



### Highlights

- Integrated safety system from I/Os to drives
- Compact safety PLC
- Safety engineering integrated into TwinCAT 3

# TwinSAFE

Open and scalable safety technology

► [www.beckhoff.com/TwinSAFE](http://www.beckhoff.com/TwinSAFE)

544	Product overview
546	Technologies
546	Open and scalable safety solution
547	Safety over EtherCAT (FSOE)
548	Free choice of architecture
550	Safe drive technology
552	TwinCAT 3 and Safety
554	Workflow support
2 88	EtherCAT I/Os with TwinSAFE SC technology

556	<b>Controller/Logic</b>
556	EtherCAT Box EP1957
557	Compact Controller EK1960
558	EtherCAT Terminals EL69xx
559	EtherCAT plug-in module EJ6910
559	Bus Terminal KL6904

560	<b>Digital input</b>
560	EtherCAT Terminals EL19xx
560	EtherCAT Box EP1908
561	EtherCAT plug-in modules EJ191x
561	Bus Terminal KL1904

562	<b>Digital output</b>
562	EtherCAT Terminal EL2904
562	EtherCAT plug-in modules EJ291x
563	Bus Terminal KL2904

564	<b>Digital combi</b>
564	EtherCAT Terminal EL2911
564	EtherCAT plug-in module EJ1957

565	<b>Coupler</b>
565	EtherCAT Coupler EK1914

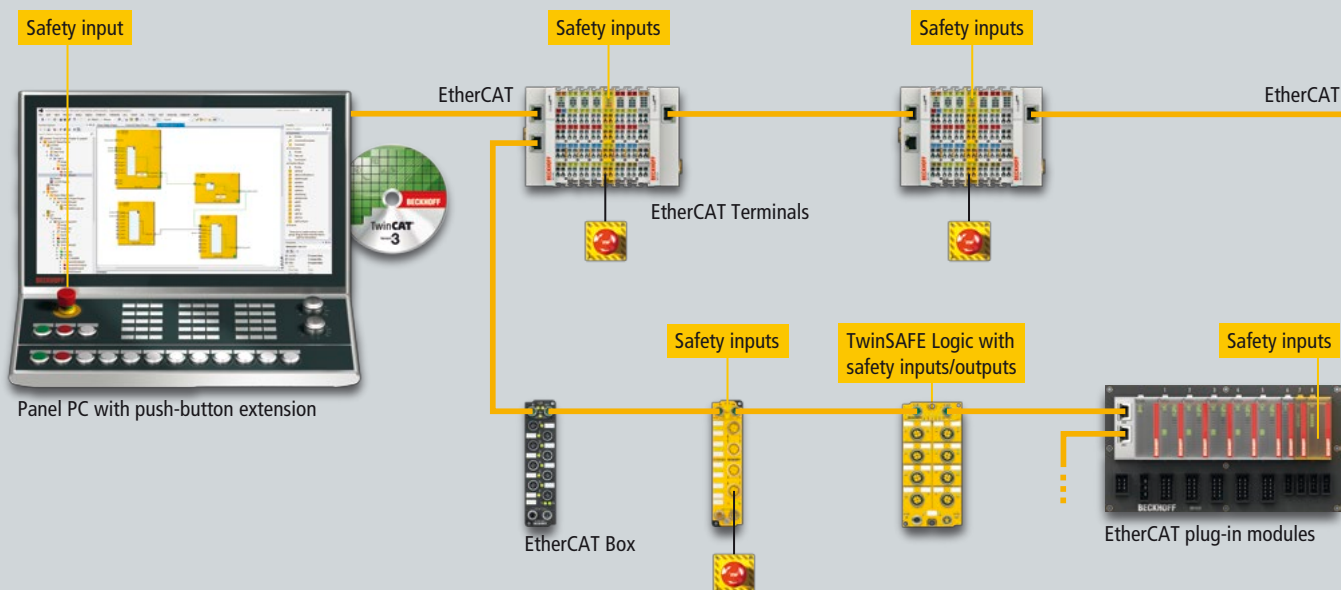
566	<b>Compact Drive Technology</b>
566	STO/SS1

568	<b>Drive Technology</b>
568	Safe Motion
570	STO/SS1
354	Distributed Servo Drive system

# Product overview TwinSAFE

TwinSAFE					
Dedicated controller			Integrated controller		
EtherCAT Terminal	EL6900	558	EtherCAT Terminal	EK1960	557
	TwinSAFE Logic			TwinSAFE Logic, 20 safe inputs, 24 safe outputs	
	EL6910	558		EL1918	560
	TwinSAFE Logic			TwinSAFE Logic, 8 safe inputs	
	EL6930	559		EL2911	564
	TwinSAFE Logic and PROFIsafe gateway			TwinSAFE Logic, 4 safe inputs, 1 safe output	
EtherCAT Plug-in Modules	EJ6910	559	EtherCAT Box	EP1957-0022	556
	TwinSAFE Logic			TwinSAFE Logic, 8 safe inputs, 4 safe outputs	
Bus Terminal	KL6904	559	EtherCAT Plug-in Modules	EJ1914	561
	TwinSAFE Logic, 4 safe outputs			EJ1918	561
				TwinSAFE Logic, 8 safe inputs	
				EJ1957	564
				TwinSAFE Logic, 8 safe inputs, 4 safe outputs	
				EJ2914	562
				TwinSAFE Logic, 4 safe outputs	
				EJ2918	563
				TwinSAFE Logic, 8 safe outputs	
			Drive Technology	AX81xx-0100, AX82xx-0100	570
				TwinSAFE Logic, feedback: OCT, TwinSAFE: STO/SSI	
				AX81xx-0200, AX82xx-0200	569
				TwinSAFE Logic, feedback: OCT, TwinSAFE: Safe Motion	

I/O			Drive Technology		
EtherCAT Terminal	<b>EK1914</b>	565	Option cards	<b>AX5801-0200</b>	570
	4 standard inputs, 4 standard outputs, 2 safe inputs, 2 safe outputs			drive-integrated safety functions: STO, SS1	
	<b>EK1960</b>	557	Axis modules	<b>AX5805, AX5806</b>	568
	TwinSAFE Logic, 20 safe inputs, 24 safe outputs			drive-integrated safety functions: STO, SOS, SS1, SS2, SLS, SSM, SSR, SMS, SLP, SCA, SLI, SAR, SMA, SDIp and SDIn	
	<b>EL1904</b>	560		<b>AX81xx-0100, AX82xx-0100</b>	570
	TwinSAFE, 4 safe inputs			TwinSAFE Logic, feedback: OCT, TwinSAFE: STO/SS1	
	<b>EL1918</b>	560		<b>AX81xx-0200, AX82xx-0200</b>	569
EtherCAT Box	<b>EP1908-0002</b>	560	Servomotor terminal	<b>EL7201-9014</b>	566
	TwinSAFE, 8 safe inputs			$I_{ms} = 2.8 \text{ A}$ , 50 V DC, OCT, STO	
	<b>EP1957-0022</b>	556		<b>EL7211-9014</b>	566
EtherCAT Plug-in Modules	<b>EJ1914</b>	561	Servomotor module	<b>EL7221-9014</b>	566
	TwinSAFE Logic, 4 safe inputs			$I_{ms} = 7 \dots 8 \text{ A}$ with ZB8610, 50 V DC, OCT, STO	
	<b>EJ1918</b>	561		<b>EP7211-9034</b>	567
	TwinSAFE Logic, 8 safe inputs		Servomotor output stage	<b>EJ7211-9414</b>	567
	<b>EJ1957</b>	564		$I_{ms} = 4.5 \text{ A}$ , 50 V DC, OCT, STO, TwinSAFE SC	
	TwinSAFE Logic, 8 safe inputs, 4 safe outputs		Stepper motor terminal	<b>EL7047-9014</b>	567
	<b>EJ2914</b>	562		$I_{max} = 5.0 \text{ A}$ , 50 V DC, incremental encoder, vector control, STO	
Bus Terminal	<b>EJ2918</b>	563	DC motor	<b>EL7411-9014</b>	567
	TwinSAFE Logic, 8 safe outputs			$I_{ms} = 4.5 \text{ A}$ , 50 V DC, STO	
	<b>KL1904</b>	561			
	TwinSAFE, 4 safe inputs				
	<b>KL2904</b>	563			
	TwinSAFE, 4 safe outputs				
	<b>KL6904</b>	559			
	TwinSAFE Logic, 4 safe outputs				



## TwinSAFE | Open and scalable safety solution

The TwinSAFE integrated safety solution represents the consistent continuation of the open and PC-based control philosophy from Beckhoff. Due to their modularity and versatility, the TwinSAFE terminals fit seamlessly into the Beckhoff control system. The I/O components are available as Bus Terminals, EtherCAT Terminals, EtherCAT plug-in modules and EtherCAT Box modules.

With the fieldbus-neutral safety protocol (TwinSAFE/Safety over EtherCAT), TwinSAFE devices can be integrated into any desired fieldbus system. To this end, the IP 20 TwinSAFE Bus Terminals are integrated into existing stations with K-bus or EtherCAT or used directly in the machine as IP 67 modules. These safety I/Os provide the interfaces to safety-relevant sensors and actuators.

The possibility to transmit safety-relevant signals over a standard bus system creates significant advantages in terms of planning, installation, operation, maintenance, diagnostics and costs.

The safety-relevant application is configured or programmed in TwinCAT software. This application is then transmitted over the bus system to a TwinSAFE Logic terminal. These logic terminals are at the heart of the TwinSAFE system. Due to the enormous flexibility of the system, however, several TwinSAFE Logic terminals can be operated simultaneously in one network. All safety devices in an installation communicate with these logic terminals.

### Communication via independent safety circuits

Communication between distributed TwinSAFE Logic terminals is very simple to implement with TwinCAT software. This applies not only to terminals in a network, but also to devices connected to different controllers. Safety-relevant data and signals can also be exchanged as soon as the controllers have established a communication connection via a fieldbus or via network variables. Of course, the response times and capabilities of the systems employed need to be considered.

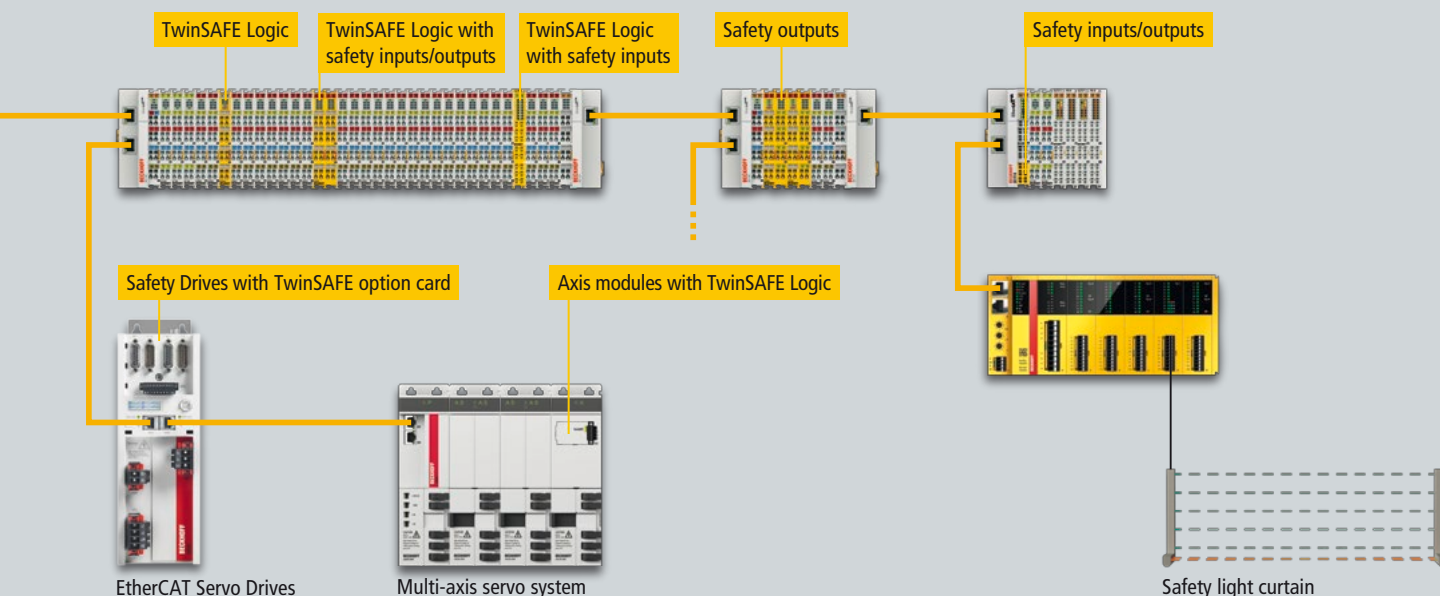
For this purpose, TwinCAT software assumes the task of distributing the data. This central distribution of the data has two significant advantages:

- Since all safety-relevant data are fed via the functional controller, it can be used by the controller for diagnostic purposes. The generation of diagnostic data on the safety controller is not necessary. That saves programming effort as well as computing performance and thus costs.
- All fieldbus systems that are interoperable with TwinCAT software are also accessible to the safety equipment. The TwinSAFE/Safety over EtherCAT protocol is so safe that even heterogeneous fieldbus environments as well as the safety-relevant exchange of data between modules on different fieldbus systems are not a problem.

### Certified safety function blocks and customising options facilitate configuration

The certified safety function blocks of the TwinSAFE Logic terminals allow the simple, error-free and inexpensive implementation of all safety tasks: from the simple monitoring of a safety door to complex muting functions based on digital signals and the safe control of highly complex process based on analog signals. It's also possible to implement connected and daisy-chained systems in compliance with safety requirements. For this purpose, the so-called customising capability is especially useful: Within a safety application, safety-relevant subgroups can be formed. Subsequently they can be deactivated or passivated permanently or temporarily during ongoing operation. These are essential functions that are required to reliably operate networked safety systems. Without these functions, commissioning, maintenance and partial operation of linked machines is not possible or a highly complex task.

With the TwinSAFE Logic terminals, all diagnostic and status data of the function blocks can be merged into the cyclic EtherCAT telegram. In addition, diagnostic data are stored directly in the logic component to enable asynchronous access. Extensive diagnostics is thus easy to implement without additional application requirements.



### A backup and restore mechanism facilitates exchange in the event of a fault

Since all parameters and settings as well as the application software are stored on TwinSAFE Logic components, the safety controller can be programmed either in the plant over the bus system or at the workstation and then simply plugged into the system.

The logic components provide a special backup and restore mechanism. Therefore, no additional exchangeable storage medium is required as in other systems. The user can activate this function in TwinCAT software or by the application.

If the original terminal has been exchanged, e.g. due to a defect, the system automatically recognises a new TwinSAFE

Logic component and the valid TwinSAFE application is loaded automatically into the new terminal. The safety-related check takes place fully automatically and requires no intervention by the user.

The maintenance staff only needs to exchange the Bus Terminal, everything else is accomplished reliably and securely by the TwinSAFE system.

## Safety over EtherCAT – Open safety protocol according to IEC 61784-3

The open Safety over EtherCAT protocol (FSoE for short: "Failsafe over EtherCAT") defines a safety-related communication layer for EtherCAT. It meets the requirements of IEC 61508 SIL 3 and enables the transmission of secure and standard information on the same communication system without restrictions regarding transmission rates and cycle time.

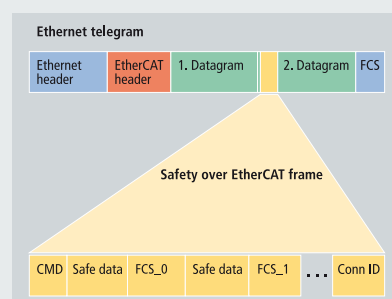
Thanks to this openness any transmission media and transmission path can be used with Safety over EtherCAT. FSoE is focused on EtherCAT, the high-performance Ethernet fieldbus, and the transmission of safety-related process data is based on the Black Channel principle.

Thus, Safety over EtherCAT is also supported by other fieldbus systems and protocols such as PROFIBUS, CANopen or Ethernet. Copper or optical fibre cables, radio links or transmission technologies such as data light barriers can be used as transmission path. The telegram is arranged in such a way that a minimal container length of 6 bytes is sufficient for the transmission of all safety information including one byte of safe process data.

Safe data are cyclically exchanged between a Safety over EtherCAT master and a Safety over EtherCAT slave. This mechanism is called a connection (TwinSAFE connection). A master can

establish and monitor several connections to different slaves.

Further information see page **2 67**







Stand-alone controller, small controller and classic architecture (from left to right)

## TwinSAFE | Free choice of architecture

With the introduction of the new Logic generation in the I/O level (from EL6910), Beckhoff has triggered a revolution in safety technology. The functionality of the TwinSAFE Logic is integrated in all new TwinSAFE components, which results in a great variety of possible architectures of TwinSAFE applications.

### Stand-alone

As the first step after introducing the new Logic generation, the functionality of the EL6910 TwinSAFE Logic was transferred to the EK1960 Compact Controller. This is a TwinSAFE Logic component with safe local inputs and outputs. Unlike previous TwinSAFE components, the EK1960 can also be operated without EtherCAT connection.

The same applies to the EP1957 EtherCAT Box. In addition to the availability of safe outputs in an IP 67 environment, Beckhoff provides the possibility of implementing a complete safety loop in an IP 67 environment through integration of the TwinSAFE Logic in this component. Like the EK1960, the EP1957 can also be operated in stand-alone mode.

Possible components for stand-alone architectures:

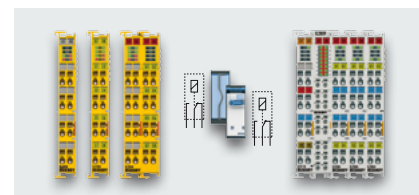
- EK1960 Compact Controller
- EP1957 digital combi module

### Small controllers

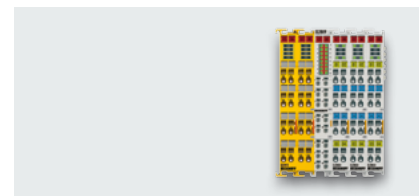
Following the introduction of stand-alone architectures in addition to classic safety architectures, Beckhoff is now also closing the gap between these two solutions. Whereas the stand-alone components can be used integrated in the EtherCAT network as usual, they are often oversized for very small applications. For this reason Beckhoff has introduced further small controllers enabling highly efficient and cost-effective implementation of very small safety applications.

As a small controller, the EL2911 terminal has four safe inputs and one safe output rated at 10 A. It allows very simple implementation of safe potential groups within a terminal segment. Standard terminals can be placed in the safe state with the help of the EL2911. Note, however, that this is only possible for non-reactive components (a corresponding list of possible components can be found on the Beckhoff website). The EL2911 allows the cost-effective substitution of previous solutions for this function. For an existing architecture as shown in the illustration, the following components can be replaced by the simple use of an EL2911:

- 1 x EL69x0
- 1 x EL1904
- 1 x EL2904
- 2 contactors
- 1 potential supply terminal



Before



After

Possible small controllers:

- EK1960 Compact Controller
- EP1957 digital combi module
- EL2911 potential supply terminal
- EJ1957 8-channel digital input, 4-channel digital output

### Classic architecture

The classic architecture is based on a safety application with a dedicated safety controller, which can exchange data with 1 to n safe communication devices. In this architecture, all safety-relevant data is transmitted to this controller and processed there. As a general rule, all components with logic functionality can be used; however, below please find a list of components that do not have safe inputs as well as safe outputs.



Distributed controllers

Possible components for classic architectures:

- EtherCAT Terminals
  - EL6910 TwinSAFE Logic
  - EL1918 8-channel digital input terminal
  - EL6900 TwinSAFE Logic
  - EL6930 TwinSAFE/PROFIsafe logic and gateway terminal
- EtherCAT plug-in modules
  - EJ6910 TwinSAFE Logic
  - EJ1914 4-channel digital input
  - EJ1918 8-channel digital input
  - EJ2914 4-channel digital output
  - EJ2918 8-channel digital output
- AX8911 TwinSAFE drive option

### Distributed controllers

The integration of the TwinSAFE Logic functionality in all new TwinSAFE components also provides an additional option to adopt a further method of modularisation. Based on the customising functionality, fine-granular modularisation is already possible at software level and also flexibly at runtime. This modularity can now also be implemented at the safety project level in TwinCAT 3 and at the hardware level. Whereas in a classic architecture all safety-relevant data is processed in the form of a large, complex safety project by a dedicated safety controller, the introduction of the new possibilities allows safety applications to be distributed directly to the individual and possibly to a certain

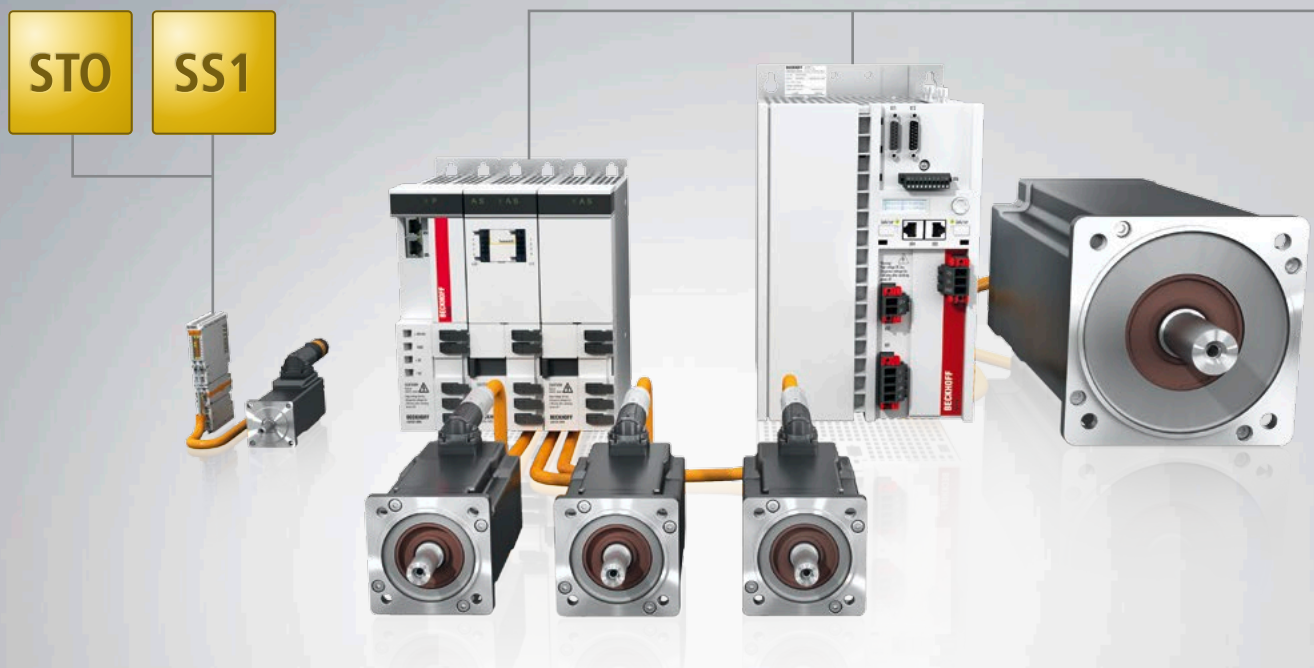
degree independent modules. With previous components this is possible only by using additional dedicated safety controllers in these modules, which means an additional cost expense. In future it will be very simple to implement this by providing individual components in these modules with a safety project. For example, a classic architecture can be used inside the modules. A module can thus be individually developed, validated and verified, whereas any from a safety aspect central safety controller that exists only has to process aggregated data from a defined interface to the modules. Through customisation, modules can be individually developed very efficiently and the commissioning of the partial or complete system is very easy to accomplish.

The distribution of the safety controller is not only very useful for the modularisation of the complete system. It may also be used, for example, for a simplified pre-processing of sensor data. Whereas previously the specific processing of input data was only possible in the dedicated safety controller, if an input component was not able to provide adequate functions, this can now be implemented very simply directly inside the input component. In this way, the actual safety project becomes less complex and is easier to manage, because any special treatment is no longer necessary.

Possible components for distributed controllers:

- EtherCAT Terminals
  - EK1960 Compact Controller
  - EL6910 TwinSAFE Logic
  - EL1918 8-channel digital input terminal
  - EL2911 potential supply terminal
- EtherCAT Box
  - EP1957 digital combi module
- EtherCAT plug-in modules
  - EJ6910 TwinSAFE Logic
  - EJ1914 4-channel digital input
  - EJ1918 8-channel digital input
  - EJ2914 4-channel digital output
  - EJ2918 8-channel digital output
  - EJ1957 8-channel digital input, 4-channel digital output
- AX8911 TwinSAFE drive option





## TwinSAFE | Safe drive technology

Dynamic movements of the electrical drive technology used in a machine can create considerable hazards to people and the environment. From a normative point of view, drive technology components must be considered in a safety-oriented manner by co-ordinating and monitoring certain movements and motion sequences. The integrated safety solution TwinSAFE enables the implementation of safe drive technology in three levels corresponding to the complexity of the machine.

The safe drive components are able to switch the motor torque-free or to monitor speed, position and direction of rotation. No further devices such as contactors or circuit breakers are necessary in the supply lines for this. This enables a very lean installation and helps to lower costs and control cabinet space requirements.

Even safe position monitoring or position range monitoring is simple to implement with the aid of the safe drive technology. This does not require any additional wiring, because the EtherCAT communication is used in the servo drives, enabling seamless communication between TwinSAFE Logic components and the safe drive technology.

Like the programming or configuration of a safety application, the entire param-

eterisation of the safe drive technology is performed from the TwinCAT software. All system-specific settings are stored together with the application in the TwinSAFE Logic components. For that reason, the safe drive components can be exchanged at any time without software modification. The respective component receives all the parameters necessary for operation at the next power-on or boot-up.

### STO/SS1 according to IEC 61800-5-2

The safety functions Safe Torque Off (STO) and Safe Stop 1 (SS1 | Monitored braking, STO after time or standstill) in accordance with IEC 61800-5-2 can be implemented with the following TwinSAFE components:

- stand-alone AX5000 Servo Drive with AX5801-0200 option card
- AX8000 multi-axis servo system with TwinSAFE AX81xx-x1xx and AX82xx-x1xx axis modules
- servo terminals variant: EL72xx-9014
- servomotor box variant: EP7211-9034

### Safe Motion according to IEC 61800-5-2

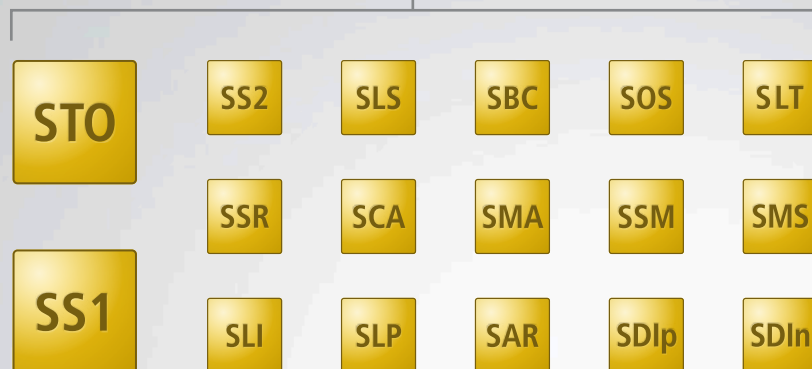
More complex safety functions can be implemented with the aid of the Safe Motion function package:

- Stop functions (STO, SOS, SS1, SS2)
- Speed functions (SLS, SSM, SSR, SMS) with up to 8 speeds
- Position functions (SLP, SCA, SLI) with reference cams
- Acceleration functions (SAR, SMA)
- Direction of rotation functions (SDIp, SDIn)

The following TwinSAFE components support the Safe Motion function package:

- stand-alone AX5000 Servo Drive with AX5805-0200 and AX5806-0020 option cards
- AX8000 multi-axis servo system with TwinSAFE AX81xx and AX82xx axis modules

The above-mentioned safety functions can be implemented with AX58xx option cards for the AX5000. No special encoder system is necessary in order to implement the safety functions SDI (Safe Direction) or SLS (Safely Limited Speed); many standard motors from Beckhoff support these functions without further expense and without additional encoder system when the AX5000 is used. A detailed list of permissible motors can be found under ► [www.beckhoff.com/Documentation](http://www.beckhoff.com/Documentation)



The SBC function (Safe Brake Control) can additionally be implemented with the AX8000 and the ordering option AX8xxx-x2xx.

### Programmable, safe drive technology through integrated logic

The AX8000 multi-axis servo drive encompasses new functions of safe drive technology with TwinSAFE: With the ordering options -0100 and -0200, the AX8108, AX8118 and AX8206 axis modules feature a programmable TwinSAFE Logic corresponding to an EL6910 and enable the direct implementation of safety applications in the servo drives. The number of TwinSAFE connections is limited to eight. The user achieves greater degrees of freedom in the implementation of a drive technology safety application and the flexibility of programming allows the design of safe drive technology to suit the specific system requirements.

The STO and SS1 safety functions can be implemented with TwinSAFE axis modules selecting the ordering option -0100 (STO/SS1). These functions can be initiated both via hard wiring and via FSoE. For TwinSAFE axis modules with the ordering option -0200 (Safe Motion), various drive-integrated

signals are available for the implementation of an application-specific safety function.

As is familiar from the EL6910, internal and external signals can be used inside the TwinSAFE axis modules -0100 and -0200 in conjunction with the well-known pre-certified function blocks in order to implement complex drive functions. Depending on the application, the safety-oriented information can be pre-processed directly in the drive so that the central TwinSAFE Logic needs only process the aggregated information.

For AX8000 multi-axis servo drive system  
see page [336](#)

For AX5000 Digital Compact Servo Drives  
see page [344](#)

For compact Drive Technology  
see page [410](#)

### Safety Engineering

- FBD
- Safety C

### TwinCAT Safety PLC



With a safety development environment and a safety runtime, the next step in the field of safety solutions is completed with TwinCAT 3.

## TwinCAT 3 and Safety | Simplified engineering

TwinCAT 3 as a universal development tool creates further possibilities for safety-relevant fields of application. First, TwinCAT 3 offers additional functionality for creating and managing safety-relevant applications with the safety editor. Second, a standard Industrial PC can be used as a safety controller for the first time. This is possible due to the new safety runtime.

### Safety editor

The safety editor integrated in TwinCAT 3 allows the implementation of a safety application in a graphical environment. The desired logic is programmed according to a function block diagram (FBD). The application can be represented in the network infrastructures for increased clarity. The functions blocks known from the logic components can be used as logic elements (digital function blocks for KL6904 and EL69xx; additional analog function blocks for EL6910, EJ6910, EK1960, AX8xxx-x1xx, AX8xxx-x2xx etc.).

The safety editor offers increased flexibility and portability. This is achieved by initially programming independently of the actual hardware used. To this end, both the target system and all input and output devices are made available as so-called alias devices. At this level, all safety-relevant settings can be selected in advance. Before the project is finally transferred to the executing hardware, these alias devices must be assigned to the actually installed physical devices.

In addition to using pre-specified function blocks, there is also the possibility to create custom function blocks. These can be created by combining existing – pre-certified – function blocks or by using Safety C (this can only be done for the safety runtime). Safety C is an almost unrestricted derivative of standard C. This allows well-known control structures such as IF-THEN-ELSE, SWITCH CASE and the data types usual in C to be used for safety applications.

An important novelty in the programming of safety-relevant applications in TwinCAT 3 is the extended user management. In the so-called basic mode, the user can create an application exclusively from pre-specified – and thus certified – function blocks. These also include function blocks that the user has created on the basis of pre-certified function blocks. In the expert mode on the other hand, it is possible to create function blocks in Safety C and thus to create custom libraries. Before loading it into the safety controller, a check is made as to whether the programmed logic consists of already certified function blocks or whether the created application requires renewed examination.

In addition to programming, improved tools optimally support the debugging and test phase. Programs can be debugged as usual in the Visual Studio® environment: the online values of variables and states of the function blocks are displayed directly in the graphical environment, enabling fast and

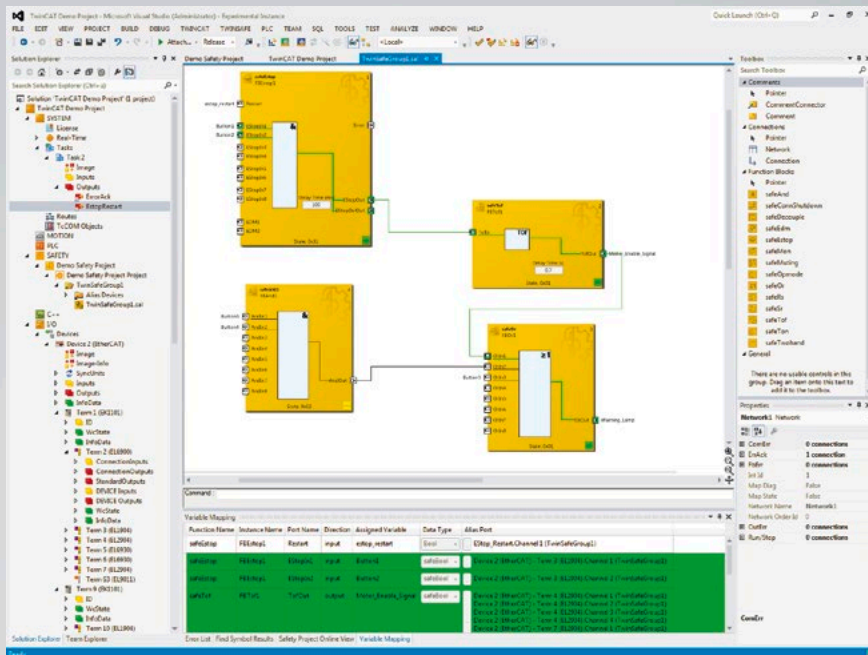
simple debugging of the application. Furthermore, the project can be simulated offline in order to considerably speed up and simplify commissioning.

The editor is equipped with an automatic verification mechanism which automatically checks whether the saved project corresponds to the one created in the editor. The previously required manual comparison by uploading the project back to the safety controller is no longer necessary.

In addition, the safety editor automatically generates documentation containing a detailed view of all relevant project data. From the representation of the hardware terminals with their safety-relevant settings through to an exact listing of the function blocks used and their interconnections, this documentation contains all important data required to facilitate the wiring of the plant, debugging and maintenance.

### TwinCAT Safety PLC

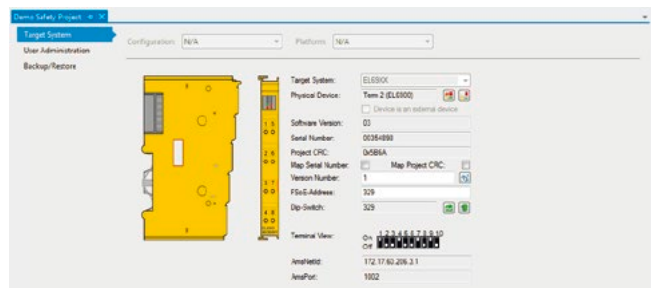
The enormous advances in the field of Industrial PCs and the associated increase in reliability and quality allow a standard IPC to be used as a safety controller. This is enabled on a strictly mathematical basis, so that the proof of safety does not only hold for a specific processor and its environment. The independence from the hardware component used that this creates, enables the use of standard components up to a SIL 3 safety level according to IEC 61508.



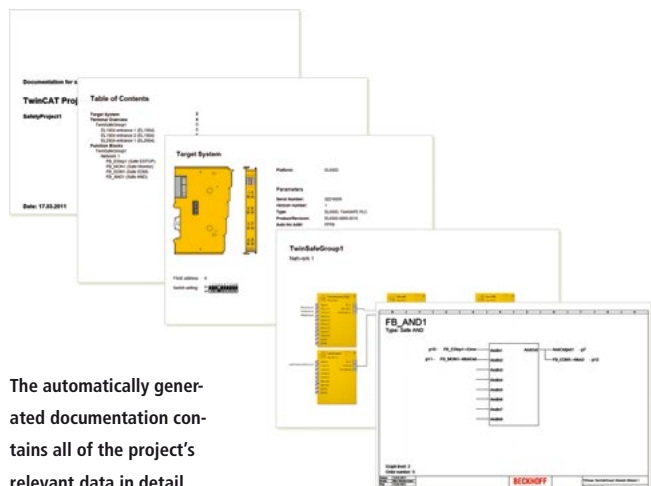
View of the fully graphical safety editors in TwinCAT 3

For this purpose, mathematical coding is used that creates diverse data redundancy, which ensures that the correct execution of operations within the safety application can be verified and a safe reaction initiated in the case of an error. In addition to pre-specified function blocks, the use of Safety C allows custom function blocks to be created and saved in a library for later use.

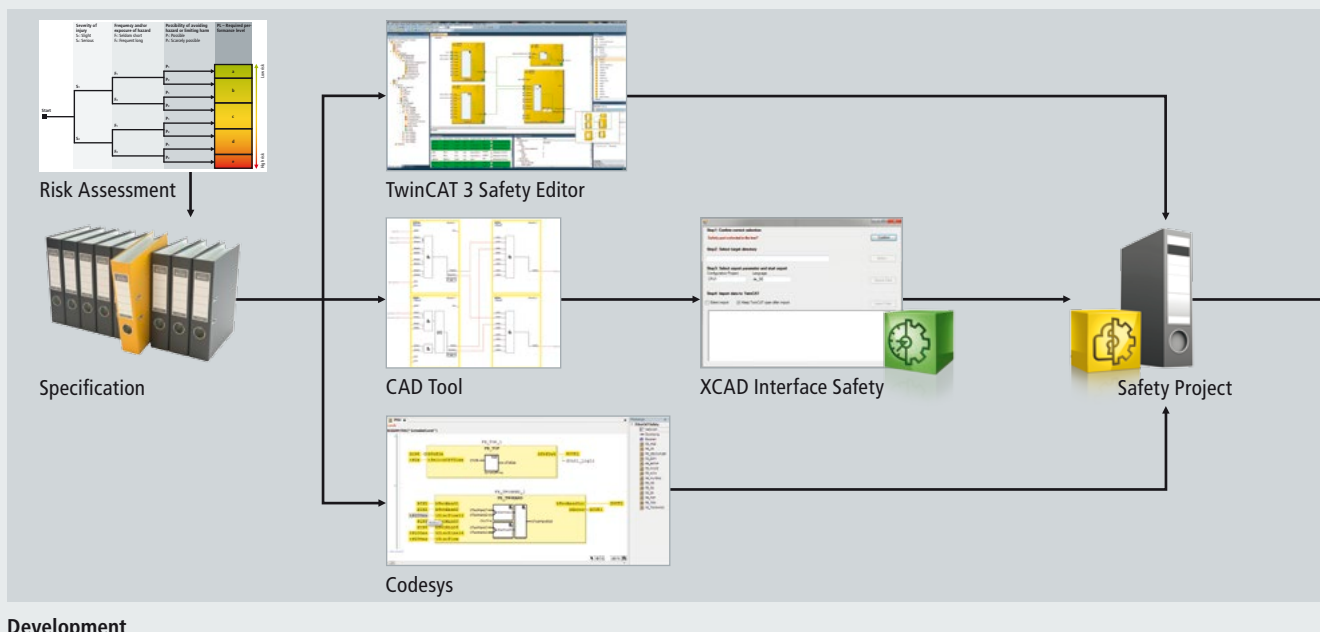
Further information on TwinCAT 3  
see page 470 or  
► [www.beckhoff.com/TwinCAT3](http://www.beckhoff.com/TwinCAT3)



Configuring the target system



The automatically generated documentation contains all of the project's relevant data in detail.



## TwinSAFE | Workflow support

### Application manual

To simplify the design of safety functions, Beckhoff has made the TwinSAFE application manual available for download via the website. The user-friendly manual contains a compilation of application samples for TwinSAFE with a collection of widely used safety functions. Each sample shows the interconnection of the hardware components and the corresponding mapping inside the safety application itself, i.e. the implementation with the help of pre-certified function blocks and the parameterisation of the input and output components. For further support the verification of the respective safety level as confirmed by the TÜV SÜD authority is executed for each sample, so that the samples can either be adopted 1:1 or adapted very simply to specific application requirements.

### TwinCAT 3 and TwinCAT 2

In the Beckhoff world the safety application is implemented either with TwinCAT 2 or 3. Whereas TwinCAT 2 can be used exclusively for the TwinSAFE Logic components EL6900, EL6930 and KL6904, all Logic components with the exception of the KL6904 can be configured with TwinCAT 3.

### XCAD Interface Safety

Beckhoff provides the possibility to create a safety application directly in a CAD tool. With the help of XCAD Interface Safety the application can subsequently be converted into a functional safety project in TwinCAT 3.

### Codesys

The Beckhoff TwinSAFE Logic components can also be configured with Codesys Safety.

### TwinSAFE Loader

The TwinSAFE Loader tool represents a possibility to download the safety project entirely without the TwinCAT development environment. It is a command line tool that can be integrated into customer-specific processes. It enables, for example, the loading of TwinSAFE Logic components during series production without the use of a development environment. Furthermore, an existing system can be customised at runtime with the help of the TwinSAFE Loader.

When using the TwinSAFE Loader in the context of a customer-specific process, the FMEDA given in the user manual must always be observed.

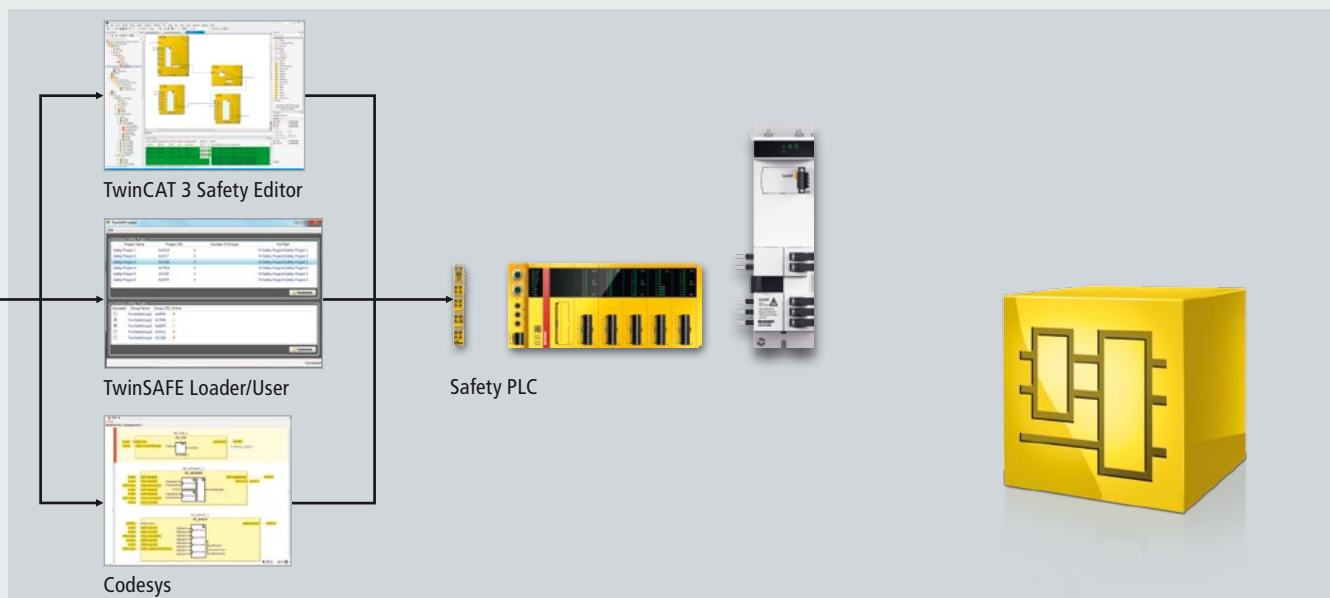
### TwinSAFE User

The TwinSAFE User tool is used to handle the user administration of a TwinSAFE Logic component. For example, the user administration on a TwinSAFE Logic component can be configured during series production without the use of a development environment.

### Deployment on TwinSAFE Logic components

The safety project generated with the help of the TwinSAFE workflow can be transferred to the TwinSAFE Logic components using the tools described above. The TwinSAFE components listed in the table are available as target systems.





## Deployment

Ordering information	Integrated TwinSAFE Logic: modularity and scalability on all levels	
EtherCAT Terminal		
EK1960	TwinSAFE Compact Controller	557
EL1918	8-channel digital input terminal, TwinSAFE, 24 V DC, TwinSAFE Logic	560
EL2911	potential supply terminal, TwinSAFE Logic, 24 V DC, 10 A, 4 safe inputs, 1 safe output	564
EL6900	TwinSAFE Logic	558
EL6910	TwinSAFE Logic	558
EL6930	FSoE/PROFIsafe logic and gateway terminal	559
EtherCAT Box		
EP1957-0022	digital combi module, TwinSAFE Logic, 24 V DC, 8 safe inputs, 4 safe outputs	556
EtherCAT Plug-in Modules		
EJ1914	4-channel digital input, TwinSAFE, 24 V DC	561
EJ1918	8-channel digital input, TwinSAFE, 24 V DC	561
EJ1957	8 fail-safe inputs, 4 fail-safe outputs, TwinSAFE, 24 V DC	564
EJ2914	4-channel digital output, TwinSAFE, 24 V DC, 0.5 A	562
EJ2918	8-channel digital output, TwinSAFE, 24 V DC, 0.5 A	563
EJ6910	TwinSAFE Logic	559
Drive Technology		
AX8108-0100	single-axis module 8 A, feedback: OCT, TwinSAFE: STO/SS1, TwinSAFE Logic integrated	570
AX8108-0200	single-axis module 8 A, feedback: OCT, TwinSAFE: Safe Motion, TwinSAFE Logic integrated	569
AX8118-0100	single-axis module 18 A, feedback: OCT, TwinSAFE: STO/SS1, TwinSAFE Logic integrated	570
AX8118-0200	single-axis module 18 A, feedback: OCT, TwinSAFE: Safe Motion, TwinSAFE Logic integrated	569
AX8206-0100	double-axis module 2 x 6 A, feedback: OCT, TwinSAFE: STO/SS1, TwinSAFE Logic integrated	570
AX8206-0200	double-axis module 2 x 6 A, feedback: OCT, TwinSAFE: Safe Motion, TwinSAFE Logic integrated	569

# Stand-alone | TwinSAFE Logic without EtherCAT network

The EK1960 TwinSAFE Compact Controller extends the application range of the integrated TwinSAFE safety solution. Based on its compact design with 20 safe digital inputs and 24 safe digital outputs, it is ideal to cover the safety requirements of compact machines in particular. The EK1960 can be operated in stand-alone mode or it can be networked with other controllers via the EtherCAT connections. Like every EtherCAT Coupler, the EK1960 can be extended by all EL/ES terminals if operated in an EtherCAT network. It can, however, not be extended by terminals when operated as a stand-alone device.

The TwinSAFE Compact Controller is programmed via the TwinCAT Safety Editor in the same way as other TwinSAFE components. A TwinSAFE project is created and loaded over EtherCAT into the EK1960. The EK1960 supports the establishment of 128 TwinSAFE connections. For flexible adaptation to different safety tasks, the TwinSAFE Compact Controller can be combined with the TwinSAFE I/O components with IP 20 and IP 67 protection and the TwinSAFE drive option cards.

The EP1957-0022 TwinSAFE box is a safe small controller for the IP 67 environment with eight safe digital inputs, four safe digital outputs and integrated TwinSAFE Logic for pre-processing of safety-related information directly in the field. Apart from use within an EtherCAT network, it can also be used in stand-alone mode outside the control cabinet without a connection to an EtherCAT master.



EK1960 with M8 bus interface

TwinSAFE Logic,  
EtherCAT Box,  
8 safe inputs,  
4 safe outputs

Technical data	EP1957-0022
Connection technology	M12, screw type
Specification	link unit between safe input and output signals
Number of inputs	8
Number of outputs	4
Max. output current	0.5 A
	
Protocol	TwinSAFE/Safety over EtherCAT
Cycle time	approx. 1 ms/according to project size
Fault response time	≤ watchdog time (parameterisable)
Current consumption from U <sub>s</sub> /U <sub>p</sub>	max. 120 mA/max. 60 mA
Installation position	variable
Safety standard	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
Approvals	CE, TÜV SÜD
Weight	approx. 315 g
Protection class	IP 67 (according to EN 60529)
Further information	<a href="http://www.beckhoff.com/EP1957-0022">www.beckhoff.com/EP1957-0022</a>
Variants	
Distinguishing features	

TwinSAFE Compact Controller,  
EtherCAT Coupler,  
20 safe inputs,  
24 safe outputs (4 optional relay outputs)

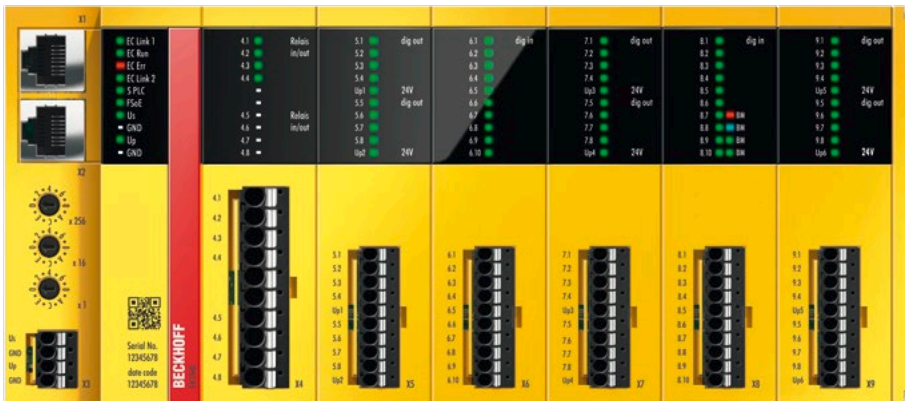
**EK1960-0000**

1-wire

20

24 (4 optional relay outputs)

2 A (simultaneity factor 50 % at 2 A)



TwinSAFE/Safety over EtherCAT

approx. 1 ms/according to project size

≤ watchdog time (parameterisable)

typ. 80 mA/typ. 2 mA

horizontal

EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)

CE, TÜV SÜD

approx. 500 g (without relay outputs), approx. 560 g (with relay outputs)

IP 20

[www.beckhoff.com/EK1960](http://www.beckhoff.com/EK1960)

**EK1960-0008**

without relay outputs, M8 bus interface

**EK1960-2600**

with relay outputs, RJ45 bus interface

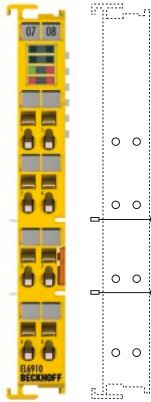
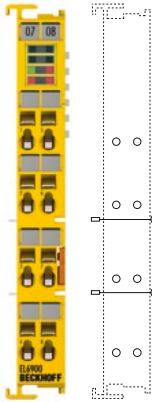
**EK1960-2608**

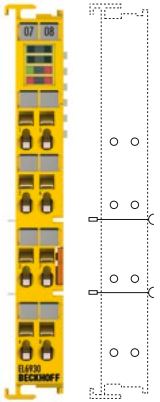

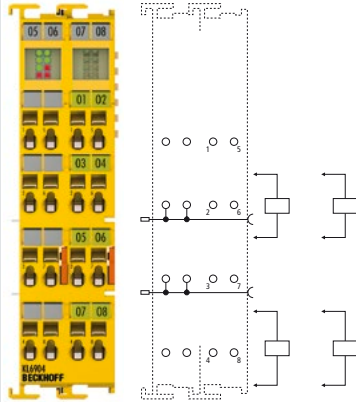
with relay outputs, M8 bus interface

# TwinSAFE | TwinSAFE Logic in the EtherCAT network

With the new generation of safety controllers based on the EL6910, Beckhoff ushers in a new era in safety technology by further expanding the concept of modularity within the TwinSAFE system. Apart from adding functionalities for the highly granular and flexible modularisation of each safety project in order to optimally meet the respective safety requirements, Beckhoff enables all new safe I/O modules to directly execute customer-specific safety projects, including communication with multiple devices. Since the intelligence of the entire safety application can be distributed over the involved safety-relevant devices, the user can adapt the TwinSAFE system even more specifically to the needs of each machine concept.

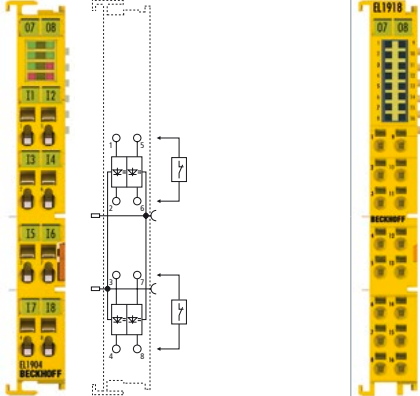
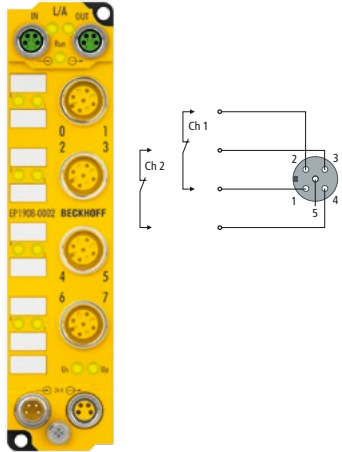
For an overview of all products with integrated TwinSAFE Logic see page **555**

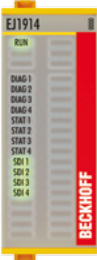

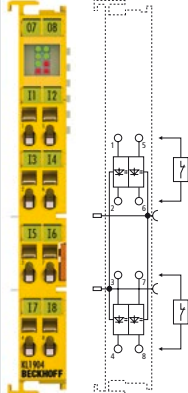
	TwinSAFE Logic, EtherCAT Terminal	TwinSAFE Logic, EtherCAT Terminal
Technical data	EL6910	EL6900
Connection technology	–	
Specification	link unit between safe input and output signals	
Number of outputs	–	–
Max. output current	–	–
	 <p>The TwinSAFE Logic can establish 212 connections to other TwinSAFE devices.</p>	 <p>The TwinSAFE Logic can establish 128 connections to other TwinSAFE devices.</p>
Protocol	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
Cycle time	approx. 1 ms/according to project size	approx. 500 µs/according to project size
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Current consumption power contacts	–	–
Current consumption E-bus	typ. 160 mA	typ. 188 mA
Current consumption K-bus	–	–
Installation position	horizontal	horizontal
Safety standard	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
Approvals	CE, UL, TÜV SÜD	CE, UL, Ex, TÜV SÜD
Weight	approx. 50 g	approx. 50 g
Protection class	IP 20	IP 20
Further information	<a href="http://www.beckhoff.com/EL6910">www.beckhoff.com/EL6910</a>	<a href="http://www.beckhoff.com/EL6900">www.beckhoff.com/EL6900</a>
Special terminals		
Distinguishing features		

	TwinSAFE/PROFIsafe logic and gateway terminal, EtherCAT Terminal	TwinSAFE Logic, EtherCAT plug-in module	TwinSAFE Logic, Bus Terminal, 4 safe outputs
	<b>EL6930</b>	<b>EJ6910</b>	<b>KL6904</b>
		distribution board	2-wire
	—	—	4
	—	—	0.5 A/20 mA min. (per channel)
	 <p>The EL6930 logic terminal can establish 127 connections to other TwinSAFE/Safety over EtherCAT devices and one PROFIsafe slave connection to a PROFIsafe master.</p>	 <p>The TwinSAFE Logic can establish 212 connections to other TwinSAFE devices.</p>	 <p>The KL6904 can establish up to 15 connections (TwinSAFE connections).</p>
	TwinSAFE/Safety over EtherCAT, PROFIsafe	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
	approx. 500 µs/according to project size	approx. 1 ms/according to project size	4...100 ms
	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
	—	—	load-dependent
	typ. 188 mA	typ. 222 mA	—
	—	—	max. 250 mA
	horizontal	horizontal	horizontal
	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
	CE, UL, TÜV SÜD	CE, TÜV SÜD	CE, UL, Ex, TÜV SÜD
	approx. 50 g	approx. 27 g	approx. 100 g
	IP 20	IP 20	IP 20
	www.beckhoff.com/EL6930	www.beckhoff.com/EJ6910	www.beckhoff.com/KL6904
			<b>KL6904-0001</b>
			pre-configured ex factory to 15 TwinSAFE connections

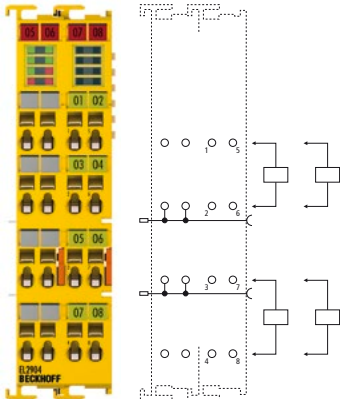




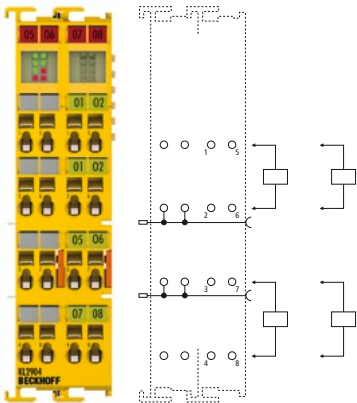
## TwinSAFE | Digital inputs

	TwinSAFE, EtherCAT Terminal, 4 safe inputs	TwinSAFE Logic, EtherCAT Terminal, 8 safe inputs	TwinSAFE, EtherCAT Box, 8 safe inputs
Technical data	EL1904	EL1918	EP1908-0002
Connection technology	1-/2-wire		M12, screw type
Specification	recording of input signals	link unit between safe input and output signals	recording of input signals
Number of inputs	4	8	8
			
Protocol	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
Response time	typ. 4 ms (read input/write to E-bus)	typ. 4 ms (read input/write to E-bus)	typ. 5.5 ms (read input/write to bus)
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Current consumption power contacts	see documentation	see documentation	–
Current consumption E-bus	typ. 200 mA	typ. 165 mA	–
Current consumption from U <sub>S</sub> /U <sub>P</sub>	–	–	max. 87 mA/max. 27 mA
Current consumption K-bus	–	–	–
Installation position	horizontal	horizontal	variable
Safety standard	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
Approvals	CE, UL, Ex, TÜV SÜD	CE, TÜV SÜD	CE, UL, TÜV SÜD
Weight	approx. 50 g	approx. 50 g	approx. 170 g
Protection class	IP 20	IP 20	IP 65/66/67 (according to EN 60529)
Further information	<a href="http://www.beckhoff.com/EL1904">www.beckhoff.com/EL1904</a>	<a href="http://www.beckhoff.com/EL1918">www.beckhoff.com/EL1918</a>	<a href="http://www.beckhoff.com/EP1908">www.beckhoff.com/EP1908</a>

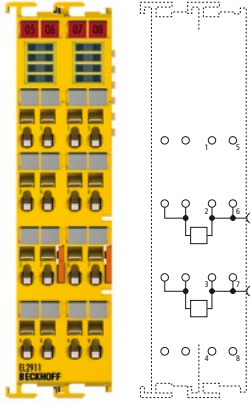

	TwinSAFE Logic, EtherCAT plug-in module, 4 safe inputs	TwinSAFE Logic, EtherCAT plug-in module, 8 safe inputs	TwinSAFE, Bus Terminal, 4 safe inputs
	<b>EJ1914</b>	<b>EJ1918</b>	<b>KL1904</b>
	distribution board		2-wire
	link unit between safe input and output signals		recording of input signals
	4	8	4
			
	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
	typ. 4 ms (read input/write to E-bus)	typ. 4 ms (read input/write to E-bus)	typ. 4 ms (read input/write to K-bus)
	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
	–	–	–
	typ. 260 mA	typ. 290 mA	–
	–	–	–
	–	–	48 mA
	horizontal	horizontal	horizontal
	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
	CE, TÜV SÜD	CE, TÜV SÜD	CE, UL, Ex, TÜV SÜD
	approx. 45 g	approx. 60 g	approx. 50 g
	IP 20	IP 20	IP 20
	<a href="http://www.beckhoff.com/EJ1914">www.beckhoff.com/EJ1914</a>	<a href="http://www.beckhoff.com/EJ1918">www.beckhoff.com/EJ1918</a>	<a href="http://www.beckhoff.com/KL1904">www.beckhoff.com/KL1904</a>

# TwinSAFE | Digital outputs

	TwinSAFE, EtherCAT Terminal, 4 safe outputs	TwinSAFE Logic, EtherCAT plug-in module, 4 safe outputs
<b>Technical data</b>	<b>EL2904</b>	<b>EJ2914</b>
Connection technology	1-/2-wire	distribution board
Specification	output of output signals	link unit between safe input and output signals
Number of outputs	4	4
Max. output current	0.5 A (per channel), min. 20 mA (with active current measurement)	0.5 A
		
Protocol	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Current consumption power contacts	load-dependent	–
Current consumption E-bus	typ. 221 mA	typ. 260 mA
Current consumption K-bus	–	–
Installation position	horizontal	horizontal
Safety standard	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
Approvals	CE, UL, Ex, TÜV SÜD	CE, TÜV SÜD
Weight	approx. 100 g	approx. 47 g
Protection class	IP 20	IP 20
Further information	<a href="http://www.beckhoff.com/EL2904">www.beckhoff.com/EL2904</a>	<a href="http://www.beckhoff.com/EJ2914">www.beckhoff.com/EJ2914</a>

	TwinSAFE Logic, EtherCAT plug-in module, 8 safe outputs	TwinSAFE, Bus Terminal, 4 safe outputs
	<b>EJ2918</b>	<b>KL2904</b>
		2-wire
		output of output signals
	8	4
	0.5 A	0.5 A/20 mA min. (per channel)
		
	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
	–	load-dependent
	typ. 310 mA	–
	–	250 mA
	horizontal	horizontal
	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	DIN EN ISO 13849-1:2008 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
	CE, TÜV SÜD	CE, UL, Ex, TÜV SÜD
	approx. 62 g	approx. 100 g
	IP 20	IP 20
	<a href="http://www.beckhoff.com/EJ2918">www.beckhoff.com/EJ2918</a>	<a href="http://www.beckhoff.com/KL2904">www.beckhoff.com/KL2904</a>

## TwinSAFE | Digital combi

	TwinSAFE, EtherCAT Terminal, 4 safe inputs, 1 safe output, potential power supply terminal	TwinSAFE Logic, EtherCAT plug-in module, 8 safe inputs, 4 safe outputs
<b>Technical data</b>	<b>EL2911</b>	<b>EJ1957</b>
<b>Connection technology</b>	1-/2-wire and/or via power contacts	distribution board
<b>Specification</b>	link unit between safe input and output signals	
<b>Number of inputs</b>	4	8
<b>Number of outputs</b>	1	4
<b>Max. output current</b>	10 A	0.5 A
		
<b>Protocol</b>	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
<b>Fault response time</b>	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
<b>Current consumption power contacts</b>	load-dependent	–
<b>Current consumption E-bus</b>	typ. 180 mA	typ. 330 mA
<b>Installation position</b>	horizontal	horizontal
<b>Safety standard</b>	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
<b>Approvals</b>	CE, TÜV SÜD	CE, TÜV SÜD
<b>Weight</b>	approx. 98 g	approx. 64 g
<b>Protection class</b>	IP 20	IP 20
<b>Further information</b>	<a href="http://www.beckhoff.com/EL2911">www.beckhoff.com/EL2911</a>	<a href="http://www.beckhoff.com/EJ1957">www.beckhoff.com/EJ1957</a>

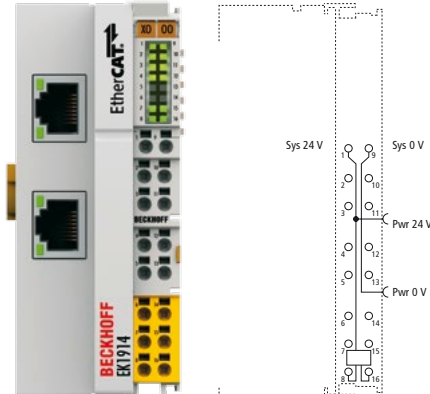


# TwinSAFE | E-bus coupler

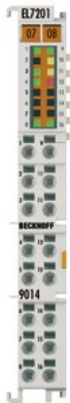
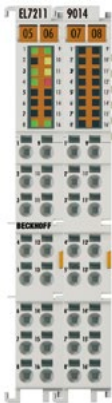

The EK1914 EtherCAT Coupler combines the functionalities of the EK1100 EtherCAT Coupler with standard and safe digital I/Os. This results in a compact design that is especially suitable for applications with a low number of I/Os.




Like the EK1100, the EK1914 can be extended by all EL/ES terminals. The EK1914 has four digital inputs and four digital outputs as well as two fail-safe inputs and two fail-safe outputs.

TwinSAFE,  
EtherCAT Coupler,  
4 standard inputs, 4 standard outputs,  
2 safe inputs, 2 safe outputs



Technical data	EK1914
Connection technology	1-/2-wire
Specification	EtherCAT Coupler with standard and safety I/Os
Number of inputs	6 digital inputs, 2 of which are fail-safe inputs
Number of outputs	6 digital outputs, 2 of which are fail-safe outputs
Max. output current	per standard output: 0.5 A, per safe output: 0.5 A, min. 20 mA
	
Protocol	EtherCAT
Fault response time	≤ watchdog time
Current consumption power contacts	–
Current consumption E-bus	–
Installation position	horizontal
Safety standard	DIN EN ISO 13849-1:2008 (Cat. 4, PL e)
Approvals	CE, UL, TÜV SÜD
Weight	approx. 123 g
Protection class	IP 20
Further information	<a href="http://www.beckhoff.com/EK1914">www.beckhoff.com/EK1914</a>



# STO/SS1 | Compact Drive Technology

	Servomotor terminal with OCT and STO, 50 V DC, 2.8 A ( $I_{rms}$ )	Servomotor terminal with OCT and STO, 50 V DC, 4.5 A ( $I_{rms}$ )	Servomotor terminal with OCT and STO, 50 V DC, 7...8 A ( $I_{rms}$ ), for operation with the ZB8610 fan cartridge
<b>Technical data</b>	<b>EL7201-9014</b>	<b>EL7211-9014</b>	<b>EL7221-9014</b>
<b>Technology</b>	compact Drive Technology		
<b>Function</b>	servo drive in IP 20 for one drive axis		
<b>Number of channels</b>	1	1	1
<b>Number of inputs</b>	2 x end position, 1 x feedback, 1 x STO	2 x end position, 1 x feedback, 1 x STO	2 x end position, 1 x feedback, 1 x STO
<b>Output current (rms)</b>	2.8 A	4.5 A	7...8 A only with ZB8610
			
<b>Realisation STO</b>	hard-wired via safe output	hard-wired via safe output	hard-wired via safe output
<b>Stop functions</b>	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)
<b>Protocol</b>	EtherCAT	EtherCAT	EtherCAT
<b>Fault response time</b>	see documentation	see documentation	see documentation
<b>Safety standard</b>	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)
<b>Approvals</b>	CE, UL, TÜV SÜD	CE, UL, TÜV SÜD	CE, UL, TÜV SÜD
<b>Weight</b>	approx. 60 g	approx. 95 g	approx. 95 g
<b>Further information</b>	<a href="http://www.beckhoff.com/EL7201-9014">www.beckhoff.com/EL7201-9014</a>	<a href="http://www.beckhoff.com/EL7211-9014">www.beckhoff.com/EL7211-9014</a>	<a href="http://www.beckhoff.com/EL7221-9014">www.beckhoff.com/EL7221-9014</a>

	Servomotor module with OCT and STO, 50 V DC, 4.5 A ( $I_{rms}$ )	Servomotor module with OCT, STO and TwinSAFE SC, 50 V DC, 4.5 A ( $I_{rms}$ )	Stepper motor terminal 50 V DC, 5 A, with incremental encoder, vector control, STO	BLDC motor terminal with incremental encoder and STO, 50 V DC, 4.5 A ( $I_{rms}$ )
	<b>EP7211-9034</b>	<b>EJ7211-9414</b>	<b>EL7047-9014</b>	<b>EL7411-9014</b>
	servo drive in IP 67 for one drive axis	servo drive in IP 20 for one drive axis	stepper motor output stage in IP 20 for one drive axis	BLDC motor output stage in IP 20 for one drive axis
	1	1	1	1
	2 x end position, 1 x feedback, 1 x STO	2 x end position, 1 x feedback, 1 x STO	2 x end position, 1 x feedback, 1 x STO	2 x end position, 1 x feedback, 1 x STO, 1 x fan diag, 3 x hall sensor
	4.5 A	4.5 A	–	4.5 A
				
	hard-wired via safe output	hard-wired via safe output	hard-wired via safe output	hard-wired via safe output
	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)
	EtherCAT	EtherCAT	EtherCAT	EtherCAT
	see documentation	see documentation	see documentation	see documentation
	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)	DIN EN ISO 13849-1:2015 (Cat. 3, PL d)
	CE, UL in preparation, TÜV SÜD (certification in preparation)	CE, UL, TÜV SÜD (certification in preparation)	CE, TÜV SÜD (certification in preparation)	CE, UL in preparation, TÜV SÜD (certification in preparation)
	approx. 440 g	approx. 95 g	approx. 90 g	approx. 95 g
	<a href="http://www.beckhoff.com/EP7211-9034">www.beckhoff.com/EP7211-9034</a>	<a href="http://www.beckhoff.com/EJ7211-9414">www.beckhoff.com/EJ7211-9414</a>	<a href="http://www.beckhoff.com/EL7047-9014">www.beckhoff.com/EL7047-9014</a>	<a href="http://www.beckhoff.com/EL7411-9014">www.beckhoff.com/EL7411-9014</a>




# Safe Motion | Drive Technology

	TwinSAFE drive option card for AX5000 up to 40 A, TwinSAFE: Safe Motion	TwinSAFE drive option card for AX5000 from 60 A, TwinSAFE: Safe Motion
<b>Technical data</b>	<b>AX5805-0000</b>	<b>AX5806-0000</b>
<b>Technology</b>	digital compact servo drives	
<b>Function</b>	option card	
<b>Number of channels</b>	1	1
<b>Number of inputs</b>	–	–
<b>Output current (rms)</b>	servo drives up to 40 A	servo drives from 60 A
		
<b>Realisation STO</b>	initiated by TwinSAFE Logic via FSoE	initiated by TwinSAFE Logic via FSoE
<b>Stop functions</b>	Safe Torque Off (STO), Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop (SOS)	Safe Torque Off (STO), Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop (SOS)
<b>Safe position functions</b>	Safely Limited Position (SLP), Safe CAM (SCA), Safely Limited Increment (SLI)	Safely Limited Position (SLP), Safe CAM (SCA), Safely Limited Increment (SLI)
<b>Safe speed functions</b>	Safe Speed Range (SSR), Safely Limited Speed (SLS), Safe Speed Monitor (SSM)	Safe Speed Range (SSR), Safely Limited Speed (SLS), Safe Speed Monitor (SSM)
<b>Direction functions</b>	Safe Direction positive (SDIp), Safe Direction negative (SDIn)	Safe Direction positive (SDIp), Safe Direction negative (SDIn)
<b>Acceleration functions</b>	Safe Maximum Acceleration (SMA), Safe Acceleration Range (SAR)	Safe Maximum Acceleration (SMA), Safe Acceleration Range (SAR)
<b>Braking functions</b>	–	–
<b>Protocol</b>	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
<b>Fault response time</b>	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
<b>Safety standard</b>	EN ISO 13849-1:2006 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)	EN ISO 13849-1:2006 (Cat. 4, PL e) and EN 61508:2010 (SIL 3)
<b>Approvals</b>	CE, UL, TÜV SÜD	CE, UL, TÜV SÜD
<b>Weight</b>	approx. 75 g	approx. 75 g
<b>Further information</b>	<a href="http://www.beckhoff.com/AX5805">www.beckhoff.com/AX5805</a>	<a href="http://www.beckhoff.com/AX5806">www.beckhoff.com/AX5806</a>

Single-axis module, 8 A/18 A, feedback: OCT, TwinSAFE: Safe Motion, TwinSAFE Logic	Double-axis module 2 x 6 A, feedback: OCT, TwinSAFE: Safe Motion, TwinSAFE Logic
<b>AX81xx-0200</b>	<b>AX82xx-0200</b>
multi-axis servo system	
axis module with TwinSAFE Logic	
1	2
2 x digital inputs per channel (X15, X25)	2 x digital inputs per channel (X15, X25)
AX8101: 8 A, AX8118: 18 A	2 x 6 A
	
initiated by TwinSAFE Logic via FSoE or hard-wired via safe output	initiated by TwinSAFE Logic via FSoE or hard-wired via safe output
Safe Torque Off (STO), Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop (SOS)	Safe Torque Off (STO), Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop (SOS)
Safely Limited Position (SLP), Safe CAM (SCA), Safely Limited Increment (SLI)	Safely Limited Position (SLP), Safe CAM (SCA), Safely Limited Increment (SLI)
Safe Speed Range (SSR), Safely Limited Speed (SLS), Safe Speed Monitor (SSM)	Safe Speed Range (SSR), Safely Limited Speed (SLS), Safe Speed Monitor (SSM)
Safe Direction positive (SDIp), Safe Direction negative (SDIn)	Safe Direction positive (SDIp), Safe Direction negative (SDIn)
Safe Maximum Acceleration (SMA), Safe Acceleration Range (SAR)	Safe Maximum Acceleration (SMA), Safe Acceleration Range (SAR)
Safe Brake Control (SBC)	Safe Brake Control (SBC)
TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
EN ISO 13849-1:2015 (Cat. 4, PL e) and IEC 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and IEC 61508:2010 (SIL 3)
CE, UL in preparation, TÜV SÜD	CE, UL in preparation, TÜV SÜD
AX8108: 2.0 kg, AX8118: 2.5 kg	approx. 2.0 kg
<a href="http://www.beckhoff.com/AX81xx">www.beckhoff.com/AX81xx</a>	<a href="http://www.beckhoff.com/AX82xx">www.beckhoff.com/AX82xx</a>



# STO/SS1 | Drive Technology

	TwinSAFE drive option card for AX5000 up to 40 A, TwinSAFE: STO/SS1	Single-axis module, 8 A/18 A, feedback: OCT, TwinSAFE: STO/SS1, TwinSAFE Logic	Double-axis module 2 x 6 A, feedback: OCT, TwinSAFE: STO/SS1, TwinSAFE Logic
<b>Technical data</b>	<b>AX5801-0200</b>	<b>AX81xx-0100</b>	<b>AX82xx-0100</b>
<b>Technology</b>	digital compact servo drives	multi-axis servo system	
<b>Function</b>	option card	axis module with TwinSAFE Logic	
<b>Number of channels</b>	1	1	2
<b>Number of inputs</b>	1 x STO (2 channel), 1 x feedback loop	2 x digital inputs per channel (X15, X25)	2 x digital inputs per channel (X15, X25)
<b>Output current (rms)</b>	–	AX8101: 8 A, AX8118: 18 A	2 x 6 A
			
<b>Realisation STO</b>	hard-wired via safe output	initiated by TwinSAFE Logic via FSoE or hard-wired via safe output	initiated by TwinSAFE Logic via FSoE or hard-wired via safe output
<b>Stop functions</b>	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)	Safe Torque Off (STO), Safe Stop 1 (SS1)
<b>Protocol</b>	–	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
<b>Fault response time</b>	–	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
<b>Safety standard</b>	ISO 13849-1:2006 (Cat. 4, PL e) and IEC 61508 (ed.2) (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and IEC 61508:2010 (SIL 3)	EN ISO 13849-1:2015 (Cat. 4, PL e) and IEC 61508:2010 (SIL 3)
<b>Approvals</b>	CE, UL, TÜV SÜD	CE, UL in preparation, TÜV SÜD	CE, UL in preparation, TÜV SÜD
<b>Weight</b>	approx. 85 g	AX8108: 2.0 kg, AX8118: 2.5 kg	approx. 2.0 kg
<b>Further information</b>	<a href="http://www.beckhoff.com/AX5801">www.beckhoff.com/AX5801</a>	<a href="http://www.beckhoff.com/AX81xx">www.beckhoff.com/AX81xx</a>	<a href="http://www.beckhoff.com/AX82xx">www.beckhoff.com/AX82xx</a>

