



# SAFETY

INTEGRATED SAFETY SYSTEM SOLUTION

EN



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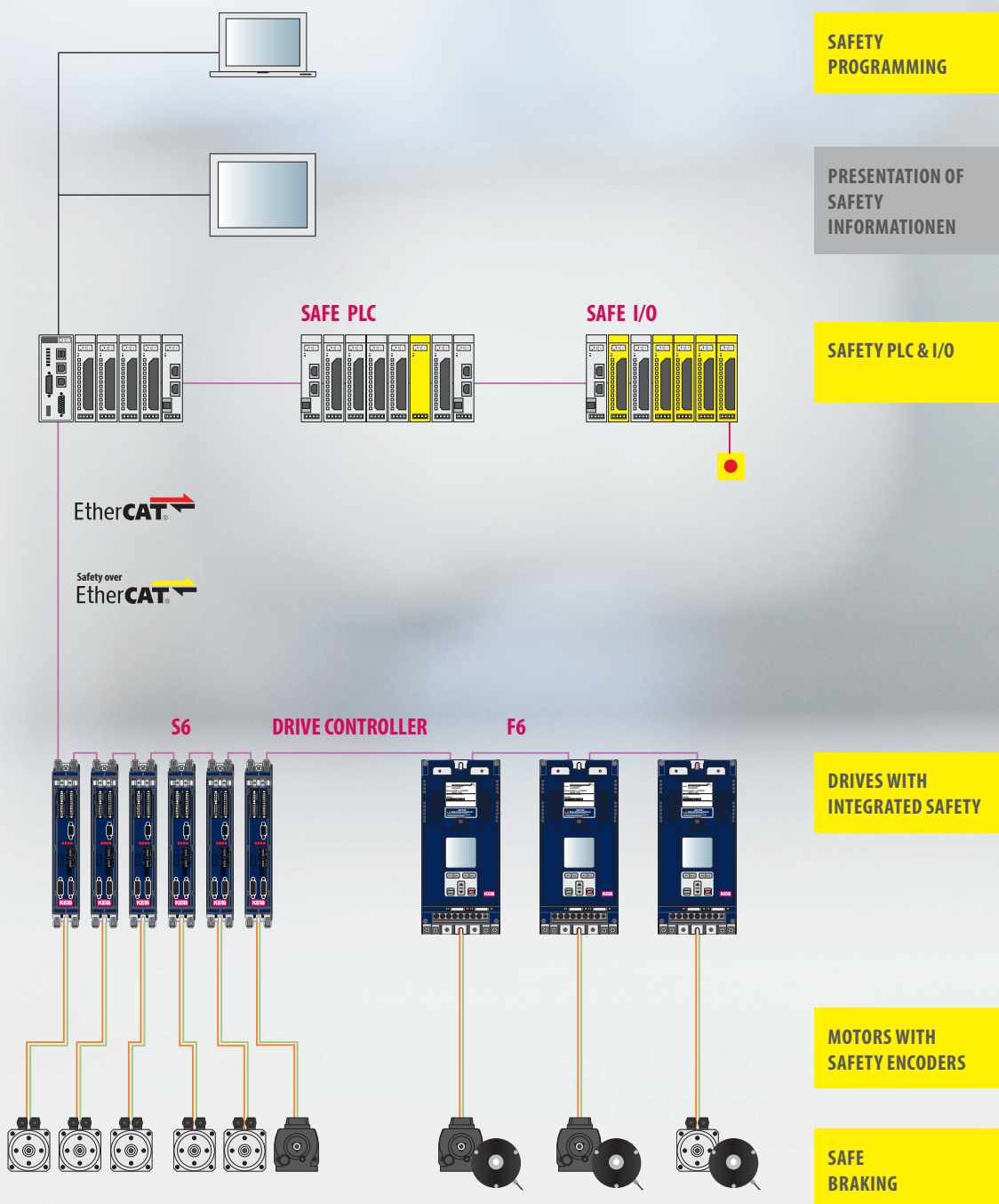
# INTEGRATED SAFETY SYSTEM

KEB's system solutions span from control through automation to mechanical interface. Parallel to the certified software tool KEB offers a complete portfolio of powerful hardware for the machine and plant automation.

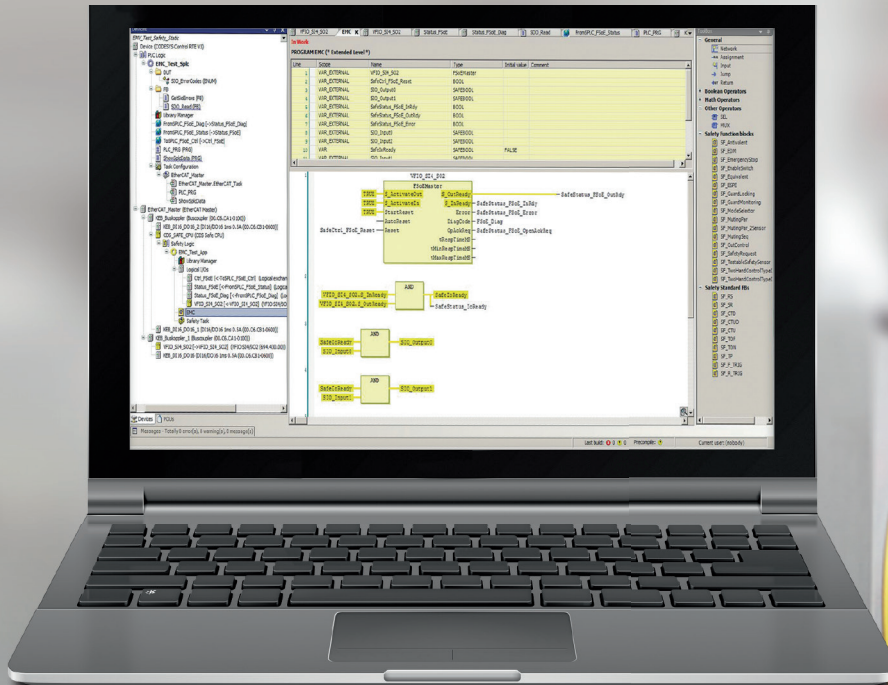
Integrated into the EtherCAT-based control and remote I/O system, the Safety PLC and the Safety I/O module take over all safety relevant tasks of the control level.

The safety-oriented Safety over EtherCAT communication (FSoE) creates a flexible interface in the drive level where modular safety solutions provide various safety functions.

Synchronous/asynchronous motors and gear motors described as FS = "Safety Ready" are fitted with encoder feedbacks for safety tasks.



# SOFTWARE



## SINGLE POINT OF ENGINEERING



### DEVELOPMENT ENVIRONMENT (IDE)

With COMBIVIS studio 6 safety machine designers can meet compliance with IEC 61508 SIL3 and ISO/EN 13849 PL e for their safety PLC application. COMBIVIS studio 6 safety uses a TÜV certified CODESYS plug-in which is fully integrated in COMBIVIS studio 6 development environment. This means the machine and safety program can be developed in one unified software platform. The safety controller programs as a sub-node of the main machine controller and the application, tasks, global variable lists, POEs and logic I/Os are also integrated.

### SAFE PROJECT MANAGEMENT

COMBIVIS studio 6 safety also offers additional functionality for managing the project. This includes change tracking, safe signal flow, safe versioning (pinning), and the separation of safe mode and debug mode.

### PROGRAMMING OF SAFETY APPLICATIONS

The safety controller is programmed based of a Function Block Diagram (FBD) via Safety Editor in IEC 61131-3. The FBD Safety Editor contains certified safe modules according to PLCopen Safety. The safety modules facilitate the programming of common machine elements like for example e-stop circuits, light curtains, and two-handed control.

This reduces the time required for the development, verification and acceptance of the safety application for the user.

## CONFIGURATION OF INTEGRATED SAFETY ON THE DRIVES

The configuration of the KEB Safety Drives is done with the certified Safety Editor, which is integrated in the KEB parameterization environment COMBIVIS 6. This is where the safety functionality and limits can be configured. These safety-related settings can be saved and downloaded to other drives via COMBIVIS or via the controller.

Current parameters and the error history can be used for system diagnosis. The export function makes it easy to create the required documentation.

COMBIVIS 6 is available free of charge for every user.

The image displays three overlapping screenshots of the Safety Editor software interface. The top-left screenshot shows the 'General' configuration page for a 'Safety Module Type 3' drive, including fields for software version, device serial number, and CRC. Below this is a table of parameters with columns for 'Parameter', 'Value', and 'Unit'. The top-right screenshot shows the 'Safety parameterization' window, which includes a 'Categories' section with checkboxes for 'Error', 'New configuration download', and 'Configuration Error', and a table listing various safety functions like 'Safety function request' and 'Safety function release' with their respective addresses and parameters. The bottom screenshot shows the 'Safety module configuration' dialog, which is used to select and configure safety POC (Process Object Class) parameters. It features two columns: 'Selected POC configuration' and 'Remain POC configuration', each with a list of parameters and their data types (e.g., BOOL, UNINT, LINT).

Safety Editor



### HIGHLIGHTS

- User administration
- Creation and adaptation of the configuration
- Diagnosis
- Data backup
- Documentation of the settings
- Change history
- Creating the MDP file for Safety over EtherCAT

# HARDWARE

## SAFETY PLC & I/O

The freely programmable Safety PLC and the Safety I/O modules form an innovative safety solution. Communication takes place via the existing EtherCAT bus with the certified Safety over EtherCAT (FSoE) safety protocol. Any FSoE slaves can be addressed via the Safety PLC (FSoE master).

**PROGRAM POU (\* Basic Level \*)**

Line	Scope	Name	Type	Initial va...	Comment
1	VAR_EXTERNAL	Input0	SAFEBOOL		
2	VAR_EXTERNAL	Input0_1	SAFEBOOL		
3	VAR_EXTERNAL	Input0_0	SAFEBOOL		
4	VAR_EXTERNAL	Input1_1	SAFEBOOL		
5	VAR_EXTERNAL	Output0_1	SAFEBOOL		
6	VAR_EXTERNAL	Output1_1	SAFEBOOL		
7	VAR_EXTERNAL	SI0	SAFEBOOL		
8	VAR_EXTERNAL	SI1	SAFEBOOL		
9	VAR_EXTERNAL	FSoE_...oError	SAFEBOOL		
10	VAR_EXTERNAL	S6_FSoE_SS1	SAFEBOOL		

Freely programmable via function block diagram



Safety PLC

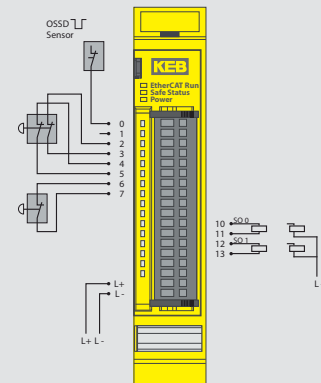
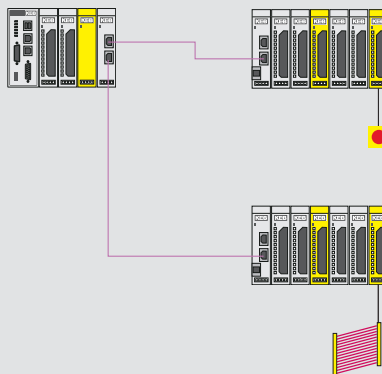
Safety I/O

EtherCAT

Safety over EtherCAT



### DECENTRALIZED SAFETY CONCEPT



### HIGHLIGHTS

#### Safety PLC

- Safety over EtherCAT Master
- Free programmable Safety PLC
- IEC 61508 SIL3 and EN ISO 13849-1 CAT.4/PL e
- Cross communication between PLC and Safety PLC on common bus

#### Safety I/O

- Safety over EtherCAT Slave
- Safe I/O module with safe inputs and outputs
- IEC 61508 SIL3 and EN ISO 13849-1 CAT.3/PL e
- Four safe inputs (with dedicated test pulse outputs)
- Two safe outputs (max = 2 Amps)

## FUNCTIONAL SAFETY (FS) DRIVES

The sixth generation of KEB drives offers scalable safety functions directly in the drive controller. The device variants are Compact, Application and Pro for the COMBIVERT F6 and S6 enabling selectable functions according to the requirements.

### COMPACT

In the Compact device variant, Safe-Torque-Off (STO) is integrated as the basic function.

### APPLICATION

The Application device variant is available for speed and position-dependent safety functions with encoders. Flexible adaptation of the safety functions and limit values is possible via digital I/Os and/or Safety over EtherCAT (FSoE).

### PRO

The Pro device variant offers possibilities for implementation in the area of encoderless safety. For example, safe solutions can be implemented in applications where encoder mounting is not possible. This also results in a reduction in costs. Here, too, the safety functions and limit values can be flexibly adapted via digital I/Os and/or Safety over EtherCAT (FSoE).



Drive controllers COMBIVERT F6 and S6 provide integrated safety functions

EtherCAT<sup>®</sup>

Safety over  
EtherCAT<sup>®</sup>



## HIGHLIGHTS

- Scalable safety concept up to PL e (ISO 13849-1) and SIL3 (IEC 61508 and IEC 62061)
- Advanced safe motion functions according to IEC 61800-5-2
- Safety over EtherCAT (FSoE) Slave Option
- OSSD outputs (detection of wire breakage, shorts, etc.)
- Safe parameterization through COMBIVIS 6
- Safe speed measurement without encoder
- Dual channel ripple interface for cascading safety chain
- Up to 8 different configurations stored

# SAFETY FUNCTIONS IN THE DRIVE

## BASIS FOR SAFETY

### COMPACT

In the Compact version, the COMBIVERT F6 and S6 drive controllers are equipped with Safe-Torque-Off (STO).

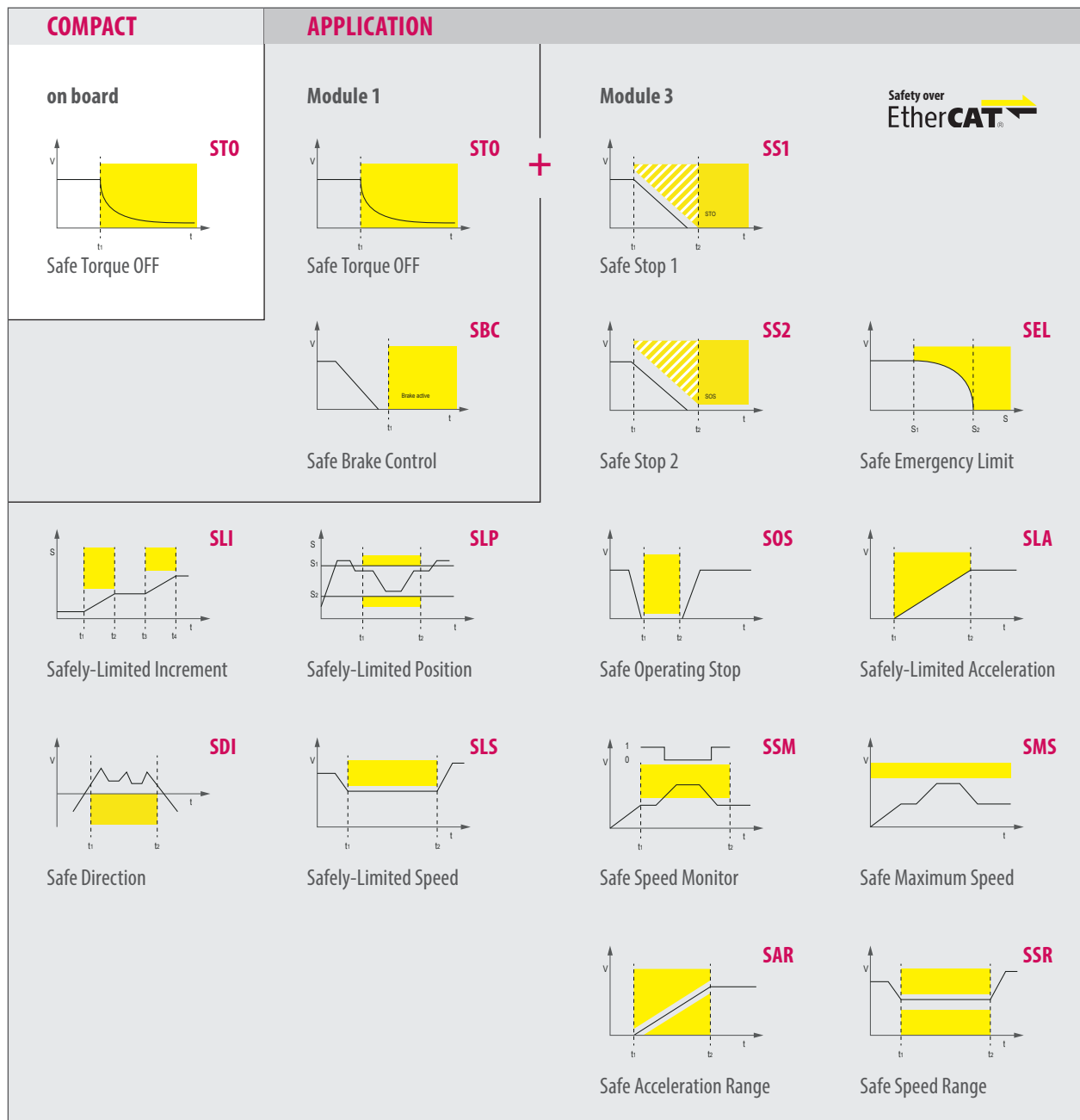
## SAFETY FUNCTIONS WITH SPEED AND POSITION MONITORING

### APPLICATION

The device variant Application is available in two versions. In addition to STO, Module 1 adds safe brake control (SBC) which provides a safe 24 V supply for the brakes.

Module 3 offers safe motion functionality according to IEC 61800-5-2 through speed and position detection using encoders.

The error reaction time is shortened and costs are reduced by reducing the number of separate protective devices. Module 3 also offers the option of controlling all available safety functions and limit values via Safety over EtherCAT (FSoE).





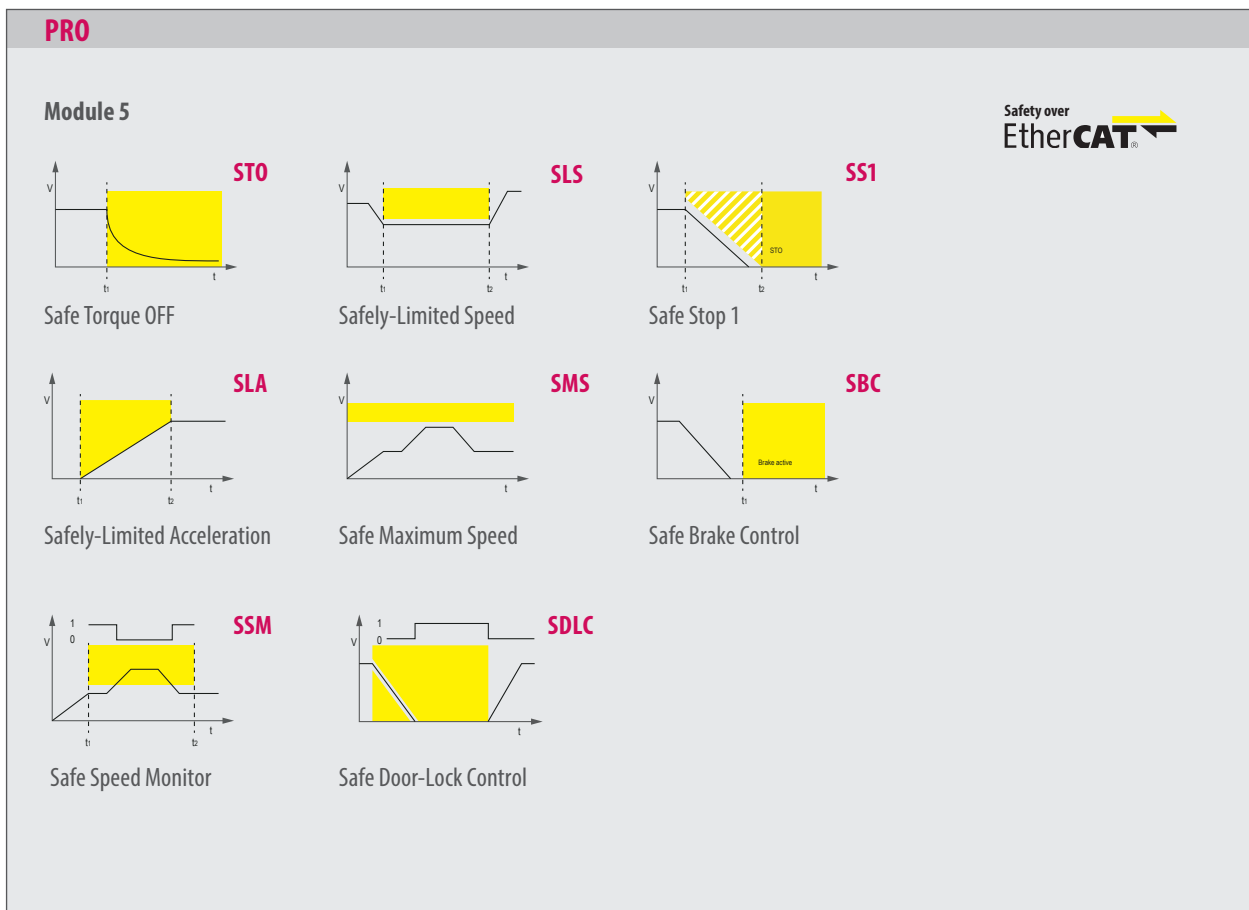
## SENSORLESS SAFETY FUNCTIONS

### PRO

The Pro device variant of the COMBIVERT F6 and S6 drive controllers offers advanced safety functions without having to use a safety encoder. The device determines the safe velocity parameters from the pulse width modulation (PWM) of the motor supply.

In addition to STO, Module 5 is equipped with a safe brake control (SBC), which provides a safe 24 V supply for braking operation as well as a monitoring of the switching status of the brake via microswitch evaluation.

Module 5 also offers the option of controlling all available safety functions via Safety over EtherCAT (FSoE).

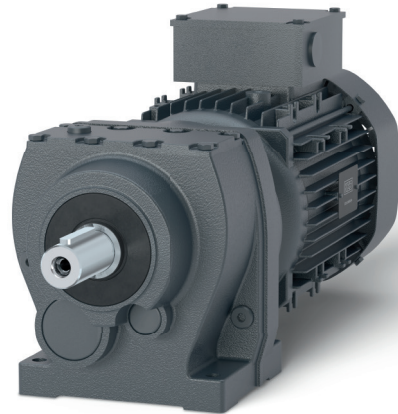


### WHY USE DRIVE-BASED SAFETY (SAFE MOTION)?

- Less wiring - remove contactors and other traditional safety components
- Fast reaction - direct handling inside the drive
- Easy to operate - up to 8 different safety setups per function
- Cost savings compared to traditional safety solution

# MOTORS & GEARS

## THREE-PHASE ASYNCHRONOUS MOTORS



## KEB DRIVE

The fast configuration for motors and gears is done with the software KEB DRIVE.

**KEB-DRIVE 2019**

Choice | Text | Dimensions | Motor

**ZG32** Helical gear unit **TA53** Servo motor  
30 Nm, 4500 1/min 400V

1/min	Nm	cG	i	T2dyn[Nm]
0 - 218	620-320	0.80	20.61	570

Foot mounted version  
Output shaft with key Ø48x110  
Breather valve  
Lubricant: CLP VG220 Mineraloil  
Brake BF04, 36Nm / 24VDC  
EN06 - Absolute encoder singleturn, 12bit/rev + 128ppr SinCos, Hiperface  
TW - PTC thermistor sensor  
FS02 - Encoder Hiperface SIL2/PLd  
Forced ventilation  
Motor connection: Plug connector radial, position OA  
condensation drain hole  
Dust- and water protection IP65  
Paint: normal / RAL9005 black  
Mounting position: M1 / 0° / inclined to M2

**KEB-DRIVE 2019**

Choice | Text | Dimensions | Motor

Nominal current I0(I1)/Imax: 29.0/14.9/58A  
Insulation class: 155  
Protection standard: IP54  
Spring applied brake BF04, 36Nm, 24VDC  
EN06 - Absolute encoder singleturn, 12bit/rev + 128ppr SinCos, Hiperface  
Supply voltage 5VDC  
Motor protection: PTC thermistor sensor  
functional safety: FS02 - Encoder Hiperface SIL2/PLd  
Forced ventilation 3x400VAC, Plug connector HANS3A, position 90D  
With counterplug  
Motor connection: Plug connector radial, position OA  
Paint: normal, RAL9005 black  
Mounting position: M1  
Weight: ~49 kg  
M0/M1/Mmax=30/15.5/60Nm  
I0/I1/Imax=29.0/14.9/58A  
nn=4500 1/min  
Pm=7.3kW Jm=28.15kgcm² Jb=1.4kgcm²  
T2dyn=570Nm T2n=820Nm  
Jg=0.627 kgcm² i=6699/325 cg=24 Nm/  
HS-Code: 85015220

**KEB-DRIVE 2019**

Choice | Text | Dimensions | Motor

Mn=15.5Nm -Nominal torque  
Mmax=60Nm -Maximum torque  
I0=29.0A -Current at stall torque  
In=14.9A -Current at nominal torque  
Imax=58A -Current at maximum torque  
η=94.5% -Efficiency  
Ru-v,20=0.364Ω -Winding resistance 20°C  
Ru-v=0.513Ω -Winding resistance warm  
Lq=2.5551mH -Winding inductance  
Ld=2.839mH -Winding inductance  
KEpk=93.84V\*min/1000 -Voltage constant Peak value 20°C  
KEpk=93.84V\*min/1000 -Voltage constant Peak value warm  
Jm=28.15kgcm² -Inertia  
Jb=1.4kgcm² -Inertia

**KEB** IEC60034  
ZG32 TA53 V40 BF04 EN06 TW FS02 F 3-BDC Motor  
(serial-no) 49kg  
Pm=7.3kW IP54 Tn Cl 155  
Uli=400V In=14.9A Mn=15.5Nm  
nn=4500 1/min fn=225Hz M0=30Nm Mmax=60Nm  
KEpk=93.84V\*min R=0.513Ω L=2.84mH  
BF04=36Nm 24VDC F 3-400V 50Hz 0.19A  
ZG32: i=20.61 T2n=820Nm M1 n1eff=1500 1/min  
CLP VG220 0.55l

**Dimensions:** 822, 254, 538, 115, 185, 138, 21, 150, 192, 100, 14, 110, 205, 245, 110, 100, 14, 110, 205, 245

ZG32 TA53 V40 BF04 EN06 TW FS02 F  
KEB-DRIVE 30.04.2019

STEP RTF Text

**Performance Graph:** M[Nm] vs n[1/min]. Motor: TA53 V40. Legend: 1) M S1-105K, 2) Mmax motor, 3) nmax 400V, 4) nmax 360V, 5) nmax 460V.

## SERVOMOTORS



## SPRING-APPLIED BRAKES

- Holding brakes from 0.3 Nm ... 1,500 Nm
- Options such as protection class IP 65
- Double brake design possible for theatres, elevators and lifts
- Optional microswitch to increase the diagnostic coverage level



*COMBISTOP for servomotors*



*COMBISTOP for three-phase motors*



## HIGHLIGHTS

### Servomotors DL3 & TA series

- Powerful, compact design, up to 82Nm nominal torque
- Option with KEB spring-applied brake
- Quick connect power and feedback connectors
- Safe encoder option: Hiperface, Resolver

### Gear motors

- Induction or servo motor (up to 45kW)
- Spring-applied brake option with micro switch
- SIL2 and SIL3 encoder



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THE COMPLETE WORLDWIDE KEB PARTNER NETWORK



Automation with Drive

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