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General Information on this Manual
- Content
  This equipment manual contains product-specific information valid at the time of publication.
- Completeness
  This equipment manual is only complete in conjunction with the product-related hardware and software user manuals required for the individual application.

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Update

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Subject</th>
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<td>25.09.2012</td>
<td>First Version</td>
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<td>31.10.2012</td>
<td>Update of chapter ‘Product description, Block diagram’</td>
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<td>1.2</td>
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<td>Update the trademarks</td>
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<td>1.4</td>
<td>20.05.2014</td>
<td>New corporate name ‘Berghof Automation GmbH’ UL certification</td>
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<td>1.5</td>
<td>19.10.2015</td>
<td>Update of chapter ‘General Information, Working on the controller module’ Update of chapter ‘Annex, Nameplate’</td>
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1. General Information

Documentation
This equipment manual is intended for qualified personnel and contains information regarding mounting, installation, commissioning and maintenance. The information contained in this manual is subject to change without prior notice.

1.1. About This Manual

This equipment manual is an integral part of the product. Make sure the equipment manual is always available near the product’s point-of-employment. The manual contains information about the following topics:

- Areas of application;
- Safety;
- Mechanical construction;
- Electrical construction;
- Connections;
- Commissioning;
- Care and maintenance;
- Decommissioning;
- Disposal.
1.2. Hazard Categories and Terminology

The indications described below are used in connection with safety instructions you will need to observe for your own personal safety and the avoidance of damage to property.

The indications have the following meaning:

<table>
<thead>
<tr>
<th>Indication</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>Immediate danger</td>
</tr>
<tr>
<td></td>
<td>Failure to observe the information indicated by this warning will result in death, serious injury or extensive property damage.</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>Potential danger</td>
</tr>
<tr>
<td></td>
<td>Failure to observe the information indicated by this warning may result in death, serious injury or extensive property damage.</td>
</tr>
<tr>
<td><strong>CAUTION</strong></td>
<td>Danger</td>
</tr>
<tr>
<td></td>
<td>Failure to observe the information indicated by this warning may result in injury or property damage.</td>
</tr>
<tr>
<td><strong>NOTICE</strong></td>
<td>No hazard</td>
</tr>
<tr>
<td></td>
<td>Information indicated in this manner provides additional notes concerning the product.</td>
</tr>
</tbody>
</table>

1.3. Conformity Declaration

Both the standard version of the controller module and the extension modules mentioned below comply with and make allowance for the following directives and standards:

- EMC Directive 2014/30/EU
- RoHS Directive 2011/65/EU
- DIN EN 61131-2: Programmable controllers
  Part 2: Equipment requirements and tests
- EN 50581: Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
- UL 508: Industrial Control Equipment
  17th edition / 1999-01-28
1.4. Qualified Personnel

Only qualified personnel may install, operate and maintain the controller module. Within the context of this documentation and the safety information it contains, qualified personnel constitutes trained specialists who have the authority to mount, install, commission, ground and identify equipment, systems and power circuits in accordance with the standards of safety technology, and who are familiar with the safety concepts of automation technology.

1.5. Due Diligence

The operator, or the processor (OEM) must ensure that...

- the controller module is only used for the purpose for which it was intended;
- the controller module is only operated in impeccable full working order;
- the user manual is always available in full and in a legible condition;
- only specialists with sufficient qualification and authorisation mount, install, commission and maintain the controller module;
- these specialists are regularly instructed in all relevant questions of occupational health and safety and environmental protection and that they also know the contents of the user manual and especially of the safety notes therein;
- the device markings, identifications, safety and warning notes attached to the controller module are not removed and are always kept in a legible state;
- the national and international regulations for controlling machines and systems which apply at the relevant usage site are observed;
- the relevant information about the controller module and its application and operation is always available to the users.

1.5.1. Working on the controller module

Before carrying out work on the controller module you must always:

- first ensure that the controller and the system are in a secure state;
- only then switch off the controller and the system and
- only now disconnect the controller module from the system.

Live parts!
Before starting any work on the device, disconnect all inputs, including any connected peripherals.
Inappropriate handling (installation and movement), while the device is powered on, may result in damage and/or data loss.
1.6. Use as Prescribed

This is a modular automation system based on the CANbus, intended for industrial control applications within the medium to high performance range.

The automation system is designed for use within Overvoltage Category I (IEC 364-4-443) for the controlling and regulating of machinery and industrial processes in low-voltage installations in which the rated supply voltage does not exceed 1,000 VAC (50/60 Hz) or 1,500 VDC.

The automation system is further usable in a pollution degree 2 environment or similar.

The modules shall be supplied by a power source with safe separation protected by an UL 248 fuse, rated max. 100/V where V is the DC supply voltage with maximum value of 28.8 VDC, such that the limited voltage / limited current requirements of UL 508 are met.

Wire connection specifications: Use AWG wire size 16-22 or equivalent.

Qualified project planning and design, proper transport, storage, installation, use and careful maintenance are essential to the flawless and safe operation of the automation system. The automation system may only be used within the scope of the data and applications specified in the present documentation and associated user manuals.

The automation system is to be used only as follows:
→ as prescribed
→ in technically flawless condition
→ without arbitrary or unauthorized changes and
→ exclusively by qualified users

The regulations of the German professional and trade associations, the German technical supervisory board (TÜV), the VDE (Association of German electricians) or other corresponding national bodies are to be observed.

Safety-oriented (fail-safe) systems

Particular measures are required in connection with the use of SPC in safety-oriented systems. If an SPC is to be used in a safety-oriented system, the user ought to seek the full advice of the SPC manufacturer in addition to observing any standards or guidelines on safety installations which may be available.

As with any electronic control system, the failure of particular components may result in uncontrolled and/or unpredictable operation. All types of failure and the associated fuse systems are to be taken into account at system level. The advice of the SPC manufacturer should be sought if necessary.
2. Product description EC1000

2.1. Overview

The EC1000 is a CODESYS PLC controller with a broad range of data interfaces.

In compliance with IEC 61131-3 the module can be programmed either with version 2.3 or 3.x.

Installation

The EC1000 is designed for installation in switching cabinets on a DIN mounting rail in a rough industrial environment. The fanless design and the flash memory make the cost and effort for maintenance minimal.

Ethernet

A 10/100 Mbit/s Ethernet interface is available. Thanks to the TCP/IP and UDP/IP protocols it is possible to link it very variably to visualisation software, to higher order control units or to the IT infrastructure.

EtherCAT interface

An EtherCAT E-bus interface with a lateral 10-pin connection is available.

USB

The USB host interface provides a widely-used peripheral interface. For example, it can be used to carry out an application update or data migration simply via a USB stick. Please contact our Technical Support if no driver support is available for a specific USB device.

CAN Interfaces

The EC1000 possesses 1 standard CAN interface which can be used up to 1 Mbit/s.

Serial Interfaces

The RS232 can also be used as a programming interface.

Realtime clock

An accumulator battery-buffered, maintenance-free realtime clock can be set at the current time via a software interface.

SD card

The EC1000 possesses 1 SD card slot, e.g. for data copies.

Slot extension

Optionally, for communication purposes a slot is available for an extension module on the left-hand side. Applicable interfaces are LAN, CAN RS485 or RS232.

Visualisation

CODESYS Target and Web Visualisation are included in the scope of supply. An easy-to-use display is available with the Berghof ET1000 Ethernet Terminal.

Networking

PROFINET device and BACnet controller function as a software option.
Performance features – an overview

- 400 MHz CPU
- User program and data memory (RAM): 128 MB on board, max. 96 MB for application
- User program memory (Flash): 64 MB on board / 56 MB for CODESYS V2.3 resp. 40 MB for CODESYS V3 application
- Retain memory, 24 kB
- 1 Ethernet 10/100 base T interface
- 1 USB Host interface V1.1
- 1 CAN interface at the front
- 1 RS232 serial interface for programming tools and application
- 1 EtherCAT interface with up to 10 users (or max. 2 A)
- Realtime clock
- 1 SD card slot
- Slot for left-hand extension module for communication (optional)

Scope of Supply

The scope of supply of the controller module consists of:

- Ethernet Controller EC1000

Accessories

- PLUG-IN CONNECTOR SET for EC1000; order no.: 201605600 (only 204900001 and 204900101)
- PLUG-IN CONNECTOR SET for EC1000; order no.: 201608400 (all)
- Shield connection terminals:
  - 2 x 8 mm; order no.: 204802400
  - 1 x 14 mm; order no.: 204802500
## 2.2. Technical data

### Ethernet Controller EC1000

<table>
<thead>
<tr>
<th>Module data</th>
<th>EC1000 MP400 00 1131</th>
<th>EC1000 MP400 00 1131 V3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item no.</td>
<td>204900001</td>
<td>204900002</td>
</tr>
<tr>
<td>Programming tool</td>
<td>CODESYS V2.3</td>
<td>At least CODESYS V3.5</td>
</tr>
<tr>
<td>Installation</td>
<td>Bearing rail NS 35/7.5 EN 60715</td>
<td></td>
</tr>
<tr>
<td>I/O Extension</td>
<td>Via EtherCAT</td>
<td></td>
</tr>
</tbody>
</table>

### CPU, user memory

| CPU | Freescale PowerPC, CPU 400 MHz |
| Program memory (Flash) | 64 MB on board / 56 MB for CODESYS V2.3 / 40 MB CODESYS V3 |
| Program memory and data memory (RAM) | 128 MB on board / max. 96 MB for application |
| Retain memory | 24 kB |

### Sizes and weights

| Dimensions (WxHxD [mm]) | 25 x 120 x 90 |
| Weight | Approx. 150 g |

### Operating conditions

| Ambient temperature | 0 °C to 50 °C; 55 °C as standalone specification (if installation instructions are observed) |
| Relative air humidity | Max. 85 %, non-condensating |

### Transportation, storage

| Ambient temperature | -20 °C to +70 °C |
| Relative air humidity | Max. 85 %, non-condensating |

### Resistance to vibrations

| Vibration | Sinus-shaped (EN 60068-2-6) test: Fc 10 ... 150 Hz, 10 m/s² |
| Shock resistance | 15 G (approximately 150 m/s²), 11 ms duration, semi-sinus (EN 60068-2-27) test: Ea |

### EMC, protection class

| Emitted interference | EN 61000-6-4, industrial sector |
| Immunity to interference | EN 61000-6-2, industrial sector |
| Protection class | III |
| Insulation strength | SELV (Ue < 30 V) in compliance with EN 61131-2 |
| Protection type | IP20 |
### Ethernet Controller EC1000

#### Energy supply (24 V power supply unit)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>+24 VDC (-20 % / +25 %) SELV max. proportion of a.c. voltage 5 %</td>
</tr>
<tr>
<td>Power consumption</td>
<td>typ. 0.3 A, max. 0.3 A with +24 VDC, fuses depending on number of connected extension modules, max. 2.5 A</td>
</tr>
<tr>
<td>Reverse voltage protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>No</td>
</tr>
<tr>
<td>Bridging in case of power failure</td>
<td>10 ms at &lt; 20.4 VDC (at max. external bus load of 5 V / 2 A) Power Fail &lt; 19.2 VDC</td>
</tr>
</tbody>
</table>

#### Ethernet interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number / type of interface</td>
<td>1x 10/100 Base T</td>
</tr>
<tr>
<td>Connection technology</td>
<td>1x RJ45</td>
</tr>
</tbody>
</table>

#### EtherCAT interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number / type of interface</td>
<td>1x EtherCAT E-bus, lateral 10-pin connection</td>
</tr>
<tr>
<td>Connection technology</td>
<td>Series connectors on right-hand side</td>
</tr>
</tbody>
</table>

#### USB interfaces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number / type of interface</td>
<td>1 x Host USB Rev. 1.1</td>
</tr>
<tr>
<td>Number of mating cycles</td>
<td>max. 1.000</td>
</tr>
</tbody>
</table>

#### CAN-Bus interfaces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number / type of interfaces</td>
<td>1x CAN in front (on 2x 5-pin multipoint connector COM / CAN)</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>Yes (galvanic isolation)</td>
</tr>
<tr>
<td>Transmission rate</td>
<td>ISO 11898 max. 1 Mbit/s</td>
</tr>
<tr>
<td>Terminating resistor</td>
<td>external via plug-in connector</td>
</tr>
</tbody>
</table>

#### Serial interfaces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number / type of interfaces</td>
<td>1x RS232 3 wire connection to 2x 5-pin multi-point connector in front panel (RS232+CAN) (RX, TX, GND)</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>Yes (galvanic isolation)</td>
</tr>
<tr>
<td>Transmission rate</td>
<td>max. Baud rate 115 kBaud</td>
</tr>
</tbody>
</table>

#### Other functions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realtime clock</td>
<td>Yes, accumulator battery-buffered (maintenance-free)</td>
</tr>
<tr>
<td>SD card</td>
<td>1 SD card slot</td>
</tr>
<tr>
<td>Digital input</td>
<td>24 V (-20 % / +25 %)</td>
</tr>
</tbody>
</table>

#### Slot for left-hand extension module for communication (optional)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number / type of interfaces</td>
<td>prepared for 1x LAN, 1x CAN, 1x RS485 / 1x RS232</td>
</tr>
</tbody>
</table>
2.3. Block diagram

[Diagram of the block diagram showing various components such as USB, LAN, COM, Accu, RTC, SIO, CAN, Ethernet, RAM, and their connections.]

2VF100514DG01.vsd
2.4. Identification

**Product:** Ethernet-Controller, Type EC1000

**Identification code**

The features of the Ethernet-Controller (see 'Annex, Nameplate') can be itemised according to the identification code.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>C</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>M</td>
<td>P</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>V</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Product:** EC = Ethernet-Controller
- **Variant:** 00 = part equipping variant
- **Version Programming tool:** V3 = CODESYS Version 3.x
- **Programming tool:** 1131 = CODESYS controller
- **Processor type:** MP400 = Power PC 400 MHz

2VF100582DG00.cdr

2.5. Module view and pin assignment

- **EtherCAT** green/red
- Run/Stop red/green/yellow
- Error red
- LAN activity
- Stop/Reset Button
- SD Card Slot
- DI yellow
- Power green
- USB
- COM / CAN
- DI / Supply
- 2VF100515DG02.vsd
2.6. Mounting and connecting

2.6.1. Mounting

The CANtrol E-I/O modules are intended for mounting rail installation (DIN EN 60715, 35 x 7.5 mm).

➔ Push up the module against the mounting rail from below, allowing the metal spring to snap in between mounting rail and mounting area as illustrated.
➔ Push the module above against the mounting wall until it snaps in.

Rail mounting of module

CAUTION

There must be at least 100 mm clearance above and below the EC1000.
This guarantees the necessary convection cooling for the EC1000.
The mounting plate must be metal in order to ensure heat conduction.

To interconnect two modules
After snapping on the first module to the rail, snap on the second module about 1 cm away towards the right of the first module. Push the second module along the rail towards the first module until you hear the locking device snap in.

To disconnect two modules
Push down the unlock button (see figure below) of the module that you wish to disconnect from the module to the left of it. Push both modules away from one another until they are about 1 cm apart.

➔ Push the module up and against the metal spring located on the underside of the rail guide.
➔ Tip the module away from the rail as shown in the illustration.
➔ Pull the module down and out of the mounting rail.

Unlock button

Uninstalling a module

➔ To take down a single module
➔ To snap on a single module
2.6.2. Connecting

Power supply
The controller is energised from an external 24 VDC external power supply. Before connecting up, check that the specifications required for the external power supply are observed.

<table>
<thead>
<tr>
<th>External power supply (24 VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
</tr>
<tr>
<td>Ripple</td>
</tr>
</tbody>
</table>

Internal power supply unit
A power supply unit for the system electronics is installed to provide 24-VDC input voltage (-15 % / +20 %). The power supply unit possesses integrated polarity-reversal protection and inrush-current limitation. Both supply lines and the power supplies must be protected by an external short circuit and overload protection with a maximal tripping current of 5 A in each case (depending on the number of I/O).

Installation
All connections and lines must be executed so that no faults are caused by inductive and capacitive interference in the controller. The supply lines must be sufficiently resilient to current and voltage. Shielded lines must be used for communication. The shield must be fitted onto the module.

Plug DI/Supply assignment

<table>
<thead>
<tr>
<th>DI/Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI</td>
</tr>
<tr>
<td>L+</td>
</tr>
<tr>
<td>L-</td>
</tr>
</tbody>
</table>

Energy buffering
Power Fail 10 ms depending on compliance with the max. number/load by I/O modules.
2.6.3. Earth

Connect the EC1000 to earth by attaching the metal housing to operative earth. Since the operative earth connectors dissipate HF currents, it is of utmost importance for the module's noise immunity. HF interference is dissipated from the electronics board to the metal housing. The metal housing therefore needs to be suitably connected to an operative earth connector.

You will normally have to ensure that

➔ the connection between module housing and DIN rail conducts well,
➔ the connection between DIN rail and switching cabinet conducts well,
➔ the switching cabinet is safely connected to earth.

In special cases you may attach the earth wire straight to the module.

![Diagram showing connection to earth](image)

**NOTICE**

Earth wires should be short and have a large surface (copper mesh).
2.7. Pin assignment

2.7.1. 10/100 Base-T network connection (Ethernet)

The 10/100 Base-T on board Ethernet adapter with RJ-45 connection enables connection to the network. The “LNK” and “RCV” status LED give information about successful connection to the network in compliance with IEEE 802.3, clause 25.

LAN plug-in connector assignment

<table>
<thead>
<tr>
<th>LAN</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ45</td>
<td>1</td>
<td>TX+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TX-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>RX+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>75 Ohm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>75 Ohm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>RX-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>75 Ohm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>75 Ohm</td>
<td></td>
</tr>
</tbody>
</table>

“LNK” LED green ON: ready to operate

“RCV” LED yellow FLASHING: Data Receive

2.7.2. USB

Devices with USB interfaces can be connected on the USB master port (rev. 1.1). The only classes of USB devices which can be used by CODESYS users are USB sticks. A mouse can only be used at the level of Linux. The following issues must be taken into account when using USB sticks:

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A USB stick may only be unplugged during operation if all file operations have been completed, otherwise the USB may become unserviceable!</td>
</tr>
</tbody>
</table>

If programs still have files open, the directory cannot be deleted when the USB stick is removed. In this situation file or directory operations cause blockages because a reading must be taken from a device which is no longer available in the system. Therefore, when removing the USB stick, always make sure that no program has any files still open on the USB stick.
USB memory sticks can be plugged in and removed during operation. The plugged-in device is automatically identified and mounted in the /media/usbX directory. When the USB stick is unplugged, the relevant /media/usbX directory automatically “vanishes” again, if it is no longer being accessed by a program (see above).

Either the first partition or – if there is no partition – the entire memory is mounted on the memory stick, i.e. it appears automatically in the appropriate directory.

The first stick is mounted under /media/usb0, the second under /media/usb1, etc. Maximally 8 sticks can be plugged in and used at once (/media/usb [0-7]. If a new stick is plugged in (or one which has previously been plugged in and then removed), it will be placed in the directory with the lowest free number. By connecting an USB hub it is possible to operate multiple sticks on one USB interface. In this case attention must be paid that there are no USB devices still attached to the hub itself when it is plugged in and unplugged.

**NOTICE**

The mechanical structure of the USB port is designed for max. 1,000 mating cycles.

**CAUTION**

The maximum current available on the USB port is 0.5 A! Before you use the USB device, check its power consumption. The controller performs a reset if a USB device requires more than the max. permissible current. A reset immediately stops the controller and the machine and plant it controls. This may cause more extensive damage. A USB device requiring more current cannot function and may be damaged by this.
2.7.3. CAN bus and serial interface

The CAN interface conforms to the ISO 11898 standard and can be operated up to the maximum baud rate of 1 Mbit/s. The lowest baud rate which can be set is 50 kBit/s.

**COM/CAN plug assignment:**

<table>
<thead>
<tr>
<th>COM/CAN</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232</td>
<td>CAN-Bus</td>
</tr>
<tr>
<td>RxD</td>
<td>CAN-H</td>
</tr>
<tr>
<td>TxD</td>
<td>CAN-L</td>
</tr>
<tr>
<td>Ground</td>
<td>CAN Ground</td>
</tr>
<tr>
<td>Shield</td>
<td>CAN-H</td>
</tr>
<tr>
<td>Shield</td>
<td>CAN-L</td>
</tr>
</tbody>
</table>

**NOTICE**

A 120 Ω terminal resistor can be connected between the CAN_L and CAN_H connections.

This is necessary if the appropriate CAN interface is located at the beginning or end of the relevant CAN bus topology.

**NOTICE**

The RS232 interface X3 has an exceptional position!

Depending on the configuration, it can be used either as a Linux console, or as a PPP interface for remote maintenance, or as a CODESYS programming interface.

If the controller is started in the configuration mode, the module can be configured via a serial PPP connection in this mode. Here, too, the connection is made via X3.

The serial interface is addressed in the software under the name of COM1.
2.7.4. EtherCAT

The EC1000 PLC controller can be extended by means of a system of EtherCAT I/O modules (E-I/O). The E-I/O modules which are lined up on the side to the right are designed for connecting diverse process signals (refer to the EtherCAT I/O manual).

At the same time the EC1000 assumes the function of the PLC controller and an EtherCAT bus coupler. Therefore, the conversion of the EtherCAT communication signals to the LVDS (E-bus) transmission physics takes place internally. As the EtherCAT Master the EC1000 sends frames for writing the output data and for reading the input data. The Ethernet EtherCAT protocol is retained right down to the very last I/O module by this method. At the end of the modular device the connection of the outward and return line is made automatically.

Furthermore, the system voltage of the connected I/O modules is generated in the EC1000. While this simplifies the connection of the I/O modules on the one hand, on the other hand the maximum number of I/O modules which can be connected has to be taken into account.

An extender module facilitates the connection of further EtherCAT Slaves to the EC1000.

---

![CAUTION]

The number of connectable EtherCAT I/O modules is limited!
Each EtherCAT I/O module produces a so-called “E-bus load” load. This is what the power load is called which is required to supply the electronics inside the device. The EC1000 supplies current up to 2 A for the purpose. This means that, at most, one EC1000 can supply maximally 10 I/O modules.

---

**Status display LED**
The EtherCAT LED indicates the status of the EtherCAT ASICs.

<table>
<thead>
<tr>
<th>Status</th>
<th>LED, flash code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Init</td>
<td>Red, continuous light</td>
<td>Initialisation status, no data exchange</td>
</tr>
<tr>
<td>Pre-Op</td>
<td>Red/Green, 1:1</td>
<td>Preoperational status, no data exchange</td>
</tr>
<tr>
<td>Safe-Op</td>
<td>Red/Green, 3:1</td>
<td>Safe operational status, inputs can be read</td>
</tr>
<tr>
<td>Op</td>
<td>Green, Continuous light</td>
<td>Operational status, full data exchange</td>
</tr>
</tbody>
</table>
2.7.5. SD Card

**WARNING**

While the EC1000 is in operation the SD card may not be inserted or removed, otherwise the functions of the EC1000 may be impaired!
The SD card may only be inserted when the EC1000 is de-energised!

The compact SD card drive is equipped with a push-in/push-out insertion and ejection mechanism. Gold-plated contacts guarantee low contact resistances and a service life of 10,000 push-in cycles.

- At present the write protection switch on the SD card is not identified.
- The SD card drive has to be activated via the web configuration.
- The files on the SD drive can be written, read and copied.
- The drive can be accessed via the following path: /media/sd.
- At present data memory cards with a memory capacity of up to 1 GB can be used.
3. Controller operation

**CAUTION**

Never plug in, apply, disconnect or touch connections while the device is operating!

This could result in malfunction or destruction of the device. Before working on the modules, always switch all infeeds to them off; including infeeds from connected peripheral devices such as remote-feed encoders, programming devices, etc.

3.1. Commissioning

Before applying the supply voltage, recheck all connections to ensure they are properly wired and have the correct polarity.

**Switching on**
The module is not equipped with its own main power switch. The PLC controller starts when the associated equipment is switched on or when the power supply is connected.

**Switching off**
The PLC controller switches off when the associated equipment is switched off or the power supply is disconnected.

3.2. Function Selection, Indicators, Diagnostics

3.2.1. Status Indicators

The function of the status indicators frequently depends on the software development environment employed on the PLC controller.

→ **CP1131-P:**

PLC programming using CODESYS and Berghof Target Support Package.

→ **CPC++:**

C programming directly on the LINUX operating system.
Power LED
4 operating status LED indicate the current status of the voltage supply, module mode and error messages.

<table>
<thead>
<tr>
<th>LED</th>
<th>Logical status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PWR (green)</td>
</tr>
</tbody>
</table>

**RUN/STOP BUTTON**
The Run/Stop control button replaces the former control switch.
This slightly changes the operating concept:

<table>
<thead>
<tr>
<th>Action</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submarine, boot phase</td>
<td>Activation of the pushbutton</td>
</tr>
<tr>
<td>CODESYS PLC/ CP1131-P</td>
<td>Change into PPP mode or submarine console</td>
</tr>
<tr>
<td>Short push</td>
<td>Change between RUN and STOP mode of PLC</td>
</tr>
<tr>
<td>Long push</td>
<td>STOP the PLC using RESET of the variables, but not the retain data (corresponding to the activation of the rocker switch on the DC1000 modules)</td>
</tr>
</tbody>
</table>

It is then no longer possible to force-hold the PLC controller in the STOP state!

**LEDs: RUN/STOP ERROR - LED signalisation**
2 LED are available on the module to signalise the system status (RUN/STOP in two colours: red/green/(yellow); ERROR in red only). The flash codes familiar from the DC1000 are therefore no longer applicable. The following system states are signalised via the LED:

<table>
<thead>
<tr>
<th>System states</th>
<th>LED RUN/STOP</th>
<th>LED ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPP configuration mode active</td>
<td>Yellow</td>
<td>Off</td>
</tr>
<tr>
<td>USB packet update active</td>
<td>Yellow, flashing</td>
<td>Off</td>
</tr>
<tr>
<td>System error</td>
<td>Off</td>
<td>On</td>
</tr>
</tbody>
</table>

**PLC states**

<table>
<thead>
<tr>
<th>RUN</th>
<th>Green</th>
<th>Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP</td>
<td>Red</td>
<td>Off</td>
</tr>
<tr>
<td>Error stop</td>
<td>Red</td>
<td>On</td>
</tr>
<tr>
<td>Reset button registered</td>
<td>Red, flashing</td>
<td>Off</td>
</tr>
</tbody>
</table>

**Applicatory states**

<table>
<thead>
<tr>
<th>Identification of ProfiNET device</th>
<th>Yellow, flashing</th>
<th>Flash</th>
</tr>
</thead>
</table>
Basic procedure in case of error stop:

- Establish cause of error (read via web browser)
- Eliminate cause of error
- Perform reset on controller, alternatively: Mode selector switch / CODESYS / web browser
- Put controller back into operation

**NOTICE**

CP1131-P mode FORCE:
FORCE means that the user program is running and at least one variable is compulsorily attributed via CODESYS at the beginning of each cycle. The user can therefore see that without this intervention in the sequence of the PLC program the user program might react differently.

**Status LED for CPC++ programs**
The LED can be controlled by user software.

**Ethernet status LED**
Refer to section: 10/100 Base-T network connection (Ethernet).

### 3.3. Real-Time Clock with Backup Battery

The EC1000 is equipped with a real-time clock.

**Setting the clock**
Use either the web configuration or the CODESYS “BGHSysLibRtc.lib” library.

**Power supply**
A rechargeable battery is incorporated to energise this clock.

**Changing the rechargeable battery**
There is no need for the user to change the battery.

**NOTICE**
The battery must be changed expertly by the manufacturer of the module.

**Type of rechargeable battery**
Panasonic VL2020 or equivalent.

**Battery service life**
typ. 10 years depending on temperature in use.

**Battery storage**
> 1 year voltage-free; thereafter the data of the RTC may possibly be lost.
Battery transport
The VL2020 Accu is permanently installed in the device. The battery contains 0.01g lithium.

NOTICE
TRANSPORT

The devices contain lithium-ion batteries of the Panasonic manufacturer. They are classified in UN 3091.
For further information look in the PSDS to be found under
4. **Annex**

4.1. **Environmental Protection**

4.1.1. **Emission**

When used correctly, our modules do not produce any harmful emissions.

4.1.2. **Disposal**

At the end of their service life, modules may be returned to the manufacturer against payment of an all-inclusive charge to cover costs. The manufacturer will then arrange for the modules to be recycled.

4.2. **Maintenance/Upkeep**

**WARNING**

Do not insert, apply, detach or touch connections while in operation – risk of destruction or malfunction.

Disconnect all incoming power supplies before working on our modules; this also applies to connected peripheral equipment such as externally powered sensors, programming devices, etc. All ventilation openings must always be kept free of any obstruction.

→ The modules are maintenance-free when used correctly.
→ Clean only with a dry, non-fluffing cloth.
→ Do not use detergents!

4.3. **Repairs/Service**

**WARNING**

Repair work may only be carried out by the manufacturer or its authorised service engineers.

4.3.1. **Warranty**

Sold under statutory warranty conditions. Warranty lapses in the event of unauthorised attempts to repair the equipment and/or product, or in the event of any other form of intervention.
4.4. Nameplate

Nameplate descriptions (example)

1. Designation of device type
2. Identification no. (item no. + serial no.)
3. Customer no.
4. Supply voltage
5. Manufacturer’s address
6. Mac addresses
7. Production date
8. QR code (identification no.)
9. CE marking
10. Brand of the manufacturer (trademark)
4.5. Addresses and Bibliography / Standards

4.5.1. Addresses

CAN in Automation; international manufacturers and users organisation for CAN users in the field of automation:
CAN in Automation e.V. (CiA)
Am Weichselgarten 26
D-91058 Erlangen / Germany
headquarters@can-cia.de
www.can-cia.de

EtherCAT Technology Group
ETG Headquarters
Ostendstraße 196
D-90482 Nuremberg / Germany
info@ethercat.org
www.ethercat.org

Beuth Verlag GmbH, 10772 Berlin
or
VDE-Verlag GmbH, 10625 Berlin

VDE Verlag GmbH, 10625 Berlin
or
Internet search: www.iec.ch

\( \rightarrow \) CiA
\( \rightarrow \) ETG
\( \rightarrow \) DIN-EN Standards
\( \rightarrow \) IEC Standards
### 4.5.2. Bibliography / Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Label</th>
</tr>
</thead>
</table>
| IEC61131-1 / EN61131-1 | Programmable controllers  
Part 1: General information                                  |
| IEC61131-2 / EN61131-2 | Programmable controllers  
Part 2: Equipment requirements and tests                           |
| IEC61131-3 / EN61131-3 | Programmable controllers  
Part 3: Programming languages                                      |
| IEC61131-4 / EN61131Bl1 | Programmable logic controllers  
Supplementary Sheet 1: User guidelines                             |
| IEC61000-6-4 / EN61000-6-4 | German EMC Standard: Emitted interference          |
| IEC61000-6-2 / EN61000-6-2 | German EMC Standard: Noise immunity                           |
| ISO/DIS 11898     | Draft International Standard:  
Road vehicles - Interchange of digital information - Controller Area  
Network (CAN) for high-speed communication                          |
| DIN EN ISO 13849-1 | Safety of machinery:  
Safety-related parts of control systems (Part 1)                |
| UL 508            | Industrial Control Equipment  
17 th edition / 1999-01-28                                         |
| EN 50581          | Technical documentation for the assessment of electrical and electro-  
nic products with respect to the restriction of hazardous substances |

Notice: Our Technical Support team will be glad to provide other literature references on request.