

**KEB**



# COMBILINE Z1i05

**SINE WAVE EMC FILTER 9.5 ... 460 A**

- ACTIVE-FRONT-END MAINS FILTERS
- MOTOR FILTERS

**EN**



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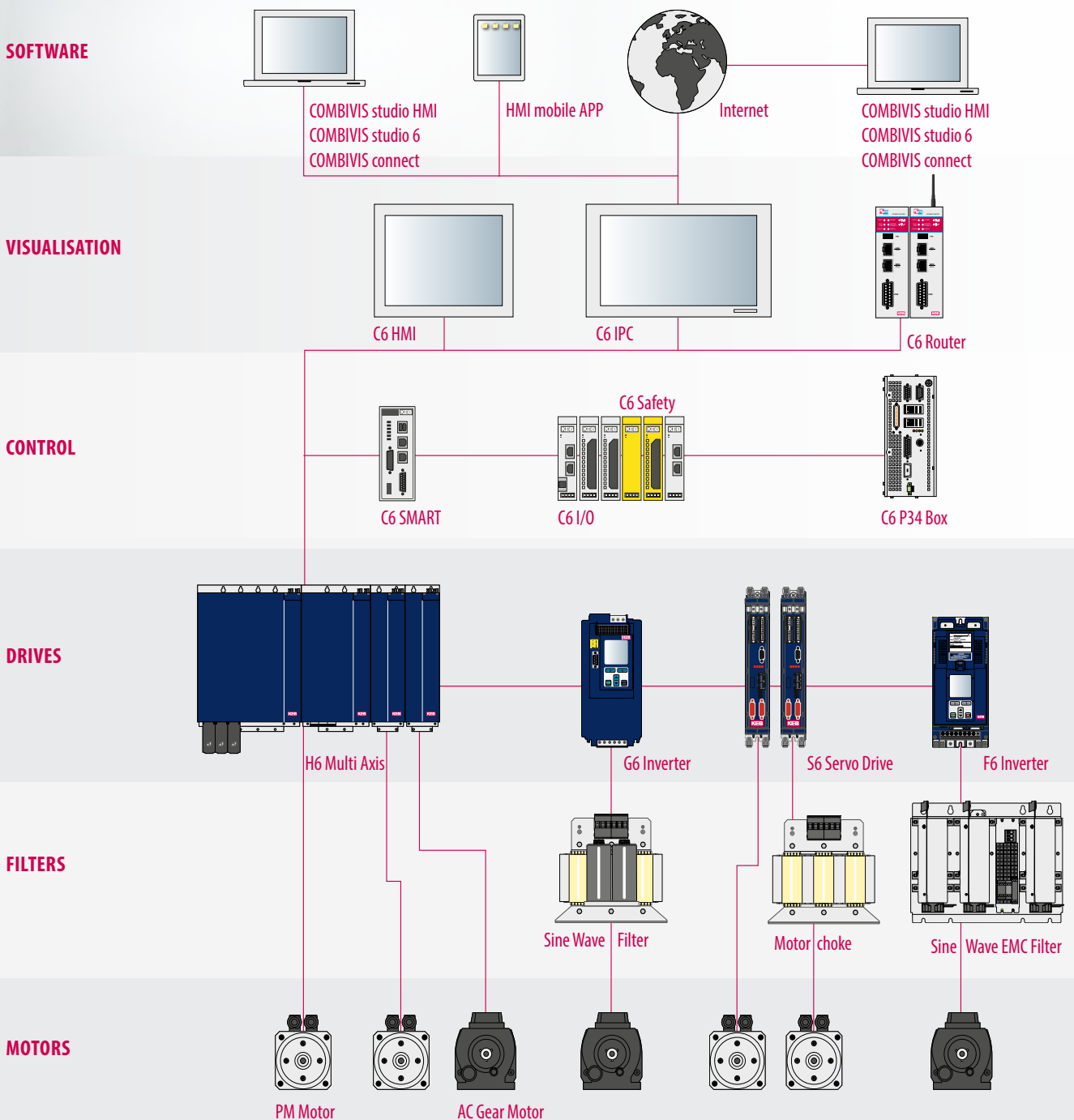
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# SYSTEM OVERVIEW

## Automation with Drive

Movement, dynamics, accuracy, long service life and continuity: These, and a whole lot more, make a really good drive.

From the right selection of all the components, to the observation of all the rules set by law, up to the protection of motor windings or the feedback of energy into the supply network: robust solutions as complete packages from KEB are designed to provide maximize the efficiency.

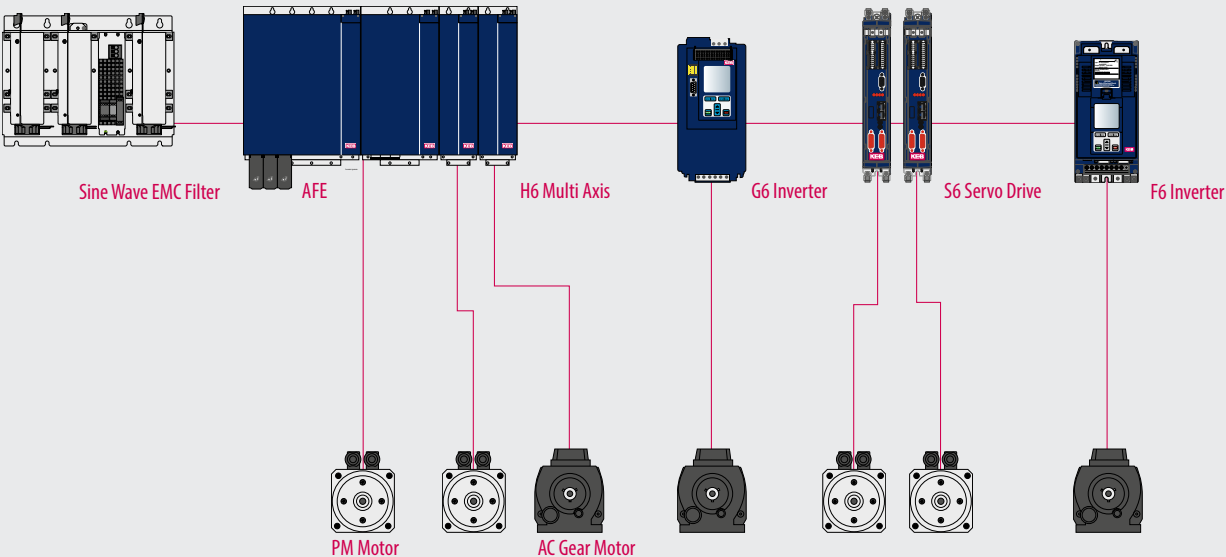


# SINE WAVE EMC FILTERS AS ACTIVE FRONT-END NETWORK FILTERS

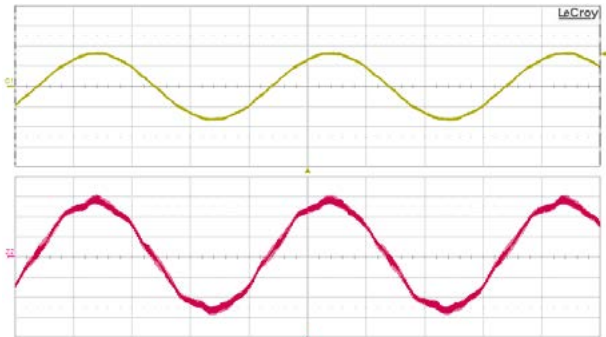
The safe operation of industrial production equipment is only achieved with a high quality and reliable supply network. For this reason KEB offers regulated supply network rectifiers as DC supply units. The so-called Active Front End (AFE) is designed to draw sinusoidal current from and also back to the supply network. A high and constant DC voltage is provided at the output of the supply unit to feed drive controllers. This arrangement guarantees a reliable operation of the equipment, regardless of any fluctuations on the supply voltage.

Generating sinusoidal currents is only possible with the use of filters, such as the newly developed all-pole sine wave EMC filter type Z1i05, as the perfect complement to the AFE supply and regeneration units from KEB. This combination guarantees clean sinusoidal current input and protects supply transformers and cables against overload. As a result, the retrofit of power regeneration units to boost energy efficiency is easier and more economical.

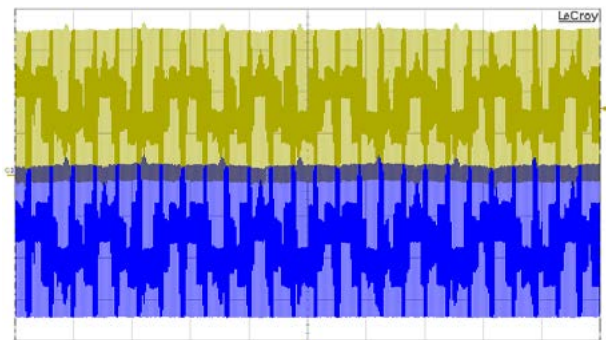
On the supply side, these units are recommended for their stable and precise DC voltage for the connection of frequency converters or devices with DC filters which are equipped with Y interference suppression capacitors. Z1i05 sine wave EMC filters are prewired, and are plug and play.



## SUPPLY SIDE WITHOUT KEB SINE WAVE EMC FILTER

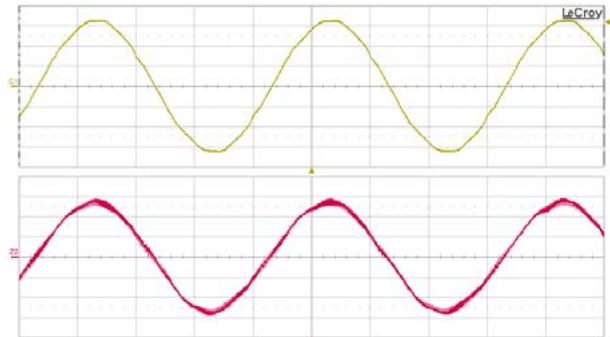


Current and voltage to the supply network

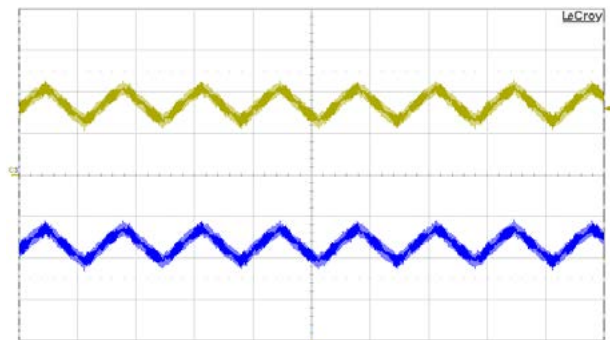


DC voltage to PE at AFE output

## SUPPLY SIDE WITH KEB SINE WAVE EMC FILTER



Current and voltage to the supply network



DC voltage to PE at AFE output

**HIGHLIGHTS:**

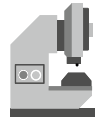
- Sinusoidal voltages between phases and Ground
- Sinusoidal network currents in four-quadrant operation too
- Perfect DC voltage source for use with DC/DC converters or equipments with DC EMC filters
- Perfect matching with battery storage units
- Significant reduction of PE current on the supply network
- Ready for use on TN, TT, and IT networks too\*
- UL certification in preparation

\* Without EMC filter

# SOME APPLICATION EXAMPLES OF ACTIVE FRONT END NETWORK FILTERS

## MACHINE TOOLS

The sinusoidal current input is the base to take gently the full capacity out of the supply networks through supply units. The energy generated during braking can be fed back easily into the supply network.



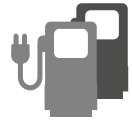
## TEST BENCHES

During load analyses, the units under test are frequently held between two electric motors, the first producing the load torque and the second the braking torque. With this kind of arrangement, it is recommended to supply the associated drive controllers via a common DC bus. The direct energy exchange between both drives improves significantly the overall efficiency, because the braking energy is exchanged through the DC network. As a result, test benches for high loads can be operated with a comparatively low supply power. This type of DC supply can be achieved with the help of an AFE and sine wave EMC filters, and can brake the system in all four torque quadrants. Goal: energy feedback instead of energy wasted by heating up a braking resistor.



## E-MOBILITY

With the sine wave EMC filter, perfectly tuned DC voltage can be produced, the best possible preconditions for providing optimum supply for electric vehicle charging stations, with or without backup batteries. The sine wave EMC filter protects the battery and generates a reliable sinusoidal input current drain from the public network. If the charging station is equipped with a battery storage unit, it can be used to support the public network in a specific way within the smart grid.



## TEXTILE MACHINES

Central main drives with mechanical line shafts are old fashioned when it comes to modern textile machines. The answer is: individual modern drives controllers. With Active Front End units, together with sine wave EMC filters, it is now possible to create a perfect adjustable constant DC source powering frequency converters and servo-converters even on long motor cables. In addition, DC/DC converters can be connected directly onto the DC bus for the supply of machine controllers.



## ENERGY PRODUCTION

In the application of regenerative energy production on public networks it is necessary that the decentralized power generation systems feed their electrical energy into the public network with an optimised sine wave current. In this situation, the sine wave EMC filter supplements the KEB Active Front Ends (AFE) at infeed, while respecting local grid codes.



## DC SUPPLY FOR MACHINE PARKS

With a real DC interconnection, peak loads within a machine park can be efficiently and effectively smoothed. On the top, if there is an energy surplus, the network regeneration can be combined and sent back to the supply network. This increases the efficiency of the machine park and reduces the peak loads on the supply. Targeted placed KEB DC EMC filters reduce the interference on the DC bus, and so allow longer DC supply lines.



## LIFTS AND ESCALATORS

With the conveying of personnel in multi-storey buildings using lifts and escalators, a high potential of energy is generated during downwards travel. Thanks to AFE technology from KEB and a sine wave EMC filter, this can be fed cleanly back into the network. The quality of sinusoidal current input fulfils the relevant standards such as IEC61000-3-2/12 and IEEE 519.

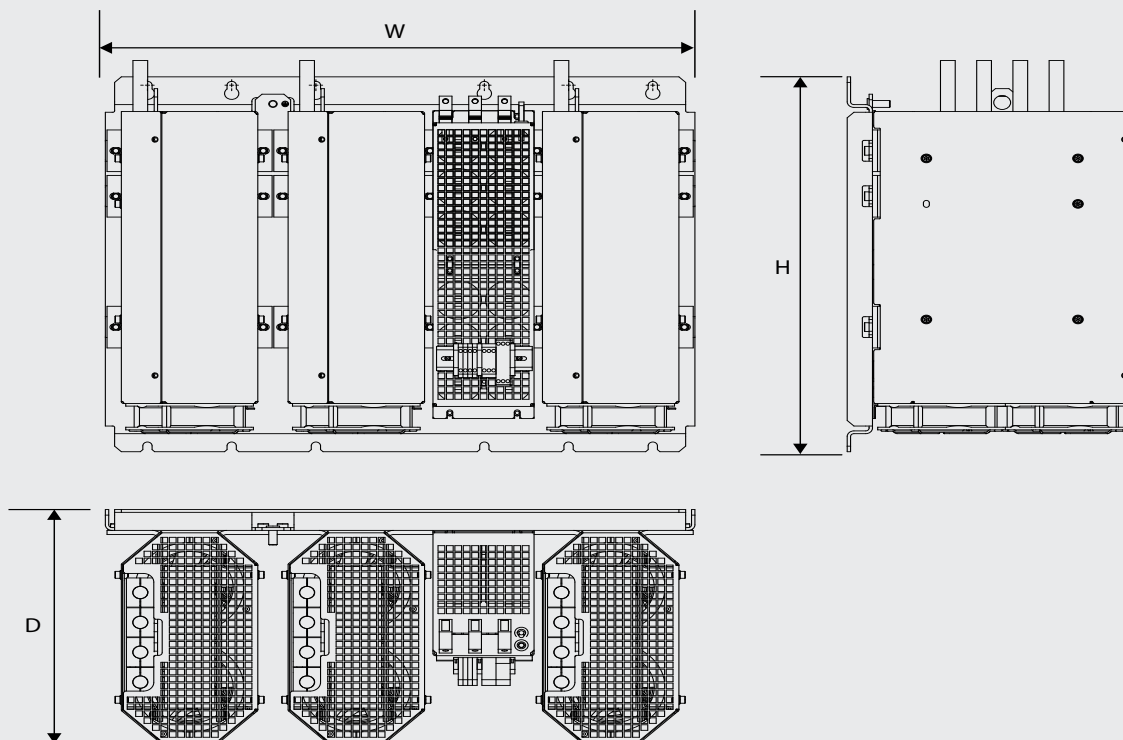


## POWERING DRIVE CONTROLLERS THROUGH MOBILE GENERATORS

Diesel generators do not accept any large current harmonic components which are generated by non-linear loads. Adding an AFE with sine wave EMC filter in front reduces the harmonic components effectively down to just a few percent.



		<b>0D</b>	<b>0H</b>	<b>0L</b>	<b>0P</b>	<b>0S</b>	<b>0X</b>	<b>0Y</b>
		<b>Z1105-1001</b>	<b>Z1105-1001</b>	<b>Z1105-1001</b>	<b>Z1105-1001</b>	<b>Z1105-1001</b>	<b>Z1105-1001</b>	<b>Z1105-1001</b>
Rated current	[A]	9.5	16.5	50	115	180	300	460
Rated voltage	[V]	400 / 480 V AC +/- 10 %						
Power supplies		50/60Hz +/-2Hz, TN, TT and IT(*)						
THDi		typical < 3 %						
Min. switching frequency	[kHz]	8	8	8	8	8	4	4
T <sub>max</sub>	[°C]	45						
Protection		IP00	IP20	IP20	IP20	IP20	IP20	IP20
Fan 24V DC	[A]	-	3	3	3	3	3	3
Line reactor		12Z1B04-1000	14Z1B04-1000	18Z1B04-1000	22Z1B04-1000	24Z1B04-1000	27Z1B04-1000	29Z1B04-1000
EMC filter (*)		12E6T60-3000	14E6T60-3000	18E6T60-3000	22E6T60-3000	24E6T60-3000	26U5A0U-3000	30U5A0W-3000
Rated power loss	[W]	290	275	675	1120	1560	1560	2560
W	[mm]	420	420	420	570	570	700	700
H	[mm]	318	318	318	420	420	540	540
D	[mm]	161	173.5	173.5	233.5	233.5	337	377
Weight	[kg]	8	13	16.5	46	52.5	177	143.5



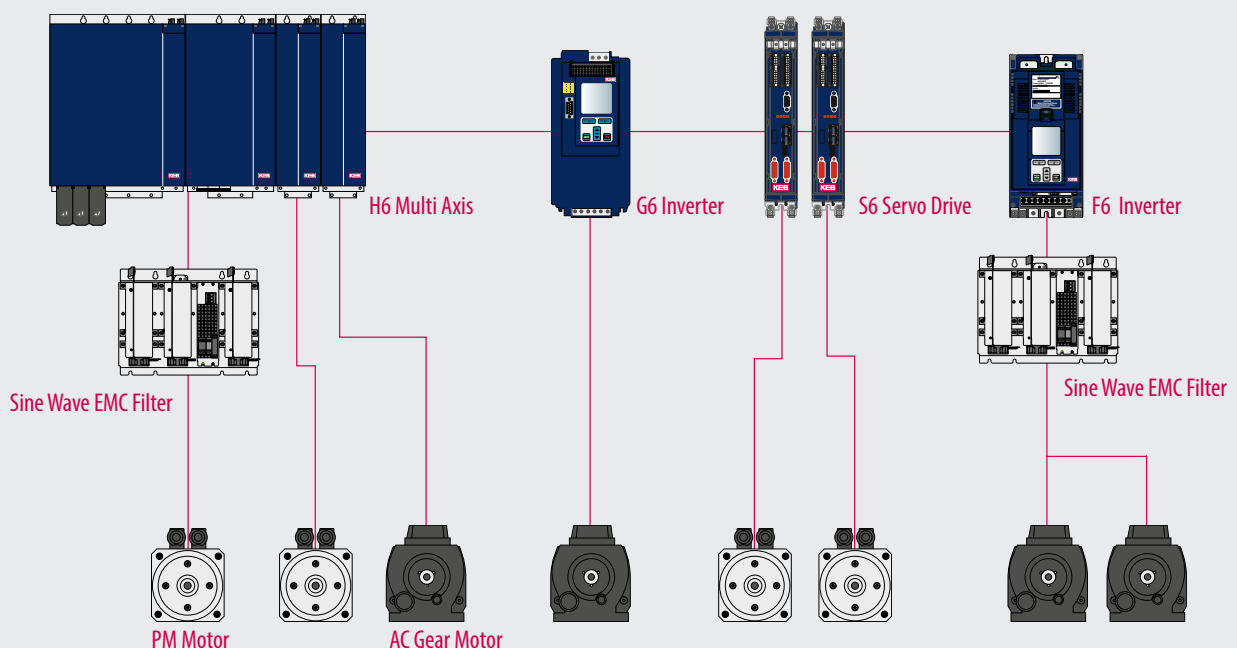
\*Operation on IT mains possible without EMC filter

# SINE WAVE EMC FILTER AS MOTOR FILTER

Drive controllers in conjunction with speed-controlled or precisely regulated asynchronous or synchronous motors are state of the art in machines and equipment. The goal is to build more flexible machines and to control processes better. Applications with long motor cables which are the result because of long distances, or due to the use of multiple motors on a single drive, is a challenging task. Because of the increase in efficiency of the power modules used in the drive controllers, high  $dU/dt$ 's at the output voltage are the result. The voltage overshoot have the potential to damage windings and motor bearings. The all-pole KEB sine wave EMC filter reduces the  $dU/dt$ 's and smooths the square-wave voltage back into a perfect sine wave voltage.

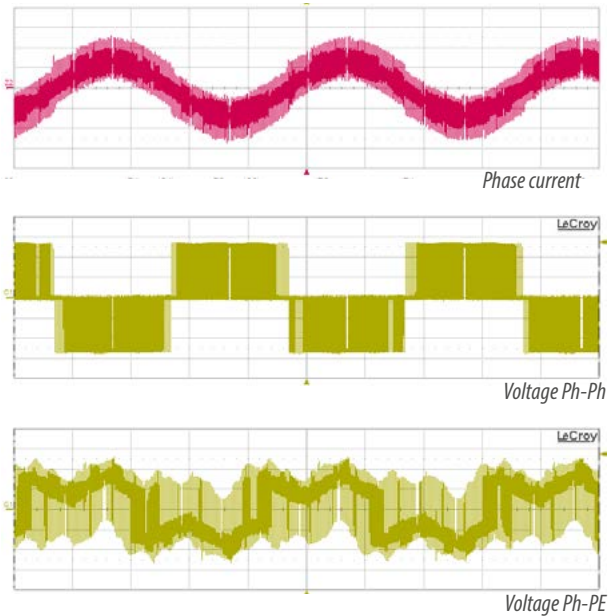
## SUMMARY:

- Longer lifetime of the motor winding thanks to protection against premature ageing
- Protection of the motor bearings, with the effect that standard bearings are acceptable for operation with drive controllers
- Thanks to the sinusoidal voltage between phase and ground, there is no need for a shielded cable, which means clear costs savings particularly with long cable runs
- Compatibility with CE Directives
- Same conditions as on a standard power network
- Compatibility with induction and PM motors. Thanks to the F6 ASCL or SCL software, the motors can also be operated without encoders.
- The filter series consists of seven sizes, the selection is made according to the KEB drive controller current
- The filters are prewired, and are plug & play

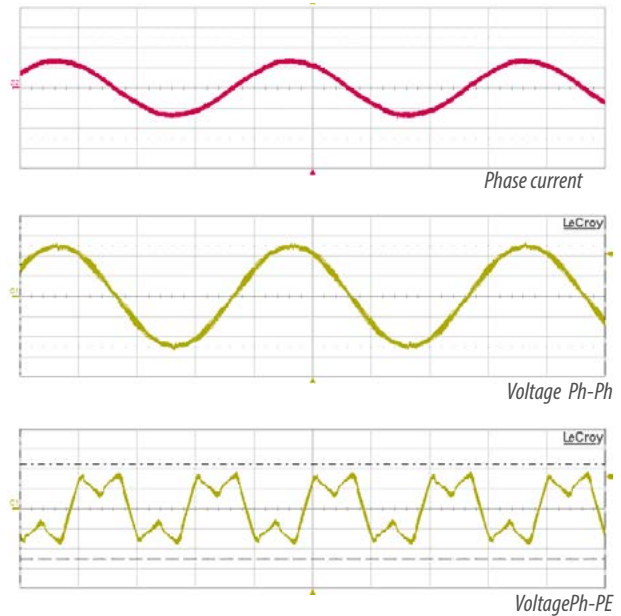




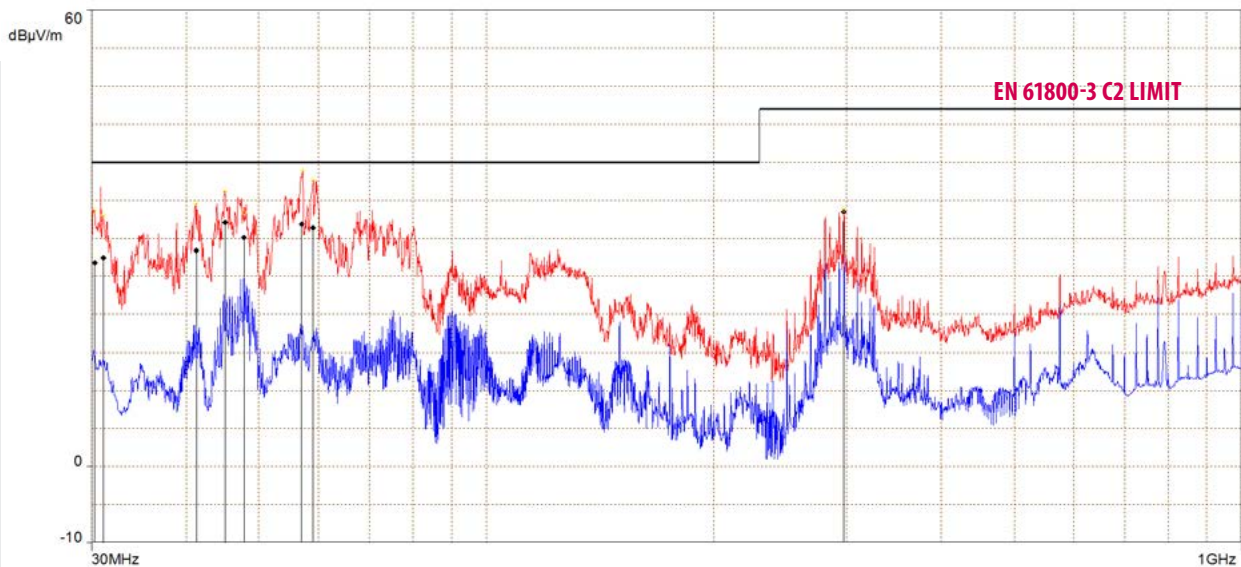
## OUTPUT WITHOUT FILTER



## OUTPUT WITH KEB SINE WAVE EMC FILTER



## MEASUREMENT OF THE EMITTED INTERFERENCE WITH UNSHIELDED MOTOR CABLES



## HIGHLIGHTS

- Sinusoidal voltages phase/phase and phase/ground
- No motor cable shield necessary
- Increases the degree of efficiency of the motor
- No limitation on motor cable lengths
- Unlimited amount of motors connected on one drive controller
- UL certification in preparation

# EXAMPLES OF APPLICATIONS MOTOR FILTER

## CONVEYOR BELTS

Conveyor belts cannot always be operated with decentralized drive systems. The mining sector is a typical example of placing frequency converters in a central electric cabinet due to the harsh environment. This results in long motor cables. With KEB sine wave EMC filters, it is possible to control motors which are far away from the electric cabinet without complex and expensive solutions. Thanks to their characteristics, it is possible to use unshielded cables; an upgrade or economic retrofit of an existing installation is possible.



## ASYNCHRONOUS LINEAR MOTORS

The operation of several motors on one drive controller is a major challenge. In order to meet the applicable EMC directives and guidelines, shielded cables lines are necessary. This, however, means that with longer cables can result in high leakage currents, which can lead to interference. An alternative is the use of the all-pole KEB sine wave EMC filter, which not only provides an optimum sinusoidal voltage between the phases, but also a sine wave between phase and ground. The advantages are that shielded cables are not necessary, and their length is almost unlimited.



## IMMERSION PUMPS

If petroleum or water needs to be brought up from depths of several kilometres, sine wave EMC filters are smoothing the motor voltage and as a result the  $dV/dt$ 's are also reduced. This protects the windings against damage or premature ageing. The filter also smooths the motor current and is reducing the losses inside the motor. In addition with the use of a sine wave EMC filter, the motor can be operated without shielded cable.



## ISLAND POWER SUPPLIES

With the KEB drive controller, together with a sine wave EMC filter and an isolating transformer, a freely definable network can be emulated. This allows for special motors to be actuated or entire machine parts to be supplied. Artificial mains are requested, for example, for test benches, in order to operate machines within limit ranges. If no neutral conductor is needed with island networks, the transformer can be omitted as well.



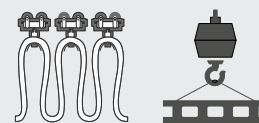
## CURRENT HEAT SYSTEM

During the manufacturing process of transformers, to dry out the coils they have to be heated. This is done by injecting a defined current inside the coils. The combination of KEB drive controllers and sine wave EMC filters provides the sinusoidal current for this operation. This allows for precise and exact repetition of the drying process.



## TRAILING CABLES

Shielded trailing cables are very complex to manufacture, and that makes them expensive. They are also very susceptible to damages. With the sine wave EMC filter, a motor can be provided with a drive controller via a conventional trailing cable. That brings costs down, and increases system reliability.



## FANS

In ventilation systems, drive controllers and fans are often connected over longer distances. For this KEB provides drive controllers with power ratings up to 800 kW. In this situation, the sine wave EMC filter provides a voltage similar to the network, which makes shielded motor cables superfluous.



## TEST BENCHES

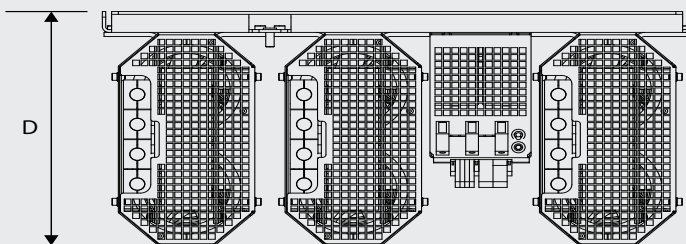
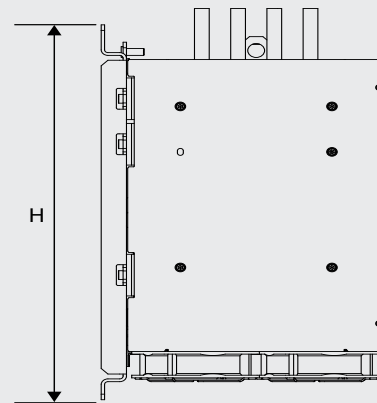
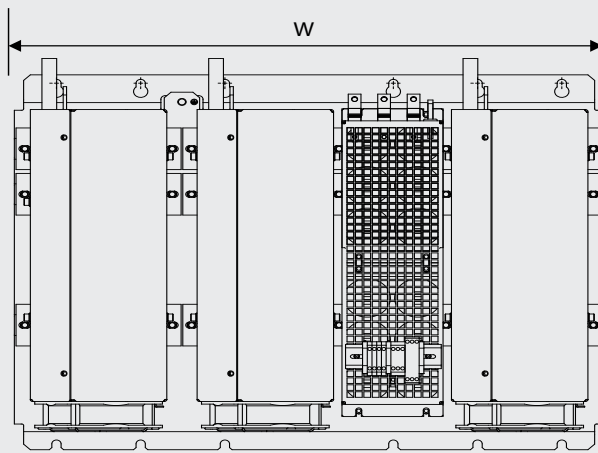
In test benches, where the power loss in electric motors has to be evaluated, there are strict requirements for the supply voltage to the motors. These can easily be met with KEB sine wave EMC filters. This allows the pure measurement of motor losses without the interfering influence of the pulse width modulation (PWM).

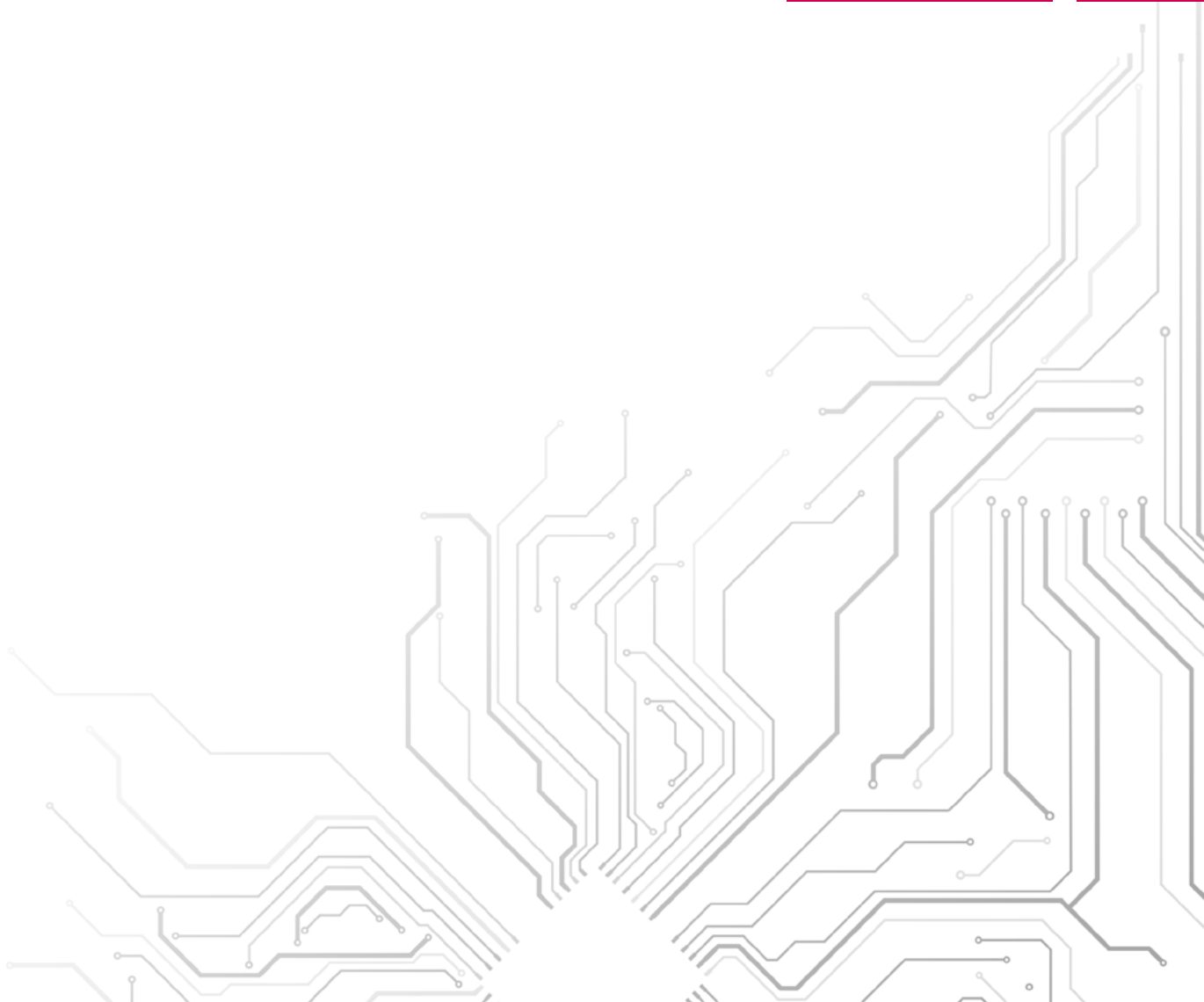


### HIGHLIGHTS

- Motors are provided with a voltage with grid quality .

SIZES		0D	0H	0L	0P	0S	0X	0Y
		Z1105-1001	Z1105-1001	Z1105-1001	Z1105-1001	Z1105-1001	Z1105-1001	Z1105-1001
Rated current	[A]	9.5	16.5	50	115	180	300	460
Rated voltage	[V AC]	3 x 400 / 480						
Frequency	[Hz]	0 ... 100						
Min. switching frequency	[kHz]	8	8	8	8	8	4	4
T <sub>max</sub>	[°C]	45						
Protection		IP00	IP20	IP20	IP20	IP20	IP20	IP20
Fan 24V DC	[A]	-	3	3	3	3	3	3
THDu Ph-Ph		typical < 3%						
Rated power loss	[W]	290	275	675	1120	1560	1560	2560
W	[mm]	420	420	420	570	570	700	700
H	[mm]	318	318	318	420	420	540	540
D	[mm]	161	173.5	173.5	233.5	233.5	337	377
Weight	[kg]	8	13	165	46	52.5	177	143.5





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