with text. This is not a

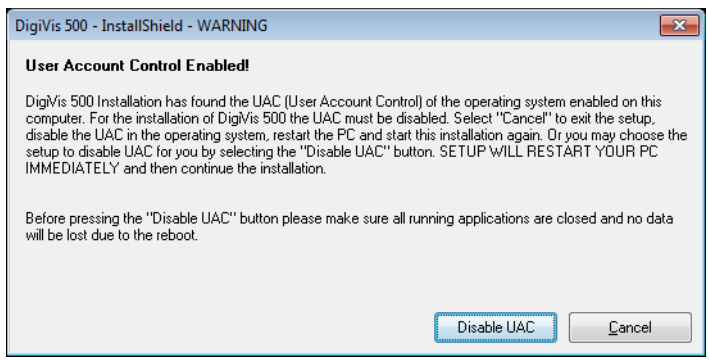
security problem, as long as the taskbar is in the background of DigiVis 500 Operations. DigiVis 500 Operations is not able to suppress the taskbar in all cases. If the taskbar is configured “Always on top” it is shown in front of DigiVis 500 Operations, therefore, the taskbar property “Always on top” must be disabled to make sure that the DigiVis user has no access to other applications.

Windows 7 User Account Control Settings

The User Account Control (UAC) is a new feature in Windows 7. The instructions to disable the User Account Control are applicable for Windows 7 only. To ensure the proper operation of DigiVis 500, it is highly recommended to disable the UAC feature in the Windows 7 environment.

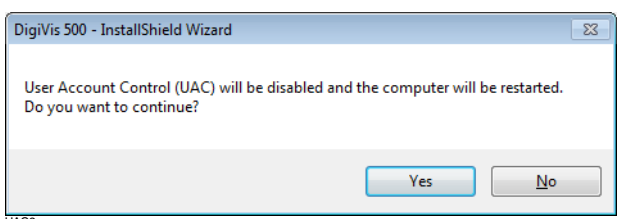
UAC handling by the DigiVis 500 Setup

The DigiVis 500 setup detects, if the UAC configuration is not appropriate and shows this warning:



UAC1

Click **Disable UAC** to disable the UAC. The setup will disable the UAC and restart the PC. Ensure that you have no unsaved work and click Yes to restart the computer.



UAC2

After the restart, setup will continue with the DigiVis 500 Installation.

Verifying the User Account Control settings

The UAC setting can be verified, after the installation of DigiVis 500:

> **Start** > **Control Panel** > **User Accounts** > **Change User Account control settings**

The slider bar must be in the **Never Notify** position.

Network and IP Address Settings

The **Network protocol** used by DigiVis 500 is **TCP/IP**. No other protocol is required. Proper operation with other network protocols is not guaranteed.

IP addresses and/or host names can be used for addressing the Engineering station and Operator station(s) in a project.

IP Address Settings

Windows XP

> **Start** > **Settings** > **Network and Dial-up Connections**
> > Double-click a network connection > **Properties**
> > **Internet Protocol TCP/IP** > **Properties**

Windows 7

> **Start** > **Control Panel** > **Click Network and Internet**

> Click **Network and Sharing Center** > Click **Change adapter settings**

> Right-click a network adapter and select **Properties**

> Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**

Parameters for DNS Server and WINS

No parameters need to be set for DNS or WINS if the software is running as a standalone system. The default network settings of the Windows XP/Windows 7

installation can be used unchanged to operate a DigiVis 500 system. The TCP/IP protocol must be used on all PCs.

Use Host Names

When configuring a project, symbolic names can be used for the computers instead of IP addresses. With the aid of a file the system translates these names into physical addresses. This file must first be edited according to the requirements.

When Windows is installed an example file is created on the computer:

```
<Windows directory>\system32\drivers\etc\hosts
```

Edit this file according to your requirements. A value must be entered for each computer and each process station that is to be configured using not an IP address but a name. (The names may be up to 14 characters in length):

```
<IP address>      <name>
```

Example:

```
172.16.1.1        Computer1
```

Administrative rights are necessary to edit the hosts file.

In Windows 7 start the text editor as Administrator or disable the User Access Control for editing.

Network Configuration Check

You can check the configuration of the Windows Operating System and the network installation by executing a “ping” to a station in the command line (after booting).

> **Start** > **Run** > **cmd** [Enter]

Enter (existing) address or host name: **ping TCP/IP address**
(for example, **`ping 172.16.1.20`**), close window: **Exit**

Windows 7 Firewall Settings to Use the Ping Command

To check the connection to a Windows 7 computer, the firewall rules on the Windows 7 target machine need to be adjusted. By default, the Windows 7 firewall blocks incoming ping requests.

Open the configuration of the advanced Windows 7 Firewall on the target machine (not the machine where the ping is entered):

> Start > Control Panel > System and Security > Administrative Tools > Windows Firewall with Advanced Security.

Enable the inbound firewall rules named **File and Printer Sharing (Echo Request - ICMPv4-In)** to allow ping requests to this computer.

FTP Server under Windows XP

The FTP service must be installed to allow for usage of the automatic export of archives and logs.

> Start > Settings > Control Panel > Add/Remove Programs

Click the **Add/Remove Windows Components** icon**.** Select the **Internet Information Services (IIS)** and click **Details...**then select **File Transfer Protocol (FTP)** Service

Ensure that the **Internet Information Services Snap-In** is checked as well

Click **OK**

Click **Next**

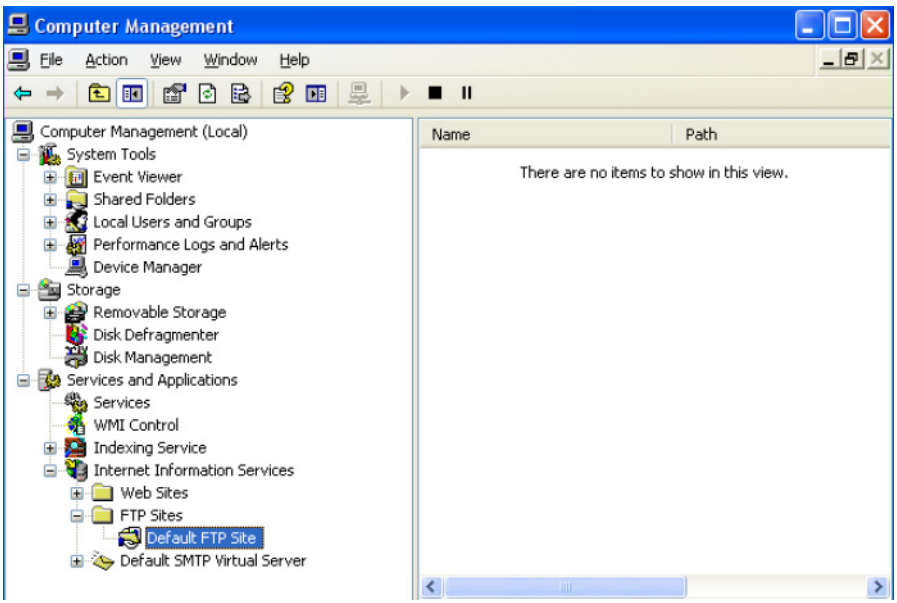
The FTP Server is installed now.

FTP Server Configuration

> **Start > Control Panel > Administrative Tools**

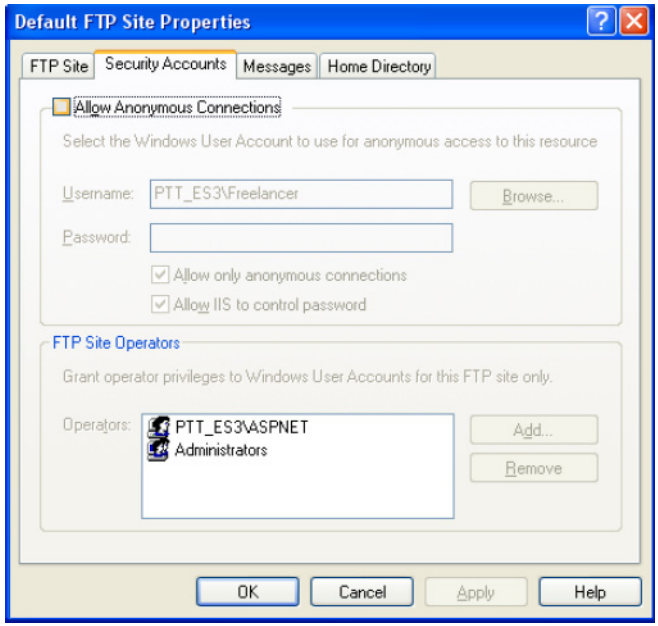
Double-click **Computer Management**

Expand **Services and Applications > Internet Information Services > FTP Sites > Default FTP Site**.



FTP WinXP Default FTP Site

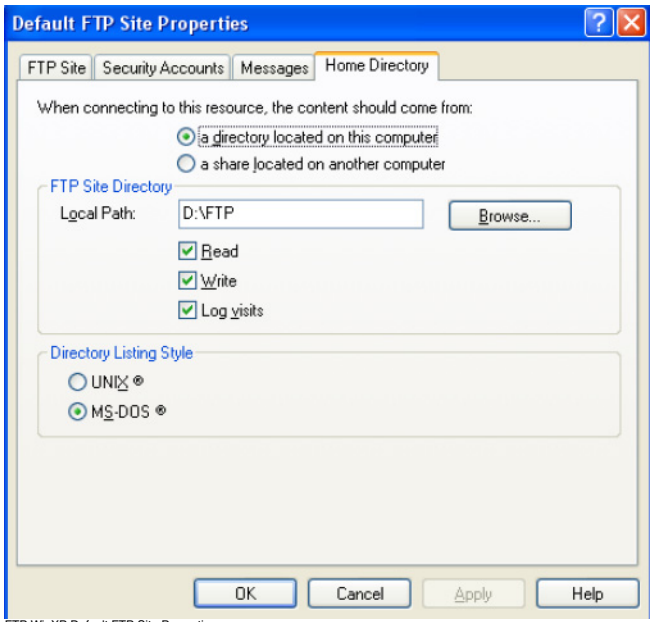
Right-click **Default FTP Site** and select **Properties**. The configuration dialog for the FTP Server is displayed now.



FTP WinXP FTP Security

Click the **Security Accounts** tab.

Clear the check box **Allow Anonymous Connections** to disallow anonymous access.



FTP WinXP Default FTP Site Properties

Click the **Home Directory** tab.

Select an appropriate **FTP Site Directory** directory.

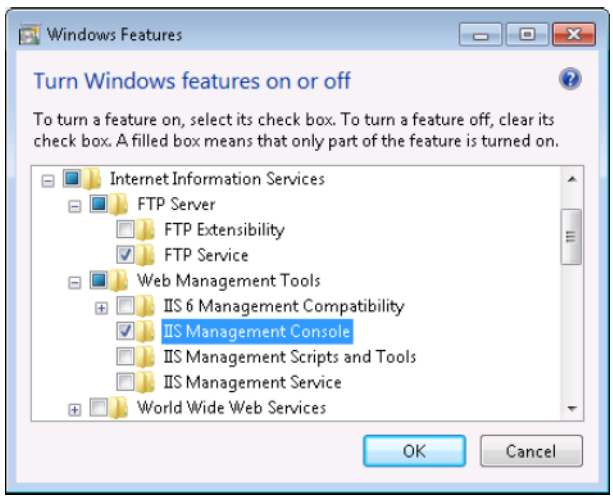
Check all three access levels **Read**, **Write** and **Log visits**.

Click **OK** to finish the FTP Server setup. The basic FTP Server configuration is complete now.

The FTP login user - for example, “DigiVis 500 FTP” - must have the necessary access rights to the FTP site directory - here “D:\FTP” - and subdirectories on file system level. Otherwise he might not be able to read or write files, even if the Server allows it.

FTP Server under Windows 7

FTP Server Installation



FTP Server Win7 Windows Features.bmp

> Start > Control Panel > Programs > Programs and Features

Click **Turn Windows features on or off** in the left navigation bar.

The **Windows Features** are displayed.

Expand **Internet Information Services > FTP Server and Select FTP Server**

Expand **Internet Information Services > Web Management Tools** and select **IIS Management Console**

Click **OK**

The FTP Server is installed now.

FTP Server Configuration

> **Start > Control Panel > System and Security > Administrative Tools**

Double-click **Computer Management**

Expand **Services and Applications > Internet Information Services**

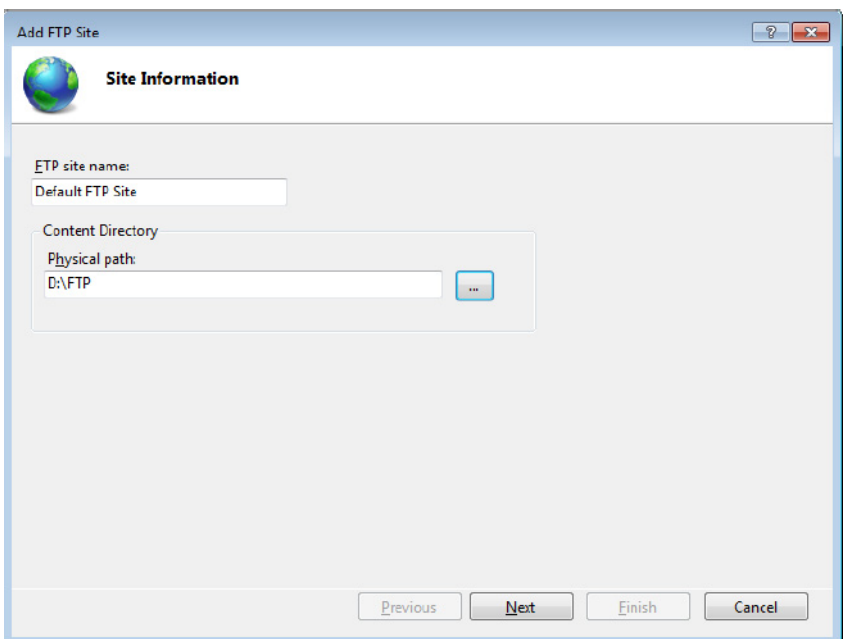
The IIS Management Console is displayed. It has a left tree area named “Connections”, a right area called “Actions” and context dependent area in the middle.

> In the **Connections** tree, expand the root node

> Select **Sites**

> Right-click **Sites** and then select **Add FTP Site**

A wizard to configure an FTP site opens.



FTP Add FTP Site us.bmp

Enter the FTP site properties:

FTP site name:

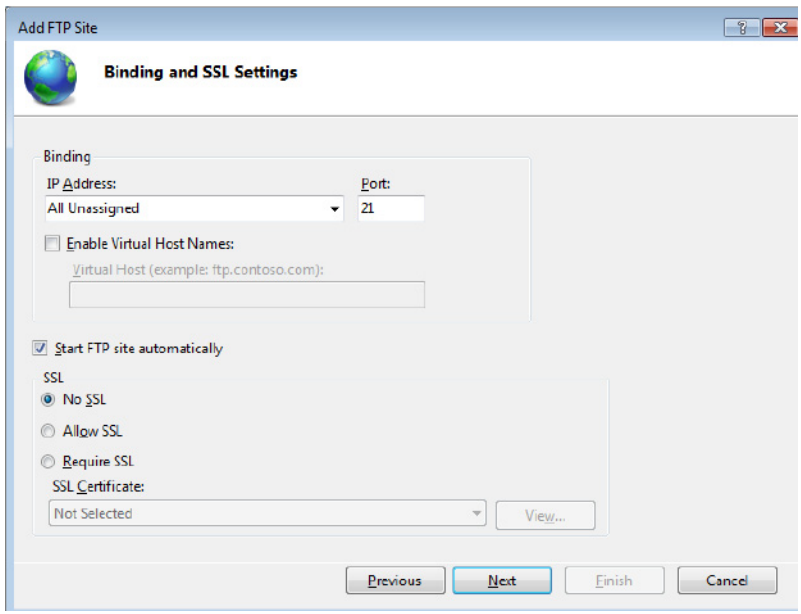
Enter a free choosable name for your site, for example, “Default FTP Site”.

Content Directory:

Select a root directory path for the FTP site. Below this directory all content of the FTP site is stored.

Click **Next**.

The **Bindings and SSL Settings** can be configured now.

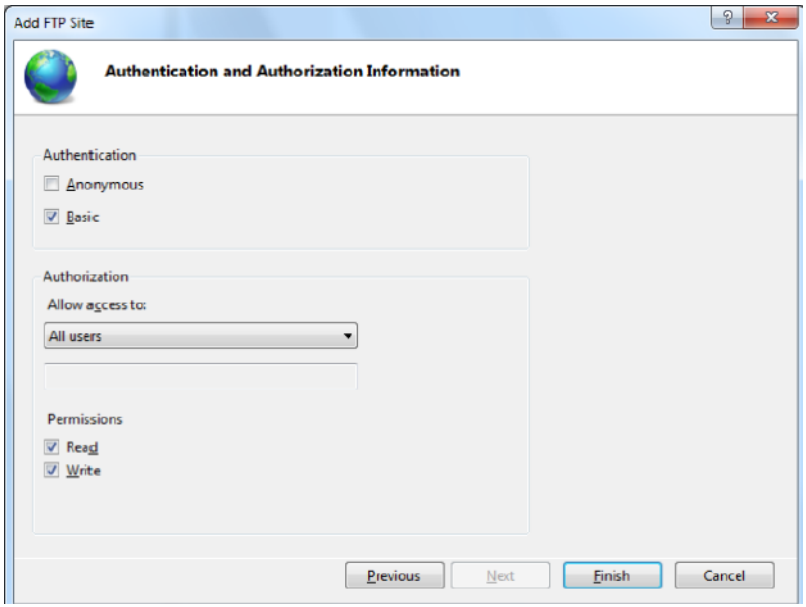


FTP Binding and SSL figure us

Select **No SSL** instead of **Require SSL**.

Click **Next** to continue the wizard.

The **Authentication and Authorization Information** page is shown.



FTP Basic Authentication us

Enable **Basic Authentication**.

Under **Authorization**, select **All users** from the Allow access list.

Under **Permissions**, select both **Read**, **Write**.

Click **Finish**. The basic FTP Server configuration is complete now.

The FTP login user - for example, “DigiVis 500 FTP” - must have the necessary access rights to the FTP site directory - here “D:\FTP” - and subdirectories on file system level. Otherwise he might not be able to read or write files, even if the Server allows it.

Enable FTP Firewall Rules

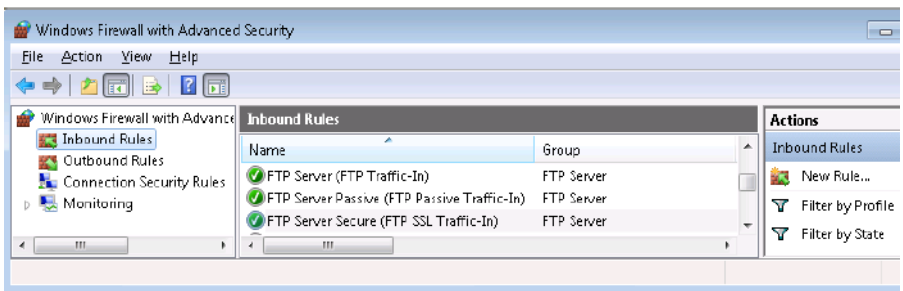
When the FTP Server is installed the Windows Firewall with Advanced Security will still block all external FTP traffic. To prepare external access, the FTP Server installer has added 5 pre-configured firewall rules, 3 inbound and 2 outbound, which need to be enabled.

Open the configuration dialog of the Windows Firewall with Advanced Security.

> **Start > Control Panel > Administrative Tools > Windows Firewall with Advanced Security** > Select **Inbound Rules**

Enable the following Inbound Rules:

1. **FTP Server (FTP-In)**
2. **FTP Server Passive (FTP Passive Traffic-In)**
3. **FTP Server Secure (FTP SSL Traffic-In)**

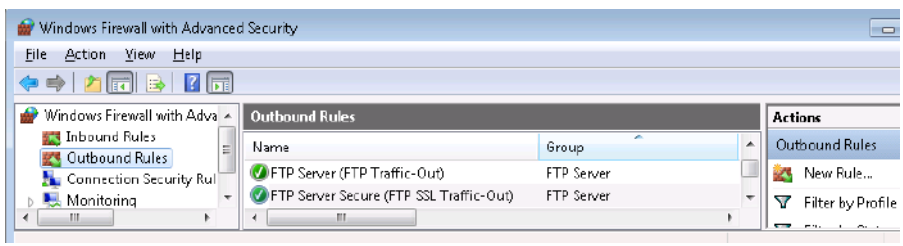


FTP Inbound FTP Rules Windows 7

> Select **Outbound Rules**

Enable the following outbound rules:

1. **FTP Server (FTP Traffic-Out)**
2. **FTP Server Secure (FTP SSL Traffic-Out)**



FTP Outbound FTP Rules Windows 7

If the FTP Server is initially installed, the firewall still blocks the traffic until the service of the FTP Server is restarted.

Restart the Windows service Microsoft FTP Service:

> **Start** > **Control Panel** > **System and Security** > **Administrative Tools**

> Double-click **Services**

> Select **Microsoft FTP Service**

> Click **Restart the Service**

The FTP Server is now restarted and the firewall will use the exception rules now.

Testing the FTP Server

To test the FTP Server functionality:

Logon with an FTP Client (for example, the Windows FTP command line Client or FileZilla), from another windows PC using the created limited user (for example, “DigiVis 500 FTP”) for login.

Upload a file.

Download a file.

Now the FTP based functionality in DigiVis 500 Graphics Builder and DigiVis can be configured and used.

Virtual Memory Size

A virtual memory size of 1 GB is recommended. The upper and lower limits should be set to the same value.

Windows XP

> **Start** > **Settings** > **Control Panel**. In the classic view browse to **System**. Select the **Advanced** tab. Click the **Settings** button in the **Performance group**. In the **Advanced** tab, click the **Change** button in the **Virtual Memory** group.

Windows 7

> **Start** > **Control Panel** > **System and Security** > **System**. Select **Advanced system settings**. Click **Settings** in the **Performance**. In the **Performance Options**, click **Advanced** tab.

The larger the installed physical memory the larger the virtual memory size should be. It is recommended to configure the size of the virtual memory at 1.5 times the size of the total available memory.

Disable Automatic Updates

The automatic update of the Windows Operating System must be disabled:

Windows XP

> Start > Settings > Control Panel. In the classic view browse to **System**. Select the tab **Automatic updates** and activate the **Turn off Automatic Updates** radio button.

Windows 7

> Start > Control Panel > System and Security >Windows Update.

Select **Change settings**

Select **Never check for updates** from the list of.

Press **OK**.

Configure the Antivirus Program

Certain antivirus programs on a DigiVis 500 PC can cause problems both in DigiVis 500 Operations and Graphics Builder, for example, when a project is created in Graphics Builder, and when a project is loaded in DigiVis 500 Operations.

To avoid access problems, exclude the directories **< DigiVis 500_Installation_Folder>\proj** and the Windows XP/Windows 7 Temp-directories from virus scanning.

Windows Temp-directories must be excluded for all users working with DigiVis 500. To find the Temp folder for current logged user on Windows XP/Windows 7 Operating Systems.

Select **Start > Run Command**. Type **%temp%** in the Run Command box and click **Enter**.

In Windows XP, the Temp folder path will be “C:\Documents and Settings\<Username>\Local Settings\Temp”.

In Windows 7, the Temp folder path will be “C:\Users\<Username>\AppData\Local\Temp”.

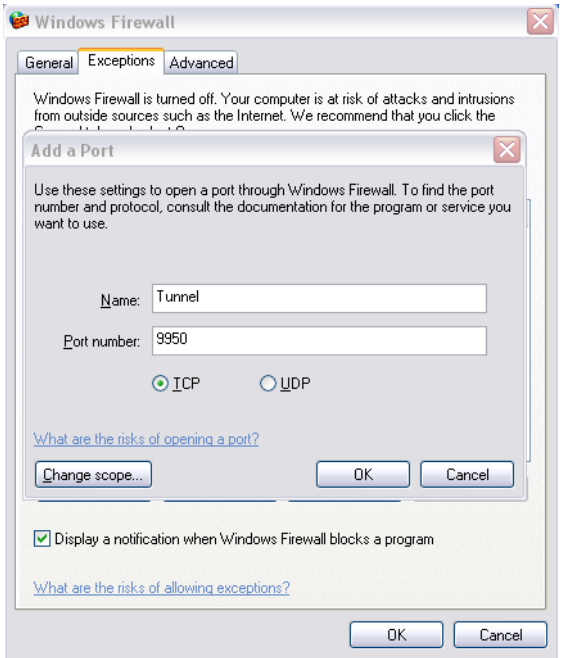
Firewall Configuration

Windows XP

If the Firewall is enabled, following settings for Firewall configuration are required for both DigiVis 500 Graphics Builder and DigiVis 500 Operations.

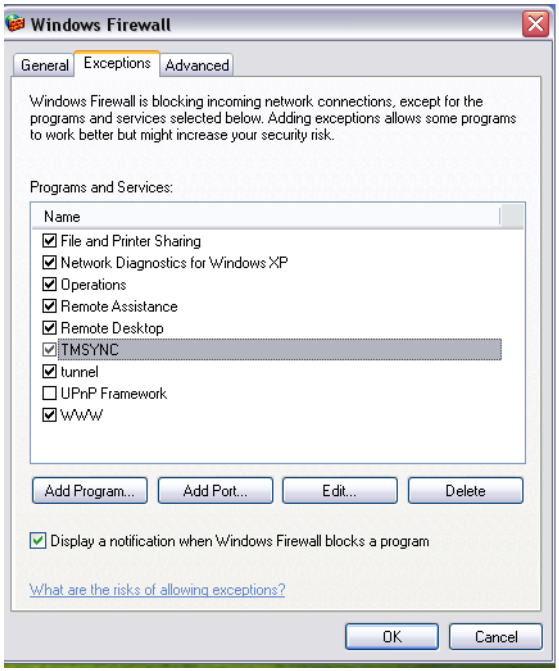
1. For OPC Tunnel, add the Tunnel Port with port address (By default 9950) in the Firewall Exception list.

Go to **Start** > **Settings** > **Network Connections** > **Change Windows Firewall settings** > Select **Exceptions** tab > **Add Port** > Enter **Name** for the Port, Port number as 9950 and select **TCP**.



2. For Digivis500 Operations, add Programs **Operations** and **TMSYNC** in the Windows Firewall > Select **Exceptions** tab.

Go to **Start** > **Settings** > **Network connections** > **Change Windows Firewall settings** > Select **Exceptions** tab > **Add Program** > Select **BUBMAIN/Operations** and **TMSYNC**.



Windows 7

For Windows 7 the firewall configuration is handled by the DigiVis 500 setup. The firewall is configured to allow the DigiVis 500 applications to communicate properly.

There is no specific configuration by the user necessary.

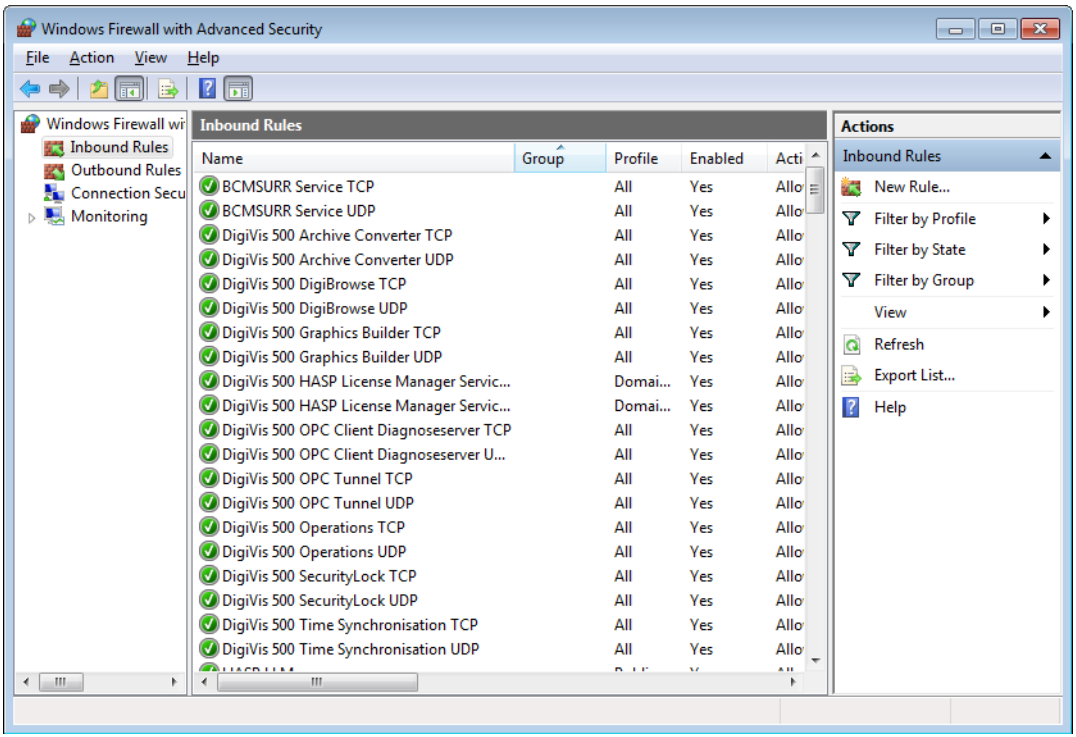
During the installation process the setup will add several DigiVis 500 programs to the firewall exclusion list. To verify the entries made, you can open the Windows Advance Firewall configuration as follows:

> Start > Control Panel > System and Security >Windows Firewall

Select **Advanced settings**.

The Windows Firewall with Advanced Security configuration is shown. Select **Inbound Rules**.

When the setup has finished there are several new entries that start with “DigiVis 500”.



Windows 7_Firewall Configuration.bmp

For firewall exceptions related to CoDeSys software and OPC Server, refer to **CoDeSys 2.3 User Manual for PLC Programming** and **CoDeSys OPC Server V3 Installation and Usage Manual**.

Disable Screen Saver

If the Firewall is enabled, following settings for Firewall configuration are required for both DigiVis 500 Graphics Builder and DigiVis 500 Operations.

The screen saver needs to be disabled in the Windows Operating System settings.

Screen Saver in Windows XP

> **Start** > **Control Panel** > **Appearance and Themes** > **Display**

The **Display Properties** are displayed.

Select the **Screen Saver** tab**.**

In the **Screen Saver** list, select **(None)**.

Click **OK**.

Screen Saver in Windows 7

> **Start** > **Control Panel** > **Appearance and Personalization** > **Personalization**

Click **Screen Saver** in the lower right corner.

In the **Screen Saver list**, select **(None)**.

Click **OK**.

For Installation of DigiVis: Setting the Theme and Screen Resolution

The DigiVis software supports two different user interfaces. Which one is selected depends on the Windows screen resolution.

When the DigiVis program starts, the currently configured monitor screen resolution is checked and, depending on this setting, DigiVis is started with the conventional-design or new-design user interface.

The conventional-design GUI is in principle the display as known from the earlier versions. For all resolutions with a minimum of 1024 pixel in the vertical direction, DigiVis starts with the new-design GUI. On screens with a resolution of less than 1024 pixel in vertical direction, DigiVis starts with the conventional-design user interface.DigiVis supports the use of two monitors, even with different screen resolution.

Settings for the New-Design DigiVis User Interface

The standard resolution for the new-design user interface is **1280 x 1024 pixels**. Under Windows XP select the “Windows XP” theme. Under Windows 7, select the “Windows 7 Basic” theme.

Windows XP New

> **Start** > **Control Panel** > **Appearance and Themes** > **Display**

Appearance:

> Tab **Themes** > Select **Windows XP** as theme.

Resolution:

> Tab **Settings** > Select resolution **1280 x 1024** pixels.

Windows 7 New

> **Start** > **Control Panel** > **Appearance and Personalization**

Appearance:

> **Personalization** > Select **Windows 7 Basic** as theme

Resolution:

> **Display** > Click **Adjust resolution** > Select resolution **1280 x 1024** pixels

Settings for the Conventional-Design DigiVis User Interface

For the conventional-design user interface, a resolution of **1024 x 768 pixels** is recommended. Under Windows XP select the “Windows Classic” theme. Under Windows 7 select the “Windows 7 Basic” theme.

Windows XP Conventional

> **Start** > **Control Panel** > **Appearance and Themes** > **Display**

Appearance:

> **Tab Themes** > Select **Windows Classic** as theme.

Resolution:

> Tab **Settings** > Select resolution **1024 x 768** pixels.

Windows 7 Conventional

> **Start** > **Control Panel** > **Appearance and Personalization**

Appearance:

> **Personalization** > Select **Windows 7 Basic** as theme.

Resolution:

> **Display** > Click **Adjust resolution** > Select resolution **1024 x 768** pixels.

For Installation of DigiVis: Additional Steps to disallow Operating System Access

Operator stations shall be configured to disallow Operating System access. DigiVis 500 is especially designed to support this. The additional steps required to disallow Operating System access in Windows XP and Windows 7 are described below.

Windows XP

The taskbar property “Keep the taskbar on top of other windows” must be disabled:

> Right click the taskbar

> **Properties**

Disable “**Keep the taskbar on top of other windows**”

Windows 7

> Right click the taskbar.

> Select **Properties**. The Taskbar and Start Menu Properties window appears.

In the Taskbar menu, disable **“Lock the taskbar”** and enable **“Auto-hide the taskbar”**.

Disable **“Use Aero Peek to preview the desktop”** in the Preview desktop with Aero Peek message box.

> Select > **Apply** > **OK**.

Background Information

When you start DigiVis in Production Mode the Windows Start button is disabled. There is no minimize button in DigiVis. This behavior has been implemented because of security concerns. The DigiVis user cannot switch to other applications.

Only those applications that have been started before the start of DigiVis can be reached by the DigiVis user by pressing the ALT+TAB keys.

The Windows Operating System can be reached from the DigiVis menu (Tools / System / Operating System) after entering a password. With this action the Windows start button is enabled and is displayed with text. This is not a security problem, as long as the taskbar is in the background of DigiVis. DigiVis is not able to suppress the taskbar in all cases.

In Windows XP, if the taskbar property is configured with “Keep the taskbar on top of other windows” option, it is shown in front of DigiVis. Therefore, the taskbar property “Keep the taskbar on top of other windows” option must be disabled to make sure that the DigiVis user has no access to other applications.

Upgrade an Existing Version to the New Version

Upgrading means changing from a DigiVis 500 old version to a new version. In this process, existing project configurations can be taken over without any problem, if the upgrade is within a main version (for example, from V1.0 to V1.0 SP1).

If the Graphics Builder project is created in Windows XP and opened in Windows 7, the timezone setting will be lost.

To set time zone

Open the Graphics Builder project on the Windows 7 system

Project tree > Right-click on **CONF** node > Click **Header** > **Timezone**

Notes to Follow Before Performing an Upgrade

Back up Project Files from Older Versions

Existing projects from a previous version must be exported (create *.CSV file) using old Graphics Builder version, before starting the setup of the new software version.

Exporting the Project

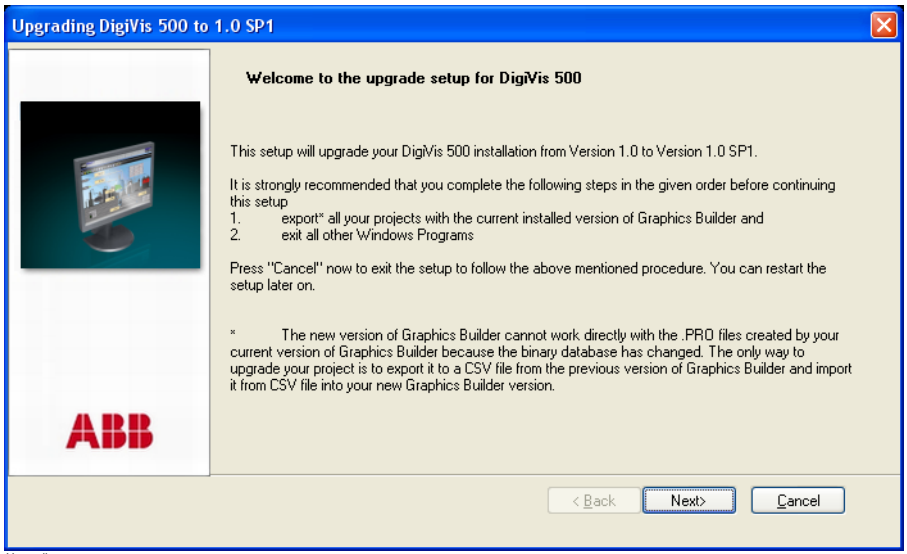
Export the project and save the project in *.CSV file format.

For more information on exporting the project, refer to **DigiVis 500 Engineering Manual, System Configuration, Project Manager, Exporting a project**.

With import of a project all conflicting names are removed automatically by suffixing the current variable names with ..._var. In the variable list, changed variable names can easily be selected with the search function. If required, the crossreference function allows you to easily detect changed variable names and to modify them.

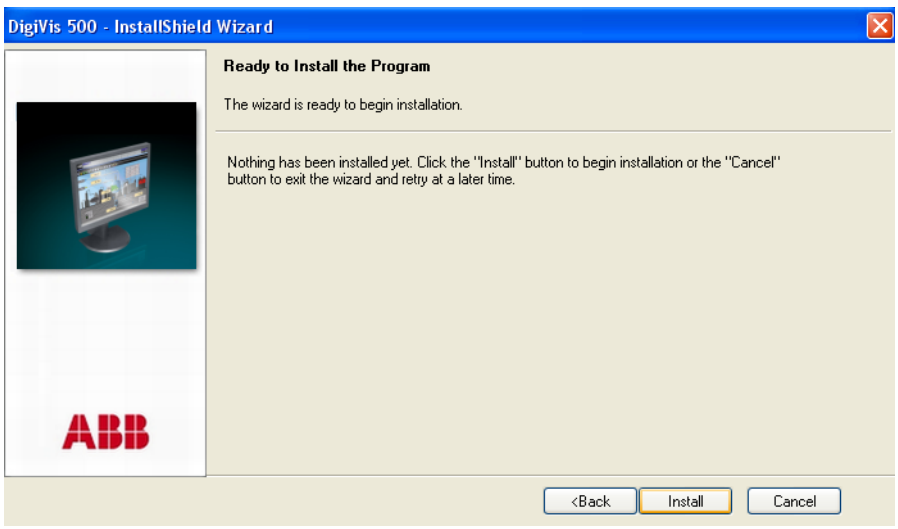
Upgrade from V1.0 to V1.0 SP1

If DigiVis 500 V1.0 is already installed on the system and the user runs the setup then the “upgrade screen” is displayed.



Upgrading.png

Click **Next**.



InstallShield.png

Click **Install**. The existing V1.0 features will be upgraded to V1.0 SP1.

To add new features after the upgrade has finished, run the setup again. The setup goes into the **Maintenance mode**.

Start Setup for New Installation

Insert the DigiVis 500 Software CD in the drive. The CD autoplay dialog starts automatically if the Autoplay function is enabled in Windows. If this function is disabled you have to start the dialog manually.

> In **Explorer:** Select CDROM drive
> Open file **Autoplay.exe** for example, **e:\autoplay**

First select the **language** (in this case “English”) for the software in the Language screen. The “setup dialog” with the different software packages is displayed.

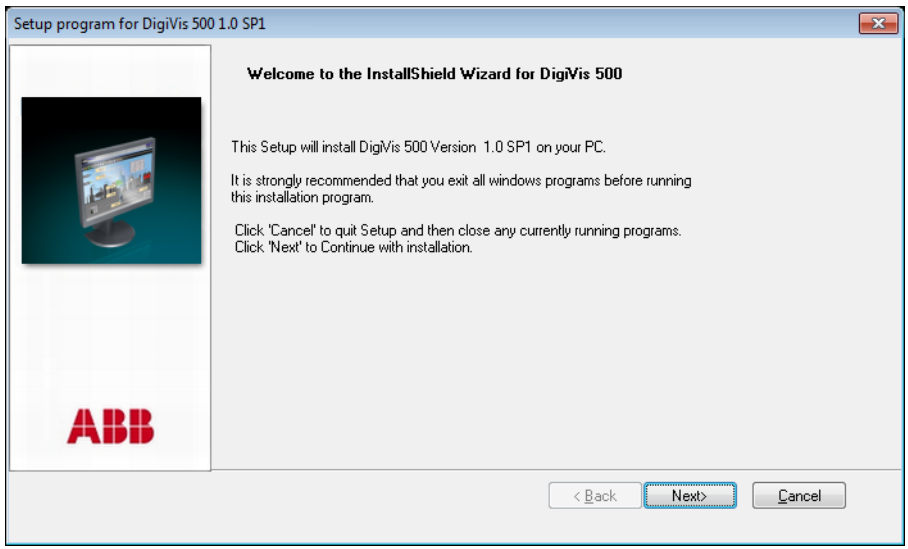
tb499.bmp

Release Notes This option opens the document “Release Notes” for reading, which lists the new features of this version.

DigiVis 500 Software
This option allows the selection of the DigiVis 500 software packages that can be installed.

Install DigiVis 500 Software

To install the DigiVis 500 software select **DigiVis 500 Software** in the left part of the setup dialog. The “Welcome screen” is displayed thereafter.



tb499_1.bmp

General notes on operation in the setup procedure

Buttons in the Dialog Boxes

Next Continue the installation with the next dialog box.

Back Returns to previous window.

Installation can be exited at any time by clicking **Cancel**.

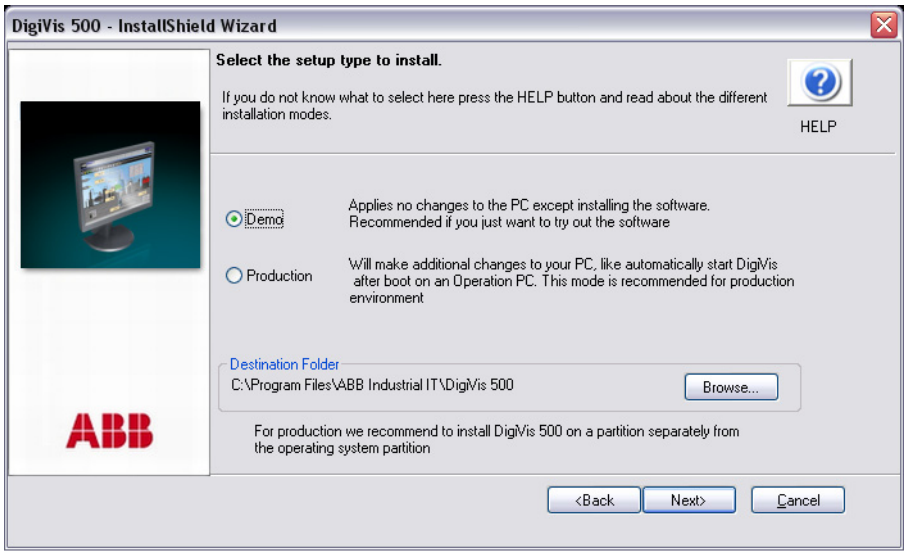
tb500.bmp

Once you have clicked **Next** in the “Welcome screen” the “License agreement” screen is displayed. On selecting the “**I accept**...” option and clicking on **Next**, the “Setup type” screen is displayed.

Selecting a Setup type

Choose the desired Setup type.

Demo	To install the Software for demo purpose or as a try-out.
Production	To install the Software in the production-environment



tb500_1.bmp

Detailed description on each of the Setup types can be obtained by clicking on the Help icon provided on the top right side of the screen

The destination folder for the installation can be changed using the **Browse** button.

Destination Directory for Installation

By default, DigiVis 500 software programs are installed in directory

C:\Program Files\ABB Industrial IT\ DigiVis 500

(for Demo Version)

or

E:\Program Files\ABB Industrial IT\ DigiVis 500

(for Production)

The following subdirectories are created:

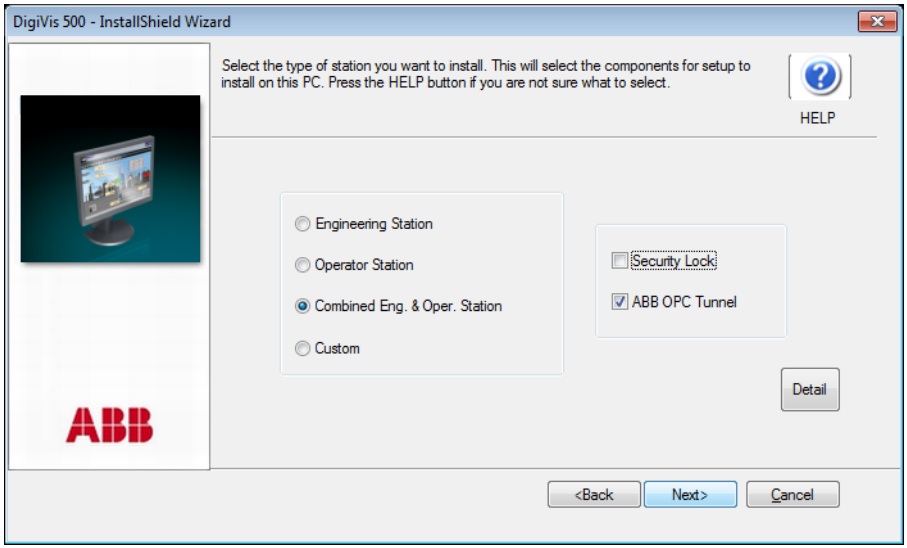
...\bitmaps	Bitmap files for the hardware devices in the DigiVis system display
...\bpr	Operation logs
...\curv	Trend archives
...\doc	Project documentation
...\exe	System files
...\export	Project export files
...\gsd	Reserved
...\macros	Graphics Builder macros
...\OPCTunnel	Executables and configuration files for OPC Tunnel
...\proj	Default for Project data files
...\reports	Default for Excel reports
...\sap	Reserved
...\setctrl	Setup control
...\sfp	Signal sequence logs
...\ucurv	Reserved
...\VisHelp	Online Help for DigiVis 500 Operations
...\wave	Wave files for alarm messages in DigiVis 500 Operations

The table above lists all the possible directories that may be created after the installation of DigiVis 500 on your PC. Some of these directories may not be created based on the type of installation and the DigiVis 500 packages that are selected for installation.

Demo Mode

Selecting this mode will install the software on the system for a try-out. No license is needed and all functionalities of the software are available to the user. The validity of this mode is however limited to 100 days.

Selecting the setup type **Demo** from the Setup type screen and clicking on **Next** will display the “Workplace type” screen.



tb500_2.bmp

The default selection for the **Demo** mode is shown in the screen shot above, However the user can choose any one of the workplace types that are listed on the screen or choose the *custom* option.

Detailed description of each of the workplace types can be obtained by clicking on the **Help** icon provided on the top right side of the screen

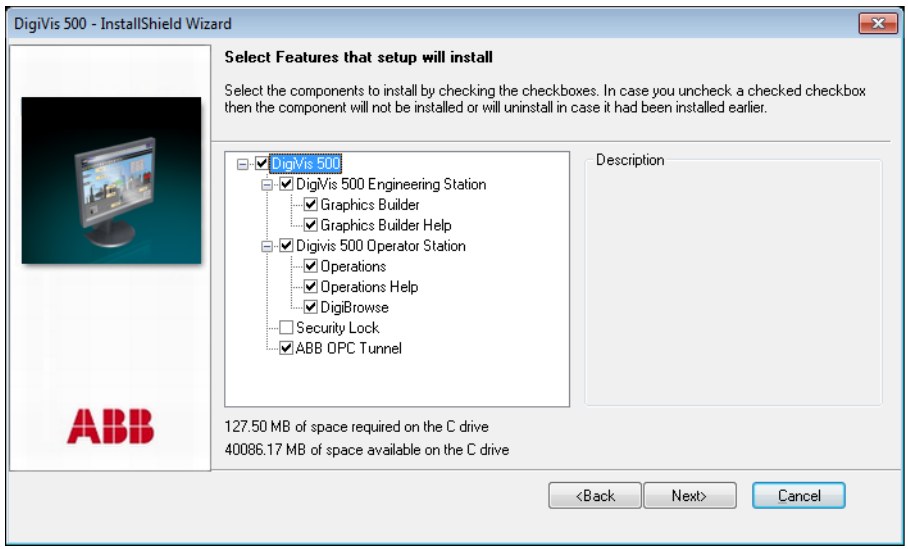
The **Detail** button can be used to view the feature tree showing the components that will be installed for the workplace type that is selected, in the chosen mode. This is just a view of the feature tree and the user cannot select or deselect the components in this view.

Selecting a workstation type and clicking on **Next** brings up the “Ready to install” dialog. Refer to Ready to install dialog on page 50.

Custom Option

This option is recommended for advanced users of the DigiVis 500 software. It gives the user most flexibility in terms of selecting or deselecting the components to

be installed. On selecting the setup type **Custom** and clicking on **Next** the following screen with the feature tree appears.



tb500_10.bmp

Click on a component name in the feature tree and a brief description of that component will be displayed on the right side. The space required on the drive as shown in the screen above does not include the requirements from the Hardkey, DigiVis 500 Graphics Builder/Operations Help and ABB OPC Tunnel.

Select Software Packages to Be Installed

In the features tree dialog box, select the software packages that are to be installed on the PC by clicking on the checkbox in front of the Component.

The DigiVis 500 software components are listed in a tree structure in the left-hand section of the dialog. The check box in front of each software package indicates the state of that component on the PC.

(blank) The component will not be installed.

(checked) The component will be installed

DigiVis 500 Software Packages

The following software packages can be installed with this setup:

DigiVis 500 Software

- DigiVis 500 Engineering Station
  - Graphics Builder

    Software package for configuring project objects and commissioning operator stations for DigiVis 500 projects
  - Graphics Builder Help

    Windows Help for DigiVis 500 Graphics Builder
- DigiVis 500 Operator Station
  - Operations

    Software for an operator station for operating and observing the processes configured using DigiVis 500 Graphics Builder.
  - Operations Help

    Online help for the DigiVis 500 Operations software
  - DigiBrowse

Software package for viewing archived trends and logs

- Security Lock

  Access control for DigiVis 500 Graphics Builder and Digivis 500 Operations

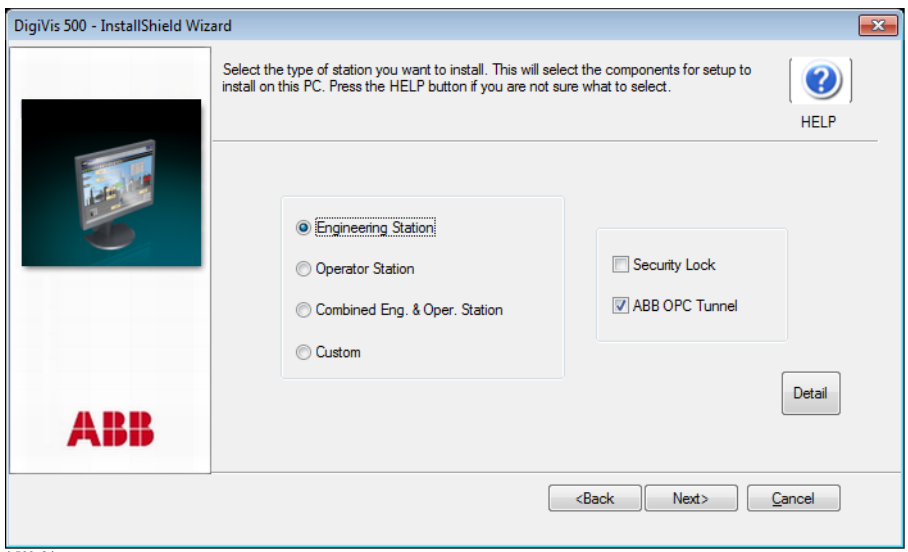
- ABB OPC Tunnel

  Links the OPC Server to the DigiVis 500 Graphics Builder and DigiVis 500 Operations.

Production Mode

This mode will modify the setting on the PC besides installing the Software. License key should be provided for installing the selected components.

On selecting the **Production** mode in the *Setup type* screen and clicking on **Next** the "Workplace type" screen is displayed.



tb500_8.bmp

The default selection for the **production** mode is shown in the screen shot above, however the user can choose any one of the workplace types that are listed.

The default destination directory for the installation in Production mode is E:\Program Files\ABB Industrial IT\DigiVis 500.

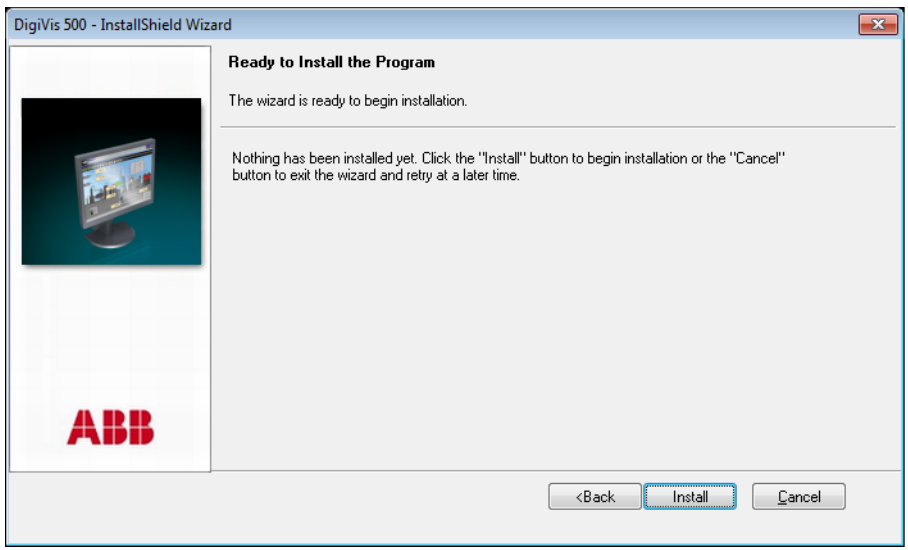
For Production we recommended to install DigiVis 500 Software on a partition separate from the one where the Operating System is installed

Selecting a workstation type and clicking on **Next** brings up the “Ready to install” dialog. Refer to Ready to install dialog on page 50.

If the Custom option is selected clicking on Next brings up the feature tree dialog. Refer to Select Software Packages to Be Installed on page 48.

Ready to install dialog

Click on **Next** and the “Installation screen” is displayed.



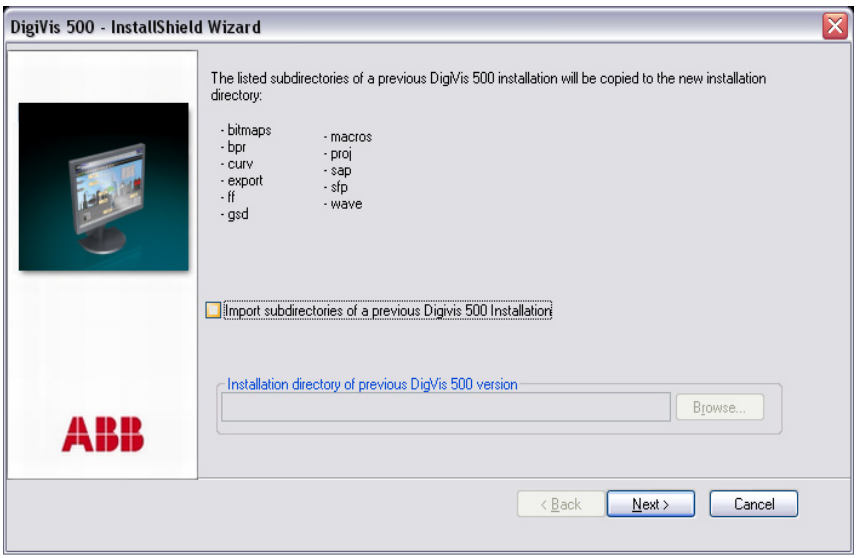
tb500_11.bmp

Clicking on the **Install** button will install the selected components.

The dialog **DigiVis 500 Software Setup / Import directory** will be displayed when the installation has been completed.

Import Data from Previous DigiVis 500 Installation

If you had a previous DigiVis 500 installation and now want to install the Software in a different directory then you can use this dialog to copy all project and archive data into the new DigiVis 500 installation directory.



tb500_14.bmp

If the project data are to be copied into the new directory, activate checkbox **Import subdirectories of a previous DigiVis 500 Installation** and Browse to the directory name of the previously used DigiVis 500 Installation.

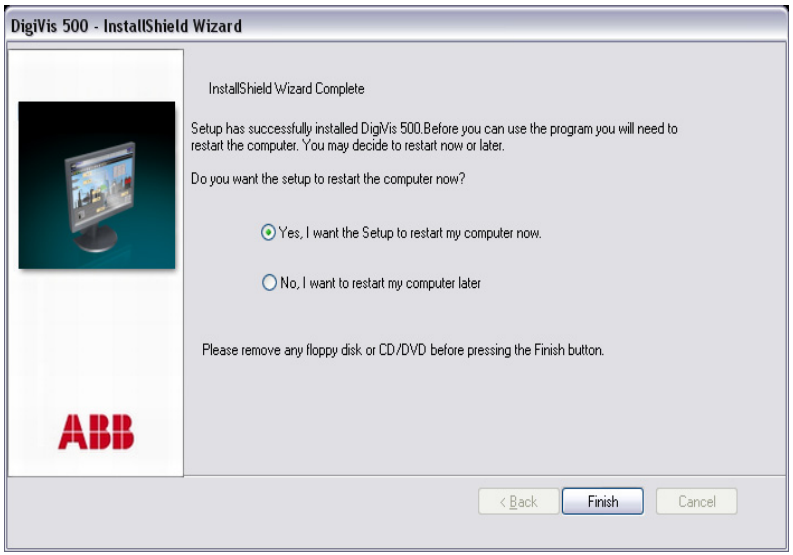
Clicking the **Next** button copies the data from the previous DigiVis 500 installation, if so desired. The configuration screen is displayed thereafter.

The configuration dialogs can be used to customize the installation to your computer and requirements. The settings can be modified retroactively after the installation has been completed without having to carry out the installation again.

For a detailed description, refer to Configure DigiVis 500 System on page 56.

Click **OK** on the “Configuration screen” to go to the end of this installation part.

A screen indicating the completion of the Installation is displayed as follows.



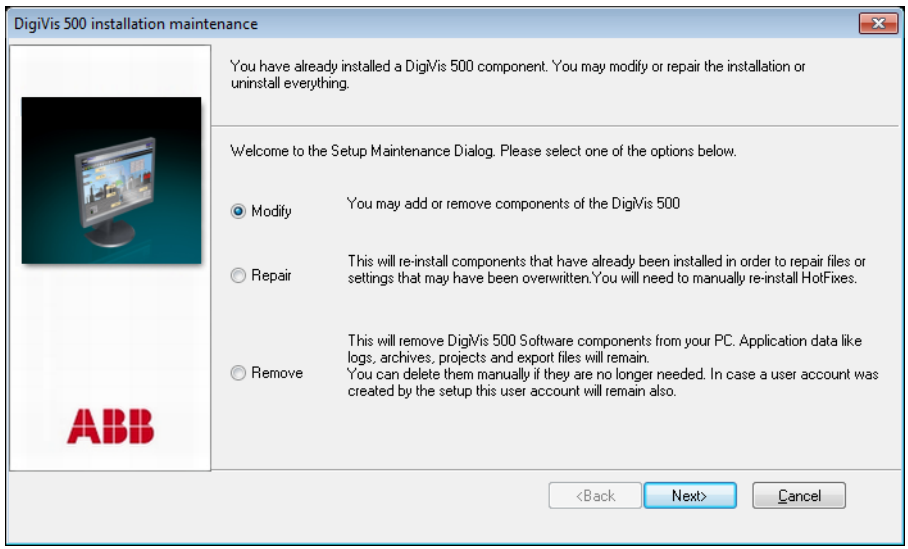
tb500_31.bmp

The **Finish** button is used to complete the installation.

If relevant, a message informing the user that the computer must be rebooted is displayed. If you want to install additional DigiVis 500 products on this computer it is sufficient to restart the computer once after completing all installation procedures.

Maintenance Mode

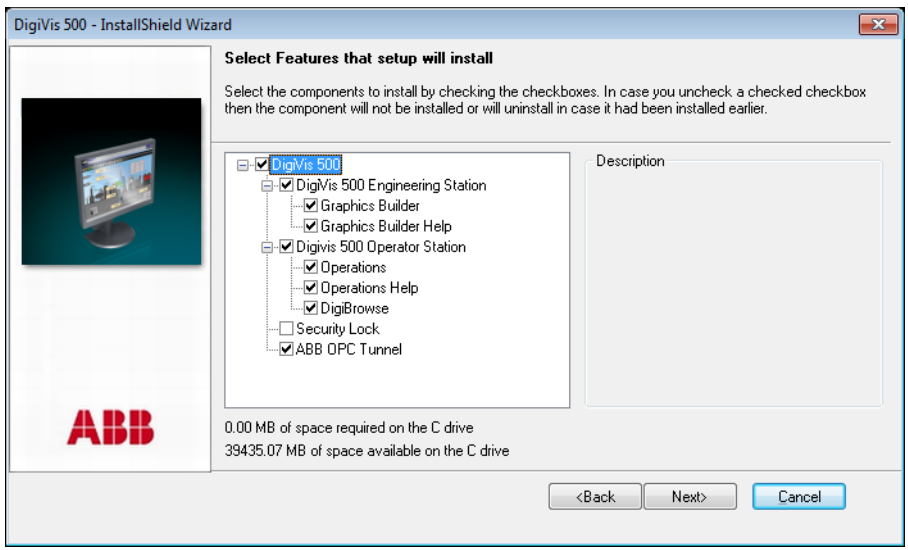
If one or more DigiVis 500 software component(s) of the same version are already installed on the System, then Setup goes into **Maintenance Mode**.



tb500_12.bmp

Modify Option

This option can be used to add or remove components of the DigiVis 500 Software. Choosing this option and clicking **Next** will bring up the “feature-tree” dialog.



tb500_16.bmp

The components that are already installed on the System will appear with a check mark against them, all other components will be unchecked.

If you want to uninstall a component that is already installed on the System, then uncheck that component from the list.

Check the components that are to be installed and click on **Next**.

The Setup makes the required modification and displays the “Maintenance complete” screen. Click on **Finish** to complete the installation.

Repair Option

This option is used to reinstall components that have already been installed on the System, in order to repair files or settings that may have been overwritten.

The repair option will overwrite the content of the Hot Fix. If you had installed any Hot Fixes you need to manually re-install them.

If any file, registry key or content of any installed component is corrupted in the system, choosing this option will repair or put back the contents of the components. Setup replaces or repairs and verifies files and registry keys contained in the DigiVis 500 software components.

Select the **Repair** option and click on **Next**, the Setup makes the necessary repairs.

The configuration screen is displayed when the repair process is completed. Modify the settings if required. The settings can be modified retroactively after the installation has been completed without having to carry out the installation again.

For a detailed description, refer to Configure DigiVis 500 System on page 56.

Click on **OK** and the **Maintenance complete** screen is displayed. Click on **Install** and the Repair is complete.

Remove Option

This will remove DigiVis 500 components from your System. Choosing this option and clicking on **Next** will remove all the installed components from the system. This is similar to “Remove” option in Add/Remove Programs of the Windows operation system.

Select the **Remove** option in the Maintenance screen and the Setup asks the user to confirm the removal of the components.

Click on **Yes** and all the DigiVis 500 software components will be removed from the System. Application data like logs, archives, projects and export files will not be removed.

These can be deleted manually if they are no longer needed. In case a user account was created by the setup this user account will also remain.

The Setup displays the *Uninstall complete screen*. There is an option in this dialog to choose between restarting the System right away or later. Choose the appropriate option and click on **Finish** to complete the removal of the software components.

Configure DigiVis 500 System

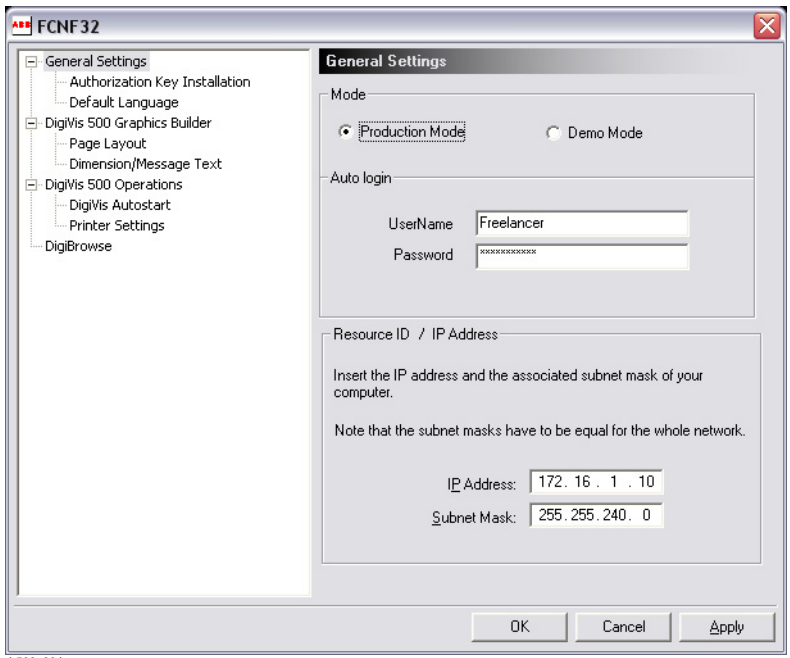
During the installation you can customize required computer settings and execute initialization procedures.

It is also possible to change these settings after the installation is finished, without having to repeat the actual installation. For this purpose, start the **Configure** program via the Start menu.

> Start > Programs > ABB Industrial IT > DigiVis 500 > Configure

Identical dialogs are used for the initial installation as well as for subsequent modifications of the software configuration. In the tree structure in the left part of the dialog box, select all entries one by one to configure the required settings.

General Settings



tb500_20.bmp

Installation Modes

The Installation-mode can be changed from Demo to Production or vice versa in this dialog without having to reinstall the Software.

Demo Mode: To install the Software for demo-purpose or for a try-out

*Production Mode:*To install the Software in the production environment

Selecting Production Mode will enable DigiVis 500 Operations Autostart. After reboot, Windows will start DigiVis 500 Operations automatically. This will prevent access to the Operating System.

User account details

The DigiVis 500 Operations-user for the Production Mode in the Autostart mode is defined in this dialog. The default User is “DigiVis 500” and the default password is “welcome123#”. This can be changed as per your requirement.

IP Address The IP address uniquely identifies devices in the network. Entry of IP address: 172.16.1.x, also refer to Network and IP Address Settings on page 18. *Subnet Mask* Defines whether the addressed device is located in the same network or has to be addressed through routers.
Entry: 255.255.240.0

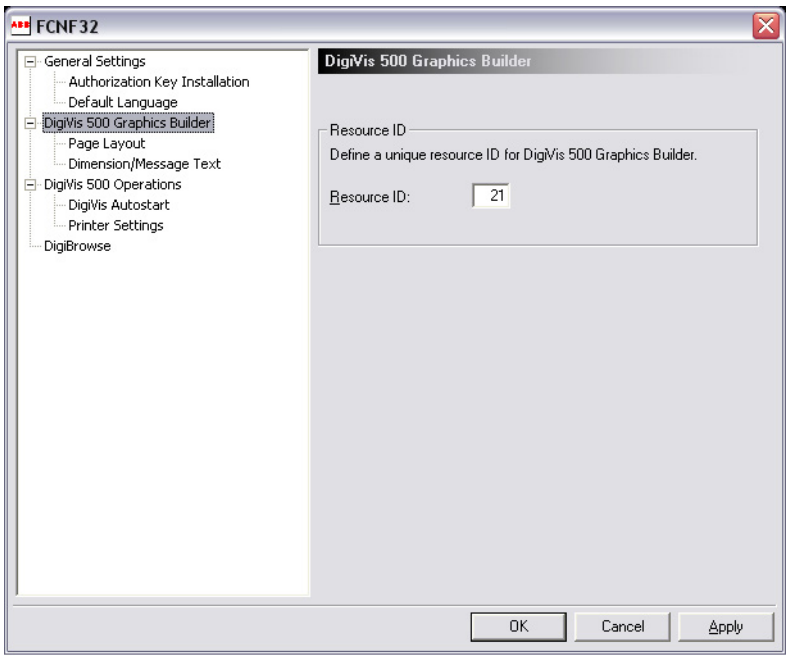
If you operate your DigiVis 500 system in a network with other network components, you should contact your network administrator before allocating the IP addresses.

Authorization Key Installation

You should have received an authorization key file from ABB. Enter the drive name and/or directory path or select the directory where the authorization key is located, using the browser button.

When the Install button is clicked, the authorization code is transferred to the installation directory.

Settings for DigiVis 500 Graphics Builder



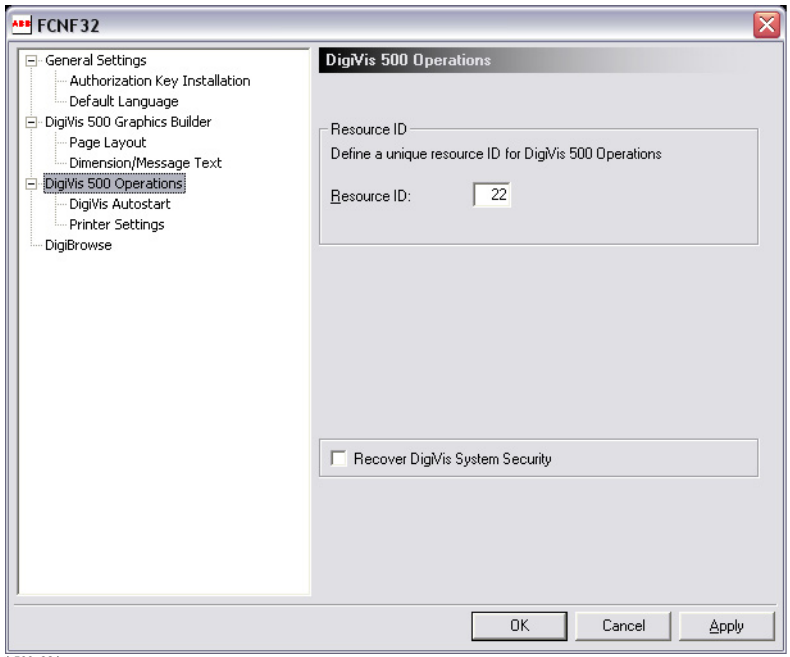
tb500_21.bmp

Resource ID Several software packages can be run at the same time on a PC. To enable these software packages to be addressed unambiguously, each one must be assigned a unique number, the resource identification number.
All the resources within a DigiVis 500 system must also have a unique resource ID.

Dimension/Message Text

This option is reserved for future use.

Settings for DigiVis 500 Operations



tb500_23.bmp

Resource ID Several software packages can be run at the same time on a PC. To enable these software packages to be addressed unambiguously, each one must be assigned a unique number, the resource identification number.
All the resources within a DigiVis 500 system must also have a unique resource ID.

Recover DigiVis System Security
If the DigiVis system security is corrupted (indicated by the message “DigiVis 500 Operations system security corrupted! Please use the Configure tool to recover” when DigiVis 500 Operations is started), for example, after network software has been re-installed, then this option is used for recovery.

A message is displayed when system security has been successfully restored.

Recover DigiVis System Security option will be disabled in Windows 7 Operating System and only enabled for Windows XP Operating System.

DigiVis 500 Operations Autostart

DigiVis 500 Operations can be installed such that it is launched automatically after Windows starts.

Yes, start DigiVis500 Operations automatically (Recommended)

The Windows Operating System and then DigiVis 500 Operations are started after switching on the PC.
Only those applications that have been **started before the start of DigiVis** 500 Operations can be reached by the DigiVis 500 Operations user via the ALT+TAB keys.

No, start DigiVis500 Operations manually

DigiVis will not be started automatically. DigiVis is started using the Start menu.

This option is enabled only in the Production mode. In the case of Demo mode the user has to start DigiVis 500 operations manually.

Printer Settings

Two printers are supported per operator station. One printer should be used for the continuous output of the signal sequence log. The other printer is then available for printing the operation logs. One of the two printers is also
used for hard copies.

Printer 1 Choose a printer installed under Windows, for example, for continuous stationery.

Printer 2 Choose a printer installed under Windows, for example, a color printer.

Hardcopy Printer 1 / 2

Choose one of the installed printers to output a hardcopy from the operator.

For hardcopies do not choose a printer which is used for producing signal sequence logs.

Margins of Printer 1/2 in cm

The page layout for the two installed printers is defined.

Settings for DigiBrowse

This dialog is used to specify whether or not the user can delete archive files within DigiBrowse. For detailed information on DigiBrowse, refer to **DigiVis 500 Graphics Builder Engineering Manual, Section 13, DigiBrowse**.

Installation Complete

Once all the settings have been made, click OK to finish the Setup program or Configure tool.

We wish you every success to perform your automation tasks using DigiVis 500. DigiVis 500 Graphics Builder will greatly reduce the effort required because of standards such as Windows and the use of Tag Type Library.

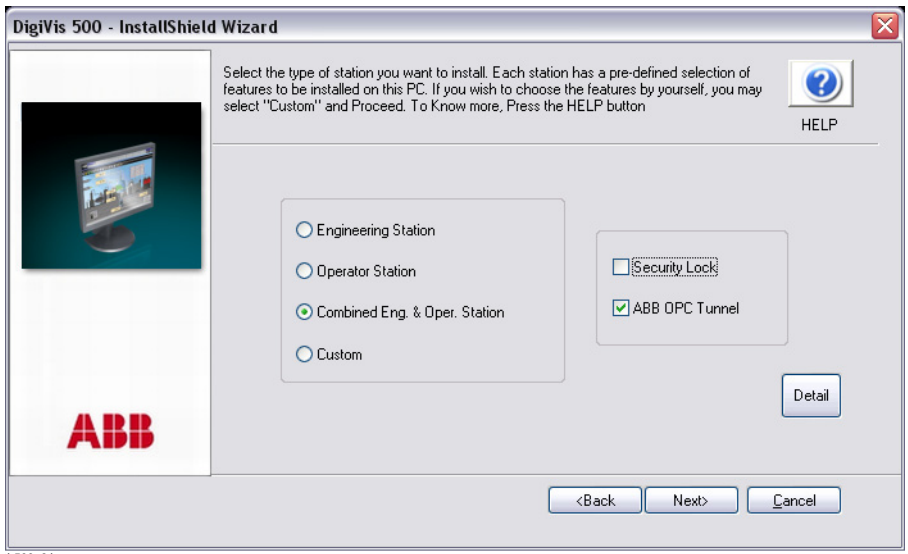
Should you have unexpected problems during installation, please contact your local DigiVis 500 service provider or your local ABB office.

ABB OPC Tunnel

This software is used for communication between the DigiVis 500 nodes and the OPC Server.

Installing the ABB OPC Tunnel Software

The ABB OPC Tunnel software is installed by the DigiVis 500 setup, if the software is selected for installation in the “Workstation Type” screen as shown in the screenshot below.



tb500_2.bmp

If the software was not installed on your system, then run the DigiVis 500 setup and use the Modify option to select the software for installation from the feature tree dialog. Refer to Modify Option on page 54.

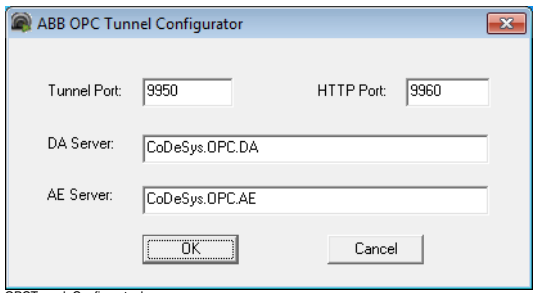
Starting the ABB OPC Tunnel

Start > Programs > ABB Industrial IT > DigiVis 500 > OPC Tunnel > Configurator

Configurator

This window is used to specify the PROG ID of the OPC DA and OPC AE Servers and the port number that are used for the services.

The default entries are shown in the screenshot below. The User can however modify these values based on his requirement.



OPCTunnel_Configurator.bmp

System Tray

A system tray can be enabled for easy access of the ABB OPC Tunnel components.

Start > Programs > ABB Industrial IT > DigiVis 500 > OPC Tunnel > System Tray

The status of the OPC Tunnel is indicated by an icon in the windows status bar. The OPC Tunnel components can also be reached by right-clicking on this icon as shown below.

System-Tray.bmp

Advanced Configurator

This option is for the advanced user for the purpose of configuring additional options and for diagnostic purposes.

Web Pages

Web interface for diagnostic functionality.

Microsoft Windows XP/Windows 7 has an built in option for every service for its recovery handling, which is visible in the service applet under the tab "**Recovery**". If the service fails, a restart service shall be configured.

Start > Settings > Control Panel > Administrative Tools > Services >ABB OPC Tunnel.

Section 2 Initial Steps

General Notes

Once you have carried out the installation of DigiVis 500 Graphics Builder as described in the preceding section, you can begin to set up a project.

Use the Start menu to launch DigiVis 500 Graphics Builder.

If the hard key is not plugged in or if the authorization key is not installed, a message to that effect will be displayed. Correct the cause of the problem and relaunch the program.

The version details of the installed software are displayed in the “About DigiVis 500 Graphics Builder” window. Click on the OK button to proceed further.

Creating a Project File

Choose **New** from the **Project** menu and specify a file name for saving your project on the hard disk. The default directory used is **<Install-Dir>\proj**, but a different directory path may be specified.

Once a unique file name is specified a **Project Header** dialog is displayed. Enter the general project data such as project number, person in charge, customer etc. in this dialog. This data can also be entered or modified at any time in the future. Click on OK and a project file with the specified name is created.

Any new project created in DigiVis 500 Graphics Builder has by default the following three nodes:

- TagType_Lib (TAG-LIB) Node
- OPCS (OPC Server) Node
- VIS (DigiVis Operations) Node

The steps described below will guide the user to configure a **DigiVis 500 system** in a single PC.

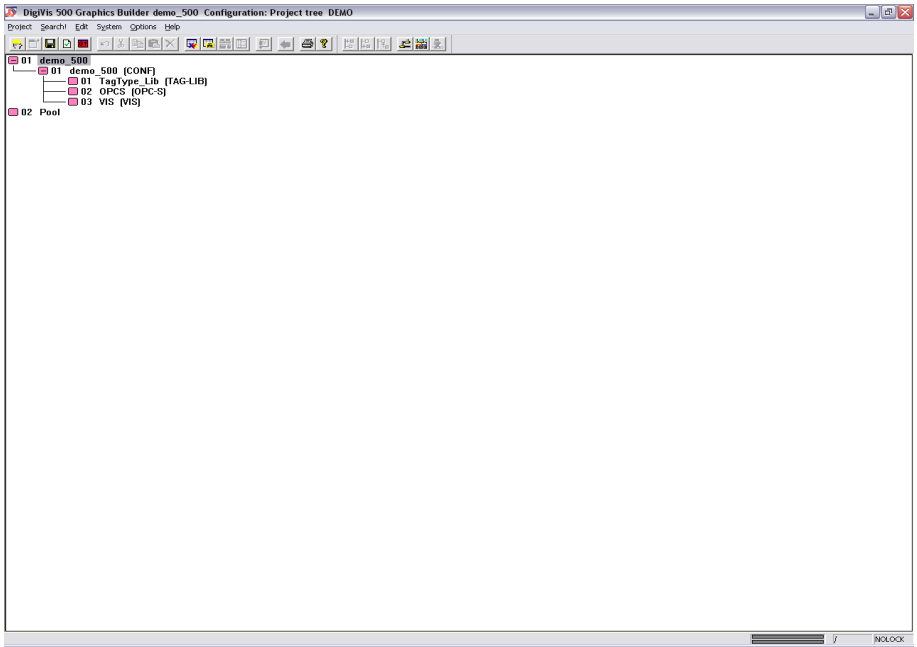
Step 1: Configuring the Software View of the Project

Once you have defined the general project data choose the **Configuration!** menu or use the corresponding tool bar button to reach the software view of the configuration that is, **project tree**.

Import the **AC500 Tag Type Library**.

Edit > Import Block > Browse the file C:\Program Files\ABB Industrial IT\DigiVis500\export\AC500 Standard TagTypeLibrary V1.0.prt > click on **open**

The Tag_Type_Li00 Library gets added under the **POOL** node in the **project tree**. Drag and drop it under the **CONF** node in the **project tree** below the **TagType_Lib** node. The library may now be used in the project.

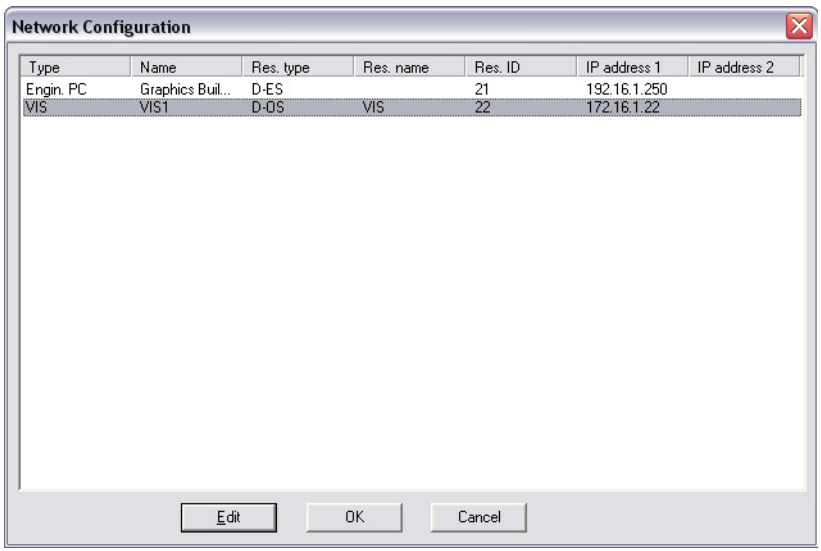


First_Steps_New project.bmp

Network Configuration

Click on the **Network** icon in the Toolbar

Specify the IP address and resource IDs for Digivis 500 Operator and DigiVis 500 Graphics Builder stations. The IDs should be unique.



First_Steps_Network_Configuration.bmp

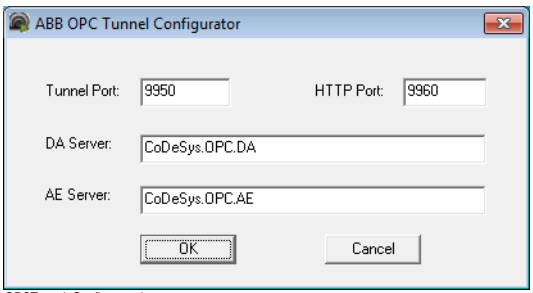
In order to proceed further with the instructions in this chapter, ensure that:

- AC500 Application (AC500_Demo.PRO) is developed and downloaded to the controller.
- OPC Server and alarm configurations (OPCServer.ini and OPC ServerA.ini) are done.

If not already done, install the **ABB OPC Tunnel** on the PC where **OPC Server** is installed. Select the *OPC Tunnel Server* option in the “Workplace type” screen while running the DigiVis 500 installation.

Step 2: ABB OPC Tunnel Configuration

- Select the ABB OPC tunnel configurator.
- Specify the PROG IDs of DA/AE Servers and the port number of the service. The default values are as shown below.
- User may use the default settings or change them as per requirements.

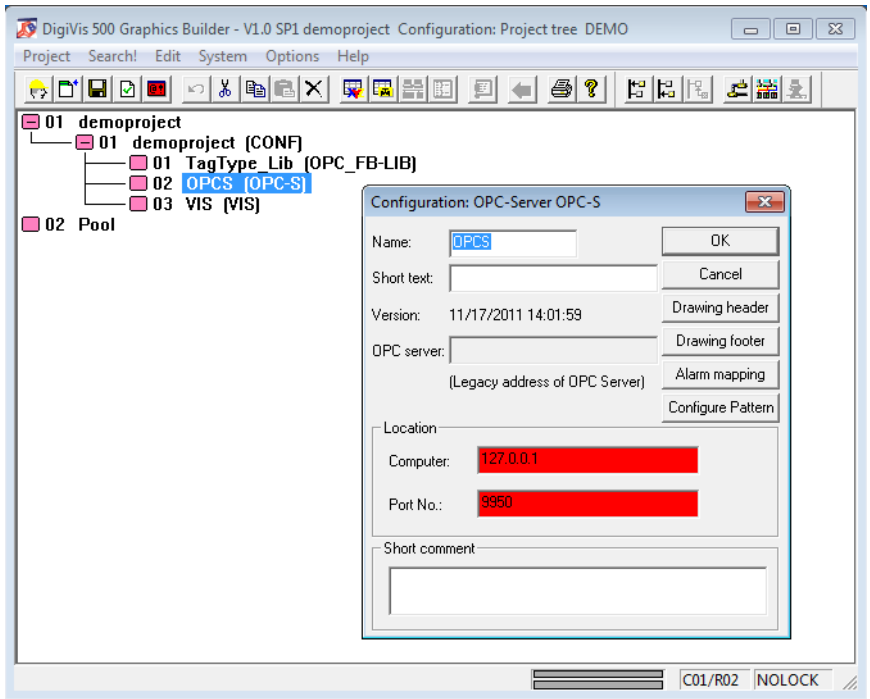


OPCTunnel_Configurator.bmp

Step 3: OPC Server Configuration

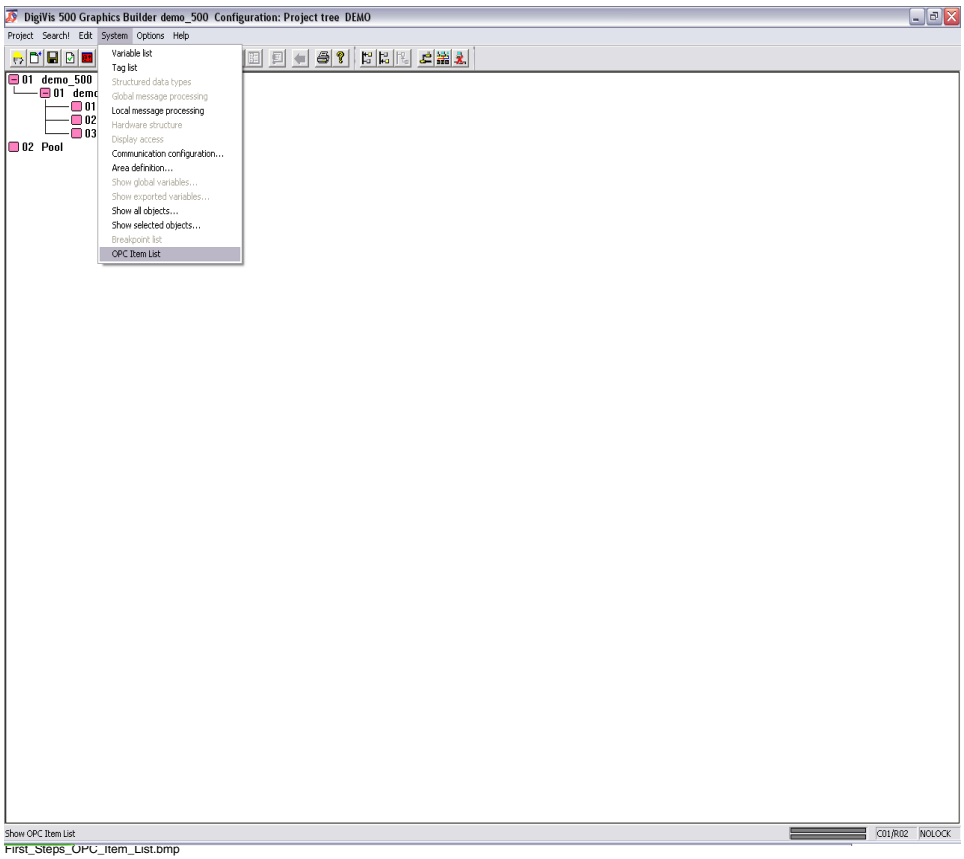
Project tree > Double click on the OPCS Node

Specify the IP address of the PC on which the **ABB OPC Tunnel** is installed. The port number is the same as the one used for the OPC tunnel configuration, that is 9950.



First_Steps_OPC_Config.bmp

Step 4: Browsing and adding items to the OPC Item list



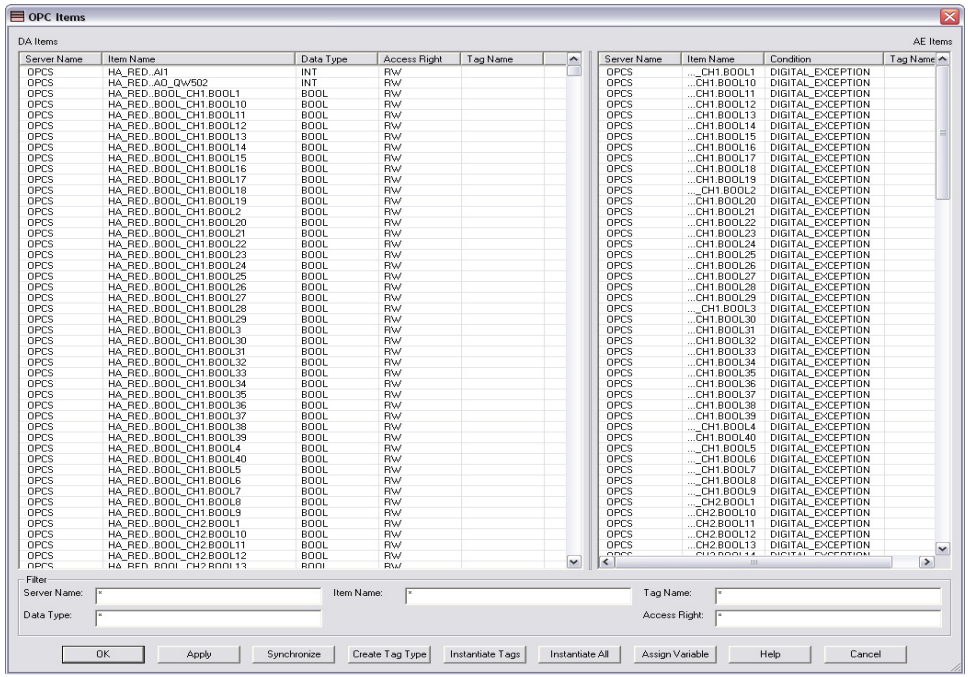
First_Steps_OPC_Item_List.bmp

Project tree > System > OPC Item List

Open the OPC Item List and click on the *Synchronize* button. Select the required OPC Server from the list and click on **OK**. This will import all the OPC Items from the OPC Server into the OPC Item List.

First step synchronize

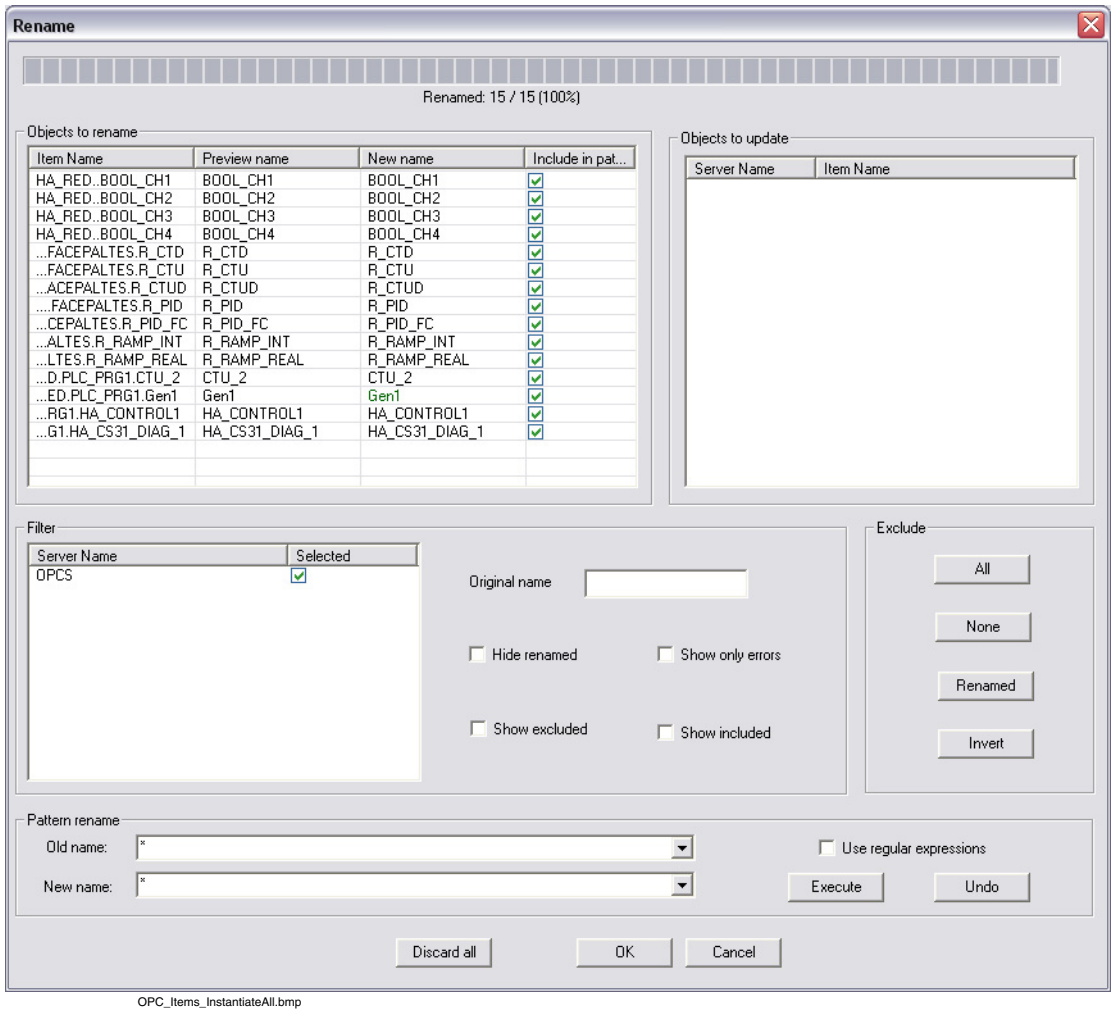
The OPC Item List is thus populated with items from the OPC Server.



OPC_items_browsed.bmp

Step 5:Instantiate Tags

Instantiate Tags using the *Instantiate All* button in the OPC Item List. This will match the OPC Items (the “selector” part of the OPC Item name after the separator) in the Item list with that in the Tag Type library and lists the Tags using Tag Type selector matching. The list of tags with proposed tag names are listed in a **Rename** dialog as shown below.

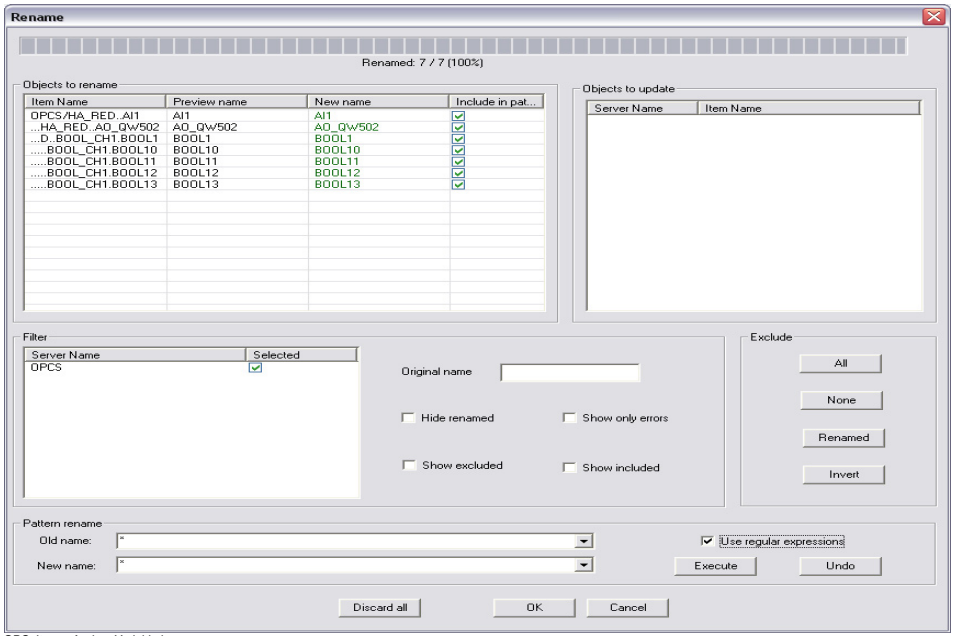


OPC_Items_InstantiateAll.bmp

Specify the Tag names for these OPC Items in the *New name* column and click on OK. The tags linked to the corresponding OPC Items are created in the Tag list.

Step 6: Assign Variables

Select the OPC Items from the OPC Item List that are to be used in free graphics/ trends and assign variables to them. A new window suggesting variable names for the OPC Item opens as below.



OPC_Items_Assign_Variable.bmp

Specify the required “variable name” in the *New name* column and click on OK. All the OPC Items with the suggested name will be assigned as a variable in the **variable list**.

User can configure free graphics and Trend from the Tags and Variables created in Step 5:Instantiate Tags on page 72 and Step 6: Assign Variables on page 74.

Step 7: Commissioning

In the project tree perform the plausibility check. If any errors are reported from the plausibility check, rectify the same. Choose **Project / Commissioning** to switch from configuration to commissioning mode.

When switching to commissioning mode, DigiVis 500 Graphics Builder attempts to establish a communication link with all the configured operator stations and OPC Servers. As well as the resource nodes, the current states of the connections are indicated in the project tree.

An arrow before the node indicates that the data for the node is not yet available (data has changed from last download) and needs to be loaded.

Select the resource node of Operator Station, if commissioning for the first time, choose **Load / Whole station**. Changes and enhancements to the configuration can be loaded into the operator station at a later stage using the **Load / Changed objects**.

If the load operation has concluded successfully, the nodes in the project tree will appear green and the load arrows will be removed.

Step 7: Saving the Project Data

The project data can be saved in the form of a binary file in the project tree view or in the startup menu. It is only possible to save the data as a text file in the main menu or startup menu. You can move back from the project tree view to the startup menu by choosing **Project / Exit**. **Project / Export** allows you to specify a file name for the saved data (<name>.csv).

You should always save your project data in the form of a CSV file. Projects should also always be archived in the form of CSV files. This file is also used in order to change from one software version to the next.

As well as the resource nodes, the current states of the connections are indicated in the project tree.

The process station should be flagged with the connection status **running**, and the operator station with **Version error**. The DigiVis500 Operations software must be launched; if this is not done, then **No connection** will be reported for the operator station.

Select the node for the process station and choose **Load / Changed objects**; then select the node for the operator station and choose **Load / Entire station**.

Switch to the operator station. Choose **Display / Using tag list**. The name of the PID1 function block is displayed in a list. The name of the function block should first be selected, and then its faceplate will be displayed.

The current alarms are listed in the **message list** along with their current time stamps.

Section 3 Licensing

Introduction

The licensing for DigiVis 500 system is based on **OPC signal based** licensing model.

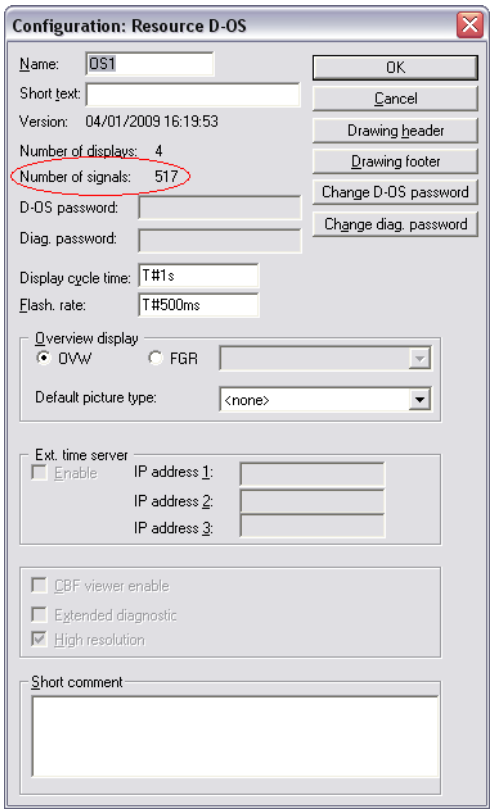
All used OPC DA Items are counted as OPC signals. DigiVis 500 Operations will refuse to work, if more than the licensed items are used in the actual configuration.

Used OPC DA Items are those that are configured in:

- Variable list
- Tags List (instantiated tags)

The number of OPC Items (OPC signals) that are used in DigiVis 500 Operations are displayed in the header dialog for the VIS node in the project tree.

Select operator station object in **Project Tree > Project > Header**



td004us.bmp

Base License

The following versions are available:

- DigiVis 500 Graphics Builder
- DigiVis 500 Operations (available for 50, 100, 250, 500, 1000, 2000 or Unlimited OPC signals)
- Combination - DigiVis 500 Graphics Builder with DigiVis 500 Operations (available for 50, 100, 250, 500, 1000, 2000 or Unlimited OPC signals)

Optional Licenses

Additional options for DigiVis 500 Operations

- **WEB display runtime**

  Web display functionality is used to load the local web browser. Calling the web display from DigiVis 500 Operations will activate the link to the configured Web site.

- **Dual monitor support**

  Windows Dualview feature support is provided for DigiVis 500 Operations station provided the graphic card which supports this feature and the appropriate device driver is installed.

- **DigiBrowse**

  DigiBrowse permits viewing archived trend, log files and reports without the use of DigiVis 500 Operations.

Additional options for the DigiVis 500 system

- **Security Lock**

  Provides access control for configuration with DigiVis 500 Graphics Builder and for **operation and observation with DigiVis 500 Operations**.

If the number of OPC signals exceed the maximum limit of the OPC signal based license for DigiVis 500 Operations, then a message indicating the same is displayed and the loading of the operator station is aborted.

Any OPC Item that is assigned as a variable and not used in any DigiVis 500 Operations display is still counted as a OPC signal.

All the OPC Items which has been assigned either as a variable or Tag from the OPC Server will be counted as a signal from all the DigiVis Operator station(s) linked to that OPC Server. This means that for a given OPC Server all the connected DigiVis 500 Operations stations must have the license for the same number of OPC signals. If one DigiVis 500 Operations station is connected to 2 OPC Servers then the license should consider the combined OPC signal count from both the OPC Servers.

The **communication configuration** option (Project Tree > System > Communication Configuration) may be used to disconnect the VIS station from a particular OPC Server, if all the OPC Items configured for that VIS station are not used. This ensures that the OPC Items are not counted as OPC signals for that particular VIS station.

License Expansion

The signal based license for DigiVis 500 Operations can be expanded as follows:

- 50, 100, 250, 500, 1000, 2000 OPC signals
- From any number to Unlimited OPC signals

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