BECKHOFF New Automation Technology

Documentation | EN

EL31xx

Analog Input Terminals (16 Bit)

2023-08-24 | Version: 7.0

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1.2 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.
The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

Trademarks

Beckhoff®, TwinCAT®, TwinCAT/BSD®, TC/BSD®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® are registered trademarks of and licensed by Beckhoff Automation GmbH. Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702 with corresponding applications or registrations in various other countries.

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Copyright

1.3 Guide through documentation

NOTICE

Further components of documentation

This documentation describes device-specific content. It is part of the modular documentation concept for Beckhoff I/O components. For the use and safe operation of the device / devices described in this documentation, additional cross-product descriptions are required, which can be found in the following table.

Title	Description
EtherCAT System Documentation (PDF)	• System overview • EtherCAT basics • Cable redundancy • Hot Connect • EtherCAT devices configuration
I/O Analog Manual (PDF)	Notes on I/O components with analog in and outputs
Explosion Protection for Terminal Systems (PDF)	Notes on the use of the Beckhoff terminal systems in hazardous areas according to ATEX and IECEx
Control Drawing I/O, CX, CPX (PDF)	Connection diagrams and Ex markings (conform to cFMus)
EtherCAT Terminals in the Marine Sector (PDF)	Notes for operation of the Beckhoff EtherCAT Terminal System in the Marine Sector (DNV GL)
Infrastructure for EtherCAT/Ethernet (PDF)	Technical recommendations and notes for design, implementation and testing
Software Declarations I/O (PDF)	Open source software declarations for Beckhoff I/O components

The documentations can be viewed at and downloaded from the Beckhoff website (www.beckhoff.com) via:

- the “Documentation and Download” area of the respective product page,
- the Download finder,
- the Beckhoff Information System.

1.4 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

1.5 Documentation issue status

Version	Comment
7.0	• Update chapter “Connection, display and diagnostics” • Update structure
6.9	• EL3174-0042 added • Update structure
6.8	• EL3174-0030 added • EL3172 added • Update chapter “Technical data” • Update chapter "LEDs and connection" • Update chapter "Object description" • Update structure • Update revision status
6.7	• Update chapter “Technical data” • Update chapter "LEDs and connection" • Update structure
6.6	• Update chapter “EL3174, EL3174-0090 - Technical data” • Update chapter "LEDs and connection" • Update revision status
6.5	• Chapter "Commissioning": addenda subchapter "Basics about signal isolators, barriers" • Update Chapter "Configuration of 0/4..20 mA differential inputs” • Update structure
6.4	• Update chapter "Technical data” • Update structure • Update revision status
6.3	• Update chapter "Introduction” • Update structure • Update revision status
6.2	• Update chapter "Technical data" • Update chapter "Connecstion system" -> "Connection" • Update chapter "TwinSAFE SC" • Update structure • Update revision status
6.1	• Update chapter "Settings and operation modes” • Update structure

Version	Comment
6.0	• Update chapter "Introduction” • Update chapter "Technical data" • Update structure • Update revision status
5.9	• Update chapter "Process data and operation modes” • Update revision status
5.8	• Addenda EL3174-0090
5.7	• Update chapter "Commissioning”
5.6	• Addenda EL3124-0090 • Addenda EL3174-0032 • Update chapter "Technical data" • Update chapter "Commissioning” • Update revision status
5.5	• Addenda EL3112-0011 • Update chapter "Technical data" • Update revision status
5.4	• Update chapter "Process data and operation modes”
5.3	• Update chapter "Technical data" • Addenda chapter "Instructions for ESD protection" • Update chapter "Notices on Analog specification" • Update revision status
5.2	• Update chapter "Technical data" • Several corrections
5.1	• Addenda of EL3174 and EL3174-0002 • Update chapter "Technical data"
5.0	• Migration • Update structure • Update revision status
4.5	• Update chapter "Technical data" • Addenda chapter "Installation instructions for enhanced mechanical load capacity" • Update structure • Update revision status
4.4	• Update chapter "Technical data" • Update chapter "Analog specification" • Update structure • Update firmware status
4.3	• Update chapter "Technical data" • Update chapter "Object description" • Update chapter "Process data" • Update structure • Update firmware status
4.2	• Update chapter "Technical data" • Update firmware status
4.1	• Update chapter "LEDs and connection" • Update firmware status
4.0	• Update chapter "Configuration of 0/4..20 mA differential inputs" • Update firmware status
3.9	• Update Technical data • Update Fast mode description
3.8	• Update Technical data
3.7	• Update Technical data
3.6	• Update Technical data
3.5	• Update connection diagrams
3.4	• Addenda chapter "Configuration of 0/4..20 mA differential inputs"
3.3	• Update chapter "Introduction" and "LEDs and connection"

Version	Comment
3.2	• Addenda chapter "LEDs and connection"
3.1	• Update chapter "LEDs and connection"
3.0	• Restructuring • 1 and 4 channel terminals added
2.3	• Addenda LED information
2.2	• Technical data and safety instructions added
2.1	• Basic function principles added
2.0	• Addenda Object description, firmware/hardware versions
1.1	• EL3142-0010 description amended, technical data corrected
1.0	• Description of filter settings amended (object description)
0.1	• Provisional documentation for EL31x2

1.6 Version identification of EtherCAT devices

1.6.1 General notes on marking

Designation

A Beckhoff EtherCAT device has a 14-digit designation, made up of

- family key
- type
- version
- revision

Example	Family	Type	Version	Revision
EL3314-0000-0016	EL terminal 12 mm, non-pluggable connection level	3314 4-channel thermocouple terminal	0000 basic type	0016
ES3602-0010-0017	ES terminal 12 mm, pluggable connection level	3602 2-channel voltage measurement	0010 high-precision version	0017
CU2008-0000-0000	CU device	2008 8-port fast ethernet switch	0000 basic type	0000

Notes

- The elements mentioned above result in the **technical designation**. EL3314-0000-0016 is used in the example below.
- EL3314-0000 is the order identifier, in the case of “-0000” usually abbreviated to EL3314. “-0016” is the EtherCAT revision.
- The **order identifier** is made up of
  - family key (EL, EP, CU, ES, KL, CX, etc.)
  - type (3314)
  - version (-0000)
- The **revision** -0016 shows the technical progress, such as the extension of features with regard to the EtherCAT communication, and is managed by Beckhoff.
  In principle, a device with a higher revision can replace a device with a lower revision, unless specified otherwise, e.g. in the documentation.
  Associated and synonymous with each revision there is usually a description (ESI, EtherCAT Slave Information) in the form of an XML file, which is available for download from the Beckhoff web site.
  From 2014/01 the revision is shown on the outside of the IP20 terminals, see Fig. *“EL5021 EL terminal, standard IP20 IO device with batch number and revision ID (since 2014/01)”*.
- The type, version and revision are read as decimal numbers, even if they are technically saved in hexadecimal.

1.6.2 Version identification of EL terminals

The serial number/ data code for Beckhoff IO devices is usually the 8-digit number printed on the device or on a sticker. The serial number indicates the configuration in delivery state and therefore refers to a whole production batch, without distinguishing the individual modules of a batch.

Structure of the serial number: **KK YY FF HH**	Example with serial number 12 06 3A 02:
KK - week of production (CW, calendar week)	12 - production week 12
YY - year of production	06 - production year 2006
FF - firmware version	3A - firmware version 3A
HH - hardware version	02 - hardware version 02

Fig. 1: EL2872 with revision 0022 and serial number 01200815

1.6.3 Beckhoff Identification Code (BIC)

The Beckhoff Identification Code (BIC) is increasingly being applied to Beckhoff products to uniquely identify the product. The BIC is represented as a Data Matrix Code (DMC, code scheme ECC200), the content is based on the ANSI standard MH10.8.2-2016.

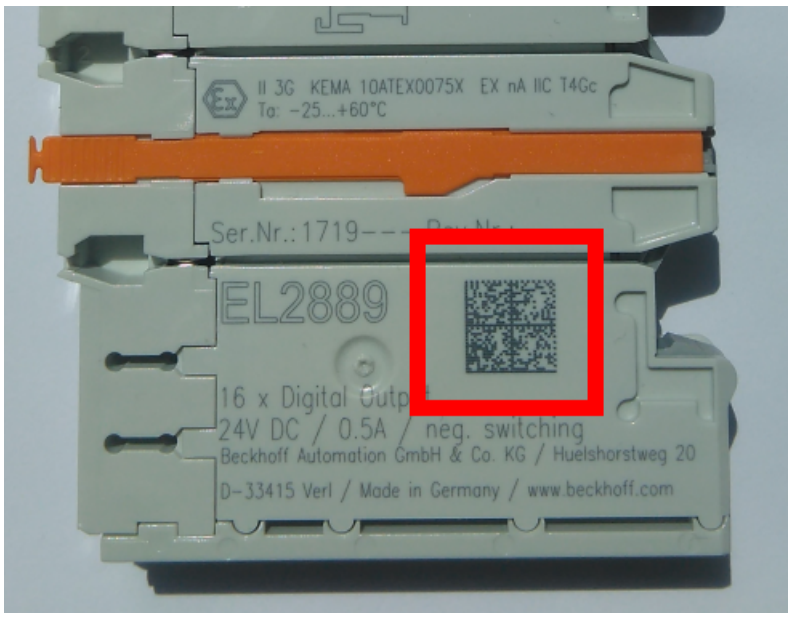


Fig. 2: BIC as data matrix code (DMC, code scheme ECC200)

The BIC will be introduced step by step across all product groups.

Depending on the product, it can be found in the following places:

- on the packaging unit
- directly on the product (if space suffices)
- on the packaging unit and the product

The BIC is machine-readable and contains information that can also be used by the customer for handling and product management.

Each piece of information can be uniquely identified using the so-called data identifier (ANSI MH10.8.2-2016). The data identifier is followed by a character string. Both together have a maximum length according to the table below. If the information is shorter, spaces are added to it.

Following information is possible, positions 1 to 4 are always present, the other according to need of production:

Position	Type of information	Explanation	Data identifier	Number of digits incl. data identifier	Example
1	Beckhoff order number	**Beckhoff order number**	1P	8	1P072222
2	Beckhoff Traceability Number (BTN)	**Unique serial number, see note below**	SBTN	12	SBTNk4p562d7
3	Article description	**Beckhoff article description, e.g. EL1008**	1K	32	1KEL1809
4	Quantity	**Quantity in packaging unit, e.g. 1, 10, etc.**	Q	6	Q1
5	Batch number	Optional: Year and week of production	2P	14	2P401503180016
6	ID/serial number	Optional: Present-day serial number system, e.g. with safety products	51S	12	51S678294
7	Variant number	Optional: Product variant number on the basis of standard products	30P	32	30PF971, 2*K183
...					

Further types of information and data identifiers are used by Beckhoff and serve internal processes.

Structure of the BIC

Example of composite information from positions 1 to 4 and with the above given example value on position 6. The data identifiers are highlighted in bold font:

1P072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

Accordingly as DMC:

Fig. 3: Example DMC **1P**072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, position 2). The BTN is a unique serial number consisting of eight characters that will replace all other serial number systems at Beckhoff in the long term (e.g. batch designations on IO components, previous serial number range for safety products, etc.). The BTN will also be introduced step by step, so it may happen that the BTN is not yet coded in the BIC.

NOTICE

This information has been carefully prepared. However, the procedure described is constantly being further developed. We reserve the right to revise and change procedures and documentation at any time and without prior notice. No claims for changes can be made from the information, illustrations and descriptions in this information.

1.6.4 Electronic access to the BIC (eBIC)

Electronic BIC (eBIC)

The Beckhoff Identification Code (BIC) is applied to the outside of Beckhoff products in a visible place. If possible, it should also be electronically readable.

Decisive for the electronic readout is the interface via which the product can be electronically addressed.

K-bus devices (IP20, IP67)

Currently, no electronic storage and readout is planned for these devices.

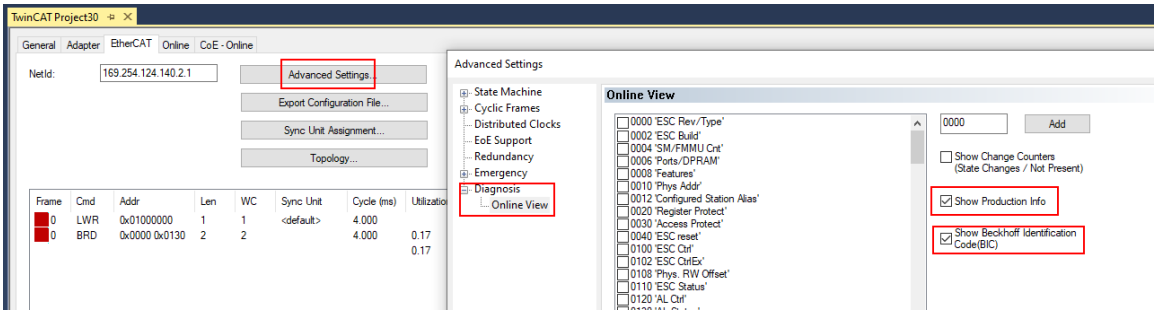
EtherCAT devices (IP20, IP67)

All Beckhoff EtherCAT devices have a so-called ESI-EEPROM, which contains the EtherCAT identity with the revision number. Stored in it is the EtherCAT slave information, also colloquially known as ESI/XML configuration file for the EtherCAT master. See the corresponding chapter in the EtherCAT system manual (Link) for the relationships.

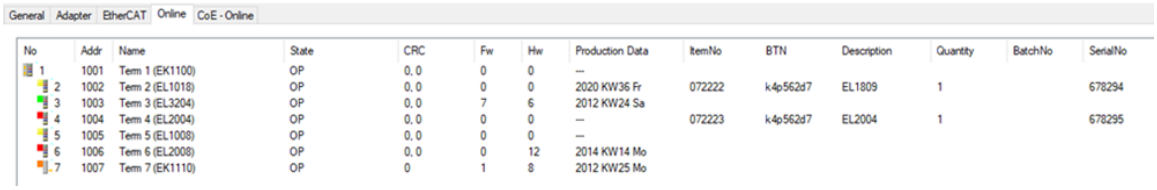
The eBIC is also stored in the ESI-EEPROM. The eBIC was introduced into the Beckhoff I/O production (terminals, box modules) from 2020; widespread implementation is expected in 2021.

The user can electronically access the eBIC (if existent) as follows:

- With all EtherCAT devices, the EtherCAT master (TwinCAT) can read the eBIC from the ESI-EEPROM
  - From TwinCAT 3.1 build 4024.11, the eBIC can be displayed in the online view.
  - To do this,
    check the checkbox "Show Beckhoff Identification Code (BIC)" under
    EtherCAT → Advanced Settings → Diagnostics:



  - The BTN and its contents are then displayed:



No	Addr	Name	State	CRC	Fw	Hw	Production Data	ItemNo	BTN	Description	Quantity	BatchNo	SerialNo
1	1001	Term 1 (EK1100)	OP	0, 0	0	0	---						
2	1002	Term 2 (EL1018)	OP	0, 0	0	0	2020 KW36 Fr	072222	k4p562d7	EL1809	1		678294
3	1003	Term 3 (EL3204)	OP	0, 0	7	6	2012 KW24 Sa						
4	1004	Term 4 (EL2004)	OP	0, 0	0	0	---	072223	k4p562d7	EL2004	1		678295
5	1005	Term 5 (EL1008)	OP	0, 0	0	0	---						
6	1006	Term 6 (EL2008)	OP	0, 0	0	12	2014 KW14 Mo						
7	1007	Term 7 (EK1110)	OP	0	1	8	2012 KW25 Mo						

  - Note: as can be seen in the illustration, the production data HW version, FW version and production date, which have been programmed since 2012, can also be displayed with "Show Production Info".
  - Access from the PLC: From TwinCAT 3.1. build 4024.24 the functions *FB_EcReadBIC* and *FB_EcReadBTN* are available in the Tc2_EtherCAT Library from v3.3.19.0 for reading into the PLC..
- In the case of EtherCAT devices with CoE directory, the object 0x10E2:01 can additionally by used to display the device's own eBIC; the PLC can also simply access the information here:

- The device must be in PREOP/SAFEOP/OP for access:

Index	Name	Flags	Value
1000	Device type	RO	0x015E1389 (22942601)
1008	Device name	RO	ELM3704-0000
1009	Hardware version	RO	00
100A	Software version	RO	01
100B	Bootloader version	RO	J0.1.27.0
1011:0	Restore default parameters	RO	> 1 <
1018:0	Identity	RO	> 4 <
10E2:0	Manufacturer-specific Identification C...	RO	> 1 <
10E2:01	SubIndex 001	RO	1P158442SBTN0008jekp1KELM3704 Q1 2P482001000016
10F0:0	Backup parameter handling	RO	> 1 <
10F3:0	Diagnosis History	RO	> 21 <
10F8	Actual Time Stamp	RO	0x170bfb277e

- The object 0x10E2 will be introduced into stock products in the course of a necessary firmware revision.
- From TwinCAT 3.1. build 4024.24 the functions *FB_EcCoEReadBIC* and *FB_EcCoEReadBTN* are available in the Tc2_EtherCAT Library from v3.3.19.0 for reading into the PLC.

- For processing the BIC/BTN data in the PLC, the following auxiliary functions are available in *Tc2_Utilities* from TwinCAT 3.1 build 4024.24 onwards
  - F_SplitBIC: The function splits the Beckhoff Identification Code (BIC) sBICValue into its components based on known identifiers and returns the recognized partial strings in a structure ST_SplitBIC as return value.
  - BIC_TO_BTN: The function extracts the BTN from the BIC and returns it as a value.
- Note: in the case of electronic further processing, the BTN is to be handled as a string(8); the identifier "SBTN" is not part of the BTN.
- Technical background
  The new BIC information is additionally written as a category in the ESI-EEPROM during the device production. The structure of the ESI content is largely dictated by the ETG specifications, therefore the additional vendor-specific content is stored with the help of a category according to ETG.2010. ID 03 indicates to all EtherCAT masters that they must not overwrite these data in case of an update or restore the data after an ESI update.
  The structure follows the content of the BIC, see there. This results in a memory requirement of approx. 50..200 bytes in the EEPROM.
- Special cases
  - If multiple, hierarchically arranged ESCs are installed in a device, only the top-level ESC carries the eBIC Information.
  - If multiple, non-hierarchically arranged ESCs are installed in a device, all ESCs carry the eBIC Information.
  - If the device consists of several sub-devices with their own identity, but only the top-level device is accessible via EtherCAT, the eBIC of the top-level device is located in the CoE object directory 0x10E2:01 and the eBICs of the sub-devices follow in 0x10E2:nn.

PROFIBUS, PROFINET, DeviceNet devices etc.

Currently, no electronic storage and readout is planned for these devices.

2 Product description

2.1 EL310x

2.1.1 EL3101

2.1.1.1 EL3101 - Introduction

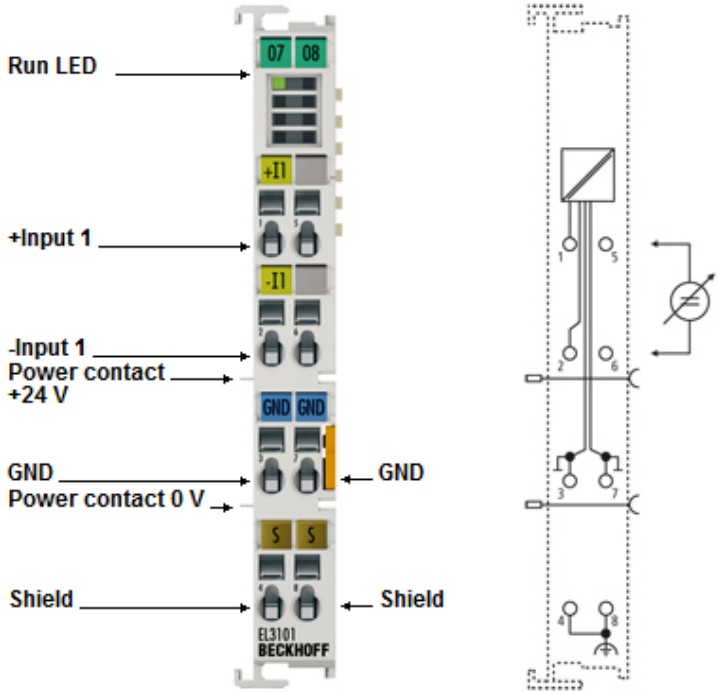


Fig. 4: EL3101

Analog Input Terminal; 1 channel, voltage, ±10 V, 16 bit, differential

The EL3101 analog input terminal handles signals in the range between -10 and +10 V. The voltage is digitized to a resolution of 16 bits, and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The signal state of the EtherCAT Terminal is indicated by light emitting diodes.

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 282]

2.1.1.2 EL3101 - Technical data

Technical data	EL3101
Analog inputs	1
Signal voltage	-10 V ... +10 V
Internal resistance	> 200 kΩ
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (without filter)	approx. 40 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 35 V (referring to internal GND)
Bit width of the process image (default setting)	Inputs: 1 x 16 bit; Status: 1 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 60 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.1.1.3 EL3101 - Connection, display and diagnostics

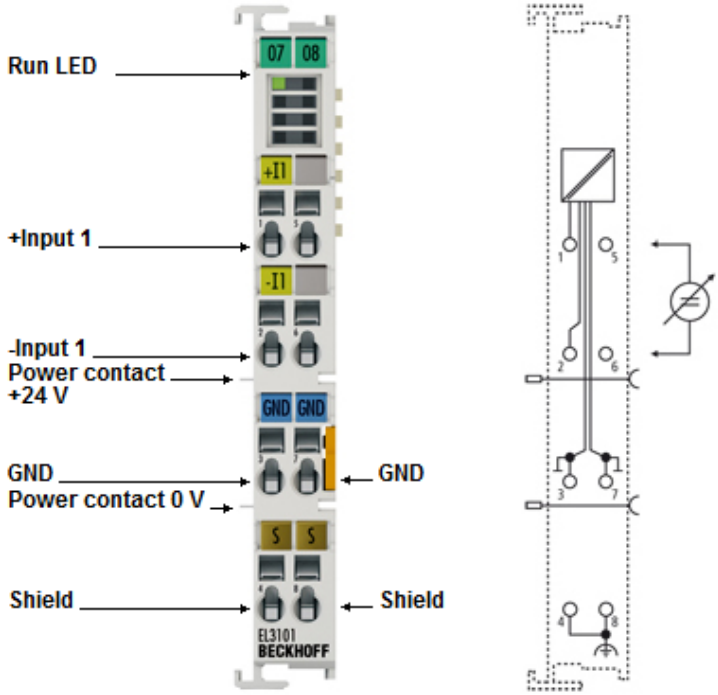


Fig. 5: EL3101 - LEDs and connection

Connection EL3101				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	not applicable (voltage input)
- Input 1	2	- Input 1	-	not applicable (voltage input)
GND	3	Signal ground for input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
n. c.	5	not connected	-	-
n.c.	6	not connected	-	-
GND	7	Signal ground for input 1	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state (if more than one RUN LED is present, all of them have the same function):	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
*) If several RUN LEDs are present, all of them have the same function			

2.1.2 EL3102

2.1.2.1 EL3102 - Introduction

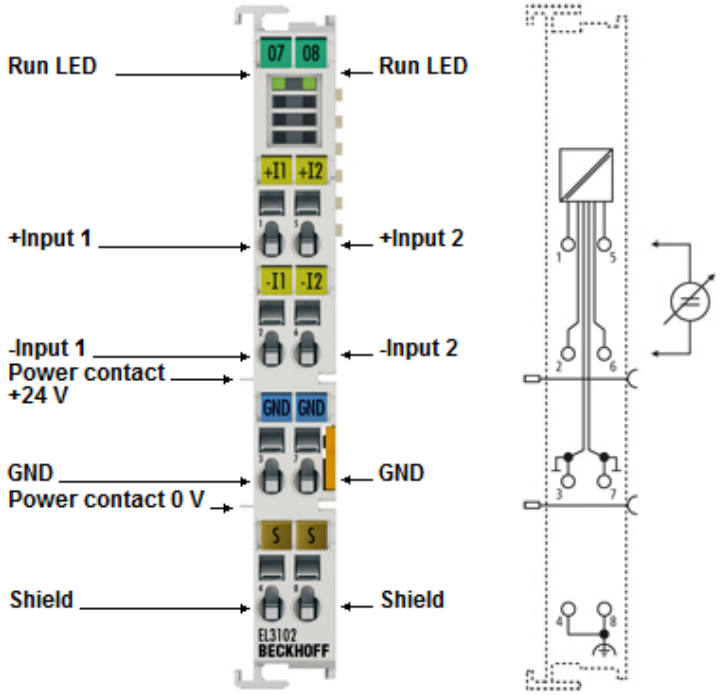


Fig. 6: EL3102

Analog Input Terminal; 2 channel, voltage, ±10 V, 16 bit, differential

The EL3102 analog input terminal handles signals in the range between -10 and +10 V. The voltage is digitized to a resolution of 16 bits, and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The signal state of the EtherCAT Terminal is indicated by light emitting diodes..

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 289]

2.1.2.2 EL3102 - Technical data

Technical data	EL3102
Analog inputs	2
Signal voltage	-10 V ... +10 V
Internal resistance	> 200 kΩ
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (without filter)	approx. 60 µs (Fast mode: approx. 40 µs)
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 170 mA
Distributed Clocks	yes (from rev. EL310x-0000-0017 [▶ 487])
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 35 V (referring to internal GND)
Bit width of the process image (default setting)	Inputs: 2 x 16 bit; Status: 2 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 60 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151] ,cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.1.2.3 EL3102 - Connection, display and diagnostics

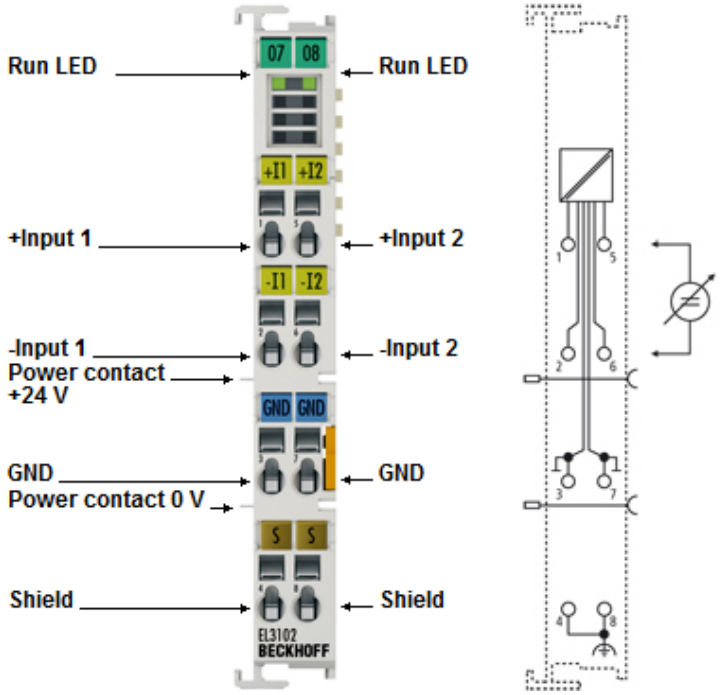


Fig. 7: EL3102 - LEDs and connection

Connection EL3102				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	not applicable (voltage input)
- Input 1	2	- Input 1	-	not applicable (voltage input)
GND	3	Signal ground for Input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
+ Input 2	5	+ Input 2	-	not applicable (voltage input)
- Input 2	6	- Input 2	-	not applicable (voltage input)
GND	7	Signal ground for Input 2	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state (if more than one RUN LED is present, all of them have the same function):	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
*) If several RUN LEDs are present, all of them have the same function			

2.1.3 EL3104

2.1.3.1 EL3104 - Introduction

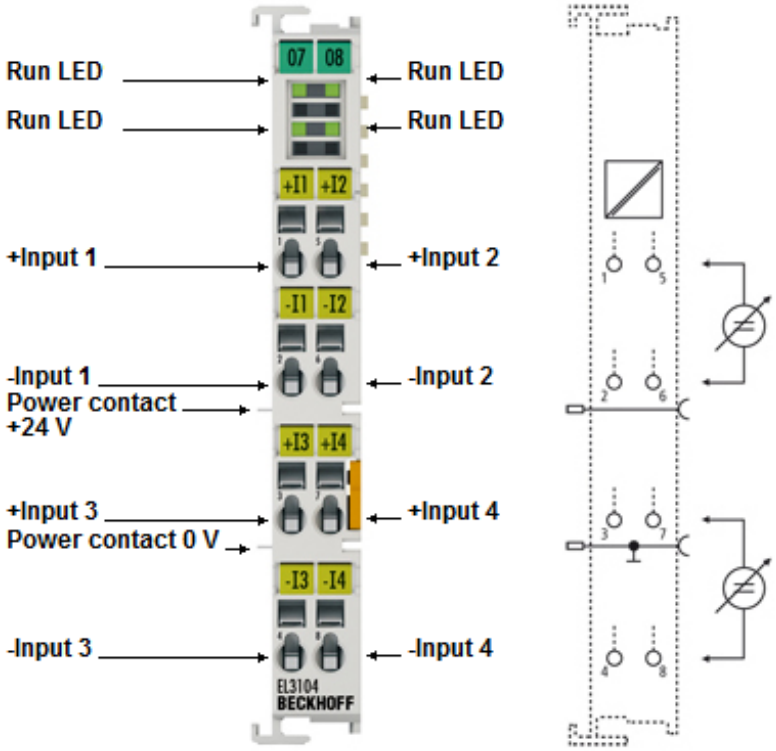


Fig. 8: EL3104

Analog Input Terminal; 4 channel, voltage, ±10 V, 16 bit, differential

The EL3104 analog input terminal processes signals in the range between -10 and +10 V. The voltage is digitized to a resolution of 16 bits, and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EL3104 EtherCAT Terminal are differential inputs. The signal state of the EtherCAT Terminal is indicated by light emitting diodes.

Quick-Links

- EtherCAT basics
- Process data and operation modes [▶ 247]
- Object description and parameterization [▶ 300]

2.1.3.2 EL3104 - Technical data

Technical data	EL3104
Analog inputs	4
Signal voltage	-10 V ... +10 V
Internal resistance	> 200 kΩ
Resolution	16 bit (including sign)
Sampling type	multiplex
Ground reference	differential
Conversion time (without filter)	approx. 100 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 35 V (referring to power contact)
Bit width of the process image (default setting)	Inputs: 4 x 16 bit; Status: 4 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 65 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151], IECEx [▶ 152], cFMus [▶ 154] cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex markings

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc II 3 D Ex tc IIIC T135 °C Dc
IECEx	Ex nA IIC T4 Gc Ex tc IIIC T135 °C Dc
cFMus	Class I, Division 2, Groups A, B, C, D Class I, Zone 2, AEx/Ex ec IIC T4 Gc

2.1.3.3 EL3104 - Connection, display and diagnostics

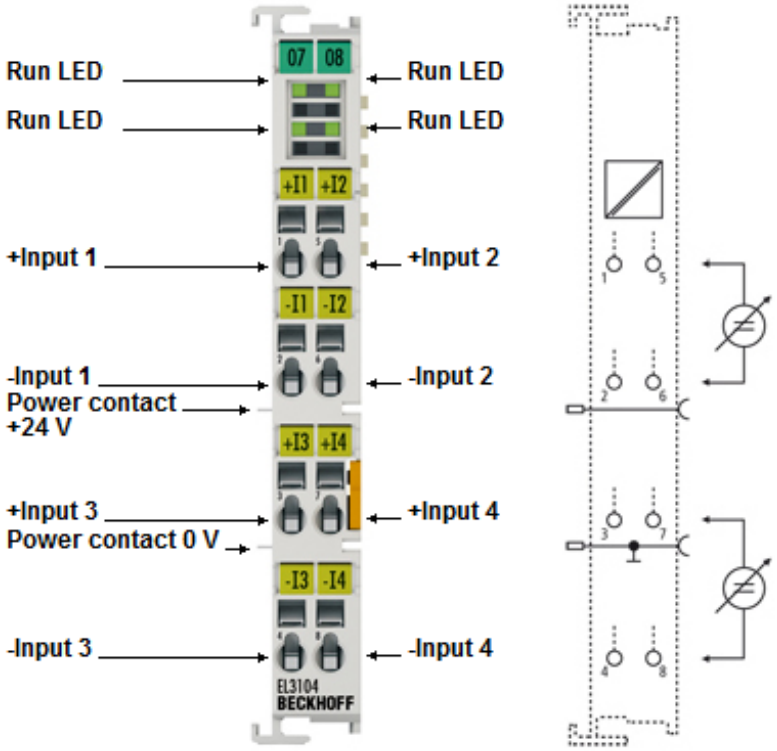


Fig. 9: EL3104 - LEDs and connection

Connection EL3104				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	not applicable (voltage input)
- Input 1	2	- Input 1	-	not applicable (voltage input)
+ Input 3	3	+ Input 3	-	not applicable (voltage input)
- Input 3	4	- Input 3	-	not applicable (voltage input)
+ Input 2	5	+ Input 2	-	not applicable (voltage input)
- Input 2	6	- Input 2	-	not applicable (voltage input)
+ Input 4	7	+ Input 4	-	not applicable (voltage input)
- Input 4	8	- Input 4	-	not applicable (voltage input)

*) Constant and peak value

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state (if more than one RUN LED is present, all of them have the same function):	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
*) If several RUN LEDs are present, all of them have the same function			

2.2 EL311x

2.2.1 EL3111

2.2.1.1 EL3111 - Introduction

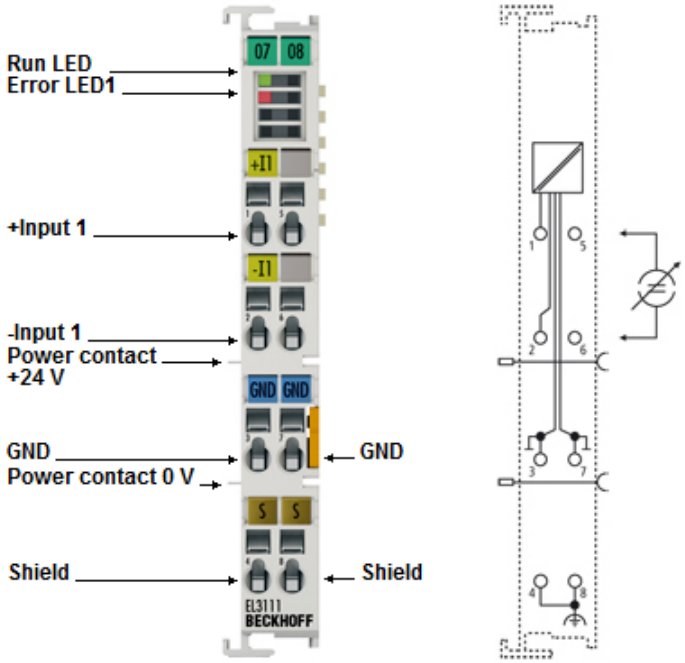


Fig. 10: EL3111

Analog Input Terminal; 1 channel, current, 0…20 mA, 16 bit, differential

The EL3111 analog input terminal processes signals in the range between 0 and 20 mA. The current is digitized to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The EL3111 is the single-channel version and is characterized by its fine granularity and electrical isolation.

Overload condition is detected, and the terminal status is relayed to the controller via the E-bus. The EtherCAT Terminal indicates its signal state by means of light emitting diodes. The error LEDs indicate an overload condition.

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 309]

2.2.1.2 EL3111 - Technical data

Technical data	EL3111
Analog inputs	1
Signal current	0 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (default setting: 50 Hz filter)	approx. 40 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 1 x 16 bit; Status: 1 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.2.1.3 EL3111 - Connection, display and diagnostics

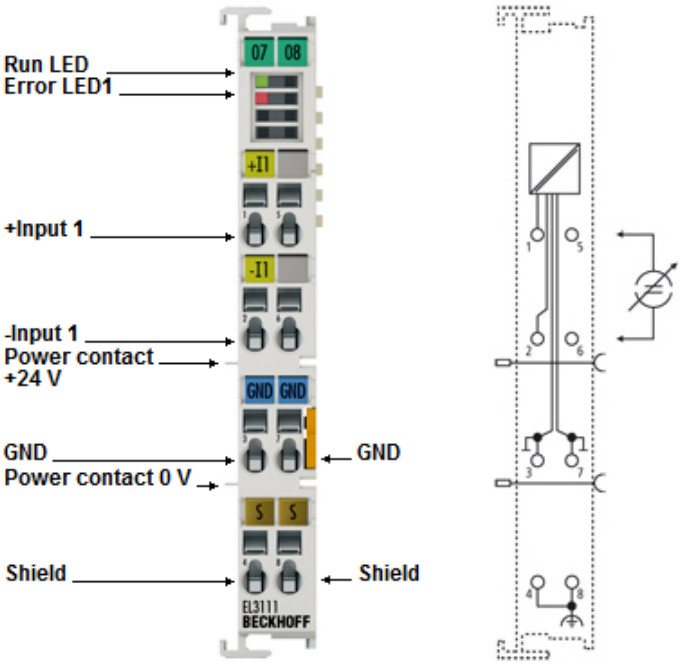


Fig. 11: EL3111 - LEDs and connection

Connection EL3111				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
GND	3	Signal ground for input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
n. c.	5	not connected	-	-
n.c.	6	not connected	-	-
GND	7	Signal ground for input 1	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.2.2 EL3112

2.2.2.1 EL3112 - Introduction

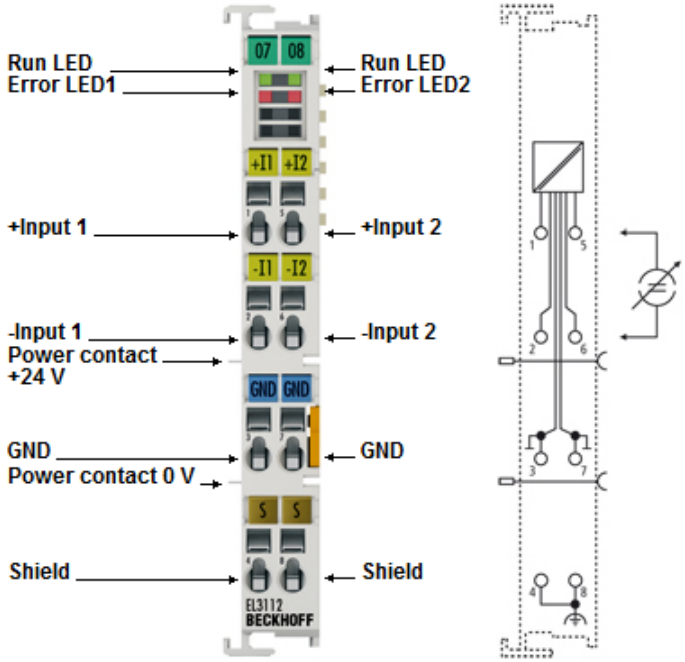


Fig. 12: EL3112

Analog Input Terminal; 2 channel, current, 0…20 mA, 16 bit, differential

The EL3112 analog input terminal processes signals in the range between 0 and 20 mA. The current is digitized to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The EL3112 combines two channels in one housing.

Overload condition is detected, and the terminal status is relayed to the controller via the E-bus. The EtherCAT Terminal indicates its signal state by means of light emitting diodes. The error LEDs indicate an overload condition..

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 316]

2.2.2.2 EL3112 - Technical data

Technical data	EL3112
Analog inputs	2
Signal current	0 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (default setting: 50 Hz filter)	approx. 50 µs (Fast mode: approx. 35 µs)
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 170 mA
Distributed Clocks	yes (from rev. EL311x-0000-0017 [▶ 487])
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 2 x 16 bit; Status: 2 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval	CE, EAC, UKCA ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.2.2.3 EL3112 - Connection, display and diagnostics

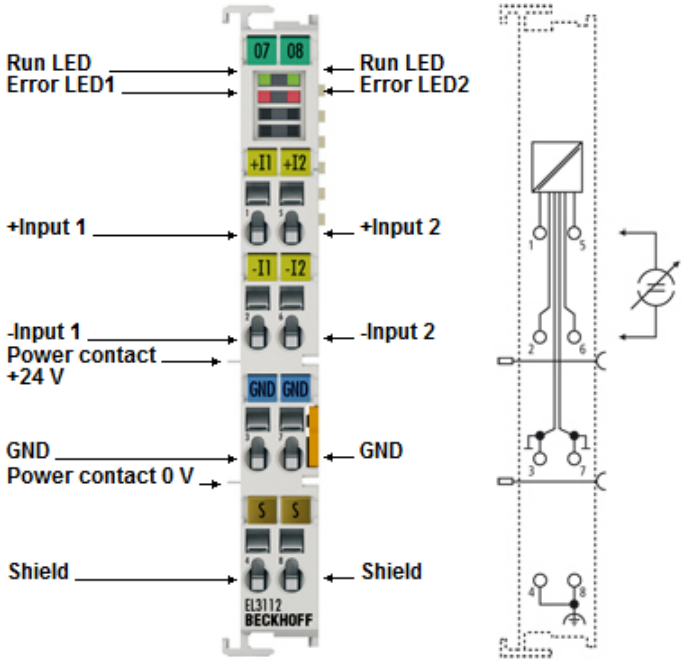


Fig. 13: EL3112 - LEDs and connection

Connection EL3112, EL3112-0011				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
GND	3	Signal ground for input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
+ Input 2	5	+ Input 2	-	40 mA
- Input 2	6	- Input 2	-	40 mA
GND	7	Signal ground for input 2	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.2.3 EL3112-0011

2.2.3.1 EL3112-0011 - Introduction

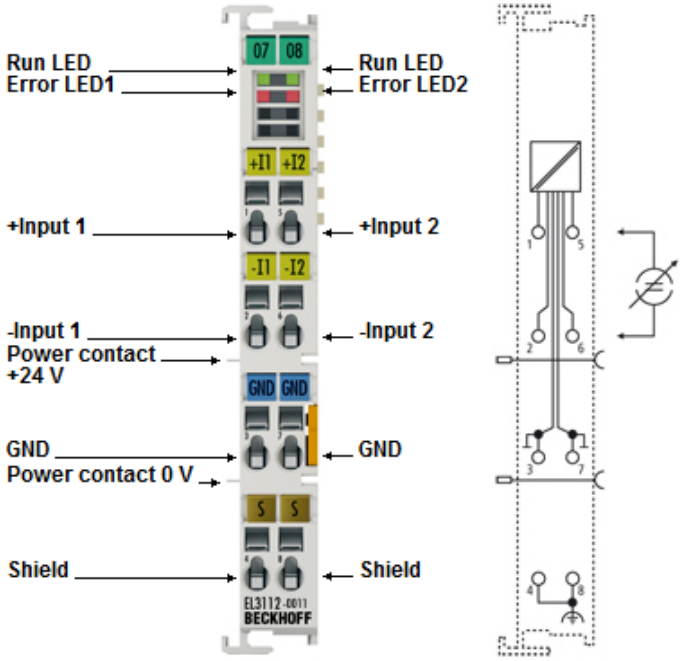


Fig. 14: EL3112-0011

Analog Input Terminal; 2 channel, current, ±20 mA, 16 bit, differential

The EL3112-0011 analog input terminal processes signals in the range between -20 and +20 mA. The current is digitized to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The EL3112-0011 combines two channels in one housing.

Overload condition is detected, and the terminal status is relayed to the controller via the E-bus. The error LEDs indicate an overload condition.

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 316]

2.2.3.2 EL3112-0011 - Technical data

Technical data	EL3112-0011
Analog inputs	2
Signal current	-20 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (default setting: 50 Hz filter)	approx. 50 µs (Fast mode: approx. 35 µs)
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 170 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 2 x 16 bit; Status: 2 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.2.3.3 EL3112-0011 - Connection, display and diagnostics

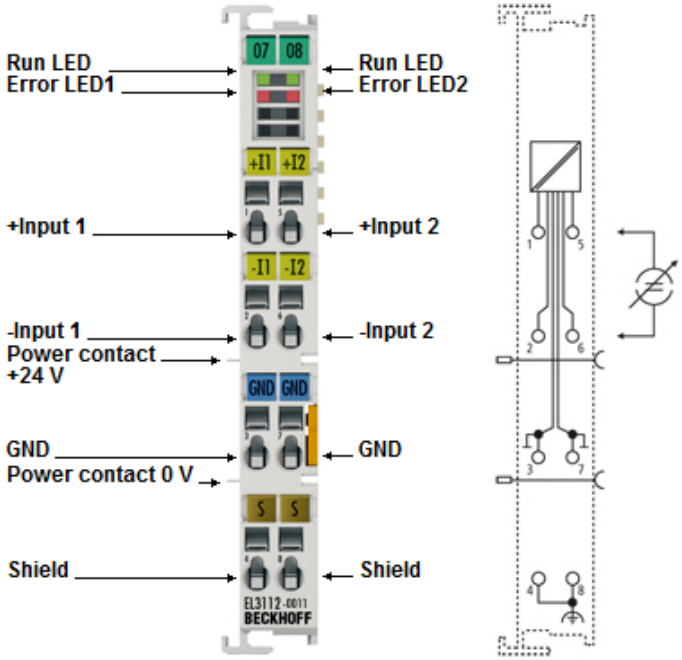


Fig. 15: EL3112-0011 – LEDs and connection

Connection EL3112, EL3112-0011				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
GND	3	Signal ground for input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
+ Input 2	5	+ Input 2	-	40 mA
- Input 2	6	- Input 2	-	40 mA
GND	7	Signal ground for input 2	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.2.4 EL3114

2.2.4.1 EL3114 - Introduction

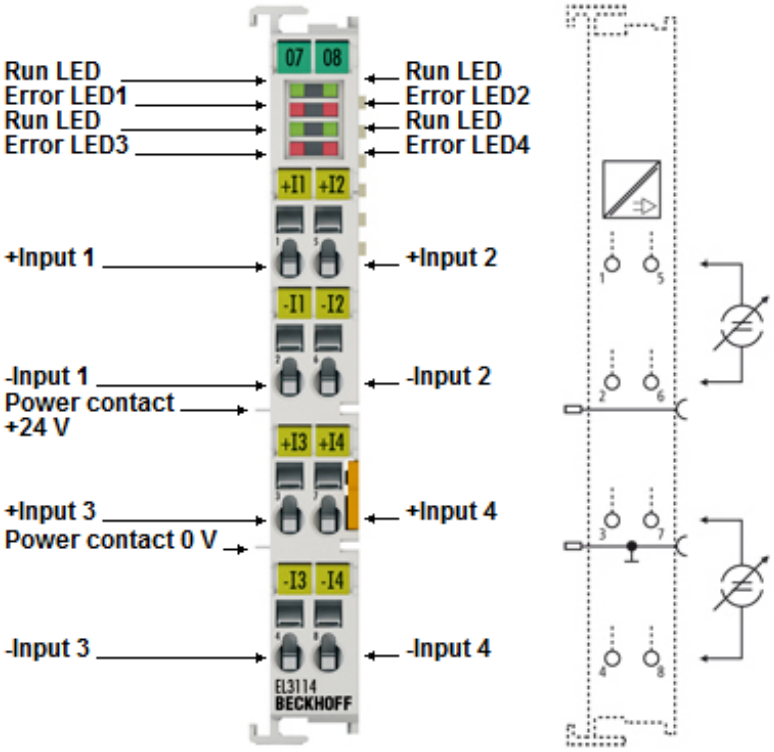


Fig. 16: EL3114

Analog Input Terminal; 4 channel, current, 0…20 mA, 16 bit, differential

The EL3114 analog input terminal processes signals in the range between 0 and 20 mA.

The current is digitized to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device.The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential.

Overload condition is detected, and the terminal status is relayed to the controller via the E-bus. The EtherCAT Terminal indicates its signal state by means of light emitting diodes..

Quick-Links

- EtherCAT basics
- Process data and operation modes [▶ 247]
- Object description and parameterization [▶ 328]

2.2.4.2 EL3114 - Technical data

Technical data	EL3114
Analog inputs	4 (differential)
Signal current	0 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (default setting: 50 Hz filter)	approx. 100 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 4 x 16 bit; Status: 4 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.2.4.3 EL3114 - Connection, display and diagnostics

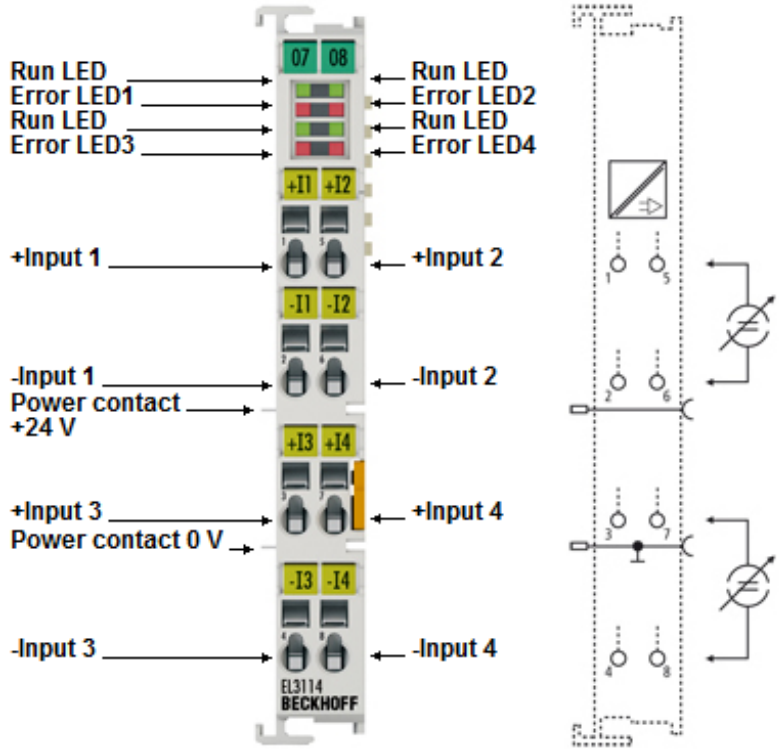


Fig. 17: EL3114 - LEDs and connection

Connection EL3114				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
+ Input 3	3	+ Input 3	-	40 mA
- Input 3	4	- Input 3	-	40 mA
+ Input 2	5	+ Input 2	-	40 mA
- Input 2	6	- Input 2	-	40 mA
+ Input 4	7	+ Input 4	-	40 mA
- Input 4	8	- Input 4	-	40 mA

*) Constant and peak value

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.3 EL312x

2.3.1 EL3121

2.3.1.1 EL3121 - Introduction

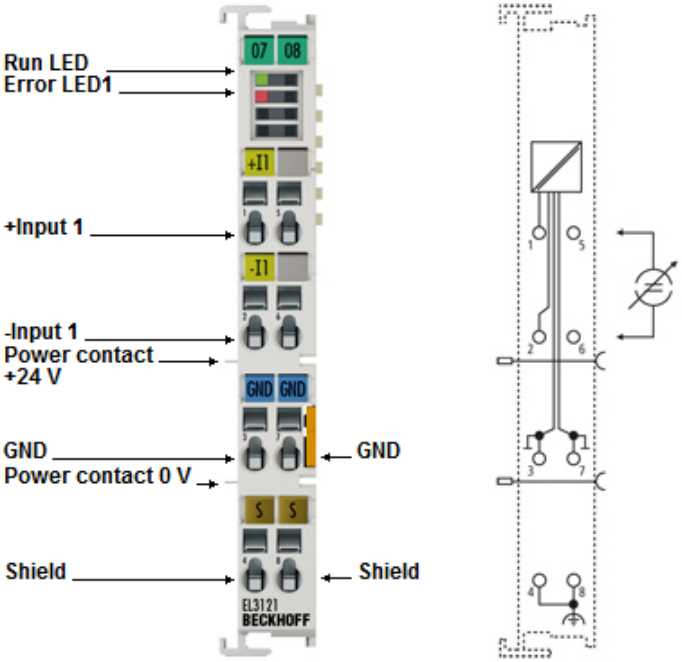


Fig. 18: EL3121

Analog Input Terminal; 1 channel, current, 4…20 mA, 16 bit, differential

The EL3121 analog input terminal processes signals in the range between 4 and 20 mA. The current is digitized to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The EL3121 is the single-channel version and is characterized by its fine granularity and electrical isolation. An open lead or overload condition are detected. The terminal status is relayed to the controller via the E-bus.

The EtherCAT Terminal indicates its signal state by means of light emitting diodes. The error LEDs indicate an overload condition and a broken wire..

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 337]

2.3.1.2 EL3121 - Technical data

Technical data	EL3121
Analog inputs	1
Signal current	4 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (without filter)	approx. 40 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 1 x 16 bit; Status: 1 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA, ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.3.1.3 EL3121 - Connection, display and diagnostics

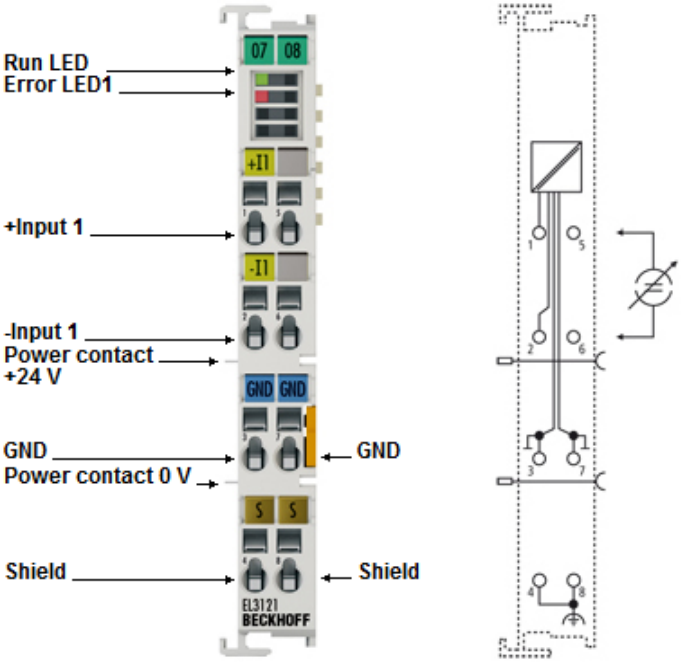


Fig. 19: EL3121 - LEDs and connection

Connection EL3121				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
GND	3	Signal ground for input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
n. c.	5	not connected	-	-
n. c.	6	not connected	-	-
GND	7	Signal ground for input 1	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.3.2 EL3122

2.3.2.1 EL3122 - Introduction

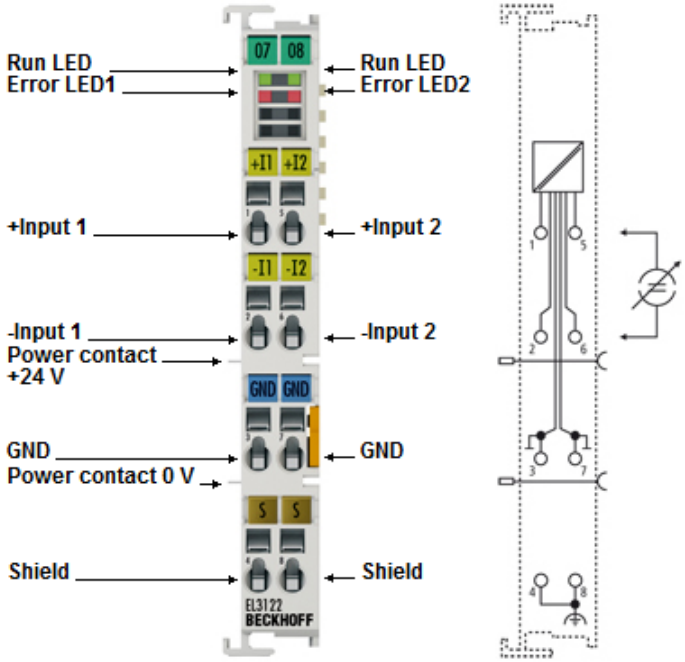


Fig. 20: EL3122

Analog Input Terminal; 2 channel, current, 4…20 mA, 16 bit, differential

The EL3122 analog input terminal processes signals in the range between 4 and 20 mA. The current is digitized to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The EL3122 combines two channels in one housing. An open lead or overload condition are detected.

The terminal status is relayed to the controller via the E-bus. The EtherCAT Terminal indicates its signal state by means of light emitting diodes. The error LEDs indicate an overload condition and a broken wire.

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 344]

2.3.2.2 EL3122 - Technical data

Technical data	EL3122
Analog inputs	2
Signal current	4 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (without filter)	approx. 50 µs (Fast mode: approx. 35 µs)
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 170 mA
Distributed Clocks	yes (from rev. EL312x-0000-0017 [▶ 487])
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 2 x 16 bit; Status: 2 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA, ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.3.2.3 EL3122 - Connection, display and diagnostics

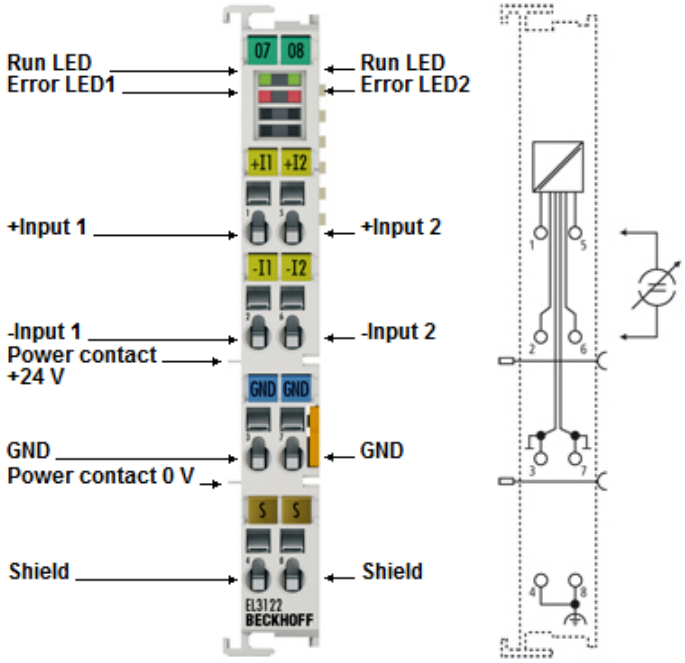


Fig. 21: EL3122 - LEDs and connection

Connection EL3122				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
GND	3	Signal ground for input 1	7, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	4	Shield (FE)	8; DIN rail	100 mA **)
+ Input 2	5	+ Input 2	-	40 mA
- Input 2	6	- Input 2	-	40 mA
GND	7	Signal ground for input 2	3, (high impedance, therefore potential equal but not current loadable)	40 mA
Shield	8	Shield (FE)	4; DIN rail	100 mA **)

*) Constant and peak value

**) Shield lines should be de-energized!

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

NOTICE

Terminal GND and system GND

The signal ground GND of this terminal is not internally connected to the negative power contact. This design allows GND to be connected to a ground other than the negative power contact "Power contact 0V" if necessary.
If disturbing potential differences occur, GND must be electrically connected to the system GND or another suitable ground.

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.3.3 EL3124

2.3.3.1 EL3124 - Introduction

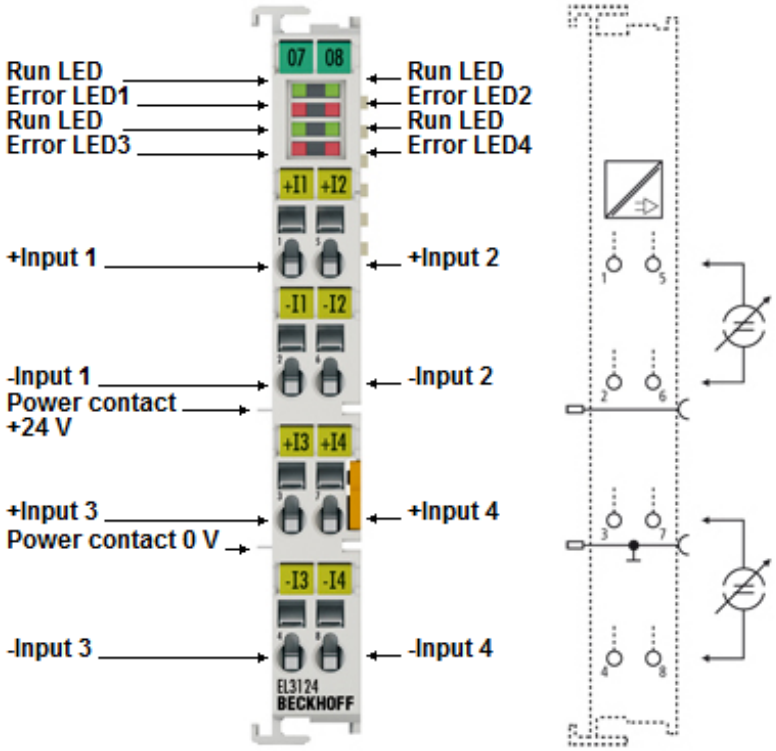


Fig. 22: EL3124

Analog Input Terminal; 4 channel, current, 4…20 mA, 16 bit, differential

The EL3124 analog input terminal handles signals in the range from 4 to 20 mA. The current is digitized to a resolution of 16 bits and is transmitted, in an electrically isolated form, to the higher-level automation device.

The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential. The EL3124 combines four channels in one housing. An open lead or overload condition are detected and the terminal status is relayed to the controller via the E-bus.

The EtherCAT Terminal indicates its signal state by means of light emitting diodes. The error LEDs indicate an overload condition and a broken wire.

Quick-Links

- EtherCAT basics
- Process data and operation modes [▶ 247]
- Object description and parameterization [▶ 356]

2.3.3.2 EL3124 - Technical data

Technical data	EL3124
Analog inputs	4
Signal current	4 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	multiplex
Ground reference	differential
Conversion time (without filter)	approx. 100 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 4 x 16 bit; Status: 4 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 60 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA, ATEX [▶ 151], IECEx [▶ 152], cFMus [▶ 154], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex markings

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc II 3 D Ex tc IIIC T135 °C Dc
IECEx	Ex nA IIC T4 Gc Ex tc IIIC T135 °C Dc
cFMus	Class I, Division 2, Groups A, B, C, D Class I, Zone 2, AEx/Ex ec IIC T4 Gc

2.3.3.3 EL3124 - Connection, display and diagnostics

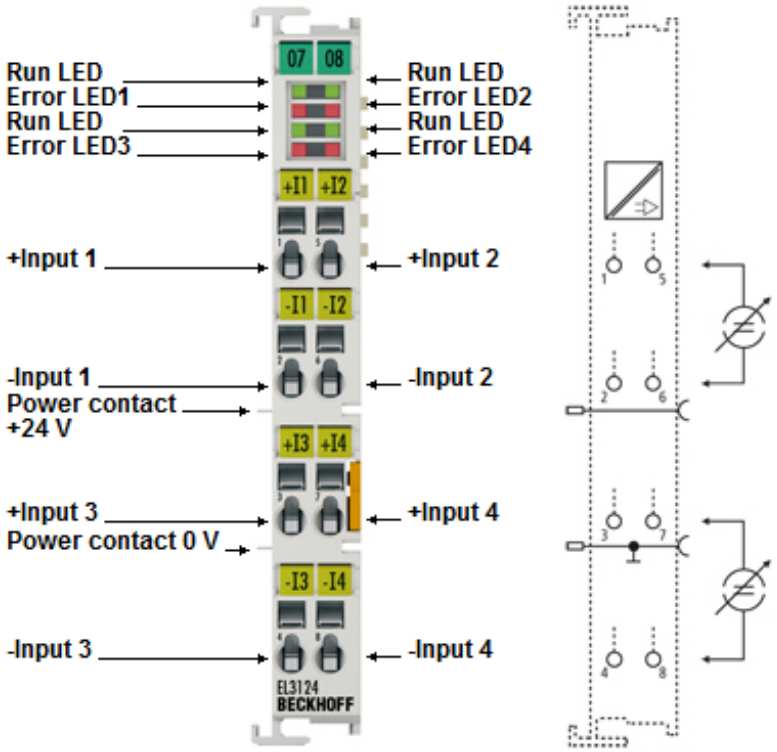


Fig. 23: EL3124 - LEDs and connection

Connection EL3124				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
+ Input 3	3	+ Input 3	-	40 mA
- Input 3	4	- Input 3	-	40 mA
+ Input 2	5	+ Input 2	-	40 mA
- Input 2	6	- Input 2	-	40 mA
+ Input 4	7	+ Input 4	-	40 mA
- Input 4	8	- Input 4	-	40 mA

*) Constant and peak value

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function			
**) The error display shows the signal processing state for each channel			

2.3.4 EL3124-0090

2.3.4.1 EL3124-0090 - Introduction

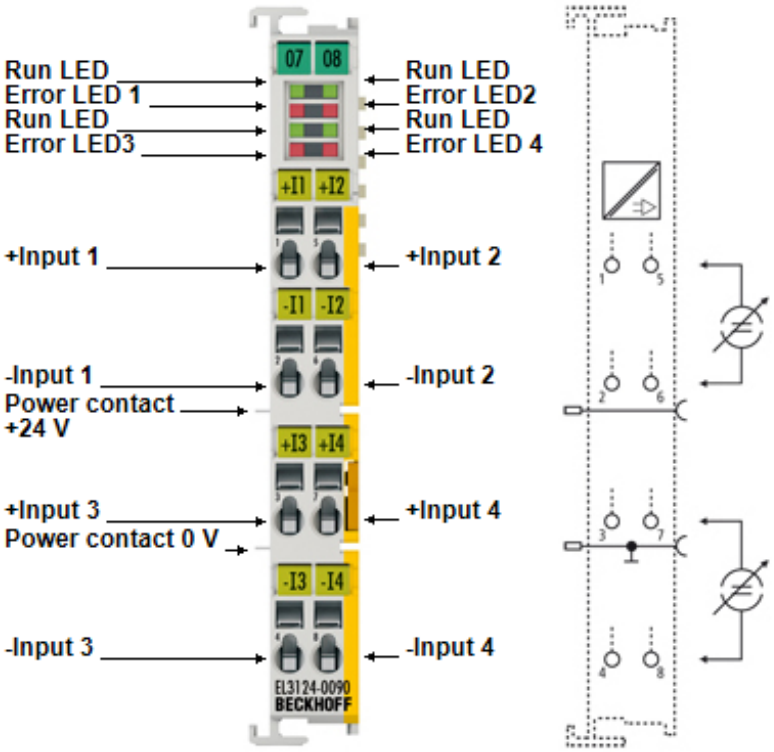


Fig. 24: EL3124-0090

Analog Input Terminal; 4 channel, current, 4…20 mA, 16 bit, differential, TwinSAFE SC

The EL3124-0090 analog input terminal handles signals in the range from 4 to 20 mA. The current is digitized to a resolution of 16 bits and is transmitted, in an electrically isolated form, to the higher-level automation device. The input channels of the EtherCAT Terminal have differential inputs and possess a common, internal ground potential.

With the aid of the TwinSAFE SC technology (TwinSAFE Single Channel) it is possible to make use of standard signals for safety tasks in any network or fieldbus. To do this, EtherCAT I/Os from the areas of analog input, position measurement or communication (4…20 mA, incremental encoder, IO-Link, etc.) are extended by the TwinSAFE SC function. The properties typical for the signals and the standard functions of the I/O components are retained. TwinSAFE SC I/Os differ optically from standard I/Os by a yellow stripe on the front of the housing.

The TwinSAFE SC technology enables communication via a TwinSAFE protocol. These connections can be distinguished from the usual secure communication via Safety over EtherCAT.

The data from the TwinSAFE SC components is fed via a TwinSAFE protocol to the TwinSAFE Logic, where it can be used in the context of safety-relevant applications. Detailed examples confirmed/calculated by the TÜV SÜD for the correct application of the TwinSAFE SC components and the respective normative classifications can be found in the TwinSAFE application manual..

Quick-Links

- EtherCAT basics
- Process data and operation modes [▶ 247]
- Object description and parameterization [▶ 365]

2.3.4.2 EL3124-0090 - Technical data

Technical data	EL3124-0090
Analog inputs	4
Signal current	4 mA…20 mA
Internal resistance	85 Ω type. + diode voltage
Resolution	16 bit (including sign)
Sampling type	simultaneous
Ground reference	differential
Conversion time (without filter)	approx. 100 µs
Input filter limit frequency	5 kHz
Measuring error (full measuring range)	< ± 0.3% (at 0 °C ... +55 °C, relative to the full scale value) < ± 0.5% (when the extended temperature range is used)
MTBF (+55°C)	> 950.000 h
Supply voltage for electronic	via the E-bus
Current consumption via E-bus	typ. 130 mA
Distributed Clocks	yes
Distributed Clocks precision	<< 1 µs
Support NoCoEStorage [▶ 144]	yes
Electrical isolation	500 V (E-bus/field voltage)
Common mode voltage U_{cm}	max. 10 V
Bit width of the process image (default setting)	Inputs: 4 x 16 bit; Status: 4 x 8 bit
Configuration	no address or configuration settings required
Weight	approx. 60 g
Permissible ambient temperature range during operation	-25°C ... +60°C (extended temperature range)
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Mounting [▶ 157]	on 35 mm mounting rail conforms to EN 60715
Enhanced mechanical load capacity	yes, see also Installation instructions for enhanced mechanical load capacity [▶ 160]
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Marking / Approval*)	CE, EAC, UKCA ATEX [▶ 151], cULus [▶ 156]

*) Real applicable approvals/markings see type plate on the side (product marking).

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

2.3.4.3 EL3124-0090 - Connection, display and diagnostics

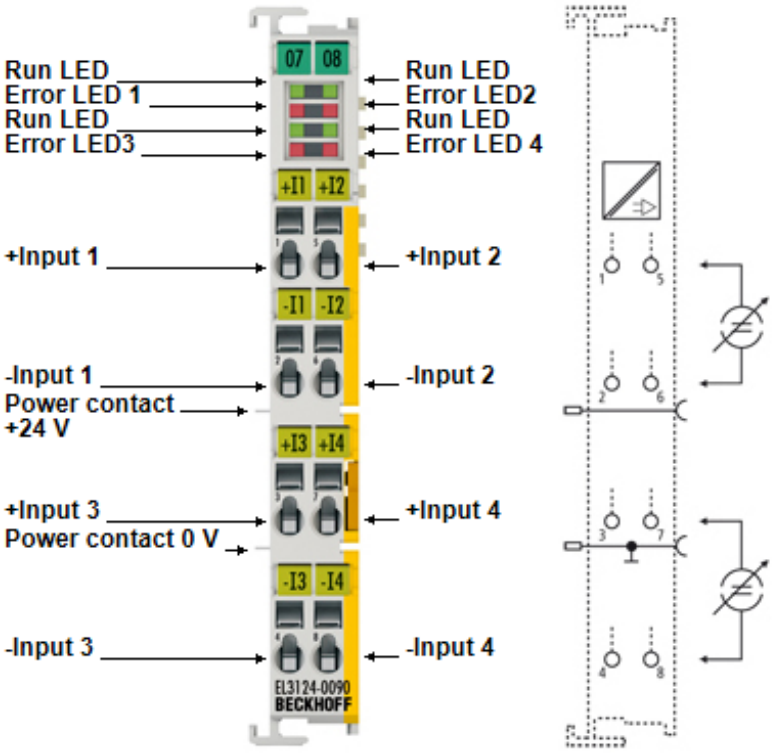


Fig. 25: EL3124-0090 - LEDs and connection

Connection EL3124-0090				
Terminal point		Description	Internally connected with connection	Max. current carrying capacity *)
Name	No.			
+ Input 1	1	+ Input 1	-	40 mA
- Input 1	2	- Input 1	-	40 mA
+ Input 3	3	+ Input 3	-	40 mA
- Input 3	4	- Input 3	-	40 mA
+ Input 2	5	+ Input 2	-	40 mA
- Input 2	6	- Input 2	-	40 mA
+ Input 4	7	+ Input 4	-	40 mA
- Input 4	8	- Input 4	-	40 mA

*) Constant and peak value

GND connection points

The GND connection points of the terminal are not connected internally directly, but via EMC protection components. Therefore, each analog encoder/sensor must be connected separately with 2 wires, even if the connection diagram of the terminal for the channels indicates a common ground (GND).

Current carrying capacity of the input contacts

The maximum permitted current on the signal-relevant terminal points (inputs, GND) is 40 mA (if applicable).

Overcurrent protection of the 20 mA inputs

The current inputs are protected against damage by overcurrent by an internal current limitation, currents > 30mA may occur. In the event of a fault, the current limiter must not be overloaded by a voltage > 30V from the source device.

Overcurrent is displayed in the process image as "Overrange". After occurrence, the error condition must be stopped immediately, the source device switched off or disconnected from the input terminal. If the error condition persists for a longer period of time, the internal terminal current limitation reduces the absorbed signal current for thermal reasons, depending on the ambient conditions also below 20 mA.

LEDs			
LED	**Color**	**Meaning**	
RUN*	green	This LED indicates the terminal's operating state *:	
		off	State of the EtherCAT State Machine [▶ 141]: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates [▶ 493] of the terminal
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different standard-settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager [▶ 223] channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR**	red	Fault indication in the event of undershooting or overshooting of the measuring range	
*) If several RUN LEDs are present, all of them have the same function **) The error display shows the signal processing state for each channel			

2.4 EL314x

2.4.1 EL3141

2.4.1.1 EL3141 - Introduction

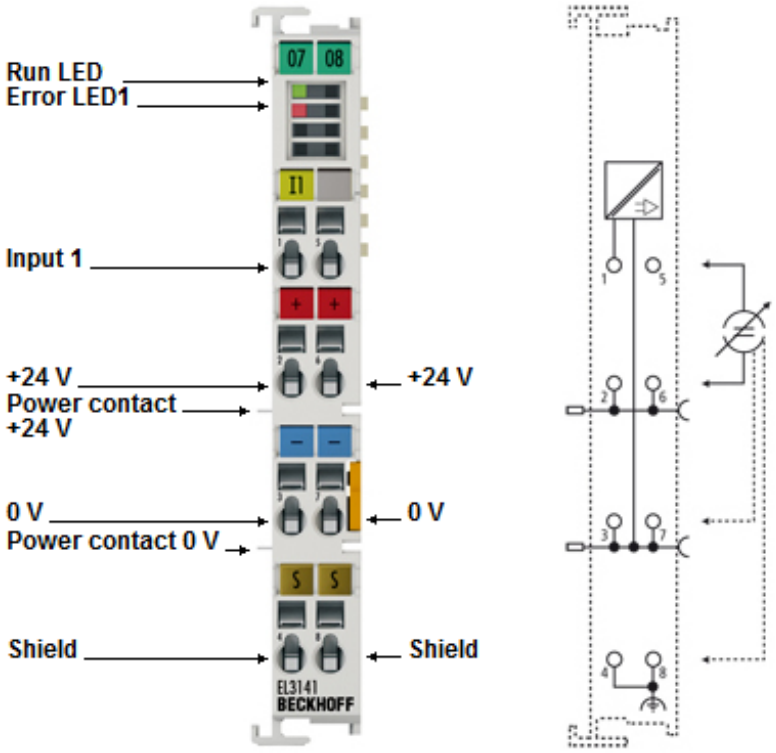


Fig. 26: EL3141

Analog Input Terminal; 1 channel, current, 0…20 mA, 16 bit, single-ended

The job of the EL3141 analog input terminal is to supply power to measuring transducers located in the field, and to transmit analog measurement signals with electrical isolation to the automation device.

The voltage for the sensors is supplied to the terminals via the power contacts. The power contacts can optionally be supplied with operating voltage in the standard way or via a supply terminal (EL9xxx) with electrical isolation.

The input electronics is independent of the supply voltage of the power contacts. The 0 V power contact is the reference potential for the inputs. The EtherCAT Terminal indicates its signal state by means of light emitting diodes..

Quick-Links

- EtherCAT basics
- Process data and operating modes [▶ 247]
- Object description and parameterization [▶ 376]