

Open interfaces for flexible operation & monitoring

Monitoring and operator functions are conveniently located in a robust aluminum housing with the Beckhoff Control Panel product. The IP 65 class Control Panel comes in several shapes and sizes which all connect to Beckhoff's wide range of controllers. The open interfaces of the Beckhoff controllers also enable straightforward integration of operating terminals from other manufacturers.

Beckhoff controllers are structured into four classes of increasing power. The lower class controllers are the BC and BX Bus Terminal Controllers while the upper class are the Embedded PC CX1000 and Industrial PC. All four control classes are uniformly configured and programmed via the TwinCAT automation software. Interfaces for the communication between controller and operating terminals from other manufacturers include the following:

- | Serial communication via ModbusRTU
- | Ethernet connection via ModbusTCP
- | Fieldbus connection

The interface used depends on the type, size and price of an application. The three options are briefly described below:

1. Communication via ModbusRTU

Most displays have a serial port as standard. Various drivers for the serial port can be downloaded to the terminals; a serial Modbus driver is usually available. For the Modbus interface, Beckhoff offers a function block that can be used for all four Beckhoff control levels. The Modbus protocol was chosen, because coverage by terminal manufacturers is nearly 100 %. Moreover, it is an open protocol that is very simply structured and has very low protocol overhead. The physical transfer is via the standard interfaces RS232, RS485 or RS422.

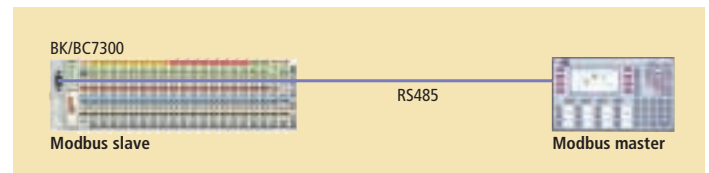
The display usually works as a master (client) and the Beckhoff interface as a slave (server). The advantage resulting from this distribution of tasks is that the MMI, i.e. the operator, knows which data are required. Communication can thus be reduced to a minimum. A Beckhoff Bus Coupler, a communication Bus Terminal or a serial COM port can serve as interface.

The ModbusRTU library for BC, BX, CX and PC

The TwinCAT function block is connected, for example, via the serial RS232 KL6001 Bus Terminal with connected display. The Modbus module deals with the complete communication. If, for example, the Bus Terminal receives a Modbus telegram, the function block evaluates the telegram and automatically sends a response to the master. The data can be stored in three memories: an input memory with read access, an output memory with write access, and a flag memory with read and write access.

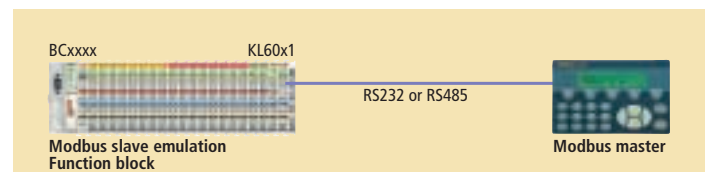
The minimum solution with Modbus Bus Couplers

An operator terminal with ModbusRTU interface is directly connected as a Modbus slave to one or several BK7300 Bus Couplers or BC7300 Bus Terminal Controllers. The terminal operates as a master and receives the data directly from the BK7300 or – pre-processed – from the BC7300.



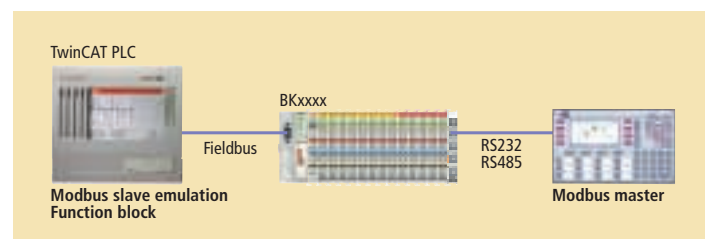
Bus Terminal Controller BC with fieldbus interface

When used with the Bus Terminal Controller, the ModbusRTU function block is directly integrated into the mini PLC. The communication Bus Terminal KL60x1 transforms the respective controller into a Modbus slave. The displays connected via these Bus Terminals can simultaneously exchange data with the higher-level controller via the integrated fieldbus interface such as Lightbus, Profibus, CANopen etc.



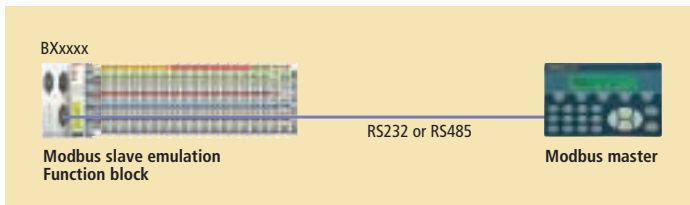
Bus Coupler with fieldbus interface

This solution is almost identical to the previous one, except that the program for the communication is not executed decentrally in the Bus Coupler but on the PC control.



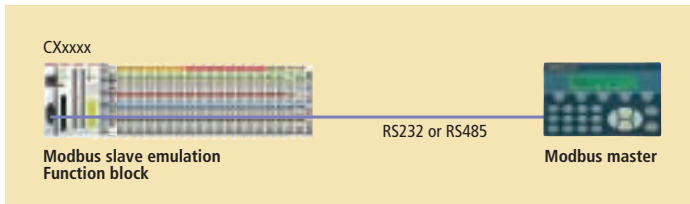
Bus Terminal Controller BX

The BX series Bus Terminal controllers do not require additional communication Bus Terminals, since these devices already have a free communication port as standard. Like in the BC solution, here too the Modbus library transforms the serial interface into a Modbus slave interface or optionally an RS232 or RS485 interface.



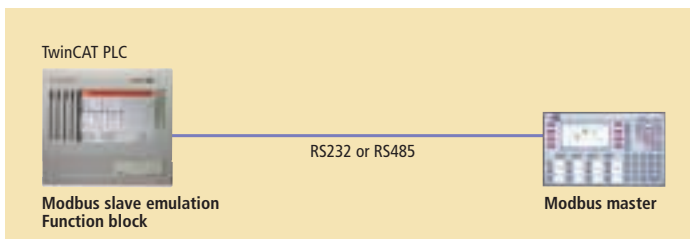
Embedded PC CX1000

Like the BX devices, these devices also have a serial port on-board and can therefore be used in the same way.



Industrial PC: Direct connection to the COM port

Via the COM interface of the PC, the display can be connected directly to the PC. The ModbusRTU slave library is then not connected to a serial Bus Terminal like in the previous solutions, but directly to the "KL6xx1 emulation" of TwinCAT.



Overview of displays

The communication between Beckhoff controllers and operating terminals from the following manufacturers has been tested successfully:

ModbusRTU

Cimrex, Exor, Hakko, pro-face, SAE-Stahl, Siemens, Süttron

ModbusTCP

Cimrex, pro-face, SAE-Stahl

Fieldbus Interface (Profibus DP)

Cimrex, SAE-Stahl, Siemens

Through continuous co-operation with further manufacturers, the communication options and types are constantly expanded.

2. Communication via ModbusTCP

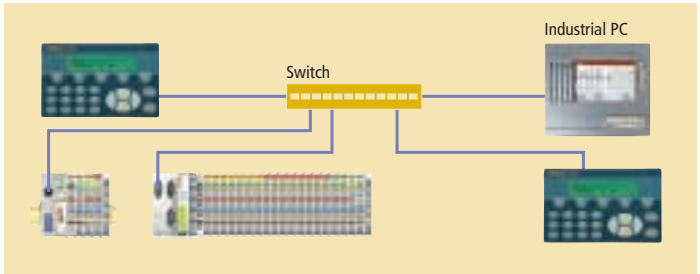
Like the serial Modbus communication, ModbusTCP provides simple, open communication via TCP/IP (Ethernet). The Beckhoff Ethernet components BK9000, BC9000 and BX9000 come with an integrated ModbusTCP communication interface. A Modbus server and client driver is available for the PC (TwinCAT). Any number of distributed operating terminals can therefore be connected to a TwinCAT PC control via Ethernet. The solution via Ethernet is recommended particularly for large systems such as building automation or conveying systems. The ModbusTCP interface via Ethernet is usually offered as a server or client interface. Both solutions can be used in combination with the Bus Terminal controllers BC9000 or BX9000.

Display as ModbusTCP slave

In this case, the Bus Terminal Controllers BC9000 or BX9000 act as master and send event-driven ModbusTCP telegrams to the display. The BC9000/BX9000 contains a ModbusTCP library that can send all functions that are permitted by ModbusTCP.

Display as ModbusTCP master

In this variant, the Bus Couplers BC9000, BX9000 or BK9000 function as slaves; the communication is established via the display.



3. Communication via the fieldbus

In the fieldbus variant, data are transferred via the integrated slave interface of the terminal. The communication is usually such that all data are transferred, since the controller (master) does not automatically recognize which data are required by the display and which are not. If the data quantity is limited, this is not a problem. However, for higher data volumes, it leads to increased network load and a slowing down of the communication process. In order to compensate for this disadvantage, additional protocols are used on top of the standard fieldbus protocols that enable the master or the display to only request those data that are actually required. Since these protocols are usually not standardized, Beckhoff has developed a TwinCAT function block, e.g. for Siemens panels with Profibus interface, which communicates with the panels via the universal Profibus driver.

