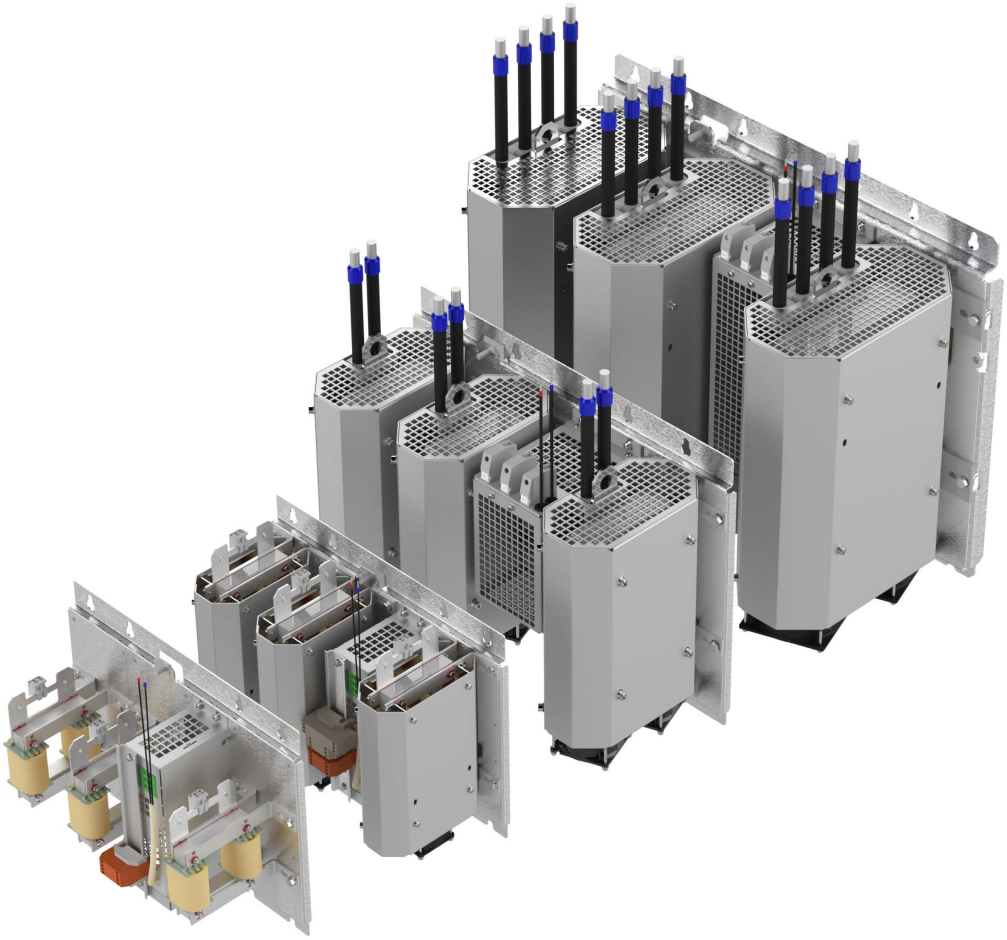

COMBILINE **Z1I05**

INSTRUCTIONS FOR USE | **INSTALLATION SINE-WAVE EMC FILTER**

Translation of the original manual
Document 20146892 EN 04

Preface

The hardware and software described in this document are products of KEB. The information contained in this document is valid at the time of publishing. KEB reserves the right to update this document in response to misprints, mistakes or technical changes.

Signal words and symbols

Certain procedures within this document can cause safety hazards during the installation or operation of the device. Refer to the safety warnings in this document when performing these procedures. Safety signs are also located on the device where applicable. A safety warning is marked by one of the following warning signs:

⚠ DANGER	Dangerous situation, which will cause death or serious injury iif this safety warning is ignored.
⚠ WARNING	Dangerous situation, which may cause death or serious injury if this safety warning is ignored.
⚠ CAUTION	Dangerous situation, which may cause minor injury if this safety warning is ignored.
NOTICE	Situation, which can cause damage to property if this safety warning is ignored.

RESTRICTION

Used when the following statements depend on certain conditions or are only valid for certain ranges of values.

Used for informational messages or recommended procedures.

More symbols

►	This arrow starts an action step.
• / -	Enumerations are marked with dots or indents.
=>	Cross reference to another chapter or another page.

Note to further documentation.
https://www.keb-automation.com/search

Laws and guidelines

KEB Automation KG confirms with the EC declaration of conformity and the CE mark on the device nameplate that it complies with the essential safety requirements.

The EC declaration of conformity can be downloaded on demand via our website.

Warranty and liability

The warranty and liability on design, material or workmanship for the acquired device is given in the general sales conditions.

Here you will find our general sales conditions.
https://www.keb-automation.com/terms-conditions

Further agreements or specifications require a written confirmation.

Support

Although multiple applications are referenced, not every case has been taking into account. If you require further information or if problems occur which are not referenced in the documentation, you can request the necessary information via the local KEB agency.

The use of our units in the target products is outside of our control and therefore lies exclusively in the area of responsibility of the customer.

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the intended use. However, they are regarded as being only informal and changes are expressly reserved, in particular due to technical changes. This also applies to any violation of industrial property rights of a third-party. Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the intended end use of the product (application) by the customer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Copyright

This KEB product or parts thereof may contain third-party software, including free and/or open source software. If applicable, the license terms of this software are contained in the instructions for use. The instructions for use are already available to you, can be downloaded free of charge from the KEB website or can be requested from the respective KEB contact person.

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Standards for EMC components

Product standards:

EN 61558-1	Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests (IEC 96/449/CD:2015)
EN 61558-2-20	Safety of transformers, reactors, power supply units and combinations thereof - Part 2-20: Particular requirements and tests for small reactors (IEC 61558-2-20:2010); German version EN 61558-2-20:2011
EN 61800-5-1	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy (IEC 61800-5-1); German version EN 61800-5-1
UL 61800-5-1	American version of the EN 61800-5-1 with „National Deviations“

Basic standards:

EN 60529	Degrees of protection provided by enclosures (IP Code) (IEC 60529)
EN 60664-1	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests (IEC 60664-1)
EN 60721-3-1	Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - Section 1: Storage (IEC 60721-3-1); German version EN 60721-3-1
EN 60721-3-2	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation and handling (IEC 104/670/CD)
EN 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 3: Stationary use at weatherprotected locations; Amendment A2 (IEC 60721-3-3); German version EN 60721-3-3

General standards:

DGUV regulation 3	Electrical installations and equipment
DNVGL-CG-0339	Environmental test specification for electrical, electronic and programmable equipment and systems
VDE 0100	Erection of low voltage installations - Observance of all parts (IEC 60364-x-x)
EN 60204-1	Safety of machinery - electrical equipment of machines Part 1: General requirements (VDE 0113-1, IEC 44/709/CDV)
EN 61373	Railway applications - Rolling stock equipment - Shock and vibration tests (IEC 61373); German version EN 61373
ISO 4762	Hexagon socket head cap screws

1 Basic Safety Instructions

The products are designed and constructed in accordance with state-of-the-art technology and the recognized safety rules and regulations. However, the use of such devices may cause functional hazards for life and limb of the user or third parties, or damages to the system and other material property.

The following safety instructions have been created by the manufacturer for the area of electric drive technology. They can be supplemented by local, country- or application-specific safety instructions. This list is not exhaustive. Violation of the safety instructions by the customer, user or other third party leads to the loss of all resulting claims against the manufacturer.

NOTICE

Hazards and risks through ignorance!

- ► Read the instructions for use!
- ► Observe the safety and warning instructions!
- ► If anything is unclear, please contact KEB Automation KG!

1.1 Target group

This instruction manual is determined exclusively for electrical personnel. Electrical personnel for the purpose of this instruction manual must have the following qualifications:

- Knowledge and understanding of the safety instructions.
- Skills for installation and assembly.
- Start-up and operation of the product.
- Understanding of the function in the used machine.
- Detection of hazards and risks of the electrical drive technology.
- Knowledge of *VDE 0100*
- Knowledge of national safety regulations.

1.2 Transport, storage and proper use

The transport is carried out by qualified persons in accordance with the environmental conditions specified in this manual. The filters shall be protected against excessive strains.

The filters contain electrostatic sensitive components.

- ► Avoid contact.
- ► Wear ESD-protective clothing.

Do not store the filters

- in the environment of aggressive and/or conductive liquids or gases.
- with direct sunlight.
- outside the specified environmental conditions.

1.3 Installation

⚠ DANGER

Do not operate in an explosive environment!

► The product is not intended for the use in potentially explosive environment.

⚠ CAUTION

Design-related edges and high weight!

Contusions and bruises!

► Never stand under suspended loads.

► Wear safety shoes.

► Secure drive controller accordingly when using lifting gear.

To prevent damages to the device:

- Make sure that no components are bent and/or isolation distances are changed.
- The device must not be put into operation in case of mechanical defects.
- Do not allow moisture or mist to penetrate the unit.
- Avoid dust permeating the device. Allow for sufficient heat dissipation if installed in a dust-proof housing.
- Note installation position and minimum distances to surrounding elements. Do not cover the ventilation openings.
- Mount the drive controller according to the specified degree of protection.
- Make sure that no small parts fall into the COMBIVERT during assembly and wiring (drilling chips, screws etc.). This also applies to mechanical components, which can lose small parts during operation.
- Check the reliable fit of the device connections in order to avoid contact resistances and sparking.
- Do not walk-on drive controller.
- Follow all safety instructions!

1.4 Electrical connection

⚠ DANGER

Voltage at the terminals and in the device!

Danger to life due to electric shock!

- ► For any work on the unit switch off the supply voltage and secure it against switching on.
- ► The supplied drive converters and filters form a technical unit and must therefore not be disconnected from the mains independently of one another.
- ► Wait until the drive has stopped in order that no regenerative energy can be generated.
- ► Observe capacitor discharge time, if necessary measure DC voltage at the terminals.
- ► Never bridge upstream protective devices (also not for test purposes).

For a trouble-free and safe operation, please pay attention to the following instructions:

- The electrical installation shall be carried out in accordance with the relevant requirements.
- Cable cross-sections and fuses must be dimensioned according to the design of the machine manufacturer. Specified minimum / maximum values may not be fallen below /exceeded.
- With existing or newly wired circuits the person installing the units or machines must ensure the EN requirements are met.

1.5 Start-up and operation

⚠ CAUTION

High temperatures at the components!

Burning of the skin!

- ► Cover hot surfaces safe-to-touch.
- ► Before working let the unit cool down.
- ► If necessary, attach warning signs on the system.

- During operation, all covers and cabinet doors shall be kept closed.
- Use only approved accessories.
- Never touch terminals, busbars or cable ends.

1.6 Repair

In case of malfunction, unusual noises or smells inform a person in charge!

⚠ DANGER

Unauthorized exchange, repair and modifications!

Unpredictable malfunctions!

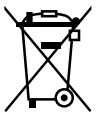
- ► Modification or repair is permitted only by authorized personnel by KEB Automation KG.
- ► Only use original manufacturer parts.
- ► Infringement will annul the liability for resulting consequences.

In case of failure, please contact the machine manufacturer. Only the machine manufacturer knows the components and can provide appropriate sqare parts or induce the maintenance.

1.7 Disposal

Electronic devices of the KEB Automation KG are exclusively professional devices for further industrial processing (so-called B2B devices).

Manufacturers of B2B devices are obliged to take back and recycle devices manufactured after 14.08.2018. These devices may not be disposed at the collection centres of public sector disposal organisations.



If no deviating agreement has been made between the customer and KEB or no deviating mandatory legal regulation exists, KEB products marked in this way can be returned. Company and keyword to the return point can be taken from the list below. Shipping costs are paid by the customer. Thereupon the devices will be professionally recycled and disposed.

The entry numbers are listed country-specific in the following table. The corresponding KEB return addresses can be found on our website.

Withdrawal by	WEEE-Reg.-No.		Keyword
Austria			
KEB Automation GmbH	ERA:	51976	Stichwort „Rücknahme WEEE“
France			
RÉCYLUM - Recycle point	ADEME:	FR021806	Mots clés „KEB DEEE“
Germany			
KEB Automation KG	EAR:	DE12653519	Stichwort „Rücknahme WEEE“
Italy			
COBAT	AEE: (IT)	19030000011216	Parola chiave „Ritiro RAEE“
Spain			
KEB Automation KG	RII-AEE	7427	Palabra clave „Retirada RAEE“
Česko			
KEB Automation KG	RETELA	09281/20 ECZ	Klíčové slovo: Zpětný odběr OEEZ
Slowakei			
KEB Automation KG	ASEKOL:	RV22EEZ0000421	Klíčové slovo: ”Spätný odber OEEZ”

The packaging must be feed to paper and cardboard recycling.

2 Product description

This instructions for use describes the sine-wave EMC filters of the series 0xZ1I05-1001. The x at the second position of the material number is representative of the corresponding letter of the filter type D, H, L, P, S, X or Y.

Sine-wave EMC filters as combination of sine-wave filters with EMC level reduce symmetrical and asymmetrical interferences and support the compliance with legal limit values.

The sine-wave EMC filter is an electrical low-pass filter which filters out the switching frequency from the PWM (pulse-width modulation) output signal of the drive controller. A sinusoidal voltage with low ripple is generated at the filter output, which causes a sinusoidal motor current.

The sine-wave EMC filter can be used both as motor filter at the drive controller and as mains filter at the Active Infeed Converter (AIC). This results in the following advantages.

2.1 Intended use

The sine-wave EMC filters are intended for installation in electrical systems or machines.

The technical data and information on connection conditions can be found on the nameplate and in the instructions for use and must be strictly observed.

NOTICE

Use of sine-wave EMC filters with COMBIVERT G6!

Operation only possible to a limited extent!

► Contact KEB.

2.2 Improper use

The operation of our products outside the limits specified in the technical data leads to the loss of any claims for damages.

2.3 Product features

Use as motor filter at the drive controller:

- All-pole effect phase-phase and phase-earth
- Reduction of additional losses occurring in the motor during direct drive controller operation
- Service life extension of the motor insulation
- Reduction of motor noises
- Reduction of recharging currents based on clock frequency at long lines
- Reduction of high-frequency emitted interferences
- Use of unshielded motor cable in unlimited lengths

Use as mains filter at the AIC:

- All-pole effect phase-phase and phase-earth
- Sinusoidal mains currents
- Reduction of PE currents

3 Technical data

Unless otherwise indicated, all electrical data in the following chapter refer to a 3-phase AC mains.

3.1 Operating conditions

3.1.1 IP protection classes

Filter type	0D	0H	0L	0P	0S	0X	0Y
Protection classes	IP 00	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20

Table 1: IP protection classes

3.1.2 Environmental conditions

Storage		Standard	Class	Notes
Ambient temperature		*EN 60721-3-1*	1K4	-25…55 °C
Relative humidity		*EN 60721-3-1*	1K3	5…95 % (without condensation)
Storage height		–	–	Max. 3000 m above sea level
Transport		**Standard**	**Class**	**Notes**
Ambient temperature		*EN 60721-3-2*	2K3	-25…70 °C
Relative humidity		*EN 60721-3-2*	2K3	95 % at 40 °C (without condensation)
Operation		**Standard**	**Class**	**Notes**
Ambient temperature		*EN 60721-3-3*	3K3	5…40 °C (extended to -10…45 °C)
Coolant inlet temperature	Air	–	–	5…40 °C (-10…45 °C)
Relative humidity		*EN 60721-3-3*	3K3	5…85 % (without condensation)
Version and degree of protection		*EN 60529*	=> *„IP protection classes“*	Protection against foreign material > ø12.5 mm No protection against water Non-conductive pollution, occasional condensation when PDS is out of service.
Site altitude		–	–	Max. 2000 m above sea level • With site altitudes over 1000 m a derating of 1 % per 100 m must be taken into consideration.

Table 2: Environmental conditions

3.1.3 Mechanical environmental conditions

Storage	Standard	Class	Notes
Vibration limits	*EN 60721-3-1*	1M2	Vibration amplitude 1.5 mm (2…9 Hz) Acceleration amplitude 5 m/s² (9…200 Hz)
Shock limit values	*EN 60721-3-1*	1M2	40 m/s²; 22 ms
Transport	**Standard**	**Class**	**Notes**
Vibration limits	*EN 60721-3-2*	2M1	Vibration amplitude 3.5 mm (2…9 Hz) Acceleration amplitude 10 m/s² (9…200 Hz) Acceleration amplitude 15 m/s² (200…500 Hz)
Shock limit values	*EN 60721-3-2*	2M1	100 m/s²; 11 ms
Operation	**Standard**	**Class**	**Notes**
Vibration limits	*EN 60721-3-3*	3M4	Vibration amplitude 3.5 mm (2…9 Hz) Acceleration amplitude 10 m/s² (9…200 Hz)
	EN 61800-5-1	–	Vibration amplitude 0.075 mm (10…57 Hz) Acceleration amplitude 10 m/s² (57…150 Hz)
Shock limit values	*EN 60721-3-3*	3M4	100 m/s²; 11 ms

Table 3: Mechanical environmental conditions

3.1.4 Chemical/mechanical active substances

Storage		Standard	Class	Notes
Contamination	Gases	*EN 60721-3-1*	1C2	–
	Solids		1S2	–
Transport		**Standard**	**Class**	**Notes**
Contamination	Gases	*EN 60721-3-2*	2C2	–
	Solids		2S2	–
Operation		**Standard**	**Class**	**Notes**
Contamination	Gases	*EN 60721-3-3*	3C2	–
	Solids		3S2	–

Table 4: Chemical/mechanical active substances

3.1.5 Electrical operating conditions

3.1.5.1 Device classification

Requirement	Standard	Class	Notes
Pollution degree	*EN 60664-1*	2	Non-conductive pollution, occasional moisture condensation when PDS is out of service.

Table 5: Device classification

3.2 Electrical data

Sine-wave EMC filter xxZ1I05-1001

The two x at the 1st and 2nd digit of the material number are representative for the corresponding size of the filter type.

Filter type		0D	0H	0L	0P	0S	0X	0Y
Rated connection cross-section supply cable	A / mm²	1,5	1,5	10	25	50	95	2x70
Connection cross section ++/--	A / mm²	0,5	0,5	1,5	4	4	10	25
Number of conductors		3Ph+PE						
Rated voltage	U_{N_ac} / V	3x400/480V						
Operating voltage range	U_{in_ac} / V	0...530						
Rated current (I_N at T_{a_max})	I_{in} / A	9,5	16,5	50	115	180	300	460
Maximum current ($T_{\_max}$ < 60s)	$I_{\_max}$ / A	16	26	75	175	280	460	710
Operating frequency range	f_S / Hz	0...100						
Drive controller switching frequency	f / kHz	8...16					4...16	
Maximum ambient temperature	$T_{\_max}$ / °C	45						
Weight	m / kg	8	13	16,5	46	52,5	117	143,5
Copper weight	m_{Cu} / kg	0,8	2,7	5,3	8,1	9,7	23	35
Inductance	L / mH	5,5	3,21	0,9	0,6	0,33	0,35	0,23
Capacity in star connection	C / µF	1	2	6	16	16	60	120
DC resistance	R / mΩ	340	89	34,5	12,2	5,11	3,75	2,18
Power dissipation (at I_N, f_N)	P_D / W	290	275	675	1120	1560	1560	2560
Fan current	I / A	—	0,4		3		7,2	
Fusing fan	I / A	—	1		2		3	

Table 6: Electrical data

3.2.1 Electrical equivalent circuit diagram

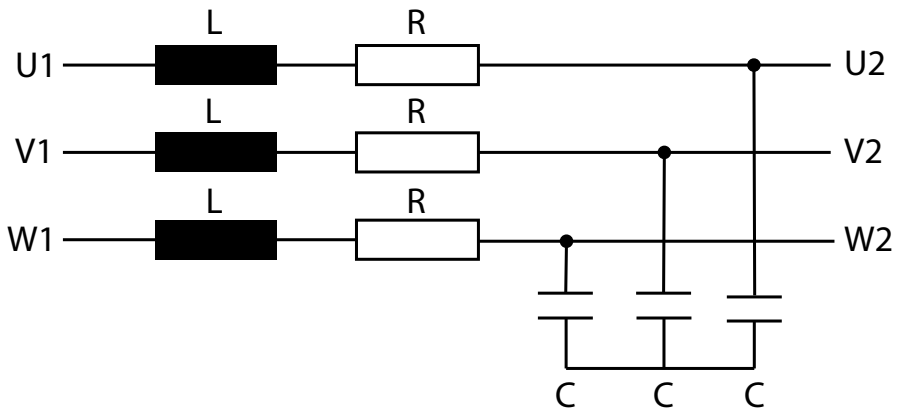
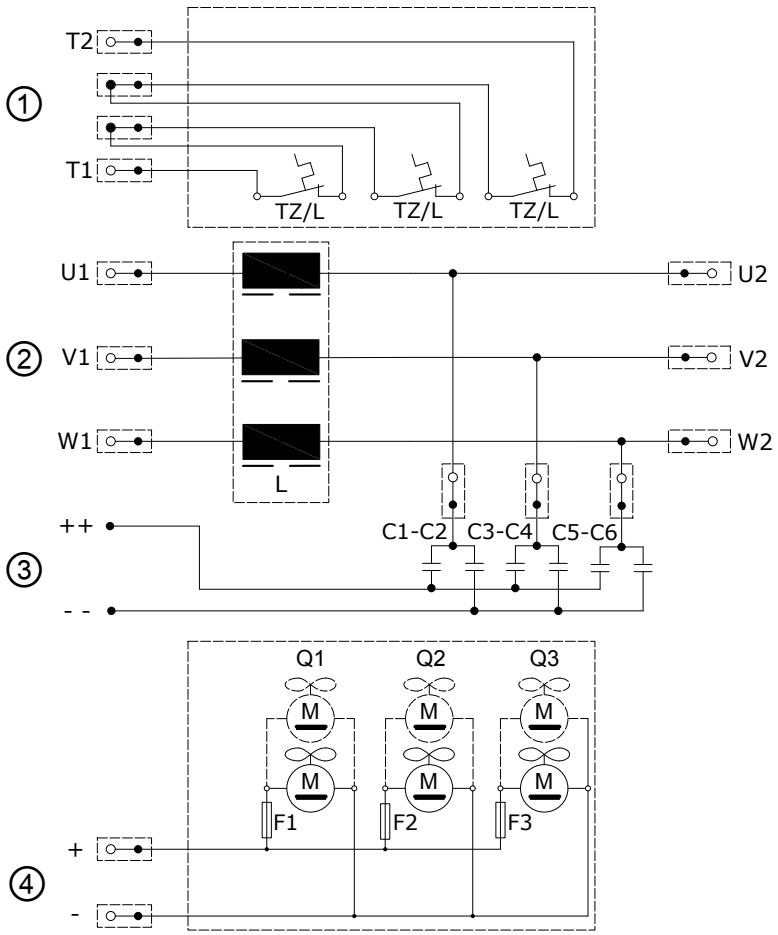


Figure 1: Electrical equivalent circuit diagram of the sine-wave EMC filters

4 Installation and connection

4.1 Schematic diagram



Legend	
①	Temperature monitoring
T1, T2	Temperature switch (NC contact)
TZ/L	Temperature switch
②	Main connections
U1, V1, W1	Connection drive controller
U2, V2, W2	Connection motor / mains
L	Choke
③	DC link
++, - -	DC link regeneration
C1...C6	Feedback capacitors to the DC link
④	External 24 V DC power supply
+, -	Fan power supply
Q1...Q3	Fan (not existing on all sizes)
F1...F3	Fan fuses

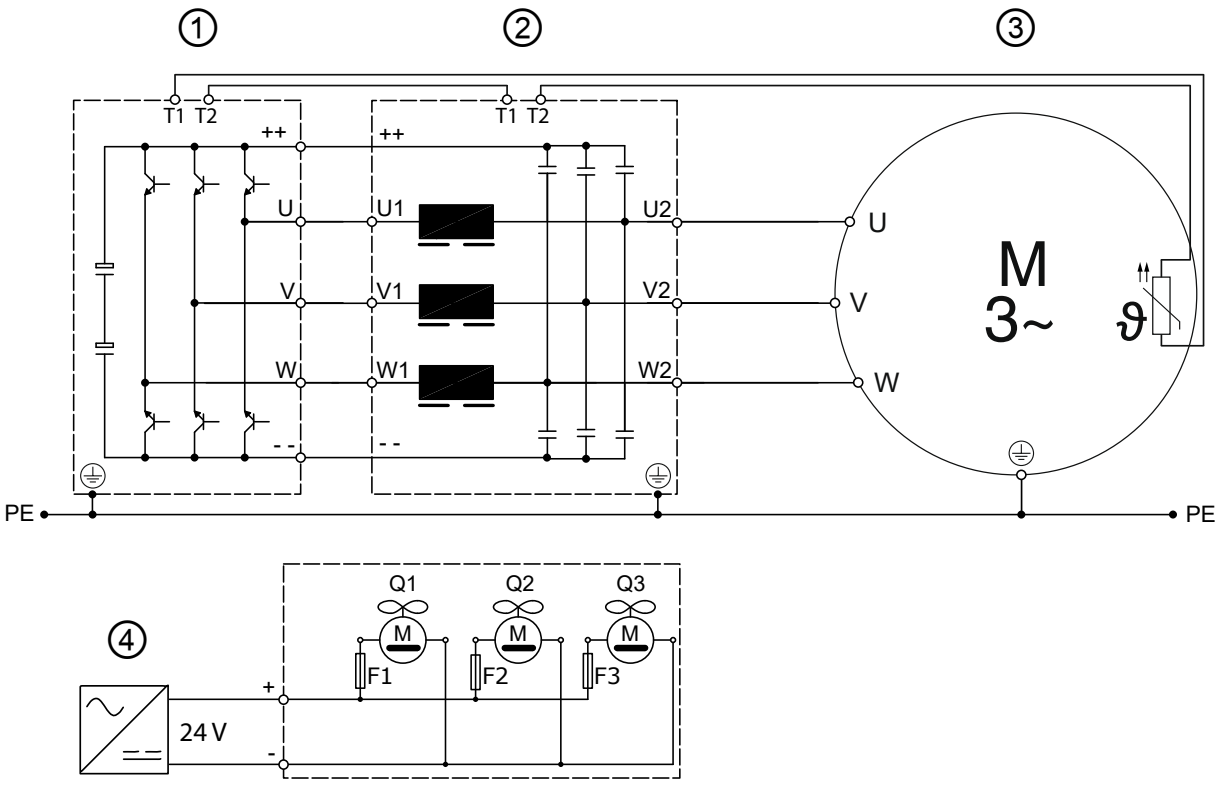
Figure 2: Schematic diagram

4.1.1 Motor operation

NOTICE

Measurement distortions and sooting of the contacts!

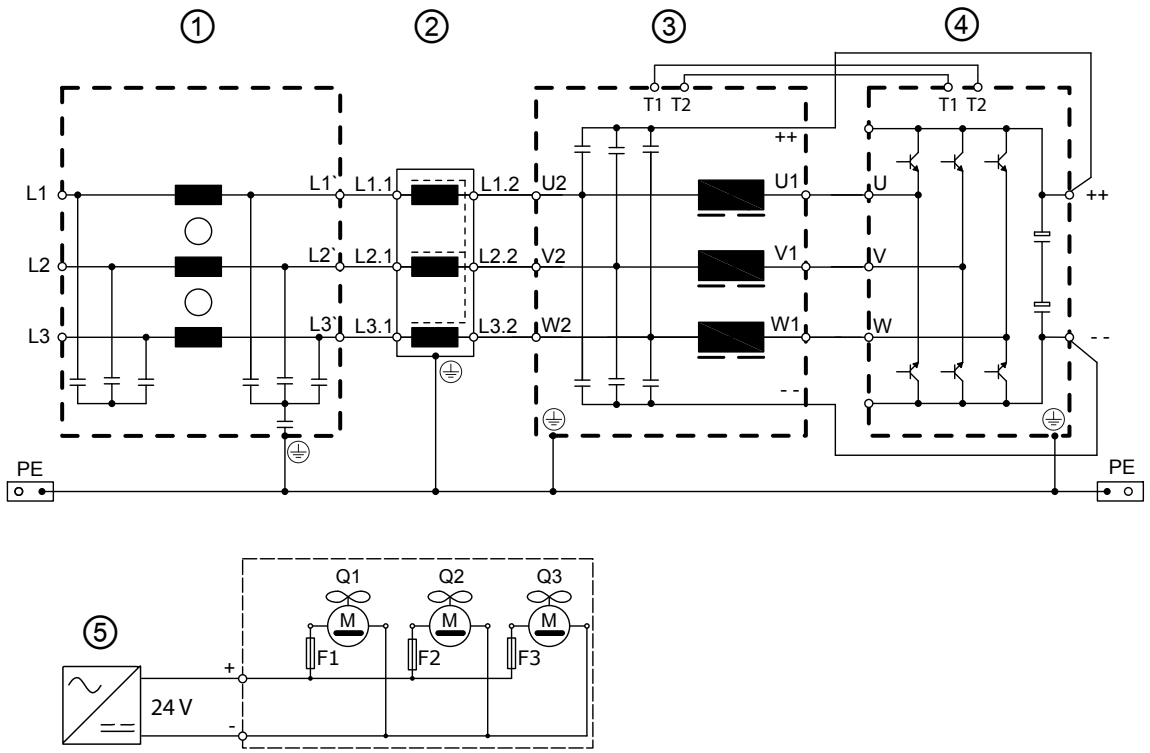
- ► For devices with PT100/ KTY or analogue signal evaluation, no temperature switches may be installed in the detection chain, as these can distort the signal and lead to incorrect measurements.
- ► A different protective measure must be used for appliances with a temperature switch.



Legend	
①	Drive controller
U, V, W	Output terminals of the drive controller
T1, T2	Connection terminals temperature monitoring
++, - -	Output terminals DC link
②	Sine-wave EMC filter
U1, V1, W1	Input terminals at the sine-wave EMC filter
U2, V2, W2	Output terminals at the sine-wave EMC filter / input terminals at the motor
T1, T2	Connection terminals temperature monitoring
++, - -	Output terminals DC link
③	Motor
U, V, W	Input terminals on the motor
④	External 24 V DC power supply
+, -	Input terminals power supply
Q1...Q3	Fan
F1...F3	Fan fuses
PE	Protective earth

Figure 3: Motor operation

4.1.2 AIC operation



Legend	
①	EMC filter
L1, L2, L3	Supply from the supply system
L1`, L2`, L3`	Output EMC filter
②	Mains choke
L1.1, L2.1, L3.1	Input mains choke
L1.2, L2.2, L3.2	Output mains choke
③	Sine-wave EMC filter
U2, V2, W2	Input sine-wave EMC filter
U1, V1, W1	Output sine-wave EMC filter
T1, T2	Connection terminals temperature monitoring
++, - -	DC link terminals
④	Active Infeed Converter (AIC)
U, V, W	Input Active Infeed Converter (AIC)
T1, T2	Connection terminals temperature monitoring
++, - -	DC link terminals
⑤	External 24 V DC power supply
+, -	Input terminals power supply
Q1...Q3	Fan
F1...F3	Fan fuses
PE	Protective earth

Figure 4: Complete circuitry with additional elements

4.1.2.1 Using the sine-wave filter in conjunction with AIC (Active Infeed Converter)

When using the sine filter in conjunction with AIC (Active Infeed Converter), the following items are required to set up a complete AIC filter:

Sine-wave EMC filter	Mains choke	EMC filter
0DZ1I05-1001	12Z1B04-1000	12E6T60-3000
0HZ1I05-1001	14Z1B04-1000	14E6T60-3000
0LZ1I05-1001	18Z1B04-1000	18E6T60-3000
0PZ1I05-1001	22Z1B04-1000	22E6T60-3000
0SZ1I05-1001	24Z1B04-1000	24E6T60-3000
0XZ1I05-1001	27Z1B04-1000	26U5A0U-3000
0YZ1I05-1001	29Z1B04-1000	30U5A0W-3000

Table 7: Installation of a complete AIC filter

4.2 Connection temperature measurement and fan

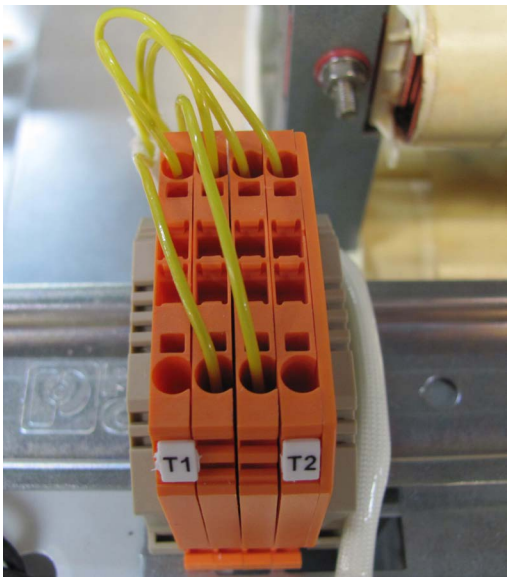


Figure 5: Connection principle filter type 0D

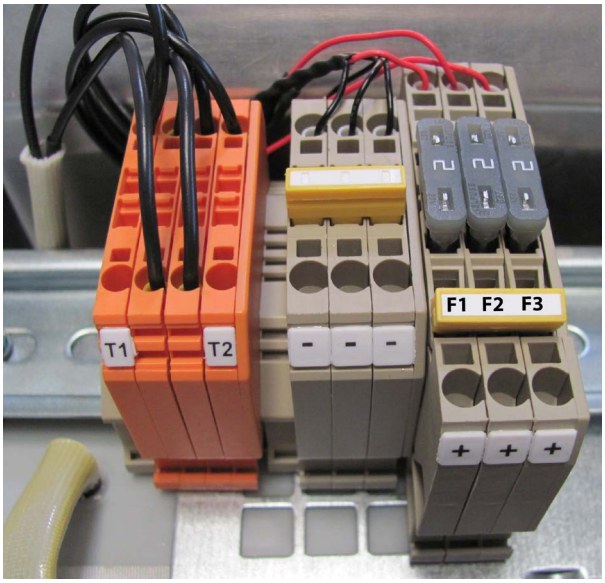


Figure 6: Connection principle filter types 0H...0Y

Legend	
T1, T2	Temperature switch (NC contact)
+, -	24 V fan power supply
F1...F3	Flat fuses

4.2.1 Rated data of the integrated fans

Description	Data
Connection terminals	+, -
Rated DC voltage	24 V
Permissible DC voltage range	18 V...27.6 V
Rated current	0H, 0L: 3 x 0.13 A = 0.4 A 0P, 0S: 6 x 0.5 A = 3 A 0X, 0Y: 6 x 1.2 A = 7.2 A
Fuses F1...F3	Flat fuse ATC 32 V Company Bussmann 0H, 0L: ATC1 (1.0 A) 0P, 0S: ATC2 (2.0 A) 0X, 0Y: ATC3 (3.0 A)
Colour code fuse	Grey
Table 8: Voltage supply of the integrated fans	

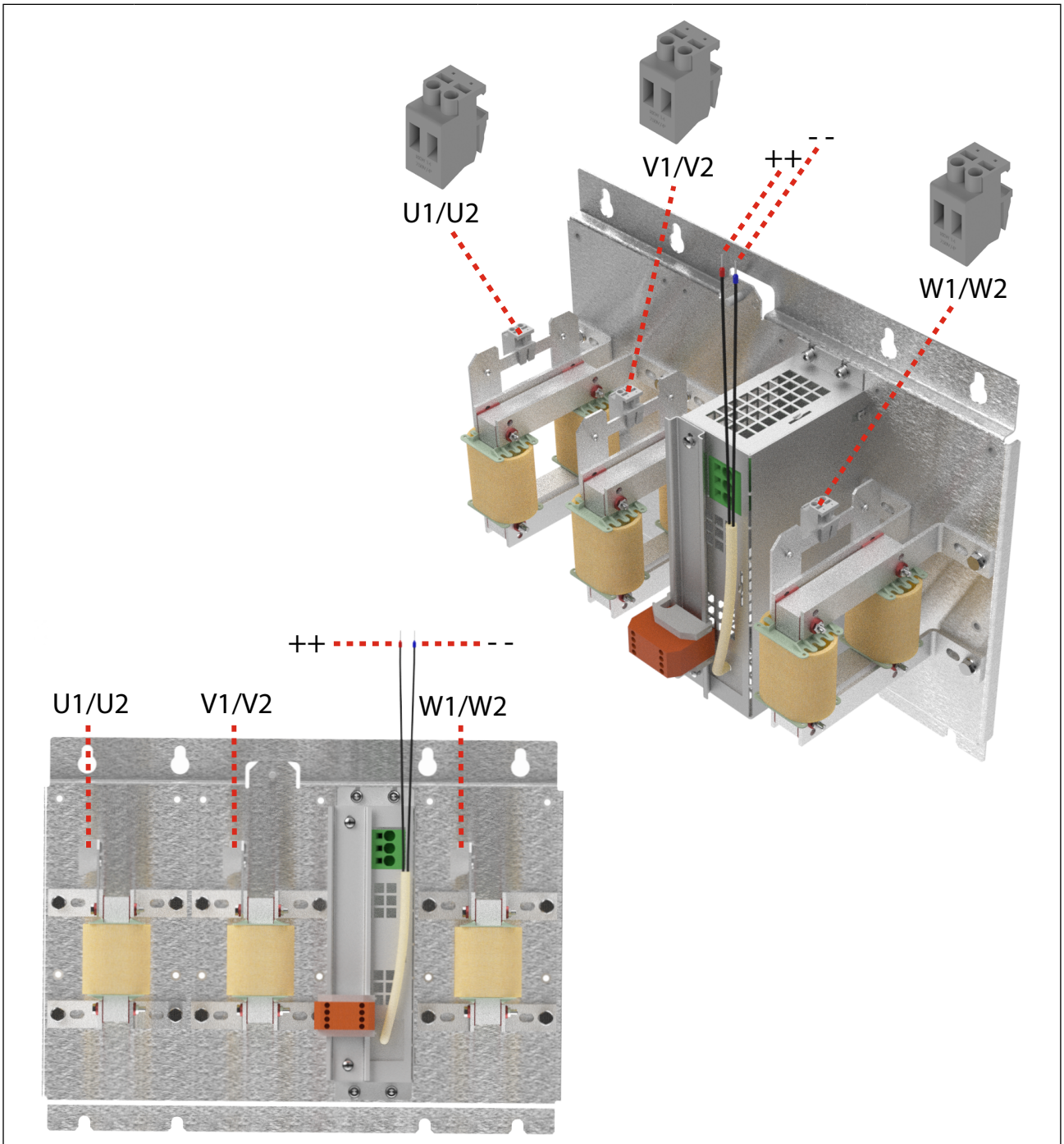
4.2.2 Overtemperature shutdown

The chokes are equipped with temperature switches in order to protect the system against inadmissible overtemperatures. These must be interconnected with the input terminals T1/T2 of the AIC drive controller.Rated data NC contact temperature monitoring.

Description	Data
Tripping temperature	155 °C
AC cos φ = 1.0	2.5 A / 250 V
AC cos φ = 0.6	1.6 A / 250 V
DC ohmic	1.6 A / 24 V
DC ohmic	1.25 A / 48 V
Table 9: Rated data NC contact	

4.3 Connection power terminals

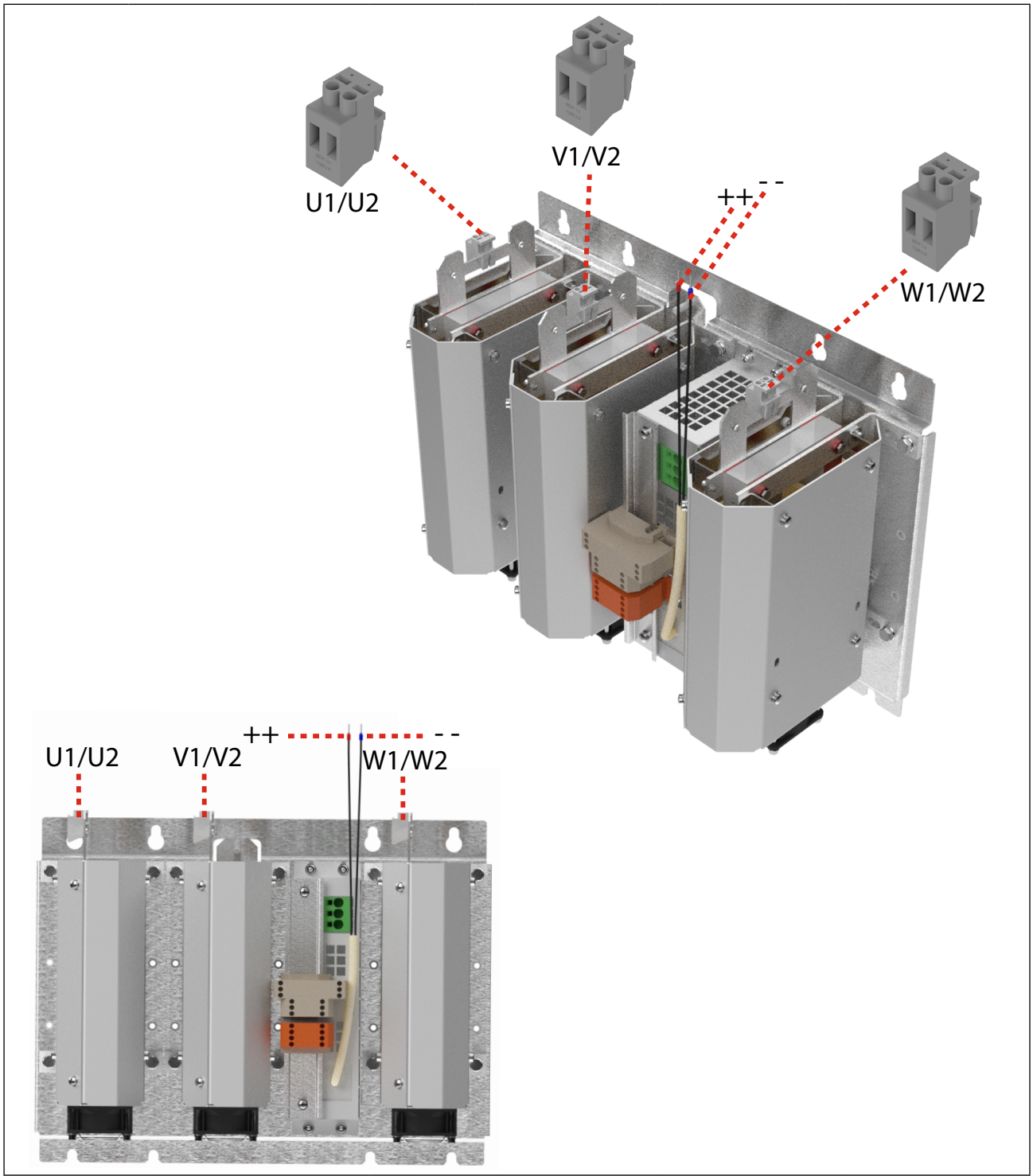
4.3.1 Filter type 0D



Filter type	Connection		U1 / U2	V1 / V2	W1 / W2
0D	Cable cross-section	*A* / mm²	1,5...4		
	Tightening torque	*M* / Nm	0,5...1,0		

Figure 7: Filter type 0D

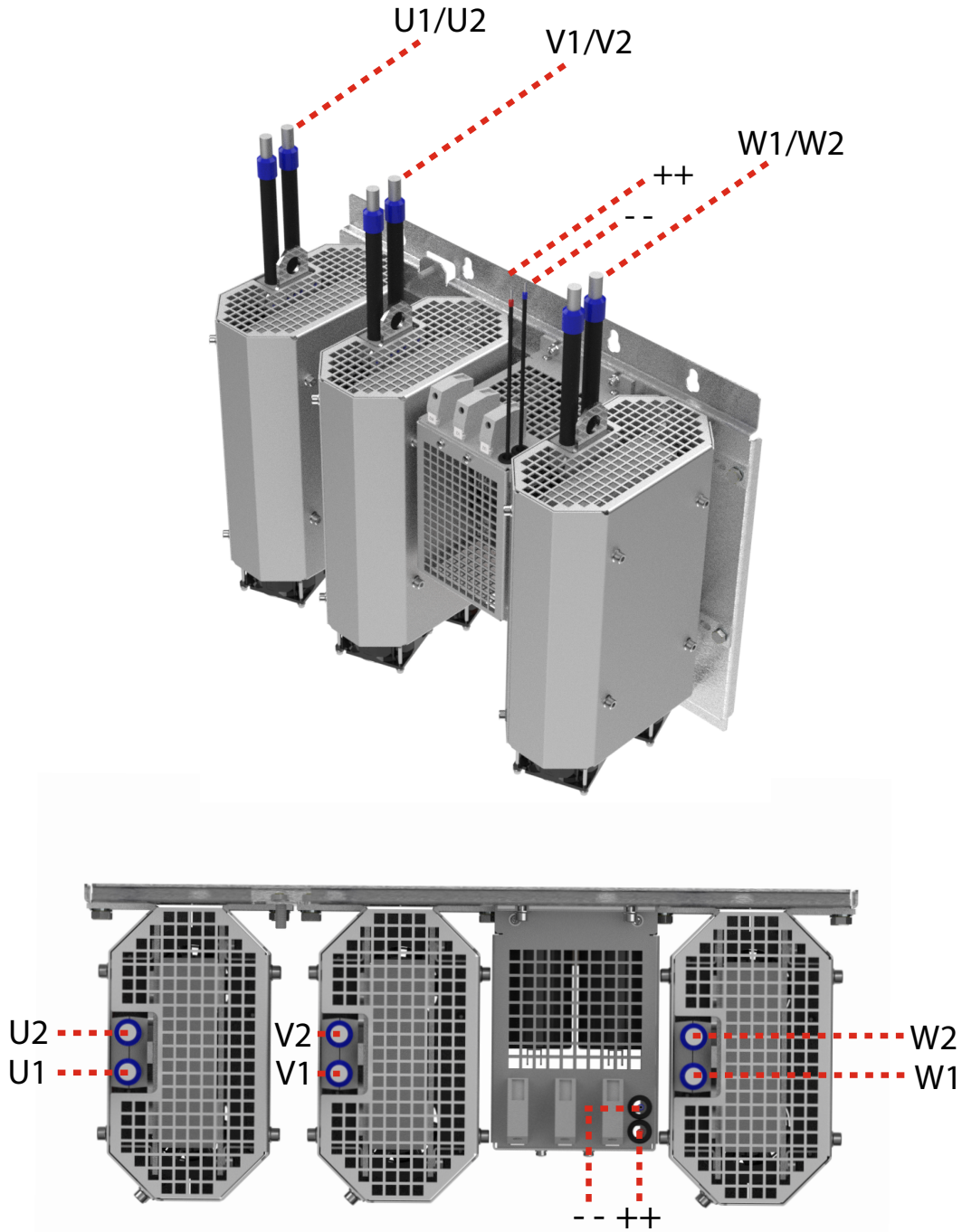
4.3.2 Filter type 0H and 0L



Filter type	Connection		U1/U2	V1/V2	W1/W2
0H	Cable cross-section	*A* / mm²	1,5...4		
	Tightening torque	*M* / Nm	0,5...1,0		
0L	Cable cross-section	*A* / mm²	2,5...16		
	Tightening torque	*M* / Nm	0,5...2,5		

Figure 8: Filter type 0H and 0L

4.3.3 Filter type 0P, 0S and 0X

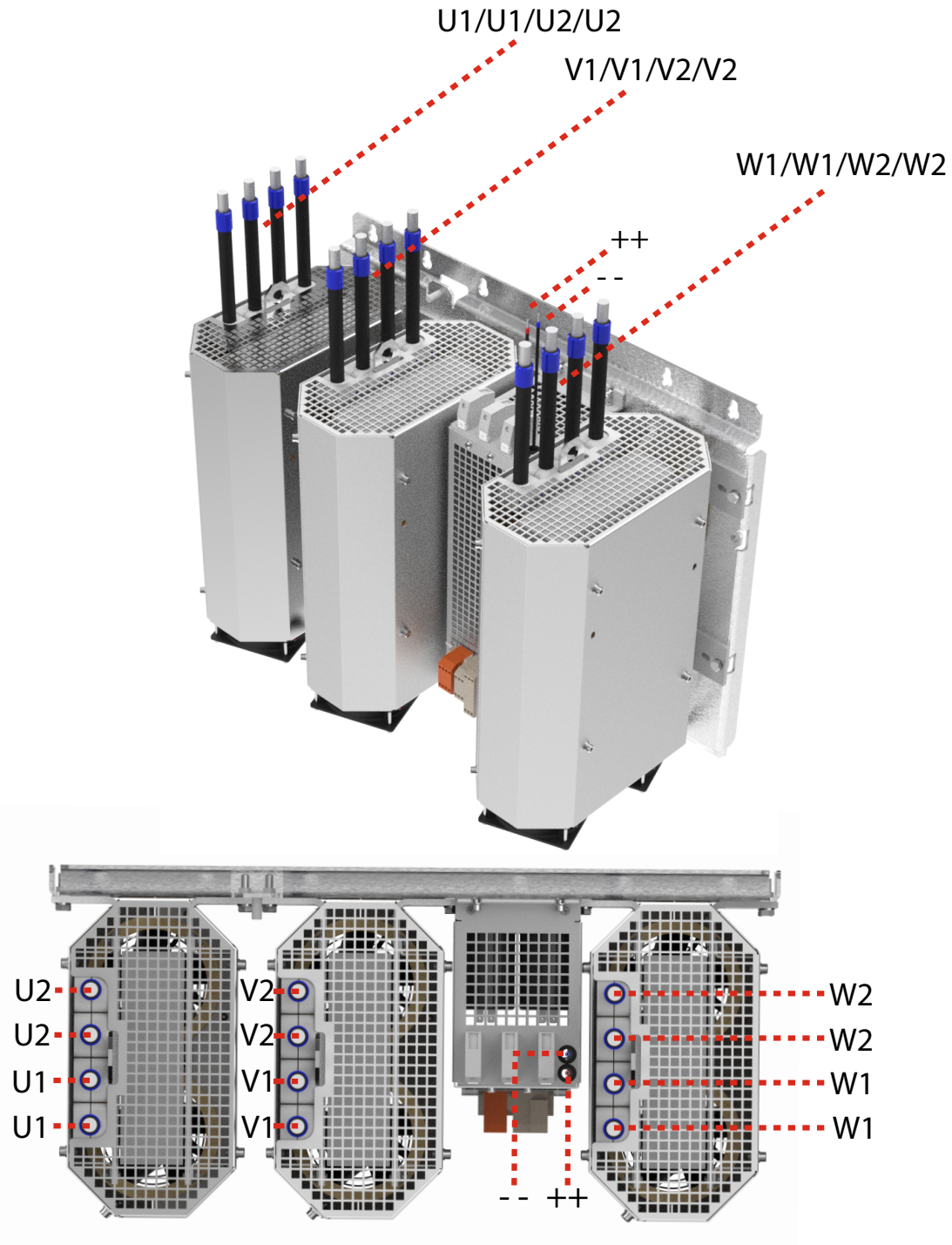


Filter type	Used wire-end ferrules
0P	A25 - 16
0S	A50 - 20
0X	A95 - 25

Figure 9: Filter type 0P, 0S and 0X

If necessary, the user is free to exchange the wire-end ferrules against ring crimp connectors. => *„Alternative connection option“*

4.3.4 Filter type 0Y



Filter type	Used wire-end ferrules
0Y	2 x A70 - 25

Figure 10: Filter type 0Y

If necessary, the user is free to exchange the wire-end ferrules against ring crimp connectors. => *„Alternative connection option“*

4.3.4.1 Alternative connection option

The user is free to exchange the wire-end ferrules against ring crimp connectors. In this case, the end of the ferrule corresponds to the centre of the opening in the ring crimp connector.

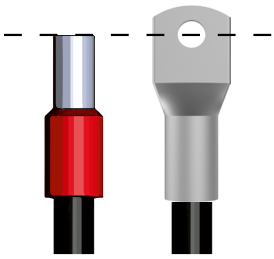


Figure 11: Alternative connection option

NOTICE

Wrong intersection point on the cable!

Connection problems due to too short cable!

► Cut off the wire-end ferrule between the metal and plastic sleeves.

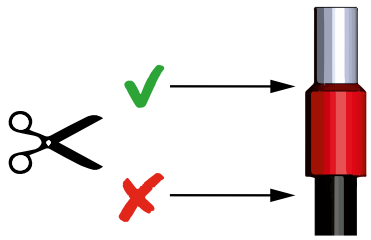


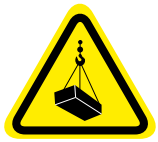
Figure 12: Cutting off the wire-end ferrule

4.4 Transport

The filter types 0P, 0S, 0X and 0Y are delivered with lifting eyes. These serve to accommodate corresponding lifting devices for the transport.

⚠ WARNING

Wrong chain angle damages the lifting eyes!



- ► Maintain a chain angle of max. 60°.
- ► Always attach to two lifting eyes simultaneously.
- ► Do not place the filter on the fans.
- ► Do not stand under the floating filter during transport.

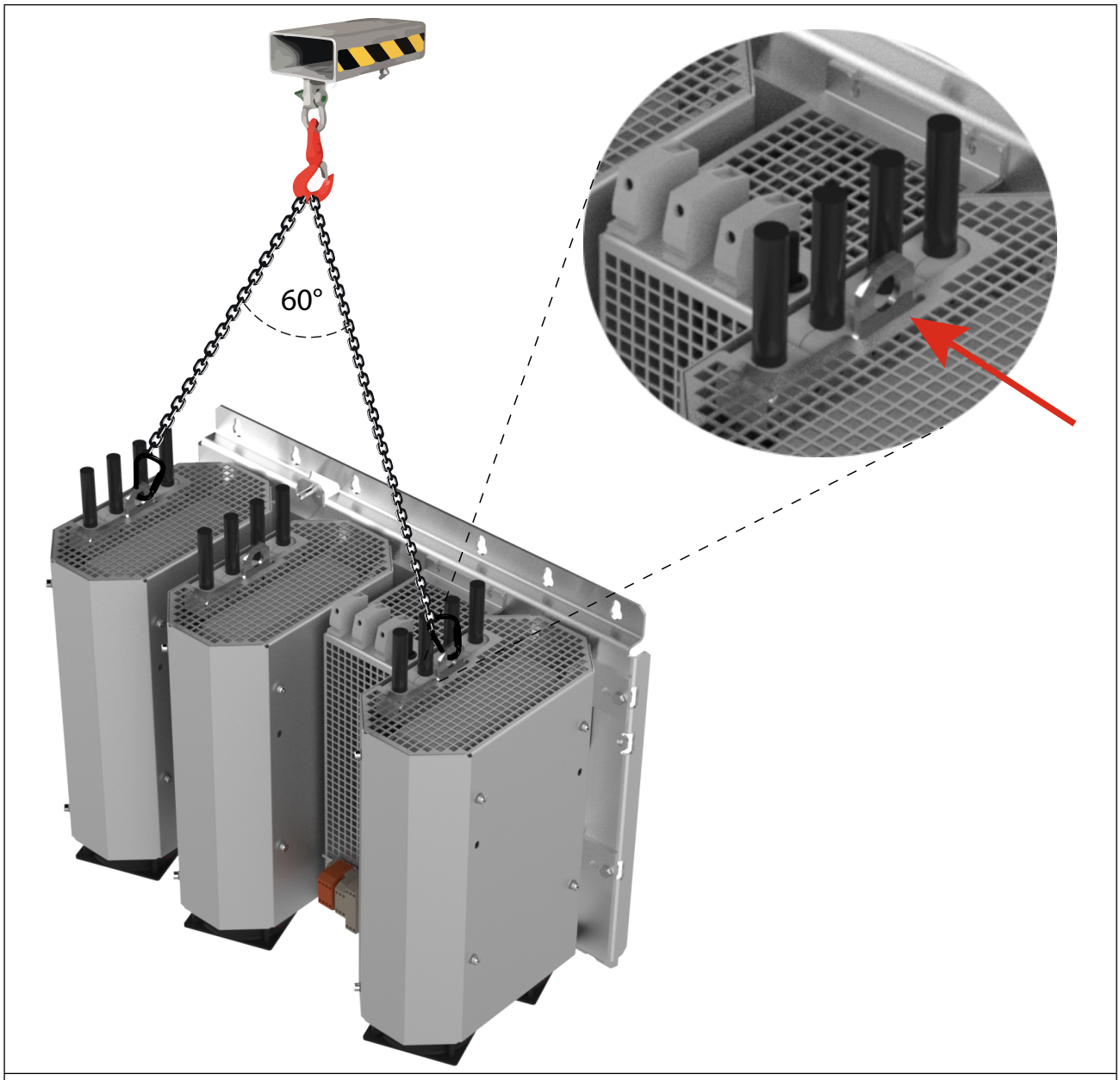


Figure 13: Transport

4.5 Mechanical construction

NOTICE

Observe the cable length!

- ► The maximum permissible cable length between filter and drive controller is 1.5 m.
- ► For filters that are already delivered with cable, the cable may be shortened as required, but not extended.

4.5.1 Dimensions filter type 0D

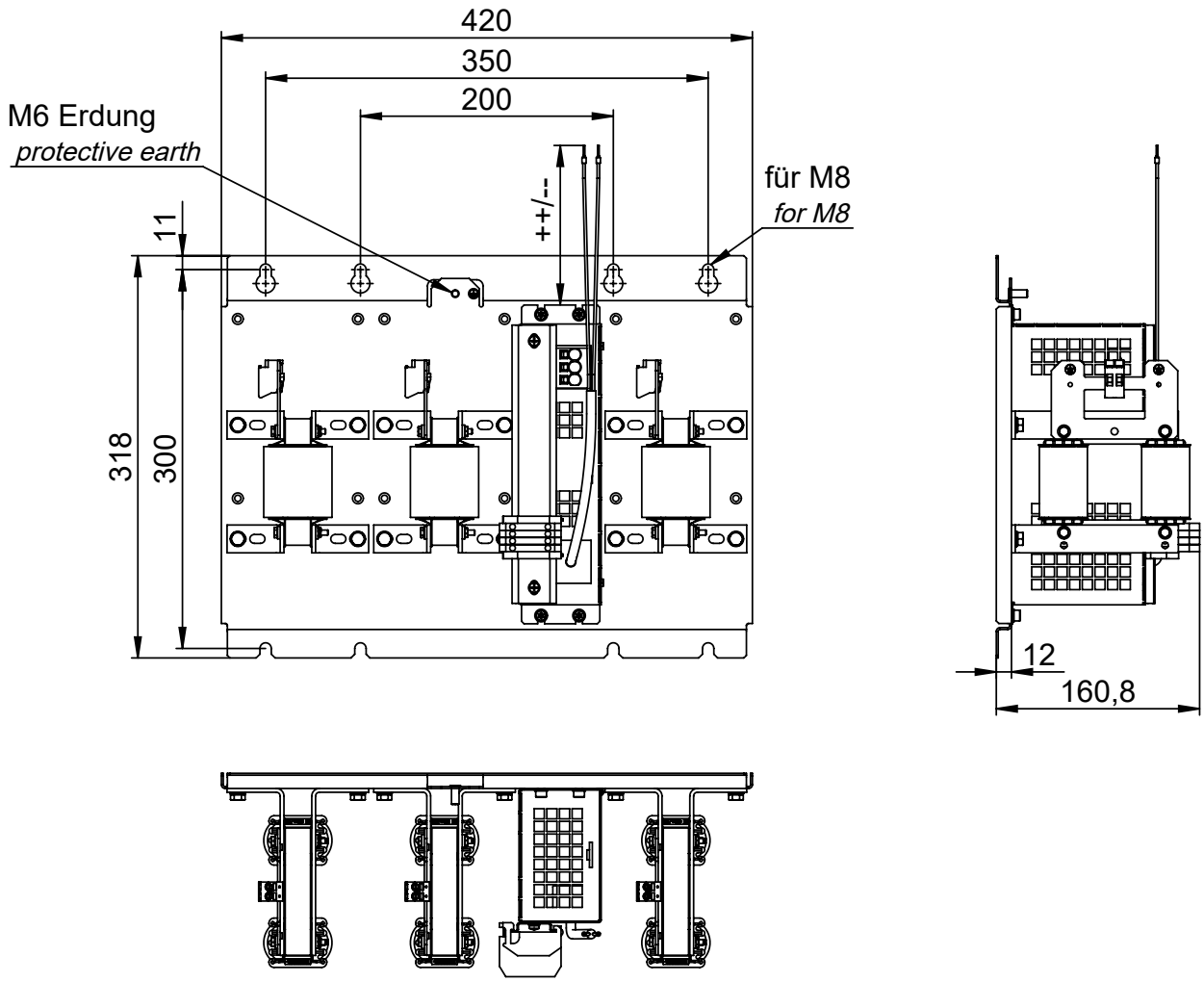


Figure 14: Dimensions filter type 0D

Connection cable	Standard	
	Length in m	Connection
++/--	1,5	Wire-end ferrule

Table 10: Length of the connection cables filter type 0D

4.5.2 Dimensions filter type 0H and 0L

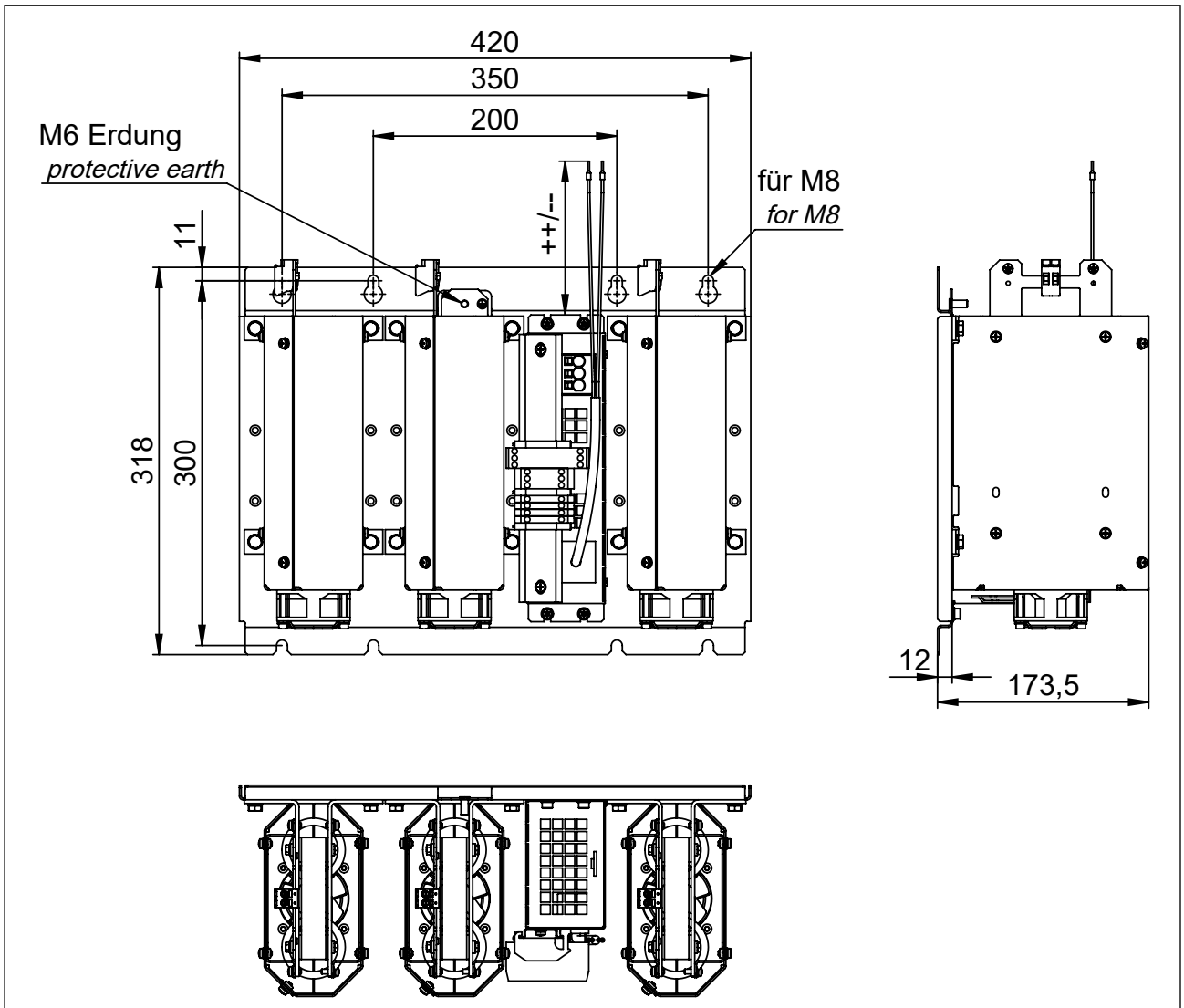


Figure 15: Dimensions filter type 0H and 0L

Connection cable	Standard	
	Length in m	Connection
++/--	1,5	Wire-end ferrule

Table 11: Length of the connection cables filter type 0H and 0L

4.5.3 Dimensions filter type 0P and 0S

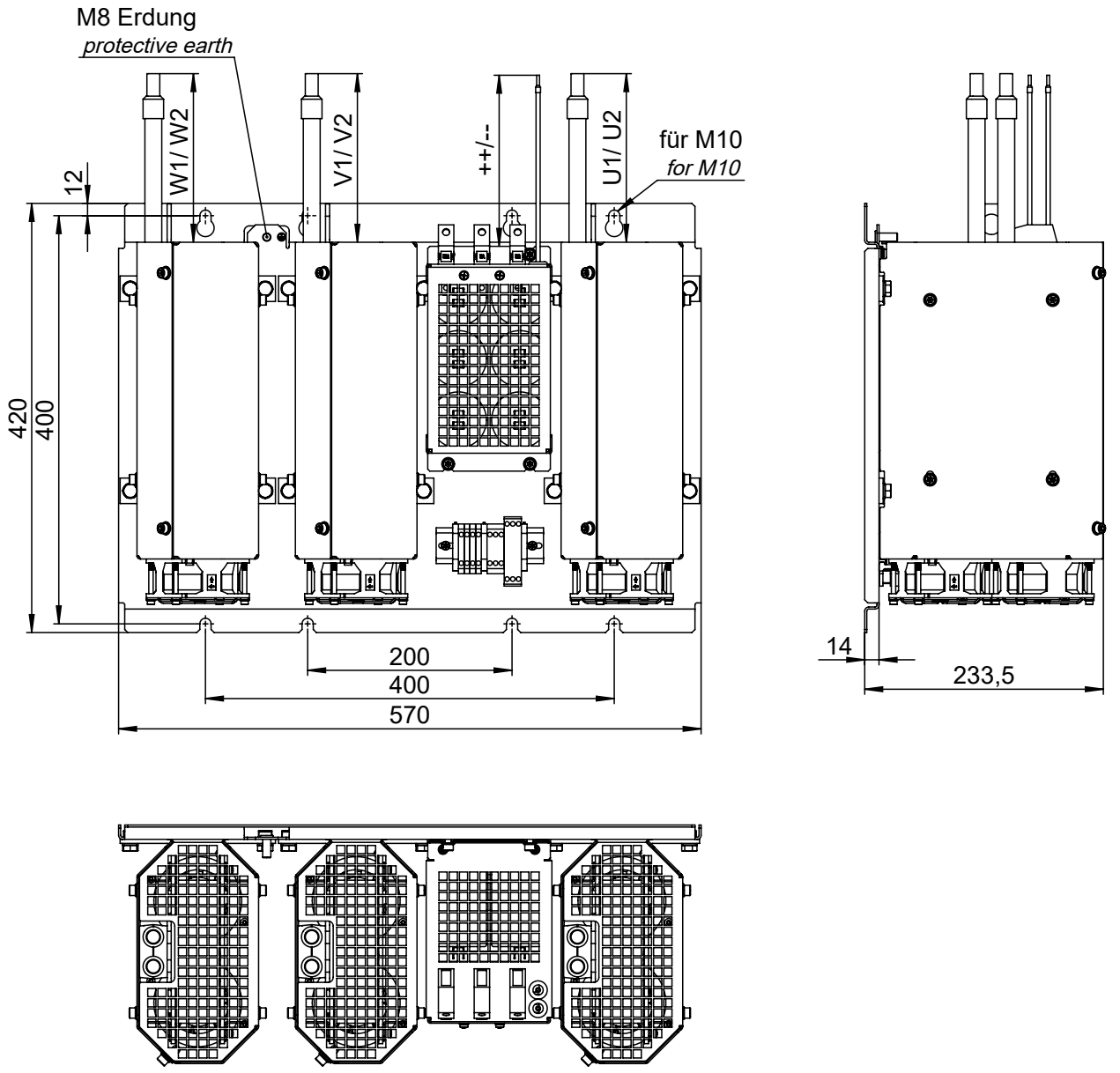


Figure 16: Dimensions filter type 0P and 0S

Connection cable	Standard	
	Length in m	Connection
U1	1,5	Wire-end ferrule
U2		
V1		
V2		
W1		
W2		
++/--		

Table 12: Length of the connection cables filter type 0P and 0S

4.5.4 Dimensions filter type 0X and 0Y

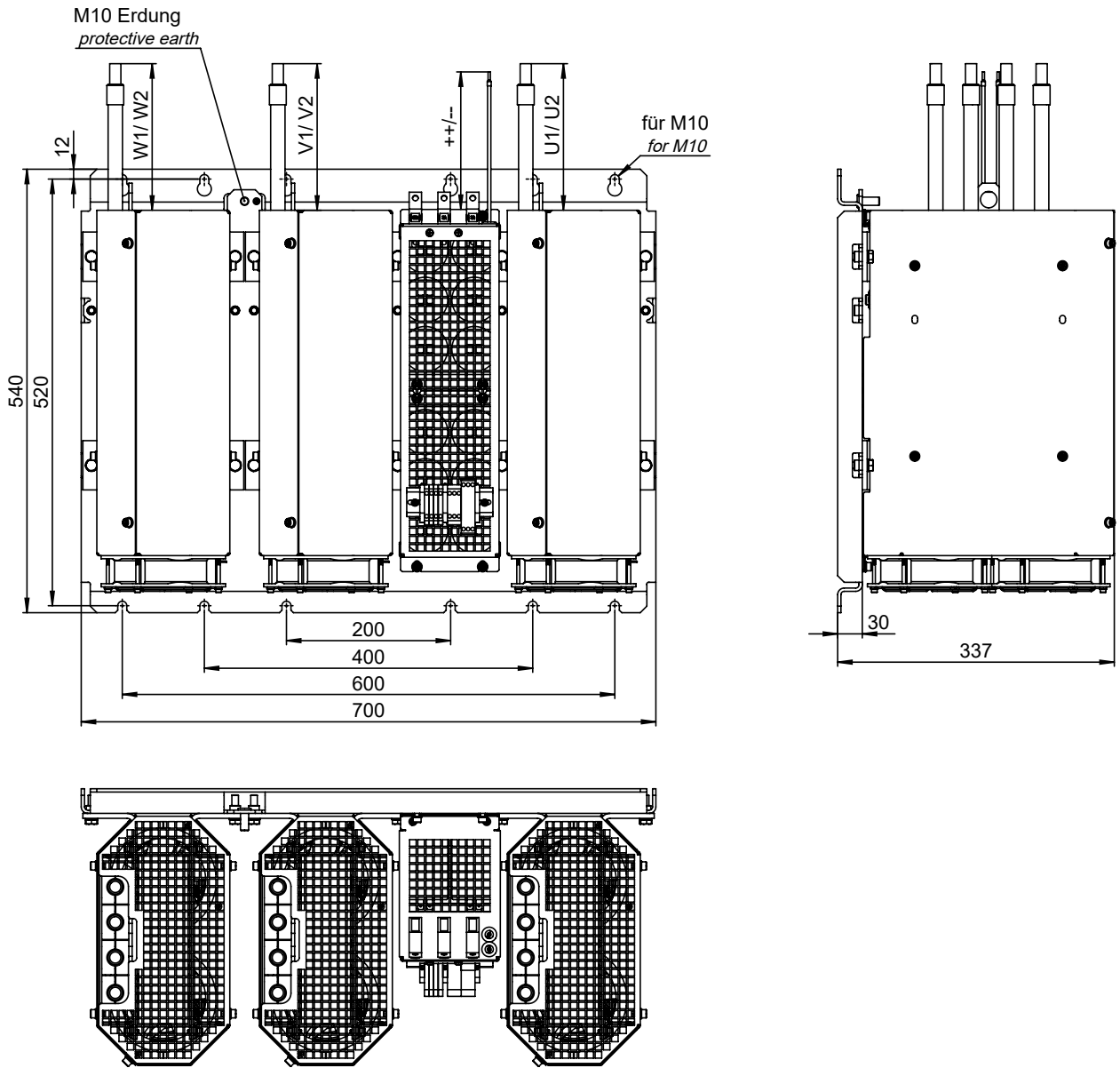


Figure 17: Dimensions filter type 0X and 0Y

Connection cable	Standard	
	Length in m	Connection
U1	1,5	Wire-end ferrule
U2		
V1		
V2		
W1		
W2		
++/--		

Table 13: Length of the connection cables filter type 0X and 0Y

4.6 Control cabinet installation

NOTICE

Observe mounting orientation!

- ► The sine-wave filters must always be mounted hanging with the ventilation grilles downwards and the cable versions upwards in the control cabinet.
- ► In case of another installation method, please contact KEB.

4.6.1 Installation distances of the sine-wave EMC filters

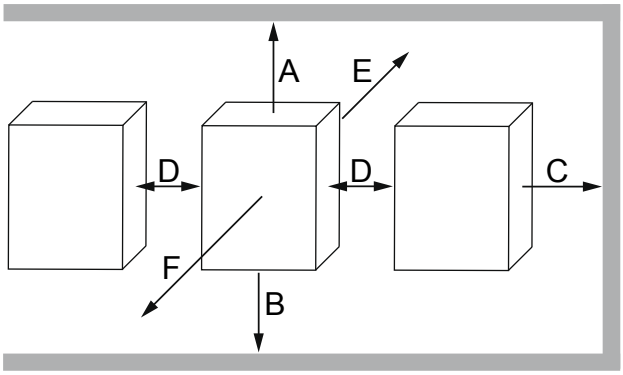
Installation distances	Dimen-sion	Distance in mm	Distance in inch
	A	150	6
	B	100	4
	C	0	0
	D	0	0
	F [1)]	20	1
	[1)] Distance to upstream operating elements in the control cabinet door.		

Figure 18: Installation distances of the sine-wave EMC filters

4.6.1.1 Mounting instructions for control cabinet installation

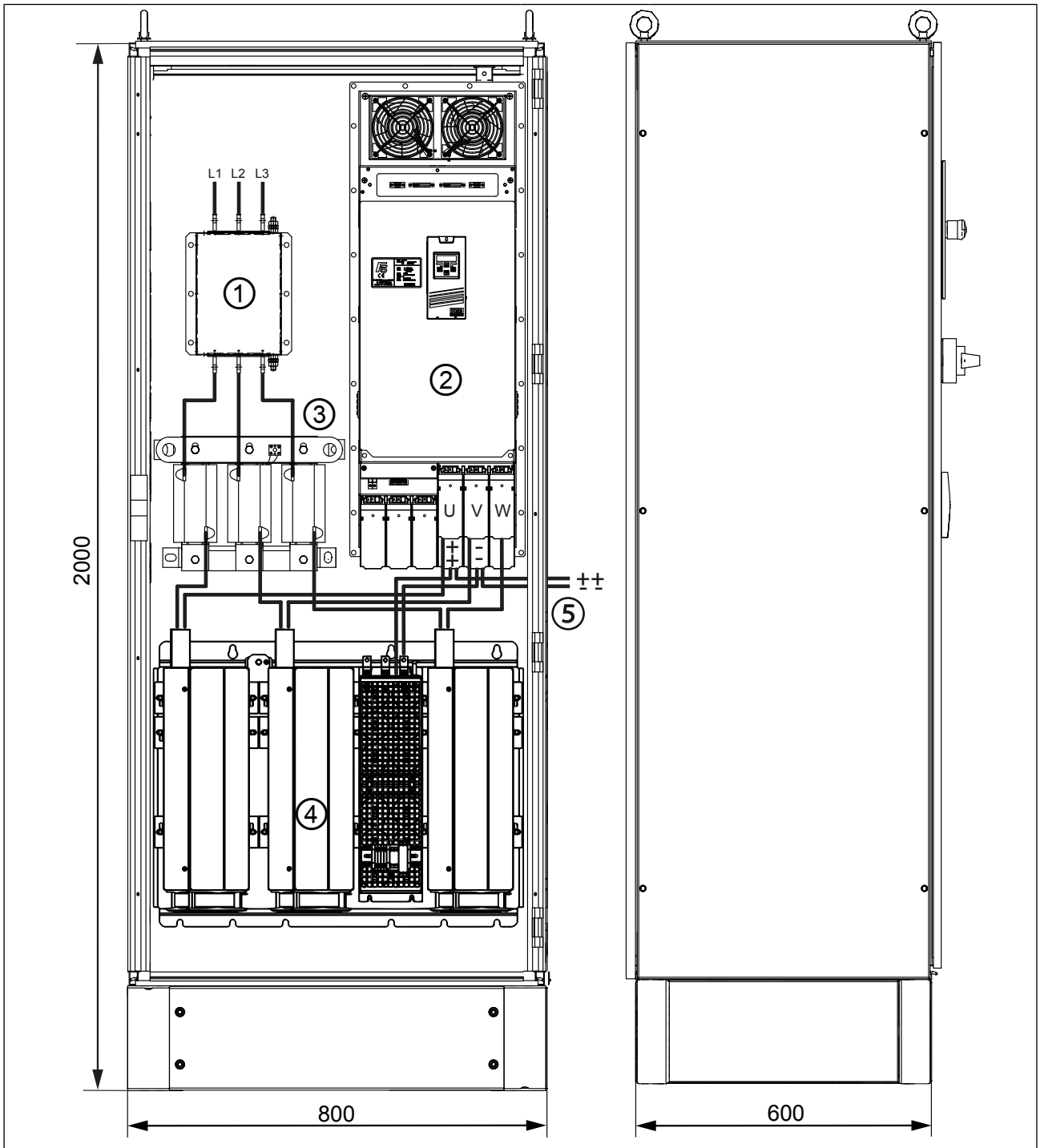
For mounting the sine-wave EMC filters, the following mounting materials with the appropriate quality must be used.

Filter type 0D, 0H and 0L	**Tightening torque**
Socket screw with hexagon socket *ISO 4762*- M8 - 8.8	6.0 Nm 53 lb inch
Filter type 0P, 0S, 0X and 0Y	**Tightening torque**
Socket screw with hexagon socket *ISO 4762- M10 - 8.8*	10.0 Nm 88.5 lb inch

Table 14: Mounting instructions for control cabinet installation

4.6.2 EMC conform installation in the control cabinet

EMC conform installation in a Rittal TS8 control cabinet through the example of filter type 0Y.



Legend			
①	HF filter	④	Sine-wave EMC filter
②	Drive controller	⑤	External DC bus connection
③	Mains choke		

Figure 19: EMC conform installation in the control cabinet

4.7 Fan replacement

If the fan is defective, it can be replaced.
The following figure shows how to change the fan.

The following must be observed:

① The arrows on the fan for the correct direction of the air flow.

② The correct wiring of the 24 V DC voltage supply at the terminals +/-.

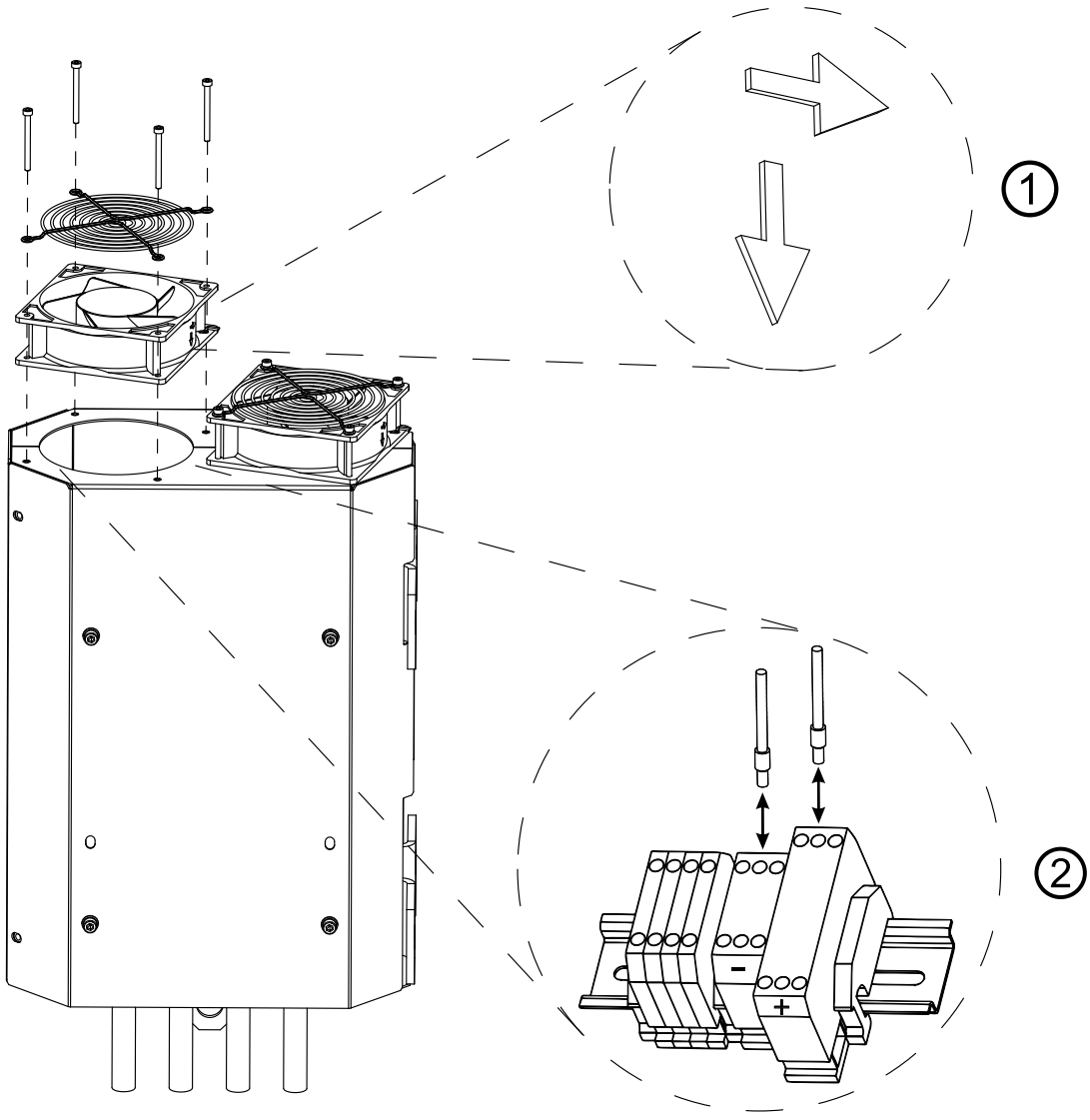


Figure 20: Fan replacement

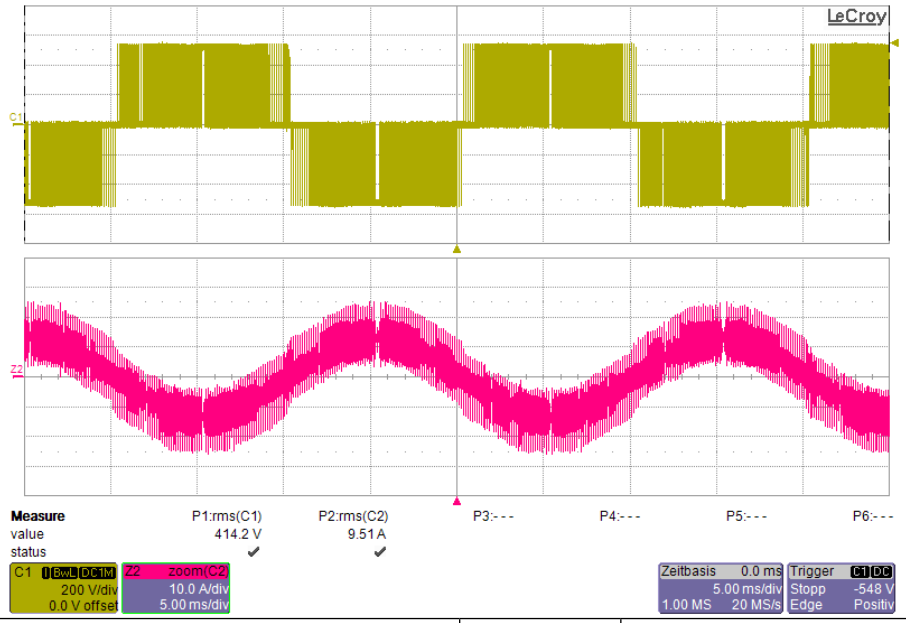
Filter type	Part number fan	Required quantity
0D	No fan	—
0H, 0L	0090990-9092	3
0P, 0S	0090990-9113	6
0X, 0Y	0090990-9089	6

Table 15: Part numbers of the fans

5 Mode of action sine-wave EMC filter

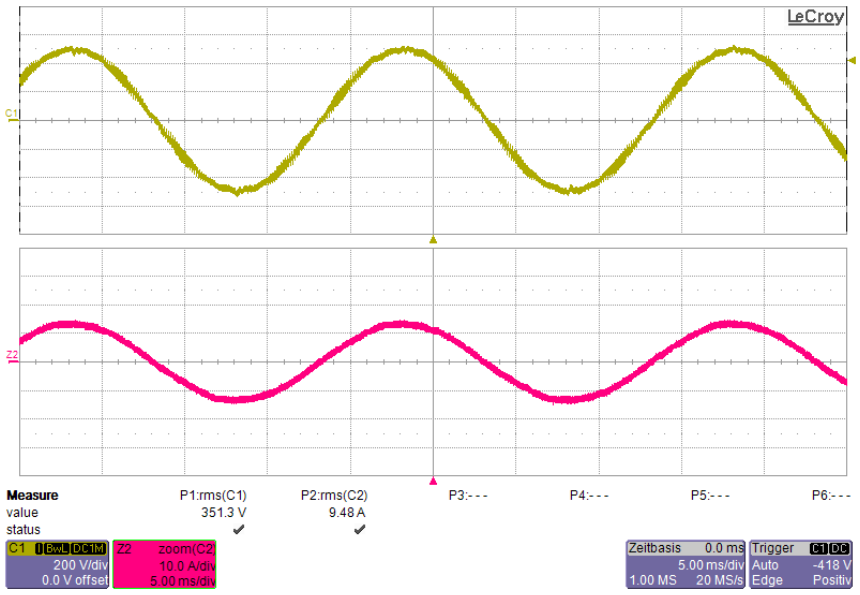
5.1 Sine-wave EMC filter in motor operation

5.1.1 Mode of action sine-wave EMC filter



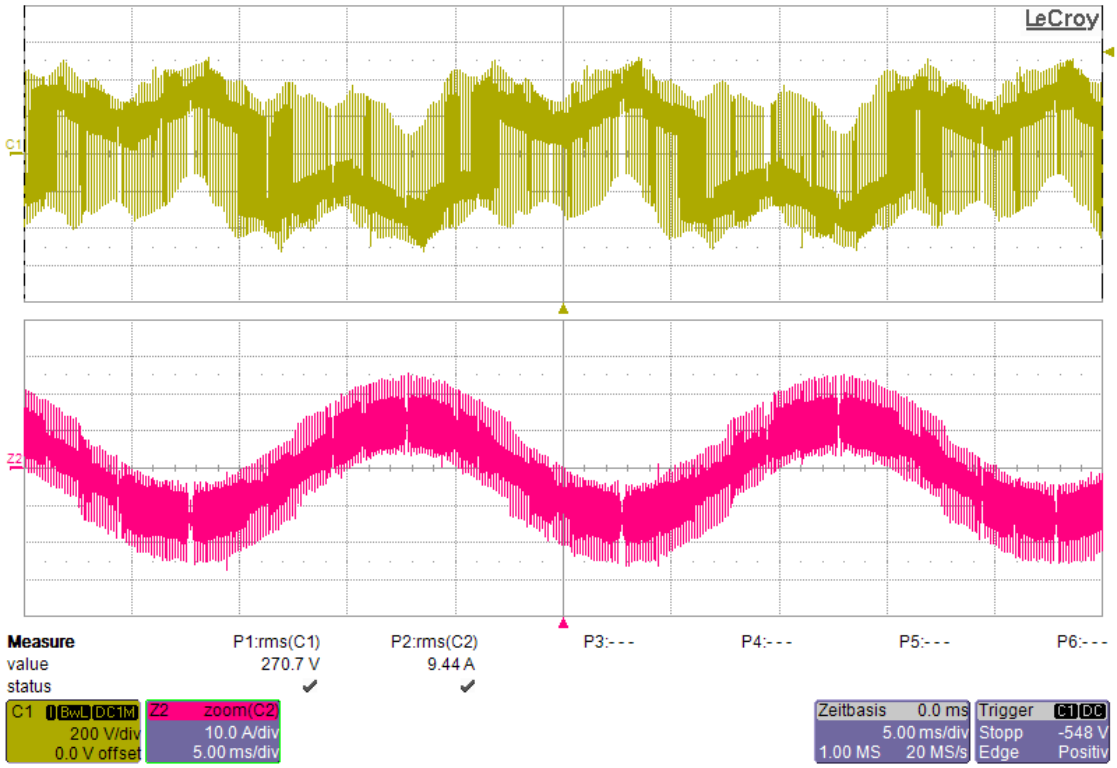
	Voltage Ph-Ph at drive controller output		Current Ph-Ph at drive controller output

Figure 21: Voltage/current at the drive controller output



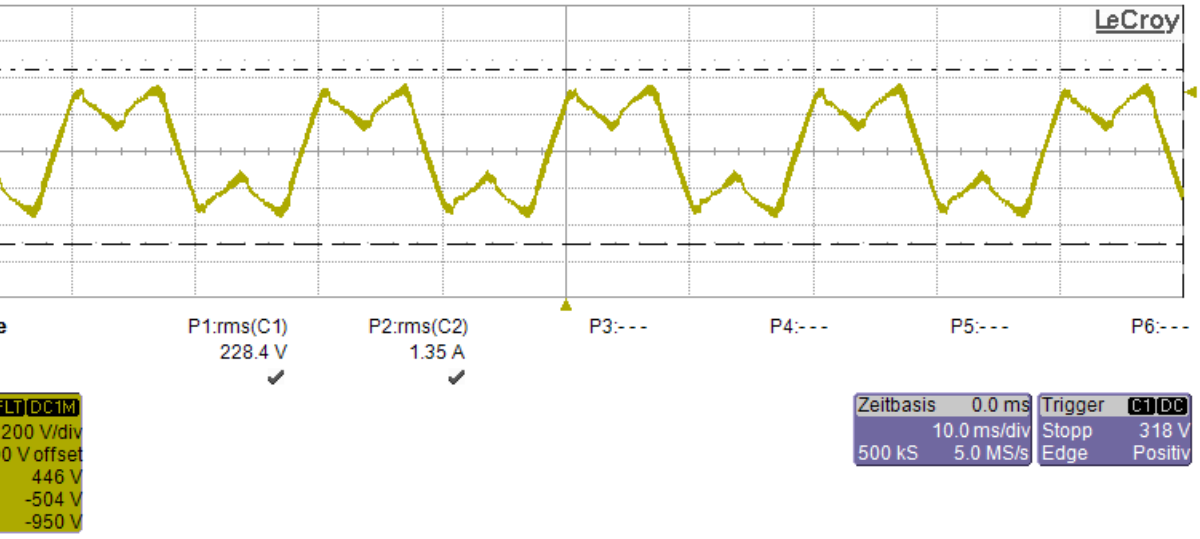
	Voltage Ph-Ph with sine-wave EMC filter		Current Ph-Ph with sine-wave EMC filter

Figure 22: Voltage/current with sine-wave EMC filter



	Voltage against PE		Phase current

Figure 23: Voltage U against PE and phase current at the drive controller

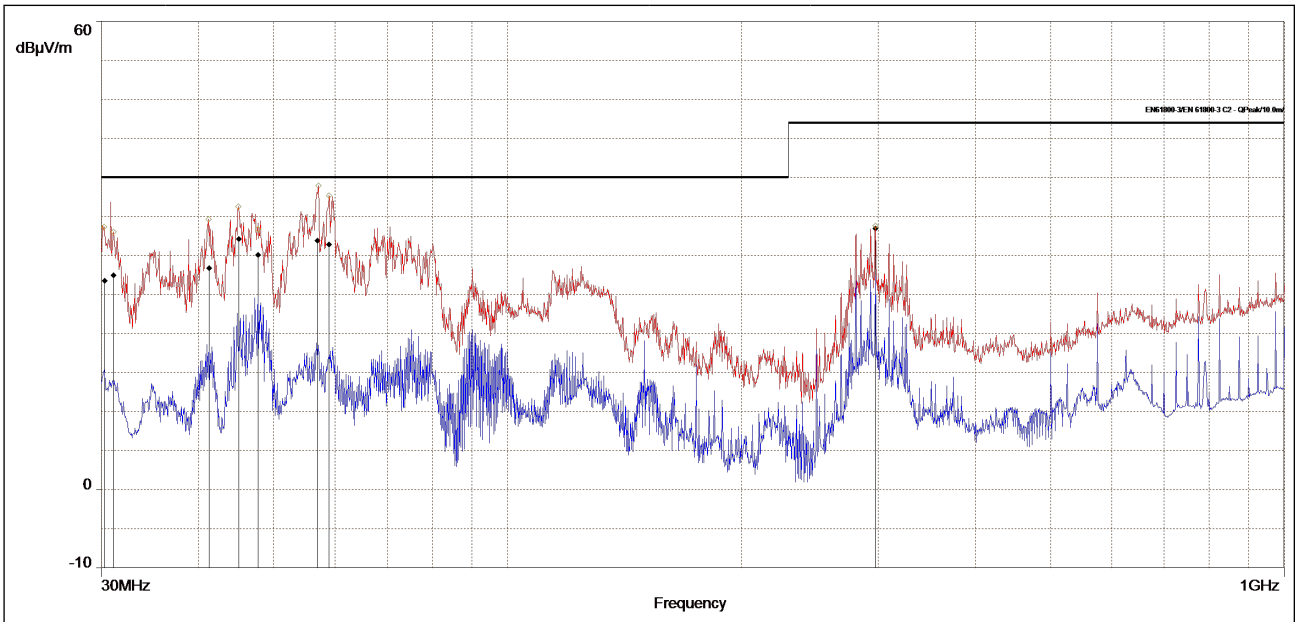


	Voltage against PE with sine-wave EMC filter

Figure 24: Voltage U against PE with sine-wave EMC filter

At the output phases against earth, no purely sinusoidal voltage is generated. The third harmonic of the output frequency for voltage rise is contained in the output signal of the drive controller.

5.1.2 Measurement of the emitted interference with unshielded motor cable



	Peak		Average
	Quasi Peak		Quasi Peak upper limit

Figure 25: Measurement of the emitted interference with unshielded motor cable

NOTICE

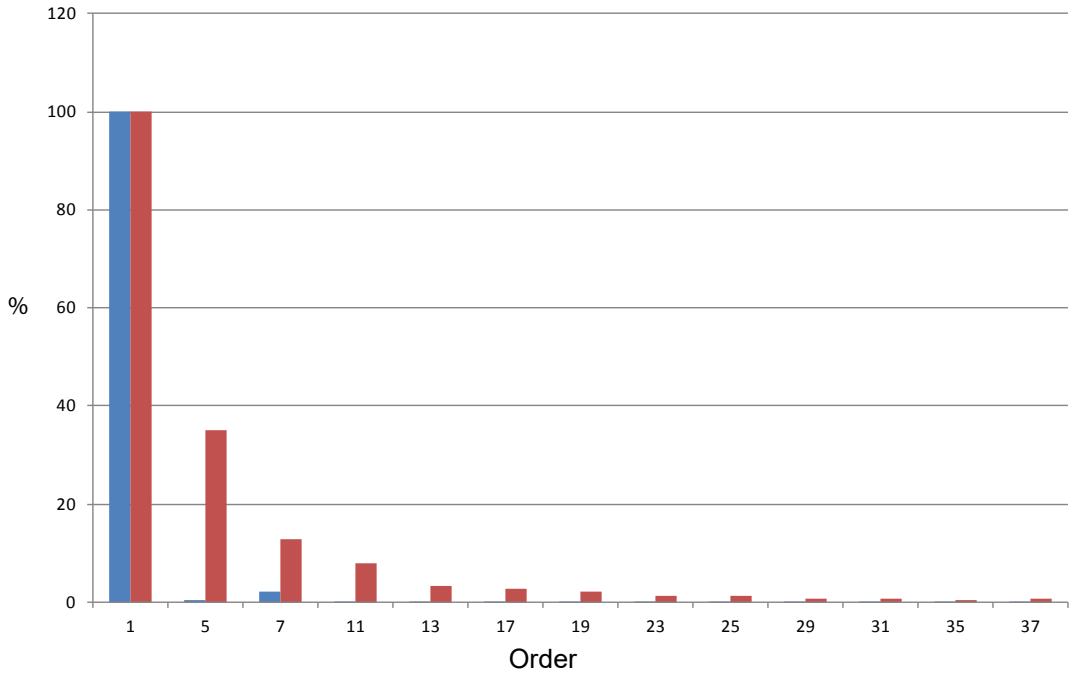
Pay attention to distances when laying the cables!

- ► An unshielded motor cable can be used, when using a sine-wave EMC filter.
- ► A distance of 20 cm between the motor line to mains, bus and control lines must be maintained.

5.2 Active Infeed Converter operation

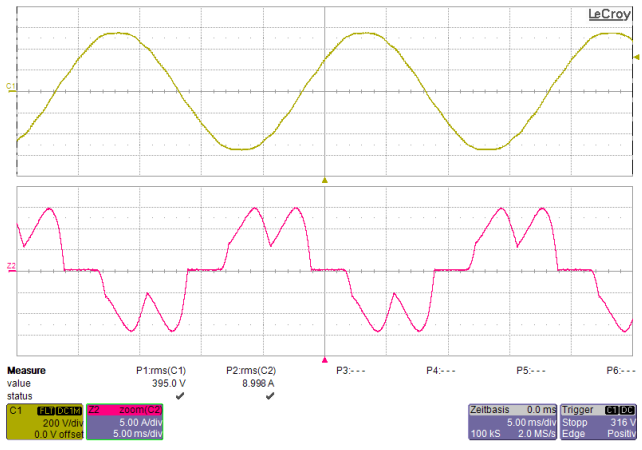
5.2.1 Comparison of mains harmonics

Comparison of mains harmonics from a drive controller with B6 rectification and 4 % U_k choke to an Active Infeed Converter (AIC) with sine-wave EMC filter.



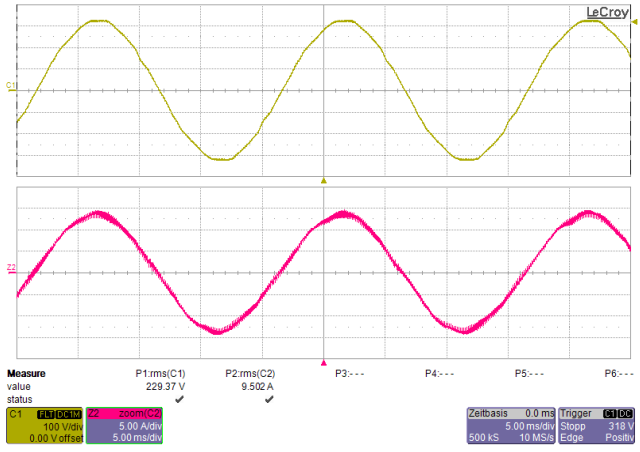
	AIC + sine-wave EMC filter		B6 with 4% U_k choke

Figure 26: Comparison of mains harmonics in % with the same motor power



	Voltage Ph-Ph against earth
	Phase current

Figure 27: Drive controller with B6 rectifier and 4% uk choke



	Voltage Ph-Ph against earth
	Phase current

Figure 28: Active Infeed Converter

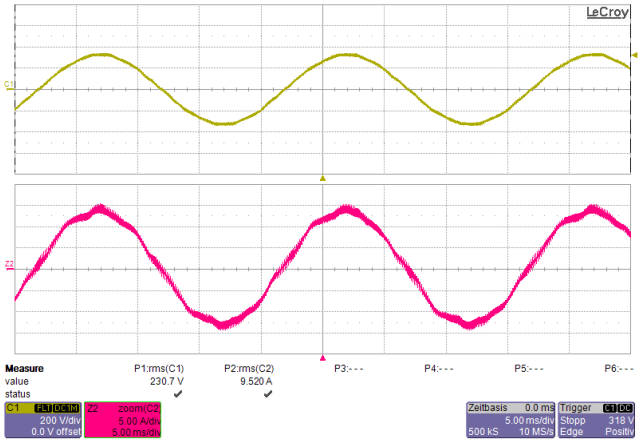
5.2.2 Mode of action sine-wave EMC filter in AIC

The mains current of the choke solution (=> *Figure 29*) hardly differs from the sine-wave EMC filter solution (=> *Figure 30*), while the voltage quality "DC link + and - against earth" is much better with the sine-wave EMC solution. By reducing the switching-frequency voltage components (=> *Figure 31*) the DC bus can be connected with unshielded cables. Earth currents are massively reduced with the sine EMC solution (=> *Figure 32*).

When operating an AIC with sine-wave EMC filter, the DC output can be equipped with a DC HF filter for interference suppression.

Drive controllers connected to the DC bus can be equipped with DC HF filters. As a consequence, all drives are "HF-technical" decoupled from each other, such as an AC supply. Interferences between AIC and drive controller are therefore eliminated.

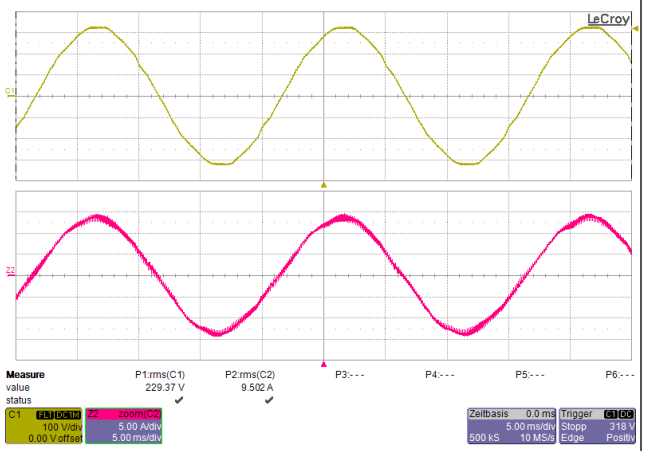
AIC with 7.2 % U_k choke filtering



	Mains voltage Ph-Ph against earth
	Phase current

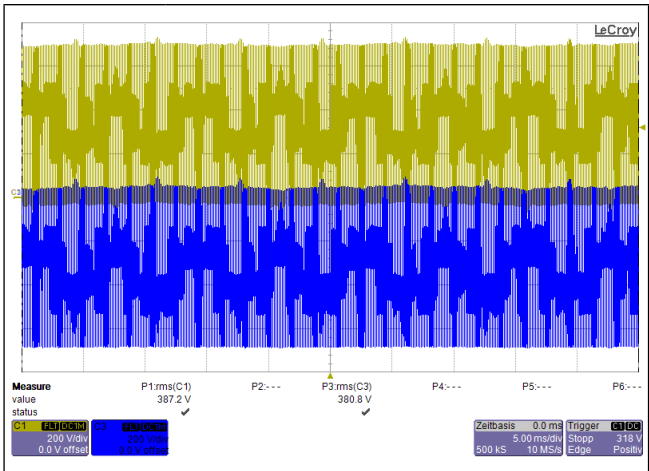
Figure 29: AIC with choke filtering Ph against PE

AIC with sine-wave EMC filter



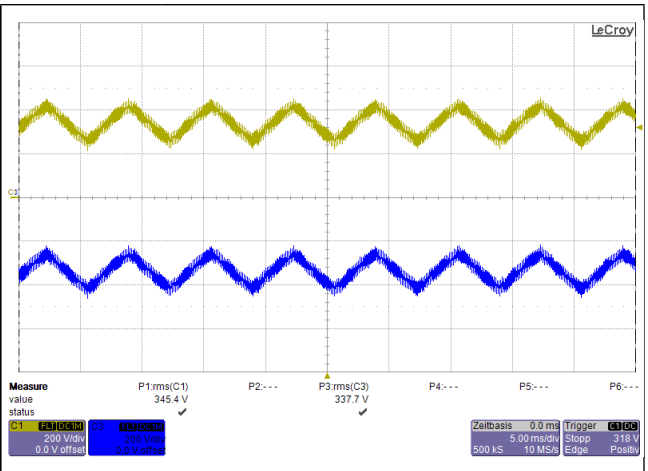
	Mains voltage Ph-Ph against earth
	Phase current

Figure 30: AIC with sine-wave EMC filter Ph against PE



	DC link + against earth
	DC link - against earth

Figure 31: AIC choke filtering UK against PE



	DC link + against earth
	DC link - against earth

Figure 32: AIC with sine-wave EMC filter UK against PE

6 Certifications

6.1 CE Marking

CE marked sine-wave filter - EMC were developed and manufactured to comply with the regulations of the Low-Voltage Directive. The harmonized standards *DIN EN 61558-1* and *DIN EN 61558-2-20* as well as *EN 61800-5-1* are applied as base.

7 Revision history

Version	Date	Description
00	2017-06	Completion pre-series
01	2017-11	Change of title picture, insert operating conditions, extension technical data
02	2020-01	Insertion of new figures, adaptation of drawings, editorial revisions
03	2023-04	Revision of images and dimension drawings, editorial changes
04	2024-12	Inserting cable cross-sections and torques

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