BECKHOFF New Automation Technology

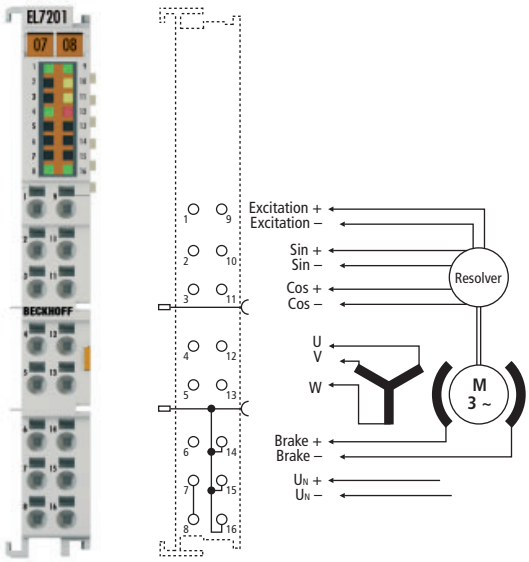
Product Overview | **Compact Drive Technology**

Compact Drive Technology Overview

	Servomotor	Stepper Motor					
	EtherCAT Terminals	Bus Terminals		EtherCAT Terminals		EtherCAT Box	
	IP 20	IP 20		IP 20		IP 67	
I/O	**EL7201** 4 A	**KL2531** 1.5 A	**KL2541** 5 A	**EL7031** 1.5 A	**EL7041** 5 A	**EP7041-0002** 5 A	**EP7041-2002** 5 A
Option	**EL9570**	**KL9570**		**EL9570**			
Motors	**AM3111** 3.22 A, 0.16 Nm **AM3112** 3.4 A, 0.32 Nm **AM3121** 4.6 A, 0.65 Nm	**AS1010** 1 A, 0.38 Nm	**AS1020** 1 A, 0.5 Nm	**AS1030** 1.5 A, 0.6 Nm	**AS1050** 5 A, 1.2 Nm	**AS1060** 5 A, 5.0 Nm	
Gear units	**AG2250**			**AG1000-+PM52.x** to AS1030/AS1050		**AG1000-** **+PM81.x** to AS1060	
Accessor.	**ZK4704-0411-2xxx** Motor cable **ZK4724-0410-2xxx** Resolver cable	**ZK4000-6200-2xxx** Motor cable **ZK4000-5100-00xx** Encoder cable				**ZK4000-6261-2xxx** Motor cable **ZK4000-5151-00xx** Encoder cable	

DC motor

	Bus Terminals		EtherCAT Terminals		EtherCAT Box
	IP 20		IP 20		IP 67
EP7041-3002 5 A	**EP7041-1002** 1.5 A	**KL2532** 1 A	**KL2552** 5 A	**EL7332** 1 A	**EL7342** 3.5 A	**EP7342** 3.5 A
						
		KL9570		**EL9570**		
						



EL7201

The shielding connection system enables the shielding to be located very close to the terminals of the shielded line.

EL7201 | Servomotor terminal 50 V DC, 4 A

The EL7201 servomotor EtherCAT Terminal, with integrated resolver interface, offers high servo performance in a very compact design. The fast control technology, based on field-oriented current and PI speed control, supports fast and highly dynamic positioning tasks. The monitoring of numerous parameters, such as overvoltage and undervoltage, overcurrent, terminal temperature or motor load via the calculation of a I^2T model, offers maximum operational reliability. EtherCAT, as a high-performance system communication, and CAN-over-EtherCAT (CoE), as the application layer, enable ideal interfacing with PC-based control technology. The latest power semiconductors guarantee minimum power loss and enable feedback into the DC-Link when braking. 16 LEDs indicate status, warning and error messages as well as possibly active limitations.

Technical data	EL7201
Number of channels	1 servomotor, resolver, motor brake
Connection method	direct motor connection
Load type	permanent-magnet synchronous motors
Nominal voltage	8…50 V DC
Output current I_N	4 A
Peak current I_N	8 A, 1 s
Frequency range	0…1 kHz
PWM clock frequency	16 kHz
Current controller frequency	double PWM clock frequency
Rated speed controller frequ.	16 kHz
Output voltage motor brake	24 V DC (+6 %/-10 %)
Output current motor brake	max. 0.5 A
Current consumption power contacts	typ. 50 mA + holding current motor brake
Current consumption E-bus	120 mA

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Accessories | Shielding connection system

Ordering information	Description
ZB8500	clamp strap for shield connection with knurled screw, width 11 mm, shield diameter max. 8 mm, packing unit = 10
ZB8510	shield busbar 10 x 3 mm, 1000 mm galvanised Cu, packing unit = 1
ZB8511	shield busbar clamp 10 x 3 mm for 5 Bus Terminals/EtherCAT Terminals 12 mm, packing unit = 10
ZB8520	mounting rail holder for shield busbar (10 x 3 mm), packing unit = 2
ZB8530	U-clamp terminal up to 4 mm² for PE connection to the rail (10 x 3 mm), packing unit = 20

AM31xx | **Synchronous Servomotors for servo terminal EL7201**

AM31uv-wxyz-000a	Standstill torque	Standstill current	Rated speed at rated supply voltage 24 V DC	48 V DC	Rotor moment of inertia
AM3111-0300-0001	0.16 Nm	3.22 A	3000 min^{-1}	5000 min^{-1}	0.026 kg cm^2
AM3111-0301-0001	0.16 Nm	3.22 A	3000 min^{-1}	5000 min^{-1}	0.04 kg cm^2
AM3112-0400-0001	0.32 Nm	3.4 A	1500 min^{-1}	3500 min^{-1}	0.046 kg cm^2
AM3112-0401-0001	0.32 Nm	3.4 A	1500 min^{-1}	3500 min^{-1}	0.06 kg cm^2
AM3121-0200-0001	0.65 Nm	4.6 A	900 min^{-1}	2000 min^{-1}	0.13 kg cm^2
AM3121-0201-0001	0.65 Nm	4.6 A	900 min^{-1}	2000 min^{-1}	0.18 kg cm^2

u: flange code, v: motor length
Option w = 0: smooth shaft
Option x = key number for rated speed
Option y = 0: resolver
Option z = 0: without holding brake, z = 1: with holding brake
Option a = 1: cable 0.3 m, with mini CPC plug for power, M12 plug for feedback

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AG2250 | **Planetary gear units for Servomotors AM31xx**

Ordering information	Acceleration torque	Typ. combination with AM3xxx
AG2250-+PLE40-M01-x-1B1	max. 15 Nm	AM311x
AG2250-+PLE60-M01-x-1B1	max. 40 Nm	AM312x
AG2250-+WPLE40-M01-x-1B1	max. 7.5 Nm	AM311x
AG2250-+WPLE60-M01-x-1B1	max. 24 Nm	AM312x

x = gear ratio 3, 4, 5, 7, 10

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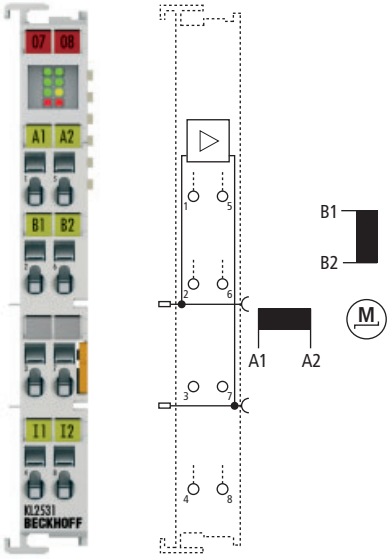
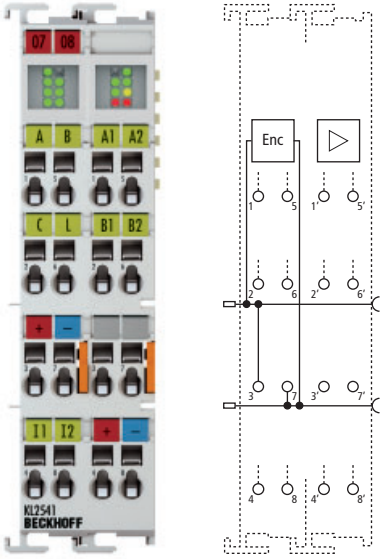
Accessories | **Motor and resolver cables for servomotors**

Ordering information	Cable length
ZK4704-0411-2030	motor cable, assembled at both ends for AM31xx to EL7201, l = 3 m, shielded
ZK4704-0411-2050	motor cable, assembled at both ends for AM31xx to EL7201, l = 5 m, shielded
ZK4704-0411-2100	motor cable, assembled at both ends for AM31xx to EL7201, l = 10 m, shielded
ZK4704-0411-2150	motor cable, assembled at both ends for AM31xx to EL7201, l = 15 m, shielded
ZK4704-0411-2200	motor cable, assembled at both ends for AM31xx to EL7201, l = 20 m, shielded

Ordering information	Cable length
ZK4724-0410-2030	resolver cable, assembled at both ends for AM31xx to EL7201, l = 3 m, shielded
ZK4724-0410-2050	resolver cable, assembled at both ends for AM31xx to EL7201, l = 5 m, shielded
ZK4724-0410-2100	resolver cable, assembled at both ends for AM31xx to EL7201, l = 10 m, shielded
ZK4724-0410-2150	resolver cable, assembled at both ends for AM31xx to EL7201, l = 15 m, shielded
ZK4724-0410-2200	resolver cable, assembled at both ends for AM31xx to EL7201, l = 20 m, shielded



KL2531



KL2541

KL2531, KL2541 | Stepper Motor Bus Terminals

The KL2531 Bus Terminal is intended for the direct connection of different small Stepper Motors. The slimline PWM output stage for two motor coils is located in the Bus Terminal together with two inputs for limit switches.

The KL2541 Bus Terminal is intended for Stepper Motors with medium performance range. The PWM output stages cover a wide range of voltages and currents. Together with two inputs for limit switches, they are located in the Bus Terminal.

Together with a Stepper Motor, the Bus Terminals represent an inexpensive small servo axis. 64-fold micro stepping ensures particularly quiet and precise motor operation.

Technical data	**KL2531** | KS2531	**KL2541** | KS2541
Connection technology	direct motor connection	
Load type	uni- or bipolar Stepper Motors	
Max. output current	1.5 A	5 A
Number of outputs	1 Stepper Motor	1 Stepper Motor, encoder input
Number of inputs	2	2 for limit position, 4 for an encoder system
Nominal voltage	24 V (-15 %/+20 %)	8…50 V DC
Current consumption power contacts	only load	typ. 35 mA
Current consumption K-bus	typ. 60 mA	typ. 100 mA
Maximum step frequency	125,000 steps/s	
Step pattern	full step, half step, up to 64-fold micro stepping	
Current controller frequency	approx. 25 kHz	
Control resolution	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	
Approvals	CE	

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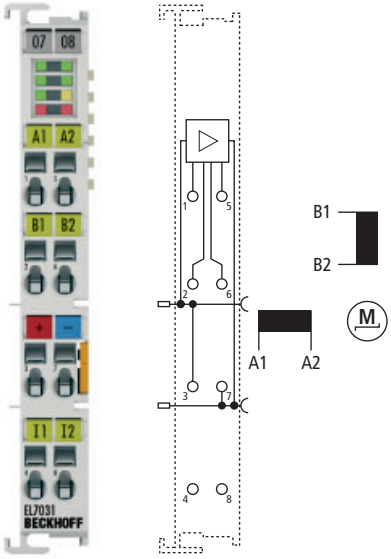
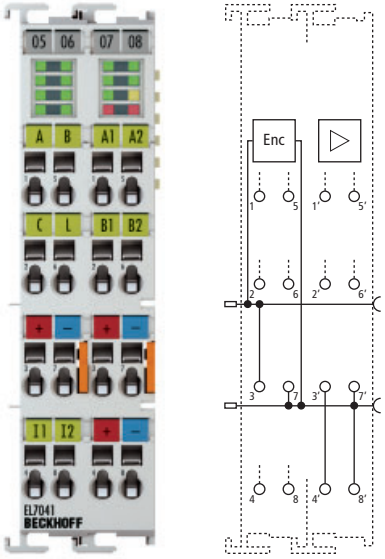
For Stepper Motors see page 9



EL7031



EL7041

EL7031, EL7041 | Stepper Motor EtherCAT Terminals

The EL7031 EtherCAT Terminal is intended for the direct connection of different small Stepper Motors. The slimline PWM output stage for two motor coils is located in the EtherCAT Terminal together with two inputs for limit switches.

The EL7041 EtherCAT Terminal is intended for Stepper Motors with medium performance range. The PWM output stages cover a wide range of voltages and currents. Together with two inputs for limit switches, they are located in the EtherCAT Terminal.

Together with a Stepper Motor, the EtherCAT Terminals represent an inexpensive small servo axis. 64-fold micro stepping ensures particularly quiet and precise motor operation.

Technical data	**EL7031** | ES7031	**EL7041** | ES7041
Connection technology	direct motor connection	
Load type	uni- or bipolar Stepper Motors	
Max. output current	1.5 A	5 A
Number of outputs	1 Stepper Motor, 2 digital inputs	1 Stepper Motor, encoder input
Number of inputs	2	2 for limit position, 4 for an encoder system
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	120 mA typ.	130 mA typ.
Maximum step frequency	1,000, 2,000, 4,000 or 8,000 full steps/s (configurable)	
Step pattern	64-fold micro stepping	
Current controller frequency	approx. 25 kHz	approx. 30 kHz
Control resolution	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	
Approvals	CE	

Special terminals	
EL7041-1000	for resonance-critical applications

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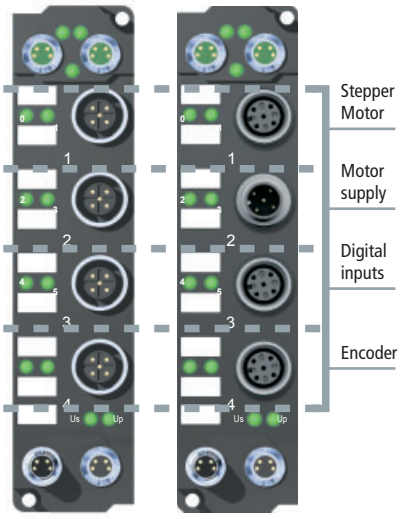
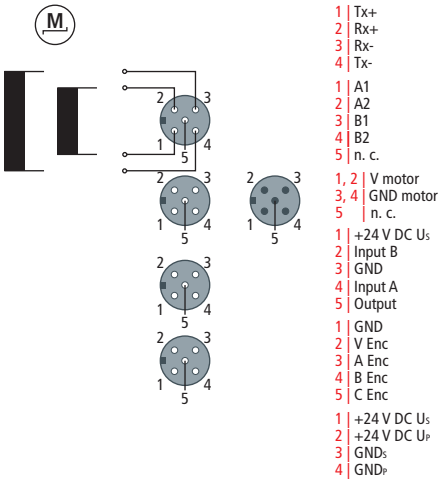
For Stepper Motors see page 9





EP7041-0002
EP7041-1002

EP7041-2002
EP7041-3002

EP7041-xxxx | Stepper Motor EtherCAT Box

The EP7041 EtherCAT Box is intended for the direct connection of different Stepper Motors. The PWM output stages for two motor coils with compact design are located in the module together with two inputs for limit switches and cover a wide voltage and current range. The EP7041 can be adjusted to the motor and the application by changing just a few parameters. 64-fold micro-stepping ensures particularly quiet and precise motor operation. Connection of an incremental encoder enables a simple servo axis to be realised. Two digital inputs and a digital 0.5 A output enable connection of end switches and a motor brake.

Technical data	EP7041-3002	EP7041-0002, EP7041-2002	EP7041-1002
Connection method	screw type M12		
Load type	uni- or bipolar Stepper Motors		
Number of outputs	1 Stepper Motor, 1 digital 24 V DC output		
Number of inputs	2 digital inputs, encoder system (24 V DC encoder)		
Nominal voltage	8…50 V DC		
Distributed clocks	yes		
Protocol	EtherCAT		
Output current	2 x 3.5 A, 2 x 5 A peak current (overload- and short-circuit-proof)	2 x 3.5 A, 2 x 5 A peak current (overload- and short-circuit-proof)	1.5 A
Maximum step frequency	1,000, 2,000, 4,000 or 8,000 full steps/s (configurable)		
Step pattern	64-fold micro stepping		
Current controller frequency	dynamic	approx. 30 kHz	approx. 30 kHz
Resolution	approx. 5,000 positions (per revolution, according to motor and encoder type)		
Current consumption from U_s (without sensor current)	120 mA		
Special features	travel distance control, encoder input, load indication, for resonance-critical applications	travel distance control, encoder input	travel distance control, encoder input
Operating temperature	-25…+60 °C		
Approvals	CE, UL		
Protection class	IP 65/66/67 (according to EN 60529)		

AS1xxx | Stepper Motors for KL2531, KL2541, EL7031, EL7041 Stepper Motor terminals and EP7041 Stepper Motor module

Technical data	AS1010-0000	AS1020-0xyz	AS1030-0000	AS1050-0xyz	AS1060-wxyz
Rated supply voltage	24…50 V DC				
Rated current (per phase)	1.0 A	1.0 A	1.5 A	5.0 A	5.0 A
Standstill torque	0.38 Nm	0.5 Nm	0.6 Nm	1.2 Nm	5.0 Nm
Rotor moment of inertia	0.056 kg cm²	0.074 kg cm²	0.21 kg cm²	0.36 kg cm²	3.0 kg cm²
Resolution	1.8°/200 full steps				
Dimensions (r x length)	42 mm x 39 mm	42 mm x 48 mm	56 mm x 53 mm	56 mm x 75 mm	86 mm x 97 mm
Bus Terminal	KL2531/EL7031	EL7031/EP7041	KL2531/EL7031	KL2541/EL7041	KL2541/EL7041

Option w = 0: smooth shaft with 2 flats (AS1030/AS1050 only smooth shaft);
w = 1: shaft with groove and feather key according to DIN 6885 (only AS1060)
Option x = 0: single shaft, x = 1; second shaft (only AS1020/AS1050/AS1060)
Option y = 0: no incremental encoder; y = 1: incremental encoder 24 V DC, 200 inc/rev; y = 2: 1,024 inc/rev
Option z = 0: standard; z = 1: customer-specific

WWW. beckhoff.com/AS1010

AG1000 | Planetary gear unit for Stepper Motors

Ordering information	AG1000-+PM52.x to AS1030/AS1050	AG1000-+PM81.x to AS1060
Rated torque	4 Nm	20 Nm
Acceleration torque	6 Nm	30 Nm
Gear backlash	≤ 0.7°	≤ 0.5°

x = 4: gear ratio 1:4 (more precisely 3.7 or 63/17 as a fraction),
x = 7: gear ratio 1:7 (more precisely 6.75 or 27/4 as a fraction)

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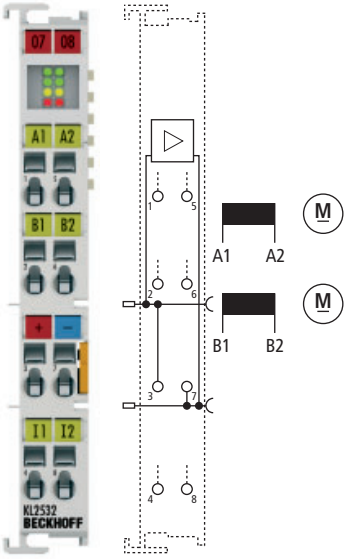
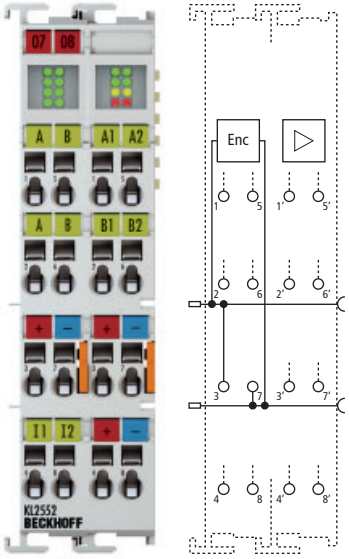
Accessories | Motor and encoder cables for Stepper Motors

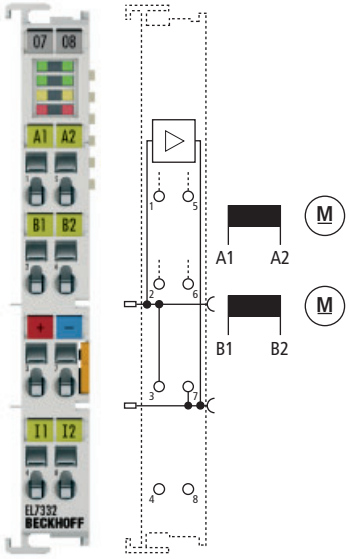
Ordering information	Motor cables for AS1000 Stepper Motors to Bus Terminals KL2531/41 or EtherCAT Terminals EL70x1
ZK4000-6200-2010	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 1 m, shielded
ZK4000-6200-2030	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 3 m, shielded
ZK4000-6200-2050	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 5 m, shielded
ZK4000-6200-2100	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 10 m, shielded
The maximum motor cable length is 10 m.	
Ordering information	**Encoder cables for AS1000 Stepper Motors to KL2531/41 or EL70x1**
ZK4000-5100-2010	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 1 m, shielded
ZK4000-5100-2030	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 3 m, shielded
ZK4000-5100-2050	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 5 m, shielded
ZK4000-5100-2100	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 10 m, shielded
Ordering information	**Motor cables for AS1000 Stepper Motors to EP7041 EtherCAT Box**
ZK4000-6261-0005	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 0.5 m, shielded
ZK4000-6261-0010	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 1 m, shielded
ZK4000-6261-0020	motor cable, assembled at both ends for AS1000 Stepper Motors, 4 x 0.5 mm², l = 2 m, shielded
Ordering information	**Encoder cables for AS1000 Stepper Motors to EP7041 EtherCAT Box**
ZK4000-5151-0005	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 0.5 m, shielded
ZK4000-5151-0010	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 1 m, shielded
ZK4000-5151-0020	encoder cable, assembled on both sides for AS1000 Stepper Motors, 5 x 0.35 mm², l = 2 m, shielded



KL2532



KL2552



EL7332

KL2532, KL2552 | **DC motor output stages**

DC motors can replace the 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 KL2532 and KL2552 Bus Terminals. All parameters are adjustable via the fieldbus. The small, compact design and DIN rail mounting make the 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 DC motor output stage.

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 KL9570 or EL9570 buffer capacitor terminal (see page 12) protect 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.

Technical data	**KL2532** | KS2532	**KL2552** | KS2552
Connection technology	direct motor connection	
Load type	DC brush motors, inductive	
Max. output current	2 x 1 A (short-circuit-proof, thermal overload-proof for both channels together)	2 x 5 A (short-circuit-proof, thermal overload-proof for both channels together)
Number of channels	2 DC motors	2 DC motors, encoder input
Nominal voltage	24 V DC (-15 %/+20 %)	8…50 V DC
Current consumption power contacts	typ. 30 mA + load	typ. 50 mA
Current consumption K-bus	typ. 50 mA	typ. 100 mA
Distributed clocks	–	
PWM clock frequency	30 kHz with 180° phase shift each	
Duty factor	0…100 % (voltage-controlled)	
Control resolution	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)
Special features	travel distance control	travel distance control, encoder input
Operating temperature	0…+55 °C	
Approvals	CE	
Weight	approx. 55 g	approx. 100 g

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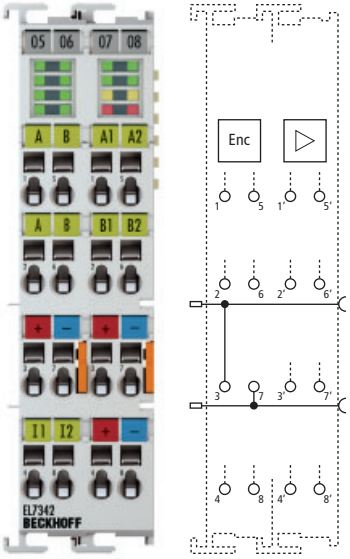
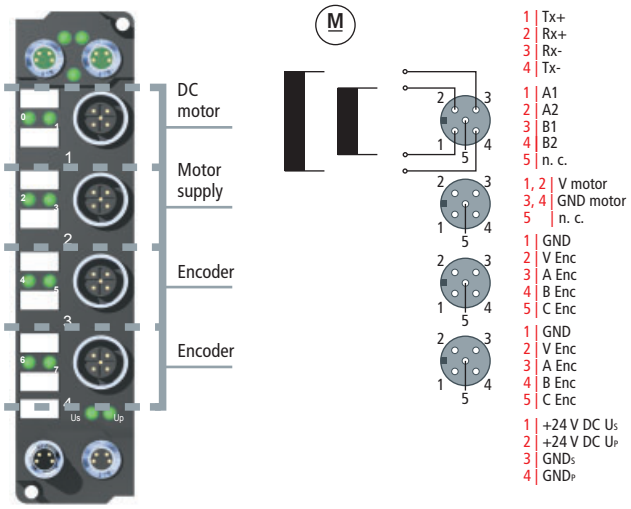


EL7342



EP7342-0002

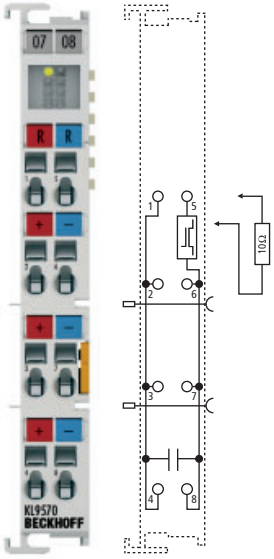
EL73xx, EP7342 | EtherCAT DC motor output stages

DC motors can replace the 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 in IP 20 or the EP7342 EtherCAT Box in IP 67. 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 DC motor output stage.

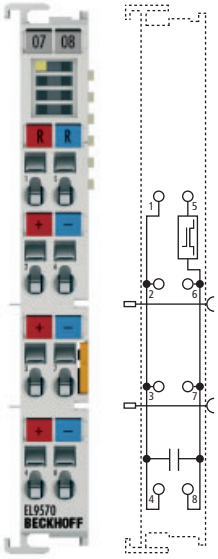
The peak current may briefly significantly exceed the rated current and in this way makes the whole drive system very dynamic. In such dynamic applications, negative acceleration causes the feedback of energy, which leads to voltage peaks at the power supply unit. The KL9570 or EL9570 buffer capacitor terminal (see page 12) protect 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.

Technical data	**EL7332** | ES7332	**EL7342** | ES7342	**EP7342-0002**
Connection technology	direct motor connection	direct motor connection	screw type M12
Load type	DC brush motors, inductive		
Max. output current	2 x 1 A	2 x 3.5 A	max. 2 x 3.5 A (short-circuit-proof, common thermal overload warning for both output stages) per channel
Number of channels	2 DC motors, 2 digital inputs	2 DC motors, encoder input	2 DC motors, encoder input
Nominal voltage	24 V DC (-15 %/+20 %)	8…50 V DC	8…50 V DC
Current consumption power contacts	typ. 40 mA	typ. 70 mA + motor current	–
Current consumption E-bus	140 mA typ.	200 mA typ.	–
Distributed clocks	yes		
PWM clock frequency	32 kHz with 180° phase shift each		
Duty factor	0…100 % (voltage-controlled)		
Control resolution	max. 10 bits current, 16 bits speed		
Encoder signal	–	5 … 24 V, 5 mA, single-ended	24 V, single-ended
Pulse frequency	–	max. 400,000 increments/s (with 4-fold evaluation)	max. 400,000 increments/s (with 4-fold evaluation)
Special features	travel distance control	travel distance control, encoder input	travel distance control, encoder input
Operating temperature	0…+55 °C	0…+55 °C	-25…+60 °C
Approvals	CE	CE	CE, UL
Weight	approx. 50 g	approx. 90 g	approx. 165 g

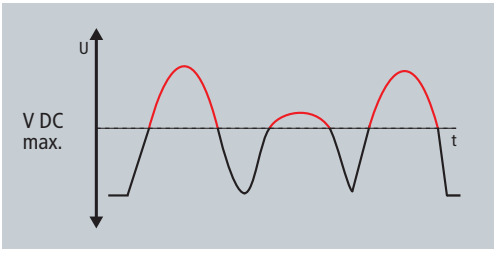
WWW. beckhoff.com/EL7332 **WWW. beckhoff.com/EL7342** **WWW. beckhoff.com/EP7342**



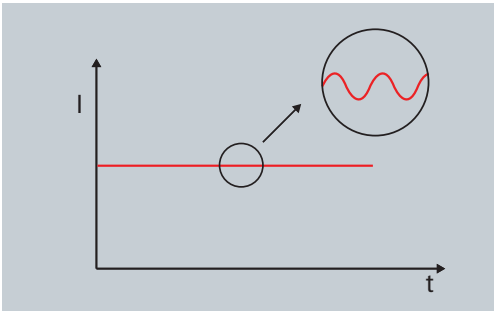
KL9570



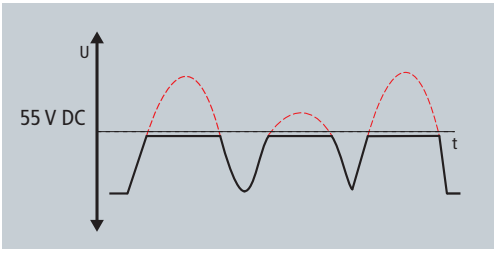
EL9570



Voltage spikes at the power supply unit



Occurrence of ripple currents



Prevention of overvoltage

KL9570, EL9570 | **Buffer capacitor terminals**

The buffer capacitor terminals KL9570 (Bus Terminal) and EL9570 (EtherCAT Terminal) contain high-performance capacitors for stabilising supply voltages. They can be used in conjunction with the terminals of the compact Drive Technology. 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 regenerative energy exceeds the capacity of the capacitors, the KL9570/EL950 switches the load voltage through to the terminal points 1 and 5. The energy is dissipated by the connection of an external ballast resistor.

Technical data	**KL9570** | KS9570	**EL9570** | ES9570
Technology	buffer capacitor terminal	
Diagnostics	–	
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/K-bus)	1,500 V (terminal/E-bus)
Operating temperature	0…+55 °C	
Approvals	CE, Ex	
Weight	approx. 65 g	approx. 90 g

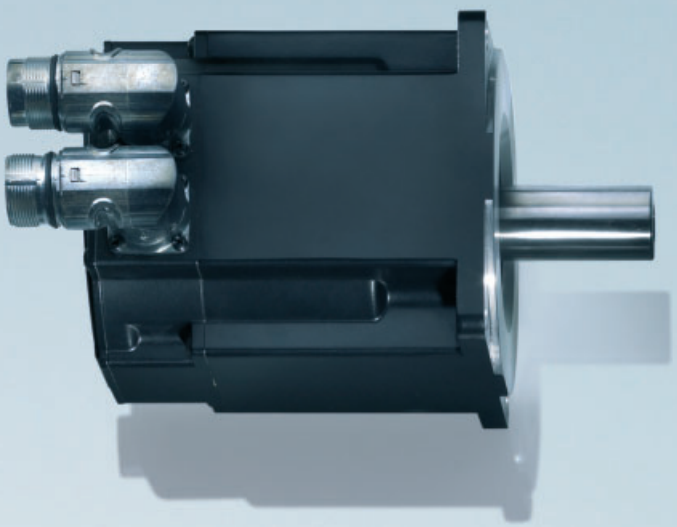
WWW. beckhoff.com/KL9570

WWW. beckhoff.com/EL9570

Drive Technology for the medium and high-performance range up to 118 kW:

Synchronous Servomotors

WWW. beckhoff.com/Servomotors



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Beckhoff Drive Technology
This flyer provides an overview over the compact Drive Technology. The complete product range up to 118 KW can be found on the Internet:

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