

Ether**CAT**®

EtherCAT Terminal

Ultra high-speed communication

324 EtherCAT Terminals

EtherCAT 



EtherCAT Terminal

Ethernet Control Automation Technology

298	Product overview
306	System description
310	Features
314	Technical data

316 EtherCAT Couplers

414 Accessories EtherCAT

324 EtherCAT Terminals

828 TwinSAFE

326	Digital input EL1xxx, ES1xxx
336	Digital output EL2xxx, ES2xxx
350	Analog input EL3xxx, ES3xxx
374	Analog output EL4xxx, ES4xxx
382	Position measurement EL5xxx, ES5xxx
386	Communication EL6xxx, ES6xxx
401	Motion terminals EL7xxx, ES7xxx
406	System terminals EL9xxx, ES9xxx

Product overview EtherCAT Terminals

EtherCAT Coupler		Embedded PC	
EtherCAT Coupler E-bus	EK1100 318 E-bus interface (EtherCAT Terminals ELxxxx)	EK1101 318 E-bus interface (EtherCAT Terminals ELxxxx)	Embedded PC with E-bus interface
	EK1501 319 EtherCAT Coupler with ID switch, multimode fibre optic	EK1501-0010 319 EtherCAT Coupler with ID switch, singlemode fibre optic	
EtherCAT Coupler K-bus	BK1120 321 EtherCAT Coupler for K-bus terminals (KLxxxx)	BK1250 321 "Compact" Coupler between E-bus and K-bus terminals	CX80xx 182 Embedded PC with directly integrated E-bus interface
	Bus Coupler	EK3100 322 PROFIBUS Coupler for EtherCAT Terminals	EK9300 323 PROFINET IO Coupler for EtherCAT Terminals
EK5100 322 CANopen Coupler for EtherCAT Terminals		EK9500 323 EtherNet/IP Coupler for EtherCAT Terminals	CX1010 196 Embedded PC, EtherCAT Terminal integration via power supply CX1100-0004
EK5200 322 DeviceNet Coupler for EtherCAT Terminals		EK9700 323 Sercos III Coupler for EtherCAT Terminals	CX5010, CX5020 202 Embedded PC with directly integrated E-bus interface
EK9000 323 Ethernet Coupler for EtherCAT Terminals			CX1020, CX1030 206 Embedded PC, EtherCAT Terminal integration via power supply CX1100-00x4
Extension system	EK1110 320 EtherCAT extension end terminal	EK1122 320 2-port EtherCAT junction	Slave cards
	EK1521 319 1-port EtherCAT multimode fibre optic junction	EK1132 320 2-port Power over EtherCAT junction	
	EK1521-0010 319 1-port EtherCAT singlemode fibre optic junction		
			PCI EtherCAT
			FC1100 709 PCI EtherCAT slave card

Digital input: EL1xxx | ES1xxx

Signal	2-channel	4-channel	8-channel	16-channel	
5 V DC		EL1124 ES1124 332 filter 10 µs			
12 V DC		EL1144 ES1144 332 filter 10 µs			
24 V DC	EL1002 ES1002 329 filter 3.0 ms, type 3, positive switching EL1012 ES1012 329 filter 10 µs, type 3, positive switching EL1202 ES1202 330 T _{on} /T _{off} 1 µs, fast input EL1252 ES1252 330 T _{on} /T _{off} 1 µs, time stamp EL1262 ES1262 330 T _{on} /T _{off} 1 µs, oversampling	EL1004 ES1004 327 filter 3.0 ms, type 3, positive switching EL1014 ES1014 327 filter 10 µs, type 3, positive switching EL1024 ES1024 328 filter 3.0 ms, type 2, positive switching EL1804 331 8 x 24 V, 4 x 0 V, filter 3.0 ms, type 3 EL1104 ES1104 328 filter 3.0 ms, with sensor supply EL1084 ES1084 329 filter 3.0 ms, negative switching EL1904 335 TwinSAFE, 4 safe inputs	EL1034 ES1034 328 filter 10 µs, potential-free inputs EL1814 329 8 x 24 V, 4 x 0 V, filter 10 µs, type 3 EL1114 ES1114 328 filter 10 µs, with sensor supply EL1094 ES1094 331 filter 10 µs, negative switching EL1934 335 PROFIsafe, 4 safe inputs	EL1008 ES1008 326 filter 3.0 ms, type 3, positive switching EL1018 ES1018 326 filter 10 µs, type 3, positive switching EL1808 327 8 x 24 V DC, filter 3.0 ms, type 3 EL1088 ES1088 331 filter 3.0 ms, negative switching EL1098 ES1098 331 filter 10 µs, negative switching	EL1862 329 filter 3.0 ms, flat-ribbon cable, type 3 EL1862-0010 331 filter 3.0 ms, flat-ribbon cable, negative switching EL1872 329 filter 10 µs, flat-ribbon cable, type 3 EL1809 327 filter 3.0 ms, type 3 EL1819 327 filter 10 µs, type 3 EL1859 327 8 inputs, 8 outputs, filter 3.0 ms, type 3, I _{max} = 0.5 A EL1889 331 filter 3.0 ms, negative switching
48 V DC		EL1134 ES1134 333 filter 10 µs			
120 V AC/DC	EL1712 ES1712 333 power contacts				
230 V AC	EL1702 ES1702 333 power contacts EL1722 ES1722 333 no power contacts				
Counter	EL1502 ES1502 334 up/down, 24 V DC, 100 kHz, 32 bit EL1512 ES1512 334 up/down, 24 V DC, 1 kHz, 16 bit				

ELxxxx: Standard EtherCAT Terminals, ESxxxx: EtherCAT Terminals with pluggable wiring level

EN 61131-2 specification: www.beckhoff.com/EN61131-2

Product overview EtherCAT Terminals

Digital output: EL2xxx ES2xxx		
Signal	1-channel	2-channel
5 V DC		
12 V DC		
24 V DC		<p>EL2002 ES2002 340 I_{MAX} = 0.5 A</p> <p>EL2022 ES2022 340 I_{MAX} = 2.0 A</p> <p>EL2032 ES2032 340 I_{MAX} = 2.0 A, with diagnostic</p> <p>EL2042 ES2042 340 2 x 4 A/1 x 8 A</p>
		<p>EL2202 ES2202 338 EL2212 ES2212 339 T_{ON}/T_{OFF} 1 µs, push-pull outputs T_{ON}/T_{OFF} 1 µs, I_{MAX} = 0.5 A, overexcitation, time stamp</p> <p>EL2252 ES2252 339 EL2262 ES2262 339 T_{ON}/T_{OFF} 1 µs, I_{MAX} = 0.5 A, time stamp I_{MAX} = 0.5 A, oversampling</p> <p>EL2902 349 TwinSAFE, 2 safe outputs</p>
Relay (up to 230 V AC)		<p>EL2602 ES2602 346 EL2622 ES2622 347 I_{MAX} = 2.0 A, make contact, power contacts I_{MAX} = 2.0 A, make contact, no power contacts</p> <p>EL2612 ES2612 347 I_{MAX} = 1.0 A, change-over, no power contacts</p>
Triac (up to 230 V AC)		<p>EL2712 ES2712 348 EL2722 ES2722 348 12...230 V AC, 0.5 A, power contacts 12...230 V AC, 1.0 A, mutually locked outputs</p> <p>EL2732 ES2732 348 12...230 V AC, 0.5 A, no power contacts</p>
PWM		<p>EL2502 ES2502 344 PWM output, 24 V DC, 1.0 A</p> <p>EL2535 ES2535 345 EL2545 ES2545 345 24 V DC, 1.0 A, current-controlled 50 V DC, 3.5 A, current-controlled</p>
Frequency output	EL2521 ES2521 343 1...500 kHz	

ELxxxx: Standard EtherCAT Terminals, ESxxxx: EtherCAT Terminals with pluggable wiring level

				EM2xxx
4-channel	8-channel	16-channel	16-channel	
EL2124 ES2124 342				
EL2024-0010 342 <i>I</i> _{MAX} = 2.0 A				
EL2004 ES2004 337 <i>I</i> _{MAX} = 0.5 A	EL2008 ES2008 336 <i>I</i> _{MAX} = 0.5 A		EM2042 340 <i>I</i> _{MAX} = 0.5 A, D-sub connection	
EL2024 ES2024 337 <i>I</i> _{MAX} = 2.0 A		EL2872 340 <i>I</i> _{MAX} = 0.5 A, flat-ribbon cable		
EL2034 ES2034 337 <i>I</i> _{MAX} = 2.0 A, with diagnostic		EL2872-0010 341 <i>I</i> _{MAX} = 0.5 A, flat-ribbon cable, negative switching		
EL2084 ES2084 341 <i>I</i> _{MAX} = 0.5 A, negative switching	EL2088 ES2088 341 <i>I</i> _{MAX} = 0.5 A, negative switching	EL1859 337 8 inputs, 8 outputs, filter 3.0 ms, type 3, <i>I</i> _{MAX} = 0.5 A		
EL2904 349 TwinsAFE, 4 safe outputs		EL2809 336 <i>I</i> _{MAX} = 0.5 A		
EL2934 349 PROFIsafe, 4 safe outputs		EL2889 341 <i>I</i> _{MAX} = 0.5 A, negative switching		
EL2624 ES2624 347 make contact, no power contacts	EL2808 337 <i>I</i> _{MAX} = 0.5 A, 8 x 0 V			

Product overview EtherCAT Terminals

Analog input: EL3xxx ES3xxx					
Signal	1-channel		2-channel		4-channel
±75 mV			EL3602-0010 353 differential input, 24 bit		
0...10 V	EL3061 ES3061 354 single-ended, 12 bit	EL3161 ES3161 355 single-ended, 16 bit	EL3062 ES3062 354 single-ended, 12 bit	EL3162 ES3162 355 single-ended, 16 bit	EL3064 ES3064 354 single-ended, 12 bit
0...30 V			EL3062-0030 354 single-ended, 12 bit		
±10 V	EL3001 ES3001 350 single-ended, 12 bit		EL3002 ES3002 351 single-ended, 12 bit	EL3602 ES3602 353 differential input, 24 bit	EL3702 ES3702 353 16 bit, differential input, oversampling
	EL3101 ES3101 352 differential input, 16 bit		EL3102 ES3102 352 differential input, 16 bit		EL3004 ES3004 351 single-ended, 12 bit
0...20 mA	EL3041 ES3041 356 single-ended, 12 bit, with sensor supply	EL3141 ES3141 358 single-ended, 16 bit, with sensor supply	EL3042 ES3042 356 single-ended, 12 bit, with sensor supply	EL3142 ES3142 358 single-ended, 16 bit, with sensor supply	EL3742 ES3742 359 differential input, 16 bit, oversampling
	EL3011 ES3011 357 differential input, 12 bit	EL3111 ES3111 359 differential input, 16 bit	EL3012 ES3012 357 differential input, 12 bit	EL3112 ES3112 359 differential input, 16 bit	EL3612 ES3612 359 differential input, 24 bit
4...20 mA	EL3051 ES3051 360 single-ended, 12 bit, with sensor supply	EL3151 ES3151 362 single-ended, 16 bit, with sensor supply	EL3052 ES3052 360 single-ended, 12 bit, with sensor supply	EL3152 ES3152 362 single-ended, 16 bit, with sensor supply	EL3054 ES3054 360 single-ended, 12 bit
	EL3021 ES3021 361 differential input, 12 bit	EL3121 ES3121 363 differential input, 16 bit	EL3022 ES3022 361 differential input, 12 bit	EL3122 ES3122 363 differential input, 16 bit	EL3024 ES3024 361 differential input, 12 bit
±10 mA			EL3142-0010 358 single-ended, 16 bit, with sensor supply		
Thermo-couples/mV	EL3311 366 type J, K, L, ...U, 16 bit		EL3312 367 type J, K, L, ...U, 16 bit		EL3314 367 type J, K, L, ...U, 16 bit
Resistance thermometer (RTD)	EL3201 ES3201 364 PT100...1000, Ni100, 16 bit		EL3202 ES3202 365 PT100...1000, Ni100, 16 bit		EL3204 ES3204 365 PT100...1000, Ni100, 16 bit
Potentiometer					
Resistor bridge	EL3351 ES3351 370 strain gauge, 16 bit	EL3356 ES3356 370 strain gauge, 16 bit, self-calibration			
Measurement technology	EL3681 ES3681 371 digital multimeter terminal, 18 bit		EL3403 ES3403 372 3-phase power measurement terminal	EL3692 369 resistance measurement, 10 mΩ...10 MΩ	
Condition monitoring			EL3632 368 IEPE terminal, acceleration sensors		

ELxxxx: Standard EtherCAT Terminals, ESxxxx: EtherCAT Terminals with pluggable wiring level

5-, 8-channel	
EL3164 ES3164 355	EL3068 ES3068 354
single-ended, 16 bit	single-ended, 12 bit, 8-ch.
	EL3008 ES3008 351
	single-ended, 12 bit, 8-channel
EL3144 ES3144 358	EL3048 ES3048 356
single-ended, 16 bit	single-ended, 12 bit, 8-channel
EL3114 ES3114 359	
differential input, 16 bit	
EL3154 ES3154 362	EL3058 ES3058 360
single-ended, 16 bit	single-ended, 12 bit, 8-channel
EL3124 ES3124 363	
differential input, 16 bit	
	EL3318 367
	type J, K, L, ... U, 16 bit, 8-ch.
	EL3255 373
	potentiometer measur. with sensor supply, 5-ch.

Analog output: EL4xxx | ES4xxx

Signal	1-channel	2-channel	4-channel	8-channel
0...10 V	EL4001 ES4001 376 12 bit	EL4002 ES4002 376 12 bit EL4102 ES4102 377 16 bit	EL4004 ES4004 376 12 bit EL4104 ES4104 377 16 bit	EL4008 ES4008 376 12 bit
±10 V	EL4031 ES4031 374 12 bit	EL4032 ES4032 374 12 bit EL4132 ES4132 375 16 bit EL4732 ES4732 375 16 bit, oversampling	EL4034 ES4034 375 12 bit EL4134 ES4134 375 16 bit	EL4038 ES4038 375 12 bit
0...20 mA	EL4011 ES4011 378 12 bit	EL4012 ES4012 378 12 bit EL4112 ES4112 379 16 bit EL4712 ES4712 379 16 bit, oversampling	EL4014 ES4014 378 12 bit EL4114 ES4114 379 16 bit	EL4018 ES4018 378 12 bit
4...20 mA	EL4021 ES4021 380 12 bit	EL4022 ES4022 380 12 bit EL4122 ES4122 381 16 bit	EL4024 ES4024 380 12 bit EL4124 ES4124 381 16 bit	EL4028 ES4028 380 12 bit
±10 mA		EL4112-0010 ES4112-0010 379 16 bit		

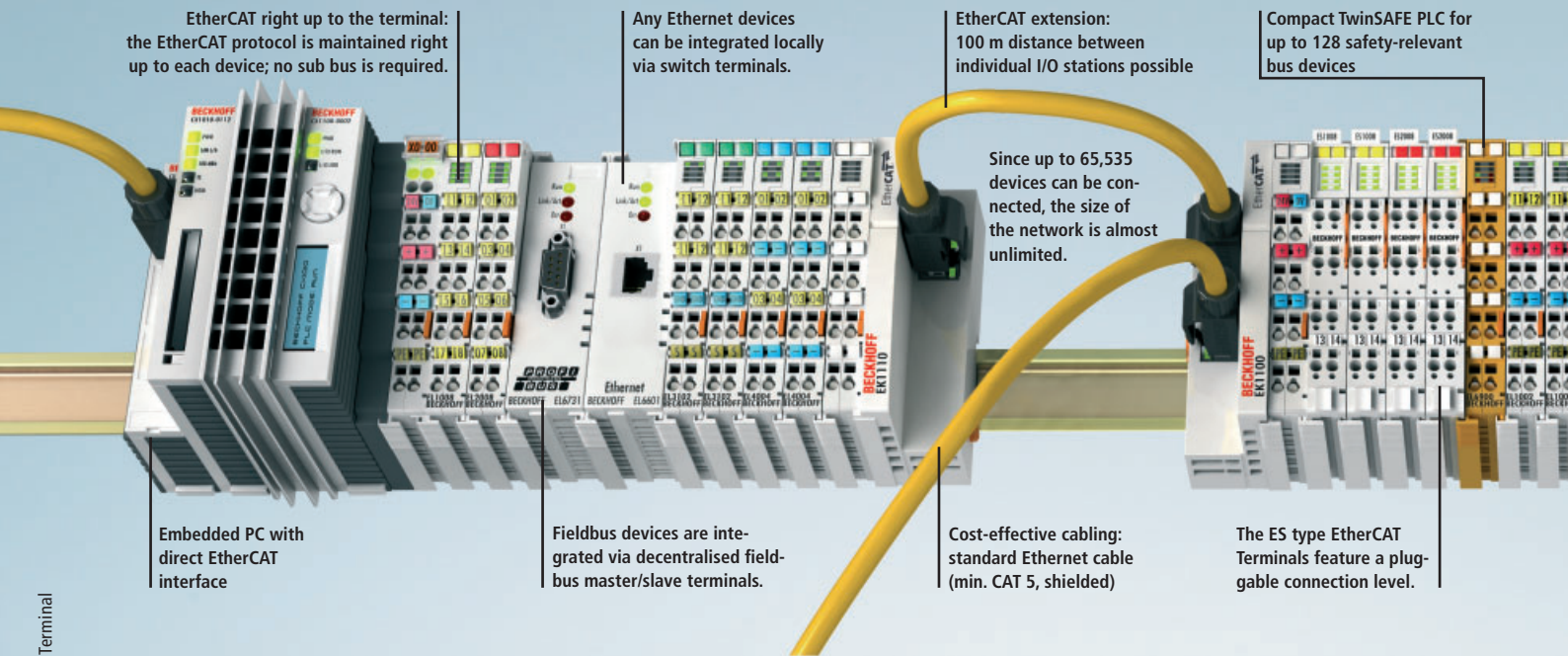
Product overview EtherCAT Terminals

Special functions: EL5xxx ES5xxx, EL6xxx ES6xxx, EL7xxx ES7xxx, EM7xxx				Safety EtherCAT Terminals		
Signal	1-channel		2-channel	4-channel	Signal	
Position measurement	EL5001 ES5001 382	EL5021 ES5021 383	EL5002 ES5002 382		24 V DC	EL1904 335
	SSI encoder interface	SinCos encoder interface, 1 V _{SS}	SSI encoder interface			TwinSAFE, 4 safe inputs
	EL5001-0011 382					EL1934 335
	SSI monitor terminal				PROFIsafe, 4 safe inputs	
	EL5101 ES5101 384	EL5151 ES5151 385	EL5152 ES5152 385			EL2902 349
	incremental encoder interface, differential inputs	incremental encoder interface, 32 bit	incremental encoder interface, 32 bit		TwinSAFE, 2 safe outputs	
Communication	EL6001 ES6001 386	EL6021 ES6021 386	EL6002 386			EL2904 349
	RS232, 115.2 kbaud	RS422/RS485, 115.2 kbaud	RS232, 115.2 kBaud, D-sub			TwinSAFE, 4 safe outputs
	EL6080 387	EL6201 ES6201 391	EL6022 386	EL6224 392		EL2904 349
	memory terminal 128 kbyte	AS-Interface master terminal	RS422/RS485, 115.2 kbaud, D-sub	IO-Link master		TwinSAFE, 4 safe outputs
	EL6601 388		EL6692 390	EL6614 388		EL2934 349
	switch port		EtherCAT bridge terminal	switch port		PROFIsafe, 4 safe outputs
	EL6631 393	EL6688 389	EL6632 393			EL6900 400
	PROFINET IO controller/device terminal	IEEE 1588 master/slave	PROFINET IRT controller			TwinSAFE PLC
	EL6720 394					
	Lightbus master terminal					
	EL6731 395	EL6731-0010 395				
	PROFIBUS master terminal	PROFIBUS slave terminal				
		EL6740-0010 396				
	Interbus slave terminal					
EL6751 397	EL6751-0010 397					
CANopen master terminal	CANopen slave terminal					
EL6752 398	EL6752-0010 398					
DeviceNet master terminal	DeviceNet slave terminal					
EL6851 399	EL6851-0010 399					
DMX master	DMX slave					
Motion	EL7031 ES7031 402		EL7332 ES7332 404			
	stepper motor terminal, I _{max} = 1.5 A, 24 V		DC motor output stage, 24 V DC, 1.0 A			
EL7041 ES7041 402		EL7342 ES7342 404	EM7004 401			
stepper motor terminal, I _{max} = 5.0 A, 50 V, incremental encoder interface		DC motor output stage, 50 V DC, 3.5 A, incremental encoder interface	3 incremental encoders, 16 digital inputs 24 V DC, 16 digital outputs 24 V DC, 4 analog inputs ±10 V			

ELxxxx: Standard EtherCAT Terminals, ESxxxx: EtherCAT Terminals with pluggable wiring level

System terminals: EL9xxx | ES9xxx

Signal	System	Signal	Potential supply	Power supply and accessories
System	EL9011 408 bus end cap	24 V DC	EL9100 ES9100 406	EL9400 ES9400 410 input 24 V DC, E-bus power supply, 2 A
	EL9070 407 shield terminal		EL9110 ES9110 406 diagnostic	EL9410 ES9410 410 input 24 V DC, output 5 V/2 A
	EL9080 407 isolation terminal		EL9200 407 with fuse	EL9505 ES9505 411 input 24 V DC, output 5 V DC, 0.5 A
	EL9180 ES9180 408 potential distribution terminal, 2 clamping units per power contact		EL9210 407 diagnostic, with fuse	EL9508 ES9508 411 input 24 V DC, output 8 V DC, 0.5 A
	EL9184 409 potential distribution, 8 x 24 V DC, 8 x 0 V DC		EL9210 407 diagnostic, with fuse	EL9510 ES9510 411 input 24 V DC, output 10 V DC, 0.5 A
	EL9185 ES9185 408 potential distribution terminal, 4 clamping units at 2 power contacts		EL9520 ES9520 410 AS-Interface potential supply with filter	EL9512 ES9512 411 input 24 V DC, output 12 V DC, 0.5 A
	EL9186 ES9186 409 potential distribution terminal, 8 x 24 V	50 V DC		EL9515 ES9515 411 input 24 V DC, output 15 V DC, 0.5 A
	EL9187 ES9187 409 potential distribution terminal, 8 x 0 V			EL9540 ES9540 412 surge filter terminal for field supply
	EL9188 409 potential distribution, 16 x 24 V DC	120... 230 V AC	EL9150 ES9150 406 with LED	EL9550 ES9550 412 surge filter terminal for system/field supply
	EL9189 409 potential distribution, 16 x 0 V DC		EL9160 ES9160 406 diagnostic	EL9560 ES9560 411 input 24 V DC, output 24 V DC, 0.1 A with electrical isolation
	EL9195 ES9195 407 shield terminal		EL9190 ES9190 407 diagnostic	EL9570 ES9570 413 buffer capacitor terminal, 500 µF, 50 V DC
			EL9250 407 with fuse, with LED	
			EL9260 407 diagnostic, with fuse	
			EL9290 407 with fuse	



EtherCAT right up to the terminal: the EtherCAT protocol is maintained right up to each device; no sub bus is required.

Any Ethernet devices can be integrated locally via switch terminals.

EtherCAT extension: 100 m distance between individual I/O stations possible

Compact TwinSAFE PLC for up to 128 safety-relevant bus devices

Since up to 65,535 devices can be connected, the size of the network is almost unlimited.

Embedded PC with direct EtherCAT interface

Fieldbus devices are integrated via decentralised fieldbus master/slave terminals.

Cost-effective cabling: standard Ethernet cable (min. CAT 5, shielded)

The ES type EtherCAT Terminals feature a plug-gable connection level.

Beckhoff EtherCAT Terminals

In analogy to the Beckhoff Bus Terminals, the EtherCAT Terminal system is a modular I/O system consisting of electronic terminal blocks. In contrast to Bus Terminals, where the fieldbus signal is implemented within the Bus Coupler on the internal, fieldbus-independent terminal bus, the EtherCAT protocol remains fully intact down to the individual terminal. In addition to EtherCAT Terminals with E-bus connection, the proven standard Bus Terminals with K-bus connection can also be connected via the BK1120 EtherCAT Bus Coupler. This ensures compatibility and continuity with the existing system. Existing and future investments are protected.

Structure

The robust housing, secure contacts and the solidly built electronics are prominent features of Beckhoff components. An I/O station consists of an EtherCAT Coupler and almost any number of terminals. Since up to 65,535 devices can be connected, the size of the network is almost unlimited.

The electronic terminal blocks are attached to the EtherCAT Coupler. The contacts are made as the terminal clicks into place, without any other manipulation. This means that each electronic terminal block can be individually exchanged. It can be placed on a standard DIN rail.

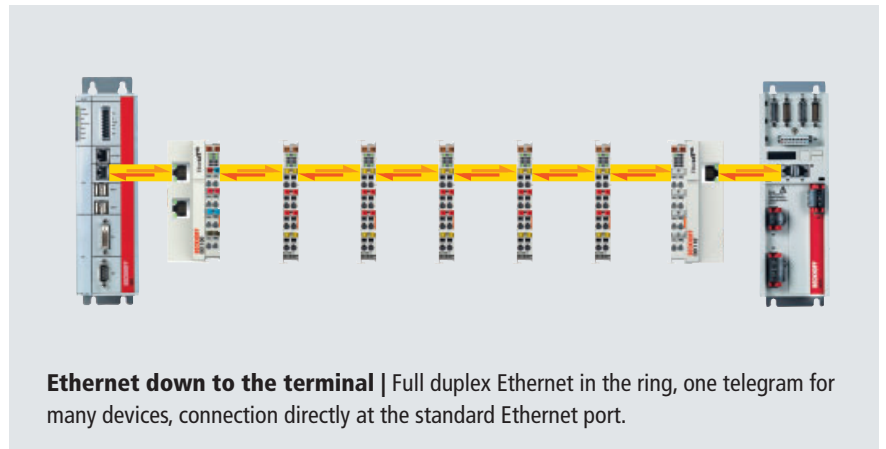
Like the Beckhoff Bus Terminals, the outer contour of the EtherCAT Terminals perfectly adapts to the dimensions of terminal boxes. A clearly arranged connection panel with LEDs for status display and push-in contact labels ensures clarity in the field. 3-wire conductors with an additional connection for a protective conductor, enable direct connection of sensors and actuators.

Free mix of signals

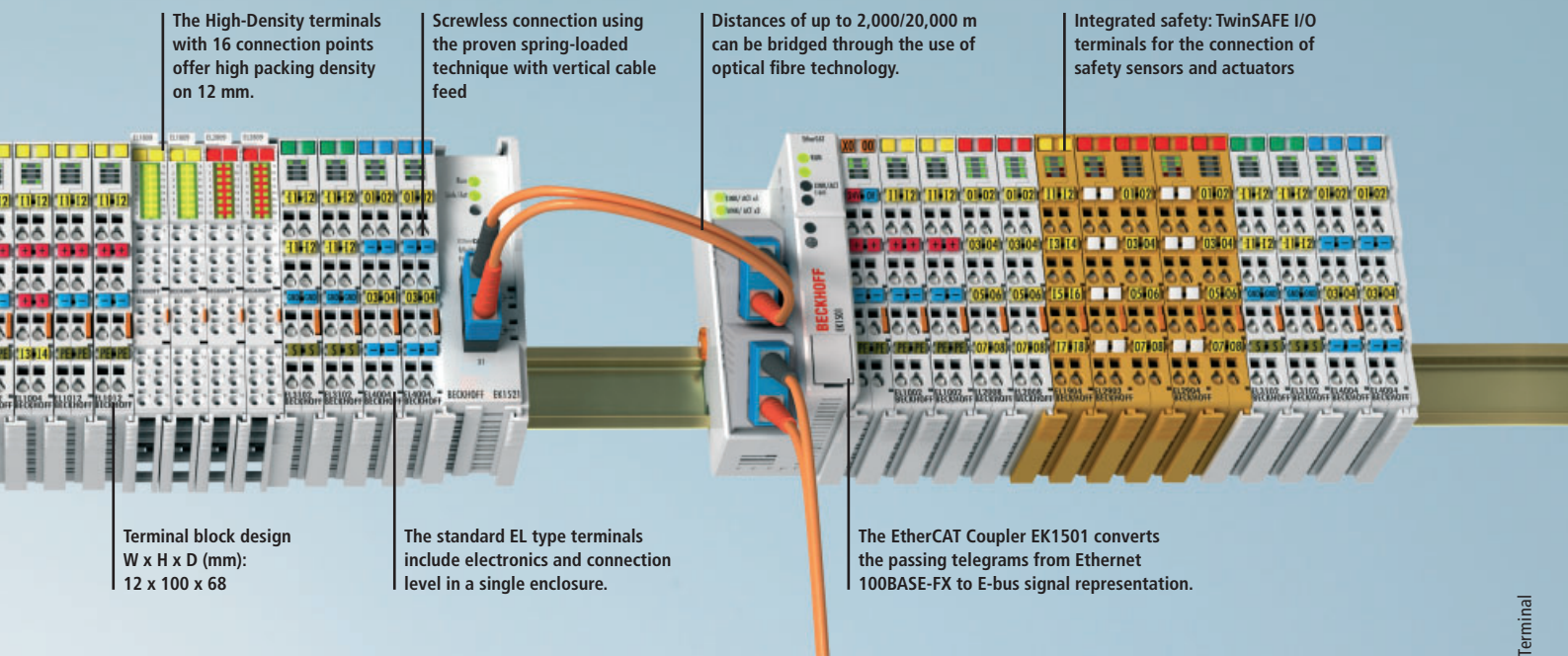
Suitable EtherCAT Terminals are available for all common digital and analog signal types encountered in the world of automa-

tion. Fieldbus devices, e.g. for PROFIBUS, PROFINET, CANopen, DeviceNet, Interbus, IO-Link or Lightbus, are integrated via local fieldbus master/slave terminals. Removal of the fieldbus master saves PCI slots in the PC. Any Ethernet devices can be integrated locally via switch port terminals.

The fine granularity of the EtherCAT Terminals enables bit-precise composition of the required I/O channels. The digital EtherCAT Terminals are designed as 2-, 4-, 8- or 16-channel terminals. In the 16-channel variant, digital input and output signals are arranged in an ultra-compact way within



Ethernet down to the terminal | Full duplex Ethernet in the ring, one telegram for many devices, connection directly at the standard Ethernet port.



The High-Density terminals with 16 connection points offer high packing density on 12 mm.

Screwless connection using the proven spring-loaded technique with vertical cable feed

Distances of up to 2,000/20,000 m can be bridged through the use of optical fibre technology.

Integrated safety: TwinSAFE I/O terminals for the connection of safety sensors and actuators

Terminal block design
W x H x D (mm):
12 x 100 x 68

The standard EL type terminals include electronics and connection level in a single enclosure.

The EtherCAT Coupler EK1501 converts the passing telegrams from Ethernet 100BASE-FX to E-bus signal representation.

a standard terminal housing across a width of only 12 mm. The standard analog signals of -10...+10 V, 0...10 V, 0...20 mA and 4...20 mA are all available as 1-, 2-, 4- and 8-channel variants within a standard housing.

Flexible connection system

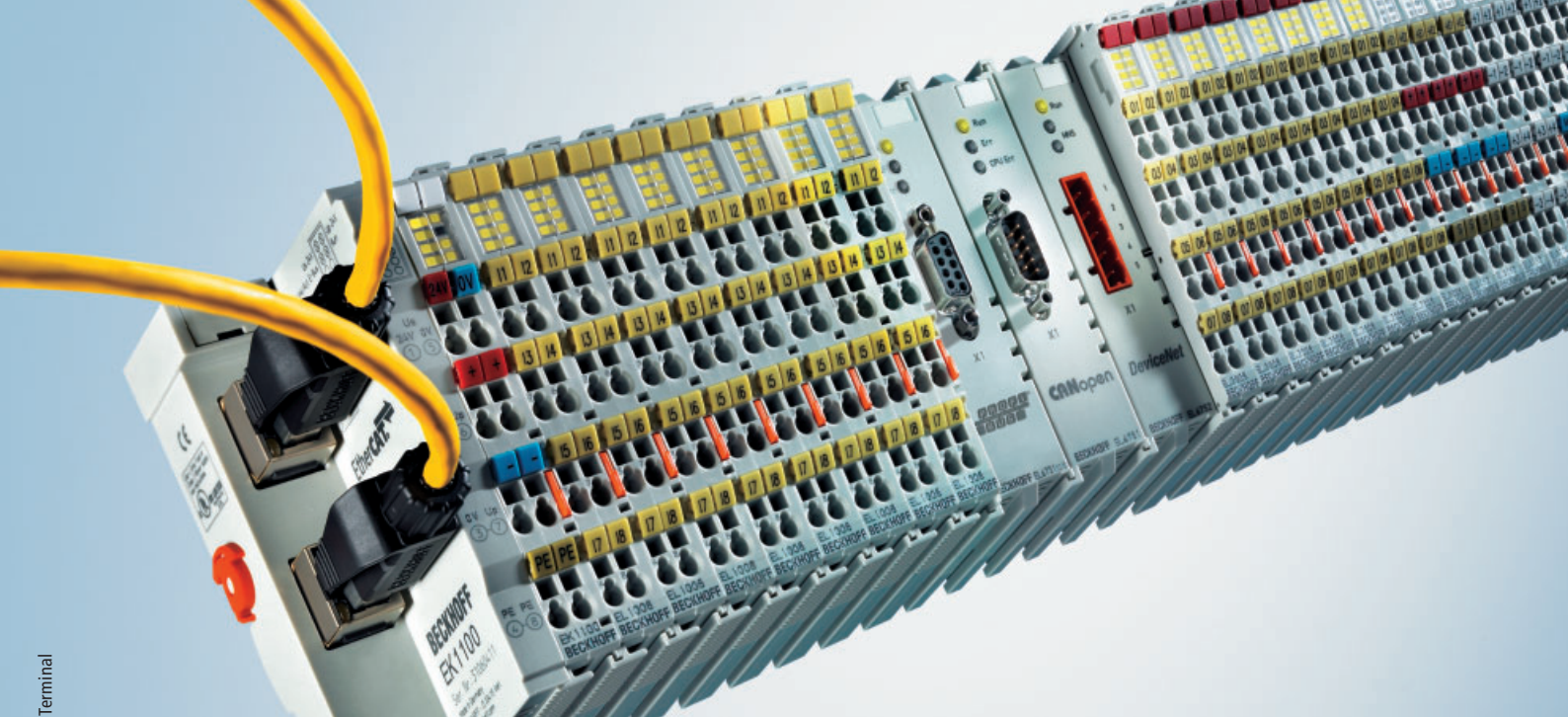
The EtherCAT Terminal system offers different connection options for optimum adaptation to the respective application. The ELxxxx EtherCAT Terminals include electronics and connection level in a single enclosure. The ESxxxx type EtherCAT Terminals feature a pluggable connection level.

The ES series Bus Terminals enable the complete wiring to be removed as a plug connector from the top of the housing for servicing.

Bus Coupler for the EtherCAT Terminal system

The Bus Couplers from the EKxxxx series connect conventional fieldbus systems to EtherCAT. The ultra-fast, powerful I/O system with its large choice of terminals is now available for other fieldbus and Industrial Ethernet systems. EtherCAT makes a very flexible topology configuration possible. Thanks to the Ethernet physics, long dis-

tances can also be bridged without the bus speed being affected. When changing to the field level – without a control cabinet – the IP 67 EtherCAT Box modules (EPxxxx) can also be connected to the EKxxxx. The EKxxxx Bus Couplers are fieldbus slaves and contain an EtherCAT master for the EtherCAT Terminals. The EKxxxx is integrated in exactly the same way as the Bus Couplers from the BKxxxx series via the corresponding fieldbus system configuration tools and the associated configuration files, such as GSD, ESD or GSDML. The TwinCAT-programmable variant is the CX8000 Embedded PC series.



Flexible connection system

ELxxxx | Standard wiring



The EtherCAT Terminal system offers different connection options for optimum adaptation to the respective application. The ELxxxx EtherCAT Terminals include electronics and connection level in a single enclosure. The ESxxxx type EtherCAT Terminals feature a pluggable connection level. All terminal types are bus-neutral and can be combined as required.

The standard EL EtherCAT Terminals have been tried and tested for years. They feature integrated screwless spring-loaded technique for fast and simple assembly.



The HD EtherCAT Terminals (High Density) with 16 terminal points are distinguished by a particularly compact design, as the packaging density is twice as large as that of the standard 12 mm EtherCAT Terminals. Single-wire conductors and conductors with a wire end sleeve can be inserted directly into the spring loaded terminal point without tools.

ESxxxx | Pluggable wiring



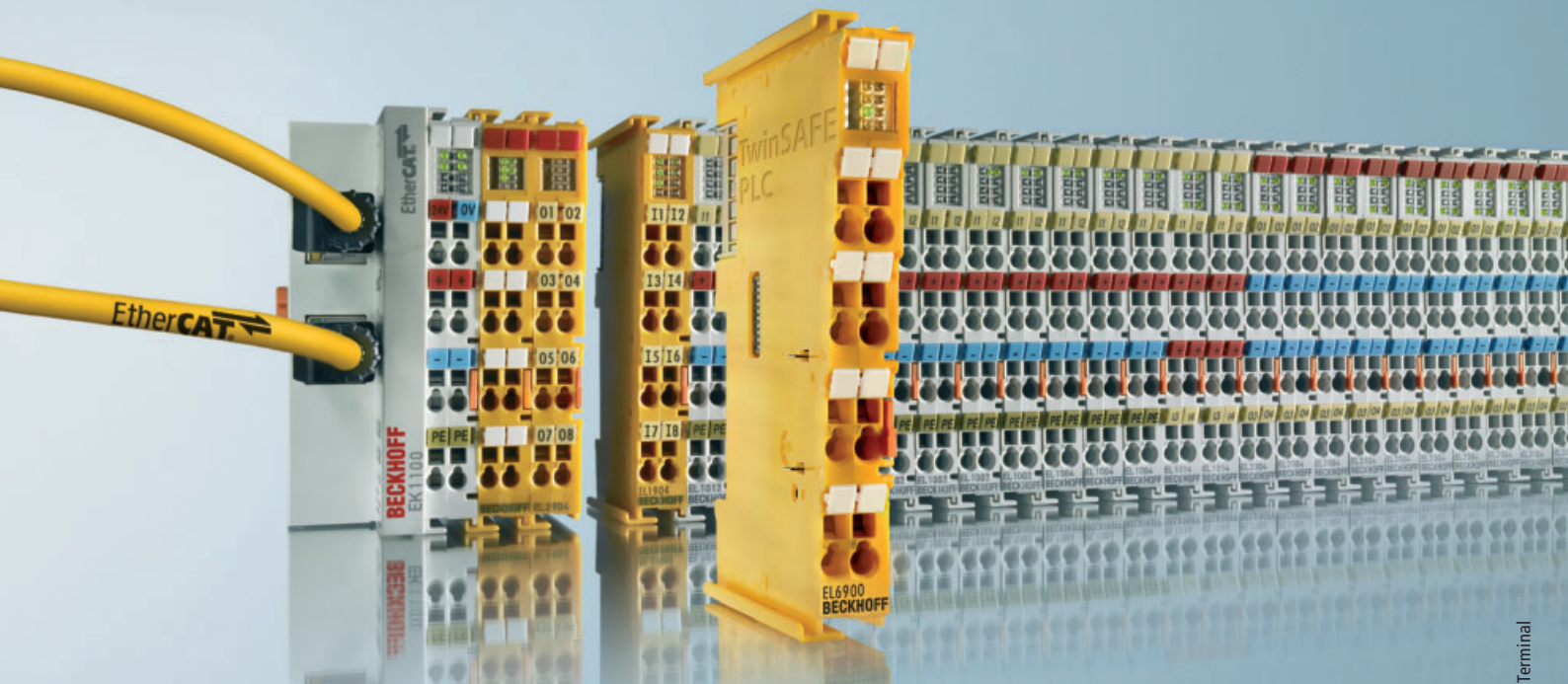
The ES type EtherCAT Terminals feature a pluggable connection level. The assembly and wiring procedure for the ES series is the same as for the EL series. The ES series EtherCAT Terminals enable the complete wiring to be removed as a plug connector from the top of the housing for servicing. The lower section can be removed from the EtherCAT Terminal assembly by pulling the unlocking tab. Insert the new component and plug in the connector with the wiring. This reduces the installation time and eliminates the risk of wires being mixed up.

The familiar dimensions of the EtherCAT Terminal only had to be changed slightly. The new connector adds about 3 mm. The maximum height of the EtherCAT Terminal remains unchanged.

The overview and nomenclature of the product names has been retained: The plug connector variant is identified in the part number by an additional letter.

Conductor cross sections between 0.08 mm² and 2.5 mm² can continue to be used with the proven spring-loaded technique.

A tab for strain relief of the cable simplifies assembly in many applications and prevents tangling of individual connection wires when the connector is removed.



TwinSAFE: Safety and I/O technology in one system

TwinSAFE – the safety solution from Beckhoff – integrates safety functionalities into the existing control architecture. TwinSAFE from Beckhoff provides a consistent hardware and software technology for achieving integrated and simplified handling, ranging from safe input and output terminals and safe miniature controllers for the Bus Terminal system and the AX5000 Servo Drives to the PC-based Safety PLC.

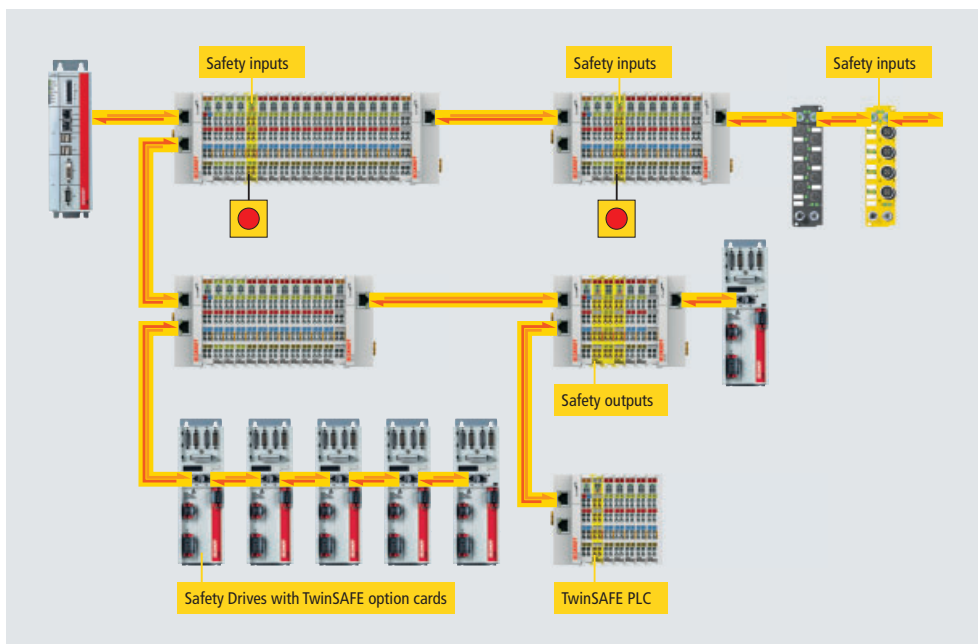
The following TwinSAFE EtherCAT Terminals are available:

- EL1904 | 4-channel digital input
- EL1934 | 4-channel digital input, PROFI-safe
- EL2902 | 2-channel digital output
- EL2904 | 4-channel digital output
- EL2934 | 4-channel digital output, PROFI-safe
- EL6900 | TwinSAFE PLC

In addition, TwinSAFE is available in IP 67:

- EP1908 | 8-channel digital input

For further information on TwinSAFE and the TwinSAFE products see page [828](#)



Open control technology for safety integration: the TwinSAFE protocol enables transfer of safety-relevant data via any medium.

EtherCAT Terminal features

EtherCAT down to the terminal: the EtherCAT protocol is maintained down to each device; no sub bus is required.

Status LEDs for secure commissioning

Terminal block design
W x H x D (mm):
12 x 100 x 68

EtherCAT Terminals

Embedded PC with direct E-bus interface

Protection of investment: fieldbus devices are integrated via decentralised fieldbus master/slave terminals.

Any Ethernet device can be integrated locally via switch port terminals.

Compatibility and integration: in addition to EtherCAT Terminals, the tried and tested Bus Terminals can also be connected via the BK1120 EtherCAT Bus Coupler.

EtherCAT®

Beckhoff EtherCAT Terminals



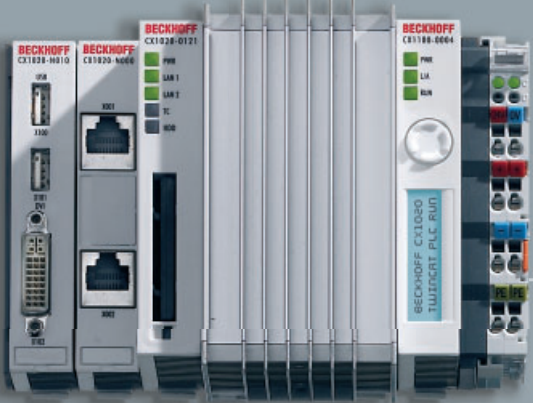
EK EtherCAT Coupler series



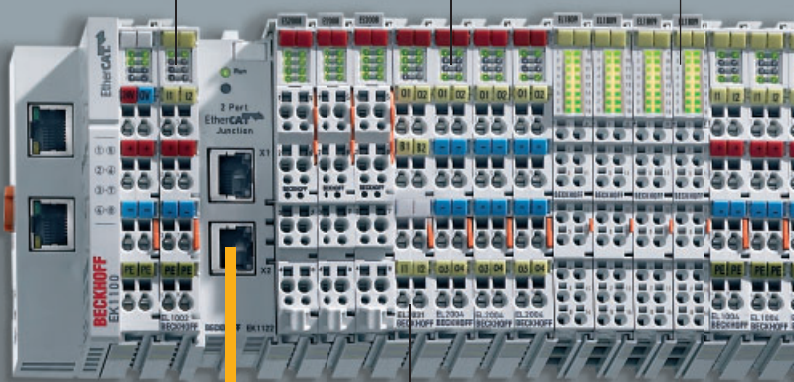
Bus Coupler, e.g. PROFIBUS, PROFINET



CX8000 Embedded PC series with integrated fieldbus slave



Embedded PC series CX for PLC and Motion Control applications

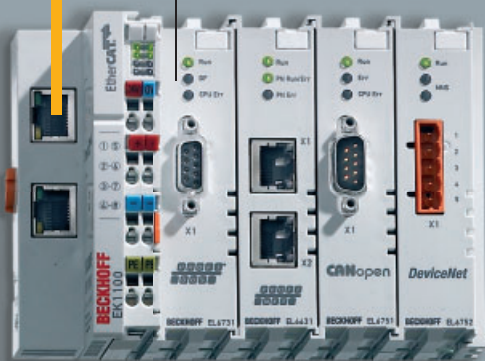


Free mix of signals: more than 200 different EtherCAT Terminals enable connection of all common sensors and actuators.

The EtherCAT Terminals with 16 connection points offer high packing density on 12 mm.

EtherCAT motion terminals for stepper motors, DC motors or hydraulic valves

Optional fieldbus integration via decentralised fieldbus master/slave terminals

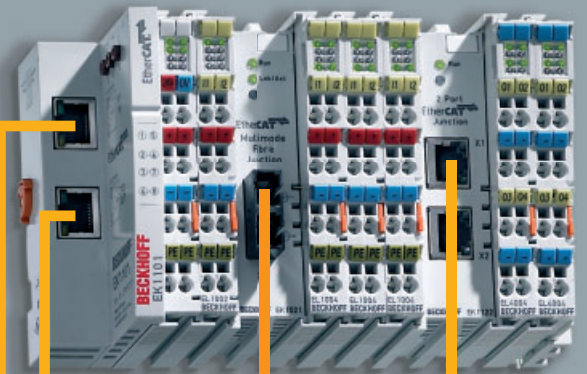


Compact Safety PLC for TwinSAFE for up to 128 safety-relevant bus devices

Ultra-fast I/O terminals for I/O response times $< 100 \mu\text{s}$ for fast I/O, oversampling and time stamp

Power over EtherCAT junction

Advanced measurement technology based on EtherCAT and XFC: high-speed measurement, high-precision measurement, Condition Monitoring, energy monitoring, closed loop control



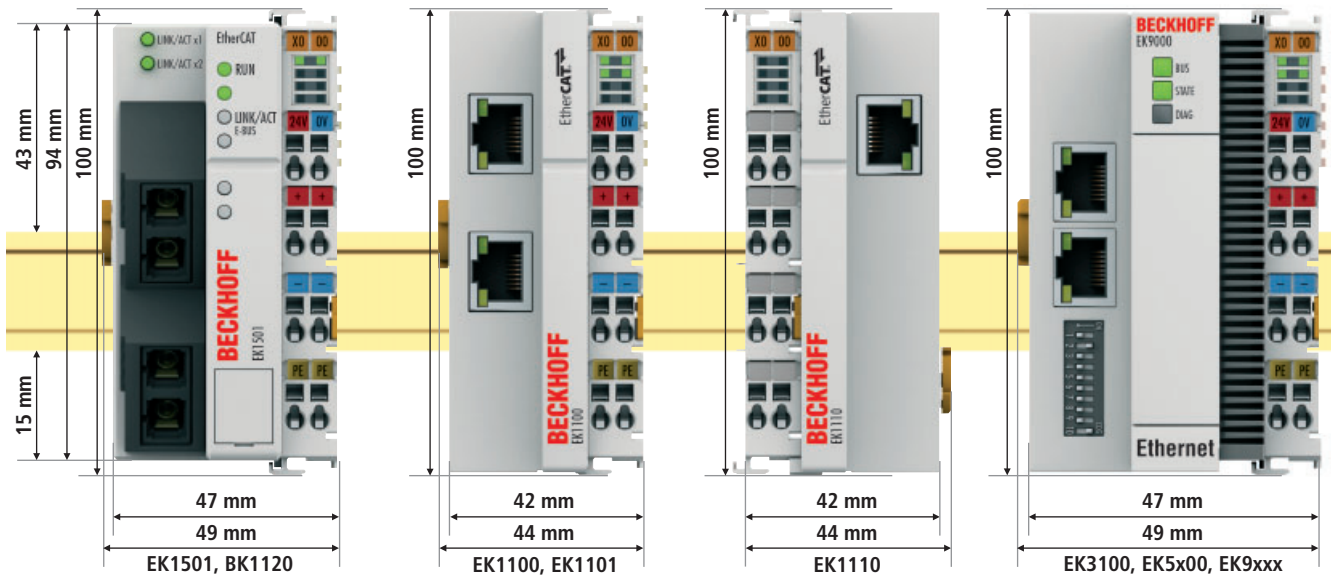
2,000/20,000 m fibre optic (100BASE-FX)

100 m Industrial Ethernet cable (100BASE-TX)



IP 67 EtherCAT Box





Technical data – EtherCAT Coupler housing

The EtherCAT Coupler electronics can be mounted in a variety of housings. A housing has three power contacts, which, if the application requires, automatically implement a continued connection, carrying the potential of the power circuit to the next EtherCAT Terminal. The supply voltage that is connected to the coupler spring-loaded terminals is 24 V DC. If a different voltage is required for the power contacts, the appropriate power feed terminal must be inserted after the coupler.

Mechanical data	EK1501, BK1120	EK1100, EK1101, EK1110	EK3100, EK5x00, EK9xxx
Design form	compact terminal housing with signal LED		
Material	polycarbonate		
Dimensions (W x H x D)	49 mm x 100 mm x 68 mm	44 mm x 100 mm x 68 mm	65 mm x 100 mm x 80 mm
Installation	on 35 mm DIN rail, conforming to EN 50022 with lock		
Side by side mounting by means of	double slot and key connection		
Marking	standard terminal block marking and plain language slides (8 mm x 47 mm)		
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27/29		
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4		
Connection	EK1501, BK1120, EK1100, EK1101, EK1110, EK3100, EK5x00, EK9xxx		
Wiring	spring-loaded technique		
Connection cross-section	0.08...2.5 mm ² , AWG 28-14, stranded wire, solid wire		
Stripping length	8...9 mm		
Fieldbus connection	depending on fieldbus		
Power contacts	3 spring contacts		
Current load	I _{max} : 10 A (125 A short-circuit)		
Nominal voltage	24 V DC		



Technical data – EtherCAT Terminal housing

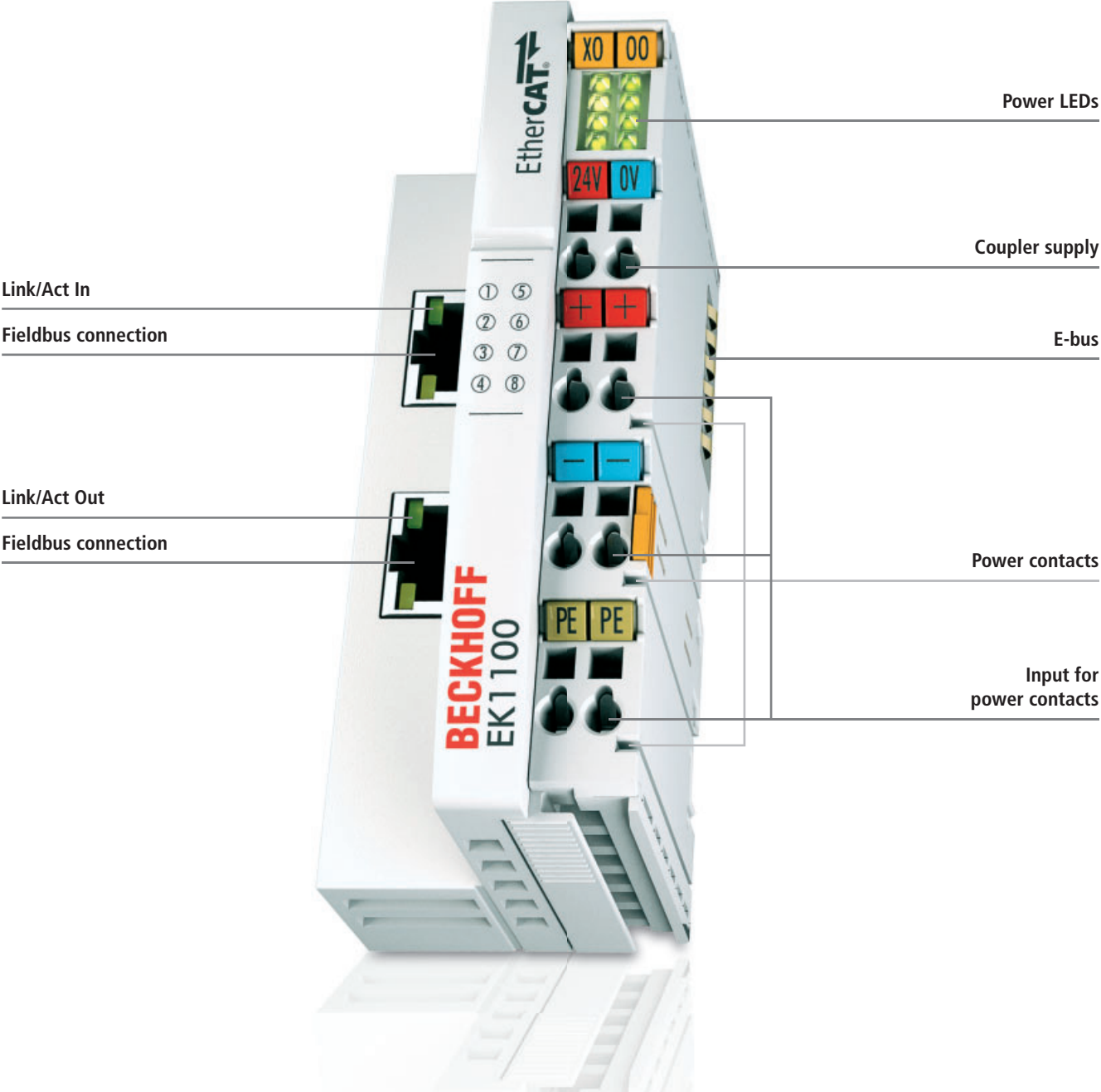
The EtherCAT Terminals have different housings. They are available with up to three power contacts and can have a variety of voltages. Care should be taken to ensure that a change in voltage always starts with a power feed terminal.

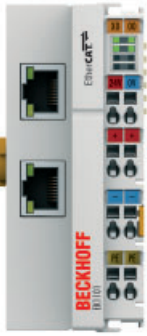
Mechanical data	ELxxxx, BK1250	EL66xx, EL67xx, EK1122, EK1521	ESxxxx	ELx80x, ELx81x, ELx889	EL1862, ELx872
Design form	compact terminal housing with signal LED	compact terminal housing with signal LED	terminal housing with pluggable wiring level	compact terminal housing with signal LED	compact terminal housing with signal LED
Material	polycarbonate				
Dimensions (W x H x D)	12/24 mm x 100 mm x 68 mm	24 mm x 100 mm x 68 mm	12/24 mm x 100 mm x 71 mm	12 mm x 100 mm x 68 mm	12 mm x 100 mm x 68 mm
Installation	on 35 mm DIN rail, conforming to EN 50022 with lock				
Side by side mounting by means of	double slot and key connection				
Marking	standard terminal block marking	–	standard terminal block marking	–	standard terminal block marking
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27/29				
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4				

Connection	ELxxxx, BK1250	EL66xx, EL67xx, EK1122, EK1521	ESxxxx	ELx80x, ELx81x, ELx889	EL1862, ELx872
Wiring	spring-loaded technique	specific push-in connection	spring-loaded technique	direct plug-in technique	flat-ribbon cable connection
Connection cross-section	s, st*: 0.08...2.5 mm ² , AWG 28-14	–	s, st*: 0.08...1.5 mm ²	s*: 0.08...1.5 mm ² ; st: 0.25...1.5 mm ² ; f: 0.14...0.75 mm ²	common flat-ribbon cables
Stripping length	8...9 mm	–	9...10 mm	8...9 mm	–
Fieldbus connection	depending on fieldbus				
Power contacts	3 spring contacts				
Current load	I _{MAX} : 10 A (125 A short-circuit)				
Nominal voltage	24 V DC				

*s: solid wire; st: stranded wire; f: ferrule

EKxxxx | EtherCAT Coupler





E-bus EtherCAT Coupler

An I/O station consists of an EtherCAT Coupler and almost any number of terminals. The EtherCAT protocol is maintained right down into the individual terminal.

K-bus EtherCAT Coupler

EtherCAT Couplers with K-bus connection can also be used to connect Beckhoff Bus Terminals. This way, compatibility and consistency with existing system are guaranteed.

EtherCAT Couplers with optical fibre connection

EtherCAT Couplers with optical fibre connection can be used to link devices over large distances:

- multimode glass fibre: up to 2 km
- singlemode glass fibre: up to 20 km

E-bus Bus Coupler

The Bus Couplers for EtherCAT Terminals are used to connect conventional fieldbus systems with EtherCAT.

The EtherCAT Couplers are the link between the EtherCAT protocol at the fieldbus level and E-bus-based EL/ES/EM terminals. Different versions are available, depending on:

- which physical layer is used 'on the left', i.e. on the fieldbus side;
- whether the coupler supports Hot Connect functionality,
- and whether it has a dedicated, local PLC/small controller.

In a traditional fieldbus the coupler can be the most complex and most expensive element, since it has to translate between the fieldbus protocol level and the terminal bus I/O level, which can be complex and time-consuming. This often results in delays and inconsistent access to parameters and diagnostic data in the individual downstream devices.

In EtherCAT systems the coupler is one of the simplest devices. It has almost no dedicated intelligence, but merely transforms the electrical physical layer without changing the data structure: EtherCAT means integrated communication down to the last terminal. The EtherCAT Couplers of the EK1xxx series are currently available with copper-based RJ 45 connectors or optical fibre connectors. The number of downstream terminals is almost unlimited and is subject to only two conditions. In an EtherCAT network a maximum of 65,535 slaves are permitted. If necessary, the E-bus current has to be supplemented with an EL9410 E-bus power supply unit.

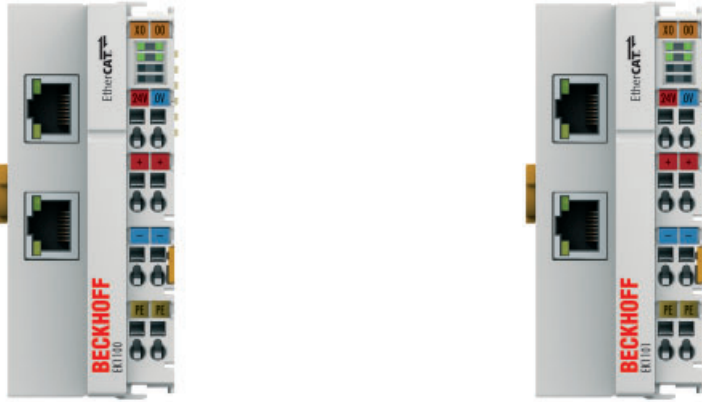
Some couplers support Hot Connect functionality. They have three hexadecimal ID switches on the side, which enable ID

settings between 0 and 4,095. The EtherCAT master detects a terminal station at this ID if it is connected to an EK1122 or EK1521 junction terminal at any point in the network during operation. In the TwinCAT System Manager the corresponding terminal station (coupler and terminals) has to be defined as a Hot Connect group.

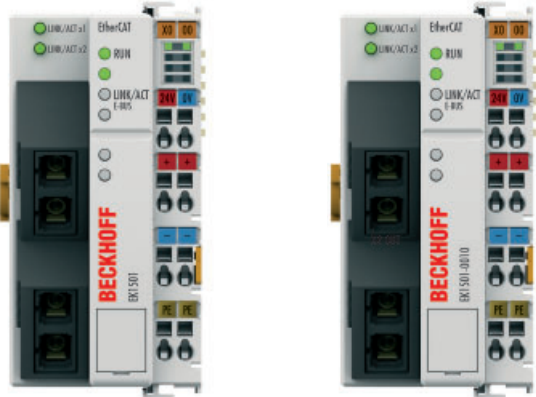

Couplers from the EK3xxx or EK9xxx series are available for integrating the EtherCAT Terminals in a fieldbus other than EtherCAT. They feature a microcontroller that deals with the data management and the data transfer between the different bus systems: EtherCAT on the right-hand terminal side and the fieldbus protocol on the left.

Technical data	EKxxxx
Electrical isolation	500 V
Operating/storage temperature	0...+55 °C/-25...+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27/29
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protect. class/installation pos.	IP 20/variable (see documentation)




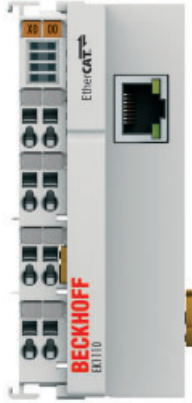
EtherCAT Coupler E-bus

	EtherCAT Coupler	EtherCAT Coupler with ID switch, Hot Connect
Technical data	EK1100	EK1101
Task within EtherCAT system	coupling of EtherCAT Terminals (ELxxxx) to 100BASE-TX EtherCAT networks	coupling of EtherCAT Terminals (ELxxxx) to 100BASE-TX EtherCAT networks, with identity verification
Number of EtherCAT Terminals	up to 65,534	
Protocol	EtherCAT	EtherCAT
Data transfer rates	100 Mbaud	100 Mbaud
		
	<p>The EK1100 and EK1101 EtherCAT Couplers connect 100BASE-TX EtherCAT with the EtherCAT Terminals and are equipped with two RJ 45 sockets. A station consists of one coupler, any number of EtherCAT Terminals (ELxxxx, ESxxxx, EMxxxx) and a bus end cap. The coupler converts the passing telegrams from Ethernet 100BASE-TX to E-bus signal representation.</p> <p>The coupler is connected to the network via the upper Ethernet interface. The lower RJ 45 socket may be used to connect further EtherCAT devices in the same strand. The couplers do not need to be parameterised and are treated as EtherCAT slaves without process data.</p> <p>The EK1101 has three hexadecimal ID switches, with which an ID can be assigned to the coupler station. This group can be located at any position within the EtherCAT network. Variable topologies are therefore easily implementable.</p>	
Bus interface	2 x RJ 45	2 x RJ 45
Type/number of peripheral signals	max. 4.2 GB addressable I/O points	max. 4.2 GB addressable I/O points
Data transfer medium	Ethernet/EtherCAT cable (min. CAT 5), shielded	Ethernet/EtherCAT cable (min. CAT 5), shielded
Current consumption 24 V DC	typ. 70 mA	typ. 70 mA
Distance between stations	max. 100 m (100BASE-TX)	max. 100 m (100BASE-TX)
Delay	approx. 1 µs	approx. 1 µs
Power supply	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consumption E-bus	–	–
Weight	approx. 105 g	approx. 105 g
Approvals	CE, UL, Ex	CE, UL, Ex
Further information	www.beckhoff.com/EK1100	www.beckhoff.com/EK1101
Accessories		
Cordsets and connectors	see page 414	see page 414

EtherCAT Couplers and junctions with fibre optic connection



	EtherCAT Coupler with ID switch, multimode fibre optic connection, Hot Connect	EtherCAT Coupler with ID switch, singlemode fibre optic connection, Hot Connect	1-port EtherCAT multimode fibre optic junction, Hot Connect	1-port EtherCAT singlemode fibre optic junction, Hot Connect
	EK1501	EK1501-0010	EK1521	EK1521-0010
	coupling of EtherCAT Terminals (ELxxxx) to 100BASE-FX EtherCAT networks, with identity verification up to 65,534		coupling of EtherCAT junctions via multimode glass fibre	coupling of EtherCAT junctions via singlemode glass fibre
	EtherCAT	EtherCAT	EtherCAT	EtherCAT
	100 Mbaud	100 Mbaud	100 Mbaud	100 Mbaud
				
	<p>The EK1501 and EK1501-0010 EtherCAT Couplers connect fibre optic-based EtherCAT with the EtherCAT Terminals and have SC duplex sockets. The coupler converts the passing telegrams from Ethernet 100BASE-FX to E-bus signal representation. The coupler is connected to the network via the upper interface. The lower SC socket may be used to connect further EtherCAT devices in the same strand. The couplers do not have to be parameterised. They are treated as EtherCAT slaves without process data. Both couplers have three hexadecimal ID switches for assigning an ID to a group of EtherCAT components. This group can then be located at any position within the EtherCAT network.</p>		<p>In conjunction with an EK1100 EtherCAT Coupler, the 1-port EtherCAT fibre optic junction enables conversion from 100BASE-TX to 100BASE-FX physics (glass fibre). Distances of up to 2 km can be bridged with the EK1521 and the EK1501 EtherCAT Coupler for multimode fibre optics. EK1521-0010 and EK1501-0010 for singlemode fibre optics permit distances up to 20 km. Even cable redundant systems with fibre optic can be realised using the 1-port EtherCAT fibre optic junction.</p>	
	2 x SC Duplex	2 x SC Duplex	1 x SC Duplex	1 x SC Duplex
	max. 4.2 GB addressable I/O points	max. 4.2 GB addressable I/O points	–	–
	multimode glass fibre 50/125 µm (MM)	singlemode glass fibre 9/125 µm (SM)	multimode glass fibre 50/125 µm (MM)	singlemode glass fibre 9/125 µm (SM)
	typ. 70 mA	typ. 70 mA	–	–
	max. 2,000 m (100BASE-FX)	max. 20,000 m (100BASE-FX)	max. 2,000 m (100BASE-FX)	max. 20,000 m (100BASE-FX)
	approx. 1 µs	approx. 1 µs	approx. 1 µs	approx. 1 µs
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	from E-bus	from E-bus
	–	–	typ. 400 mA	typ. 400 mA
	approx. 190 g	approx. 190 g	approx. 65 g	approx. 65 g
	CE, Ex	CE	CE, Ex	CE
	www.beckhoff.com/EK1501	www.beckhoff.com/EK1501	www.beckhoff.com/EK1521	www.beckhoff.com/EK1521
	see page 414	see page 414	see page 414	see page 414

EtherCAT junctions and extensions

	2-port EtherCAT junction	2-port Power over EtherCAT junction	EtherCAT extension
Technical data	EK1122	 EK1132	EK1110
Task within EtherCAT system	coupling of EtherCAT junctions	coupling of EtherCAT junctions incl. power supply	conversion of the E-bus signals to 100BASE-TX Ethernet for extension of the EtherCAT network
Data transfer rates	100 Mbaud		
	 <p>The 2-port EtherCAT junction enables configuration of EtherCAT star topologies. A modular EtherCAT star can be realised by using several EK1122 units in a station. Individual devices or complete EtherCAT strands can be connected at the junction ports. The EtherCAT junctions are connected via RJ 45 sockets with direct display of link and activity status.</p>	 <p>The EK1132 EtherCAT junction is based on IEEE standard 802.3af and supports power sourcing equipment (PSE), in order to ensure the supply of connected consumers (power devices, PD) via the four-wire standard EtherCAT/Ethernet cable. The PSE-PD supply voltage of 48 V is generated in the junction from the 24 V voltage used as industry standard. The maximum current input of the terminal devices is 350 mA. The signal and energy transfer takes place on the same wires, so that four-wire cables can be used. The Power over EtherCAT sensors are connected via a 4-pin connector, e.g. M12.</p>	 <p>Like the E-bus end cap, the EK1110 EtherCAT extension is connected to the end of the EtherCAT Terminal block. The terminal offers the option of connecting an Ethernet cable with RJ 45 connector, thereby extending the EtherCAT strand electrically isolated by up to 100 m. In the EK1110 terminal, the E-bus signals are converted on the fly to 100BASE-TX Ethernet signal representation. Power supply to the EK1110 electronics is via the E-bus. No parameterisation or configuration tasks are required.</p>
Bus interface	2 x RJ 45	2 x RJ 45	1 x RJ 45
Data transfer medium	Ethernet/EtherCAT cable (min. CAT 5), shielded		
Distance between stations	100 m (100BASE-TX)	100 m (100BASE-TX)	100 m (100BASE-TX)
Delay	approx. 1 µs	approx. 1 µs	approx. 1 µs
Power supply	from E-bus	from E-bus and external power supply 24 V	from E-bus
Current consumption E-bus	typ. 220 mA	typ. 220 mA	typ. 125 mA
Weight	approx. 65 g	approx. 85 g	approx. 50 g
Approvals	CE, UL, Ex	CE	CE, UL, Ex
Further information	www.beckhoff.com/EK1122	www.beckhoff.com/EK1132	www.beckhoff.com/EK1110
Accessories			
Cordssets and connectors	see page 414	see page 414	see page 414

 For availability status see Beckhoff website at: www.beckhoff.com/EK1132




EtherCAT Coupler K-bus

	EtherCAT "Economy plus" Bus Coupler for up to 64 Bus Terminals (255 with K-bus extension)	"Compact" coupler between E-bus and K-bus Terminals
Technical data	BK1120	BK1250
Number of Bus Terminals	64 (255 with K-bus extension)	
Max. number of bytes fieldbus	1,024 byte input and 1,024 byte output	
Current supply K-bus	1,750 mA	500 mA
	 <p>The BK1120 Bus Coupler connects EtherCAT, the real-time Ethernet system, with the modular, extendable electronic terminal blocks. A unit consists of a Bus Coupler, any number (between 1 and 64) of terminals (255 with K-bus extension) and one end terminal.</p>	 <p>The BK1250 is a "Bus Coupler in terminal housing" for mixed application of EtherCAT Terminals (ELxxxx) and standard Bus Terminals (KLxxxx) in a bus station. It enables implementation of compact and cost-effective control solutions. The wide range of Bus Terminals can thus be optimally combined with the communication speed and large bandwidth of EtherCAT Terminals. Up to 64 Bus Terminals (with K-bus extension up to 255) can be connected to a BK1250. The Bus Coupler recognises the connected Bus Terminals and automatically allocates them into the EtherCAT process image.</p>
Bus interface	2 x RJ 45	E-bus contacts on the left/K-bus contacts on the right
Data transfer rates	100 Mbaud	100 Mbaud E-bus
Distance between stations	100 m (100BASE-TX)	–
Weight	approx. 150 g	approx. 55 g
Operating temperature	-20...+60 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex
Further information	www.beckhoff.com/BK1120	www.beckhoff.com/BK1250
Accessories		
Cordsets and connectors	see page 414	see page 414

Bus Terminals see page 460

Bus Coupler for EtherCAT Terminals


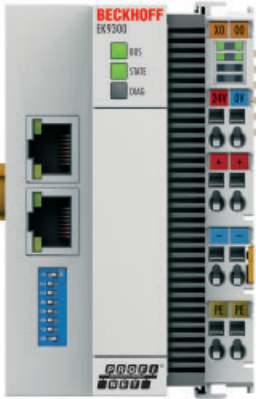
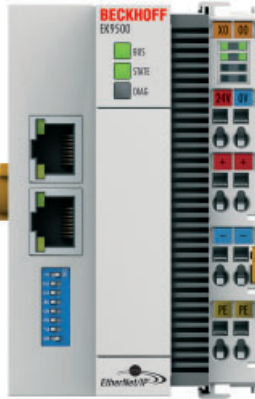
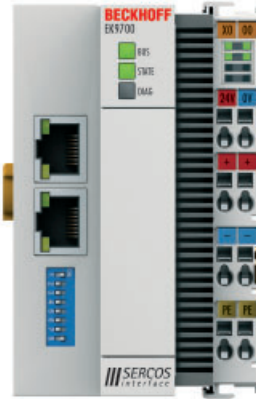


	PROFIBUS Bus Coupler	CANopen Bus Coupler	DeviceNet Bus Coupler
Technical data	i EK3100	i EK5100	i EK5200
Task within EtherCAT system	coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to PROFIBUS networks	coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to CANopen networks	coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to DeviceNet networks
Number of EtherCAT Terminals	depending on the process data size		
Data transfer rates	up to 12 Mbaud (automatic detection)	up to 1 Mbaud (automatic detection)	up to 500 kbaud (automatic detection)
	 <p>The EK3100 Bus Coupler converts the telegrams from PROFIBUS to the E-bus signal representation. The coupler supports the PROFIBUS profile and fits seamlessly into PROFIBUS networks.</p>	 <p>The EK5100 Bus Coupler converts the telegrams from CANopen to the E-bus signal representation. The coupler supports the CANopen profile and fits seamlessly into CANopen networks.</p>	 <p>The EK5200 Bus Coupler converts the telegrams from DeviceNet to the E-bus signal representation. The coupler supports the DeviceNet profile and fits seamlessly into DeviceNet networks.</p>
Protocol	PROFIBUS DP	CANopen	DeviceNet
Bus interface	1 x D-sub 9-pin socket with shielding	1 x open style connector, 5-pin, included	1 x open style connector, 5-pin, included
Type/number of peripheral signals	depending on the process data size		
Power supply	24 V DC (-15 %/+20 %)		
Approvals	CE		
Further information	www.beckhoff.com/EK3100	www.beckhoff.com/EK5100	www.beckhoff.com/EK5200
Accessories			
Cordssets and connectors	see page 414	see page 414	see page 414
PC Fieldbus Cards	FC310x 702	FC510x 703	FC520x 704

i For availability status see Beckhoff website at: www.beckhoff.com/EK3100

Ethernet



Ethernet Bus Coupler	PROFINET IO Bus Coupler	EtherNet/IP Bus Coupler	SERCOS III Bus Coupler
i EK9000	i EK9300	i EK9500	i EK9700
coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to Ethernet networks	coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to PROFINET IO networks	coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to EtherNet/IP networks	coupling of standard digital and analog EtherCAT Terminals and EtherCAT Box modules to SERCOS III networks
10/100 Mbaud	10/100 Mbaud	10/100 Mbaud	10/100 Mbaud
			
<p>The EK9000 Bus Coupler converts the telegrams from Ethernet to the E-bus signal representation. The coupler supports the EAP and Modbus TCP protocol and fits seamlessly into Ethernet networks.</p>	<p>The EK9300 Bus Coupler converts the telegrams from PROFINET IO to the E-bus signal representation. The coupler supports the PROFINET IO profile and fits seamlessly into PROFINET IO networks.</p>	<p>The EK9500 Bus Coupler converts the telegrams from EtherNet/IP to the E-bus signal representation. The coupler supports the EtherNet/IP profile and fits seamlessly into EtherNet/IP networks.</p>	<p>The EK9700 Bus Coupler converts the telegrams from SERCOS III to the E-bus signal representation. The coupler supports the SERCOS III profile and fits seamlessly into SERCOS III networks.</p>
EAP (EtherCAT Automation Protocol), Modbus TCP, ADS/TCP, ADS/UDP	PROFINET RT	EtherNet/IP	SERCOS III I/O profile
2 x RJ 45 (switched)	2 x RJ 45 (switched)	2 x RJ 45 (switched)	2 x RJ 45 (switched)
depending on the process data size	depending on the process data size	depending on the process data size	depending on the process data size
24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
CE	CE	CE	CE
www.beckhoff.com/EK9000	www.beckhoff.com/EK9300	www.beckhoff.com/EK9500	www.beckhoff.com/EK9700
see page 414	see page 414	see page 414	see page 414
FC90xx 706	FC90xx 706	FC90xx 706	FC750x 705

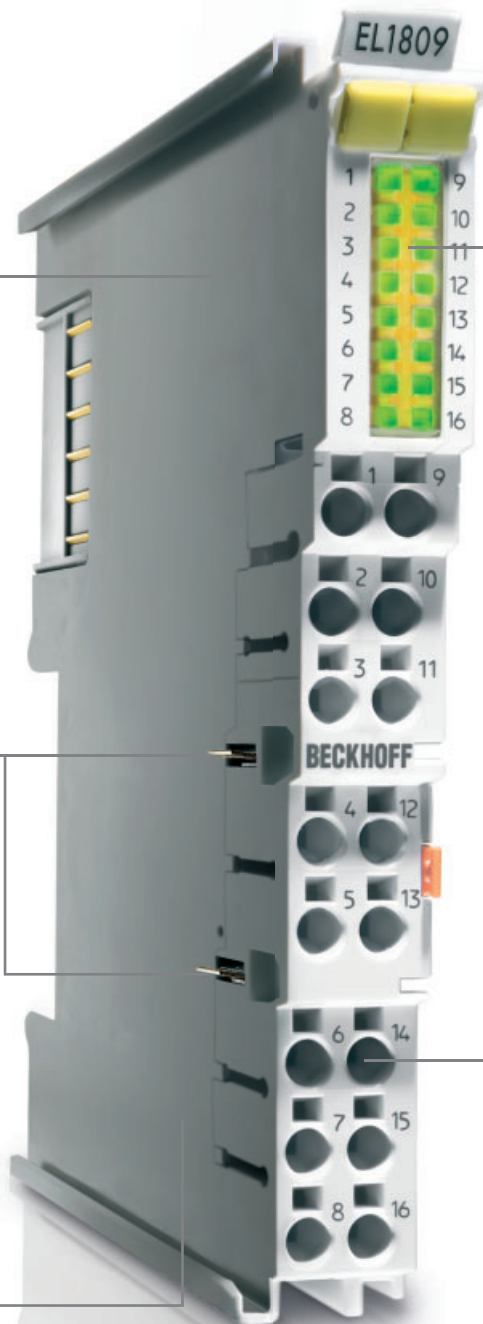
Embedded PC CX8000 see page 182

EtherCAT | I/O modules with 100 Mbit communication

The EtherCAT Terminals have a galvanic isolation between the field level and the communication level (E-bus). A terminal is equipped with 1...n input or output channels. The channels within a terminal are usually not electrically isolated from each other.

The terminals are supplied with field voltage by the power contacts which are available on the left hand side, provided that the terminals have power contacts. Depending on the terminals 24 V DC, 230 V AC or other voltages are transferred by the power contacts. The supply power required for each terminal, which is provided through the power contacts, is listed in the technical data of each terminal. The maximum load of the power contacts is 10 A.

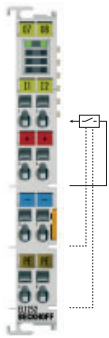
Some 2-channel EtherCAT Terminals have a PE power contact, which can be used for PE distribution by connecting it together with similar terminals. The EMC spring contact on the underside of the terminal only serves to remove interference \oplus and may not be used as a protective earth \ominus .



Beckhoff EtherCAT HD Terminals feature function-dependant colour-coded LED frames: yellow for digital inputs, red for digital outputs, green for analog inputs, blue for analog outputs.

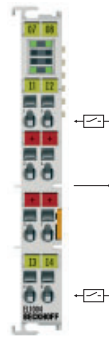
Different field level connection techniques can be used for EtherCAT Terminals:

- standard terminal point: 0.08...2.5 mm² spring-loaded technique
- HD EtherCAT Terminal: 0.08...0.75 mm² (with ferrule); 0.08...1.5 mm² (single-wire); spring-loaded technique; direct plug-in technique
- D-sub, 9-pin, common for serial communication or fieldbus master terminals
- ribbon: especially used in Asia for digital input/output channels
- plug-in wiring level: ES terminals



2-channel terminals

The 2-channel terminals provide additional power (+24 V DC), ground (0 V DC) and in many cases also PE for each channel. Connection is carried out with 3- or 4-wire connection.



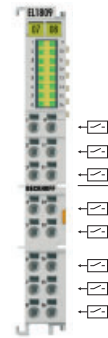
4-channel terminals

Along with four channels the 4-channel terminals have another four connection points available. These can provide 24 V DC or ground. Connection is carried out with 2-wire connection.



8-channel terminals

The 8-channel terminals have one channel per connection point due to a high packing density. The power contact of the terminal will be used as the common reference potential. Connection is carried out with 1-wire connection.



16-channel terminals

The HD (High Density) housing allows 16 channels to be accommodated on a unit that is only 12 mm wide. The power contact of the terminal will be used as the common reference potential. Connection is carried out with 1-wire connection.

The EtherCAT Terminals offer the possibility to directly connect many different signals. No signal converter or additional evaluation device is needed. The direct connection reduces the costs and simplifies the control technology. Each EtherCAT Terminal separates the internal electronics from the connection level and thus simplifies the creation of voltage groups with different voltages. In addition, interfering voltages on the signal connector lose their adverse effects.

The EL1xxx, EL2xxx EtherCAT Terminal product family is designed for the processing of digital or binary signals. There are "High" and "Low" states. In the positive switching logic the High state corresponds to the level of the supply voltage, the Low state corre-

sponds to ground level. For negative switching logic it is the other way around. The EtherCAT Terminal product family supports both types of logic for various supply voltages. 1-, 2-, 3- and 4-wire connections allow the use of EtherCAT Terminals in almost all applications without further wiring work.

The EL3xxx and EL4xxx EtherCAT Terminal product family processes analogue signals. The most commonly used are 0...10 V, ±10 V, 0...20 mA and 4...20 mA. Also many other industry-standard voltage and current signals are supported and pre-processed.

In the EL5xxx and EL6xxx EtherCAT Terminal product families other complex signals, such as position values and digital interfaces, are supported. Some EtherCAT Terminals

act as fieldbus masters for subordinate bus systems. The EtherCAT Terminal station thus becomes a universal gateway between different systems.

The EL9xxx system terminals round off the application of EtherCAT Terminals with power feed and power supply units.

Some modules referred to as XFC terminals are particularly suitable for fast, precise sensor detection or actuator control in the ns range in conjunction with TwinCAT as real-time environment and PC-based high-performance control technology.

Technical data	ELxxxx ESxxxx
Electrical isolation	500 V (E-bus/field voltage); if not indicated otherwise
Operating/storage temperature	0...+55 °C/-25...+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27/29
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protect. class/installation pos.	IP 20/variable according to DIN EN 60529 (see documentation)
Pluggable wiring	for all ESxxxx terminals

Digital input | 24 V DC, positive switching

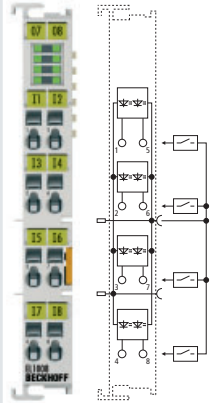
The digital inputs of a 24 V supply are among the most used signals. The EN 61131-2 standard describes the input characteristic and distinguishes three types. Type 1 has a small input current with low power dissipation. This input is optimised for mechanical switches and actively-switched electronic outputs. Type 2 has a significantly larger input current and is optimised for 2-wire sensors with a high quiescent current consumption. In switched-on state the current consumption of this input is high. The related power dissipation is generally not acceptable. Type 3 is a combination between type 1, with low current in switched-on state, and a satisfactorily high quiescent current for the majority of modern 2-wire sensors. The type 3 input can be used in almost all applications as a replacement for type 1. The diagram

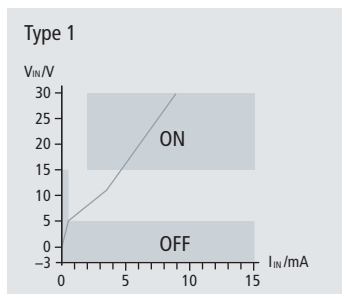
shows the typical current/voltage curves of the EtherCAT Terminal inputs and the allowable range of conformity in accordance with the standard.

The input circuits differ in their filtering functions. The filtering has the task of suppressing electromagnetic interference. However, this does have the drawback of signal deceleration. The filter time of 3 ms is comparatively slow, but it can suppress the bouncing of a mechanical switch and delivers a stable signal for simple PLC applications. Filter times of 10 μ s are suitable for applications with shortest possible reaction times and should be used for mechanical switches only in a restricted manner.

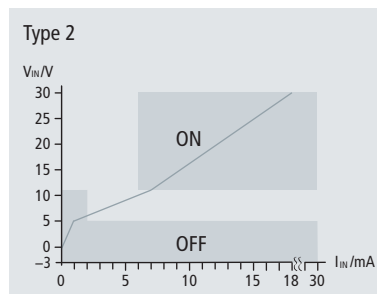
XFC terminals with a filter time of $\ll 1 \mu$ s are available for particularly fast signals and exact edge identification.

8-channel digital input terminal, 1-wire, 24 V DC, type 1/3

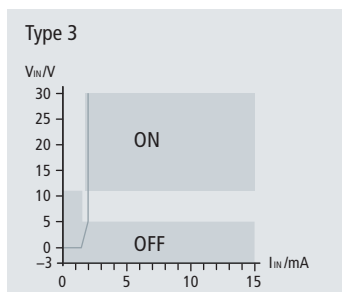
Technical data	EL1008 ES1008	EL1018 ES1018
Connection technology	1-wire	
Specification	EN 61131-2, type 1/3	
Input filter	typ. 3.0 ms	typ. 10 μ s
Number of inputs	8	
		
	<p>The EL1008 and EL1018 digital input terminals acquire the binary control signals from the process level and transmit them, in an electrically isolated form, to the higher-level automation unit.</p>	
Nominal voltage	24 V DC (-15 %/+20 %)	
Current consumption power contacts	typ. 2 mA + load	
Current consumption E-bus	typ. 90 mA	
Distributed clocks	–	
Special features	standard input terminals for fast (filter 10 μ s) or bouncing signals (filter 3 ms)	
Operating temperature	0...+55 °C	
Approvals	CE, UL, Ex	
Weight	approx. 55 g	
Further information	www.beckhoff.com/EL1008	



Signal voltage "0": -3...5 V DC
Signal voltage "1": 15...30 V DC

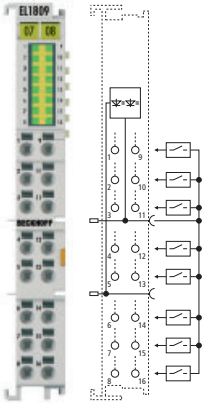
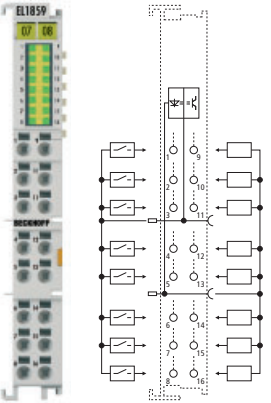
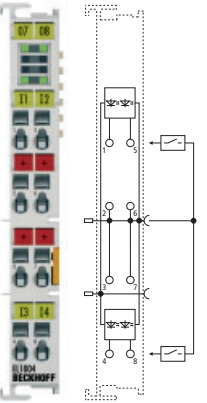
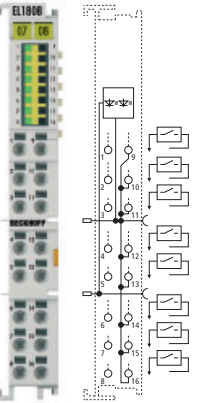


Signal voltage "0": -3...5 V DC
Signal voltage "1": 11...30 V DC

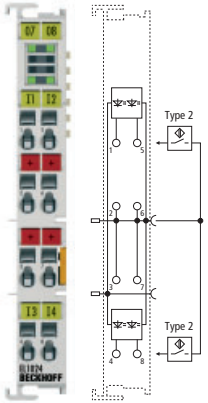
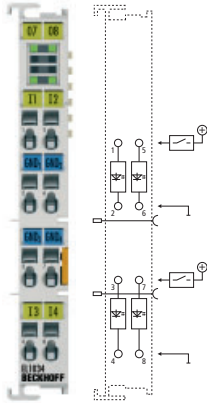
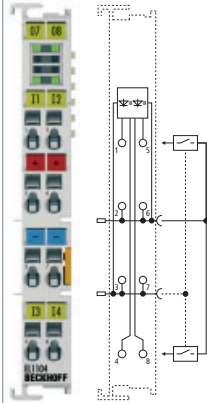


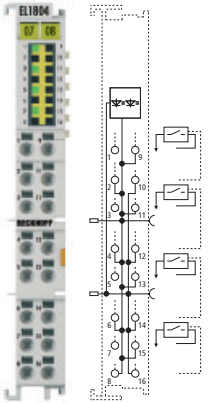
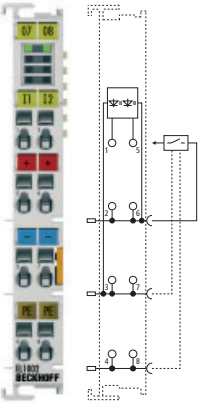
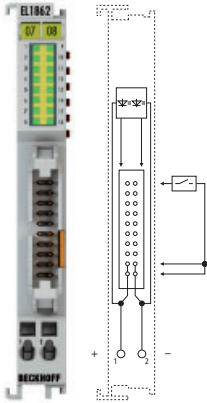
Signal voltage "0": -3...5 V DC
Signal voltage "1": 11...30 V DC

Characteristics of the 3 input types according to EN 61131-2 (24 V DC)

16-channel digital input terminal, 1-wire, 24 V DC, type 1/3		8-channel digital input + 8-channel digital output, 1-wire, 24 V DC, type 1/3		4-channel digital input terminal, 2-wire, 24 V DC, type 1/3		8-channel digital input terminal, 2-wire, 24 V DC, type 1/3	
EL1809		EL1819		EL1859		EL1004 ES1004	
						EL1014 ES1014	
						EL1808	
				2-wire			
typ. 3.0 ms		typ. 10 µs		typ. 3.0 ms		typ. 3.0 ms	
typ. 10 µs				typ. 3.0 ms		typ. 10 µs	
16		8 inputs + 8 outputs		4		8	
 <p>With 16 input channels and only 12 mm width the EL1809 and EL1819 digital input terminals are suitable for space-saving control cabinet installation. Reference ground for all terminal points is the 0 V power contact. Single wires can be connected directly without tools. A screwdriver is required for disconnection.</p>		 <p>The digital EL1859 EtherCAT Terminal combines eight digital inputs and eight digital outputs in one device.</p> <ul style="list-style-type: none"> – number of outputs: 8 – max. output current: 0.5 A (per channel) – load type: ohmic, inductive, lamp load – reverse voltage protection: yes 		 <p>With its 3 ms input filter the EL1004 is suitable for identifying slow edges or bouncing signals, for which multiple detection is undesirable. The EL1014 is suitable for identifying fast signal edges in the µs range. There is no electrical isolation between the channels.</p>		 <p>The EL1808 digital input terminal acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the higher-level automation device. With its 3 ms input filter it is suitable for identifying slow edges or bouncing signals, for which multiple detection is undesirable.</p>	
24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	
typ. 4 mA + load		typ. 15 mA + load		typ. 2 mA + load		typ. 2 mA + load	
typ. 90 mA		typ. 110 mA		typ. 90 mA		typ. 100 mA	
–		–		–		–	
standard input terminal with high number of channels for slow or fast 24 V DC edges, direct plug-in technique		direct plug-in technique, 8 x output 24 V DC/0.5 A		standard input terminals for 2-wire connection		direct plug-in technique, 2-wire connection	
0...+55 °C		0...+55 °C		0...+55 °C		0...+55 °C	
CE, Ex		CE, Ex		CE, UL, Ex		CE, Ex	
approx. 65 g		approx. 65 g		approx. 50 g		approx. 60 g	
www.beckhoff.com/EL1809		www.beckhoff.com/EL1859		www.beckhoff.com/EL1004		www.beckhoff.com/EL1808	

Digital input | 24 V DC, positive switching

	4-channel digital input terminal, 2-wire, 24 V DC, type 2	4-channel digital input terminal, 2-wire, 24 V DC, type 1	4-channel digital input terminal, 2-/3-wire, 24 V DC, type 1/3	
Technical data	EL1024 ES1024	EL1034 ES1034	EL1104 ES1104	EL1114 ES1114
Connection technology	2-wire		2-/3-wire	
Specification	EN 61131-2, type 2		EN 61131-2, type 1	
Input filter	typ. 3.0 ms	typ. 10 μ s	typ. 3.0 ms	typ. 10 μ s
Number of inputs	4		4	
	 <p>The EL1024 enables the connection of up to four type 2 24 V sensors with high quiescent current consumption. 2-wire connection is possible through the four 24 V connection points. The input filter is 3 ms, e.g. for bouncing signals.</p>	 <p>The EL1034 enables electrically isolated and potential-free connection of four digital 24 V signals. A filter time of 10 μs enables sampling of fast signal edges.</p>	 <p>With 2- or 3-wire connections the EL1104/EL1114 enables reading of up to four digital signals. The EL1114 with a 10 μs filter time is a good choice for fast signal changes with short cycle times. Reference ground for all terminal points is the 0 V power contact.</p>	
Nominal voltage	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	
Current consumption power contacts	typ. 30 mA + load		-	
Current consumption E-bus	typ. 90 mA		typ. 90 mA	
Distributed clocks	-		-	
Special features	type 2		4 inputs for 2- and 3-wire connection	
Operating temperature	0...+55 °C		0...+55 °C	
Approvals	CE, UL, Ex		CE, UL, Ex	
Weight	approx. 50 g		approx. 55 g	
Further information	www.beckhoff.com/EL1024		www.beckhoff.com/EL1034	
Special terminals				
Distinguishing features				

4-channel digital input terminal, 3-wire, 24 V DC, type 1/3		2-channel digital input terminal, 4-wire, 24 V DC, type 1/3		16-channel digital input terminal, flat-ribbon cable connection, 24 V DC, type 1/3	
EL1804	EL1814	EL1002 ES1002	EL1012 ES1012	EL1862	EL1872
3-wire		4-wire		flat-ribbon cable	
typ. 3.0 ms		typ. 3.0 ms		typ. 3.0 ms	
typ. 10 µs		typ. 10 µs		typ. 10 µs	
4		2		16	
 <p>The EL1804 and EL1814 digital input terminals acquire the binary control signals from the process level and transmit them, in an electrically isolated form, to the higher-level automation device. The EtherCAT Terminals each contain four channels, consisting of a signal input, 24 V DC and 0 V. The power contacts are looped through.</p>		 <p>The EL1002 and EL1012 digital input terminals acquire the binary control signals from the process level and transmit them, in an electrically isolated form, to the higher-level automation unit.</p>		 <p>A 20-pin plug connector with 2.54 mm contact spacing enables the secure connection of plug connectors using insulation displacement contact, as is usual for ribbon cables and special round cables. The required 24 V DC voltage supply must be input by the ribbon cable or the terminal points.</p>	
24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	
typ. 2 mA + load		typ. 2 mA + load		4 mA from the 24 V supply (no power contacts)	
typ. 110 mA		typ. 90 mA		typ. 130 mA	
-		-		-	
-		4-wire connection		also available as negative switching	
0...+55 °C		0...+55 °C		0...+55 °C	
CE, Ex		CE, UL, Ex		CE	
approx. 60 g		approx. 50 g		approx. 50 g	
www.beckhoff.com/EL1804		www.beckhoff.com/EL1002		www.beckhoff.com/EL1862	
				EL1862-0010	
				negative switching, see page	

XFC digital input | 24 V DC, positive, fast inputs

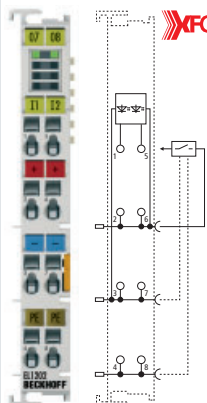
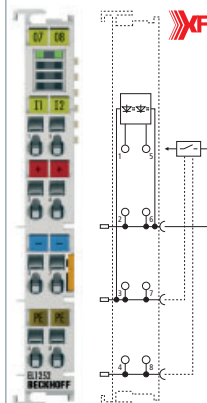
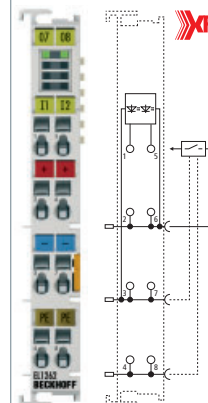
XFC – eXtreme Fast Control – comprises a fast controller, fast real-time capable communication and fast, high-precision input/output modules. Based on synchronisation through the distributed clocks principle, input modules read their inputs at exactly defined times. Outputs can be controlled with nanosecond precision, irrespective of restrictions through the bus cycle time or communication jitter.

The DC devices trigger the reading of inputs or the activation of outputs through their local clocks. This way, a uniform, application-wide timebase is formed in the modules, which makes parallel hardware wiring unnecessary. Responses with equidistant time intervals are possible largely independent of the bus cycle time.

EtherCAT components with DC support, such as shaft encoders, drives or I/O modules, enable synchronised, time-based operation for exact control of the mechanical components. All EL12xx terminals feature a fast input circuit, which enables the signal information from the field to be transferred to the communication level without delay.

For further information on XFC see page [278](#)



	2-channel digital input terminal, 24 V DC, 4-wire, fast input	2-channel digital input terminal, 24 V DC, 4-wire, time stamp	2-channel digital input terminal, 24 V DC, 4-wire, oversampling
Technical data	EL1202 ES1202	EL1252 ES1252	EL1262 ES1262
Connection technology	4-wire		
Specification	similar to EN 61131-2, type 3, "0": -3...5 V DC, "1": 11...30 V DC, typ. 3 mA input current		
Input filter	typ. < 1 µs	typ. < 1 µs	typ. < 1 µs
Number of inputs	2	2	2
	 <p>The very fast input circuit enables sampling of short input pulses, even with very short EtherCAT cycle times.</p>	 <p>The EL1252 allocates a 64-bit time stamp (1 ns triggering) to each edge change as a process data.</p>	 <p>Due to the fast input circuit the EL1262 should be operated with steep-edged signals.</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consum. pow.cont.	typ. 6 mA + load	typ. 6 mA + load	typ. 20 mA + load
Current consumption E-bus	typ. 110 mA	typ. 110 mA	typ. 70 mA
Distributed clocks	yes	yes	yes
Time resolution signal	–	1 ns	≥ 1 µs, adjustable
Precision of time stamp in the terminal	10 ns (+ input delay)	10 ns (+ input delay)	10 ns (+ input delay)
Distributed clock precision	<< 1 µs	<< 1 µs	<< 1 µs
Oversampling factor	–	–	n = integer multiple of the cycle time, 1...1,000, see documentation
Sampling rate	–	–	max. 1 Msample/s
Special features	DC can be activated, see documentation	time stamp, latch last edge	oversampling
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 55 g	approx. 55 g	approx. 60 g
Further information	www.beckhoff.com/EL1202	www.beckhoff.com/EL1252	www.beckhoff.com/EL1262

Digital input | 24 V DC, negative switching

	8-channel digital input terminal, 1-wire, 24 V DC, negative switching		16-channel digital input terminal, 1-wire, 24 V DC, negative switching		4-channel digital input terminal, 2-wire, 24 V DC, negative switching		16-channel digital input terminal, flat-ribbon, 24 V DC, negative switching	
Technical data	EL1088 ES1088		EL1098 ES1098		EL1889		EL1084 ES1084	
Connection technology	1-wire				2-wire		flat-ribbon cable	
Specification	negative switching "0": 18...30 V DC, "1": 0...7 V DC, typ. 3 mA input current							
Input filter	typ. 3.0 ms	typ. 10 µs	typ. 3.0 ms		typ. 3.0 ms	typ. 10 µs	typ. 3.0 ms	
Number of inputs	8		16		4		16	
	<p>The EL terminals of the EL108x and EL109x series and the EL1862-0010 interpret input signals with negative logic: 0 V signal level means logic "1". The rated voltage level is read as logic "0". Versions with 10 µs input filter are available for sampling fast input edges. The slow 3 ms filter enables logging of bouncing contacts or slowly rising signal edges. The 4-channel versions enable 2-wire connection. In the ribbon version the 0 V and 24 V rails are available for 3-wire connection. In all cases, a power supply with 24 V DC rated voltage is required for operation.</p> <p>In the EL1862-0010 a 20-pole pin contact strip with a 2.54 mm contact spacing with locking enables safe connection of plug connectors with insulation displacement.</p>							
Nominal voltage	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	
Current consumption power contacts	typ. 25 mA		typ. 35 mA		typ. 20 mA		typ. 35 mA	
Current consumption E-bus	typ. 90 mA		typ. 110 mA		typ. 90 mA		typ. 100 mA	
Distributed clocks	–		–		–		–	
Special features	–		–		2-wire connection		–	
Operating temperature	0...+55 °C		0...+55 °C		0...+55 °C		0...+55 °C	
Approvals	CE, UL, Ex		CE, Ex		CE, UL, Ex		CE	
Weight	approx. 50 g		approx. 55 g		approx. 50 g		approx. 50 g	
Further information	www.beckhoff.com/EL1088		www.beckhoff.com/EL1889		www.beckhoff.com/EL1084		www.beckhoff.com/EL1862	

i For availability status see Beckhoff website at: www.beckhoff.com/EL1889

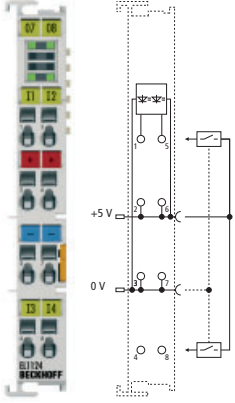
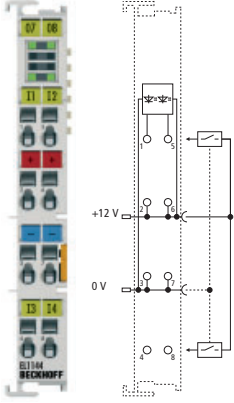
Digital input | 5 V...230 V

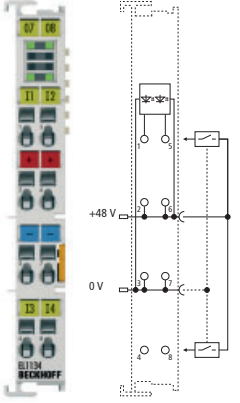
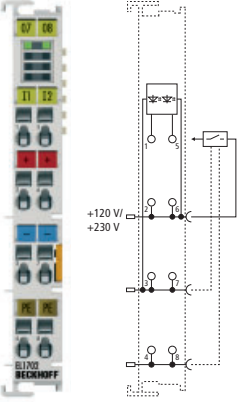
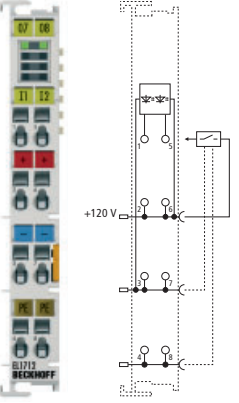
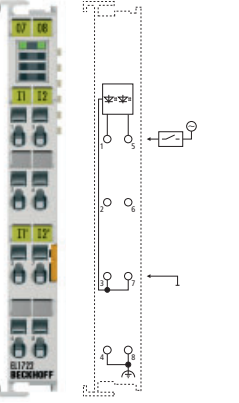
Rather than the usual 24 V DC control voltage, additional voltage range/potentials are implemented for sensors and actuators. The digital input terminals from the signal range 5...230 V allow direct input of these special sensor/actuator supplies without a further level conversion. The EtherCAT Terminals are separately supplied with the corresponding control voltage by a power feed terminal, so that an EtherCAT Terminal station can be operated with various different potential groups.

EL9xxx power feed terminals
see page [406](#)

4-channel digital
input terminal,
2-/3-wire, 5 V DC

4-channel digital
input terminal,
2-/3-wire, 12 V DC

Technical data	EL1124 ES1124	EL1144 ES1144
Connection technology	2-/3-wire	
Specification	"0": < 0.8 V DC, "1": > 2.4 V DC, typ. 50 μ A	"0": < 2.4 V DC, "1": > 8.5 V 3DC, input current "1": typ. 3 mA
Input filter	typ. 0.05 μ s	typ. 10 μ s
Number of inputs	4	4
	 <p>The EL1124 digital input terminal is suitable for the reading of 5 V DC logic signals. The 5 V supply voltage at the power contacts can be generated with the EL9505 power supply terminal.</p>	 <p>The EL1144 digital input terminal is suitable for the reading of 12 V DC logic signals.</p>
Nominal voltage	5 V DC	12 V DC
Current consumption power contacts	typ. 14 mA + load	typ. 14 mA + load
Current consumption E-bus	typ. 90 mA	typ. 90 mA
Distributed clocks	–	–
Electrical isolation	500 V (E-bus/field potential)	500 V (E-bus/field potential)
Special features	fast CMOS input	–
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, Ex
Weight	approx. 55 g	approx. 55 g
Further information	www.beckhoff.com/EL1124	www.beckhoff.com/EL1144

	4-channel digital input terminal, 4-wire, type 1, 48 V DC	2-channel digital input terminal, 4-wire, type 1, 120 V AC/230 V AC	2-channel digital input terminal, 4-wire, type 1, 120 V AC/DC	2-channel digital input terminal, 2-wire, type 1, 120 V AC/230 V AC
	EL1134 ES1134	EL1702 ES1702	EL1712 ES1712	EL1722 ES1722
	4-wire			2-wire
	EN 61131-2, type 1	"0": < 40 V, "1": 79...260 V, input current "1": > typ. 3 mA, typ. 6 mA	"0": < 40 V, "1": 80...140 V, input current "1": > typ. 3 mA, typ. 6 mA	"0": < 40 V, "1": 79...260 V, input current "1": > typ. 3 mA, typ. 6 mA
	typ. 10 μ s	typ. 10 ms	typ. 10 ms	typ. 10 ms
	4	2	2	2
				
	The EL1134 digital input terminal is suitable for the reading of 48 V DC logic signals.	The EL1702 digital input terminal is suitable for the acquisition of logic signals in the alternating voltage range from 120 to 230 V AC.	The EL1712 digital input terminal is suitable for the acquisition of direct and alternating voltage logic signals.	The EL1722 has no power contacts and can therefore be used for setting up individual potential groups. The inputs are not electrically isolated among each other. The terminal has no PE connection.
	48 V DC	120 V AC/230 V AC	120 V AC/DC	120 V AC/230 V AC
	typ. 10 mA + load	–	–	–
	typ. 90 mA	typ. 110 mA	typ. 110 mA	typ. 110 mA
	–	–	–	–
	500 V (E-bus/field potential)	500 V (E-bus/mains voltage); 3,750 V AC, 1 min.	500 V (E-bus/mains voltage); 3,750 V AC, 1 min.	500 V (E-bus/mains voltage); 3,750 V AC, 1 min.
	–	–	also suitable for 120 V DC	no power contacts
	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
	CE, Ex	CE	CE	CE
	approx. 55 g	approx. 60 g	approx. 60 g	approx. 60 g
	www.beckhoff.com/EL1134	www.beckhoff.com/EL1702	www.beckhoff.com/EL1712	www.beckhoff.com/EL1722

i For availability status see Beckhoff website at: www.beckhoff.com/EL1702

Digital input | 24 V DC, counter

Pulses often need to be captured in technical control applications. This can be done with fast inputs such as EL1202 and a central pulse counter. If the pulse length is the order of magnitude of the control cycle time or less, the controller cannot record these signals correctly any more. Pre-processing counter terminals can then be used to count the number and direction of the pulses, which enables the controller to determine reliable values. The counter is adapted to the individual requirements, such as up/down counter or Gate/Latch-controlled, by fieldbus parameterisation. With a counting depth of 32 bit any overflow can be controlled reliably, even at high frequencies.

As a multi-functional EtherCAT Terminal the EL1502 supports the following operating modes:

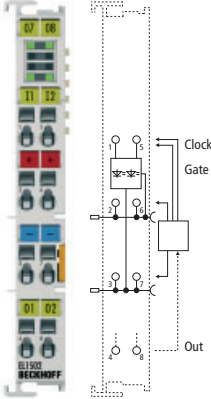
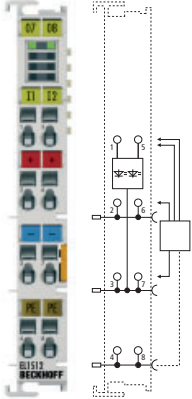
- 1 x 32 bit up/down counter (the counting direction is specified via the input)
- 1 x 32 bit gated counter (the counter is enabled via the input)
- 2 x 32 bit forward counter (no direction detection)

The EtherCAT Terminal can switch its outputs depending on the counter values. The EL1502 device supports the distributed clocks function. This enables the counter value to be read at highly constant intervals.

The EL1512 was developed for price-sensitive applications and has limitations in terms of speed and functionality.

2-channel digital input terminal, 24 V DC, 100 kHz, counter

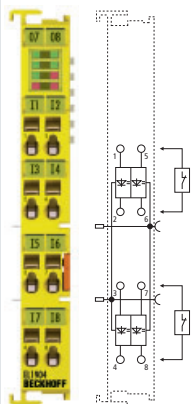
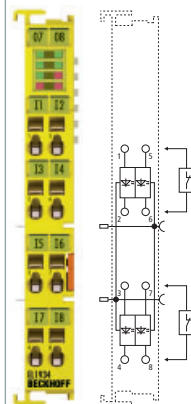
2-channel digital input terminal, 24 V DC, 1 kHz, counter

Technical data	EL1502 ES1502	EL1512 ES1512
Connection technology	1 x up/down counter	2 up counters
Specification	"0": < 5 V DC, "1" > 15 V DC, input current "1": typ. 5 mA	EN 61131-2, type 1, "0": < 5 V DC, "1" > 15 V DC
	 <p>The EL1502 supports numerous functions for demanding counting tasks such as distributed clocks, fast counting frequency and switchable outputs.</p>	 <p>The EL1512 is suitable for slow, simple and unidirectional counting tasks with two channels.</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consumption power contacts	typ. 14 mA + load	typ. 14 mA + load
Current consumption E-bus	typ. 130 mA	typ. 130 mA
Distributed clocks	yes	–
Electrical isolation	500 V (E-bus/field potential)	500 V (E-bus/field potential)
Counting frequency	max. 100 kHz	max. 1 kHz
Max. output current	24 V/0.5 A (short-circuit-proof) per channel	–
Counter depth	32 bits	32 bits
Special features	set counters, switch outputs	10 µs input filter
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex
Weight	approx. 50 g	approx. 55 g
Further information	www.beckhoff.com/EL1502	www.beckhoff.com/EL1512

Digital input | 24 V DC, TwinSAFE, PROFIsafe

The EL1904 and EL1934 safety terminals are digital input terminals for sensors with potential-free 24 V DC contacts. They have four fail-safe inputs. They conform to the requirements of IEC 61508 SIL 3 and DIN EN ISO 13849-1:2008 PL_e. The EL1934 PROFIsafe EtherCAT Terminal is designed for operation with PROFIBUS/PROFINET.

For further information on TwinSAFE and the TwinSAFE products see page [828](#)

	4-channel digital input terminal, TwinSAFE, 24 V DC	4-channel digital input terminal, PROFIsafe, 24 V DC
Technical data	EL1904	EL1934
Connection technology	1-/2-wire	
Safety standard	IEC 61508 SIL 3 and DIN EN ISO 13849-1:2008 PL _e	
Number of inputs	4	4
	 <p>The EL1904 Safety EtherCAT Terminal has four fail-safe inputs.</p>	 <p>The EL1934 PROFIsafe terminal has four fail-safe inputs.</p>
Protocol	TwinSAFE/FSoE	PROFIsafe
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consumption power contacts	–	–
Current consumption E-bus	approx. 200 mA	approx. 200 mA
Response time	typ. 4 ms (read input/write to E-bus)	typ. 4 ms (read input/write to E-bus)
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Permiss. degree of contamination	2	2
Climate class EN60721-3-3	3K3	3K3
Installation position	horizontal	horizontal
Special features	4 safe inputs	4 safe inputs; may only be operated on PROFIBUS/PROFINET
Operating temperature	0...+55 °C	0...+55 °C
Electrical interference	EN 61000-6-2/EN 61000-6-4	EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	EN 60068-2-6/EN 60068-2-27/29	EN 60068-2-6/EN 60068-2-27/29
Approvals	CE, UL, Ex, TÜV Süd	CE, UL, Ex, TÜV Süd
Weight	approx. 50 g	approx. 50 g
Protection class	IP 20	IP 20
Further information	www.beckhoff.com/EL1904	www.beckhoff.com/EL1934



For availability status see Beckhoff website at: www.beckhoff.com/EL1934

Digital output | 24 V DC, positive switching

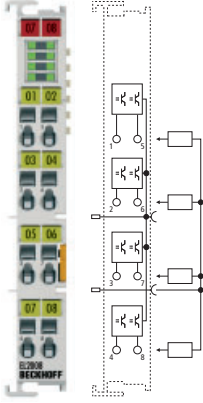
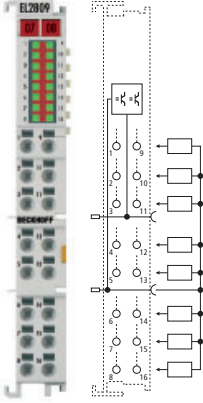
Many actuators are driven or controlled with 24 V DC. The EtherCAT Terminals of the "positive switching" category switch all output channels to 24 V DC, so all connected actuators are hard-wired to ground (0 V). The output of an EtherCAT Terminal can be considered as a functional 24 V DC relay contact. The output circuit offers further functions such as short-circuit-current limitation, short-circuit switch-off and the rapid depletion of inductive energy from the coil.

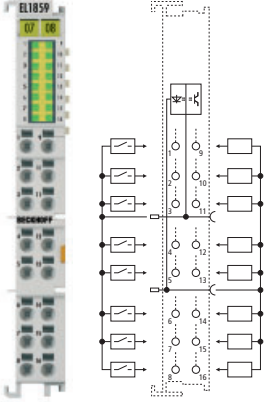
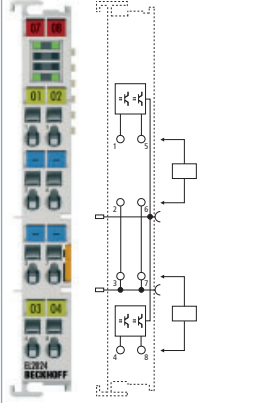
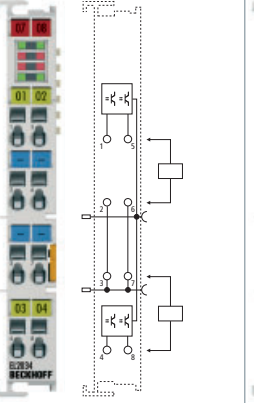
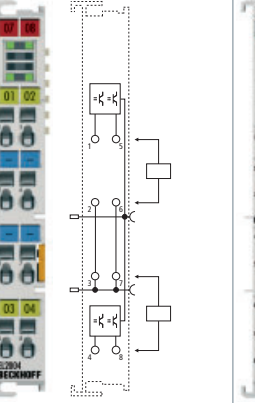
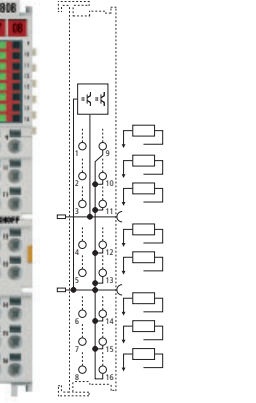
The most common output circuit delivers a maximum continuous current of 0.5 A. Special output terminals are available for higher currents. Any type of load (ohmic, capacitive, inductive) can be connected to an output terminal. As lamp and capacitive loads are critical due to their high starting currents, they are limited by the output circuits of the EtherCAT Terminals. This ensures that the upstream circuit-breaker is not triggered. Inductive loads are problematic at switch-off, as high induction voltages develop if the current is interrupted too fast. An integrated freewheeling diode prevents this voltage peak. However, the current is reduced so slowly that it leads to faults in many technical control applications. For example, a valve remains open for many milliseconds. The EtherCAT Terminals represent a compromise between prevention of overvoltage and rapid switch-off. They suppress the induction voltage to about 24 V DC and realise switch-off times which approximately correspond to the switch-on time of the coil.

In the case of short-circuit, the output circuit limits the current and prevents the activation of the upstream circuit-breaker. The EtherCAT Terminal maintains this current until important self-heating and finally switches off. After the circuit has cooled, it switches back on. The output signal is driven in time until the output of the controller is switched off or the short-circuit is rectified. The clock frequency depends on the ambient temperature and the load of the other terminal channels. The overload protection of the output is also realised by thermal switch-off.

8-channel digital output terminal, 1-wire, 24 V DC, 0.5 A

16-channel digital output terminal, 1-wire, 24 V DC, 0.5 A

Technical data	EL2008 ES2008	EL2809
Connection technology	1-wire	
Load type	ohmic, inductive, lamp load	
Max. output current	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof) per channel
Switching times	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs
Number of outputs	8	16
	 <p>8-channel standard output terminal for 1-wire connection; output signalling through LED</p>	 <p>16-channel standard output terminal for 1-wire connection; output signalling through LED</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consum. pow.cont.	typ. 15 mA + load	typ. 35 mA + load
Current consumption E-bus	typ. 110 mA	typ. 140 mA
Distributed clocks	–	–
Breaking energy	< 150 mJ/channel	< 150 mJ/channel
Reverse voltage protection	yes	yes
Short circuit current	typ. < 2 A	typ. < 2 A
Special features	–	–
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, Ex
Weight	approx. 55 g	approx. 70 g
Further information	www.beckhoff.com/EL2008	www.beckhoff.com/EL2809
Special terminals		
Distinguishing features		

	8-channel digital input + 8-channel digital output, 1-wire, 24 V DC, 0.5 A	4-channel digital output terminal, 2-wire, 24/12 V DC, 2 A	4-channel digital output terminal, 2-wire, 24 V DC, 2 A, with diagnostics	4-channel digital output terminal, 2-wire, 24 V DC, 0.5 A	8-channel digital output terminal, 2-wire, 24 V DC, 0.5 A
	EL1859	EL2024 ES2024	EL2034 ES2034	EL2004 ES2004	EL2808
		2-wire			
	0.5 A (short-circuit-proof) per channel	2.0 A (short-circuit-proof) per channel	2.0 A (short-circuit-proof) per channel, with diagnostics	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof) per channel
	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs	typ. T _{ON} : 40 µs, typ. T _{OFF} : 200 µs	typ. T _{ON} : 40 µs, typ. T _{OFF} : 200 µs	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs
	8 outputs + 8 inputs	4	4	4	8
					
	Combi EtherCAT Terminal with 8 digital inputs and outputs in HD direct plug-in technique and 1-wire connection – number of inputs: 8 – input filter: 3 ms – type: 1/3	direct 2-wire connection of 4 actuators	direct 2-wire connection of 4 actuators with diag- nostics over EtherCAT	The digital EL2004 EtherCAT Terminal is suitable for the connec- tion of four 2-wire actuators.	The EL2808 High Density EtherCAT Terminal contains eight outputs for the con- nection of 2-wire actuators and thus allows a very high packing density.
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	typ. 15 mA + load	typ. 13 mA + load	typ. 14 mA + load	typ. 15 mA + load	typ. 15 mA + load
	typ. 110 mA	typ. 120 mA	typ. 120 mA	typ. 100 mA	typ. 110 mA
	–	–	–	–	–
	< 150 mJ/channel	< 1.7 J/channel	< 1.7 J/channel	< 150 mJ/channel	< 150 mJ/channel
	yes	yes	yes	yes	yes
	typ. < 2 A	typ. < 70 A	typ. < 70 A	typ. < 2 A	typ. < 2 A
	combi EtherCAT Terminal, 8 x input 24 V DC	–	diagnostics: short circuit and open circuit	–	–
	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
	CE, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, Ex
	approx. 65 g	approx. 55 g	approx. 55 g	approx. 55 g	approx. 65 g
	www.beckhoff.com/EL1859	www.beckhoff.com/EL2024	www.beckhoff.com/EL2034	www.beckhoff.com/EL2004	www.beckhoff.com/EL2808
		EL2024-0010			
		nominal voltage 12 V DC			

XFC digital output | 24 V DC, positive switching

XFC – eXtreme Fast Control – comprises a fast controller, fast real-time capable communication and fast, high-precision input/output modules. Based on synchronisation through the distributed clocks principle, input modules read their inputs at exactly defined time. Outputs can be controlled with nanosecond precision, irrespective of restrictions through the bus cycle time or communication jitter.

The DC devices trigger the reading of inputs or the activation of outputs through their local clocks. This way, a uniform, application-wide timebase is formed in the modules, which makes parallel hardware wiring unnecessary. Responses with equidistant time intervals are possible largely independent of the bus cycle time.

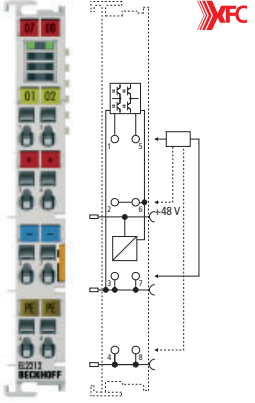
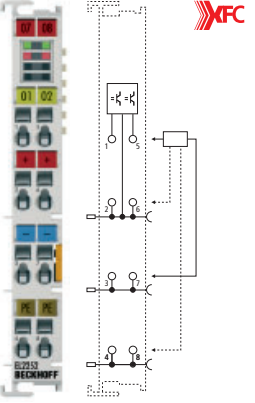
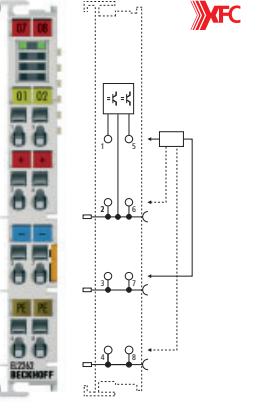
EtherCAT components with DC support, such as shaft encoders, drives or I/O modules, enable synchronised, time-based operation for exact control of the mechanical components. All EL12xx terminals feature a fast input circuit, which enables the signal information from the field to be transferred to the communication level without delay. The EL22xx XFC output terminals connect their outputs correspondingly fast and with distributed clock accuracy.

For further information on XFC see page [278](#)



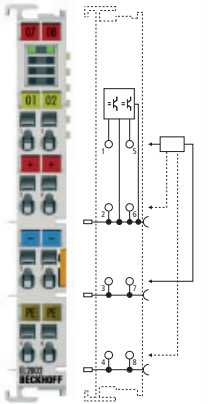
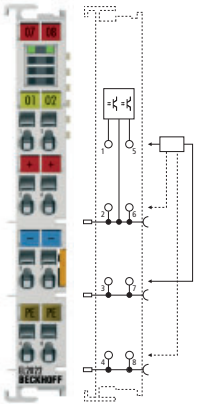
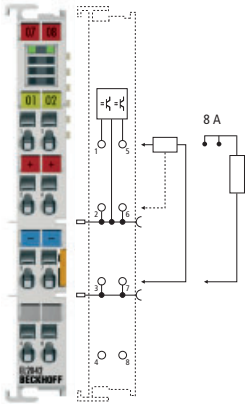
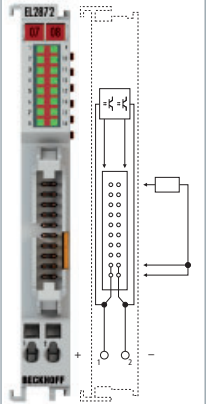

2-channel digital output terminal, 4-wire, 24 V DC, T_{ON}/T_{OFF} 1 μ s, push-pull outputs, tri-state

Technical data	EL2202 ES2202
Connection technology	4-wire
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit-proof in push operation) per channel
Switching times	typ. T_{ON} : < 1 μ s, typ. T_{OFF} : < 1 μ s
Number of outputs	2
Nominal voltage	24 V DC (-15 %/+20 %)
Current consum. pow.cont.	typ. 30 mA + load
Current consumption E-bus	typ. 130 mA
Distributed clocks	– (EL2202-0100 yes, see documentation)
Output stage	push-pull, high-ohmic
Resolution time stamp	–
Precision of time stamp in the terminal	–
Distributed clock precision	<< 1 μ s
Output rate	–
Oversampling factor	–
Breaking energy	< 150 mJ/channel
Reverse voltage protection	yes
Short circuit current	typ. < 1.5 A
Special features	Can be converted to DC version EL2202-0100. Outputs can be connected in high-resistance mode.
Operating temperature	0...+55 °C
Approvals	CE, Ex
Weight	approx. 55 g
Further information	www.beckhoff.com/EL2202
Special terminals	EL2202-0100
Distinguishing features	preset to DC

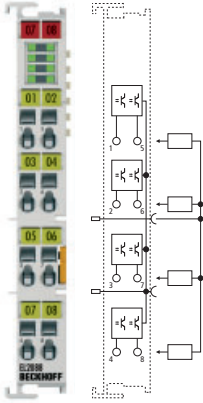
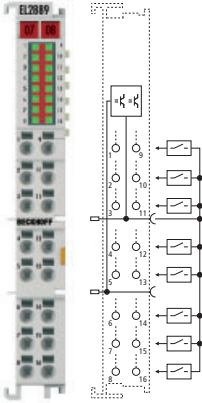
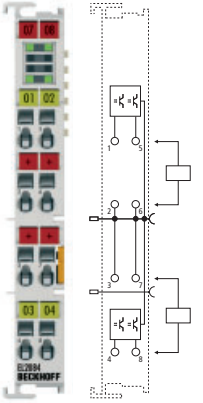
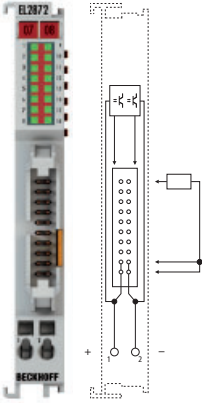
2-channel digital output terminal, 4-wire, 24 V DC, with time stamp, overexcitation	2-channel digital output terminal, 4-wire, with time stamp, push-pull outputs, tri-state	2-channel digital output terminal, 4-wire, with oversampling, push-pull outputs
EL2212 ES2212	EL2252 ES2252	EL2262 ES2262
ohmic, inductive	ohmic, inductive, lamp load	
0.5 A (per channel), max. 5 A peak current	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof in push operation) per channel
typ. T _{ON} : < 1 μs, typ. T _{OFF} : < 1 μs	typ. T _{ON} : < 1 μs, typ. T _{OFF} : < 1 μs	typ. T _{ON} : < 1 μs, typ. T _{OFF} : < 1 μs
2	2	2
		
24 V DC (-15 %/+20 %)		
typ. 20 mA (dependent on load and dynamics)	typ. 30 mA + load	typ. 35 mA + load
typ. 130 mA	typ. 130 mA	typ. 70 mA
yes	yes	yes
push-pull	push-pull	push-pull
1 ns	1 ns	–
10 ns (+ output circuit delay)	10 ns (+ output circuit delay)	–
<< 1 μs	<< 1 μs	<< 1 μs
–	–	max. 1 Msample/s, min. cycle 1 μs
–	–	n = integer multiple of the cycle time, 1...1,000
< 150 mJ/channel	< 150 mJ/channel	< 150 mJ/channel
yes	yes	yes
–	typ. < 1.5 A	typ. < 1.5 A
booster stage with 48 V DC integrated	Outputs can be connected in high-resistance mode, short-circuit-proof.	up to 1,000 x oversampling
0...+55 °C	0...+55 °C	0...+55 °C
CE, UL, Ex	CE, Ex	CE, Ex
approx. 55 g	approx. 60 g	approx. 60 g
www.beckhoff.com/EL2212	www.beckhoff.com/EL2252	www.beckhoff.com/EL2262

i For availability status see Beckhoff website at: www.beckhoff.com/EL2212

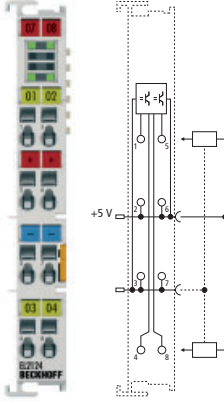
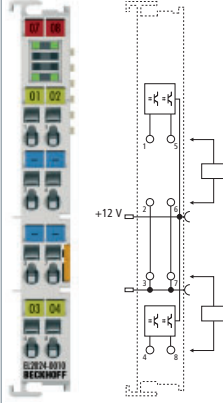
Digital output | 24 V DC, positive switching

	2-channel digital output terminal, 4-wire, 24 V DC, 0.5 A	2-channel digital output terminal, 4-wire, 24 V DC, 2 A (+ diagnostics)	2-channel digital output terminal, 3-wire, 24 V DC, 2 x 4 A/1 x 8 A	16-channel digital output terminal, flat-ribbon cable connection, 24 V DC	16-channel digital output terminal, D-sub, 24 V DC	
Technical data	EL2002 ES2002	EL2022 ES2022	EL2032 ES2032	EL2042 ES2042	EL2872	EM2042
Connection technology	4-wire			3-wire	flat-ribbon cable	D-sub
Load type	ohmic, inductive, lamp load					
Max. output current	0.5 A (short-circuit-proof) per channel	2.0 A (short-circuit-proof) per channel	4.0 A (short-circuit-proof) per channel, 8 A for parallel connection	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof) per channel	
Switching times	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs	typ. T _{ON} : 40 µs, typ. T _{OFF} : 200 µs	typ. T _{ON} : 40 µs, typ. T _{OFF} : 200 µs	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs	typ. T _{ON} : 60 µs, typ. T _{OFF} : 300 µs	
Number of outputs	2	2	2	16	16	
		 The EL2032 has diagnostics for short circuit and open circuit.	 The EL2042 can supply up to 8 A output current if the outputs are connected in parallel.			
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	
Current consumption power contacts	typ. 15 mA + load	typ. 9 mA + load	typ. 15 mA + load	typ. 25 mA + load	typ. 25 mA + load	
Current consumption E-bus	typ. 100 mA	typ. 100 mA	typ. 120 mA	typ. 130 mA	typ. 120 mA	
Distributed clocks	–	–	–	–	–	
Breaking energy	< 150 mJ/channel	< 1.7 J/channel	< 1.7 J/channel	< 150 mJ/channel	< 150 mJ/channel	
Reverse voltage protection	yes	yes	yes	yes	yes	
Short circuit current	–	typ. < 70 A	typ. < 70 A	typ. < 2 A	typ. < 2 A	
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	
Approvals	CE, UL, Ex	CE, UL, Ex	CE	CE	CE	
Weight	approx. 55 g	approx. 55 g	approx. 55 g	approx. 55 g	approx. 90 g	
Further information	www.beckhoff.com/EL2002	www.beckhoff.com/EL2022	www.beckhoff.com/EL2042	www.beckhoff.com/EL2872	www.beckhoff.com/EM2042	
Special terminals				EL2872-0010		
Distinguishing features				negative switching		

Digital output | 24 V DC, negative switching

	8-channel digital output terminal, 1-wire, 24 V DC, 0.5 A	16-channel digital output terminal, 1-wire, 24 V DC, 0.5 A	4-channel digital output terminal, 2-wire, 24 V DC, 0.5 A	16-channel digital output terminal, flat-ribbon cable connection, 24 V DC, 0.5 A
Technical data	EL2088 ES2088	EL2889	EL2084 ES2084	EL2872-0010
Connection technology	1-wire		2-wire	flat-ribbon cable
Load type	ohmic, inductive, lamp load			
Max. output current	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof) per channel	0.5 A (short-circuit-proof) per channel
Switching times	T _{ON} : 50 µs, T _{OFF} : 200 µs	T _{ON} : 50 µs, T _{OFF} : 200 µs	T _{ON} : 50 µs, T _{OFF} : 200 µs	T _{ON} : 50 µs, T _{OFF} : 200 µs
Number of outputs	8	16	4	16
	 <p>The negative switching EL2088 digital output terminal is suitable for the connection of eight actuators using 1-wire connection technology.</p>	 <p>The negative switching EL2889 digital output terminal offers terminal points for 16 actuators using 1-wire connection technology and thus a very high packing density.</p>	 <p>The negative switching EL2084 digital output terminal offers four outputs and additionally provides 24 V DC for each channel.</p>	 <p>A 20-pin plug connector with 2.54 mm contact spacing enables the secure connection of plug connectors using insulation displacement contact, as is usual for ribbon cables and special round cables. The required 24 V DC voltage supply must be input by the ribbon cable or the terminal points 1 and 2.</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consumption power contacts	typ. 30 mA + load	typ. 30 mA + load	typ. 30 mA + load	typ. 30 mA + load
Current consumption E-bus	typ. 100 mA	typ. 140 mA	typ. 100 mA	typ. 130 mA
Distributed clocks	–	–	–	–
Breaking energy	< 100 mJ/channel	< 100 mJ/channel	< 100 mJ/channel	< 150 mJ/channel
Reverse voltage protection	yes	yes	yes	yes
Short circuit current	typ. < 7 A	typ. < 7 A	typ. < 7 A	typ. < 7 A
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, Ex	CE, UL, Ex	CE
Weight	approx. 70 g	approx. 70 g	approx. 70 g	approx. 55 g
Further information	www.beckhoff.com/EL2088	www.beckhoff.com/EL2889	www.beckhoff.com/EL2084	www.beckhoff.com/EL2872

Digital output | 5 V DC/12 V DC, positive switching

	4-channel digital output terminal, 2-/3-wire, 5 V DC, 20 mA	4-channel digital output terminal, 2-wire, 12 V DC, 2 A
Technical data	EL2124 ES2124	EL2024-0010
Connection technology	2-/3-wire	2-wire
Load type	ohmic, lamp load	ohmic, inductive, lamp load
Max. output current	±20 mA (short-circuit-proof) per channel, type CMOS output/push-pull	2.0 A (short-circuit-proof) per channel
Switching times	typ. T _{ON} : < 1 μs, typ. T _{OFF} : < 1 μs	typ. T _{ON} : 40 μs, typ. T _{OFF} : 200 μs
Number of outputs	4	4
	 <p>The EL2124 is suitable for particularly fast switching of 5 V signals in push/pull mode. A 5 V supply is required via the power contacts, e.g. via a EL9505 power supply terminal.</p>	 <p>The 12 V EL2024-0010 version is particularly suitable for automotive and building applications.</p>
Nominal voltage	5 V DC	12 V DC (-15 %/+20 %)
Current consumption power contacts	typ. 12 mA + load	typ. 13 mA + load
Current consumption E-bus	typ. 130 mA	typ. 120 mA
Distributed clocks	–	–
Breaking energy	–	< 1.7 J/channel
Reverse voltage protection	–	yes
Short circuit current	typ. < 50 A	typ. < 70 A
Special features	fast 5 V output	for automotive applications
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, Ex	CE
Weight	approx. 70 g	approx. 55 g
Further information	www.beckhoff.com/EL2124	www.beckhoff.com/EL2024

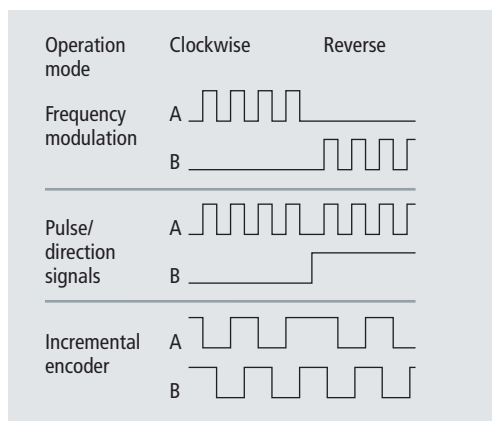
Digital output | 24 V DC, pulse train/frequency output

The EL2521-xxxx output terminals provide a specifiable pulse sequence via their two outputs. The relationship between channel A and B is configurable, e.g. as encoder characteristics or for controlling of stepper motor power stages. The pulse rate and the frequency is specified by the controller via a 16-bit value. The LEDs are driven in time with the outputs and each displays an active output. The galvanic isolation from the E-bus is provided.

The EL2521 has two digital inputs, which are transferred to the process image. The EL2521-0124 has a special latch input. The two RS422-compatible differential outputs of the EL2521 are supplied (electrically isolated) from the E-bus. For the EL2521-0024 both output channels are implemented as potential-free FET switches and must be fed externally. In the EL2521-0025 the two output channels are negative switching, potential-free FET switches that also require an external supply.

Another version is the EL2521-0124 with a 24 V latch input and an automatically switching 24 V output ("capture-compare"). This way, the EtherCAT Terminal can automatically switch the output at a specifiable step number, for example for controlling an external device at a required position, independent of the bus cycle. The 100 mA switch output is short-circuit-proof.

The EL2521 series offers different modes of operation: frequency modulation on the individual channels, incremental encoder or pulsed direction specification. A travel distance control can also be parameterised. Distributed clock synchronisation enables the output to be synchronised with other EtherCAT slaves.



Frequency pulse patterns

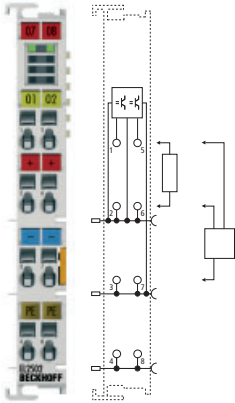
	1-channel pulse train output terminal, 2 x RS422	1-channel pulse train output terminal, 2 x 24 V DC
Technical data	EL2521 ES2521	EL2521-0024
Connection technology	pulse train (frequency output)	
Load type	ohmic, min. 220 Ω	ohmic, inductive
Max. output current	RS422 specification	5...24 V DC, 1 A
Number of outputs	1 channel (2 differential outputs A, B)	1 channel (2 outputs A, B)
Nominal voltage	–	24 V DC (-15 %/+20 %)
Current consum. pow.cont.	–	load
Current consumption E-bus	typ. 280 mA (load-dependent)	typ. 280 mA (load-dependent)
Distributed clocks	yes	yes
Input specification	24 V DC	24 V DC
Output specification	RS422, differential	5...24 V DC
Base frequency	0...500 kHz, 50 kHz default	0...500 kHz, 50 kHz default
Duty factor	0...50 % (±10 %)	0...50 % (±10 %)
Resolution	max. 24 bits	max. 24 bits
Step size	10 mHz	10 mHz
Short circuit current	short-circuit-proof	–
Special features	different modes, ramp function, travel distance control	different modes, ramp function, travel distance control
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, Ex
Weight	approx. 50 g	approx. 50 g
Further information	www.beckhoff.com/EL2521	www.beckhoff.com/EL2521
Special terminals	EL2521-0025	EL2521-0124
Distinguishing features	negative switching	24 V version, with "Capture & Compare" input/output



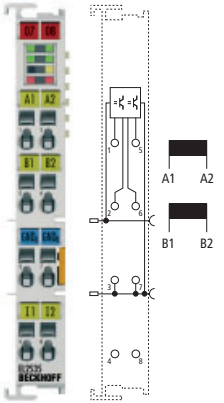
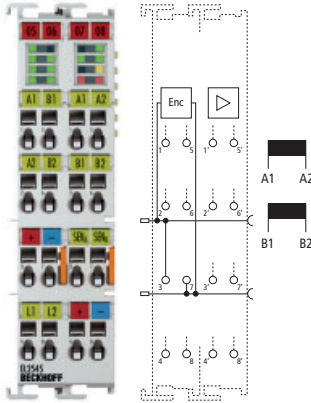
Digital output | PWM outputs up to 24 V DC/50 V DC

EtherCAT Terminals with PWM output are used to control variable actuators such as valves, solenoid coils, lamps, heating elements or rotary magnets. The base frequency can be set via process data (EL2502) or parameterisation.

The EL25xx PWM terminals deal with determining the switching times, thereby taking a load off the central controller. While the EL2502 (as an uncontrolled actuator) operates based on a specified duty factor, the EL25x5 measures the actual current and controls it via the duty factor based on the set current.

2-channel pulse width
output terminal,
24 V DC, 0.5 A

Technical data	EL2502 ES2502
Connection technology	PWM output, push-pull outputs
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit-proof) per channel
Number of outputs	2
	 <p>The EL2502 modulates its 24 V outputs independently in terms of frequency and pulse width based on the process data specification. The output stage is protected against overload and short-circuit.</p>
Nominal voltage	24 V DC (-15 %/+20 %)
Current consumption power contacts	typ. 30 mA + load
Current consumption E-bus	typ. 150 mA
Distributed clocks	–
PWM clock frequency	20 Hz...20 kHz, 250 Hz default
Duty factor	0...100 % ($T_{ON} > 750 \text{ ns}$, $T_{OFF} > 500 \text{ ns}$)
Resolution	10 bits
Reverse voltage protection	yes
Short circuit current	typ. < 1.5 A
Special features	separate frequency can be set for each channel
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 50 g
Further information	www.beckhoff.com/EL2502

	2-channel pulse width current terminal, 24 V DC, 1 A, current-controlled	2-channel pulse width current terminal, 50 V DC, 3.5 A, current-controlled, with incremental encoder
	 EL2535 ES2535	 EL2545 ES2545
	ohmic, inductive > 1 mH	inductive
	1 A (short-circuit-proof, thermal overload-proof) per channel	3.5 A (short-circuit-proof, thermal overload-proof) per channel
	2	2
	 <p>The EL2535 controls its two output channels based on a specified current value and also monitors overload and short circuits. Stored valve characteristic curves can be retrieved. The PWM frequency can be set separately for the two channels. Two digital 24 V inputs can be read via the process data.</p>	 <p>The EL2545 operates like the EL2535, but has a larger output stage. In addition, it features an integrated 24 V incremental encoder unit with up to 400,000 increments/s, which can be synchronised with other input terminals via the distributed clocks principle. It can be used as a single or two-encoder unit, with latch and reset function through the two digital inputs.</p>
	24 V DC (-15 %/+20 %) typ. 30 mA + load	8...50 V DC typ. 50 mA + load
	typ. 180 mA	typ. 180 mA
	yes	yes
	25 kHz default	25 kHz default
	0...100 % (current-controlled)	0...100 % (current-controlled)
	12 bits	12 bits
	yes	yes
	typ. < 2 A	typ. < 5 A
	Stored valve characteristic curves can be retrieved; two 24 V digital inputs.	with encoder 5...24 V, 5 mA, single-ended, max. 100 kHz (400,000 increments/s)
	0...+55 °C	0...+55 °C
	CE	CE
	approx. 50 g	approx. 50 g
	www.beckhoff.com/EL2535	www.beckhoff.com/EL2545

 For availability status see Beckhoff website at: www.beckhoff.com/EL2535

Digital output | Relay outputs up to 230 V AC

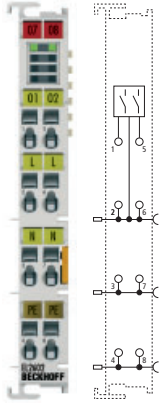
The EtherCAT Terminals switch a relay as a function of a bit in the process image. The relays completely isolate the current flow by a mechanical contact; there is no residual current through the open contact. The EtherCAT Terminals are not equipped with a protective circuit, so as not to allow for residual current by parallel switched components. The relay contacts differ in their contact material. Signal contacts also switch small voltages and currents; large current here leads to a change in the contact characteristics. Power contacts can also switch large loads. However, an oxide layer on the power contacts prevents safe contact for small voltages below 1 V DC. The contacts of the small-signal relays in the EL2612 and EL2614 are specially coated, so that they can switch small loads reliably. Should this coating become damaged through overload caused by high switching currents, only larger loads can be handled thereafter.

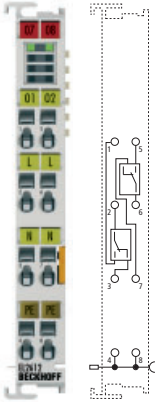
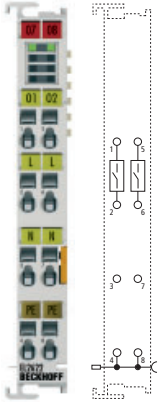
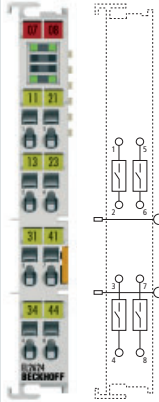
Switching on is accompanied by a bouncing: the electrical connection is initially switched on and off briefly, until the contact is securely in its closed location. With an inductive load (coil) this behaviour leads to a spark and

to corresponding electromagnetic radiation. Capacitive loads create a short-circuit for a brief period of time. This can – particularly with alternating voltages – lead to such high switch-on currents at switch-on under peak value that the bouncing contact is burned shut. A capacitive load can also be electronic devices, which are typically equipped with a rectifier in the input and a relatively large smoothing capacitor. Electronic ballast is especially critical for fluorescent lamps. The maximum switch-on currents of the devices are generally specified in the technical data.

The relay is switched off through opening of a mechanical contact. An arc burns for a short moment and warms the contact. For an inductive load (coil) a large part of the magnetic energy stored in the coil is additionally released as heat at the contact. This load on the contact determines the service life of the relay and is called the electrical service life. The mechanical service life is defined as the number of switching operations without current flow through the contact.

2-channel relay output terminal, 230 V AC/30 V DC

Technical data	EL2602 ES2602
Connection technology	relay output
Load type	ohmic, inductive, lamp load
Number of outputs	2 x make contacts for power contact
	
Nominal voltage	230 V AC/30 V DC
Current consumption power contacts	–
Current consumption E-bus	typ. 170 mA
Distributed clocks	–
Ohmic switching current	5 A AC/DC
Inductive switching current	2 A AC/DC
Operating cycles mech. (min.)	2 x 10 ⁷
Operating cycles electr. (min.)	1 x 10 ⁵ (5 A/30 V DC)
Lamp test, electronic ballast	4 x 58 W
Minimum permitted load	10 mA at 5 V DC
Special features	1-wire connection possible
Operating temperature	0...+55 °C
Approvals	CE, UL
Weight	approx. 50 g
Further information	www.beckhoff.com/EL2602

	2-channel relay output terminal, 125 V AC/30 V DC	2-channel relay output terminal, 230 V AC/30 V DC	4-channel relay output terminal, 125 V AC/30 V DC
	EL2612 ES2612	EL2622 ES2622	EL2624 ES2624
	ohmic	ohmic, inductive, lamp load	ohmic
	2 x change-over	2 x make contacts	4 x make contacts
			
	125 V AC/30 V DC	230 V AC/30 V DC	125 V AC/30 V DC
	–	–	–
	typ. 150 mA	typ. 170 mA	typ. 200 mA
	–	–	–
	0.5 A AC/2 A DC	5 A AC/DC	0.5 A AC/2 A DC
	no data	2 A AC/DC	no data
	1 x 10 ⁸	2 x 10 ⁷	1 x 10 ⁸
	2 x 10 ⁵ (1 A/30 V DC)	1 x 10 ⁵ (5 A/30 V DC)	2 x 10 ⁵ (1 A/30 V DC)
	–	4 x 58 W	–
	10 µA at 10 mV DC with intact contact coating	10 mA at 5 V DC	10 µA at 10 mV DC with intact contact coating
	signal relay	–	–
	0...+55 °C	0...+55 °C	0...+55 °C
	CE, UL	CE, UL	CE
	approx. 50 g	approx. 50 g	approx. 50 g
	www.beckhoff.com/EL2612	www.beckhoff.com/EL2622	www.beckhoff.com/EL2624

Digital output | Triac outputs up to 230 V AC




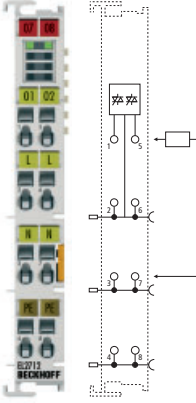
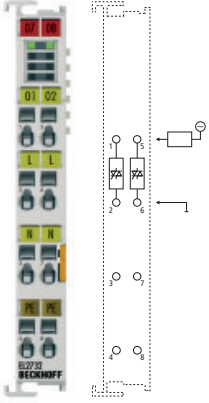
In applications with particularly frequent switching operations the service life of a mechanical relay is potentially very short. An electronic switch in the form of triacs and Mosfet transistors is an almost wear-free replacement.

A triac is a robust switch and will only be used as a zero crossing switch in the EtherCAT Terminals. Switch-on only occurs in zero crossing voltage and switch-off only in zero crossing current. Inductive loads are therefore switched off without overvoltage. The disadvantage of a Triac is a relatively high voltage drop in switched-on state, which leads to a higher power dissipation compared to a relay contact. An essential protective circuit leads to a leakage current in switched-off state. The output is not safely isolated from the mains. Triacs need a minimum load so that they remain switched-on, and a minimum voltage for error-free zero crossing detection.

When fusing EtherCAT Terminals from the triac family it should be noted that electronic switches cannot withstand high short-circuit currents. The fuses which are used should at least be fast-acting (characteristic: F) with low rated/reference current.

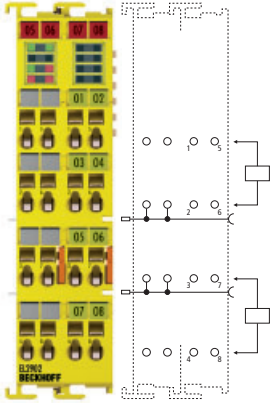
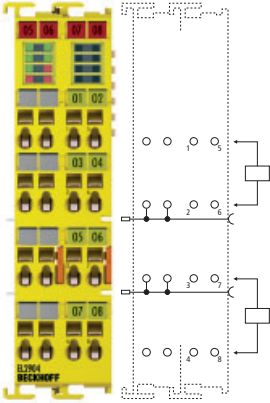
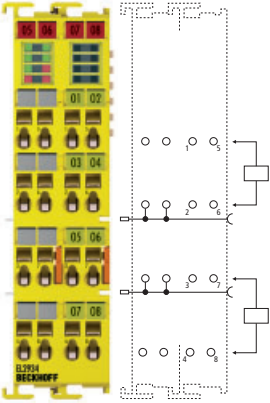
2-channel triac output terminal, up to 230 V AC

2-channel triac output terminal, up to 230 V AC

Technical data	 EL2712 ES2712	 EL2722 ES2722	 EL2732 ES2732
Connection technology	triac output, 2-wire		
Load type	ohmic, inductive		
Max. output current	0.5 A	1 A (0.5 A if both outputs are on)	0.5 A
Switching times	in zero crossing, 0.1...10 ms		in zero crossing, 0.1...10 ms
Number of outputs	2 x make contacts	2 x make contacts, mutually locked	2 x make contacts (without power contacts), mutually locked
			
Nominal voltage	12...230 V AC		12...230 V AC
Current consum. pow.cont.	-		-
Current consumption E-bus	typ. 120 mA		typ. 120 mA
Distributed clocks	-		-
Frequency range	47...63 Hz		47...63 Hz
Surge voltage protection	> 275 V		> 275 V
Peak current	40 A (16 ms), 1.5 A (30 s)		40 A (16 ms), 1.5 A (30 s)
Leakage current	typ. 0.8 mA, max. 1.5 mA (OFF state)		typ. 0.8 mA, max. 1.5 mA (OFF state)
Switch-off time	T/2		T/2
Maximum residual voltage	1.5 V (60 mA...1 A), 150 Ω (< 60 mA)		1.5 V (60 mA...1 A), 150 Ω (< 60 mA)
Special features	suitable for conventional blind motors		suitable for conventional blind motors
Operating temperature	0...+55 °C		0...+55 °C
Approvals	CE		CE
Weight	approx. 55 g		approx. 55 g
Further information	www.beckhoff.com/EL2712	www.beckhoff.com/EL2722	www.beckhoff.com/EL2732

 For availability status see Beckhoff website at: www.beckhoff.com/EL2712

Digital output | 24 V DC, TwinSAFE, PROFIsafe

	2-channel digital output terminal, TwinSAFE, 24 V DC	4-channel digital output terminal, TwinSAFE, 24 V DC	4-channel digital output terminal, PROFIsafe, 24 V DC
Technical data	EL2902	EL2904	EL2934
Connection technology	1-wire	1-/2-wire	
Safety standard	IEC 61508 SIL 3 and DIN EN ISO 13849-1:2008 PL e		
Max. output current	2.3 A (per channel)	0.5 A (per channel), min. 20 mA (with active current measurement)	0.5 A (per channel), min. 20 mA (with active current measurement)
Number of outputs	2	4	4
	 <p>The EL2902 Safety EtherCAT Terminal has two outputs.</p>	 <p>The EL2904 Safety EtherCAT Terminal has four outputs.</p>	 <p>The EL2934 PROFIsafe terminal has four outputs.</p>
Protocol	TwinSAFE/FSoE	TwinSAFE/FSoE	PROFIsafe
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consumption power contacts	load-dependent	load-dependent	load-dependent
Current consumption E-bus	approx. 221 mA	approx. 221 mA	approx. 221 mA
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Permiss. degree of contamination	2	2	2
Climate class EN60721-3-3	3K3	3K3	3K3
Installation position	horizontal	horizontal	horizontal
Special features	2 safe outputs	4 safe outputs	4 safe outputs; may only be operated on PROFIBUS/PROFINET
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C
Electrical interference	EN 61000-6-2/EN 61000-6-4	EN 61000-6-2/EN 61000-6-4	EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	EN 60068-2-6/EN 60068-2-27/29	EN 60068-2-6/EN 60068-2-27/29	EN 60068-2-6/EN 60068-2-27/29
Approvals	CE, UL, Ex, TÜV Süd	CE, UL, Ex, TÜV Süd	CE, UL, Ex, TÜV Süd
Weight	approx. 90 g	approx. 90 g	approx. 100 g
Protection class	IP 20	IP 20	IP 20
Further information	www.beckhoff.com/EL2902	www.beckhoff.com/EL2904	www.beckhoff.com/EL2934

For further information on TwinSAFE and the TwinSAFE products see page **828**

i For availability status see Beckhoff website at: www.beckhoff.com/EL2934

Analog input | -10...+10 V, 12 bits, single-ended

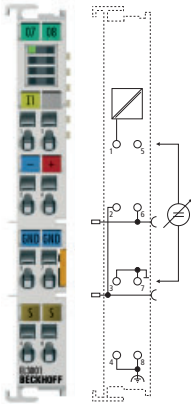
The EL3xxx EtherCAT Terminals read analog signal voltages in the common standard signal range of -10...+10 V, 0...10 V, 0...20 mA and 4...20 mA. Within the EtherCAT Terminal the field side is electrically isolated from the E-bus and enables interconnection to form potential groups as required. The 1-channel terminals are available for applications in which each signal must be completely electrically isolated. An additional electrically isolated 24 V DC supply can be created by the application of the EL9560 power supply terminal (24 V DC/24 V DC).

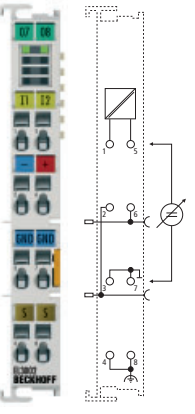
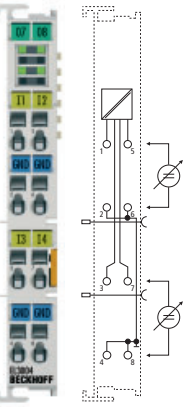
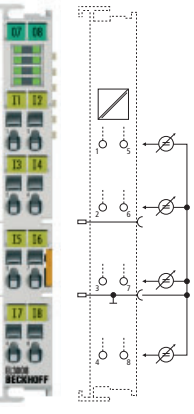
The analog input EtherCAT Terminals differ in their different resolutions of the analog/digital conversion, conversion speed and accuracy. For 1- and 2-channel terminals 1-, 2-, 3- and 4-wire connections are available for the sensors. 4-channel EtherCAT Terminals can only be used with 1- and 2-wire connections.

The input circuit of the EtherCAT Terminals differs between single-ended and differential inputs. A single-ended input expects a signal with a fixed reference to ground. In practice, single-ended is easily to be wired using single-wire connection. The differential input measures the difference between both inputs +I and -I. A superposition within the common-mode area (common-mode voltage) has no effect on the measuring result. For measurement two conductors should always be connected; in the case of single-wire connection input -I can be connected to ground.

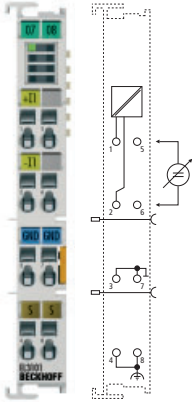
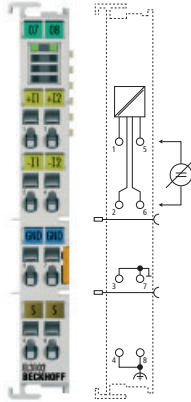
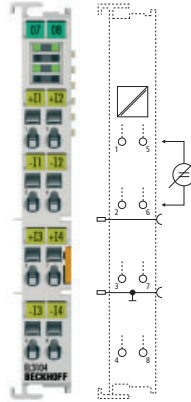
The product range is rounded off by further special input voltages and covers a wide field of application for the processing of analog signals. By the expansion of power supply terminals well-stabilised auxiliary voltages from 5 to 15 V can be generated.

1-channel analog input terminal, -10...+10 V, 12 bits, single-ended

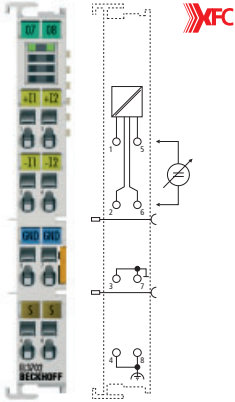
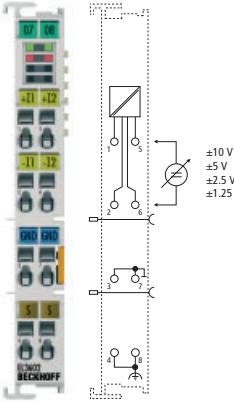
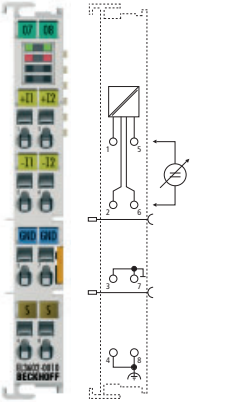
Technical data	EL3001 ES3001
Signal voltage	-10...+10 V
Resolution	12 bits (16 bits presentation, incl. sign)
Technology	single-ended
Conversion time	0.625 ms default setting, configurable
Number of inputs	1 (single-ended)
	
	The EL3001 analog input terminal is characterised by its fine granularity and electrical isolation.
Dielectric strength	max. 30 V
Current consum. pow.cont.	–
Current consumption E-bus	typ. 130 mA
Distributed clocks	–
Internal resistance	> 130 kΩ
Input filter limit frequency	1 kHz
Measuring error	< ±0.3 % (relative to full scale value)
Special features	standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring, overload display in the process data
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 70 g
Further information	www.beckhoff.com/EL3001

2-channel analog input terminal, -10...+10 V, 12 bits, single-ended	4-channel analog input terminal, -10...+10 V, 12 bits, single-ended	8-channel analog input terminal, -10...+10 V, 12 bits, single-ended
EL3002 ES3002	EL3004 ES3004	EL3008 ES3008
single-ended	single-ended	single-ended
0.625 ms default setting, configurable	0.625 ms default setting, configurable	1.25 ms default setting, configurable
2 (single-ended)	4 (single-ended)	8 (single-ended)
 <p>The EL3002 analog input terminal combines two analog inputs with a common internal ground potential in one housing.</p>	 <p>The four single-ended inputs of the EL3004 have a common reference ground that is fed out. A 2-wire connection is thus possible.</p>	 <p>With eight input channels, the EL3008 is particularly suitable for space-saving installation in the control cabinet. The common reference ground is the 0 V power contact. A 0 V distribution terminal, e.g. EL9187 or EL9189, must be added for a 2-wire connection.</p>
max. 30 V	max. 30 V	max. 30 V
–	–	–
typ. 130 mA	typ. 130 mA	typ. 130 mA
–	–	–
> 130 kΩ	> 130 kΩ	> 130 kΩ
1 kHz	1 kHz	1 kHz
< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)
standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring, overload display in the process data	standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring, overload display in the process data	standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring, overload display in the process data
0...+55 °C	0...+55 °C	0...+55 °C
CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
approx. 70 g	approx. 70 g	approx. 70 g
www.beckhoff.com/EL3002	www.beckhoff.com/EL3004	www.beckhoff.com/EL3008

Analog input | -10...+10 V, 16 bits, differential input

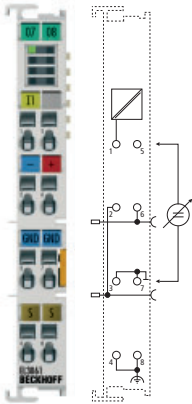
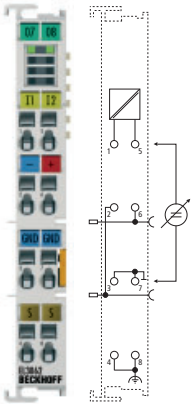
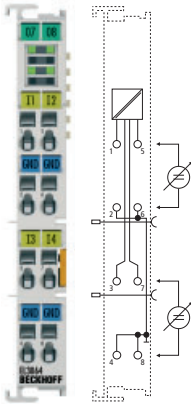
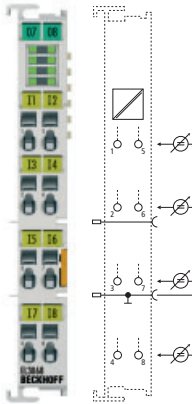
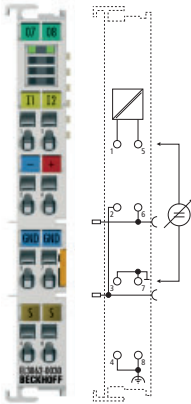
	1-channel analog input terminal, -10...+10 V, 16 bits, differential input	2-channel analog input terminal, -10...+10 V, 16 bits, differential input	4-channel analog input terminal, -10...+10 V, 16 bits, differential input
Technical data	EL3101 ES3101	EL3102 ES3102	EL3104 ES3104
Signal voltage	-10...+10 V		
Resolution	16 bits (incl. sign)		
Technology	differential input	differential input	differential input
Conversion time	~ 40 μ s	~ 60 μ s (fast mode ~ 40 μ s)	~ 100 μ s
Number of inputs	1 (differential)	2 (differential)	4 (differential)
			
	<p>The EL310x analog input terminals measure input voltages from -10 to +10 V with 16-bit resolution. The significantly faster conversion time and support for distributed clocks enable use in time-critical applications and set them apart from the EL30x series. The differential inputs of the EL3102/EL3104 have the same reference ground.</p>		
Common-mode voltage U_{CM}	35 V max.	35 V max.	35 V max.
Current consumption power contacts	–	–	–
Current consumption E-bus	typ. 180 mA	typ. 180 mA	typ. 180 mA
Distributed clocks	yes	yes	yes
Oversampling factor	–	–	–
Distributed clock precision	<< 1 μ s	<< 1 μ s	<< 1 μ s
Input signal bandwidth	–	–	–
Internal resistance	> 200 k Ω	> 200 k Ω	> 200 k Ω
Input filter limit frequency	5 kHz	5 kHz	5 kHz
Measuring error	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)
Special features	standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, switchable measuring data representation, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 65 g
Further information	www.beckhoff.com/EL3101	www.beckhoff.com/EL3102	www.beckhoff.com/EL3104

Analog input | Oversampling, precision measurement

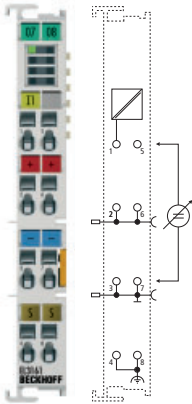
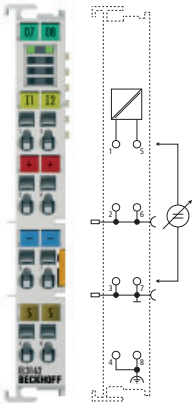
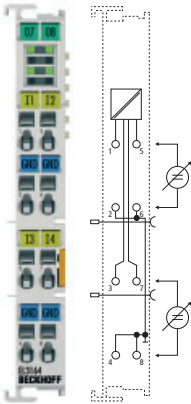
	2-channel analog input terminal, -10...+10 V, 16 bits, oversampling, differential input	2-channel analog input terminal, -10...+10 V, 24 bits, differential input	2-channel analog input terminal, -75...+75 mV, 24 bits, differential input
Technical data	EL3702 ES3702	EL3602 ES3602	EL3602-0010
Signal voltage	-10...+10 V	-10...+10 V, -5...+5 V, -2.5...+2.5 V, -1.25...+1.25 V (parameterisable)	-75...+75 mV
Resolution	16 bits (incl. sign)	24 bits (incl. sign)	
Technology	differential input, oversampling	differential input	differential input
Conversion time	~ 10 μ s per sample	20 ms default setting, 1...400 ms configurable	
Number of inputs	2 (differential)	2 (differential)	2 (differential)
	 <p>In the EL3702, the ± 10V signals are sampled with an adjustable integral multiple (oversampling factor: n) of the bus cycle time (n microcycles for each bus cycle). For each microcycle, the EtherCAT Terminal generates a process data block that is transferred collectively during the next bus cycle. The maximum sampling frequency for each channel is 100 ksamples/s.</p>	 <p>The EL3602 terminal is a precise measuring device with 24-bit resolution and a common ground potential for both differential inputs. Shielded connecting cables, secure shield and earth connections and a controlled ambient temperature are necessary in order to obtain precise results. The EL9195 shield terminal is to be placed adjacently if necessary.</p>	
Common-mode voltage U_{CM}	35 V max.	35 V max.	35 V max.
Current consum. pow.cont.	–	–	–
Current consumption E-bus	typ. 200 mA	typ. 190 mA	typ. 190 mA
Distributed clocks	yes	–	–
Oversampling factor	n = 1...100 selectable	–	–
Distributed clock precision	$\ll 1 \mu$ s	–	–
Input signal bandwidth	0...30 kHz recommended	–	–
Internal resistance	> 200 k Ω	> 200 k Ω	> 200 k Ω
Input filter limit frequency	30 kHz	3 kHz	3 kHz
Measuring error	< ± 0.3 % up to 10 Hz (relative to full scale value)	< ± 0.01 % at 25 $^{\circ}$ C, 50 Hz filter (relative to full scale value)	< ± 0.05 % at 25 $^{\circ}$ C, 50 Hz filter (relative to full scale value)
Special features	oversampling	various filter times, limit value monitoring, high precision	
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3702	www.beckhoff.com/EL3602	www.beckhoff.com/EL3602

Further information on XFC see page **278**

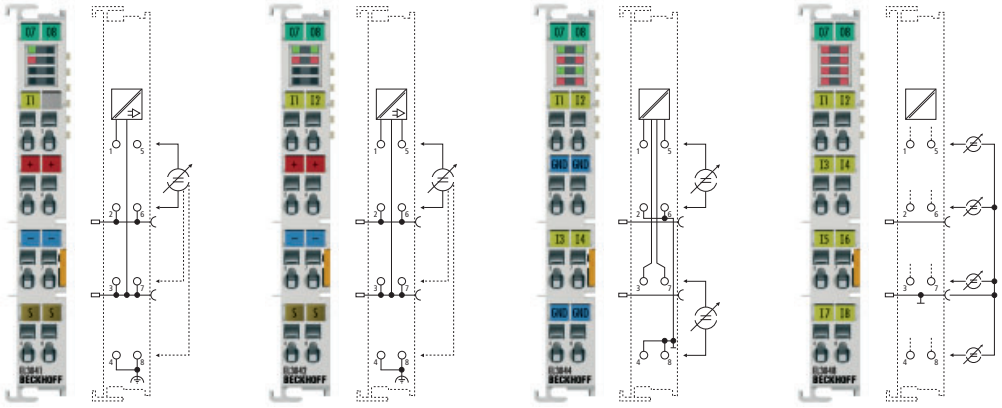
Analog input | 0...10 V/30 V, 12 bits, single-ended

	1-channel analog input terminal, 0...10 V, 12 bits, single-ended	2-channel analog input terminal, 0...10 V, 12 bits, single-ended	4-channel analog input terminal, 0...10 V, 12 bits, single-ended	8-channel analog input terminal, 0...10 V, 12 bits, single-ended	2-channel analog input terminal, 0...30 V, 12 bits, single-ended
Technical data	EL3061 ES3061	EL3062 ES3062	EL3064 ES3064	EL3068 ES3068	EL3062-0030
Signal voltage	0...10 V				0...30 V
Resolution	12 bits (16 bits presentation, incl. sign)				
Technology	single-ended	single-ended	single-ended	single-ended	single-ended
Conversion time	0.625 ms default setting, configurable	0.625 ms default setting, configurable	0.625 ms default setting, configurable	1.25 ms default setting, configurable	0.625 ms default setting, configurable
Number of inputs	1 (single-ended)	2 (single-ended)	4 (single-ended)	8 (single-ended)	2 (single-ended)
					
Dielectric strength	max. 30 V	max. 30 V	max. 30 V	max. 30 V	max. 30 V
Current consumption power contacts	–	–	–	–	–
Current consumption E-bus	typ. 130 mA	typ. 130 mA	typ. 130 mA	typ. 130 mA	typ. 130 mA
Distributed clocks	–	–	–	–	–
Internal resistance	> 130 kΩ	> 130 kΩ	> 130 kΩ	> 130 kΩ	> 130 kΩ
Input filter limit frequency	1 kHz	1 kHz	1 kHz	1 kHz	1 kHz
Measuring error	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)
Special features	activatable FIR/IIR filters, limit value monitoring	activatable FIR/IIR filters, limit value monitoring	activatable FIR/IIR filters, limit value monitoring	activatable FIR/IIR filters, limit value monitoring	activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 60 g	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3061	www.beckhoff.com/EL3062	www.beckhoff.com/EL3064	www.beckhoff.com/EL3068	www.beckhoff.com/EL3062

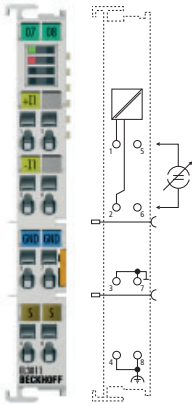
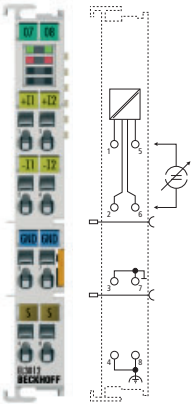
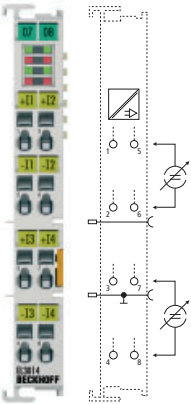
Analog input | 0...10 V, 16 bits, single-ended

	1-channel analog input terminal, 0...10 V, 16 bits, single-ended	2-channel analog input terminal, 0...10 V, 16 bits, single-ended	4-channel analog input terminal, 0...10 V, 16 bits, single-ended
Technical data	EL3161 ES3161	EL3162 ES3162	EL3164 ES3164
Signal voltage	0...10 V		
Resolution	16 bits (incl. sign)		
Technology	single-ended	single-ended	single-ended
Conversion time	~ 35 μ s	~ 50 μ s	~ 100 μ s
Number of inputs	1 (single-ended)	2 (single-ended)	4 (single-ended)
			
<p>The EL316x analog input terminals measure input voltages from 0 to 10 V with 16-bit resolution. The significantly faster conversion time and support for distributed clocks enable use in time-critical applications and set them apart from the EL30xx series. The inputs have a common reference potential and display overrange and limit evaluation via the process data.</p>			
Dielectric strength	max. 30 V	max. 30 V	max. 30 V
Current consumption power contacts	–	–	–
Current consumption E-bus	typ. 180 mA	typ. 180 mA	typ. 180 mA
Distributed clocks	yes	yes	yes
Internal resistance	> 200 k Ω	> 200 k Ω	> 200 k Ω
Input filter limit frequency	5 kHz	5 kHz	5 kHz
Measuring error	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)
Special features	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 65 g
Further information	www.beckhoff.com/EL3161	www.beckhoff.com/EL3162	www.beckhoff.com/EL3164

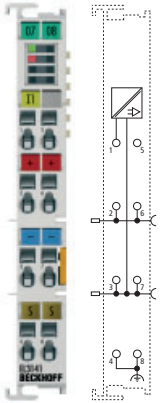
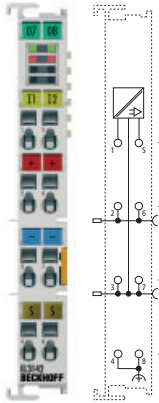
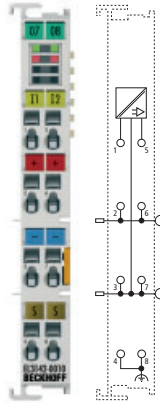
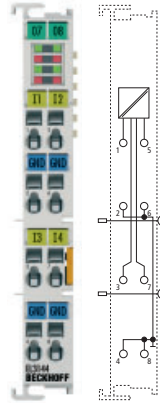
Analog input | 0...20 mA, 12 bits, single-ended

	1-channel analog supply terminal, 0...20 mA, 12 bits, single-ended	2-channel analog supply terminal, 0...20 mA, 12 bits, single-ended	4-channel analog supply terminal, 0...20 mA, 12 bits, single-ended	8-channel analog supply terminal, 0...20 mA, 12 bits, single-ended
Technical data	EL3041 ES3041	EL3042 ES3042	EL3044 ES3044	EL3048 ES3048
Signal voltage	0...20 mA			
Resolution	12 bits (16 bits presentation, incl. sign)			
Technology	single-ended	single-ended	single-ended	single-ended
Conversion time	0.625 ms default setting, configurable	0.625 ms default setting, configurable	0.625 ms default setting, configurable	1.25 ms default setting, configurable
Number of inputs	1 (single-ended)	2 (single-ended)	4 (single-ended)	8 (single-ended)
				
	<p>The EL304x analog input terminals have a common reference potential. This reference potential is connected to the 0 V power contact in the EL3041, EL3042 and EL3048. Overcurrent is displayed not only in the process image, but also by an error LED for each channel.</p>			
Dielectric strength	max. 30 V	max. 30 V	max. 30 V	max. 30 V
Current consumption power contacts	–	–	–	–
Current consumption E-bus	typ. 130 mA	typ. 130 mA	typ. 130 mA	typ. 130 mA
Distributed clocks	–	–	–	–
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	1 kHz	1 kHz	1 kHz	1 kHz
Measuring error	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)
Special features	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3041	www.beckhoff.com/EL3042	www.beckhoff.com/EL3044	www.beckhoff.com/EL3048

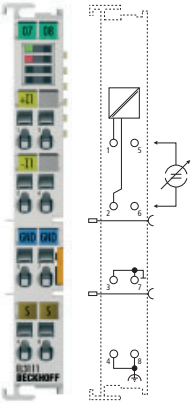
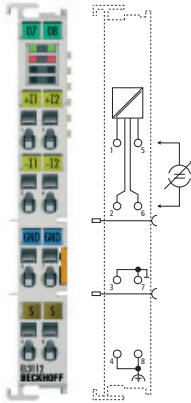
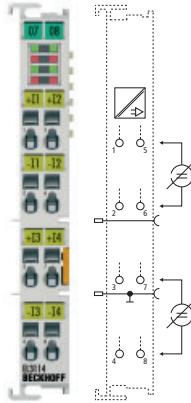
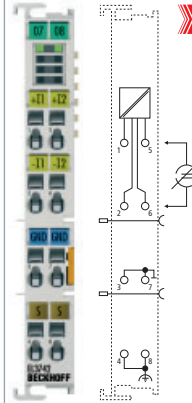
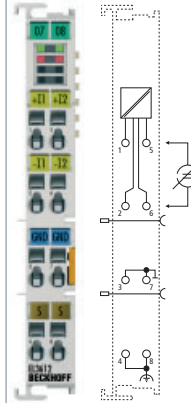
Analog input | 0...20 mA, 12 bits, differential input

	1-channel analog input terminal, 0...20 mA, 12 bits, differential input	2-channel analog input terminal, 0...20 mA, 12 bits, differential input	4-channel analog input terminal, 0...20 mA, 12 bits, differential input
Technical data	EL3011 ES3011	EL3012 ES3012	EL3014 ES3014
Signal voltage	0...20 mA		
Resolution	12 bits (16 bits presentation, incl. sign)		
Technology	differential input	differential input	differential input
Conversion time	0.625 ms default setting, configurable	0.625 ms default setting, configurable	0.625 ms default setting, configurable
Number of inputs	1 (differential)	2 (differential)	4 (differential)
			
	<p>The differential inputs of the EL301x series measure the current between input and output as a floating current measurement. Overcurrent is displayed not only in the process image, but also by an error LED for each channel.</p>		
Common-mode voltage U_{CM}	35 V max.	35 V max.	35 V max.
Current consumption power contacts	–	–	–
Current consumption E-bus	typ. 130 mA	typ. 130 mA	typ. 130 mA
Distributed clocks	–	–	–
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	1 kHz	1 kHz	1 kHz
Measuring error	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)
Special features	activatable FIR/IIR filters, limit value monitoring	activatable FIR/IIR filters, limit value monitoring	activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 55 g	approx. 55 g	approx. 55 g
Further information	www.beckhoff.com/EL3011	www.beckhoff.com/EL3012	www.beckhoff.com/EL3014

Analog input | 0...20 mA, 16 bits, single-ended

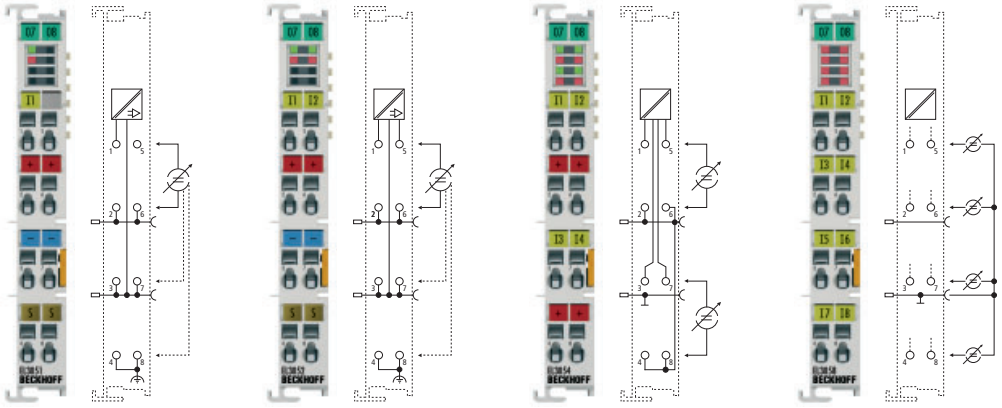
	1-channel analog input terminal, 0...20 mA, 16 bits, single-ended	2-channel analog input terminal, 0...20 mA, 16 bits, single-ended	2-channel analog input terminal, -10...+10 mA, 16 bits, single-ended	4-channel analog input terminal, 0...20 mA, 16 bits, single-ended
Technical data	EL3141 ES3141	EL3142 ES3142	EL3142-0010	EL3144 ES3144
Signal voltage	0...20 mA		-10...+10 mA	0...20 mA
Resolution	16 bits (incl. sign)			
Technology	single-ended	single-ended	single-ended	single-ended
Conversion time	~ 40 μ s	~ 60 μ s (fast mode ~ 40 μ s)	~ 60 μ s (fast mode ~ 40 μ s)	~ 40 μ s
Number of inputs	1 (single-ended)	2 (single-ended)	2 (single-ended)	4 (single-ended)
				
	The EL314x analog input terminals measure input currents from 0 to 20 mA. The significantly faster conversion time and support for distributed clocks enable use in time-critical applications and set them apart from the EL30xx series. Overcurrent is displayed not only in the process image, but also by an error LED for each channel.			
Dielectric strength	max. 30 V	max. 30 V	max. 30 V	max. 30 V
Current consum. pow.cont.	–	–	–	–
Current consumption E-bus	typ. 180 mA	typ. 180 mA	typ. 180 mA	typ. 180 mA
Distributed clocks	yes	yes	yes	yes
Oversampling factor	–	–	–	–
Distributed clock precision	<< 1 μ s	<< 1 μ s	<< 1 μ s	<< 1 μ s
Input signal bandwidth	see input filter	see input filter	see input filter	see input filter
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	5 kHz	5 kHz	5 kHz	5 kHz
Measuring error	< \pm 0.3 % (relative to full scale value)	< \pm 0.3 % (relative to full scale value)	< \pm 0.3 % (relative to full scale value)	< \pm 0.3 % (relative to full scale value)
Special features	standard and compact process image, switchable measuring data representation in the EL3142-0010, activatable FIR/IIR filters, limit value monitoring			
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3141	www.beckhoff.com/EL3142	www.beckhoff.com/EL3142	www.beckhoff.com/EL3144

Analog input | 0...20 mA, 16/24 bits, differential input

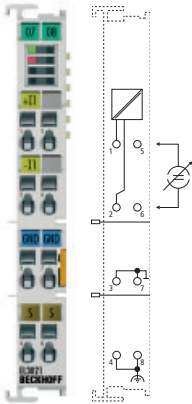
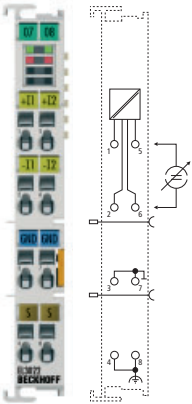
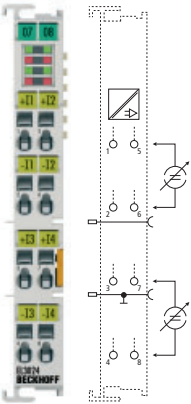
1-channel analog input terminal, 0...20 mA, 16 bits, differential input	2-channel analog input terminal, 0...20 mA, 16 bits, differential input	4-channel analog input terminal, 0...20 mA, 16 bits, differential input	2-channel analog input terminal, 0...20 mA, 16 bits, differential input, with oversampling	2-channel analog input terminal, 0...20 mA, 24 bits, differential input
EL3111 ES3111	EL3112 ES3112	EL3114 ES3114	EL3742 ES3742	EL3612 ES3612
				24 bits (incl. sign)
differential input	differential input	differential input	differential input, oversampling	differential input
~ 40 μ s	~ 50 μ s (fast mode ~ 35 μ s)	~ 100 μ s	min. 10 μ s	1...400 ms configurable
1 (differential)	2 (differential)	4 (differential)	2 (differential)	2 (differential)
				
<p>The EL311x analog input terminals measure input currents from 0 to 20 mA. The significantly faster conversion time and support for distributed clocks enable use in time-critical applications and set them apart from the EL30xx series. Overcurrent is displayed not only in the process image, but also by an error LED for each channel.</p>			<p>The EL3742 is an over-sampling terminal like the EL3702, see description on page 353</p>	<p>The EL3612 terminal is a precise measuring device with 24-bit resolution.</p>
max. 35 V common-mode voltage	max. 35 V common-mode voltage	max. 35 V common-mode voltage	max. 35 V common-mode voltage	max. 35 V common-mode voltage
–	–	–	–	–
typ. 180 mA	typ. 180 mA	typ. 180 mA	typ. 200 mA	typ. 190 mA
yes	yes	yes	yes	–
–	–	–	n = 1...100 selectable	–
<< 1 μ s	<< 1 μ s	<< 1 μ s	<< 1 μ s	–
see input filter	see input filter	see input filter	0...30 kHz recommended	see input filter
85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
5 kHz	5 kHz	5 kHz	30 kHz	3 kHz
< \pm 0.3 % (relative to full scale value)	< \pm 0.3 % (relative to full scale value)	< \pm 0.3 % (relative to full scale value)	< \pm 0.3 % (relative to full scale value) up to 10 Hz input signal	< \pm 0.01 % at 25 $^{\circ}$ C (relative to full scale value, 50 Hz filter)
standard and compact process image, activatable FIR/IIR filters, limit value monitoring			oversampling	various filter times, limit evaluation, high precision
0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, Ex
approx. 55 g	approx. 55 g	approx. 55 g	approx. 60 g	approx. 60 g
www.beckhoff.com/EL3111	www.beckhoff.com/EL3112	www.beckhoff.com/EL3114	www.beckhoff.com/EL3742	www.beckhoff.com/EL3612

Further information on XFC see page **278**

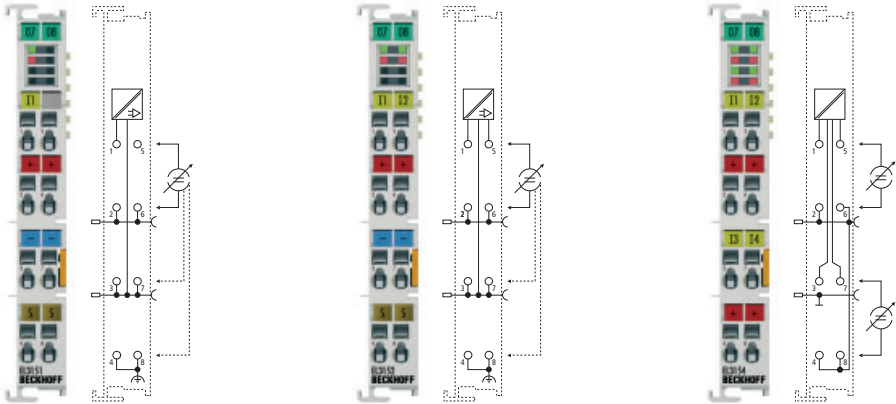
Analog input | 4...20 mA, 12 bits, single-ended

	1-channel analog supply terminal, 4...20 mA, 12 bits, single-ended	2-channel analog supply terminal, 4...20 mA, 12 bits, single-ended	4-channel analog supply terminal, 4...20 mA, 12 bits, single-ended	8-channel analog supply terminal, 4...20 mA, 12 bits, single-ended
Technical data	EL3051 ES3051	EL3052 ES3052	EL3054 ES3054	EL3058 ES3058
Signal voltage	4...20 mA			
Resolution	12 bits (16 bits presentation, incl. sign)			
Technology	single-ended	single-ended	single-ended	single-ended
Conversion time	0.625 ms default setting, configurable	0.625 ms default setting, configurable	0.625 ms default setting, configurable	1.25 ms default setting, configurable
Number of inputs	1 (single-ended)	2 (single-ended)	4 (single-ended)	8 (single-ended)
				
	<p>In the EL305x series (4 to 20 mA), overcurrent and undercurrent are displayed not only in the process image, but also by an error LED for each channel. The EL3054 is particularly suitable for the connection of 2-wire sensors.</p>			
Dielectric strength	max. 30 V	max. 30 V	max. 30 V	max. 30 V
Current consumption power contacts	–	–	–	–
Current consumption E-bus	typ. 130 mA	typ. 130 mA	typ. 130 mA	typ. 130 mA
Distributed clocks	–	–	–	–
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	1 kHz	1 kHz	1 kHz	1 kHz
Measuring error	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)
Special features	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3051	www.beckhoff.com/EL3052	www.beckhoff.com/EL3054	www.beckhoff.com/EL3058

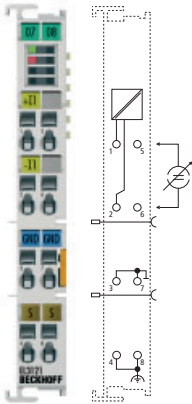
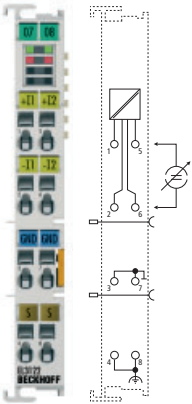
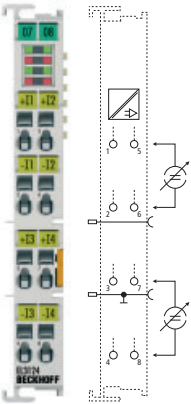
Analog input | 4...20 mA, 12 bits, differential input

	1-channel analog input terminal, 4...20 mA, 12 bits, differential input	2-channel analog input terminal, 4...20 mA, 12 bits, differential input	4-channel analog input terminal, 4...20 mA, 12 bits, differential input
Technical data	EL3021 ES3021	EL3022 ES3022	EL3024 ES3024
Signal voltage	4...20 mA		
Resolution	12 bits (16 bits presentation, incl. sign)		
Technology	differential input	differential input	differential input
Conversion time	0.625 ms default setting, configurable	0.625 ms default setting, configurable	0.625 ms default setting, configurable
Number of inputs	1 (differential)	2 (differential)	4 (differential)
			
	In the EL302x series (4 to 20 mA), overcurrent and undercurrent are displayed not only in the process image, but also by an error LED for each channel.		
Common-mode voltage U_{CM}	35 V max.	35 V max.	35 V max.
Current consumption power contacts	–	–	–
Current consumption E-bus	typ. 130 mA	typ. 130 mA	typ. 130 mA
Distributed clocks	–	–	–
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	1 kHz	1 kHz	1 kHz
Measuring error	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)
Special features	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 55 g	approx. 55 g	approx. 60 g
Further information	www.beckhoff.com/EL3021	www.beckhoff.com/EL3022	www.beckhoff.com/EL3024

Analog input | 4...20 mA, 16 bits, single-ended

	1-channel analog supply terminal, 4...20 mA, 16 bits, single-ended	2-channel analog supply terminal, 4...20 mA, 16 bits, single-ended	4-channel analog supply terminal, 4...20 mA, 16 bits, single-ended
Technical data	EL3151 ES3151	EL3152 ES3152	EL3154 ES3154
Signal voltage	4...20 mA		
Resolution	16 bits (incl. sign)		
Technology	single-ended	single-ended	single-ended
Conversion time	~ 40 μ s	~ 60 μ s (fast mode ~ 40 μ s)	~ 100 μ s
Number of inputs	1 (single-ended)	2 (single-ended)	4 (single-ended)
			
	<p>The EL315x analog input terminals measure input currents from 4 to 20 mA. The significantly faster conversion time and support for distributed clocks enable use in time-critical applications and set them apart from the EL30xx series. Overcurrent and undercurrent are displayed not only in the process image, but also by an error LED for each channel.</p>		
Dielectric strength	max. 30 V	max. 30 V	max. 30 V
Current consumption power contacts	–	–	–
Current consumption E-bus	typ. 180 mA	typ. 180 mA	typ. 180 mA
Distributed clocks	yes	yes	yes
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	5 kHz	5 kHz	5 kHz
Measuring error	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)
Special features	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3151	www.beckhoff.com/EL3152	www.beckhoff.com/EL3154

Analog input | 4...20 mA, 16 bits, differential input

	1-channel analog input terminal, 4...20 mA, 16 bits, differential input	2-channel analog input terminal, 4...20 mA, 16 bits, differential input	4-channel analog input terminal, 4...20 mA, 16 bits, differential input
Technical data	EL3121 ES3121	EL3122 ES3122	EL3124 ES3124
Signal voltage	4...20 mA		
Resolution	16 bits (incl. sign)		
Technology	differential input	differential input	differential input
Conversion time	~ 40 μ s	~ 50 μ s (fast mode ~ 35 μ s)	~ 100 μ s
Number of inputs	1	2	4
			
<p>The EL312x analog input terminals measure input currents from 4 to 20 mA. The significantly faster conversion time and support for distributed clocks enable use in time-critical applications and set them apart from the EL30xx series. Overcurrent and undercurrent are displayed not only in the process image, but also by an error LED for each channel.</p>			
Common-mode voltage U_{CM}	35 V max.	35 V max.	35 V max.
Current consumption power contacts	–	–	–
Current consumption E-bus	typ. 180 mA	typ. 180 mA	typ. 180 mA
Distributed clocks	yes	yes	yes
Internal resistance	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage	85 Ω typ. + diode voltage
Input filter limit frequency	5 kHz	5 kHz	5 kHz
Measuring error	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)	< ± 0.3 % (relative to full scale value)
Special features	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring	standard and compact process image, activatable FIR/IIR filters, limit value monitoring
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 55 g	approx. 55 g	approx. 60 g
Further information	www.beckhoff.com/EL3121	www.beckhoff.com/EL3122	www.beckhoff.com/EL3124

Analog input | Resistance thermometer (RTD, PT100)

The EL320x analog input terminals enable resistance sensors to be connected directly. A microprocessor in the terminal converts the resistance value to temperature and linearises it, depending on the set characteristic curve.

The following measurement scaling is used:

- for temperature: 1/10 °C
(1 digit = 0.1 °C)
- in the measuring range 10 to 1,047 Ω:
1/64 Ω (approx. 15 mΩ)
- in the measuring range 10 to 4,095 Ω:
1/16 Ω (approx. 62 mΩ)

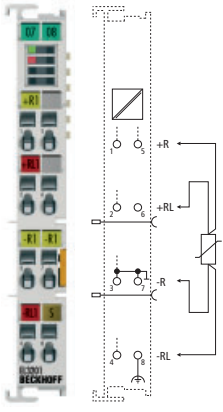
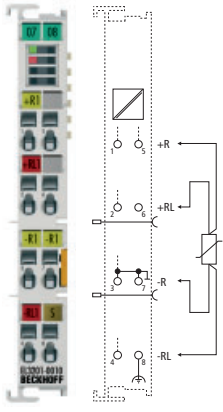
Besides that, a wire breakage is reported to the controller and indicated by the error LED. Resistance sensors with different characteristic curves are implemented over their entire measuring range, so that temperature measurements can be carried out between -200 and +850 °C. The terminal is fully configurable via the fieldbus, so that the temperature conversion can be switched off, for example.

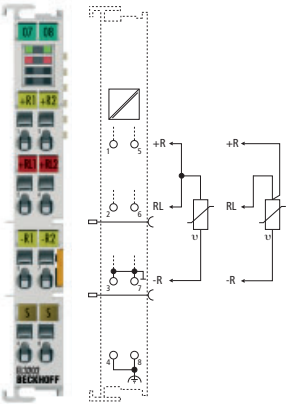
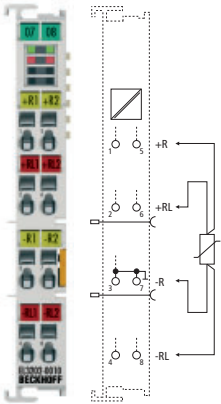
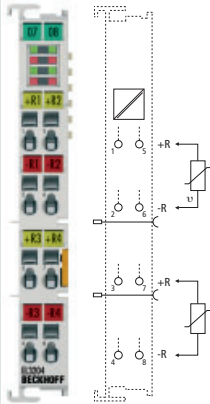
A 3- or 4-wire connection should be used for achieving maximum measuring accuracy (in conjunction with suitably precise sensors). For 2-wire measurements PT/Ni1000 sensors are recommended.

The EL320x-0010 versions offer increased accuracy at a resolution of 0.01 °C/digit and required 4-wire connection. The synchronisation result provided by the EL3201-0020 is confirmed with a calibration certificate.

1-channel analog input terminal, PT100 (RTD), 16 bits

1-channel analog input terminal, PT100 (RTD), 16 bits, high-precision

Technical data	EL3201 ES3201	EL3201-0010
Sensor types	PT100, PT200, PT500, PT1000, Ni100, Ni120, Ni1000 resistance measurement (e.g. potentiometer, 10 Ω...1.2/4 kΩ), KTY sensors (types see documentation)	
Technology	2-, 3-, 4-wire	4-wire
Resolution	0.1 °C per digit	0.01 °C per digit
Conversion time	approx. 24 ms default setting, 4...500 ms configurable	approx. 24 ms default setting, 4...500 ms configurable
Number of inputs	1	1
		
Temperature range	-200...+850 °C (PT sensors); -60...+250 °C (Ni sensors)	-200...+320 °C (PT sensors)
Current consum. pow.cont.	–	–
Current consumption E-bus	typ. 190 mA	typ. 190 mA
Distributed clocks	–	–
Measuring current	< 0.5 mA (load-dependent)	< 0.5 mA (load-dependent)
Input filter limit frequency	typ. 1 kHz	typ. 1 kHz
Measuring error	< ±0.5 °C for PT sensors	< ±0.1 °C (for PT100 sensors, ambient temperature 40 °C, 4-wire connection, measuring range -200...+320 °C, 50 Hz filter)
Special features	integrated digital filter, limit value monitoring, variable connection technology	integrated digital filter, limit value monitoring, variable connection technology
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g
Further information	www.beckhoff.com/EL3201	www.beckhoff.com/EL3201
Special terminals		EL3201-0020
Distinguishing features		with calibration certificate

	2-channel analog input terminal, PT100 (RTD), 16 bits	2-channel analog input terminal, PT100 (RTD), 16 bits, high-precision	4-channel analog input terminal, PT100 (RTD), 16 bits
	EL3202 ES3202	EL3202-0010	EL3204 ES3204
			PT100, PT200, PT500, PT1000, Ni100, Ni120, Ni1000 resistance measurement (e.g. potentiometer, 10 Ω...1.2/4 kΩ), KTY sensors
	2-, 3-wire (default setting: 3-wire)	4-wire	2-wire
	0.1 °C per digit	0.01 °C per digit	0.1 °C per digit
	approx. 85 ms default setting, 2...800 ms configurable	approx. 85 ms default setting, 2...800 ms configurable	approx. 85 ms default setting, 2...800 ms configurable
	2	2	4
			
	-200...+850 °C (PT sensors); -60...+250 °C (Ni sensors)	-200...+320 °C (PT sensors)	-200...+850 °C (PT sensors); -60...+250 °C (Ni sensors)
	–	–	–
	typ. 190 mA	typ. 190 mA	typ. 190 mA
	–	–	–
	< 0.5 mA (load-dependent)	< 0.5 mA (load-dependent)	< 0.5 mA (load-dependent)
	typ. 1 kHz	typ. 1 kHz	typ. 1 kHz
	< ±0.5 °C for PT sensors	< ±0.1 °C (for PT100 sensors, ambient temperature 40 °C, 4-wire connection, measuring range -200...+320 °C, 50 Hz filter)	< ±0.5 °C for PT sensors
	integrated digital filter, limit value monitoring, variable connection technology	integrated digital filter, limit value monitoring, variable connection technology	integrated digital filter, limit value monitoring, variable connection technology
	0...+55 °C	0...+55 °C	0...+55 °C
	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
	approx. 60 g	approx. 60 g	approx. 60 g
	www.beckhoff.com/EL3202	www.beckhoff.com/EL3202	www.beckhoff.com/EL3204

Analog input | Thermocouple/mV measurement

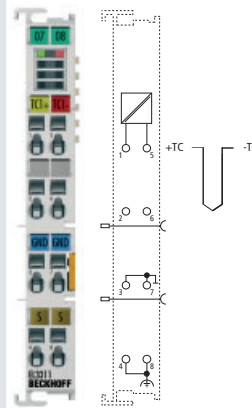
Thermocouples can be classified as active transducers. They exploit the thermo-electric effect (Seebeck, Peltier, Thomson). Where two electrical conductors of different materials (e.g. iron and constantan) make contact, a contact voltage occurs, which is clearly a function of temperature and thus is called thermovoltage. The material change associated with thermocouples will always result in at least two such material combinations. One is placed at the measurement location, the other is the so-called comparison point, which is normally located in the measurement device. In order to compensate for the reference point effect, the temperature at the reference point must be known. For the EL331x this is the connection point of the thermocouple to the terminal contacts, which is why the terminal contact temperature is specially measured here.

Thermocouples represent cost-effective and easy to install sensors for temperature measurement with reduced need for accuracy.

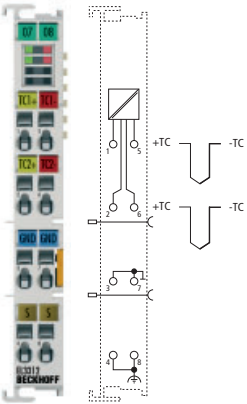
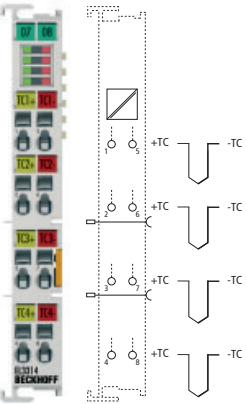
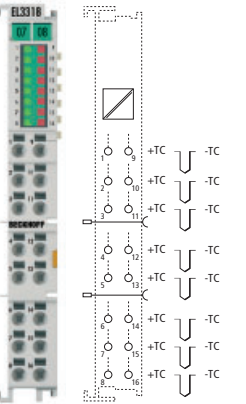
Depending on the type of thermocouple temperatures from -200 to +2,300 °C can be measured. The linearisation and cold junction compensation is carried out by a characteristic curve on a microprocessor. The directions in the documentation, concerning earthing and thermocouples which are not potential-free, must be observed. An error LED indicates any broken wire.

1-channel analog input terminal, thermocouple with open-circuit recognition

Technical data	EL3311
Thermocouple sensor types	types J, K, L, B, E, N, R, S, T, U (default setting type K), mV measurement
Technology	2-wire
Resolution	0.1 °C per digit
Conversion time	approx. 750 ms up to 20 ms, depending on configuration and filter setting, default: approx. 75 ms
Number of inputs	1



Temperature range	in the range defined in each case for the sensor (default setting: type K; -100...+1,370 °C); voltage measurement: ±30 mV...±75 mV
Current consumption power contacts	–
Current consumption E-bus	200 mA
Distributed clocks	–
Input filter limit frequency	typ. 1 kHz; dependent on sensor length, conversion time, sensor type
Measuring error	< ±0.3 % (relative to full scale value)
Special features	open-circuit recognition
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 60 g
Further information	www.beckhoff.com/EL3311

2-channel analog input terminal, thermocouple with open-circuit recognition	4-channel analog input terminal, thermocouple with open-circuit recognition	8-channel analog input terminal, thermocouple with open-circuit recognition
EL3312	EL3314	EL3318
0.1 °C per digit	0.1 °C per digit	0.1 °C per digit
approx. 1.2 s up to 20 ms, depending on configuration and filter setting, default: approx. 125 ms	approx. 2.5 s up to 20 ms, depending on configuration and filter setting, default: approx. 250 ms	approx. 5 s up to 40 ms, depending on configuration and filter setting, default: approx. 500 ms
2	4	8
		 <p data-bbox="1013 1283 1422 1389">The 16-pin HD housing enables the connection of up to eight thermocouples on a terminal width of 12 mm. Errors are displayed for each channel by LED and process data.</p>
in the range defined in each case for the sensor (default setting: type K; -100...+1,370 °C); voltage measurement: ±30 mV...±75 mV	in the range defined in each case for the sensor (default setting: type K; -100...+1,370 °C); voltage measurement: ±30 mV...±75 mV	in the range defined in each case for the sensor (default setting: type K; -100...+1,370 °C); voltage measurement: ±30 mV...±75 mV
–	–	–
200 mA	typ. 200 mA	typ. 210 mA
–	–	–
typ. 1 kHz; dependent on sensor length, conversion time, sensor type	typ. 1 kHz; dependent on sensor length, conversion time, sensor type	typ. 1 kHz; dependent on sensor length, conversion time, sensor type
< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)	< ±0.3 % (relative to full scale value)
open-circuit recognition	open-circuit recognition	open-circuit recognition
0...+55 °C	0...+55 °C	0...+55 °C
CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
approx. 60 g	approx. 60 g	approx. 70 g
www.beckhoff.com/EL3312	www.beckhoff.com/EL3314	www.beckhoff.com/EL3318

Analog input | Oscillation measurement

The EL3632 EtherCAT Terminal is a 2-channel oversampling input terminal, which is able to sample up to 50 ksamples per channel and second. As a minimum every 20 μ s an analog input value is sampled and stored in a buffer for retrieval by the EtherCAT master. The master cyclically retrieves not only a single measured value, but a package consisting of n measurement readings that were sampled at equidistant intervals. System-wide distributed clock synchronisation enables the measurement readings to be related to other system components. This is used for correlation with axis positions, for example.

Many manufacturers offer suitable sensors, usually under their brand names or the standardised IEPE interface name.


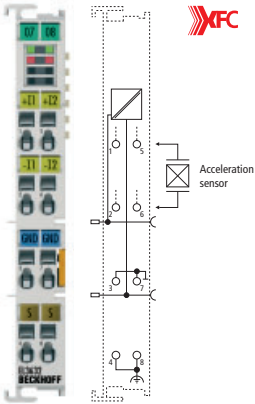
Up to two IEPE sensors can be connected to the EL3632 in 2-wire mode. IEPE sensors are dynamic vibration sensors that are supplied with a constant current and respond to mechanical deflection with a variable resistance. The constant current source integrated in the EL3632 continues to stabilise the constant current rapidly, so that the change in resistance results in a change in voltage on the feed line, which is measured by the EL3632. The constant current can be set separately between 4 and 10 mA for each channel, depending on the sensor and the cable length. It is generated from the 24 V voltage available at the power contacts. An electrically isolated measurement configuration can be achieved using the EL9560 power supply terminal.

Except for filtering no preprocessing of the vibration amplitude values takes place in the EL3632. This is handled by the retrieving controller.

Please note that such dynamic sensors can only be used for vibrations up to a lower limit frequency, but not for static position without dynamic movement.

A TwinCAT library with mathematical functions is available for evaluating the signals on the controller. This enables all benefits of the PC platform, such as performance and flexibility, to be fully utilised.

2-channel analog input terminal for Condition Monitoring (IEPE), 16 bits

Technical data	 EL3632
Signal voltage	IEPE constant current supply and recording of modulated AC voltage
Technology	Condition Monitoring (IEPE), oversampling recording
Resolution	16 bits (incl. sign)
Conversion time	20 μ s (max. 50 kSamples/s)
Number of inputs	2
	
Measuring range	default ± 5 V up to 25 kHz, ± 250 mV up to 10 Hz
Voltage U_{Sensor}	power contact voltage less 1 V
Constant current	typ. 4, 8, 10 mA parameterisable per channel
Current consumption power contacts	24 V, typ. 20 mA + load
Current consumption E-bus	typ. 180 mA
Distributed clocks	yes
Input filter limit frequency	analog parameterisable 5 th order low-pass filter up to 25 kHz, typically 0.05 Hz high-pass filter
Measuring error	$< \pm 0.5$ % up to 25 kHz (relative to full scale value)
Special features	automatic anti-aliasing function, wire breakage detection
Operating temperature	0...+55 $^{\circ}$ C
Approvals	CE
Weight	approx. 60 g
Further information	www.beckhoff.com/EL3632

Further information on XFC see page **278**


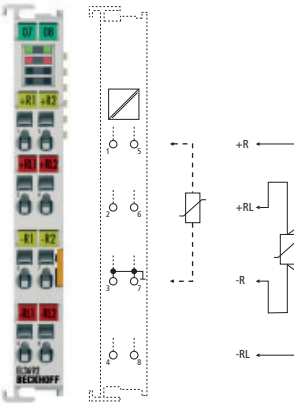


For availability status see Beckhoff website at: www.beckhoff.com/EL3632

Analog input | Resistance measurement

The EL3692 2-channel resistance measurement terminal is designed for slow sampling of ohmic resistors over a wide range from 10 mΩ to 10 MΩ. The circuitry of the EtherCAT Terminal enables measurement in 2- or 4-wire versions. Due to the electrical isolation of 1.5 kV between the field side and the E-bus, in single-channel mode measurements can be carried out at live points (within the permissible range). Contact resistance values of contacts can be sampled both in closed and open state. The measurement is parameterisable for continuous measurement (single-channel) or alternate measurement in pulsed mode.

2-channel analog resistance measurement terminal, 10 mΩ...10 MΩ, 14 bits, high-precision

Technical data	 EL3692
Measuring range	500 mΩ, 100 Ω, 50 kΩ, 10 MΩ
Technology	2- or 4-wire, resistance measurement
Resolution	depending on the range, typ. 14 bits
Conversion time	typ. 250 ms
Number of inputs	2
	
Current consumption power contacts	–
Current consumption E-bus	typ. 250 mA
Distributed clocks	–
Internal resistance	> 100 MΩ
Electrical isolation	1500 V (E-bus/signal voltage)
Input filter limit frequency	100 Hz
Measuring error	< ±0.5 % (relative to full scale value with 4-wire connection)
Special features	automatic range selection, pulse and continuous measurement, wire breakage detection
Operating temperature	0...+55 °C
Approvals	CE
Weight	approx. 60 g
Further information	www.beckhoff.com/EL3692



For availability status see Beckhoff website at: www.beckhoff.com/EL3692

Analog input | Measurement technology, strain gauge

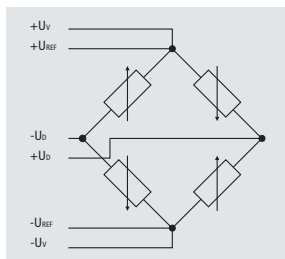
The analog input terminals EL3351 and EL3356 are suitable for connection of full resistor bridges such as strain gauges, for example. Like 2-channel analog input terminals, they measure the two voltages U_{REF} (power supply of the bridge) and U_D (variable sensor voltage depending on the detuning of the bridge). The measuring range is optimally set: The bridge is operated with a high supply voltage (± 12 V), while the bridge voltage is in the mV range. Through measurement of both voltages long-term and temperature drifts are eliminated. In addition, the EL335x offers adapted filter functions.

The EL3351 generates ± 5 V as bridge supply voltage from the E-bus supply. Alternatively, a bridge supply up to ± 12 V can be connected. The EL3356 can be supplied with max. 12 V via the power contacts (e.g. from the EL9512 power supply terminal) for the bridge supply. Here too an external power supply up to ± 12 V is possible.

Various sensors operate based on such resistance measuring bridge techniques, which are configured as quarter, half or full bridges, depending on the required accuracy and sensitivity. In a quarter bridge only one of the four resistors is variable depending on the measurand, in a full bridge all four are variable.

Applications where such sensors are used include:

- weighing tasks: slow silo measurement or fast bag filling
- vibration measurement for moving components
- deformation measurement under static load and deformation warning
- pressure measurement through sensor deformation measurement



Full bridge

2-channel analog input terminal, resistor bridge analysis, 16 bits

2-channel analog input terminal, precise resistor bridge analysis, 16 bits

Technical data	EL3351 ES3351	EL3356 ES3356
Resolution	16 bits, 32 bits presentation	
Technology	resistor bridge, strain gauge	
Conversion time	2.5...800 ms, configurable, default 82 ms	50 ms default setting
Number of inputs	2, for 1 resistor bridge	2, for 1 resistor bridge
	<p>The EL3351 analog input terminal is suitable for slow measuring tasks.</p>	<p>The EL3356 analog input terminal is suitable for fast measurements with high demands on the prefiltering of the measured values in the terminal.</p>
Power supply U_V	5 V, max. 20 mA	12 V from power contacts
Current consumption power contacts	–	12 V supply necessary for strain gauge supply
Current consumption E-bus	typ. 170 mA	typ. 250 mA
Distributed clocks	–	yes
Measuring range U_D	max. -20...+20 mV	max. -25...+25 mV
Measuring range U_{REF}	max. -12...+12 V	max. -12...+12 V
Internal resistance	$> 200 \text{ k}\Omega (U_{REF}), > 1 \text{ M}\Omega (U_D)$	$> 200 \text{ k}\Omega (U_{REF}), > 1 \text{ M}\Omega (U_D)$
Input filter limit frequency	50 Hz default setting, parameterisable	50 Hz default setting, -5 kHz parameterisable
Measuring error	$< \pm 0.1 \%$ (relative to full scale value, 50 Hz filter)	$< \pm 0.01 \%$ (relative to full scale value), auto-calibration
Special features	slow measured value determination, integrated ± 5 V bridge supply	auto-calibration (deactivatable), parameterisable filters and averager
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE	CE
Weight	approx. 70 g	approx. 60 g
Further information	www.beckhoff.com/EL3351	www.beckhoff.com/EL3356

i For availability status see Beckhoff website at: www.beckhoff.com/EL3356

Analog input | Measurement technology, multimeter terminal

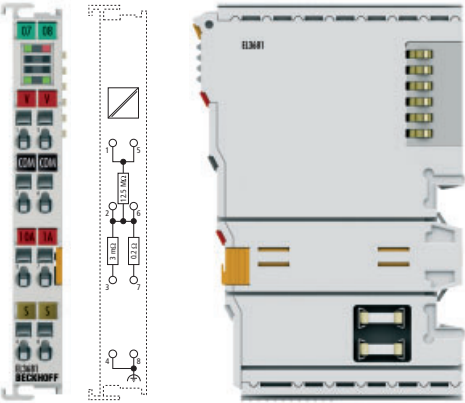
The EL3681 EtherCAT Terminal enables measurement of currents and voltages in a wide input range. The measuring ranges are switched automatically, as usual in advanced digital multimeters. There are two current paths available for current measurement: for small currents protected with 1 A and a high-current path for up to 10 A. The current and the high-resistance voltage measurement can be used for DC and AC. The alternating parameters are issued as true RMS values, the direct parameters with arithmetic averaging. The measured data are read via EtherCAT and processed further in the controller. At the same time, the EL3681 enables the measuring type and range to be set via the bus.

Excellent interference immunity is achieved through the fully electrically isolated design of the electronic measuring system and the dual slope conversion system. High precision and simple, high-impedance measurement from 300 mV to 300 V allow the EtherCAT Terminals to be used like a modern digital multimeter.

For voltages greater than 25 V AC (42 V peak) or 60 V DC the fuse opening must be covered by an additional terminal or the EL9011 end terminal.

In measuring applications in particular, the voltage to be expected is often not yet known during the planning phase. Automatic adjustment of the measurement range simplifies use and reduces stock levels.

Digital multimeter terminal, 18 bits

Technical data	EL3681 ES3681
Signal voltage	max. 300 V AC/DC, 10 A
Resolution	18 bits + sign in each measurement range
Conversion time	0.5 s (1 s during measuring range switching) preset, min. 65 ms
Number of inputs	1 voltage or 1 current
	
Measuring voltage	300 mV, 3 V, 30 V, 300 V
Current consumption power contacts	–
Current consumption E-bus	150 mA
Distributed clocks	–
Measuring current	100 mA, 1 A and 10 A via high-current path
Internal resistance	3 mΩ/0.2 Ω/12.5 MΩ
Electrical isolation	1,500 V (terminal/E-bus)
Measuring error	0.01 % DC voltage measurement at 25 °C
Special features	automatic or manual range selection, 1.25 A fuse installed + spare fuse, filter deactivatable
Operating temperature	0...+55 °C
Approvals	CE
Weight	approx. 70 g
Further information	www.beckhoff.com/EL3681
Accessories	ZB8000-0001
Spare fuse	10 pieces, 1.25 A

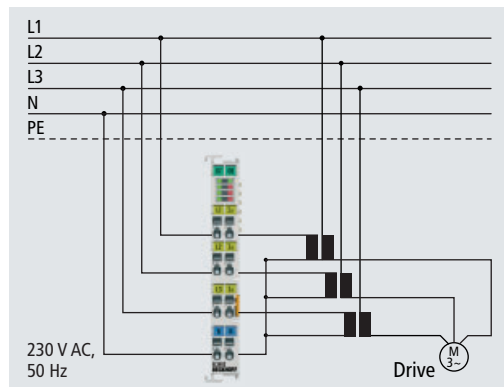
Analog input | Power measurement

Via the fieldbus the EL3403 EtherCAT Terminal enables analysis of the energy consumption of the connected system or building segment or specific energy data for individual consumers.

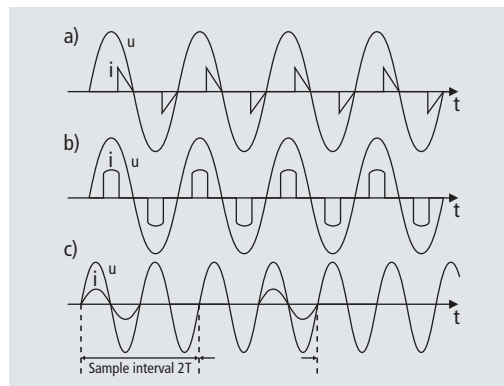
It is suitable for 50 Hz and 60 Hz mains supply. The voltages of the three phases and neutral can be measured by directly wiring the individual cables to the terminal. In order to measure current, the current of the three phases L1, L2 and L3 is fed in via simple current transformers. The measured current and voltage values are output as effective values. From the effective

values for voltage (U) and current (I), the EL3403 calculates the effective power (P), the energy consumption (W) and the power factor ($\cos \varphi$) for each phase. From these values the terminal calculates the apparent power (S) and the phase shift angle (φ).

The following types of current can be measured with the EL3403: current and voltage curve for leading edge phase control (a), pulse duration control (b) and burst firing control (c); the measurement interval is set analogous to the control interval.



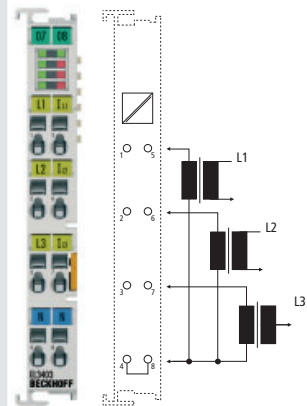
Connection diagram 3-phase measurement



Measurable types of current

3-phase power measurement terminal

Technical data	EL3403 ES3403
Technology	3-phase power measurement for alternating voltages
Measuring voltage	max. 500 V AC 3~ (ULx-N: max. 288 V AC)
Resolution	1 μ A, 0.1 mV, 10 mW
Conversion time	mains-synchronous
Number of inputs	3 x current, 3 x voltage
Measured values	current, voltage, effective power, reactive power, apparent power, energy, $\cos \varphi$, peak values U, I and P, frequency
Current consumption power contacts	–
Current consumption E-bus	typ. 120 mA
Distributed clocks	–
Measuring current	max. 1 A (AC), via measuring transformers x A/1 A
Measuring error	0.5 % relative to full scale value (U/I), 1 % calculated value (P)
Special features	true RMS value calculation, single-phase operation also possible
Operating temperature	0...+55 °C
Approvals	CE, UL
Weight	approx. 75 g
Further information	www.beckhoff.com/EL3403
Special terminals	EL3403-0xxx
Distinguishing features	special terminals see www.beckhoff.com/EL3403


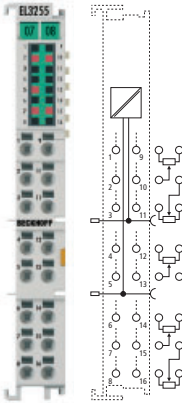


Analog input | Potentiometer measurement

The EL3255 EtherCAT Terminal enables direct connection of up to five resistive voltage dividers. It is possible to connect potentiometers, e.g. for manual operation of a system, or path or pressure sensors, whose value can be determined through resistance comparison.

The EL3255 generates the 10 V supply voltage for the sensors internally and measures this voltage as well as the voltages fed back by the five sensors. Since all voltages are subject to the same influences, the potentiometer analysis is based on determination of the individual voltage components.

5-channel input,
potentiometer measurement
with sensor supply,
10 V

Technical data	 EL3255
Sensor types	potentiometer 300 Ω...50 kΩ
Technology	ratiometric potentiometer evaluation, 3-wire connection
Resolution	16 bits
Number of inputs	5
	
Conversion time	approx. 5 s up to 1 ms, depending on configuration and filter setting, default: approx. 50 ms
Current consumption power contacts	typ. 20 mA + load
Current consumption E-bus	typ. 210 mA
Distributed clocks	–
Feed voltage pot.	10 V, max. 0.3 A total current
Internal resistance	>> 100 kΩ
Measuring error	< ±0.5 % (relative to full scale value)
Special features	open-circuit recognition
Operating temperature	0...+55 °C
Approvals	CE
Weight	approx. 70 g
Further information	www.beckhoff.com/EL3255



For availability status see Beckhoff website at: www.beckhoff.com/EL3255

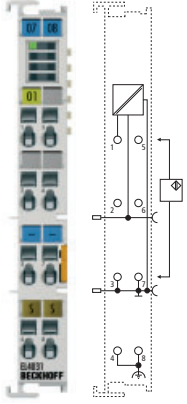
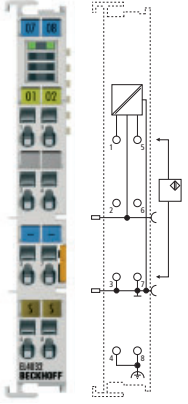
Analog output | -10...+10 V, 12 bits/16 bits

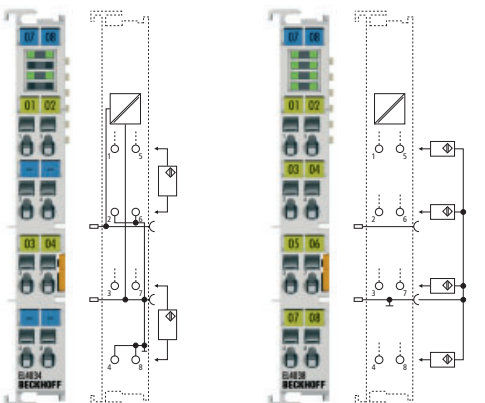
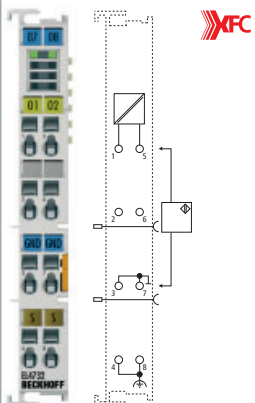
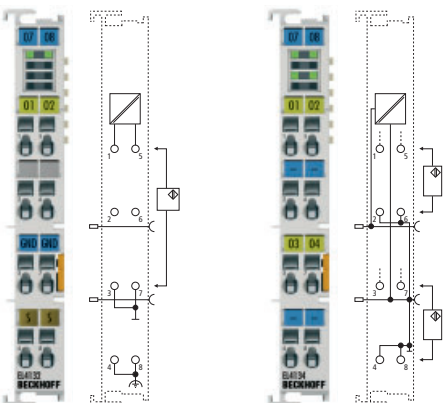
The output from the EL4xxx EtherCAT Terminals is an analog voltage or current parameter, depending on the controller specification: Terminals with 1 to 8 output channels on a 12 mm wide terminal are available for the ranges -10...+10 V, 0...10 V, 0...20 mA and 4...20 mA. All terminals feature a watchdog which, in the event of a communication failure, issues a stored value (default: 0) or even moves to it via a ramp. All EL4xxx units feature distributed clocks, which means that, if activated, they issue their output values reproducibly and synchronous with the other distributed clock devices in the system. The fewer channels a terminal has, the faster it can update its channels. The EL47xx is even able to generate new output values every 10 µs and can therefore output up to 100,000 samples per second.

The EL4732 and EL4712 oversampling terminals are particularly suitable for high-precision responses in DC systems, e.g. in conjunction with input terminals (EL37xx, EL31xx) or servo controllers.

1-channel analog output terminal, -10...+10 V, 12 bits

2-channel analog output terminal, -10...+10 V, 12 bits

Technical data	EL4031 ES4031	EL4032 ES4032
Signal voltage	-10...+10 V	
Resolution	12 bits	
Connection technology	2-wire, single-ended	2-wire, single-ended
Conversion time	~ 100 µs	~ 150 µs
Number of outputs	1	2
		
	The EL4031 and EL4032 EtherCAT Terminals are analog output terminals with average conversion times and 12-bit resolution. Both use the 0 V power contact as common reference potential and are designed for 2-wire connection. User scaling can be set in the terminal.	
Load	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)
Current consumption E-bus	typ. 140 mA	typ. 140 mA
Distributed clocks	yes	yes
Distributed clock precision	<< 1 µs	<< 1 µs
Oversampling factor	–	–
Output rate	–	–
Current consum. pow.cont.	typ. 25 mA	typ. 25 mA
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex
Weight	approx. 55 g	approx. 55 g
Further information	www.beckhoff.com/EL4031	www.beckhoff.com/EL4032

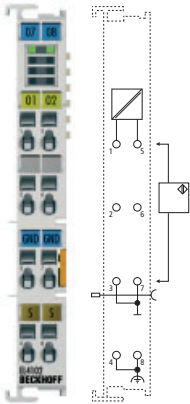
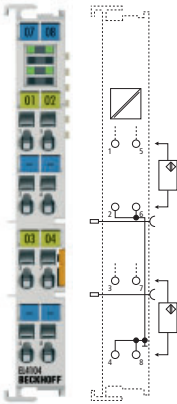
4-channel analog output terminal, -10...+10 V, 12 bits	8-channel analog output terminal, -10...+10 V, 12 bits	2-channel analog output terminal, -10...+10 V, 16 bits, oversampling	2-channel analog output terminal, -10...+10 V, 16 bits	4-channel analog output terminal, -10...+10 V, 16 bits	
EL4034 ES4034	EL4038 ES4038	EL4732 ES4732	EL4132 ES4132	EL4134 ES4134	
		16 bits (incl. sign)			
2-wire, single-ended	1-wire, single-ended	2-wire, single-ended	2-wire, single-ended	2-wire, single-ended	
~ 250 µs	~ 400 µs	~ 10 µs	~ 40 µs	~ 80 µs	
4	8	2	2	4	
 <p>The EL4034 and EL4038 EtherCAT Terminals are analog output terminals with average conversion times and 12-bit resolution. The EL4034 is designed for 2-wire connection. The channels have a common reference ground. The EL4038 uses the 0 V power contact as reference potential and is designed for single-wire connection. User scaling can be set in the terminal.</p>		 <p>The EL4732 EtherCAT Terminal can output up to 100 sequential output values (which have previously been supplied as a package) per EtherCAT cycle. The oversampling factor must be an integer multiple of the cycle time.</p>		 <p>The EL4132 and EL4134 EtherCAT Terminals are analog output terminals with short conversion times and 16-bit resolution and are suitable for fast control tasks. Both terminals are designed for 2-wire connection. The channels have a common reference ground. The EL4134 uses the 0 V power contact as reference potential. User scaling can be set in the terminal.</p>	
> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)	
typ. 140 mA	typ. 100 mA	typ. 180 mA	typ. 210 mA	typ. 265 mA	
yes	yes	yes	yes	yes	
<< 1 µs	<< 1 µs	<< 1 µs	<< 1 µs	<< 1 µs	
–	–	n = 1...100 selectable	–	–	
–	–	max. 100 ksamples/s	–	–	
typ. 25 mA	typ. 25 mA	–	–	–	
< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	
Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	oversampling	Watchdog parameterisable; user synchronisation can be activated.	Watchdog parameterisable; user synchronisation can be activated.	
0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	
CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	
approx. 85 g	approx. 85 g	approx. 50 g	approx. 55 g	approx. 65 g	
www.beckhoff.com/EL4034	www.beckhoff.com/EL4038	www.beckhoff.com/EL4732	www.beckhoff.com/EL4132	www.beckhoff.com/EL4134	

Further information on XFC see page 278

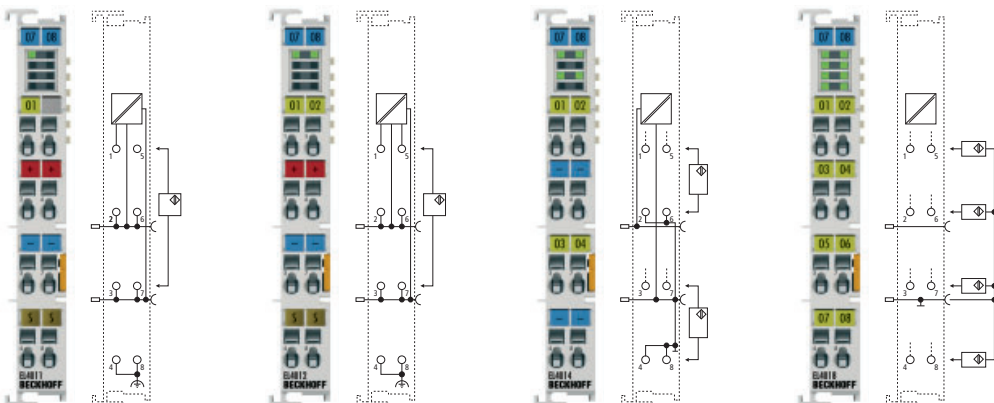
Analog output | 0...10 V, 12 bits

	1-channel analog output terminal, 0...10 V, 12 bits	2-channel analog output terminal, 0...10 V, 12 bits	4-channel analog output terminal, 0...10 V, 12 bits	8-channel analog output terminal, 0...10 V, 12 bits
Technical data	EL4001 ES4001	EL4002 ES4002	EL4004 ES4004	EL4008 ES4008
Signal voltage	0...10 V			
Resolution	12 bits			
Connection technology	2-wire, single-ended	2-wire, single-ended	2-wire, single-ended	1-wire, single-ended
Conversion time	~ 100 µs	~ 150 µs	~ 250 µs	~ 400 µs
Number of outputs	1	2	4	8
	<p>The EL4001, EL4002, EL4004 and EL4008 EtherCAT Terminals are analog output terminals with average conversion times and 12-bit resolution. The channels use the 0 V power contact as common reference potential. The EL4008 is designed for single-wire connection. The other terminals are designed for 2-wire connection. User scaling can be set in the terminal.</p>			
Load	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)	> 5 kΩ (short-circuit-proof)
Current consumption E-bus	typ. 140 mA	typ. 140 mA	typ. 140 mA	typ. 100 mA
Distributed clocks	yes	yes	yes	yes
Distributed clock precision	<< 1 µs	<< 1 µs	<< 1 µs	<< 1 µs
Current consumption power contacts	typ. 25 mA	typ. 25 mA	typ. 25 mA	typ. 25 mA
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 85 g	approx. 85 g
Further information	www.beckhoff.com/EL4001	www.beckhoff.com/EL4002	www.beckhoff.com/EL4004	www.beckhoff.com/EL4008

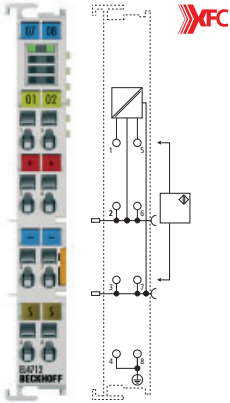
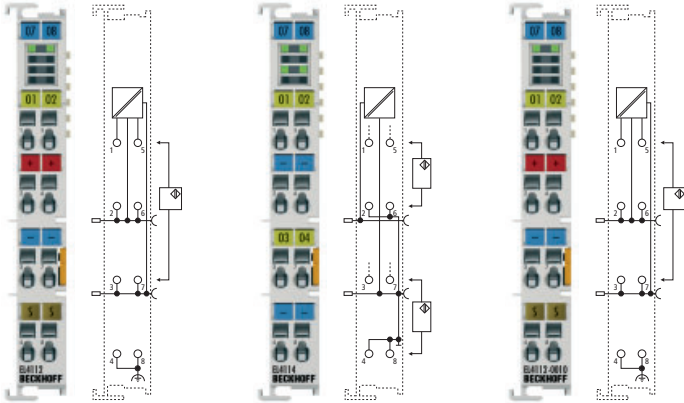
Analog output | 0...10 V, 16 bits

	2-channel analog output terminal, 0...10 V, 16 bits	4-channel analog output terminal, 0...10 V, 16 bits
Technical data	EL4102 ES4102	EL4104 ES4104
Signal voltage	0...10 V	
Resolution	16 bits (incl. sign)	
Connection technology	2-wire, single-ended	2-wire, single-ended
Conversion time	~ 40 μ s	~ 80 μ s
Number of outputs	2	4
		
	<p>The EL4102 and EL4104 EtherCAT Terminals are analog output terminals with short conversion times and 16-bit resolution and are suitable for fast control tasks. Both terminals are designed for 2-wire connection. The channels have a common reference ground. User scaling can be set in the terminal.</p>	
Load	> 5 k Ω (short-circuit-proof)	> 5 k Ω (short-circuit-proof)
Current consumption E-bus	typ. 210 mA	typ. 190 mA
Distributed clocks	yes	yes
Distributed clock precision	<< 1 μ s	<< 1 μ s
Current consumption power contacts	–	–
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	Watchdog parameterisable; user synchronisation can be activated.	Watchdog parameterisable; user synchronisation can be activated.
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 65 g
Further information	www.beckhoff.com/EL4102	www.beckhoff.com/EL4104

Analog output | 0...20 mA, 12 bits

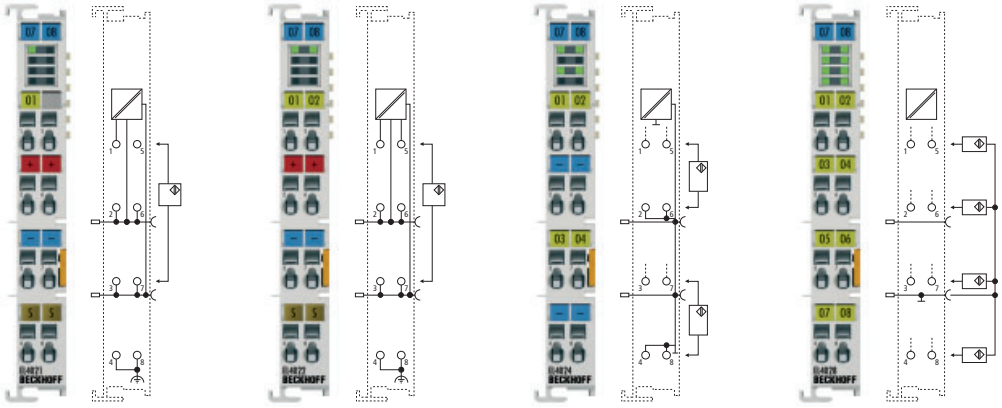
	1-channel analog output terminal, 0...20 mA, 12 bits	2-channel analog output terminal, 0...20 mA, 12 bits	4-channel analog output terminal, 0...20 mA, 12 bits	8-channel analog output terminal, 0...20 mA, 12 bits
Technical data	EL4011 ES4011	EL4012 ES4012	EL4014 ES4014	EL4018 ES4018
Signal voltage	0...20 mA			
Resolution	12 bits			
Connection technology	3-wire, single-ended	3-wire, single-ended	2-wire, single-ended	1-wire, single-ended
Conversion time	~ 100 µs	~ 150 µs	~ 250 µs	~ 400 µs
Number of outputs	1	2	4	8
				
	<p>The EtherCAT Terminals of the EL401x series are analog output terminals with average conversion times and 12-bit resolution. The channels use the 0 V power contact as common reference potential. Apart from the 8-channel version EL4018, the terminals of the EL401x series are designed for 2-wire connection. User scaling can be set in the terminal.</p>			
Load	< 500 Ω (short-circuit-proof)	< 500 Ω (short-circuit-proof)	< 350 Ω (short-circuit-proof)	< 150 Ω
Current consumption E-bus	typ. 140 mA	typ. 140 mA	typ. 140 mA	typ. 100 mA
Distributed clocks	yes	yes	yes	yes
Distributed clock precision	<< 1 µs	<< 1 µs	<< 1 µs	<< 1 µs
Oversampling factor	–	–	–	–
Output rate	–	–	–	–
Current consumption power contacts	typ. 25 mA	typ. 25 mA	typ. 25 mA	typ. 25 mA
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 65 g	approx. 65 g
Further information	www.beckhoff.com/EL4011	www.beckhoff.com/EL4012	www.beckhoff.com/EL4014	www.beckhoff.com/EL4018

Analog output | 0...20 mA/-10...+10 mA, 16 bits

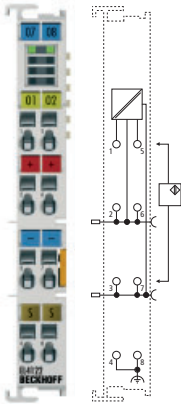
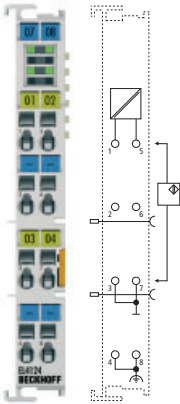
	2-channel analog output terminal, 0...20 mA, 16 bits with oversampling	2-channel analog output terminal, 0...20 mA, 16 bits	4-channel analog output terminal, 0...20 mA, 16 bits	2-channel analog output terminal, -10...+10 mA, 16 bits
Technical data	EL4712 ES4712	EL4112 ES4112	EL4114 ES4114	EL4112-0010 ES4112-0010
Signal voltage	0...20 mA			-10...+10 mA
Resolution	16 bits (incl. sign)			
Connection technology	3-wire, single-ended	3-wire, single-ended	2-wire, single-ended	3-wire, single-ended
Conversion time	~ 10 μ s	~ 40 μ s	~ 80 μ s	~ 40 μ s
Number of outputs	2	2	4	2
	 <p>The EL4712 EtherCAT Terminal can output up to 100 sequential output values (which have previously been supplied as a package) per EtherCAT cycle. The oversampling factor must be an integer multiple of the cycle time.</p>	 <p>The EtherCAT Terminals of the EL411x series are analog output terminals with short conversion times and 16-bit resolution and are suitable for fast control tasks. The terminals are designed for 2-wire connection. The channels use the 0 V power contact as common reference potential. User scaling can be set in the terminal.</p>		
Load	< 500 Ω (short-circuit-proof)	< 500 Ω (short-circuit-proof)	< 350 Ω (short-circuit-proof)	< 500 Ω (short-circuit-proof)
Current consumption E-bus	typ. 100 mA	typ. 160 mA	typ. 160 mA	typ. 160 mA
Distributed clocks	yes	yes	yes	yes
Distributed clock precision	<< 1 μ s	<< 1 μ s	<< 1 μ s	<< 1 μ s
Oversampling factor	n = integer multiple of the cycle time, 1...100 selectable	–	–	–
Output rate	max. 100 ksamples/s	–	–	–
Current consum. pow.cont.	typ. 15 mA	typ. 15 mA	typ. 15 mA	typ. 15 mA
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	oversampling	Watchdog parameterisable; user synchronisation can be activated.	Watchdog parameterisable; user synchronisation can be activated.	Watchdog parameterisable; user synchronisation can be activated.
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 65 g	approx. 60 g	approx. 65 g	approx. 65 g
Further information	www.beckhoff.com/EL4712	www.beckhoff.com/EL4112	www.beckhoff.com/EL4114	www.beckhoff.com/EL4112

Further information on XFC see page **278**

Analog output | 4...20 mA, 12 bits

	1-channel analog output terminal, 4...20 mA, 12 bits	2-channel analog output terminal, 4...20 mA, 12 bits	4-channel analog output terminal, 4...20 mA, 12 bits	8-channel analog output terminal, 4...20 mA, 12 bits
Technical data	EL4021 ES4021	EL4022 ES4022	EL4024 ES4024	EL4028 ES4028
Signal voltage	4...20 mA			
Resolution	12 bits			
Connection technology	3-wire, single-ended	3-wire, single-ended	2-wire, single-ended	1-wire, single-ended
Conversion time	~ 100 µs	~ 150 µs	~ 250 µs	~ 400 µs
Number of outputs	1	2	4	8
				
	<p>The EtherCAT Terminals of the EL402x series are analog output terminals with average conversion times and 12-bit resolution. The channels use the 0 V power contact as common reference potential. Apart from the 8-channel version EL4028, the terminals of the EL402x series are designed for 2-wire connection. User scaling can be set in the terminal.</p>			
Load	< 500 Ω (short-circuit-proof)	< 500 Ω (short-circuit-proof)	< 350 Ω (short-circuit-proof)	< 150 Ω
Current consumption E-bus	typ. 140 mA	typ. 140 mA	typ. 140 mA	typ. 100 mA
Distributed clocks	yes	yes	yes	yes
Distributed clock precision	<< 1 µs	<< 1 µs	<< 1 µs	<< 1 µs
Current consumption power contacts	typ. 25 mA	typ. 25 mA	typ. 25 mA	typ. 25 mA
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.	Optional watchdog: user-specific output value with ramp; user synchronisation can be activated.
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 60 g	approx. 80 g	approx. 80 g
Further information	www.beckhoff.com/EL4021	www.beckhoff.com/EL4022	www.beckhoff.com/EL4024	www.beckhoff.com/EL4028

Analog output | 4...20 mA, 16 bits

	2-channel analog output terminal, 4...20 mA, 16 bits	4-channel analog output terminal, 4...20 mA, 16 bits
Technical data	EL4122 ES4122	EL4124 ES4124
Signal voltage	4...20 mA	
Resolution	16 bits (incl. sign)	
Connection technology	3-wire, single-ended	2-wire, single-ended
Conversion time	~ 40 μ s	~ 80 μ s
Number of outputs	2	4
		
	<p>The EL4122 and EL4124 EtherCAT Terminals are analog output terminals with short conversion times and 16-bit resolution and are suitable for fast control tasks. The terminals are designed for 2-wire connection. The channels have a common reference ground. The EL4122 uses the 0 V power contact as reference potential. User scaling can be set in the terminal.</p>	
Load	< 500 Ω (short-circuit-proof)	< 350 Ω (short-circuit-proof)
Current consumption E-bus	typ. 160 mA	typ. 190 mA
Distributed clocks	yes	yes
Distributed clock precision	<< 1 μ s	<< 1 μ s
Current consumption power contacts	typ. 15 mA	typ. 15 mA
Output error	< 0.1 % (relative to end value)	< 0.1 % (relative to end value)
Special features	Watchdog parameterisable; user synchronisation can be activated.	Watchdog parameterisable; user synchronisation can be activated.
Operating temperature	0...+55 $^{\circ}$ C	0...+55 $^{\circ}$ C
Approvals	CE, UL, Ex	CE, UL, Ex
Weight	approx. 60 g	approx. 65 g
Further information	www.beckhoff.com/EL4122	www.beckhoff.com/EL4124

Position measurement | SSI encoder interface

The EL5001 SSI interface EtherCAT Terminal enables the direct connection of an SSI encoder; two SSI encoders can be connected to the 2-channel EL5002 version.

SSI communication is normal for the connection of position encoders and needs two differential wire pairs as the clock and data line. Via the clock line, the master specifies the speed with which the SSI slave on the data line returns its position, e.g. with 24-bit length.

The interface circuit of the EL500x generates a pulse for reading the encoder, and makes the incoming data stream available to the controller as a data word in the process image. Various operating modes, transmission frequencies and bit widths can be permanently stored in a control register.

The EL5001 and EL5002 feature the distributed clocks function. Cyclic reading of the SSI encoder can thus be started with high precision, enabling detailed dynamic analysis of the axis in the control system. If the distributed clocks function is deactivated, the EL500x clocks the data synchronously with the EtherCAT cycle from the position encoder.

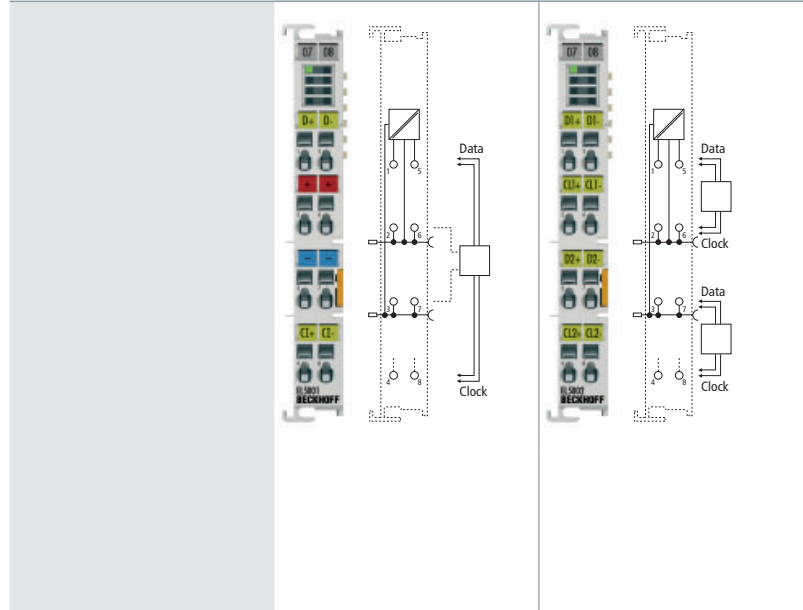
If the transmitted position data are also to be read by a second controller while an SSI master-slave connection already exists, the EL5001-0011 can be used as an SSI monitor, which passively and jointly reads the SSI data on the data lines.

	SSI encoder interface	SSI encoder interface
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Technical data	EL5001 ES5001	EL5002 ES5002
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Technology	SSI encoder interface	
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Number of channels	1	2
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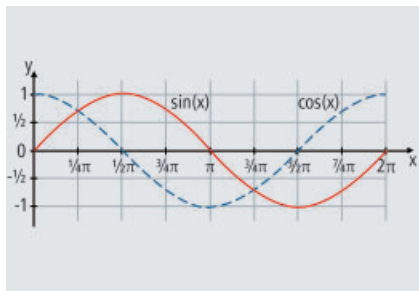


Encoder supply	24 V DC via power contacts	external e.g. EL91xx
Current consumption power contacts	typ. 20 mA	typ. 20 mA
Current consumption E-bus	typ. 120 mA	typ. 190 mA
Distributed clocks	yes	yes
Signal output (pulse)	difference signal (RS422)	difference signal (RS422)
Signal input (data)	difference signal (RS422)	difference signal (RS422)
Encoder connection	binary input: D+, D-; binary output: Cl+, Cl-	binary input: D+, D-; binary output: Cl+, Cl-
Data transfer rates	variable up to 1 MHz, 250 kHz default	variable up to 1 MHz, 250 kHz default
Special features	adjustable baud rate, coding and data length	adjustable baud rate, coding and data length
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, Ex
Weight	approx. 55 g	approx. 55 g
Further information	www.beckhoff.com/EL5001	www.beckhoff.com/EL5002
Special terminals	EL5001-0011	
Distinguishing features	SSI monitor terminal, no clock output (simply listening)	

Position measurement | 1-channel SinCos encoder interface

Position encoders with a 1 V_{PP} sine/cosine interface output two sine signals phase-shifted by 90° as analog voltages. The two signals are each transmitted differentially as signal and counter-signal, so that the voltage difference between the two lines corresponds to the wanted signal in volts peak-to-peak (usual voltage level: 1 V_{PP}). In the case of rotary encoders, a full mechanical revolution is divided into up to 10,000 periods, wherein one period corresponds to the full cycle of the sine/cosine signal in 1 V_{PP} encoders. In order to refine the resolution, an n-thousandfold more exact determination of the position within one period is achieved by the interpolation of the two 90° phase-shifted sine signals. For the EL5021 SinCos EtherCAT Terminal, this resolution of the period by interpolation is 8 to 13 bits, depending upon the setting, and is equivalent to a 256 to 8,192-fold micro-resolution of the period.

Digital encoder evaluations mostly use only full steps to determine position, so that the reciprocal value of the number of periods of an encoder corresponds to the maximum resolution. The EL5101 encoder terminal, however, uses a time-based micro-increment method to achieve 256-fold interpolation.



SinCos signal depending on the encoder position

1-channel SinCos encoder interface,
1 V_{PP}

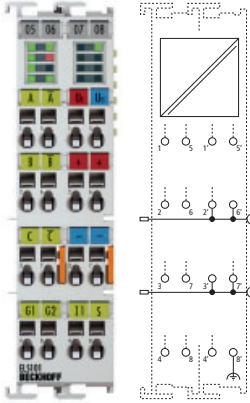
Technical data	EL5021 ES5021
Technology	SinCos encoder interface for differential 1 V _{PP} signal
Number of channels	1
	<p>The EL5021 SinCos EtherCAT Terminal serves as interface for the direct connection of a measuring sensor, e.g. a measuring probe with sinusoidal voltage output 1 V_{PP} to the higher-level fieldbus. The measuring signal is processed, interpolated and made available as a 32 bit value. The signal period resolution is 13 bit. The reference mark is also stored in a 32 bit value. The current count and the reference mark value can be read. The terminal provides 5 V for the supply of the encoder.</p>
Nominal voltage	24 V at power contact, 5 V encoder supply built in
Current consumption power contacts	typ. 50 mA without connected sensor
Current consumption E-bus	typ. 120 mA
Distributed clocks	yes
Signal input	1 V _{PP}
Encoder connection	A, A (inv), B, B (inv), C, C (inv)
Input frequency	250 kHz (scanning of the input signals with 70 MHz)
Resolution	max. 13 bits, 1,024 steps per period
Special features	latch, reset, amplitude and frequency error recognition, frequency-dependent period resolution, frequency counter max. 24 bit
Operating temperature	0...+55 °C
Approvals	CE, Ex
Weight	approx. 55 g
Further information	www.beckhoff.com/EL5021

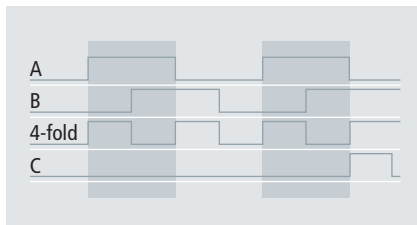
Position measurement | Incremental encoder interface

As opposed to absolute value encoders, incremental encoders do not supply a direct position, but rather a changing/pulsed signal, which can be calculated back to a position. Incremental encoders divide a 360° rotation of the encoder axis into individual steps (increments) and mark a full revolution by means of a special mark (zero pulse).

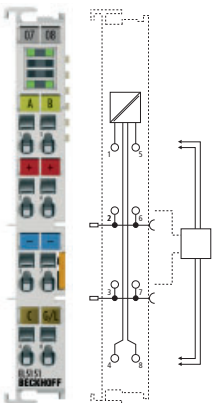
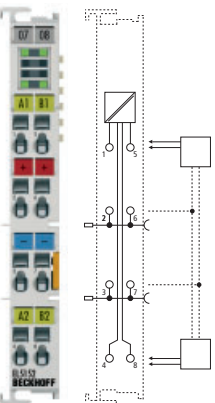
The number of increments determines both the resolution of an encoder and the accuracy of the position. In order to refine the position determination or to increase the resolution, the Beckhoff encoder terminals support the micro-increment mode. The interpolation of the signal voltages results in a 256-fold greater resolution, without which an encoder with a finer resolution would have to be used. Due to the functional principal, this time-based function requires a minimum speed in the case of dynamic axes; i.e. micro-increments cannot be evaluated at a (virtual) standstill.

1-channel incremental encoder interface, differential input (RS485)

Technical data	EL5101 ES5101
Technology	incremental encoder interface RS485
Number of channels	1
	
	<p>The EL5101 EtherCAT Terminal is an interface for the direct connection of incremental encoders with differential (RS485) or single-ended inputs. It supplies 5 V for the encoder supply.</p>
Nominal voltage	24 V DC at power contact
Current consum. pow.cont.	typ. 100 mA + load
Current consumption E-bus	typ. 130 mA
Distributed clocks	yes
Input signal	difference signal (RS485), single-ended possible
Encoder connection	A, A (inv), B, B (inv), C, C (inv), differential inputs (RS485); status input 5 V DC; gate/latch input 24 V DC
Encoder operating voltage	5 V DC/max. 0.5 A
Input frequency	max. 4 million increments/s (with 4-fold evaluation)
Resolution	1/256 bit microincrements
Counter	1 x 16/32 bit switchable
Special features	wire breakage detection, latch and gate function, period duration and frequency measurement, micro-increments, time-stamping of edges, filters
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 100 g
Further information	www.beckhoff.com/EL5101
Special terminals	EL5101-0010
Distinguishing features	20 million increments/s (with 4-fold evaluation), no single-ended operation



The quadruple evaluation of the signals A and B (quadrature encoder) produces a fine positional resolution and enables detection of the direction.

<p>1-channel incremental encoder interface, single-ended, 24 V DC</p>	<p>2-channel incremental encoder interface, single-ended, 24 V DC</p>
<p>EL5151 ES5151</p>	<p>EL5152 ES5152</p>
<p>incremental encoder interface 24 V DC</p>	
<p>2</p>	
 <p>The EL5151 EtherCAT Terminal is an interface with 24 V inputs for the direct connection of incremental encoders. A 32 bit counter with a quadrature decoder and a 32 bit latch for the zero pulse can be read, set or enabled. Alternatively, the EL5151 can be used as up/down counter terminal with gate.</p>	 <p>Two 32-bit counters with quadrature encoder can be read and set in the EL5152 EtherCAT Terminal. Due to their support for distributed clocks, the EL51xx terminals can detect the axis positions synchronously and with high temporal accuracy together with other slaves. In the case of dynamic axes above a certain minimum speed, the micro-increment function allows a 256-fold finer positional resolution than that provided by the encoder with its clock signals.</p>
<p>24 V DC at power contact</p>	<p>24 V DC at power contact</p>
<p>typ. 100 mA + load</p>	<p>typ. 100 mA + load</p>
<p>typ. 130 mA</p>	<p>typ. 180 mA</p>
<p>yes</p>	<p>yes</p>
<p>24 V DC</p>	<p>24 V DC</p>
<p>A, B, C, gate/latch input 24 V DC, 24 V/0 V</p>	<p>A1, B1, A2, B2, 24 V/0 V</p>
<p>24 V DC</p>	<p>24 V DC</p>
<p>max. 400,000 increments/s (with 4-fold evaluation)</p>	<p>max. 400,000 increments/s (with 4-fold evaluation)</p>
<p>1/256 bit microincrements</p>	<p>1/256 bit microincrements</p>
<p>1 x 16/32 bit switchable</p>	<p>2 x 32 bit</p>
<p>gate or latch function, micro-increments, time stamping of edges, period duration and frequency measurement, up/down counters</p>	<p>gate or latch function, micro-increments, time stamping of edges, period duration and frequency measurement, up/down counters</p>
<p>0...+55 °C</p>	<p>0...+55 °C</p>
<p>CE, UL, Ex</p>	<p>CE, UL, Ex</p>
<p>approx. 50 g</p>	<p>approx. 50 g</p>
<p>www.beckhoff.com/EL5151</p>	<p>www.beckhoff.com/EL5152</p>

Communication | Serial interfaces RS232/RS485

The EL60xx serial interfaces enable the connection of devices with RS232 or RS422/RS485 interfaces to the control level. The devices connected to the EtherCAT Terminal communicate via the EtherCAT network with the automation device. The active communication channel works independently of the cycle of the higher-level EtherCAT system in full duplex mode at up to 115.2 kbaud. This way, any desired number of serial interfaces can be used in the application without having to consider structural restrictions in the control device. The serial interface can be positioned close to the place of use, this way reducing the necessary cable lengths.

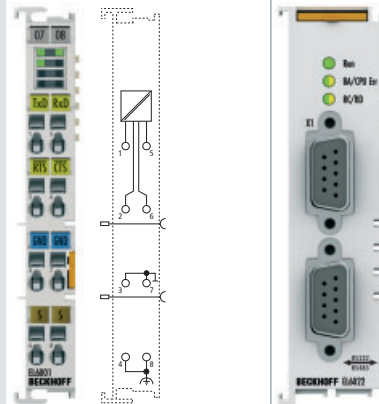
The RS232 interface allows for high immunity to interference through electrically isolated signals. In the EL6021 this is additionally supported by differential signal transmission according to RS422. The EL6022 can make 2 x 5 V/20 mA from the E-bus supply available for powering external devices.

The EL60xx can be used as a normal Windows COM interface in conjunction with the TwinCAT Virtual Serial COM Driver (see page [822](#)).

1 x serial interface
RS232/RS422/RS485

2 x serial interface
RS232/RS422/RS485

Technical data	EL6001 ES6001		EL6021 ES6021		EL6002		EL6022	
	Data transfer rates	2,400...115,200 baud; default: 9,600 baud, 8 data bits, no parity and one stop bit				300...115,200 baud; default: 9,600 baud, 8 data bits, no parity and one stop bit		
Interfaces	1 x RS232	1 x RS422/ RS485		2 x RS232	2 x RS422/ RS485			
Technology	terminal contact				D-sub, 9-pin			
Data buffer	864 bytes receive buffer, 128 bytes transmit buffer				864 bytes receive buffer, 128 bytes transmit buffer			
Current consumption power contacts	–				–			
Current consumption E-bus	typ. 120 mA	typ. 170 mA		typ. 170 mA	typ. 270 mA			
Distributed clocks	–				–			
Cable length	max. 15 m	approx. 1,000 m twisted pair		max. 15 m	approx. 1,000 m twisted pair			
Line impedance	–	120 Ω		–	120 Ω			
Special features	–				2 x 5 V/20 mA for external supply (EL6022)			
Operating temperature	0...+55 °C				0...+55 °C			
Approvals	CE, UL, Ex				CE, UL, Ex			
Weight	approx. 55 g				approx. 55 g			
Further information	www.beckhoff.com/EL6001				www.beckhoff.com/EL6002			



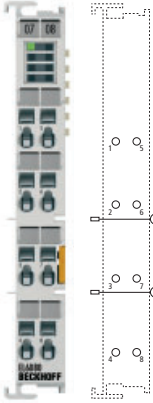
Communication | EtherCAT memory terminal 128 kbyte

The EL6080 EtherCAT memory terminal has 128 KB of non-volatile memory (NOVRAM). The terminal can be used to store and read out parameters and recipes. Part of the memory can also be used for the cyclic storage of machine data such as operating hour meters or production numbers. The EtherCAT Terminal is used, for example, for storing module-related data in the machine module in modular machine concepts with a central controller.

Data is only stored in the RAM in the live terminal and is therefore not stored permanently. However, this allows unlimited access for reading and writing. In the event of a power failure, an internal buffer supplies the NOVRAM block until the entire contents of the RAM have been stored in a non-volatile memory.

The EL6080 supports memory access with cyclic process data or via acyclic SDO/CoE. The access time depends in both cases on the size of the data. For cyclic access, the user must create a set of process data with an arbitrary structure, which is then written to or read from the terminal in its entirety. This process takes several task cycles, depending upon the size of the data and the cycle time, and is controlled by a handshake.

EtherCAT memory terminal
128 kbyte, NOVRAM

Technical data	EL6080
Technology	EtherCAT memory terminal
Memory	128 kbyte NOVRAM
	
Number of write/read	arbitrary
Current consumption power contacts	–
Current consumption E-bus	typ. 130 mA
Distributed clocks	–
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 50 g
Further information	www.beckhoff.com/EL6080

Communication | Ethernet switch port terminals



The EL6601 and EL6614 Ethernet switch-port terminals serve the local connection of arbitrary Ethernet devices to the EtherCAT system. The EtherCAT system relays the Ethernet communication of the connected devices fully transparent and collision-free.

The EL6614 Ethernet switchport terminal has an integrated 5-port switch. It manages the data from the EtherCAT system and the four RJ 45 ports. In full-duplex mode, the terminal enables the collision-free communication of the connected devices with one another.

The EL6601 and EL6614 are suitable for transmitting and receiving 'normal' non-real-time-critical Ethernet frames, e.g. with TCP/IP contents. The throughput specified in the documentation must be observed. TwinCAT, as a 'virtual switch', manages these frames at the IPC Ethernet port, which is configured as an EtherCAT device.

In addition, the EL6601 and EL6614 can appear as a publisher/subscriber like a real-time Ethernet device and can be configured as such in TwinCAT. Real-time data are preferred by the terminal and processed synchronously with the EtherCAT cycle. In this way, several hundred bytes of process data can be transmitted and received cyclically, up to < 1 ms.

Ethernet

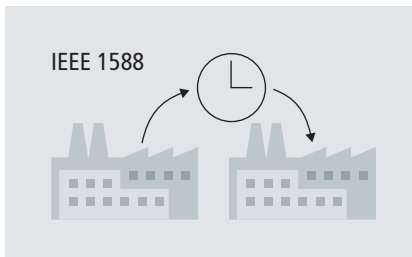
	Ethernet switch port terminal, 1 port	Ethernet switch port terminal, 4 ports, internal switch
Technical data	EL6601	EL6614
Ethernet interface	10BASE-T/100BASE-TX Ethernet with 1 x RJ 45	10BASE-T/100BASE-TX Ethernet with 4 x RJ 45
Data transfer rates	10/100 Mbit/s, IEEE 802.3u auto-negotiation, half or full duplex at 10 and 100 Mbit/s possible, automatic settings	
Protocol	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode
Cable length	up to 100 m twisted pair	up to 100 m twisted pair
		
Current consumption power contacts	–	–
Current consumption E-bus	typ. 310 mA	typ. 450 mA
Distributed clocks	–	–
Special features	support of RT Ethernet, publisher/subscriber, DHCP/BootP address allocation (1 device)	support of RT Ethernet, publisher/subscriber, DHCP/BootP address allocation (1 device)
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex
Weight	approx. 75 g	approx. 95 g
Further information	www.beckhoff.com/EL6601	www.beckhoff.com/EL6614

Communication | IEEE 1588 external synchronisation

The Precision Time Protocol can be used in order to generate an identical time base within an application, i.e. over several networks. PTP is a protocol that secures the synchronicity of the time settings of several devices in a network and which is defined in IEEE 1588 standard as the protocol standard for the synchronisation of distributed clocks in networks. As opposed to the NTP (Network Time Protocol), the emphasis in PTP is on higher accuracy. The applicational synchronisation can be implemented using TwinCAT and the EL6688 IEEE 1588 External Synchronisation Interface.


If the PTP Ethernet frames are routed by switches in a larger network, then PTP-compatible switches should be used in order to attain the highest possible synchronisation accuracy. These enter the self-caused data delays into the correction values provided in the PTP data. In this way, the accuracy of the synchronisation of the master to the slave is not affected negatively by the transmission delays.

The EL6688 is the simplest way to synchronise an EtherCAT system with appropriate interface devices to the global world time via GPS or radio transmitters such as DFC77. If more than two EtherCAT systems are to be synchronised with one another, the EtherCAT Terminal is likewise the means of choice.



Applicational synchronicity in the network thanks to distributed clocks according to IEEE 1588

IEEE 1588 external synchronisation interface

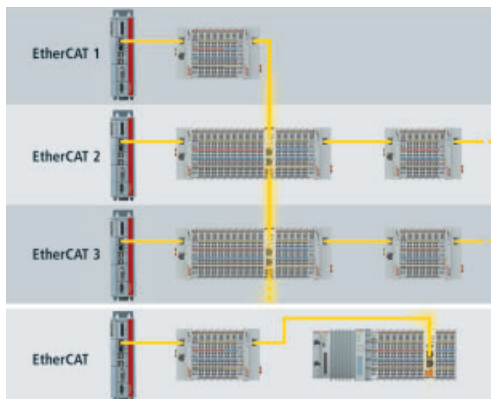
Technical data	EL6688
Ethernet interface	10BASE-T/100BASE-TX Ethernet with 1 x RJ 45
Data transfer rates	10/100 Mbit/s, IEEE 802.3u auto-negotiation, half or full duplex at 10 and 100 Mbit/s possible, automatic settings
Protocol	PTP v1 (IEEE 1588-2002), PTP v2 (IEEE 1588-2008)
Cable length	up to 100 m twisted pair
	 <p>The EL6688 EtherCAT Terminal is a device in the IEEE 1588 synchronisation system that supports the Ethernet-based precision time protocols PTPv1 (IEEE 1588-2002) and PTPv2 (IEEE 1588-2008). On the one hand, the EL6688 is an IEEE 1588 clock (master or slave), which is synchronised within the scope of the protocol accuracy. On the other hand, it is synchronised by the EtherCAT master as an EtherCAT Terminal in the distributed clocks system, or it provides the reference clock for the EtherCAT system. To do this, it only needs to be selected as the "reference clock" in the TwinCAT System Manager. This way, a consistent timebase can be created across applications for any number of spatially separated TwinCAT EtherCAT systems and machine sections, e.g. for applications with axes or measurement technology. The compact EtherCAT Terminal enables flexible deployment depending on the application requirements.</p>
Current consum. pow.cont.	–
Current consumption E-bus	typ. 310 mA
Distributed clocks	yes
Cable length	up to 100 m twisted pair
Special features	usable in TwinCAT as a reference clock
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 75 g
Further information	www.beckhoff.com/EL6688

Communication | EtherCAT bridge terminal

The slaves within an EtherCAT system are synchronised by the distributed clocks system. In each slave capable of doing so, a local clock triggers the reading in of inputs and the output of outputs synchronously with all other slaves. A slave represents the reference clock, according to which the EtherCAT master/TwinCAT synchronises all other slaves. For event logging and axis synchronisation, the synchronous operation of several EtherCAT systems may be purposeful.

The EL6692, which serves as a crossover point between two EtherCAT systems, can be used for interconnection: it is an EtherCAT Terminal on the so-called primary side and an EtherCAT slave with an RJ 45 connection on the so-called secondary side. The direction of the time synchronisation is selectable. TwinCAT can use this terminal as the reference clock in the synchronised system; this way, the entire lower-level system is operated synchronously with the primary system. With the same cycle times, both real-time tasks then work synchronously in TwinCAT.

In addition, the EL6692 can transfer data up to 480 bytes in both directions and function as an ADS over EtherCAT gateway. The EL6601 can be used in real-time mode (publisher/subscriber) for synchronous data exchange with larger data quantities.



Example topology EL6692

EtherCAT bridge terminal

Technical data	EL6692
Technology	primary side: E-bus (terminal strand), secondary side: 2 x 100 Mbit/s Ethernet, RJ 45, In/Out
Function	EtherCAT distributed clock synchronisation, data exchange (synchronous, ADS)



The EL6692 is designed for the synchronisation of two EtherCAT systems. In addition, it can exchange data packets of up to 480 bytes in both directions with a transfer time of > 1 ms. The power supply on the primary side (E-bus) comes from the E-bus, on the secondary side (RJ 45) via an external connection. If several bridge terminals are used, the data traffic continues if the power supply to a device fails. The bridge terminal can also be used for integrating a subordinate PC system as an EtherCAT slave.

Nominal voltage	24 V DC (secondary side)
Current consumption power contacts	–
Current consumption E-bus	E-bus: 120 mA, external: 60 mA/24 V typ.
Distributed clocks	yes
Power supply	primary: via the E-bus, secondary: via connector
Special features	usable in TwinCAT as a reference clock, up to 480 byte asynchronous data transfer in each direction, supports ADS over EtherCAT (AoE)
Operating temperature	0...+55 °C
Approvals	CE, Ex
Weight	approx. 85 g
Further information	www.beckhoff.com/EL6692

Communication | AS-Interface master terminal

The AS-Interface (AS-i = Actuator Sensor interface) is a fieldbus communication method for actuators and sensors. The master cyclically transmits telegrams to the individual slaves via a 2-core yellow ribbon cable, which serves at the same time for the 24 V power supply. Up to 62 slaves with a total of 496 inputs and 496 outputs are supported, depending on the protocol.



AS-Interface master terminal

Technical data	i EL6201 ES6201
Technology	AS-Interface master terminal
AS-Interface versions	V 2.0, V 2.1, V 3.0
AS-Interface slaves	31 for V 2.0, 62 for V 2.1
Number of channels	1 (AS-Interface channel)
	<p>The EL6201 AS-Interface master terminal enables the direct connection of AS-Interface slaves. The AS-Interface-compliant interface supports digital and analog slaves, versions 2.0, 2.1 and 3.0. The connected devices are supplied via the EL9520 AS-Interface potential feed terminal with filter.</p>
Cycle time	max. 5 ms (31 devices)
Current consumption power contacts	–
Current consumption E-bus	typ. 180 mA (E-bus), approx. 60 mA (AS-Interface)
Distributed clocks	–
AS-Interface diagnostics	power failure, slave failure, parameterisation error
Special features	AS-Interface address allocation: automatic or via configuration
Operating temperature	0...+55 °C
Approvals	CE
Weight	approx. 55 g
Further information	www.beckhoff.com/EL6201

i For availability status see Beckhoff website at: www.beckhoff.com/EL6201

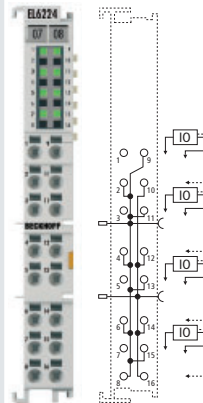
Communication | IO-Link terminal

An IO-Link system consists of IO-Link devices such as sensors, actuators or combinations of both. They are connected using the classic 3-wire technique. The EL6224 performs the IO-Link master function and is equipped with four ports. Only one IO-Link device can ever be connected to each port. IO-Link thus represents a point-to-point communication method and not a fieldbus.



4-channel input/output,
IO-Link master terminal

Technical data	EL6224
Technology	IO-Link input/output
Data transfer rates	4.8 kbaud, 38.4 kbaud and 230.4 kbaud
Number of channels	4 IO-Link interfaces



The IO-Link terminal enables connection of up to four IO-Link devices. A point-to-point connection is used between the terminal and the device. The terminal is parameterised via the EtherCAT master in TwinCAT. Both the 2-wire connection (physics 1) and the 3-wire connection (physics 2) are supported. During commissioning, the four channels of the EL6224 must be configured as inputs or outputs and parameterised for the corresponding sensor/actuator data. However, they can also be used as standard 24 V inputs.

Supply current for devices	< 200 mA per device (method 1)
Current consumption power contacts	typ. 20 mA + load
Current consumption E-bus	typ. 120 mA
Distributed clocks	–
Cable length	max. 20 m
Special features	each channel parameterisable in TwinCAT
Operating temperature	0...+55 °C
Approvals	CE, Ex
Weight	approx. 60 g
Further information	www.beckhoff.com/EL6224

Communication | PROFINET controller/device

The EL6631 PROFINET IO controller (master) terminal supports the complete real-time function (RT) as well as extensive diagnostic possibilities. All services according to conformance class B are supported. Up to 15 PROFINET IO devices can be projected on the EL6631.



The EL6631-0010 PROFINET I/O device (slave) terminal enables the simple exchange of data between EtherCAT and the PROFINET I/O controllers. Within the EtherCAT strand it represents a slave that can consist of up to 65,535 devices. The EL6631-0010 contains a 3-port switch; two of these ports are fed externally to RJ 45 sockets. This allows the construction of the I/O stations as a line topology, thus reducing wiring. The maximum distance between two devices is 100 m.

Protocols such as LLDP or SNMP can be used for network diagnostics.

The EL6632 PROFINET IRT Controller Terminal supports the complete RT (real-time) or IRT (Isochronous real-time) function as well as providing extensive diagnostic options.

All services in accordance with Conformance Class C are supported. Depending on the cycle time, up to five PROFINET IRT or up to 15 PROFINET RT devices can be operated at the EL6632 in a line topology. The maximum distance between two devices is 100 m. Protocols such as LLDP or SNMP can be used for network diagnostics.



	PROFINET IO controller/ device terminal	PROFINET IRT controller
Technical data	EL6631	i EL6632
Technology	PROFINET IO	
Ethernet interface	100BASE-TX Ethernet with 2 x RJ 45	
Protocol	RT	RT or IRT
Number of channels	1	1
		
Current consumption power contacts	–	–
Current consumption E-bus	typ. 400 mA	typ. 400 mA
Distributed clocks	–	–
Cable length	up to 100 m twisted pair	up to 100 m twisted pair
Special features	LLDP, SNMP, Conformance Class B, max. 5 IRT devices, max. 15 RT devices, min. 500 µs IRT cycle, min. 1 ms RT cycle	Conformance Class B, max. 5 IRT devices, max. 15 RT devices, min. 500 µs IRT cycle, min. 1 ms RT cycle
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE
Weight	approx. 75 g	approx. 75 g
Further information	www.beckhoff.com/EL6631	www.beckhoff.com/EL6632
Special terminals	EL6631-0010	
Distinguishing features	PROFINET IO Device	



For availability status see Beckhoff website at: www.beckhoff.com/EL6632

Communication | Lightbus master terminal

The EL6720 Lightbus master terminal enables the connection to Lightbus devices just as the Beckhoff FC2001 Lightbus PCI card.


Due to the connection via EtherCAT, no PCI slots are required in the PC. The terminal controls the Lightbus protocol with all its features. Within an EtherCAT Terminal network, the EL6720 enables the integration of any Lightbus slaves. The terminal has a powerful protocol implementation with many features:

- Cycle times up to 100 µs are possible.
- Process data communication can either be free running or synchronised.
- powerful parameter and diagnostics interfaces (ADS)

Lightbus accessories see page [695](#)

LIGHTBUS

Lightbus master terminal

Technical data	EL6720
Technology	Lightbus master terminal
Data transfer rates	2.5 Mbaud
Interfaces	2 x fibre optic standard connector Z1000 (plastic fibre), Z1010 (HCS fibre)
Number of channels	1
	
Fieldbus	Lightbus
Current consumption power contacts	–
Current consumption E-bus	typ. 240 mA
Distributed clocks	–
Bus device	max. 254 nodes with a max. of 65,280 I/O points per fieldbus connection
Special features	3 priority-controlled logical communication channels
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 70 g
Further information	www.beckhoff.com/EL6720

Communication | PROFIBUS master/slave terminal

The EL6731 PROFIBUS master terminal corresponds to the FC3101 PROFIBUS PCI card. Connection via EtherCAT allows PCI slots in the PC to be dispensed with; instead, any desired number of PROFIBUS master terminals (EL6731) or slave terminals (EL6731-0010) can be used in the field. This reduces cabling and facilitates the connection of existing fieldbus installations to the high-performance EtherCAT fieldbus.


The terminal can handle the PROFIBUS protocol with all features and enables the integration of arbitrary PROFIBUS devices in the EtherCAT Terminal network. The terminal has a PROFIBUS chip with the latest PROFIBUS technology – including a high-precision isochronous mode for axis control and advanced diagnostic options.

The EL6731 allows the operation of PROFIBUS slaves with different polling rates and is distinguished by the following characteristics:

- Cycle times from 200 μ s are possible.
- PROFIBUS DP, PROFIBUS DP-V1, PROFIBUS DP-V2
- master, slave and PROFIBUS monitor up to 12 Mbit/s
- powerful parameter and diagnostics interfaces
- The error management for each bus user is freely configurable.
- It is possible to read the bus configuration and automatically assign the "GSD" files.



PROFIBUS master/slave terminal

Technical data	EL6731	EL6731-0010
Technology	PROFIBUS master terminal	PROFIBUS slave terminal
Data transfer rates	9.6 kbaud...12 Mbaud	
Interfaces	1 x D-sub socket, 9-pin, galvanically decoupled	
Number of channels	1	
		
Fieldbus	PROFIBUS DP (standard), PROFIBUS DP-V1 (Cl. 1+2: acyclic services, alarms), DP-V2, PROFIBUS MC (equidistant)	
Cycle time	differing DP cycle times per slave are possible using the CDL concept	
Current consumption power contacts	–	
Current consumption E-bus	typ. 350 mA	
Distributed clocks	yes	–
Bus device	max. 125 slaves with up to 244 bytes input, output, parameter, configuration or diagnostic data per slave	
Special features	status LEDs, total max. 7 kbyte input and output data	
Operating temperature	0...+55 °C	
Approvals	CE, UL, Ex	
Weight	approx. 70 g	
Further information	www.beckhoff.com/EL6731	

Communication | Interbus slave terminal

Interbus is a ring system, i.e. all devices are actively integrated into a closed transmission path. Each device regenerates the incoming signal and passes it on. In the Interbus system, both the data line and the return line are fed through all devices inside one cable. This results in the physical appearance of a line or tree structure. The master-slave system allows the connection of a maximum of 512 devices, which form the structure of a spatially distributed shift register. Each device, with its registers of different lengths, is part of the shift register ring. The master pushes data through the ring serially. Due to the point-to-point connection method, termination resistors do not have to be installed.



Interbus slave terminal

Technical data	EL6740-0010
Technology	Interbus slave terminal
Data transfer rates	500 kbits, 2 Mbits (default)
Interfaces	2 x D-sub plug, 9-pin, plug and socket with screening and vibration lock
Number of channels	1



The EL6740-0010 Interbus slave terminal enables data exchange between EtherCAT and Interbus. For both bus systems the terminal "mirrors" up to 32 word input and 32 word output to the respective other system. The outputs are written to the inputs of the other bus with minimum delay. The terminal can use the Interbus protocol up to a baud rate of 2 Mbits. Due to the connection via EtherCAT, no PCI slots are required in the PC.

Fieldbus	Interbus, max. 400 m between 2 stations at 500 kbit/s
Type of connection	only remote bus
Current consumption power contacts	–
Current consumption E-bus	typ. 450 mA
Distributed clocks	–
Special features	status LEDs
Operating temperature	0...+55 °C
Approvals	CE, UL, Ex
Weight	approx. 80 g
Further information	www.beckhoff.com/EL6740

Communication | CANopen master/slave terminal

The EL6751 CANopen master terminal corresponds to the FC5101 CANopen PCI card. Connection via EtherCAT allows PCI slots in the PC to be dispensed with; instead, any desired number of CANopen master or slave terminals can be used in the field.

The EL6751 enables the integration of arbitrary CANopen devices in the EtherCAT Terminal network. It is alternatively available as a master (EL6751) or slave (EL6751-0010). In addition, general CAN messages can be sent or received – without having to bother with CAN frames in the applications program. The terminal has a powerful protocol implementation with many features:

- support for all CANopen PDO communication modes: event-controlled, time-controlled (event timer), synchronous, polling
- synchronisation with the task cycle of the PC controller
- SYNC cycle with quartz precision for drive synchronisation, zero cumulative jitter
- parameter communication (SDO) at start-up and when running
- emergency message handling, guarding and heartbeat
- powerful parameter and diagnostics interfaces
- online bus load display
- bus monitor function

CANopen

CANopen master/slave terminal

Technical data	EL6751	EL6751-0010
Technology	CANopen master terminal	CANopen slave terminal
Data transfer rates	10, 20, 50, 100, 125, 250, 500, 800, 1,000 kbaud	
Interfaces	D-sub connector, 9-pin according to CANopen specification, galvanically decoupled	
Number of channels	1	
Function	master	slave
Fieldbus	CANopen	
Current consumption power contacts	–	
Current consumption E-bus	typ. 300 mA	
Distributed clocks	–	
Bus device	max. 127 slaves	–
Special features	status LEDs, CANopen network master, CANopen Manager, supports RAW-CAN	status LEDs, CANopen slave
Operating temperature	0...+55 °C	
Approvals	CE, UL, Ex	
Weight	approx. 70 g	
Further information	www.beckhoff.com/EL6751	



Communication | DeviceNet master/slave terminal

The EL6752 DeviceNet master terminal corresponds to the FC5201 DeviceNet PCI card. Connection via EtherCAT allows PCI slots in the PC to be dispensed with; instead, any desired number of DeviceNet master or slave terminals can be used in the field. The EL6752 allows the integration of arbitrary DeviceNet devices in the EtherCAT Terminal network. It is alternatively available as a master (EL6752) or slave (EL6752-0010). The DeviceNet terminal has a powerful protocol implementation with many features:

- support of all DeviceNet I/O modes: polling, change of state, cyclic, strobed
- Unconnected Message Manager (UCMM)
- offline connection set, Device Heartbeat Messages, Device Shutdown Messages
- Auto Device Replacement (ADR)
- powerful parameter and diagnostics interfaces
- The error management for each bus user is freely configurable.



DeviceNet master/slave terminal

Technical data	EL6752	EL6752-0010
Technology	DeviceNet master terminal	DeviceNet slave terminal
Data transfer rates	125, 250, 500 kbaud	
Interfaces	open style connector, 5-pin, according to DeviceNet specification, galvanically decoupled (Connector is supplied.)	
Number of channels	1	
Fieldbus	DeviceNet master	DeviceNet slave
Current consumption power contacts	–	
Current consumption E-bus	typ. 260 mA	
Distributed clocks	–	
Bus device	max. 63 slaves	
Special features	DeviceNet scanner	
Operating temperature	0...+55 °C	
Approvals	CE, UL, Ex	
Weight	approx. 70 g	
Further information	www.beckhoff.com/EL6752	



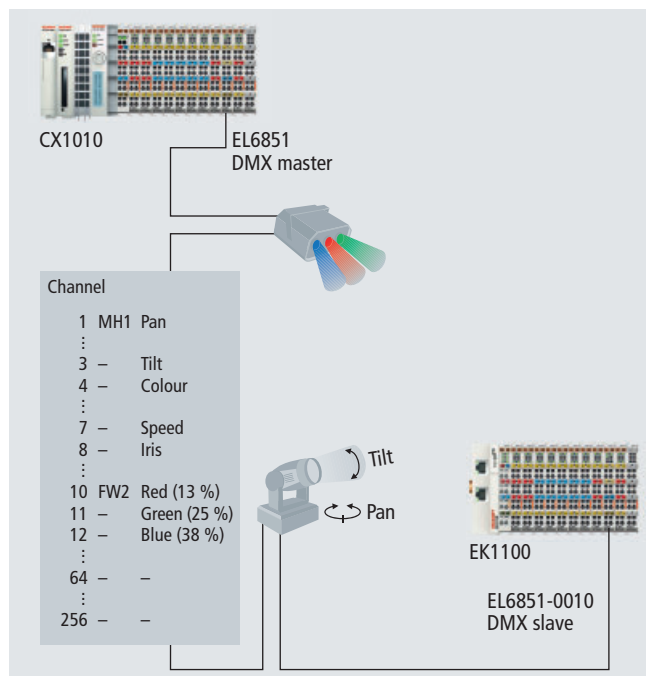
Communication | DMX master/slave terminal

DMX is the standard protocol for controlling professional stage and effect lighting equipment, which is used, for example, for the dynamic lighting of showrooms and salesrooms as well as for exclusive displays of light and colour in high-profile buildings, such as hotels and event centres. For static DMX light sources (e.g. spotlights), colour mixing and brightness values are transmitted, while moving DMX light sources (e.g. moving heads and scanners) receive additional spatial coordinates. The high data transfer rate of EtherCAT permits higher update rates of light settings, resulting in more harmonious changes of light and colour as perceived by the human eye.

The EL6851 DMX master terminal allows the direct connection of up to 32 DMX devices and supports the transmission of the full DMX protocol width

of 512 bytes in just one control cycle using EtherCAT. This way, three-axis devices, such as scanners, moving heads or spotlights can be controlled (see illustration below).

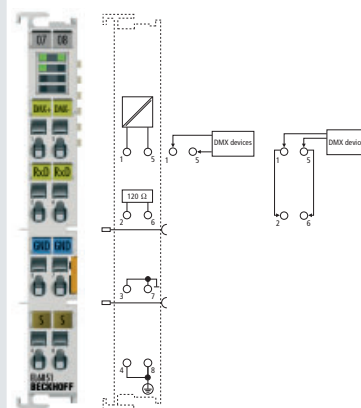
The EL6851-0010 DMX slave terminal acts as a link to the DMX world and enables professional stage and effect lighting to be implemented in conjunction with standard hardware. It takes on the information from the DMX master for the assigned automation equipment. This way, theatre and show stages can be constructed with standard hardware at reduced cost, but with full flexibility. The data from the DMX telegram are output on simple digital outputs, stepper motors or dimmer terminals. Furthermore, it is possible to transmit the DMX data to a DALI network and in this way to indirectly operate DALI ballasts with DMX.



DMX

DMX master/slave terminal

Technical data	EL6851	EL6851-0010
Technology	DMX master terminal	DMX slave terminal
Data transfer rates	250 kbit, one start bit, two stop bits	
Interfaces	RS485, termination resistor can be switched, half duplex	
Number of channels	1	



The EL6851 EtherCAT Terminal is a DMX master terminal and enables connection of up to 32 devices without repeater. The DMX master terminal can send up to 512 bytes of data. At 250 kbit/s a maximum data rate of 44 kHz is thus possible.

Data length	max. 512 bytes	
Protocol	DMX512	
Current consumption power contacts	-	
Current consumption E-bus	typ. 190 mA	
Distributed clocks	-	
Bus device	max. 32 without repeater	-
Line impedance	120 Ω	
Special features	supports RDM protocol, library available; electrically isolated	start address and data length can be set
Operating temperature	0...+55 °C	
Approvals	CE, UL, Ex	
Weight	approx. 55 g	
Further information	www.beckhoff.com/EL6851	

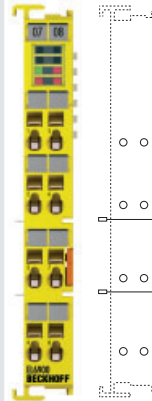
Communication | TwinSAFE

TwinSAFE enables networks with up to 1,024 TwinSAFE devices. Multiple TwinSAFE PLCs are cascable within a network. The EL6900 EtherCAT PLC features certified safety function blocks, which are configured according to the application to be realised. Functions such as emergency stop, safety door monitoring etc. can thus easily be selected and linked. All blocks can be freely connected among each other and are complemented by operators such as AND, OR, etc. The necessary functions are configured using the TwinCAT System Manager and loaded into the terminal via the fieldbus.

For further information on TwinSAFE and the TwinSAFE products see page **828**

TwinSAFE PLC

Technical data	EL6900
Technology	TwinSAFE PLC
Safety standard	IEC 61508 SIL 3 and DIN EN ISO 13849-1:2008 PL _e
Protocol	TwinSAFE/FS _o E



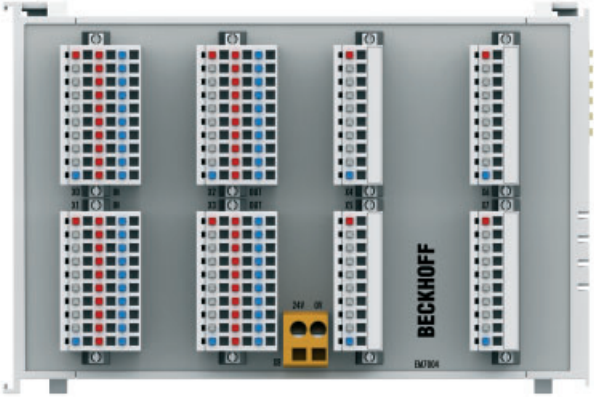
The TwinSAFE PLC can establish 128 connections to other TwinSAFE devices.

Nominal voltage	24 V DC (-15 %/+20 %)
Current consumption power contacts	–
Current consumption E-bus	approx. 188 mA
Cycle time	500 µs...~25 ms
Fault response time	≤ watchdog time (parameterisable)
Permiss. degree of contamination	2
Climate class EN60721-3-3	3K3
Installation position	horizontal
Special features	backup restore
Operating temperature	0...+55 °C
Electrical interference	EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	EN 60068-2-6/EN 60068-2-27/29
Approvals	CE, UL, Ex, TÜV Süd
Weight	approx. 50 g
Further information	www.beckhoff.com/EL6900

Motion | 4-axis interface

The EM7004 interface module is designed for direct connection of servo drives with ± 10 V DC interface and incremental encoder output for position feedback and represents a cost-effective solution for drives in the lower and medium speed range. The individual servo interfaces are electrically isolated from each other. The analog I/Os and the incremental encoder connections have a common reference potential. Further digital inputs and outputs turn the compact module into a complete – and sole – link between the control and application level. Internal preprocessing of the signals enables users to modify outputs with short reaction times, depending on the position.

4-axis interface

Technical data	EM7004						
Technology	4-axis interface						
Number of channels	4 encoder inputs, 4 analog inputs, 16 digital inputs and 16 digital outputs						
Cycle time	min. 1 ms						
							
	<p>The EM7004 module is available with different connectors:</p> <table> <tr> <td>EM7004-0000</td> <td>without connectors</td> </tr> <tr> <td>EM7004-0002</td> <td>4 x ZS2001-0002 (1-wire, LED), 4 x ZS2001-0005 (1-wire, LED)</td> </tr> <tr> <td>EM7004-0004</td> <td>4 x ZS2001-0005 (1-wire), 4 x ZS2001-0004 (3-wire, LED)</td> </tr> </table>	EM7004-0000	without connectors	EM7004-0002	4 x ZS2001-0002 (1-wire, LED), 4 x ZS2001-0005 (1-wire, LED)	EM7004-0004	4 x ZS2001-0005 (1-wire), 4 x ZS2001-0004 (3-wire, LED)
EM7004-0000	without connectors						
EM7004-0002	4 x ZS2001-0002 (1-wire, LED), 4 x ZS2001-0005 (1-wire, LED)						
EM7004-0004	4 x ZS2001-0005 (1-wire), 4 x ZS2001-0004 (3-wire, LED)						
Nominal voltage	24 V DC (-15 %/+20 %)						
Current consumption power contacts	– (no power contacts)						
Current consumption E-bus	typ. 280 mA						
Distributed clocks	–						
Digital inputs	16 x 24 V DC						
Digital outputs	16 (8 x 0.5 A, 8 x 1.5 A), 24 V DC						
Analog outputs	4 x ± 10 V (2 mA)						
Encoder inputs	4 x (A, /A, B, /B, gate, latch, ground); A B – isolated RS485 inputs (RS422); 4 x 16 bits quadrature encoder; < 400 kHz						
Special features	outputs switchable in relation to counter states, user scaling parameterisable, watchdog parameterisable						
Operating temperature	0...+55 °C						
Approvals	CE						
Weight	approx. 260 g						
Further information	www.beckhoff.com/EM7004						

Motion | Stepper motor terminal

Stepper motors are often used in positioning drives. They allow, by the combination of single steps, a positioning process without feedback of the rotor positions. This "open control chain" mode of operation and the longevity of a stepper motor are particularly interesting for price-sensitive fields of application. However, safe positioning is only guaranteed within the performance limits.

In contrast with a DC motor the control of a stepper motor is carried out by the different energisation of the individual motor windings following a defined pattern of pulses. The electromagnetic field of the stator is switched intermittently so that the shaft turns through the step angle α . The motor follows the impulse pattern of the control unit, until the coupled momentum exceeds its holding momentum or the impulse demand is too dynamic, which leads to standstill of the motor. The EL7031 and EL7041 EtherCAT stepper motor terminals, which are suitable for highly dynamic movement, solve this problem also in areas of higher speeds of rotation.

The EL7031 and EL7041 stepper motor terminals are designed for direct connection of medium capacity stepper motors. A high frequency clocked PWM output stage regulates the currents through the motor coils.

The stepper motor terminals are synchronised with the motor by parameterising. Unipolar as well as bipolar stepper motors can be driven. Additional inputs support functions like homing and final position monitoring. 64-fold micro stepping ensures

particularly quiet and precise motor operation. Together with a stepper motor, the stepper motor terminals represent an inexpensive small servo axis. The EL7041 also includes an incremental encoder interface to read position data.

The EL7031 and EL7041 stepper motor terminals can be controlled like a servo drive by a speed interface from a Motion Control software such as TwinCAT for example. In applications with a less complex and less powerful CPU the control is also possible via a position interface (travel distance control). The stepper motor terminals move the motor themselves to a desired position. Ramp steepness and maximum speed can be entered as parameters.

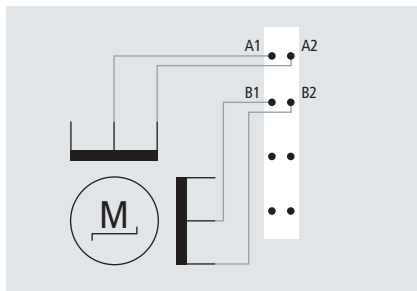
Irregular operation at certain speed ranges, particularly without coupled load, indicates that the stepper motor is being run at its resonance frequency. Under certain circumstances the motor may even stop. Resonances in the lower frequency range essentially result from the mechanical motor parameters. Apart from their impact on smooth running, such resonances can lead to significant loss of torque, or even loss of step of the motor, and are therefore particularly undesirable. The EL7041-1000 special version is particularly well suited for such low-mass and therefore resonance-critical applications.

The EL7031 stepper motor terminal is designed exclusively for 24 V supply voltage. The motor current can reach up to 1.5 A. The EL7041 covers a supply voltage range

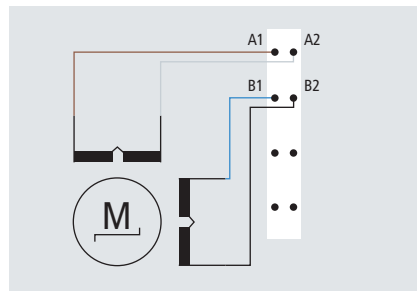
from 8 V DC to 50 V DC and also needs a 24 V supply from the power contacts. The motor current can be set from 1 to 5 A. The EL7041-1000 special version is compatible to the KL2541.

The peak current may briefly significantly exceed the rated current and in this way makes the whole drive system very dynamic. In such dynamic applications, negative acceleration causes the feedback of energy, which leads to voltage peaks at the power supply unit. A EL9570 buffer capacitor terminal protects from the effects of overvoltage, in that it absorbs some of the energy. If the voltage exceeds the capacity of the terminal, it gets rid of the excess energy via an external resistance.

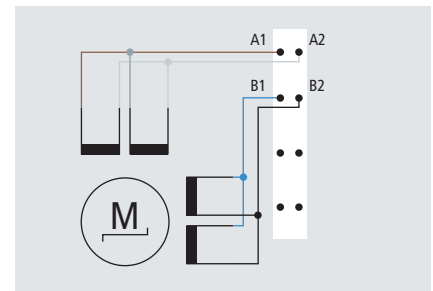
AS1xxx | Stepper motors see page **776**
 EL9570 | Buffer capacitor terminal see page **413**



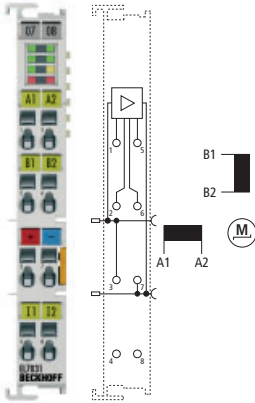
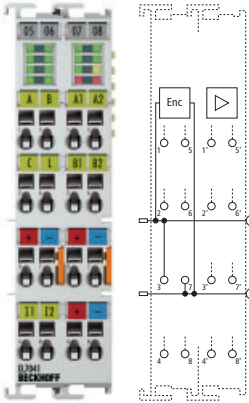
Connection of a unipolar stepper motor



Connection of a bipolar AS10x0 stepper motor, serial



Connection of a bipolar AS10x0 stepper motor, parallel

	Stepper motor terminal 24 V DC, 1.5 A	Stepper motor terminal 50 V DC, 5 A, with incremental encoder
Technical data	EL7031 ES7031	EL7041 ES7041
Technology	direct motor connection	
Load type	uni- or bipolar stepper motors	
Max. output current	1.5 A (overload- and short-circuit-proof)	5 A (overload- and short-circuit-proof)
Number of channels	1 stepper motor, 2 digital inputs	1 stepper motor, encoder input
		
Nominal voltage	24 V DC (-15 %/+20 %)	8...50 V DC
Current consumption power contacts	typ. 30 mA + motor current	typ. 50 mA
Current consumption E-bus	typ. 120 mA	typ. 130 mA
Distributed clocks	yes	yes
Maximum step frequency	1,000, 2,000, 4,000 or 8,000 full steps/s (configurable)	1,000, 2,000, 4,000 or 8,000 full steps/s (configurable)
Step pattern	64-fold micro stepping	64-fold micro stepping
Current controller frequency	approx. 25 kHz	approx. 30 kHz
Control resolution	approx. 5,000 positions in typ. applications (per revolution)	approx. 5,000 positions in typ. applications (per revolution)
Encoder signal	–	5...24 V, 5 mA, single-ended
Pulse frequency	–	max. 400,000 increments/s (with 4-fold evaluation)
Special features	travel distance control	travel distance control, encoder input
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE	CE
Weight	approx. 50 g	approx. 90 g
Further information	www.beckhoff.com/EL7031	www.beckhoff.com/EL7041
Special terminals		EL7041-1000
Distinguishing features		for resonance-critical applications

Motion | 2-channel DC motor output stage

DC motors can replace the considerably more expensive servomotors in many applications if they are operated with an intelligent controller. A DC motor can be integrated very simply into the control system using the EL7332 and EL7342 EtherCAT Terminals. All parameters are adjustable via the fieldbus. The small, compact design and DIN rail mounting make the EtherCAT DC motor output stages suitable for a wide range of applications. The output stages are protected against overload and short circuit and offer an integrated feedback system for incremental encoders on a case-by-case basis. Two DC motors can be controlled by one terminal.

Two areas of application are particularly well supported by the output stages:

1. Simple controller | low demands on the cycle time | inexpensive processor power: by the use of the integrated travel distance control, the EL73x2 EtherCAT Terminal can perform positioning travels independently without the use of NC. Nothing further is required apart from a DC motor and a terminal.
2. High-end positioning by means of integration in TwinCAT NC: in conjunction with the EtherCAT DC motor output stage, the DC motor is used with TwinCAT for the application without further changes – analogous to a servo-axis.

The control of a DC motor is simple to implement in comparison with other motors, since the speed of rotation is proportional to the voltage. It can be adjusted directly via the process data with the EL7332 and EL7342 EtherCAT Terminals. The integrated compensation of the internal resistance keeps the motor at the desired speed for load changes. Thus a simple drive task can be solved using a simple controller.

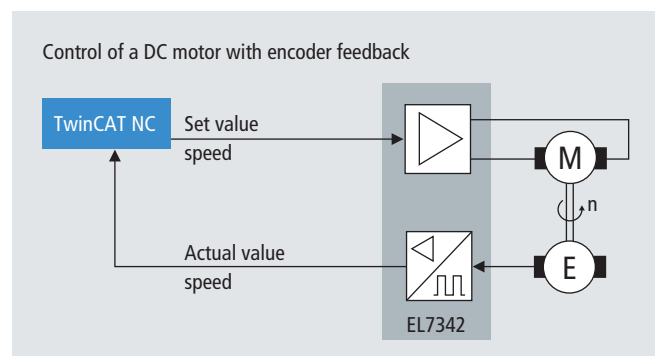
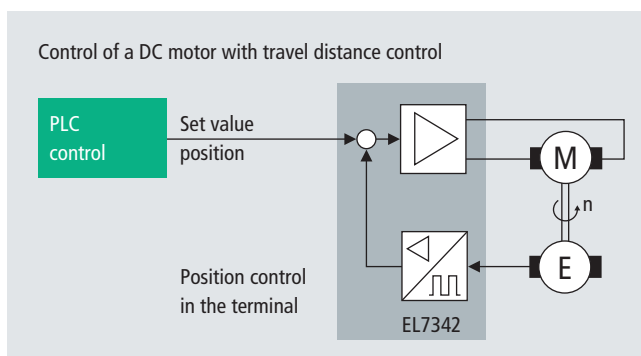
The EL7332 EtherCAT Terminal enables direct operation of two DC motors. It is electrically isolated from the E-bus. The speed is preset by a 16 bit value from the automation unit. The EtherCAT Terminal contains two channels whose signal state is indicated by LEDs. The LEDs enable quick local diagnosis.

For demanding positioning tasks a closed speed control loop with a feedback system is needed. Apart from the operation of two DC motors, the EL7342 EtherCAT Terminal enables the connection of an incremental encoder. The control loop can be closed either by the EtherCAT Terminal itself or by higher-level controller (see illustration).

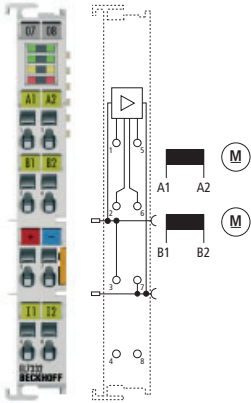
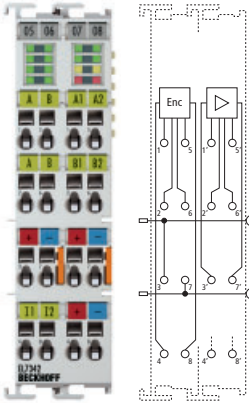
The peak current may briefly significantly exceed the rated current and in this way makes the whole drive system very dynamic. In such dynamic applications, negative acceleration causes the feedback of energy, which leads to voltage peaks at the power supply unit. The EL9570 buffer capacitor terminal protects from the effects of overvoltage, in

that it absorbs some of the energy. If the voltage exceeds the capacity of the terminal, it gets rid of the excess energy via an external resistance.

EL9570 | Buffer capacitor terminal
see page [413](#)



Realisation possibilities for position control loops

	2-channel DC motor output stage 24 V DC, 1.5 A	2-channel DC motor output stage 50 V DC, 3.5 A
Technical data	EL7332 ES7332	EL7342 ES7342
Technology	direct motor connection	
Load type	DC brush motors, inductive	
Max. output current	1 x 1.5 A	2 x 3.5 A
Number of channels	2 DC motors, 2 digital inputs	2 DC motors, 2 digital inputs, encoder input
		
Nominal voltage	24 V DC (-15 %/+20 %)	8...50 V DC
Current consumption power contacts	typ. 40 mA + motor current	typ. 70 mA
Current consumption E-bus	typ. 140 mA	typ. 200 mA
Distributed clocks	yes	yes
PWM clock frequency	30 kHz with 180° phase shift each	30 kHz with 180° phase shift each
Duty factor	0...100 % (voltage-controlled)	0...100 % (voltage-controlled)
Control resolution	max. 10 bits current, 16 bits speed	max. 10 bits current, 16 bits speed
Encoder signal	–	5...24 V, 5 mA, single-ended
Pulse frequency	–	max. 400,000 increments/s (with 4-fold evaluation)
Current consumption sensor supply	–	typ. 20 mA
Special features	travel distance control	travel distance control, encoder input
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE	CE
Weight	approx. 50 g	approx. 90 g
Further information	www.beckhoff.com/EL7332	www.beckhoff.com/EL7342

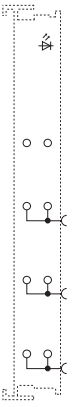
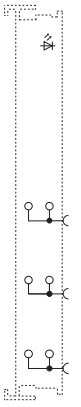
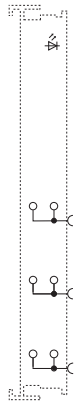
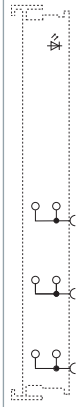
EL9xxx | Function terminals

The power feed terminals make it possible to set up various potential groups with any desired voltages (EL9190) or with the standard voltages of 24 V DC or 230 V AC (120 V AC). They are available with or without fine-wire fuse. In order to monitor the supply voltage, the terminals with diagnostics function report the status of the power feed terminal to the EtherCAT Coupler through two input bits. It is thus possible for the controller to check the distributed peripheral voltage over the fieldbus. The operating point performance conforms to the input terminals EL1002 (24 V) and EL1702 (230 V).

The EL9180, EL9185 and EL9195 EtherCAT Terminals allow the supply voltage to be accessed a number of times via spring force terminals. They make it unnecessary to use additional terminal blocks on the terminal strip.

The EL9195 or EL9070 EtherCAT Terminal can be used for the connection of screens. It connects the spring force contacts directly to the DIN rail and can optimally ground incoming electromagnetic radiation. The two power contacts are looped through by the EL9195, allowing two wires to be connected to each.

The EL9080 is used to identify potential groups (e.g. 230 V AC/24 V DC). It is inserted between two potential groups, and indicates the separation through an orange coloured cover.

	Potential supply terminal, 24 V DC	Potential supply terminal, 24 V DC, with diagnostics	Potential supply terminal, 120...230 V AC	Potential supply terminal, 120...230 V AC, with diagnostics
Technical data	EL9100 ES9100	EL9110 ES9110	EL9150 ES9150	EL9160 ES9160
Technology	potential supply terminal	potential supply terminal with diagnostics	potential supply terminal	potential supply terminal with diagnostics
Diagnostics in the process image	–	yes	–	yes
				
Nominal voltage	24 V DC	24 V DC	120 V AC/ 230 V AC	120 V AC/ 230 V AC
Integrated fine-wire fuse	–	–	–	–
Current load	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A
Power LED	green	green	green	green
Defect LED	–	–	–	–
PE contact	yes	yes	yes	yes
Shield connection	–	–	–	–
Current consumption E-bus	–	typ. 90 mA	–	typ. 90 mA
Connection to DIN rail	–	–	–	–
Electrical isolation	yes	yes	yes	yes
Special features	–	–	–	–
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL, Ex	CE, UL	CE, UL
Weight	approx. 50 g	approx. 50 g	approx. 50 g	approx. 50 g
Further information	www.beckhoff.com/EL9100	www.beckhoff.com/EL9110	www.beckhoff.com/EL9150	www.beckhoff.com/EL9160


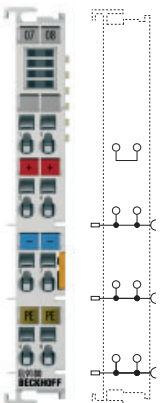
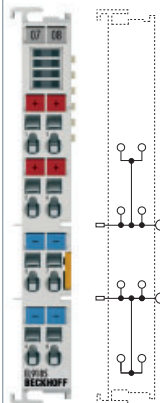
Potential supply terminal, any voltage up to 230 V AC	Potential supply terminal, 24 V DC, with fuse	Potential supply terminal, 24 V DC, with diagnostics and fuse	Potential supply terminal, 120...230 V AC, with fuse	Potential supply terminal, 120...230 V AC, with diagnostics and fuse	Potential supply terminal, arbitrary, with fuse	Shield terminal	Shield terminal	Separation terminal
EL9190 ES9190	EL9200	EL9210	i EL9250	i EL9260	i EL9290	EL9070	EL9195 ES9195	EL9080
potential supply terminal	potential supply terminal with fuse	potential supply terminal with diagnostics and fuse	potential supply terminal with fuse	potential supply terminal with diagnostics and fuse	potential supply terminal with fuse	shield terminal		separation terminal
–		yes	–	yes	–			
arbitrary up to 230 V AC/DC	24 V DC	24 V DC	120 V AC/230 V AC	120 V AC/230 V AC	arbitrary up to 230 V AC/DC	arbitrary up to 230 V AC	arbitrary up to 230 V AC/DC	separation terminal
–	...6.3 A	...6.3 A	...6.3 A	...6.3 A	...6.3 A	–	–	–
≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A
–	green	green	green	green	–	–	–	–
–	red	red	red	red	–	–	–	–
yes	yes	yes	yes	yes	yes	–	–	–
–	–	–	–	–	–	8 x	2 x	–
–	–	typ. 90 mA	–	typ. 90 mA	–	–	–	–
–	–	–	–	–	–	yes	yes	–
yes	yes	yes	yes	yes	yes	–	–	yes
–	–	–	–	–	–	dissipation of EMC interference via large copper surfaces on the DIN rail	dissipation of EMC interference	placeholder terminal with K-bus transmission
0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
CE, UL	CE, Ex	CE, Ex	CE	CE	CE	CE	CE, UL	CE, UL, Ex
approx. 50 g	approx. 50 g	approx. 55 g	approx. 55 g	approx. 55 g	approx. 50 g	approx. 50 g	approx. 50 g	approx. 50 g
www.beckhoff.com/EL9190	www.beckhoff.com/EL9200	www.beckhoff.com/EL9210	www.beckhoff.com/EL9250	www.beckhoff.com/EL9260	www.beckhoff.com/EL9290	www.beckhoff.com/EL9070	www.beckhoff.com/EL9195	www.beckhoff.com/EL9080

i For availability status see Beckhoff website at: www.beckhoff.com/EL9250

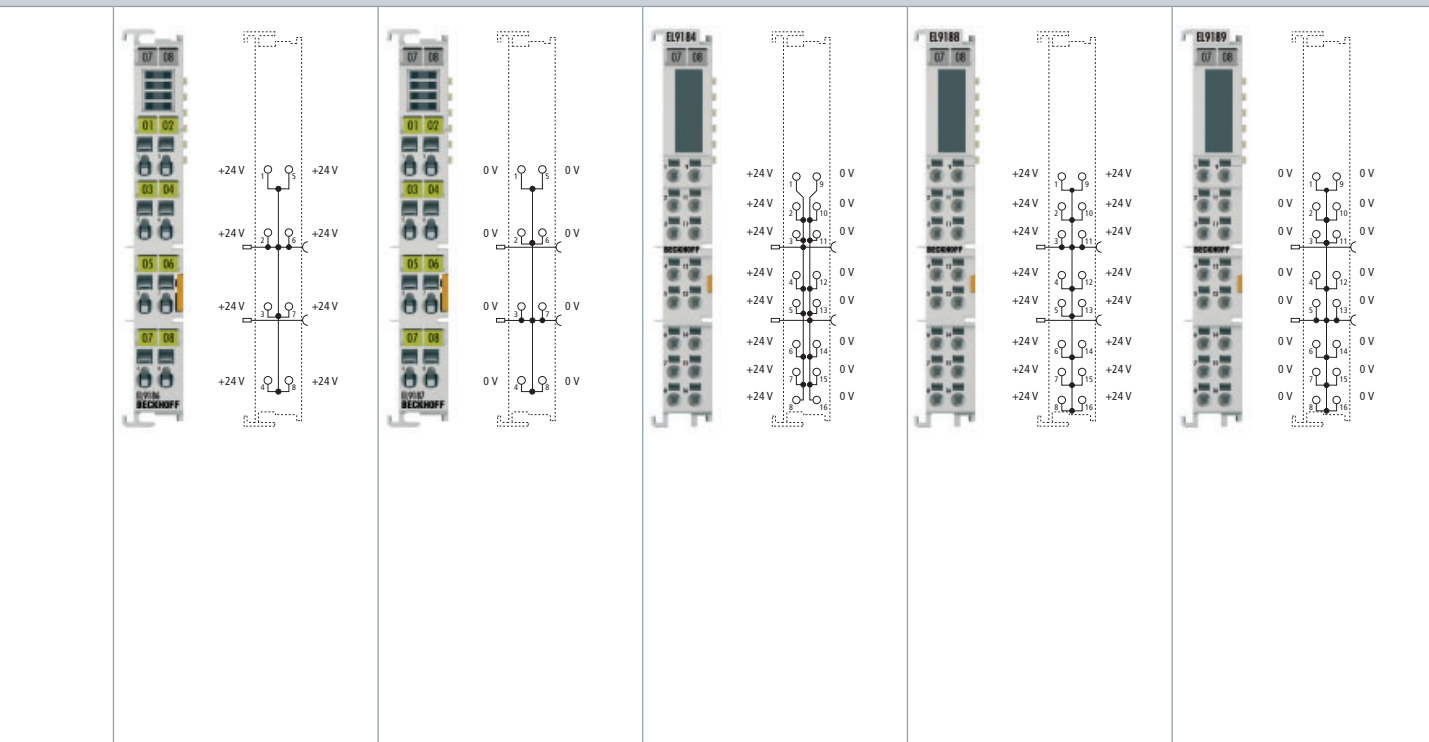
EL9xxx | Function terminals

The EL91xx potential distribution terminals enable – depending upon the type – the distribution of ground or supply potentials to external devices. Wiring work and separate potential distributors are saved. Eight ground points are required for the ground connection of 8-channel output terminals in 2-wire operating mode, e.g. EL2008, for which the EL9187 can be used. The EL9184 and EL9188 HD EtherCAT Terminals (High Density) even make 16 connection points available in a compact housing.

Each assembly must be terminated at the right hand end with an EL9011 bus end cap.

	End cap	Potential distribution terminal, 2 terminal points per power contact	Potential distribution terminal, 4 terminal points at 2 power contacts
Technical data	EL9011	EL9180 ES9180	EL9185 ES9185
Technology	end cap	potential distribution terminal	
Diagnostics in the process image	–		
			
Nominal voltage	end cap	arbitrary up to 230 V AC/DC	arbitrary up to 230 V AC/DC
Integrated fine-wire fuse	–	–	–
Current load	≤ 10 A	≤ 10 A	≤ 10 A
Power LED	–	–	–
Defect LED	–	–	–
PE contact	–	yes	–
Shield connection	–	–	–
Current consumption E-bus	–	–	–
Connection to DIN rail	–	–	–
Electrical isolation	yes	–	–
Special features	cover for the E-bus contacts	–	–
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, UL	CE, UL
Weight	approx. 10 g	approx. 50 g	approx. 50 g
Further information	www.beckhoff.com/EL9011	www.beckhoff.com/EL9180	www.beckhoff.com/EL9185

Potential distribution terminal, 8 x 24 V	Potential distribution terminal, 8 x 0 V	Potential distribution terminal, 8 x 24 V, 8 x 0 V	Potential distribution terminal, 16 x 24 V	Potential distribution terminal, 16 x 0 V
EL9186 ES9186	EL9187 ES9187	EL9184	EL9188	EL9189

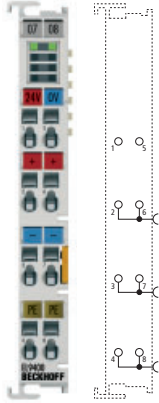
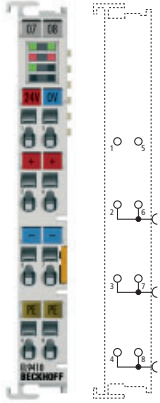
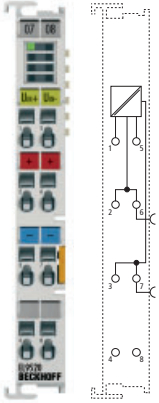


≤ 60 V	≤ 60 V	≤ 60 V	≤ 60 V	≤ 60 V
–	–	–	–	–
≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A	≤ 10 A
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	direct plug-in technique	direct plug-in technique	direct plug-in technique
0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
CE, UL, Ex	CE, UL, Ex	CE, Ex	CE, Ex	CE, Ex
approx. 50 g	approx. 50 g	approx. 60 g	approx. 60 g	approx. 60 g
www.beckhoff.com/EL9186	www.beckhoff.com/EL9187	www.beckhoff.com/EL9184	www.beckhoff.com/EL9188	www.beckhoff.com/EL9189

EL94xx, EL95xx | Power supply terminals

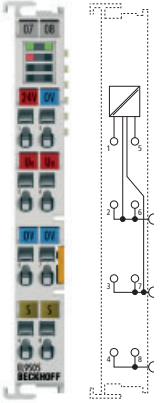
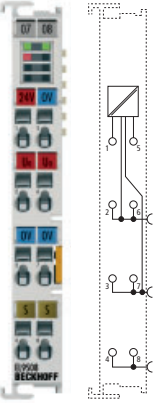
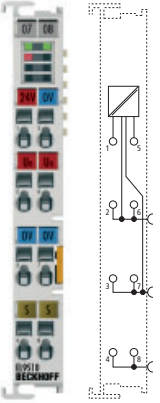
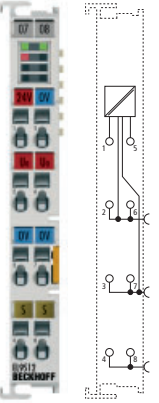
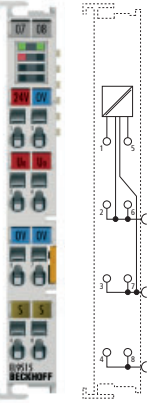
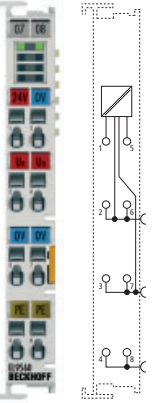
The EL94xx and EL95xx terminal series are designed for the modified feeding of the operating voltage into the terminal strand. The EL9400 and EL9410 power supply terminals enable the refreshment of the E-bus, via which data exchange takes place between the EtherCAT Coupler and the EtherCAT Terminals. Each EtherCAT Terminal requires a certain amount of current from the E-bus (see technical data: "Current consumption E-bus"). This current is fed into the E-bus by the relevant EtherCAT Coupler's power supply unit. When configuring a large number of EtherCAT Terminals, the 5 V power supply to the E-bus can be increased by 2 A via the EL9400/EL9410. As opposed to the EL9400, the EL9410 has a diagnostic function which is displayed by LED and on the process image.

The EL95xx power supply terminals produce different output voltages from the input voltage (24 V DC) that can be accessed at the terminals. The following EtherCAT Terminals are also supplied with this voltage via the power contacts. The power LEDs indicate the operating states of the terminals; short-circuits or overloads are indicated by the overcurrent LEDs. There is no electrical isolation of the input and output voltage.

	Power supply terminal for refreshing the E-bus	Power supply terminal for refreshing the E-bus, with diagnostics	AS-Interface potential feed terminal, with filter
Technical data	EL9400 ES9400	EL9410 ES9410	i EL9520 ES9520
Technology	power supply terminal		AS-Interface potential feed terminal
Diagnostics in the process image	–	yes	–
			
			The EL9520 potential feed terminal uncouples the input and output signal through an integrated filter and enables the supply of AS-Interface networks from standard power supply units or another AS-Interface network.
Input voltage	24 V DC	24 V DC	up to 35 V
Output voltage	5 V for E-bus supply	5 V for E-bus supply	up to 35 V
Max. output current	2 A	2 A	2 A
Short-circuit-proof	–	yes	–
Current consumption E-bus	–	–	–
Electrical isolation	–	–	–
Insulation voltage input/output	–	–	–
Special features	not for new projects, please use EL9410 instead	standard EL supply	no electrical isolation
Operating temperature	0...+55 °C	0...+55 °C	0...+55 °C
Approvals	CE, UL, Ex	CE, Ex	CE
Weight	approx. 65 g	approx. 65 g	approx. 90 g
Further information	www.beckhoff.com/EL9400	www.beckhoff.com/EL9410	www.beckhoff.com/EL9520

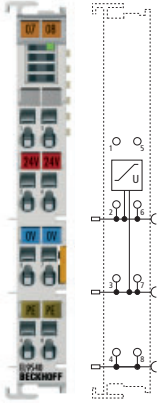
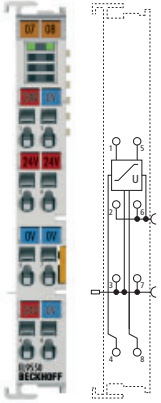


For availability status see Beckhoff website at: www.beckhoff.com/EL9520

	Power supply terminal, 5 V DC, with diagnostics	Power supply terminal, 8 V DC, with diagnostics	Power supply terminal, 10 V DC, with diagnostics	Power supply terminal, 12 V DC, with diagnostics	Power supply terminal, 15 V DC, with diagnostics	Power supply terminal, 24 V DC, electrical isolation
	EL9505 ES9505	EL9508 ES9508	EL9510 ES9510	EL9512 ES9512	EL9515 ES9515	EL9560 ES9560
	power supply terminal					
	yes					
						
	The EL9505 generates 5 V from the fed-in 24 V without electrical isolation.	The EL9508 generates 8 V from the fed-in 24 V without electrical isolation.	The EL9510 generates 10 V from the fed-in 24 V without electrical isolation.	The EL9512 generates 12 V from the fed-in 24 V without electrical isolation.	The EL9515 generates 15 V from the fed-in 24 V without electrical isolation.	24 V generation from the 24 V fed-in with electrical isolation, potential-free
	24 V DC (-15 %/+20 %) 5 V DC ± 1 %	24 V DC (-15 %/+20 %) 8 V DC ± 1 %	24 V DC (-15 %/+20 %) 10 V DC ± 1 %	24 V DC (-15 %/+20 %) 12 V DC ± 1 %	24 V DC (-15 %/+20 %) 15 V DC ± 1 %	24 V DC (-15 %/+20 %) 24 V DC (-15 %/+5 %)
	0.5 A	0.5 A	0.5 A	0.5 A	0.5 A	0.1 A
	yes	yes	yes	yes	yes	yes
	90 mA	90 mA	90 mA	90 mA	90 mA	90 mA
	–	–	–	–	–	1,500 V AC constant load field side/E-bus
	–	–	–	–	–	500 V AC permanent load (field side)
	diagnostics overcurrent, output voltage	diagnostics overcurrent, output voltage	diagnostics overcurrent, output voltage	diagnostics overcurrent, output voltage	diagnostics overcurrent, output voltage	electrical isolation, automatic restart after short-circuit, diagnostics U_{IN}/U_{OUT}
	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C	0...+55 °C
	CE, Ex	CE, Ex	CE, Ex	CE, Ex	CE, Ex	CE
	approx. 65 g	approx. 65 g	approx. 65 g	approx. 65 g	approx. 65 g	approx. 65 g
	www.beckhoff.com/EL9505	www.beckhoff.com/EL9508	www.beckhoff.com/EL9510	www.beckhoff.com/EL9512	www.beckhoff.com/EL9515	www.beckhoff.com/EL9560

EL9540, EL9550 | Surge filter system and field supply

The EL9540 system terminal contains an overvoltage filter for the 24 V field supply, the EL9550 for the 24 V field and system supply. The filter protects the EtherCAT Terminals from line-bound surge voltages that can occur due to high-energy disturbances such as switching overvoltages at inductive consumers or lightning strikes at the supply lines. The EtherCAT Terminals EL9540 or EL9550 protect the terminal station from damage in particularly harsh environments. The ship classification organisations require the use in shipbuilding applications and in the onshore/offshore sector.

	Surge filter field supply	Surge filter system and field supply
Technical data	EL9540 ES9540	EL9550 ES9550
Technology	surge filter field supply	surge filter system and field supply
Diagnostics	–	
		
Nominal voltage	24 V (-15 %/+20 %)	24 V (-15 %/+20 %)
Surge filter field supply	yes	yes
Surge filter system supply	–	yes
PE connection	yes	–
Operating temperature	0...+55 °C	0...+55 °C
Approvals	CE	CE
Weight	approx. 50 g	approx. 50 g
Further information	www.beckhoff.com/EL9540	www.beckhoff.com/EL9550

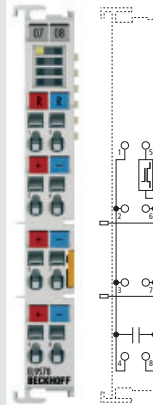
EL9570 | Buffer capacitor terminal

The EL9570 EtherCAT Terminal contains high-performance capacitors for stabilising supply voltages. It can be used in connection with the drive terminals of the EL7xxx series. Low internal resistance and high pulsed current capability enable good buffering in parallel with a power supply unit. Return currents are stored, particularly in the context of drive applications, thereby preventing overvoltages. If the fed back energy exceeds the capacity of the capacitors, the EL9570 switches the load voltage through to the terminal points 1 and 5. The energy is dissipated by the connection of an external ballast resistor.

EL7xxx | Motion terminals
see page **401**

Buffer capacitor terminal

Technical data	EL9570 ES9570
Technology	buffer capacitor
Diagnostics	–



The EL9570 buffers the connected voltage via its integrated capacitors and connects the external brake resistor if the internal voltage of approx. 56 V is exceeded.

Nominal voltage	50 V
Capacity	500 µF
Ripple current	10 A in continuous operation
Internal resistance	< 10 mΩ
Surge voltage protection	> 56 V
Recommended ballast resistor	10 Ω, typ. 10 W
Overvoltage control range	±2 V
Ballast resistor clock rate	load-dependent, 2-point control
Electrical isolation	1,500 V (terminal/E-bus)
Operating temperature	0...+55 °C
Approvals	CE, Ex
Weight	approx. 90 g
Further information	www.beckhoff.com/EL9570

Accessories EtherCAT

Patch cable

The pre-assembled Industrial Ethernet/EtherCAT cables with RJ 45 plug enable fast, easy wiring inside the control cabinet and are suitable for short distances on the machine. The robust, industrial quality PUR cables distinguish themselves from office cables by both their mechanical and their EMC characteristics. Further lengths and variants on request.

Technical data	ZK1090-9191-xxxx
Cross-section	4 x 2 x AWG26/7 ... 4 x 2 x 0.128 mm ²
Cable sheath material	PUR
Colour	green (RAL 6018)
Line configuration	SF/UTP (shielded)
Diameter	sheath: typ. 5.9 mm ±0.2 mm
Bending radius	> 5 x diameter
Category/class	CAT 5, class D
Operating/installation temperature	-40...+75 °C/-10...+60 °C
Insertion cycles	min. 750

Ordering information	Description
ZK1090-9191-0001	Industrial Ethernet/EtherCAT patch cable, 0.17 m
ZK1090-9191-0002	Industrial Ethernet/EtherCAT patch cable, 0.26 m
ZK1090-9191-0005	Industrial Ethernet/EtherCAT patch cable, 0.5 m
ZK1090-9191-0010	Industrial Ethernet/EtherCAT patch cable, 1.0 m
ZK1090-9191-0020	Industrial Ethernet/EtherCAT patch cable, 2.0 m
ZK1090-9191-0030	Industrial Ethernet/EtherCAT patch cable, 3.0 m
ZK1090-9191-0050	Industrial Ethernet/EtherCAT patch cable, 5.0 m
ZK1090-9191-0100	Industrial Ethernet/EtherCAT patch cable, 10.0 m
ZK1090-9191-0150	Industrial Ethernet/EtherCAT patch cable, 15.0 m
ZK1090-9191-0200	Industrial Ethernet/EtherCAT patch cable, 20.0 m
ZK1090-9191-0250	Industrial Ethernet/EtherCAT patch cable, 25.0 m
ZK1090-9191-0300	Industrial Ethernet/EtherCAT patch cable, 30.0 m
ZK1090-9191-0350	Industrial Ethernet/EtherCAT patch cable, 35.0 m
ZK1090-9191-0400	Industrial Ethernet/EtherCAT patch cable, 40.0 m
ZK1090-9191-0450	Industrial Ethernet/EtherCAT patch cable, 45.0 m
ZK1090-9191-0500	Industrial Ethernet/EtherCAT patch cable, 50.0 m



Cable

Ordering information	Description
ZB9010	Industrial Ethernet/EtherCAT cable, fixed installation, CAT 5e, 4 wires, SF/UTP
ZB9020	Industrial Ethernet/EtherCAT cable, drag chain suitable, CAT 5e, 4 wires, SF/UTP
ZB903x	Industrial Ethernet/EtherCAT cable, reduced diameter for M8 wiring, SF/UTP, see page

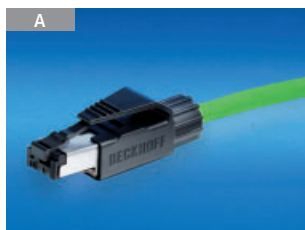
Fibre-optic cables for EK1501, EK1521 (multimode 50/125 µm)

Ordering information	Description
ZK1091-1001-0001	fibre-optic duplex cable, SC connector, 1 m
ZK1091-1001-0005	fibre-optic duplex cable, SC connector, 5 m
ZK1091-1001-0010	fibre-optic duplex cable, SC connector, 10 m

Further lengths and variants on request

Connectors

Ordering information	Description	Pict.
ZS1090-0003	EtherCAT/Ethernet RJ 45 connector, IP 20, 4-pin, for field assembly, AWG 22-24, packing unit = 10	A
ZS1090-0005	EtherCAT/Ethernet RJ 45 plug, IP 20, 8-pin, for field assembly, AWG 22-24, packing unit = 10	B



Connectors for KS Bus Terminals, ES EtherCAT Terminals

Ordering information	Description
ZS2010	10 connectors for KS and ES series, spare part (KS/ES terminals are supplied with connector.)

Connectors for KM and EM modules

Ordering information	Description
ZS2001-0001	connector for KM/EM module, 1-pin, without LED; spare part (KM/EM terminals are supplied with connector.)
ZS2001-0002	connector for KM/EM module, 1-pin, with LED; spare part (KM/EM terminals are supplied with connector.)
ZS2001-0004	connector for KM/EM module, 3-pin, with LED; spare part (KM/EM terminals are supplied with connector.)
ZS2001-0005	connector for KM/EM module, 1-pin, without LED, labelling (1...10); spare part (KM/EM terminals are supplied with connector.)

Assembly aids

Ordering information	Description
ZB8700	slot screwdriver assembly tool for pressing the spring force clamps on the coupler and the terminals

Bus system housing

The BG1558 and BG1559 housings are especially suitable for the construction of compact I/O stations with a higher protection class (IP 65). The housings are supplied with mounting rails. If desired, the housings can be supplied fully fitted with EtherCAT Terminals, flanges and PG threaded fittings. Further sizes are available on request.

Ordering information	Description	Pict.
BG1558	bus system housing 400 mm x 200 mm x 120 mm (W x H x D) with mounting rails and holes	A
BG1559	bus system housing 600 mm x 200 mm x 120 mm (W x H x D) with mounting rails and holes	



Marking material

The EtherCAT Terminals can be individually labelled with standard contact signs. The marking material is not included in the EtherCAT Terminal delivery. Other versions in other colours and with other texts are available on request or on the internet (www.beckhoff.com).

Ordering information	Unprinted
BZ1000	100 unprinted contact labels
BZ1002	100 unprinted contact labels, yellow
BZ1005	100 unprinted contact labels, red
BZ1006	100 unprinted contact labels, blue
BZ1007	100 unprinted contact labels, orange
BZ1008	100 unprinted contact labels, light green
BZ3000	180 equipment identification labels 12 x 7 mm for Bus Terminals with removable identification section, blank

Ordering information	Printed
BZ1100	100 contact labels, printed with: 0 V, blue
BZ1102	100 contact labels, printed with: -, blue
BZ1104	100 contact labels, printed with: 24 V, red
BZ1106	100 contact labels, printed with: +, red
BZ1107	100 contact labels, printed with: +, white
BZ1108	100 contact labels, printed with: PE, light green
BZ1300	100 contact labels, ten of each printed with: 0...7, 20 unprinted, white
BZ1400	100 contact labels, two of each printed with: 00 01...48 49, white
BZ3010	180 equipment identification labels 12 x 7 mm for Bus Terminals with removable identification section, printed (printed according to customer specification [in Excel file])



Coding pins and sockets for KS and ES terminals

The coding pins and sockets for ZS2010 and KS/ES terminals with pluggable wiring level enable coding between terminal and plug in order to prevent incorrect plug insertion.

Ordering information	Description
ZS2010-0010	The set contains 100 sockets and 100 pins.



Demokit

The TC9910-B11x EtherCAT demokit offers a quick introduction into EtherCAT communication. It includes EtherCAT Terminals and a Coupler for testing simple I/O functions. The enclosed CD contains a step-by-step guide and a full version of TwinCAT as programming environment for the

Beckhoff EtherCAT master. EtherCAT slaves of any type can be tested with this field-proven EtherCAT master. It also includes a comprehensive help collection that facilitates familiarisation with Beckhoff ADS communication and programming according to IEC 61131.

The demokit consists of:

- EK1100 EtherCAT Coupler
- 2 digital input terminals 24 V DC
- 2 digital output terminals 24 V DC
- Beckhoff product folder
- Beckhoff TwinCAT CD
- "TwinCAT Quickstart" documentation

- documentation describing the EK1100
- a 25 cm section of 35 mm mounting rail for fitting the terminal system
- TwinCAT PLC licence (only TC9910-B110)
- EL9011 end cap
- Ethernet cable

Ordering information	Description
TC9910-B110	EtherCAT demokit, with TwinCAT PLC licence
TC9910-B111	EtherCAT demokit, without TwinCAT PLC licence
TC9910-B112	EtherCAT demokit, without TwinCAT PLC licence (1 instead of 2 digital input terminals)

