

**KEB**



# COMBIVERT F6

DRIVE CONTROLLER 2.2 kW ... 450 kW

EN



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# SYSTEM OVERVIEW

## Automation with Drive

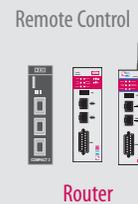
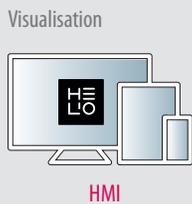
stands for the optimally selected combination of control and automation with the drive package as the key to successful machine concepts.

Let the following pages inspire you with regards to the diversity and performance of the COMBIVERT F6 drive controller, and help you to find a solution that reliably meets your requirements.

### IIOT



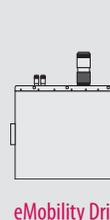
### CONTROL SOFTWARE



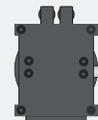
### CONTROL HARDWARE



### DRIVES



### MOTORS



### BRAKES & CLUTCHES



# BENEFITS AT A GLANCE

## OPTIMALLY SELECTED COMPONENTS

Flexibility, functionality, efficiency and cost-effectiveness are the key requirements for today's drive system. In single-axis drive controller applications in the power range from 2.2 kW to 450 kW, COMBIVERT F6 covers these requirements and is the universal solution for all drive tasks.

The COMBIVERT F6 with its capability to operate different motor types, the various real-time communication to higher-level controllers, the choice of integrated Safety function modules or the cooling concept is the perfect drive controller for every machine. The intuitive COMBIVIS 6 PC tool makes it easy to operate the drives developed by KEB.



## DRIVE BASED SAFETY

Integrated Safety functionality:

- Basic function STO in Compact variant
- Additional High Level Safety in Application variant
- Encoderless safety in variant PRO

## REAL - TIME COMMUNICATION

Or simply serially:

- Real-time Ethernet-based interfaces
- CAN
- RS232/485 for diagnostics or display

## ALL IN ONE - UNIVERSAL MOTOR OPERATIONS

Control for synchronous, asynchronous, IPM or synchronous reluctance motors:

- Motor operation with encoder feedback or encoderless ASCL/SCL for precise speed control
- Motor temperature monitoring with PTC, KTY or PT1000 sensors
- Two-channel multi-encoder interface
- Integrated brake transistor
- Integrated brake control

## ANALOG & DIGITAL

Supports actual machine concepts with:

- 8 digital and 2 analog inputs
- 2 digital and 1 relay output
- 1 analog output 0 V ... 10 V



## HIGHLIGHTS

- Best speed and torque performance
- Modern realtime communication standards
- Integrated functional safety
- Particular compact size
- Modular design, flexible cooling systems

## DEVICE VARIANTS FOR SPECIAL REQUIREMENTS

### HIGH SPEED

Whether for asynchronous, synchronous, synchronous reluctance or IPM motors: All motor types can be controlled and operated by the COMBIVERT F6 or COMBIVERT S6 drive controllers with high speeds of up to 120,000 revolutions per minute using the ASCL or SCL method with highly dynamic sensorless control. Depending on individual requirements, this is possible with or without an encoder. This means that nothing stands in the way of motor use in high-speed applications.

- Drives with outputs up to 450 kW
- Suitable sine filters for high-speed requirements
- Highest performance for many motor designs
- Up to 120,000 revolutions
- Output frequencies up to 2,000 Hz
- Control methods SCL, ASCL, ASiCL
- Multi-encoder interface for many encoder variants



### PEAK POWER DRIVES

Optimised for applications with increased short-term overload and switching frequencies, for example in hoists, cranes or lift systems. The combination of special software for lift applications provides the following features:

- Automatic inertia determination of the entire system
- Pointed arc run
- Travel counter and change of direction counter
- Safe brake monitoring
- Emergency programmes in the event of earthquakes, evacuations, etc.
- Easy commissioning via elevator app on the smartphone
- Universal control via CANopen Lift, DCP, serial, Ethernet, digital parallel, analogue and others
- Event and error logs with time stamp
- Automatic calibration of the motor data



# COMBIVERT F6 - VARIANTS

## FUNCTIONAL SAFETY

## INTERFACES

CAN interface  
Realtime Ethernet  
Modbus

## LCD DISPLAY

LCD Operator  
Ethernet Operator  
USB Operator

## PTC/KTY/PT1000 EVALUATION

## BRAKE CONTROL 24 V / 2 A

## MAINS CONNECTIONS

## I/O

8 digital inputs  
2 digital outputs  
1 relay  
2 analog inputs  
1 analog output  
24V DC supply

## STATUS LEDS

## DIAGNOSTIC INTERFACE

## MULTI ENCODER INTERFACES

Resolver, EnDAT, HIPERFACE, BISS, SSI,  
Incremental HTL/TTL,  
Incremental output

## MOTOR TERMINALS

## DC SUPPLY TERMINALS

and braking resistor

EtherCAT®

Safety over  
EtherCAT®



CANopen®



## HIGHLIGHTS

- Universally usable for many motor technologies
- Highest performance in torque, speed and position control
- Uncompromising integration
- User-friendly
- Scalable safety functions...

**COMPACT**  
**HIGHLY INTEGRATED**  
**AND ECONOMICAL**

STO

**REALTIME ETHERNET**

**EtherCAT OR VARAN**

Communication interface

**CAN**  
**DIAGNOSTIC RS232/485**

**APPLICATION**  
**MODULAR AND FLEXIBLE**

STO, SBC and speed/position related safety functions

**REALTIME ETHERNET**

**EtherCAT**  
**PROFINET**  
**POWERLINK**  
**EtherNet/IP**  
**Modbus TCP**

Communication interface

**CAN**  
**DIAGNOSTIC RS232/485**

**PRO**  
**ENCODERLESS SAFETY**

STO, SBC and speed related safety functions without encoder feedback

**REALTIME ETHERNET**

**EtherCAT**  
**PROFINET**

Communication interface

**CAN**  
**DIAGNOSE RS232/485**  
**Ethernet**  
**Modbus RTU**  
**Modbus TCP**



**HIGHLIGHTS**

- Brake handling
- Power-off
- DC-brake
- PID controller
- Round table function
- Recipe management
- Multi motor handling
- Anti cogging
- Liquid cooling management
- Protective function for submounted braking resistors

# SAFETY FUNCTIONS IN THE DRIVE

## BASIS FOR SAFETY

### COMPACT

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

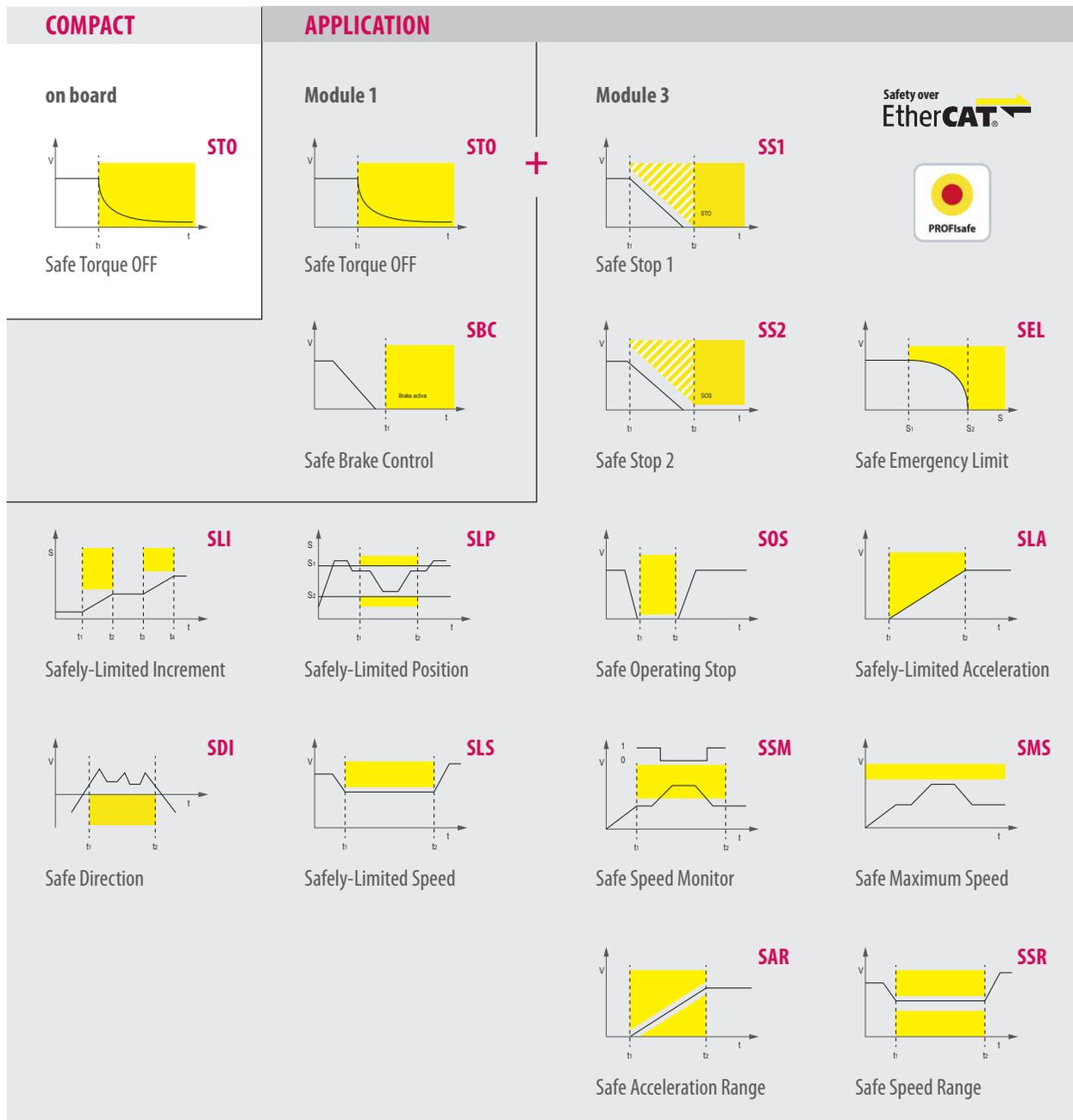
## SAFETY FUNCTIONS WITH SPEED AND POSITION MONITORING

### 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 or PROFIsafe.



## ENCODERLESS 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).

**PRO**

**Module 5**

<p><b>STO</b></p> <p>Safe Torque OFF</p>	<p><b>SLS</b></p> <p>Safely-Limited Speed</p>	<p><b>SS1</b></p> <p>Safe Stop 1</p>
<p><b>SLA</b></p> <p>Safely-Limited Acceleration</p>	<p><b>SMS</b></p> <p>Safe Maximum Speed</p>	<p><b>SBC</b></p> <p>Safe Brake Control</p>
<p><b>SSM</b></p> <p>Safe Speed Monitor</p>	<p><b>SDLC</b></p> <p>Safe Door-Lock Control</p>	



### 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

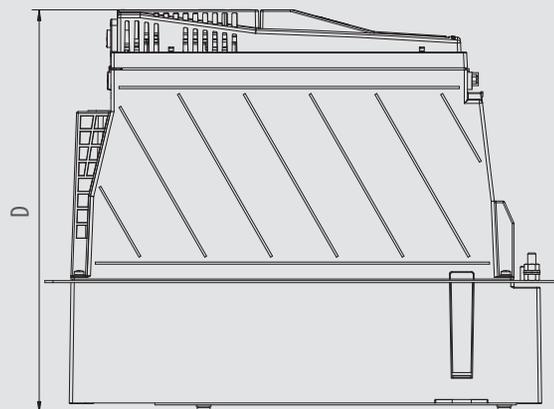
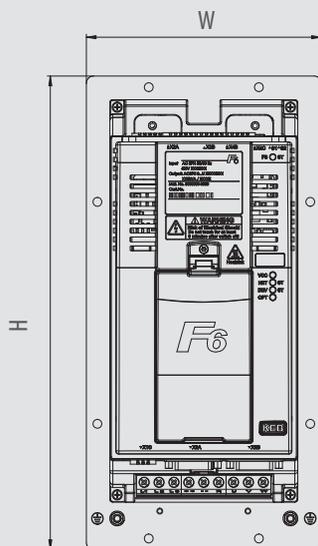
# COMBIVERT F6 230 V

## TECHNICAL DATA

HOUSING		F6-2				F6-3			F6-4	F6-6		
		10	12	13	14	15	16	17	18	19	20	21
Device size												
Rated output power	[kVA]	4.4	7	9,6	13	19	25	30	34	46	58	70
Typical rated motor power	[kW]	2.2	4	5.5	7.5	11	15	18,5	22	30	37	45
Rated output current 230 V	[A]	11	17.5	24	33	48	60	75	85	115	145	175
Rated output current 240 V (UL)	[A]	11	17.5	24	33	48	60	75	85	115	145	175
Short-term current limit (60 s / max.)	[%]	150 / 216		150 / 180		150 / 216			150 / 180	150		
Rated input current 230 V	[A]	16.5	22	30	41.5	57	68	82	101	126	156	189
Rated input current 240 V (UL)	[A]	16.5	22	30	41.5	57	68	82	101	126	156	189
Rated switching frequency	[kHz]	8	4	4	4	2	4	2	4	8	4	2
Max. switching frequency	[kHz]	16										
Mains phases		3										
Rated input voltage (AC)	[V]	230 (UL: 240)										
Input voltage range (AC)	[V]	170 ... 264										
Input voltage range (DC)	[V]	240 ... 373										
Mains frequency	[Hz]	50 / 60 ±2										
Output voltage	[V]	3 x 0 ... U <sub>IN</sub>										
Output frequency	[Hz]	0 ... 599 (optional 0 ... 2.000)*										

\* The maximum possible output frequency depends on the switching frequency

## PUSH-THROUGH VARIANT



# COMBIVERT F6 400 V

HOUSING		F6-2					F6-3				F6-4			
		12	13	14	15	16	17	18	19	20	19	20	21	22
Device size														
Rated output power	[kVA]	6.6	8.3	11.4	16.6	22.9	29	35	42	52	42	52	62	76
Typical rated motor power	[kW]	4	5.5	7.5	11	15	18.5	22	30	37	30	37	45	55
Rated output current 400 V	[A]	9.5	12	16.5	24	33	42	50	60	75	60	75	90	110
Rated output current 480 V (UL)	[A]	7.6	11	14	21	27	34	40	52	65	52	65	77	96
Short-term current limit (60 s / max.)	[%]	150 / 216					150 / 180							
Rated input current 400 V	[A]	13	17	21	31	43	55	59	66	82	66	82	99	121
Rated input current 480 V (UL)	[A]	11	15	18	27	35	44	48	57	71	57	71	85	106
Rated switching frequency	[kHz]	8	8	4	4	4	2	2	2 / 4	2	4	4	2	2
Max. switching frequency	[kHz]	16												
Mains phases		3												
Rated input voltage (AC)	[V]	400 (UL: 480)												
Input voltage range (AC)	[V]	280 ... 550												
Input voltage range (DC)	[V]	390 ... 780												
Mains frequency	[Hz]	50 / 60 ±2												
Output voltage	[V]	3 x 0 ... U <sub>IN</sub>												
Output frequency	[Hz]	0 ... 599 (optional 0 ... 2,000)*												

\* The maximum possible output frequency depends on the switching frequency

## MECHANICAL DIMENSIONS

HOUSING	H** (mm)	W** (mm)	D** (mm)	AIR COOLING		LIQUID COOLING	
				built-in	push-through	built-in	push-through
2	290	130	240	X	X	-	-
3	340	170	261	X	X	X	X
4	375	224	272	X	X	X	X
6	525	249	272	X	X	X	X
7	570	336	360	X	X	X	X
8	860	336	360	X	X	X	X
9	960	503	360	X	X	X	X

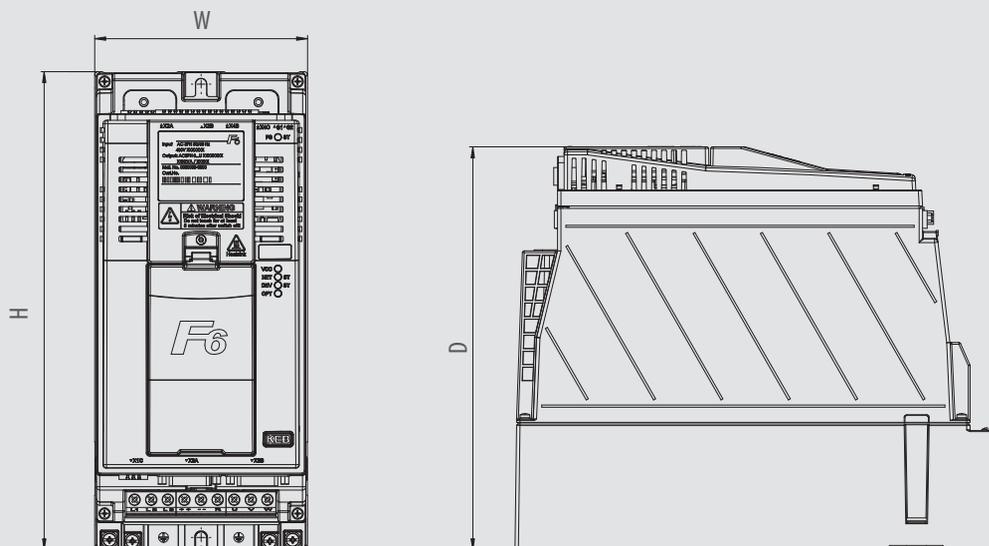
\*\* air-cooled built-in variant

HOUSING		F6-6				F6-7				F6-8			F6-9			
		21	22	23	24	25	26	27	28	28	29	30	30	31	32	33**
Device size																
Rated output power	[kVA]	62	80	104	125	145	173	208	256	256	319	395	395	436	492	554
Typical rated motor power	[kW]	45	55	75	90	110	132	160	200	200	250	315	315	355	400	450
Rated output current 400 V	[A]	90	115	150	180	210	250	300	370	370	460	570	570	630	710	800
Rated output current 480 V (UL)	[A]	85	106	124	156	180	210	260	325	302	414	477	477	515	590	719
Short-term current limit (60 s / max.)	[%]	150 / 180				125 / 150				150 / 180			125 / 150			
Rated input current 400 V	[A]	99	126	158	189	221	263	315	390	390	485	600	600	700	746	840
Rated input current 480 V (UL)	[A]	85	106	128	162	186	217	269	337	374	429	494	494	533	611	744
Rated switching frequency	[kHz]	8	4	2/4/(8**)	2	4	4	2	2	4	2	2	2	2	2	2
Max. switching frequency	[kHz]	16								4						
Mains phases		3														
Rated input voltage (AC)	[V]	400 (UL: 480)														
Input voltage range (AC)	[V]	280 ... 550														
Input voltage range (DC)	[V]	390 ... 780														
Mains frequency	[Hz]	50 / 60 +/- 2														
Output voltage	[V]	3 x 0 ... U <sub>IN</sub>														
Output frequency	[Hz]	0 ... 599 (optional 0 ... 2,000)*														

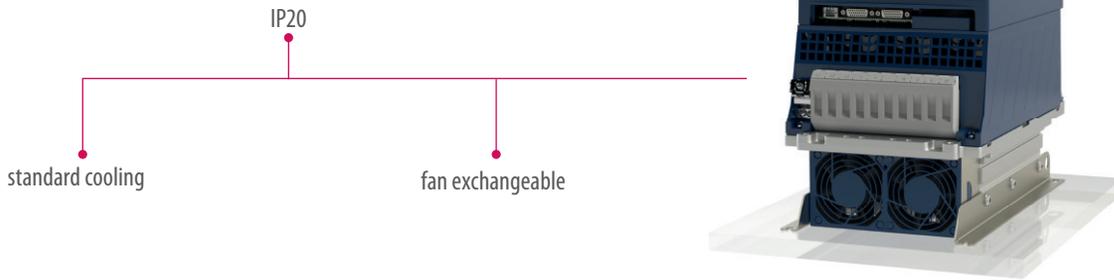
\* The maximum possible output frequency depends on the switching frequency

\*\* Liquid-cooled only

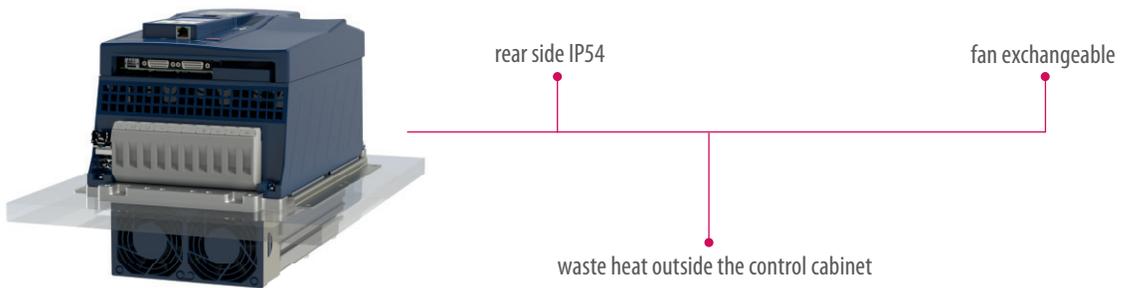
### BUILT-IN VARIANT



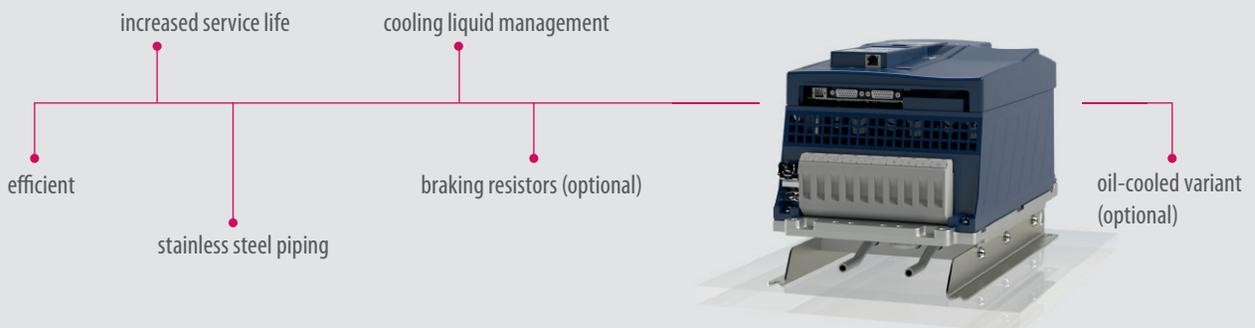
## Air-cooled built-in variant



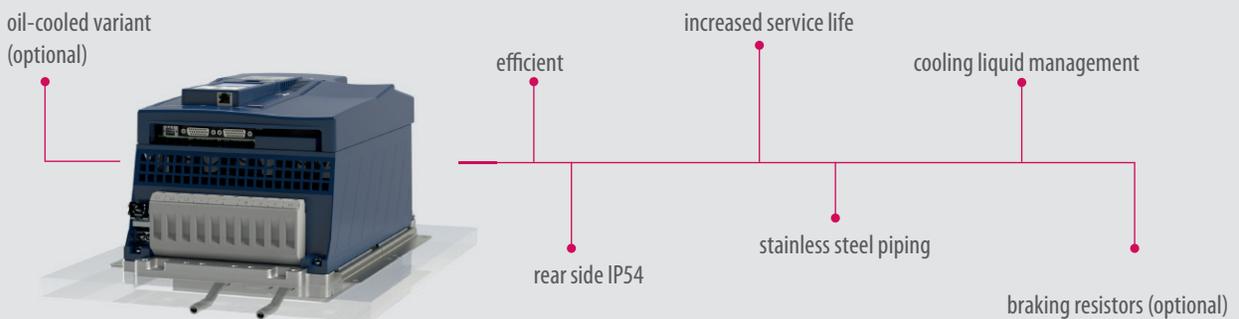
## Air-cooled push-through variant



## Liquid-cooled built-in variant



## Liquid-cooled push-through variant

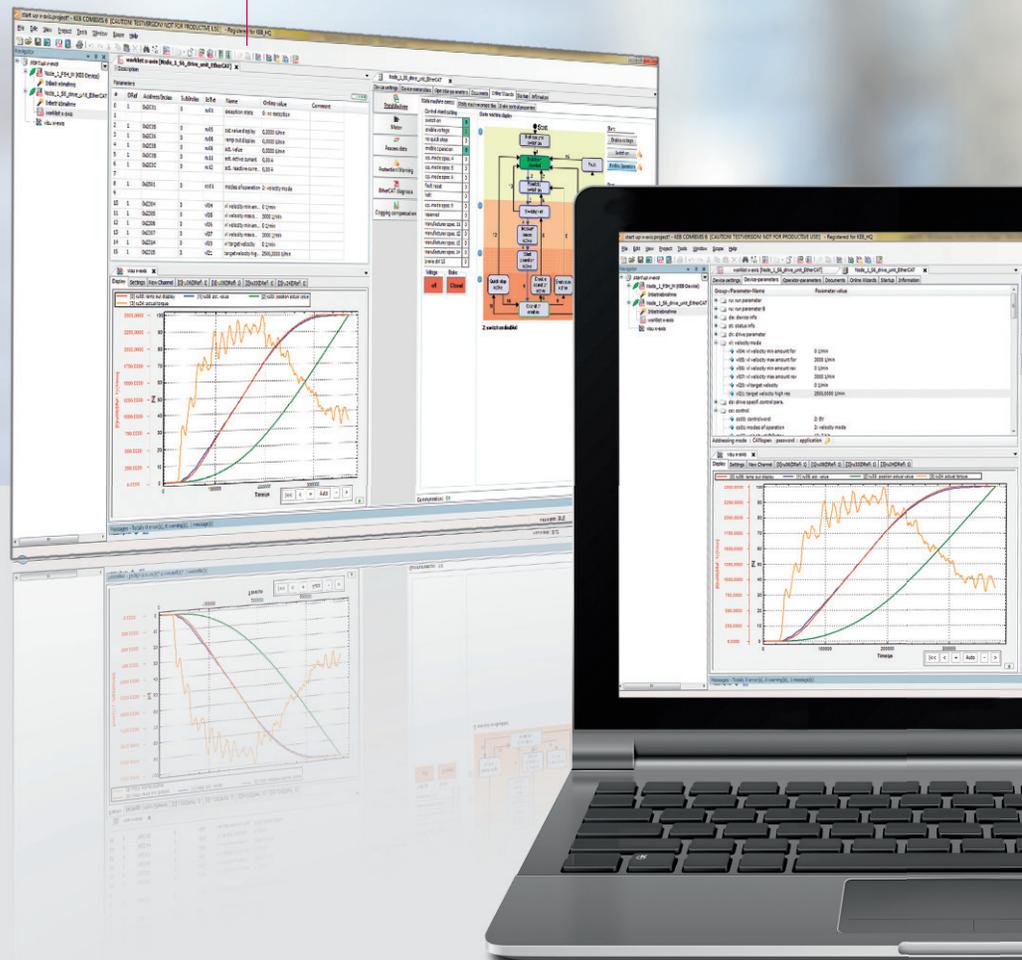


# COMBIVIS 6 - THE TOOL FOR ALL TASKS

## COMBIVIS 6

Commissioning software for parameterisation, diagnostics and project management

- Free and easy-to-use software for startup, administration and analysis
- Integrated start-up assistants (Wizards) for quick and easy configuration
- Direct access to device documentation
- 16 channel oscilloscope for extensive analysis
- Online parameter list comparison
- Parameterisation of key safety indicators and functions



## COMBIVIS studio 6

The automation suite for complete system creation

The intelligent automation suite from KEB combines an assistant-guided component selection, fieldbus configuration, drive parameterisation, IEC 61131-3 project generation and motion control. Throughout the planning and layout phase, implementation of control sequences and multi-axis movement profiles, to start-up and fine tuning, the user is supported by a tool developed by experienced application engineers. With a foundation built on libraries, devices and template databases, rapid and simple solutions can be generated for a wide range of applications.

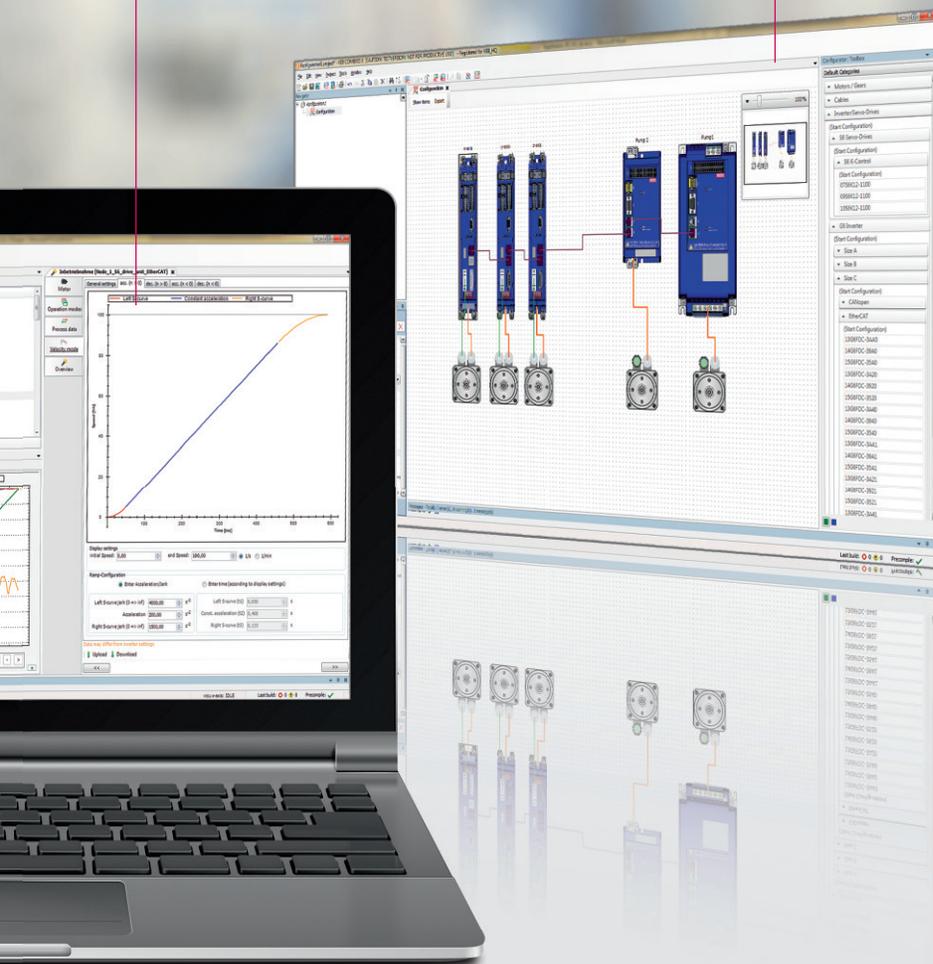
## COMMISSIONING ASSISTANT

**Wizards:** easy start-up and diagnosis with the help of intuitive graphical user interfaces

- Complete user guidance through the commissioning process
- KEB Motor database, free for extensions
- Anti cogging
- Fieldbus diagnostic and optimisation

## SYSTEM CONFIGURATION AS A COMPONENT OF COMBIVIS

- Access to KEB product database
- Intuitive gear component selection and system configuration using drag and drop
- Selection assistant with display of compatible components
- Display of all interfaces and connection components
- Material number generator
- Extensive export function for quote list, COMBIVIS Project, Excel ...



## HIGHLIGHTS

- IEC 61131-3 Applications development
- Device and library database
- Product configuration
- Start-up and diagnosis assistant
- COMBIVIS studio HMI integration
- Document database

# ACCESSORIES

## STABLE OPERATION IN INDUSTRIAL ENVIRONMENT

An EMC-compliant assembly with efficient control cabinet and suppression system is the basis for safe operation of machinery and equipment. The current and voltage limiting COMBILINE modules are optimally designed to meet the requirements of the COMBIVERT F6 drive controller series and support the use through:



### MAINS EMC FILTERS

Reduce the cable-fed emission to the required limits IEC 61800-3 - C1/C2. Further variants offer low leakage currents or the operation of special mains networks, additionally available as submounted filter for COMBIVERT F6.

### MAINS CHOKES

Reduce the input peak current draw and the mains distortion. By smoothing the input current draw, the lifetime of the drive is enhanced, in particular at constantly high utilization.

### OUTPUT CHOKES AND FILTERS

Reduce the voltage and current stress of the motor winding.

### INPUT / OUTPUT COMBI FILTERS

Space-saving combination, consistently adapted and optimised to the drive controller.

### SINE-WAVE FILTERS

Protect the motor winding from voltage peaks and allow the use of long motor cables.

### HARMONIC FILTERS

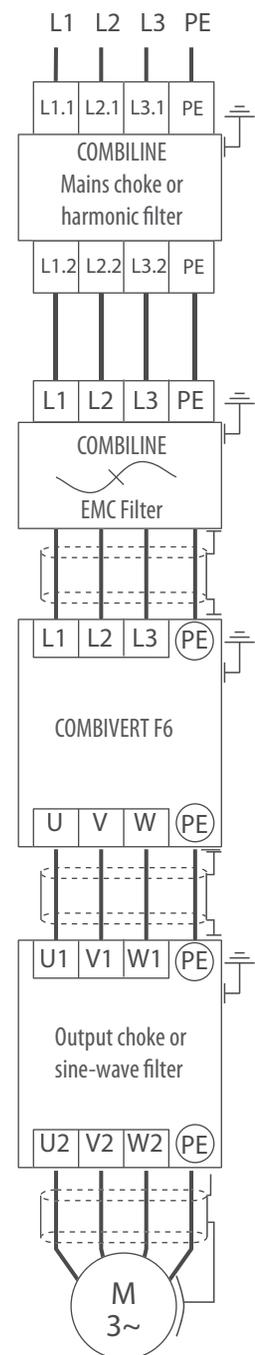
Reduce the low frequency mains distortion of B6-rectifier supplied devices. These harmonic filters are the innovative solution to comply to most international standards. The integration to a switch gear layout is as simple as of mains chokes.

### SINE-WAVE EMC FILTERS

Allow operation of motors with long motor cables even without screening.

### HIGH PERFORMANCE FERRITE CORES

Reduces the values of  $du/dt$ 's also in the frequency range of the bearing currents.



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## KEB PARTNERS WORLDWIDE

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The KEB logo consists of the letters 'KEB' in a bold, white, sans-serif font, set against a dark red rectangular background. To the right of this rectangle is another solid dark red rectangle of the same height.

**Automation with Drive**

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