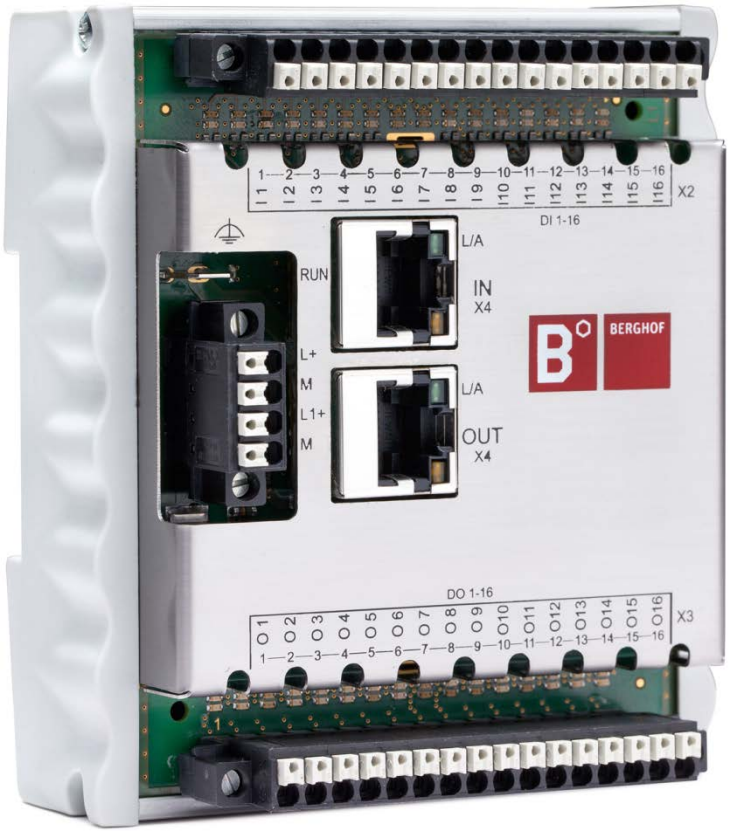
USER HANDBOOK 1.2

ECC DIO / ECC AIO
I/O expansion



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Notes on this handbook

This device handbook 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
0.8	13/03/2015	Preliminary version
1.0	20/05/2015	First version
1.1	27/07/2016	Addition ECC AIO 12/6, corrections, update certificates
1.2	02/12/2016	Corrections scope of delivery and accessories 3.1.3

Table of contents

1. General information

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

1.1. Notes on the handbook

This user handbook is a component of the product and applies to the following devices:
→ ECC DIO 16/16 positive switching
→ ECC DIO 16/16 negative switching
→ ECC AIO 12/6

It 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 handbook:

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

Design of warnings:

WARNING	**Danger type and source**
Optional: additional symbols	Short description and possible consequences ▶ 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.

Further information

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 with the authorisation to assemble, install, start up, earth and identify devices, systems and electrical circuits in accordance with standards set in safety engineering and who are familiar with safety concepts in automation engineering.

1.5. Duty of care

The user or processor (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.
- → This authorised personnel must receive regular training on all relevant occupational health and safety and environmental protection issues and must be fully familiar with the content 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.

1.6. Intended use

The devices are intended for use in modular automation systems for industrial control applications within the medium to high performance range. They expand the control system (e. g. ECC22XX) by addition of further digital or analogue inputs and outputs, and are connected by means of EtherCAT.
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
- → for use in maximum category 2 pollution environment (EN 60950)
- → 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

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 within enclosed control cabinets of 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 “Technical data”).

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 “Technical data”).
- ► Protect the device against condensation and damp.

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

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

1. Check the packaging for external damage.
2. 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.
3. Remove the packaging and keep it safe for subsequent transport.
4. Check the contents for evidence of damage in transport.
5. 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.
6. If you discover damage in transport or the contents do not match the order: Inform the supplier immediately.

2. Safety

Safety-related systems
The use of PLCs and additional devices in safety-related systems requires specific measures. Wherever the device 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 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.

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.

1. Bring the system into a safe condition.
2. Switch the system and the device off.
3. Secure the system against being switched on again.
4. 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 “Addresses”).

3. Product description

Each ECC DIO 16/16 module expands an automation system by 16 digital inputs and 16 digital outputs. The device is connected to a suitable controller by means of EtherCAT.

The connection ports are all the plug-in type and are located on the front face of the device. The ECC DIO 16/16 is intended for installation on a mounting rail in the control cabinet.

3.1. Overview

3.1.1. Overview ECC DIO 16/16

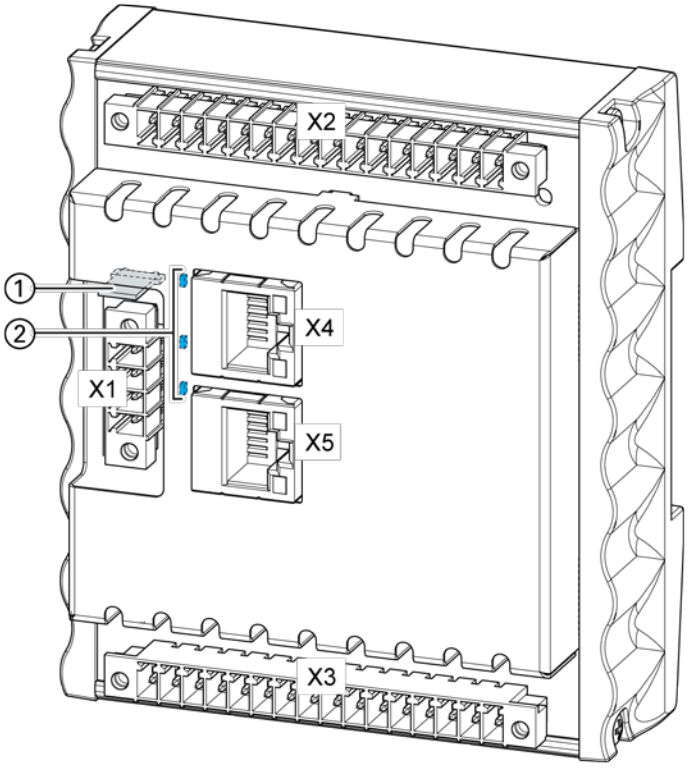


Fig. 1: Overview ECC DIO 16/16

Item	Designation	Item	Designation
X1	Power supply	X5	EtherCAT input
X2	Digital inputs	1	Functional earth (FE)
X3	Digital outputs	2	LEDs: EtherCAT Run, +24 V, +24 V I/O
X4	EtherCAT output		

3.1.2. Overview ECC AIO 12/6

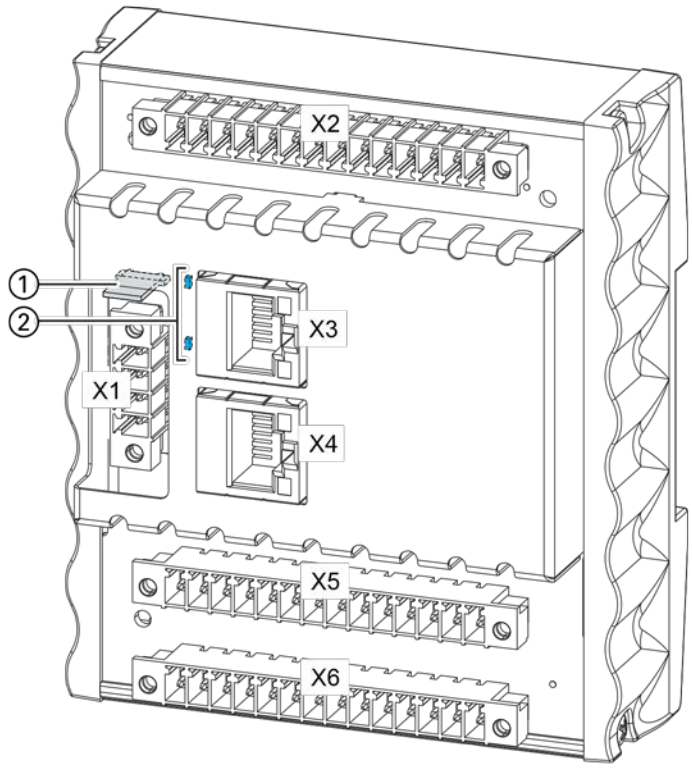


Fig. 2: Overview ECC AIO 12/6

Item	Designation	Item	Designation
X1	Power supply	X5	Analogue inputs / outputs
X2	Analogue inputs / outputs	X6	Analogue inputs / outputs
X3	EtherCAT output	1	Functional earth (FE)
X4	EtherCAT input	2	LEDs: EtherCAT Run, +24 V

3.1.3. Scope of delivery and accessories

Scope of delivery
ECC DIO 16/16:
→ Device
ECC AIO 12/6:
→ Device

Accessories
ECC DIO 16/16:
→ Connector Set FK ECC DIO (Best.-Nr. Berghof 201607600)
→ E-I/O plug 16-P. black (order no. Weidmüller 1972070000)
→ E-I/O plug, 4-pin, black (order no. Weidmüller 1971590000)
ECC AIO 12/6:
→ Connector Set FK ECC AIO (Best.-Nr. Berghof 201607900)
→ E-I/O plug 14-P. black (order no. Weidmüller 1972000000)
→ E-I/O plug, 4-pin, black (order no. Weidmüller 1971590000)

3.2. Product features

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

EtherCAT
The device has two EtherCAT interfaces. The first EtherCAT interface is used as an input, the second interface as an output.

Summary of features
ECC DIO 16/16:
→ 2 EtherCAT RJ-45 interfaces (1 input, 1 output)
→ 16 digital inputs
→ 16 digital outputs
ECC AIO 12/6:
→ 2 EtherCAT RJ-45 interfaces (1 input, 1 output)
→ 12 analogue inputs
→ 6 analogue outputs

4. Installation

4.1. Installing the device

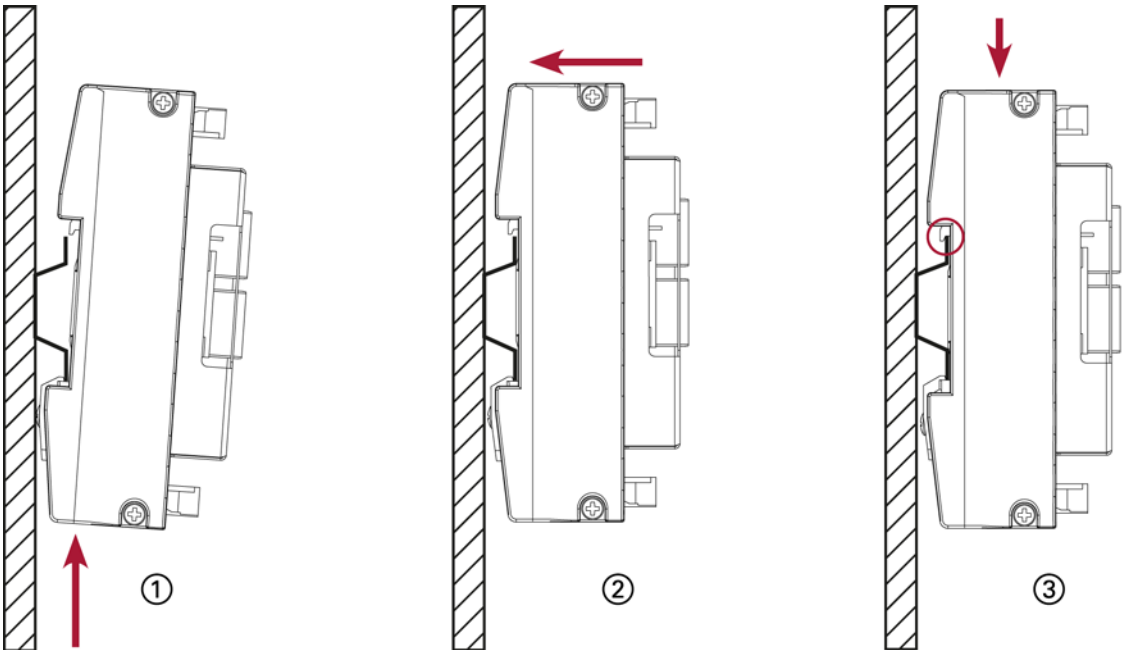


Fig. 3: Installing the device

1. Insert the device into the support rail according to the image above so that the spring hooks in between the mounting surface and the rail.
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 a 24 V DC external power supply. It is not designed to be connected to a DC mains supply.

- ► Before plugging in the device, ensure that the external power supply meets the required specifications (type K to 61131-2).

External power supply (24 V DC)	
Supply voltage	+24 V DC SELV (–15% / +20%)
Ripple current proportion	Max. 5% The direct voltage level must not fall below 20.4 V.
Power consumption	Total max. 0.25 A at +24 V DC (typ. 0.05 A electronic)
Energy buffering	10 ms

Internal power supply

The power supply unit that supplies the system electronics is specified for an input voltage of 24 V DC (–15% / +20%) and is incorporated within the device. The power supply has integrated protection against reverse polarity and surge current protection (0.5 A).

Installation

- ► All connections and cables must be laid 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 power supply

WARNING

Uncontrolled and unpredictable operational behaviour!

If the device is operated without both the ground terminals connected, uncontrolled and unpredictable operational behaviour may occur at both the inputs and outputs.

- ▶ Make sure that both the ground terminals – GND and GND IO – are connected to the common GND of the machine/system.

CAUTION

Live parts!

- ▶ Before starting any work on the device, switch off all power feeds, including the feeds to peripherals.

▶ Connect the power supply to plug X1 according to the following table.

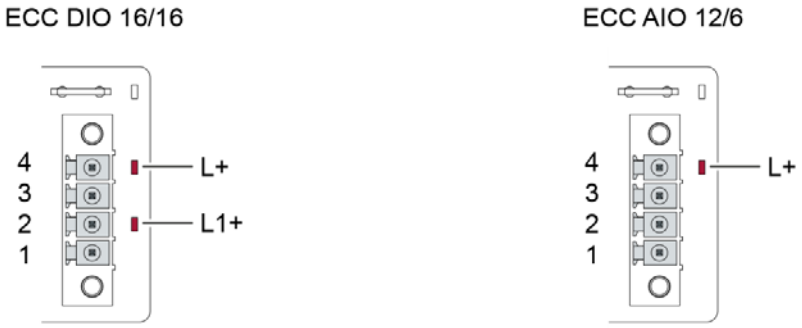


Fig. 4: Power supply at plug X1 with Power LEDs

Power supply plug X1				
Pin	**ECC DIO 16/16**		**ECC AIO 12/6**	
	Des.	**Assignment**	**Des.**	**Assignment**
1	GND IO	Digital inputs / outputs ground	GND	Device ground
2	+24 V IO	Supply 24 V DC to digital I/O	+24 V	Supply 24 V DC to device
3	GND	Device ground	GND	Device ground
4	+24 V	Supply 24 V DC to device	+24 V	Supply 24 V DC to device
–	L+	Device power supply LED	L+	Device power supply LED
–	L1+	Digital outputs power supply LED	–	–

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

→ Weidmüller BCZ 3.81/04/180 (F, LH)

→ Weidmüller BCF 3.81/04/180 (F, LH)

ECC DIO 16/16: L+ and GND, and L1+ and GND IO are two separate circuits, which are not connected internally. Both circuits must be connected or externally bridged.

5.2. Earth

The functional earth dissipates HF currents and increases the electromagnetic immunity of the device. HF interference is transferred internally from the electronic circuit board to the metal housing. The metal housing requires its own suitable connection to a functional earth.

Earthing the device

Requirements:

→ The support rail has a conductive contact with the control cabinet.
→ The control cabinet itself must be earthed.

▶ Make sure that the device housing has a 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 functional earth (FE) of the device can also be connected directly to the earth.

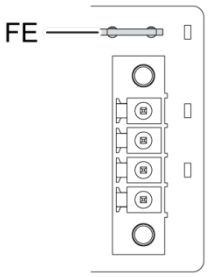


Fig. 5: Functional earth (FE) on the device

5.3. Data connections

5.3.1. Block diagram of the ECC DIO 16/16

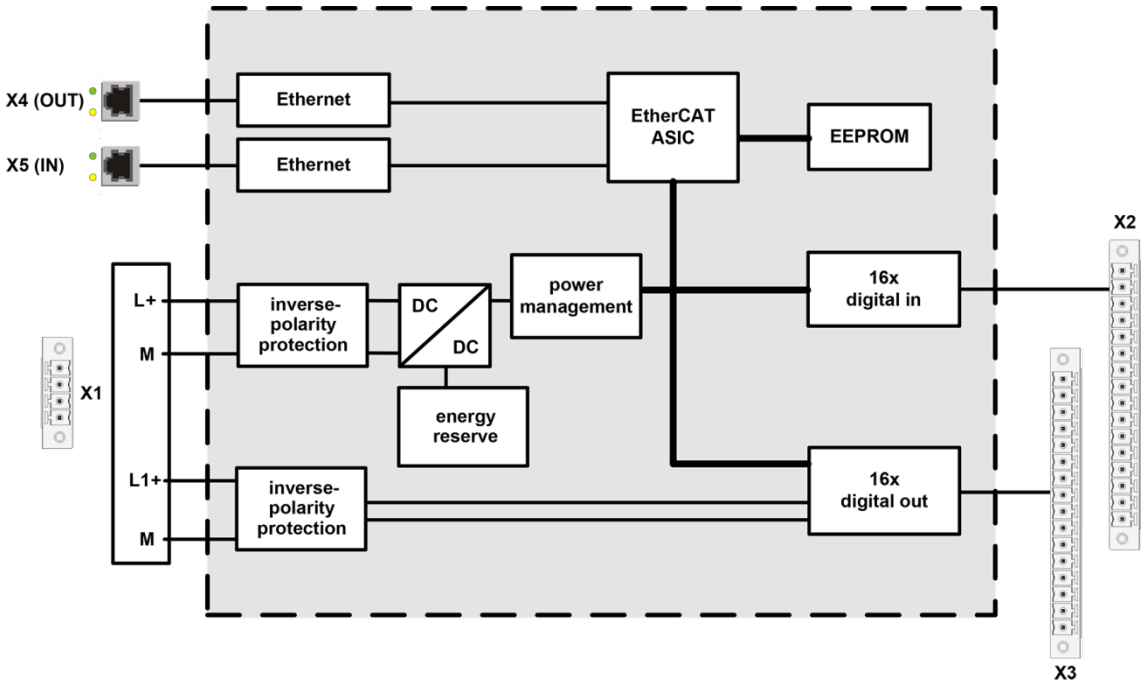


Fig. 6: Blockdiagram of the ECC DIO 16/16

5.3.2. Block diagram ECC AIO 12/6

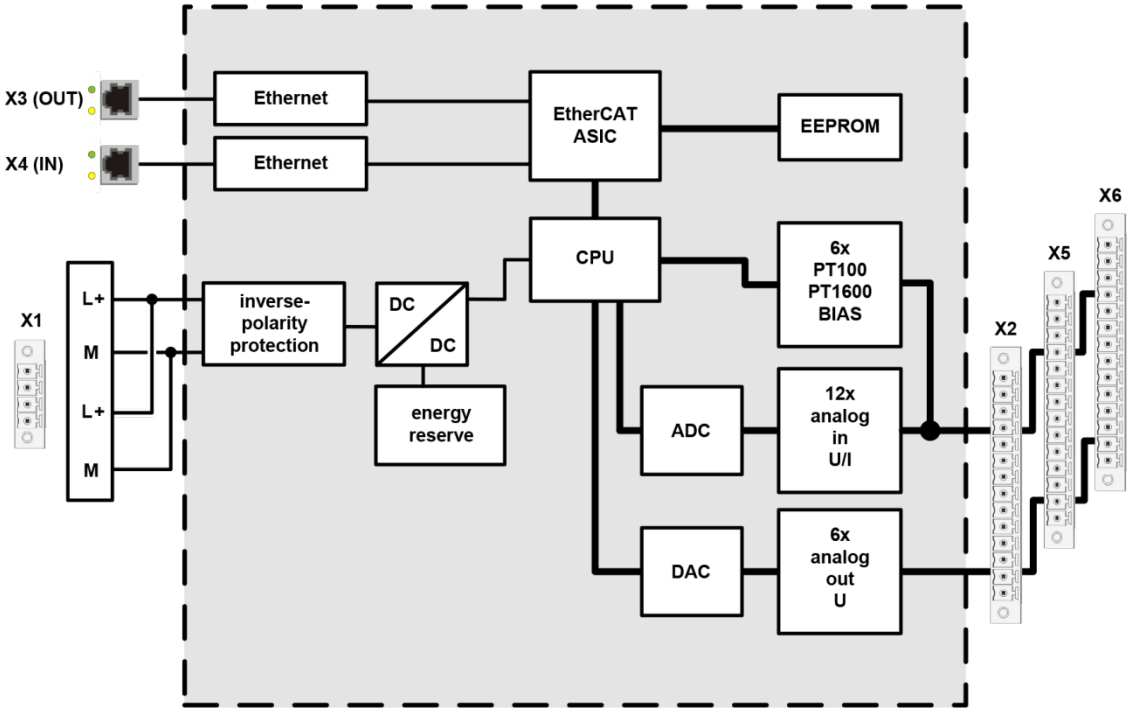


Fig. 7: Block diagram ECC AIO 12/6

5.3.3. Digital inputs of the ECC DIO 16/16

NOTE

Damage to the inputs or to the device!

Voltages over ±32 V can damage the inputs or the device.

► No voltage in excess of ±32 V may be present at the inputs.

Depending on the version of the device, the digital inputs are positive or negative switching inputs of type 1 (IEC 61131-2). They are designed for nominal input voltages of 24 V. The input signals are transmitted internally on a cyclical basis for process data processing. An open input is always interpreted in the programming system as logical 0 (LOW) (level: 0 V for P, +24 V for N). The inputs also have a common reference potential (GND).

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

→ Weidmüller BCZ 3.81/16/180 (F, LH)

→ Weidmüller BCF 3.81/16/180 (F, LH)

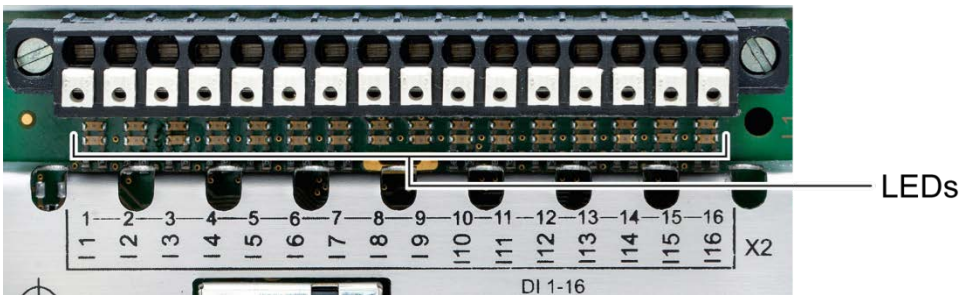


Fig. 8: Digital inputs of the ECC DIO 16/16 plug X2 with LEDs 1 to 16

Digital inputs plug X2					
Pin	Desig-nation	Assignment n-switching		Assignment p-switching	
		logical 0	logical 1	logical 0	logical 1
1	I 1	+24 V DC	0 V DC	0 V DC	+24 V DC
2	I 2	+24 V DC	0 V DC	0 V DC	+24 V DC
3	I 3	+24 V DC	0 V DC	0 V DC	+24 V DC
4	I 4	+24 V DC	0 V DC	0 V DC	+24 V DC
5	I 5	+24 V DC	0 V DC	0 V DC	+24 V DC
6	I 6	+24 V DC	0 V DC	0 V DC	+24 V DC
7	I 7	+24 V DC	0 V DC	0 V DC	+24 V DC
8	I 8	+24 V DC	0 V DC	0 V DC	+24 V DC

9	I 9	+24 V DC	0 V DC	0 V DC	+24 V DC
10	I 10	+24 V DC	0 V DC	0 V DC	+24 V DC
11	I 11	+24 V DC	0 V DC	0 V DC	+24 V DC
12	I 12	+24 V DC	0 V DC	0 V DC	+24 V DC
13	I 13	+24 V DC	0 V DC	0 V DC	+24 V DC
14	I 14	+24 V DC	0 V DC	0 V DC	+24 V DC
15	I 15	+24 V DC	0 V DC	0 V DC	+24 V DC
16	I 16	+24 V DC	0 V DC	0 V DC	+24 V DC

Data from the digital inputs		
Feature	**Value**	**Description**
Type of inputs	Type 1	Positive (to IEC 61131-2) or negative switching
Cable length	max. 30 m	For unshielded connection cables Cables over 30 m in length must be shielded.
Cable cross-section within the control cabinet	0.14 – 1.5 mm² (26-16 AWG)	Aim for plug connector limits to UL specifications.
Field wiring	according to regulations and standards	Comply with all local regulations and the stipulations of DIN EN 61131-2.
Rated load voltage	24 V DC (SELV)	–
Delay time	1 ms	Applies for transitions from 0 to 1 and 1 to 0
Signal evaluation	cyclical	Dependent on the cycle time set in the programming system
Protection against reverse polarity	yes	–
Potential isolation	no	–
Status display	yes	One orange LED per input Lights at logical 1

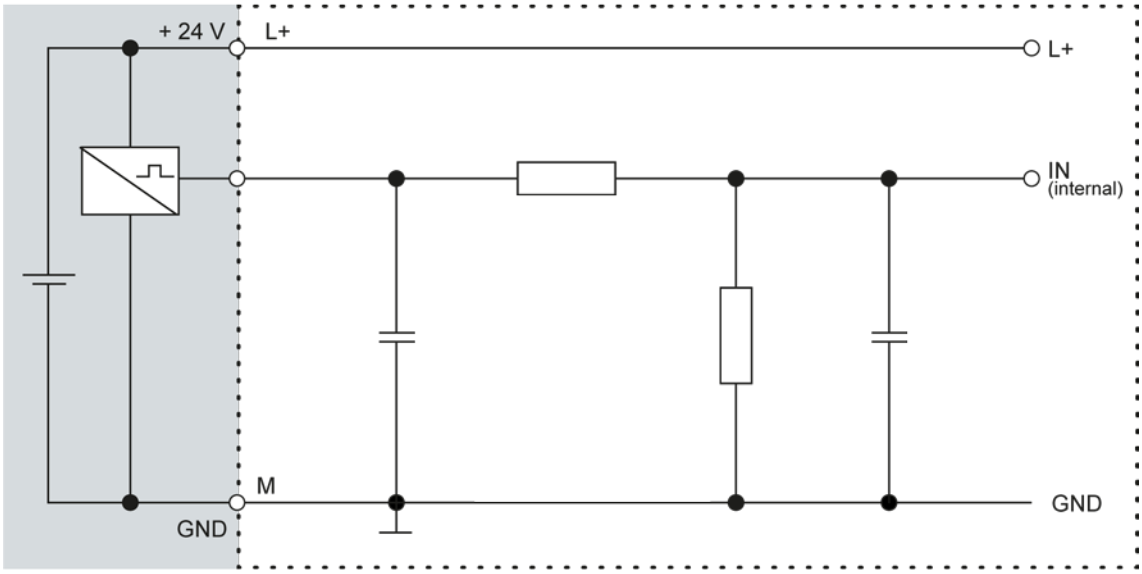


Fig. 9: ECC DIO 16/16: Circuit diagram of the principles of positive switching input

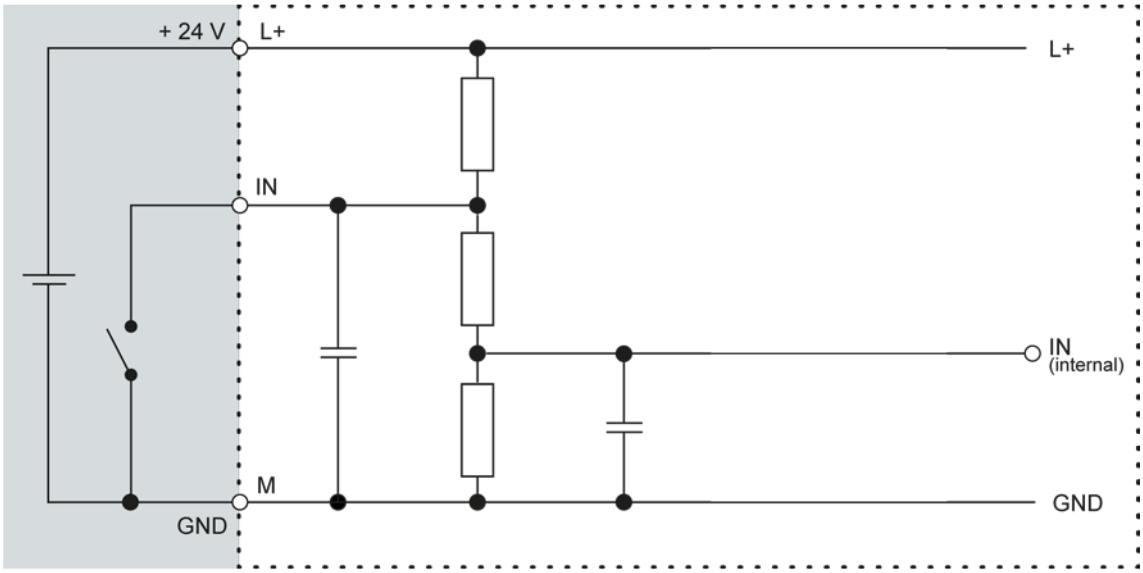


Fig. 10: ECC DIO 16/16: Circuit diagram of the principles of negative switching input

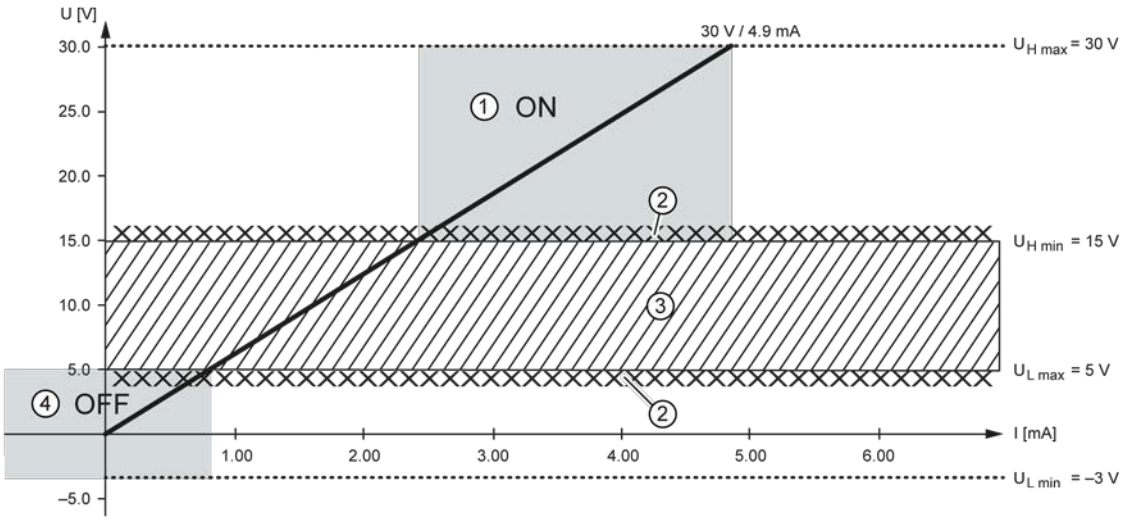


Fig. 11: ECC DIO 16/16: Operating ranges of the digital inputs (type 1), positive switching

Item	Designation	Item	Designation
1	“ON” range	3	Transition range
2	Signal-noise ratio < 1 V	4	“OFF” range

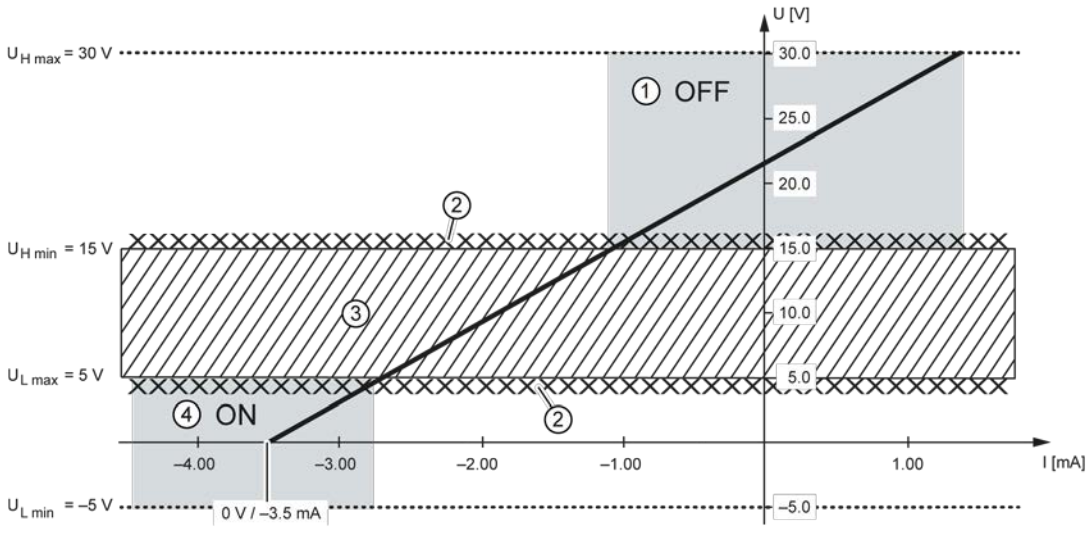


Fig. 12: ECC DIO 16/16: Operating ranges of the digital inputs (type 1), negative switching

Item	Designation	Item	Designation
1	“OFF” range	3	Transition range
2	Signal-noise ratio < 1 V	4	“ON” range

5.3.4. Digital outputs ECC DIO 16/16

Depending on the version of the device, the digital outputs are positive or negative switching 24 V outputs with an output current of max. 500 mA. They have a common reference potential (GND) with the supply voltage. The following counterparts have been tested with the SC-SMT 3.81 (Weidmüller) plug-in connector and are approved for use with the device:

→ Weidmüller BCZ 3.81/16/180 (F, LH)
→ Weidmüller BCF 3.81/16/180 (F, LH)

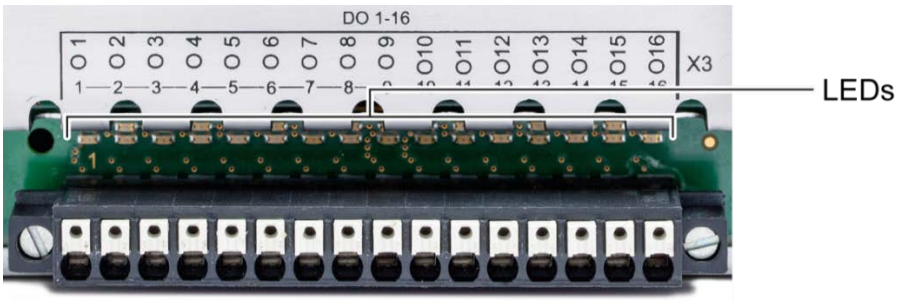


Fig. 13: Digital outputs of the ECC DIO 16/16 plug X3 with LEDs 1 to 16

Digital outputs plug X3					
Pin	Desig-nation	Assignment n-switching		Assignment p-switching	
		logical 0	logical 1	logical 0	logical 1
1	O 1	+24 V DC	0 V DC	0 V DC	+24 V DC
2	O 2	+24 V DC	0 V DC	0 V DC	+24 V DC
3	O 3	+24 V DC	0 V DC	0 V DC	+24 V DC
4	O 4	+24 V DC	0 V DC	0 V DC	+24 V DC
5	O 5	+24 V DC	0 V DC	0 V DC	+24 V DC
6	O 6	+24 V DC	0 V DC	0 V DC	+24 V DC
7	O 7	+24 V DC	0 V DC	0 V DC	+24 V DC
8	O 8	+24 V DC	0 V DC	0 V DC	+24 V DC
9	O 9	+24 V DC	0 V DC	0 V DC	+24 V DC
10	O 10	+24 V DC	0 V DC	0 V DC	+24 V DC
11	O 11	+24 V DC	0 V DC	0 V DC	+24 V DC
12	O 12	+24 V DC	0 V DC	0 V DC	+24 V DC
13	O 13	+24 V DC	0 V DC	0 V DC	+24 V DC
14	O 14	+24 V DC	0 V DC	0 V DC	+24 V DC
15	O 15	+24 V DC	0 V DC	0 V DC	+24 V DC
16	O 16	+24 V DC	0 V DC	0 V DC	+24 V DC

Data from the digital outputs		
Feature	**Value**	**Description**
Output type	Semiconductor	Non-storing, positive- or negative-switching
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 Lights at logical 1
Overload protection	yes	In the case of thermal overload, auto-resetting
Short circuit protection response threshold	yes	Electronic voltage limitation: typ. 5 A The current is limited electronically. Activation of short circuit protection results in thermal overload and tripping of thermal overload protection. Permissible limits based on cold state for P switches: max. 10,000 short circuits; overall duration max. 500 hours.
Status under unclear operating conditions	Logical 0	If the supply voltage is insufficient, and at booting up and shutting down the control system, the outputs are set to logical 0.
Output delay “0” after “1”	typ. 1 ms	–
Output delay “1” after “0”	typ. 1 ms	–
Output capacitance	< 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. 4 A	–
Parallel circuit in two outputs	max. 1 A	Maximum permissible value with a logical connection to increase power

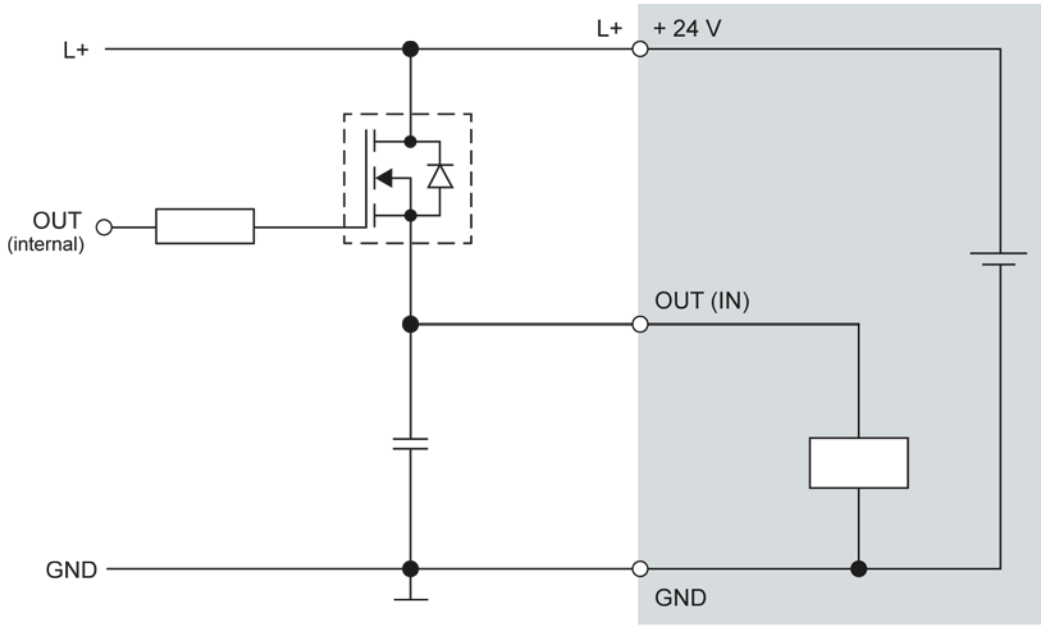


Fig. 14: ECC DIO 16/16: Circuit diagram of the principles of positive switching output

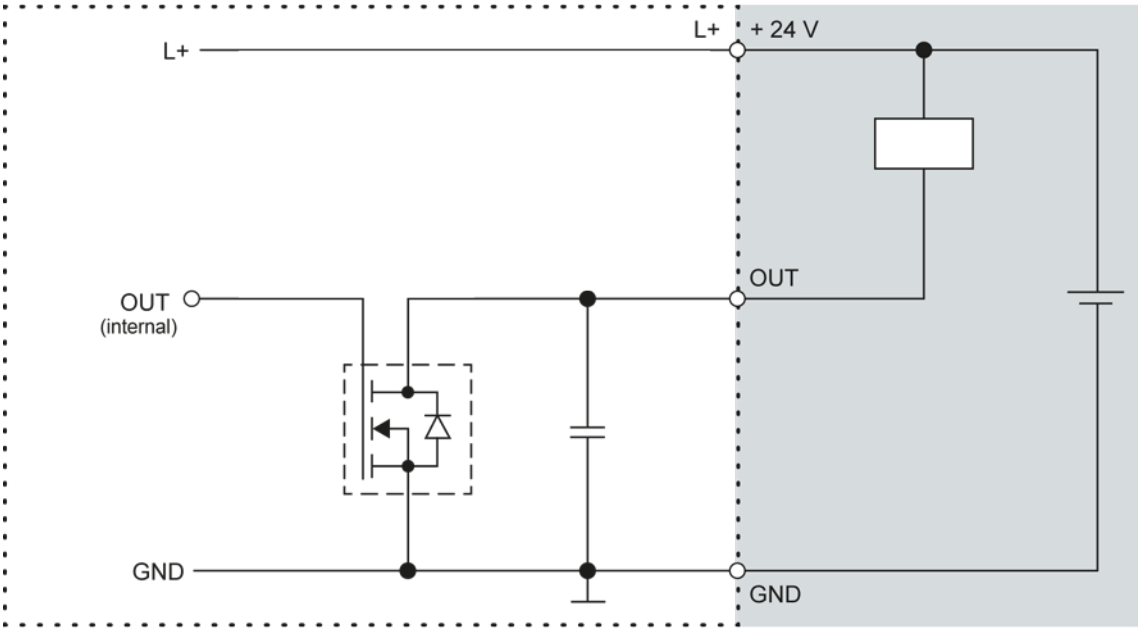


Fig. 15: ECC DIO 16/16: Circuit diagram of the principles of negative switching output

5.3.5. Analogue inputs and outputs ECC AIO 12/6

The ECC AIO 12/6 has up to 12 analogue inputs (AI) and 6 analogue outputs (AO) on plugs X2, X5 and X6. The layout of the I/O is identical on all 3 plugs.

The following counterparts have been tested with the SC-SMT 3.81 (Weidmüller) plug-in connector and are approved for use with the ECC AIO 12/6:

→ Weidmüller BCZ 3.81/14/180 (F, LH, LR)
→ Weidmüller BCF 3.81/14/180 (F, LH, LR)

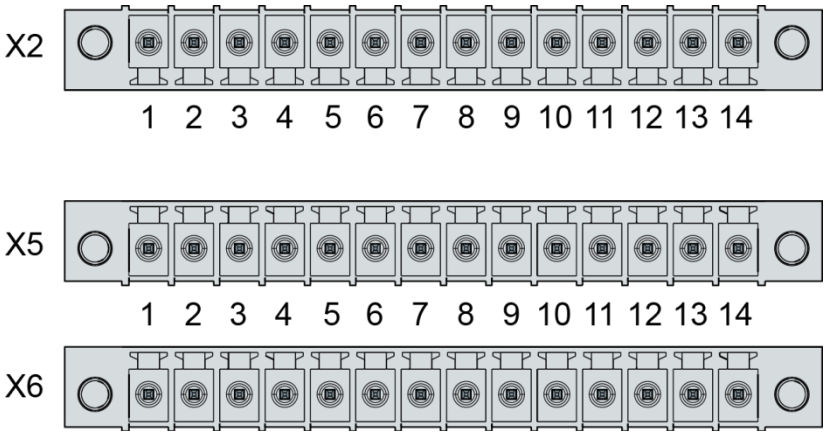


Fig. 16: Analogue inputs and outputs plugs X2, X5 and X6 (Weidmüller SC-SMT 3.81/14/180 LF 3.2)

Analogue inputs and outputs plugs X2, X5 and X6				
Pin	**X2**	**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
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 from analogue inputs

Data from 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
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

NOTICE

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	±2500 ppm (±25 mV)	–
Temperature coefficient	±40 ppm/K (±0.4 mV/K)	–
Digital resolution	24 bit	–
Data format in the 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 at 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 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	±2,000 ppm (±40 µA)	–
Temperature coefficient	±40 ppm/K (±0.8 µA/K)	–
Digital resolution	24 bit	–
Data format in the 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. 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	±2100 ppm (±0.5 °C)	–
Temperature coefficient	±50 ppm/K (±0.012 °C/K)	–
Digital resolution	24 bit	–
Data format in the 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 from analogue outputs

Data from analogue outputs		
Feature	**Value**	**Description**
Protection	Thermal overload protection	–
Isolation voltage between channel and other circuits	none	–
Cable length	max. 30 m	Only valid for unshielded connection cables. Cables over 30 m in length must be shielded
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 result in oscillation of the output.
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 signal range	< 1 Ω	for 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 the 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	–

If a voltage source greater than 30 V is connected to the analogue outputs due to a wiring error, this can lead to a defect in the channels.

5.3.6. Example connections of analogue inputs and outputs

Voltage input AI (U)

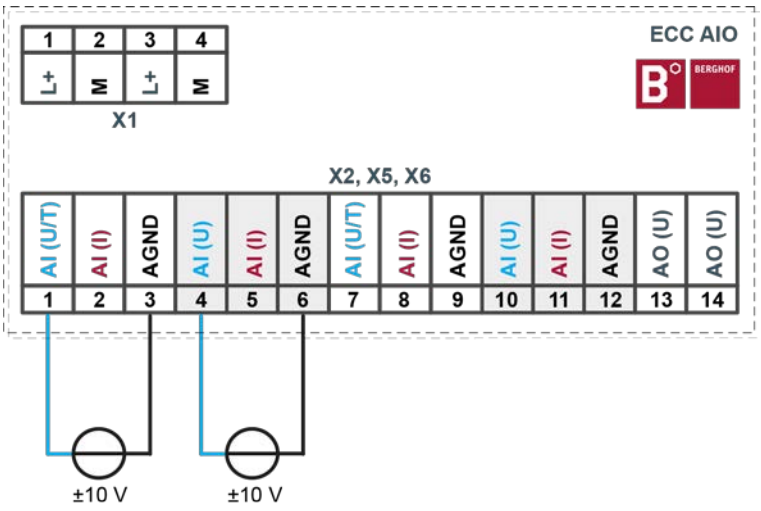


Fig. 17: Example connection: voltage input

- 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).

Current input AI (I)

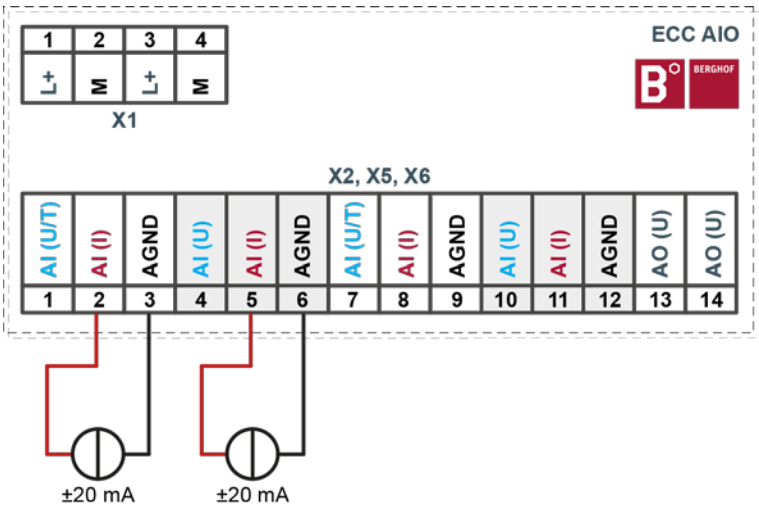


Fig. 18: Example connection: current input

- 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)

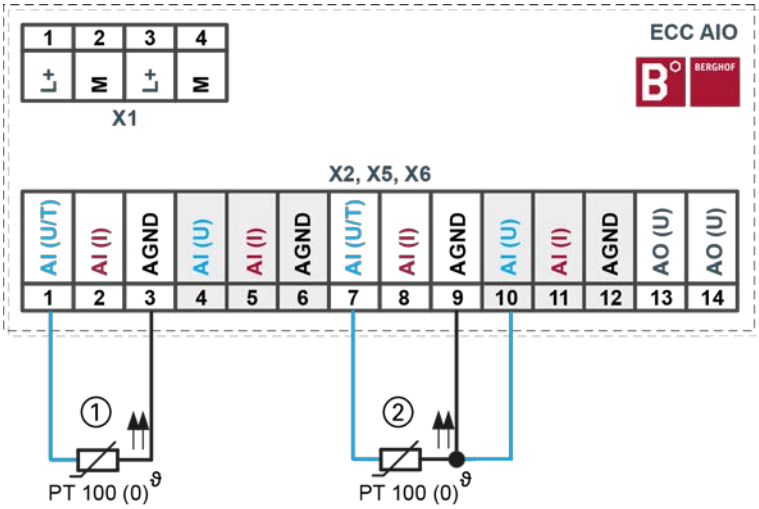


Fig. 19: Example connection: temperature measurement

Item	Description
1	PT 100 or PT 1000 with 2-wire connection
2	PT 100 or PT 1000 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 by the software automatically and compensated (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)

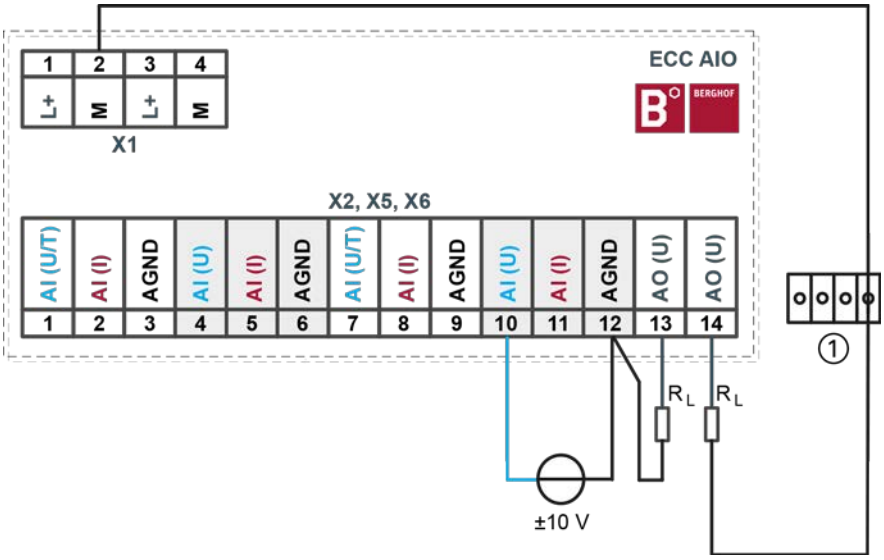


Fig. 20: Example connection: voltage output

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 R_L so as to guarantee high measuring accuracy. Take into account the voltage divider between the load and cable resistance.

5.3.7. EtherCAT output

The on-board Ethernet adapter has two RJ45-EtherCat ports for connection to the network. The EtherCAT X3 interface can be used only as an EtherCAT output.

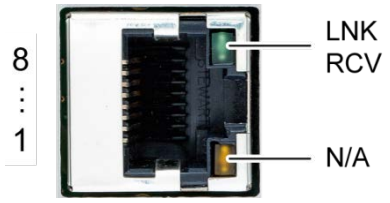


Fig. 21: EtherCAT X3 output

Assignment of the EtherCAT X3 output			
Pin	**Assignment**	**Pin**	**Assignment**
1	TX+	5	NC
2	TX–	6	RX–
3	RX+	7	NC
4	NC	8	NC

LEDs		
LED	**Colour**	**Meaning to IEEE 802.3 clause 25**
LNK/RCV	green	Link, Data Receive Flashing: connection active; data transfer in progress Off: no connection established
N/A	yellow	not used

5.3.8. EtherCAT input

The on-board Ethernet adapter has two 100 Base-T interfaces with RJ-45 connections for networking. The EtherCAT X4 interface can be used only as an EtherCAT input.

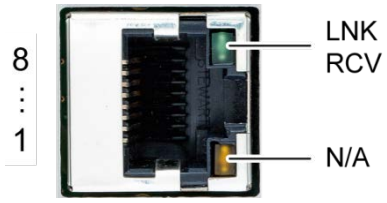


Fig. 22: EtherCAT X4 input

Assignment of the EtherCAT X4 input			
Pin	**Assignment**	**Pin**	**Assignment**
1	TX+	5	NC
2	TX–	6	RX–
3	RX+	7	NC
4	NC	8	NC

LEDs		
LED	**Colour**	**Meaning to IEEE 802.3 clause 25**
LNK/RCV	green	Link, Data Receive Flashing: connection active; data transfer in progress Off: no connection established
N/A	yellow	not used

6. Operation

6.1. Switching on and off

NOTE	**Damage or malfunction!**
	▶ Do not insert, connect, undo or touch any connections whilst the device is in operation. ▶ Before starting any work on the device, switch off all power feeds, including the power feeds to any connected peripherals (sensors and programmable devices etc. with independent power supplies).

NOTE	**Damage to property!**
	▶ 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. Initial start-up ECC DIO 16/16

1. Download the device description “BerghofECCDIO_x.x.x.xml” of www.berghof.com from the download area and install it on the controller.
2. Integrate the device into the CODESYS project as shown in the graphics below.

The device will log itself on to the bus as ECC DIO 16/16 P (or ECC DIO 16/16 N).

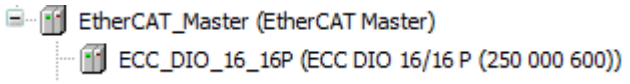


Fig. 23: Logged on device

There are two bytes for each of the digital inputs and also for the digital outputs.

Variable	Mapping	Channel	Address	Type	Default Value	Unit	Description
ecc_out_0		Digital Output 0	%QB0	USINT			Digital Output 0
ecc_out_1		Digital Output 1	%QB1	USINT			Digital Output 1
ecc_in_0		Digital Input 0	%IB0	USINT			Digital Input 0
ecc_in_1		Digital Input 1	%IB1	USINT			Digital Input 1

Fig. 24: Bytes for the inputs and outputs

Variable	Mapping	Channel	Address	Type	Default Value	Unit	Description
ecc_out_0		Digital Output 0	%QB0	USINT			Digital Output 0
ecc_out_1		Digital Output 1	%QB1	USINT			Digital Output 1
ecc_in_0		Digital Input 0	%IB0	USINT			Digital Input 0
		Bit0	%IX0.0	BOOL	FALSE		Digital Input 0
		Bit1	%IX0.1	BOOL	FALSE		Digital Input 0
		Bit2	%IX0.2	BOOL	FALSE		Digital Input 0
		Bit3	%IX0.3	BOOL	FALSE		Digital Input 0
		Bit4	%IX0.4	BOOL	FALSE		Digital Input 0
		Bit5	%IX0.5	BOOL	FALSE		Digital Input 0
		Bit6	%IX0.6	BOOL	FALSE		Digital Input 0
		Bit7	%IX0.7	BOOL	FALSE		Digital Input 0
ecc_in_1		Digital Input 1	%IB1	USINT			Digital Input 1
		Bit0	%IX1.0	BOOL	FALSE		Digital Input 1
		Bit1	%IX1.1	BOOL	FALSE		Digital Input 1
		Bit2	%IX1.2	BOOL	FALSE		Digital Input 1
		Bit3	%IX1.3	BOOL	FALSE		Digital Input 1
		Bit4	%IX1.4	BOOL	FALSE		Digital Input 1
		Bit5	%IX1.5	BOOL	FALSE		Digital Input 1
		Bit6	%IX1.6	BOOL	FALSE		Digital Input 1
		Bit7	%IX1.7	BOOL	FALSE		Digital Input 1

Fig. 25: Bytes for the digital inputs

Variable	Channel	Inputs
ecc_in_0	Digital Input 0, Bit 0–7	1–8
ecc_in_1	Digital Input 1, Bit 0–7	9–16

Variable	Mapping	Channel	Address	Type	Default Value	Unit	Description
ecc_out_0		Digital Output 0	%QB0	USINT			Digital Output 0
		Bit0	%QX0.0	BOOL	FALSE		Digital Output 0
		Bit1	%QX0.1	BOOL	FALSE		Digital Output 0
		Bit2	%QX0.2	BOOL	FALSE		Digital Output 0
		Bit3	%QX0.3	BOOL	FALSE		Digital Output 0
		Bit4	%QX0.4	BOOL	FALSE		Digital Output 0
		Bit5	%QX0.5	BOOL	FALSE		Digital Output 0
		Bit6	%QX0.6	BOOL	FALSE		Digital Output 0
		Bit7	%QX0.7	BOOL	FALSE		Digital Output 0
ecc_out_1		Digital Output 1	%QB1	USINT			Digital Output 1
		Bit0	%QX1.0	BOOL	FALSE		Digital Output 1
		Bit1	%QX1.1	BOOL	FALSE		Digital Output 1
		Bit2	%QX1.2	BOOL	FALSE		Digital Output 1
		Bit3	%QX1.3	BOOL	FALSE		Digital Output 1
		Bit4	%QX1.4	BOOL	FALSE		Digital Output 1
		Bit5	%QX1.5	BOOL	FALSE		Digital Output 1
		Bit6	%QX1.6	BOOL	FALSE		Digital Output 1
		Bit7	%QX1.7	BOOL	FALSE		Digital Output 1

Fig. 26: Bytes from the digital outputs

Variable	Channel	Inputs
ecc_out_0	Digital Output 0, Bit 0–7	1–8
ecc_out_1	Digital Output 1, Bit 0–7	9–16

6.3. Initial start-up ECC AIO 12/6

1. Download the device description “BerghofECCAIO_x.x.x.xml” of www.berghof.com from the download area and install it on the controller.
2. Integrate the device into the CODESYS project as shown in the graphics below.

The device will log itself on to the bus as ECC DIO 12/6.

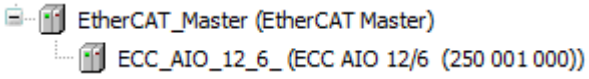
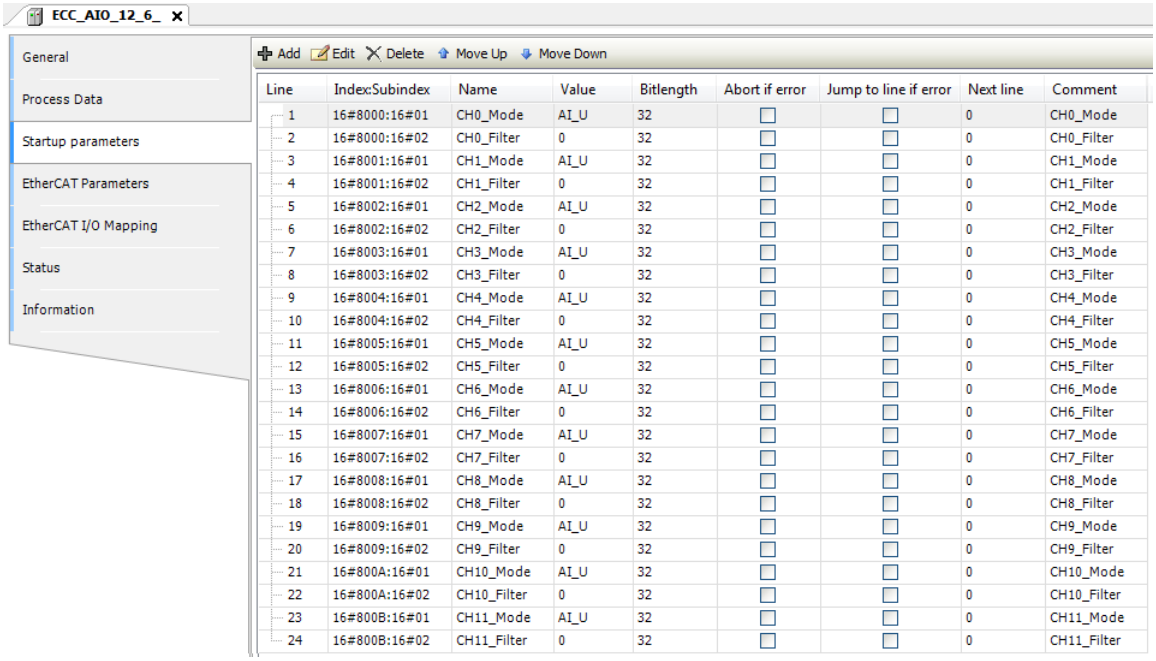


Fig. 27: Logged on device

6.3.1. Configuration

The multifunctional analogue inputs (AI) are configured via the startup parameters of the EtherCAT slave module.

1. Choose the function of the channel via the drop-down list (AI_U, AI_I, AI_PT100_2, AI_PT100_3, AI_PT1000_2 or AI_PT1000_3).
2. If required, choose optional filters of the AI-channels via the drop-down list (standard setting of all channels: voltage input without filter function).



Line	Index:Subindex	Name	Value	Bitlength	Abort if error	Jump to line if error	Next line	Comment
1	16#8000:16#01	CH0_Mode	AI_U	32	☐	☐	0	CH0_Mode
2	16#8000:16#02	CH0_Filter	0	32	☐	☐	0	CH0_Filter
3	16#8001:16#01	CH1_Mode	AI_U	32	☐	☐	0	CH1_Mode
4	16#8001:16#02	CH1_Filter	0	32	☐	☐	0	CH1_Filter
5	16#8002:16#01	CH2_Mode	AI_U	32	☐	☐	0	CH2_Mode
6	16#8002:16#02	CH2_Filter	0	32	☐	☐	0	CH2_Filter
7	16#8003:16#01	CH3_Mode	AI_U	32	☐	☐	0	CH3_Mode
8	16#8003:16#02	CH3_Filter	0	32	☐	☐	0	CH3_Filter
9	16#8004:16#01	CH4_Mode	AI_U	32	☐	☐	0	CH4_Mode
10	16#8004:16#02	CH4_Filter	0	32	☐	☐	0	CH4_Filter
11	16#8005:16#01	CH5_Mode	AI_U	32	☐	☐	0	CH5_Mode
12	16#8005:16#02	CH5_Filter	0	32	☐	☐	0	CH5_Filter
13	16#8006:16#01	CH6_Mode	AI_U	32	☐	☐	0	CH6_Mode
14	16#8006:16#02	CH6_Filter	0	32	☐	☐	0	CH6_Filter
15	16#8007:16#01	CH7_Mode	AI_U	32	☐	☐	0	CH7_Mode
16	16#8007:16#02	CH7_Filter	0	32	☐	☐	0	CH7_Filter
17	16#8008:16#01	CH8_Mode	AI_U	32	☐	☐	0	CH8_Mode
18	16#8008:16#02	CH8_Filter	0	32	☐	☐	0	CH8_Filter
19	16#8009:16#01	CH9_Mode	AI_U	32	☐	☐	0	CH9_Mode
20	16#8009:16#02	CH9_Filter	0	32	☐	☐	0	CH9_Filter
21	16#800A:16#01	CH10_Mode	AI_U	32	☐	☐	0	CH10_Mode
22	16#800A:16#02	CH10_Filter	0	32	☐	☐	0	CH10_Filter
23	16#800B:16#01	CH11_Mode	AI_U	32	☐	☐	0	CH11_Mode
24	16#800B:16#02	CH11_Filter	0	32	☐	☐	0	CH11_Filter

Fig. 28: ECC AIO startup parameters

6.3.2. I/O mapping

The I/O mapping contains the analogue outputs (AO) channel 0–5 (CH0_AO to CH5_AO) and the analogue inputs (AI) channel 0–11 (CH0_AI to CH11_AI).
The analogue inputs consist of a REAL value, that contains the measured analogue value and a status byte of the type USINT. The status byte must be checked to validate the input before usage and to detect errors. Depending on the configuration of each channel, the value shown can be interpreted as millivolts (mV), as milliampere (mA) or as degrees Celsius (°C).

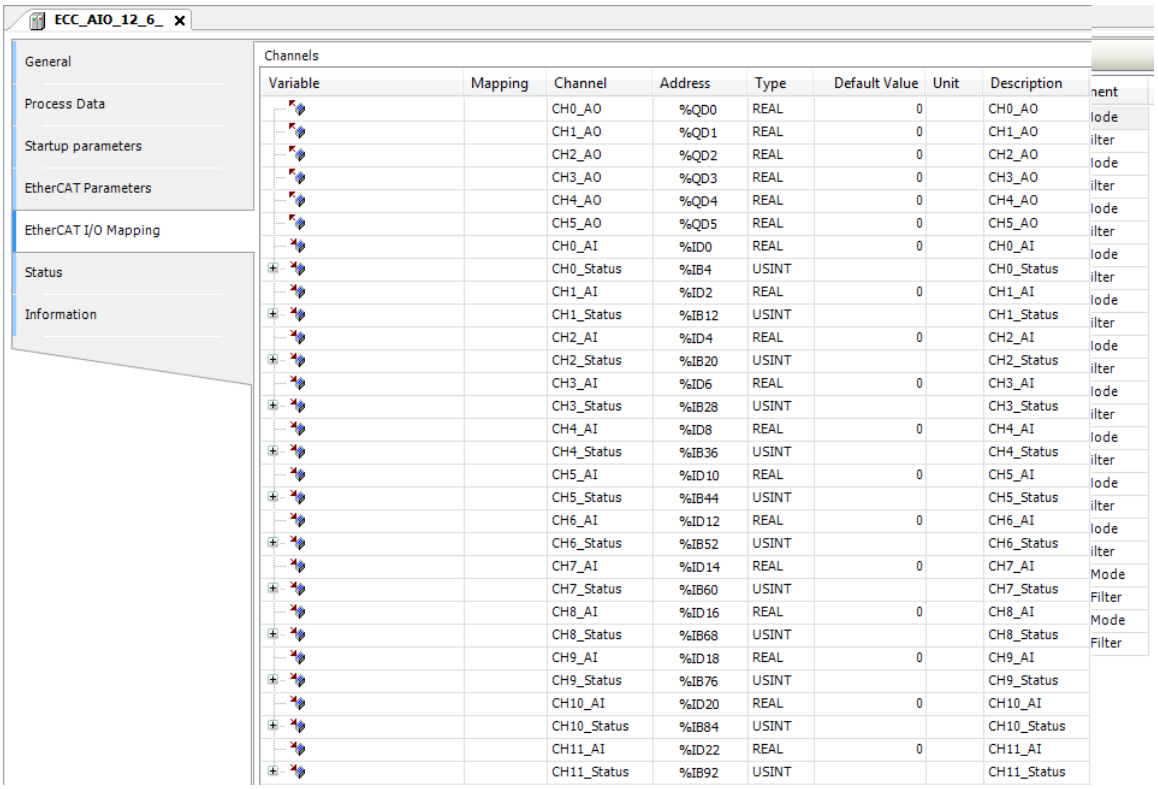


Fig. 29: ECC AIO I/O mapping

Coding of the status bytes

Status	Description
Bit 0	Positive overvoltage in the AI_U mode
Bit 1	Negative overvoltage in the AI_U mode
Bit 2	Wire breakage detection in the AI_PT mode
Bit 3	Reserved
Bit 4	Reserved
Bit 5	Reserved
Bit 6	Reserved
Bit 7	PT multiplexer signal (only for diagnostic purposes)

6.4. Operation

6.4.1. Status displays

The operating status LEDs show the current status of the power supply and the status of the EtherCAT connection.
The signals from the LEDs depend on the current operating status of the device:

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

Fig. 30: Location of the operating status LEDs

ECC DIO 16/16		
LED		**Meaning**
L1+	+24 V I/O (yellow)	Off: No power supply connected Dark: The necessary supply voltage has not yet been reached Bright: The correct supply voltage is present
L+	+24 V (yellow)	Off: No power supply connected Dark: The necessary supply voltage has not yet been reached Bright: The correct supply voltage is present
RUN	EtherCAT Run (green)	Off: Init (device not active) On: OP (operational, is being operated by the control system)

ECC AIO 12/6		
LED		**Meaning**
L+	+24 V (yellow)	Off: No power supply connected Dark: The necessary supply voltage has not yet been reached Bright: The correct supply voltage is present
RUN	EtherCAT Run (green)	Off: Init (device not active) On: OP (operational, is being operated by the control system)
ERR	EtherCAT Error (red)	On: Error

7. Maintenance/upkeep

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

7.1. Maintenance

WARNING	**Uncontrolled and unpredictable operational behaviour!** Failures or malfunctions may result in uncontrolled and unpredictable operational behaviour. ► Do not insert, connect, undo or touch any connections whilst the device is in operation. ► Before starting any work on the device, switch off all power feeds, including those to any connected peripherals (sensors and programmable devices etc. with independent power supplies).

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

- ► Make sure all the ventilation holes are kept free of obstructions.
- ► Do not open the device. If work is required on the device necessary contact customer service.

7.2. Cleaning

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

8. Uninstallation

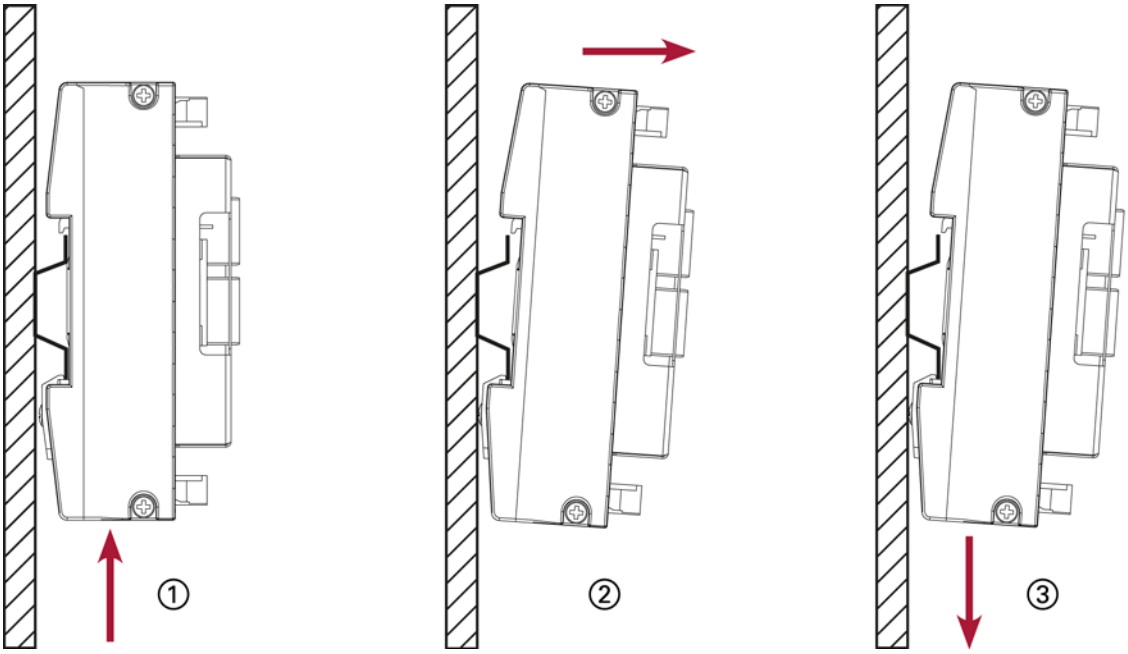


Fig. 31: Disassembling the device

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 device contains the following components which need to be disposed of separately:

→ Metals
→ Electronic components
→ Plastics

The following options are available for disposal of the device:

Disposal by the 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.

Disposal in accordance with regional regulations

- Dismantle the device and disassemble it completely into its component parts.
- Send the metal parts for metal recycling.
- Sort the electronic parts (circuit boards, drives etc.).
- Dispose of the electronic scrap in accordance with the national laws and regulations.

10. Technical data

10.1. ECC DIO 16/16 P/N

EtherCAT expansion	ECC DIO 16/16
Dimensions and weight	
Dimensions (WxHxD)	92 x 105 x 50 mm (incl. plugs and stainless steel cover)
Housing	Housing for installation on a mounting rail, anodised aluminium
Weight	approx. 200 g
Operating conditions	
Operating temperature	0 °C to 55 °C (in compliance with installation requirements)
Relative humidity	max. 85%, non-condensing
Transport and storage	
Operating temperature	–20 °C to +70 °C
Relative humidity	max. 85%, non-condensing
Operation	
Installation	on a mounting rail to DIN EN 60715:2001, 35 x 7.5 mm
Certification	to product standards DIN EN 61010-2-201, DIN EN 61131-2
Shock resistance	
Vibration	Sinusoidal (EN 60068-2-6) test: Fc 10…150 Hz, 1 G (Operation Mode)
Shock resistance	15 G (approx. 150 m/s²), 10 ms duration, sinusoidal half-wave (EN 60068-2-27) test: Ea
EMC, protection rating	
Emitted interference	EN 61000-6-3, residential areas
Resistance to interference	EN 61000-6-2, industrial zone
Protection class	III
Insulation resistance	SELV (Ue < 30 V) acc. to EN 61131-2
Protection rating	IP20
Power supply (electronics, 24 V power supply unit)	
Supply voltage	+24 V DC (–15 % / +20 %) SELV max. ripple component 5%
Power consumption	typ. 0.05 A, max. 0.25 A at +24 V DC
Protection against reverse polarity	yes

EtherCAT expansion	ECC DIO 16/16
Internal overload protection	0.1 A, self-resetting
‘Power’ lamp	yes
Power supply (digital outputs, 24 V power supply unit)	
Supply voltage	+24 V DC (–15 % / +20 %) SELV max. ripple component 5%
Power consumption	depending on the output load, max. 4 A continuous rating
Protection against reverse polarity	yes
‘Power’ lamp	yes
EtherCAT interfaces	
No. / type of interface	2x EtherCAT (EtherCAT slave, 1 input, 1 output)
Connection system	RJ45
I/O	
Digital IN	16x
Digital OUT	16x (0.5 A)

10.2. ECC AIO 12/6

EtherCAT expansion	ECC AIO 12/6
Dimensions and weight	
Dimensions (WxHxD)	92 x 105 x 50 mm (incl. plugs and stainless steel cover)
Housing	Housing for installation on a mounting rail, anodised aluminium
Weight	approx. 200 g
Operating conditions	
Operating temperature	0 °C to 55 °C (in compliance with installation requirements)
Relative humidity	max. 85%, non-condensing
Transport and storage	
Operating temperature	–20 °C to +70 °C
Relative humidity	max. 85%, non-condensing
Operation	
Installation	on a mounting rail to DIN EN 60715:2001, 35 x 7.5 mm
Certification	to product standards DIN EN 61010-2-201, DIN EN 61131-2
Shock resistance	
Vibration	Sinusoidal (EN 60068-2-6) test: Fc 10…150 Hz, 1 G (Operation Mode)
Shock resistance	15 G (approx. 150 m/s²), 10 ms duration, sinusoidal half-wave (EN 60068-2-27) test: Ea
EMC, protection rating	
Emitted interference	EN 61000-6-3, residential areas
Resistance to interference	EN 61000-6-2, industrial zone
Protection class	III
Insulation resistance	SELV (Ue < 30 V) acc. to EN 61131-2
Protection rating	IP20
Power supply (electronics, 24 V power supply unit)	
Supply voltage	+24 V DC (–15 % / +20 %) SELV max. ripple component 5%
Power consumption	typ. 0.05 A, max. 0.25 A at +24 V DC
Protection against reverse polarity	yes
Internal overload protection	0.1 A, self-resetting
‘Power’ lamp	yes
Power supply (digital outputs, 24 V power supply unit)	

EtherCAT expansion	ECC AIO 12/6
Supply voltage	+24 V DC (–15 % / +20 %) SELV max. ripple component 5%
Power consumption	depending on the output load, max. 4 A continuous rating
Protection against reverse polarity	yes
‘Power’ lamp	yes
EtherCAT interfaces	
No. / type of interface	2x EtherCAT (EtherCAT slave, 1 input, 1 output)
Connection system	RJ45
I/O	
Analogue inputs	6 A inputs (voltage ±10 V; current ±20 mA; PT100/1000 – 2-wire) 6 B inputs (voltage ±10 V; current ±20 mA) (alternatively the adjacent A+B inputs can also be used as 1 PT100/1000 3-wire input)
Analogue outputs	6x voltage; 0–10 V; 12 bit resolution

10.3. Identification plate

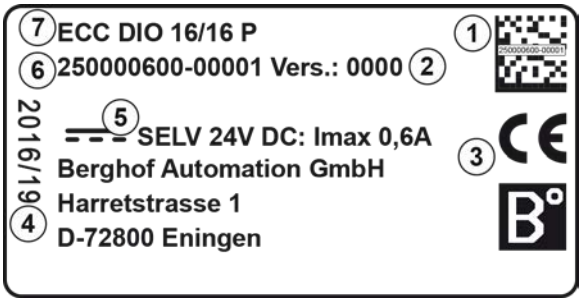


Fig. 32: Identification plate ECC DIO 16/16

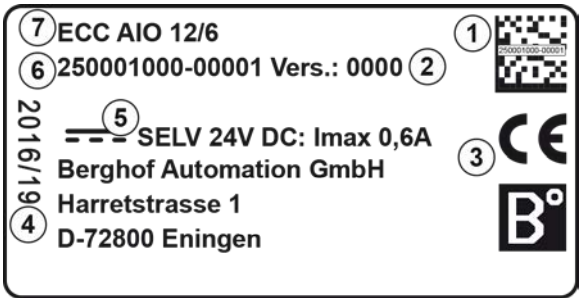


Fig. 33: Identification plate ECC AIO 12/6

Item	Designation	Item	Designation
1	QR code (identification no.)	5	Supply voltage
2	Version (delivery version; as-delivered condition)	6	Identification no. (article no. and serial no.)
3	CE mark	7	Device type description
4	Date of manufacture (year/calendar week)		

11. Standards and certificates

11.1. Standards

Applicable directives

→ EMC directive 2014/30/EU

Applicable standards

→ PLC standard EN 61131-2:2008-4

→ Emission standards EN 61000-6-3:2012-11

→ Safety provisions DIN EN 61010-2-201

11.2. UL certificate

CERTIFICATE OF COMPLIANCE

Certificate Number	2016-7-13-E242595
Report Reference	E242595-D1002-1/A0/C0-UL
Issue Date	2016-7-13
Issued to:	BERGHOF AUTOMATION GMBH
Applicant Company:	Harreststrasse 1 ENINGEN, BADEN-WUERTTEMBERG 72800 GERMANY
Listed Company:	Same as Applicant
This is to certify that representative samples of	Programmable controller ECC DIO 16/16 P; ECC AIO 12/6 Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 61010-1, 3rd Edition, May 11, 2012, Revised July 15, 2015, CAN/CSA-C22.2 No. 61010-1, 3rd Edition, Revision date July 1, 2015
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information.

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Bruce Mahrenholz, Assistant Chief Engineer, Global Inspection and Field Services, UL LLC
Joseph Hosey, General Manager, Director of Sales – Canada, UNDERWRITERS LABORATORIES OF CANADA INC.

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11.3. Declaration of conformity

ECC DIO 16/16:

ZERTIFIKAT / CERTIFICATE S. 1/1

EG-Konformitätserklärung
Declaration of conformity

Hiermit erklären wir in alleiniger Verantwortung, dass die nachstehend bezeichneten Geräte in ihrer Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den aufgeführten Richtlinien und Normen entsprechen. Bei einer mit uns nicht abgestimmten Änderung der Geräte verliert diese Erklärung ihre Gültigkeit.

We hereby declare, that the following described modules in their conception, construction and form are in compliance with the listed directives and standards. In case of any alteration of the modules, not certified by us, this declaration is void.

Hersteller / manufacturer	Berghof Automation GmbH Harretstrasse 1 D-72800 Eningen
Produktbezeichnung / product name	**ECC DIO 16/16 P; ECC DIO 16/16 N**
Produktnummer / product number	**250000600; 250000700**

Es wird die Übereinstimmung mit folgenden EG-Richtlinien und Normen erklärt:
The requirements of the following EC directives and standards are met:

Angewandte Richtlinien / applied directives

EMV Richtlinie	2014/30/EU

Angewandte Normen / applied standards

Produktnorm SPS	DIN EN61131-2:2008-4 + Berichtigung 1:2009-01
Fachgrundnorm Störaussendung Wohnbereich	EN61000-6-3:2012-11

18.04.2016	Stefan Stemmer	i.V. Uwe Manzow
Datum Date	Geschäftsführer Berghof Automation GmbH Chief Executive Officer Berghof Automation GmbH	Projektleiter Project Manager

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21-0099-88-10-05-032 | S_250000600CE1B_DeclarationofConformity_ECCDIO.docx

ECC AIO 12/6:

ZERTIFIKAT / CERTIFICATE S. 1/1

EG-Konformitätserklärung
Declaration of conformity

Hiermit erklären wir in alleiniger Verantwortung, dass die nachstehend bezeichneten Geräte in ihrer Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den aufgeführten Richtlinien und Normen entsprechen. Bei einer mit uns nicht abgestimmten Änderung der Geräte verliert diese Erklärung ihre Gültigkeit.

We hereby declare, that the following described modules in their conception, construction and form are in compliance with the listed directives and standards. In case of any alteration of the modules, not certified by us, this declaration is void.

Hersteller / manufacturer	Berghof Automation GmbH Harretstrasse 1 D-72800 Eningen
Produktbezeichnung / product name	**ECC AIO 12/6**
Produktnummer / product number	**250001000**

Es wird die Übereinstimmung mit folgenden EG-Richtlinen und Normen erklärt:
The requirements of the following EC directives and standards are met:

Angewandte Richtlinien / applied directives

EMV Richtlinie	2014/30/EU

Angewandte Normen / applied standards

Produktnorm SPS	EN61131-2:2008-4 + Berichtigung 1:2009-01
Industrielle, wissenschaftliche und medizinische Geräte - Funkstörungen - Grenzwerte und Messverfahren	EN55011: 2010; Klasse B; Gruppe 1

18.04.2016	Stefan Stemmer	i.V. Uwe Manzow
Datum Date	Geschäftsführer Berghof Automation GmbH Chief Executive Officer Berghof Automation GmbH	Projektleiter Project Manager

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12. Customer services / addresses

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

12.1. Customer services

Berghof Automation GmbH
Harretstr. 1
72800 Eningen
Germany
T +49.7121.894-183
F +49.7121.894-100
e-mail: support-controls@berghof.com
www.berghof.com

12.2. Addresses

CAN in Automation; international manufacturer and user organisation for CAN users in automation:
CAN in Automation e.V. (CiA)
Am Weichselgarten 26
91058 Erlangen
headquarters@can-cia.de
www.can-cia.de

EtherCAT Technology Group
ETG Headquarters
Ostendstraße 196
90482 Nuremberg
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. List of figures