Getting Started with IWS and TwinCAT

Contents

Note

This document assumes that you are familiar with the Microsoft Windows NT/2000/XP environment, including how to move files, manage system preferences, establish network connections, and install new software. If you do not have this familiarity, then please consult the Windows Help feature as you work through this document.

Introduction

This document describes how to configure InduSoft Web Studio (IWS) and Beckhoff's TwinCAT control software to run together on various Microsoft Windows-based devices, as well as how to establish communication between those devices on an Ethernet network.

The following diagram shows a mixed device network using both InduSoft and Beckhoff software components:

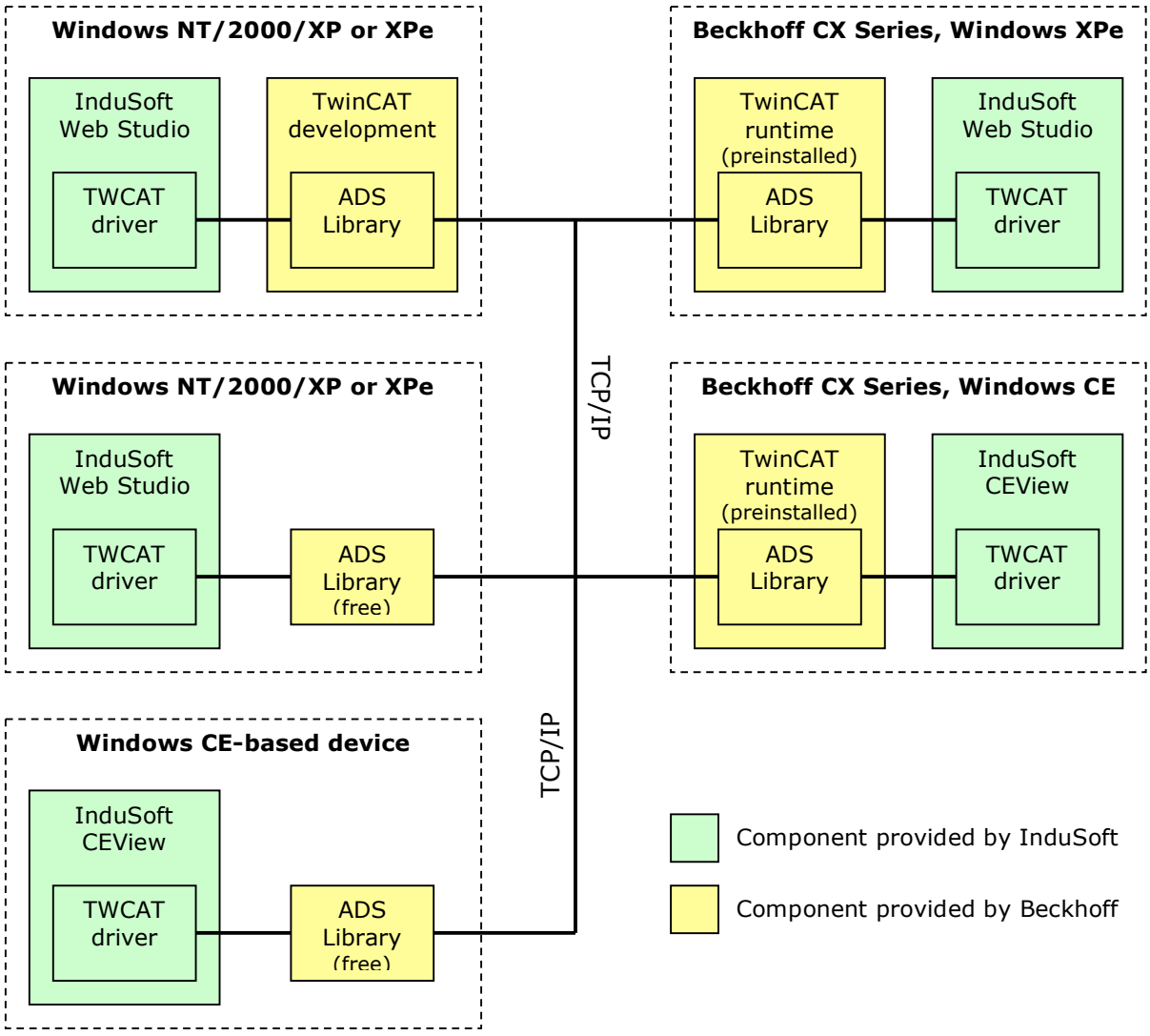


Figure 1. Mixed Device Network Using IWS and Beckhoff Components

Each device in the diagram shows a unique combination of operating system, InduSoft software components, and Beckhoff software components.

The primary component in this system is Beckhoff's Automation Device Specification (ADS) library, which makes a compatible workstation or industrial PC running Windows NT/2000/XP, an embedded PC running Windows XPe, or a Windows CE-based device into a TwinCAT-compliant node. This library establishes a data exchange protocol that works over standard Ethernet TCP/IP, so that any node with the library installed can communicate directly with your TwinCAT control application,

wherever it may be hosted. The ADS library is included in the full TwinCAT software, but it is also available as a free, separate package from Beckhoff.

InduSoft provides a TWCAT communication driver for IWS and CEView. The TWCAT driver, when properly selected configured in your IWS application project, communicates with TwinCAT through the ADS library. In this way, IWS is fully compatible with TwinCAT.

The rest of this document will explain…

- How to choose, acquire and install the necessary software components for each of these device configurations;
- How to use the utilities provided with the ADS library to establish communication between devices; and
- How to build a sample application in IWS that uses the TWCAT driver and the ADS library to communicate with TwinCAT.

Quickstart for Beckhoff CX1020 or CX1000

This document covers most conceivable options and configurations for working with IWS and TwinCAT, and as such it is very detailed and somewhat spread out. However, the majority of users will probably need to know only how to set up a Beckhoff CX1020 or CX1000 running Windows CE.

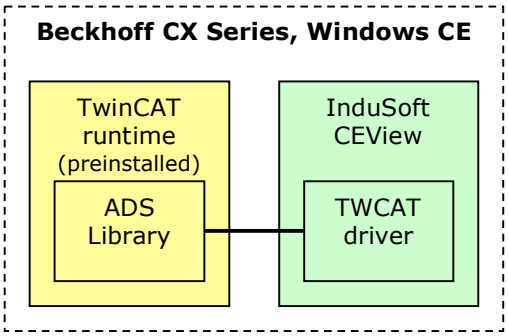


Figure 2. Typical Configuration for Majority of Users

If this is your configuration, then you can use the following quickstart guide to jump directly to the relevant sections in this document:

1) Download and run the CEView custom installer (i.e., the `.CAB` file) for Beckhoff CX Series devices — starting on page 12.
2) Establish a link between IWS on your workstation and CEView on the device, and then update CEView to the latest version — starting on page 14.
3) License CEView on the device — starting on page 15.
4) Select the TWCAT driver and add it to your IWS application project — starting on page 39.
5) Build the driver worksheet — starting on page 46.
6) Download the finished IWS application to the device — starting on page 53.

> **Note**
>
> This quickstart guide assumes that you are already familiar with both InduSoft Web Studio and the TwinCAT programming software. It only describes how to set up a Beckhoff CX Series device in an existing production environment. If you need more thorough instructions, then please review this entire document.

Installing the Software Components

This section explains how to choose, acquire and install the necessary IWS and Beckhoff software components for several different platforms. These platforms include:

- A workstation or industrial PC running Windows NT/2000/XP;
- An embedded PC running Windows XPe;
- A Beckhoff PLC, model CX1020 or CX1000; and
- A Windows CE-based device (other than Beckhoff's CX Series).

Each configuration is described in detail in this section, but first…

Getting the Software

Before proceeding with installation on any device, make sure that you have all of the correct software (as well as the latest versions thereof) on hand.

IWS, CEView, and the TWCAT Driver

As of this document revision, the latest version of IWS is 6.1+SP1. You can order it on CD from your InduSoft sales representative, or you can download it from InduSoft's Web site at www.indusoft.com. The full version of IWS can be installed directly on a desktop PC running Windows NT/2000/XP or on an embedded PC running Windows XPe.

Included in IWS are all of the files required to install CEView — the IWS runtime engine for Windows CE-based devices — on any of the following embedded PC (a.k.a. mobile) processor types: ARM V4, ARM V4I, ARM V4T, MIPS II, MIPS II FP, MIPS IV, MIPS IV FP, SH3, SH4, and x86.

> **Note**
>
> Although the full version of IWS can be downloaded from InduSoft's Web site, you must have a valid license to run it beyond the free evaluation period. Please contact your InduSoft sales representative for licensing options, and consult the *InduSoft Web Studio User Guide* for more information about applying the license.

Also included in IWS are all of the communication drivers available at the time of release. However, these drivers are always under development, so a newer version of the TWCAT driver may be available. You can download the latest TWCAT driver from InduSoft's up-to-date driver list at www.indusoft.com.br/download/drivers/.

TwinCAT and the ADS Communication Library

You can order the TwinCAT development software on CD from your Beckhoff sales representative, or you can download it from Beckhoff's Web site at www.beckhoff.com. TwinCAT can be installed on a wide variety of platforms including traditional PCs, embedded PCs, and Beckhoff's own CX Series of PLCs. However, for the purposes of this document, only installation on traditional PCs will be discussed. For more information about installing TwinCAT on other platforms, please consult Beckhoff's documentation.

> **Note**
>
> Although the full version of TwinCAT can be downloaded from Beckhoff's Web site, you must have a valid license to run it beyond the free evaluation period. Please contact your Beck-

hoff sales representative for licensing options, and consult the TwinCAT documentation for more information about applying the license.

Keep in mind that you may not need to acquire the full version of TwinCAT for your installation; the TwinCAT runtime engine comes preinstalled on most Beckhoff devices, and on other devices you may only need to install the ADS library to enable communication.

The ADS communication library is freely available from Beckhoff and can be acquired in several different ways:

- If you have already installed TwinCAT on a traditional PC, then the ADS library files are available on that PC in the **`\TwinCAT\ADS Api`** directory;
- The ADS library can be installed from the TwinCAT Supplement CD that comes with the TwinCAT Installation CD; or
- The ADS library is available as a free, standalone download from Beckhoff's Web site at www.beckhoff.com. The full name of the download is **TwinCAT_ADS_Communication_Library**, and it is listed in the TwinCAT Supplement section of the site.

The ADS communication library can be installed on a traditional PC running Windows NT/2000/XP, on an embedded PC running Windows XPe, or on a Windows CE device using any of the following processor types: ARM, I586, MIPS, SH3, SH4, StrongARM HPC, StrongARM PPC, StrongARM 1100, and StrongARM V4I.

Windows CE Utilities

If you will be working with Windows CE — either on a Beckhoff PLC or on some other Windows CE-based device — then you should consider having these two utilities installed on your workstation:

- First, you can use **Microsoft ActiveSync** to easily transfer files between your workstation and a connected Windows CE-based device. ActiveSync communicates with the device via serial or USB, and when the device is properly connected, it appears on your workstation (under **My Computer**) as a removable drive.

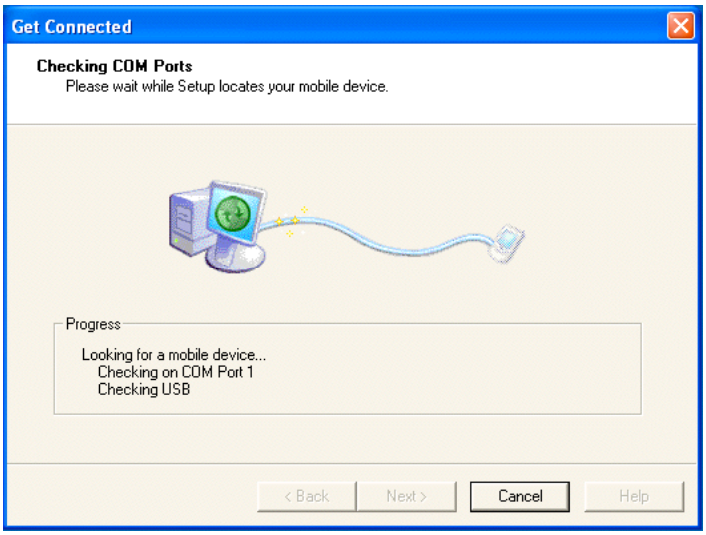


Figure 3: Using Microsoft ActiveSync to Connect to a Windows CE-based Device

ActiveSync can be downloaded for free from Microsoft's Web site at:

http://www.microsoft.com/windowsmobile/addons/

- Second, you can use **Remote Display Control for Windows CE** (also known as **`CERHOST.exe`**) to open a console window on your workstation that shows the desktop of a connected Windows CE-based device. Through this console window, you can fully operate a "headless" device — that is, a device without its own display, keyboard or mouse — using only your workstation.

  Remote Display Control communicates with the device via Ethernet TCP/IP, similar to both TwinCAT and IWS. However, you must know the hostname or IP address of the device in order to connect to it, so be sure to get this information beforehand.

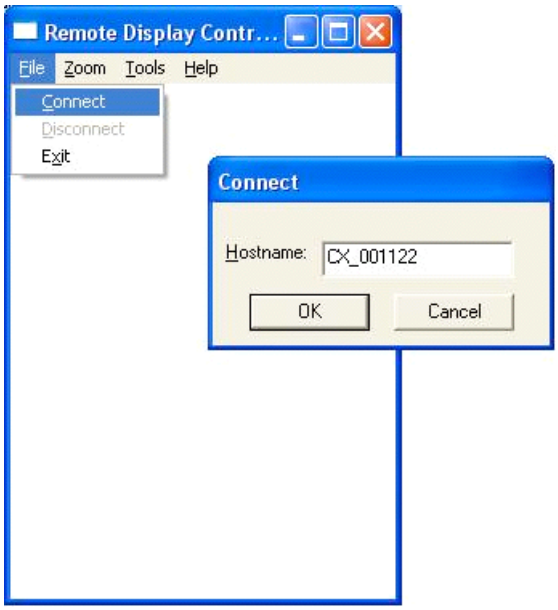


Figure 4: Using Remote Display Control to Connect to a Windows CE-based Device

  Microsoft includes Remote Display Control as part of their Windows Mobile developer toolkit, but Beckhoff also offers the utility on their Web site at:

  http://ftp.beckhoff.de/Software/embPC-Control/CE/Tools/RemoteDisplay/

For more information about using Microsoft ActiveSync or Remote Display Control, please consult Microsoft's documentation.

> **Note**
>
> The addresses given above are accurate at the time of this writing, but they may change in the future as Microsoft and/or Beckhoff update their Web sites.

Installing on a Workstation or Industrial PC — Windows NT/2000/XP

When installing on a workstation or industrial PC running Windows NT/2000/XP, there are typically only two possible configurations. (See page 2 for more information about these configurations and their places in a mixed network.) Each configuration is described below.

Full Version of IWS + Full Version of TwinCAT

To install both IWS and TwinCAT on the same PC:

1) Install and license the full IWS development software, as described in its documentation.
2) Download the latest TWCAT driver from InduSoft's Web site (see page 4), unzip it, and copy all of its files to the **\DRV** directory of your IWS installation. For example…

   C:\Program Files\Indusoft Web Studio v6.1\DRV

3) Install and license the full TwinCAT development software, as described in its own documentation.

Installing TwinCAT will automatically enable communication between the PC and other TwinCAT-compliant devices, so you do not need to do anything else to configure IWS.

Full Version of IWS + the ADS Communication Library

To install IWS and the ADS library on the same PC:

1) Install and license the full IWS development software, as described in its documentation.
2) Download the latest TWCAT driver from InduSoft's Web site (see page 4), unzip it, and copy all of its files to the **\DRV** directory of your IWS installation. For example…

   C:\Program Files\Indusoft Web Studio v6.1\DRV

3) Acquire the ADS communication library (see page 4), and locate the following files therein:
   - **\TcAdsDll\AdsDll.dll**
   - **\TcAdsDll\TcAdsDll.dll**
   - **\TcAdsDll\TcAdsTest.exe**
   - **\TcAdsDll\TcAmsRemoteMgr.exe**
4) Copy all four files to the **\BIN** directory of your IWS installation. For example…

   C:\Program Files\Indusoft Web Studio v6.1\BIN

With the ADS library and the latest TWCAT driver both installed, IWS is ready to communicate with TwinCAT running on a remote device. Unless you are performing additional installations on other devices, you may proceed to the next section, "Establishing Communication Between TwinCAT Stations," on page 25.

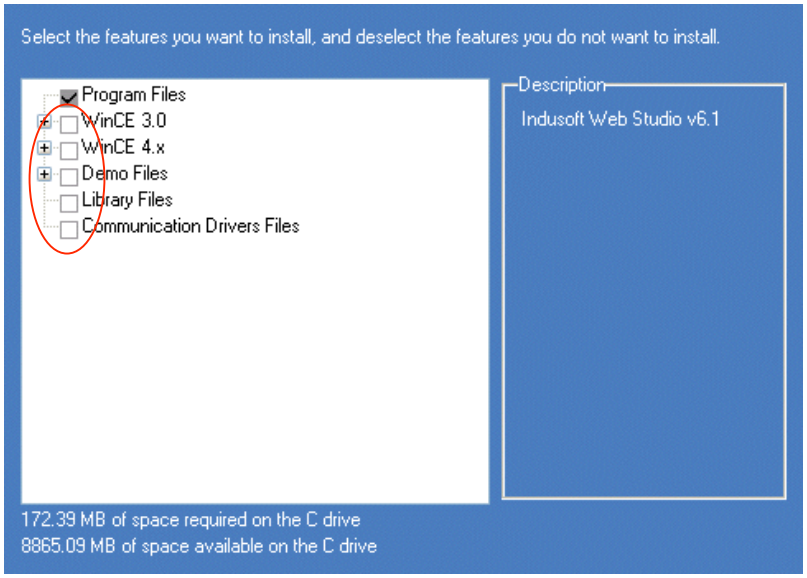
Installing on an Embedded PC — Windows XPe

Although it is technically an embedded PC — that is, a slimmed down operating system running on solid-state hardware — a system running Windows XP Embedded (XPe) provides the same basic compatibility as a workstation or industrial PC running Windows XP. As such, you can configure this Windows XPe-based device much like the workstation described in the previous section, with full versions of both IWS and TwinCAT *or* with the full version of IWS and the ADS library.

The biggest difference between a traditional workstation and an embedded PC — at least for the purposes of this document — is that the embedded PC does not have its own CD drive. (If it did, then it wouldn't be solid-state.) Without a CD drive, it is not possible to install software directly from CD to the device. Therefore, you must find another way to install the software.

IMPORTANT! Do Not Install Supplemental Files!

Regardless of *how* you install IWS on your embedded PC, you are likely to use it only as a runtime engine and not as a development station. Therefore, you should **not** install any of the supplemental files (i.e., files other than the core Program Files); when you run the IWS installation wizard, be sure to deselect these files as shown at right. Skipping these files will reduce the size of the IWS installation by over 260 MB, which is important on an embedded PC where persistent (non-volatile) memory is extremely limited.



Deselecting the Supplemental Files in the Installation Wizard

Don't worry about not installing the communication drivers. You only need the TWCAT driver to communicate with other TwinCAT stations, and you can always download the latest version of that driver from InduSoft's Web site. For more information, see pages 4 and 7.

Installing from External CD

You can attach an external (or "backpack") CD drive to your embedded PC, typically using a USB 2.0 connection. The drive should mount normally under Windows XPe. From there — assuming you have installation CDs for IWS and TwinCAT — you can proceed to install the software on your embedded PC just as if it's a traditional workstation, as described in the previous section.

Installing from Internet Download

If your embedded PC is connected to the Internet, then you can directly download the IWS, TwinCAT and/or ADS library installers from their respective Web sites. And again, you can proceed from there to install the software on your system as described in the previous section.

However, you may not want to do this because merely downloading the installers requires several hundred megabytes, and an embedded PC's persistent (non-volatile) memory is extremely limited.

It's possible that there simply isn't enough space to both download the installers and install the software. It all depends on how much non-volatile memory you have available.

Furthermore, for the sake of network maintenance and security, embedded PCs on the plant floor often are not connected to the Internet. Yet, they usually are connected to the internal network so you may be able to run the installers from another PC.

Installing from Another PC

If your embedded PC is connected to the internal network, then you may be able to run the IWS, TwinCAT and/or ADS library installers from another PC on the network. To do this, you must first locate a workstation that is connected to both the Internet and the building network, and then you must download the installers to that workstation.

Once you have the installers, you can upload them from the workstation to a common file server (a.k.a. network drive) *or* you can share them directly from that workstation. Either way, you can then go to the embedded PC, map the appropriate network drive, and run the installers. For more information on sharing files and mapping network drives, please consult the Windows help system.

Installing from CompactFlash

CompactFlash (CF) memory is a popular form of solid-state, non-volatile file storage, and most embedded PCs are designed with not only internal flash memory but also CF memory card readers. You can copy the IWS, TwinCAT and/or ADS library installers from your workstation onto a CF card, and then insert that card into your embedded PC. The card should appear under **My Computer** as a removable drive, and once it does, you can then run the installers saved on it.

Installing from USB Drive

Windows XPe provides full support for USB, so you should be able to use a USB flash drive (also known as a "thumb drive") to transfer files in the same way that you would use a CF memory card, as described above. The only limitation is whether your embedded PC has an open USB port.

Installing on a Beckhoff PLC (CX1020 or CX1000)

Beckhoff offers the CX Series of embedded PCs that are packaged with all of the necessary communication and I/O options to make them fully functional PLCs. The CX Series includes:

- The Beckhoff CX1020 with an Intel® Celeron® M processor up to 1.0 GHz; and
- The Beckhoff CX1000 with an AMD® Geode processor up to 266 MHz.

The CX1020 can be configured with either Windows XPe or Windows CE. The CX1000 can only be configured with Windows CE.

Both models come with the TwinCAT runtime software preinstalled, so you only need install the InduSoft software component that is appropriate to the operating system: the full version of IWS on Windows XPe, or the CEView runtime engine on Windows CE.

Installing IWS on a Beckhoff CX1020 Running Windows XPe

For the purposes of this document, a Beckhoff PLC running Windows XPe is just like any other embedded PC running that operating system. Therefore, to install the full version of IWS, follow the instructions already provided in "Installing on an Embedded PC — Windows XP" on page 8.

Please consult Beckhoff's documentation for more information about the device's communication options and OS configuration.

Installing CEView on a Beckhoff CX1020 or CX1000 Running Windows CE

Installing new software on a Windows CE-based device can be tricky because the default system preferences and directory structure vary greatly from manufacturer to manufacturer and from model to model. This is because such devices have extremely specific hardware configurations and limited system resources. When the manufacturer develops the OS load for these devices, it selects only the minimum options required to drive the hardware.

The same is true for Beckhoff's CX Series, but to make things easier for users who want to run TwinCAT and InduSoft together on the same device, Beckhoff has also developed a custom installer that automatically installs InduSoft's CEView in the correct directory and makes the necessary changes to the system registry.

> **Note**
>
> This custom installer is only available for Beckhoff CX Series devices running Windows CE. There is no equivalent for CX Series devices running Windows XPe; see "Installing IWS on a Beckhoff CX1020 Running Windows XPe" above.

CX Series devices can be ordered from Beckhoff with this custom installer already applied; the option is listed in Beckhoff's catalog as "CX1800-0005 InduSoft HMI CE Runtime." The installer can also be downloaded from Beckhoff's Web site and run by the user, in case a device is ordered without the InduSoft option.

InduSoft and Beckhoff work together to try to make sure this installer always includes the latest version of CEView. It is important to have the latest version installed on your CX Series device, in order to correctly run your IWS applications. Working with different versions of IWS and CEView may result in serious errors.

Unfortunately, it's still possible for InduSoft and Beckhoff to fall out of sync, so that even a freshly downloaded installer may include an old version of CEView. As such, when you receive a new device with the InduSoft option or when you run the installer yourself, you should still use the Execution Environment tool in IWS to update CEView on the device.

In general, the rest of this section describes the following procedure:

1) Check to see if CEView is already installed on the device — that is, check to see if the custom installer has already been applied.
2) If CEView is not installed, then download the custom installer and run it.
3) Use the *Execution Environment* tool in IWS to connect to the device, and then update CE-View to match IWS.
4) Entire your runtime license for CEView.

You may wonder why you should download and run the custom installer if there's a chance it will install an old version of CEView that needs to be updated anyhow. Why not install CEView from scratch using the Execution Environment tool in IWS? Well, because the installer automatically makes changes to the device's directory structure and system registry that are more difficult to make manually. In the end, it's simply easier to run the installer and then update.

Before you proceed, make sure that you meet the following prerequisites:

- You must have the full IWS development software installed on your workstation;
- Your CX Series device should be connected to your workstation by serial or Ethernet. If it is connected by Ethernet, then it should be assigned a valid IP address;
- You must have a way to control the device, either through a console window (see page 6) or by physically attaching a display and a mouse; and
- You must have a way to transfer files from your workstation to the device, either through Microsoft ActiveSync (see page 5), by manually copying the files onto the device's Compact Flash memory card, or by copying across the network.

For help with meeting these prerequisites, please consult Microsoft's documentation for Windows CE and Beckhoff's documentation for the CX Series device.

Checking for CEView and Remote Agent

Now that you're ready, check to see if the custom installer has already been run on your CX Series device. You can do this by looking for the **`\Hard Disk\InduSoft`** directory which contains the CE-View files.

Also, if the installer has been run on the device, then it should already be configured to automatically start Remote Agent on boot. Try rebooting the device — that is, tap the **Start** button to open the Start menu and then select **Suspend**. When the device boots up again, the Remote Agent utility should appear:

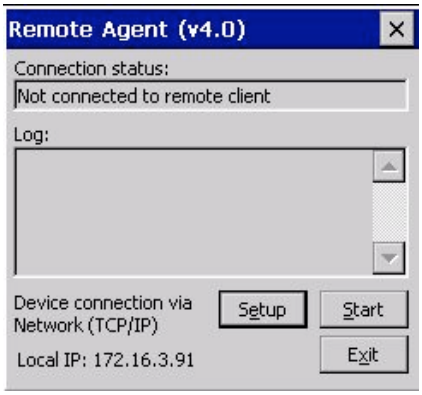


Figure 5. Remote Agent Utility Running in Windows CE

> **Note**
>
> Remote Agent is a communications utility included in the CEView installation. It enables communication between IWS on your workstation and CEView on the device. In this way, it serves much the same purpose that the ADS library serves in TwinCAT.

If the CEView files are present and Remote Agent starts automatically on boot, then skip to "Updating CEView to the Latest Version" on page 14. If not, then proceed to "Downloading and Running the Custom Installer" below.

Downloading and Running the Custom Installer

To download and run the installer yourself:

1) Acquire the "CX1800-0005 InduSoft HMI CE Runtime" installer. The actual name of the installer file is:

   `CX1800-0005_HMI_InduSoft.I586.CAB`

   This file is included on the TwinCAT Supplement CD, but it can also be downloaded for free from Beckhoff's Web site at:

   http://www.beckhoff.com/english/default.htm?download/cx_ce_hmi.htm

   > **Note**
   >
   > The address given above is correct at the time of this writing, but it may become invalid as Beckhoff updates their Web site. You can also use the site's navigation tree to find the Web page; it should be listed under **Download** > **Software** > **Embedded PC**.

2) Copy the installer file to the device. You should save the file in the device's **`\Hard Disk\System`** directory.
3) Locate the installer file on the device and double-tap its icon. This will run the installer.
4) Follow the on-screen installation instructions. When the installer prompts you to confirm the creation of the **`\Hard Disk\InduSoft`** directory, tap the **OK** button.

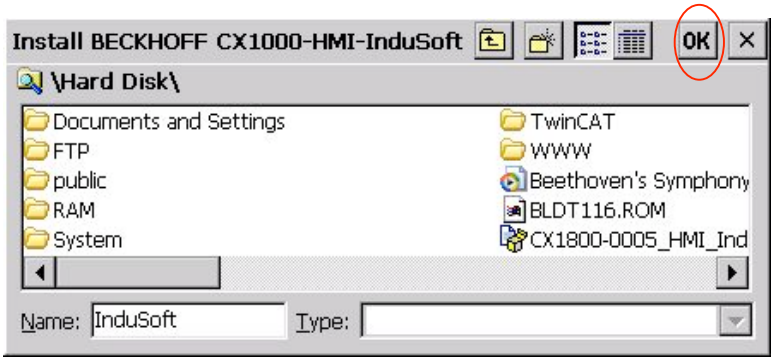


Figure 6. Creating the InduSoft Directory

The CEView files are installed in the **`\Hard Disk\InduSoft`** directory, and the system registry is updated.

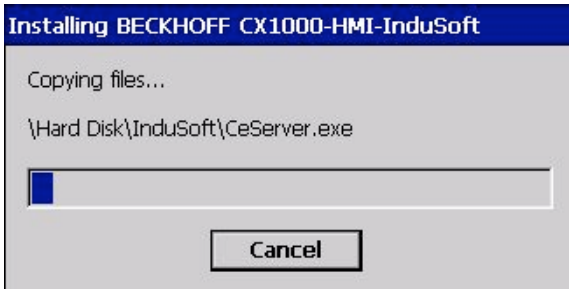


Figure 7. Installing Files in the InduSoft Directory

5) When the installation is finished, reboot the device by selecting **Start** ▸ **Suspend**. This will save the updated directory and registry information to the persistent (non-volatile) memory.

   After the reboot, the Remote Agent utility should start automatically.

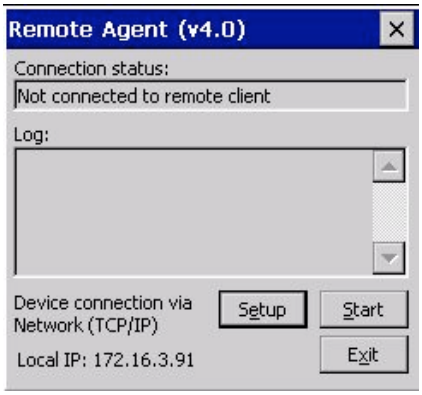


Figure 8. Remote Agent Utility Running in Windows CE

6) Tap **Setup** to open the *Setup* dialog:

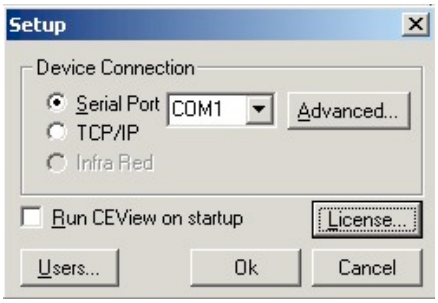


Figure 9. Setup Dialog in Remote Agent

   Configure the *Device Connection* settings as needed, depending on how you've connected the device to your workstation. For complete instructions, please consult the *InduSoft Web Studio User Guide*. **You do not need to enter a license at this time.**

7) Tap **OK** to close the *Setup* dialog.

Remote Agent is now ready to receive communication from IWS running on your workstation.

Updating CEView to the Latest Version

Assuming you have already installed the full, latest version of IWS and the latest TWCAT driver (see "Getting the Software" on page 4), you can use the following instructions to update CEView on your CX Series device:

1) On your workstation, start Indusoft Web Studio.
2) From the main menu bar, select **Tools** ▸ **Execution Environment**. The *Execution Environment* dialog will be displayed:

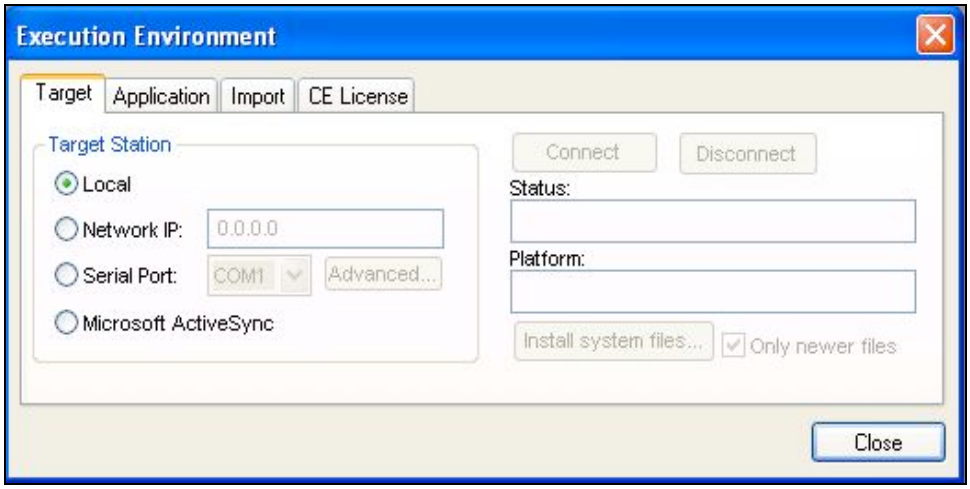


Figure 10. Execution Environment Dialog

3) Configure the *Target Station* settings as needed, depending on how you've connected the device to your workstation. For complete instructions, please consult the *InduSoft Web Studio User Guide*.
4) Click **Connect** to establish communication with the device.

   If communication is successfully established, then the *Status* and *Platform* fields will be updated to reflect the connected device. Also, the Remote Agent utility on the device will show that it has successfully connected back to IWS.
5) Make sure the **Only newer files** option (checkbox) is enabled, and then click **Install system files**... to update the CEView files on the device.
6) When the installation is completed, click **Close** to close the *Execution Environment* dialog.
7) Reboot the device once more by selecting **Start** ▸ **Suspend**. This will save the updated files to the device's persistent (non-volatile) memory.

You should now have the TwinCAT runtime software, the Remote Agent utility, and the updated CEView files all installed on your CX Series device.

Licensing CEView

You must have a valid license to run CEView beyond the free evaluation period. You can obtain this license by contacting your InduSoft sales representative and providing the device's "site code." The representative will use this site code to generate a corresponding license code, which you can then apply to the device.

The actual licensing can be done in either of two ways: via the Execution Environment tool in IWS, or directly at the device. If you've already used the Execution Environment tool to connect to the device and update the CEView software (see the previous page), then it's very easy to also license the software.

When you are ready, proceed with the following instructions:

1) In the *Execution Environment* dialog, select the *CE License* tab:

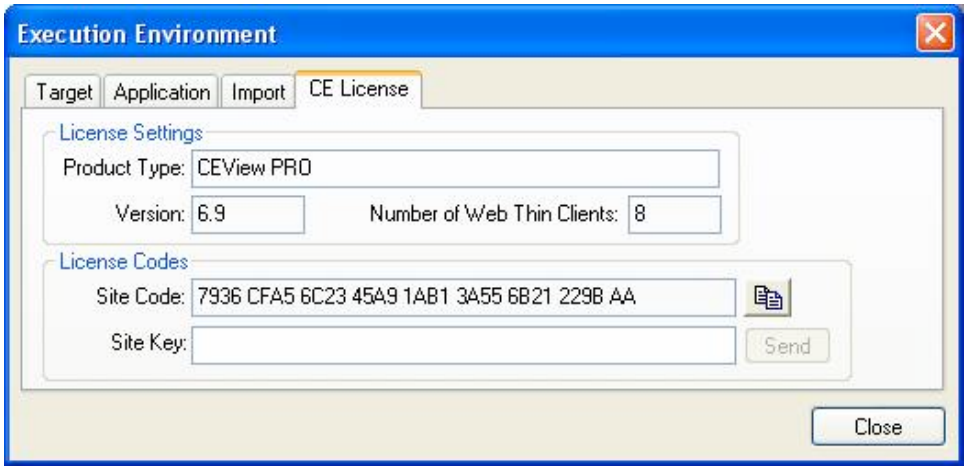


Figure 11: CE License Tab in the Execution Environment Dialog

2) Copy the code given in the *Site Code* field and send it to your InduSoft sales representative. Your representative will return a license key that corresponds to the site code.

> **Note**
>
> The site code shown above is given only as an example. Your device's actual site code is generated when CEView is installed, and it is unique to your device.

3) Enter the license key in the *Site Key* field and click **Send**.

   If the site key is accepted (validated), then a confirmation message will be displayed. If the site key is not accepted, verify that you have entered it correctly and try again. If it is still not accepted, then contact your InduSoft sales representative for assistance.

If for whatever reason you cannot connect to the device via the *Execution Environment* tool in IWS, you can still apply a license directly on the device itself:

1) On your CX Series device, in the Remote Agent utility, tap **Setup** to open the *Setup* dialog:

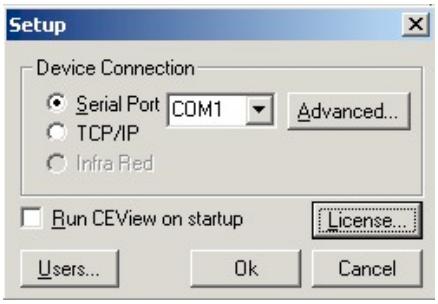


Figure 12. Setup Dialog in Remote Agent

2) Tap **License** to open the *License* dialog:

Figure 13: License Dialog in Remote Agent

3) Tap **Change License** to open the *Change License* dialog:

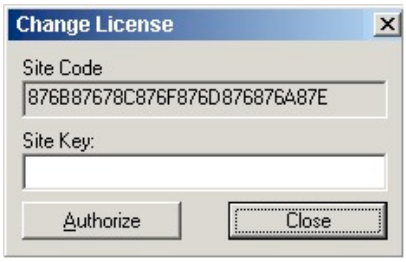


Figure 14: Change License Dialog in Remote Agent

4) Copy the code given in *Site Code* field and send it to your InduSoft sales representative. Your representative will return a license key that corresponds to the site code.

> **Note**
>
> The site code shown above is given only as an example. Your device's actual site code is generated when CEView is installed, and it is unique to your device.

5) Enter the license key in the *Site Key* field and click **Authorize**.

   If the site key is accepted (validated), then the following message is displayed:

Figure 15: Site Key Accepted

   If the site key is not accepted, verify that you have entered it correctly and try again. If it is still not accepted, then contact your InduSoft sales representative for assistance.

When CEView is properly installed, updated, licensed, and ready for runtime, you can proceed to "Establishing Communication Between TwinCAT Stations" on page 25.

Installing on a Windows CE-based Device

> **Note**
>
> This section discusses Windows CE-based devices in general. Beckhoff's CX Series devices (i.e., the CX1020 and the CX1000) are discussed in the previous section.

Any Windows CE-based device can be made a fully compatible node in your TwinCAT/InduSoft system, but it requires a few extra steps because the device does not come with any of the necessary software preinstalled and there is no custom installer to do it for you.

Since this is not a Beckhoff device, you cannot install the full TwinCAT runtime software. Instead, you can install the ADS library that enables communication with other TwinCAT nodes. You can then install InduSoft CEView, which ties into and communicates through the ADS library.

In general, the rest of this section describes the following procedure:

1) Determine the OS version and processor type of your Windows CE-based device.
2) Install the ADS library that is appropriate to the processor type.
3) Install the Remote Agent utility and configure it to start automatically on boot.
4) Use the *Execution Environment* tool in IWS to establish communication between your workstation and the device, and then install CEView on the device.
5) Enter your runtime license for CEView.

Before you proceed, make sure that you meet the following prerequisites:

- You must have the full IWS development software installed on your workstation;
- Your Windows CE-based device should be connected to your workstation by serial or Ethernet. If it is connected by Ethernet, then it should be assigned a valid IP address;
- You must have a way to control the device, either through a console window (see page 6) or by physically attaching a display and a mouse; and
- You must have a way to transfer files from your workstation to the device, either through Microsoft ActiveSync (see page 5), by manually copying the files onto the device's Compact Flash memory card, or by copying across the network.

For help with meeting these prerequisites, please consult Microsoft's documentation for Windows CE and the manufacturer's documentation for the device.

Determining Your OS Version and Processor Type

Both CEView and the ADS library come in different "flavors" for the various processor types, so you must determine the processor type on your Windows CE-based device. You should also note which specific version of Windows CE your device is running.

To determine OS version and processor type in Windows CE:

1) Tap the **Start** button to open the Start menu, and then select **Settings** ▸ **Control Panel**.
2) In the Control Panel, double-tap the **System** icon to open the *System* dialog.
3) In the *System* dialog, select the **General** tab. The OS version (e.g., Windows CE 3.x, Windows CE .NET, Windows CE 5.x) and processor type (e.g., ARM, MIPS, SH3) will be displayed. Make note of this information.
4) Close the *System* dialog.

> **Note**
>
> "Windows CE .NET" is another name for Windows CE 4.x.

Installing the ADS Library

The ADS communication library for Windows CE is provided as a single cabinet file, as opposed to the handful of separate files that are provided for Windows NT/2000/XP. A cabinet file (***.CAB**) is an automated installer that is specifically written for Windows CE. All you have to do is copy the cabinet file to the Windows CE device and run it there; it will install its files in the correct places, edit the system registry (if necessary), and remove itself when it's done.

To install the ADS library on your Windows CE device:

1) Acquire the ADS communication library as described previously (see page 4), open it on your workstation, and locate the following file therein:

   \TcAdsDllCe\setup\TcAdsDllCe.*<processor type>*.CAB

   …where ***<processor type>*** is the type of processor that is in your device.

   For example:

   \TcAdsDllCe\setup\TcAdsDllCe.MIPS.CAB

   Please note that each cabinet file is a complete installer. You will only need **one** file — the one that corresponds to your device's processor type — to install the ADS library.

2) Copy this file to the device's persistent (non-volatile) file storage. If you don't know where this is, then please consult the manufacturer's documentation.

   The directory structures of different Windows CE-based devices can vary greatly, and the device manufacturer may require that files be stored in a specific directory, so please consult the manufacturer's documentation.

3) Go to the Windows CE device, locate the cabinet file there, and double-tap its icon to run it.

4) Follow the on-screen instructions, if any.

5) When the installation is finished, reboot the device to save the new files and settings to persistent (non-volatile) memory.

The ADS library should now be installed on your Windows CE device. You will verify it in the next section, "Establishing Communication Between TwinCAT Stations," on page 25.

Installing the Remote Agent Utility

To install Remote Agent on your Windows CE device:

1) On your workstation, locate the following file:

   ***<IWS directory>*\Redist*<OS version>**<processor type>*\BIN\CEServer.exe**

   …where:

   - ***<IWS directory>*** is the directory where you installed IWS;
   - ***<OS version>*** is the version of Windows CE running on your device (see note); and
   - ***<processor type>*** is the processor type that is in your device.

> **Note**
>
> For devices running Windows CE 3.x, use the files located in the **\Redist\CeView** directory.
>
> For devices running Windows CE 4.x (a.k.a. Windows CE .NET) and Windows CE 5.x, use the files located in the **\Redist\Wince 4.0** directory.

For example, for a device running Windows CE 3.1 on an Intel x86 processor:

\InduSoft Web Studio v6.1\Redist\CeView\x86\BIN\CEServer.exe

For a device running Windows CE 5.0 on an ARM V4 processor:

\InduSoft Web Studio v6.1\Redist\Wince 4.0\Armv4\BIN\CEServer.exe

2) Copy this file to the device's persistent (non-volatile) file storage.

   The directory structures of different Windows CE-based devices can vary greatly, and the device manufacturer may require that applications be stored in a specific directory, so please consult the manufacturer's documentation.

3) You can now run Remote Agent in Windows CE by double-tapping the **CEServer.exe** icon. When you run it, the *Remote Agent* window is displayed:

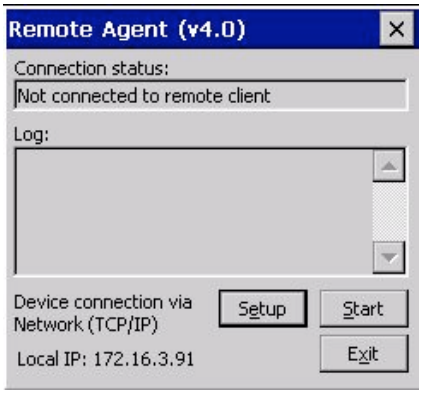


Figure 16. Remote Agent Running in Windows CE

4) Tap **Setup** to open the *Setup* dialog:

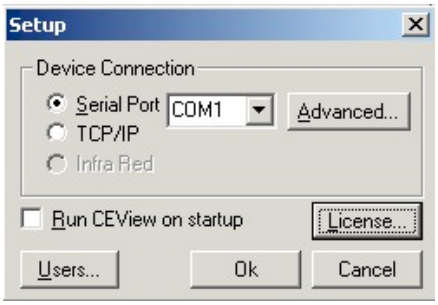


Figure 17. Setup Dialog in Remote Agent

Configure the *Device Connection* settings as needed, depending on how you've connected the device to your workstation. For complete instructions, please consult the *InduSoft Web Studio User Guide*. **You do not need to enter a license at this time.**

5) Tap **OK** to close the *Setup* dialog.

Remote Agent is now ready to receive communication from IWS running on your workstation.

Automatically Starting Remote Agent on Boot

Please keep in mind that it can be awkward to have to manually start Remote Agent on the device every time you want to establish communication between the device and IWS on your workstation. As such, you should configure the device to automatically start Remote Agent whenever the device is booted. Please consult the manufacturer's documentation for the preferred method to automatically start an application.

Installing the Remaining CEView Files

Now, with Remote Agent installed and running on the Windows CE-based device, IWS can connect to the device and install the remaining CEView files.

To install CEView on your device:

1) On your workstation, start Indusoft Web Studio.
2) From the main menu bar, select **Tools** ▸ **Execution Environment.** The *Execution Environment* dialog will be displayed:

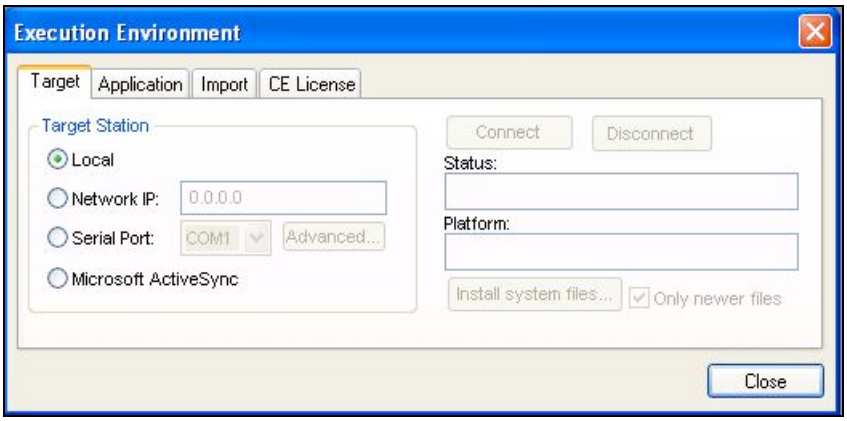


Figure 18. Execution Environment Dialog

3) Configure the *Target Station* settings as needed, depending on how you've connected the device to your workstation. For complete instructions, please consult the *InduSoft Web Studio User Guide*.
4) Click **Connect** to establish communication with the device.

   If communication is successfully established, then the *Status* and *Platform* fields will be updated to reflect the connected device. Also, the Remote Agent utility on the device will show that it has successfully connected back to IWS.
5) Click **Install system files**... to install the CEView files on the device.
6) When the installation is completed, click **Close** to close the *Execution Environment* dialog.
7) Reboot the device once more to save the updated files to the device's persistent (non-volatile) memory.

You should now have the ADS library, the Remote Agent utility, and the CEView files all installed on your Windows CE-based device.

Licensing CEView

You must have a valid license to run CEView beyond the free evaluation period. You can obtain this license by contacting your InduSoft sales representative and providing the device's "site code." The representative will use this site code to generate a corresponding license code, which you can then apply to the device.

The actual licensing can be done in either of two ways: via the Execution Environment tool in IWS, or directly at the device. If you've already used the Execution Environment tool to connect to the device and update the CEView software (see the previous page), then it's very easy to also license the software.

When you are ready, proceed with the following instructions:

1) In the *Execution Environment* dialog, select the *CE License* tab:

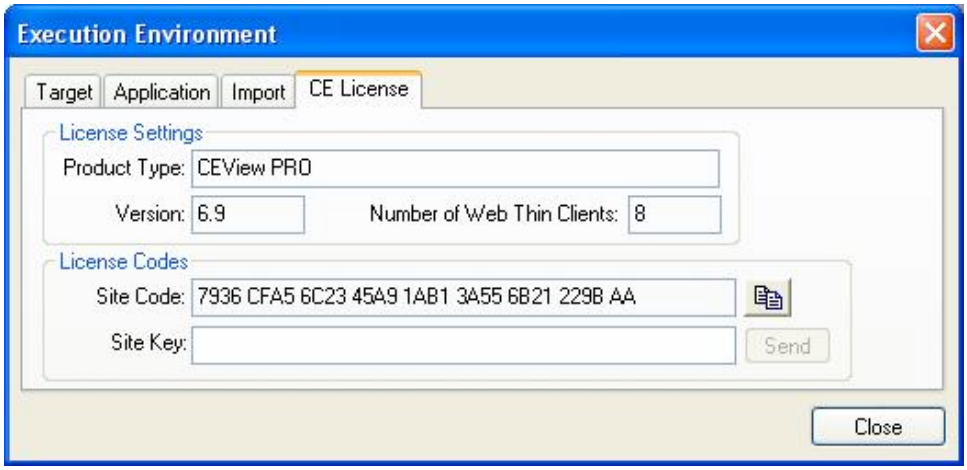


Figure 19: CE License Tab in the Execution Environment Dialog

2) Copy the code given in the *Site Code* field and send it to your InduSoft sales representative. Your representative will return a license key that corresponds to the site code.

> **Note**
>
> The site code shown above is given only as an example. Your device's actual site code is generated when CEView is installed, and it is unique to your device.

3) Enter the license key in the *Site Key* field and click **Send**.

   If the site key is accepted (validated), then a confirmation message will be displayed. If the site key is not accepted, verify that you have entered it correctly and try again. If it is still not accepted, then contact your InduSoft sales representative for assistance.

If for whatever reason you cannot connect to the device via the *Execution Environment* tool in IWS, you can still apply a license directly on the device itself:

1) On your Windows CE-based device, in the Remote Agent utility, tap **Setup** to open the *Setup* dialog:

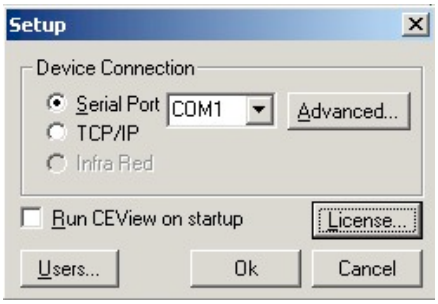


Figure 20. Setup Dialog in Remote Agent

2) Tap **License** to open the *License* dialog:

Figure 21: License Dialog in Remote Agent

3) Tap **Change License** to open the *Change License* dialog:

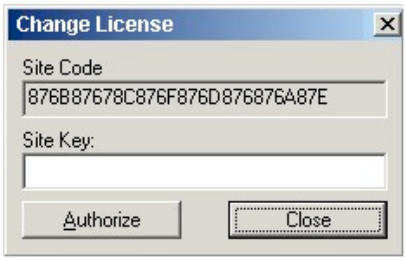


Figure 22: Change License Dialog in Remote Agent

4) Copy the code given in *Site Code* field and send it to your InduSoft sales representative. Your representative will return a license key that corresponds to the site code.

> **Note**
>
> The site code shown above is given only as an example. Your device's actual site code is generated when CEView is installed, and it is unique to your device.

5) Enter the license key in the *Site Key* field and click **Authorize**.

   If the site key is accepted (validated), then the following message is displayed:

Figure 23: Site Key Accepted

   If the site key is not accepted, verify that you have entered it correctly and try again. If it is still not accepted, then contact your InduSoft sales representative for assistance.

When CEView is properly installed, licensed, and ready for runtime, you can proceed to "Establishing Communication Between TwinCAT Stations" on page 25.

Establishing Communication Between TwinCAT Stations

To establish communication between TwinCAT stations, you must assign each station — that is, each workstation, industrial PC, embedded PC, Beckhoff PLC, or Windows CE-based device that is running either the TwinCAT software or the ADS library — a unique station ID.

Furthermore, you must give each station a list of the other TwinCAT stations with which it is allowed to communicate. Why is this necessary? Well, because TwinCAT messages are **not** broadcast over the network for all stations to hear. Instead, messages are routed directly to their intended station(s) according to the specified list.

Keep in mind that for two stations to communicate with each other, in both directions, you must make these changes on **both** stations.

What is an AMS Net ID?

Each TwinCAT station must be assigned a unique station ID, which is also called an **AMS Net ID**. AMS stands for "Anlagenmanagement-System," which is a German translation of "Plant Management System." It simply refers to the messaging protocol used by TwinCAT and the ADS library, and it works on top of the physical network.

By default, a station's AMS Net ID is automatically generated when the software is installed, by combining the station's existing IP address with a minimum ".1.1" suffix. For example, on a station with the IP address `10.168.23.163`, the default AMS Net ID would be `10.168.23.163.1.1`.

However, you can change the AMS Net ID to whatever you need it to be, according to your TwinCAT system layout. This is especially important in a mixed-network system (i.e., TCP/IP and Serial) where not all stations have IP addresses. The only requirements are that the ID must follow the six-byte, period delimited format and it must be unique to the station.

For more information about the AMS messaging protocol, please consult Beckhoff's documentation.

Editing Connection Settings in the Full TwinCAT Software

If you have the full TwinCAT development software installed on your workstation or industrial PC, then the connection settings are completed in two parts. First, you must use the *System Properties* dialog to assign an AMS Net ID to the station. Second, you must use the *System Manager* to search for other TwinCAT stations on the network and add them to your router list.

Assigning an AMS Net ID

To assign the AMS Net ID in the *TwinCAT System Properties* dialog:

1) If the TwinCAT software is not running already, then start it now.

> **Note**
>
> By default, the TwinCAT software is configured to start automatically on boot.

2) Find the TwinCAT icon in the Windows system tray:

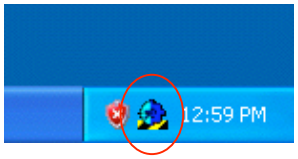


Figure 24. TwinCAT Icon in the System Tray

3) Right-click on the TwinCAT icon and select **Properties** from the pop-up menu:

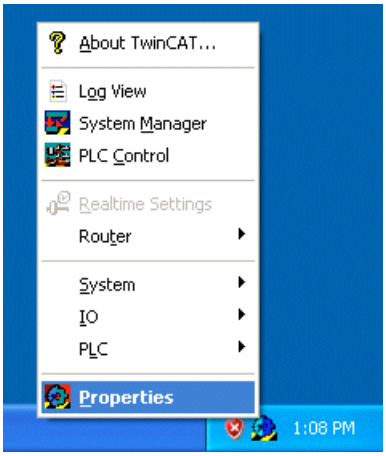


Figure 25. Opening the TwinCAT System Properties

The *TwinCAT System Properties* dialog is displayed:

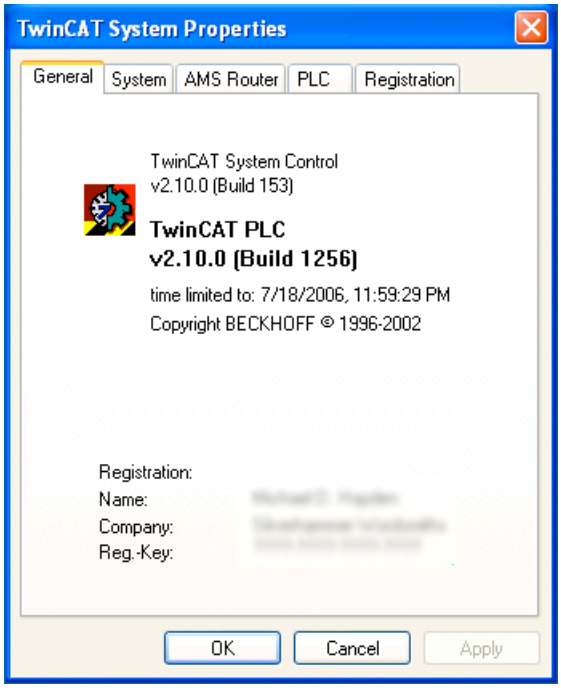


Figure 26. TwinCAT System Properties Dialog

4) Select the **AMS Router** tab:

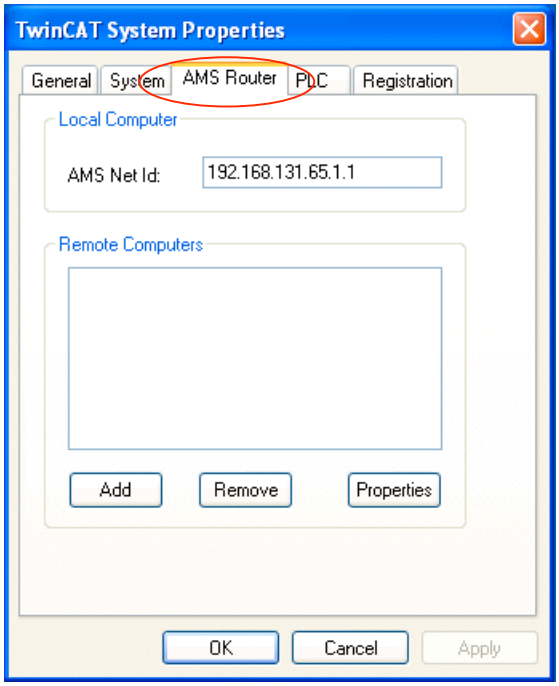


Figure 27. AMS Router Tab in the System Properties Dialog

5) Check the default AMS Net ID and change it if necessary:

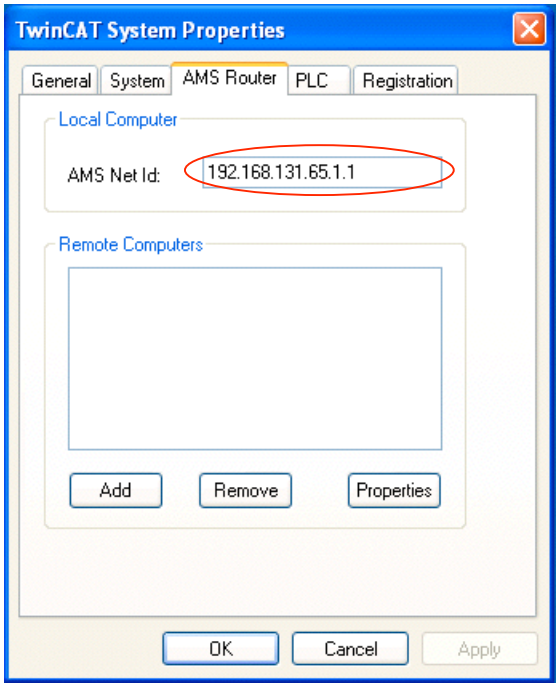


Figure 28. AMS Router Tab in the System Properties Dialog

6) Click **OK** to apply your changes and close the *TwinCAT System Properties* dialog.

Adding Stations to the Router List

To search for other TwinCAT stations and add them to your router list:

1) Right-click on the TwinCAT icon in the system tray, and then select **System Manager** from the pop-up menu:

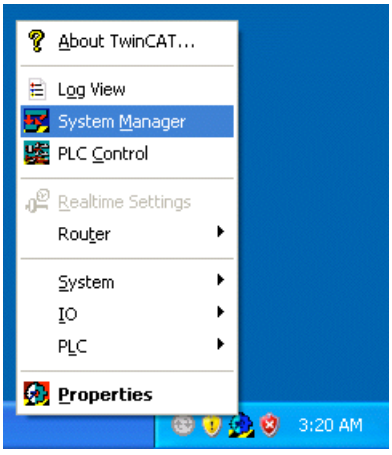


Figure 29. Opening the TwinCAT System Manager

The *TwinCAT System Manager* window is displayed:

Figure 30: TwinCAT System Manager

2) Click **Choose Target**. The *Choose Target System* dialog is displayed:

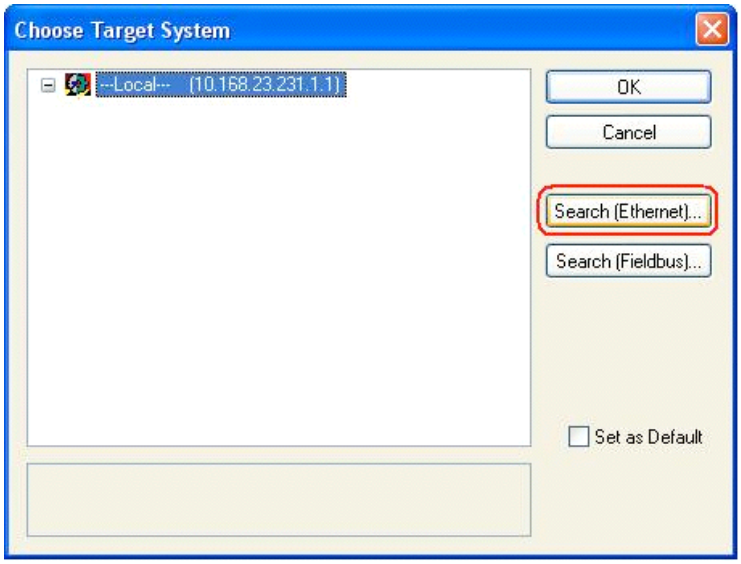


Figure 31: Choose Target System Dialog

3) Click **Search (Ethernet)**. The *Add Route* dialog is displayed:

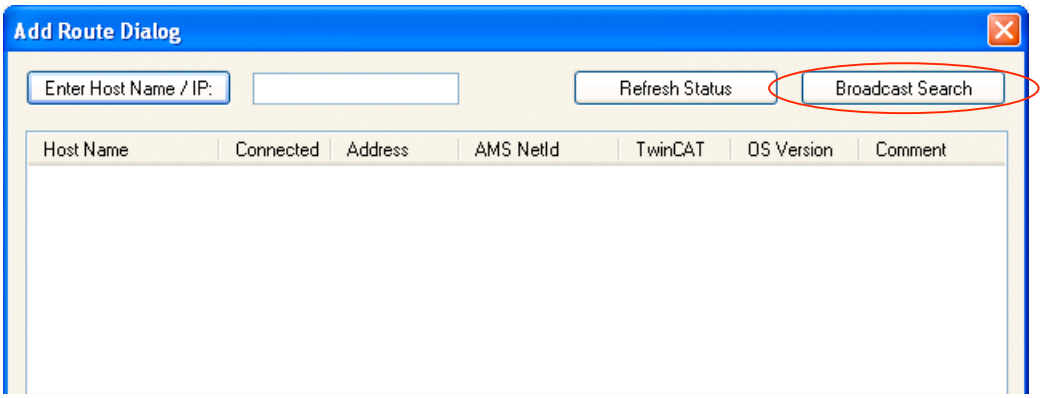


Figure 32: Add Route Dialog

4) Click **Broadcast Search**. The System Manager will search the network for other TwinCAT stations and display them. Stations to which routes have already been established will be marked:

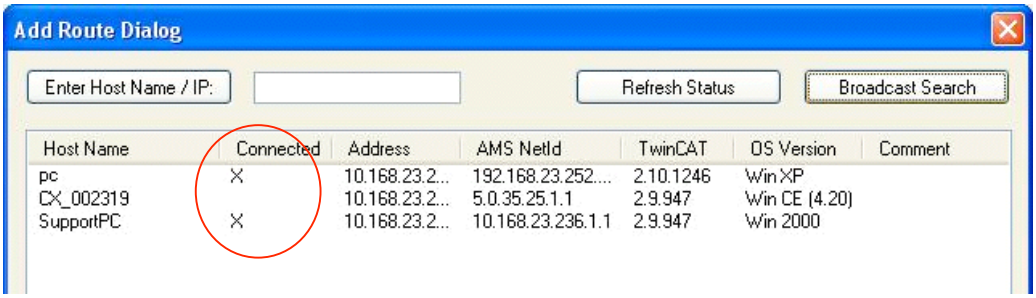


Figure 33: Results of Broadcast Search for Other TwinCAT Stations

5) Select a new station and click **Add Route**, or simply double-click on the station. You will be prompted for a *Username* and *Password* for the station:

Figure 34: Logon Information for the Target Station

6) Enter the Username and Password for the new station, and then click **OK**.

> **Note**
>
> If the target station is a Beckhoff CX Series device (CX1020 or CX1000) running Windows CE, then the default *Username* is **`administrator`** with no password.

If the logon is successful, then the station will be marked as connected in the route list:

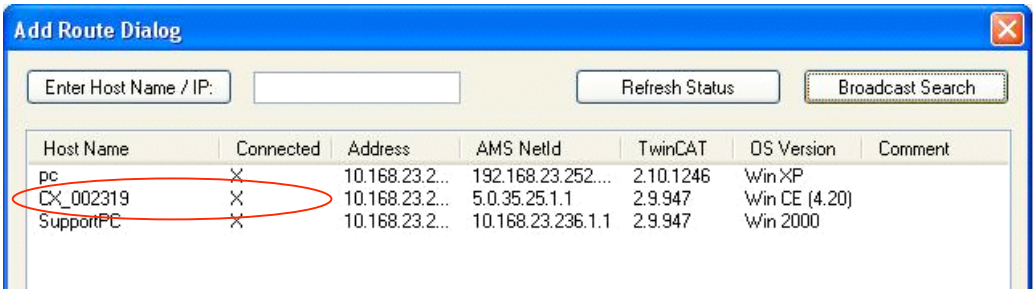


Figure 35: Target Station is Successfully Connected

7) Repeat steps 5 and 6 for each station to which you want to establish a route.

   Keep in mind that this list only shows the other TwinCAT stations to which routes have been established, allowing communications and making those stations *available* to be targeted by the TwinCAT development software. Actually targeting a station for your control program is a separate procedure; please consult Beckhoff's documentation for more information.

8) Click **Close** to close the *Add Route* dialog and return to the *Choose Target System* dialog. Stations that can be targeted for your control program are now listed here.

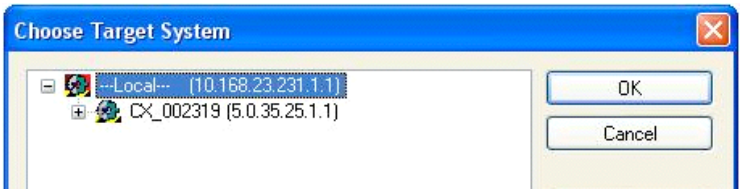


Figure 36: Choose Target System Dialog Showing Available Stations

9) Click **OK** to close the *Choose Target System* dialog.

10) From the main menu bar in the *TwinCAT System Manager* window, select **File** ▸ **Exit** to exit the System Manager.

Your connections are now set and ready for communications. Furthermore, because you used this method to establish your connections — that is, you searched the network and actually logged onto the stations — there is no need to manually test them. You can proceed to "Building a Sample IWS Application" on page 36.

Editing Connection Settings in the TwinCAT Runtime or the ADS Library

If you have the TwinCAT runtime engine on a Beckhoff PLC, or the ADS library on any other type of station, then you can use the AMS Remote Connections Manager utility to assign the AMS Net ID and establish routes to other TwinCAT stations…

1) On your station, find the AMS Remote Connections Manager utility (**`TcAmsRemoteMgr.exe`**).

> **Note**
>
> Even though this file is installed as part of the TwinCAT runtime engine or ADS library, it can be difficult to find since the installation of the library varies by platform. For more information, please see pages 7 and 19.
>
> You can also use the Windows Search function to find the file more quickly, but remember to search for the actual filename (**`TcAmsRemoteMgr.exe`**).

2) Double-click (or double-tap) on the utility to run it. The *AMS Remote Connections* dialog is displayed:

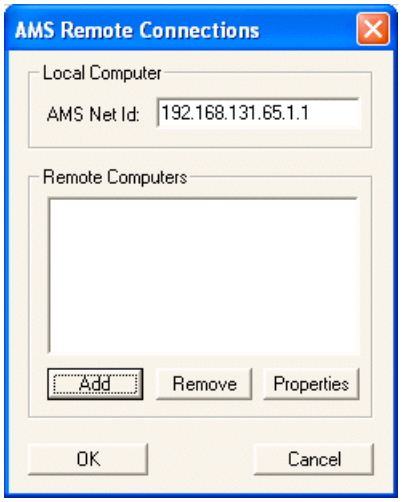


Figure 37. AMS Remote Connections Manager

3) Check the default AMS Net ID for the local station and change it if necessary.

4) Click **Add** to add a new connection (route) to another TwinCAT station:

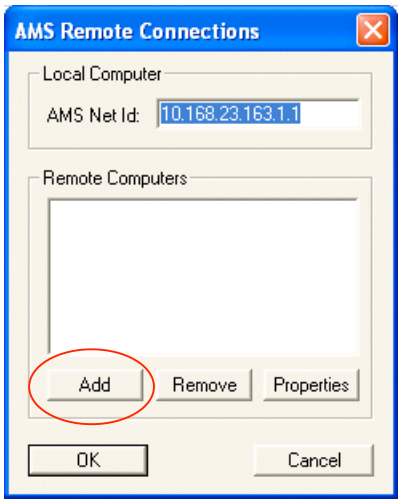


Figure 38. Adding a New Route in AMS Remote Connections

The *Add Remote Connection* dialog is displayed:

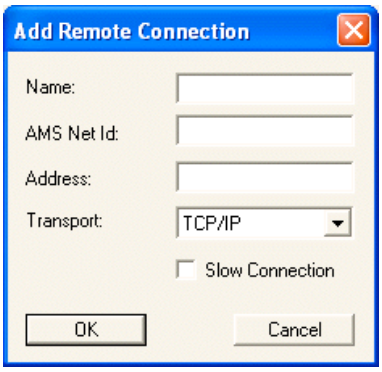


Figure 39. Add Remote Connection Dialog

Before you proceed, make sure that you have the required information for the other station.

5) In the **Name** field, enter a descriptive name for the remote computer. For example, "SupportPC" or "CX1020 #3."

6) In the **AMS Net ID** field, enter the unique station ID of the remote computer.

7) In the **Address** field, enter the address of the remote computer on the physical network.

   The format of this address depends on the type of network. For example, if the type of network is Ethernet TCP/IP, then the address will be in standard four-byte, period delimited format (ex. `10.168.23.163`).

8) Click on the **Transport** pull-down menu and select the type of physical network.

> **Note**
>
> There are many different types of physical network to choose from, and the address format can vary greatly from type to type. If you are using a network other than Ethernet TCP/IP, then please consult Beckhoff's documentation and/or the hardware manufacturer's documentation for more information.

9) Click **OK** to accept the properties and add the connection to the *Remote Computers* list.
10) Repeat steps 4 through 9 for each connection (route) you want to add.

    New connections are **not** tested as they are added. You will be able to test these connections in the next section below.
11) Click **OK** to close the *AMS Remote Connections* dialog.
12) To apply these new settings, you must restart the TwinCAT runtime engine or ADS library.

    If you are working on a workstation or industrial PC running Windows NT/2000/XP, or an embedded PC running Windows XPe, then you must completely reboot the PC.

    If you are working on a Beckhoff CX1020 or CX1000, or any other Windows CE-based device, then you must save the registry and restart the device. On a Beckhoff device, simply tap the **Start** button to open the Start menu and then select **Suspend**. On any other device, please consult the manufacturer's documentation.

Testing the Connections

Since you *manually* entered the information for your connections, you must now test those connections to make sure they are valid and able to handle communications. To test a connection:

1) On your station, find the ADS Test utility (**`TcAdsTest.exe`**).

   The location of this utility can vary, depending on how the TwinCAT runtime engine or ADS library was installed on the station. In most cases, it should be in the same directory as the AMS Remote Connections Manager utility (**`TcAmsRemoteMgr.exe`**) described previously.
2) Double-click (or double-tap) on the utility to run it. The *TcAdsTest* panel is displayed.
3) Click **AdsPortOpen** to open the port for communication:

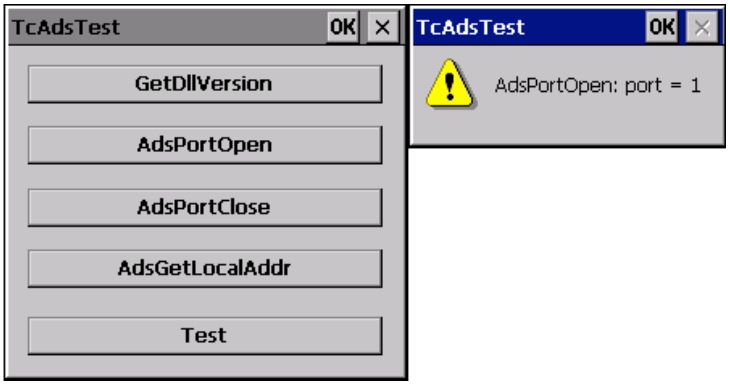


Figure 40: Opening the ADS Port for Communication

4) Click **Test** to open the *Test* dialog:

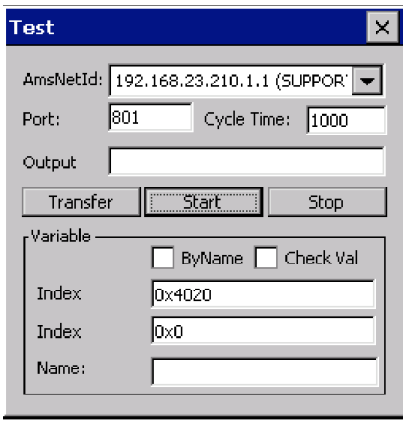


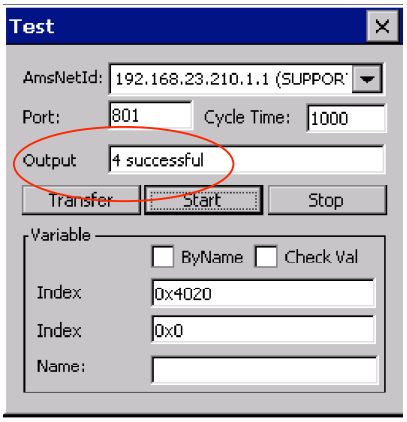
Figure 41: Setting Up the Test

5) In the *AmsNetId* field, select the connection to be tested from the pull-down menu.

> **Note**
>
> This menu should list the same stations/connections that you specified earlier using the AMS Remote Connections Manager utility.

Also, if you want to test a specific TwinCAT port on the other station, then enter it in the *Port* field. (Ports are used by various subroutines in a TwinCAT control program.)

6) Click **Start** to start the test. The results, including errors, are displayed in the *Output* field:



If the results are successful, then your AMS routing information is correct and the connection is ready for use. If the results show any errors, then check your physical cabling and routing information and try again.

7) Click **Stop** to stop the current test.

8) Repeat steps 5 through 7 for each connection that you want to test.

9) Close the *Test* dialog and exit the ADS Test utility.

Your connections are now set and ready for communications. You can proceed to "Building a Sample IWS Application" on the next page.

Building a Sample IWS Application

After you have installed the software, configured the communication settings, and tested the connections, you are ready to build a sample IWS application that uses all of these components.

For the purposes of this section, you must have the following minimum network configuration:

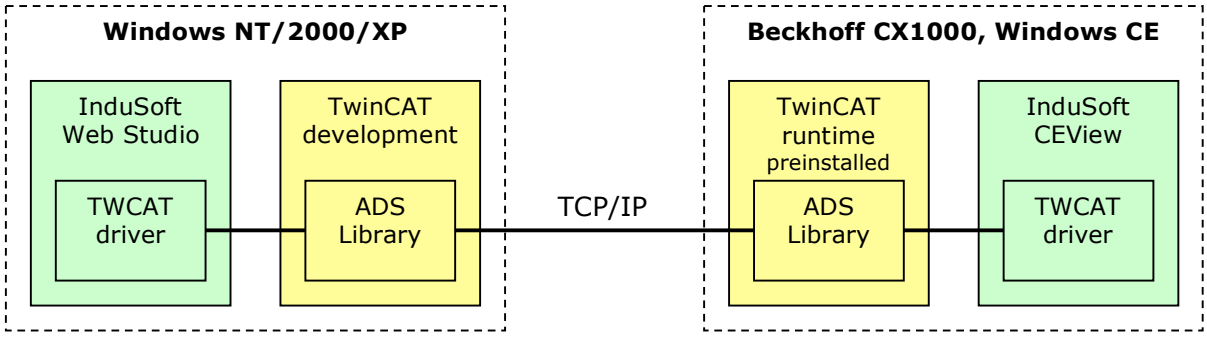


Figure 42: Network Configuration for Sample Application

Using the instructions below, you will create a IWS/CEView application screen that displays a TwinCAT program variable (a.k.a. PLC register) on the Beckhoff CX1000. Of course your network configuration may be different than the one shown above, but the same basic instructions apply to all possible configurations; only certain options would vary.

> **Note**
>
> These instructions do **not** cover how to initially configure the CX1000, nor how to use the TwinCAT development software to program the device. It is assumed that you have already created the TwinCAT program and downloaded it to the CX1000. For more information, please see Beckhoff's documentation for TwinCAT.
>
> Also, please keep in mind this is only a basic walkthrough for creating a sample IWS application. For complete instructions on using IWS, please see the *IWS User Guide*.

The rest of this section describes how to:

- Run InduSoft Web Studio and create a new IWS/CEView application project;
- Select the TWCAT communication driver;
- Build a driver worksheet that links an IWS database tag to the TwinCAT program variable;
- Lay out a simple IWS/CEView application screen that displays the variable;
- Compile the application and download it to the CX1000; and
- Start the CEView application.

Creating a New IWS Application

On the PC where InduSoft Web Studio is installed, create a new IWS/CEView application project:

1) Run IWS by selecting it from the **Start** menu or double-clicking on the desktop icon.

2) From the main menu bar, select **File** ▸ **New**. The New dialog is displayed:

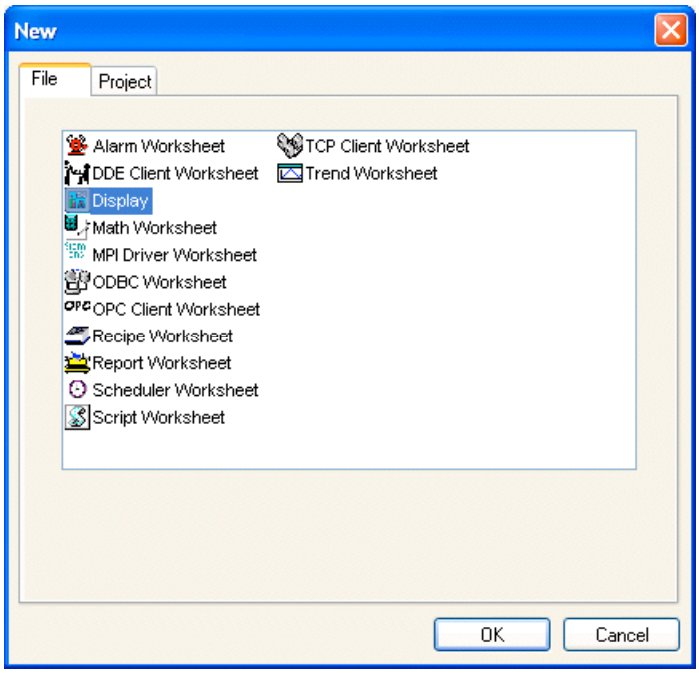


Figure 43: New Dialog

3) Click on the **Project** tab:

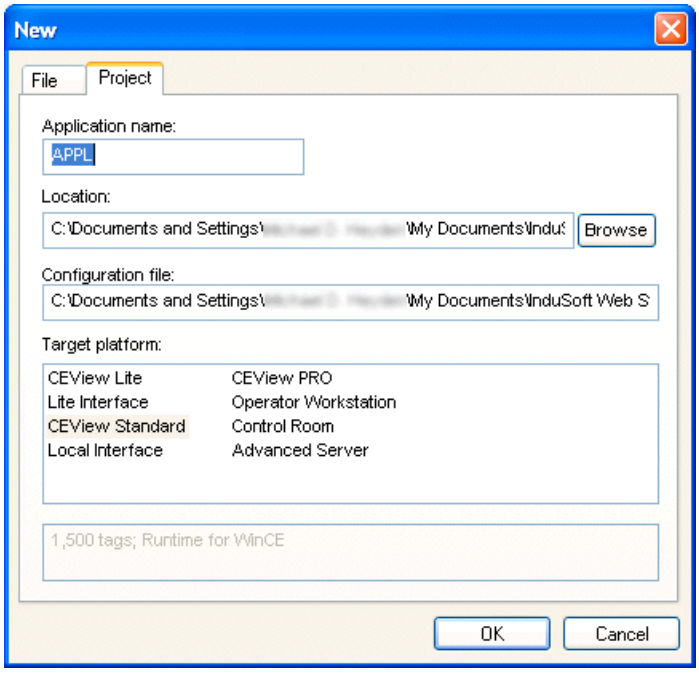


Figure 44: Project Tab of the New Dialog

4) In the *Application name* field, enter **`TWCATSample`**.

5) Under *Target platform*, select **CEView Standard**:

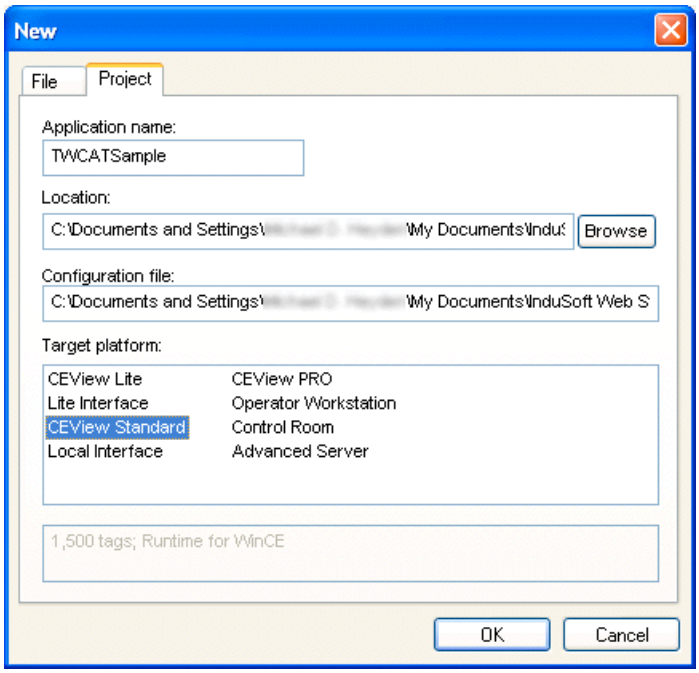
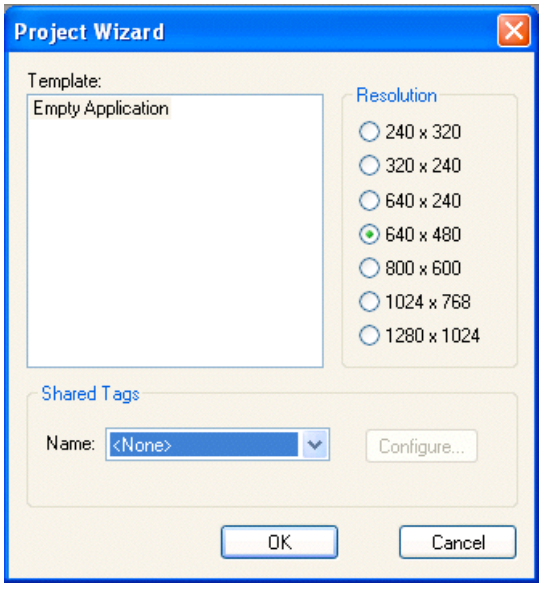


Figure 45: Selecting the Target Platform

6) Click **OK** to proceed to the *Project Wizard* dialog:



7) The default settings are fine for this sample application, so click **OK** to close the dialog.

The new application project is created in IWS and it is ready for configuration.

Selecting the TWCAT Communication Driver

By default, all available communication drivers are installed with the IWS development software, but they are not automatically enabled when you create a new IWS/CEView application project. You must manually select the specific driver(s) that you need for your application. In this case, you must select the TWCAT driver to enable communication between your IWS/CEView application and your TwinCAT control system.

To select the TWCAT communication driver:

1) In the IWS Workspace, select the *Comm* tab.
2) Right-click on the *Drivers* folder and select **Add/Remove drivers** from the pop-up menu:

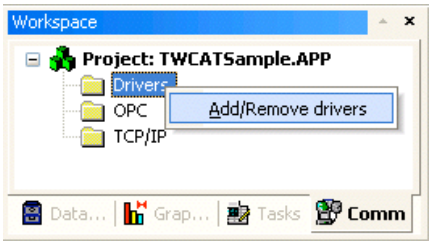


Figure 46: Right-clicking on the Drivers Folder

The *Communication Drivers* dialog is displayed.

3) In the *Communication Drivers* dialog, under *Available drivers*, select the TWCAT driver:

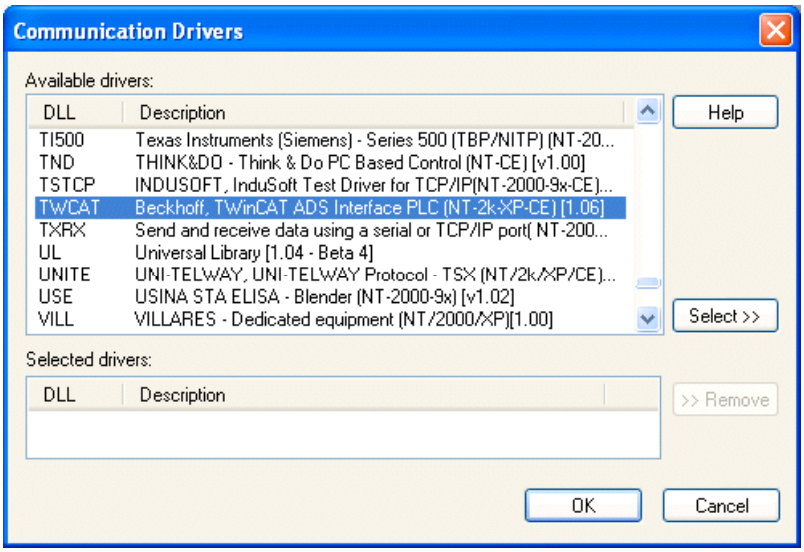


Figure 47: Selecting the TWCAT Driver

> **Note**
>
> If you have not already downloaded and installed the latest version of the TWCAT driver (see pages 4 and 7), then take a moment to note the driver version displayed in the description — in the figure above, the driver version is 1.06 — and then compare it to the latest version posted at www.indusoft.com.br/download/drivers/. If a newer version is available, then you should pause here to download and install it. (You must restart IWS to make the new driver available, so save your application project and exit IWS before you install the new driver.)

4) With the TWCAT driver selected, click **Select** to add it to the *Selected drivers* list for the application project:

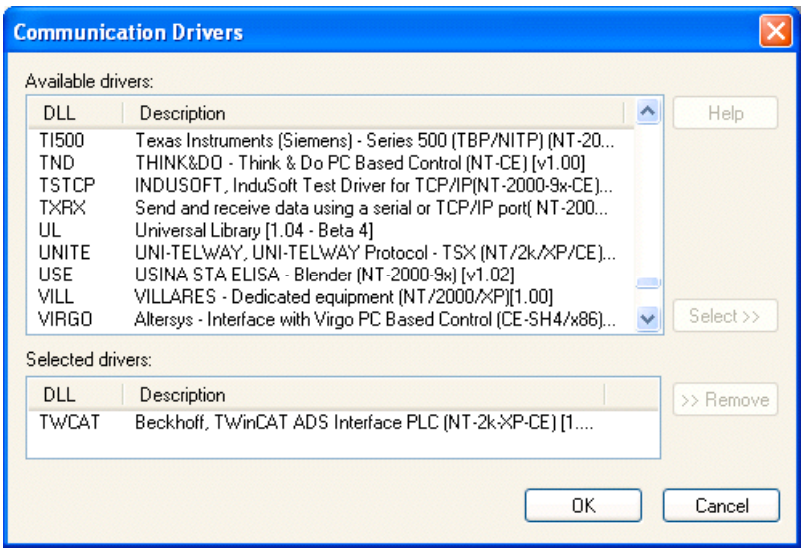


Figure 48: TWCAT Driver Added to Selected Drivers List

5) Click **OK** to close the dialog. The TWCAT driver is inserted into the *Drivers* folder:

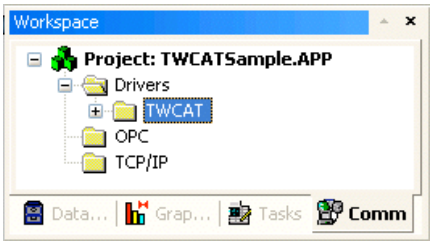


Figure 49: TWCAT Driver in the Drivers Folder

The TWCAT driver is now ready for configuration. In most cases, you should not need to change the driver's communication settings because TwinCAT communications are managed by the TwinCAT software (or ADS library), according to how you configured it earlier. For more information, see "Establishing Communication Between TwinCAT Stations" starting on page 25.

As such, you can proceed directly to building the driver worksheet.

Building the Driver Worksheet

Generally speaking, driver worksheets are used to associate database tags in IWS with device registers in your PLC or I/O. When the worksheets are processed during runtime, each tag/register association is scanned and the values are updated, as needed. You can build multiple worksheets in order to control which tag/register associations are scanned under what circumstances.

For a complete discussion about building driver worksheets, please consult the *IWS User Guide*. For driver-specific syntax and parameters, please consult the TWCAT driver document (**`TWCAT.pdf`**) that was installed with the driver files in the **`\DRV`** directory (see page 7).

To build a basic driver worksheet for the TWCAT driver:

1) In the *Workspace*, expand the *TWCAT* driver folder and select **MAIN DRIVER WORKSHEET**. Right-click on the worksheet and select **Open** from the pop-up menu.

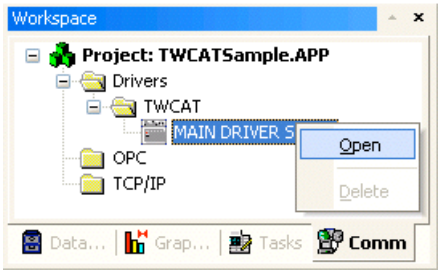


Figure 50: Opening the Main Driver Worksheet

The worksheet is opened for editing:

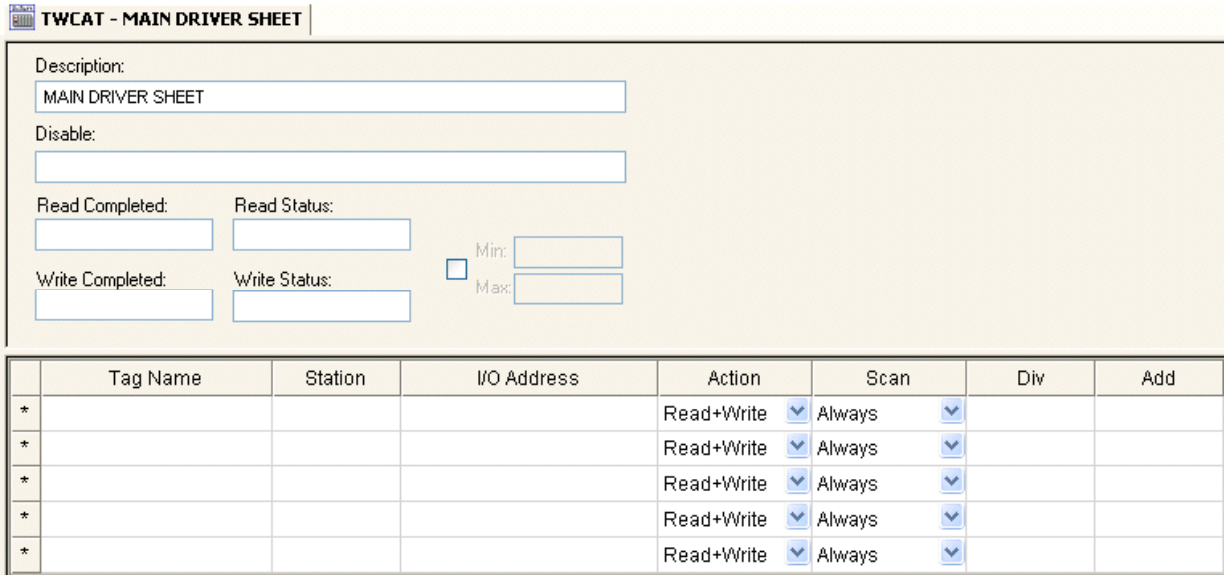


Figure 51: TWCAT Main Driver Worksheet

The **Disable**, **Read Completed**, **Read Status**, **Write Completed**, and **Write Status** fields are used for checking read/write status and logging runtime errors. They're not necessary for this sample application, so you can proceed directly to making your first tag/register association.

2) Tab down to the **Tag Name** field in the first row of the worksheet table, and then enter the name of your IWS database tag:

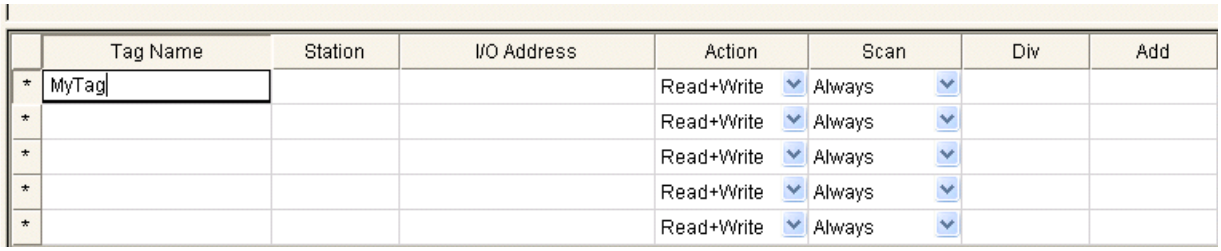


Figure 52: Entering the Tag Name

3) If the tag is not already defined in your IWS database, then you will be prompted to create the tag now:

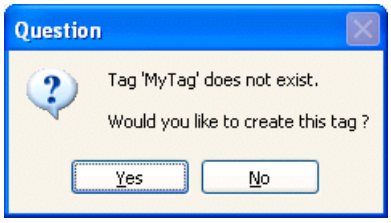


Figure 53: Creating a New Database Tag

Click **Yes**. A *New Tag* dialog is displayed:

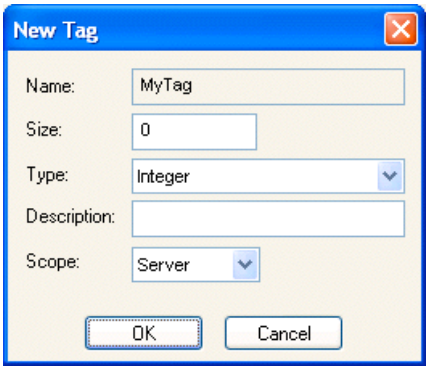


Figure 54: New Tag Dialog

Size is the number of elements, if the tag is an array (`0` is not an array); **Type** is the type of data (e.g., Integer, Boolean, Real, String); and **Description** is short description of the tag.

For this sample application, you can accept the default values for the tag, so click **OK**.

4) Tab into the **Station** field and enter the station ID for the target PLC, I/O or control program:

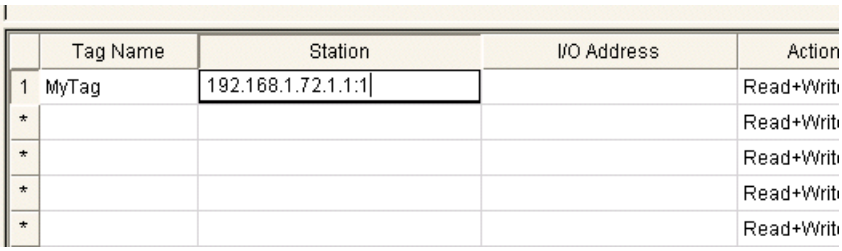


Figure 55: Entering the Station

For the TWCAT driver, the syntax of the **Station** field is:

<AmsNetID>:<Runtime or Port Number>

Where:

- ***<AmsNetID>*** is the AMS Net ID of the target station (see page 25);
- ***<Runtime>*** is the runtime number (**1**, **2**, **3** or **4**) of the TwinCAT control program; and
- ***<Port Number>*** is the ADS port used for the TwinCAT PLC, TwinCAT NC or TwinCAT I/O communications. The following ports are implemented and tested in the current version of the TWCAT driver:
  - **301** — TwinCAT I/O
  - **800** — BC9000
  - **801**, **811**, **821**, **831** — TwinCAT PLC on Windows NT/2000/XP or Windows CE

For more information about AMS Net IDs and TwinCAT port numbers, please consult Beckhoff's documentation.

> **Note**
>
> You can also leave the **Station** field blank. If you do, then the driver will automatically communicate with the first TwinCAT PLC runtime on the same workstation or device. This is equivalent to entering a value of **127.0.0.1.1.1:801**.
>
> This feature is typically used when the same IWS application will be deployed to multiple devices; you do not need to customize the addressing for each device. However, you **must** have both IWS (or CEView) and TwinCAT installed and running.

5) Tab into the **I/O Address** field and enter the program variable or register address on the target station:

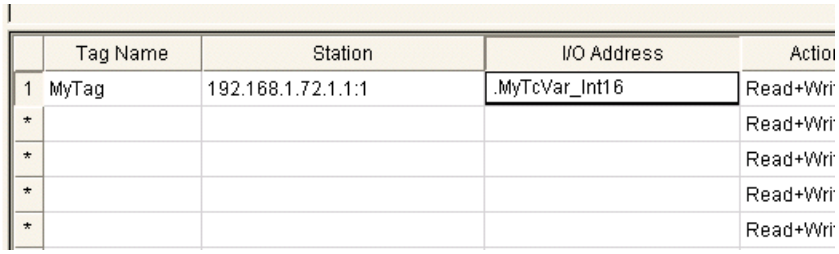


Figure 56: Entering the I/O Address

In this example, **`.MyTcVar_Int16`** is a Global Variable defined within a TwinCAT control program running on the target station. For more information about TwinCAT program variables and device registers, please consult Beckhoff's documentation.

> **Note**
>
> If you want to actually download and run your sample application (see page 50), then this must be a real program variable on a real TwinCAT station. Otherwise, you will receive communication errors during runtime.

With the **Tag Name**, **Station** and **I/O Address** fields completed, you've established an association between the tag in your IWS database and the variable in your TwinCAT control program. Now you must specify what action is taken and when.

6) In the **Action** field, click on the pull-down menu and select the type of action to be taken on this tag:

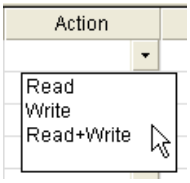


Figure 57: Selecting the Action

Where:

- **`Read`** is only read values from the target station into the IWS database;
- **`Write`** is only write values from the IWS database to the target station; and
- **`Read+Write`** is both read from and write to the target station.

7) In the **Scan** field, click on the pull-down menu and select when the values are scanned:

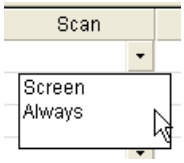


Figure 58: Selecting the Action

Where:

- **`Screen`** is only when the value of the tag is changed by user input (e.g., a button press or text entry) from your HMI screen; and
- **`Always`** is on every execution cycle.

8) From the main menu bar, select **File** ▸ **Close**. You will be prompted to save the driver worksheet:

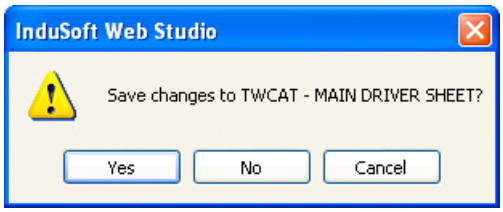


Figure 59: Saving the Driver Worksheet

9) Click **Yes** to save and close the driver worksheet.

`MyTag` is now ready to be used in an HMI screen.

> **Note**
>
> Although it is good to know how to manually build a driver worksheet, you can also use the *Import Wizard* to automatically build a driver worksheet from your existing TwinCAT program variables and communication settings. For more information, see "Advanced: Importing Your TwinCAT Variables into IWS" on page 54.

Designing the HMI Screen

You can now design an HMI screen that uses **`MyTag`**, as you defined it in the driver worksheet. For this sample application, you'll only add a simple text I/O field to the screen, but the basic procedure is the same for any screen layout.

1) In the *Workspace*, select the *Graphics* tab. Right-click on the *Screens* folder and select **Insert** from the pop-up menu:

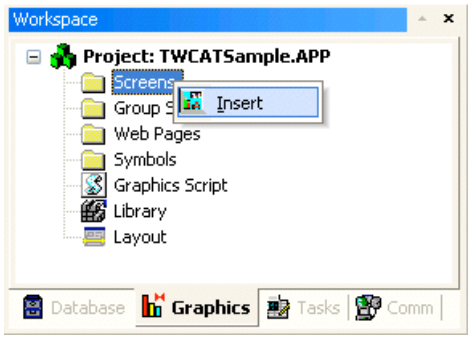


Figure 60: Inserting a New Screen

The *Screen Attributes* dialog is displayed:

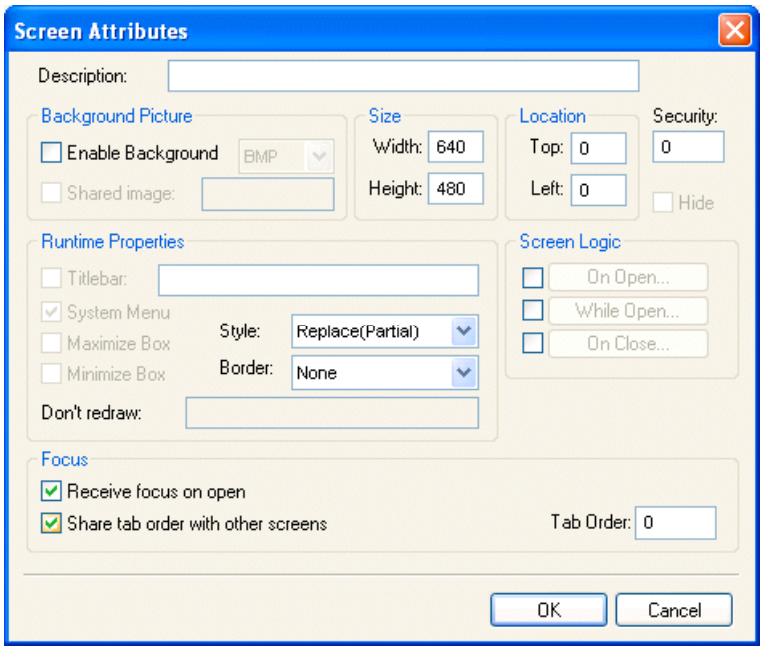


Figure 61: Screen Attributes Dialog for New Screen

2) Enter a description for the screen, such as **`TWCAT Driver Test Screen`**. Leave the screen *Size* and *Location* settings at their default values, and then click **OK**.

The new screen (display) is opened for editing:

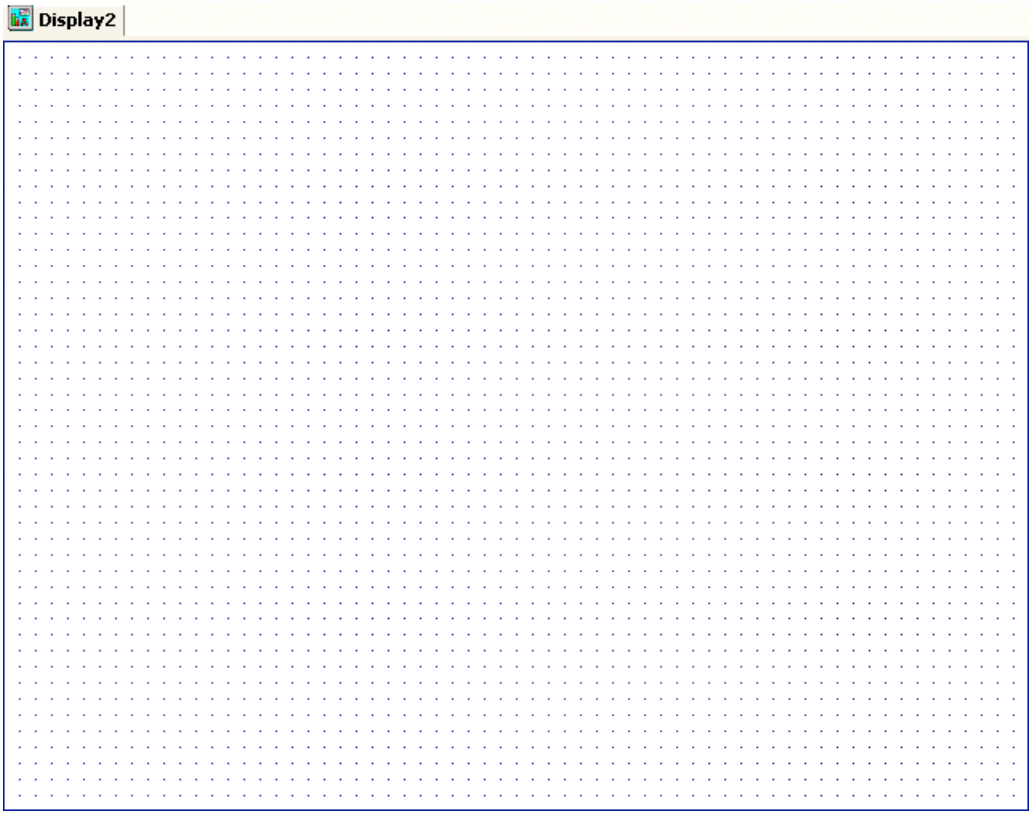
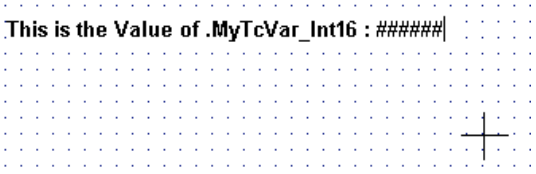


Figure 62: Editing a New Screen

3) From the *Static Objects* toolbar, select the *Text* tool:

Figure 63: Selecting the Text Tool

4) Using the *Text* tool, click in the screen and type "This is the Value of .MyTcVar_Int16: " followed by six hash marks (**#**).



The hash marks will be used to define a dynamic text I/O field. Six hash marks means that the field will be six characters long.

5) Click again on the text to highlight it.

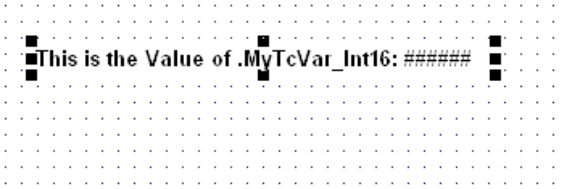


Figure 64: Highlighting the Text Object

6) From the *Dynamic Properties* toolbar, select the *Text I/O* tool:

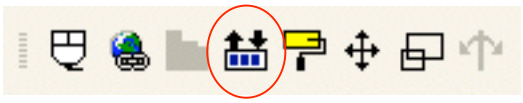


Figure 65: Selecting the Text I/O Tool

By selecting the *Text I/O* tool while the text object is highlighted, you are adding the *Text I/O* dynamic property to the object.

7) Right-click the text object and then choose *Properties* from the pop-up menu.

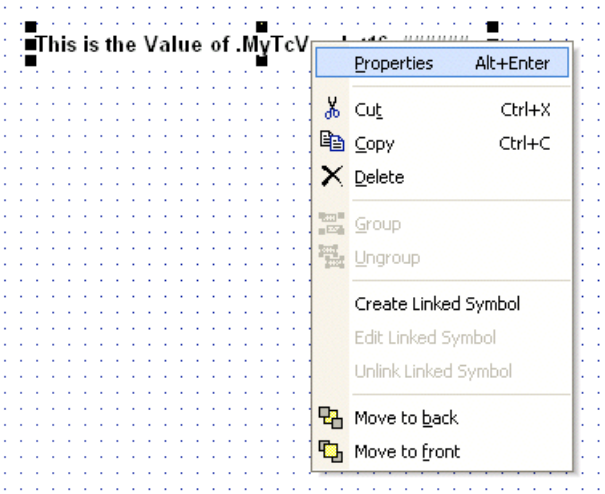


Figure 66: Opening the Object Properties

The Object Properties dialog is displayed.

8) Click the (…) button to the right of the **Tag/Expression** field.

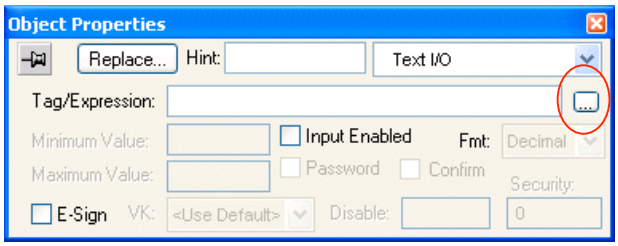


Figure 67: Object Properties for Text Object with Text I/O

The *Object Finder* dialog (a.k.a. the tag browser) is displayed:

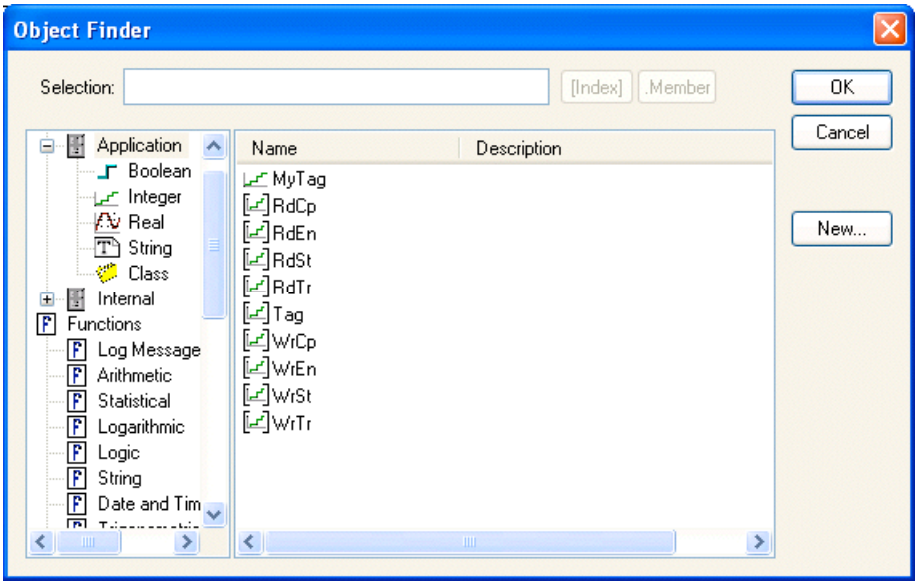


Figure 68: Opening a Tag Browser

9) Select **MyTag** from the tag list and then click **OK**. The tag is added to the *Object Properties* dialog:

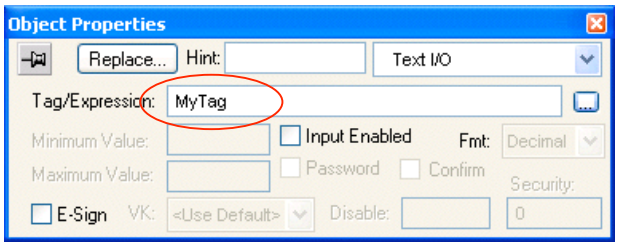


Figure 69: MyTag Added to Text I/O

10) Click (enable) the **Input Enabled** checkbox to allow the user to input a value during runtime.

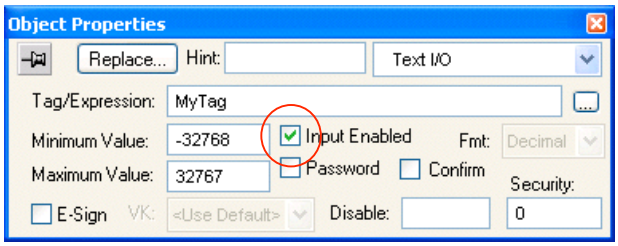


Figure 70: Enabling Input for Text I/O

The value is applied to MyTag in the IWS database, and from there it is written to the Twin-CAT program variable on the target station. Also, make sure the **Minimum** and **Maximum Values** are valid for the selected tag; e.g. a signed integer, in this instance, dictates a range of **-32768** to **32767**.

10) From the main menu bar, select **File** ▸ **Save**. You will be prompted to give the screen a filename; you can change the name or accept the default (e.g., **`Display1.scr`**). Either way, click **OK** to save the screen in your project directory.

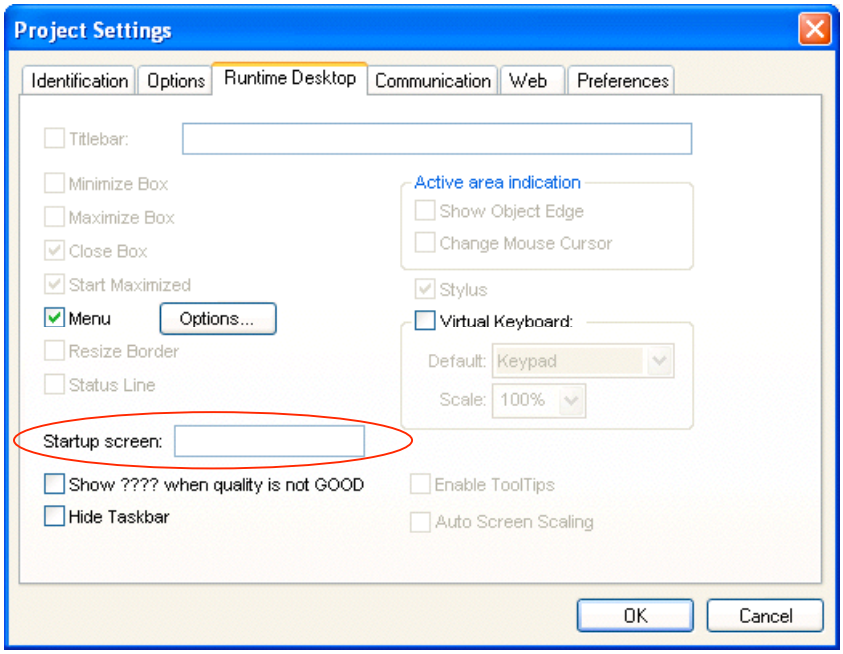
With your tag defined and your screen laid out, you can specify the screen for startup.

Specifying the Startup Screen

A single IWS application can have many different screens, so it is important to specify which screen should be displayed upon startup. We have only one screen in this sample application, but the procedure is the same.

To specify a startup screen:

1) From the main menu bar, select **Project** ▸ **Settings**. The *Project Settings* dialog is displayed.
2) Select the *Runtime Desktop* tab:



3) In the *Startup screen* field, enter the filename of your application screen.

> **Note**
>
> If you saved the screen with the default fiilename, then it should be something like **`Display1.scr`**. You can also check the list of screens in the *Graphics* tab of the *Workspace*.

4) Click **OK** to close the *Project Settings* dialog.

You can now compile and test your application.

Testing the Application Locally

> **Note**
>
> This sample application is for education and demonstration ONLY. Do not deploy any IWS application in a live production environment without thoroughly testing it first.

It is easy to test a sample application locally: IWS has a built-in CEView emulator that executes the HMI screen as if it was downloaded to an actual Windows CE-based device, and the Database Spy can show how the tag values change as the screen is used.

To test your application locally:

1) In the *Database Spy*, select **`MyTag`** for watching.

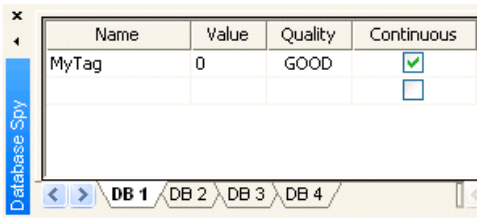


Figure 71: Watching MyTag in the Database Spy

2) From the main menu bar, select **Project** ▸ **Run Application**. The application will run locally in the CEView emulator.

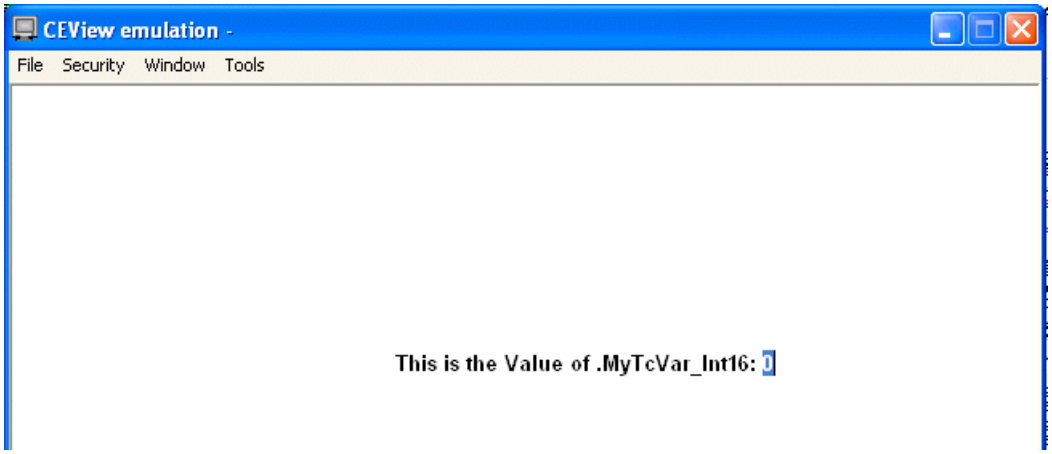


Figure 72: Sample Application Running in CEView Emulator

3) Enter a new value into the text I/O field and watch the tag change in the *Database Spy*.

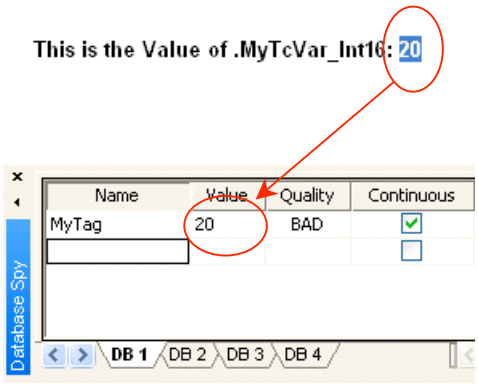


Figure 73: Entering a New Value for MyTag

4) When you are done, select **Project** ▸ **Stop Application** from the main menu bar.

> **Note**
>
> If the Quality of the tag is GOOD, then the new value is successfully being written to the TwinCAT program variable on the target station. If the Quality of the tag is BAD, then IWS is receiving a communication error from the TWCAT driver. Check your TwinCAT communication settings and your TWCAT driver worksheet.

Downloading the Application to a Windows CE-based Device

> **Note**
>
> This sample application is for education and demonstration ONLY. Do not deploy any IWS application in a live production environment without thoroughly testing it first.

If you've already established a connection with a Beckhoff PLC or other Windows CE-based device, using the *Execution Environment* tool in IWS (see pages 14 and 21), then you can also download your sample application to that device and run it.

1) Make sure that the *Remote Agent* utility (`CEServer.exe`) is running on the target device.
2) From the main menu bar, select **Project** ▸ **Execution Environment**. The *Execution Environment* dialog will appear. Check your *Target Station* settings and then click **Connect**.

   If you cannot establish a connection with the target device, then check your physical cabling and TwinCAT communication settings.
3) Once a connection is made, select the *Application* tab of the *Execution Environment* dialog:

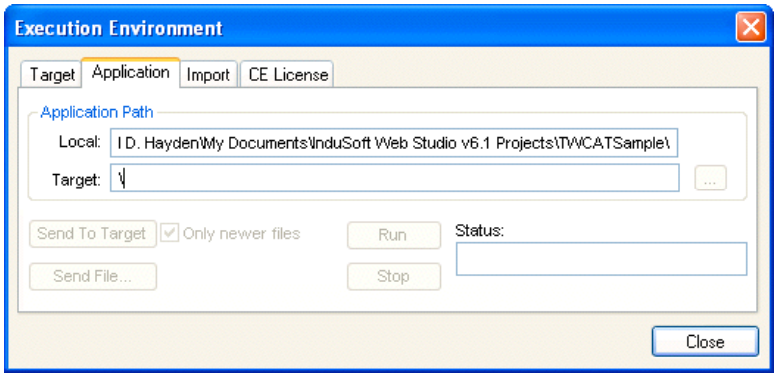


Figure 74: Application Tab of Execution Environment Dialog

4) Click **Send To Target** to download your application to the target device.
5) When the download is complete, click **Run** to run the application on the target device. The *Status* field will display the status of your application on the device.

You can also start and stop the application by using the *Remote Agent* control panel on the device:

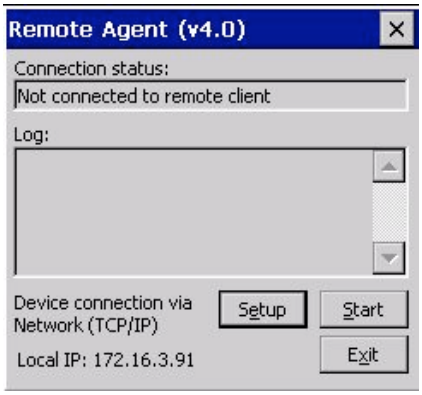


Figure 75. Remote Agent Running in Windows CE

Advanced: Importing Your TwinCAT Variables into IWS

Although it is good to know how to manually build a driver worksheet (see page 41), you can also use the database import wizard in IWS to automatically build a driver worksheet from your existing TwinCAT program variables and communication settings.

This is considered an advanced technique for a couple reasons. First, you must configure TwinCAT to export a file that defines all of the variables and settings that you want to import into IWS. Configuring this export can be tricky, as will be described below. Second, you must carefully review the variables after you've imported them into IWS, to make sure they are correct. You are more prone to overlook errors in a worksheet built automatically from an import than a worksheet you've built by hand.

Nevertheless, importing your TwinCAT variables into IWS can save a great deal of time.

> **Note**
>
> This section assumes that you are already familiar with using TwinCAT to develop and deploy control programs, and that you have a program ready to import into IWS. For complete instructions on using TwinCAT, please consult Beckhoff's documentation.

Exporting a Symbol File from TwinCAT

Before you can import program variables into IWS, you must export them from TwinCAT — or more specifically, you must export a symbol file (`*.sym`) that defines those variables.

To export a symbol file from TwinCAT:

1) Start the TwinCAT PLC Control programming software and open your project.
2) From the main menu bar, select **Project** ▸ **Options**. The *Options* control panel is displayed.
3) From the *Category* menu, select **Symbol configuration**:

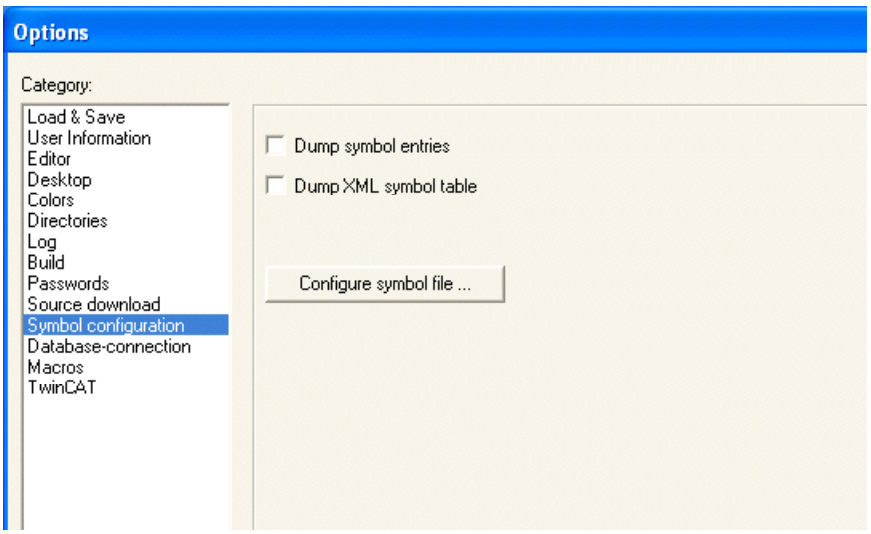


Figure 76: Symbol Configuration Control Panel

4) Enable (check) the **Dump symbol entries** option.
5) Click the **Configure symbol file** button. The *Set object attributes* dialog is displayed.

IWS can only import program objects (POUs) and global variables. It **cannot** import libraries or other system settings, so you must make sure those items are not included in the exported file.

6) In the program directory tree, select only the POUs and Global Variables that you want to export to IWS. (Ctrl-click to select/deselect individual items.)

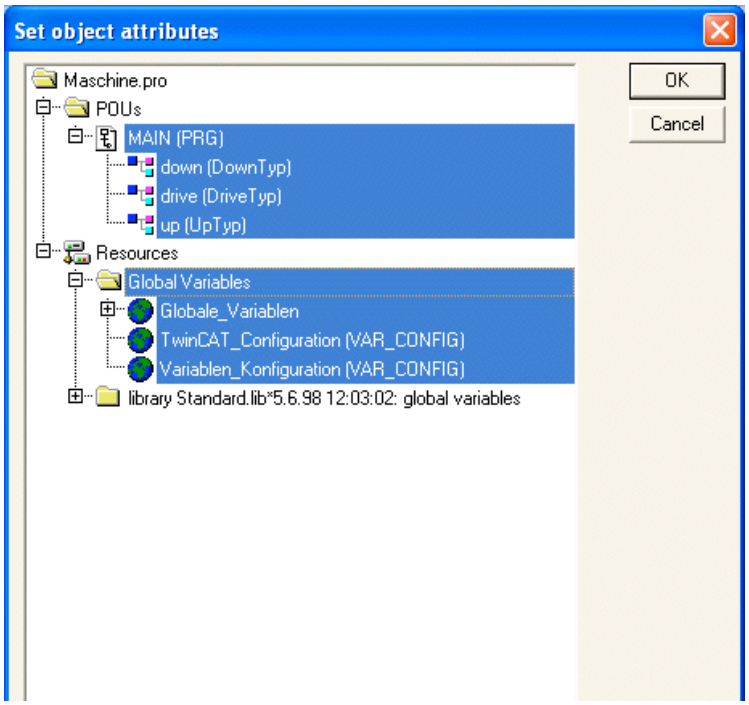


Figure 77: Selecting Program Objects and Global Variables for Export

7) Disable (uncheck) all export options other than **Export variables of object**. This will ensure that only basic variable definitions are exported, rather than any metadata or other structures.

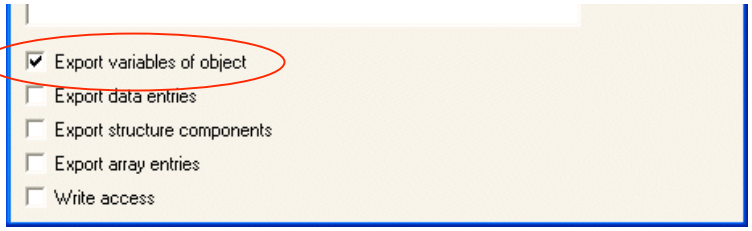


Figure 78: Disabling All Export Options

8) Click **OK** to accept the configuration and return to the *Options* control panel.

9) Click **OK** to close the *Options* control panel.

10) From the main menu bar, select **Project** ▸ **Rebuild All**. As TwinCAT rebuilds the project, it generates the symbol file and saves it in the project directory.

The symbol file is now ready for import into IWS. It will have the same name as the project file from which it was generated, so for a TwinCAT project named **`Maschine.pro`**, the symbol file is named **`Maschine.sym`**.

Keep in mind that the symbol file will be regenerated every time you rebuild your TwinCAT project, so if in the future you make changes to your project, you must consider whether you also need to reimport the symbol file into IWS.

Importing the Symbol File into IWS

Once you have exported your symbol file from the TwinCAT programming software, you can use the database import wizard to import it into IWS:

1) Start the InduSoft Web Studio development software and open your application project.
2) From the main menu bar, select **File** ▸ **Import Wizard**. The *Import Wizard* dialog is displayed.
3) From the *Source Type* menu, select **TwinCAT PLC Database**:

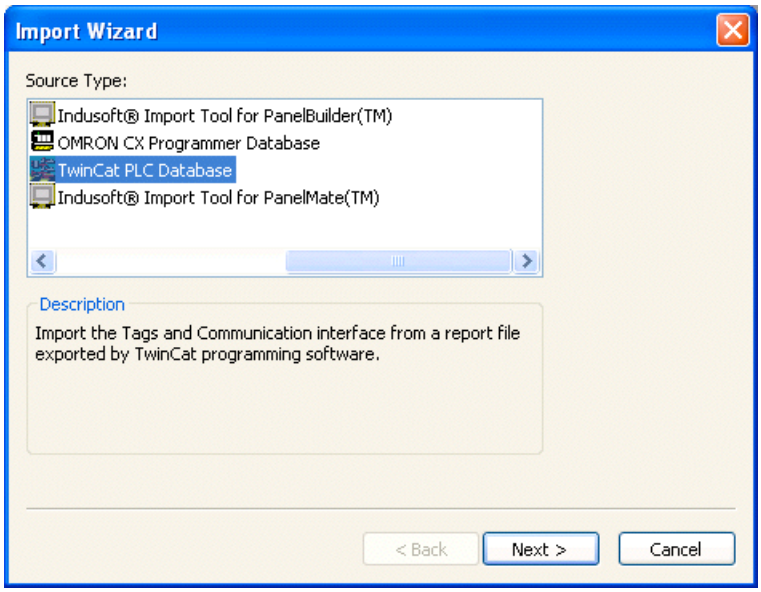


Figure 79: Selecting TwinCAT PLC Database

4) Click **Next** to proceed to the next step of the wizard.

5) Enter the AMS Net ID and port number of the TwinCAT runtime, station or device with which your IWS application will communicate. (For more information, see "Establishing Communication Between TwinCAT Stations" on page 25.)

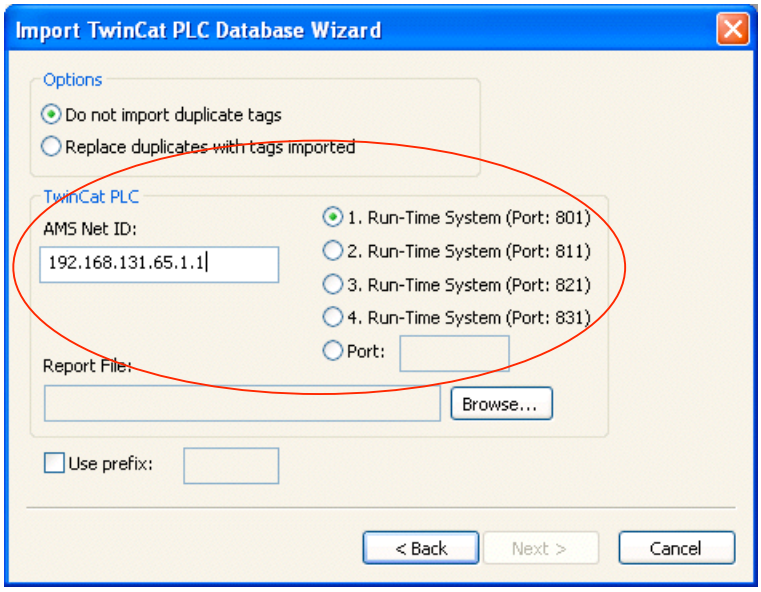


Figure 80: Specifying the AMS Net ID and Port Number

The import wizard will use this information to build the driver worksheet.

> **Note**
>
> If you plan to have IWS and TwinCAT running together on the same workstation or device, then you can specify an AMS Net ID of `127.0.0.1.1.1` and a port number of `801`. This will instruct IWS to communicate with the first TwinCAT runtime that is running locally.
>
> This feature is typically used when the same IWS application will be deployed to multiple devices; you do not need to customize the addressing for each device. However, you **must** have both IWS (or CEView) and TwinCAT installed and running on every device.

6) Click the **Browse** button to open a standard Windows file browser, and then find the TwinCAT symbol file that you want to import into IWS. The file should be saved in your TwinCAT project directory.

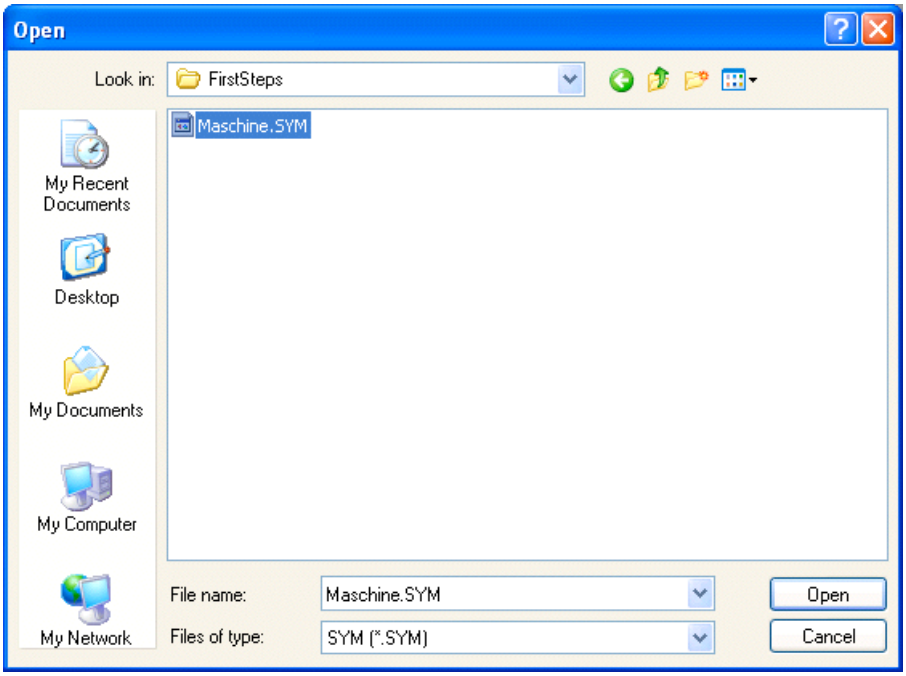


Figure 81: Browsing for the Symbol File

7) Click **Open** to select the file and return to the import wizard.

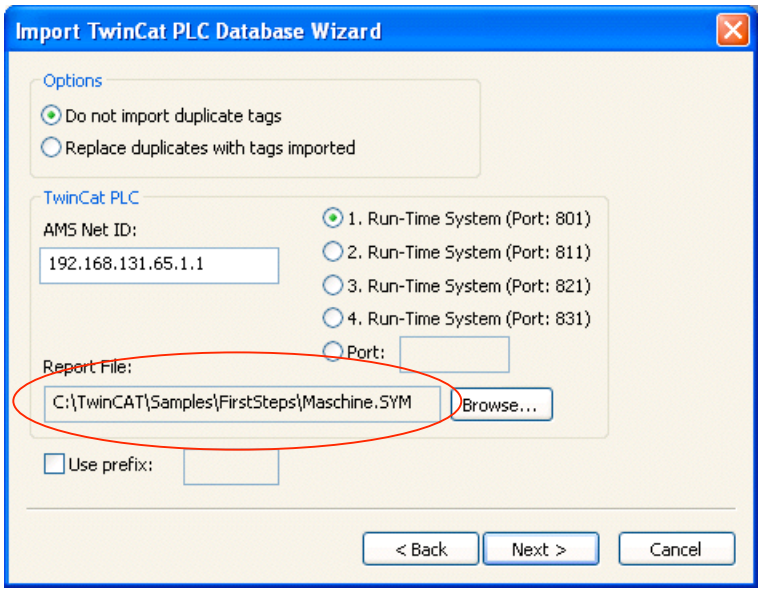


Figure 82: Symbol File Selected

8) Click **Next** to proceed to the next step of the wizard.

9) Review the variables (i.e., tags) exported from TwinCAT, and deselect (uncheck) any variables that you do not want to import into IWS.

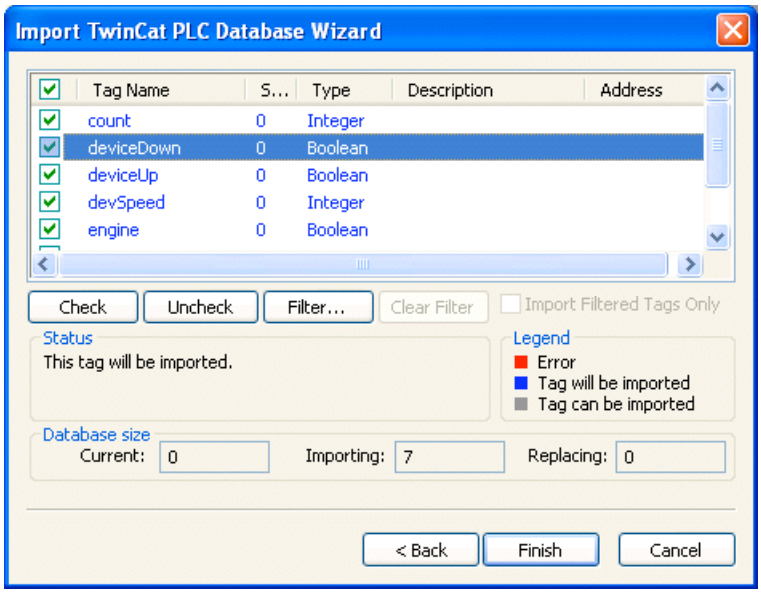


Figure 83: Reviewing the Variables To Be Imported

10) Click **Finish** to proceed with the import.

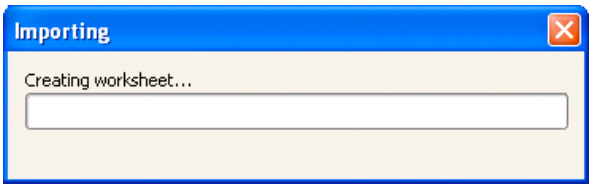
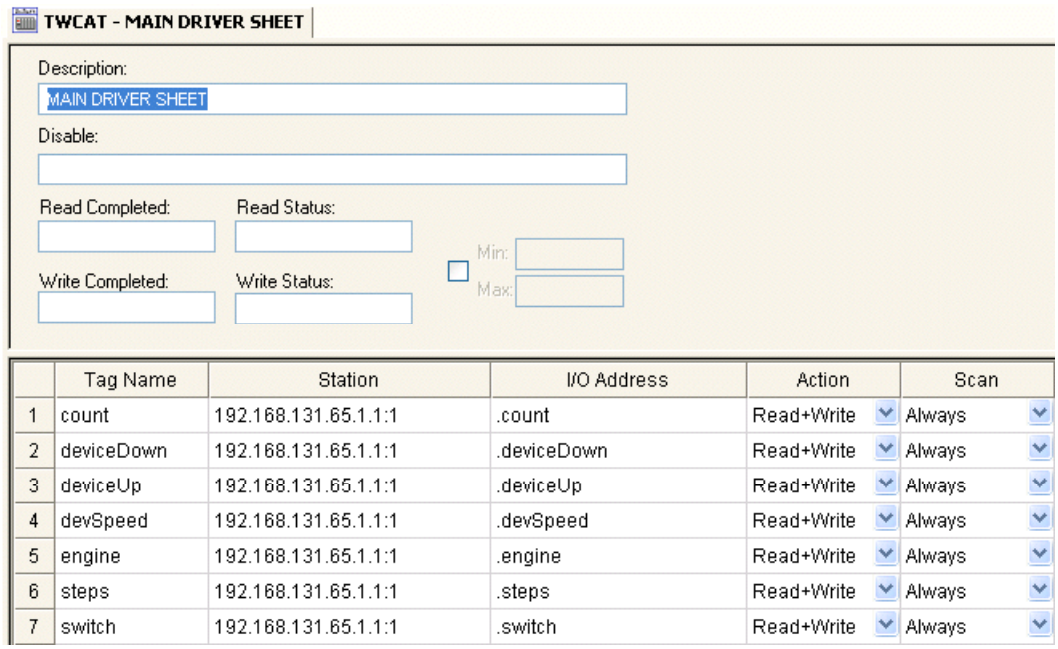


Figure 84: Finshing the Import Process

As the import process finishes up, it does several things for you automatically:

- Selects and configures the TWCAT communication driver;
- Creates new IWS database tags that correspond to the imported TwinCAT variables; and
- Configures the Main Driver Sheet to associate the new database tags with the TwinCAT variables at the specified AMS Net ID.

When it is done, it should look something like the figure below.



	Tag Name	Station	I/O Address	Action	Scan
1	count	192.168.131.65.1.1:1	.count	Read+Write	Always
2	deviceDown	192.168.131.65.1.1:1	.deviceDown	Read+Write	Always
3	deviceUp	192.168.131.65.1.1:1	.deviceUp	Read+Write	Always
4	devSpeed	192.168.131.65.1.1:1	.devSpeed	Read+Write	Always
5	engine	192.168.131.65.1.1:1	.engine	Read+Write	Always
6	steps	192.168.131.65.1.1:1	.steps	Read+Write	Always
7	switch	192.168.131.65.1.1:1	.switch	Read+Write	Always

Figure 85: Final Results of the Database Import Wizard

Make sure you **thoroughly** review both the TWCAT communication settings and the driver worksheet. If everything is satisfactory, then you can proceed to develop the rest of your IWS application as you normally would.

For more information about using the database import wizard, please refer to "Importing a Database" in Chapter 3 of the *IWS User Guide*.