Ingenieurbüro Dr.-Ing. Schoop

# Changing the IP-Adress of Beckhoff Bus Coupler and Setup of the TCPIP-Driver

## Content




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## 1. Introduction

The following describes various ways to setup the Beckhoff Bus Couplers BK9000, BK9050 and BK9100 and the WinErs-TCPIP/Modbus-Driver

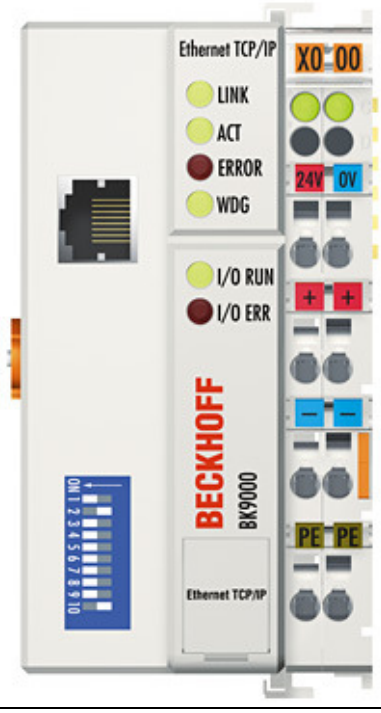
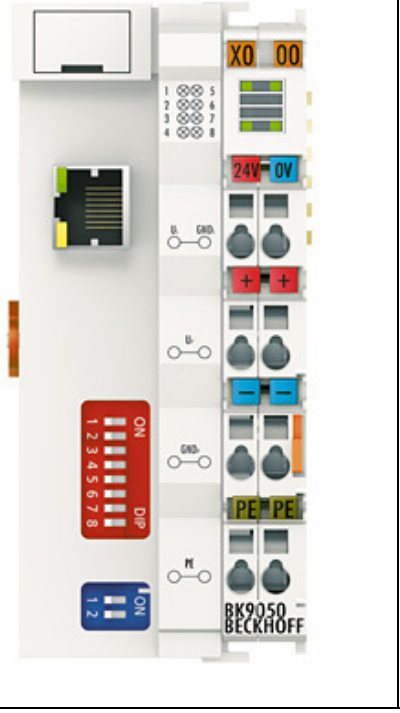
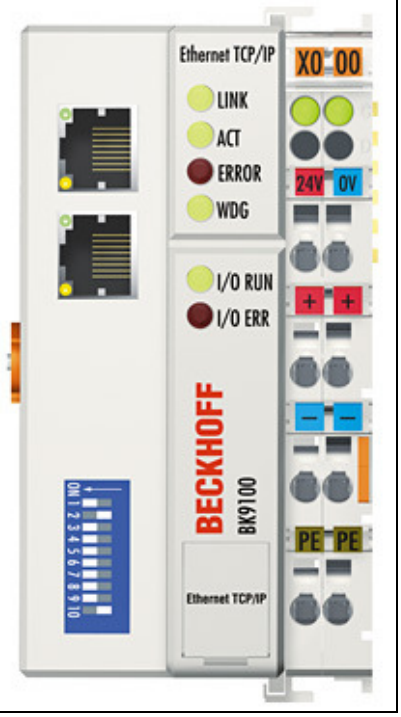
**The following steps are required:**

- Connect the Bus Coupler's power supply (Chapter 3)
- Set up PC's and Bus coupler's IP-Adresses (Chapter 4)
- Setup the TCPIP/Modbus driver (Chapter 5.1)
- Channel mapping in the TCPIP/Modbus driver(Chapter 5.2)

## 2. General Information

Three different Beckhoff Bus Couplers can be used with the TCPIP/Modbus driver. These are the *BK9000*, *BK9050* and *BK9100*.

All Bus Couplers will identify the connected Bus Terminals and build an internal process image. The signals in this process image need to setup in the channel mapping of the TCPIP/Modbus driver in the program WRPServ.

| BK9000 | BK9050 | BK9100 |
|---|---|---|
|  |  |  |



### 2.1. DIP Switches

*BK9000 and BK9100*

The Bus Coupler's IP-Adress can be configured using the DIP switches. The DIP switch position of BK9000 and BK9100 are identical. To switch these on, they need to be moved in the direction of the numbers.


*BK9050*
The BK9050 DIP switch function is identical, but it is divided into two areas. Please note that the switches' ON position varies from the BK9000 and BK9100. To switch these on, they need to be moved away from the numbers.


DIP Switches 1-8: Setup of the last Byte of the IPv4-Adress. DIP-Switches 9 and 10 need to be switched off.
DIP-Schalter 9: IP-Adress will be set via a TCBootP-Server
DIP-Schalter 10: IP-Adress will be set via a DHCP-Server.

### 2.2. Reset Bus Coupler to Initial State

To reset the Bus Coupler to its initial state follow these steps:

1. Disconnect Bus Coupler from power supply.
2. All Bus Terminals need to be removed from the Bus Coupler except the Bus End Terminal KL9010.
3. On a BK9000 or BK9100 only the DIP switches 9 and 10 need to be set to ON. On a BK9050 the blue DIP switches 1 and 2 need to be set to ON.
4. Reconnect the power supply.
5. When the LEDs ERROR, I/O RUN und die I/O ERR start blinking consecutively, the Bus Coupler has been reset and power supply has to be disconnected.
6. Set all DIP switches to OFF and insert the formerly removed Bus Terminals.

## 3. Power Supply

Connect the +24V DC cable to one of the clamps with a + symbol. Connect the second + clamp to the 24V clamp.

Connect the 0V to one of the - clamps and connect the second - to the 0V clamp.

To avoid damage the polarity of the power supply must not be interchanged.

## 4. Connection to a PC

A standard Ethernet cable (eg. CAT 5e) can be used to connect Bus Coupler and PC. For a direct connection use a cross-wiring-cable and a 1:1-wired cable when a network switch is used.

The Bus Coupler's IP address can be modified via one of the following ways:
1. DIP switches 1 to 8 and Beckhoff's configuration software KS2000
2. ARP address configuration
3. BootP-Server address configuration
4. DHCP-Server address configuration

### 4.1. DIP switches/KS2000

The standard IP address is: **172.16.17.*****

The first three address bytes can only be changed in the KS2000 software. The last byte (***) is set via the DIP switches 1-8 (blue on BK9000 and BK9100, red on BK9050) to Values from 0 to 255.


Example: To set the last IP address byte to „201" set the DIP switches 1, 4, 7 and 8 to ON while the power supply is disconnected:

| DIP | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ON | x | | | x | | | x | x | | |
| OFF | | x | x | | x | x | | | x | x |
| Weight | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | - | - |
| Value | 1 | 0 | 0 | 8 | 0 | 0 | 64 | 128 | - | - |

Total = 201

**NB:** DIP switches 9 and 10 (on BK9050 DIP switches 1 and 2 in blue) need to be set to "OFF".

### 4.2. Address Configuration via ARP

An easy method of modifying the IP address is to set the address using the DOS window. It is, however, only possible to alter addresses within the same network class. The new IP address that has been set remains stored even after the Bus Coupler has been switched off.

**Procedure**:
- Set DIP switches 9 and 10 to OFF. DIP switches 1-8 then no longer have any address function.
- Open a DOS box on your PC.
- Enter the command "ping <OLD IP address>" to create an entry in the ARP table.
- Read the table with the command "ARP -a".
- Enter "ARP -d <OLD IP address>" to remove the Bus Coupler from the table.
- Use "ARP -s <NEW IP address> <MAC-ID>" to make an entry manually.
- With "ping -l 123 <NEW IP address>" the new IP address becomes valid.

A short flash from the ERROR LED at the moment of switching on indicates that the Bus Coupler is being addressed by ARP, and that DIP switches 1-8 give no indication of the address that is set.

**Note:**
When the IP address is changed, all the dynamic ARP entries should be cleared. To change the IP address it is one ping with the length of 123 bytes is permitted for reconfiguration of the IP address (<ping -l "IP address>) necessary.

Example:

1. C:>ping 172.16.17.255
2. C:>arp -a 172.16.17.255 00-01-05-00-11-22
3. C:>arp -d 172.16.17.255
4. C:>arp -s 172.16.44.44 00-01-05-00-11-22
5. C:>ping -l 123 172.16.44.44

In this example 172.16.17.255 is the old IP address, 172.16.44.44 the new IP address, 00-01-05-00-11-22 is the MAC-ID.
The MAC-ID can be found on the back side of the Bus Coupler.
[1]

### 4.3. Address Configuration via BootP Server

If the address is to be set by the Beckhoff BootP server, then set DIP switch 9 to ON and DIP switch 10 to OFF (BK9000, BK9100). On BK9050 set the blue switch 1 to ON an 2 to OFF Position. DIP switches 1-8 then no longer have any address function. If this is not the case, the Bus Coupler will report LED error code 6 -4. The TCP/IP ERROR LED flashes while the address is being allocated.

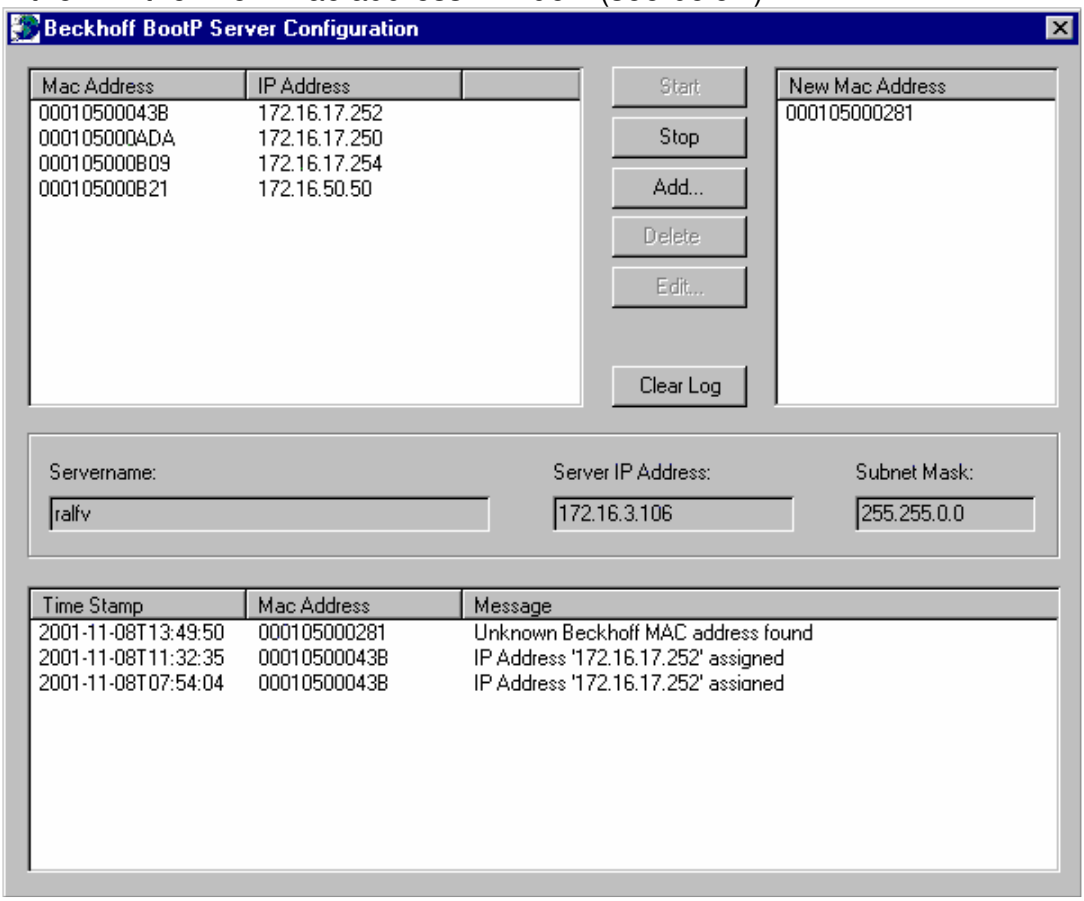
**IP address save modes**
*DIP switches 1-8 in the ON position*:
The address assigned by the BootP server is stored, and the BootP service will not be restarted after the next cold start. The address can be cleared again by reactivating the manufacturers' settings (using the KS2000 software or by DIP switch and end terminal).

*DIP switches 1-8 in the OFF position*:
The IP address assigned by the BootP server is only valid until the Bus Coupler is switched off. The BootP server must assign a new IP address to the Bus Coupler at the next cold start.

The address is, however, retained through a software reset of the Bus Coupler.

**Beckhoff BootP server**
Beckhoff supplies a BootP server for Windows 98, ME, NT4.0, NT2000 and XP. You find the installation version on the Beckhoff TwinCAT CD folder >Unsupported Utilities< or ftp://ftp.beckhoff.com/.

Start the Beckhoff BootP Server and connect the the Bus Coupler to the power supply and network. After a short time the BootP Server will find all Beckhoff nodes that are working in BootP mode and still have not received an IP address and will show them in the “New Mac address” window (see below).




As soon as the BootP server has started, the *New MAC Address* window shows all the Beckhoff nodes that are working in BootP mode and still have not received an IP address. The assignment of the MAC-ID to IP address is made with the "<<" button. Successful assignment is displayed in the log window.
To start the BootP server automatically when your PC boots, it is only necessary to provide a shortcut in the Windows autostart folder. Include the */Start* parameter in the shortcut (.../TcBootPDlg.exe/start).
[1]

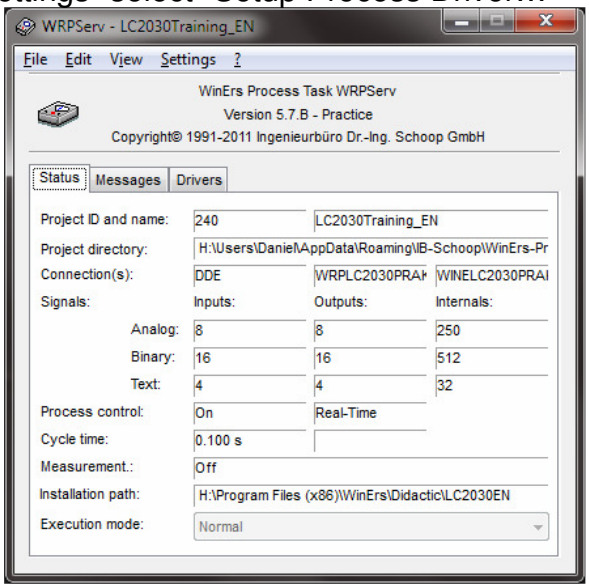
### 4.4. Address Configuration via DHCP Server

To set the address by means of a DHCP server, set DIP switch 9 to OFF and DIP switch 10 to ON (BK9000, BK9100). On a BK9050 BK9050 set the blue switch 1 to OFF an 2 to ON Position. In this state, the DHCP service is switched on, and the Bus Coupler is automatically assigned an IP number by the DHCP server. For this purpose the DHCP server must know the Bus Coupler's MAC-ID. The IP address should be set statically. The *TCP/IP Error* LED flashes while the address is being allocated.
[1]

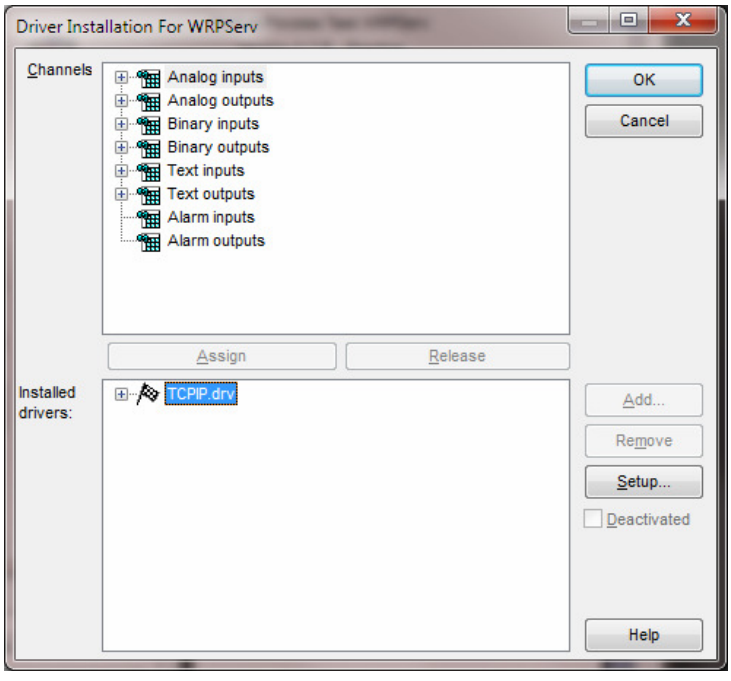
# 5. Communication with WinErs

## 5.1. Setup the TCPIP Driver for Beckhoff Bus Couplers

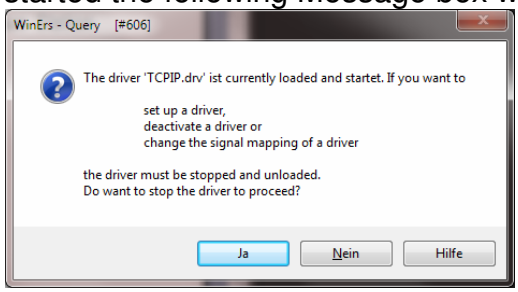
1. After the WinErs Installation the file „TCPIP.drv“ from the „Process Driver“ folder on the CD must be copied to the “driver” subfolder in the WinErs installation folder.
   In all WinErs-didactic programs the file will be copied to this folder during the installation process.
2. After setting up a new WinErs project switch to the program “WRPServ”
3. From the menu “Settings” select “Setup Process Driver…”



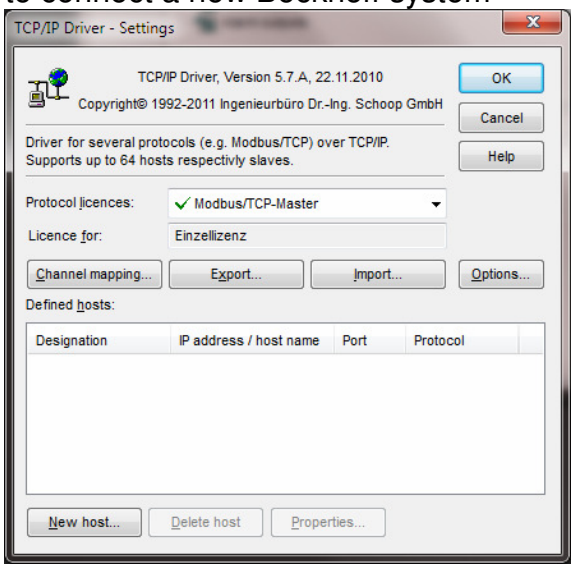

4. In WinErs Professional version click „Add“ and choose the file “TCPIP.drv”
5. In WinErs Professional version select the signals in the “Channels” window that you want to assign to the TCPIP driver
6. Select TCPIP.drv in the “Installed drivers” window and click “Setup…”



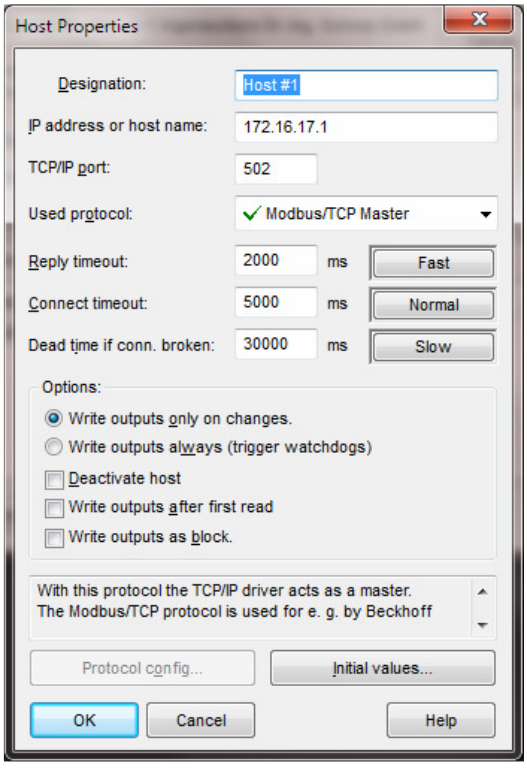
7. When the driver was started the following Message box will appear, click “Yes”




8. Click “New host…” to connect a new Beckhoff system

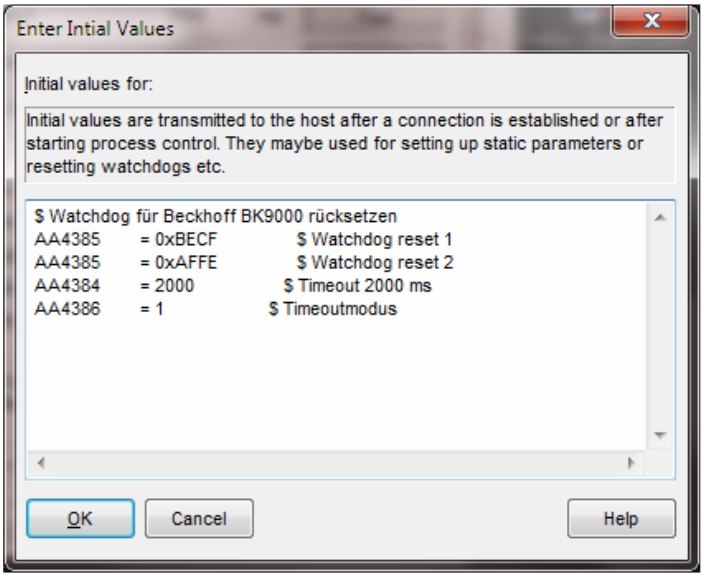



9. Fill in a designation and the IP address, select Modbus/TCP Master protocol



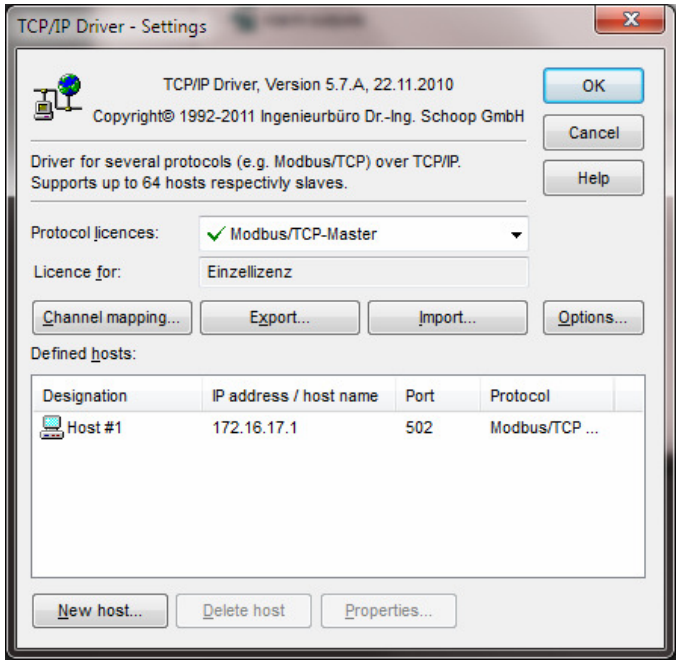
10. Click “Initial values…” to specify the watchdog settings
    Enter the following text

```
$ Watchdog for Beckhoff BK9xx0
AA4385      = 0xBECF          $ Watchdog reset 1
AA4385      = 0xAFFE          $ Watchdog reset 2
AA4384      = 2000            $ Timeout 2000 ms
AA4386      = 1               $ Timeoutmode
```



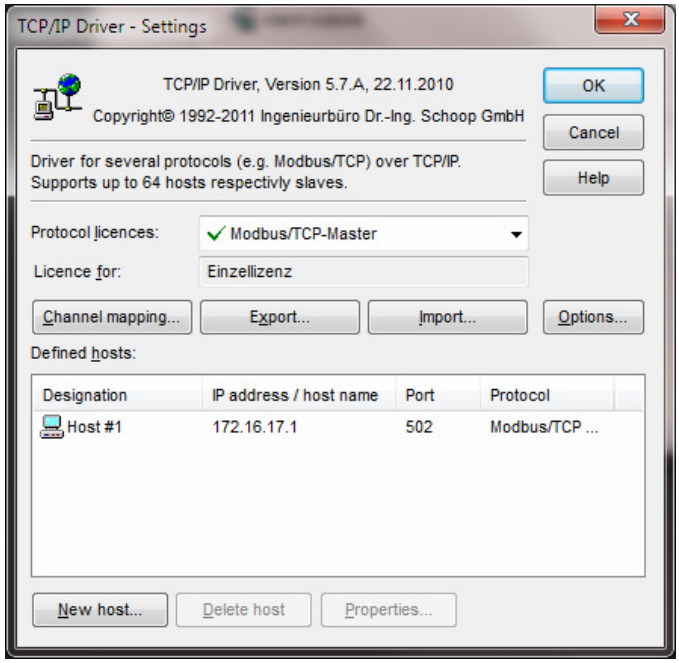

The Timeout value of 2000ms can be modified. This is recommended for slow responding networks.

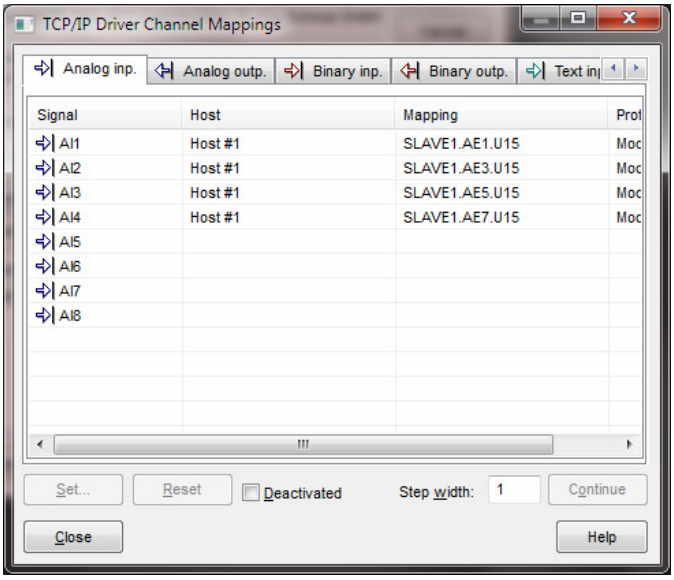
11. To modify an existing host, select the host and click the “Properties…” button



## 5.2. Channel Mapping

Input and output signals are assigned to the Bus Terminals in the “Channel mapping” dialog.




### 5.2.1. Analog Signals

The following guidelines need to be considered for the Beckhoff system:

1. For each analog signal has a status word and a data word for the signal value. For analog inputs the status word can show that the signal range is exceeded. In Beckhoff’s internal signal mapping the status word is always the first, the signal value the second data word in the address range. In some cases it can be necessary to evaluate the signal status, but in most cases it is not.

2. All analog channels are mapped sequentially according to the Bus Terminal position in the Beckhoff system. (eg.: 0 to 7 for four analog inputs (1,3,5,7) and 8 to 15 for four analog outputs; see below)

3. Analog output signals have address offset of 2048 within the signal mapping.

This gives the following channel mapping:

| Nr. | Signal Address | Function | Signal Address AE | Signal Address AA | Calculation of AA Address |
|---|---|---|---|---|---|
| 1 | 0 | Status AE1 | SLAVE1.AE0 | | |
| 2 | 1 | Signal AE1 | SLAVE1.AE1 | | |
| 3 | 2 | Status AE2 | SLAVE1.AE2 | | |
| 4 | 3 | Signal AE2 | SLAVE1.AE3 | | |
| 5 | 4 | Status AE3 | SLAVE1.AE4 | | |
| 6 | 5 | Signal AE3 | SLAVE1.AE5 | | |
| 7 | 6 | Status AE4 | SLAVE1.AE6 | | |
| 8 | 7 | Signal AE4 | SLAVE1.AE7 | | |
| 9 | 8 | Status AA1 | | SLAVE1.AA2056 | ← 8+2048=2056 |
| 10 | 9 | Signal AA1 | | SLAVE1.AA2057 | ← 9+2048=2057 |
| 11 | 10 | Status AA2 | | SLAVE1.AA2058 | ← 10+2048=2058 |
| 12 | 11 | Signal AA2 | | SLAVE1.AA2059 | ← 11+2048=2059 |
| 13 | 12 | Status AA3 | | SLAVE1.AA2060 | ← 12+2048=2060 |
| 14 | 13 | Signal AA3 | | SLAVE1.AA2061 | ← 13+2048=2061 |
| 15 | 14 | Status AA4 | | SLAVE1.AA2062 | ← 14+2048=2062 |
| 16 | 15 | Signal AA4 | | SLAVE1.AA2063 | ← 15+2048=2063 |

Each analog signals has a specific number format. This needs to be added to the channel mapping as follows: **SLAVE1. AE1.*****

*** depends on the analog signal type:
- U15 for 0/10V, (0)4/20mA
- I16 for ±10V
- F10 for Pt100

### 5.2.2. Binary Signals

Channel mapping for binary signals starts with the address 0 in ascending order:

| Binäre Eingänge | Binäre Ausgänge |
|---|---|
| SLAVE1.DE0 | SLAVE1.DA0 |
| SLAVE1.DE1 | SLAVE1.DA1 |
| SLAVE1.DE2 | SLAVE1.DA2 |
| SLAVE1.DE3 | SLAVE1.DA3 |
| SLAVE1.DE4 | SLAVE1.DA4 |
| SLAVE1.DE5 | SLAVE1.DA5 |
| SLAVE1.DE6 | SLAVE1.DA6 |
| SLAVE1.DE7 | SLAVE1.DA7 |
| . | . |
| . | . |
| etc. | etc. |

## 6. Ressources

[1] Handbook for the BK9000, Beckhoff Automation GmbH