B-Fortis CC-Prime Series

BERGHOF

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Notes on this user manual

This equipment manual contains information which is specific to the product and which is valid at the time of printing.
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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Change log

Version	Date	Description
0.1	03.01.2020	First draft regarding new catalog numbers and options , Rabold bis page 21
0.9	11.05.2020	Updates
1.0	18.06.2020	Formatting of the document and change of address
1.2	05.03.2021	Dual Core Versions added
1.3	20.09.2022	Cyber security added
1.4	06/04/2023	Chapter 11 adapted, revised table with version features

Contents

1.   General information

This user manual is intended for use by qualified professionals and contains information on the as-sembly, installation, start-up and maintenance of the device.

1.1.   Notes on the manual

This user manual is part of the product.

The manual contains information on the following topics:
→   Applications
→   Safety
→   Mechanical design
→   Electrical design
→   Connections
→   Start-up
→   Upkeep and maintenance
→   Decommissioning
→   Disposal

▶   Always keep this user handbook available alongside the product.

1.2. Symbols and visual depictions

The following symbols and visual depictions will be used in this manual:

Symbol		Meaning
→	…	List entry
▶	…	Individual instruction or list of instructions which can be carried out in any order.
1.	…	List of instructions which must be carried out in the order given.
2.	…	
i		Additional product information

Design of warnings:

⚠ **WARNING**

Optional:	**Hazard type and source**
Other	Short description and consequences
Symbols	▶ Preventive measures

1.3. Hazard categories and indications

The following indications are used in the case of warning messages so as to ensure your personal safety and avoid any damage to property.
The indications have the following meanings:

⚠ **DANGER**

Serious injury or death

Non-compliance with the safety features will result in death or serious injury.

▶   Take preventive measures.

⚠ **WARNING**

Possible serious injury or death

Non-compliance with the safety features may result in death or serious injury.

▶   Take preventive measures.

> ⚠ **CAUTION**
>
> **Possible minor injuries**
>
> Non-compliance with the safety features may result in minor injuries.
>
> ▶ Take preventive measures.

> **NOTE**
>
> **Possible damage to property**
>
> Non-compliance with the safety features may result in damage to property.
>
> ▶ Take preventive measures.

1.4. Qualified personnel

The installation, start-up and maintenance of the device must be carried out by qualified personnel. For the purposes of this documentation and the safety instructions contained therein, "qualified personnel" means trained staff who are familiar with safety concepts in automation engineering and who are authorized to assemble, install, start up, earth and identify devices, systems and electrical circuits in accordance with standards set in safety engineering.

1.5. Duty of care

1.5.1. General

The user (OEM) must ensure the following:
→   The device must only be used according to regulations.
→   The device must only be used in good working order.
→   The user handbook must always be kept legible and fully available.
→   Only sufficiently qualified and authorised personnel may carry out the assembly, installation, start-up and maintenance of the device.
→   These authorised personnel must receive regular training on all relevant occupational health and safety and environmental protection issues and must be fully familiar with the contents of this user handbook, particularly the sections regarding safety features.
→   Any markings or identification labels and safety and warning signs on the device must not be removed and must be kept legible at all times.
→   The national and international regulations regarding the operating of machinery and facilities where the device is being used must be observed at all times.
→   The user must always be kept abreast of any current relevant information regarding the device and its use or operation.
The user takes direct responsibility for agreeing with the competent authorities the use of safety-related control components, and for compliance with their instructions

1.6. Intended use

The device is part of a modular automation system for industrial control applications within the medium to high performance range. It extends the communications capabilities to include EtherCAT, Profinet, Modbus and others.

The automation system is designed for use within overvoltage category I (IEC 364 4 443) systems for controlling and regulating machinery and industrial processes in low-voltage installations in accordance with the following general parameters:
→   maximum rated supply voltage of 1,000 V AC (50/60 Hz) or 1,500 V DC
→   Environment with maximum category 2 pollution (EN 61010-1)
→   for use up to a maximum altitude of 2,000 m above msn.
→   for indoor use only in areas not exposed to direct UV radiation
→   Max. ambient temperature inside and outside the control cabinet in accordance with the technical data (see "Chapter 10")

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 this documentation and associated user manuals.

The automation system must only be used:

→   as intended

→   in a technically perfect condition

→   without any unauthorised modifications

→   by qualified users

▶   Observe the rules of the employer's liability insurance association, the technical inspectorate, and the VDE (Association of German Electrical Engineers) or corresponding country regulations.

The device is intended for installation into a suitable cut-out on industrial machines and systems in indoor areas.

▶   When installing the device, check that the seal profiles are undamaged.

▶   For operation, refer to the applicable statement of ambient conditions (see "Chapter 10").

1.7. Transport and storage

The device is susceptible to impacts, heavy vibration, moisture and extreme temperatures.

Transport and storage

▶   Protect the device against major mechanical stresses during transport.

▶   Always pack the device in its original packaging for transport.

▶   For storage, refer to the applicable statement of ambient conditions (see "Chapter 10").

▶   Protect the device against condensation and damp.

Devices with batteries/rechargeable batteries

Lithium metal batteries are hazardous items. The manufacturer's information specifies that they are subject to UN 3091 (must be permanently installed within the device).
The ADR 188 special regulations can be applied for transport.

Operation

▶   If the device has been stored or transported in cold weather or under conditions or large fluctuations in temperature, do not start to operate it until it has acclimatised to room temperature for the place it is used.

▶   If condensation is present, wait at least 12 hours before starting to operate the device.

1.8. Unpacking

On receipt of the device, a check must be made that it is complete and undamaged.

▶   Check the packaging for external damage.

▶ If the packaging is seriously damaged or if damage to the contents is evident: Do not proceed further with opening the packaging, instead immediately inform the transport company and your supplier.
▶ Remove the packaging and keep it safe for subsequent transport.
▶ Check the contents for evidence of damage in transport.
▶ Check the contents for completeness against the order documentation and keep all the delivery documentation for future reference. The delivery documentation contains important information about the device and is part of the product.
▶ If you discover damage in transport, or if the equipment delivered does not match the order: Inform the supplier immediately.

2. Safety

Safety related systems

The use of PLCs in safety-related systems requires specific measures. Wherever a PLC is to be used in a safety-related system, the user must be given comprehensive advice by the PLC manufacturer in addition to information on any available standards or regulations regarding safety installations.

▶ Before starting any work on devices, switch off all power feeds, including to peripherals.
▶ Keep all ventilation holes unobstructed.

Failure in certain components in an electronic control system may result in uncontrolled and/or unpredictable operational behaviour.

▶ All types of failure must be considered at the system level and the associated preventative measures identified.
▶ If necessary, request information from your automation system provider.

2.1. Safety instructions

The device may be operated only when it is in good working order. Exposed sharp edges pose an injury risk.

▶ If you discover damage to the front glass of the device, do not continue to operate the device. Immediately disconnect it from the power supply.

Working on the device

Do not start work on the device until all necessary safety precautions have been taken. Take precautions to avoid unforeseeable functional events and movements of the system.

▶ Bring the system into a safe condition.
▶ Switch the system and the device off.
▶ Secure the system against being switched on again.
▶ Disconnect the device from the system.

The casing of the device must not be opened.

▶ If work on the internal parts of the device is necessary, contact the manufacturer (see "Chapter ").

Password configuration

The passwords assigned by Berghof must be changed by you during the initial commissioning. You can make this change via the web menu, where you will also find the users created by Berghof (see chapter 6.2).

Cybersecurity

These controllers must not be connected directly to the Internet without external protection through suitable firewalls. In addition, we recommend a VPN connection for security. Services that are not required should be deactivated (FTP/SSH,...).

Contact person for cybersecurity of Berghof products:
Berghof Automation Product Security Incident Response Team
psirt.automation@berghof.com

3.   Product description

The compact PLC controller family B-Fortis CC-Prime are CODESYS PLCs for control and regulating of automation and industrial processes in low-voltage installations, e.g. for compact machinery or building automation. The programming language CODESYS 3.5 (IEC 61131-3) is used for programming the device. The CODESYS SoftMotion packet permits complex multi-axis drive applications.
The device can be connected via different interfaces and has additional digital and analogue inputs and outputs.

3.1.   Overview B-Fortis CC-Prime
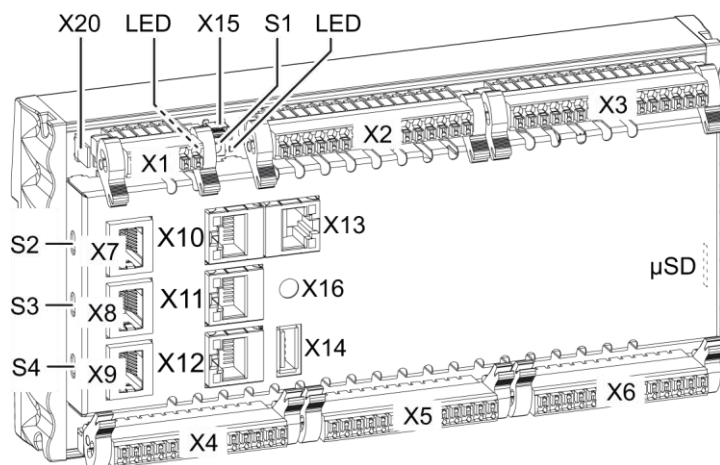
Fig. 1: Overview B-Fortis CC-Prime

Item	Description	Item	Description
X1	Electrical connection (power)	X13	EtherCAT [ETH1]
X2	Digital outputs	X14	USB 2.0
X3	Digital inputs	X15	(reserved)
X4	Analogue inputs and outputs	X16	Debug interface
X5	Analogue inputs and outputs	X20	Functional earth
X6	Analogue inputs and outputs	S1	Function key (Reset and Run/Stop)
X7	CAN Bus [CAN0][1]	S2	Terminal resistance CAN-Bus ON/OFF
X8	RS 232 [COM1] / RS 485 [COM2]	S3	Terminal resistance RS 485 ON/OFF
X9	RS 485 [COM3]	S4	Terminal resistance RS 485 ON/OFF
X10	Ethernet Switch PORT 1 [ETH0]	LED	LEDs for power and system status

[1] Designations in [ ]: CODESYS-designations of the connections

Item	Description	Item	Description
X11	Ethernet Switch PORT 2 [ETH0]	µSD	microSD card connection (optional)
X12	Ethernet Switch PORT 3 [ETH0]		

3.2. Scope of delivery and accessories

Scope of delivery

B-Fortis CC-Prime

Accessories

The following accessories can be ordered directly via the option or separately via order number:

3.2.1. CC-Prime Connector set as order option

order option: H001
note: the plug set suitable for the respective device is supplied

3.2.2. CC-Prime Connector set as order-number

Connector set via order-number	
S-02020102-0100	CC-Prime S06 connector set: 1 x 6 pin connector for power supply, 2 x 16 pin connector for digital In/Out
S-02020102-0200	CC-Prime S01/S02/S03/S07 connector set: 1 x 6 pin connector for power supply, 2 x 16 pin connector for digital In/Out und 1 x 14 pin connector for analog In/Out
S-02020102-0300	CC-Prime S04 connector set: 1 x 6 pin connector for power supply, 2 x 16 pin connector for digital In/Out und 2 x 14 pin connector for analog inputs
S-02020102-0400	CC-Pprime S05/S08 connector set: 1 x 6 pin connector for power supply, 2 x 16 pin connector for digital In/Out und 3 x 14 pin connector for analog inputs

3.3. Product features

Assembly

The device is designed for installation on a DIN rail (35 mm) in a control cabinet in an industrial environment with a category 2 pollution environment.

Processor

In its ~~the~~ basic configuration the device is equipped with an 800 MHz ARM® CPU with a Cortex™-A9 core.

Ethernet

The device has two 10/100 Mbit/s Ethernet interfaces. TCP/IP and UDP/IP protocols permit flexible connections to visualisation software, higher-level control units and to the IT infrastructure. One Ethernet interface can be equipped with an optional 3-switch (3 ports for the user) connected directly to the CPU.
The second Ethernet interface is connected to the controller via a PCIe.
Additional protocols are available: PROFINET, BACnet, Ethernet IP and Modbus.

USB

Thanks to the USB host interface, a wide range of peripherals can be connected to the device. Examples are a USB stick for updating the application or for downloading data directly.

CAN interfaces (S02-S08)

The device has one standard CAN interface which can be used at a speed of up to 1 Mbit/s.

Serial interfaces (S04-S08

The B-Fortis CC-Prime has up to three potential-free serial interfaces (2x RS485; 1x RS232).

Additional interfaces

There is also a debugging interface located on the modulw which can be used in conjunction with a special cable to be connected to the jack plug (for additional information, please contact our customer services team).

Real Time Clock

A battery-buffered, maintenance-free real-time clock can be used within the CODESYS application via a software interface.

microSD card (optional)

The standard commercial microSD card interface (SDHC up to max. 32 GB) allows data to be written to memory cards or read from memory cards.

Onboard inputs / outputs

The device provides digital inputs, digital outputs and analogue inputs.

Visualisation

CODESYS target visualisation is included in the scope of delivery. The Berghof Ethernet terminals B-Primis ET series provide a simple, user-friendly display.
The B-Fortis-CC-Prime also supports web visualisation.

Summary of features

→ ARM® CPU with CortexTM-A9 single-core (800 MHz; optional dual or quad core)
→ Program memory and data memory (RAM): up to 1024 MB
→ Program memory (flash): up to 1024 MB onboard/ 896MB user memory
→ 1 x USB host interfaces (USB 2.0, type A)
→ Retain memory 100 kB
→ 2 x Ethernet 10/100 Base T interfaces (2nd Interface: EtherCAT master interface)
→ Up to 2 CAN interfaces (SXX dependent)
→ Up to 3 serial interfaces (2 x RS-485; 1 x RS-232)
→ 1 µSD card slot
→ Onboard I/O, up to 16 digital inputs, up to 16 x digital outputs, up to 12 x analogue inputs, up to 6 x analogue outputs
→ Real Time Clock (RTC)

4. Installation

The B-Fortis CC-Compact devices are designed to be mounted on DIN rails (according to EN 60715:2001, 35 x 7.5 mm).

⚠ CAUTION

Hot surfaces

The surface of the device can become hot.

▶ Ensure that there is sufficient convectional cooling for heat to dissipate

▶ Ensure that there is also a minimum of 50 mm free space both above and below the device.
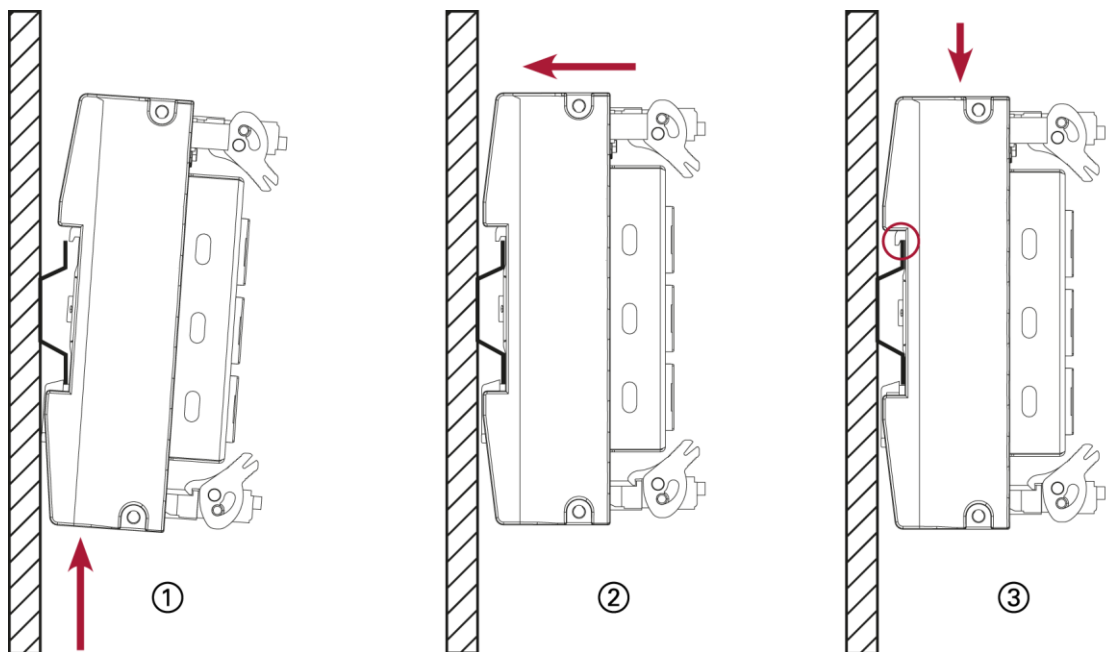
Fig. 2: mounting the device

Requirements:

at least 1 cm free space must be left between the device and the adjacent module.

1. Insert the device into the support rail according to the image above so that the plastic snap-in hooks between the mounting surface and the rail are pressed in.
2. Push the device at the top in towards the mounting surface.
3. Push the device down so that the profile is aligned with the upper part of the rail mounting.

The device should now be fixed in place.

5.   Connection

> ⚠ **WARNING**

Uncontrolled and unpredictable operational behaviour!

Failure of certain components in electronic control systems may result in uncontrolled and unpredictable operational behaviour.

▶   All types of failure and the associated protection systems must be taken into account at system level.

▶   Comply with all automation system manufacturer instructions.

5.1.   Power supply

The device is powered by an external 24 V DC supply.

▶   Before plugging in the device, ensure it meets the specifications for external power supplies (type K according to 61131-2).

External PLC power supply (24 V DC: L+; L1+; L2+; L3+; L4+)	
Supply voltage	+24 V DC SELV (−15% / +20%)
Alternating current proportion	Max. 5% The direct voltage level must not fall below 20.4 V.
Energy buffering	Power fail 10 ms

Internal power supply

A power supply for the system electronics for an input voltage of 24 V DC (−15% / +20%) is integrated into the device. The power supply has integrated protection against reverse polarity and surge current protection (1.2 A).

▶   Fuse the supply lines for the IO lines (L1+ to L4+) externally so that the value (approx. 5 A) for the power-limited electrical circuits (150/U) are not exceeded (U = value of the voltage applied).

Installation

▶   All connections and cables must be laid out so as to prevent inductive and capacitive interference causing any damage to the device.

▶   Ensure that the infeed lines provide adequate current and voltage carrying capacity.

5.1.1. Connecting the power supply

> ⚠ **CAUTION**
>
> **Live parts!**
> ▶ Before starting any work on the device, switch off all power feeds, including peripherals.

Connect the power supply to plug X1 according to the following table.
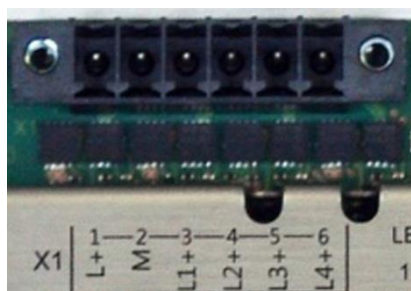
Fig. 3: power supply plug X1

Power supply plug X1		
Pin	**Label**	**Assignment**
1	L+	external 24 V DC (−15% / +20%) power supply (internal PLC) max. 1 A
2	M	external GND power supply
3	L1+	Digital output DO1–4 supply, 24 V DC (−20% / +25%) max. 2 A [1]
4	L2+	Digital output DO5–8 supply, 24 V DC (−20% / +25%) max. 2 A [1]
5	L3+	Digital output DO9–12 supply, 24 V DC (−20% / +25%) max. 2 A [1]
6	L4+	Digital output DO13–16 supply, 24 V DC (−20% / +25%) max. 2 A [1]

[1] Nominal current 2 A at peak load; in case of overload, up to 3 A might flow.

5.2. Earth

The functional earth dissipates HF currents and increase the stability of the device.
HF faults are transferred internally from the electronic circuit board to the metallic housing which requires a suitable connection to a functional earth (X20).

Earthing the B-Fortis CC-Prime

Requirements:
The support rail has a good conductive contact with the control cabinet.
The control cabinet must be earthed correctly.

▶ Ensure that the device housing has good conductive contact with the support rail.
▶ If specifically required in certain installations, additional PE conductors may be connected to protect all metallic parts from high voltages on the underside of the device (PE connection).

The device is now earthed.

ⓘ Where necessary, the device can also be connected directly to the earth.

5.3.   Data connections
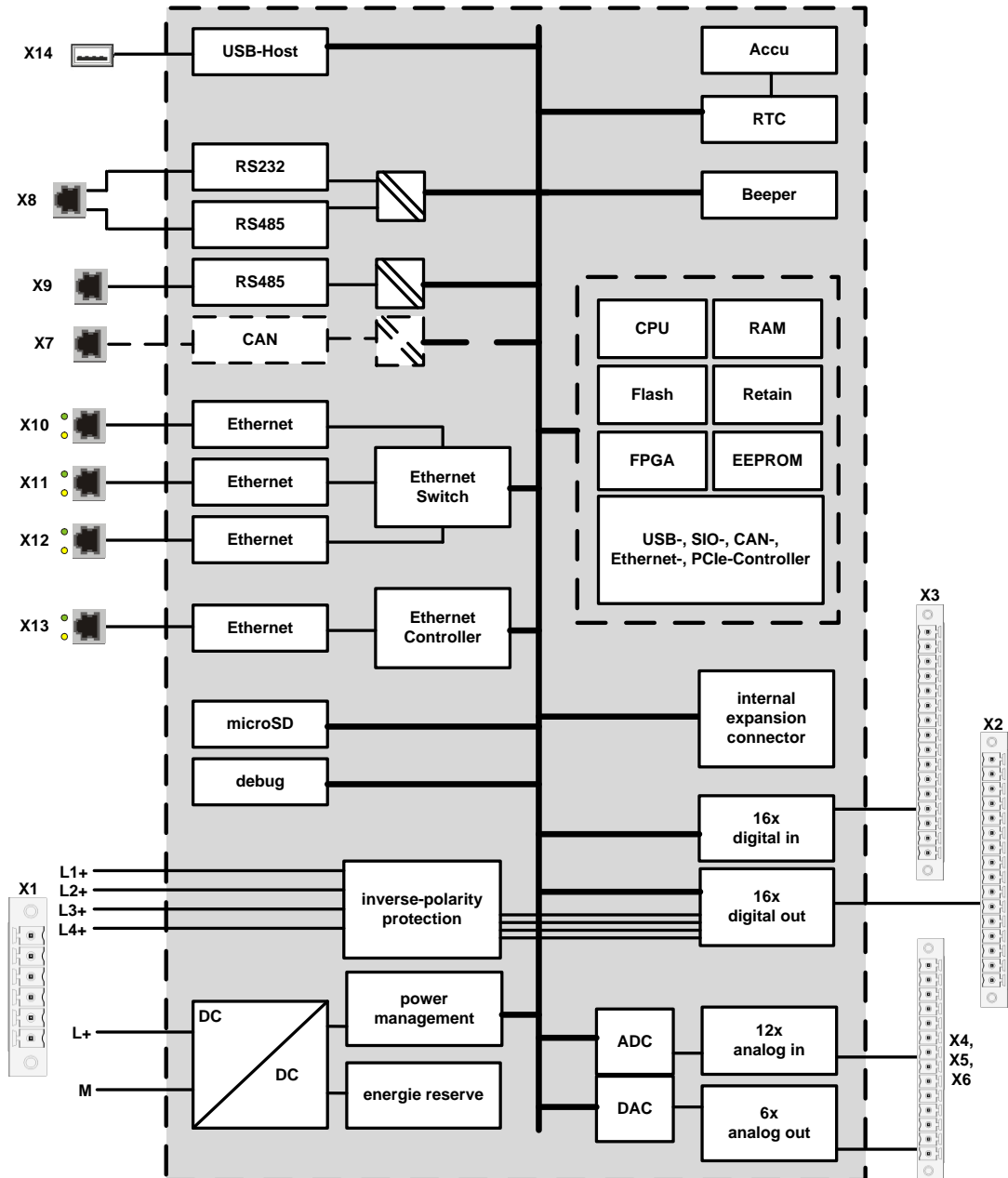
Fig. 4: block diagram

5.3.1. Digital outputs (O)

The digital outputs are positive switching 24 V outputs with an output current of max. 500 mA. They have a common reference potential (GND) with the supply voltage. The supply lines are organised into four groups of four.

The following counterpieces have been tested for the SC-SMT 3.81 (Weidmüller) plug-in connector and are approved for use with the ECC22XX:

Weidmüller BCZ 3.81/16/180 (F, LH)
Weidmüller BCF 3.81/16/180 (F, LH)
Phoenix FK-MCP 1.5/16-ST-3.81-LR
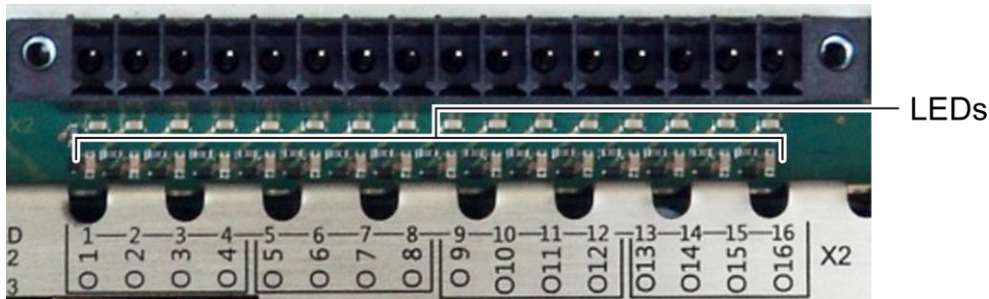
Fig. 5: digital outputs plug X2 (Weidmüller SC-SMT 3.81/16/180 LF 3.2)

Digital outputs plug X2		
Pin	**Label**	**Assignment**
1	O 1	+24 V (supply from L1+)
2	O 2	
3	O 3	
4	O 4	
5	O 5	+24 V (supply from L2+)
6	O 6	
7	O 7	
8	O 8	
9	O 9	+24 V (supply from L3+)
10	O 10	
11	O 11	
12	O 12	
13	O 13	+24 V (supply from L4+)
14	O 14	
15	O 15	
16	O 16	

ℹ️ The maximum output current is 0.5 A and the output stage is protected against overload.
  ▶ Take possible limitation of the output current when connecting external devices (e.g. increased surge current from lamps) into account.

Data of the the digital outputs		
Feature	**Value**	**Description**
Output type	semiconductor	non-storing
Protective circuit for inductive loads	41 V terminal voltage (typ.) compared to +24 V	fast de-excitation (must be provided externally)
Status display	yes	one orange LED per output
Overload protection	yes	in the case of thermal overload
Short circuit protection response threshold	yes	electronic voltage limitation: typ. 7 A The electricity is limited electronically. Activation of short circuit protection results in thermal overload and tripping of thermal overload protection. Permissible limits based on cold state: max. 10,000 short circuits; overall duration max. 500 hours.
Output delay "0" after "1"	typ. 1 ms	–
Output delay "1" after "0"	typ. 1 ms	–
Output capacity	< 20 nF	–
Rated voltage	+24 V DC	–
Voltage drop (at rated current)	< 0.1 V	–
Rated current at "1" signal	0.5 A	–
Total current of all outputs	max. 2 A per group	group: 4 adjacent pins with supply from same source (e.g. pins 1-4, power supply L1+)
Parallel circuit in two outputs	max. 1 A	maximum permissible value with a logical connection to increase performance
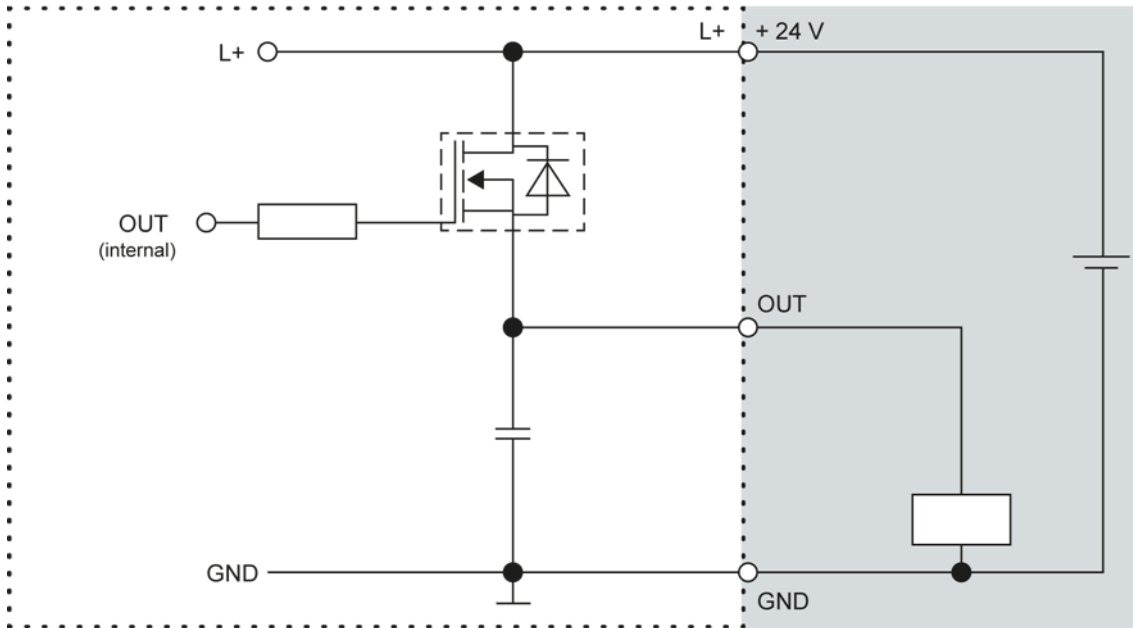
Fig. 6: Principle circuit diagram output, positive switching

5.3.2. Digital inputs (I)

The digital inputs are type 1 or 3 (IEC61131-2) positive switching inputs. They are designed for nominal input voltages of 24 V. The inputs are transferred internally for process data processing in a cyclical fashion. An open input is interpreted as static 0.

The following counterpieces have been tested with the SC-SMT 3.81 (Weidmüller) plug-in connector and are approved for use with the ECC22XX:
Weidmüller BCZ 3.81/16/180 (F, LH, LR)
Weidmüller BCF 3.81/16/180 (F, LH, LR)
Phoenix FK-MCP 1,5/16-ST-3.81-LR
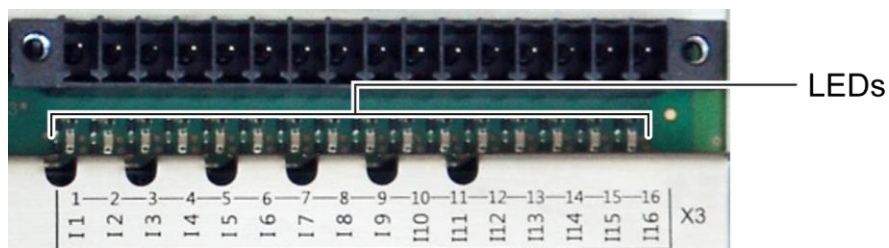
Fig. 7: digital inputs plug X3 (Weidmüller SC-SMT 3.81/16/180 LF 3.2)

Digital inputs plug X3		
Pin	**Label**	**Assignment**
1	I 1 / C 1	+24 V / counter input 1
2	I 2 / C 2	+24 V / counter input 2
3	I 3 / C 3	+24 V / counter input 3
4	I 4 / C 4	+24 V / counter input 4
5	I 5	+24 V
6	I 6	+24 V
7	I 7	+24 V
8	I 8	+24 V
9	I 9	+24 V
10	I 10	+24 V
11	I 11	+24 V
12	I 12	+24 V
13	I 13	+24 V
14	I 14	+24 V

Digital inputs plug X3		
Pin	Label	Assignment
15	I 15	+24 V
16	I 16	+24 V

Data of the the digital inputs		
Feature	Value	Description
Cable length	max. 30 m	For unshielded connection cables Cables over 30 m in length must be shielded
Cable cross-section in control cabinet	after voltage drop	Only select after voltage drop (there are no further practical restraints).
Field wiring	according to regulations and standards	Comply with all local regulations and the stipulations of EN 61131-2.
Rated load voltage	24 V DC (SELV)	–
Protection against reverse polarity	yes	–
Potential isolation	no	–
Status display	yes	One orange LED per input
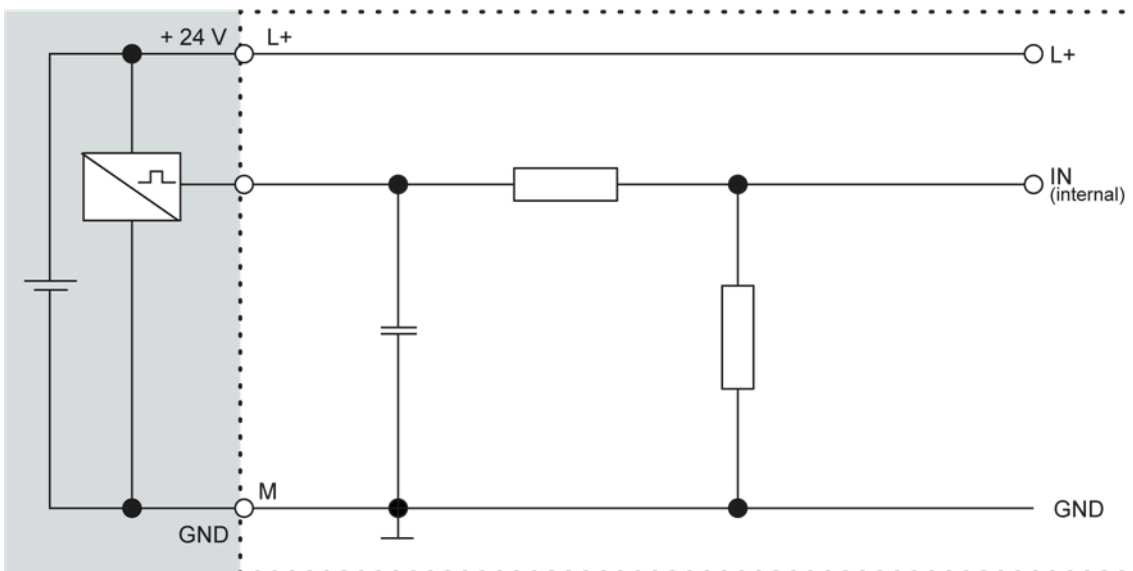
Fig. 8: Principle circuit diagram input, positive switching
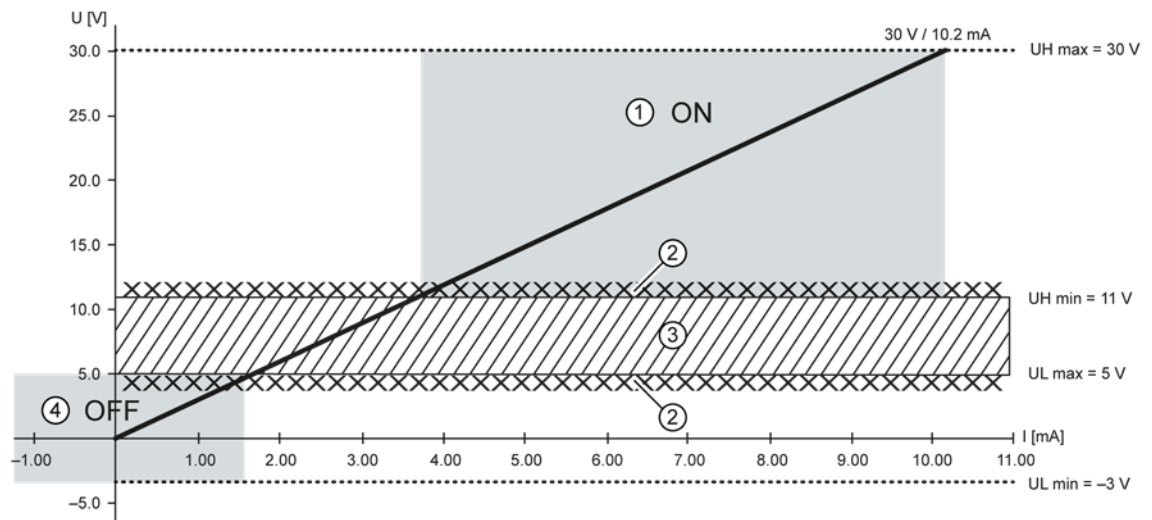
Fig. 9: Operating ranges of the digital inputs (type 1/3)

Item	Description	Item	Description
1	„ON"-area	3	Transition area
2	signal-to-noise ratio < 1 V	4	„OFF"-area

5.3.3. Counter inputs

The first 4 digital inputs of the CC-Prime (X3: I1…I4) may alternatively be used as counter inputs (C1…C4).
To activate this function requires a license, which can be obtained subsequently S-xxxxx or as an order option (-S000 CounterEncoder Interface)
The counter inputs C1…C4 have fast filters, the unipolar inputs I5…I16 have hysteresis.
The counter inputs are connected to the signals of the other unipolar inputs. There is no changeover switching.

Available options for the counter inputs:

up-down counter
pulse and direction counter
quadrature decoder

One of the counter inputs may alternatively be used as a capture input. This configuration requires 3 inputs (partially as CNT input or CAPT input).
The edges for up, down or pulse may be set to falling and/or rising edge.
Direction: high = up; low = down

Examples for counters: up/down; pulse/direction; encoder (A/B)
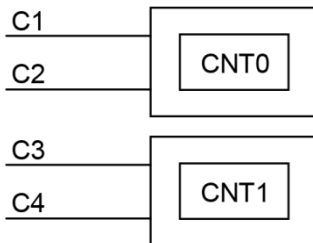
Fig. 10: counter up/down or pulse/direction

Pin	Designation	Pin	Designation
C1	Up, pulse, A (CNT0)	C3	Up, pulse, A (CNT1)
C2	Down, direction, B (CNT0)	C4	Down, direction, B (CNT1)

Example for counter: capture input or Z input
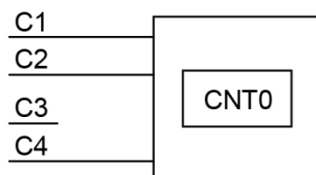
Fig. 11: counter with capture input

Pin	Designation	Pin	Designation
C1	Up, A (CNT0)	C3	–
C2	Down, B (CNT0)	C4	Capture (rise), Z (CNT0)

Counter CNT1 is not available in this configuration.

Data of the counter inputs

Data of the counter inputs		
Feature	Value	Description
Number of counters	2	–
Signal voltage	(1): DC 15…28 V (0): DC –3…3 V	Pulse width at the valid level for at least 1 µs
Max. frequency signal counter	500 kHz 1 counts/s	For 100 kHz see specific installation information. At the maximum counter frequency the signal transmitter must ensure an edge steepness of at least 20 V/µs at the counter input.
Min. pulse width	10 µs	Per level
Counter resolution	32 Bit	–
Internal pull-up	3 kΩ	–

Installation information

The counter inputs must be connected with shielded cables.
Supply voltage (24 V DC; GND) and signals of the transmitters must go through the same cable.
The SPS and the transmitter must use the same power supply.

5.3.4. Analogue inputs and outputs (AIO)(not for S06)

The CC-Prime has up to 12 analogue inputs (AI) and 6 analogue outputs (AO) on plugs X4, X5 and X6. The layout of the I/O is identical on all 3 plugs.

The following counterpieces have been tested for the SC-SMT 3.81 (Weidmüller) plug-in connector and are approved for use with the ECC22XX:
Weidmüller BCZ 3.81/14/180 (F, LH, LR)
Weidmüller BCF 3.81/14/180 (F, LH, LR)
Phoenix FK-MCP 1,5/14-ST-3.81-LR
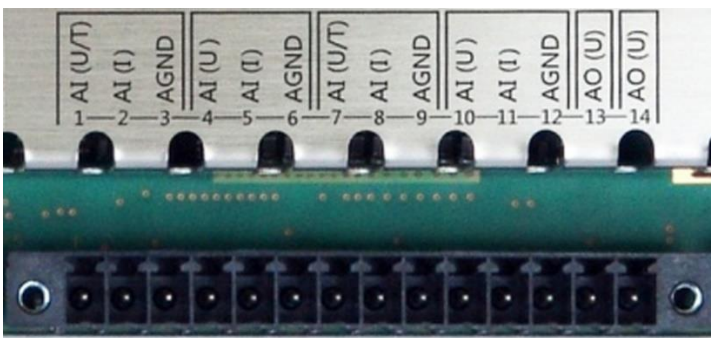
Fig. 12: analogue inputs a.outputs plugs X4, X5 a.X6 (Weidmüller SC-SMT 3.81/14/180 LF 3.2)

Analogue inputs and outputs plugs X4, X5 and X6				
Pin	X4	X5	X6	Assignment
1	AI 1	AI 5	AI 9	U/T; ±10 V; PT100/1000
2	AI 1	AI 5	AI 9	I; ±20 mA
3	–	–	–	AGND
4	AI 2	AI 6	AI 10	U; ±10 V
5	AI 2	AI 6	AI 10	I; ±20 mA
6	–	–	–	AGND
7	AI 3	AI 7	AI 11	U/T; ±10 V; PT100/1000
8	AI 3	AI 7	AI 11	I; ±20 mA
9	–	–	–	AGND
10	AI 4	AI 8	AI 12	U; ±10 V
11	AI 4	AI 8	AI 12	I; ±20 mA
12	–	–	–	AGND
13	AO 1	AO 3	AO 5	U; 0–10 V

Analogue inputs and outputs plugs X4, X5 and X6				
Pin	**X4**	**X5**	**X6**	**Assignment**
14	AO 2	AO 4	AO 6	U; 0–10 V

Analogue channel wiring

Ensure the following connection requirements are met so as to guarantee the measuring accuracy of the device:

- ▶ Use analogue cables with a braided shield.
- ▶ Separate the laying of analogue cables and power cables. Where required, install metallic shielding in cable channels.
- ▶ Earth the screen at the place where it enters the control cabinet.
- ▶ Connect the screen close and directly with AGND.

Data of the analogue inputs

Data of the analogue inputs		
Feature	**Value**	**Description**
Cable length	max. 30 m	Only valid for unshielded connection cables Cables over 30 m in length must be shielded
Modulation method	Delta-sigma modulation	–
Shared points between the channels	AGND reference ground	–
Calibration frequency	12 months	Maintenance of accuracy class
Clamp arrangement	Shielding on common AGND pins	–
Sampling duration/rate for measuring values	1 ms	A reading is taken from each input channel every millisecond, regardless of how many channels are actually in operation.
Sampling rate Operating mode AI-PT	250 ms	In operating mode AI-PT, calculations are carried out after the millisecond sampling rate. A new value is available in the user program every 250 ms.

Digital filtering		
Possible filter settings	**Time range for averaging**	**Time range for averaging Operating mode AI-PT**
10	10 ms	2.5 s
100	100 ms	25 s

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1,000	1,000 ms (1 s)	250 s

If filtering is active, an average is calculated for the set time range. However a value is still issued during the sampling rate interval. For example, if the filter is set to 1,000, the average of the measurements for the previous 1,000 ms / 1,000 measurements is issued each millisecond (or, in the case of operating mode AI-PT, the average for the last 250 ms / 1,000 measurements).
The filtering can be activated and configured using CODESYS V3. The sampling rate is constant. It can only be filtered with a whole multiple of the sampling rate.

Operating modes for the analogue inputs

HINWEIS

Damage to channel

High voltages can damage analogue channels, stopping them from working correctly.

▶   Ensure the input voltage does not exceed ±30 V.

Operating mode: voltage input AI (U)		
Feature	**Value**	**Description**
Connections per input	–	AI (U/T) and AGND or AI (U) and AGND; connect screening with AGND.
Measuring range	−10 to +10 V	–
Input impedance in signal range	100 kΩ	between AI (U/T) and AGND or between AI (U) and AGND
Max. errors at 25°C	±0.25% (±50 mV)	–
Temperature coefficient	±40 ppm/K (±0.4 mV/K)	–
Digital resolution	24 bit	–
Data format in user program	32 bit real	(floating-point number) in millivolts (mV)
Maximum permissible permanent overload	Max. ±30 V compared to AGND	±30 V = max. voltage on AI channel
Output of digital value in case of overload	–	If a voltage of ±10 V is applied to an AI (U), a plausible value is still given up to approx. ±15 V. The specified accuracy is only valid for the range −10 to +10 V. From a voltage of ±16 V, the values are distorted considerably and from +23 V an

Operating mode: voltage input AI (U)		
Feature	**Value**	**Description**
		error bit is set which can be queried in the application program.
Input type	–	Unsymmetrical voltage metering (single-ended)
Reference potential	AGND	–
Dynamic characteristics		
Analogue filtering	Second-grade low-pass filter; time constant T = approx. 500 µs	–
Greatest temporary deviation during electrical error testing according to IEC 61131-2	0.5% of measuring range	–

Operating mode: voltage input AI (I)		
Feature	**Value**	**Description**
Connections per input	–	AI (I) and AGND; connect screening with AGND.
Protection	–	Thermal current limitation
Measuring range	–20 to +20 mA	Technical current direction into AI (I)
Load impedance	typ. 20 Ω	–
Max. errors at 25°C	±0.2% (±80 µA)	–
Temperature coefficient	±40 ppm/K (±0.8 µA/K)	–
Digital resolution	24 bit	–
Data format in user program	32 bit real	(floating-point number) in milliamps (mA)
Maximum permissible permanent overload	Max. ±25 mA	–
Output of digital value in case of overload	–	If a current greater than ±20 mA flows into an AI (I), a plausible value is still given up to approx. ±25 mA.

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Operating mode: voltage input AI (I)		
Feature	**Value**	**Description**
		The specified accuracy is only valid for the range −20 to +20 mA.
Input type	–	Current measurement compared to AGND
Reference potential	AGND	–
Dynamic characteristics		
Analogue filtering	Second-grade low-pass filter; time constant T = approx. 215 µs	–
Greatest temporary deviation during electrical error testing according to IEC 61131-2	0.5% of measuring range	–

Operating mode: temperature inputs AI-PT		
Feature	**Value**	**Description**
Connections per input	–	Sensor connection between AI (U/T) and AGND
Possible sensors	PT100 and PT1000 acc. to EN 60751	Accuracy class AA, A, B and C platinum sensors may be used; recommendation: B or C
Measuring range	–40 to +200°C	–
Measuring current (RMS)	0.3 mA	–
Conversion time	250 ms	–
Max. errors at 25°C	±0.21% (±0.5°C)	–
Temperature coefficient	±50 ppm/K (±0.012°C/K)	–
Digital resolution	24 bit	–
Data format in user program	2 × 32 bit real	(floating-point number) in Ohms (Ω) and degrees Celsius (°C)
Linearisation	–	The value in degrees Celsius is calculated from the resistance value and linearised (3rd degree polynomial)
Input type	–	2-wire measurement or 3-wire measurement
Reference potential	AGND	–
Dynamic characteristics		
Analogue filtering	Second-grade low-pass filter; time constant T = approx. 500 µs	–
Greatest temporary deviation during electrical error testing according to IEC 61131-2	0.5% of measuring range	–

Data of the analogue outputs

Data of the analogue outputs		
Feature	**Value**	**Description**
Protection	Thermal overload protection	–
Isolation voltage between channel and other circuits	none	–
Cable length	max. 30 m	Applies to unshielded connection cables. At cable lengths of more than 30 m it is necessary to use shielded cables.
Shared points between the channels	AGND	AGND is the reference potential for all analogue outputs.
Calibration frequency	12 months	Maintenance of accuracy class
Permissible load types	–	Ohmic and capacitive loads
Largest capacitive load	10 µF	Higher capacitive loads may cause the output to oscillate.
Load impedance range	≥ 1 kΩ	–
Overload protection	Short-circuit-proof	Current limitation from approx. 22 mA (at 25°C ambient temperature)
Output response during power supply switching on and switching off processes		
No supply voltage	AI (I) to AGND: < 40 Ω	Low-resistance output
During device boot-up	–	The analogue output is not active during device boot-up. Deviations from the zero value during switching on are approx. ≤ 1.5% of the signal range (voltage connected to open output for approx. 150 ms).
During temporary interruptions	–	The analogue outputs are disconnected and low-resistance in the case of temporary interruptions to the power supply of > 10 ms.
Behaviour in stop mode		
Voltage output	–	Can be configured in CODESYS. Either the last valid value is used or 0 V is used.

Operating modes for the analogue outputs

Operating mode: voltage output AO (U)		
Feature	**Value**	**Description**
Signal range	0 to 10 V	–
Connections per output	–	AO (U) and AGND; connect screening to AGND. Screening used alongside AI channels.
Load impedance	> 1 kΩ	–
Output impedance in the signal range	< 1 Ω	At an active output
Output current	Max. 10 mA	–
Max. errors at 25°C	±0.5% (±50 mV)	–
Temperature coefficient	±40 ppm/K (±0.4 mV/K)	–
Value of least significant bit (LSB)	±244 ppm (±2.44 mV)	–
Digital resolution	12 bit	–
Data format in user program	32 bit real	(floating-point number) in millivolts (mV)
Dynamic characteristics		
Build-up time for change in full range to 95% of final value	320 µs	–
Overshooting	0.1% of measuring range	–
Greatest temporary deviation during electrical error testing according to IEC 61131-2	0.5% of measuring range	–

ℹ A voltage of more than 30 V may damage the analogue outputs.

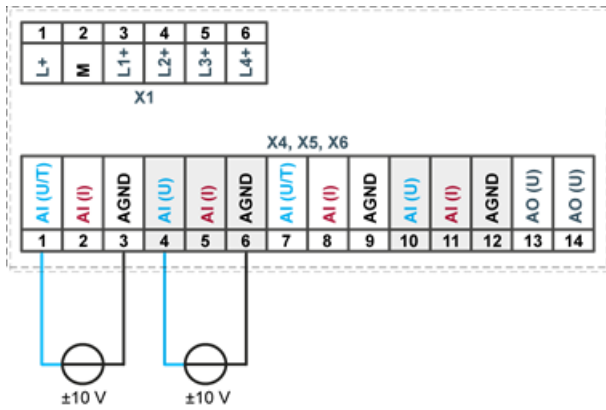## 5.3.5. Example connections of analogue inputs and outputs

Voltage input AI (U)

Fig. 13: example connection: voltage input

▶ Only use the corresponding AGND for each voltage input.
▶ Do not connect AGNDs from different channels.
▶ Only use one channel per function: either AI (U) or AI (I).
▶ Do not connect to the common GND. The required connections can already be found on the circuit board.
▶ Cables to the analogue sensors/encoders should be connected as directly as possible (avoid the use of terminals and terminal blocks).
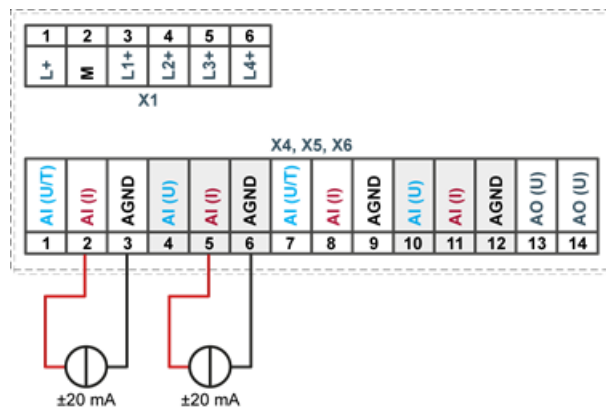
Power input AI (I)

Fig. 14: example connection: power input

▶ Only use the corresponding AGND for each power input.

▶ Do not connect AGNDs from different channels.

▶ Only use one channel per function: either AI (U) or AI (I).

▶ Do not connect to the common GND. The required connections can already be found on the circuit board.

▶ Cables to the analogue sensors/encoders should be connected as directly as possible (avoid the use of terminals and terminal blocks).
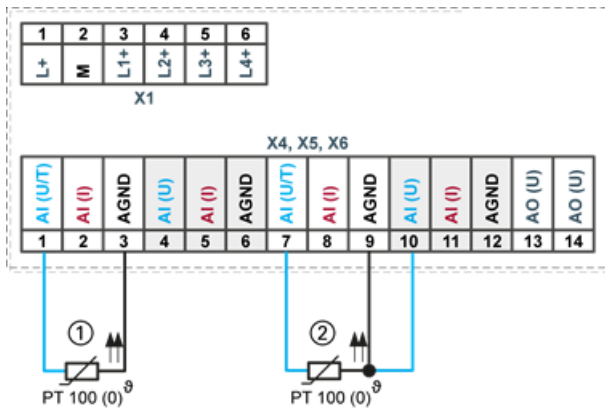
Temperature measurement AI (T)

Fig. 15: example connection: temperature measurement

Item	Description
1	PT 100 with 2-wire connection
2	PT 100 with 3-wire connection

- ▶ Only use the corresponding AGND for each power input.
- ▶ Do not connect AGNDs from different channels.
- ▶ Only use one channel per function: either AI (U) or AI (I).
- ▶ Do not connect to the common GND. The required connections can already be found on the circuit board.
- ▶ Cables to the PT100(0) sensors should be connected as directly as possible (avoid the use of terminals and terminal blocks).
- ▶ Only connect PT100(0) sensors to AI (U/T) channels. Each 14-pin plug-in connector has 2 AI (U/T) channels.

2-wire measurement

Resistance can result in a measurement error, which in the case of long cables with a small cross-section can be up to 10°. If the temperature of the sensor is known, this deviation can be subtracted and this way compensated through the software (alternatively, use 3-wire measurement).

3-wire measurement

The nearest AI (U) connection is used to compensate the resistance in the cable. It can only be used directly in conjunction with the following AI (U/T) channel.
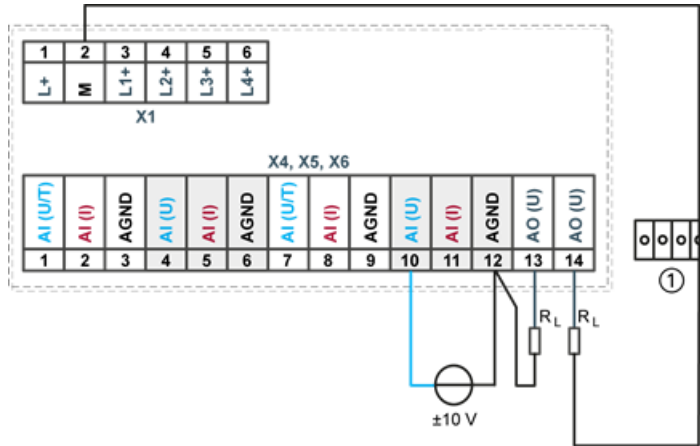
Voltage output AO (U)

Fig. 16: example connection: voltage output

Item	Description
1	Terminal block

▶ Connect the voltage outputs directly to the input channel AGND.
  If direct connection to the AGND is not possible: connect the voltage input to the overall GND of the device.
▶ AGNDs which are also used by other input channels should not be connected to the same terminal block in order to avoid changes in the voltage to the AO (U) and the temperature value.
▶ Only use the corresponding AGND for each power input.
▶ Ensure that the cable resistance is substantially lower than the load resistance RL so as to guarantee high measuring accuracy. Take into account the voltage divider between the load and cable resistance.

5.3.6. CAN interface (only S02 and higher)

Properties of the CAN interface	
Standard	ISO 11898
Maximum baud rate	1 MBit/s
Lowest adjustable baud rate	50 kBit/s
Contacts	Electrically isolated
Assignment	acc. to CiA303
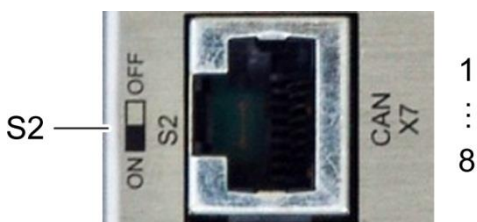
Fig. 17: CAN interface

Assignment CAN interface plug X7			
Pin	**Assignment**	**Pin**	**Assignment**
1	CAN_H	5	NC
2	CAN_L	6	NC
3	ISO GND	7	ISO GND
4	NC	8	NC

If the CAN interface is located at the start or end of the CAN bus topology:

▶ set switch S2 to ON in order to switch on the 120 Ω terminal resistance between CAN_L and CAN_H.

> ℹ ▶ For baud rates, settings and cable length observe the recommendations of the CiA-303-1.
> Example: at 1 Mbit max. 25 m

5.3.7. RS 485 / RS 232 interface

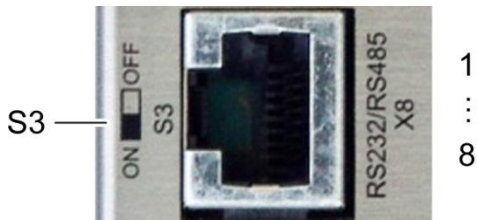Fig. 18: RS 485 / RS 232 interface

Assignment RS 485 / RS 232 interface plug X8			
Pin	**Assignment**	**Pin**	**Assignment**
1	RS 232 RX	5	RS 485 Tx/Rx–
2	RS 232 TX	6	NC
3	NC	7	ECC22X2: 5 V Other variants: reserved
4	RS 485 Tx/Rx+	8	ISO GND

If the RS-485 interface is located at the start or end of the bus topology:

▶ set switch S3 to ON in order to switch on the 120 Ω terminal resistance between Tx/Rx+ and Tx/Rx–.

> **i** As far as possible, the assignment of the interfaces should be carried out in accordance with the specifications given in "MODBUS over Serial Line; Specification and Implementation Guide V1.02".
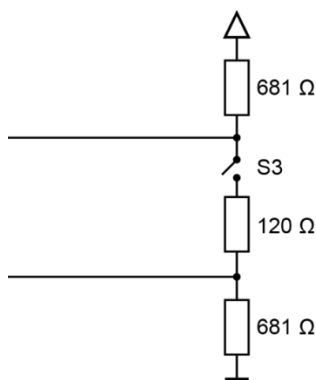

Fig. 19: RS 485 switchable terminating resistor

Special feature S08

In this variant the two terminating resistors (681 Ω) are not installed. This allows the multimaster operation of multiple ECC22X2-modules. In this case the bus has to be terminated externally.

n addition pin 7 is assigned with 5 V DC with a maximum load of 50 mA. This voltage source is supplied via an "isolated " 5 V DC of the interface and is not protected against overvoltage or short circuit. It is used only to power external polarisation modules on the bus.

⚠ WARNING

Serious injury as a result of uncontrolled and unpredictable operational sequences!

Incorrect wiring may lead to failure or destruction of the controller.

- ▶ Make sure that the load on the voltage source of 5 V DC on pin 7 of the variant ECC22X2 never exceeds 50 mA.
- ▶ Avoid an external supply

5.3.8. RS 485 interface
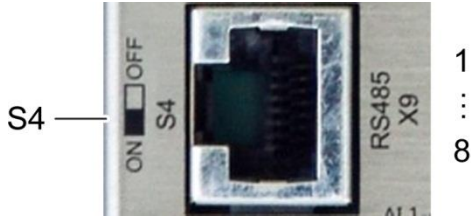
Fig. 20: RS 485 interface

Assignment RS 485 interface plug X9			
Pin	**Assignment**	**Pin**	**Assignment**
1	NC	5	RS 485 Tx/Rx–
2	NC	6	NC
3	NC	7	ECC22X2: 5 V Other variants: reserved
4	RS 485 Tx/Rx+	8	ISO GND

If the RS-485 interface is located at the start or end of the bus topology:

▶ Set switch S4 to ON in order to switch on the 120 Ω terminal resistance between Tx/Rx+ and Tx/Rx–.

ℹ As far as possible, the assignment of the interfaces should be carried out in accordance with the specifications given in "MODBUS over Serial Line; Specification and Implementation Guide V1.02".

Fig. 21: RS 485 switchable terminating resistor

Special feature S08

In this variant the two terminating resistors (681 Ω) are not installed. This allows the multimaster operation of multiple ECC22X2-modules. In this case the bus has to be terminated externally.

In addition pin 7 is assigned with 5 V DC with a maximum load of 50 mA. This voltage source is supplied via an "isolated " 5 V DC of the interface and is not protected against overvoltage or short circuit. It is used only to power external polarisation modules on the bus.

⚠ **WARNING**

Serious injury as a result of uncontrolled and unpredictable operational sequences!

Incorrect wiring may lead to failure or destruction of the controller.

▶ Make sure that the load on the voltage source of 5 V DC on pin 7 of the variant ECC22X2 never exceeds 50 mA.

▶ Avoid an external supply

5.3.9. Ethernet (switch) interface

The onboard switch has 10/100 Base-T with RJ-45 connections for networking.
The switch cannot be managed.
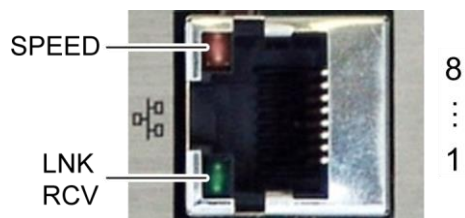
Fig. 22: Ethernet interface

Ethernet interface assignments on plugs X10, X11 and X12			
Pin	**Assignment**	**Pin**	**Assignment**
1	TX+	5	NC
2	TX–	6	RX–
3	RX+	7	NC
4	NC	8	NC

LEDs		
LED	**Colour**	**Meaning according to IEEE 802.3 clause 25**
SPEED	yellow	On = 100 Mbit/s Off = 10 Mbit/s
LNK/RCV	green	Link, Data Receive Flashing: connection active; data transfer underway Off: no connection established

5.3.10. EtherCAT interface

The onboard EtherCAT adapter 10/100 Base-T with RJ-45 connection enables network connection to components with synchronised data transfer in real-time.
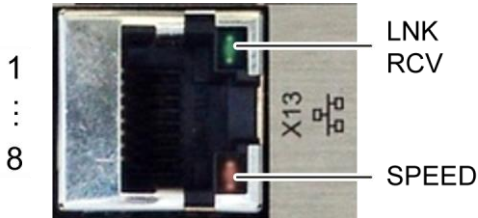
Fig. 23: EtherCAT interface

Assignment of EtherCAT interface plug X13			
Pin	**Assignment**	**Pin**	**Assignment**
1	TX+	5	NC
2	TX–	6	RX–
3	RX+	7	NC
4	NC	8	NC

LEDs		
LED	**Colour**	**Meaning according to IEEE 802.3 clause 25**
SPEED	yellow	On = 100 Mbit/s Off = 10 Mbit/s
LNK/RCV	green	Link, Data Receive Flashing: connection active; data transfer underway Off: no connection established

5.3.11. USB interface

Devices with a USB interface can be connected to the USB host port (Rev. 2.0). Suitable USB device classes are:
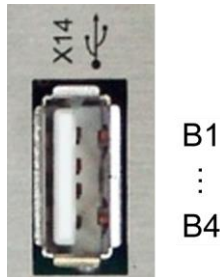CODESYS user: only USB stick
Linux level: USB stick or mouse

Fig. 24: USB interface

Assignment USB interface plug X14			
Pin	**Assignment**	**Pin**	**Assignment**
B1	VCC	B3	D+
B2	D–	B4	GND

NOTE

Damage to USB stick and malfunction due to data loss!

Removing a USB stick while it is still in use and data is being transferred can result in irretrievable damage to the memory. Open files which cannot be accessed due to removal of the USB stick can block the device.

▶ Therefore ensure that all operations are complete before removing the USB stick

NOTE

Property damage and malfunction due to data loss!

If a USB device requires more than the available 0.5 A, the device will carry out a reset. A reset will result in immediate stoppage of the device and any connected machines or systems.

Substantial property damage and damage to the USB device may ensue.

▶ Before using a USB device, check carefully its power requirements.

ℹ The USB interface plug is designed to withstand 1,000 plugging and unplugging cycles.

ℹ Due to the diversity of USB hardware and manufacturers it is not possible for Berghof to test all USB devices.

6. Operation

6.1. Switching on and off

NOTE

Destruction or malfunction!
- ▶ Do not plug, connect, disconnect or touch any connections during operation
- ▶ Before working on the device, switch off all power supplies, including those of connected peripherals (externally supplied encoders, programming devices, etc.).

NOTE

Property damage!
- ▶ Before connecting the power supply, ensure that all cabling and the polarity of all the connections are correct.

Switching on

The device does not have an on/off switch. The device starts automatically when the system is switched on or the power is connected.

Switching off

The device is switched off when the system is switched off or the power supply is disconnected.

6.2. Network start-up

The device must be connected to the network with the correct settings before it can be used.

Note down the IP address and subnet mask:
IP address: 169.254.255.XX
XX corresponds to the last 2 digits of the device serial number. Exception: 00 becomes 100.
Subnet mask: 255.255.255.0

NOTE

Property damage!
▶ Before connecting the power supply, ensure that all cabling and the polarity of all the connections are correct.

Supply power to the device (24 V).
Connect the device to a programming computer using a network cable (X10) and network switch.
Open a web browser on the programming computer.
Enter the IP address of the device into the web browser.
The login screen will appear.

Fig. 25: login window

Use the following user name and password to log into the device:
Name: admin
Password: admin
The web configuration page will be displayed.

Configuration
Network
Real-Time-Clock
Display
FTP-Server
Users

System
Info
Update
Reboot
Format Filesys

PLC-Manager
Control
Application Info
Application Files
Font Files

Fig. 26: list of web interface settings

Click on the "Network" link. The "Network Configuration" page is displayed.

Network Configuration

COMMON

Hostname	BGH-IMX6
Default Gateway	0.0.0.0
DNS Server 1	0.0.0.0
DNS Server 2	0.0.0.0

ETH0

Mode:	static
IPAdress	169.254.255.100
NetMask	255.255.255.0

ETH1

Mode:	ethercat

Save

Fig. 27: "Network Configuration" page

Check the network settings and make any changes in the text boxes if required.
ECC22XX configuration: ETH0 = X10…X12, ETH1 = X13
Save the settings by clicking on "Save".
Additional settings can also be viewed and/or modified on the web configuration page (e.g.
system time, display resolution, TargetVisu).
In order to activate all of the modified settings, reboot the device:
Remove the device temporarily from the power supply
– or –
Click on "Reboot" in the web interface and then confirm on the next screen by clicking on "Reboot
Module".

The device is now configured and ready for use.

6.3. Operation

6.3.1. Status displays

The status display function is dependent on the software development environment used in conjunction with the device.

The operating status LEDs show the current status of the power supply, the module mode and any error messages.
The signals from the LEDs depend on the current operating status of the device:
CODESYS inactive: the firmware controls the LEDs.
CODESYS active: only the CODESYS runtime system (CODESYS Runtime) controls the LEDs.

Location of the operating status LEDs
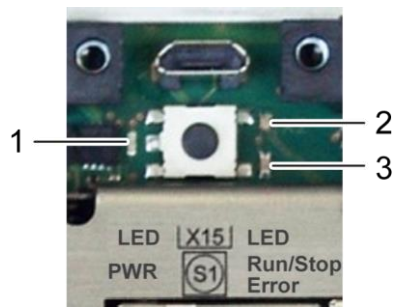
The Run/Stop and Error LEDs display the system status.

Fig. 28: location of the LEDs

LED		Meaning
1	PWR (green)	shows that the power supply to the electronics is correct.
2	Run/Stop (yellow/green/red)	shows the system statuses and CODESYS operating statuses.
3	Error (red)	shows the device has been stopped due to an error.

Meaning of the LED displays

System statuses are shown using flashing signals on the Run/Stop LED in yellow.

CODESYS operating statuses are shown via continuous illumination of the Run/Stop LED in either red or green.

While the Run/Stop light is flashing yellow: the device is in use and must not be switched off.

The device does not show warnings via the LEDs during start-up.

| Run/Stop LED	Error LED	System status	Description
System statuses			
–	–	BOOTLOADER	Bootloader active
		BOOTING	Linux booting sequence active
YELLOW: flashes 1 x, 2 s pause	–	MAINTENANCE	Maintenance mode active
YELLOW: flashes slowly (1 s)	–	USB_UPDATE	Packet update via USB active
YELLOW: flashes rapidly (400 ms)	–	RUN_IN_RAM	Operating from RAM (firmware update active)
YELLOW: flashes 2 x, 2 s pause	–	NEEDS_REBOOT	Reboot required (e.g. after update).
–	RED	–	Error beyond scope of CODESYS runtime system
CODESYS operating statuses			
RED or GREEN	–	PLC_ACTIVE	CODESYS runtime system active.
RED	–	PLC_STOPPED	At least one PLC application is stopped.
		PLC_ALL_STOPPED	All PLC applications are stopped.
GREEN	–	PLC_ALL_RUNNING	All PLC applications running.
RED	RED	PLC_ERROR	At least one PLC application is stopped due to an error.
RED: flashing	–	–	RESET COLD underway.

6.3.2. Start/Stop
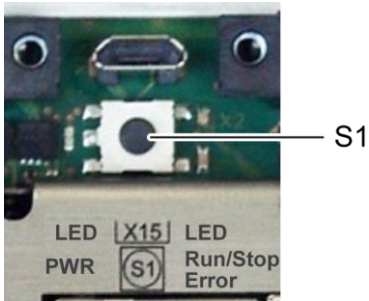
Fig. 29: function key (S1)

Function key (S1)		
Operating status	**Action**	**Command**
Bootphase	Press	Change to maintenance mode
CODESYS SPS/ CP1131-P	Press quickly	Change between PLC run and stop mode.
	Press and hold	Stop PLC with reset of variables (except retain data)

6.3.3. Real-time clock with buffer battery

Setting the time

The time can be set via the web configuration page or the "SysTimeRTC Library" CODESYS library.

Changing the battery

The battery is not designed to be changed by the user; the manufacturer should be contacted in order to change the battery.

6.3.4. microSD card

⚠ **WARNING**

Serious injury as a result of uncontrolled and unpredictable operational sequences!

Inserting or removing the microSD card can result in the ECC22XX malfunctioning. Failure in electronic control systems may result in uncontrolled and unpredictable operational sequences.

▶ Only insert or remove microSD cards with the ECC22XX switched off..

NOTE

Loss of data!

microSD cards do not have their own write protection system.

▶ Ensure that no data is deleted or overwritten by accident.

Inserting a microSD card

1. Turn off the ECC22XX.
2. Insert the microSD card into the microSD card slot.
3. Turn the ECC22XX back on.

The microSD card is now ready for data transfer (read, write and copy).

ℹ Max. possible storage capacity: 32 GB.

Any write protection on the microSD card itself is ignored - data can still be overwritten.

The life cycle of the gold-plated contacts is up to 10,000 plugging and unplugging cycles.

6.4. Troubleshooting

6.4.1. In error stop mode

1. Establish cause of fault (log into device on web browser).
2. Correct the fault.
3. Restart the device.

The device is now ready for use.

6.4.2. Unknown IP address

If the IP address of the device is unknown, maintenance mode can be used to reconfigure it.

1. Reboot the device while pressing and holding S1 until the Run/Stop LED flashes every 2 seconds.

The device is now in maintenance mode and can be reached via the default IP address.

2. Connect to the device using the default IP address:

IP address: 169.254.255.XX

XX corresponds to the last 2 digits of the device serial number. Exception: 00 becomes 100.

3. Correct the network settings and make a note of them.
4. Restart the device.

Maintenance mode is disconnected.

The device is now configured and ready for use.

7. Maintenance/upkeep

7.1. Maintenance

If the device is used correctly it should not require maintenance.

7.2. Cleaning

▶ Only clean the device using a dry, lint-free cloth.
▶ Do not use any cleaning liquids.
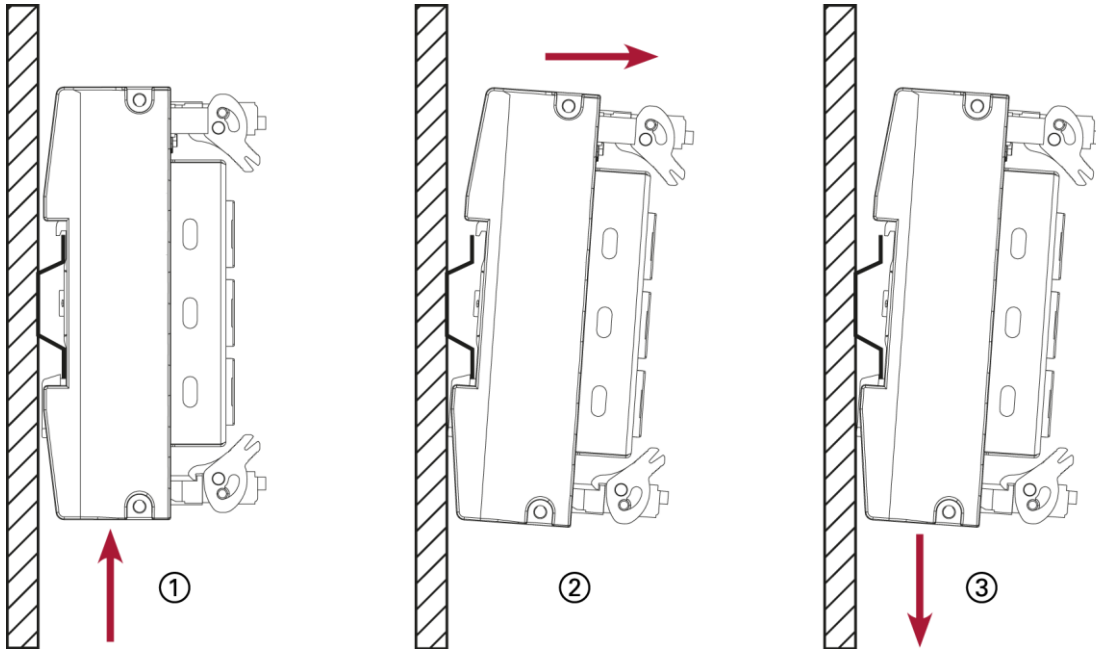
8.   Uninstallation

Fig. 30: dismounting the device

1.   Remove the device from the support rail according to the image above by pushing it in at the bottom so that the plastic snap-in hooks on the frame are pressed in.
2.   Lift the device away from the top of the support rail.
3.   Push the device downwards and remove completely from the support rail.

9. Disposal

The following options are available for disposal of the device:
→ Metals
→ electronic components
→ battery

The respective national regulations for the disposal of electrical appliances in B2B business apply.

The following options are available for disposing of the device:

Disposal via manufacturer

At the end of the device's life cycle you can return it to the manufacturer for a set fee. The manufacturer will then deal with the recycling of the device.

Dispose of the device according to regional specifications.

- ▶ Demount the device and disassemble it completely into its individual parts.Metallische
- ▶ Feed individual parts to metal recycling.
- ▶ Sort electronic parts (circuit boards, drives, etc.).
- ▶ Dispose of electronic scrap in accordance with national regulations and laws.
- ▶ Make sure that the battery is completely discharged.
- ▶ Dispose of the battery according to national regulations and laws via an approved collection point.

10. Technical data

10.1. B-Fortis CC-Prime

B-Fortis CC-Prime	Variations							
	S01	S02	S03	S04	S05 *S05 DUO*	S06	S07	S08 *S08 DUO*

Pprogramming Tool	CODESYS V3.5 (IEC 61131-3)
Montage	Support rail NS 35/7.5 EN 60715
CPU	*Single Core:* 800 MHz ARM® CPU Cortex™- A9 *Dual Core:* 2x 800 MHz ARM® CPU Cortex™- A9
RAM	256 MB — 1GB
Flash	256 MB (only S05 Duo 512 MB) — 1GB
Retain memory	100 kB (FRAM)
Certifications	CE (EN 61131-2) / cULus (UL 61010-2-201)

Environment	
Weight	ca. 750g
Ambient temperature	Single Core: 0°C bis 55°C (if the installation instructions are observed) Dual Core: 0°C bis 50°C (if the installation instructions are observed)
Relative humidity	max. 85 %, non-condensing
Ambient temperature transport and storage	–20 °C bis +70 °C
Relative humidity transport and storage	max. 85 %, non-condensing
Vibration	sinusoidal (EN 60068-2-6) Test: Fc 10 ... 150 Hz, 10 m/s²
Shock	15 G (approx. 150 m/s²), 11 ms duration, half-sine (EN 60068-2-27) Test: Ea

Communication interfaces	
Ethernet	1x 10/100 Base T and 3x 10/100 Base T with Switch, RJ45

B-Fortis CC-Prime	Variations							
	S01	S02	S03	S04	S05 *S05 DUO*	S06	S07	S08 *S08 DUO*
EtherCAT	1x EtherCAT over 2. Ethernetport, RJ45							
CAN	0	1	1	1	1	1	1	1
USB	1x host USB 2.0 / USB plug type A; plugging cycles max. 1.000							
Serial RS232	0	0	0	1	1	1	1	1
Serial RS485	0	0	0	1	2	2	2	2(a)

(a) without BIAS-resistors, with 5V on pin7

EMC, protection rating

Emission standard	EN 61131-2; EN 61000-6-3, living area
Resistance to interference	EN 61131-2; EN 61000-6-2, industrial area
Protection class	III
Protection rating	IP20

Power supply (24 V power supply unit)

Supply voltage	+24 VDC (–20 % / +25 %) SELV max. AC voltage component 5%
Power consumption	typ. 0,3 A, max. 1 A at +24 VDC (L+ - Internal supply), supply DO (L1+…L4+) max. 2 A per group
Protection against reverse polarity	Yes
Bridging in case of power failure	10 ms at < 20,4 VDC Power Fail < 19,2 VDC
Potential isolation	CAN, RS 485 and RS 232 galvanic isolation

Futher functions

Real time clock	Yes, rechargeable battery buffered (maintenance-free)							
microSD-Slot	0	0	1	1	1	1	1	1

B-Fortis CC-Prime	Variations							
	S01	S02	S03	S04	S05 *S05 DUO*	S06	S07	S08 *S08 DUO*
I/O								
Digital inputs	8	12	16	16	16	16	16	16
Digital outputs	8	12	16	16	16	16	16	16
Analog inputs	4	4	4	8	12	0	4	12
Analog outputs	2	2	2	4	6	0	2	6
Rechargeable battery								
Type	Panasonic VL2020 or similar							
Lifetime	10 years (depending on operating temperature)							
Storage	At least three month without voltage (RTC data may be lost in case of longer storage periods)							

10.2. Identification plate
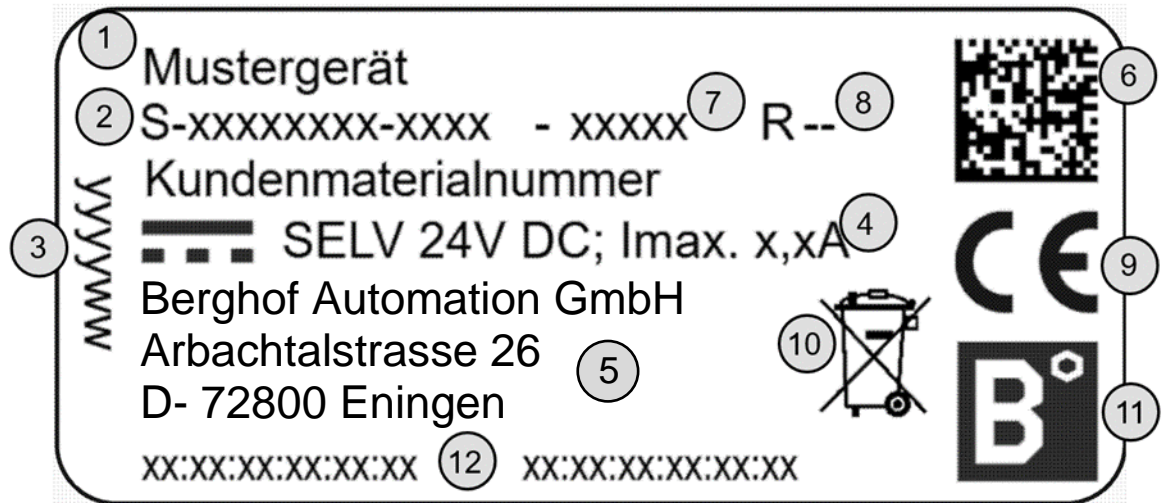
Fig. 31: identification plate

Item	Description	Item	Description
1	Device type description	7	Serial number of the device
2	Order number/part number	8	Version (delivery version; as-delivered condition)
3	Date of manufacture (year/calendar week)	9	CE marking
4	Supply voltage and maximum current	10	Disposal information
5	Manufacturer (manufacturer's address)	11	Manufacturer's logo
6	QR code (identification no.)	12	MAC addresses of the device

10.3. Device variants and identification

Bezeichnung	Bestellnummer	Merkmale
B-Fortis CC-Prime S01	S-01020103-0100	8DI, 8DO, 256 Flash, 256 RAM, 4AI(I/U/PT); 2AO(U)
B-Fortis CC-Prime S02	S-01020103-0200	12DI, 12DO, 256MB Flash, 256MB RAM, 4AI(I/U/PT); 2AO(U), 1x CAN
B-Fortis CC-Prime S03	S-01020103-0300	16DI, 16DO, 256MB Flash, 256MB RAM, 4AI(I/U/PT); 2AO(U), 1x CAN, SD-Slot
B-Fortis CC-Prime S04	S-01020103-0400	16DI, 16DO, 256MB Flash, 256MB RAM, 8AI(I/U/PT); 4AO(U), 1x CAN, SD-Slot, 1x RS232/485 Combi
B-Fortis CC-Prime S05	S-01020103-0500	16DI, 16DO, 256MB Flash, 256MB RAM, 12AI(I/U/PT); 6AO(U), 1x CAN, SD-Slot, 1x RS232/485 Combi, 1x RS485
B-Fortis CC-Prime S05 DUO	S-01020103-2500	16DI, 16DO, 256MB Flash, 512MB RAM, 12AI(I/U/PT); 6AO(U), 1x CAN, SD-Slot, 1x RS232/485 Combi, 1x RS485
B-Fortis CC-Prime S06	S-01020103-0600	16DI, 16DO, 256MB Flash, 256MB RAM, 1x CAN, SD-Slot, 1x RS232/485 Combi, 1x RS485
B-Fortis CC-Prime S07	S-01020103-0700	16DI, 16DO, 256MB Flash, 256MB RAM, 4AI(I/U/PT); 2AO(U), 1x CAN, SD-Slot, 1x RS232/485 Kombi, 1x RS485
B-Fortis CC-Prime S08	S-01020103-0800	16DI, 16DO, 1GB Flash, 1GB RAM, 12AI(I/U/PT); 6AO(U), 1x CAN, SD-Slot, 1x RS232/485 Kombi (5 V auf Pin 7), 1x RS485
B-Fortis CC-Prime S08 DUO	S-01020103-2800	16DI, 16DO, 1GB Flash, 1GB RAM, 12AI(I/U/PT); 6AO(U), 1x CAN, SD-Slot, 1x RS232/485 Kombi (5 V auf Pin 7), 1x RS485

10.4. Options and extensions

The options are ordered via the composition "Order number Option1 Option2 ...".

z.B.: **S-01010104-0204 S001 S002 H001**

Beside the order number, additional extensions in the form of hardware, software and customer-specific options are identified as follows:

Option code	Option type
S000-S999	Software options e.g.: Fieldbuses
H000-H999	Hardware options e.g. Connector set, certifications
C000-C999	Customized options e.g. customized Firmware, customized front

Please refer to the product catalogue or homepage for further information on the options available for this device..

The additional features included or installed in the respective device are listed in the option label. This label can be found on the device and/or on the packaging.

Fig. 32: Option label

Extensions for tooling and debugging

→   USB-to-Ethernet-Adapter   Order-no: S-02040101-0000
→   USB-to-Wlan-Adapter EasyConnect   Order-no: S-02040102-0000

11. Certificates

11.1. Declaration of Conformity

The declaration of conformity is available on our website
https://www.berghof-automation.com/

Select the appropriate area (automation technology) and fill out the form. Information on data protection can also be found on the page.

The technical data can be found under the categories compact controllers. Select the appropriate product and data to view or download.
Clicking on a link will initiate a download of the corresponding data.

Example path:

Products ➔ compact controllers ➔ B Fortis CC-Prime ➔ Declaration of Conformity
A link to download the Declaration of Conformity can be found on the product page

COMPACT CONTROLLERS

B-Fortis CC-Lite	⌄
B-Fortis CC-Slim	⌄
B-Fortis CC-Prime	✕

→ Manual

→ Technical data

→ Dimension sheet

→ Declaration of conformity

→ Step data (.stp)

B-Fortis CC extension modules	⌄
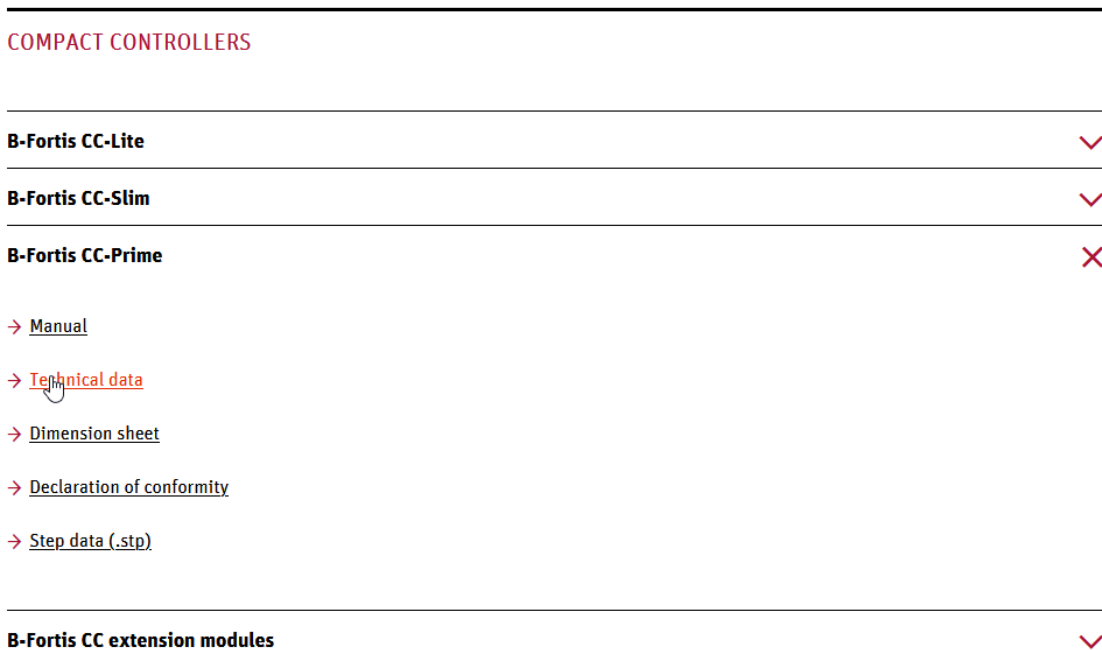
Fig. 33: Download menu

12. Customer services / addresses

Repairs and corrective maintenance may only be carried out by the manufacturer or its authorised customer service centres.

12.1. Customer services

Berghof Automation GmbH
Arbachtalstrasse 26
72800 Eningen
Germany
T +49.7121.894-183
F +49.7121.894-100
email: support-controls@berghof.com
https://www.berghof-automation.com

12.2. Repair service

Please send the goods to the Berghof repair service for repairs, stating the RMA number and a detailed description of the fault..

Berghof Automation GmbH
BU Automatisierungstechnik
Reparaturservice
Arbachtalstrasse 26
72800 Eningen

You can request the RMA number at:
www.berghof-reparaturservice.com

12.3. Addresses

EtherCAT Technology Group
ETG Headquarters
Ostendstrasse 196
90482 Nürnberg
info@ethercat.org
www.ethercat.org

Beuth Verlag GmbH, 10772 Berlin
or
VDE-Verlag GmbH, 10625 Berlin
or
Internet research: www.iec.ch

13. Appendix

13.1. Notes on copyright and licence of the software

The firmware of the devices contains free software. Parts of this software are under the following and other OpenSource licenses:

→ GNU General Public License (GPL)

→ GNU Lesser General Public License (LGPL)

→ Mozilla Public License (MPL)

→ FreeType License (FTL)

The source code of the free software can be requested from Berghof customer service at cost price within three years of delivery of the device.

13.2. Table of figures