

Displays with built-in intelligence

→ The Beckhoff range of TFT display devices – called Control Panels – has been expanded with a powerful model in which an Intel Pentium-compatible 266 MHz CPU was integrated without changing the external dimensions. The previously passive displays thus become independent controllers running on standard operating systems such as Windows CE and XP Embedded.

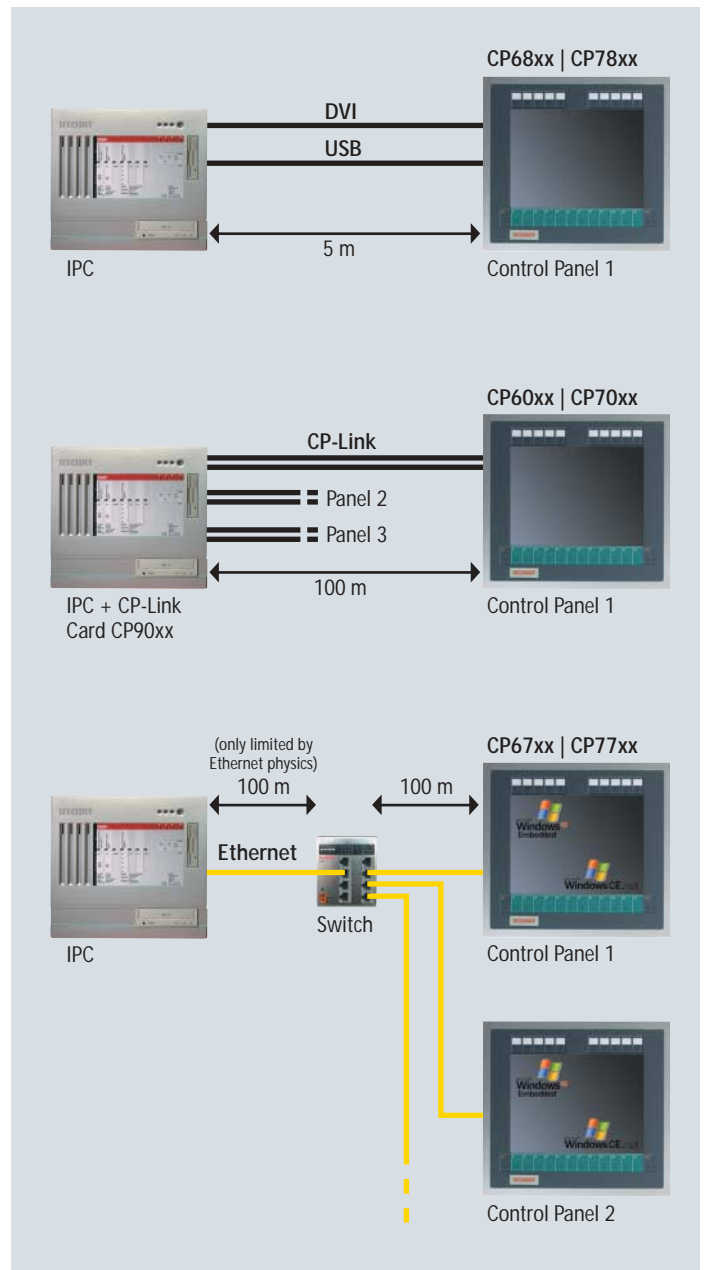
Robust, elegant, equipped for high flexibility, and adaptable to customer requirements – with these features Beckhoff Control Panels have been writing their success story as combined operating and display devices for many years. The list of features speaks for itself and explains why the Control Panel concept has been a market leader for many years:

- | Robust, anodized solid aluminium housing
- | Low depth: only approx. 3 cm
- | High-quality TFT display in the following sizes: 6.5", 10", 12", 15", 19" and 20"
- | Resistive touch screen (optional)
- | Operating front panel adaptable to customer requirements, optionally with:
 - full alphanumeric, numeric keyboard, or without keyboard
 - PC keys combined with PLC keys or electromechanical keys
 - customer-specific key layout
 - optional touchpad
- | Optionally in protection class IP 65 (front)/IP 20 (rear) or IP 65 all-round
- | Optionally available as built-in, add-on or support arm variant
- | CP-Link or DVI/USB for connection to an Industrial PC

Previously, Beckhoff Control Panels have been used exclusively as passive display or operator control elements where they were connected to an Industrial PC located at a remote location (with coaxial CP-Link technology up to 100 m). This separation has the advantage that an Industrial PC, equipped with fan and rotating storage media, can be located in the control cabinet or computer room, rather than at the place of operation, if the mechanical and thermal load make this advisable.

Ethernet panel: New device in proven packaging

This new design integrates the CPU used in the Beckhoff CX1000 controller with the innovative aluminum Control Panel design without an increase in size. This was made possible by the development of an embedded CPU board with the same dimensions as the CP-Link board that it replaces. So customers can now mount a unified display and control unit wherever they want on their machine



Beckhoff Ethernet panels with 266 MHz CPU are compact control and operating devices with 2 Ethernet and 2 USB master connections.



for maximum design flexibility. The term "Ethernet panel" does not adequately describe the resulting device, which is a complete control computer with

- | Intel Pentium-compatible CPU, 266 MHz clock frequency
- | Passive cooling
- | 256 MB RAM main memory
- | 8 kB NOVRAM (non-volatile memory)
- | IDE interface for Compact Flash (can be changed from outside)
- | Real-time clock with date (RTC) and backup battery
- | 2 x Ethernet interfaces 10/100 Mbit
- | 2 x USB master interfaces
- | 1 x RS232 interface (optional)

The two Ethernet interfaces ensure clear separation between IT and automation level.

A Beckhoff Ethernet panel and a passive Beckhoff CP-Link Control Panel can only be distinguished by the connections at the rear: Where previously CP-Link coaxial cable BNC sockets were used, two RJ 45 and USB sockets and the connection for the 24 V DC supply voltage can now be found. Everything else remains unchanged: Everything also works with an Ethernet panel, particularly the flexible provision of normal keys, PLC keys, touchscreen, and touchpad. Note: The Ethernet panel family is only available in display sizes up to 15" (resolution 1024 x 768).

The Ethernet panel remains fanless and without rotating storage media, since a Compact Flash card is used as a hard disk substitute. No internal Flash is used –

the current technical development of Compact Flash cards is rapid and offers price and performance benefits that can be utilized better with a plug-in CF. In the event of a fault, the device can be replaced quickly.

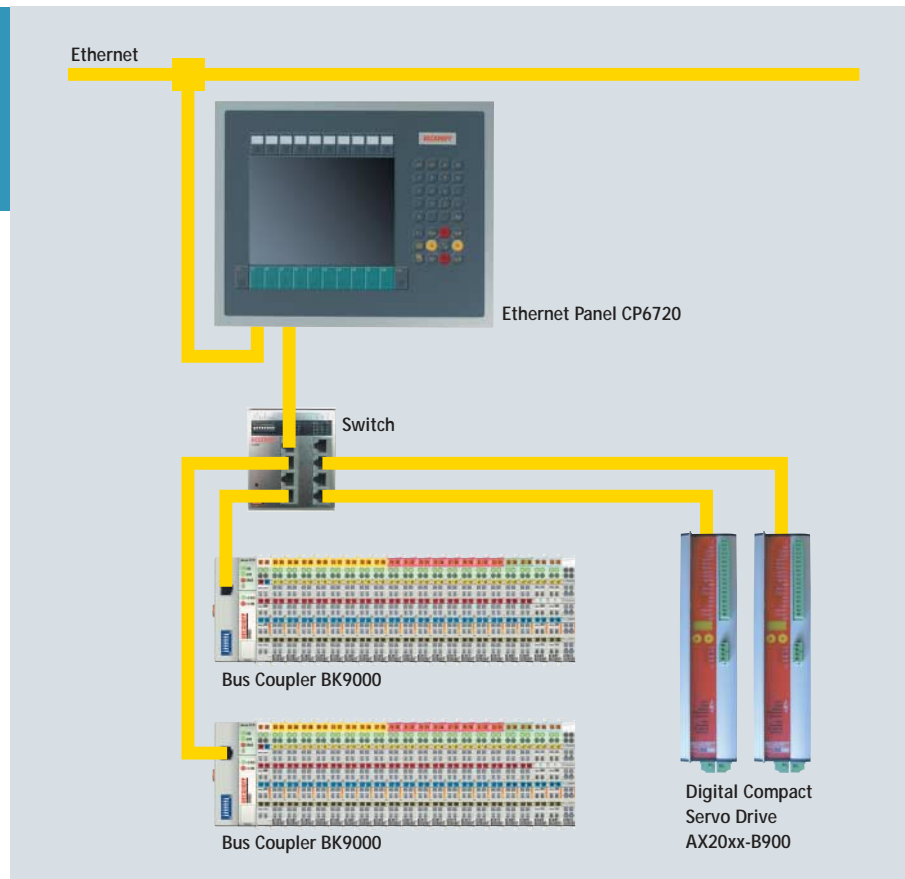
The generous main memory of 256 MB is particularly useful if the Ethernet panel is used with Windows XP Embedded: It enables "memory-hungry" .NET applications to run without problem.

Software determines application options

The application options of the Ethernet panel are as diverse as that of an IPC with screen. Because optionally Windows CE.NET 4.2 or Windows XP Embedded are used as operating system, the system can be used to run either SCADA software or visualization software developed by the customer.

If the Ethernet panel is additionally to be used for solving an automation task, it makes sense to use TwinCAT, for PLC and motion control application. I/O is integrated via one of the Ethernet connections: Either via the Beckhoff real-time Ethernet protocol, or, in future, via the Ethernet-based EtherCAT protocol, which provides even higher data throughput at the field level. The basic difference in architecture is explained in the figures below. For both solutions, the complete field level should ideally be connected digitally to the controller via Ethernet, which can be achieved with Beckhoff I/Os and drives. In this case, a conventional field-bus such as Profibus or CAN is no longer required. It should be stressed once again that in terms of the Ethernet Control Panel the only difference are the protocols implemented in TwinCAT. The Control Panel hardware is identical in both cases, i.e. real-time Ethernet and EtherCAT.

Ethernet Control Panel with standard Ethernet wiring and Beckhoff real-time Ethernet protocol. A switch is required for the integration of all devices.



Since Ethernet panels and the CX1000 Embedded PC controllers use the same CPU, the performance data relevant for automation purposes are identical and are therefore only mentioned briefly: 1024 PLC commands (practice-relevant mix of BOOL, INT, DINT WORD and REAL operations) are processed in approx. 50 μ s. For the motion control software, a base time of 200 μ s applies, and approx. 100 μ s for each activated axis within the TwinCAT NC PTP system. More complex motion control functions such as “cam plates”, “electronic gear box” and “flying saw” are also available.

Local operating stations

Another use for Ethernet Control Panels is as local operating and display stations that are connected via Ethernet with one or several host computers. In this context, the Microsoft nomenclature often refers to “thin client” or “rich client”, depending on whether the actual application runs on the local Ethernet panel or on the central computer.

For “thin clients”, a distinction is made between pure HTML browser clients and RDP clients (remote desktop protocol). For browser clients, the Ethernet panel typically uses Windows CE with Internet Explorer, the server side runs Windows XP Pro or Windows 2003 Server. The server is programmed in HTML via .NET languages (C#, VB) or Java. Accordingly, communication with the client is via HTTP or SOAP. The client is used for calling up HTML pages from the server and displaying them locally. In general, for “thin client” mode, Windows CE.NET is preferable on the client side, since this operating system offers short boot times (approx. 20 s) and lower costs, especially since a

64 MB Compact Flash card is quite adequate for both operating system and application.

Windows CE is usually also used in remote desktop mode with RDP client. On the server side, once again XP Pro or Windows 2003 Server is used. In the latter case, a session is opened for each client on the server. While the Ethernet panel visually gives the appearance of a Windows XP computer, the application does in fact run on the server. Only the screen data and keyboard information are exchanged via the RDP protocol. If Windows XP Pro is used on the server side, only one client at a time can establish a remote desktop connection, with the server also being inaccessible during the session.

In “rich client” mode, the application is executed on the Ethernet Control Panel running Windows CE or XP Embedded. On the server side several clients can exchange data simultaneously, e.g. via SOAP, TwinCAT ADS, Modbus TCP or other protocols. In this application, the Ethernet panel is used as a PC, which means that all programming techniques available for Windows can be used.

These examples demonstrate the flexibility and versatility of the Ethernet panel application options. The spectrum ranges from pure displays to autonomous automation devices. Beckhoff Ethernet panel and Ethernet as fieldbus are two of the blocks that form a compact control technology. In future, PCs will be less obvious within a system. Miniaturization and embedded technology make them shrink, although their performance will nevertheless follow the continuous upward trend. As a slight exaggeration one could say that in future the display will control the machine, because it is increasingly becoming the control hardware element that determines the shape factor for the user.

The use of EtherCAT with an Ethernet Control Panel has benefits in terms of wiring (“daisy chain”, no switch required) compared with conventional Ethernet wiring.

