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Installation- and Operating instructions for

FC9001-0010, FC9011, FC9002, FC9004 FC9022, FC9024, FC9062

PCI/PCIe Cards for Ethernet

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BECKHOFF

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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.

1.1.1 Liability Conditions

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.

1.1.2 Trademarks

Beckhoff®, TwinCAT®, TwinCAT/BSD®, TC/BSD®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® are registered and licensed trademarks of Beckhoff Automation GmbH.
Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

1.1.3 Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702 and similar applications and registrations in several other countries.

1.1.4 Copyright

© Beckhoff Automation GmbH & Co. KG. Publication of this document on websites other than ours is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

1.1.5 Delivery conditions

In addition, the general delivery conditions of the company Beckhoff Automation GmbH & Co. KG apply.

1.2 Safety instructions

1.2.1 State at Delivery

All the components are supplied in particular hardware and software configurations appropriate for the application. Changes to the hardware or software configuration are permitted, provided they are within the specified limits for power consumption and power loss (please refer to the respective data sheet).

1.2.2 Operator's obligation to exercise diligence

The operator must ensure that

- the product is only used as intended (see chapter *Product Description*)
- the product is in a sound condition and in working order during operation
- the product is operated, maintained and repaired only by suitably qualified and authorized personnel
- the personnel is instructed regularly about relevant occupational safety and environmental protection aspects, and is familiar with the operating manual and in particular the safety notes contained herein
- the operation manual is in good condition and complete, and always available for reference at the location of the product
- none of the safety and warning notes attached to product are removed, and that all notes remain legible.

1.3 Description of safety symbols

The following safety symbols are used in this operating manual. They are intended to alert the reader to the associated safety instructions.

 **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.
 **Note**	**Note or pointer** This symbol indicates information that contributes to better understanding.

2 Product Description

2.1 Product Overview

2.1.1 FC9001-0010, FC9011, FC9022, FC9024 PCI Ethernet



The Ethernet PCI network cards FC9001-0010, FC9011 und FC9022 from Beckhoff save space and costs. They can be used in office and automation networks and offer the following benefits:

- plug-and-play interface
- 10/100/1.000 MBit/s (FC9011), 10/100 MBit/s (FC9001-0010), 100/1.000 Mbit/s (FC9022, FC9024), full duplex
- automatic baud rate setting according to IEEE 802.3u
- maximum performance through hardware-integrated checksum creation and verification
- The hardware side supports Quality of Service (QoS) through prioritised multiple queues.
- Wake on LAN
- Boot from LAN (PXE) (only FC9011)

Naturally, the cards (or individual channels) can also be operated with TwinCAT drivers – and therefore in real-time.

2.1.2 FC9002, FC9004 PCI Ethernet



Up to four Ethernet channels in one slot: The Ethernet PCI network cards from Beckhoff save space and costs. They can be used in office and automation networks and offer the following benefits:

- plug-and-play interface
- 10/100 Mbit/s, full duplex
- automatic baud rate setting according to IEEE 802.3u for each channel
- maximum performance through hardware-integrated checksum creation and verification
- The hardware side supports Quality of Service (QoS) through prioritised multiple queues.

Naturally, the cards (or individual channels) can also be operated with TwinCAT drivers – and therefore in real-time.

2.1.3 FC9062 PCIe Modul



Beckhoff PCIe modules are based on a new definition of highly integrated PCI Express plug-in cards and follow the trend towards ever smaller PCs. The function of PC plug-in cards is integrated in a compact format that is suitable for harsh industrial environments.

The 3½-inch motherboard CB3052 offers four PCI Express lanes to be distributed to the PCIe module slots or standard plug-in card slots. The result are PCs with module slots and/or slots for plug-in cards. A PCIe module is connected to the motherboard via one PCI Express lane with a data transfer rate of 2 Gigabit. A module can therefore provide two Gigabit Ethernet interfaces, for example.

The FC9062 module complements the slide-in IPC C5210, the Panel PC CP62xx and the control cabinet IPCs C6515, C6525 and C6930 with two Gigabit Ethernet ports. If two modules are used, these PCs have a total of six Ethernet interfaces, while the PCI Express socket continues to be available for a seventh Ethernet port or a fieldbus interface for PROFIBUS, CANopen, DeviceNet or SERCOS. If only one of the two module slots is equipped with a PCIe module, the second slot is available for feeding motherboard interfaces such as COM ports, USB or sound out of the PC. The connection for a Mini PCI card can also be fed out through the module slots, even if the basic configuration of the PC, e.g. the C6515, does not allow for Mini PCI fieldbus cards.

2.2 Technical data

2.2.1 FC9001-0010, FC9011, FC9002, FC9004

Technical data	FC9001-0010	FC9011	FC9002	FC9004
Bus system	Ethernet (all Ethernet (IEEE 802.3) based protocols)			
Number of Ethernet channels	1	1	2	4
Ethernet Interface	10BASE-T/ 100BASE-TX	10BASE-T/ 100BASE-TX/ 1000BASE-TX	10BASE-T/ 100BASE-TX	
Ethernet sockets	1 x RJ45		2 x RJ45	4 x RJ45
Cable length	maximum 100 m up to Hub, Switch or end device			
Baud rate	10/100 MBit/s IEEE 802.3u auto-negotiation, full duplex at 10 or 100 MBit/s	10/100/1000 MBit/s IEEE 802.3ab auto-negotiation, full duplex at 10/100/1000 MBit/s	10/100 MBit/s IEEE 802.3u auto-negotiation, full duplex at 10 or 100 MBit/s, separate settings for each channel	
Diagnose	2 LEDs per channel: - Link/ Speed (Green = 100MBit/ Orange = 1GBit) - Activity			
Interface to the PC	32 Bit Plug-and-Play PCI-Interface			
Standard driver	standard operating system drivers for Intel-compatible NIC		Standard driver for Intel or Beckhoff driver (Drivers can be selected separately for each channel)	
Real time driver	TwinCAT driver for real time Ethernet			
Supply voltage (PCI-Bus)	5 V			
Current consumption typ. (PCI-Bus, 5 V)	200 mA	350 mA	800 mA	1200 mA
Weight	45 g	45 g	75 g	95 g
Dimensions (B x H x T, without slot plate)	18 x 45 x 120		18 x 95 x 125	
Permissible ambient temperature range during operation	0°C ... + 55°C			
Permissible ambient temperature range during storage	-25°C ... + 85°C			
Permissible relative humidity	95%, no condensation			
Vibration / shock resistance	according to EN 60068-2-6 / EN 60068-2-27, EN 60068-2-29			
EMC resistance burst / ESD	according to EN 61000-6-2 / EN 61000-6-4			
Installation position	variable			
Approval	CE			

2.2.2 FC9022, FC9024, FC9062

Technical data	FC9022	FC9024	FC9062
Bus system	Ethernet (all Ethernet (IEEE 802.3) based protocols)		
Number of Ethernet channels	2	4	2
Ethernet Interface	100/1000Base-T	10/100/1000Base-T	100/1000Base-T
Ethernet sockets	2 x RJ45	3 x RJ45	2 x RJ45
Cable length	maximum 100 m up to Hub, Switch or end device		
Baud rate	10/100 MBit/s, IEEE 802.3ab auto-negotiation, full duplex at 10, 100 or 1000 MBit/s, separate settings for each channel		
Diagnose	2 LEDs per channel: - Link/ Speed (Green = 100MBit/ Orange = 1GBit) - Activity		
Interface to the PC	1x PCIe-Interface Plug-And-Play		
Standard driver	Standard driver for Intel or Beckhoff driver (Drivers can be selected separately for each channel)		
Real time driver	TwinCAT driver for real time Ethernet		
Supply voltage	3,3 V		
Current consumption	800 mA typical		
weight	55 g	217 g	45 g
Dimensions (without slot plate)	62 x 100	98 x 98	46 x 91
Permissible ambient temperature range during operation	0°C ... + 55°C		
Permissible ambient temperature range during storage	-25°C ... + 85°C		
Permissible relative humidity	95%, no condensation		
Vibration / shock resistance	according to EN 60068-2-6 / EN 60068-2-27, EN 60068-2-29		
EMC resistance burst / ESD	according to EN 61000-6-2 / EN 61000-6-4		
Installation position	variable		
Approval	CE		

2.3 Ethernet

Ethernet was originally developed by DEC, Intel and XEROX (as the "DIX" standard) for passing data between office devices. The term nowadays generally refers to the *IEEE 802.3 CSMA/CD* specification, published in 1985. Because of the high acceptance around the world this technology is available everywhere and is very economical. This means that it is easy to make connections to existing networks.

There are now a number of quite different transmission media: coaxial cable (10Base5), optical fiber (10BaseF) or twisted pairs (10BaseT) with screen (STP) or without screen (UTP). A variety of topologies such as ring, line or star can be constructed with Ethernet.

Ethernet transmits Ethernet packets from a sender to one or more receivers. This transmission takes place without acknowledgement, and without the repetition of lost packets. To achieve reliable data communication, there are protocols, such as TCP/IP, that can run on top of Ethernet.

2.3.1 Basic Principles

2.3.1.1 The Internet Protocol (IP)

The internet protocol (IP) forms the basis of this data communication. IP transports data packets from one device to another; the devices can be in the same network, or in different networks. IP here looks after the address management (finding and assigning MAC-IDs), segmentation and routing. Like the Ethernet protocol, IP does not guarantee that the data is transported - data packets can be lost, or their sequence can be changed.

TCP/IP was developed to provide standardized, reliable data exchange between any number of different networks. TCP/IP is thus substantially independent of the hardware or software being used. Although the term is often used as if it were a single concept, a number of protocols are layered together: e.g. IP, TCP, UDP, ARP and ICMP.

2.3.1.2 Transmission Control Protocol (TCP)

The Transmission Control Protocol (TCP) which runs on top of IP is a connection-oriented transport protocol. It includes error detection and error handling mechanisms. Lost telegrams are repeated.

2.3.1.3 User Datagram Protocol (UDP)

UDP is connectionless transport protocol. It provides no control mechanism when exchanging data between sender and receiver. This results in a higher processing speed than, for example, TCP. Checking whether or not the telegram has arrived must be carried out by the higher-level protocol.

2.3.1.4 Internet Control Message Protocol (ICMP)

It is used by end devices, to exchange information about the current status of the internet protocol.

2.3.1.5 Address Resolution Protocol (ARP)

Performs conversion between the IP addresses and MAC addresses.

2.3.1.6 BootP

The BootP protocol allows the TCP/IP address to be set or altered, by addressing the network device with its MAC-ID.

3 Installation

3.1 Installation in the PC

Warning	**Follow the usual ESD guidelines** The Ethernet cards are supplied in ESD packaging. Follow the usual ESD guidelines for handling PC cards during installation!

1. Before installing the Ethernet card, switch off the PC and any external power supplies, and separate the PC from the mains.
2. Open the PC case.
3. For a free PCI slot on the motherboard, remove the metal plate in the PC case.
4. Insert the Ethernet card into the free PCI slot and fix it with the screw or device provided. Ensure that there is sufficient space between the Ethernet card and other PC components, so that the Ethernet card cannot come into contact with other plug-in cards or memory components etc.
5. Close the PC case.
6. Connect the Ethernet cables with the optical fibre connections of the Ethernet card.
7. Connect the PC to the mains and switch it on.
8. The Ethernet card will be detected as new hardware when the operating system starts up. Follow the assistant's instructions for installing the Ethernet card driver.
9. If you wish to use the TwinCAT driver for real-time Ethernet and EtherCAT, you should now
   - install TwinCAT
   - install or modify the driver.

The Ethernet card does not require an external power supply. It is supplied directly from the PC via the PCI bus. The power supply of the PC has to be adequate for meeting the power requirement of the Ethernet cards, particularly if several Ethernet cards are installed.

3.2 TwinCAT driver for Ethernet cards

Note	**First install Software** Install the Beckhoff TwinCAT automation software before installing the Beckhoff Ethernet card.

3.2.1 Driver Overview

TwinCAT delivers two different drivers for Ethernet cards:

- TwinCAT driver for real-time Ethernet
- TwinCAT RT-Ethernet Intermediate Driver.

TwinCAT driver for real-time Ethernet

The TwinCAT driver for real-time Ethernet works only for Ethernet cards with Intel chipset!

It supports hard real time for Beckhoff Real Time Ethernet and EtherCAT applications.

TwinCAT RT-Ethernet Intermediate Driver

The TwinCAT RT-Ethernet Intermediate Driver works also with other network cards that have no Intel chip set,

It is an evaluation driver for laboratory and test operation, to be able to test TwinCAT also with other network cards that have no Intel chip set.
It supports no hard real time and may cause jitter!

Further information about TwinCAT RT-Ethernet Intermediate Driver may be found in the TwinCAT Information System.

3.2.2 Installation of the TwinCAT driver for real-time Ethernet

There are three ways to install the TwinCAT driver for real-time Ethernet on your PC.

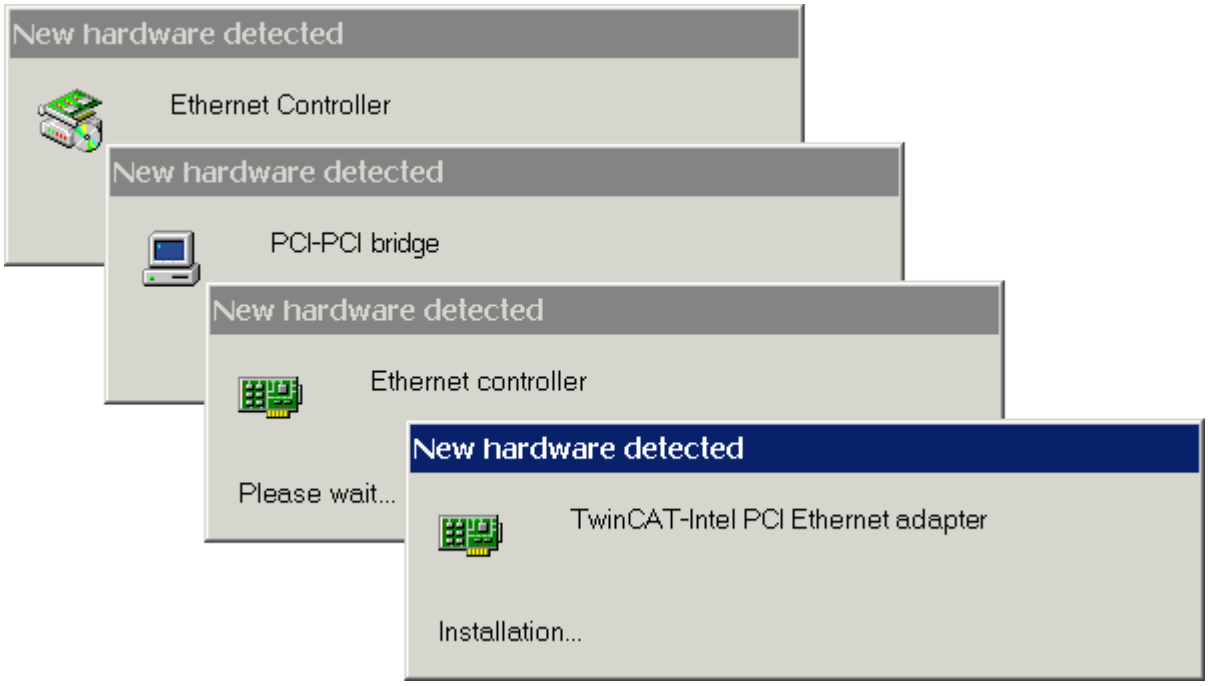
- Driver installation using the Add New Hardware Wizard:
  This is the usual way to install hardware drivers.
- Driver substitution via the TwinCAT System Manager:
  If your operating system installed its own driver for the Beckhoff Intel PCI/Ethernet card, you can substitute this driver by the TwinCAT driver for real-time Ethernet manually in order to be able to take advantage of its real-time capability.
- Manual driver installation:
  If your operating system installed its own driver for the Beckhoff Intel PCI/Ethernet card, you can substitute the TwinCAT driver for real-time Ethernet manually in order to be able to take advantage of its real-time capability.

3.3 Driver installation using the Add New Hardware Wizard

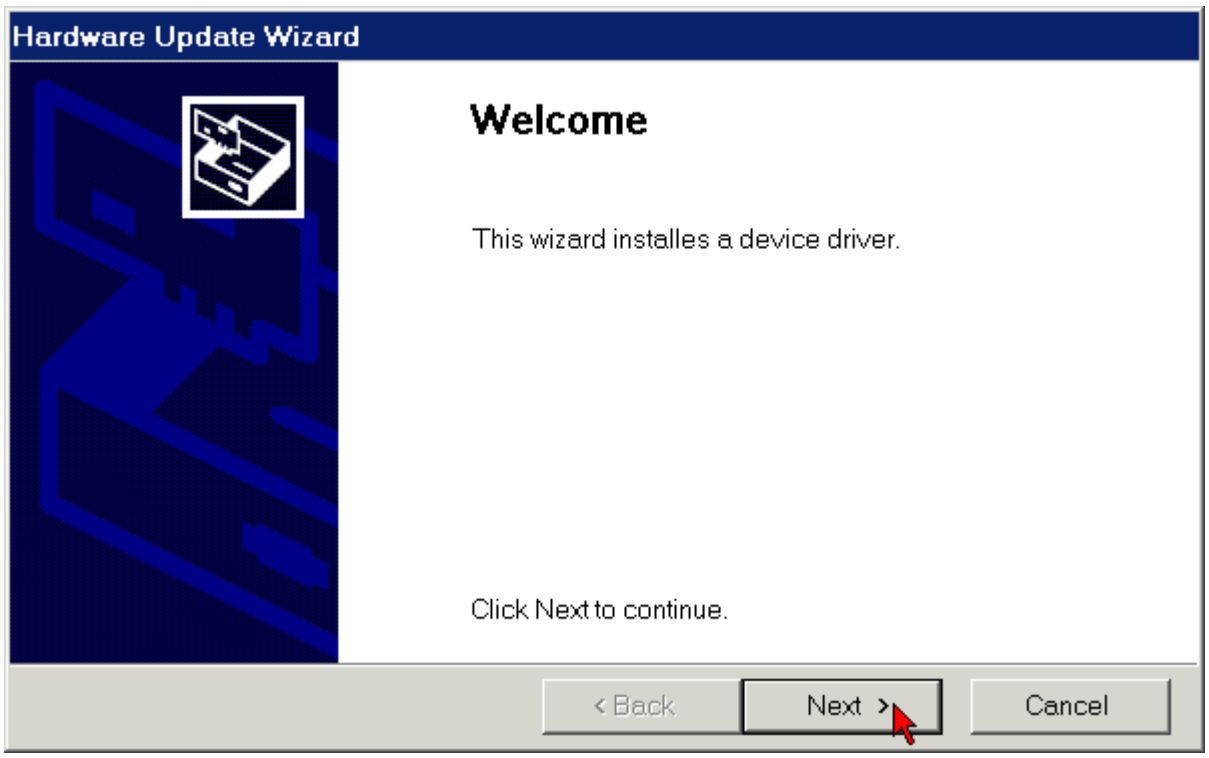
Note	**First install Software** Install the Beckhoff TwinCAT automation software before installing the Beckhoff Ethernet card.

Note	**Installation under Windows operating systems** All screen shots of this documentation are made under Windows 2000. Under all Windows operating systems, the TwinCAT driver is installed in the same way.

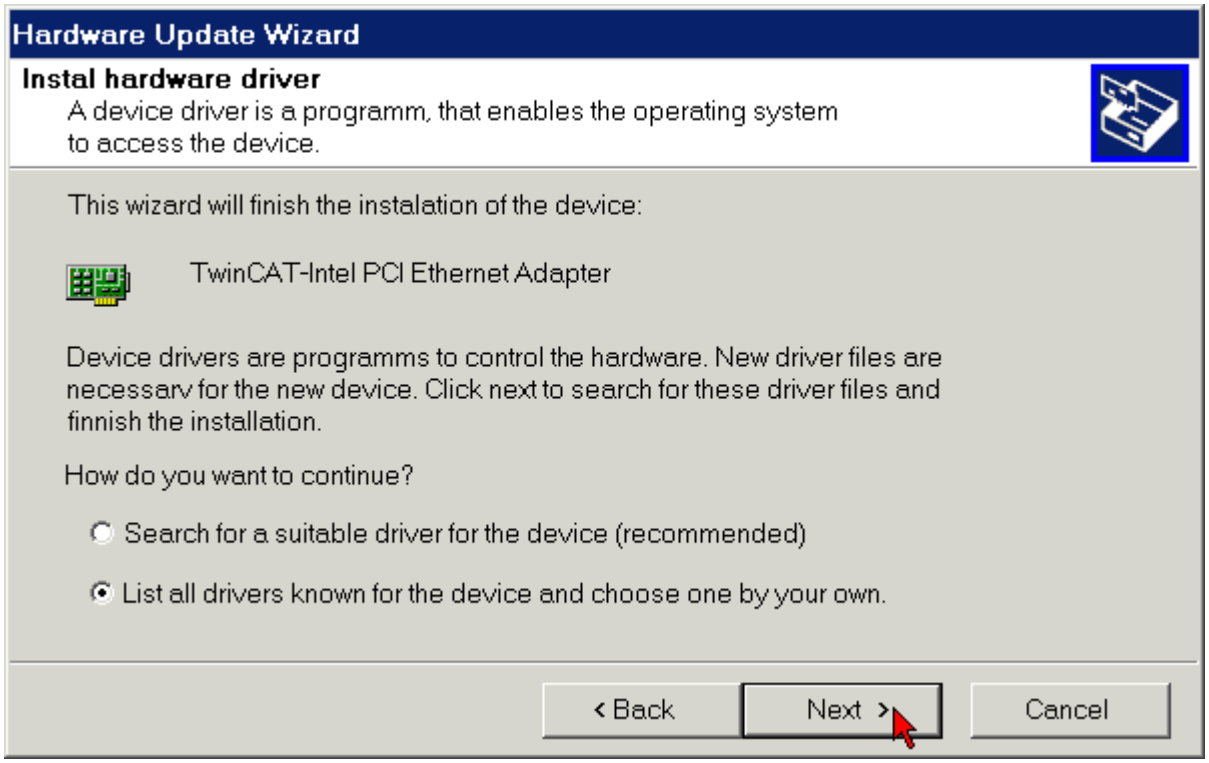
After installation of the Beckhoff Ethernet card, the operating system comes up with the following message during start-up:



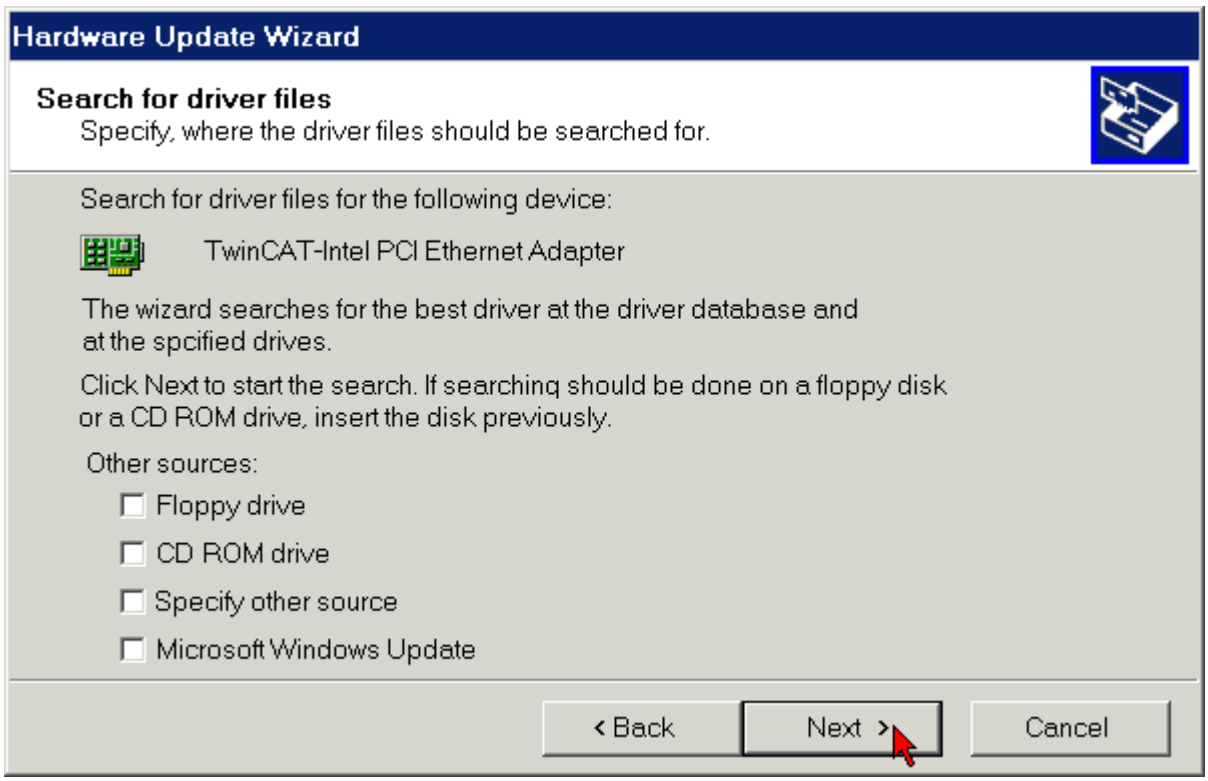
Follow the instructions of the Add Hardware Wizard.



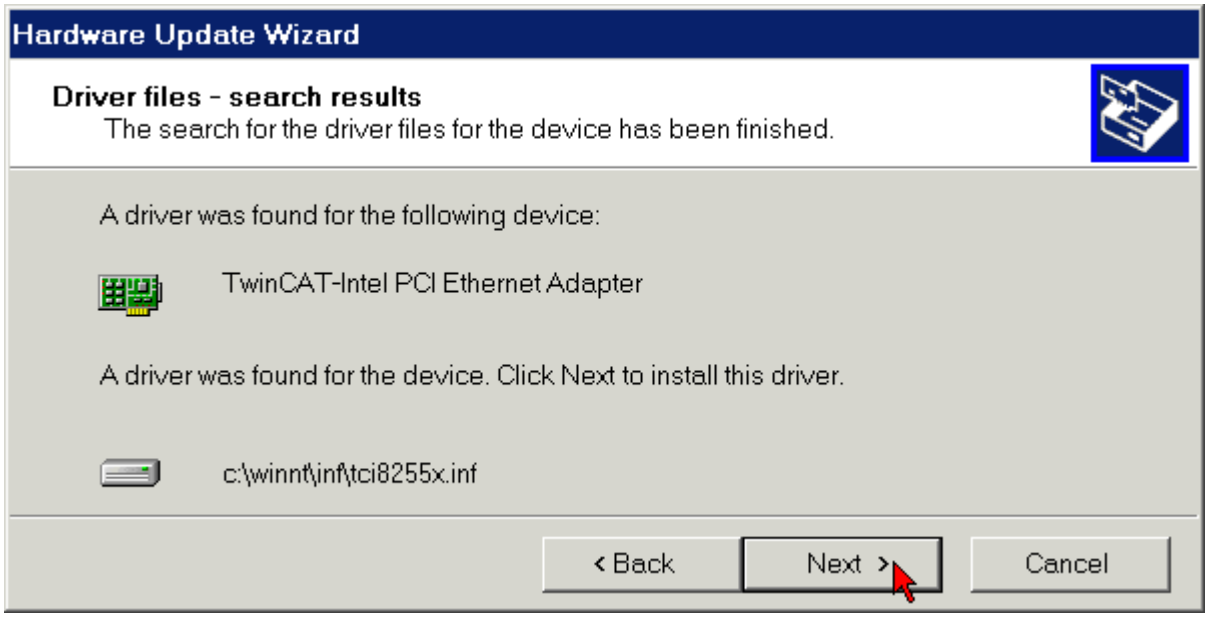
Allow the assistant to search for a suitable driver.



The TwinCAT driver for real-time Ethernet is included with the Beckhoff TwinCAT automation software.

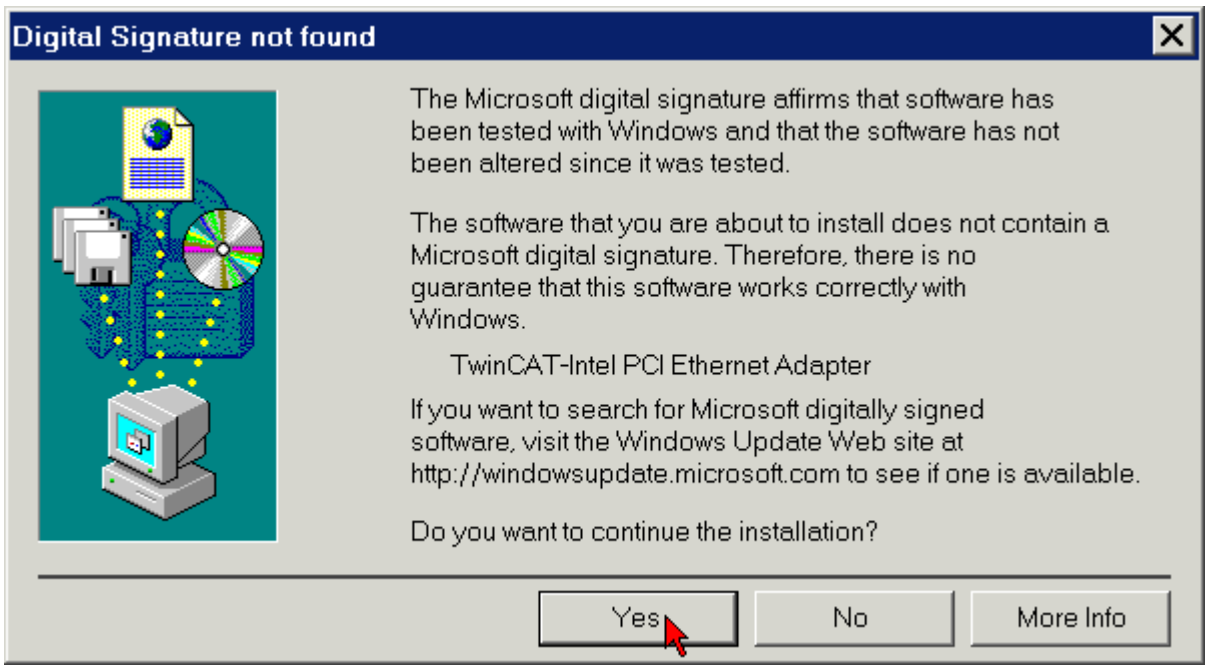


If you have installed the Beckhoff TwinCAT automation software before installing the Beckhoff Ethernet card, the Add New Hardware Wizard will find the TwinCAT driver for real-time Ethernet in the driver database on the hard disk of your PC.

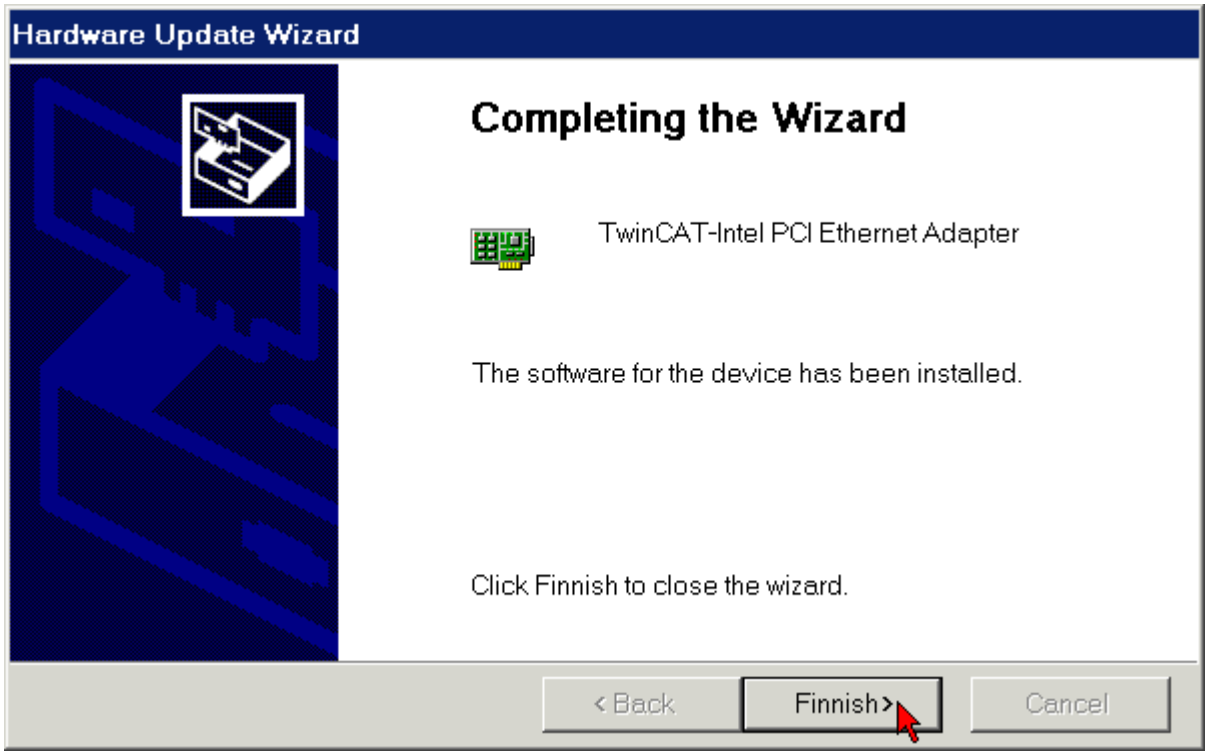


Operation of the TwinCAT drivers for real-time Ethernet requires no digital signature from Microsoft. Beckhoff has thoroughly tested this driver in conjunction with the supported hardware and has verified compatibility with Windows operating systems.

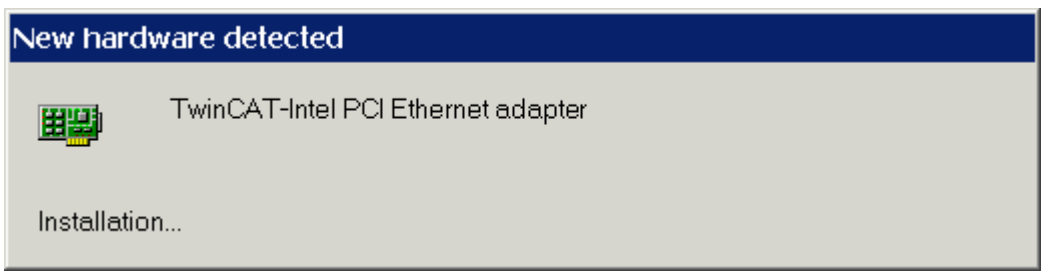
Click *Yes* to continue with the rest of the installation.



The TwinCAT driver for real-time Ethernet was installed successfully for an Ethernet port. Exit the installation with *Finish*.



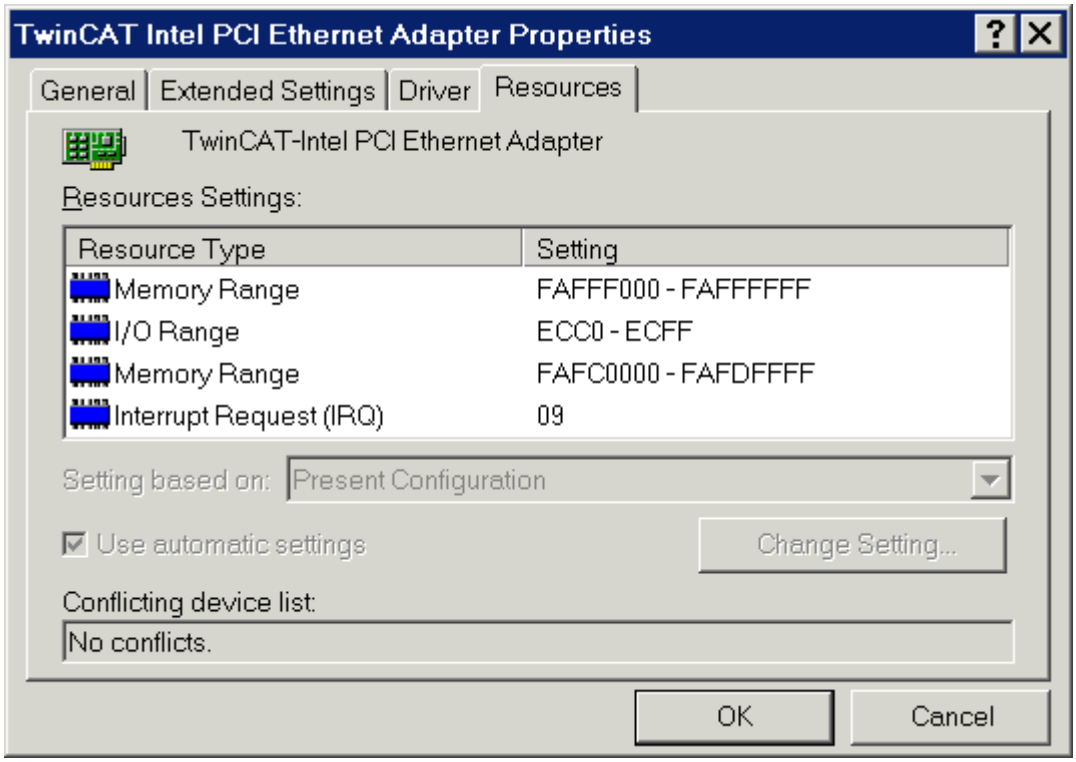
If you are using a multi-channel Beckhoff Ethernet card, repeat the driver installation procedure for each additional channel:



Now you have to activate the TwinCAT Ethernet Protocol (see chapter *Activating the TwinCAT Ethernet protocol*).

3.3.1 Resources

Example for the resources of an FC900x under Windows 2000
(Control Panel/System/Hardware/Device Manager/Network adapters/TwinCAT Intel PCI-Ethernet adapter/Resources):



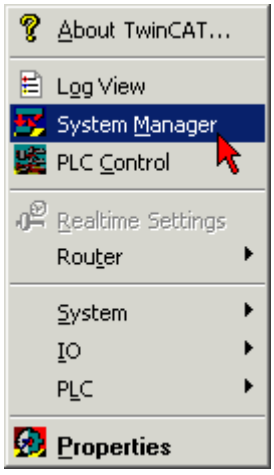
3.4 Driver substitution using the TwinCAT System Manager

Note	**First install Software** Install the Beckhoff TwinCAT automation software before installing the Beckhoff Ethernet card.

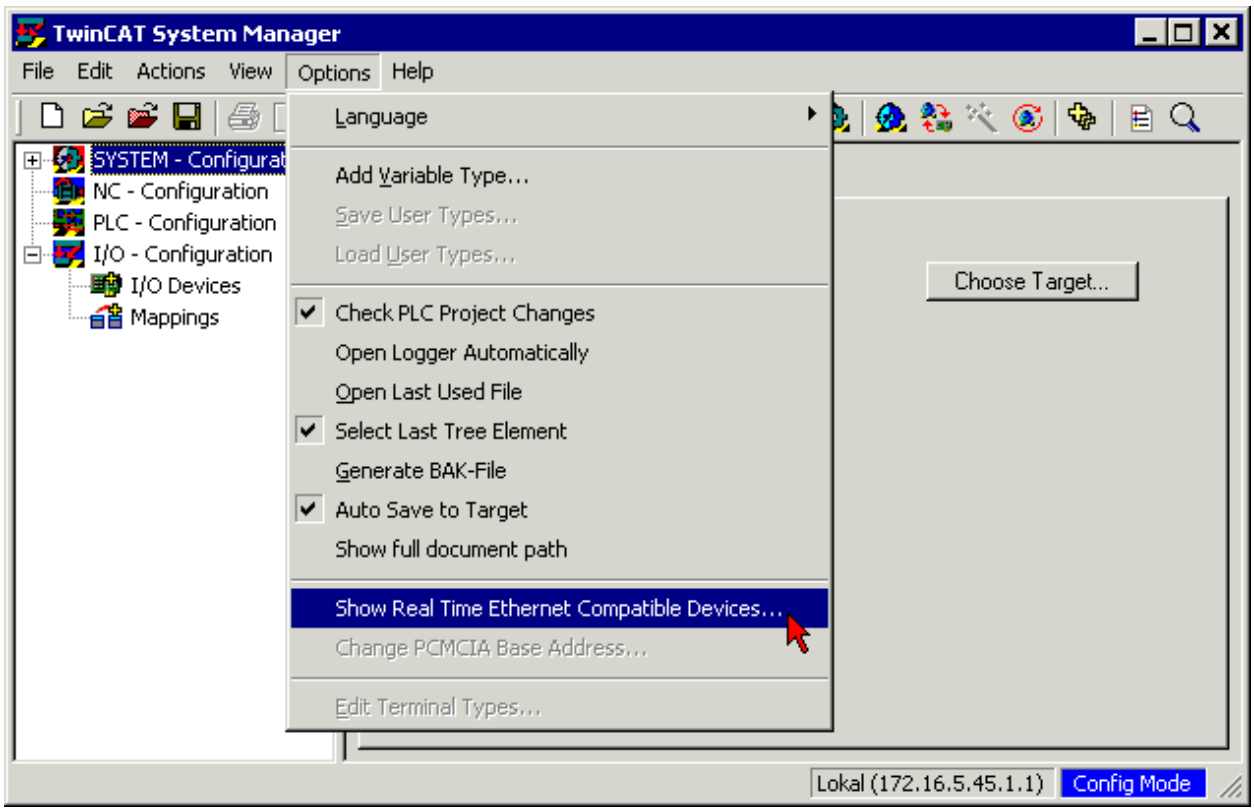
Note	**Installation under Windows operating systems** All screen shots of this documentation are made under Windows 2000. Under all Windows operating systems, the TwinCAT driver is installed in the same way.

Note	**Description in TwinCAT 2** All screen shots of this description are made within TwinCAT 2.

Click t al the right bottom side of the Windows taskbar on the TwinCAT icon and start the TwinCAT System-Manger.

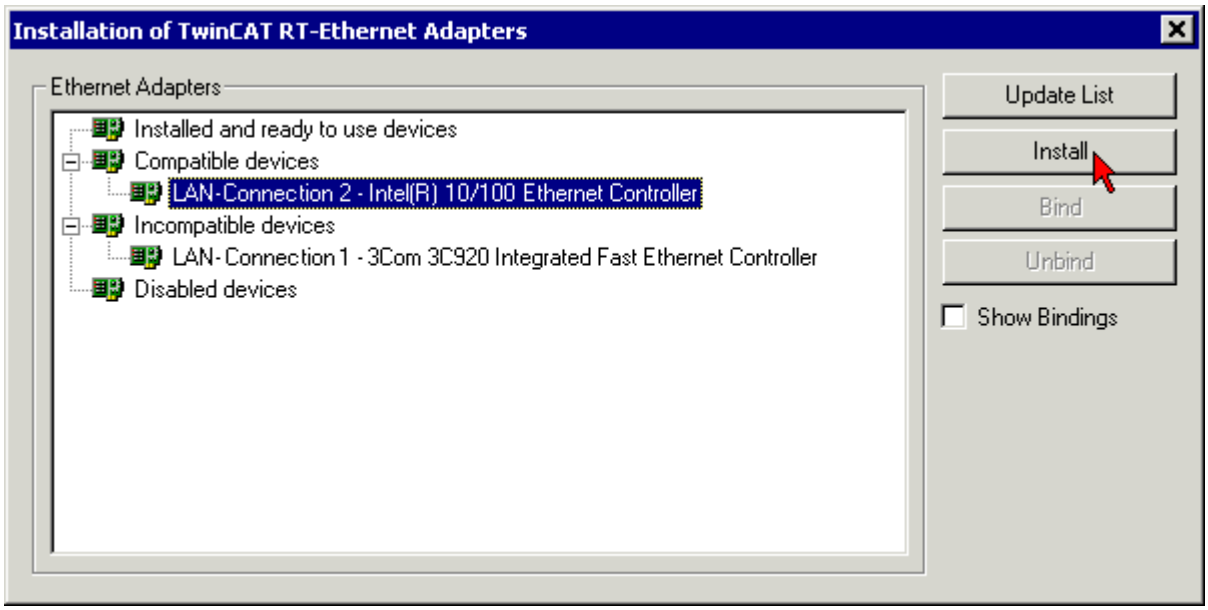


Click on *Show Real Time Ethernet Compatible Devices* in the *Options* menu.

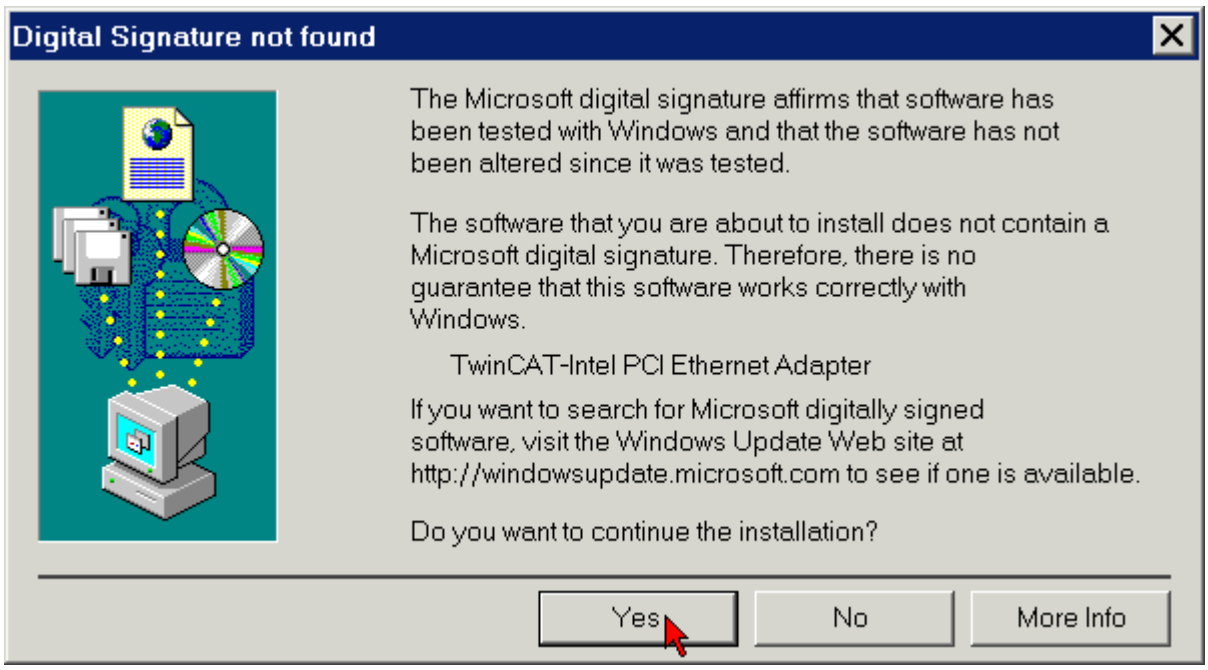


Now the TwinCAT System Manager shows the real time capable (Compatible devices) and non real time capable (Incompatible devices) network cards.

Chose a real time capable network card and click on the *Install* button.

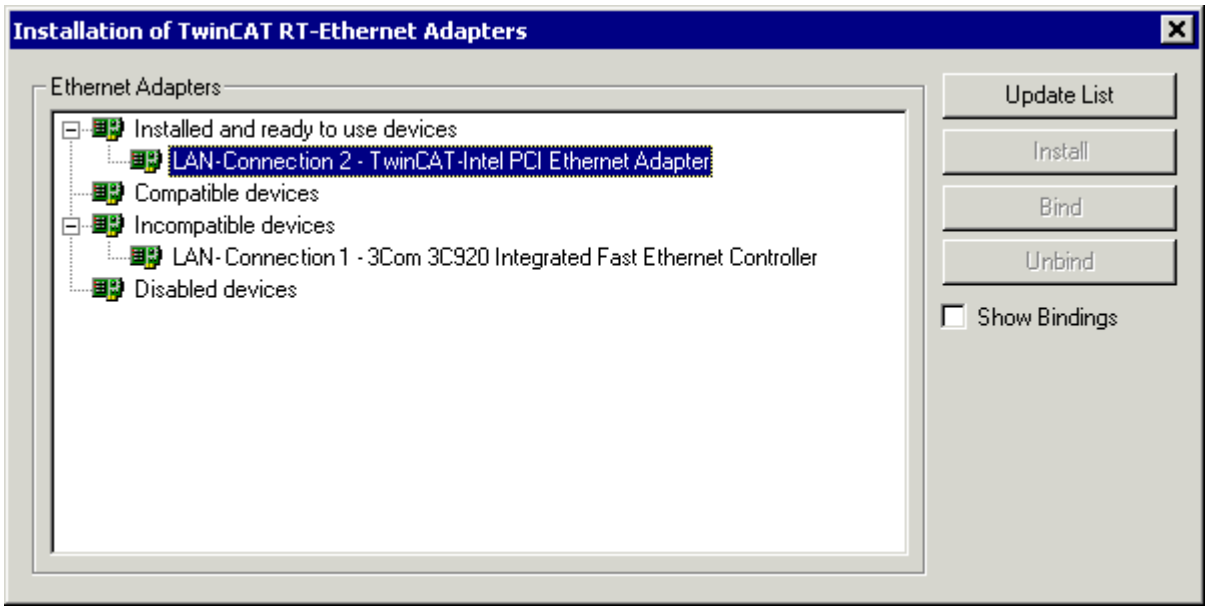


Now the TwinCAT System Manager installs the TwinCAT driver for real-time Ethernet and the TwinCAT Ethernet Protocol for the chosen device.



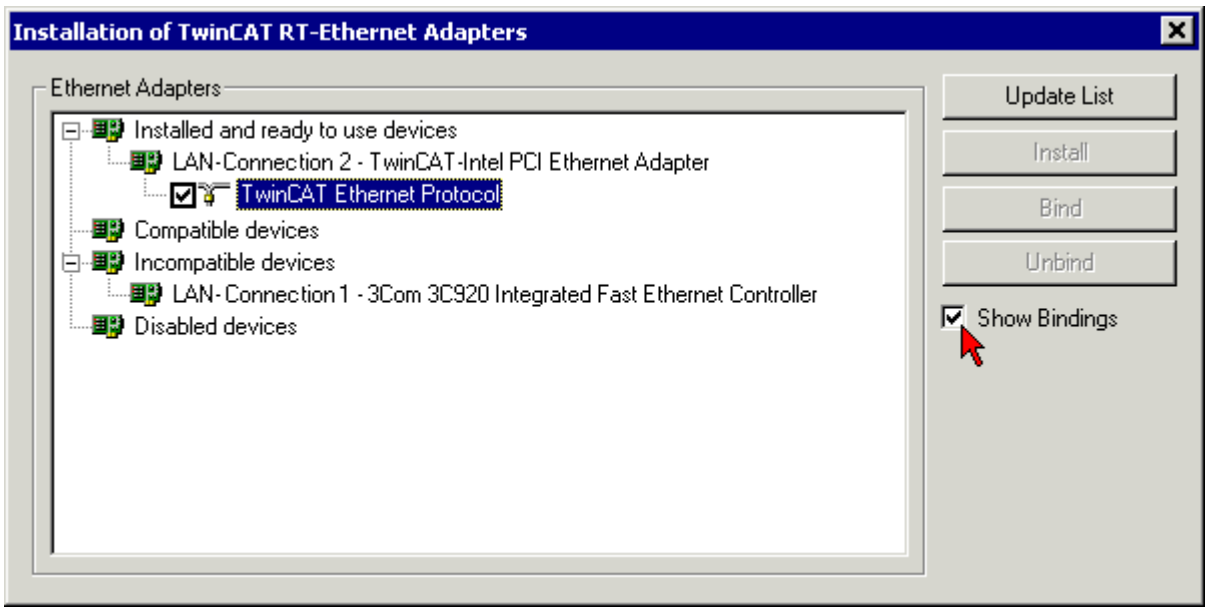
Operation of the TwinCAT drivers for real-time Ethernet requires no digital signature from Microsoft. Beckhoff has thoroughly tested this driver in conjunction with the supported hardware and has verified compatibility with Windows operating systems.

Click *Yes* to continue with the rest of the installation.



The TwinCAT driver for real-time Ethernet and the belonging TwinCAT Ethernet Protocol were installed.

Activate the *Show Bindings* Check-Box to display the bounded protocol.


Installation of TwinCAT RT-Ethernet Adapters
Ethernet Adapters
Installed and ready to use devices
LAN-Connection 2 - TwinCAT-Intel PCI Ethernet Adapter
TwinCAT Ethernet Protocol
Compatible devices
Incompatible devices
LAN-Connection 1 - 3Com 3C920 Integrated Fast Ethernet Controller
Disabled devices
Update List
Install
Bind
Unbind
Show Bindings

3.5 Manual driver installation

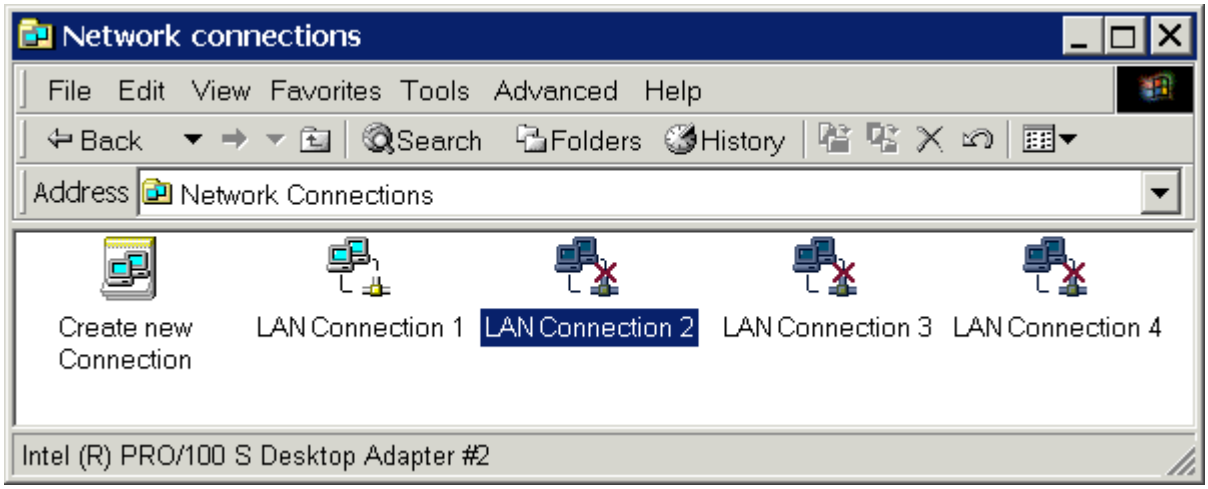
If your operating system installed its own driver for the Beckhoff Intel PCI/Ethernet card, you have to install the TwinCAT driver for real-time Ethernet manually in order to be able to take advantage of its real-time capability.

Note	**First install Software** Install the Beckhoff TwinCAT automation software before installing the Beckhoff Ethernet card.

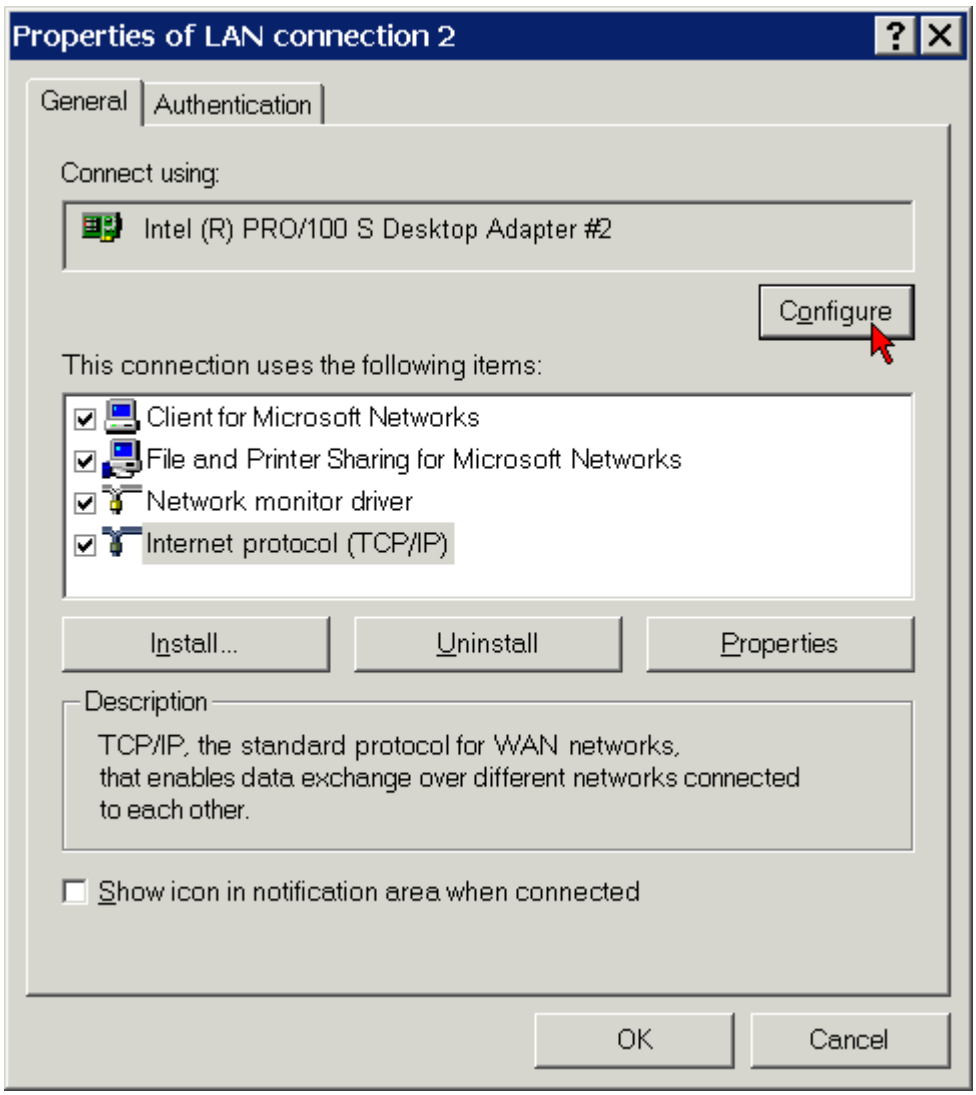
Note	**Installation under Windows operating systems** All screen shots of this documentation are made under Windows 2000. Under all Windows operating systems, the TwinCAT driver is installed in the same way.

Click on Network and Dial-up Connections under Start/Settings/Control Panel.

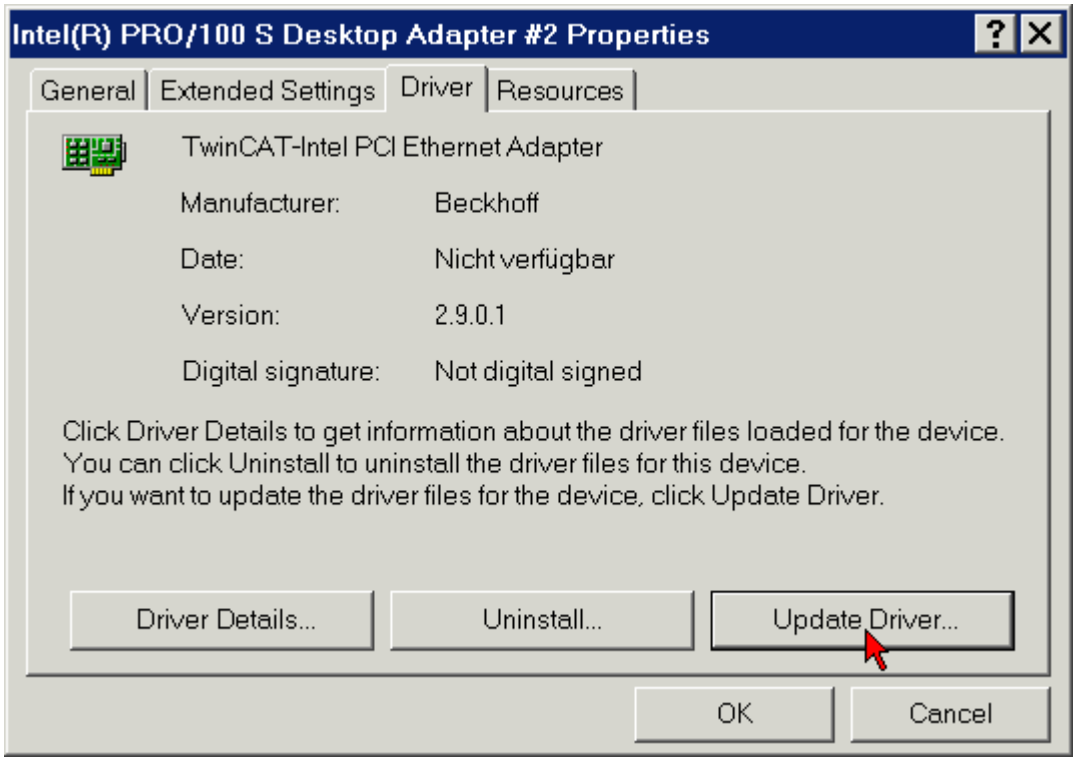
Click on an unused LAN connection (LAN connection 2).



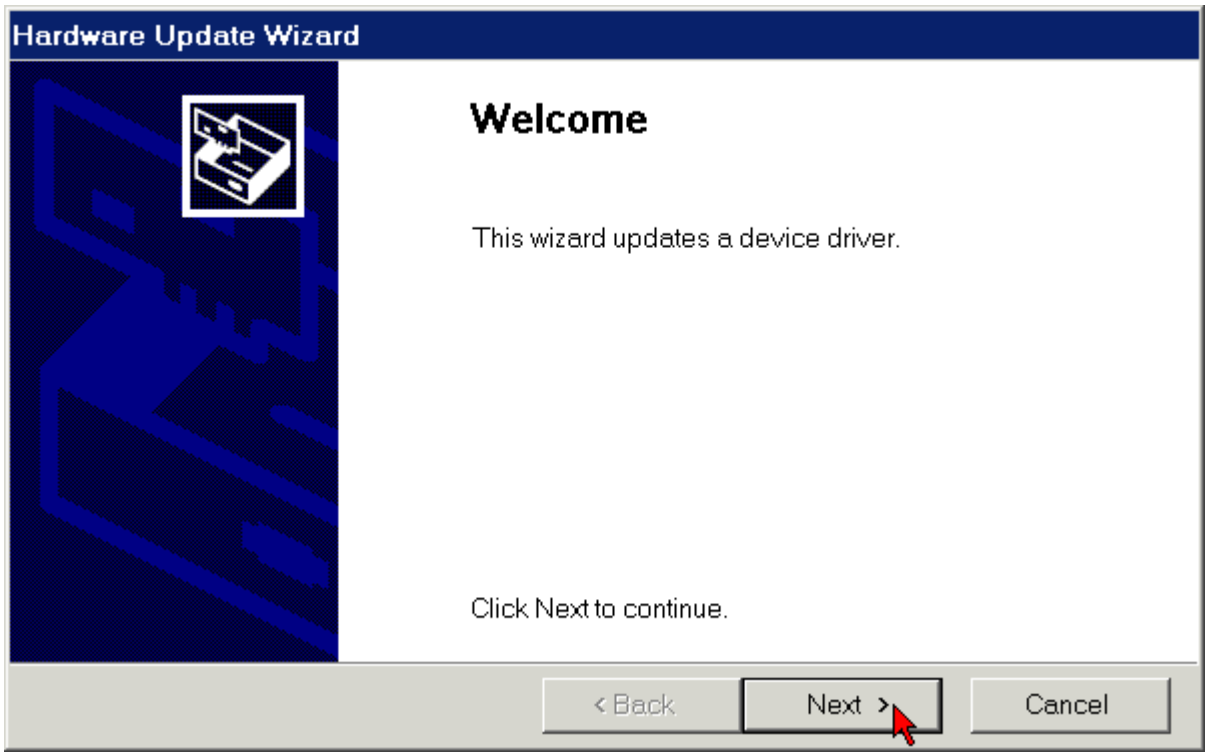
The properties of LAN connection 2 are displayed.



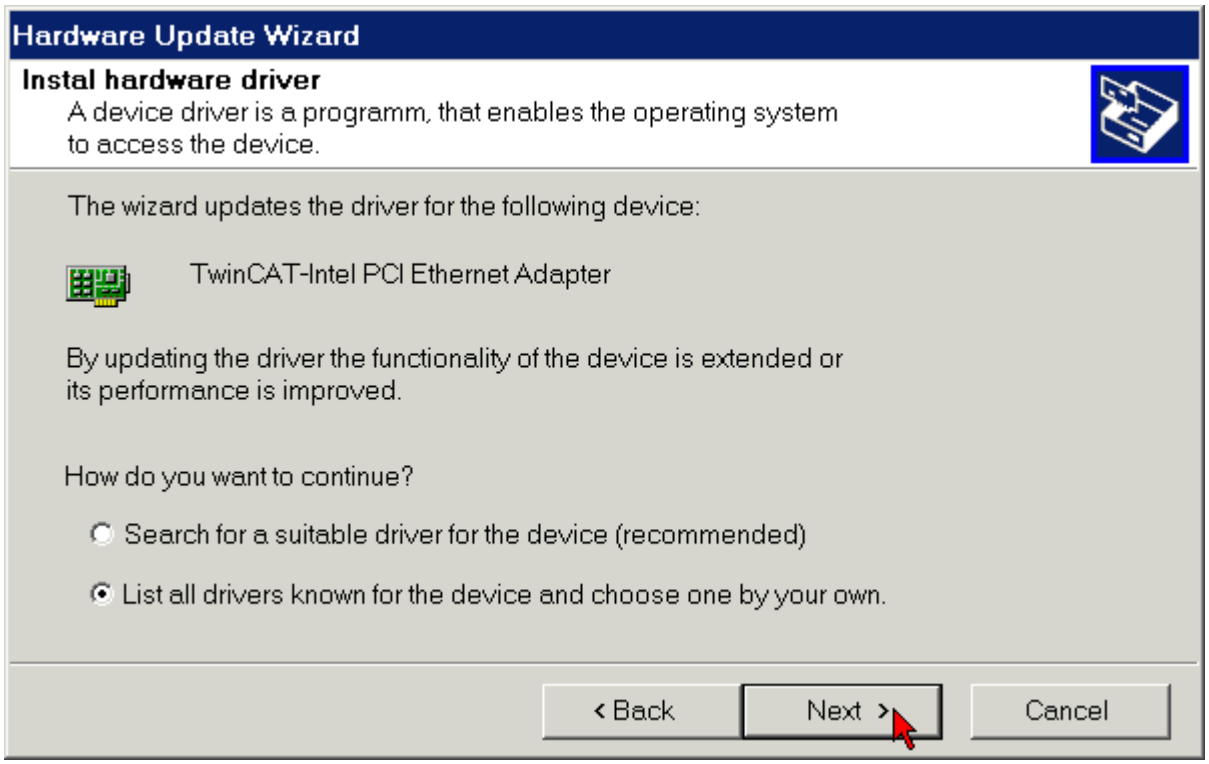
Click on Configure.



Change to the *Driver* tab, click on *Update Driver* and follow the instructions of the Add New Hardware Wizard.

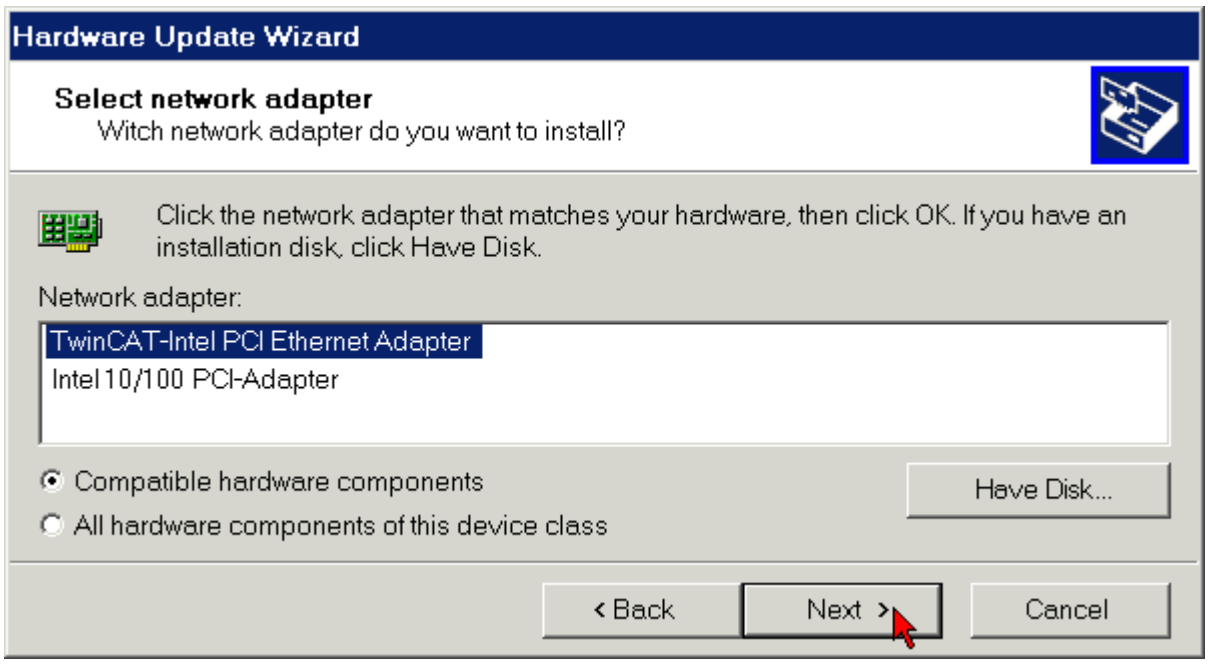


If you wish to select the associated driver yourself, select the option to display a list of all known drivers.

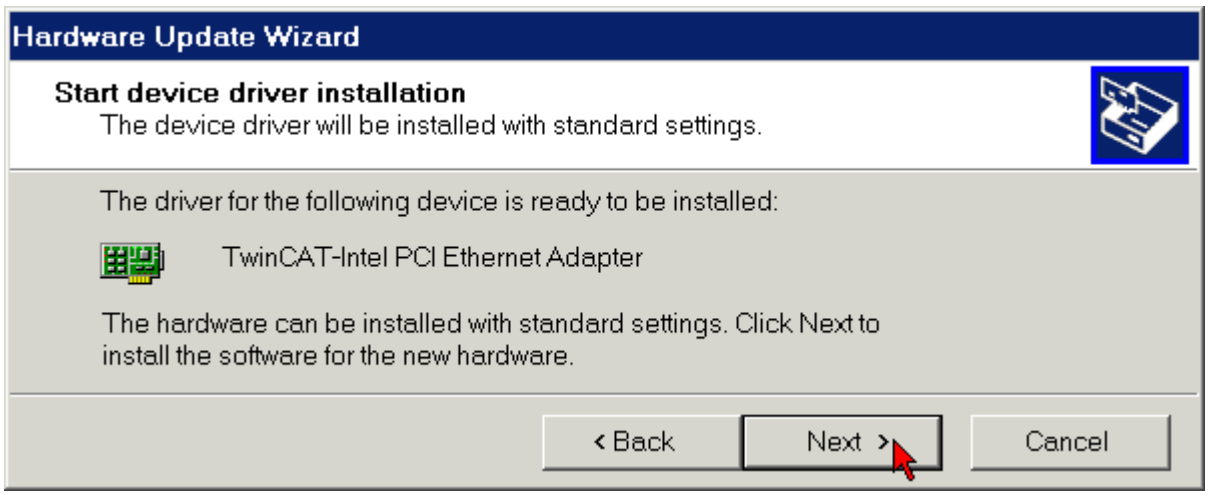


If the Beckhoff TwinCAT automation software is already installed, the Add New Hardware Wizard will offer the TwinCAT driver for real-time Ethernet.

Select the TwinCAT driver for real-time Ethernet.

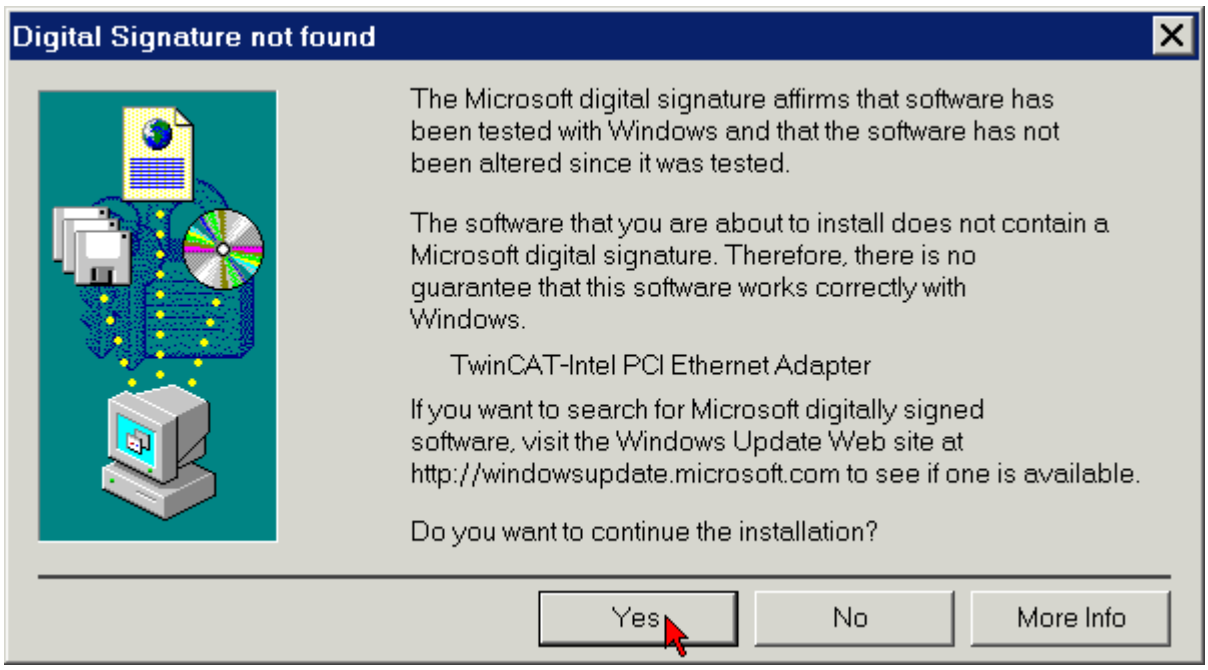


Start installing the selected driver.

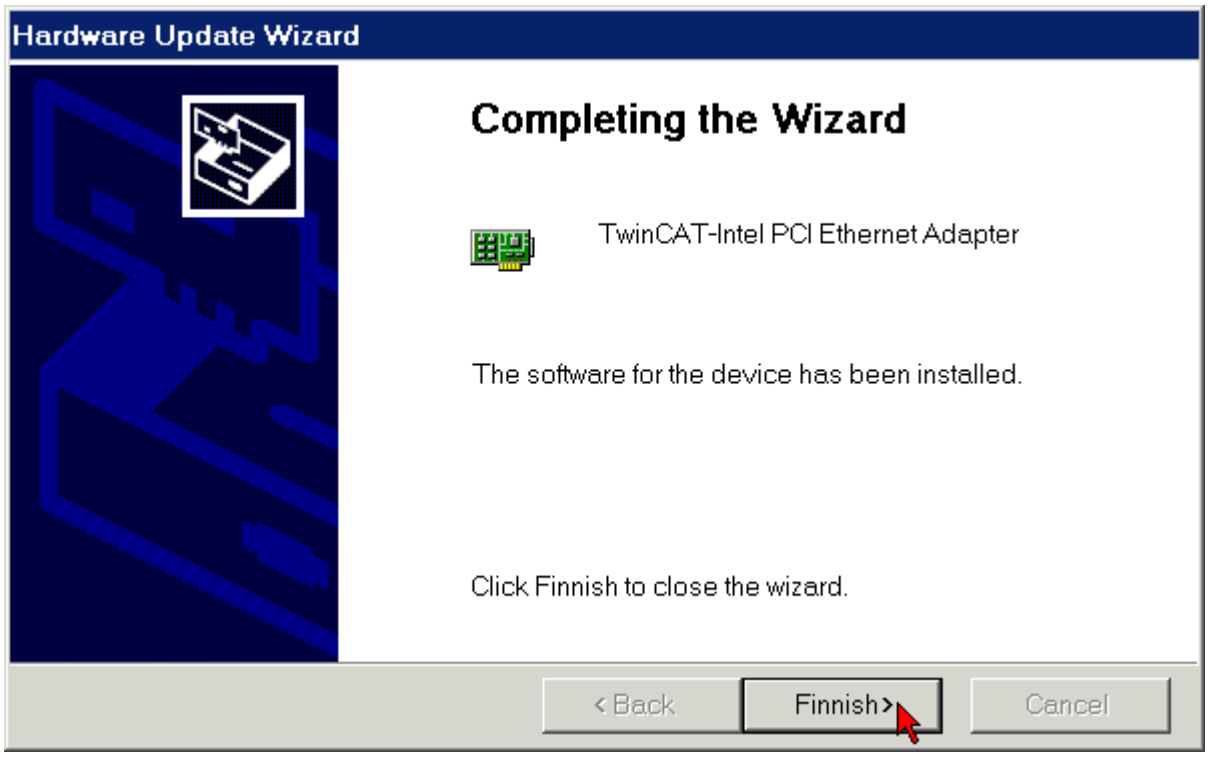


Operation of the TwinCAT drivers for real-time Ethernet requires no digital signature from Microsoft. Beckhoff has thoroughly tested this driver in conjunction with the supported hardware and has verified compatibility with Windows operating systems.

Click *Yes* to continue with the rest of the installation.



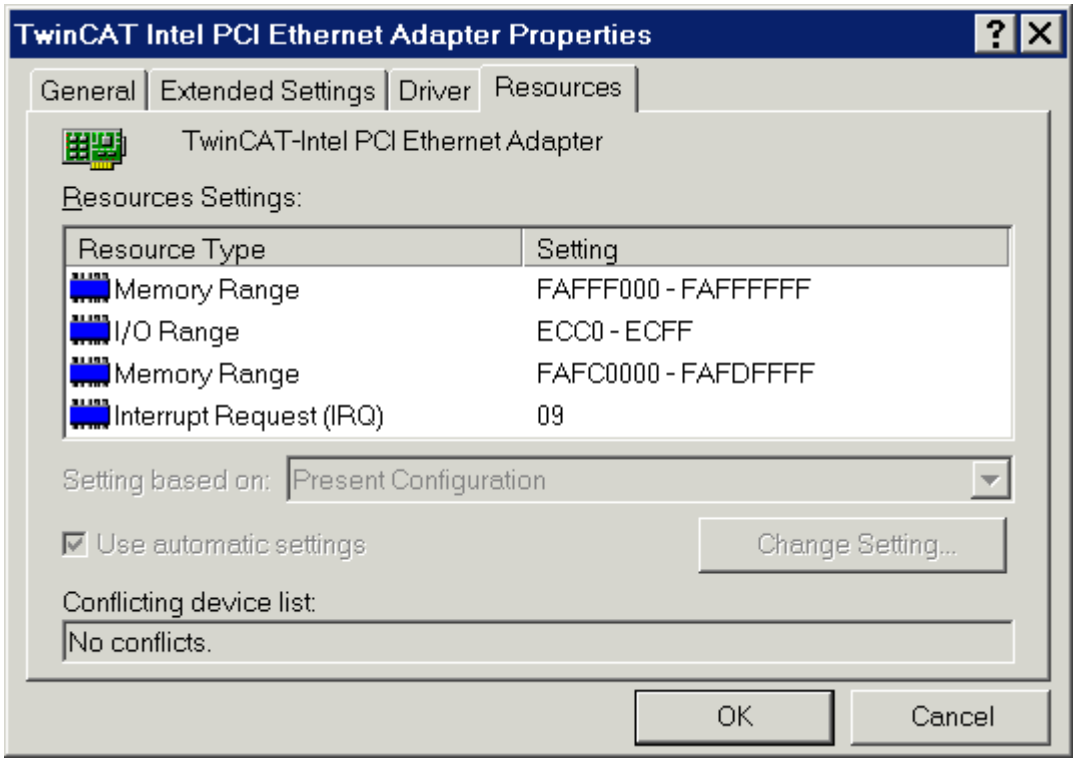
The TwinCAT driver for real-time Ethernet was installed successfully. Exit the installation with *Finish*.



Now you have to activate the TwinCAT Ethernet Protocol (see chapter *Activating the TwinCAT Ethernet protocol*).

3.5.1 Resources

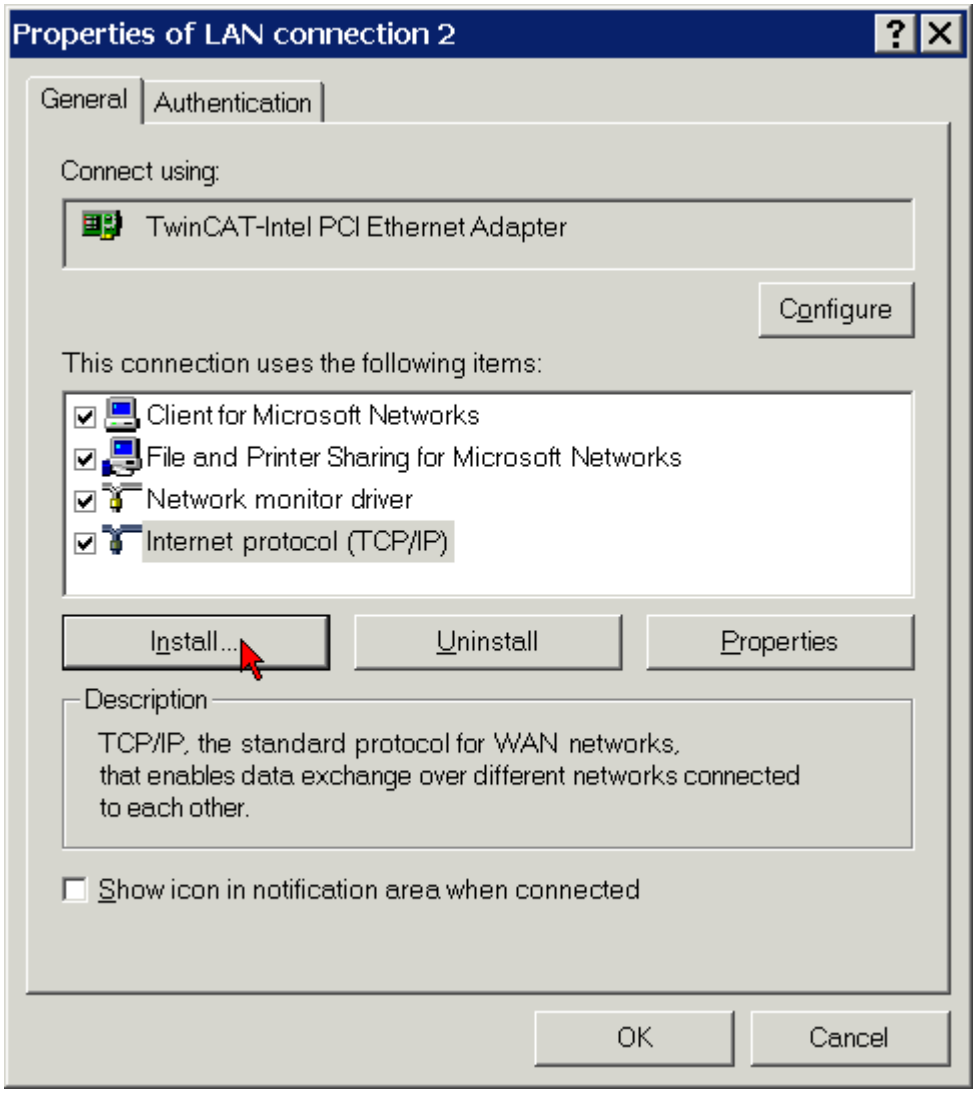
Example for the resources of an FC900x under Windows 2000.
(Control Panel/System/Hardware/Device Manager/Network adapters/TwinCAT Intel PCI-Ethernet adapter/Resources):



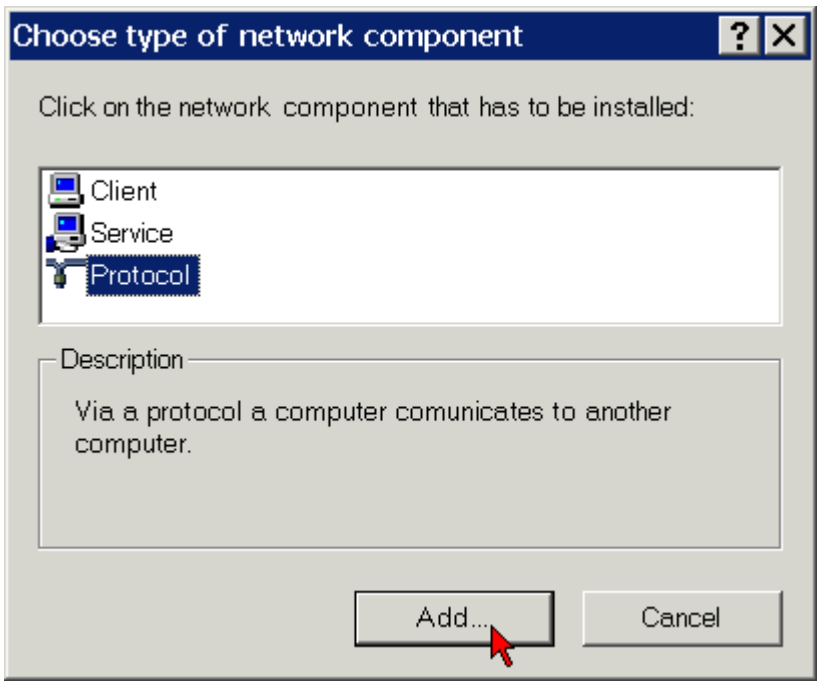
3.6 Activating the TwinCAT Ethernet protocol

In order to be able to make use of real-time capability, the TwinCAT Ethernet protocol has to be activated for the Beckhoff Intel PCI-Ethernet card.

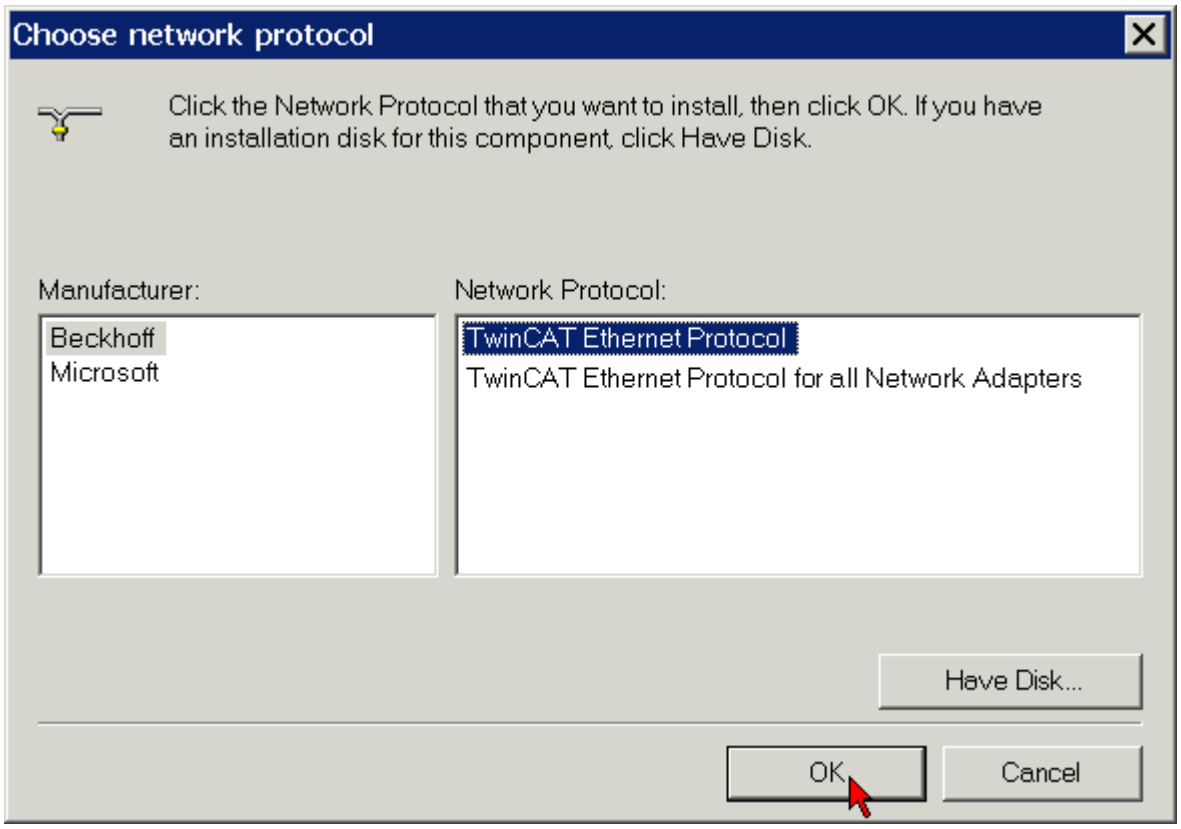
Under *Start/Settings/Control Panel/Network and Dial-up Connections* click on the LAN connection for which you would like to activate the TwinCAT Ethernet protocol (in the example LAN connection 2).



Click on *Install*.



Select Protocol (not Service!) and click on *Add*.

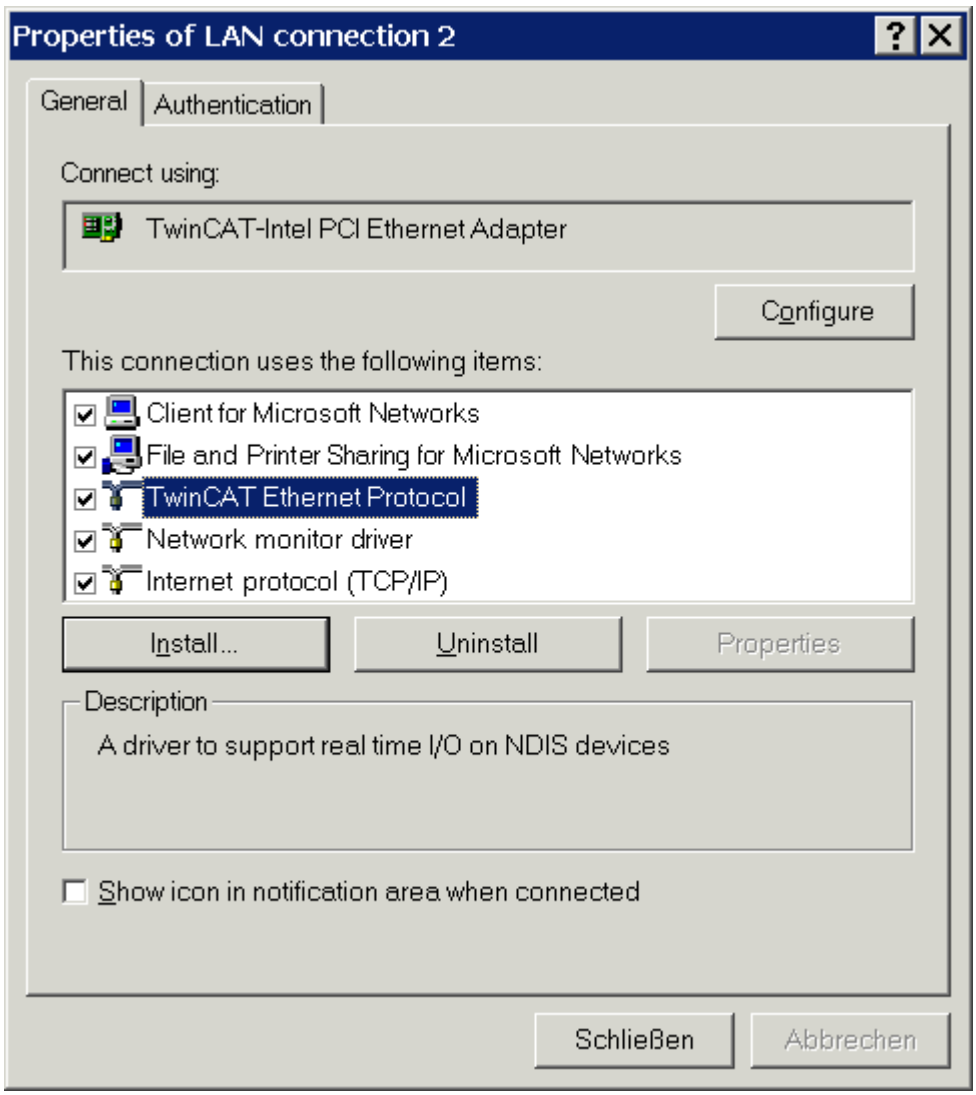


Under *Beckhoff* select the option *TwinCAT Ethernet Protocol* and click *OK*.

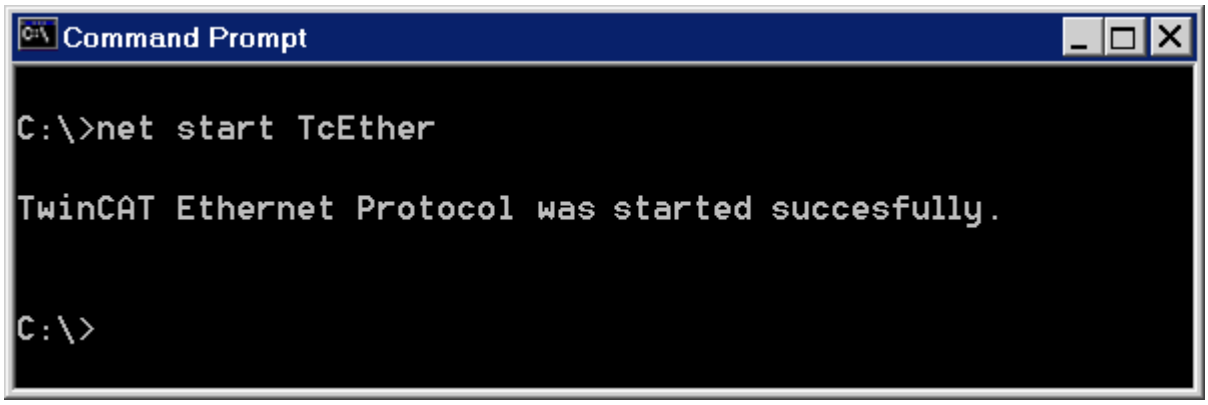
Note	**Beckhoff TwinCAT Ethernet protocol is not available** If the Beckhoff TwinCAT Ethernet protocol is not available for selection despite the fact that TwinCAT and the TwinCAT driver for real-time Ethernet have been installed, click on *Data carrier*, then *Search*, and select the file ***TcEther.inf*** in folder C:\Windows\inf. If the folder C:\Windows\inf is not displayed, activate the following options in Windows Explorer under *Tools/Folder Options/View*: • *Show content of system folders* • *Hidden files and folders - Show all files and folders*

Attention	**Controlling real applications with *TwinCAT Ethernet Protocol*** For controlling real applications choose necessarily the *TwinCAT Ethernet Protocol*, not the TwinCAT Ethernet Protocol for all Network Adapters! The *TwinCAT Ethernet Protocol for all Network Adapters* just an evaluation protocol to test TwinCAT also with other network adapters that have no Intel chip set. It supports no hard real time and may cause jitter!

The TwinCAT Ethernet protocol should now be displayed in the list of components.



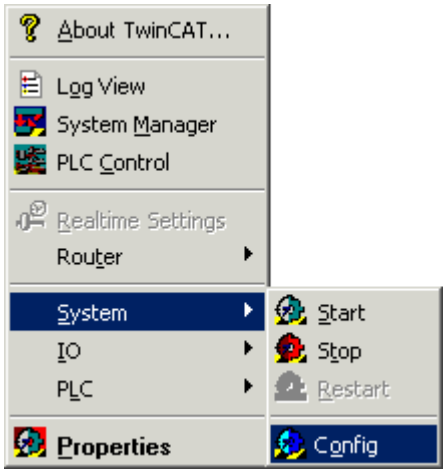
The TwinCAT Ethernet Protocol can be started by issuing can the command *net start TcEther* in a DOS Command Prompt or by restarting the PC. The TwinCAT Ethernet Protocol will be started whenever the PC is restarted.



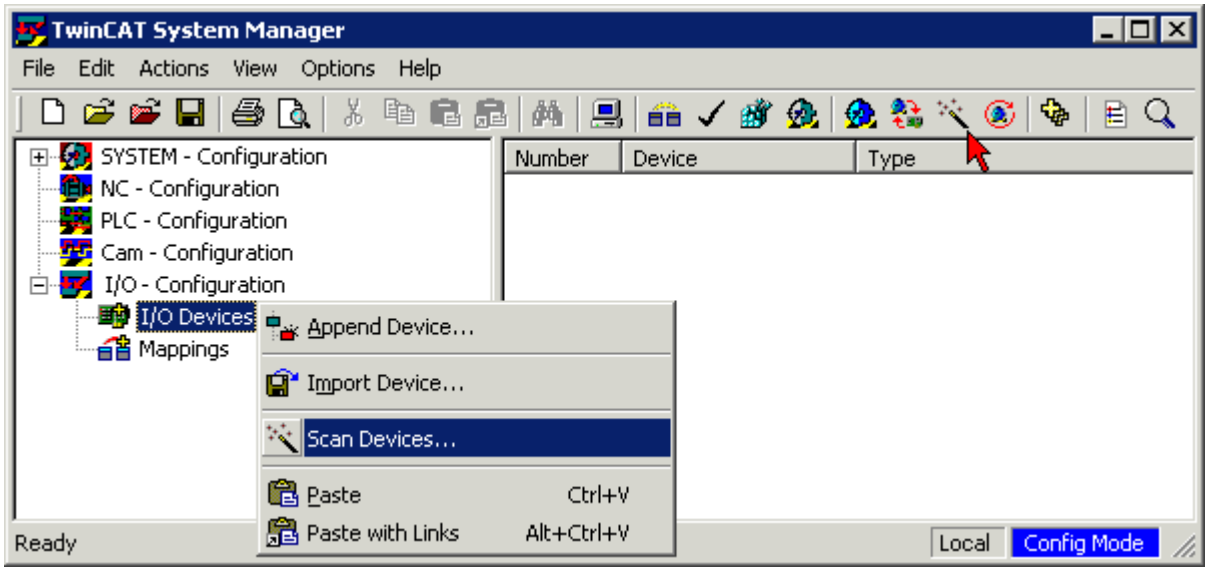
3.7 Searching for devices

Note	**Description in TwinCAT 2** All screen shots of this description are made within TwinCAT 2.

Switch TwinCAT to configuration mode.



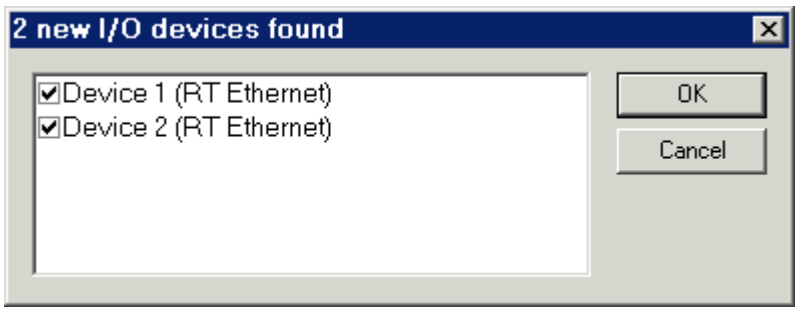
Start the TwinCAT System Manager. Using the right mouse button, start searching for new devices under the branch *I/O Configuration \I/O devices* or via the magic wand button in the button bar.



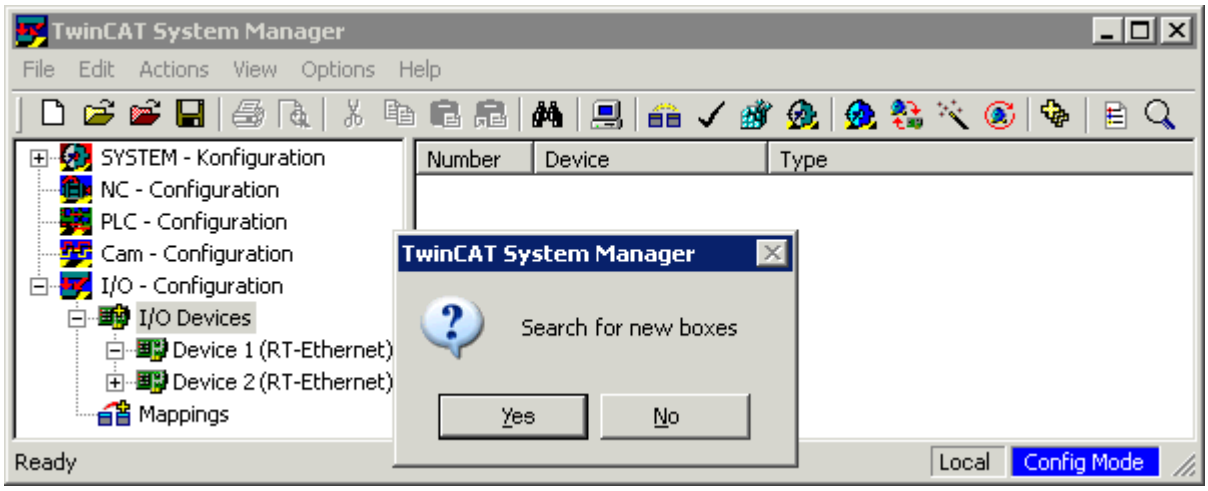
The system manager will search for I/O devices (e.g. fieldbus cards) installed on the PC.
In the example shown, the FC9004 channels for which

1. the TwinCAT driver for real-time Ethernet is installed and
2. the TwinCAT Ethernet protocol is activated

are displayed as Device 1 and Device 2.



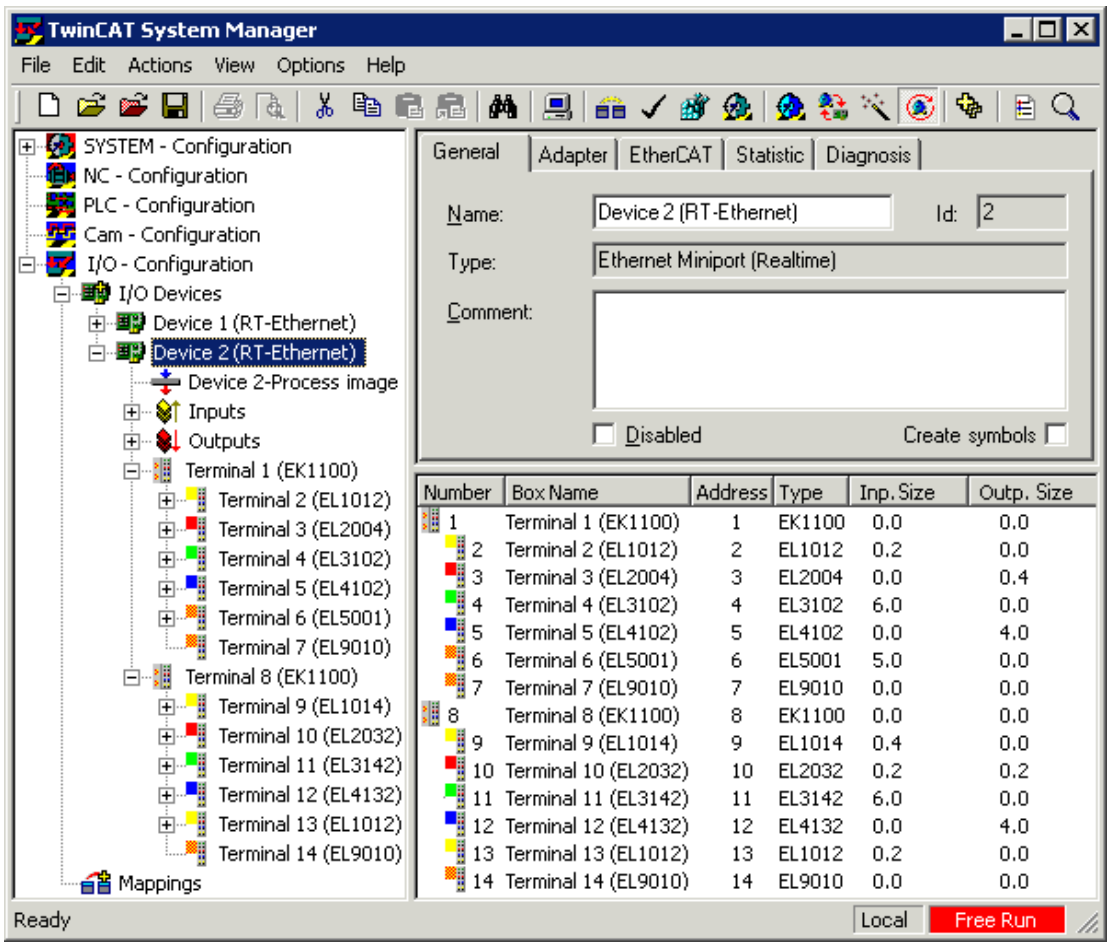
The system manager will now search the FC9004 channels for boxes (Bus Couplers, Bus Terminal controllers or Fieldbus Box modules).



The system manager now wants to activate Free Run mode. Click on *Yes*.

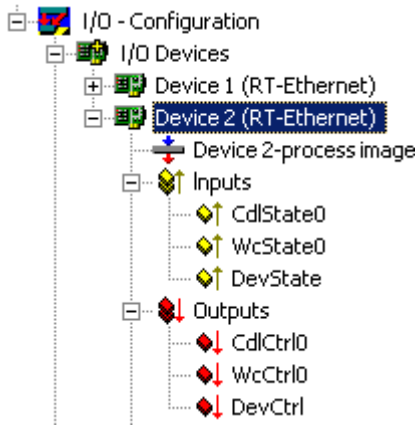


The system manager will now display the configuration it found:


TwinCAT System Manager
File Edit Actions View Options Help
SYSTEM - Configuration
NC - Configuration
PLC - Configuration
Cam - Configuration
I/O - Configuration
I/O Devices
Device 1 (RT-Ethernet)
Device 2 (RT-Ethernet)
Device 2-Process image
Inputs
Outputs
Terminal 1 (EK1100)
Terminal 2 (EL1012)
Terminal 3 (EL2004)
Terminal 4 (EL3102)
Terminal 5 (EL4102)
Terminal 6 (EL5001)
Terminal 7 (EL9010)
Terminal 8 (EK1100)
Terminal 9 (EL1014)
Terminal 10 (EL2032)
Terminal 11 (EL3142)
Terminal 12 (EL4132)
Terminal 13 (EL1012)
Terminal 14 (EL9010)
Mappings
General Adapter EtherCAT Statistic Diagnosis
Name: Device 2 (RT-Ethernet) Id: 2
Type: Ethernet Miniport (Realtime)
Comment:
Disabled Create symbols
Number Box Name Address Type Inp. Size Outp. Size
1 Terminal 1 (EK1100) 1 EK1100 0.0 0.0
2 Terminal 2 (EL1012) 2 EL1012 0.2 0.0
3 Terminal 3 (EL2004) 3 EL2004 0.0 0.4
4 Terminal 4 (EL3102) 4 EL3102 6.0 0.0
5 Terminal 5 (EL4102) 5 EL4102 0.0 4.0
6 Terminal 6 (EL5001) 6 EL5001 5.0 0.0
7 Terminal 7 (EL9010) 7 EL9010 0.0 0.0
8 Terminal 8 (EK1100) 8 EK1100 0.0 0.0
9 Terminal 9 (EL1014) 9 EL1014 0.4 0.0
10 Terminal 10 (EL2032) 10 EL2032 0.2 0.2
11 Terminal 11 (EL3142) 11 EL3142 6.0 0.0
12 Terminal 12 (EL4132) 12 EL4132 0.0 4.0
13 Terminal 13 (EL1012) 13 EL1012 0.2 0.0
14 Terminal 14 (EL9010) 14 EL9010 0.0 0.0
Ready
Local
Free Run

4 Configuration via TwinCAT System Manager

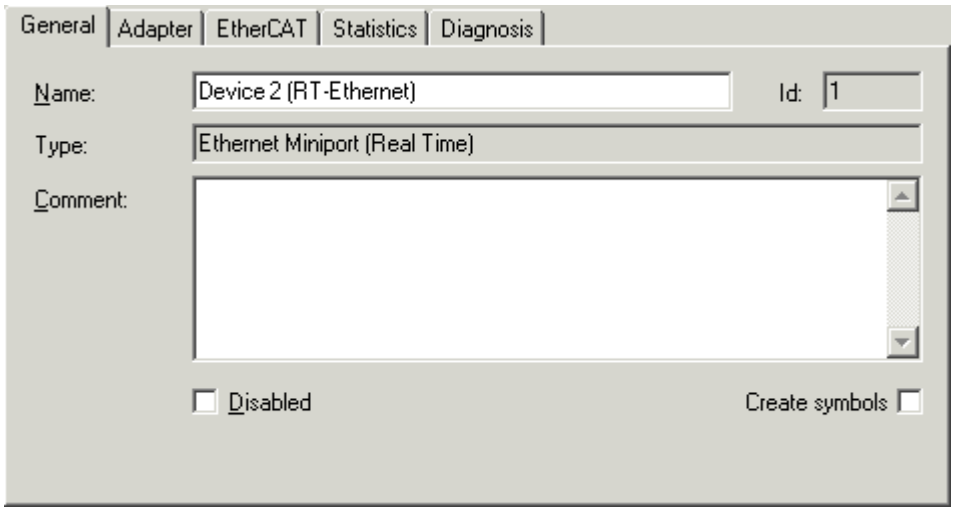
In the left-hand window of the TwinCAT system manager, click on the Ethernet channel you wish to configure (in the example: device 2 (RT Ethernet)).



In the right-window of the TwinCAT system manager, various tabs, i.e.
- General tab
- Adapter tab
- EtherCAT tab
- Statistics tab
- Diagnostics tab
are now available for configuring this Ethernet channel.

Note	**Numbering of the Ethernet channels** The system manager numbers the Ethernet channels (device 1, device 2 ...) in the order in which it recognizes them as ready for real-time Ethernet. This numbering does not have to correspond to the numbering of the LAN connections in the network connections of the Windows Control Panel or the numbering of the RJ45 sockets on the FC900x (X1, X2 ...). The channels of an FC9002/FC9004 can be identified via their unique MAC addresses.

4.1 General tab



Name
The name *Device 2 (RT Ethernet)* was allocated by the system manager. You may change it.

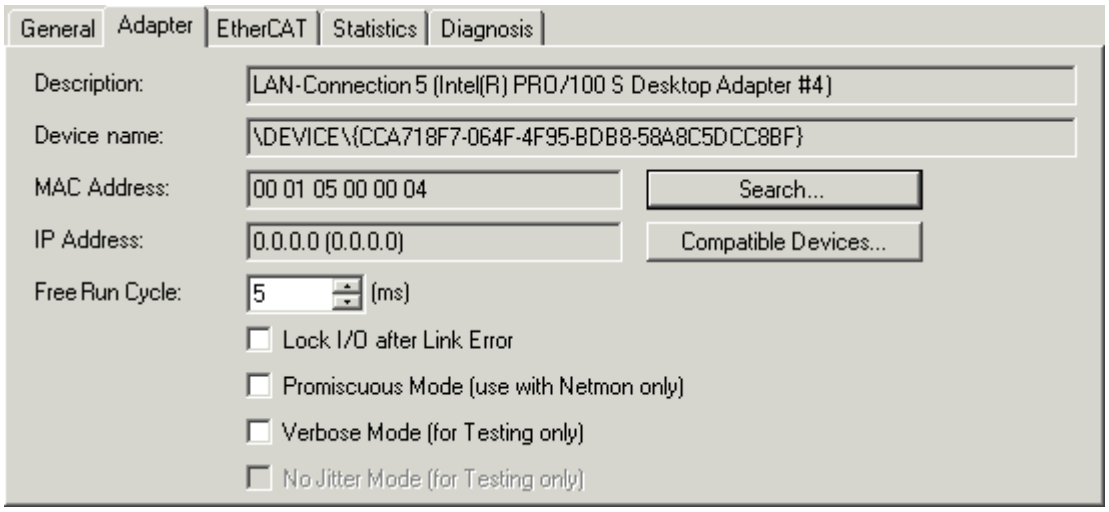
Type
Device type.

Comment
Here you can save a free comment text.

Disabled
This control box can be used to disable the Ethernet channel.

Create Symbols
If this control box is activated, the variables can also be accessed via names, although this takes up more memory.

4.2 Adapter tab



Description
Shows the number of the LAN connection and the desktop adapter of the Ethernet channel used.

Device name
Shows the Windows device name of the Ethernet channel used.

MAC address
shows the unique MAC address of the Ethernet channel used.

IP address
Shows the IP address of the Ethernet channel used.

Free Run cycle
Here you can specify the cycle time for Free Run mode.

Locking I/O after link error
If this control box is activated, process data exchange is not automatically restarted after a link error has been rectified (e.g. after pulling and reconnecting the network cable). Instead, an I/O reset is required first.

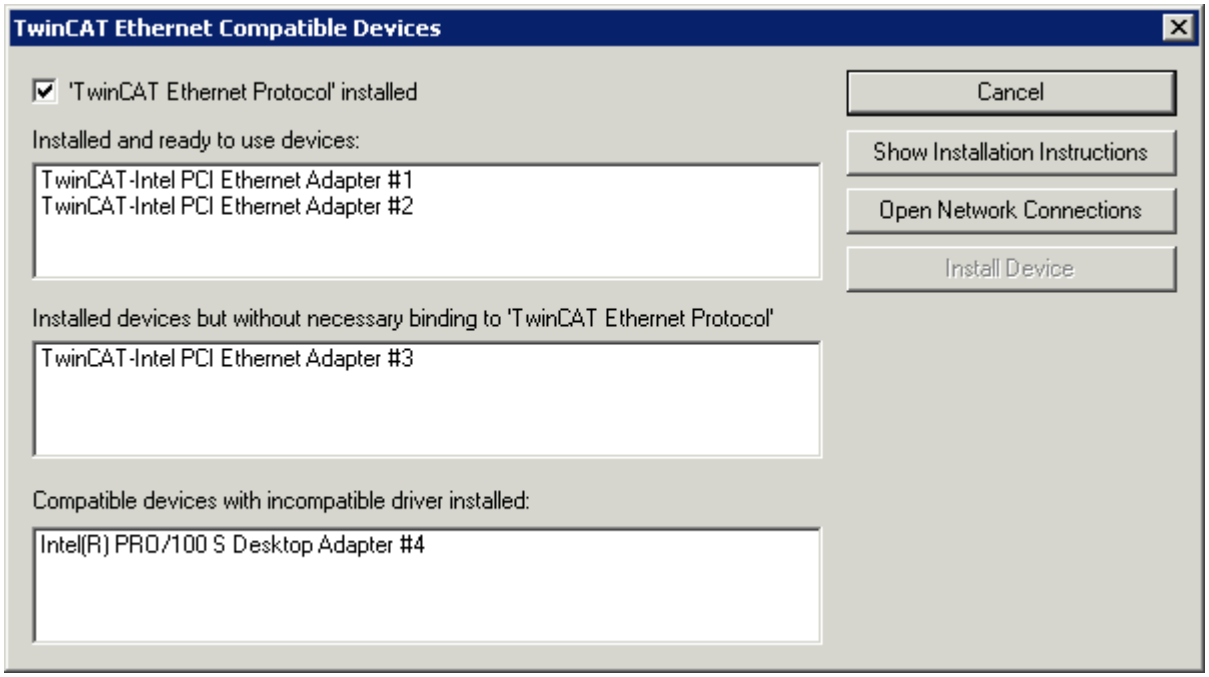
Promiscuous Mode (use with Netmon only)
If this control box is activated, the TwinCAT Ethernet telegrams are also transferred to Windows and can therefore be analyzed with a network monitor (e.g. Etherreal or MS network monitor).

Verbose Mode (for testing only)
In development.

No Jitter Mode (for testing only)
In development.

4.2.1 Compatible Devices

Click on *Compatible Devices* for displaying the TwinCAT-compatible Ethernet devices found on your PC.



TwinCAT Ethernet protocol installed

This control box indicates whether the TwinCAT protocol driver is already installed.

Installed usable devices

For the fieldbus cards/fieldbus card channels displayed here,
- the TwinCAT driver for real-time Ethernet is installed and
- the TwinCAT Ethernet protocol is activated.

These devices are ready for real-time Ethernet operation.

Installed devices without required binding to TwinCAT Ethernet

For the fieldbus cards/fieldbus card channels displayed here,
- the TwinCAT driver for real-time Ethernet is installed
- but the TwinCAT Ethernet protocol has not yet been activated.

Activate the TwinCAT Ethernet protocol, in order to make these devices ready for real-time Ethernet operation.

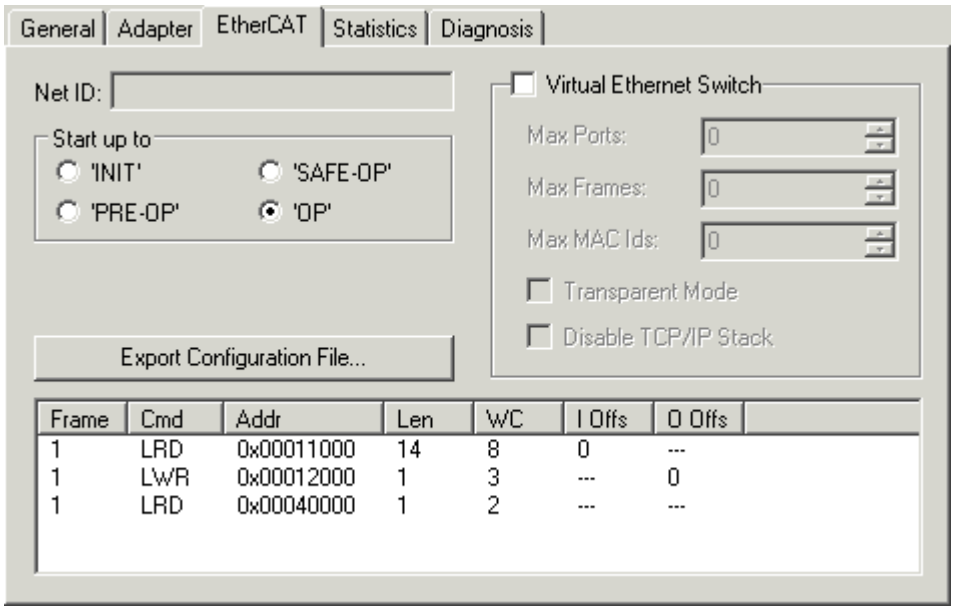
Compatible devices with incompatible driver

For the fieldbus cards/fieldbus card channels displayed here,
- the TwinCAT driver for real-time Ethernet is not installed
- and the TwinCAT Ethernet protocol has not yet been activated.

Install the TwinCAT driver for real-time Ethernet and activate the TwinCAT Ethernet protocol, in order to make these devices ready for real-time Ethernet operation.

Attention	**Disable Automatic Windows Updates** The advantage that TwinCAT real-time Ethernet uses standard hardware comes with a small disadvantage: Windows knows this standard hardware, but during a *Windows Update* or during installation of a *Service Packs* it will try and install the latest drivers that it considers to be the "best" drivers for this hardware, which means that it may overwrite the TwinCAT driver for real-time Ethernet. Remedy: Automatic Windows Updates can be disabled. For manual updates, the suggestion to replace the *Intel Networking Driver* should not be accepted. After the installation of a Service Pack, the TwinCAT driver for real-time Ethernet should be re-installed and the TwinCAT Ethernet protocol should be reactivated. Readiness for operation of TwinCAT real-time Ethernet can be checked via the *TwinCAT Ethernet compatible devices* screen.

4.3 EtherCAT tab



Net ID

Shows the AMS Net ID.

Start up to

This options field can be used to specify which EtherCAT system state should be activated when the device is switched on:
INIT: Initiate
PRE-OP: Pre Operation
SAFE-OP: Safe Operation
OP: Operation.

Export Configuration File

This button can be used to save the configuration information in an XML file for access from another master system, for example.

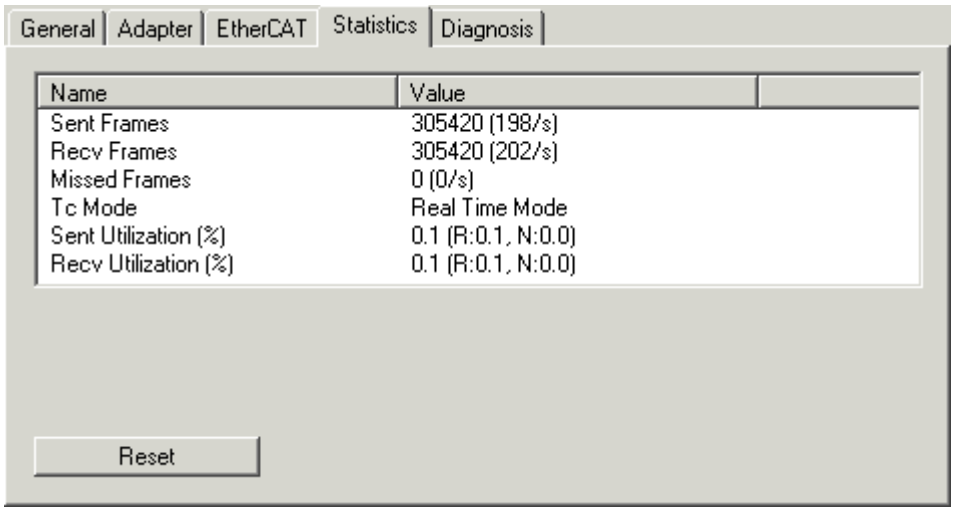
Virtual Ethernet Switch

In development.

Display window

Shows the structure of the EtherCAT frames with the commands that were called up.

4.4 Statistics tab



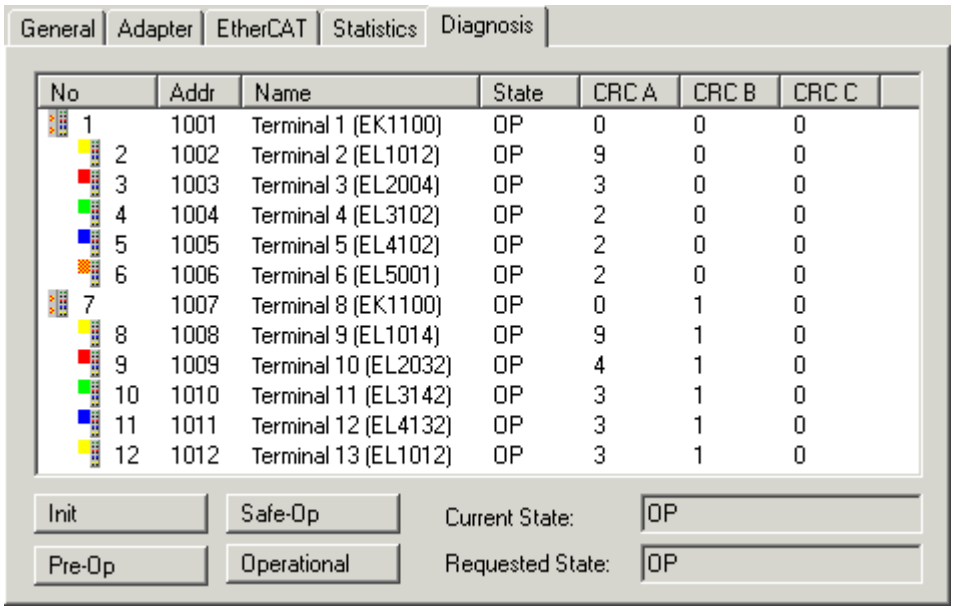
Sent Frames
Shows the number of EtherCAT frames sent and the number of frames sent per second.

Recv Frames
Shows the number of EtherCAT frames received and the number of frames received per second.

Missed Frames
Shows the number of lost EtherCAT frames.

Tc Mode
Shows TwinCAT mode.

4.5 Diagnostics tab



State

INIT: Initiate
PRE-OP: Pre Operation
SAFE-OP: Safe Operation
OP: Operation.

CRC A

Cyclic Redundancy Check at the incoming EtherCAT connection.

CRC B

Cyclic Redundancy Check at the outgoing EtherCAT connection.

CRC C

Cyclic Redundancy Check at the branch EtherCAT connection (if present).

5 Appendix

5.1 Beckhoff Support & Service

Beckhoff and its worldwide subsidiaries offer comprehensive support and service, providing fast and competent assistance with all issues relating to Beckhoff products and system solutions.

5.1.1 Beckhoff branches and partner companies

Please contact your Beckhoff branch office or partner company for local support and service on Beckhoff products!

The contact addresses for your country can be found in the list of Beckhoff branches and partner companies: www.beckhoff.com.

You will also find further documentation for Beckhoff components there.

5.1.2 Beckhoff headquarters

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany

Phone: + 49 (0) 5246 / 963-0
Fax: + 49 (0) 5246 / 963-198
e-mail: info@beckhoff.com

5.1.3 Beckhoff Support

Beckhoff offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

- worldwide support
- design, programming and commissioning of complex automation systems
- training program for Beckhoff system components

Hotline: + 49 (0) 5246 / 963-157
Fax: + 49 (0) 5246 / 963-9157
e-mail: support@beckhoff.com

5.1.4 Beckhoff Service

The Beckhoff service center supports you in all matters of after-sales service:

- on-site service
- repair service
- spare parts service
- hotline service

Hotline: + 49 (0) 5246 / 963-460
Fax: + 49 (0) 5246 / 963-479
e-mail: service@beckhoff.com

If servicing is required, please quote the serial number of your product, which can be found on the name plate.

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