Manual

CP-Link 3 (Ethernet based desktop transmission software)

IPC

Version	1.7
Date	2014-12-16

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Table of contents

1   Foreword

1.1   Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the following notes and explanations are followed when installing and commissioning these components.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
For that reason the documentation is not in every case checked for consistency with performance data, standards or other characteristics.
In the event that it contains technical or editorial errors, we retain the right to make alterations at any time and without warning.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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The EtherCAT Technology is covered, including but not limited to the following patent applications and patents:
EP1590927, EP1789857, DE102004044764, DE102007017835
with corresponding applications or registrations in various other countries.

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1.2 Safety instructions

Safety rules

Consider the following safety instructions and descriptions!
Product specific safety instructions are to be found on the following pages or in the areas mounting, wiring, commissioning etc.

Disclaimer

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH.

Personnel qualification

This description is only intended for the use of trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Description of symbols

The following symbols with a adjoining safety advise or notice are used in this documentation. You have to read the safety advices carefully and adhere them strictly!

⚠ **DANGER**	**Acute risk of injury!** If you do not adhere the safety advise adjoining this symbol, there is immediate danger to life and health of individuals!
⚠ **WARNING**	**Risk of injury!** If you do not adhere the safety advise adjoining this symbol, there is danger to life and health of individuals!
⚠ **CAUTION**	**Hazard to individuals!** If you do not adhere the safety advise adjoining this symbol, there is obvious hazard to individuals!
❗ **Attention**	**Hazard to devices and environment** If you do not adhere the notice adjoining this symbol, there is obvious hazard to materials and environment.
ℹ **Notice**	**Note or pointer** This symbol indicates information that contributes to better understanding.

2 Product overview

2.1 Functioning
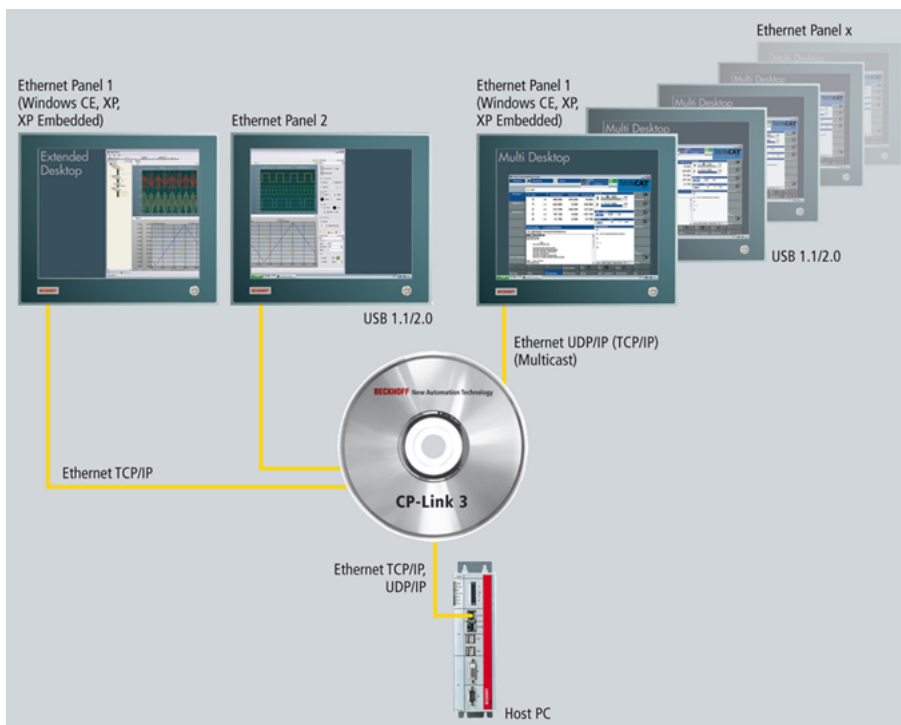
Ethernet-based desktop transfer software

On the one hand, CP-Link 3 transmits the screen content of a host PC over Ethernet to one or more Panel PCs, known as the CP-Link 3 clients. On the other hand, mouse and keyboard inputs made on the clients are transmitted to the host PC. The mouse and keyboard inputs from individual clients can be locked, automatically or manually, by the TwinCAT PLC through a software interface (ADS), so that multiple users do not get in each other's way. Economical standard Ethernet cables (CAT 5), or Ethernet cables suitable for use in drag chains, can be used to network the devices together. The scope of delivery for CP-Link 3 includes host and client software. Either Windows 7, Windows XP or Windows XP Embedded can be installed as the operating system on the host PC. Panel PCs with Windows CE are used as the clients. Only one CP-Link 3 license is required for each host PC, regardless of the number of clients.

Virtual-USB

USB devices that are connected to a client appear to the host PC as locally connected devices, and can be used in the usual way. In this way, the keyboard input, touch screen and special key functions of a client are transmitted to the host PC. It is also possible for USB sticks, USB printers or USB bar code scanners to be connected to a client and used by the host PC. "Virtual USB" emulates a USB root hub in the host PC. If a USB device is plugged to the client, then the virtual hub logs the device on to the operating system of the host PC and transparently transmits the ensuing communication. For the operating system, the USB device behaves as though it was directly connected to the PC. "Virtual USB" transfers the standards USB 1.1 and USB 2.0. As communication takes place using 100 Mbit/s Ethernet, the USB 2.0 transmission performance (480 Mbit/s) is restricted.

Communication with the connected USB devices takes place through a normal TCP/IP connection. It is therefore not possible to guarantee that these devices are queried with a deterministic cycle time. When additional input or output devices, such as rotary switches, keys and so on, are used on the client it is sometimes necessary for a specific cycle time to be observed. As an alternative, communication with such devices can take place through an additional communication channel (RT Ethernet), so ensuring deterministic cycle times.

Virtual Serial Ports

The client's serial interfaces can also be used through a virtual serial port that is created for this purpose on the host PC. This allows devices with serial interface to be connected to a client, and to be used by applications or by drivers in the host PC. Communication between the virtual serial interface on the host PC and the actual serial interface on the client again takes place here over a normal TCP/IP connection.

Virtual Graphics

One or more virtual graphic adapters are installed in the host PC in order to transmit the screen contents. There is a distinction to be made between CP-Link 3 - Mirror Devices and CP-Link 3 - Extended Desktop Devices. A CP-Link 3 - Mirror Device captures the screen content from the standard display device, and transmits it to one or more clients. The standard display device is the one that is used initially when the Windows operating system boots up. A CP-Link 3 - Extended Desktop Device extends the host PC's Windows desktop with an additional display device, whose screen content can be transmitted to one or more clients. An application's program window can be moved to the additional screens of the extended desktop. A CP-Link 3 client can thus either display the content of any of the CP-Link 3 - Extended Desktop Devices or the contents of the standard display device. The contents of other display devices (e.g. of additional graphics cards) cannot be displayed on CP-Link 3 clients.

The image data may optionally be transmitted via TCP/IP or via UDP/IP (Multicast). The advantage of Multicast is that data can be transmitted simultaneously to a number of clients, without multiplying the transmitter bandwidth by the number of receivers.

i **Notice**	**A maximum of 10 display devices is possible under Windows 7 / Windows XP** The total number of 10 display devices cannot be exceeded, and this includes the graphics cards installed in hardware, to which one or more display devices, depending on the type (single or dual head) can be connected. A CP-Link 3 - Extended Desktop Device corresponds to a single head graphics card, and thus to one display device.

Up to nine CP-Link 3 - Extended Desktop Devices can therefore be installed when a single head graphics card is used. If a dual head graphics card is used, only eight CP-Link 3 - Extended Desktop Devices can be installed.

2.2 Software variants

CP-Link 3 is available in three variants:

- **CP-Link 3 single desktop**
- **CP-Link 3 multi desktop**
- **CP-Link 3 extended desktop**

The "Virtual USB" and "Virtual Serial Port" functionalities are included in all three variants, and there are no restrictions on their use. (See also the Functioning [▶ 7] section).

The scope of "Visual Graphics" functions varies in the three variants as follows:

- **CP-Link 3 single desktop:** One virtual graphic adapter (Beckhoff CP-Link 3 - Mirror Device) captures the screen contents from the host PC's standard display device. One client displays the standard display device's image.
- **CP-Link 3 multi-desktop:** One virtual graphic adapter (Beckhoff CP-Link 3 - Mirror Device) captures the screen contents from the host PC's standard display device. Up to 255 clients display the image of the standard display device.

- **CP-Link 3 extended desktop:** One or more virtual graphic adapters (Beckhoff CP-Link 3 - Extended Desktop Devices) are used to expand the host PC's desktop. Up to 255 clients display one of the up to ten different screen contents. This includes, on the one hand, the image of the standard display device and, on the other hand, the images generated by virtual Beckhoff CP-Link 3 - Extended Desktop Devices.

2.3   Technical data

System Requirements for the Host PC	
Hardware	Beckhoff Industrial PC, Beckhoff Embedded PC as from Intel® Celeron® M ULV 1 GHz 1 GB RAM
Operating system	Windows 7 Professional, Windows 7 Ultimate, Windows Embedded Standard 7, Windows XP Professional, Windows XP Embedded or Windows Embedded Standard
Software	Microsoft .NET Framework 2.0

| System Requirements for the Client with Windows CE - (Panel PC / Control Panel)	
Hardware	Panel PC: e.g. CP77xx ,CP62xx, CP72xx, CP67xx Control Panel: CP66xx 64 MB RAM
Operating system	Windows CE 6 with TwinCAT 2.10: Image Version 3.09j or newer with TwinCAT 2.11: Image Version 3.21j or newer with TwinCAT 3.1: Image Version 4.00f or newer Windows Embedded Compact 7 with TwinCAT 2.11: Image Version 5.00l or newer with TwinCAT 3.1: Image Version 6.00i or newer

System Requirements for the Client with Windows XP / Windows 7	
Hardware	Beckhoff Industrial PC, Beckhoff Embedded PC as from Intel® Celeron® M ULV 1 GHz 1 GB RAM
Operating system	Windows 7 Professional, Windows 7 Ultimate, Windows Embedded Standard 7, Windows XP Professional, Windows XP Embedded or Windows Embedded Standard

| General	
Transmission medium	Standard Ethernet cable (CAT 5)
Transfer protocol	TCP/IP or UDP/IP
Maximum number of clients:	TCP/IP: 10 clients for each of the host PC's display devices UDP/IP: 255 clients for each of the host PC's display devices
Virtual-USB	Maximum 7 USB devices per client

3   Installation

3.1   Installation - Host

✓ The .NET Framework Version 2.0 software - or a newer version - from Microsoft is a precondition for the installation of CP-Link 3. This software is free, and can be downloaded from the Microsoft website.

  1. Execute the program *CPLink3Setup.exe* to start the installation of CP-Link 3.

   ⇨ The installation wizard, which will guide you through the installation process, opens. First, the installation requirements are checked. If necessary, a list of software packages that still have to be installed is displayed. The "Microsoft Visual C++ 2008 SP1 Redistributable Package (x86)" is included in the setup application, and is installed automatically, if necessary. The "Microsoft .NET Framework 2.0" is not included in the setup application, but can be downloaded by the setup application through an existing Internet connection. If that is not possible, this step can be skipped for the time being. The "Microsoft .NET Framework 2.0" - or a newer version - can be installed manually after CP-Link 3 has been installed.
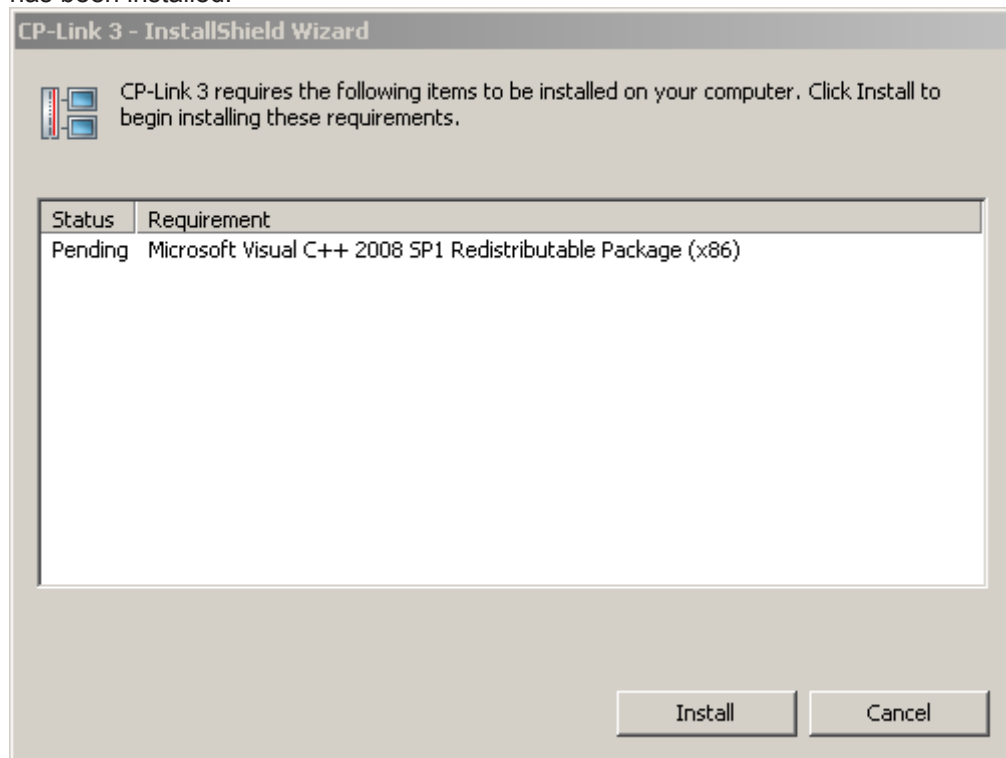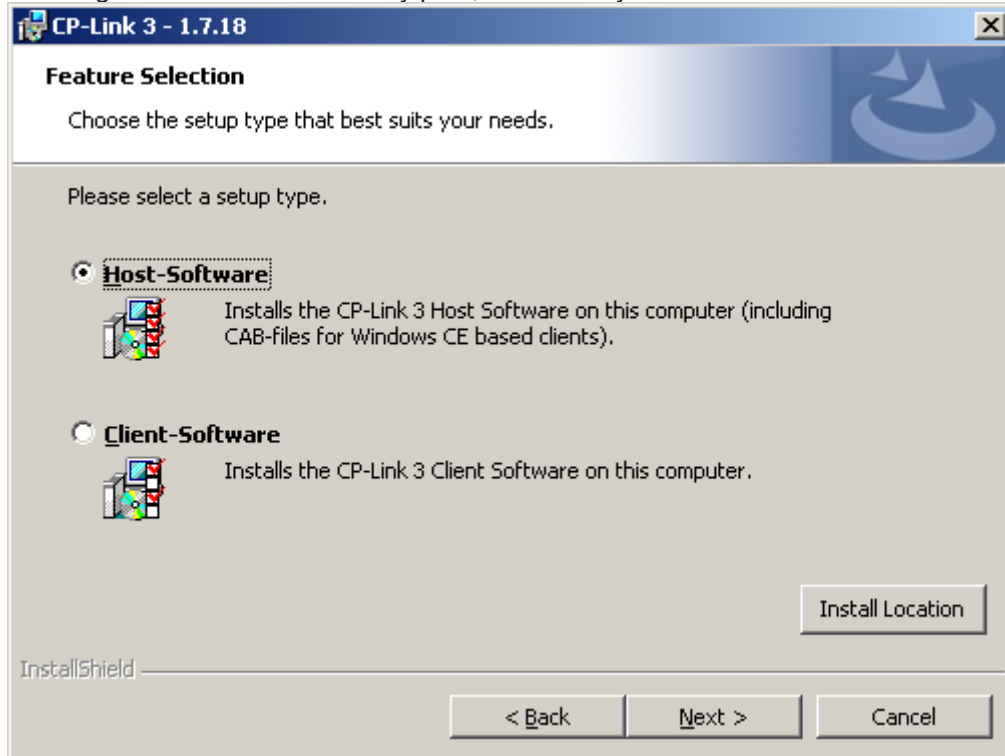
2. In the next step the installation wizard shows the Welcome dialog. Click on "Next"
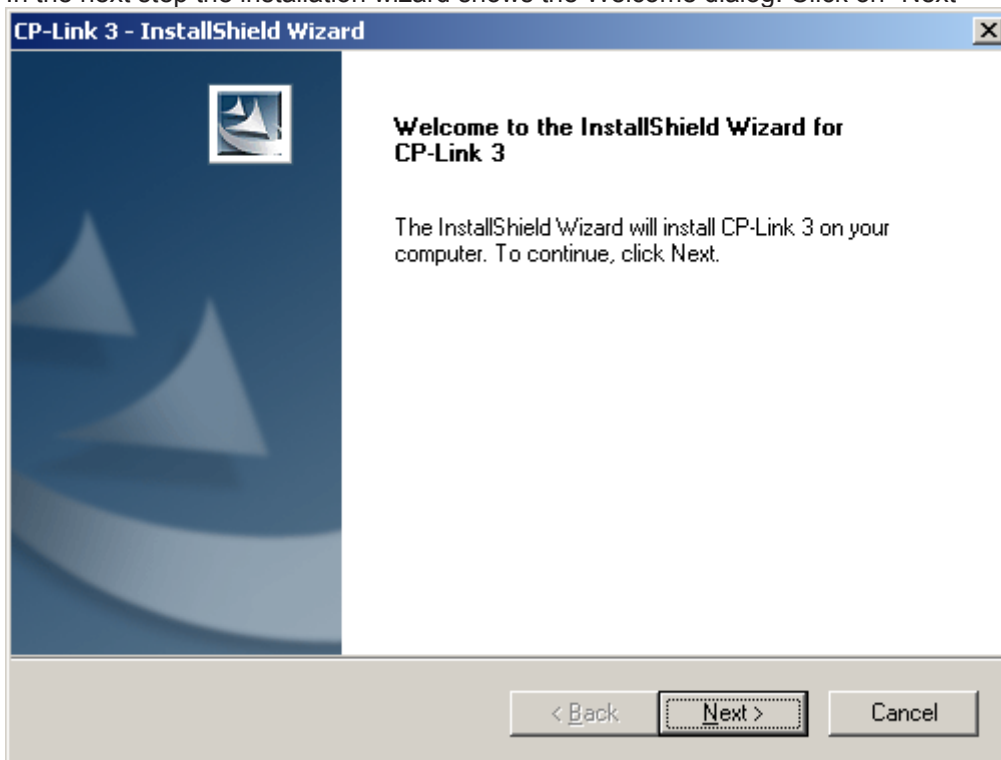
3. Accept the license terms and click on "Next".

4. In the next dialog select the *CP-Link 3 host software* installation option. Use the *Install Location* button to change the installation directory path, if necessary. Click on "Next"

5. In the dialog for entering the user data, complete the fields for *User Name* and company (*Organization*) and enter the *Serial Number* in the relevant box.

ⓘ **NOTICE! You will be given the serial number after you have purchased the CP-Link 3 license. The serial number contains information about the license level that has been bought.**
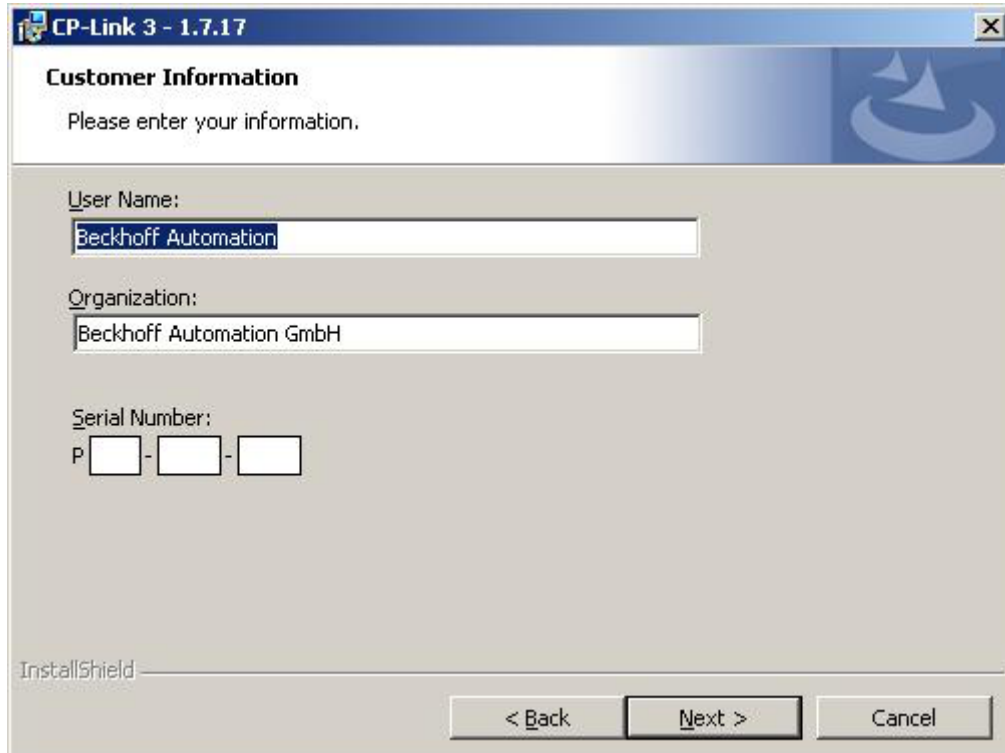
6. If **Extended-Desktop** license level is installed, in the next dialog you can specify how many CP-Link 3 - Extended Desktop devices are to be installed (see also chapter Operating principle [▶ 7]).
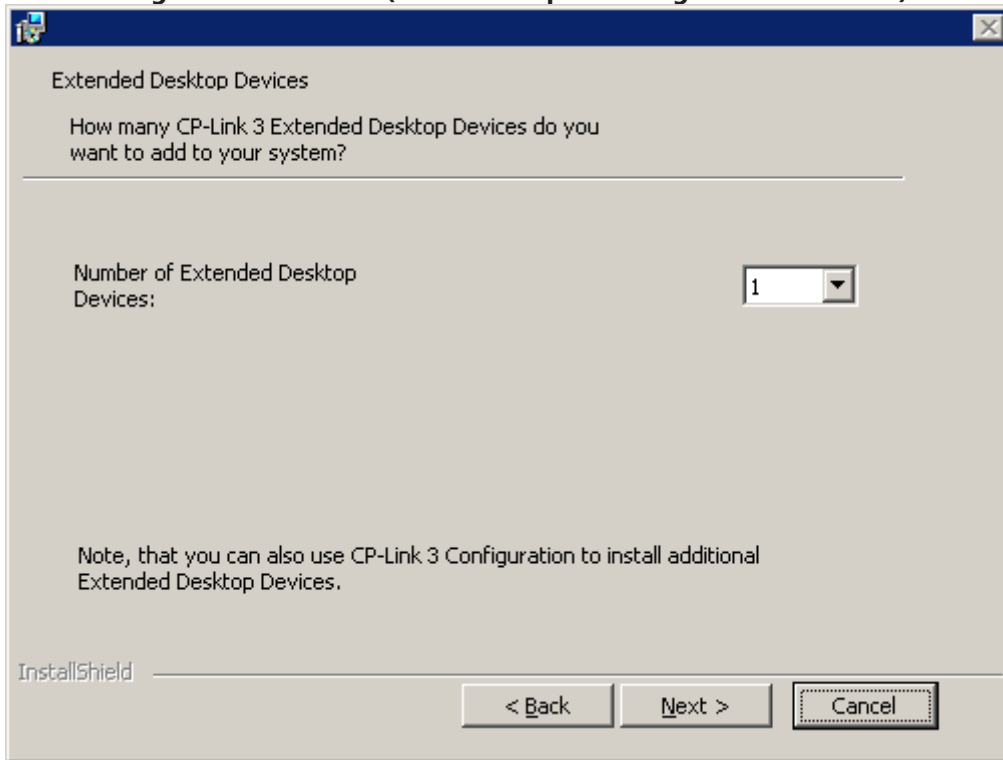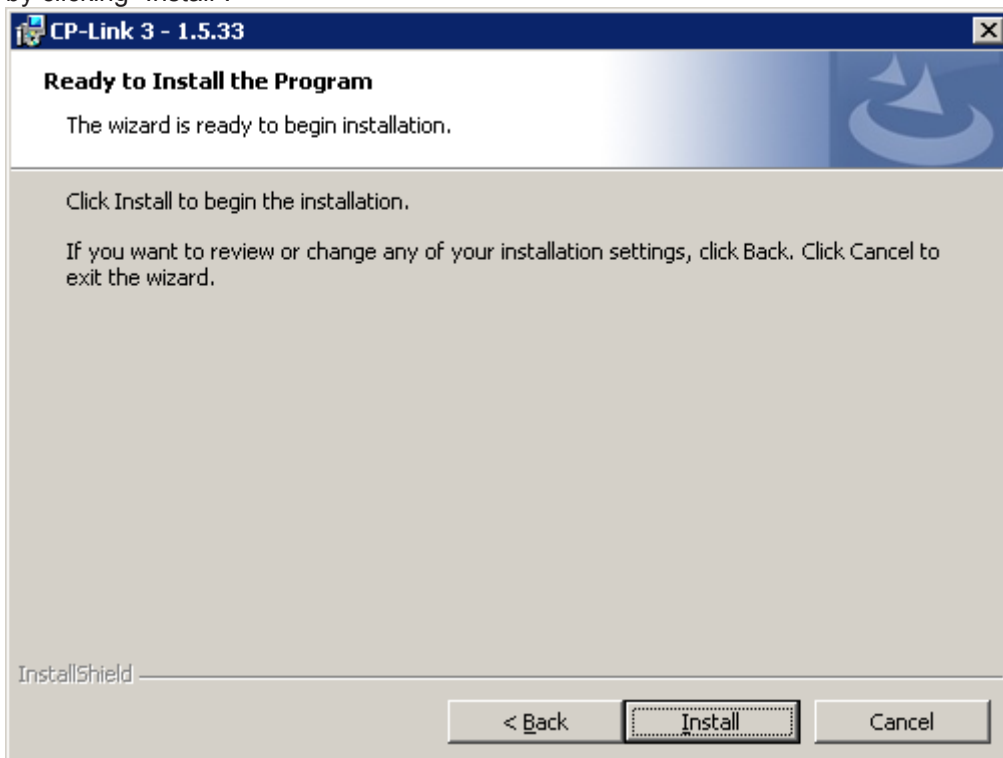   ⓘ **NOTICE! Additional CP-Link 3 - Extended Desktop devices can be added at any time via the CP-Link 3 configuration interface (See also chapter Configuration interface).**
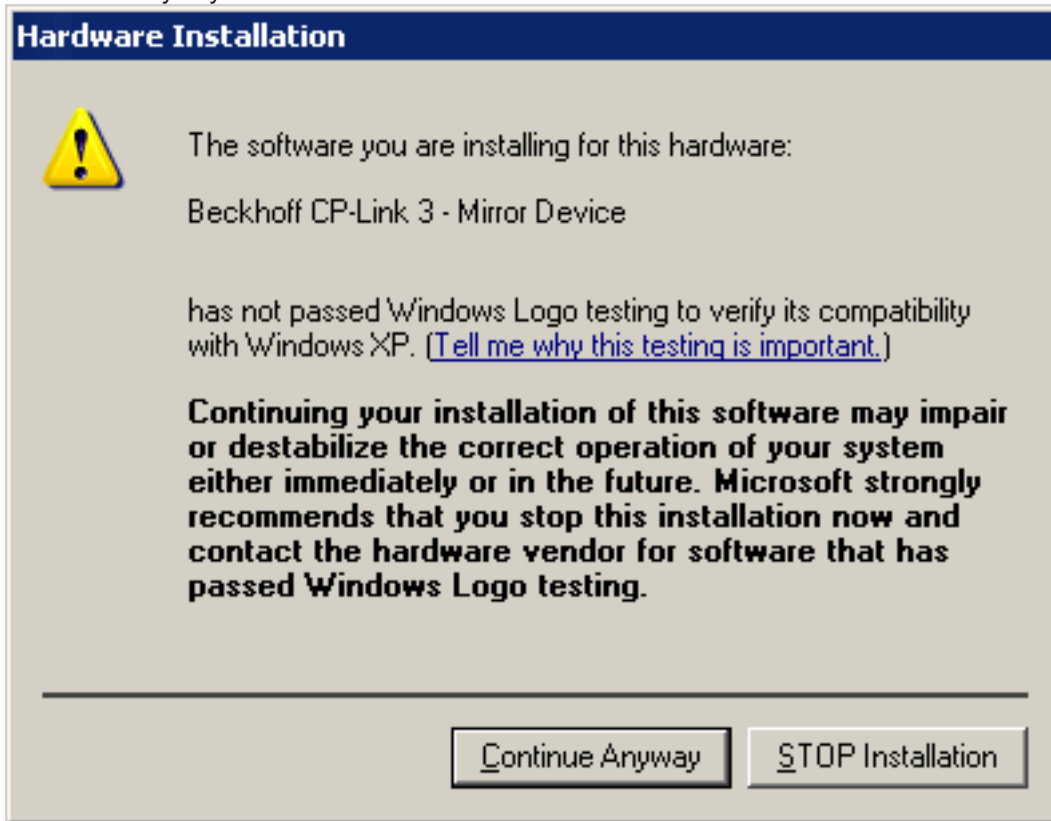
Extended Desktop Devices

How many CP-Link 3 Extended Desktop Devices do you want to add to your system?

Number of Extended Desktop Devices: 1 ▼

Note, that you can also use CP-Link 3 Configuration to install additional Extended Desktop Devices.

InstallShield

< Back   Next >   Cancel

7. Clicking "Next" will take you to the final window in the installation routine. If you want to make any changes to your installation parameters, return with "Back", otherwise initiate the installation procedure by clicking "Install".

CP-Link 3 - 1.5.33

Ready to Install the Program

The wizard is ready to begin installation.

Click Install to begin the installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
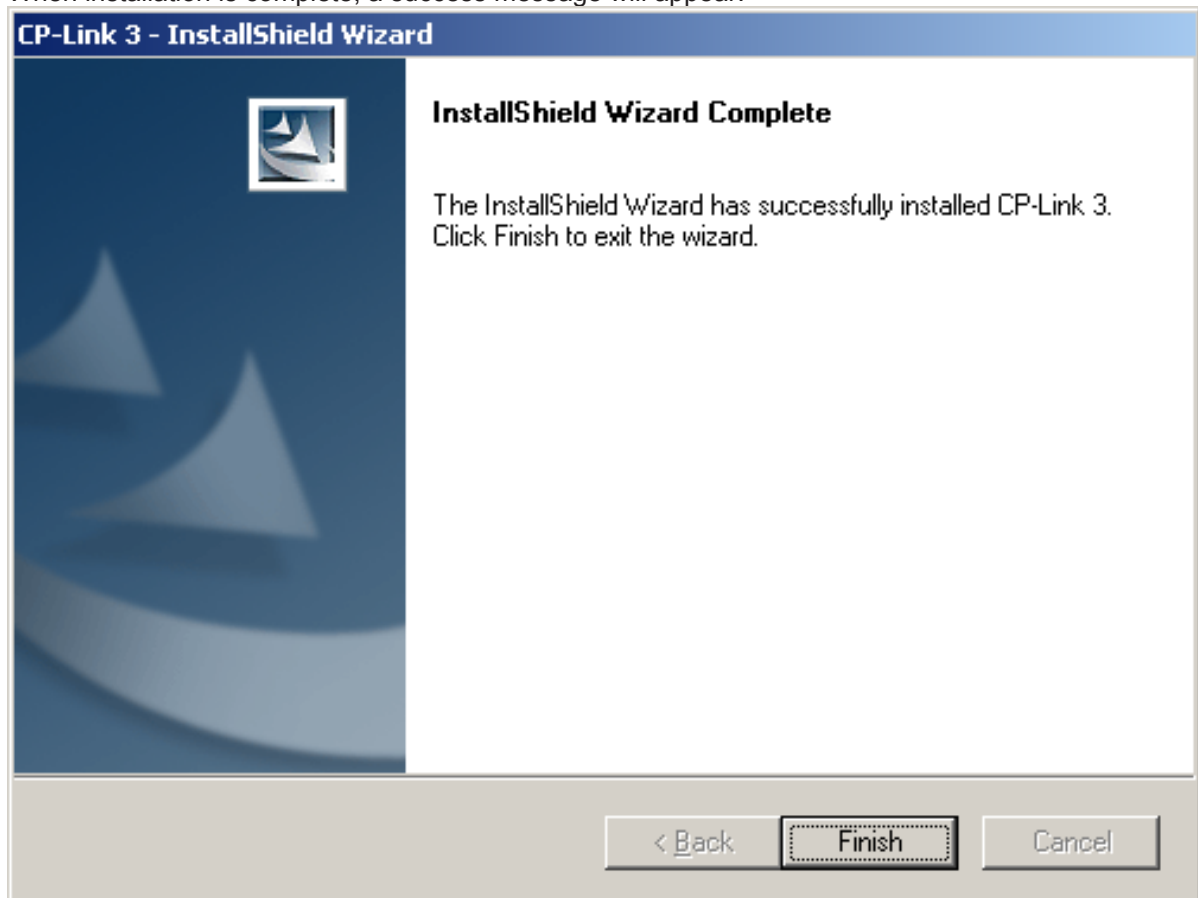
InstallShield

< Back   Install   Cancel

⇨ All the necessary files are now copied into the destination directory, and the required drivers are installed on your system.
   ⓘ **NOTICE! It can take some time to install the drivers. It is possible that the screen will flicker a number of times during the installation.**

8. It is possible that multiple messages stating that the "Windows Logo Test" has not been passed for the CP-Link 3 hardware concerned will appear during the installation. Ignore these messages, and click "Continue Anyway".

Hardware Installation

⚠ The software you are installing for this hardware:

Beckhoff CP-Link 3 - Mirror Device

has not passed Windows Logo testing to verify its compatibility with Windows XP. [Tell me why this testing is important.]

Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.

[Continue Anyway] [STOP Installation]

⇨ When installation is complete, a success message will appear:

CP-Link 3 - InstallShield Wizard

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed CP-Link 3. Click Finish to exit the wizard.

[< Back] [Finish] [Cancel]

9. Click "Finish" in order to terminate the installation process. After the installation the system has to be restarted.

⇨ The necessary software components have now been installed on your computer, and a link to the CP-Link 3 configuration application placed on the desktop.

|	**Replacing TcUsb.sys - TwinCAT installation**
i **Notice**	Depending on the installed TwinCAT version and the installation sequence of CP-Link 3 and TwinCAT, it may be necessary to replace the driver file TcUsb.sys with a more recent version. (See chapter on updating TcUsb.sys).

Also see about this

3.2   Installation - Client

In addition to the installation of CP-Link 3 on the host PC, CP-Link 3 needs to be installed on the CP-Link 3 clients too.

Installation of client software under Windows 7 / Windows XP

Starting with version 1.5.x of CP-Link 3 the installation program CPLink3Setup.exe contains, in addition to the host software, the client software for Windows 7 and Windows XP.

1. Execute the program *CPLink3Setup.exe* on the client PC to start the installation. Follow the instructions of the installation wizard.
2. On the next dialog, choose the CP-Link 3 Client Software to be installed. You can change the destination directory using the *Install Location* Button.
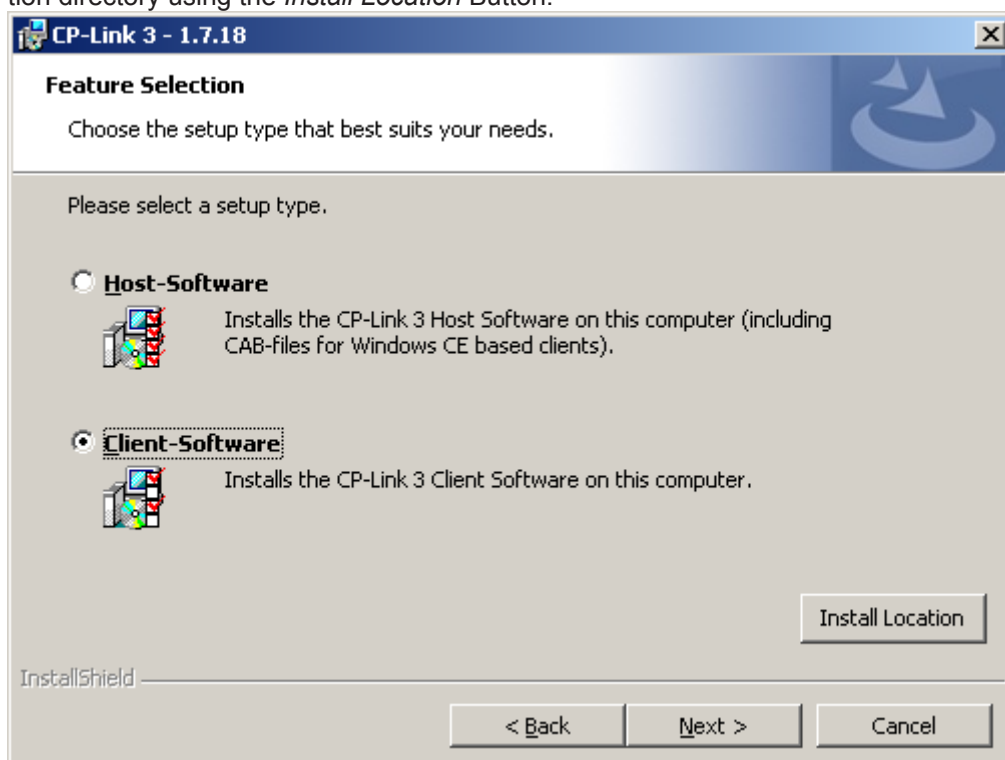
3. On the dialog where the user data is to be entered, complete the fields for the *User Name* and *Organization*:
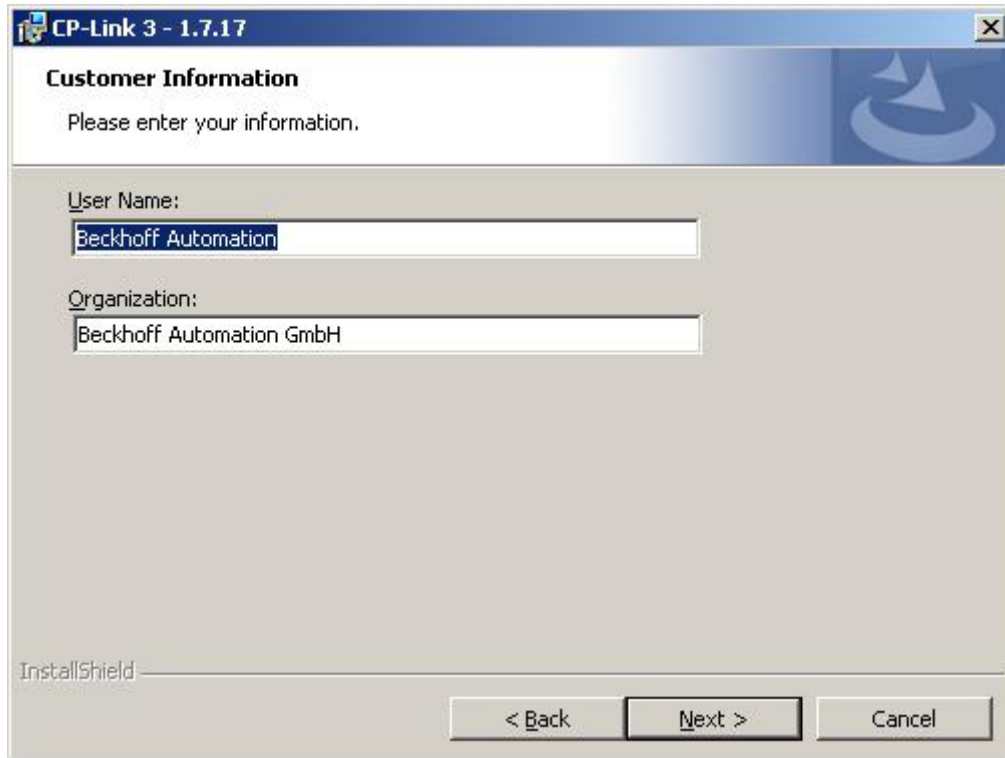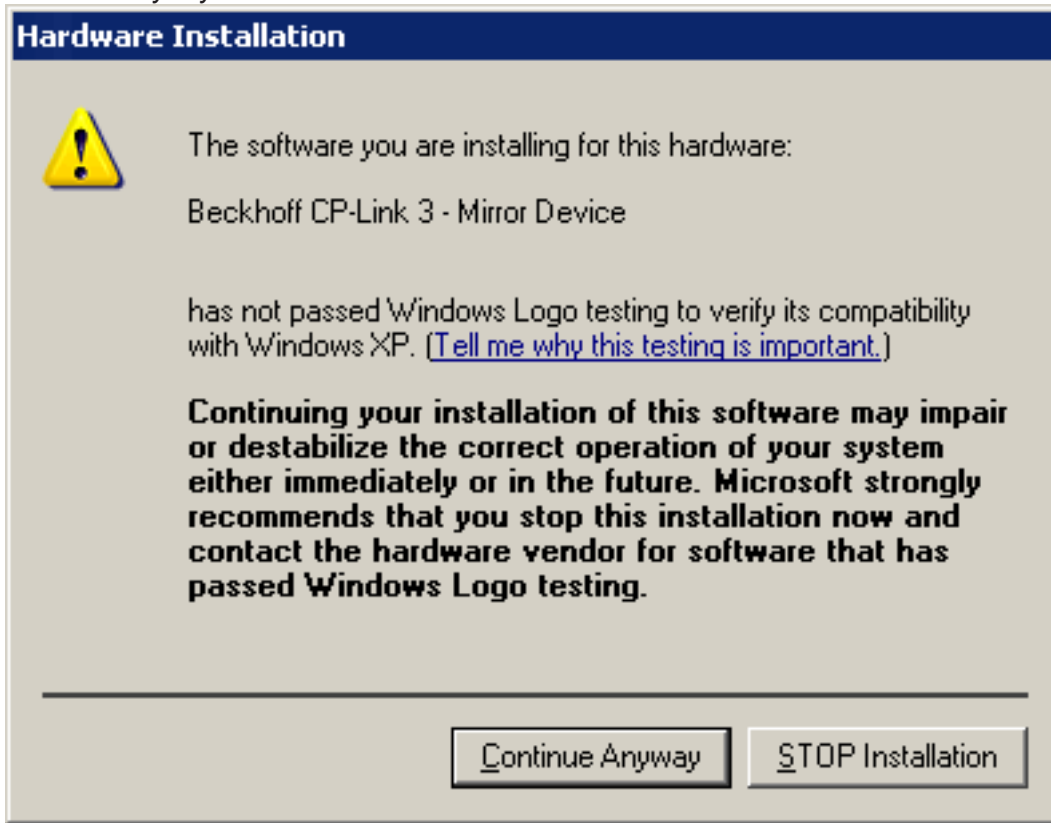

4. Clicking "Next" will take you to the final window in the installation routine. Initiate the installation procedure by clicking *Install*.
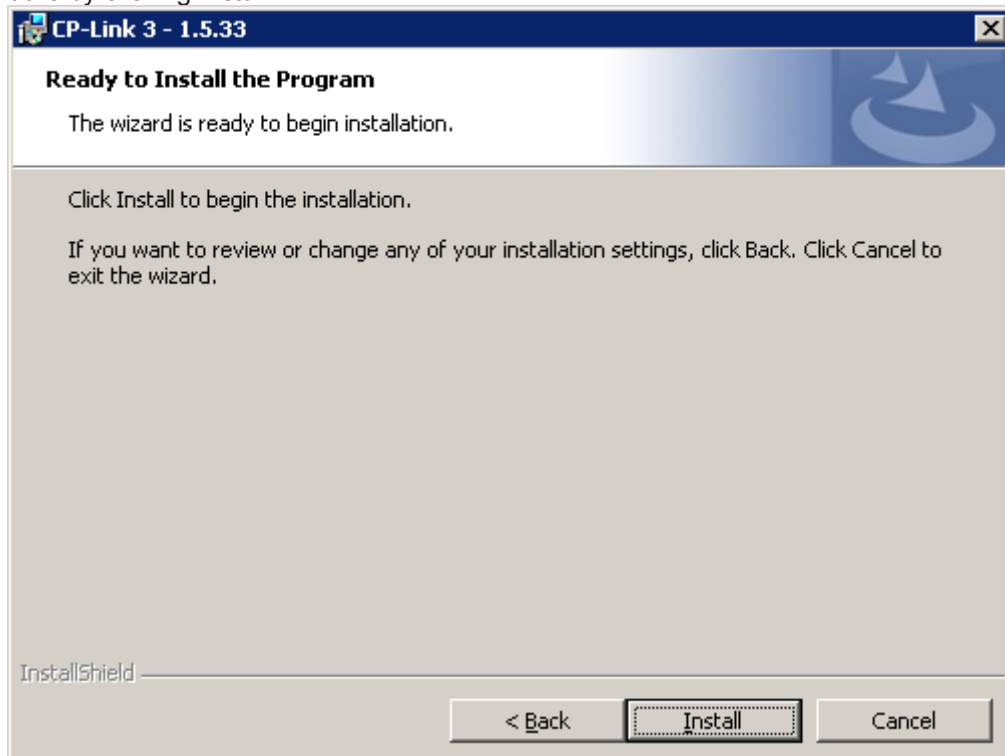
5. It is possible that multiple messages stating that the "Windows Logo Test" has not been passed for the CP-Link 3 hardware concerned will appear during the installation. Ignore these messages, and click *Continue Anyway*.

Hardware Installation

⚠ The software you are installing for this hardware:

Beckhoff CP-Link 3 - Mirror Device

has not passed Windows Logo testing to verify its compatibility with Windows XP. [Tell me why this testing is important.]

Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.

[Continue Anyway] [STOP Installation]

⇨ When installation is complete, a success message will appear. If you finish the installation program, you will be asked to restart the computer.

ⓘ	**Client PC initially not operable**
Notice	The client PC is initially not operable as long as it waits for a connection with a CP-Link 3 host. If no host connects with the client, it becomes operable after about one minute. The client indicates this state with an info box.

Client software installation under Windows CE

The subfolder "CE\X86" or "CE\ARM" in the program directory on the host PC contains the installation files for Windows CE based clients.

ⓘ	**Windows CE 6 and particular image version required**
Notice	Please note the requirements listed under System Requirements for the Client with Windows CE (see the Technical data [▸ 9] section).

1. The corresponding CE-cab installation file needs to be copied to the CE device first (via memory stick / FTP / Public Folder / ...).
2. Double click the cab file on the CE device to start the installation and follow the instructions of the installation wizard.
   ⓘ **NOTICE! In order to ensure correct functioning of CP-Link 3, always install CP-Link 3 into the directory suggested by the installation wizard.**

   ⓘ **NOTICE! After installation has finished the cab file will be deleted automatically. Therefore you should always transfer a copy of the original cab file to the client.**

i **Notice**	**CE device initially not operable** The CE device is initially not operable as long as it waits for a connection with a CP-Link 3 host. If no host connects with the client, it becomes operable after about one minute. Starting with version 1.1.19 of CP-Link 3 the client indicates this state with an info box.

Color depth adjustment

To maximize the performance of CP-Link 3 *Virtual-Graphics*, the color depth of the client's display should match the color depth of the corresponding host display. Normally, the client's color depth has to be set to 32 bit.

Adjustment of the color depth under Window CE:

- The platform specific directory "\Hard Disk\Regfiles\Samples\Cxxxx" contains registry files with which the color depth of the client can be adjusted. Note, that the settings from registry files can be written to registry by a double click on the file in the Windows CE Explorer.
- Alternatively, the color depth can be adjusted via the program *CX Configuration* on the tab *Display Settings.*

3.3   Uninstallation

## Uninstallation of the host software or the client software under Windows 7 / Windows XP

To remove CP-Link 3 from a PC, go to *Start -> Control panel -> Add or Remove Programs* (Windows XP), or *Start -> Control Panel -> Programs and Functions* (Windows 7) and select *Remove* for the CP-Link 3 software package. The installation wizard, which will guide you through the uninstallation process, opens.
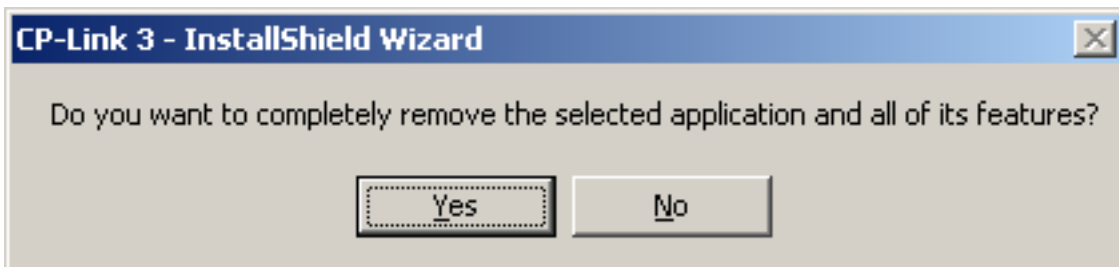
Clicking *Yes* will remove CP-Link 3 from the computer.

4 Configuration

4.1 Configuration interface
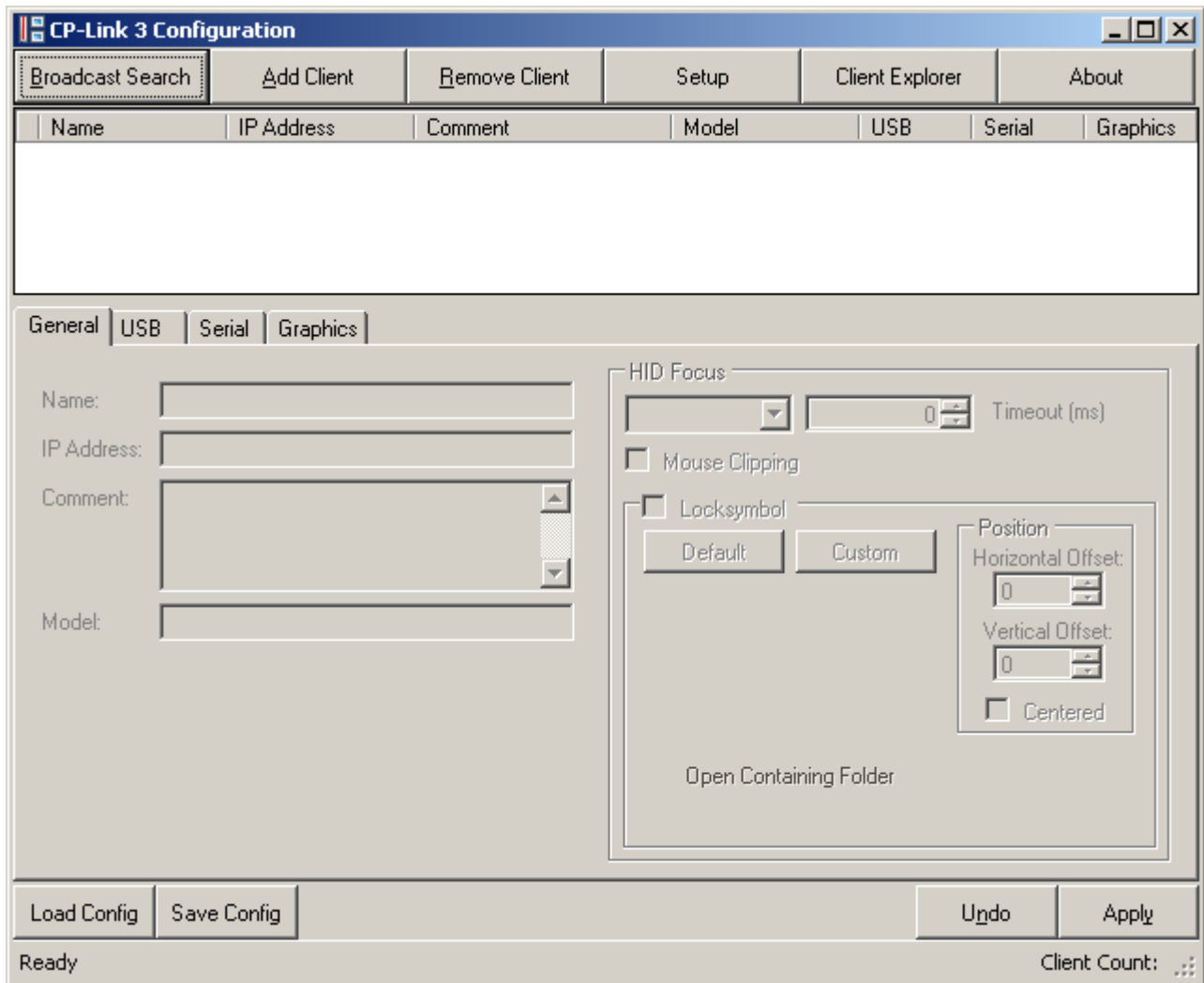
The client list, which is still empty, is located in the upper part of the configuration interface, while the settings for marked clients will later be listed in the lower part.

Editing the client list and configuring the clients are described in the sections on Edit the client list [▶ 22] and Client configuration [▶ 27].

Setup

Clicking *Setup* opens a dialog which, amongst other things, allows the user to adjust the resolution, color depth and position for all display devices. Furthermore, additional CP-Link 3 - Extended Desktop Devices can be installed/uninstalled:
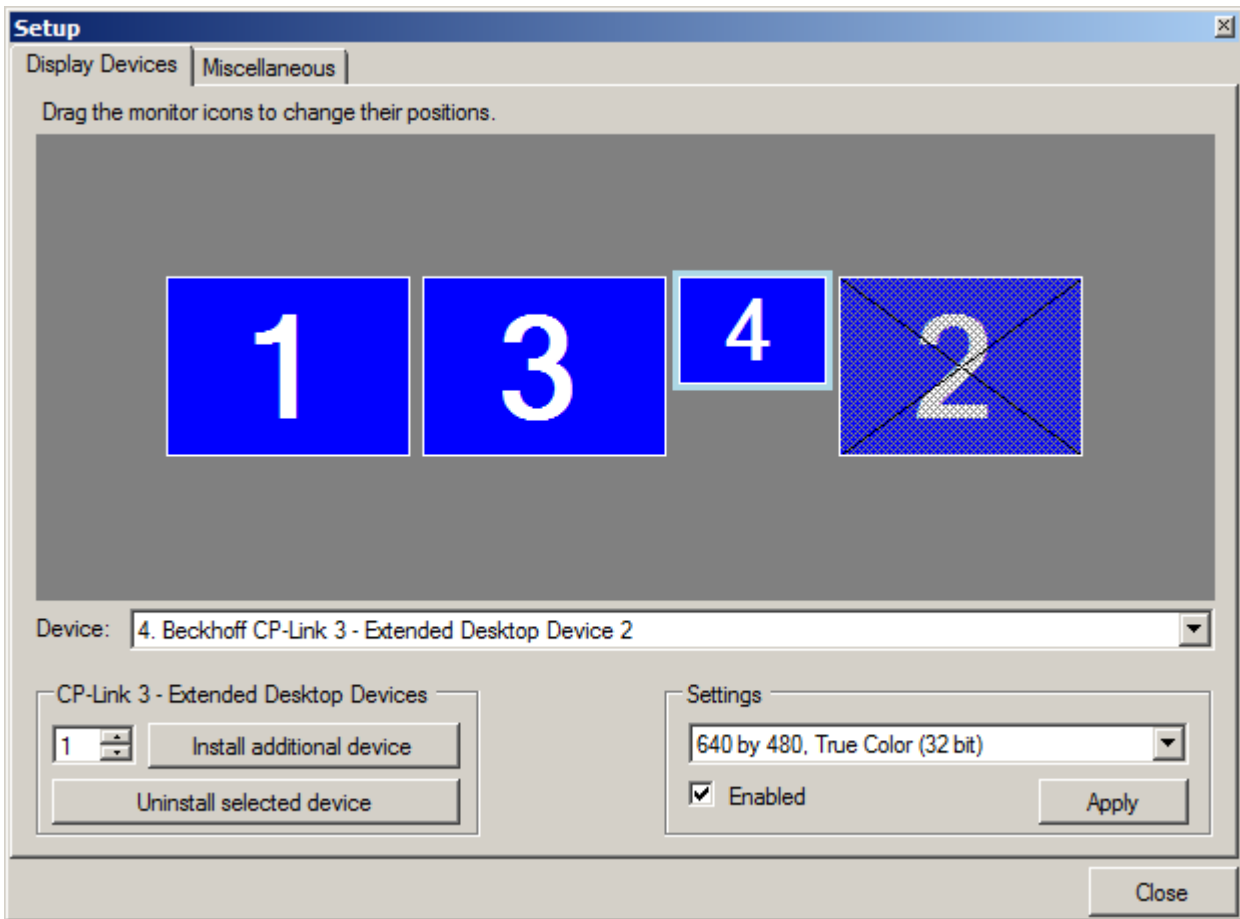
Display Devices

A display device is selected by clicking on a monitor symbol, as can be seen from a light blue border. Similarly, a display device can also be chosen from the selection list (*Device*) shown on the dialog. The settings for the selected display device can now be modified in the lower part (Setting) of this dialog. The position of the monitor icons can be adjusted by drag-and-drop. Clicking *Apply* will activate the changes.

**Installation/uninstallation of CP-Link 3 - Extended Desktop Devices:**
In the *CP-Link 3 - Extended Desktop Devices* area it is possible to enter the number of Extended Desktop Devices that are to be installed, and the installation can be started by clicking *Install additional device(s)*. It may be necessary to restart the operating system after the installation process.
After selecting a CP-Link 3 - Extended Desktop Device the device can be uninstalled by clicking *Uninstall selected device*. After the uninstallation process the operating system needs to be restarted.

i **Notice**	**A maximum of 10 display devices is possible under Windows 7 / Windows XP** The total number of 10 display devices cannot be exceeded, and this includes the graphics cards installed in hardware, to which one or more display devices, depending on the type (single or dual head) can be connected. A CP-Link 3 - Extended Desktop Device corresponds to a single head graphics card, and thus to one display device.

|	
i **Notice**	**Check the license level** You must be licensed to the appropriate level (Extended-Desktop) in order to install/uninstall Extended Desktop Devices.

Miscellaneous
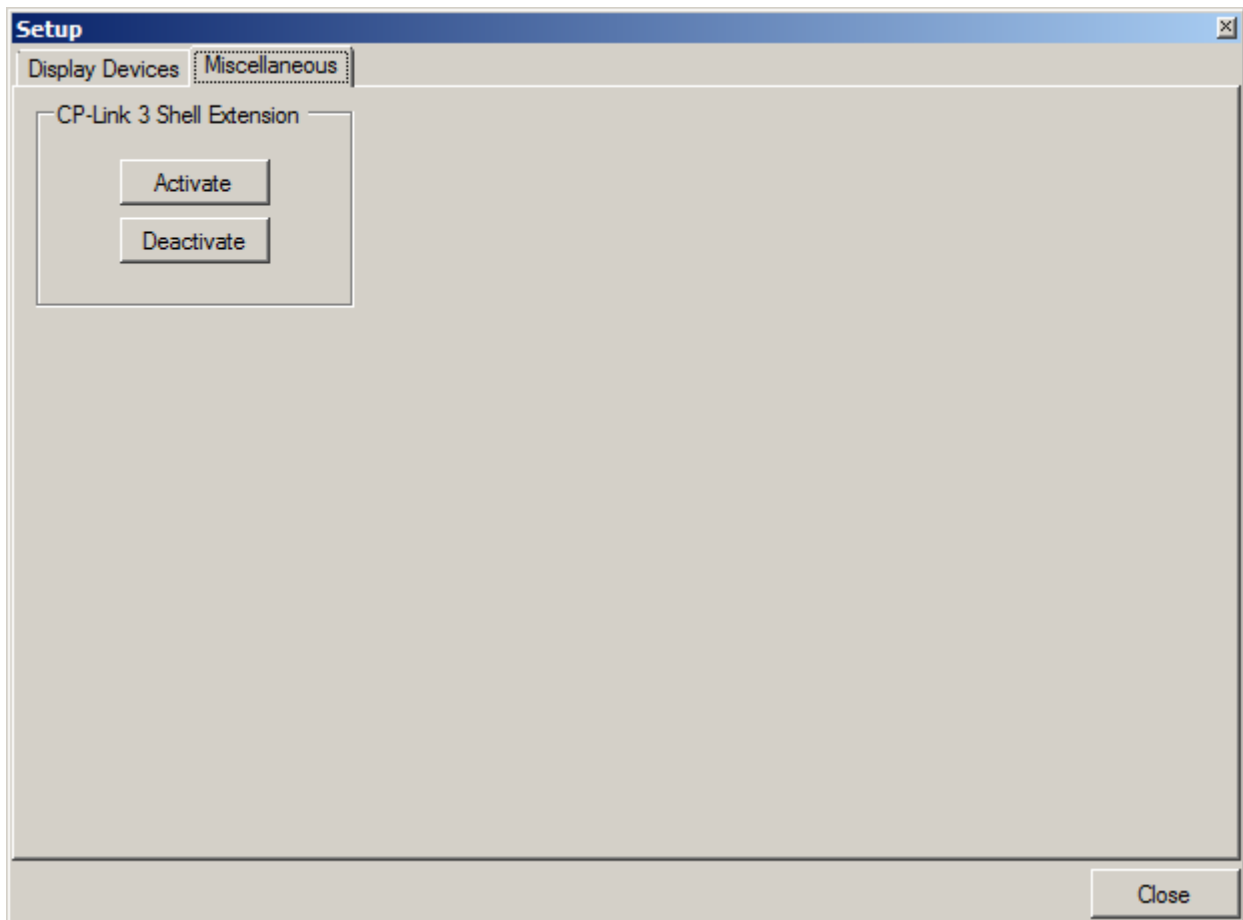
The CP-Link 3 Shell Extension can be switched on or off in the *CP-Link 3 Shell Extension* area. The CP-Link 3 Shell Extension is used to extend the desktop context menu (see also the CP-Link 3 Shell Extension [▶ 53] section).
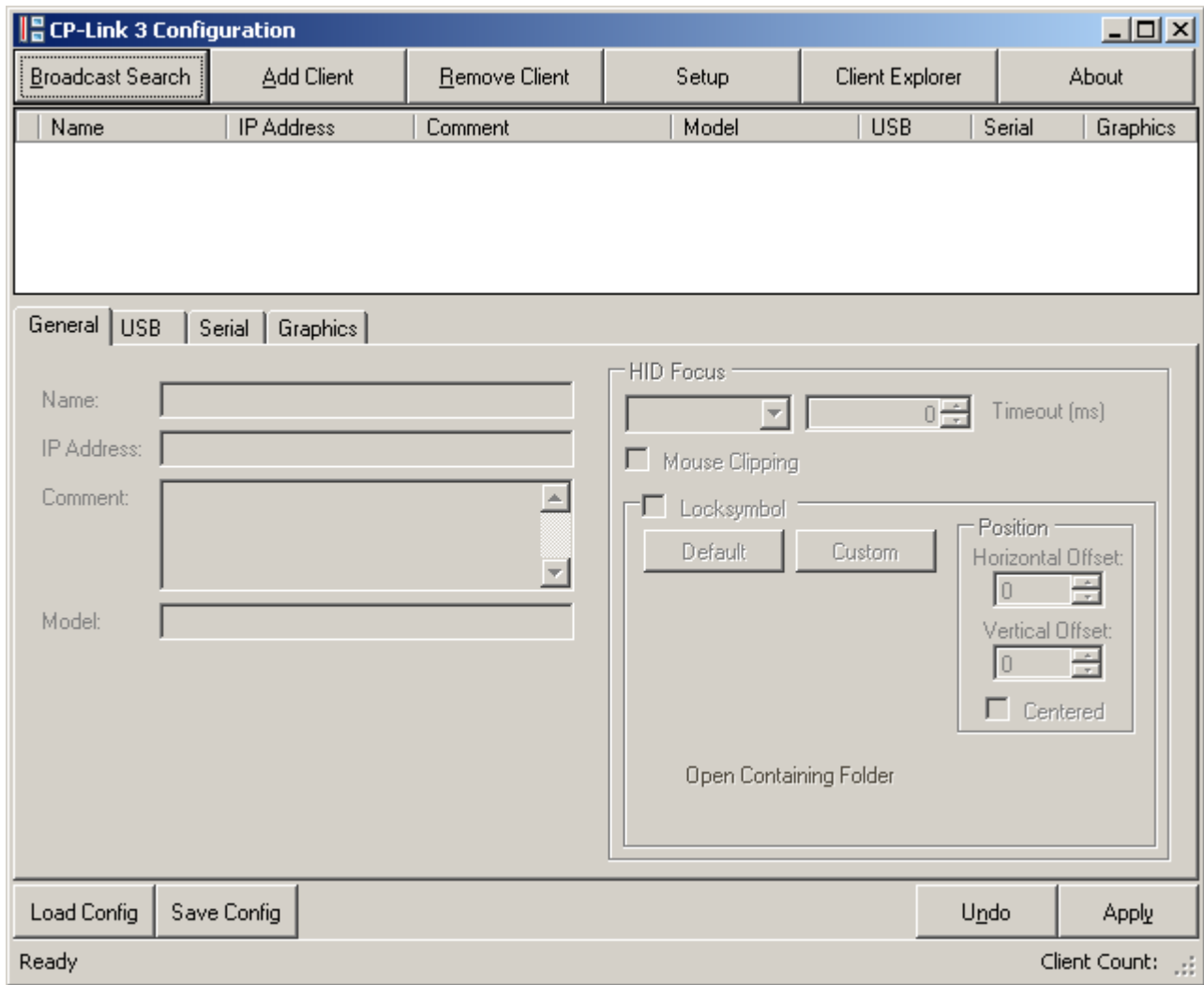
About

Clicking *About* opens a window that displays the current license and version information about the CP-Link 3 software installed on the computer.
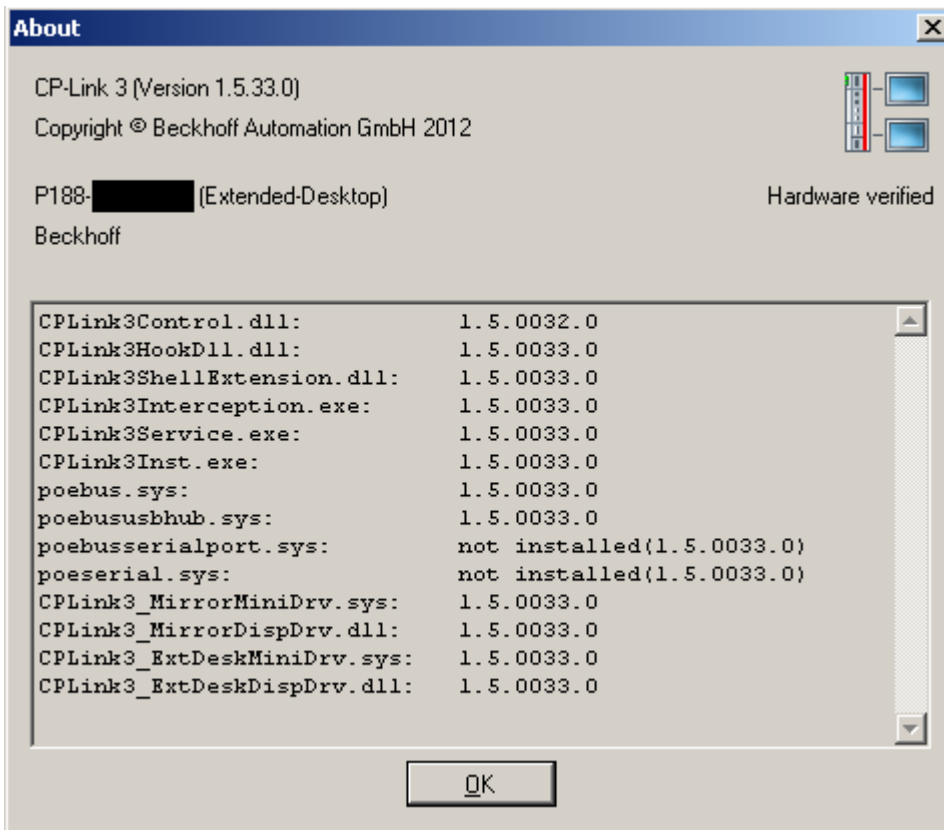
Clicking *OK* closes the information window.

4.2   Edit the client list

The configuration interface appears with an empty client list the first time that *CP-Link 3 Configuration* is started:

Clients can be added to the client list by clicking *Broadcast Search* or on *Add Client*. Clients can be removed from the client list with a click on *Remove Client*.

	Activate the settings with Apply
i **Notice**	The procedure must be completed by clicking Apply in order to finally write the changes into the client list.

Broadcast Search

The *Broadcast Search* function makes it possible to search automatically for devices in the network that are CP-Link 3-capable. Devices found by the *Broadcast Search* can be adopted into the client list.

	Windows Firewall
i **Notice**	If the Windows Firewall is enabled, the UPnP service must be authorized in the Windows Firewall if automatic searching for CP-Link 3-capable devices is to work.

If it is necessary to make modifications in the Windows Firewall, the following dialog will appear when clicking on the *Broadcast Search* button:
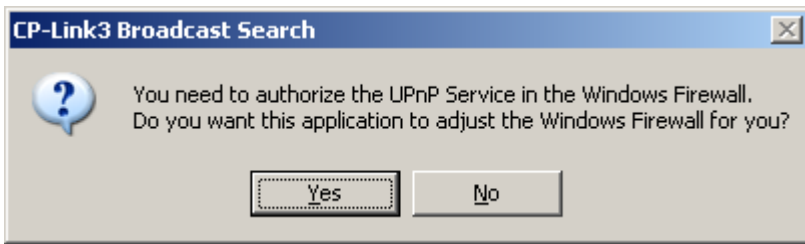
The UPnP service is authorized in the Windows Firewall by clicking *Yes*. Clicking *No* will leave all the Windows Firewall settings unchanged, as a result of which it will not be possible to search through the *Broadcast Search*.

✓ The Windows Firewall is properly configured.

1. Click the *Broadcast Search* button.
2. In the *CP-Link 3 Broadcast Search* window click on *Start Search*.
   ⇨ The search for UPnP devices in the network is started, the devices which are found are monitored.
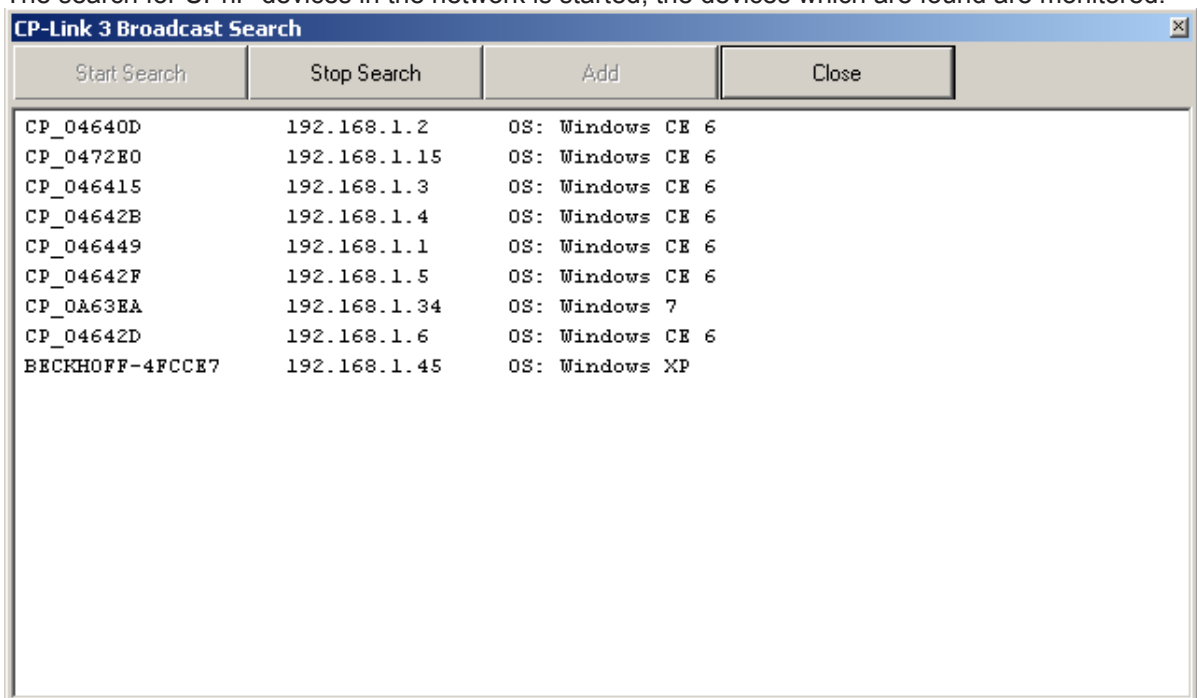
3. Add the desired device by clicking the *Add* button or by double-clicking, it will then appear in the client list.
4. Whether or not the IP address of the new device is already present in the client list is checked when a client is added. If it is, a dialog opens through which the action can be cancelled or the client overwritten.
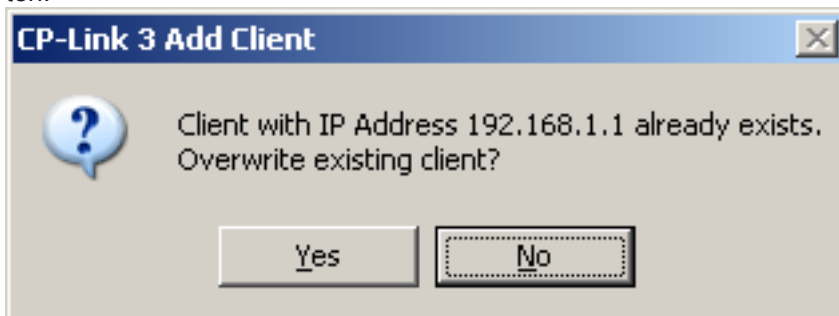
5. If clients have just been added to the client list, they remain marked in green in the status field in front of the client name until the changes have been adopted by clicking *Apply*.
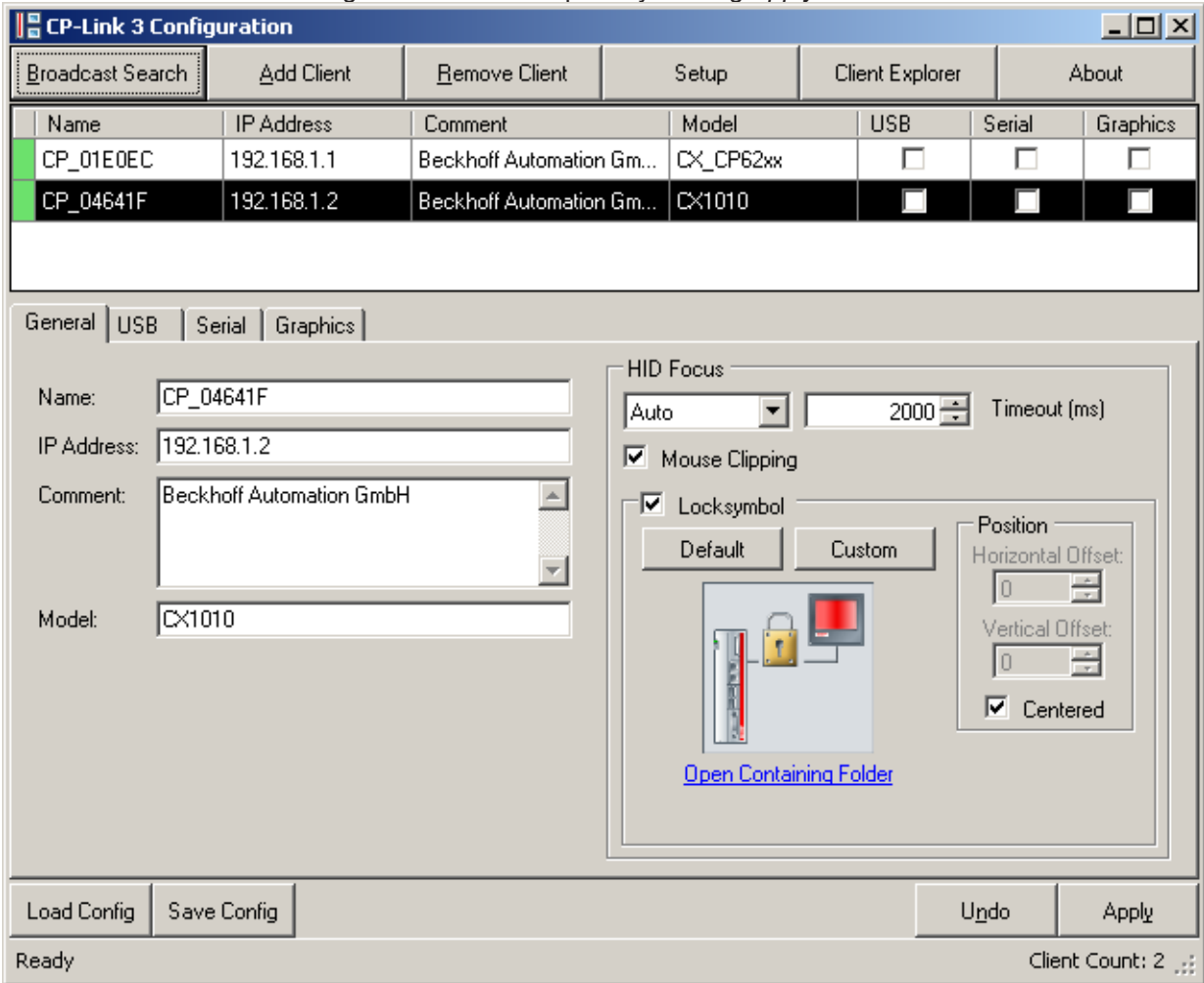
Add Client

If a client is not yet present in the network, or is not UPnP-capable, it can be added manually by means of *Add Client*:

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When a client is added through *Add Client*, standard settings for the *Name*, the *IP Address* and the *Comment* are loaded. These settings may need to be modified.
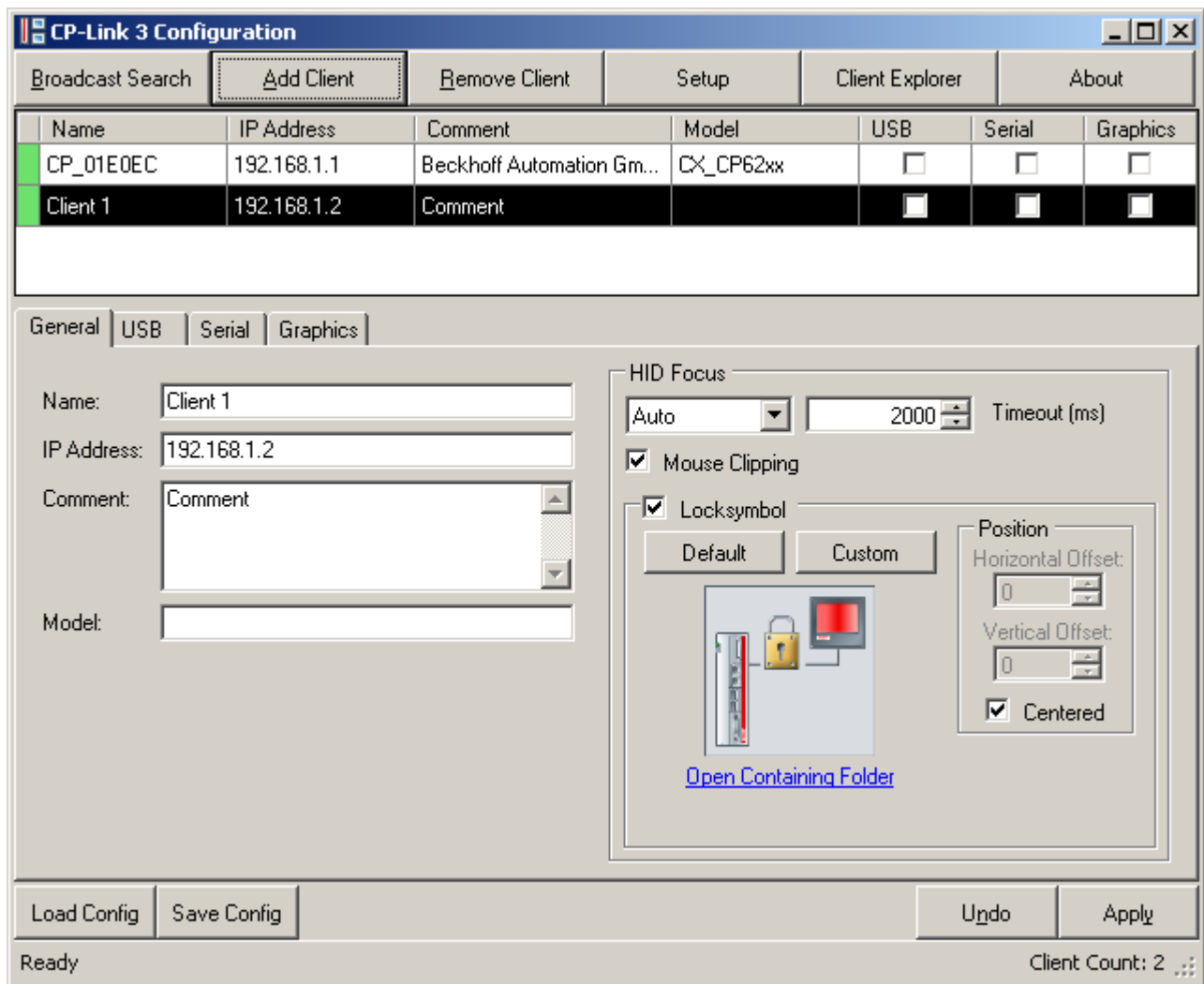
If clients have just been added to the client list, they remain marked in green in the status field in front of the client name until the changes have been adopted by clicking *Apply*.

Remove Client

Remove Client can be used to delete clients from the client list.
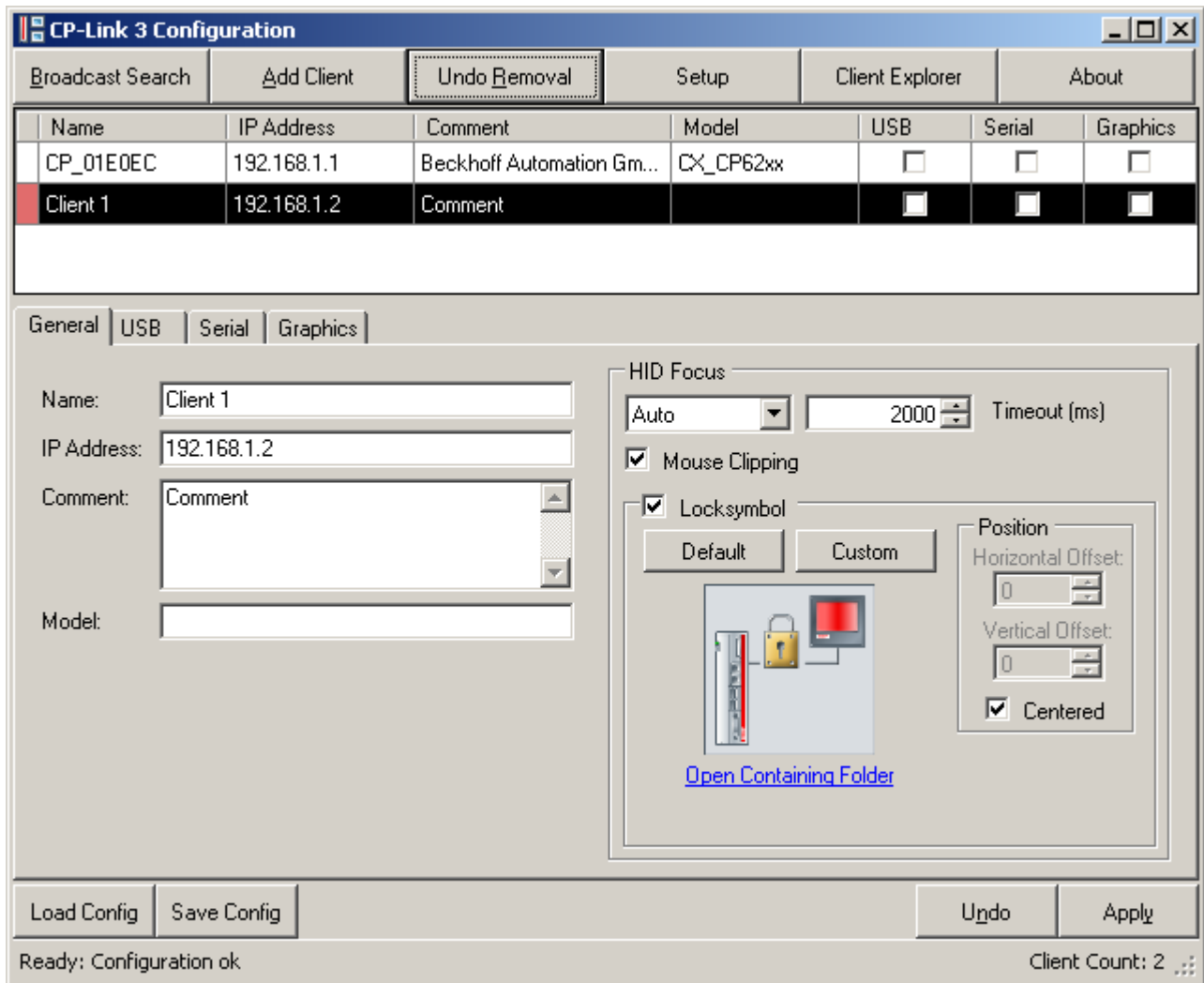
The labelling and the behaviour of the button depends on the colour of the status field for the selected client:

- The status field is coloured green (the button is labelled *Remove Client*):

  The client will be removed immediately from the client list by clicking *Remove Client*.

- The status field is coloured white (the button is labelled *Remove Client*):

  The status field is coloured red until the change is adopted by clicking Apply. Only then is the client finally removed from the client list.

- The status field is already coloured red (the button is labelled *Undo Removal*):

  The removal mark will be removed by clicking on the button again.

- The status fields of a number of selected clients have different colours (the button is labelled *Toggle Removal Marks*):

  Clients that are green will be removed immediately from the client list, clients that are marked in red will have their removal mark removed, while the status field for clients whose status field is white will turn red.

If clients are to be removed from the client list, and if they are marked red in the status field in front of the client name, the changes will not finally be adopted till *Apply* is clicked.

4.3 Client Configuration

The configuration of a client is divided into four parts, which are described in detail below:

- General [▷ 28]- a client's general parameters.

- USB [▷ 30]- settings for the "Virtual USB".

- Serial [▷ 34]- settings for the "Virtual Serial Ports".

- Graphics [▷ 35]- settings for the "Virtual Graphics".

The CP-Link 3 functionalities (Virtual USB, Virtual Serial Ports and Virtual Graphics) can be enabled or disabled separately for each client. This is either done through the appropriate selection boxes in the client list, or through the selection box on the corresponding tab in the lower part of the configuration window.

In order to configure one or more clients they must first be selected. This is done simply by clicking them in the client list. It is also possible to select multiple clients simultaneously. In this case the most recently marked client has a black background, while the others all have blue backgrounds:
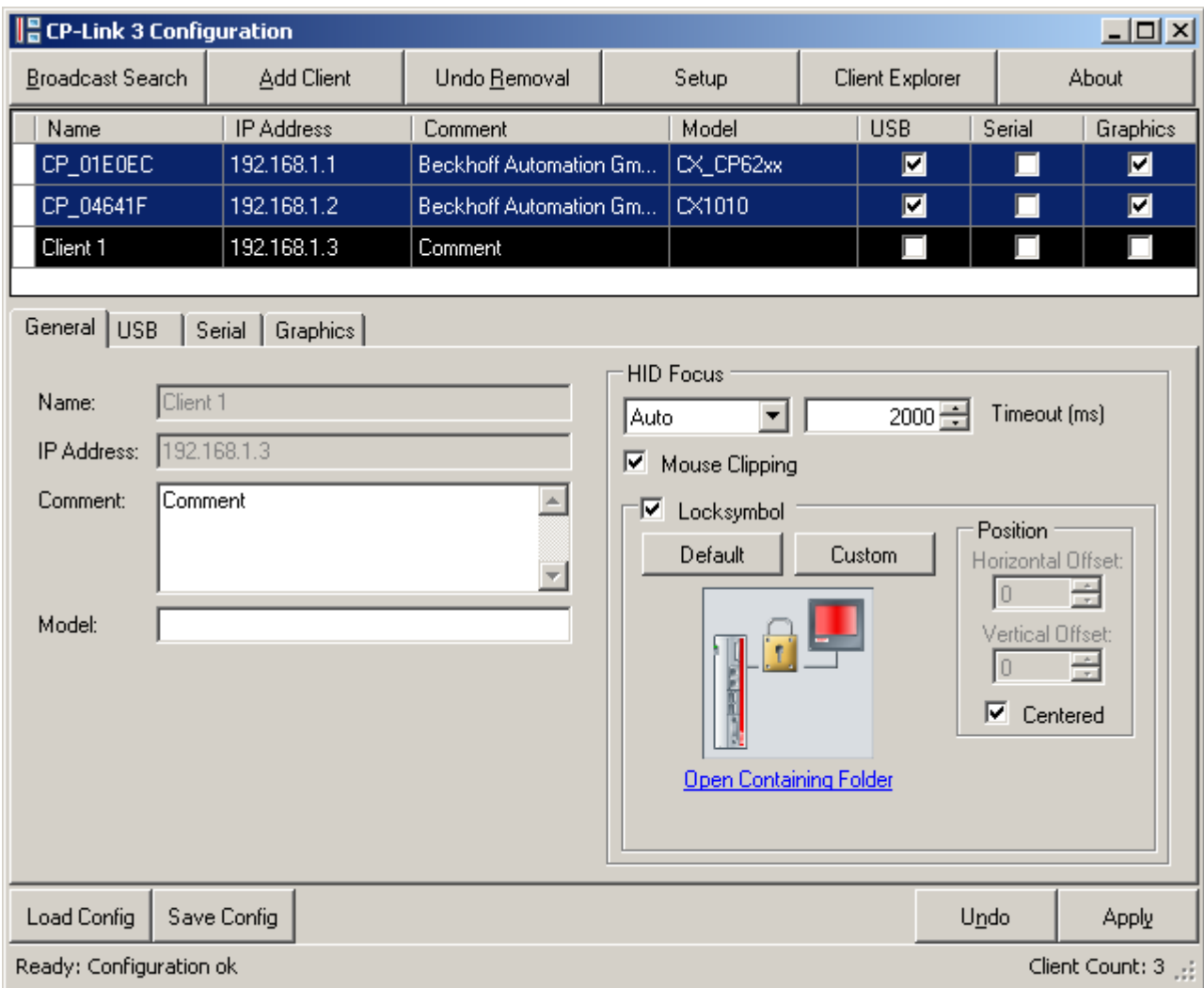
The settings displayed are always those for the most recently marked clients, while changes that are made are carried out on all the clients that have been selected.

4.3.1   General

The general parameters for a client are set on the *General* tab. An asterisk next to the name of the tab indicates that the settings for the "General" section have been changed, but have not yet been activated with *Apply*.

The general parameters of a client include the IP address along with a name and description, as well as the settings of the HID focus. The *IP Address* entry is essential. In addition, entries can also be made in the *Name, Comment* and *Model* fields. Any name can be assigned to the client in the *Name* field. The name does not have to correspond to the client's computer name.

![i] **Notice**	**Automatic entry of the IP address** If a client is added to the client list through the Add Client function, the client's IP Address field is automatically pre-filled. It may be necessary to modify this entry!

HID focus

The client's input behaviour can be configured with the aid of the HID focus (i.e. the human input device focus):

When a client has the HID focus, only this client is able to make input to the host through a keyboard, mouse or touchpad. Input from all the other clients is blocked. There is a difference between the auto and manual modes of the HID focus.

- **Auto HID focus** - If an input is made at a client, it automatically acquires the HID focus. If no further input is made for a set period of time, the client loses the HID focus again. The period can be specified, in milliseconds, in the *Timeout* field. If the timeout is set to 0, the HID focus will not be set by making inputs, which means that inputs can be made simultaneously at other clients too.

- **Manual HID focus** - Input from the client is initially blocked. The HID focus must be given to the client before inputs can be made. There is a software interface, described under Setting the HID focus manually [▶ 53], for this purpose. When manual mode is selected, the timeout is automatically set to 0 ms, and this means that it is necessary to reset the HID focus explicitly in all cases. If the timeout is anything other than 0 ms, then the manually set HID focus will automatically be reset after the given time if no other input is made.

If **MouseClipping** is active (which is the standard setting), the mouse pointer cannot leave the screen area of the client that has the HID focus. This prevents accidental operations in windows that are outside the visible area of the desktop.

Lock symbol

The graphical *lock symbol* is shown to any clients that are unable to make inputs. This allows a user to see that the HID focus is already assigned to another client.

The standard *default lock symbol* can be set by means of the *Default* button. It is also possible to select any other graphical symbol, modified to meet particular requirements, to represent the lock. The *Custom* button opens a file dialog with which the file that is to be used can be selected. By clicking *Open Containing Folder* underneath the preview of the lock symbol, an Explorer window that shows the storage location of the selected lock symbol can be opened.
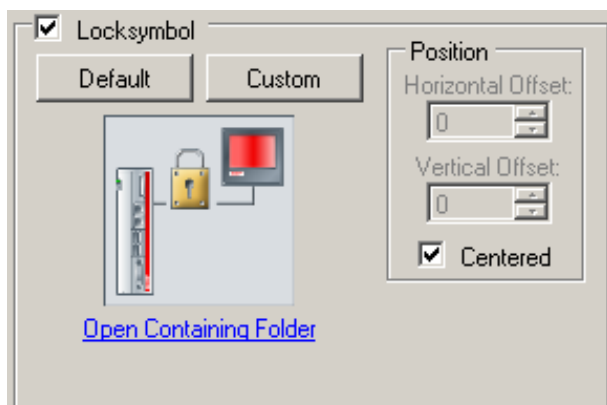
| ![i] **Notice**	**Appearance of the lock symbol diagram** The size of the lock symbol is limited to a maximum of 256 x 256 pixels. Larger images are reduced to a size of 256 x 256 pixels, smaller images retain their original size. Transparent images are supported.

Position:

By default the lock symbol is displayed centered on the client.

After unchecking the option *Centered* it is possible to specify horizontal and vertical offsets via the fields *Horizontal Offset* and *Vertical Offset*. The point of origin of the offset is the upper left corner of the screen content of the host PC that is displayed on the client.
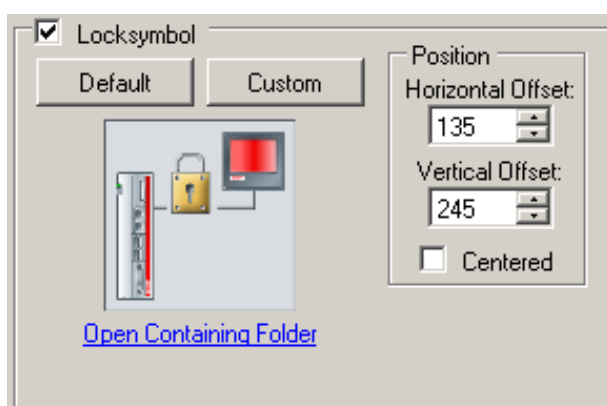
4.3.2 USB

A client's settings for the "Virtual USB" area are made on the *USB* tab. An asterisk next to the name of the tab indicates that the settings for the "Virtual USB" section have been changed, but have not yet been activated with *Apply*.
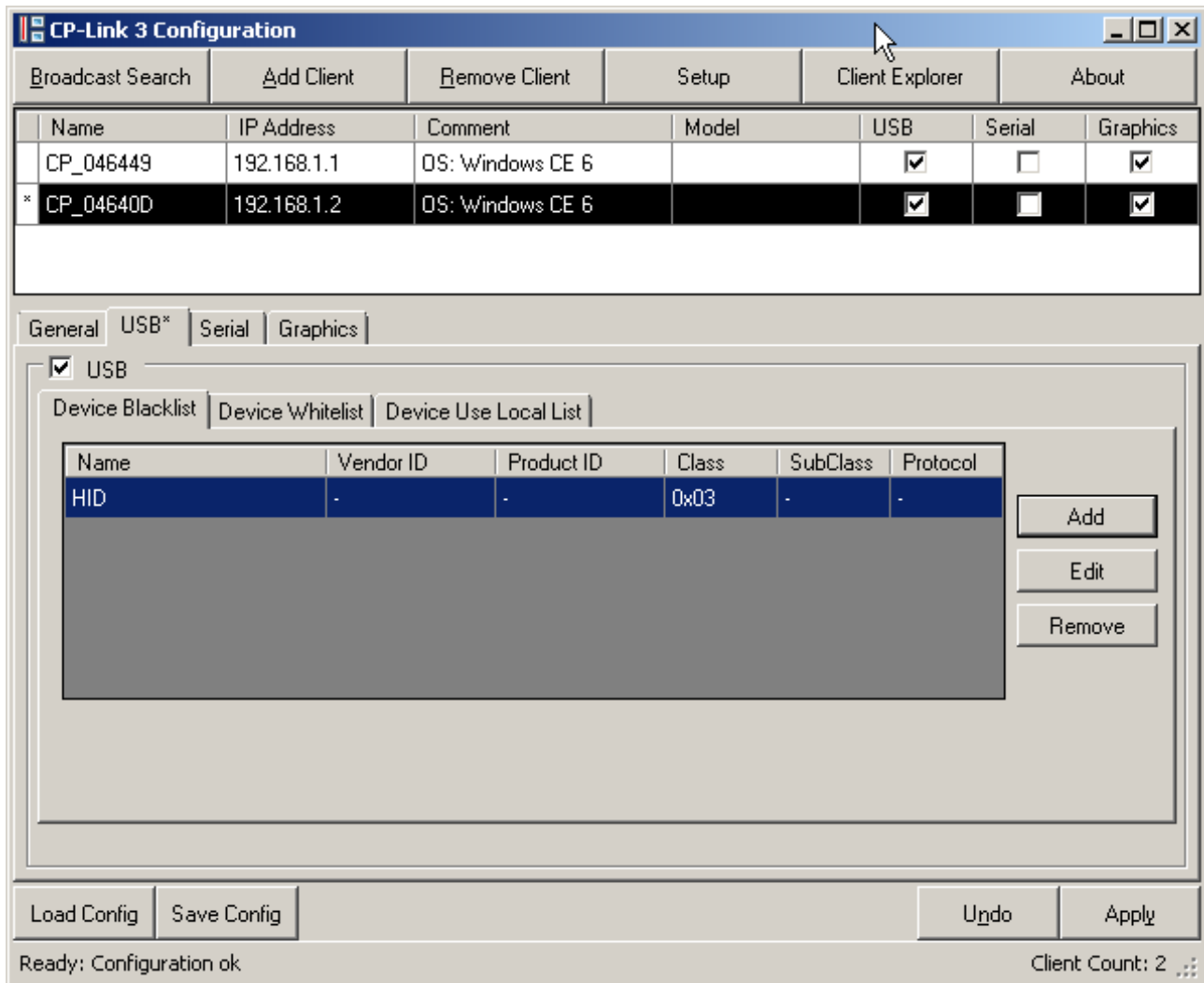
The "Virtual USB" functionality for the client can be enabled or disabled by setting or clearing the tick in the *USB* selection box.

i **Notice**	**New hardware "Beckhoff GmbH USB Control Panel CP6800" found** If "Virtual-USB" is activated for a client for the first time, the hardware assistant reports that the hardware "Beckhoff GmbH USB Control Panel CP6800" was found. This is the internal USB Bus Coupler for which the driver TcUsb.sys has to be installed. This driver is available on Beckhoff PCs and is automatically installed by the hardware wizard.

USB device filter

Device Blacklist

The Device Blacklist is a list of filters. Each entry in the blacklist is a filter representing a certain group of USB devices that are to be ignored by the host PC (see also chapter USB device filter lists [▶ 48]).

Device Whitelist

The device whitelist is a list of filters. Each entry in the whitelist is a filter representing a certain group of USB devices that are not to be ignored by the host PC, even when the blacklist contains an entry for the USB device (see also chapter USB device filter lists [▶ 48]).

Device Use Local List

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The Device Use Local List is a list of filters. Each entry in the Use Local List is a filter representing a certain group of USB devices to be used locally by the client (see also chapter USB device filter lists [▶ 48]).
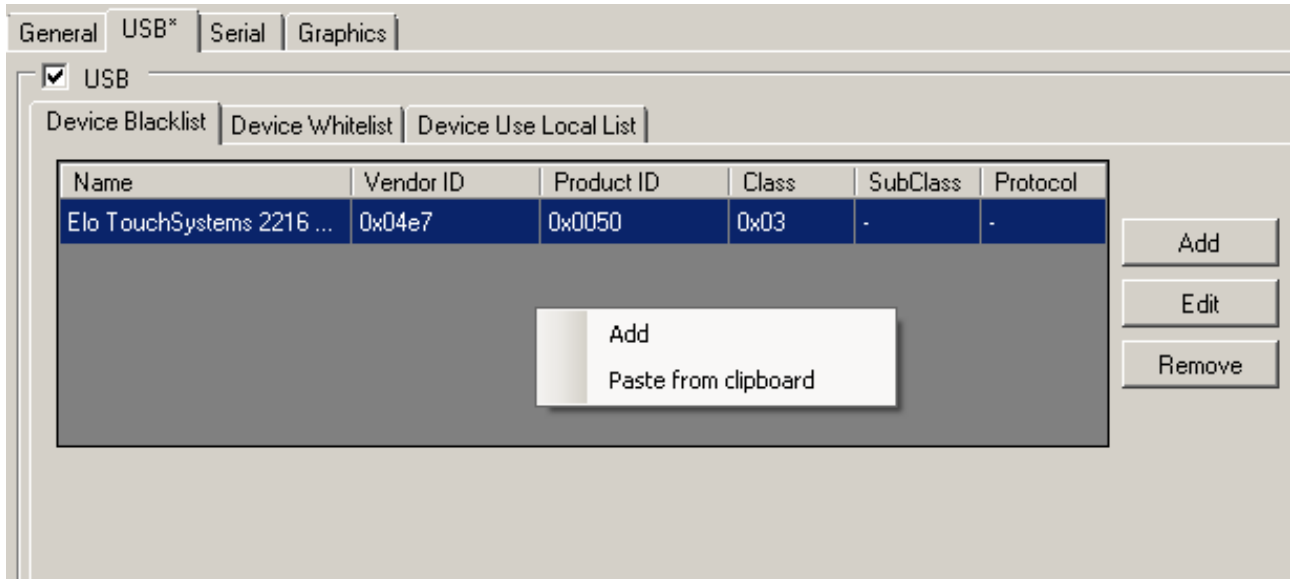
i **Notice**	**Display of device filters** If several clients were selected, the list entries are only displayed if all selected clients have the same list entries.

Editing USB device filters

The procedure for editing USB device filters is similar for all types of filter lists:

Use the *Add* or *Remove* buttons to add or remove filters for USB devices in the respective list. Click on the *Edit* button to modify existing filters. Alternatively you can use the options in the context menu to add, remove or modify filter entries. In addition, the context menu can be used to add an entry that was previously copied to the clipboard in the Client Explorer (see also chapter Client Explorer [▶ 38]).

The dialog for adding or modifying filters (*Add* or *Edit*) has the following structure:
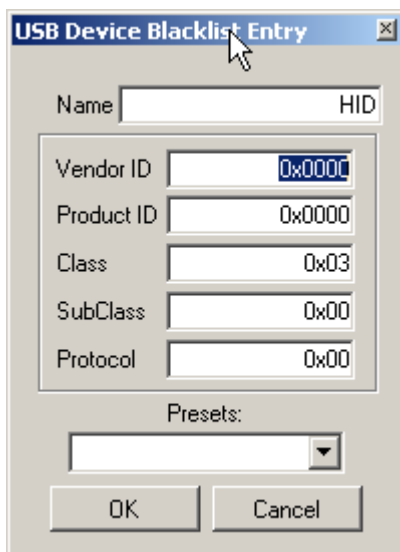
Hexadecimal notation (in which 0x can be omitted) is typically used for the entries in these fields. It is also possible to select a predefined device class (e.g. *Mass Storage*), and to enter this into the one of the lists. One option is to specify a vendor ID. In the event of an entry in the blacklist, the host PC ignores all USB devices with this vendor ID. The host PC can, similarly, ignore all devices with a defined product ID, class, subclass or protocol.

|	
i **Notice**	**Display USB device filters in the Client Explorer** The Client Explorer can be used to ascertain which device filters are configured for a certain USB device, and how the USB device can currently be used. The Client Explorer shows the current status for each USB device (see chapter Client Explorer [▶ 38]).

Editing the Device Use Local List

Up to version 1.4.x of CP-Link 3 the Device Use Local List was configured in the client device by editing the registry (see also chapter Using USB devices locally in the client [▶ 57]). From version 1.5.x of CP-Link 3 the configuration takes place from the host PC. If a client has existing entries in the Use Local List, these are shown in the tab *Device Use Local List*:
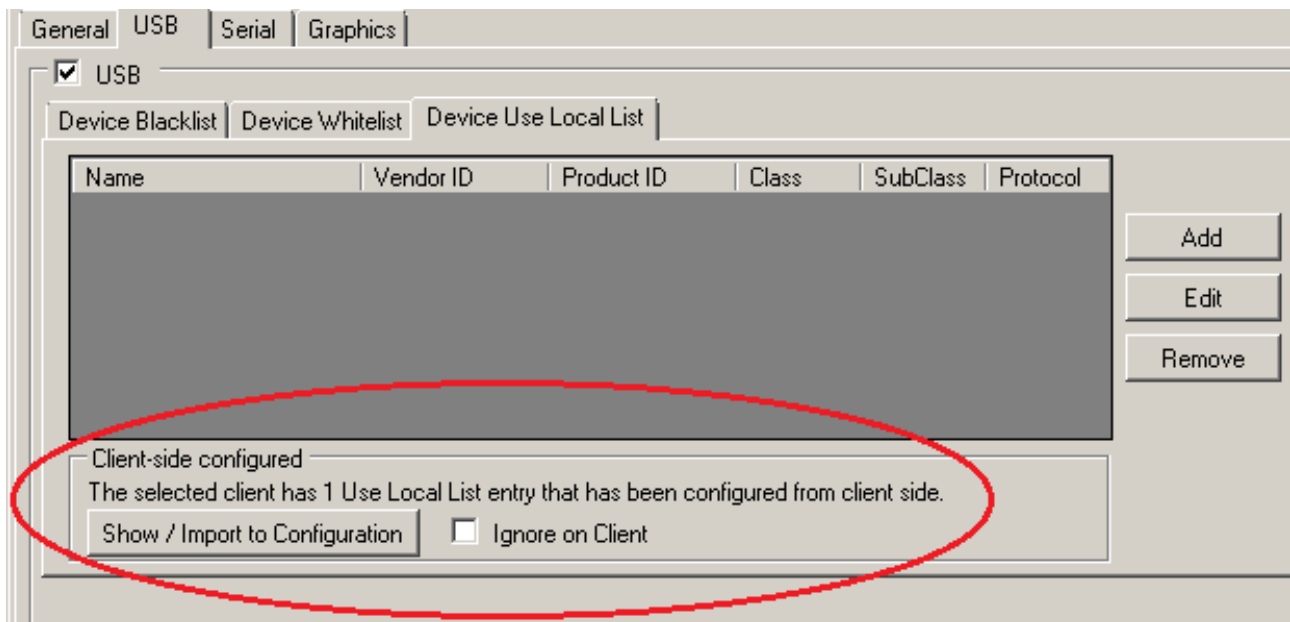
Check the selection box *Ignore on Client* to ignore the Use Local List entries configured at the client, so that only the Use Local List configured from the host PC is used.
Use the button *Show / Import to Configuration* to display the Use Local List entries configured at the client:
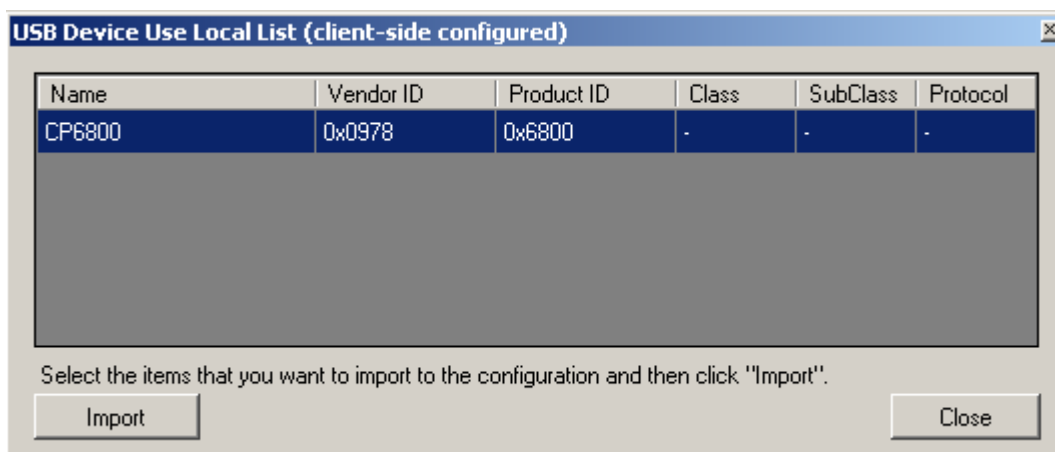
Click the *Import* button to transfer the selected Use Local List entries configured at the client into the Use Local List configured from the host PC.

4.3.3 Serial

A client's settings for the "Virtual Serial Ports" area are made on the *Serial* tab. An asterisk next to the name of the tab indicates that the settings for the "Virtual Serial Ports" section have been changed, but have not yet been activated with *Apply*.
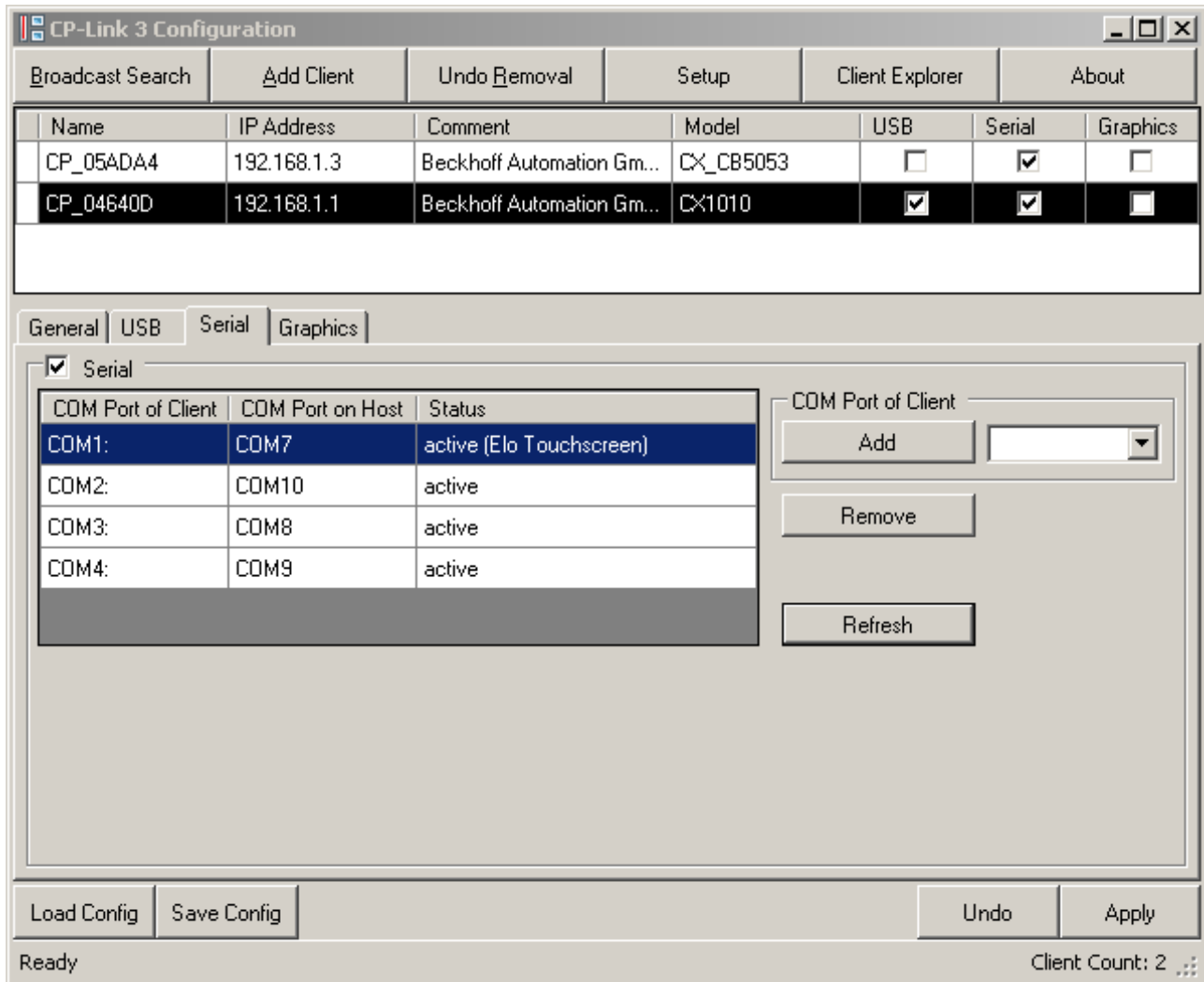
The "Virtual Serial Ports" functionality for the client can be enabled or disabled by setting or clearing the tick in the *Serial* selection box.

Under *COM Port of Client* in the selection box you can select a port name for the client and use the *Add* option to transfer it to the port list. It should be noted that only client serial ports that actually exist can be used. The currently selected entry can be deleted from the list with *Remove*.

Apply activates the configuration. The first time this is done for a client, the CP-Link 3 Remote Serial Port Enumerator is installed first, and then the CP-Link 3 Virtual COM Port driver for each virtual serial interface. In each case, the installation is done using the "Found New Hardware Wizard". The virtual interfaces only appear when the TCP/IP connection to the client is established.

The current status of the virtual serial interfaces is read and displayed in the list with *Refresh*. In particular, the list shows the correlation between the COM ports of the client (*COM Port of Client*) and the virtual COM ports on the host PC (*COM Port on Host*).

The port names are usually found at the associated device terminal. Serial devices that are connected internally, such as a serial touchscreen, are documented in the device description (e.g. a label on the rear of a Panel PC).

	COM port must be available
Notice	A virtual COM port can only be installed when a connection to the client does in fact exist and the port is available.

Elo touch panel

An Elo touch panel, connected serially, can be operated through a virtual serial interface. To this end the appropriate Elo Touch driver must be installed for the respective port. Start the installation application EloSetup.exe and follow the instructions of the installation wizard.

4.3.4　Graphics

A client's settings for the "Virtual Graphics" area are made on the *Graphics* tab. An asterisk next to the name of the tab indicates that the settings for the "Virtual Graphics" section have been changed, but have not yet been activated with *Apply*.
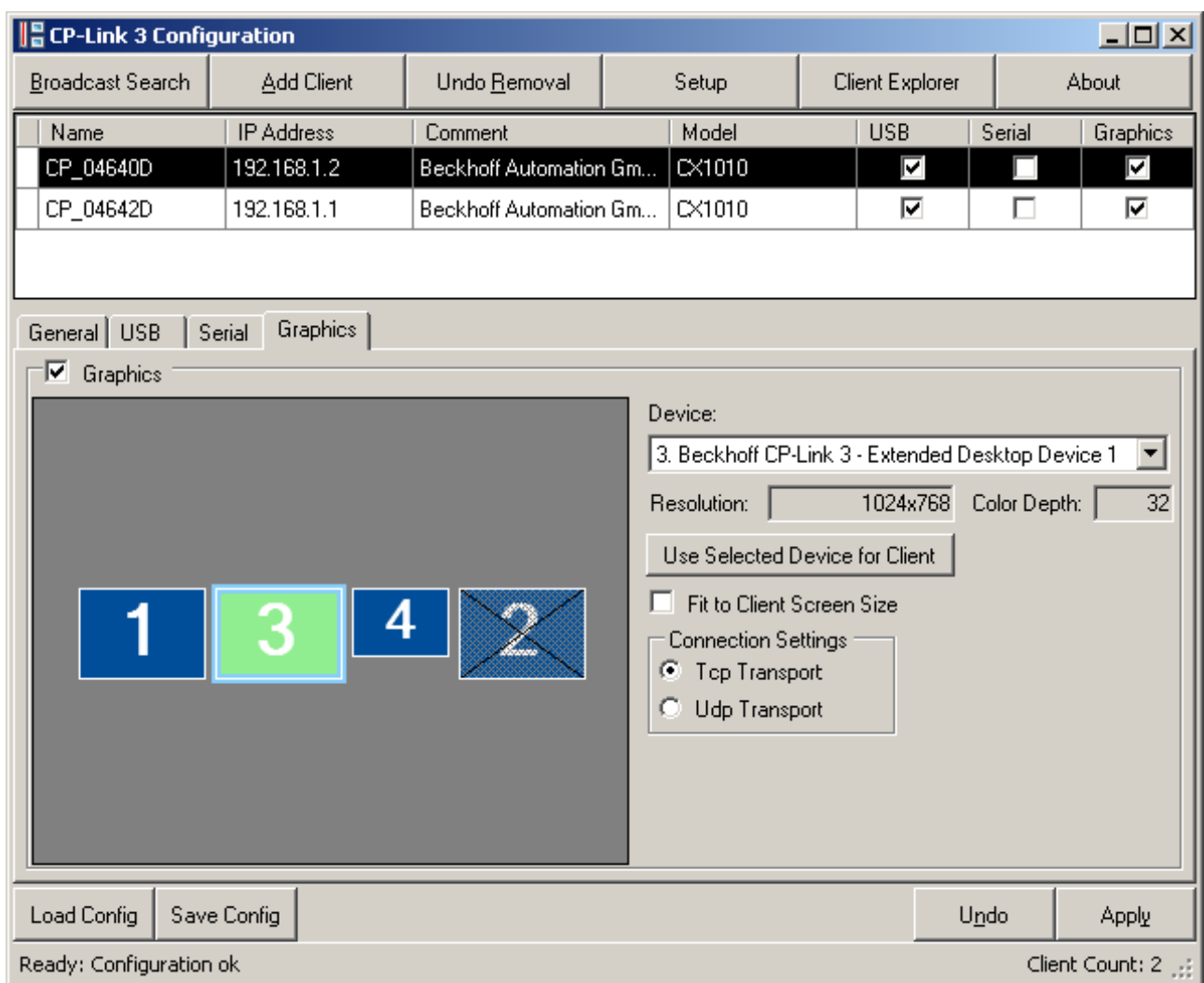
The "Virtual Graphics" functionality for the client can be enabled or disabled by setting or clearing the tick in the *Graphics* selection box.

The diagram on the left shows all the display devices available on the host PC, indicated by the monitor symbols. One of the display devices listed can be assigned to one client, which means that this client should show the screen contents of the assigned display device. The assigned display device becomes green, while all the other display devices are shown blue. If a display device is inactive, this is shown by cross-hatching. A

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monitor symbol that is crossed through indicates those display devices that can not be assigned to a client. Such devices include additional graphics cards or the second output of a dual-head graphics card, for example (see also chapter Operating principle [▷ 7]).

Assignment of a display device to a client

The display device is first selected by clicking on a monitor symbol, and this can be seen from the light blue border. Similarly, a display device can also be chosen from the selection list (*Device*) shown at the top right. The selected device can now be assigned to the client by clicking *Use Selected Device for Client* or through a right click on the selected display device. The assigned display device is emphasized in green.

i **Notice**	**Assigning the display device** The first time that the "Virtual Graphics" functionality is enabled, the first display device is automatically assigned to the client.

Resolution of the display device on the host / resolution of the client

The resolution and the colour depth for the currently selected display device are shown on the right next to the diagram. Use the *Setup* dialog for modifying these parameters, if required (See also chapter Configuration interface [▷ 19] - Setup). Under Windows XP modifications can also be implemented via the *Windows Display Settings* (see also chapter Windows Display Settings [▷ 49]).

If the resolution of an assigned display device differs from the resolution of the associated client, the display behaviour of the client can be modified by setting or clearing the tick in the *Fit to Client Screen Size* box:

- Fit to Client Screen Size not set:
  If the resolution of the assigned display device is lower than the resolution of the client, the contents of the screen are centred (with a black outline) on the client. If, on the other hand, the resolution of the assigned display device is larger than the resolution of the client, the upper left-hand portion of the screen contents are displayed on the client.

- Fit to Client Screen Size set:
  If the resolution of the assigned display device is lower than the resolution of the client, the contents of the screen are enlarged and displayed using the whole of the client's screen. If the resolution of the assigned display device is higher than the resolution of the client, the contents of the screen are shrunk and displayed using the whole of the client's screen. The settings for the resolutions of all the devices involved were not changed by this. Only the image that is to be displayed is appropriately enlarged or shrunk.

i **Notice**	**Quality of the displayed image** If the enlargement or reduction ratios are not integers, the enlargement or reduction can have negative effects on the quality of the displayed image.

Transfer protocol for graphical data - Connection Settings

The protocol used to transfer graphical data can be set separately for each client. Data transmission via TCP is preset by default. If TCP is selected, it means that the graphic data of a display device are sent separately to each client, which means the data rate is a multiple of the number of clients. If, on the other hand, data communication via UDP (UDP multicast) is selected for one or several clients, the graphic data for a display device are only sent *once* via the network, and all clients allocated to this display device, which have the option data communication via UDP set, can receive these data.

Data transmission via UDP thus has the advantage that the network bandwidth used is reduced to a minimum. A disadvantage of data transmission via UDP, as compared with data transmission via TCP, is a higher susceptibility to interference. In the event of a faulty transmission via UDP, it therefore follows that it is helpful to select TCP as the transfer protocol. Because, however, this multiplies the bandwidth used by the

number of clients, this can have a negative effect on performance. This will happen if the required bandwidth is greater than the bandwidth that is available. In cases of this sort, the performance of all the CP-Link 3 functionalities (Virtual USB, Virtual Serial Ports, Virtual Graphics) are affected.

5 Function monitoring

5.1 Client Explorer

The CP-Link 3 Client Explorer is a tool for monitoring the function of CP-Link 3. Warnings, error messages and status information of the various CP-Link 3 components are shown in Client Explorer.

The Client Explorer user interface is laid out as follows:
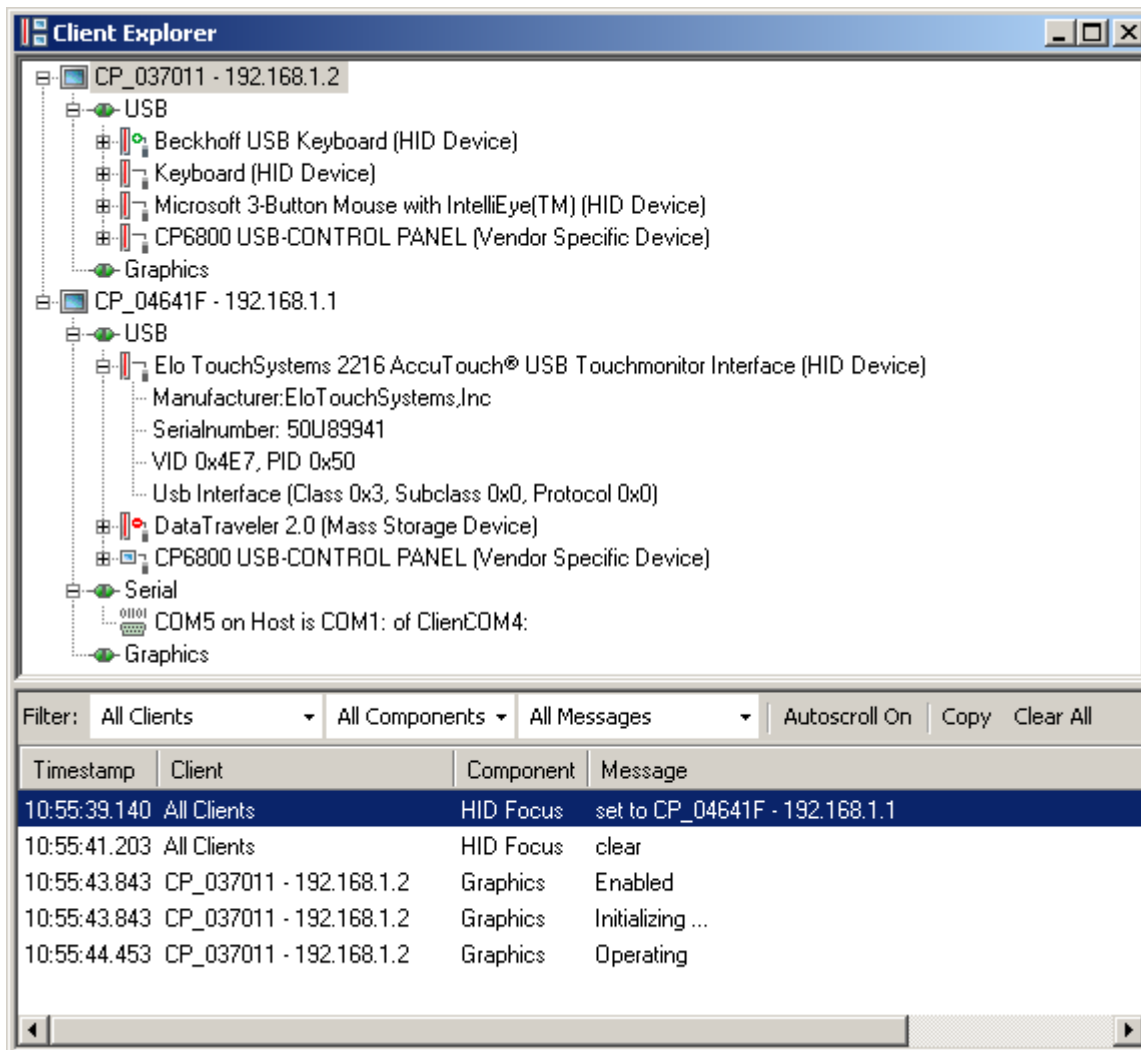
The upper section pictures a tree structure, which on one side shows the currently activated CP-Link 3 Configuration and on the other contains current status information. In the lower section is a message window in which warnings, error messages and status information is given in the form of text.

Hierarchy of the tree structure:

Each of the nodes in the **first** level corresponds to a client:

The node text contains the client's name and IP address according to the current configuration.

The nodes in the **second** level correspond to the CP-Link 3 components "Virtual USB", "Virtual Serial Ports" and "Virtual Graphics" of the client, where a node is only depicted for those components activated in the configuration. At the same time the icon of such a node gives information on the current status of the component:

- The component has no network connection. The host PC is attempting to connect to the client.- The component is in an invalid or an error state. In this case a corresponding message is shown in the message window (see below).

Network connection has been established with the component, the component is in the initialization phase.

Network connection has been made with the component and the initialization phase has been successfully completed.

Network connection has been lost with the component, the component is in the de-initialization phase.

The component has been removed from the configuration and is in the de-initialization phase.

Third level nodes contain detailed information on the corresponding component.

Nodes **underneath a USB node**: Each node represents a USB device which is plugged in at the client. The node text contains product description read from the device (if available) on one side and on the other the device class. The icon of such a node gives information on the current USB device status:

The client's USB device can be used on the host PC via "Virtual USB".

The client's USB device could be used via "Virtual USB" on the host PC, the usage is however blocked by the host PC configuration. There is a matching entry for this device in the USB Device Blacklist (see also the USB Device Filter Lists [▶ 48]).

The client's USB device can be used on the host PC via "Virtual USB", there is a matching entry for this device in the USB Device Blacklist as well as in the USB Device Whitelist (see also the USB Device Filter Lists [▶ 48]).

The client's USB device cannot be used on the host PC via "Virtual USB", as the device is being used locally on the client. There is a matching entry for this device in the USB Device Use Local List (see also the USB Device Filter Lists [▶ 48]).

Each USB device node has further sub-nodes which contain detailed information (manufacturer, serial number, etc.) on the USB device.

Right clicking a USB device opens a context menu with which you can add the selected device to one of the USB device filter lists of the configuration (see also the Client Configuration [▶ 27] section or the USB Device Filter Lists [▶ 48] section):
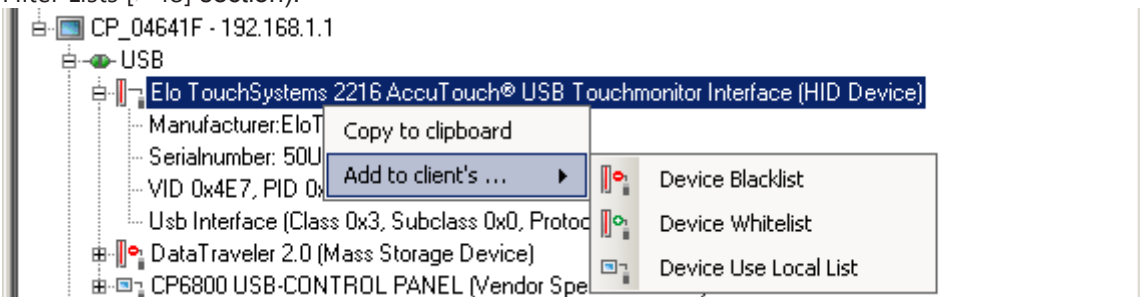
If you copy the device information into the clipboard (*Copy to clipboard*) you can paste the copied information in the configuration window in order to create a device filter entry (see also the Client Configuration [▶ 27] section - Edit USB device filters).

If the node represents a USB Bus Coupler, one of its sub-nodes indicates the Coupler's device number. Depending on the type of the Bus Coupler, the device number can also be changed. The device number can be changed for all Bus Couplers of the type CPx8xx. Right clicking the device number sub-node opens a context menu with which you can open the dialog for changing the device number.
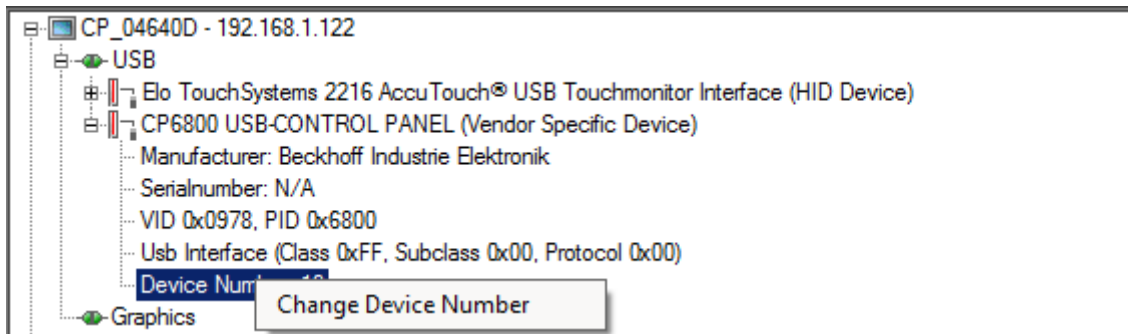
In the dialog the device number can be edited. The new value is transmitted by clicking the "Change" button. By clicking the "Cancel" button the process can be canceled.

The USB Bus Coupler-Number can alternatively be changed with the TwinCAT System Manager (see also the Using the CPx8xx USB Bus Coupler [▶ 57]-Section).

Nodes **underneath a serial node**: Each node represents a serial interface of the client which can be used on the host PC via "Virtual Serial Ports".
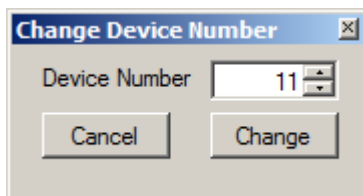
The node text contains the name of the virtual serial interface created on the host PC and the name of the corresponding client's serial interface.

The message window:

In the message window status information and error messages are shown sorted by time. Each entry has a field for the timestamp, a field for the client to whom the message does apply, a field for the component of the corresponding client and a field for the message itself. Error messages are highlighted in red.

Right clicking on the header of the output field opens a menu which is used to choose which components of the messages should be shown or not shown.
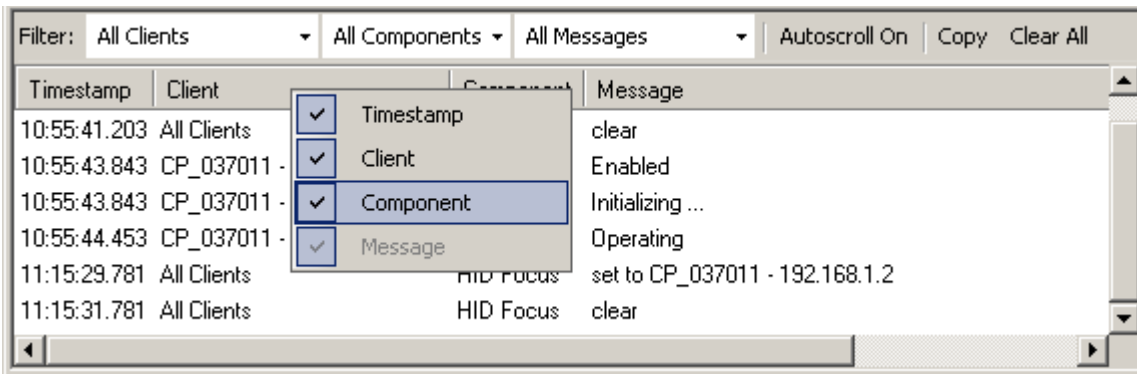
Above the output field are several selection boxes which allow different filters to be defined. These filters determine which messages are shown or not shown in the output field. Filtering can be done using any combination of the following criteria:

- Filtering on messages of certain clients: Depending on the selection either the messages of all clients (*All Clients*) or the messages of the clients selected in the tree structure (*Only Selected Client*) are shown. By default the messages of all clients are shown.
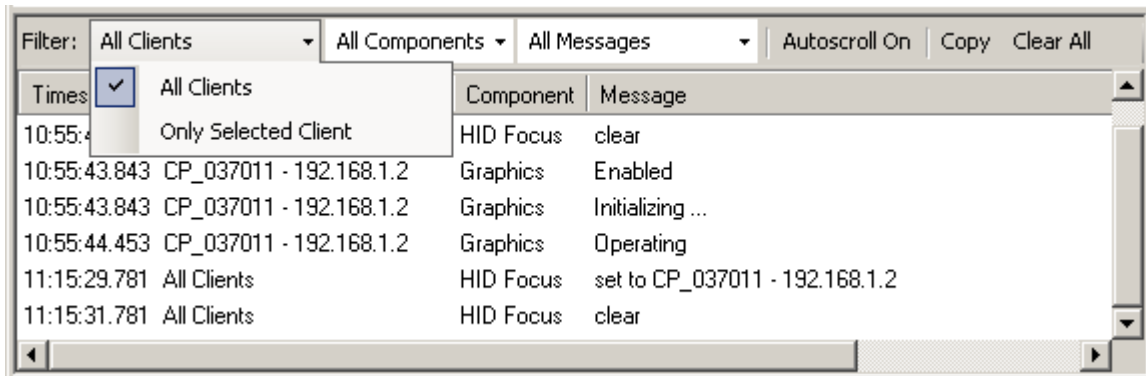
- Filtering on messages of certain components: The messages of the selected components are shown. By default the messages of all components are shown.
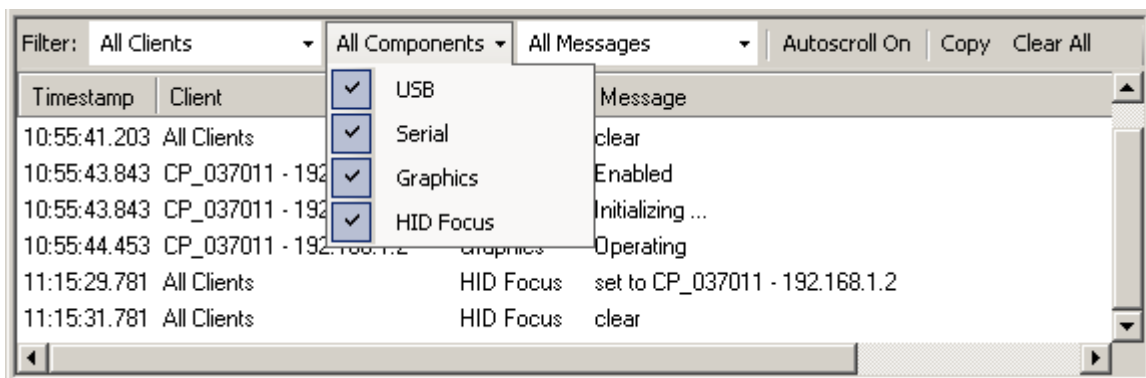
- Filtering on messages of certain type: Depending on selection either all messages (error and info messages) or only error messages are shown. By default all messages are shown.
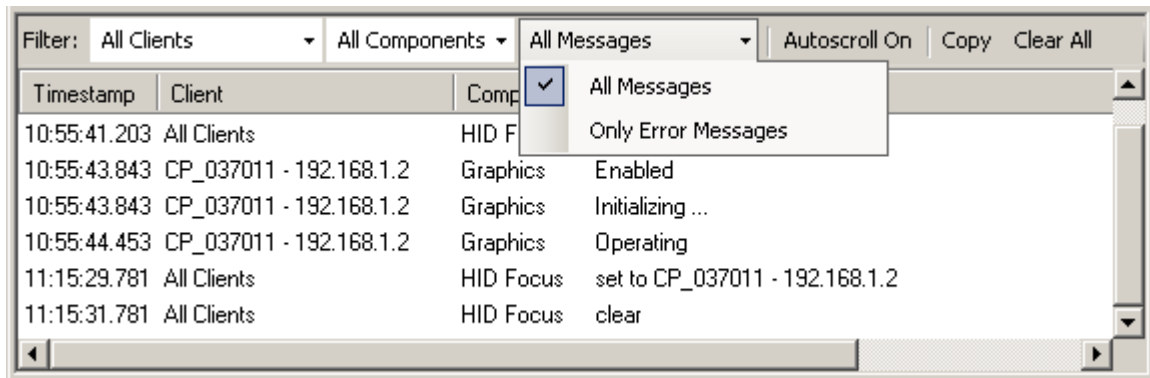
There are further buttons on the right next to the selection boxes for the message filters:

- Autoscroll On/Off - If *Autoscroll On* is selected and a new entry is inserted into the message window, the contents of the window are scrolled so that the new message appears in the visible part of the message window. If *Autoscroll Off* is selected, automatic scrolling is turned off, in other words the contents of the window are not scrolled for a new entry.
- Copy - All marked messages are copied into the clipboard.
- Clear All - All messages are deleted.

6   Network

6.1   Network Topology

Concerning the usage of CP-Link 3 please note the following:

- It is recommended to use a separate network for CP-Link 3.
- The PCs used in the network have to be connected together using tree structure, i.e. clients are connected to the host PC either directly or via one or several switches. Ring structures, bus structures or serial structures (daisy chaining) are not possible.
- The maximum length of the network cable between two PCs or switches is 100 m.
- If a host PC uses the USB Bus Couplers built into the clients via RT-Ethernet, it might be necessary to use a separate network for RT Ethernet (see also Using the CPx8xx USB Bus Coupler [▶ 57]).
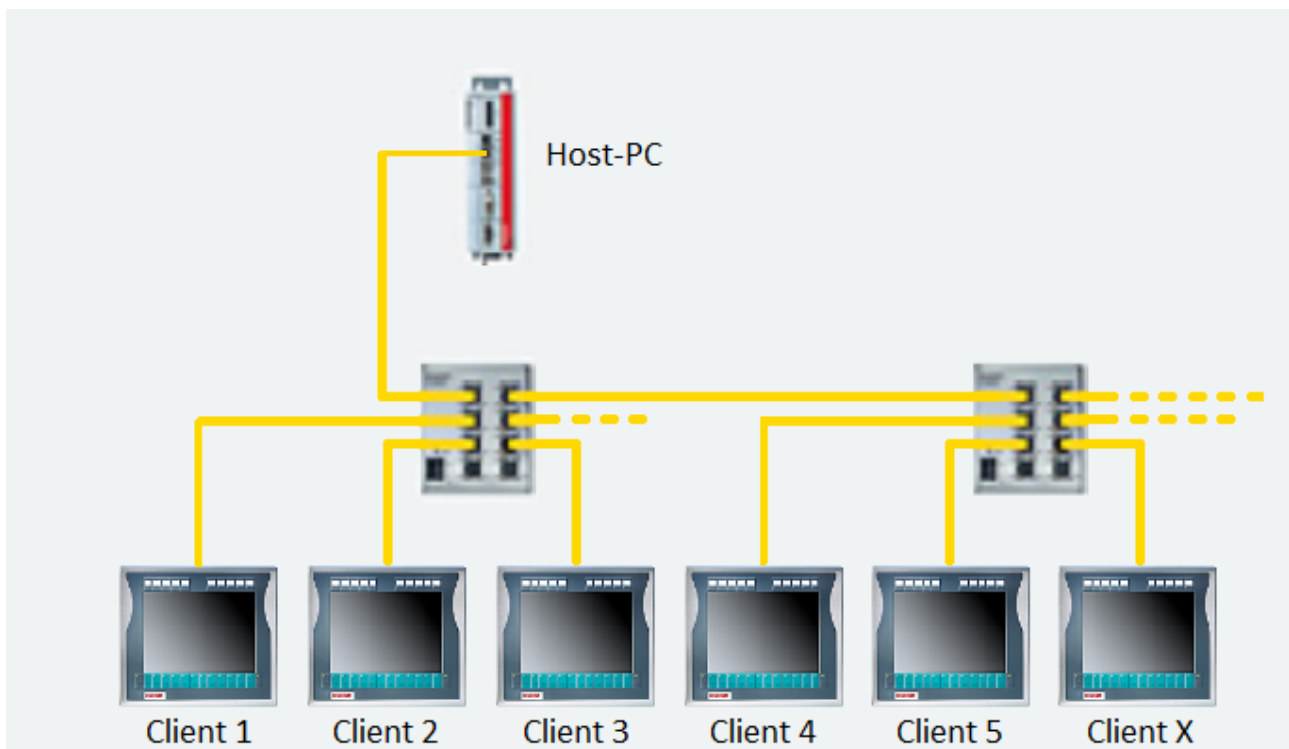
6.2   Configuration of RT Ethernet devices

By installing the special TwinCAT Intel PCI Ethernet Adapter driver, a network adapter is turned into an RT Ethernet adapter. Installation is done with the TwinCAT System Manager using the "Options|Show Real Time Ethernet Compatible Devices ..." dialog.

i **Notice**	**CP-Link 3 and RT Ethernet** If the same network adapter is used for CP-Link 3 as for RT Ethernet under certain conditions this can lead to connection losses (see Comments [▶ 73] chapter or Troubleshooting [▶ 74]). In addition, graphical data must be sent over TCP/IP, since the client's RT Ethernet adapters do not accept UDP Multicast packets (also see Client Configuration [▶ 27]).

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Adding an RT Ethernet device to the I/O Configuration

An RT Ethernet device can be added to the I/O Configuration with "Append Device". On the *Adapter* tab the RT device is associated with an RT Ethernet adapter. The cycle time of the RT Ethernet device is specified indirectly through linking the DevState variable with a task variable. The cycle time of the task then defines the cycle time for the RT Ethernet device.

The following illustration shows an I/O Configuration for a host PC with one RT Ethernet device:
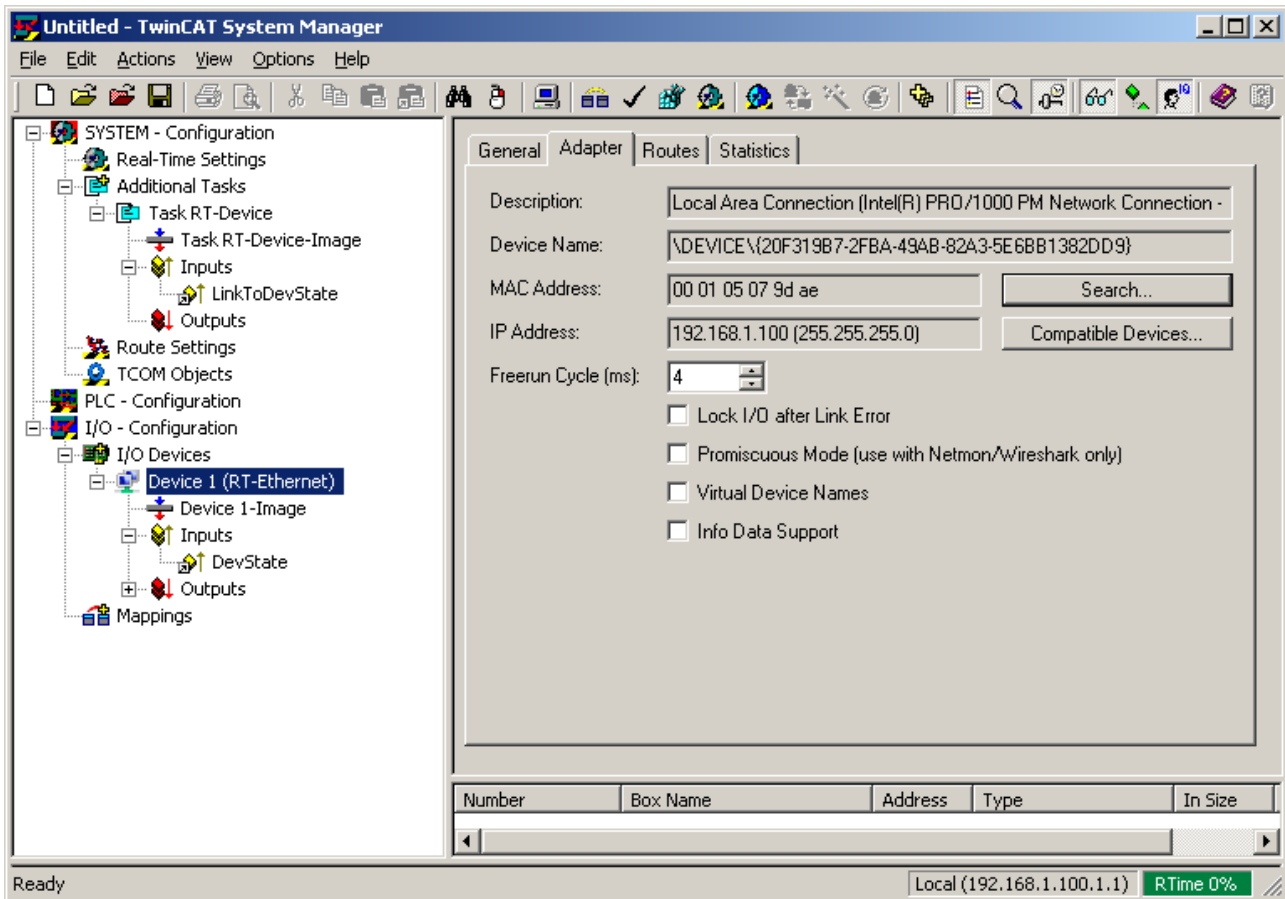
The following illustration shows an I/O Configuration for a client with one RT Ethernet device:

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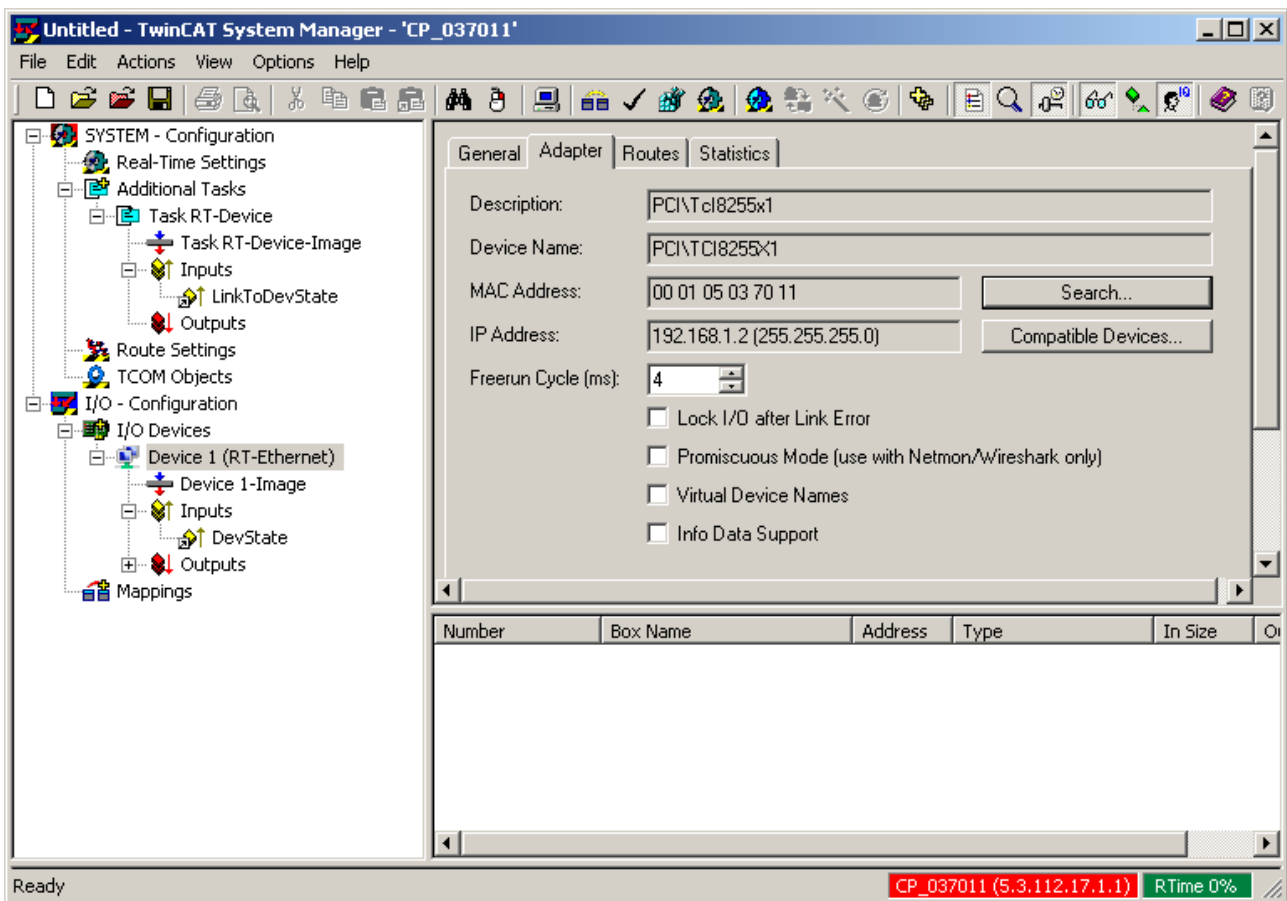
Routing configuration of RT Ethernet devices

On the *Routes* tab it is necessary for the routing to be switched on. The NetIds of both the host PC's and client's RT Ethernet devices respectively are entered in the "Routes" tables.

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The NetID of the client RT Ethernet adapter is added to the host PC "Routes" table:
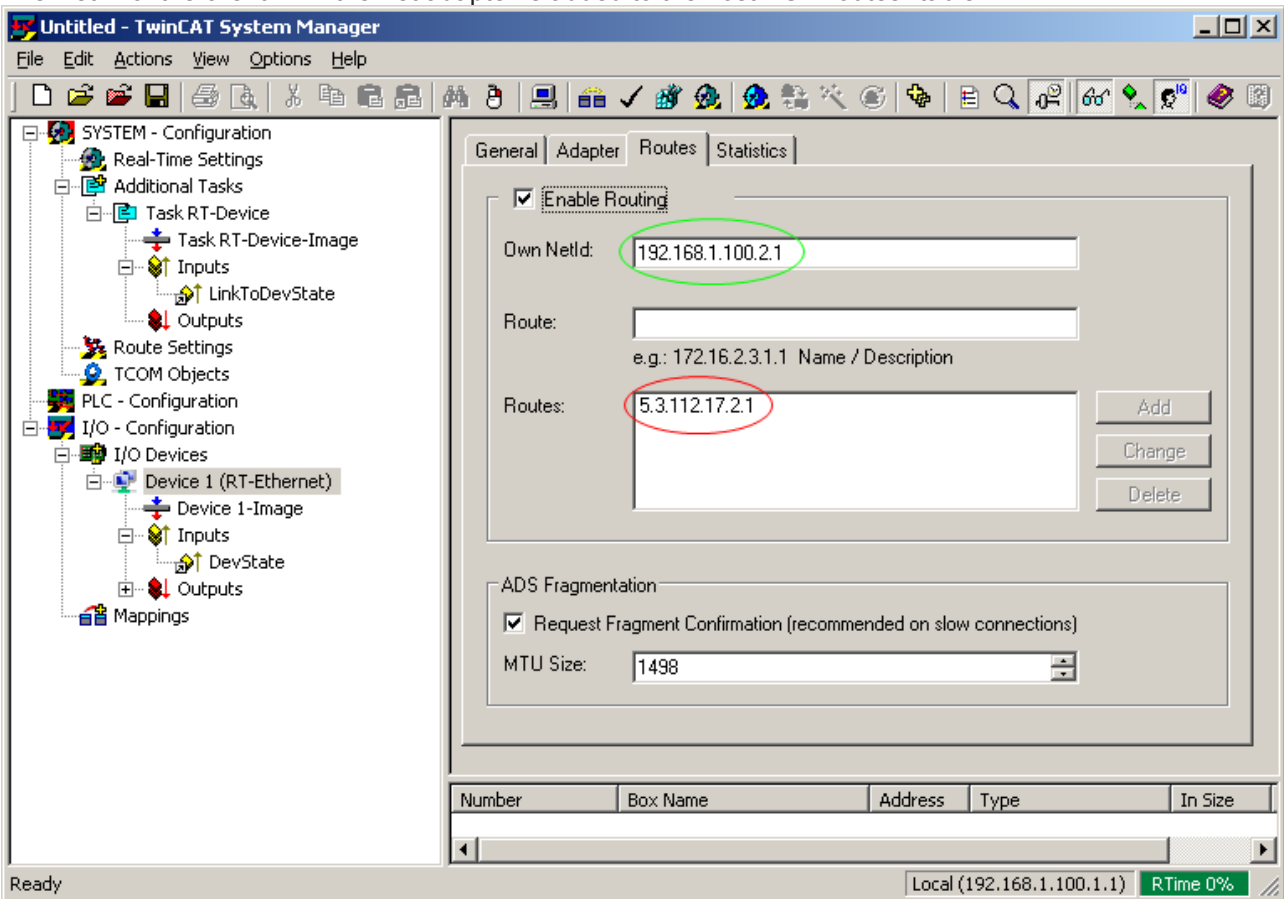
The NetId of the host PC RT Ethernet adapter is added to the client "Routes" table:
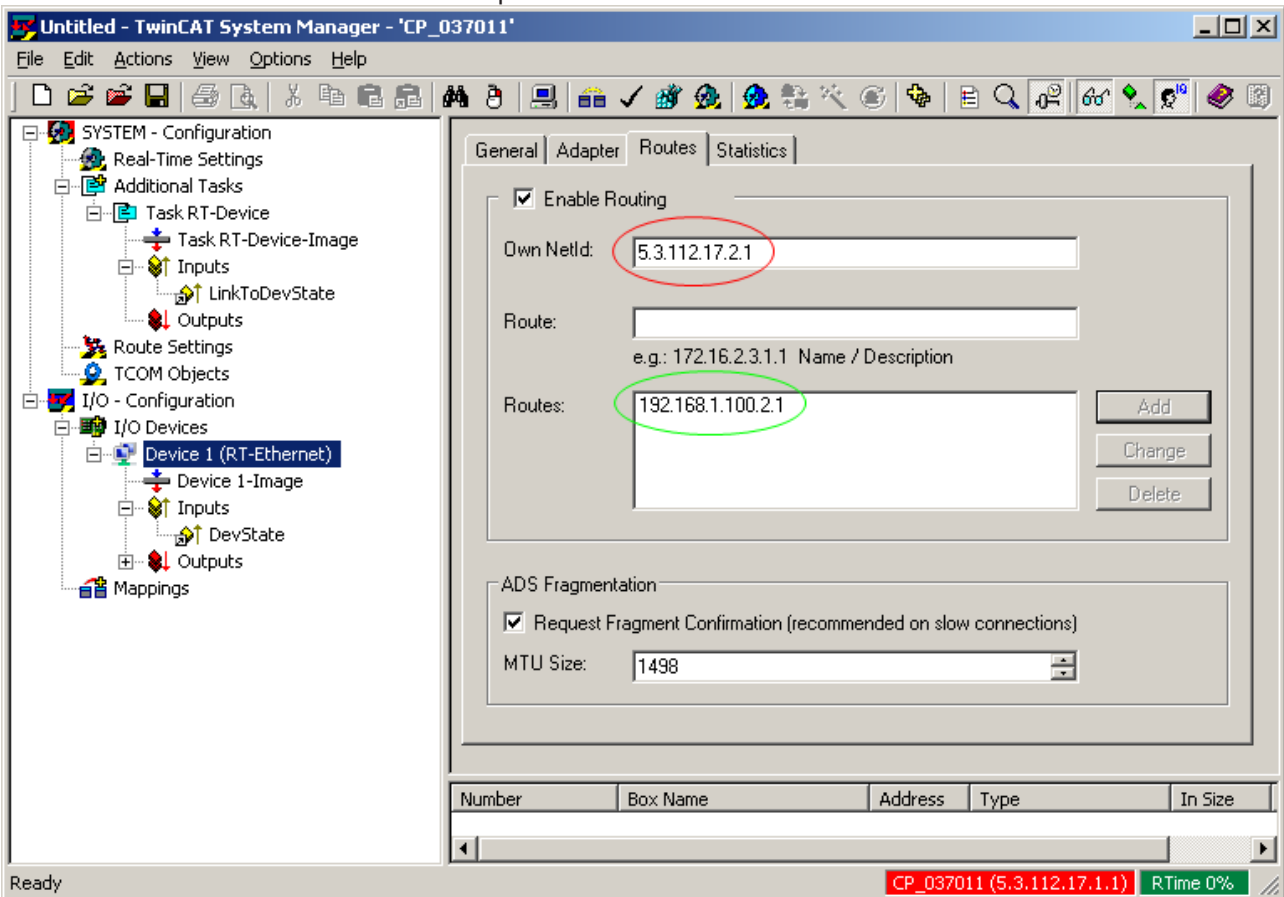
6.3   Firewall Configuration

For the data transmission of CP-Link 3 participants over the network, some firewall rules have to be configured for an active firewall in order to allow the CP-Link 3 participants to communicate through the firewall. The setup program for the CP-Link 3 Software configures these firewall rules during installation.

The following table shows the firewall rules for CP-Link 3 Clients:

Component	Direction	Port (decimal)	Protocol	Action
"Virtual-Graphics"	Incoming	60000	UDP	Allow
"Virtual-Graphics"	Incoming	60001	TCP	Allow
"Virtual-Graphics"	Incoming	60002	TCP	Allow
"Virtual-USB"	Incoming	60308	TCP	Allow
"Virtual-Serial Ports"	Incoming	60309	TCP	Allow
UPnP Network Discovery	Incoming	2869	TCP	Allow

7 Miscellaneous

7.1 USB Device Filter Lists

For each client, USB device filter lists can be configured: Blacklist, Whitelist and Use Local List (see also chapter Client configuration [▶ 27]). Each entry in these lists represents a certain group on USB devices.

Device Blacklist

USB devices with a corresponding entry in the device blacklist are ignored by the host PC.
If "Virtual-USB" is activated and an entry exists in the blacklist for a USB device of the client, the device is not connected to the host PC via "Virtual-USB". In this case, the USB device cannot be used on the host PC or the client.

Device Whitelist

A corresponding entry in the device whitelist cancels a blacklist entry. Such a USB device is not ignored by host PC, even if a blacklist entry exists for the device.
If "Virtual-USB" is activated and entries exist for the USB device of the client both in the blacklist and in the whitelist, the whitelist entry cancels the blacklist entry. In other words, the USB device is connected to the host PC, despite the entry in the blacklist. In this way it is possible to block a certain group of USB devices, e.g. all HIDs (Human Input Devices), while allowing a certain subgroup of the blocked devices, e.g. keyboards.

Device Use Local List

USB devices with a corresponding entry in the Device Use Local List are used locally at the client.
If "Virtual-USB" is activated and a corresponding entry exists in the Use Local List for a USB device of the client, the device is not connected to the host PC via "Virtual-USB" but can be used locally at the client.

Action

For each USB device connected to a client, the device filter lists described above are used as follows:
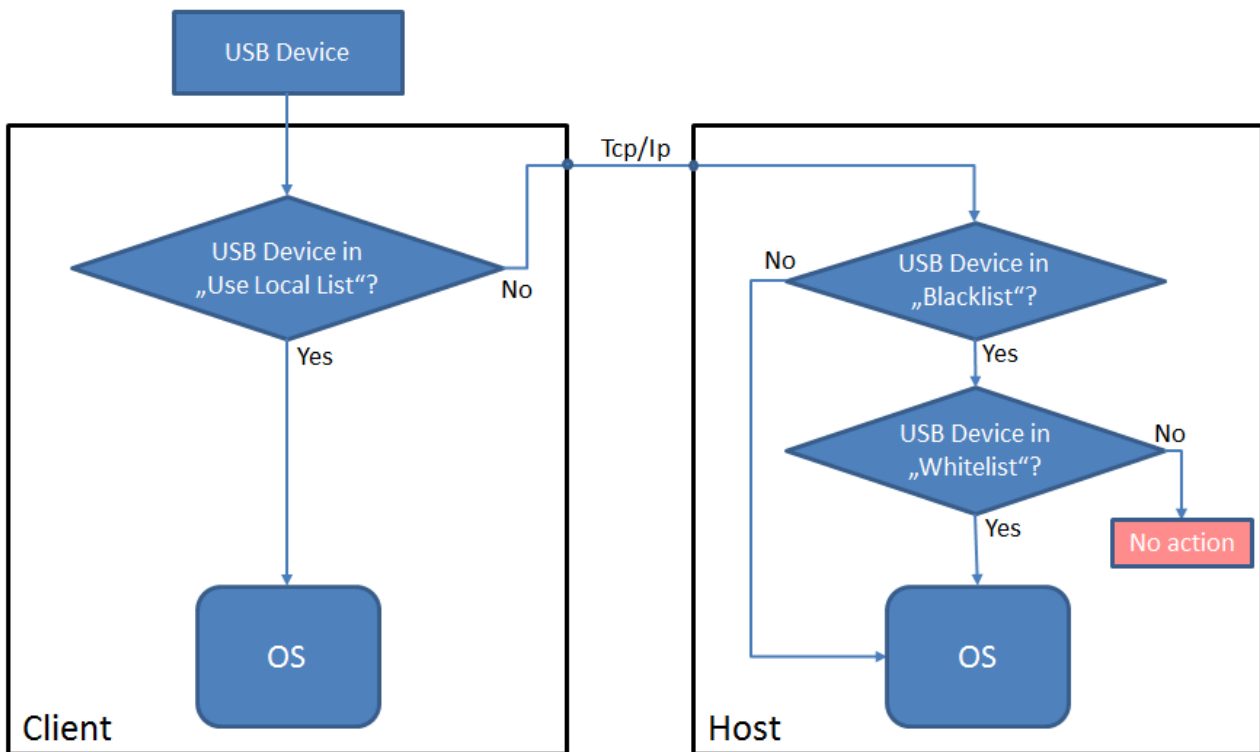
- **Device Use Local List**
  The Use Local List is used at the client itself. If a suitable entry exists for the USB device, the operating system of the client is notified about the device, so that it can be used locally at the client. If no suitable entry exists for the USB device in the Use Local List, the device is connected to the host PC via "Virtual-USB".

- **Device Blacklist**
  If no entry exists for the USB device in the Use Local List, the blacklist is used initially. If no suitable entry exists for the USB device in the blacklist, the operating system of the host PC is notified about the device, so that it can be used at the host PC. If, on the other hand, a suitable entry does exist in the blacklist, the operating system of the host PC is not notified of the USB device, and the device whitelist is used.

- **Device Whitelist**
  If an entry exists for the USB device in the blacklist, the operating system of the host PC is not notified of the device, and the whitelist is used. If a suitable entry exists for the USB device in the whitelist, the operating system of the host PC is notified of the device, irrespective of the entry in the blacklist. In other words, the whitelist entry cancels the blacklist entry, and the device can be used at the host PC. If no suitable entry exists for the USB device in the whitelist, the operating system of the host PC is not notified of the device. In this case, the device can be used neither at the host PC or at the client.

i **Notice**	**USB device filters are displayed in the Client Explorer** The Client Explorer can be used to check which device filters are configured for a certain USB device, and how the USB device can currently be used. For each USB device the Client Explorer displays the current status (see chapter Client Explorer [▶ 38]).

7.2   Windows Display Settings (XP)

The Windows dialog for configuring the display settings can be started through the desktop context menu or through the control panel. The resolution, color depth, position and so on for all the display devices can be set here. The settings for the CP-Link 3 display devices are also made through this dialog.

BECKHOFF

	Changing display settings under Windows 7
i **Notice**	Starting with Windows 7 changes to the display settings of CP-Link 3 - Extended Desktop Devices are to be done through the Setup Dialog (see also the Configuration interface section [▶ 19] - Setup).
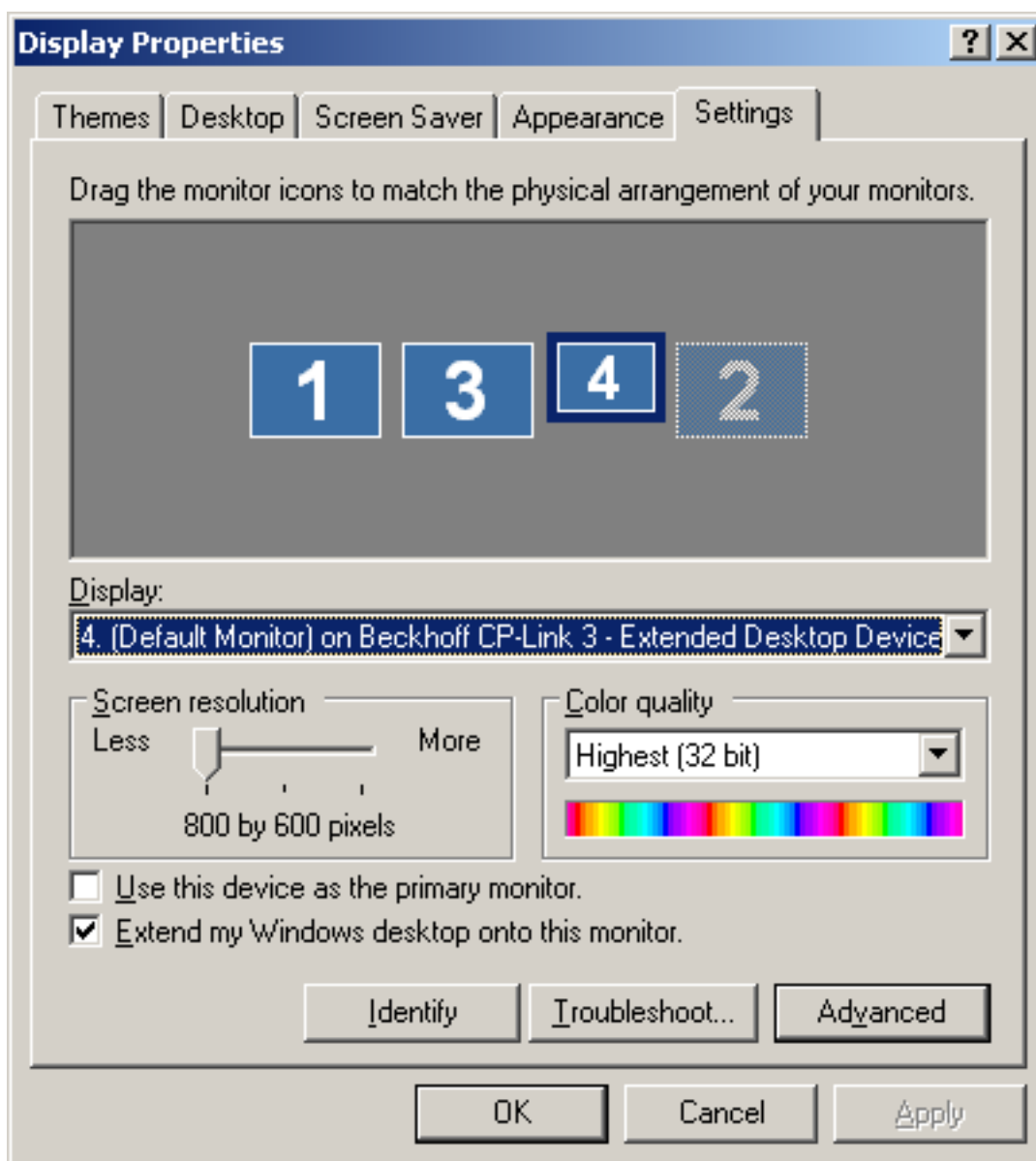
The display device is selected by clicking on the corresponding monitor symbol, and this can be seen from the border. The settings for the selected display device can now be modified in the lower part of this dialog.

Setting special resolutions

Resolutions of less than 800 x 600 pixels are not catered for under Windows as standard, and are therefore only possible indirectly. Setting a resolution of 640 x 480 pixels is shown here as an example:
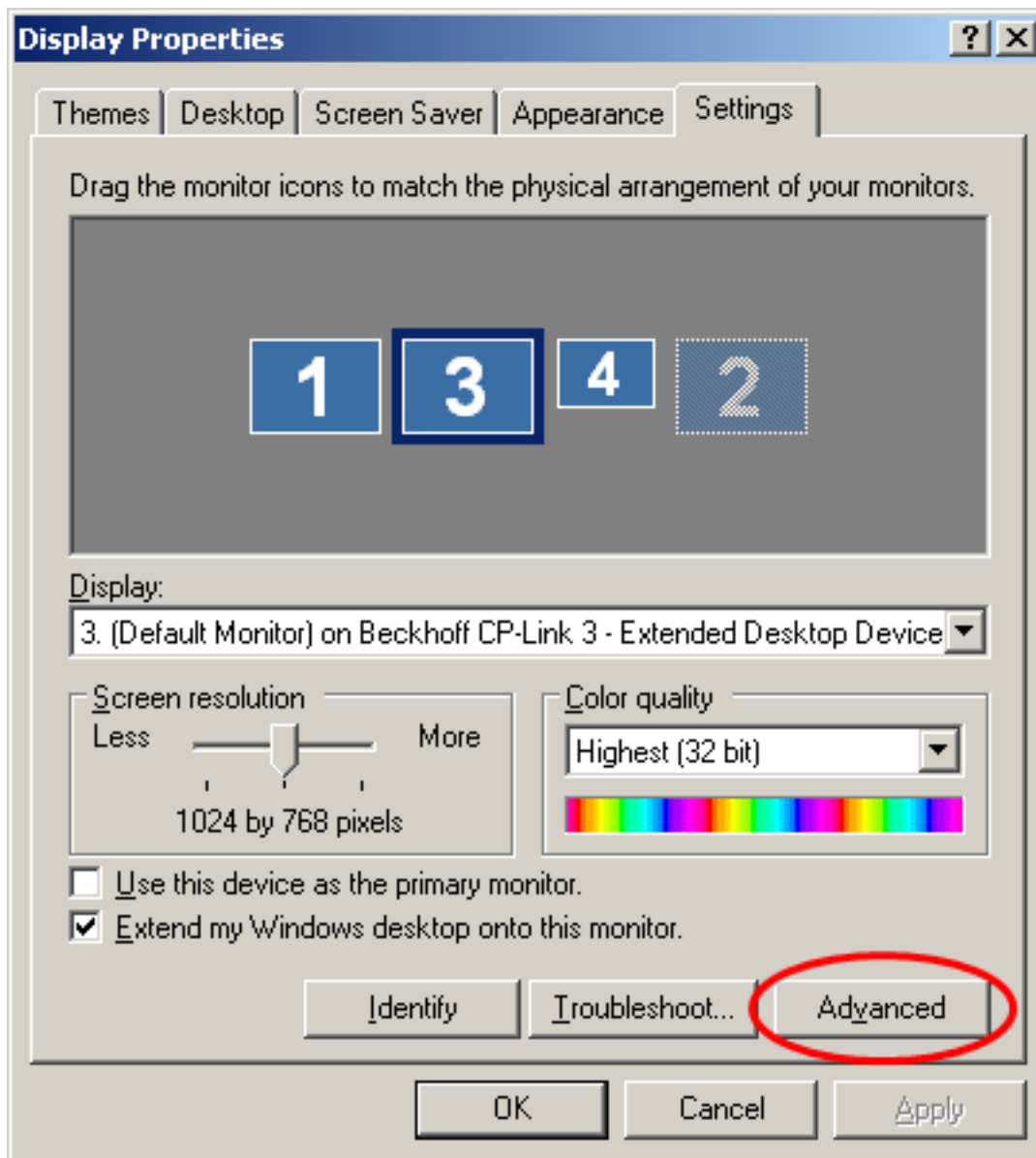
After clicking the *Advanced* button, a new window opens with the extended graphics settings:

BECKHOFF
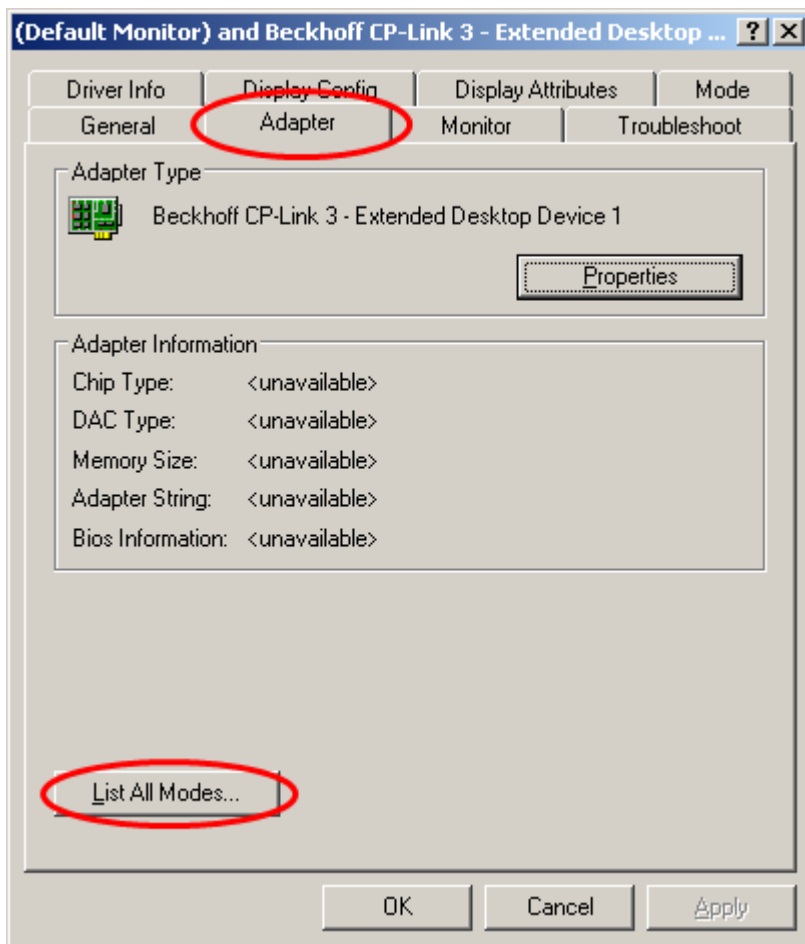
If you now click the *List All Modes* button on the *Adapter* tab, all the modes supported by the adapter are listed:
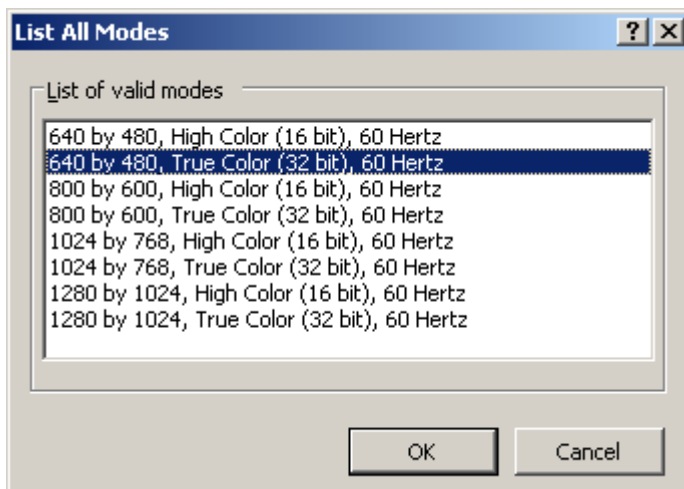
After choosing the desired resolution, it is applied by confirming with *OK*.

DirectX / OpenGL

DirectX and OpenGL are not supported.

7.3 CP-Link 3 Shell Extension

The CP-Link 3 Shell Extension extends the desktop context menu. The additional context menu entry makes it possible to move windows that are displayed on another desktop, and which therefore are not visible, onto your own desktop.

The Desktop context menu is opened by right clicking the desktop:
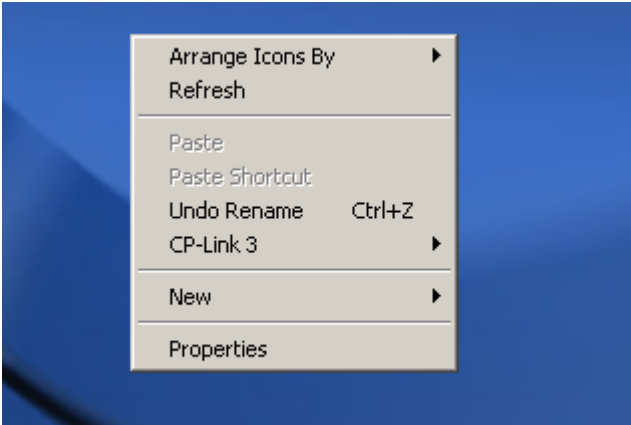
If the mouse is pulled to the CP-Link 3 entry, a window opens showing a list of all the open windows currently displayed on the host computer.
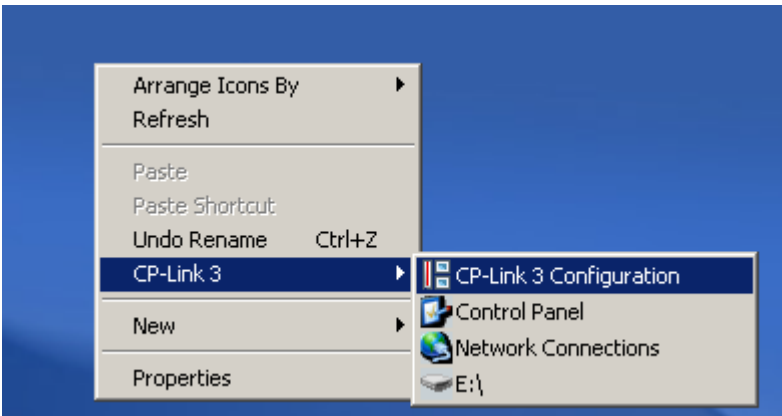
If one particular window is now selected by clicking the mouse, it will be moved onto the desktop from which the desktop context menu was called.

7.4 Set the HID focus manually

A description of how the HID focus can be set manually follows (see also Client Configuration [▶ 27] - HID-Focus).

	Basic knowledge required
i **Notice**	Setting the HID focus manually presupposes basic knowledge of how to use the TwinCAT system.

The following illustration shows schematically the host PC components involved in setting the HID Focus manually:
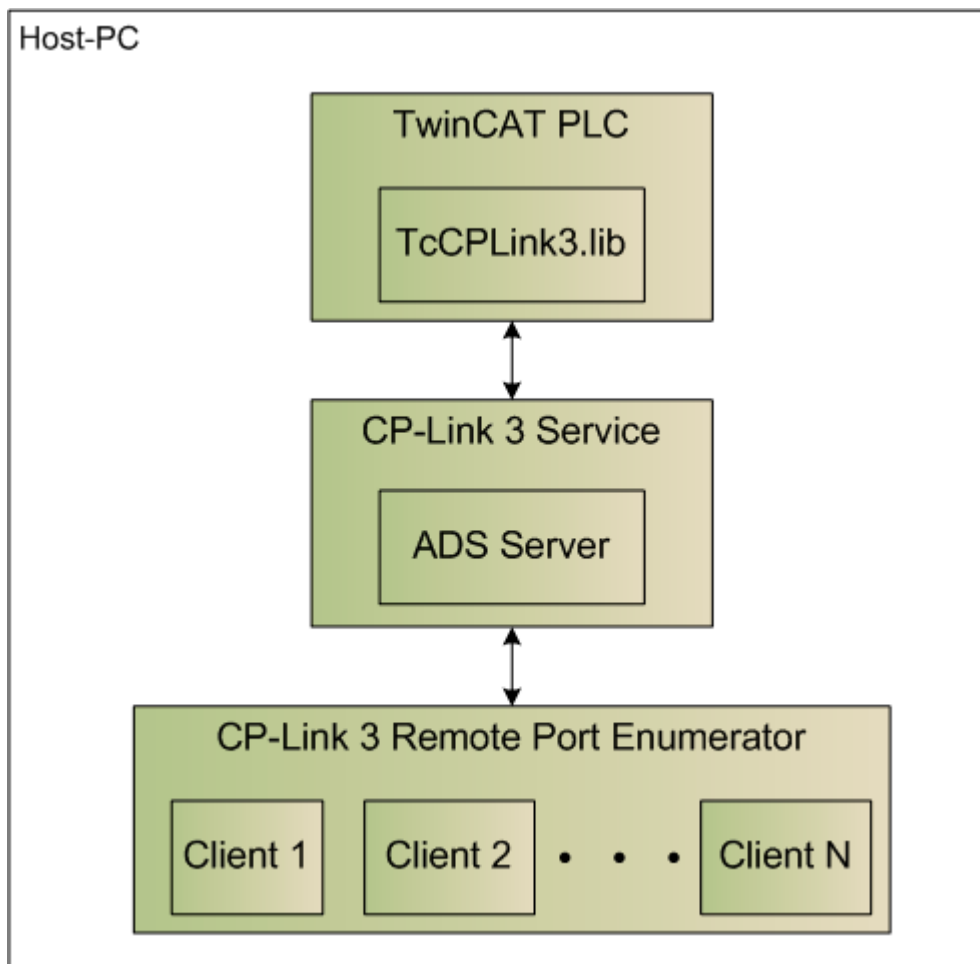
The driver for the "CP-Link 3 Remote Port Enumerator" has an interface through which the HID focus can be set to a specific client. The HID focus can also be reset through this interface. The driver's interface is indirectly accessible via ADS, i.e. through an ADS server that is implemented in the "CP-Link 3 Service". The interface can therefore be used from the TwinCAT PLC as well. Use is simplified by a PLC library. The PLC library contains the FB_CPLink3_AcquireHidFocus function block, which is used to set the HID-Focus to a specific client. The corresponding example program illustrates how the FB_CPLink3_AcquireHidFocusfunction block can be used. Both the example program and the library are placed, when CP-Link 3 is installed, in the program directory in subfolder Plc (for TwinCAT 2: TcCPLink3.lib and CplHidFocusSelect.pro, for TwinCAT 3: Tc2_CPLink3.compiled-library and CplHidFocusSelect.tpzip).

ℹ️ **Notice**	**Configuration of Clients** Setting the HID Focus manually is only possible for clients which are configured for HID Focus "Manual" (see also Client Configuration [▶ 27] - HID-Focus).

ℹ️ **Notice**	**CP-Link 3 Service** Settings the HID Focus manually is only possible if the CP-Link 3 Service [▶ 56] is running (see also CP-Link 3 Service).

Example Program: Controlling the HID focus through special keys

Manually setting the HID focus can, for instance, be controlled by a clients special key. The special key is linked to the corresponding input variable in the PLC program through the TwinCAT System Manager. An instance of FB_CPLink3_AcquireHidFocus is generated for each client, and configured with the client's IP address. After the special key at a client is pressed, where the rising edge will be detected by the R_TRIG function block, the PLC program will attempt to set the HID focus through the corresponding instance of

FB_CPLink3_AcquireHidFocus. The function block can, in addition, control an output (e.g. a LED) that indicates whether the HID focus has successfully been set, or whether it is still attempting to obtain the focus. Pressing the special key again resets the HID focus.

The three instances of the FB_CPLink3_AcquireHidFocus function block use the hFocus variable to exchange information between each other. This is used, for instance, to ensure that only the instance that has successfully set the HID focus is able to reset it.

The PLC program for three clients looks like this:

```
PROGRAM MAIN

VAR

button1 AT%IX0.0 : BOOL;
button2 AT%IX0.1 : BOOL;
button3 AT%IX0.2 : BOOL;


led1 AT%QX0.0 : BOOL;
led2 AT%QX0.1 : BOOL;
led3 AT%QX0.2 : BOOL;


hFocus : T_HCPLink3HidFocus;
fbPanel1 : FB_CPLink3_AcquireHidFocus := ( setIP := '192.168.1.1' );
fbPanel2 : FB_CPLink3_AcquireHidFocus := ( setIP := '192.168.1.2' );
fbPanel3 : FB_CPLink3_AcquireHidFocus := ( setIP := '192.168.1.3' );


trigger1 : R_TRIG;
trigger2 : R_TRIG;
trigger3 : R_TRIG;

END_VAR
```

```
(* Panel 1 *)
trigger1( CLK := button1 );
IF trigger1.Q THEN
fbPanel1.bEnable := NOT fbPanel1.bEnable;
END_IF
fbPanel1( hFocus:= hFocus, bLED=>LED1);

(* Panel 2 *)
trigger2( CLK := button2 );
IF trigger2.Q THEN
fbPanel2.bEnable := NOT fbPanel2.bEnable;
END_IF
fbPanel2( hFocus:= hFocus, bLED=>LED2 );

(* Panel 3 *)
trigger3( CLK := button3 );
IF trigger3.Q THEN
fbPanel3.bEnable := NOT fbPanel3.bEnable;
END_IF
fbPanel3( hFocus:= hFocus, bLED=>LED3 );
```

CP-Link 3 ADS Interface

The CP-Link 3 ADS server can be reached through AMS port 19300. One function is implemented at present:

AdsWrite

SetHidFocus
IndexGroup: 0x10000
IndexOffset: IP Address in network byte order or 0 to clear HID-Focus

Possible ADS return values:
ADSERR_DEVICE_INVALID_STATE - CP-Link 3 Remote Port Enumerator returned that command was not valid
ADSERR_DEVICE_NOT_FOUND - CP-Link 3 Remote Port Enumerator not installed
ADSERR_DEVICE_ERROR - CP-Link 3 Remote Port Enumerator returned an error
ADSERR_DEVICE_BUSY - HID-Focus was not set as another client has the focus
ADSERR_NOERR - HID-Focus was set to given client

7.5 CP-Link 3 Service

The CP-Link 3 Service provides an ADS interface for setting the HID-Focus manually (also see Set the HID focus manually [▶ 53]). Starting with CP-Link 3 Version 1.3.xx the CP-Link 3 Service is implemented as TwinCAT Server, in earlier versions as Windows Service application.

CP-Link 3 Service as TwinCAT Server (Starting with CP-Link 3 Version 1.3.xx)

- If you install CP-Link 3 on a PC with an already installed TwinCAT, the CP-Link 3 Service is registered as TwinCAT Server during the installation automatically.
- If you however install TwinCAT on a PC with an already installed CP-Link 3, you need to register the CP-Link 3 Service as TwinCAT Server manually.

i **Notice**	**Register CP-Link 3 Service as TwinCAT Server manually** If you install TwinCAT on a PC with an already installed CP-Link 3, the CP-Link 3 Service has to be registered as TwinCAT Server subsequently. This requires the TwinCAT System to be stopped. Open a command-line window and navigate to the subfolder Services in the CP-Link 3 program directory, e.g. "C:\Program Files\Beckhoff\CP-Link 3\Services". Now type "CPLink3Service.exe /RegTcServer" into the command-line to register the CP-Link 3 Service as TwinCAT Server. A window is displayed giving status information about the registration result.

You can use the *TwinCAT Storage Editor* to verify that the CP-Link 3 Service is registered as TwinCAT Server.

CP-Link 3 Service as Windows Service application (up to CP-Link 3 Version 1.2.xx)

During the installation of CP-Link 3 the CP-Link 3 Service is registered and started as Windows Service application automatically.

i **Notice**	**Verify status, modify properties** A list to manage Windows Service applications can be opened via the start menu Start -> Control Panel -> Administrative Tools -> Services. The status of the CP-Link 3 Service should be "Started" and the startup type should be "Automatic". If not, configure the service according to the mentioned criteria. In case the CP-Link 3 Service is not in the list of services, it has to be registered as Windows Service application manually. Open a command-line window and navigate to the subfolder Services in the CP-Link 3 program directory, e.g. C:\Program Files\Beckhoff\CP-Link 3\Services". Now type "CPLink3Service.exe /RegServer" and then "CPLink3Service.exe /service" into the command-line. Refresh the view of the services window. The CP-Link 3 Service should be in the list of services now. Maybe you need to modify the properties of the service to match the criteria mentioned above.

7.6 Using USB devices locally on the client

It may be necessary to use certain USB devices always locally on the client. This is configured using the so-called *Device Use Local List*. The Device Use Local List is a list of filters. Each entry in the Use Local List is a filter representing a specific group of USB devices which are to be used locally by the client (see also the USB Device Filter Lists [▶ 48] section).

<table>
<tr><td>**i**
Notice</td><td>**Starting with Version 1.5.x of CP-Link 3 the configuration of the Use Local List is done on the host PC**

Up to version 1.4.x of CP-Link 3 the Device Use Local List has been configured by editing the registry on the client itself. Starting with Version 1.5.x of CP-Link 3 the configuration is done on the host PC (see also the Client Configuration [▶ 27] section)</td></tr>
</table>

Adding devices to the Device Use Local List (up to Version 1.4.x of CP-Link 3)

The *Device Use Local :ist* is stored in the registry of the client under the key HKEY_LOCAL_MACHINE \SOFTWARE\Beckhoff\CP-Link 3\UsbDeviceServer\UseLocalList. Under this key the *nListEntryCount* value gives the number of list entries. For each entry in the list a sub-key is created, the name of which is its eight-character hexadecimal index (zero-based). In each subkey a filter can be defined using the "VendorId", "ProductId", "InterfaceClass", "InterfaceSubClass" and "InterfaceProtocol" values, which represents a group of USB devices.

Here for example, is a list with one entry which represents all USB mass storage devices.

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Beckhoff\CP-Link 3\UsbDeviceServer\UseLocalList]
"nListEntryCount" = dword:00000001


[HKEY_LOCAL_MACHINE\SOFTWARE\Beckhoff\CP-Link 3\UsbDeviceServer\UseLocalList\00000000]
"Name" = "Mass Storage"
"VendorId" = dword:00000000
"ProductId" = dword:00000000
"InterfaceClass" = dword:00000008
"InterfaceSubClass" = dword:00000000
"InterfaceProtocol" = dword:00000000
```

<table>
<tr><td>**i**
Notice</td><td>**Example registry files**

Some examples are stored in the program directory of the host PC in the CE\Regfiles sub-folder. From Version 1.1.19 the example registry files are also copied to the client by the CAB file installation. They are in the "\Hard Disk\Regfiles\Samples\CP-Link 3" directory. The values from a registry file can be transferred to the registry by double-clicking on the file in Windows CE Explorer.</td></tr>
</table>

Removing devices from the *Device Use Local List* (up to Version 1.4.x of CP-Link 3)

If an entry should be removed from the *Device Use Local List*, the corresponding subkey must be removed from the registry first. In addition the *nListEntryCount* value must be modified and it must be ensured that the remaining subkeys for the list entries beginning with 00000000 (eight-digit hexadecimal zero) are continuously numbered in ascending numerical order.

7.7 Using the CPx8xx USB Bus Coupler

Bus Couplers of type CPx8xx are integrated into Beckhoff Panel PCs. Various different I/O terminals are connected through these Bus Couplers. In addition to the standard I/O channels of a Panel PC, further I/O terminals can be connected through which, for instance, special keys, LEDs, rotary switches or similar items can be operated. When a Panel PC is used as a CP Link 3 client there are different options for accessing the client's integrated USB Bus Coupler from the host PC:

- Using via the CP-Link 3 Virtual USB hub [▶ 59]
- Access via "Virtual USB interface (Remote)" [▶ 61]
    - via standard Ethernet
    - via RT Ethernet
- Access via network variables (RT Ethernet) [▶ 63]
- Access via ADS to task or PLC variables linked to the local client [▶ 68]
    - via standard Ethernet
    - via RT Ethernet

The differences between the different varieties is explained in the following table:

	Bus Coupler logically connected with		I/O access from		RT Ethernet	Configuration effort	Release of outputs possible (see explanation underneath the table)
	Host PC	Client PC	Host PC	Client PC			
1	X		X			low	Yes
2.a		X	X			low-medium	Yes
2.b		X	X		X	medium	No
3		X		X	X	medium-high	No
4.a		X		X		high	No
4.b		X		X	X	high	No

Possible release of the USB Bus Coupler outputs:

The USB Bus Coupler built-in to the client expects a certain time interval, in which it receives data to write to its outputs. In the standard configuration of a CPx8xxx Bus Coupler this time interval is 100 ms. If this time interval cannot be met, the outputs of the Bus Coupler are released. Depending on the usage type of the USB Bus Coupler, in practice under certain conditions, the time interval may not be met and the outputs of the Bus Coupler released. Generally, this seldom if ever happens, but cannot be ruled out altogether. Reasons for this are the type of network connection of the Bus Coupler integrated into the client to the host PC or the operating system architecture of the host PC. If the I/O access of the host PC takes place via a standard Ethernet connection, during data exchange with the Bus Coupler, a lot of small data packets per cycle must be sent consecutively over the IP connection. Depending on the network load and the client CPU load sending of these packets can take longer than the time interval defined.

To be certain that these outputs are not released under any circumstances, I/O access from the host must be implemented by RT Ethernet, or the I/O access must take place on the client PC itself. If I/O access takes place on the client itself this does however increase the configuration effort as the inputs and outputs of the Bus Coupler cannot be used directly on the host PC, but must be made available by ADS or network variables.

i **Notice**	**CP Link 3 and RT Ethernet** If the same network adapter is used for CP Link 3 as for RT Ethernet, RT Ethernet affects the data throughput of CP Link 3. Depending on cycle time of the real-time task this effect can be so large that the performance of CP Link 3 is substantially reduced. Furthermore, when using CP Link 3 via RT Ethernet adapter under certain conditions it can lead to connection losses (see chapter on Comments [▶ 73], or alternatively Help with faults [▶ 74]). In addition, TCP/IP must be selected as transfer protocol for graphic data, since the RT Ethernet adapters of the clients do not accept UDP multicast packages (See also Client configuration [▶ 27]). In some cases it may therefore be advisable to use a separate network adapter for RT Ethernet.

Cycle time for the data exchange with the Bus Coupler

The recommended cycle time for the data exchange with the terminals of a USB Bus Coupler is 50 to 80 milliseconds. The following options are available for ensuring compliance of the cycle time during data exchange with the Bus Coupler:

- Tasks with variables that are linked with the I/O channels of the Bus Coupler are configured with a cycle time of more than 50 milliseconds.

- Tasks with variables that are linked with the I/O channels of the Bus Coupler may be configured with a cycle time of less than 50 milliseconds, although in this case it is necessary to activate the so-called *Async Mode* for the Bus Coupler:
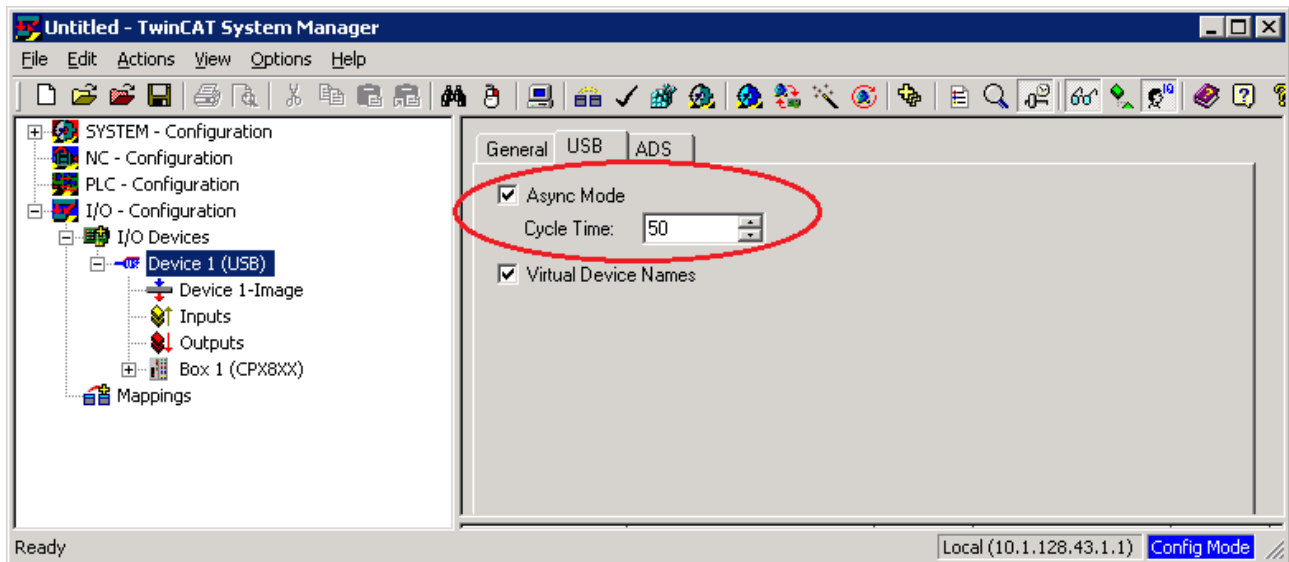

Also see about this

📄 Configuration of RT Ethernet devices [▶ 43]

7.7.1 Using via the CP-Link 3 Virtual USB hub

In this case, the host PC sees the CPx8xx Bus Coupler connected locally to the computer. For that reason it can also be addressed and configured through the System Manager. Data can be exchanged with the Bus Coupler within a cycle time of between 50 ms and 80 ms. The procedure is to generate a task with the corresponding cycle time, either in the TwinCAT PLC or directly in the TwinCAT System Manager, and to link at least one variable of this task with a variable from the I/O channels of the Bus Coupler (see also Cycle time for data exchange [▶ 59]).

Device number of the USB Bus Coupler

If a number of Bus Couplers are connected to the host PC, the user must ensure that different numbers are assigned to the Bus Couplers. On delivery the Bus Couplers integrated in Panel PCs have the number 0. If two Bus Coupler with the same number are connected, the TwinCAT System Manager can only detect one of the two Bus Couplers. In the TwinCAT System Manager, the "Dip switch" value to the right of the "Change to" button can be changed in the Box Parameters on the "BK95xx/CPx8xx" tab. The value is transmitted to the Bus Coupler by clicking the button. The new box number is recognized when the configuration is scanned again.
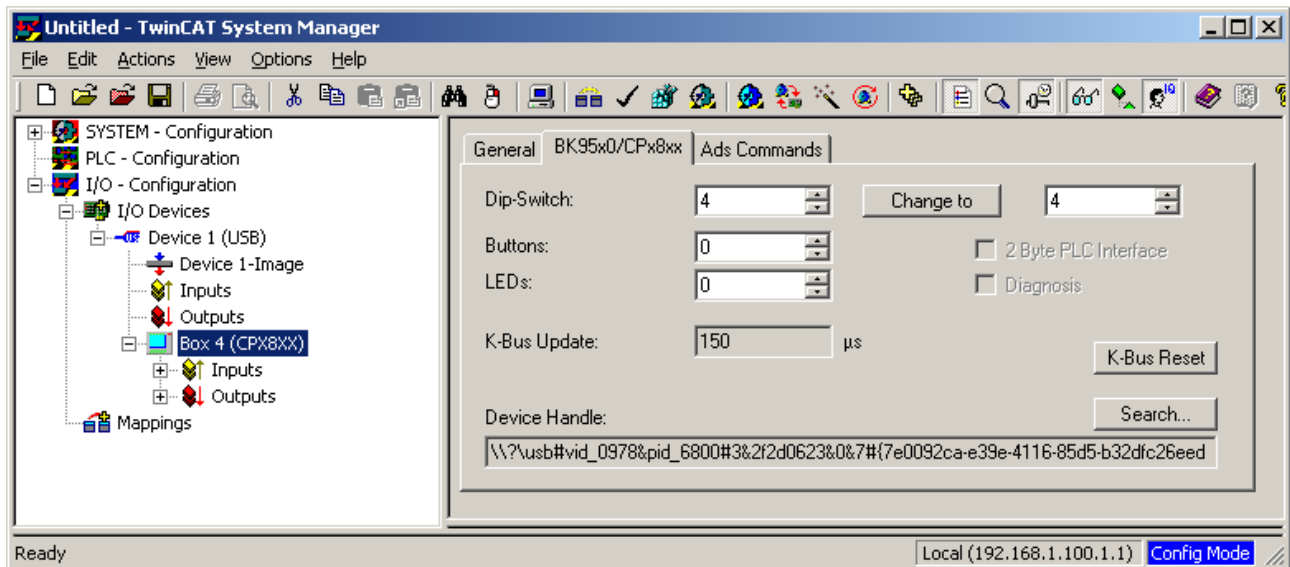
Alternatively, the Bus Coupler number can be written via the Client Explorer of CP-Link 3 (see chapter Client Explorer [▸ 38]).

Device Handle of the USB Bus Coupler

By default *Device Handle* of a USB Bus Coupler is a name generated by the operating system. When using a USB Bus Coupler via CP Link 3 Virtual USB Hub under certain conditions (e.g. after disconnection and re-connection of the network connection) this name may be changed. In this case the System Manager configuration must be updated.
To avoid this effect from the start the *Virtual Device Names* option can be activated. In this way on the basis of the device number of the Bus Coupler a unique, virtual device name is created as *Device Handle*:
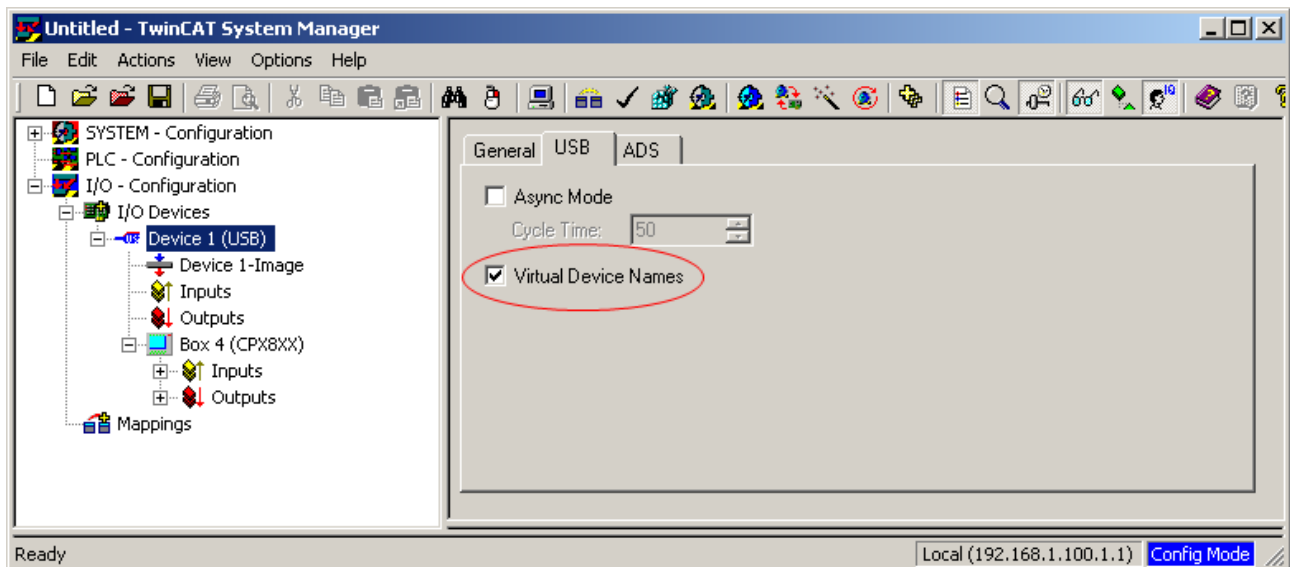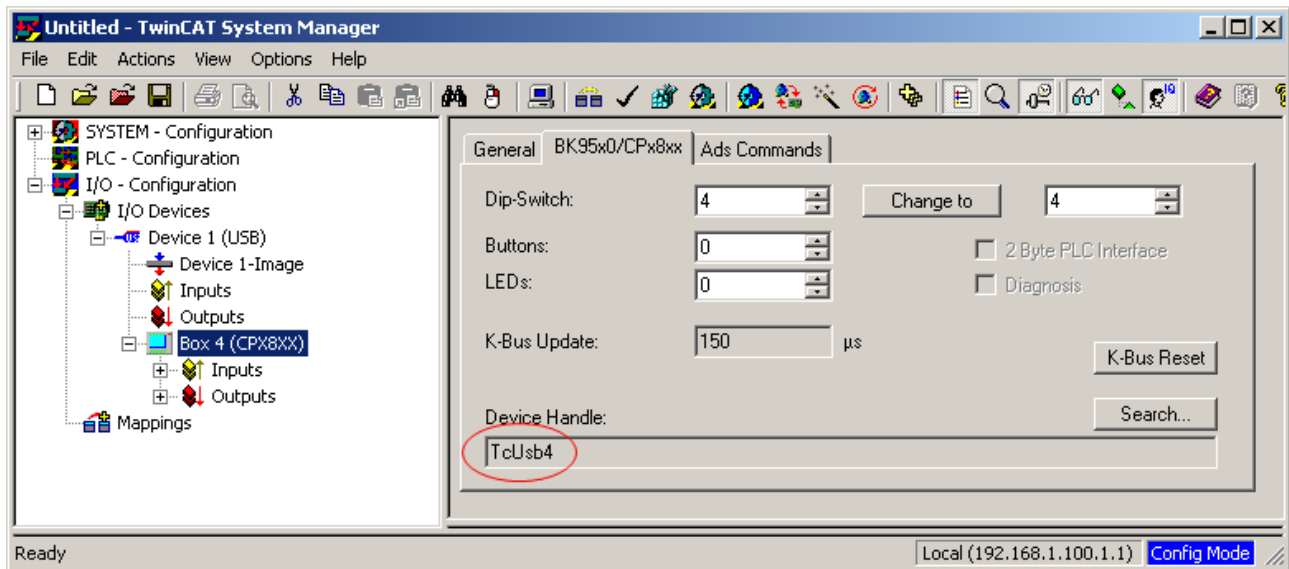
7.7.2 Access via "Virtual USB interface (Remote)"

In this case, the CPx8xx Bus Coupler is linked into the client as a local USB device. The CP Link 3 USB device server on the client is configured accordingly via a "Use Local List" (also see Using USB devices locally on the client [▶ 57]). The access from host PC to the I/O channels of the Bus Coupler does not then run over the CP Link 3 Virtual USB Hub but rather over ADS directly with the Bus Coupler driver on the client. The advantage here is that less data packets have to be sent over the network connection in each cycle. For this reason, the standard Ethernet timeout of 100 ms is practically never exceeded with this method. Here again, however, it is not possible in theory to exclude the possibility that the time required to send the data packets will become too long. If communication takes place via RT Ethernet the data exchange is carried out deterministically and the outputs cannot release.
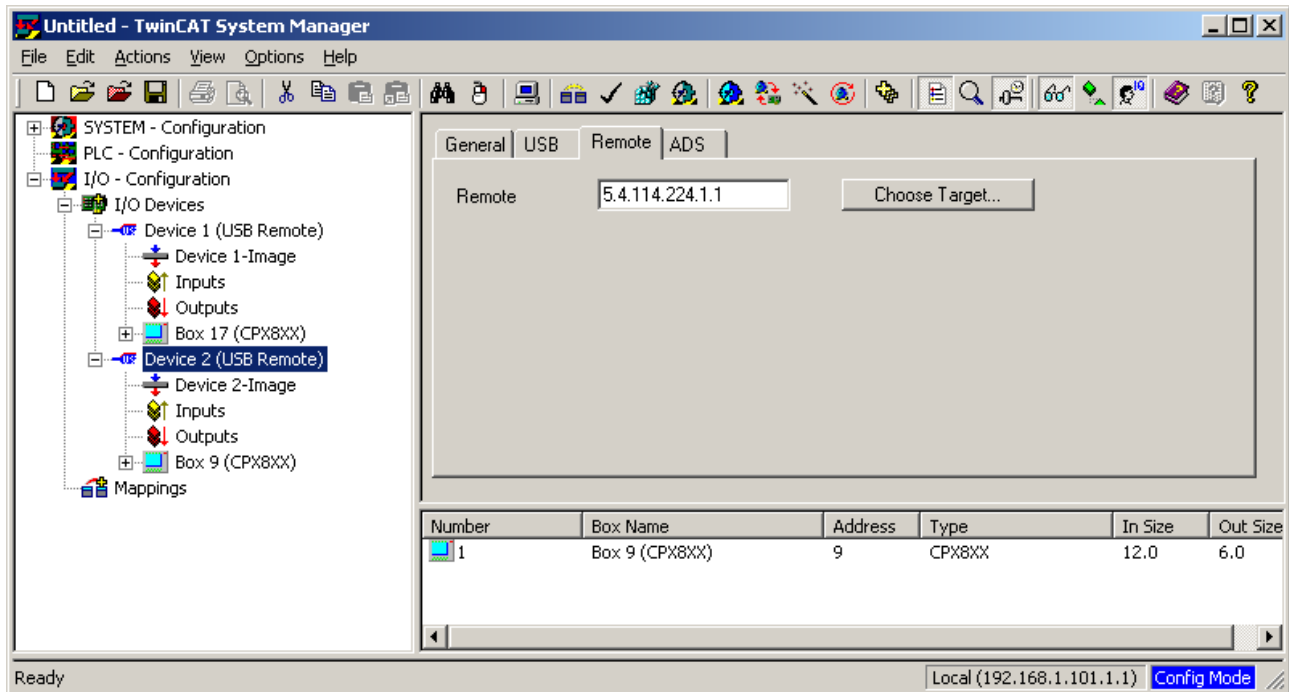
	TwinCAT v2.11 Build 1542 is required
i **Notice**	The "Virtual USB Interface (Remote)" device is supported from TwinCAT 2.11 Build 1542.

"Virtual USB Interface (Remote)" via standard Ethernet

In the TwinCAT System Manager a "Virtual USB Interface (Remote)" device can be inserted into the "I/O Devices" node in the configuration by the selection of "Append Device" in the context menu. The "Virtual USB Interface (Remote)" device can be found underneath the "USB" node in the list of available devices.
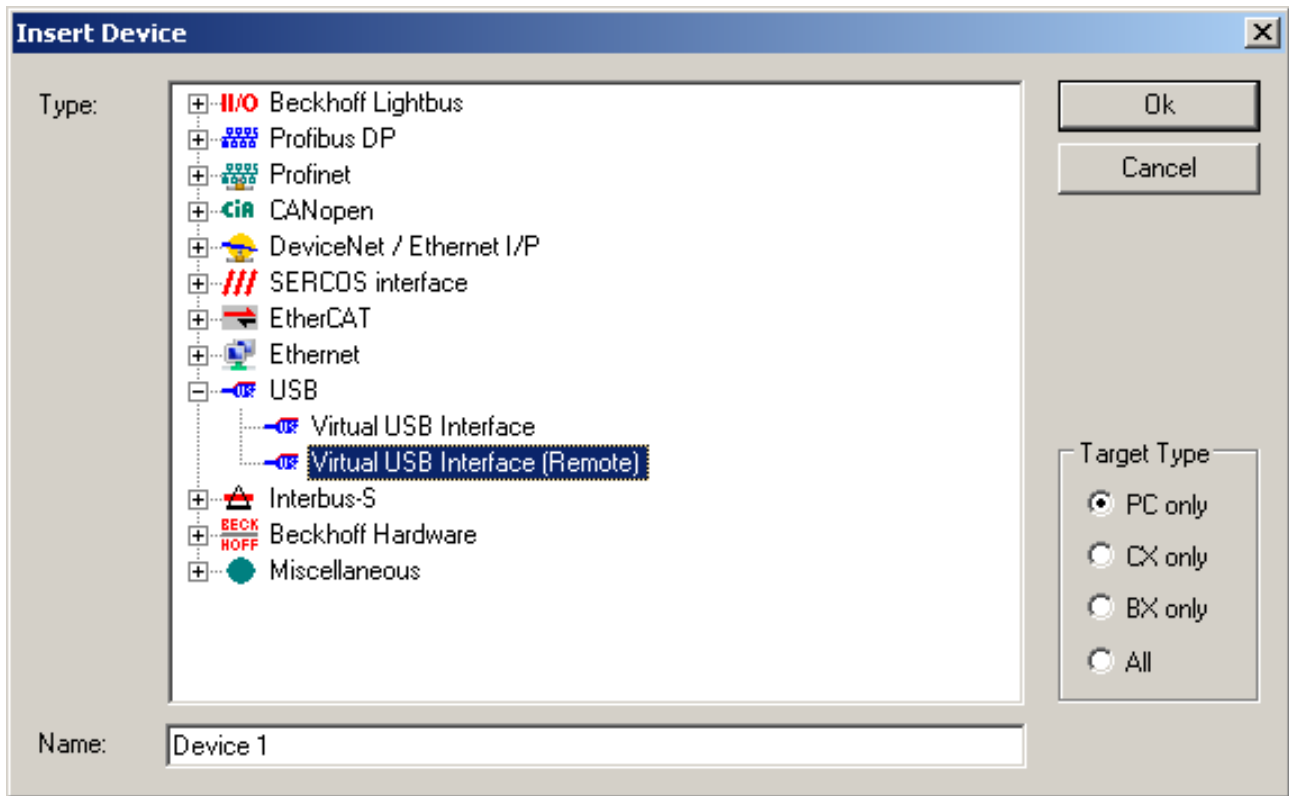
After the device has been added the NetID of the target system can be defined on the "Remote" tab. This can either be entered directly or also determined by the "Choose Target" button. When the target system has been reached then connected boxes can be addressed and configured as usual. The recommended cycle time for data exchange with the terminals at the Bus Coupler is still 50 to 80 milliseconds (see also Cycle time for data exchange).

	A USB Bus Coupler may only be used from a single TwinCAT IO system.
i **Notice**	It must be ensured that the USB Bus Coupler is not addressed by two different TwinCAT IO systems. When the USB coupler is read from the TwinCAT IO system of the host via ADS then it may not be used any more by the local TwinCAT IO system on the client.

"Virtual USB Interface (Remote)" via RT Ethernet

When an RT Ethernet connection is used for communication with the "Virtual USB Interface (Remote)" the data is exchanged in deterministic cycle times, and this allows the I/O channels of the CPx8xx to be read and written deterministically. The recommended cycle time for data exchange with the terminals at the Bus Coupler is still 50 to 80 milliseconds (see also Cycle time for data exchange).

Setting up RT Ethernet:

- A network adapter of both the host PC and the client must be configured as an RT Ethernet device and added to the I/O configuration (also see Configuration of RT Ethernet Devices [▶ 43]).
- "Routing" must be switched on for this RT Ethernet device on both on the host PC as well as on the client. In addition the NetIds of each of the RT Ethernet devices must be entered respectively in the Routing Tables (also see Configuration of RT Ethernet Devices [▶ 43]).

Further configuration is carried out as described in 2.a with the exception that for communication with the "Virtual USB Interface (Remote)" the NetId of the client RT Ethernet device will be added as target system (this differs from the normal NetId).

7.7.3   Access via network variables

In this case, the CPx8xx Bus Coupler is linked into the client as a local USB device. The CP Link 3 USB device server on the client is configured accordingly via a "Use Local List" (also see Using USB devices locally on the client [▶ 57]). Access from host PC to the I/O channels of the Bus Coupler is implemented by the use of network variables.

Setting up RT Ethernet:

A network adapter of both the host PC and the client must be configured as an RT Ethernet device and added to the I/O configuration (also see Configuration of RT Ethernet Devices [▶ 43]).

Accessing Bus Coupler inputs:

To access the inputs of the Bus Coupler a "Publisher" is added to the RT Ethernet Device on the client and a "Subscriber" is added to the RT Ethernet device on the host PC.

One or more network variable(s) are added to the client's Publisher accordingly to the inputs of the Bus Coupler to be mapped. The publisher network variable, in this example "Pub-Var CPX8XX Inputs" is linked with the input variables of the Bus Coupler.

The cycle time of the RT Ethernet device determines the cycle time for the data exchange with the Bus Coupler. The recommended cycle time for the data exchange with the Bus Coupler is 50 to 80 milliseconds (see also Cycle time for data exchange).

One or more network variable(s) are added to the host PC Subscriber corresponding with the network variables configured on the client. In the dialogue window which appears, after the Publisher computer has been searched for, a list of all Publisher variables is displayed and the corresponding variable can be added to the Subscriber.
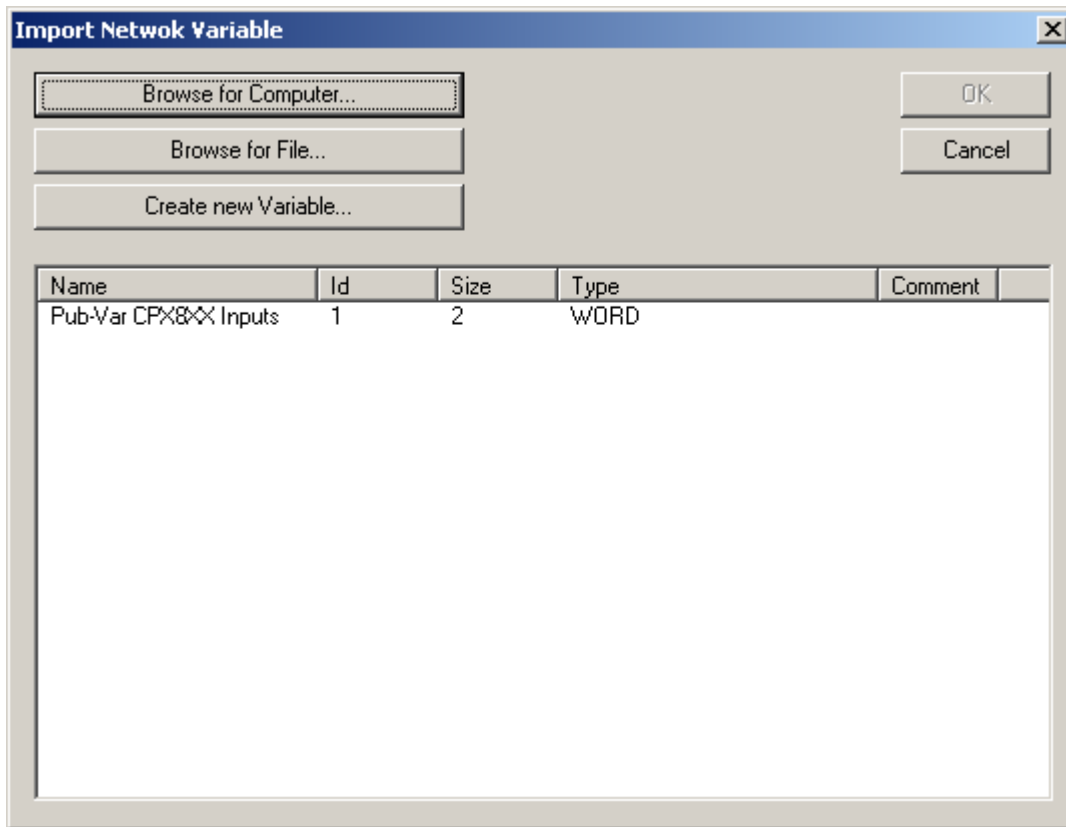
The host PC network variable can now be linked with PLC or task variables.
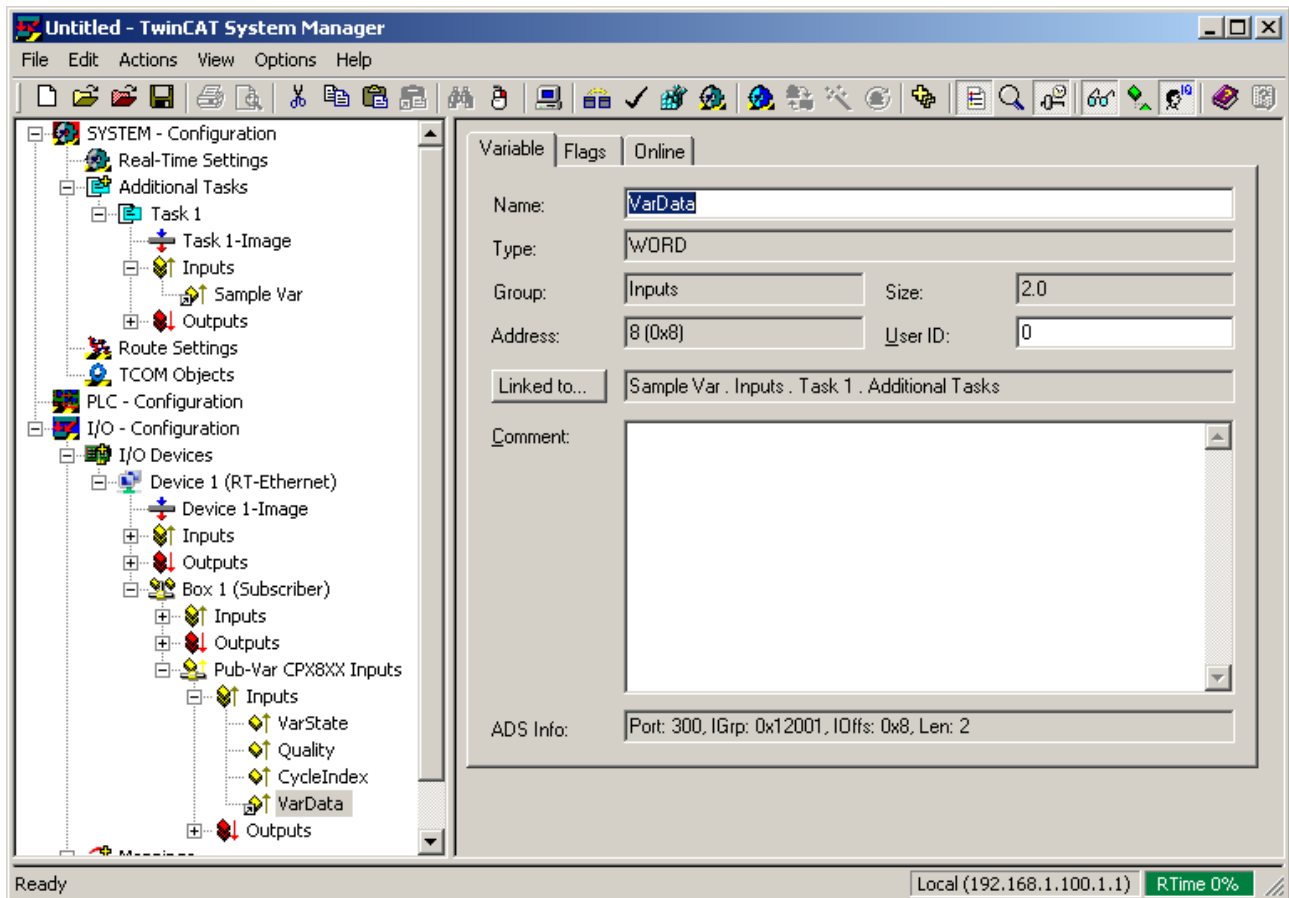
Accessing Bus Coupler outputs:

For accessing the outputs of the Bus Coupler a "Subscriber" is added to the client RT Ethernet device and a "Publisher" to the host RT Ethernet device.

One or more network variable(s) are added to the host PC Publisher according to the PLC or task variables to be mapped on the Bus Coupler outputs. The Publisher network variable, "Pub-Var CPX8XX Outputs" in this example, is linked with the corresponding PLC or task variables.
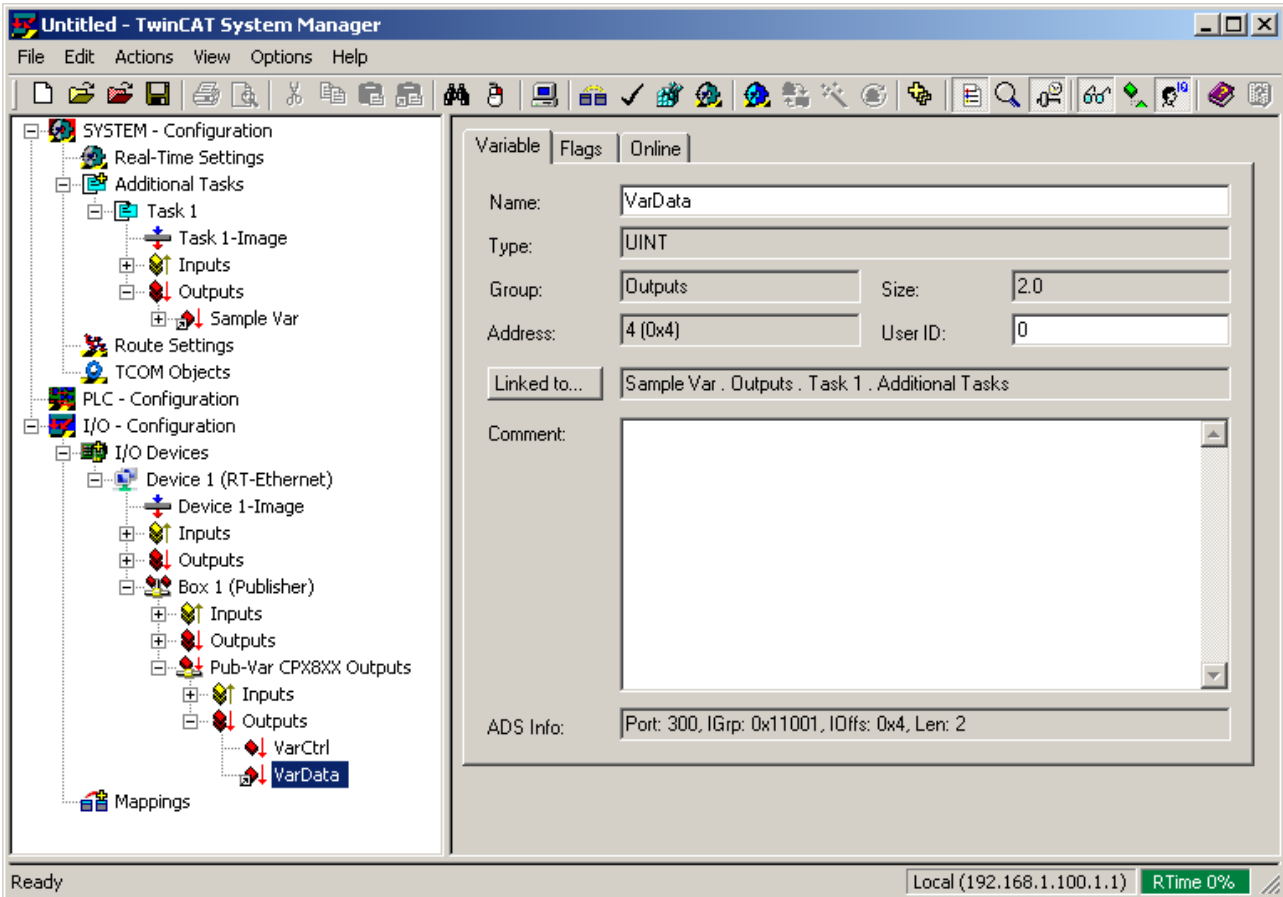
One or more network variable(s) are added to the client Subscriber corresponding with the network variables configured on the host PC. In the dialogue window which appears, after the Publisher computer has been searched for, a list of all Publisher variables is displayed and the corresponding variable can be added to the Subscriber.
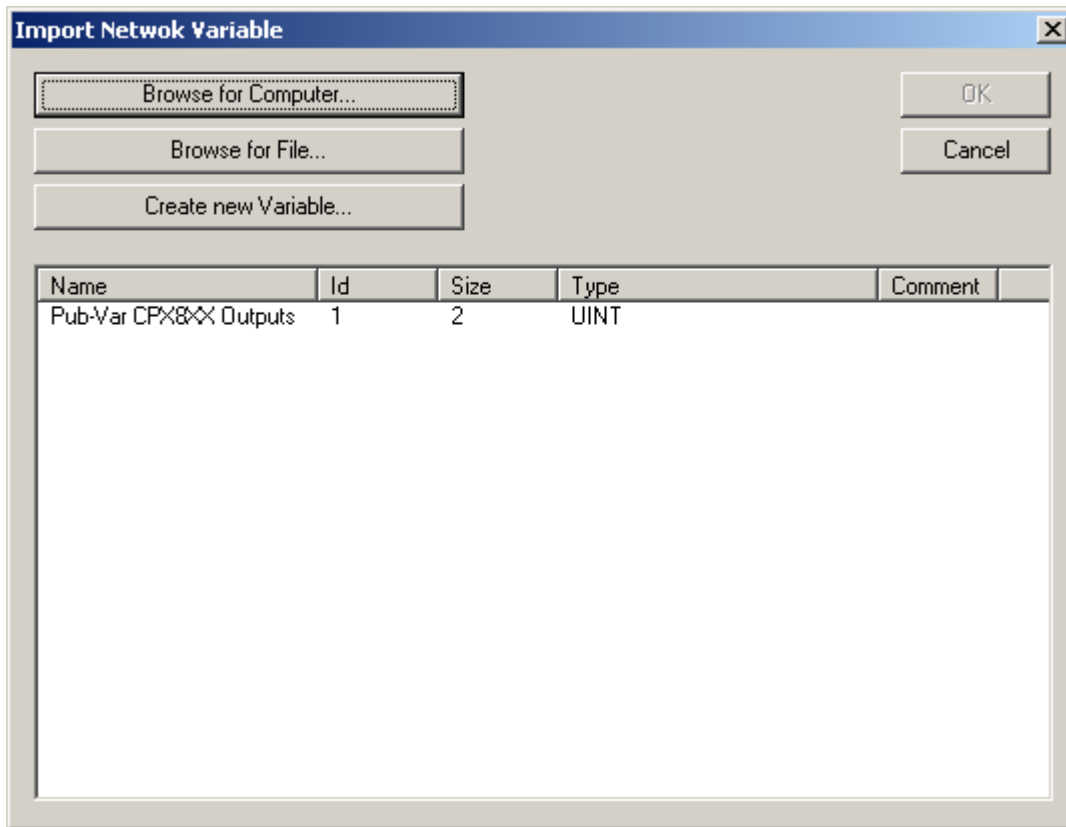
The client network variable now can be linked with the output variables of the Bus Coupler.
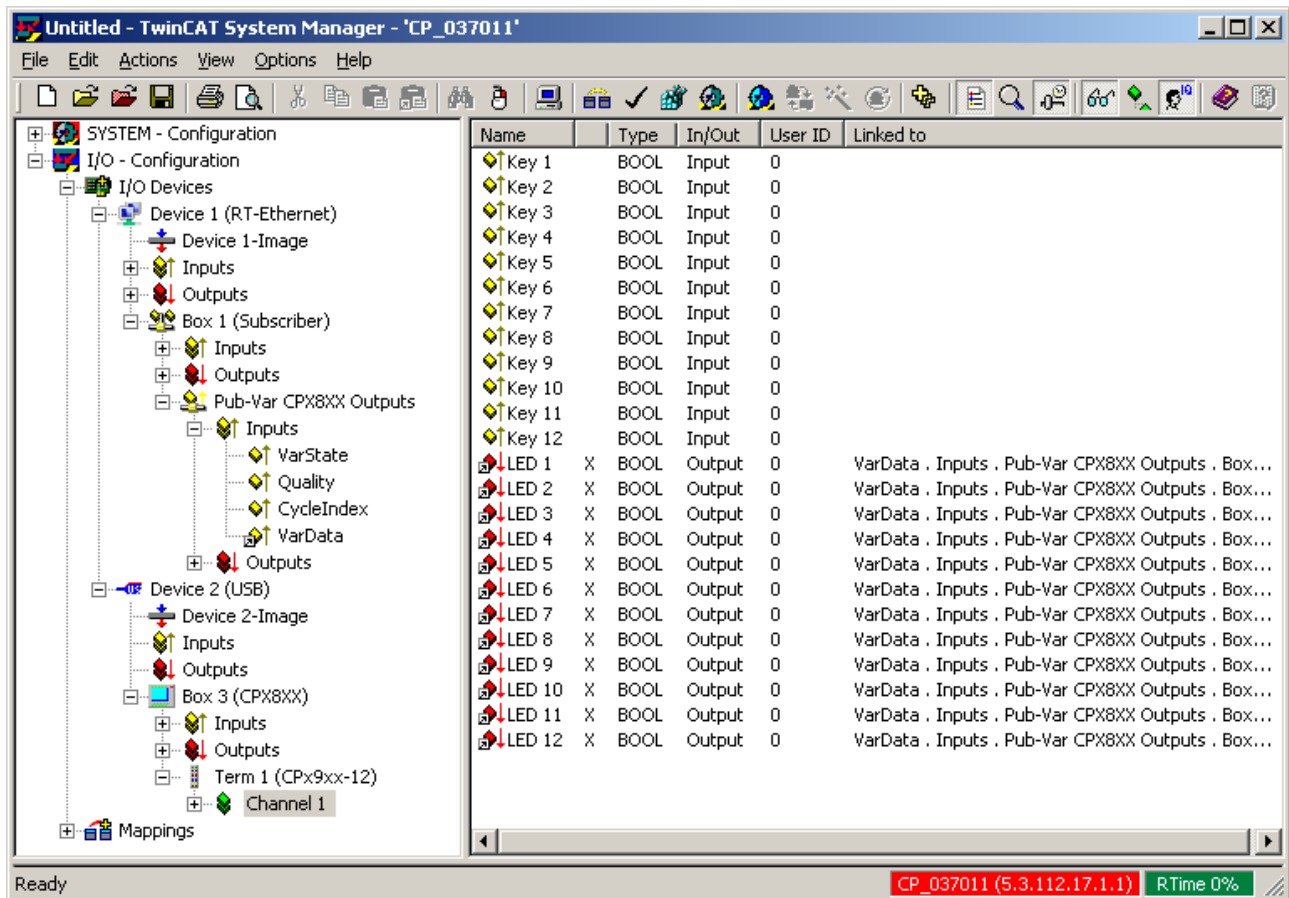

The cycle time of the RT Ethernet device determines the cycle time for the data exchange with the Bus Coupler. The recommended cycle time for the data exchange with the Bus Coupler is 50 to 80 milliseconds (see also Cycle time for data exchange).

7.7.4 Access via ADS to task or PLC variables linked to the local client

In this case, the CPx8xx Bus Coupler is linked into the client as a local USB device. The CP Link 3 USB device server on the client is configured accordingly via a "Use Local List" (also see Using USB devices locally on the client [▶ 57]). Access from host PC to the I/O channels of the Bus Coupler is implemented by the use of ADS. In this the Bus Coupler I/O channels are mapped to I/O Task variables. These variables can be read by ADS from the host PC (also see Introduction to ADS).

Access via ADS and standard Ethernet

In a simple PLC example the ADS access to the client task variables should be shown here. A task is added to the client system configuration for this. Accordingly, the input and output channels of the Bus Coupler have task variables added and linked with the input and output variables of the Bus Coupler.
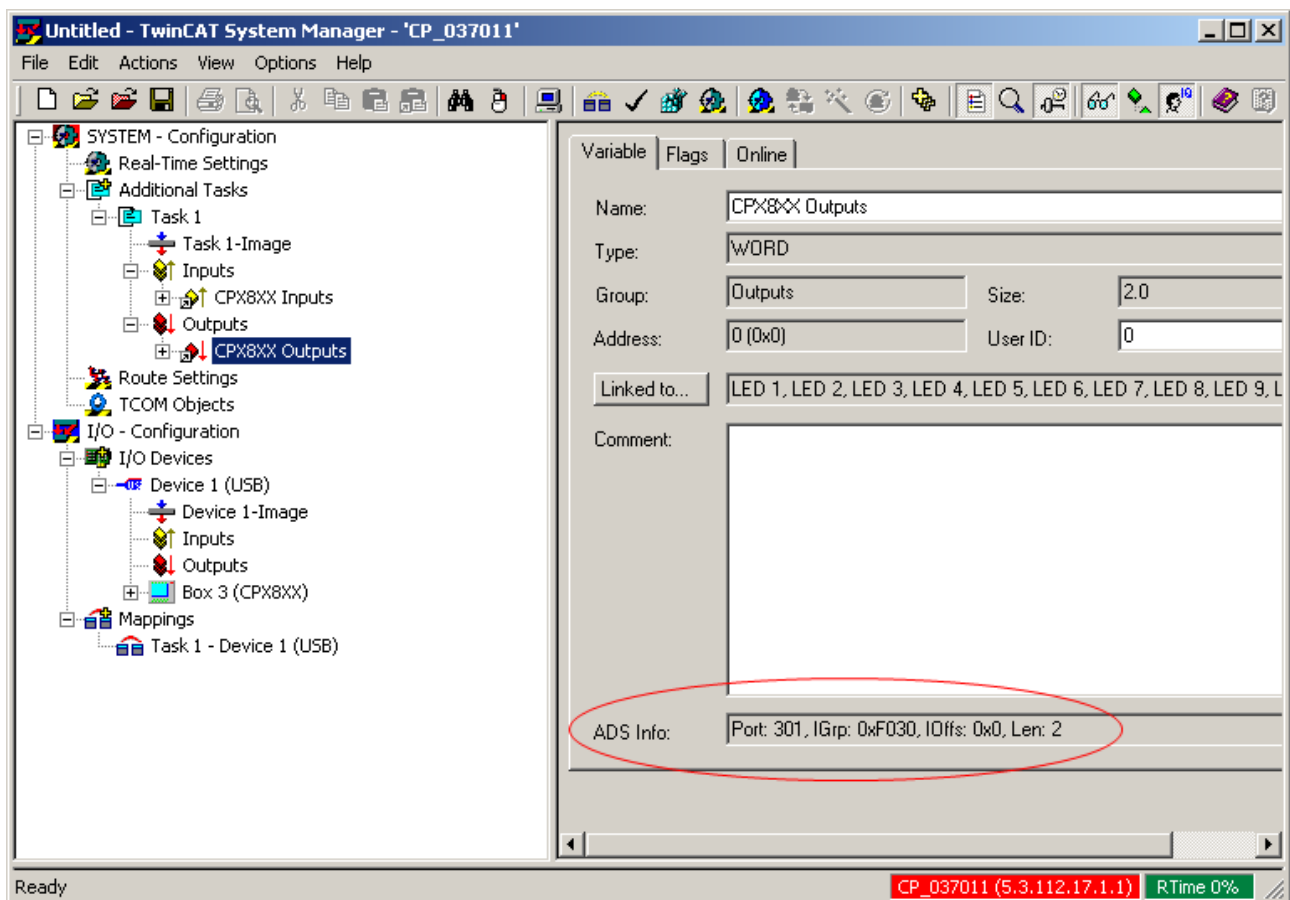
The "ADS Info" of the client task variables are then used for ADS communication in the host PC PLC program.

A host PC PLC program for accessing the Bus Coupler outputs could look like this:

```
PROGRAM MAIN

VAR

fbAdsWrite : ADSWRITE;
netId : STRING := '5.3.112.17.1.1';
port : WORD := 301;
idxGrp : UDINT := 16#F030;
idxOffs : UDINT := 16#0;
data : WORD := 2#1010101010101010;
dataLen :UDINT := 2;
state :BYTE := 0;
```

```
END_VAR

CASE state OF

0:
    fbAdsWrite(
     NETID := netId,
     PORT := port,
     IDXGRP := idxGrp,
     IDXOFFS := idxOffs,
     SRCADDR := ADR(data),
     LEN := dataLen,
     WRITE := TRUE,
     TMOUT := T#1s
     );

    IF fbAdsWrite.ERR THEN
     state := 2;
    ELSE
     state := 1;
    END_IF

1:
    fbAdsWrite(WRITE := FALSE);
    IF fbAdsWrite.ERR THEN
     state := 2;
    ELSE
     IF NOT fbAdsWrite.BUSY THEN
        state := 2;
     END_IF
    END_IF

2:
    fbAdsWrite(WRITE := FALSE);
    state := 0;

END_CASE
```

Access via ADS and RT Ethernet

When an RT Ethernet connection is used for the ADS communication, the data is exchanged in deterministic cycle times, and this allows the I/O channels of the CPx8xx to be read and written deterministically. The recommended cycle time for data exchange with the terminals at the Bus Coupler is still 50 to 80 milliseconds (see also Cycle time for data exchange).

Setting up RT Ethernet:

- A network adapter of both the host PC and the client must be configured as an RT Ethernet device and added to the I/O configuration (also see Configuration of RT Ethernet Devices [▶ 43]).
- "Routing" must be switched on for this RT Ethernet device on both on the host PC as well as on the client. In addition the NetIds of each of the RT Ethernet devices must be entered respectively in the Routing Tables (also see Configuration of RT Ethernet Devices [▶ 43]).

Further configuration is carried out as described in 4.a with the exception that in the PLC program the NetId for the client RT Ethernet devices is entered as the NetId for ADS communication (this differs from the normal NetId).

7.8 Update of TcUsb.sys

Depending on the installed version of TwinCAT and the installation order of CP-Link 3 and TwinCAT it might be necessary to update the driver file TcUsb.sys.

- If you install CP-Link 3 on a PC with an already installed TwinCAT, the version of the driver file TcUsb.sys will be checked and, if necessary, replaced by a newer version. In this case an *update is not necessary*.

- If you install TwinCAT on a PC with an already installed CP-Link 3, the installation process of TwinCAT might replace the driver file TcUsb.sys by an older version. In this case you need to *check the version* and, if necessary, *update the file*.

Version check

Open Windows Explorer and navigate to: C:\Windows\System32\drivers. If TwinCAT is installed this folder contains the file TcUsb.sys. The version number can be checked via the file properties (right click -> Properties) on the tab *Version*:
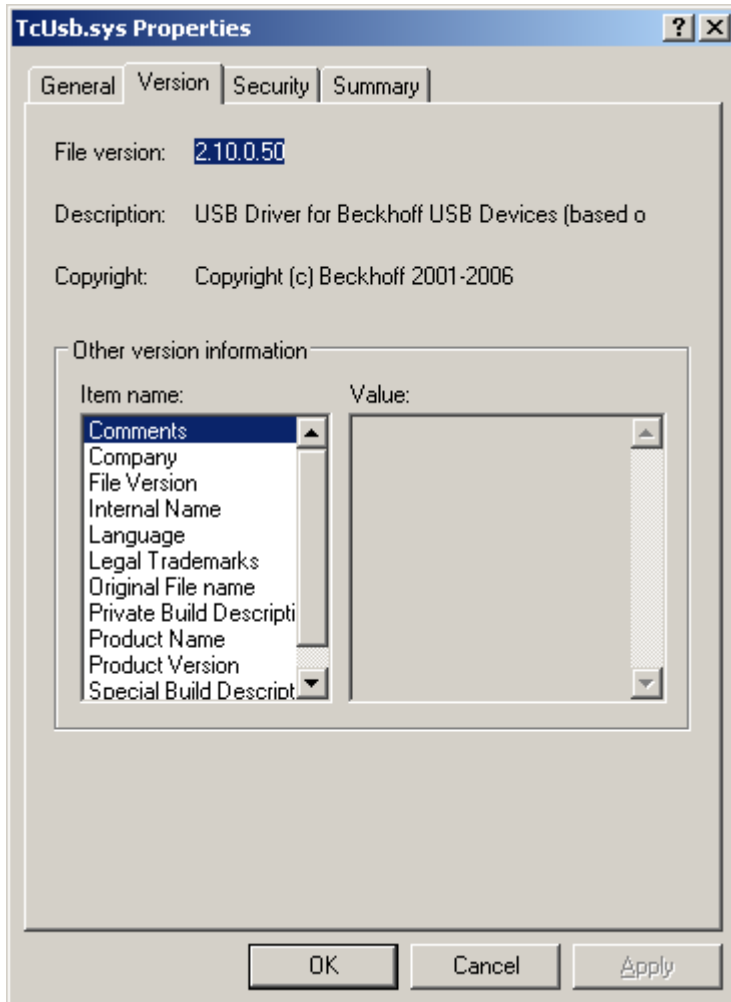
If the version of TcUsb.sys is older than 2.10.0.54 it is necessary to update the file.

Perform update

i **Notice**	**Version check of TcUsb.sys** Always check if TcUsb.sys needs to be updated (see above).

Open Windows Explorer and navigate to: C:\Windows\System32\drivers. Rename the file TcUsb.sys, e.g. to TcUsb_old.sys. The subfolder "Drivers" of the CP-Link 3 program directory contains the file TcUsb.sys. Copy this file to C:\Windows\System32\Drivers.

	Restart the operating system
i **Notice**	After the update of TcUsb.sys you need to restart the operating system!

7.9 CP-Link 3 LaunchApp

CP-Link 3 LaunchApp is a command-line application which enables the opportunity to start any application that way, that the application window opens with a specific size on a specific monitor. You can get a details description for the usage of CP-Link 3 LaunchApp when you start the program via command-line without any parameters. Therefor open a command-line window and navigate to the subfolder *Tools* within the CP-Link 3 program directory, e.g. "C:\Program Files\Beckhoff\CP-Link 3\Tools". Now type in "CPLink3LaunchApp.exe" into the command-line.

7.10 Hints for cabling

In order to ensure a correct functioning of CP-Link 3, please note the following hints concerning the cabling for the CP-Link 3 participants.

- Note the hints listed in the Network Topology [▶ 43] section.
- Always run the network cables separated from power cables. Use (sufficiently) shielded network cables.
- Ensure all CP-Link 3 participants to have the same zero potential in order to avoid potential equalisation via the network cable.

8   Appendix

8.1   Documentation issue status

Version	Comment
1.7	• Updated section Client Explorer [▶ 38] (USB-Buscoupler [▶ 38]) • Updated section Using the CPx8xx USB Bus Coupler [▶ 57] (Device number of the USB Bus Coupler [▶ 57]) • Updated section Set the HID focus manually [▶ 53] • Updated section Installation - Host [▶ 10] • Updated section Installation - Client [▶ 15]
1.6	• Updated section Technical data [▶ 9]
1.5	• Updated section Installation - Client [▶ 15] (Installation of client software under Windows 7 / Windows XP [▶ 15]) • Updated section Installation - Host [▶ 10] • Updated section Edit the client list [▶ 22] (Broadcast Search [▶ 22]) • Updated section Client Configuration [▶ 27] (USB [▶ 27], Serial [▶ 27]) • Updated section Client Explorer [▶ 38] • Description for Firewall Configuration [▶ 47] • Description for USB Device Filter Lists [▶ 48] • Updated section Using USB devices locally on the client [▶ 57] • New section Hints for cabling [▶ 71] • Updated section Toubleshooting [▶ 74]
1.4	• Updated documentation concerning Windows 7 support • Updated section Configuration interface [▶ 19] • Updated section Windows Display Settings [▶ 49] • Description for Network Topology [▶ 43]

Version	Comment
1.3	• Description for uninstallation of CP-Link 3 Extended Desktop Devices (Configuration interface [▶ 19])
	• Updated section Client Configuration [▶ 27] - Resolution of the display device on the host, Transfer protocol for graphical data
	• Updated section Using the CPx8xx USB Bus Coupler [▶ 57]
	• Updated section Using USB devices locally on the client [▶ 57]
	• Description for Configuration of RT Ethernet devices [▶ 43]
	• Description for CP-Link 3 LaunchApp [▶ 71]
	• Updated section Set the HID focus manually [▶ 53]
	• Description for CP-Link 3 Service [▶ 56]
	• Description for Client Explorer [▶ 38]
	• Updated section Troubleshooting [▶ 74]
1.2	• Updated section Technical data [▶ 9] - System Requirements for the Client
	• Description of lock symbol positioning on clients (Client Configuration [▶ 27])
1.1	• Description for installation of CP-Link 3 on clients
	• Updated description for installation of CP-Link 3 on host PCs
	• Updated description for usage of USB Bus Couplers with CP-Link 3
1.0	• First Release

8.2 Comments

Known problems:

- TwinCAT RT-Ethernet driver
  If CP-Link 3 uses a network adapter which is configured as TwinCAT RT-Ethernet Adapter at the same time, this may result in dropped connection on high network usage.
  Please use TwinCAT 2.11, Build 1552 or newer, beginning with this version this issue is fixed.

- Icons not visible
  In certain cases icons of the host PC's desktop, or the pictograms for applications running on the host PC, are only partially visible on the clients display, if at all. This phenomenon is only observed on multi-monitor host PCs. In addition, only those clients that are displaying the screen content of the host PC's standard display device are affected. This is a known issue in the Microsoft operating system Windows XP (http://support.microsoft.com/kb/2501595).

Restrictions:

- Remote desktop

  It is not possible to use *CP-Link 3 Configuration* in a Remote Desktop session.

- Realtime-Ethernet

  If a network adapter of a CP-Link 3 client is used both for the CP-Link 3 connection as well as for real-time Ethernet, it is not possible to transmit the "Virtual Graphics" data by UDP. If only one network adapter is available for CP-Link 3 and real-time Ethernet, the "Virtual Graphics" data for the client must be transmitted by TCP (see also the Client Configuration [▶ 27] section).

- Installation order of CP-Link 3 and TwinCAT
  When installing CP-Link 3 or TwinCAT assure to install TwinCAT before CP-Link 3 (see also the Update of TcUsb.sys [▶ 69] section).

8.3   Troubleshooting

Fault	Possible cause	Solution
A client is not displaying the image from the host PC, but the image of the client's operating system.	Faulty network connection. Faulty configuration.	Check the network connection. Make sure that the network configuration of the host PC and the client are correct. Check the CP-Link 3 configuration (see also the Client Configuration [▶ 27] section).
The host PC cannot connect to a client even though the client is reachable using the Ping command.	Faulty firewall setting on the client. For CE based clients: Wrong directory used for installation.	Check the firewall settings of the client (see also the Firewall Configuration [▶ 47] section). For CE based clients: Always install CP-Link 3 into the directory suggested by the installation wizard (see also the Installation - Client [▶ 15] section).
A client does not show any image (black screen).	A network adapter in the client is being used both for the CP-Link 3 connection and for real-time Ethernet. It is not possible to transmit the "Virtual Graphics" data via UDP (see also the Comments [▶ 73] section).	Change the client's "Virtual Graphics" data transfer protocol over to TCP (see also the Client Configuration [▶ 27] section).
Exceptionally slow graphics performance of a client.	The color depth of the client's display does not match the corresponding host display color depth.	Adjust the color depth of the client's display to match the color depth of the corresponding host display (see also the Installation - Client [▶ 15] section).
The image displayed at a client is faulty; some parts of the screen are not updated, or are updated only after a delay.	The network has a poor connection quality, while the "Virtual Graphics" data is being transmitted via UDP.	Change the client's "Virtual Graphics" data transfer protocol over to TCP (see also the Client Configuration [▶ 27] section).
Connection dropouts are occurring; a client sometimes shows the image from the host PC, sometimes the image of the client's operating system.	A network adapter of the host PC is being used for the CP-Link 3 connection at the same time the adapter is configured as a TwinCAT RT Ethernet adapter (see also the Comments [▶ 73] section).	Please use TwinCAT 2.11, Build 1552 or newer, beginning with this version this issue is fixed. Alternative: The network adapter may not be configured as TwinCAT RT Ethernet Adapter. Install the standard Intel® network card driver.
After touching the client touch screen a dialog opens with question "Minimize client window?"	Virtual USB is not activated for this client. The touch screen is used as local device.	Activate virtual USB for this client. If needed add HID devices to the USB Device Blacklist in order to prevent user inputs from this client. (see also the Client Configuration [▶ 27] section).

Fault	Possible cause	Solution
On using an Elo touch screen via "Virtual USB" the mouse moves, but does not follow the finger. The touch screen calibration fails.	Elo Touchscreen driver is not installed on the host PC or the driver is outdated.	Install a recent Elo Touchscreen driver on the host PC. Run the Elo alignment program on the host PC.
Setting the HID Focus manually via ADS or using the function block FB_CPLink3_AcquireHidFocus does not work.	The CP-Link 3 Service is not running.	Verify the status of the CP-Link 3 Service. Maybe the CP-Link 3 Service needs to be registered or started (see also CP-Link 3 Service [▶ 56] section).
On using an USB Bus Coupler, the Coupler's outputs drop out or the Bus Coupler does not behave like expected.	Faulty configuration or faulty use of the USB Bus Coupler. Multiple Bus Couplers have identical device numbers. The cycle time for data exchange with the Bus Coupler is too short.	Check the configuration for the use of USB Bus Couplers (see also Using the USB Bus Coupler [▶ 57]). Ensure that different device numbers are assigned to all Bus Couplers (see also Device Number of USB Bus Coupler [▶ 57]). Use the recommended cycle time for data exchange with the Bus Coupler (see also Cycle time for data exchange [▶ 57]).
The *MissedCnt* variable of an USB Bus Coupler is incrementing.	The cycle time for data exchange with the Bus Coupler is too short. Faulty configuration of the RT Ethernet when accessing the Bus Coupler via RT Ethernet.	Use the recommended cycle time for data exchange with the Bus Coupler (see also Cycle time for data exchange [▶ 57]). Check the RT Ethernet configuration when accessing the Bus Coupler via RT Ethernet (see also "Virtual USB Interface (Remote)" via RT Ethernet [▶ 57], or Access via network variables (RT Ethernet) [▶ 57], or ADS access via RT Ethernet [▶ 57])
A client's (running Windows XP) USB devices cannot be used if the PC has been started in "Safe Mode".	The operating system prevents loading particular CP-Link 3 drivers, because these drivers use network components of the operating system that are not available in "Safe Mode". The successful loading of these drivers is a requirement for the operating system to load the USB-Hub driver. Therefore, the USB-Hub driver is not loaded which leads to the client's USB devices to be unusable.	Start the operating system in "Safe Mode with Networking".

8.4 Support and Service

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