



HEIDENHAIN



Inverter Systems for HEIDENHAIN Controls

Information for the Machine Tool Builder

April 2011

HEIDENHAIN Inverter Systems

The inverter systems from HEIDENHAIN are suitable for HEIDENHAIN controls with digital speed control. They are designed for operating the synchronous and asynchronous motors from HEIDENHAIN.



MC 6241, CC 6106
with modular inverter

System tests

Controls, inverters, motors and encoders from HEIDENHAIN are usually integrated as components in larger systems. In these cases, comprehensive tests of the complete system are required, irrespective of the specifications of the individual devices.

Expendable parts

In particular the following parts in inverters from HEIDENHAIN are subject to wear:

- Fans

Standards

Standards (ISO, EN, etc.) apply only where explicitly stated in the catalog.

Contents

	Page
Inverter Systems	4
Overview	7
Compact Inverters	8
Modular Inverters	15
Accessories for Inverter Systems	20
Ribbon Cables and Covers	26
Multi-Row Configuration	30
Overview of Cables for Inverters	33
Dimensions	34
Subject Index	55

This catalog supersedes all previous editions, which thereby become invalid.

Subject to change without notice

HEIDENHAIN Inverter Systems

HEIDENHAIN inverter systems are designed for use with QSY synchronous motors and QAN asynchronous motors from HEIDENHAIN. The inverter systems are available with power ratings of 10 kW to 125 kW. They can be supplied as compact inverters or in modular versions as regenerative or nonregenerative systems.

Regenerative inverters

With **regenerative inverters**, the braking energy of the motors is fed back into the power supply. Regenerative systems need additional components, such as **line filters** and **commutating reactors** (see *Accessories for Inverter Systems*).

Nonregenerative inverters

With **nonregenerative inverters**, the braking energy of the motors is converted to heat. This requires a **braking resistor** (see *Accessories for Inverter Systems*).

Power supply

The inverter systems are designed for connection to a TN public power grid with a voltage of 3AC 400 V; 50 to 60 Hz ($\pm 10\%$). Other public grids or other line voltages must be adapted over a transformer.

DC-link voltage

Both inverter systems use a rectifier bridge circuit to convert the line power DC-link voltage and other auxiliary voltages for the electronics of the power modules, the controller unit, and the main computer. The rectified and—for regenerative systems—controlled DC-link voltage is conducted through IGBTs to the motors under frequency and voltage control. Control is by PWM signals.

The DC-link voltage is DC 565 V for nonregenerative systems and DC 650 V for regenerative systems.

Safety functions

In the event of an emergency stop, HEIDENHAIN inverter systems make it possible to shut down the motors centrally over special inputs for deleting the pulse release for PWM control of the IGBTs. The controller unit controls the emergency-stop braking until standstill.

If required, however, drive groups can be formed in order to switch them off separately (e.g. axes for the tool magazine). On controls without functional safety, the axes are then switched off through an **axis-release module**.

Functional safety (FS)

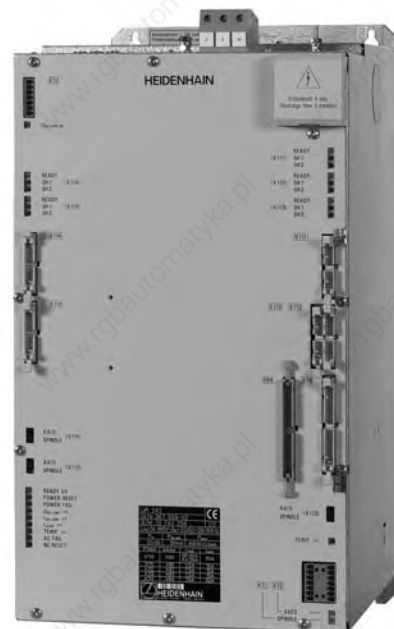
HEIDENHAIN offers control systems with functional safety (FS). Controls with HSCI, the uniformly digital control design from HEIDENHAIN, are the foundation for this.

Control systems with functional safety have two redundant safety channels that operate completely independently of each other. They capture, process and output all safety-relevant signals in two channels. Only those inverters and supply modules that have been certified for functional safety may be used in FS control systems. Please take this into account when configuring your machine and in case servicing is required.

Inverter components for functional safety are identified as such in this brochure.



UE 240D



UR 242D

Compact inverters

In a single enclosure, **UE** and **UR** compact inverters house the rectifiers for generating the DC-link voltage and the IGBT full bridges for up to five drives. Compact inverters with internal braking resistor are available for power ratings up to 15 kW. As an alternative, the internal braking resistor can be replaced by an external resistor to reduce heat generation in the electrical cabinet (not with UE 11x). Higher power ratings require regenerative systems.

For special cases, an additional power module can be connected to a compact inverter (not with UE 11x). Please note that the total power consumption of the connected motors must not exceed the power rating of the compact inverter!

The CC controller unit is connected to the compact inverter over a ribbon cable and uses PWM signals to control the IGBTs.



UVR 140D

Modular inverters

Modular inverter systems consist of the following modules:

- One **UV** or **UVR power supply unit** including the necessary additional components
- Several **UM power modules** for axes and spindle
- **Ribbon cables and covers**

In modular systems, the power supply unit produces the rectified DC-link voltage. The IGBT full bridges are housed in the separate **UM** power modules. The DC-link power bar conducts the DC-link voltage to the power modules.

The CC controller unit is connected to the power modules over a ribbon cable and uses PWM signals to control the IGBTs.

The power supply unit is arranged the farthest to the left. The power modules are arranged to the right in order of decreasing power rating.



UM 115D

Motor currents

The power modules and compact inverters are available in gradations to make it possible to match them to the required motor currents and torques. In addition, the PWM frequency can be adjusted to the motor current. Please remember that very high spindle speeds require a higher PWM frequency (see *Spindle*).

Additional power supply for CC/MC

Compact inverters and power supply units have a DC 5V output (connector X74) in addition to the supply bus (connector X69). It additionally supplies the CC/MC and thus also the connected encoders with power. The UV 105 power supply unit is not required anymore.

Current consumption of the connected modules

The UV power supply units supply the current for the electronics of the modules. The following limit values apply:

Power supply	UV 130D	UVR 1xxD	UVR 170DW
DC 15 V	1.5 A	3.5 A	4 A
DC 24 V	2 A	4 A	10 A

The current consumption for the electronics of the modular inverters depends largely on their power output. If several high-capacity modules are used, in rare cases the maximum permissible current from the power supply unit might be exceeded. Therefore, be sure to check the current consumption for the DC 15 V and DC 24 V supplies individually. The intrinsic needs of the supply unit must also be taken into account. If the total current consumption exceeds the maximum value, please contact HEIDENHAIN.

Ribbon cables and covers

The individual control components are connected through ribbon cables for PWM signals, power bus and unit bus. The ribbon cables must be covered to protect against interference. Ribbon cables and covers must be ordered in the required lengths.

The ribbon cables and covers for compact inverters are included in delivery.

Overview

	Model	Rated power	Rated current ¹		Page	Accessories	Page
			Axes	Spindle/Axis ²			
Compact inverters							
Regenerative	UR 230D	22 kW	2 x 7.5 A	1 x 35/25 A	8	KDR commutating reactor	20
	UR 240D	22 kW	3 x 7.5 A	1 x 35/25 A		EPCOS line filter	20
	UR 242D	22 kW	3 x 7.5 A	2 x 35/25 A		UP braking resistor module	22
						<i>As required:</i>	
						SM voltage protection module	23
						ZKF DC-link filter	22
						Three-phase current capacitor	21
						CML capacitor module	24
Nonregenerative	UE 110	10 kW	3 x 6 A	1 x 24/- A	10	PW braking resistor (not with UE 11x) <i>As required:</i>	21
	UE 112	10 kW	3 x 6 A/ 1 x 9 A	1 x 24/- A			
	UE 210D	15 kW	3 x 7.5 A	1 x 20/15 A			
	UE 211D	15 kW	2 x 7.5 A/ 1 x 15 A	1 x 20/15 A	12	SM voltage protection module	23
	UE 212D	15 kW	3 x 7.5 A/ 1 x 15 A	1 x 20/15 A			
	UE 230D	22 kW	2 x 7.5 A	1 x 31/23 A			
	UE 240D	22 kW	3 x 7.5 A	1 x 31/23 A			
	UE 241D	22 kW	2 x 7.5 A/ 1 x 23 A	1 x 31/23 A			
	UE 242D	22 kW	3 x 7.5 A/ 1 x 23 A	1 x 31/23 A			
	UE 242D	22 kW	3 x 7.5 A/ 1 x 23 A	1 x 31/23 A			
Nonregenerative, integrated controller unit	UEC 111	14 kW	2 x 6 A/ 1 x 9 A	1 x 24/- A	14	<i>As required:</i> PW 110, PW210 braking resistor SM voltage protection module	
	UEC 112	14 kW	3 x 6 A/ 1 x 9 A	1 x 24/- A			
Modular inverters							
Power module For one axis	UM 111D	-	1 x 7.5 A	-	14	Ribbon cables, covers	26
	UM 111BD	-	-	1 x 20/15 A			
	UM 112D	-	-	1 x 34/25 A			
	UM 113D	-	-	1 x 56/40 A	16		
	UM 114D	-	-	1 x 90/60 A			
	UM 115D	-	-	1 x 125/96 A			
	UM 116D	-	-	1 x 210/150 A			
	UM 116DW	-	-	1 x 210/150 A			
	UM 117DW	-	-	1 x 320/225 A			
For two axes	UM 121D	-	2 x 7.5 A	-	17		
	UM 121BD	-	1 x 15 A	1 x 20/15 A			
	UM 122D	-	1 x 25 A	1 x 34/25 A			
Power supply unit Regenerative	UVR 120D	22 kW	-	-	18	KDR commutating reactor	20
	UVR 130D	30 kW	-	-		EPCOS line filter	20
	UVR 140D	45 kW	-	-		UP braking resistor module	22
	UVR 150D	55 kW	-	-		<i>As required:</i>	
	UVR 160D	80 kW	-	-		SM voltage protection module	23
	UVR 160DW	80 kW	-	-		ZKF DC-link filter	22
	UVR 170DW	125 kW	-	-		Three-phase current capacitor	21
Nonregenerative	UV 130D	30 kW	-	-	19	PW braking resistor	21
						<i>As required:</i> SM voltage protection module CML/CMH capacitor module	23 24

¹⁾ At PWM frequency of 5 kHz, except for UE 1xx/UEC 1xx, where PWM frequency: 3.33 kHz

²⁾ Depending on whether the Axis or Spindle mode of operation is selected

Compact Inverters

Regenerative

Regenerative compact inverters		2 axes + spindle or 3 axes		3 axes + spindle or 4 axes	
		UR 230D		UR 240D	
		2 axes	Spindle/axis	3 axes	Spindle/axis
Rated current I_N <i>S6-40 %</i> ¹⁾ Max. current I_{max} ²⁾ for PWM frequency	3333 Hz	9.0 A – 18.0 A	42.0 A/30.0 A 60.0 A/- 60.0 A/60.0 A	9.0 A – 18.0 A	42.0 A/30.0 A 60.0 A/- 60.0 A/60.0 A
	4000 Hz	8.3 A – 16.5 A	38.5 A/27.5 A 55.0 A/- 55.0 A/55.0 A	8.3 A – 16.5 A	38.5 A/27.5 A 55.0 A/- 55.0 A/55.0 A
	5000 Hz	7.5 A – 15.0 A	35.0 A/25.0 A 50.0 A/- 50.0 A/50.0 A	7.5 A – 15.0 A	35.0 A/25.0 A 50.0 A/- 50.0 A/50.0 A
	6666 Hz	6.3 A – 12.6 A	29.4 A/21.0 A 42.0 A/- 42.0 A/42.0 A	6.3 A – 12.6 A	29.4 A/21.0 A 42.0 A/- 42.0 A/42.0 A
	8000 Hz	5.5 A – 11.0 A	25.6 A/18.3 A 36.5 A/- 36.5 A/36.5 A	5.5 A – 11.0 A	25.6 A/18.3 A 36.5 A/- 36.5 A/36.5 A
	10000 Hz	4.6 A – 9.2 A	21.4 A/15.3 A 30.5 A/- 30.5 A/30.5 A	4.6 A – 9.2 A	21.4 A/15.3 A 30.5 A/- 30.5 A/30.5 A
Power supply	3AC 400 V (± 10 %); 50 Hz to 60 Hz		3AC 400 V (± 10 %); 50 Hz to 60 Hz		
Rated power of DC link	22 kW		22 kW		
Peak power ³⁾ of DC link	30 kW / 40 kW		30 kW / 40 kW		
Power loss ⁴⁾ at I_N (approx.)	680 W		750 W		
DC-link voltage	DC 650 V		DC 650 V		
Module width	250 mm		250 mm		
Weight (approx.)	22.5 kg		22.5 kg		
Functional safety	✓		✓		
ID	741356-01		741357-01		
Additional components for regenerative compact inverters (see <i>Accessories for Inverters</i>)					
Commutating reactor	KDR 120		KDR 120		
Line filter	EPCOS 35A		EPCOS 35A		
Braking resistor	UP 110		UP 110		
DC-link filter ⁵⁾	ZKF 110 or ZKF 120		ZKF 110 or ZKF 120		
Three-phase current capacitor	Recommended		Recommended		
Voltage protection module ⁶⁾	SM 110		SM 110		

¹⁾ Spindle: 40% cyclic duration factor for duty cycle time of 10 minutes (S6-40%)

²⁾ Axes: 0.2 s cyclic duration factor for duty cycle time of 10 s with 70% rated current preload
 Spindle: 10 s cyclic duration factor for duty cycle time of 60 s with 70% rated current preload

4 axes + spindle or 5 axes			
UR 242D			
3 axes	1 axis/spindle	Spindle/axis	
9.0 A – 18.0 A	30.0 A/42.0 A 60.0 A/– 60.0 A/60.0 A	42.0 A/30.0 A 60.0 A/– 60.0 A/60.0 A	
8.3 A – 16.5 A	27.5 A/38.5 A 55.0 A/– 55.0 A/55.0 A	38.5 A/27.5 A 55.0 A/– 55.0 A/55.0 A	
7.5 A – 15.0 A	25.0 A/35.0 A 50.0 A/– 50.0 A/50.0 A	35.0 A/25.0 A 50.0 A/– 50.0 A/50.0 A	
6.3 A – 12.6 A	21.0 A/29.5 A 42.0 A/– 42.0 A/42.0 A	29.4 A/21.0 A 42.0 A/– 42.0 A/42.0 A	
5.5 A – 11.0 A	18.3 A/25.6 A 36.5 A/– 36.5 A/36.5 A	25.6 A/18.3 A 36.5 A/– 36.5 A/36.5 A	
4.6 A – 9.2 A	15.3 A/21.4 A 30.5 A/– 30.5 A/30.5 A	21.4 A/15.3 A 30.5 A/– 30.5 A/30.5 A	
3AC 400 V (± 10 %); 50 Hz to 60 Hz			
22 kW			
30 kW / 40 kW			
930 W			
DC 650 V			
250 mm			
22.5 kg			
✓			
741359-01			

KDR 120
EPCOS 35A
UP 110
ZKF 110 or ZKF 120
Recommended
SM 110

³⁾ 1st value: 40% cyclic duration factor for 10 minutes duty cycle time (S6-40%) ⁶⁾ Only for synchronous or torque motors with field weakening
2nd value: 0.2 s cyclic duration factor for 5 seconds duty cycle time

⁴⁾ Power loss during idle running; approx. 10% of the power loss at rated current

⁵⁾ Only for direct drives if an additional UM 1xxD is used

Compact inverters

Nonregenerative

Nonregenerative compact inverters (continued on next double-page spread)		3 axes + spindle		4 axes + spindle		
		UE 110		UE 112		
		3 axes	Spindle	3 axes	1 axis	Spindle
Rated current I_N $I_{S6-40\%}$ ¹⁾ Max. current I_{max} ²⁾ at PWM frequency	3333 Hz	6.0 A – 12.0 A	24.0 A 36.0 A 36.0 A	6.0 A – 12.0 A	9.0 A – 18.0 A	24.0 A 36.0 A 36.0 A
	4000 Hz	5.5 A – 11.0 A	22.0 A 33.0 A 33.0 A	5.5 A – 11.0 A	8.3 A – 16.5 A	22.0 A 33.0 A 33.0 A
	5000 Hz	5.0 A – 10.0 A	20.0 A 30.0 A 30.0 A	5.0 A – 10.0 A	7.5 A – 15.0 A	20.0 A 30.0 A 30.0 A
	6666 Hz	4.2 A – 8.4 A	16.8 A 25.2 A 25.2 A	4.2 A – 8.4 A	6.3 A – 12.6 A	16.8 A 25.2 A 25.2 A
	8000 Hz	3.65 A – 7.3 A	14.6 A 21.9 A 21.9 A	3.65 A – 7.3 A	5.5 A – 11.0 A	14.6 A 21.9 A 21.9 A
	10000 Hz	3.0 A – 6.0 A	12.2 A 18.3 A 18.3 A	3.0 A – 6.0 A	4.6 A – 9.2 A	12.2 A 18.3 A 18.3 A
	Power supply	3AC 400 V to 480 V ($\pm 10\%$); 50 Hz to 60 Hz		3AC 400 V ($\pm 10\%$); 50 to 60 Hz		
Rated power of DC link	10 kW		10 kW			
Peak power ³⁾ of DC link	15 kW / 20 kW		15 kW / 20 kW			
Power loss ⁴⁾ at I_N (approx.)	450 W		450 W			
DC-link voltage	DC 565 V		DC 565 V			
Integral braking resistance ⁵⁾	1 kW / 27 kW		1 kW / 27 kW			
Module width	175 mm		175 mm			
Weight (approx.)	20 kg		20 kg			
Functional safety	–		–			
ID	375713-xx		375715-xx			

Additional components for nonregenerative compact inverters (see *Accessories for Inverters*)

Braking resistor	–	–
Voltage protection module ⁶⁾	SM 110	SM 110

¹⁾ Spindle: 40% cyclic duration factor for duty cycle time of 10 minutes (S6-40%)

²⁾ Axes: 0.2 s cyclic duration factor for duty cycle time of 10 s with 70% rated current preload

Spindle: 10 s cyclic duration factor for duty cycle time of 60 s with 70% rated current preload

³⁾ 1st value: 40% cyclic duration factor for 10 minutes duty cycle time (S6-40%)

2nd value: 0.2 s cyclic duration factor for 5 seconds duty cycle time

3 axes + spindle						4 axes + spindle or 5 axes		
UE 210D			UE 211D			UE 212D		
3 axes	Spindle/axis		2 axes	1 axis	Spindle/axis	3 axes	1 axis	Spindle/axis
9.0 A – 18.0 A	24.0 A/18.0 A 36.0 A/– 36.0 A/36.0 A		9.0 A – 18.0 A	18.0 A – 36.0 A	24.0 A/18.0 A 36.0 A/– 36.0 A/36.0 A	9.0 A 18.0 A 18.0 A	18.0 A – 36.0 A	24.0 A/18.0 A 36.0 A/– 36.0 A/36.0 A
8,3 A – 16.5 A	22.0 A/16.5 A 33.0 A/– 33.0 A/33.0 A		8,3 A – 16.5 A	16.5 A – 33.0 A	22.0 A/16.5 A 33.0 A/– 33.0 A/33.0 A	8,3 A 16.5 A 16.5 A	16.5 A – 33.0 A	22.0 A/16.5 A 33.0 A/– 33.0 A/33.0 A
7.5 A – 15.0 A	20.0 A/15.0 A 30.0 A/– 30.0 A/30.0 A		7.5 A – 15.0 A	15.0 A – 30.0 A	20.0 A/15.0 A 30.0 A/– 30.0 A/30.0 A	7.5 A 15.0 A 15.0 A	15.0 A – 30.0 A	20.0 A/15.0 A 30.0 A/– 30.0 A/30.0 A
6.3 A – 12.6 A	16.8 A/12.6 A 25.2 A/– 25.2 A/25.2 A		6.3 A – 12.6 A	12.6 A – 25.2 A	16.8 A/12.6 A 25.2 A/– 25.2 A/25.2 A	6.3 A 12.6 A 12.6 A	12.6 A – 25.2 A	16.8 A/12.6 A 25.2 A/– 25.2 A/25.2 A
5.5 A – 11.0 A	14.6 A/11.0 A 22.0 A/– 22.0 A/22.0 A		5.5 A – 11.0 A	11.0 A – 22.0 A	14.6 A/11.0 A 22.0 A/– 22.0 A/22.0 A	5.5 A 11.0 A 11.0 A	11.0 A – 22.0 A	14.6 A/11.0 A 22.0 A/– 22.0 A/22.0 A
4.6 A – 9.2 A	12.2 A/9.1 A 18.2 A/– 18.2 A/18.2 A		4.6 A – 9.2 A	9.1 A – 18.2 A	12.2 A/9.1 A 18.2 A/– 18.2 A/18.2 A	4.6 A 9.2 A 9.2 A	9.1 A – 18.2 A	12.2 A/9.1 A 18.2 A/– 18.2 A/18.2 A
3AC 400 V (± 10 %); 50 to 60 Hz			3AC 400 V (± 10 %); 50 to 60 Hz			3AC 400 V (± 10 %); 50 to 60 Hz		
15 kW			15 kW			15 kW		
23 kW / 40 kW			23 kW / 40 kW			23 kW / 40 kW		
475 W			525 W			595 W		
DC 565 V			DC 565 V			DC 565 V		
1 kW / 27 kW			1 kW / 27 kW			1 kW / 27 kW		
200 mm			200 mm			200 mm		
20 kg			20 kg			20 kg		
✓			✓			✓		
733421-01			733423-01			733424-01		

PW 210

PW 210

PW 210

SM 110

SM 110

SM 110

4) Power loss during idle running: approx. 10% of the power loss at rated current

5) 1st value: Continuous duty

2nd value: 1.5% cyclic duration factor for duration of 120 s

6) Only for synchronous or torque motors with field weakening

Compact Inverters

Nonregenerative

Nonregenerative compact inverters	2 axes + spindle or 3 axes		3 axes + spindle or 4 axes		
	UE 230D		UE 240D		
	2 axes	Spindle/axis	3 axes	Spindle/axis	
Rated current I_N <i>S6-40 %</i> ¹⁾ Max. current I_{max} ²⁾ at PWM frequency	3333 Hz	9.0 A – 18.0 A	37.2 A/27.6 A 55.2 A/– 55.2 A/55.2 A	9.0 A – 18.0 A	37.2 A/27.6 A 55.2 A/– 55.2 A/55.2 A
	4000 Hz	8,3 A – 16.5 A	34.1 A/25.3 A 50.6 A/– 50.6 A/50.6 A	8,3 A – 16.5 A	34.1 A/25.3 A 50.6 A/– 50.6 A/50.6 A
	5000 Hz	7.5 A – 15.0 A	31.0 A/23.0 A 46.0 A/– 46.0 A/46.0 A	7.5 A – 15.0 A	31.0 A/23.0 A 46.0 A/– 46.0 A/46.0 A
	6666 Hz	6.3 A – 12.6 A	26.0 A/19.3 A 38.6 A/– 38.6 A/38.6 A	6.3 A – 12.6 A	26.0 A/19.3 A 38.6 A/– 38.6 A/38.6 A
	8000 Hz	5.5 A – 11.0 A	22.6 A/16.8 A 33.6 A/– 33.6 A/33.6 A	5.5 A – 11.0 A	22.6 A/16.8 A 33.6 A/– 33.6 A/33.6 A
	10000 Hz	4.6 A – 9.2 A	18.9 A/14.0 A 28.0 A/– 28.0 A/28.0 A	4.6 A – 9.2 A	18.9 A/14.0 A 28.0 A/– 28.0 A/28.0 A
Power supply	3AC 400 V (± 10 %); 50 Hz to 60 Hz		3AC 400 V (± 10 %); 50 Hz to 60 Hz		
Rated power of DC link	22 kW		22 kW		
Peak power ³⁾ of DC link	30 kW / 45 kW		30 kW / 45 kW		
Power loss ⁴⁾ at I_N (approx.)	520 W		590 W		
DC-link voltage	DC 565 V		DC 565 V		
Integral braking resistance ⁵⁾	–		–		
Module width	200 mm		200 mm		
Weight (approx.)	23 kg		23 kg		
Functional safety	✓		✓		
ID	733425-xx		733426-xx		

Additional components for nonregenerative compact inverters (see *Accessories for Inverters*)

Braking resistor	PW 210	PW 210
Voltage protection module ⁶⁾	SM 110	SM 110

1) Spindle: 40% cyclic duration factor for duty cycle time of 10 minutes (S6-40%)

2) Axes: 0.2 s cyclic duration factor for duty cycle time of 10 s with 70% rated current preload

Spindle: 10 s cyclic duration factor for duty cycle time of 60 s with 70% rated current preload

3) 1st value: 40% cyclic duration factor for duty cycle time of 10 minutes (S6-40%)

2nd value: 0.2 s cyclic duration factor for duty cycle time of 5 s

3 axes + spindle or 4 axes			4 axes + spindle or 5 axes		
UE 241 D			UE 242 D		
2 axes	1 axis	Spindle/axis	3 axes	1 axis	Spindle/axis
9.0 A – 18.0 A	28.2 A – 55.2 A	37.2 A/27.6 A 55.2 A/– 55.2 A/55.2 A	9.0 A – 18.0 A	27.6 A – 55.2 A	37.2 A/27.6 A 55.2 A/– 55.2 A/55.2 A
8,3 A – 16.5 A	26.0 A – 50.6 A	34.1 A/25.3 A 50.6 A/– 50.6 A/50.6 A	8,3 A – 16.5 A	25.3 A – 50.6 A	34.1 A/25.3 A 50.6 A/– 50.6 A/50.6 A
7.5 A – 15.0 A	23.0 A – 46.0 A	31.0 A/23.0 A 46.0 A/– 46.0 A/46.0 A	7.5 A – 15.0 A	23.0 A – 46.0 A	31.0 A/23.0 A 46.0 A/– 46.0 A/46.0 A
6.3 A – 12.6 A	19.3 A – 38.6 A	26.0 A/19.3 A 38.6 A/– 38.6 A/38.6 A	6.3 A – 12.6 A	19.3 A – 38.6 A	26.0 A/19.3 A 38.6 A/– 38.6 A/38.6 A
5.5 A – 11.0 A	16.7 A – 33.6 A	22.6 A/16.8 A 33.6 A/– 33.6 A/33.6 A	5.5 A – 11.0 A	16.8 A – 33.6 A	22.6 A/16.8 A 33.6 A/– 33.6 A/33.6 A
4.6 A – 9.2 A	14.1 A – 28.0 A	18.9 A/14.0 A 28.0 A/– 28.0 A/28.0 A	4.6 A – 9.2 A	14.0 A – 28.0 A	18.9 A/14.0 A 28.0 A/– 28.0 A/28.0 A
3AC 400 V (± 10 %); 50 Hz to 60 Hz			3AC 400 V (± 10 %); 50 Hz to 60 Hz		
22 kW			22 kW		
30 kW / 45 kW			30 kW / 45 kW		
590 W			770 W		
DC 565 V			DC 565 V		
–			–		
200 mm			200 mm		
23 kg			23 kg		
✓			✓		
733427-xx			733428-xx		
PW 210			PW 210		
SM 110			SM 110		

4) Power loss during idle running: approx. 10% of the power loss at rated current

5) Only for direct drives if an additional UM 1xxD is used

6) Only for synchronous or torque motors with field weakening

Compact Inverters

Nonregenerative, Integrated Controller Unit

UEC 11x The UEC 11x compact controller units not only include the controller with PLC inputs and outputs, but also an inverter with integrated braking resistor. They offer a complete solution for machines with a limited number of axes and low power demands.

- | | |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Controller | <ul style="list-style-type: none"> • Position controller, speed controller, current controller • HSCI interface • Interfaces to the speed and position encoders |
| Inverter | <ul style="list-style-type: none"> • Power electronics • Connections for axis motors and spindle motor • Braking resistor • Connections for motor holding brakes |
| System PL | <ul style="list-style-type: none"> • Interfaces for one workpiece touch probe and one tool touch probe • PLC with 38 inputs and 23 outputs (7 of these outputs can be switched off) freely available (expandable via PL 61xx) • Configuration with IOconfig PC software |

		UEC 111			UEC 112		
Controller		4 digital control loops			5 digital control loops		
Speed inputs		4 x 1 V _{PP} or EnDat 2.2			5 x 1 V _{PP} or EnDat 2.2		
Position inputs		4 x 1 V _{PP} or EnDat 2.2			5 x 1 V _{PP} or EnDat 2.2		
Inverter		<i>2 axes</i>	<i>1 axis</i>	<i>Spindle</i>	<i>3 axes</i>	<i>1 axis</i>	<i>Spindle</i>
Rated current I_N/ Max. current I_{max}¹⁾ at PWM frequency	3333 Hz	6.0/12.0 A	9.0/18.0 A	24.0/36.0 A	6.0/12.0 A	9.0/18.0 A	24.0/36.0 A
	4000 Hz	5.5/11.0 A	8.3/16.5 A	22.0/33.0 A	5.5/11.0 A	8.3/16.5 A	22.0/33.0 A
	5000 Hz	5.0/10.0 A	7.5/15.0 A	20.0/30.0 A	5.0/10.0 A	7.5/15.0 A	20.0/30.0 A
	6666 Hz	4.2/8.4 A	6.3/12.6 A	16.8/25.2 A	4.2/8.4 A	6.3/12.6 A	16.8/25.2 A
	8000 Hz	3.6/7.3 A	5.5/11.0 A	14.6/21.9 A	3.6/7.3 A	5.5/11.0 A	14.6/21.9 A
	10000 Hz	3.0/6.0 A	3.0/6.0 A	12.2/18.3 A	3.0/6.0 A	3.0/6.0 A	12.2/18.3 A
Power supply	3AC 400 V to 480 V (± 10 %); 50 Hz to 60 Hz						
Rated power of DC link	14 kW			14 kW			
Peak power ²⁾ of DC link	18 kW / 25 kW			18 kW / 25 kW			
Power loss at I _N (approx.)	450 W			450 W			
DC-link voltage	DC 565 V			DC 565 V			
Integral braking resistance	2.1 kW / 27 kW			2.1 kW / 27 kW			
Power pack for HSCI components	24 V/3.5 A			24 V/3.5 A			
Module width	175 mm			175 mm			
Weight (approx.)	20 kg			20 kg			
Functional safety	✓			✓			
ID	625777-xx			625779-xx			

¹⁾ Axes: 0.2 s 10 s 60 s
 Spindle: 10 s 60 s 60 s
 Cyclic duration factor for duty cycle time of 10 s with 70 % rated current preload
 Cyclic duration factor for duty cycle time of 60 s with 70 % rated current preload

²⁾ 1st value: 40 % 40 %
 2nd value: 4 s 20 s
 Cyclic duration factor for duty cycle time of 10 minutes (S6-40 %)
 Cyclic duration factor for duty cycle time of 20 s

Modular Inverters

Power Modules

Power modules

The power modules in the system are to be arranged so that the "heavy" modules are mounted at left and the "light" modules are to the right of these.

The total power of all connected motors must not exceed the rating of the power supply unit.

The UM 1xxD modules feature electronic ID labels. This permits advanced **diagnostic functions** (see *Diagnostic Functions*).

Power modules (continued on next double-page spread)

		1-axis modules									
		UM 111D		UM 111BD		UM 112D		UM 113D		UM 114D	
		Axis	Axis	Spindle	Axis	Spindle	Axis	Spindle	Axis	Spindle	
Rated current I_N <i>S6-40 %</i> ¹⁾ Max. current I_{max} ²⁾ at PWM frequency	3333 Hz	9.0 A – 18.0 A	17.5 A – 35.0 A	24.5 A <i>35.0 A</i> 35.0 A	29.5 A – 59.0 A	40.0 A <i>59.0 A</i> 59.0 A	47.0 A – 94.0 A	67.0 A <i>88.0 A</i> 94.0 A	70.0 A – 140.0 A	108.0 A <i>125.0 A</i> 140.0 A	
	4000 Hz	8.3 A – 16.5 A	16.5 A – 33.0 A	22.5 A <i>33.0 A</i> 33.0 A	27.5 A – 55.0 A	37.0 A <i>55.0 A</i> 59.0 A	44.0 A – 88.0 A	62.0 A <i>82.0 A</i> 88.0 A	66.0 A – 132.0 A	99.0 A <i>116.0 A</i> 132.0 A	
	5000 Hz	7.5 A – 15.0 A	15.0 A – 30.0 A	20.0 A 30.0 A 30.0 A	25.0 A – 50.0 A	34.0 A 50.0 A 50.0 A	40.0 A – 80.0 A	50.0 A 75.0 A 80.0 A	60.0 A – 120.0 A	90.0 A 105.0 A 120.0 A	
	6666 Hz	6.3 A – 12.6 A	12.5 A – 25.0 A	17.0 A <i>25.0 A</i> 25.0 A	21.0 A – 42.0 A	28.5 A <i>42.0 A</i> 42.0 A	33.5 A – 67.0 A	47.0 A <i>63.0 A</i> 67.0 A	55.0 A – 110.0 A	76.0 A <i>88.0 A</i> 110.0 A	
	8000 Hz	5.5 A – 11.0 A	11.0 A – 22.0 A	14.5 A <i>22.0 A</i> 22.0 A	18.5 A – 37.0 A	25.0 A <i>37.0 A</i> 37.0 A	29.5 A – 59.0 A	41.0 A <i>55.0 A</i> 59.0 A	44.0 A – 88.0 A	66.0 A <i>77.0 A</i> 88.0 A	
	10000 Hz	4.6 A – 9.2 A	9.0 A – 18.0 A	12.0 A <i>18.0 A</i> 18.0 A	15.5 A – 31.0 A	21.0 A <i>31.0 A</i> 31.0 A	24.5 A – 49.0 A	34.0 A <i>46.0 A</i> –	37.0 A – 73.0 A	55.0 A <i>64.0 A</i> 73.0 A	
	Current consumption ³⁾		120 mA/70 mA		150 mA/230 mA		140 mA/180 mA		170 mA/440 mA		230 mA/500 mA
Power loss ⁵⁾ at I_N (approx.)		70 W		120 W / 160 W		180 W / 270 W		280 W / 430 W		420 W / 650 W	
Cooling		Air		Air		Air		Air		Air	
Module width		50 mm		50 mm		100 mm		100 mm		100 mm	
Weight (approx.)		5.5 kg		5.5 kg		9.0 kg		9.0 kg		12.0 kg	
Functional safety		✓		✓		✓		✓		✓	
ID		667945-xx		671968-xx		731984-xx		730435-xx		671288-xx	

1) Spindle: 40% cyclic duration factor for duty cycle time of 10 minutes (S6-40%)

2) Axes: 0.2 s cyclic duration factor for duty cycle time of 10 s with 70% rated current preload
Spindle: 10 s cyclic duration factor for duty cycle time of 60 s with 70% rated current preload

3) For DC 15 V / DC 24 V (see *limit values* on page 6)

4) Power loss during idle running: approx. 10% of the power loss at rated current

5) With this 2-axis module, only the lower power stage can be used for controlling the spindle

6) Is dissipated via water cooling, remaining heat in electrical cabinet: approx. 50 W

Modular Inverters

Power Modules

Water cooling

The **UM 116DW** and **UM 117DW** water-cooled inverter components are recommended for operating powerful axis and spindle motors. Despite their great power, they are compact and only emit a small amount of heat in the electrical cabinet. The water-cooled inverter components are to be connected separately via a distributor to a closed coolant loop. The initial temperature of the coolant/water should be between 20 °C and 40 °C. Successfully tested pressure hoses from HEIDENHAIN are available. Pay attention to further information in the "Inverter Systems and Motors" Technical Manual.

Power modules

1-axis modules

		1-axis modules							
		UM 115D		UM 116D		UM 116DW		UM 117DW	
		Axis	Spindle	Axis	Spindle	Axis	Spindle	Axis	Spindle
Rated current I_N <i>$I_{S6-40\%}$</i> ¹⁾ Max. current I_{max} ²⁾ at PWM frequency	3333 Hz	115.0 A – 230.0 A	150.0 A <i>180.0 A</i> 230.0 A	175.0 A – 350.0 A	250.0 A <i>275.0 A</i> 350.0 A	175.0 A – 350.0 A	250.0 A <i>275.0 A</i> 350.0 A	250.0 A – 500.0 A	350.0 A <i>400.0 A</i> 500.0 A
	4000 Hz	106.0 A – 211.0 A	138.0 A <i>165.0 A</i> 211.0 A	165.0 A – 330.0 A	231.0 A <i>253.0 A</i> 330.0 A	165.0 A – 330.0 A	231.0 A <i>253.0 A</i> 330.0 A	236.0 A – 472.0 A	336.0 A <i>378.0 A</i> 472.0 A
	5000 Hz	96.0 A – 192.0 A	125.0 A <i>150.0 A</i> 192.0 A	150.0 A – 300.0 A	210.0 A <i>230.0 A</i> 300.0 A	150.0 A – 300.0 A	210.0 A <i>230.0 A</i> 300.0 A	225.0 A – 450.0 A	320.0 A <i>360.0 A</i> 450.0 A
	6666 Hz	80.0 A – 161.0 A	105.0 A <i>126.0 A</i> 161.0 A	126.0 A – 252.0 A	176.0 A <i>193.0 A</i> 252.0 A	126.0 A – 252.0 A	176.0 A <i>193.0 A</i> 252.0 A	189.0 A – 378.0 A	269.0 A <i>302.0 A</i> 378.0 A
	8000 Hz	70.0 A – 141.0 A	92.0 A <i>110.0 A</i> 141.0 A	110.0 A – 221.0 A	154.0 A <i>169.0 A</i> 221.0 A	110.0 A – 221.0 A	154.0 A <i>169.0 A</i> 221.0 A	164.0 A – 328.0 A	234.0 A <i>263.0 A</i> 328.0 A
	10000 Hz	59.0 A – 117.0 A	76.0 A <i>91.0 A</i> 117.0 A	91.0 A – 183.0 A	128.0 A <i>140.0 A</i> 183.0 A	91.0 A – 183.0 A	128.0 A <i>140.0 A</i> 183.0 A	137.0 A – 275.0 A	195.0 A <i>220.0 A</i> 275.0 A
	Current consumption ³⁾		310 mA/460 mA		520 mA/220 mA		520 mA/220 mA		450 mA/250 mA
Power loss ⁵⁾ at I_N (approx.)		610 W	870 W	1115 W	1560 W	1115 W ⁶⁾	1560 W ⁶⁾	1400 W ⁶⁾	2200 W ⁶⁾
Cooling		Air		Fan unit		Water		Water	
Module width		150 mm		200 mm		200 mm		200 mm	
Weight (approx.)		19.0 kg		24.0 kg		24.0 kg		24.5 kg	
Functional safety		✓		✓		✓		✓	
ID		671 566-xx		667 954-xx		667 946-xx		687 572-xx	

1) Spindle: 40% cyclic duration factor for duty cycle time of 10 minutes (S6-40%)

2) Axes: 0.2 s cyclic duration factor for duty cycle time of 10 s with 70% rated current preload; only 0.15 s for UM 117 DW
Spindle: 10 s cyclic duration factor for duty cycle time of 60 s with 70% rated current preload

3) For DC 15 V / DC 24 V (see *limit values* on page 6)

Fan cooling

Since the **UM 116D** runs with such high power, a separate fan unit is necessary as an accessory (see page 23). Please take this additional space requirement in the electrical cabinet into consideration (see *Dimensions*).

2-axis modules					
	UM 121D	UM 121BD ⁵⁾		UM 122D ⁵⁾	
	Axis	Axis	Spindle	Axis	Spindle
	9.0 A – 18.0 A	17.5 A – 35.0 A	24.5 A 35.0 A 35.0 A	29.5 A – 59.0 A	40.0 A 59.0 A 59.0 A
	8.3 A – 16.5 A	16.5 A – 33.0 A	22.5 A 33.0 A 33.0 A	27.5 A – 55.0 A	37.0 A 55.0 A 59.0 A
	7.5 A – 15.0 A	15.0 A – 30.0 A	20.0 A 30.0 A 30.0 A	25.0 A – 50.0 A	34.0 A 50.0 A 50.0 A
	6.3 A – 12.6 A	12.5 A – 25.0 A	17.0 A 25.0 A 25.0 A	21.0 A – 42.0 A	28.5 A 42.0 A 42.0 A
	5.5 A – 11.0 A	11.0 A – 22.0 A	14.5 A 22.0 A 22.0 A	18.5 A – 37.0 A	25.0 A 37.0 A 37.0 A
	4.6 A – 9.2 A	9.0 A – 18.0 A	12.0 A 18.0 A 18.0 A	15.5 A – 31.0 A	21.0 A 31.0 A 31.0 A
	200 mA/140 mA	250 mA/110 mA		240 mA/360 mA	
	140 W	2x axis: 240 W 1x axis / 1x spindle: 280 W		2x axis: 360 W 1x axis / 1x spindle: 450 W	
	Air	Air		Air	
	50 mm	100 mm		100 mm	
	5.5 kg	9 kg		12.0 kg	
	✓	✓		✓	
	667838-xx	667942-xx		667633-xx	

⁴⁾ Power loss during idle running: approx. 10% of the power loss at rated current

⁵⁾ With this 2-axis module, only the lower power stage can be used for controlling the spindle

⁶⁾ Is dissipated via water cooling, remaining heat in electrical cabinet: approx. 50 W

Modular Inverters

Power Supply Unit

Power supply unit	Regenerative			
	UVR 120D	UVR 130D	UVR 140D	UVR 150D
Power supply	3AC 400 V (± 10 %); 50 Hz to 60 Hz			
Rated power (DC link)	22 kW	30 kW	45 kW	55 kW
Peak power S6-40% (DC link)	30 kW	45 kW	65 kW	80 kW
	40 kW ²⁾	60 kW ¹⁾	80 kW ²⁾	110 kW ¹⁾
Power loss (approx.)	300 W	370 W	570 W	640 W
Dc-link voltage	DC 650 V	DC 650 V	DC 650 V	DC 650 V
Current consumption 15 V/24 V	170 mA/310 mA	200 mA/400 mA	250 mA/310 mA	300 mA/540 mA
Cooling	Air	Air	Air	Air
Module width	150 mm	150 mm	200 mm	200 mm
Weight (approx.)	12 kg	12.5 kg	20.0 kg	20.0 kg
Functional safety	✓	✓	✓	✓
ID	728252-xx	728248-xx	728253-xx	728255-xx

Additional components for power supply unit (see *Accessories for Inverters*)

Commutating reactor	KDR 120	KDR 130C	KDR 140	KDR 150
Line filter	EPCOS 35A	EPCOS 80A	EPCOS 80A	EPCOS 80A
Braking resistor	UP 110	UP 110	UP 110	UP 110
DC-link filter ³⁾	ZKF 110 or ZKF 120 or ZKF 130	ZKF 110 or ZKF 120 or ZKF 130	ZKF 110 or ZKF 120 or ZKF 130	ZKF 110 or ZKF 120 or ZKF 130
Three-phase current capacitor	Recommended	–	–	–
Voltage protection module ⁴⁾	SM 1xx	SM 1xx	SM 1xx	SM 1xx

¹⁾ 0.2 s cyclic duration factor for duration of 5 s

²⁾ 4 s cyclic duration factor for duration of 20 s

³⁾ Only for direct drives

⁴⁾ Only for synchronous or torque motors with field weakening

⁵⁾ Is dissipated via water cooling, remaining heat in electrical cabinet: approx. 100 W

	Regenerative			Nonregenerative
	UVR 160D	UVR 160DW	UVR 170DW	UV 130D
	3AC 400 V (± 10 %); 50 Hz to 60 Hz			3AC 400 V (± 10 %); 50 to 60 Hz
	80 kW	80 kW	125 kW	30 kW
	110 kW	110 kW	180 kW	40 kW
	160 kW ¹⁾	160 kW ¹⁾	250 kW ¹⁾	50 kW ¹⁾
	930 W	930 W ⁵⁾	1 400 W ⁵⁾	140 W
	DC 650 V	DC 650 V	DC 650 V	DC 565 V
	350 mA/1.1 A	350 mA/300 mA	450 mA/200 mA	100 mA/200 mA
	Air	Water	Water	Air
	250 mm	200 mm	250 mm	150 mm
	25.0 kg	20.0 kg	26.5 kg	9.8 kg
	✓	✓	✓	✓
	728257-xx	728258-xx	546911-xx	728250-xx

	KDR 160	KDR 160	KDR 170	–
	EPCOS 120A	EPCOS 120A	EPCOS 200A	–
	UP 110	UP 110	UP 120	PW 210
	ZKF 110 or ZKF 120 or ZKF 130 or ZKF 140	ZKF 110 or ZKF 120 or ZKF 130 or ZKF 140	ZKF 140	–
	–	–	–	–
	SM 1xx	SM 1xx	SM 1xx	SM 1xx

Accessories for Inverter Systems

Commutating reactor

Regenerative inverter systems require a **KDR** commutating reactor. It suppresses system perturbation and serves as energy buffer for the boost converter. It is connected between the line filter and the power supply unit (see *Cable Overview*).

The size of the commutating reactor depends on the power supply unit used.



	Application	Rated voltage	Rated current	Power loss (approx.)	Rated frequency	Degree of protection	Weight (approx.)	ID
KDR 120	UR 2xxD UVR 120D	3AC 400 V	3 x 35 A	200 W	50/60 Hz	IP 00	11 kg	344505-01
KDR 130C	UVR 130D	3AC 400 V	3 x 45 A	250 W	50/60 Hz	IP 00	15 kg	646271-01
KDR 140	UVR 140D	3AC 400 V	3 x 70 A	340 W	50/60 Hz	IP 00	22 kg	333068-01
KDR 150	UVR 150D	3AC 400 V	3 x 80 A	350 W	50/60 Hz	IP 00	23 kg	355253-01
KDR 160	UVR 160D UVR 160DW	3AC 400 V	3 x 117 A	525 W	50/60 Hz	IP 00	57 kg	573265-01
KDR 170	UVR 170DW	3AC 400 V	3 x 180 A	875 W	50/60 Hz	IP 00	106 kg	735563-01

Line filter

If you are using a regenerative inverter system, you must use an **EPCOS** line filter in addition to the commutating reactor. Line filters suppress interference and ensure EMC-compatible energy recovery. The line filter is connected between line power and the commutating reactor (see *Cable Overview*).

The size of the line filter depends on the power supply unit used.



	Application	Rated voltage	Rated current	Power loss (approx.)	Rated frequency	Degree of protection	Weight (approx.)	ID
EPCOS 35A	UR 2xxD UVR 120D	3AC 400 V	3 x 35 A	50 W	50/60 Hz	IP 00	5 kg	340691-01
EPCOS 80A¹⁾	UVR 130D UVR 140D UVR 150D	3AC 400 V	3 x 80 A	75 W	50/60 Hz	IP 00	11 kg	640908-01
EPCOS 120A¹⁾	UVR 160D UVR 160DW	3AC 400 V	3 x 120 A	115 W	50/60 Hz	IP 20	13.5 kg	575292-01
EPCOS 200A¹⁾	UVR 170DW	3AC 400 V	3 x 200 A	170 W	50/60 Hz	IP 20	20.0 kg	735542-01

¹⁾ Integrated 3 x 32 μ F three-phase current capacitor

Three-phase current capacitor

Three-phase current capacitors are recommended as standard for regenerative inverter systems. The three-phase current capacitor suppresses low-frequency noise during the recovery of energy into the supply system. It is connected between the line filter and the commutating reactor (see *Cable Overview*).



	Application	Mesh voltage	Capacitance	Degree of protection	Weight (approx.)	ID
Three-phase current capacitor	Generally recommended ¹⁾	DC 525 V	3 x 32 µF	IP 00	1.3 kg	348993-01

¹⁾ Integrated in EPCOS 80A, 120A and 200A

Braking resistor

During braking, motors feed energy back into the DC link. The **PW 210** braking resistor converts this energy to heat. The braking resistor must be mounted outside the electrical cabinet to allow the heat to dissipate. The PW 210 has no fan: heat is released through radiation.

When the nonregenerative inverter systems UE 240D, UE 241D, UE 242D and **UV 130D** are installed, the PW 210 braking resistor is required.

The PW 210 can also be used as an alternative to the integrated braking resistor in the UE 21xD.

Up to two PW 210 in parallel can be connected to the UE 230D and UE 24xD compact inverters.

No more than one PW 210 can be connected to the UE 21xD and UEC 11x.



PW 210

	Spindle power	Recommended braking resistor	Continuous rating	Peak power* (approx.)	Resistance	Degree of protection	Weight (approx.)	ID
PW 210	Up to 15 kW	1 x PW 210	2 kW	27 kW	18 ohms	IP 20	5.5 kg	333081-01
	Over 15 kW	2 x PW 210 in parallel	4 kW	54 kW	9 ohms	IP 20	11 kg	

* 1.5 % cyclic duration factor for 120 s duty cycle time

Accessories for Inverter Systems

Braking resistor module

Regenerative inverters feed the braking energy back into the line power system. When network power fails, the energy cannot be returned. This increases the DC-link voltage and results in a switch-off of the inverters. This shutdown leads to an undesired coasting of the motors. To prevent this, HEIDENHAIN recommends the use of the **UP 1x0** braking resistor module for regenerative inverters.

UP 110



	Switching voltage	Module width	Peak power (for 2 s)	Degree of protection	Weight (approx.)	ID
UP 110	DC 740 V	50 mm	60 kW	IP 20	7 kg	341 516-01
UP 120	DC 740 V	50 mm	150 kW	IP 20	9 kg	605 731-01

DC-link filter

Operating direct drives (linear motors, torque motors, and in rare cases also synchronous spindles) with regenerative inverters leads to voltage peaks that can destroy the drives. Therefore, during operation with **UVR 1xxD** and **UR 2xx** regenerative inverters, the **ZKF 1xx** DC-link filter **must** be used. The DC-link filter is mounted at left next to the power modules of the direct drives and the DC-link current is conducted through it.

If the commutating reactor causes oscillations in the DC-link voltage, you can use a DC-link filter to prevent these oscillations. The ZKF is to be installed between the supply unit and the power module.

The total power of the drives must not exceed the power rating of the filter.

Please note:

The ZKF 110 differs from the ZKF 120 only in its maximum leakage current. The use of the **ZKF 110** must be inspected by a HEIDENHAIN service technician on-site to ensure that the leakage current is less than 1.3 A. With the **ZKF 120**, **ZKF 130** or **ZKF 140**, this measurement is not necessary because a leakage current of 6 A is sufficient in any case.



ZKF 110

	Power loss (approx.)	Module width	Leakage current	Power				Degree of protection	Weight (approx.)	ID
				P _N	P _{S6-40%}	P _{S6-20%}	P _{max}			
ZKF 110	50 W	100 mm	< 1.3 A	30 kW	47 kW	67 kW	110 kW	IP 20	10 kg	385 764-01
ZKF 120	100 W	100 mm	< 6 A	30 kW	47 kW	67 kW	110 kW	IP 20	12 kg	391 232-01
ZKF 130	200 W	100 mm	< 6 A	55 kW	80 kW	100 kW	110 kW	IP 20	13 kg	531 388-01
ZKF 140	200 W	100 mm	< 6 A	80 kW	110 kW	140 kW	160 kW	IP 20	15 kg	597 954-01

Voltage protection module

If synchronous motors (e.g. synchronous spindles, torque motors) are operated with field weakening, an **SM 1xx** voltage protection module is required. In the event of a power failure, this module prevents a voltage increase at the power connections of the motors that could destroy the inverters and motors. The voltage protection module is connected between the motor and inverter. It shorts the motor phases in case of a fault.



SM 110

Operation in the field weakening range must be enabled by machine parameters in the control (see *Technical Manual for the iTNC 530*).

The maximum phase current I_{max} of the SM must be greater than the short-circuit current I_K of the motor. $I_K = U_0 / (\sqrt{3} \times X_H)$

The SM 130 features an integrated temperature switch, which (if correctly wired) prevents the drive from being switched on at temperatures above 60 °C.

	Switching voltage	Max. phase current I_{max}	Max. braking time at I_{max}	Min. wait. time	Degree of protection	Weight (approx.)	ID
SM 110	830 V	3AC 63 A	10 s	5 min.	IP 20	2 kg	368453-01
SM 130	830 V	3AC 300 A	10 s	10 min. ¹⁾	IP 20	6.5 kg	540739-02

¹⁾ Integrated temperature switch

Accessories for coolant connection

The water-cooled inverter components UVR 1x0DW and UM 11xDW must be connected to an external coolant circuit. The connecting elements can be purchased as an accessory set.

Hose (set)

1 pressure hose, length 3 m
1 coupling joint for connecting the pressure hose to the distributor block

ID 584862-01

Two sets are necessary for each inverter component.

Fan unit

Fan for UM 116D
Power supply: AC 230V, 50/60 Hz, 0.77 A

ID 749973-01

Accessories for Inverter Systems

Capacitor modules

In case of a power failure, the danger exists that the tool and workpiece can be damaged by uncontrolled motions of the axes. The LIFTOFF function of the iTNC 530 is able to protect expensive workpieces and tools from being damaged. In case of a power failure, and if the LIFTOFF function is active, the iTNC 530 attempts to retract the tool in a defined manner using the energy remaining in the DC-link.

The capacitor modules provide support for the energy necessary for the LIFTOFF function. They can also be connected in parallel for increased energy demands.

The **CML 110** capacitor module serves to maintain the 24 V control voltage in case of a power failure. In this case the enablings of the control system are maintained even after a power failure. The CML is installed in the electrical cabinet via a top hat rail.

CML 110



	Power supply	Capacitance	Charging current	ID
CML 110	DC 24 V	5.0 F	≤ 2.4 A	574 087-01

For direct drives, the **CMH 120** capacitor module is also necessary to maintain the DC-link voltage in case of a power failure. The CMH 120 is mounted directly before the corresponding inverter module.

	DC-link voltage	Capacitance	Module width	ID
CMH 120	≤ DC 850 V	10.0 F	50 mm	591 116-01

CMH 120



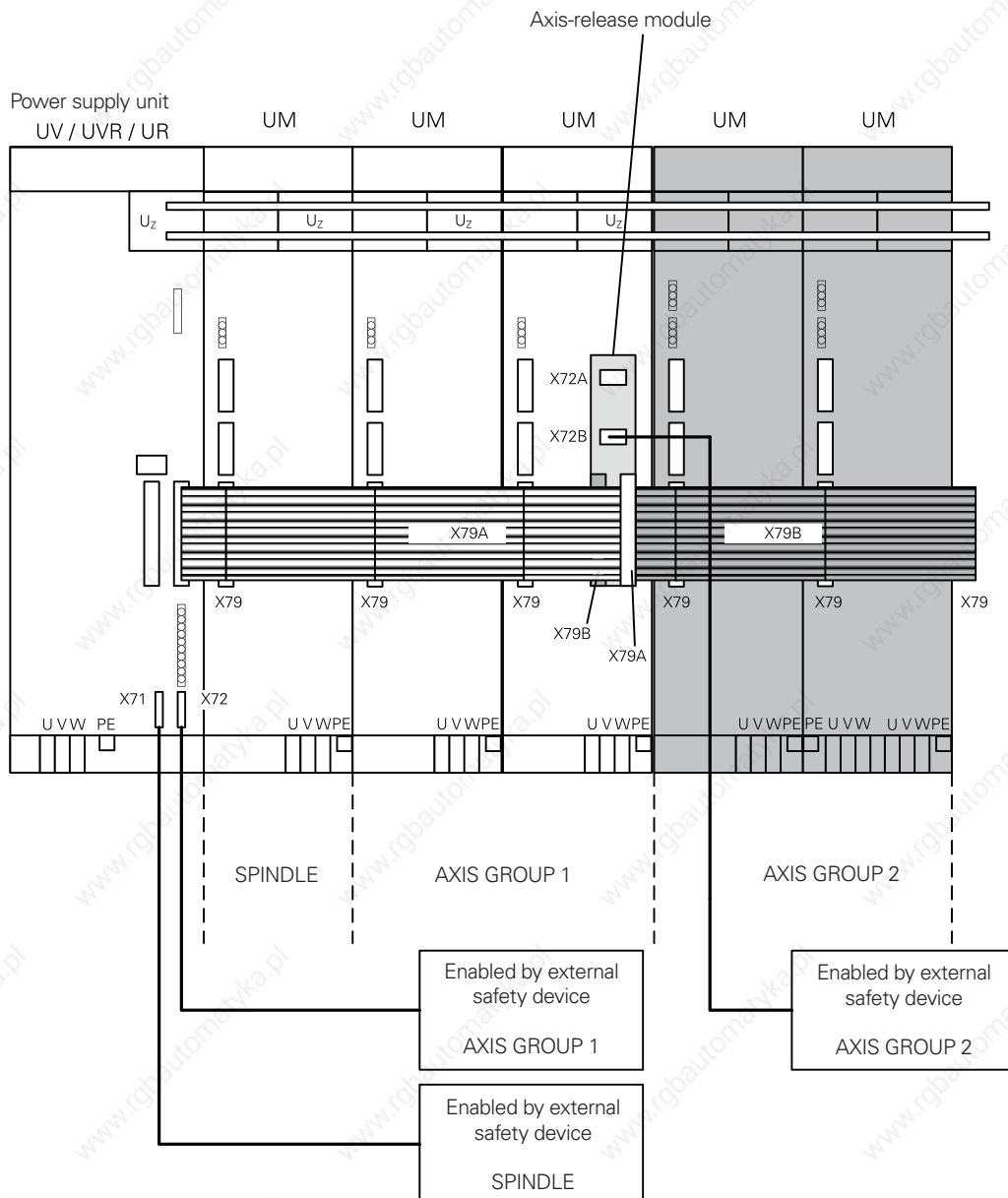
Axis-release module The axis-release module makes it possible to switch off power modules group by group. It is not needed for controls with functional safety.

The axis-release module is screwed onto the front panel of the first power module to be controlled. The axis-release signal is transmitted via a line in the unit bus from power module to power module. The axis-release module can specifically interrupt this line so that all power modules that are connected to the axis-release module are switched off. All other power modules are switched off via X72 of the UV(R) 1x0(D).

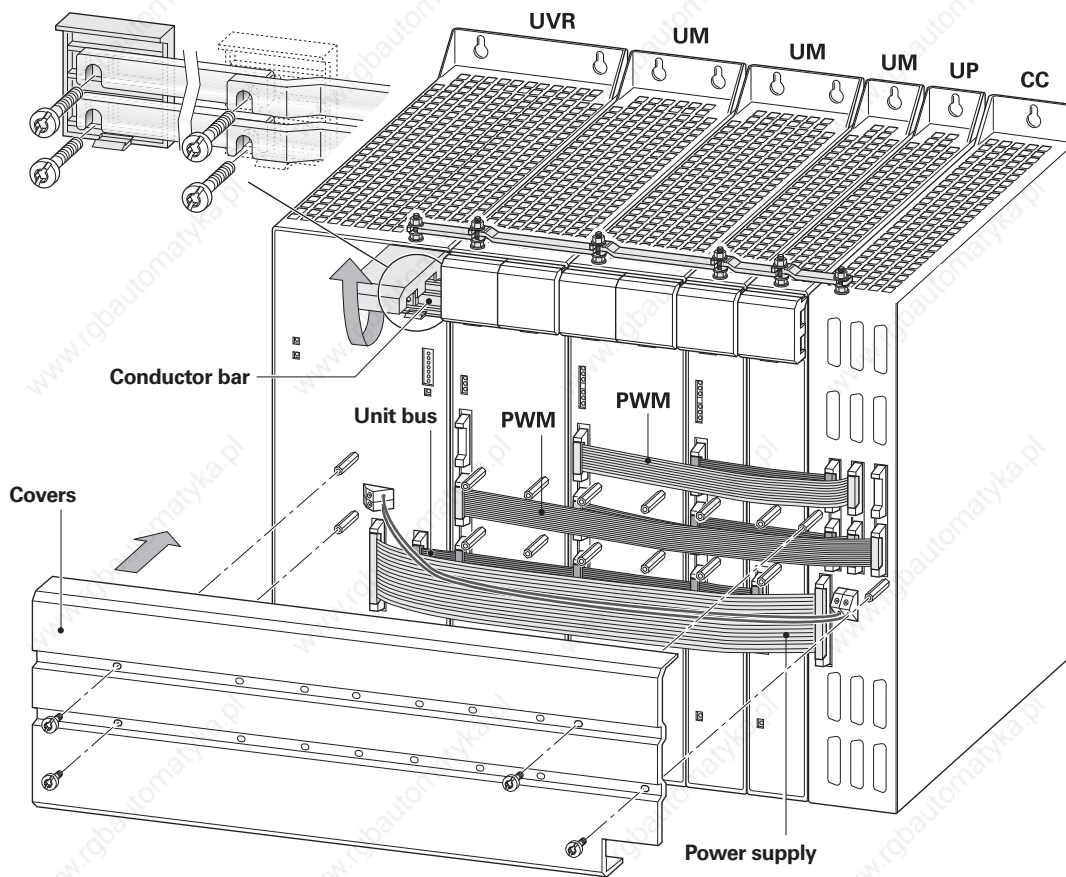
If an axis-release module is used, two unit bus cables of the appropriate lengths are necessary.

The width of the covers for the ribbon cables for the modular inverter system is reduced by the width of the axis-release module (50 mm). A suitable cover is included with the axis-release module.

ID 573732-02



Ribbon Cables and Covers



Cover for the ribbon cables

The ribbon cables must be covered to protect them against interference. The UV(R) power supply unit is shipped with a cover (329031-03) to protect the following modules.

- UV(R) 1x0
- UM 115D
- One UM 1xxD with 100 mm width and one UM 1xxD with 50 mm width

The cover for the CC is shipped with the CC. If you use further power modules and the UP 110 resistor module, you need to order suitable covers separately.

Width	ID (1 unit)	ID (5 units in collective package)
50 mm	329031-05	538427-05
100 mm	329031-10	538427-10
150 mm	329031-15	538427-15
200 mm	329031-20	538427-20

Selecting the covers

- Add the widths of all modules between the UV(R) 1x0D and CC (including UP 110)
- Subtract 150 mm from this total width (cover included with the UV(R) 1x0).
- Select the appropriate covers from the table to protect the remaining width.
- If the axis-release module is used, the width is reduced by 50 mm

50-pin ribbon cable for supply voltage

Connection between the CC and UV(R) 1xx power supply unit (required only once).

Length	ID
300 mm	325816-01
400 mm	325816-02
500 mm	325816-03
600 mm ¹⁾	325816-04
700 mm ¹⁾	325816-05
800 mm ¹⁾	325816-06

¹⁾ For transmission lengths greater than 600 mm, the ribbon cable is led doubled to the controller unit to increase the cross section.

The use of a 5 V litz wire (2 x 4 mm²), in addition to the ribbon cable, is required for reliable power supply. The litz wire must be provided by the customer.

Selecting a cable length

UVR: Add 70 mm to the width of all modules between the UVR 1xxD and CC and select the next larger cable length.

UV 130D: Add 130 mm to the width of all modules between the UV 130D and CC and select the next larger cable length.

Module	Width
UM 111 D, UM 121 D	50 mm
UM 112 D, UM 122 D UM 111 BD, UM 121 BD UM 113 D, UM 114 D	100 mm
UM 115 D	150 mm
UM 116 D, UM 116 DW, UM 117 DW	200 mm
UP 110	50 mm
UV 105	50 mm

40-pin ribbon cable for unit bus

Connection between the UV 1x0 power supply unit and the UM 1xx power modules and, if needed, the UP 110 braking resistor module (required only once).

Length	ID
300 mm	325817-01
400 mm	325817-02
500 mm	325817-03
600 mm	325817-04
700 mm	325817-05

Selecting a cable length

UVR: Add the width of all modules between the UVR 1xxD and the controller unit (including the UP 110) and choose the next larger cable length from the above table.

UV 130D: Add 80 mm to the width of all modules between the UV 130D and CC and select the next larger cable length.

Axis-release module: Two unit bus cables are required. The lengths depend on the position of the axis-release module.

20-pin ribbon cable for PWM signals

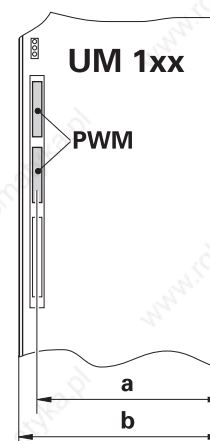
Connection between the controller unit and a UM 1xxD power module (one cable per drive).

Length	ID
100 mm	250479-07
200 mm	250479-08
300 mm	250479-09
400 mm	250479-10
500 mm	250479-11
600 mm	250479-12
700 mm	250479-13

Selecting a cable length

- See the table for distance a of the PWM input on the power module.
- Add the widths b of all modules between the respective power module and the controller unit (including UP 110 and ZFK).
- Add the distance c_n of the PWM output on the controller unit to your result (see table).
- Select the next-larger cable length from the above table.

Power module	Distance a (approx.)	Module width b
MS 110, MS 111 mounting cases UM 111 BD, UM 111 D, UM 121 D	40 mm	50 mm
UM 121 BD	85 mm	100 mm
UM 112D, UM 113D, UM 114D, UM 122D	90 mm	100 mm
UM 115D	140 mm	150 mm
UM 116D(W), UM 117DW	190 mm	200 mm

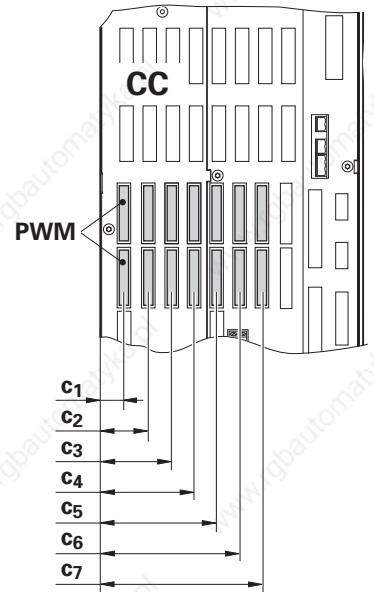


Distance c_n

CC 422	Distance in mm					
	c₁	c₂	c₃	c₄	c₅	c₆
Max. 6 control loops	25	37	50	–	–	–
Max. 10 control loops	25	37	50	64	73	–
Max. 12 control loops	25	37	50	64	73	85

CC 424B	Distance in mm						
	c₁	c₂	c₃	c₄	c₅	c₆	c₇
Max. 6 control loops	23	39	56	–	–	–	–
Max. 8 control loops	23	39	56	73	–	–	–
Max. 10 control loops	23	39	56	73	90	–	–
Max. 12 control loops	23	39	56	–	90	108	125
Max. 14 control loops	23	39	56	73	90	108	125

CC 61xx	Distance in mm				
	c₁	c₂	c₃	c₄	c₅
CC 6106	23	39	56	–	–
CC 6108	23	39	56	73	–
CC 6110	23	39	56	73	92



Example

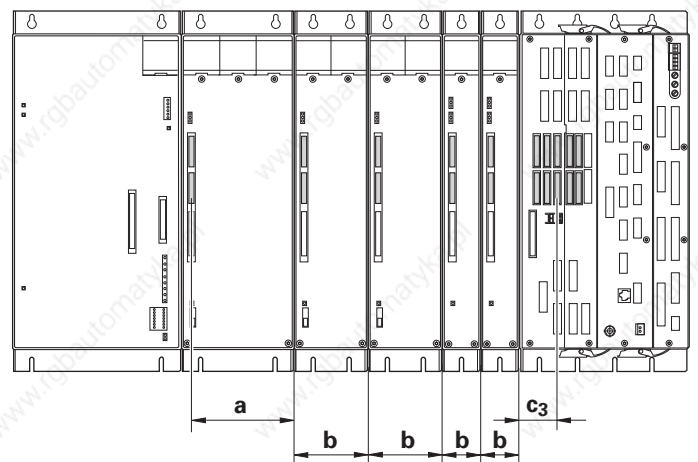
Calculating the distance l between the connectors on the UM 115D and the controller unit:

$$l = a + b_1 + b_2 + b_3 + b_4 + c_3$$

$$= (140 + 100 + 100 + 50 + 50 + 56) \text{ mm}$$

$$= 496 \text{ mm}$$

A 500 mm cable (the next larger length) is used to connect the PWM.



Multi-Row Configuration

Sometimes limited space prevents the control and inverter system(s) from being mounted in the same row in the electrical cabinet, meaning that they must be mounted in separate rows.

Mounting cases for multi-row configuration

HEIDENHAIN offers special MS 1xx mounting cases that can be used to establish an electrical connection (immune to noise) between the components of the inverter system. These mounting cases are installed immediately to the right of the UV (R) power supply unit or at the start of the second row.

MS 110

The ribbon cables (device bus, PWM lines, supply bus) in the MS 110 mounting cases are connected with shielded round cables of the appropriate lengths and at the other end, these are connected again with ribbon cables.

MS 111

The MS 111 mounting case also offers the possibility of feeding DC 24 V from an external power pack. This is necessary in rare cases, when the DC 24 V power from the UVR 1xxD power supply unit is not sufficient to supply the module fans with power. For the current consumption of the fans, refer to the specifications of the power supply units and inverter systems. Based on these values you can calculate whether feeding in the additional DC 24 V is necessary. The sum of the currents must not exceed the maximum current provided by the UV(R).

Setup without additional DC 24V feeding

In most cases it is not necessary to feed the DC 24 V. For multi-row setup, two **MS 110 units** are used.

Setup with additional DC 24V feeding

If feeding of the additional DC 24 V is necessary, one **MS 110** and one **MS 111** are required. The MS 110 is placed next to the UV (R) supply unit and the MS 111 in the other row.

Please note:

When using the MS 111, external DC 24 V power supply is mandatory in order to supply the fans with power. Otherwise, the inverters will overheat and shut down with the message „TEMP>>“!

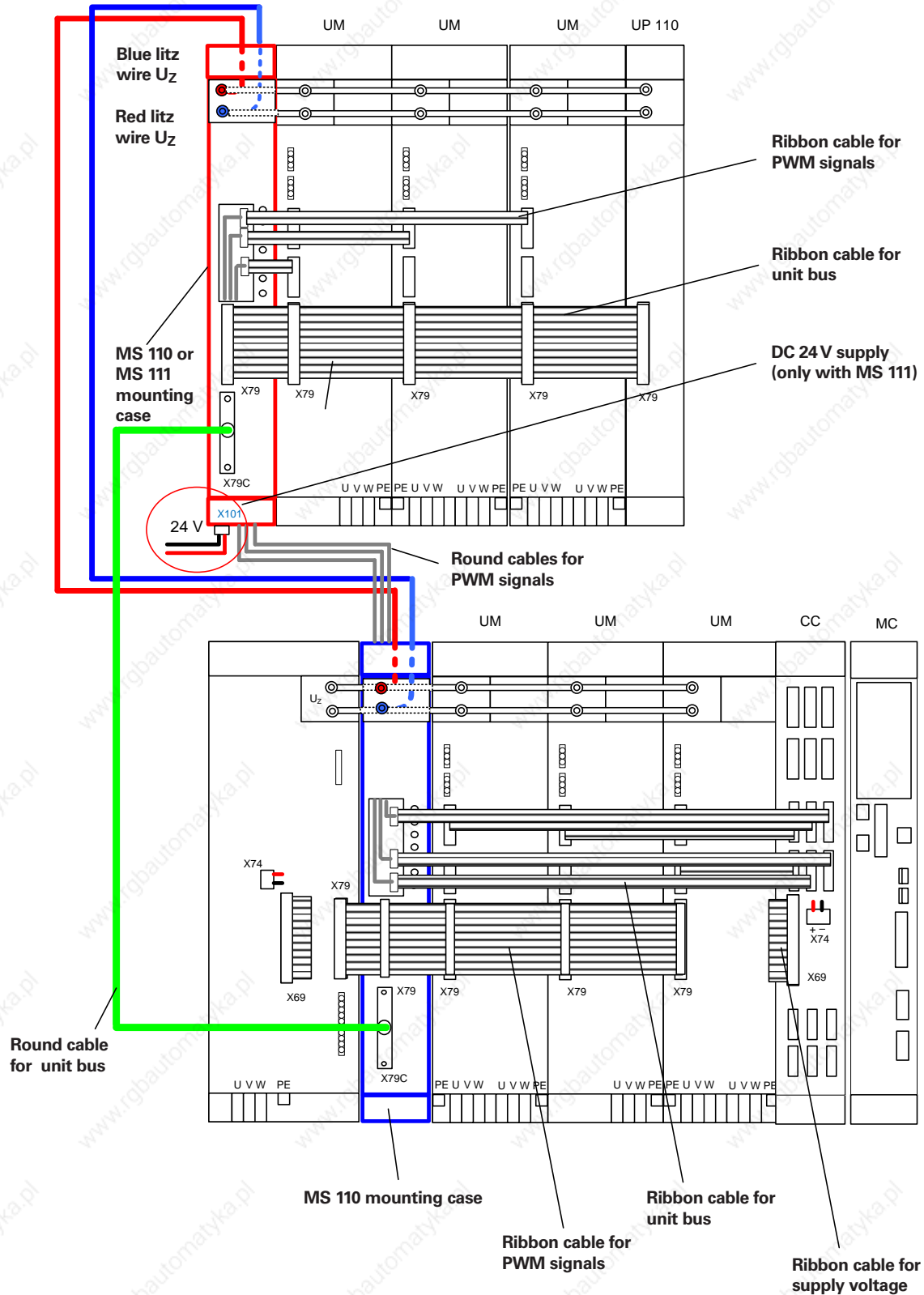


Components/ cables for multi-row configuration

MS 110 mounting case	658 132-01
MS 111 mounting case	673 685-01
Device bus cable (shielded, round) with 37-pin D-sub connector at both ends; max. length: 3 m	664 023-xx
PWM cable (round) with ribbon connector at both ends; max. length: 5 m	664 332-xx
Supply bus cable (round) with ribbon connector at both ends, max. length: 5 m (required only if UV(R) 1xxD is not in the same row as CC/MC)	361 508-xx
Litz wire for DC link (16 mm ² , shielded); max. length: 3 m	
Color: Red	655 440-xx
Color: Blue	655 438-xx

Basic circuit diagram for multi-row configuration

The MS 110 is mounted in the lower row, right next to the supply module; the MS 110 or – if required – the MS 111 for DC 24 V feeding is mounted in the upper row.

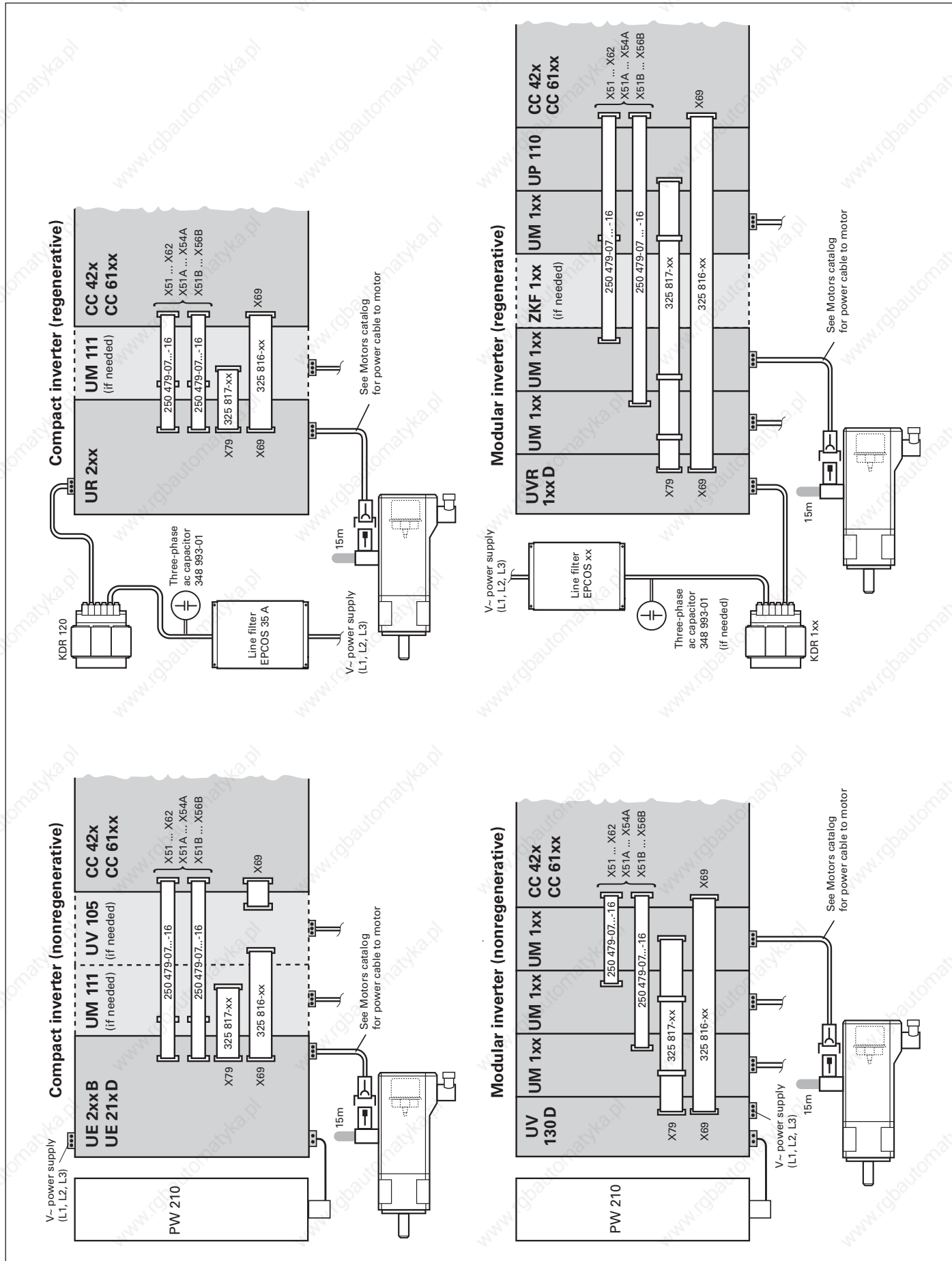


Please note the following regarding the setup of multi-row systems:

- The wires used for the DC-link connection of the power modules in the "second row" must not be longer than 3 m.
- Litz wires with 16 mm² cross section make a DC-link current of approx. 67 A possible. In a regenerative system, this results in approx. 35 kW of continuous power for the system connected by these wires.
In a nonregenerative system the resulting maximum power is approx. 25 kW.
- Use fast-acting semiconductor fuses for protection of the UV(R) 1xxD on the primary side (see *Technical Manual for Inverter Systems and Motors*).
- The length of the unit bus ribbon cable must not exceed 1 m!
If necessary, place the MS 110 or MS 111 in the "second row" in the center of the UMs.
- When calculating the length of the ribbon cables, make sure to include the module width of the MS 110 or MS 111.

Cable Overview

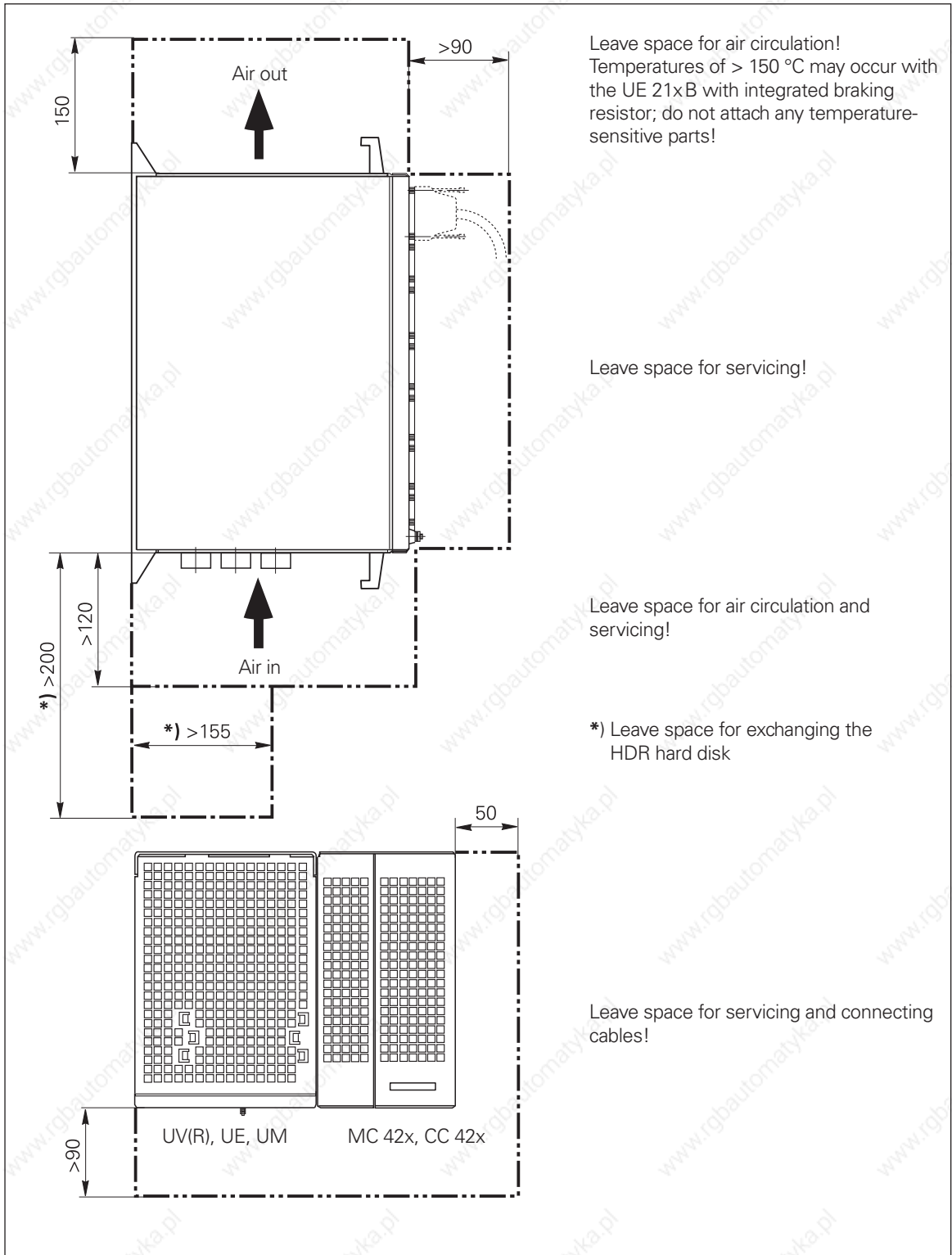
Inverters



Mounting Instructions

Mounting attitude

When installing an **MC 422C, MC 420, CC 42x, UV(R) 1xx, UM xxx** or **UE 2xxB**, take note of the minimum spacing, space needed for servicing and circulation, and the appropriate length and location of the connecting cables.



Mounting and electrical installation

Keep the following in mind during mounting and electrical installation:

- National regulations for power installations
- Interference and noise immunity
- Conditions of operation
- Mounting attitude

Degrees of protection

The following components fulfill the requirements for IP 54 (dust protection and splash-proof protection):

- Visual display unit (when properly installed)
- Keyboard unit (when properly installed)
- Machine operating panel (when properly installed)
- Handwheel

All other electrical and electronic control components (computer and controller units, inverters, etc.) must be installed in such a manner (e.g. in an electrical cabinet or housing) that fulfillment of protection class IP 54 (against dust and splash water) is guaranteed. This is the only way to avoid the deposition of dust in and on the components. Contamination is only permissible up to contamination level 2.

Electromagnetic compatibility

Intended place of operation

The units fulfill the requirements for Class A devices in accordance with the specifications in EN 55022, and are intended for use in industrially zoned areas.

Protect your equipment from interference by observing the rules and recommendations specified in the Technical Manual.

Likely sources of interference

Noise is mainly produced by capacitive and inductive coupling from electrical conductors or from device inputs/outputs, such as:

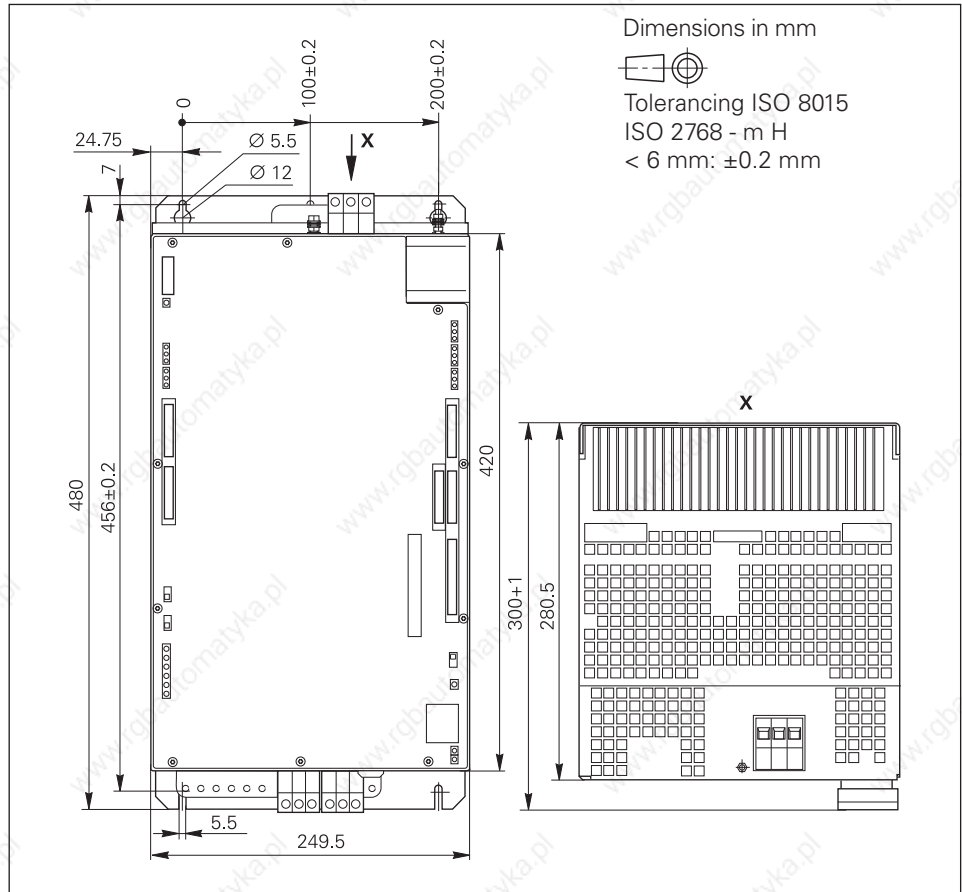
- Strong magnetic fields from transformers or electric motors
- Relays, contactors and solenoid valves
- High-frequency equipment, pulse equipment and stray magnetic fields from switch-mode power supplies
- Power lines and leads to the above equipment

Protective measures

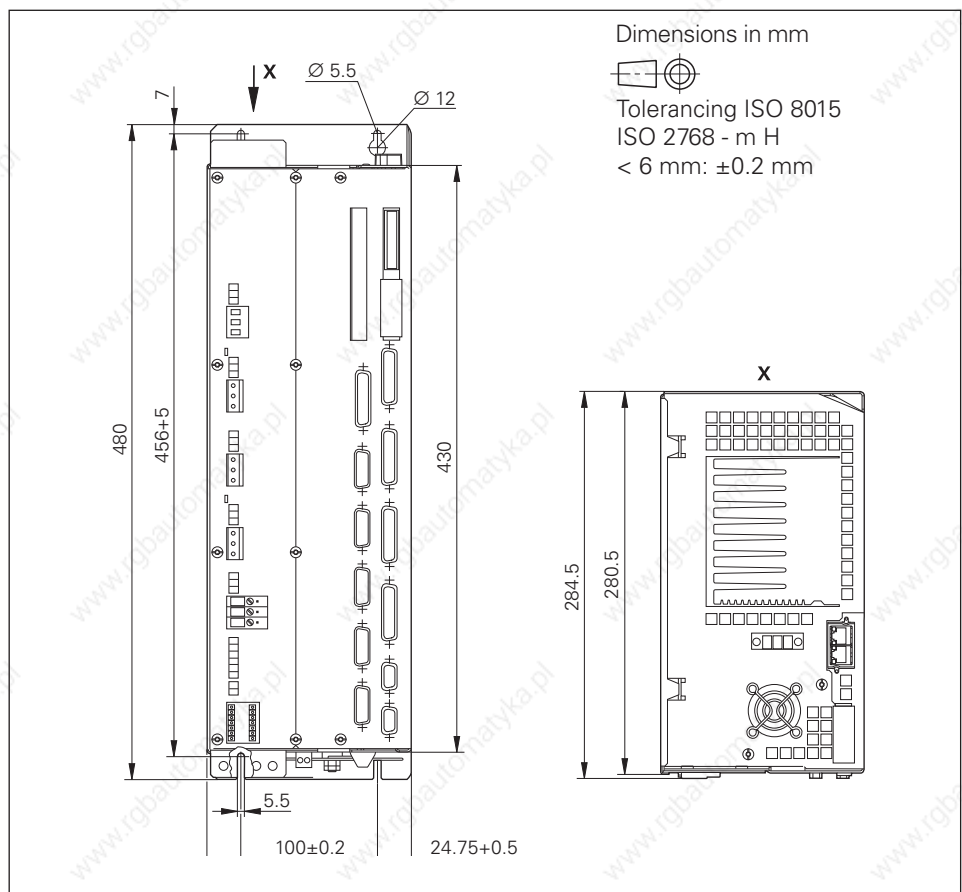
- Keep a minimum distance of 20 cm from the MC, CC and its leads to devices that carry interference signals
- Keep a minimum distance of 10 cm from the MC, CC and its leads to cables that carry interference signals. For cables in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.
- Shielding according to EN 50178
- Use potential compensating lines with a cross section of 6 mm²
- Use only genuine HEIDENHAIN cables, connectors and couplings

Dimensions

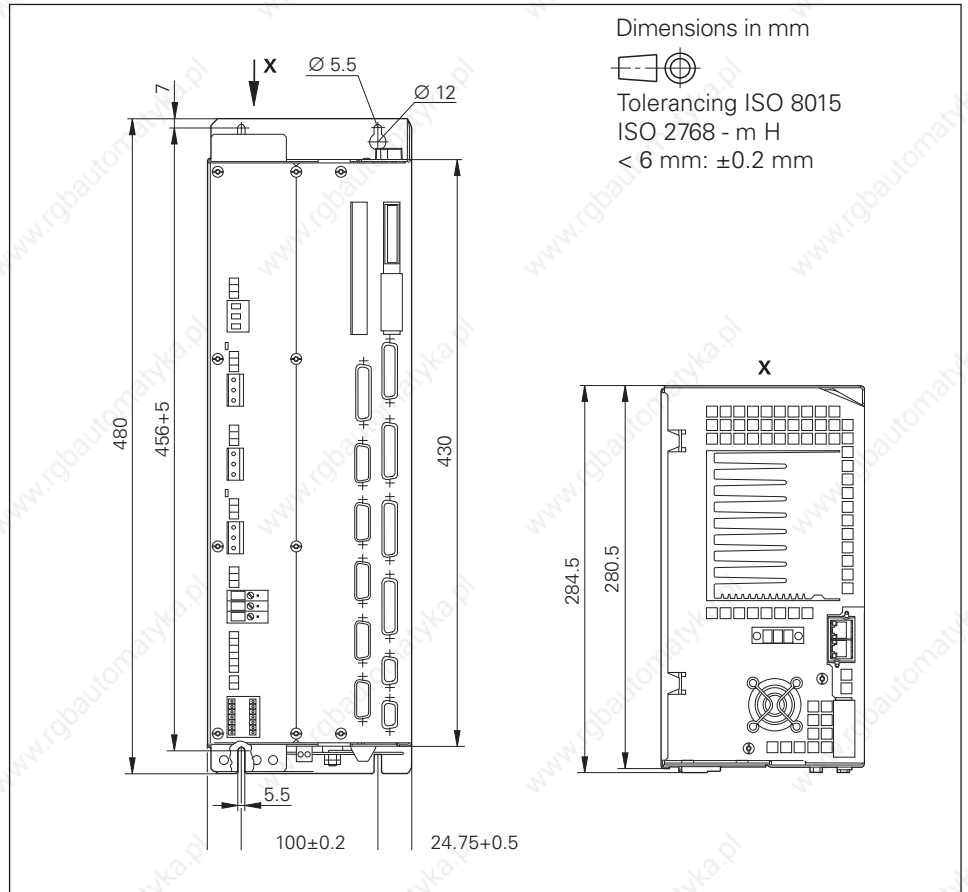
UR 2xxD Series



UEC 111 and UEC 112 Series



UE 21xD and UE 2xxD Series

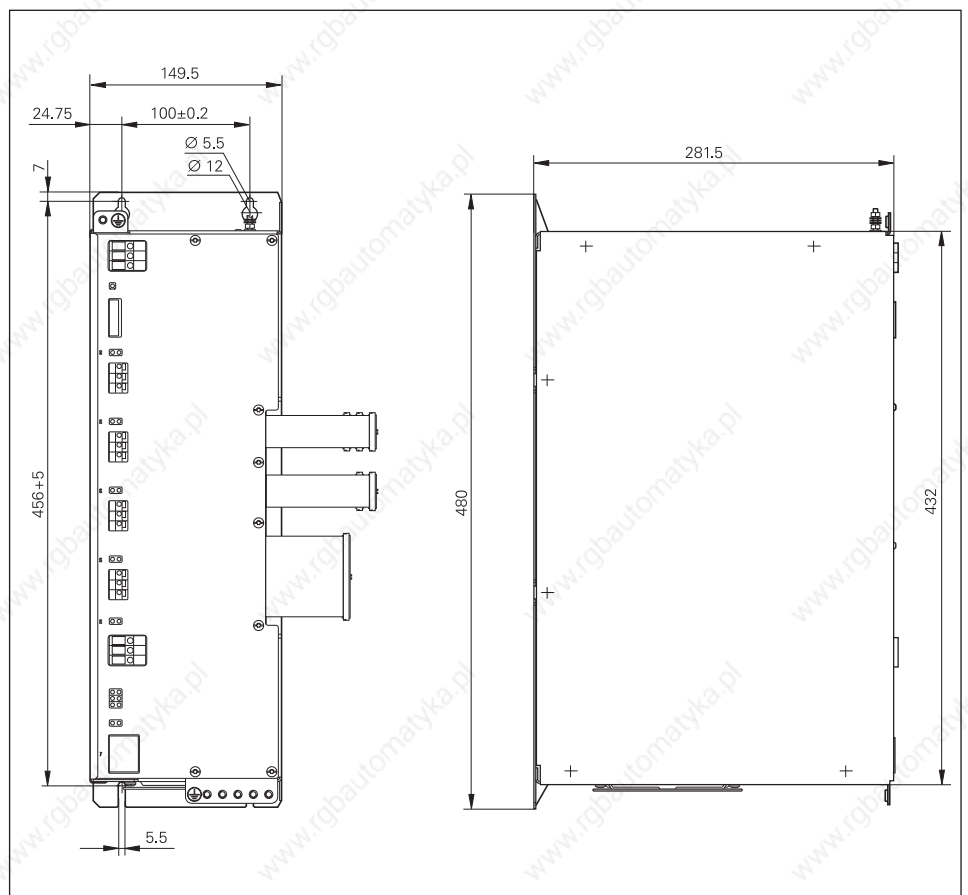


UE 1xx Series

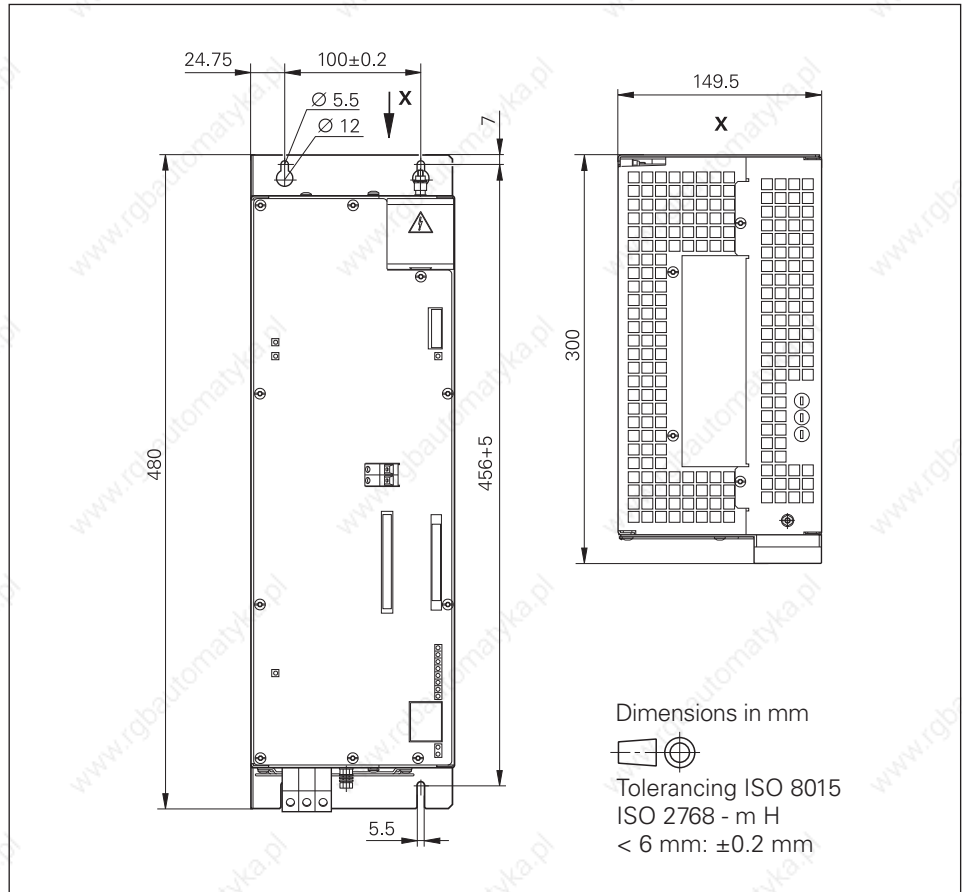
Dimensions in mm



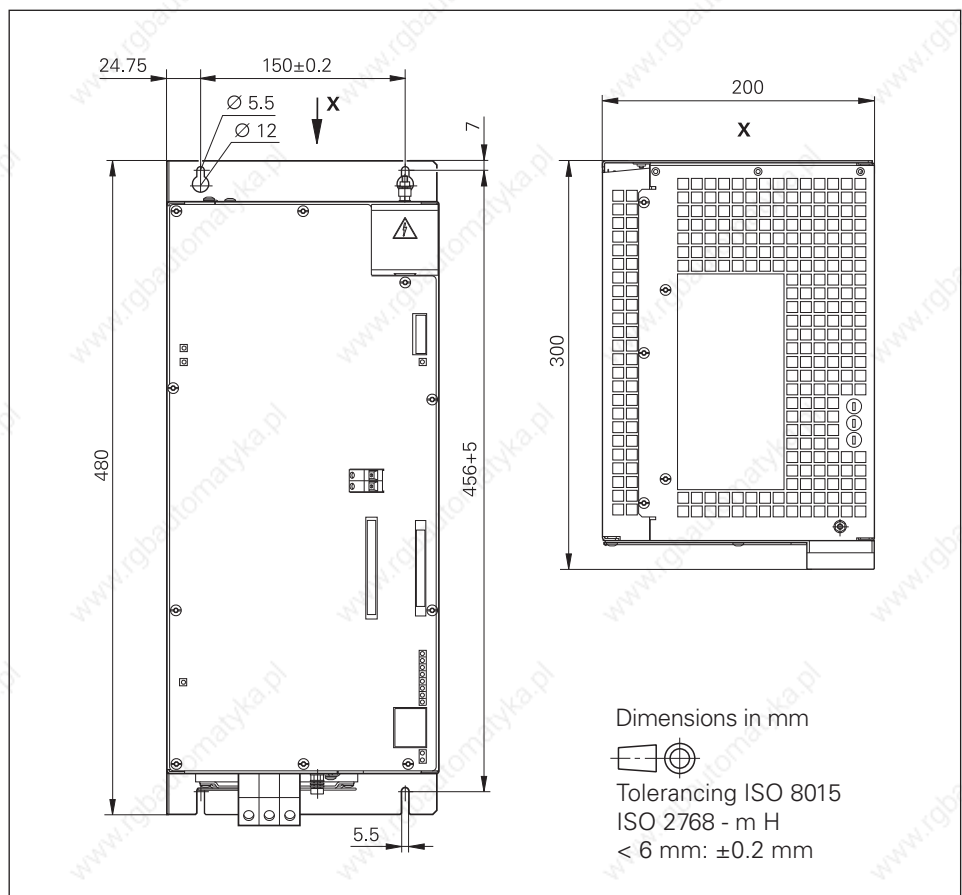
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ± 0.2 mm



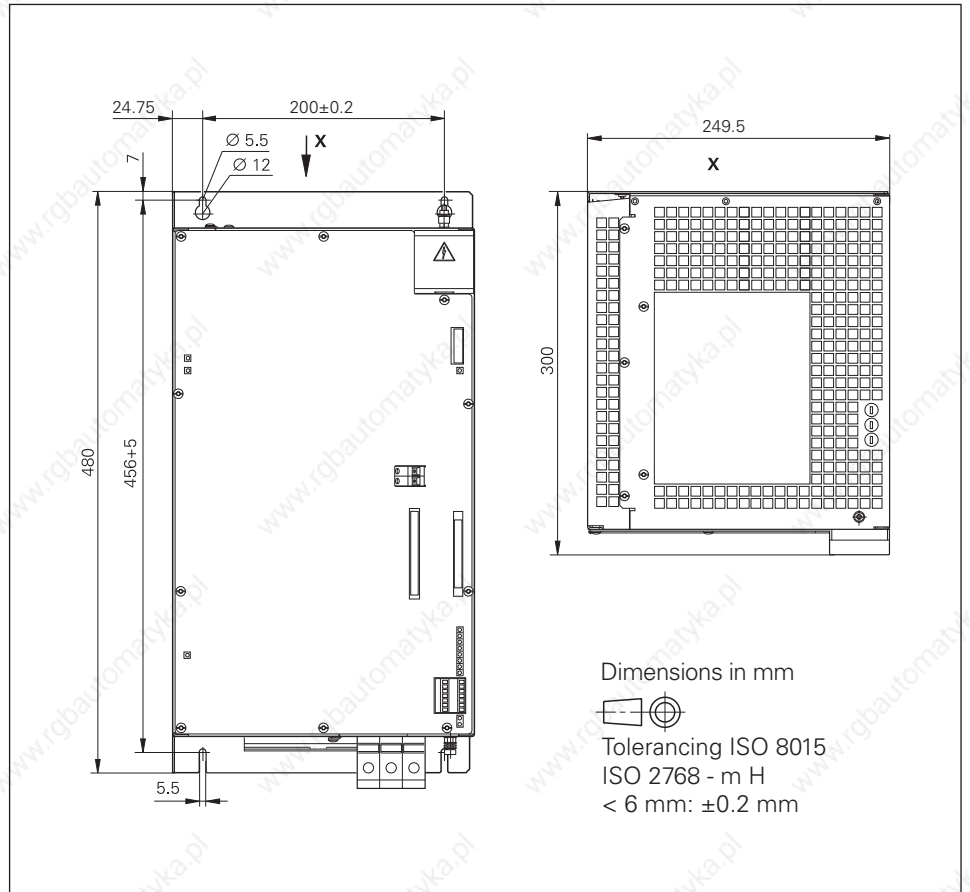
UVR 120D,
UVR 130D



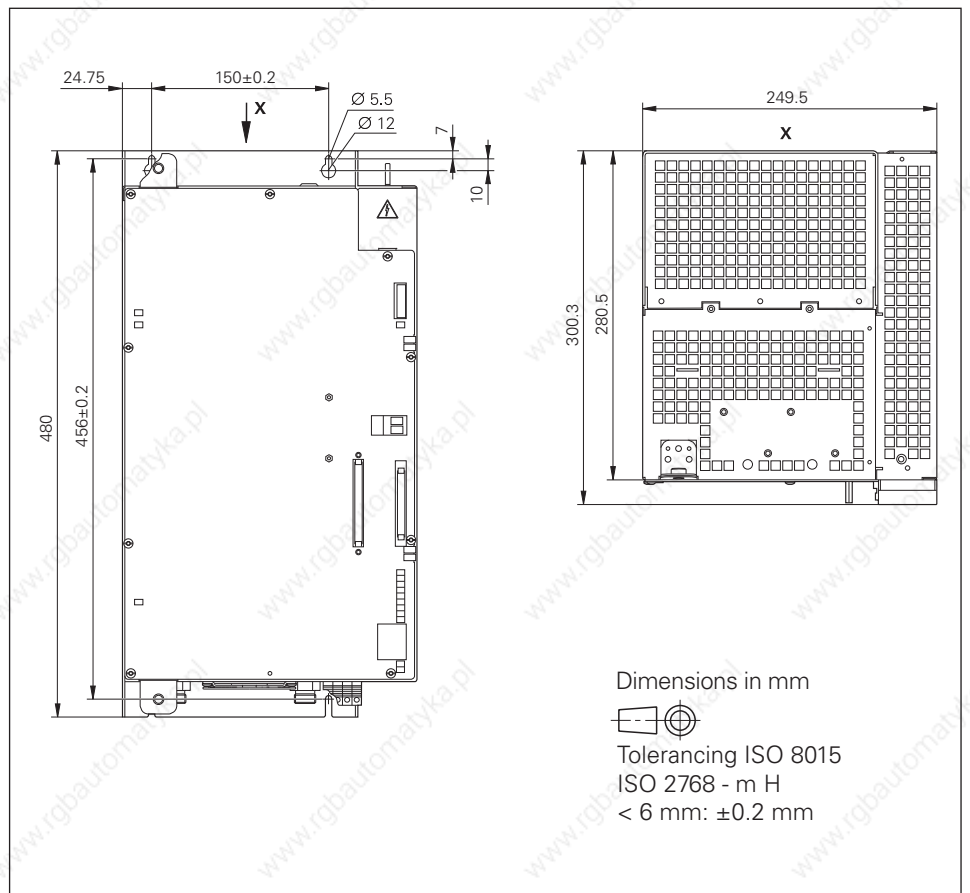
UVR 140D,
UVR 150D



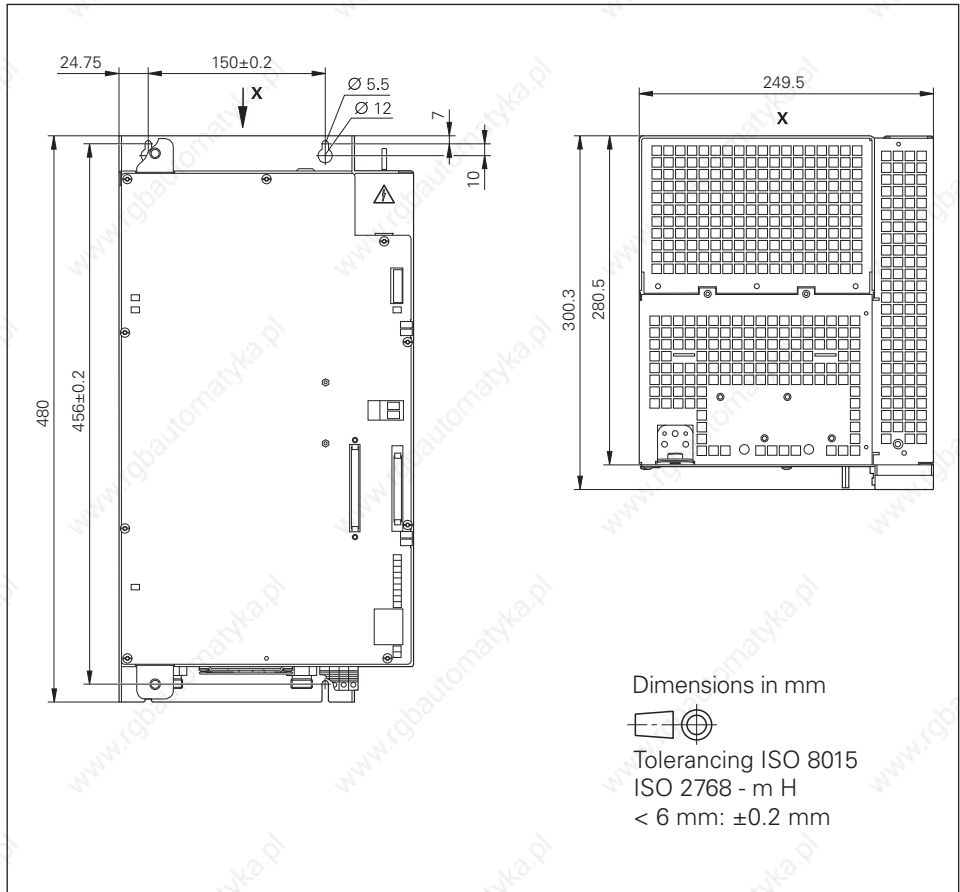
UVR 160D



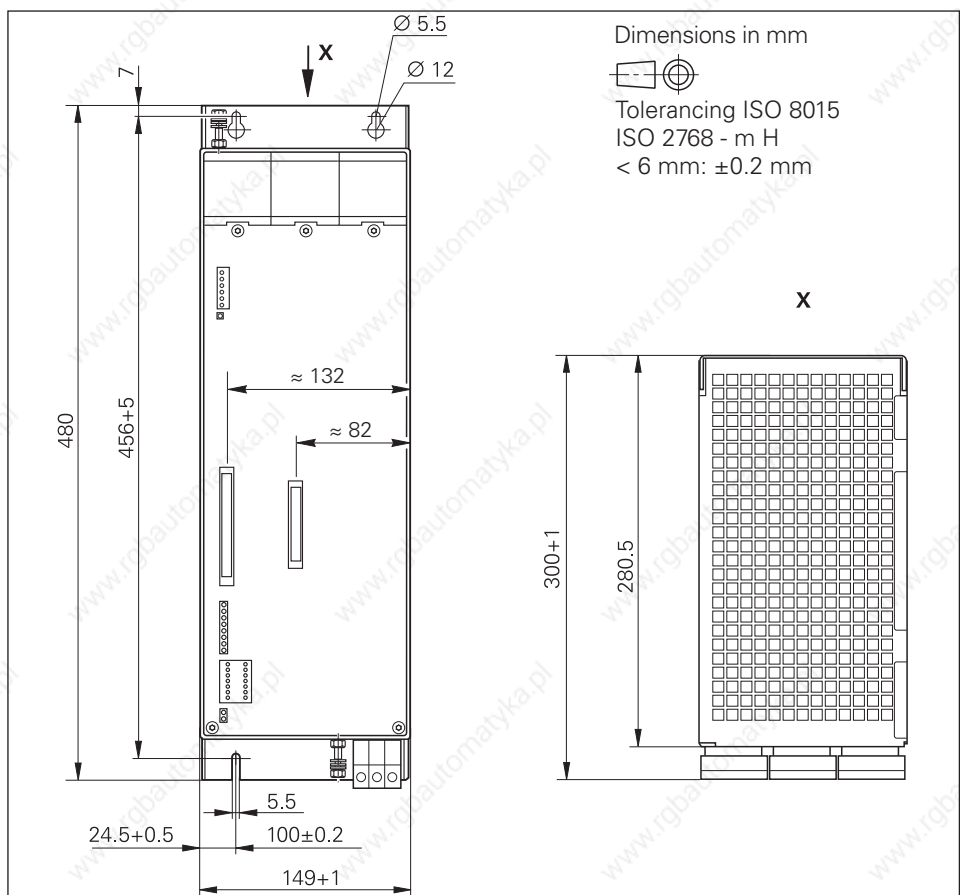
UVR 160DW



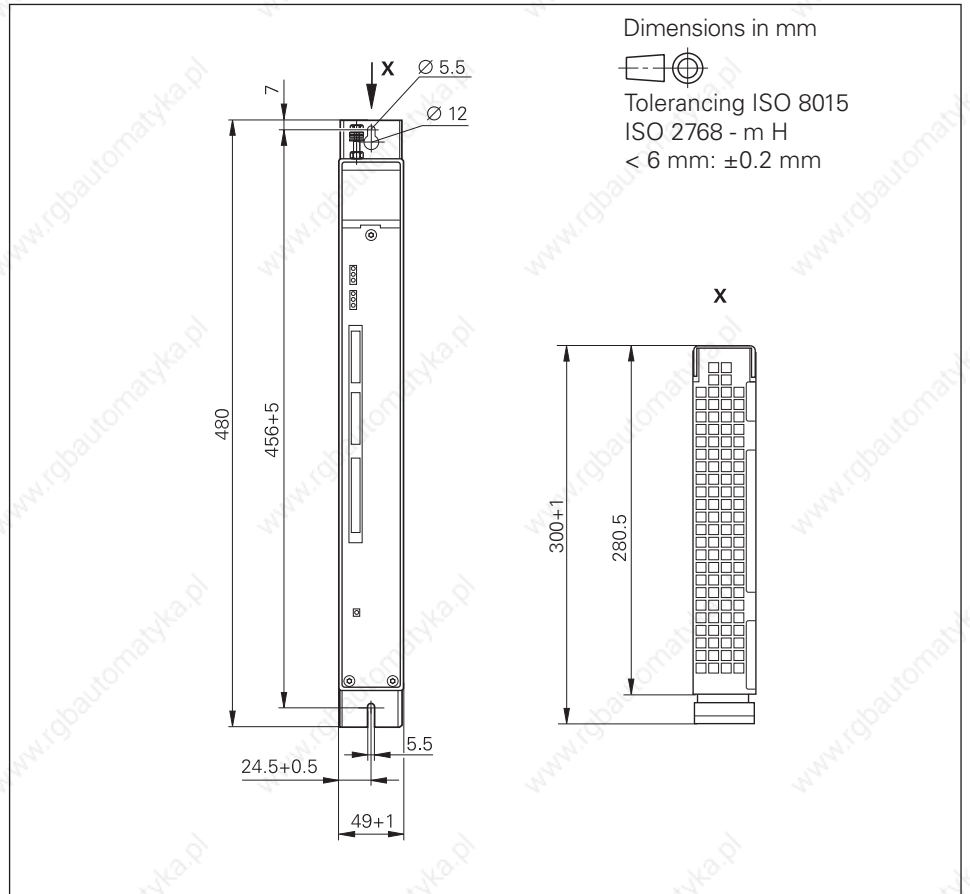
UVR 170DW



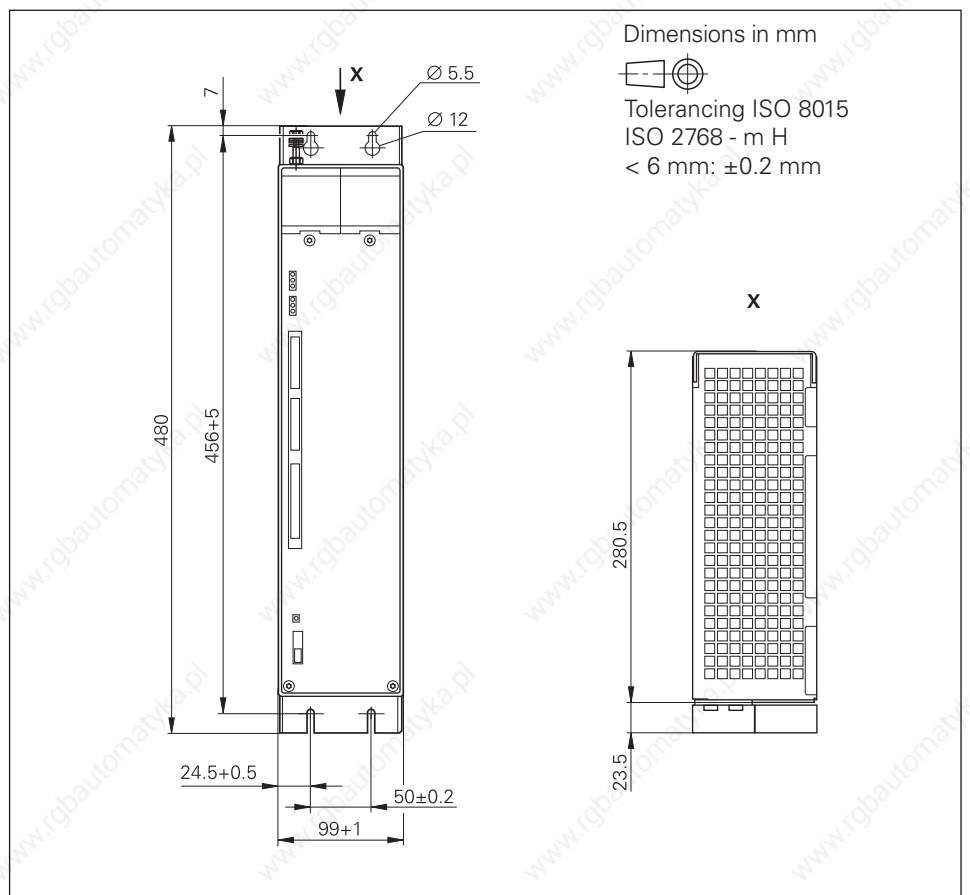
UV 130D



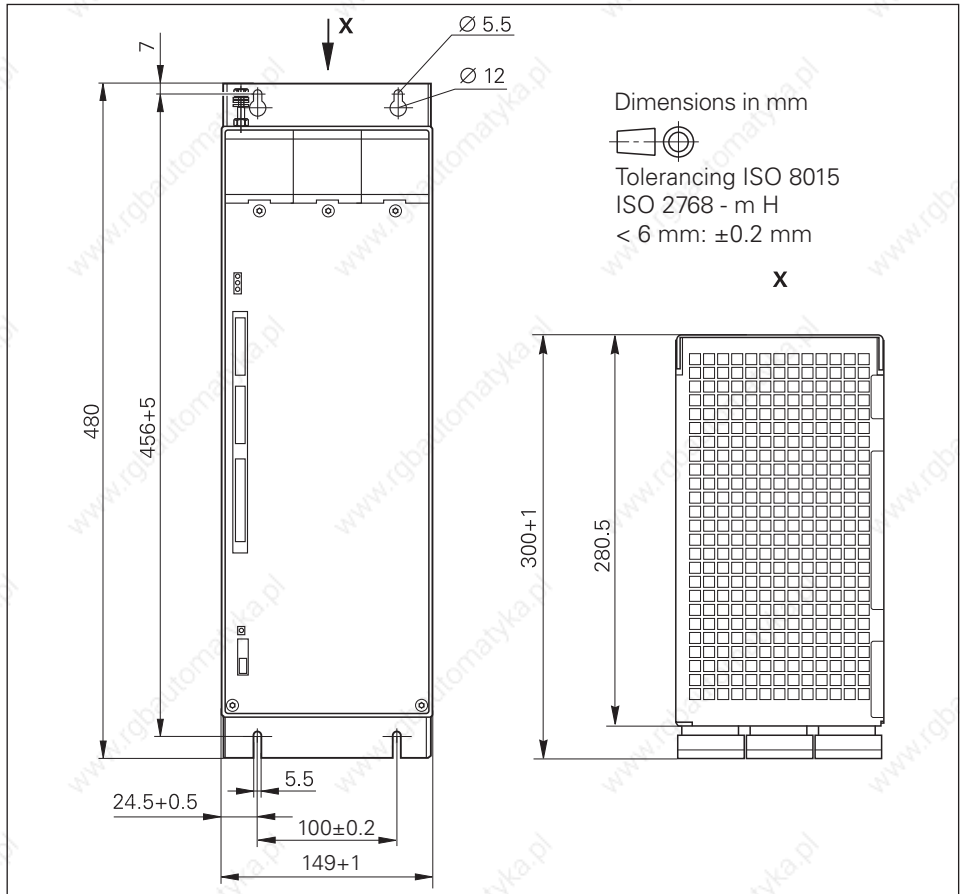
UM 111 D,
UM 111 BD,
UM 121 D



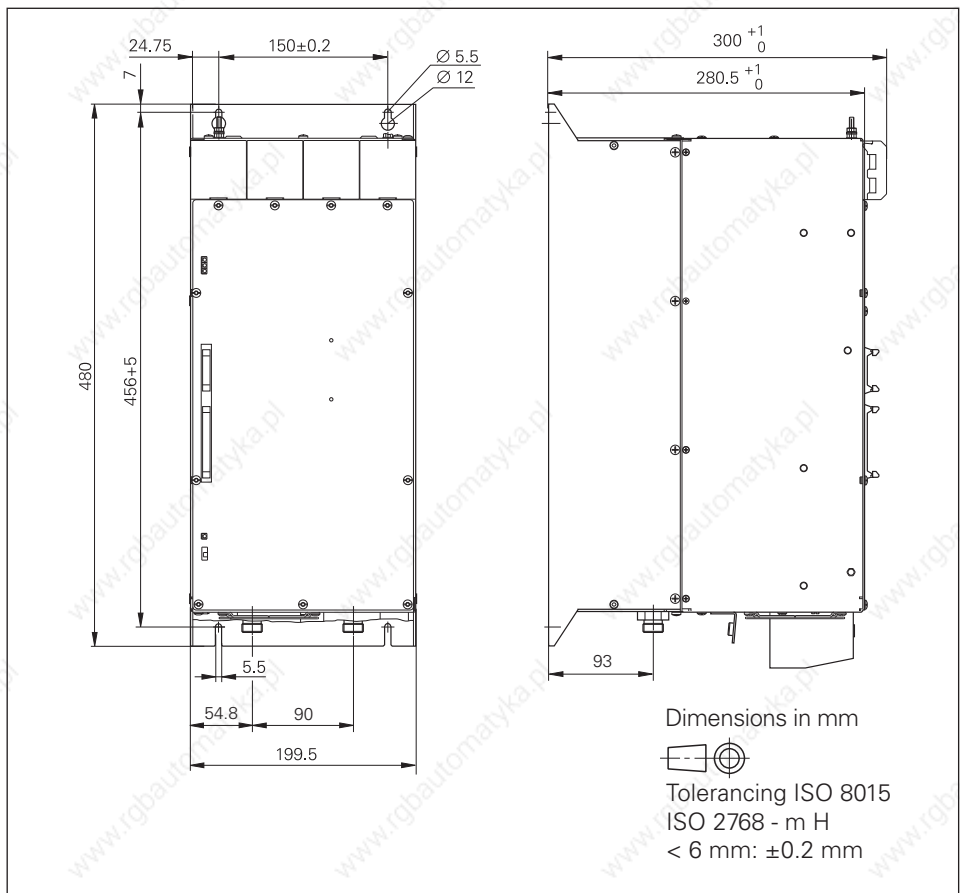
UM 112 D,
UM 113 D,
UM 114 D,
UM 121 BD,
UM 122 D



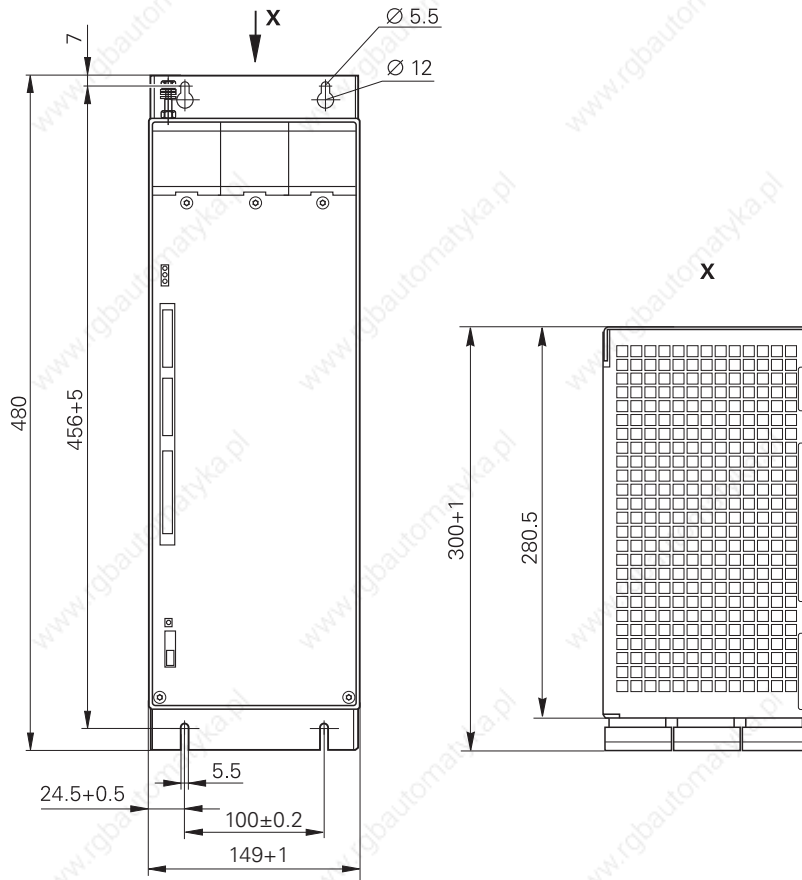
UM 115D



UM 116DW UM 117DW



UM 116D with Fan Unit



Dimensions in mm

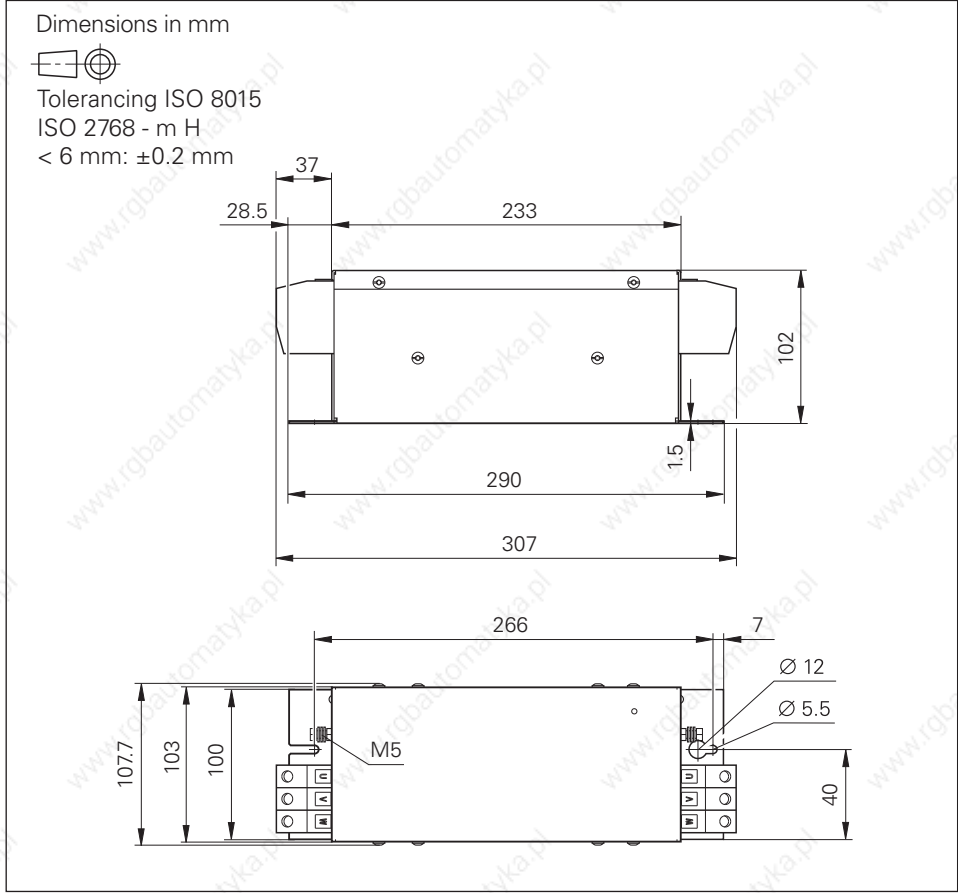


Tolerancing ISO 8015

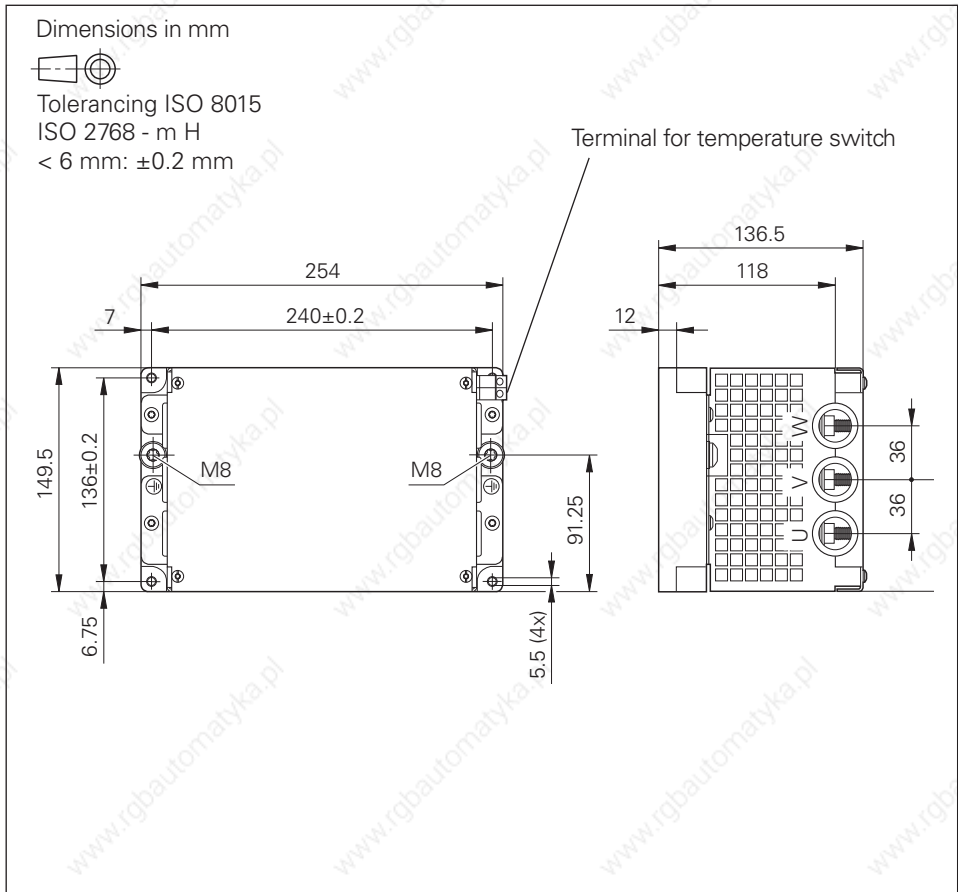
ISO 2768 - m H

< 6 mm: ±0.2 mm


SM 110

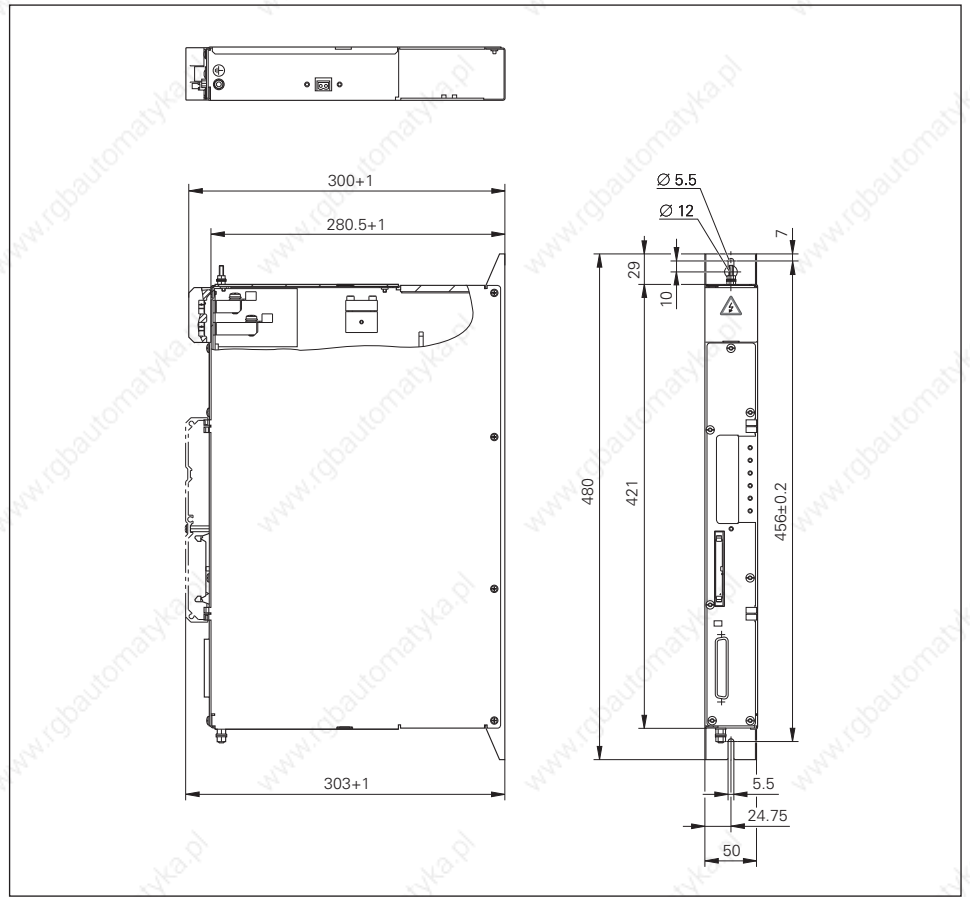


SM 130




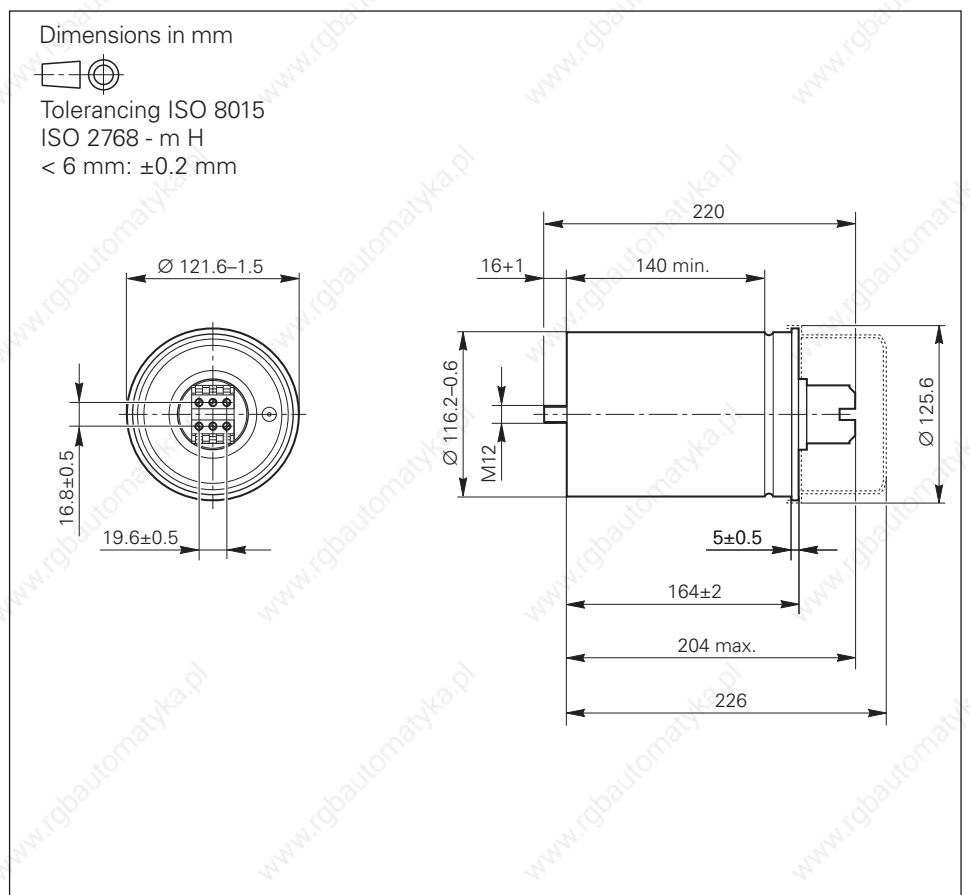
MS 110
MS 111

Dimensions in mm

 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ±0.2 mm

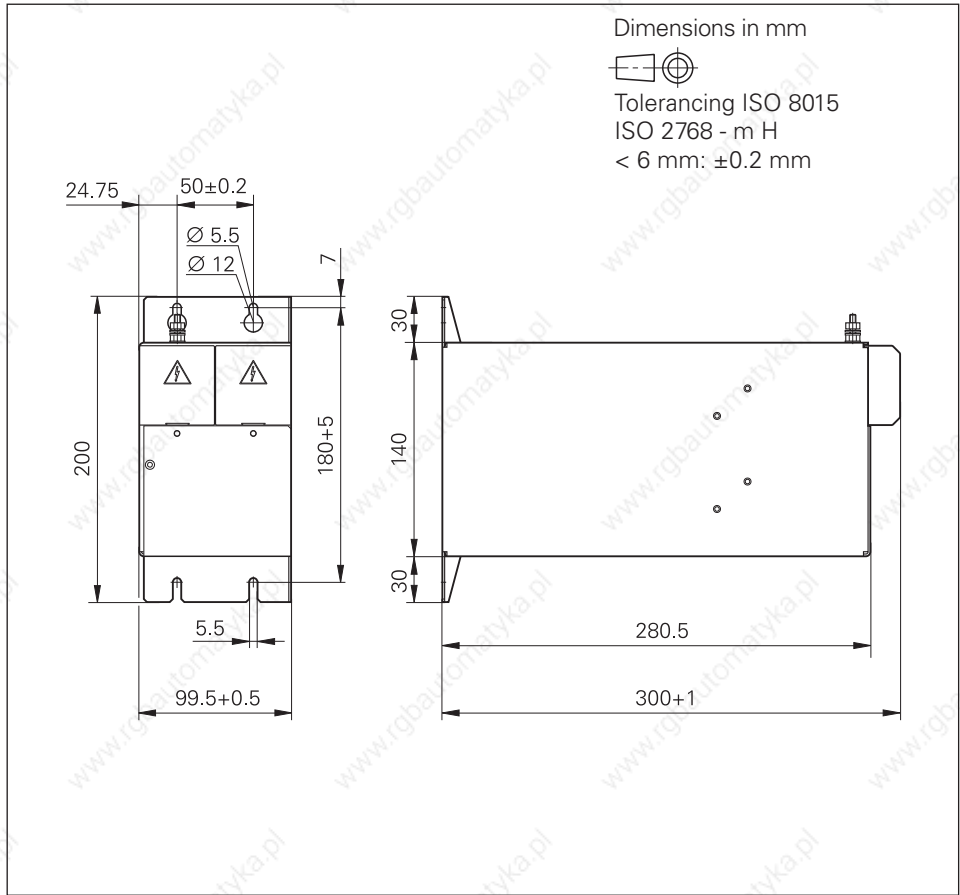


Three-Phase
Current Capacitor

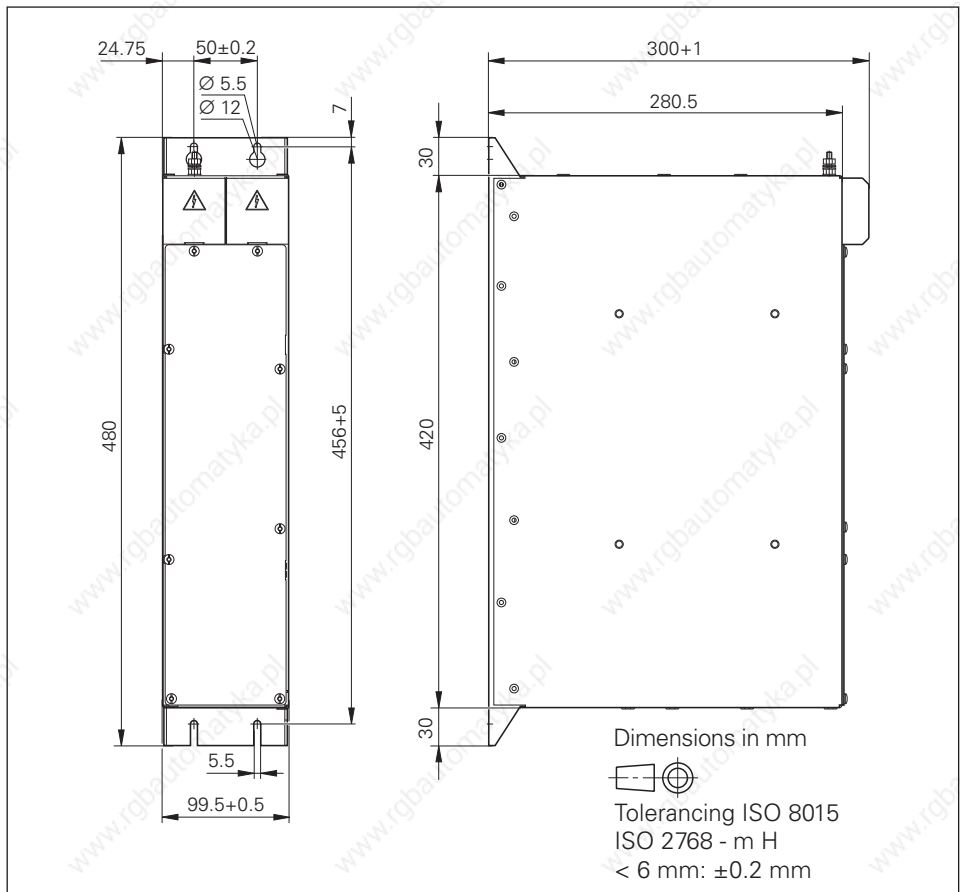
Dimensions in mm

 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ±0.2 mm



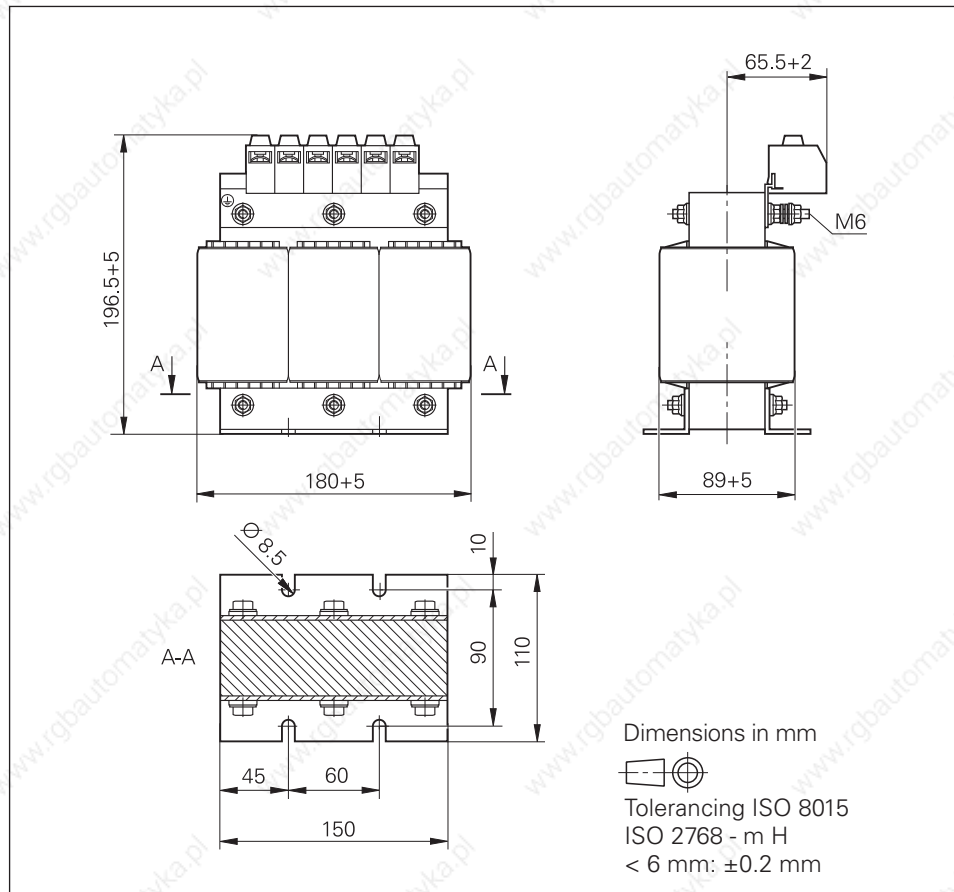
ZKF 110



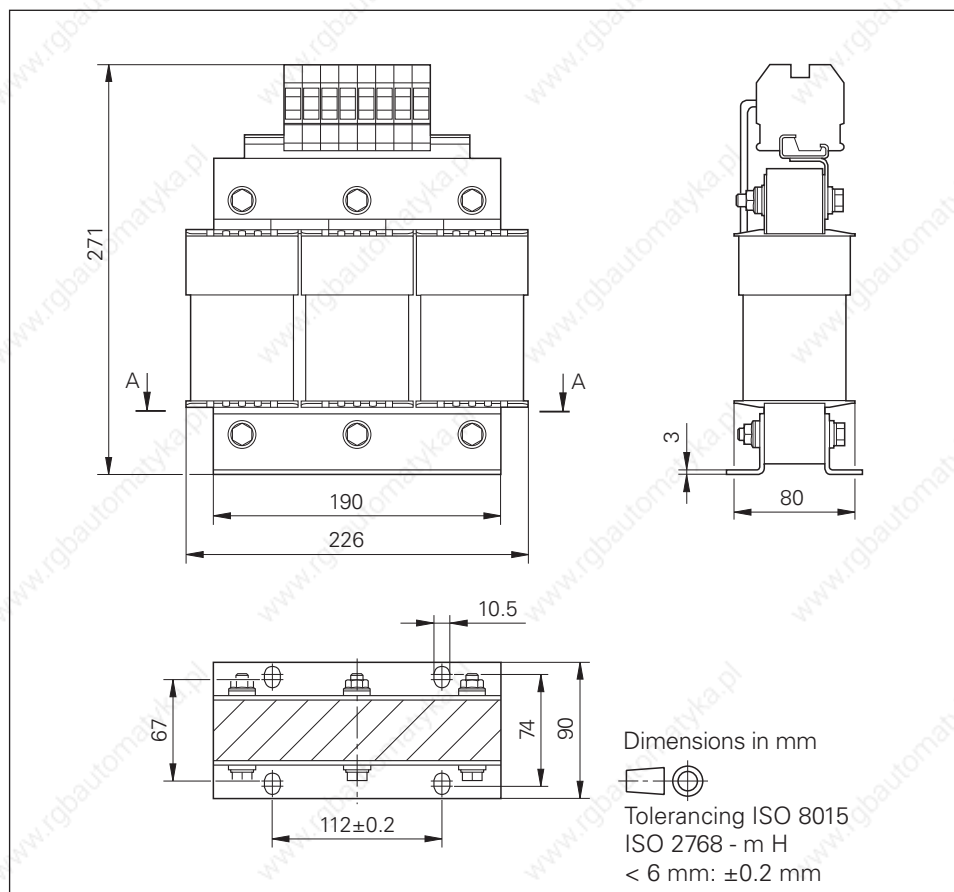
ZKF 120 ZKF 130 ZKF 140



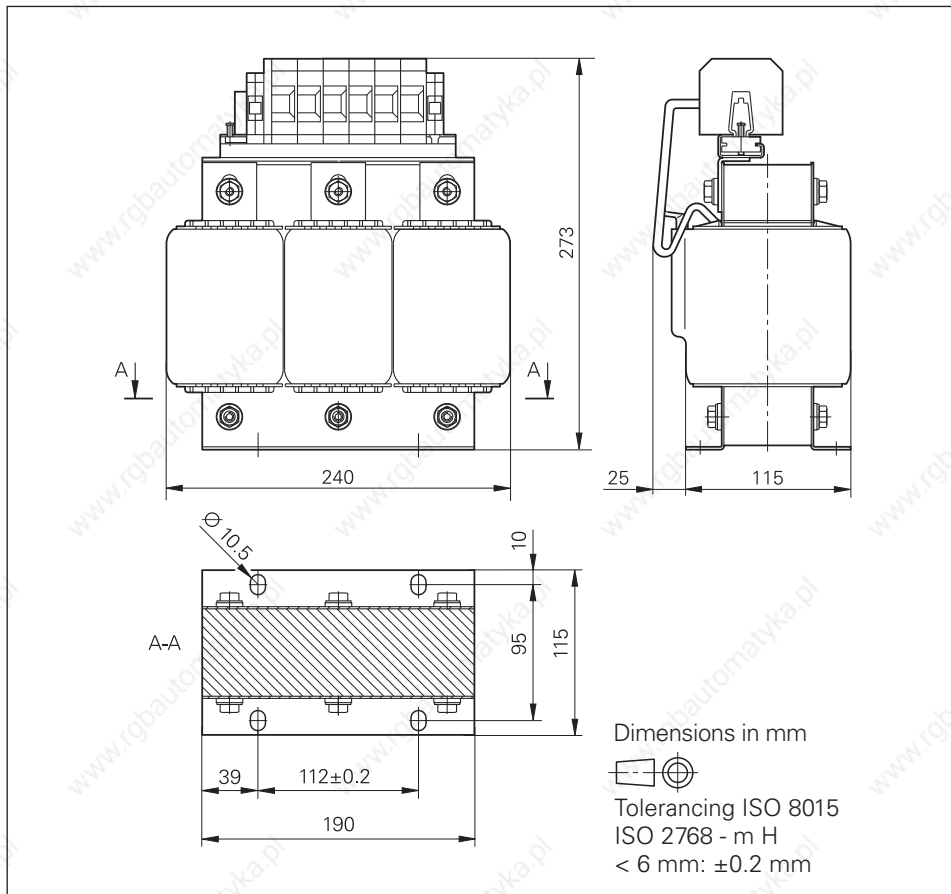
KDR 120



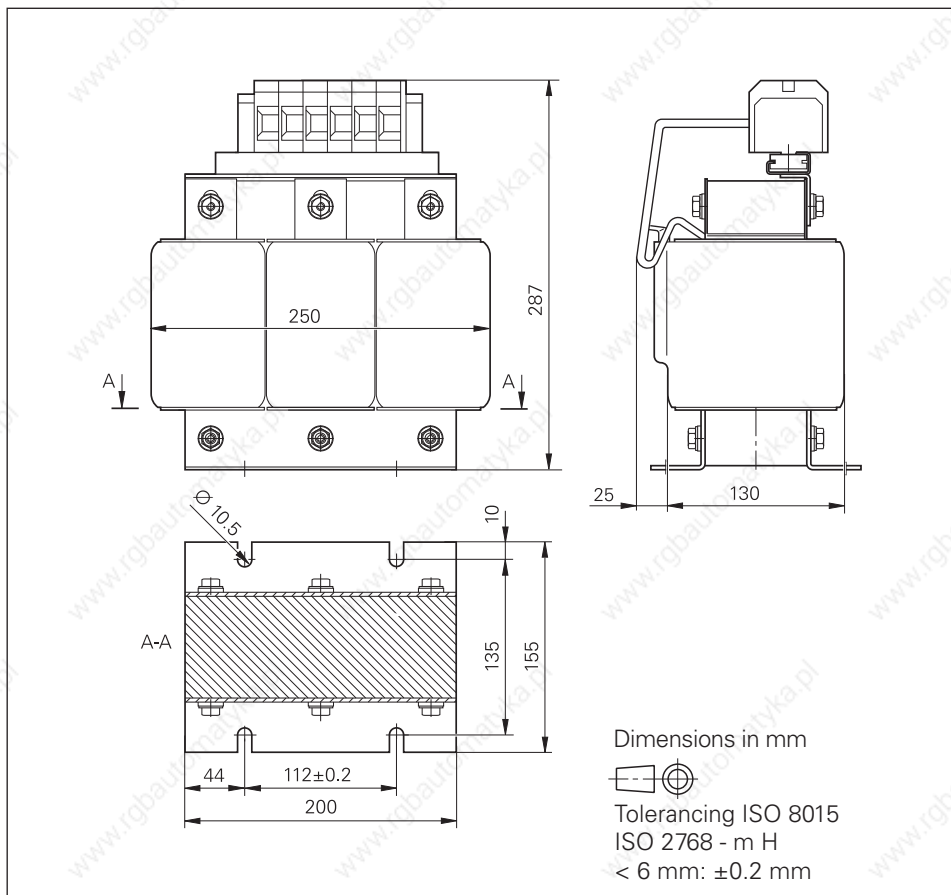
KDR 130C



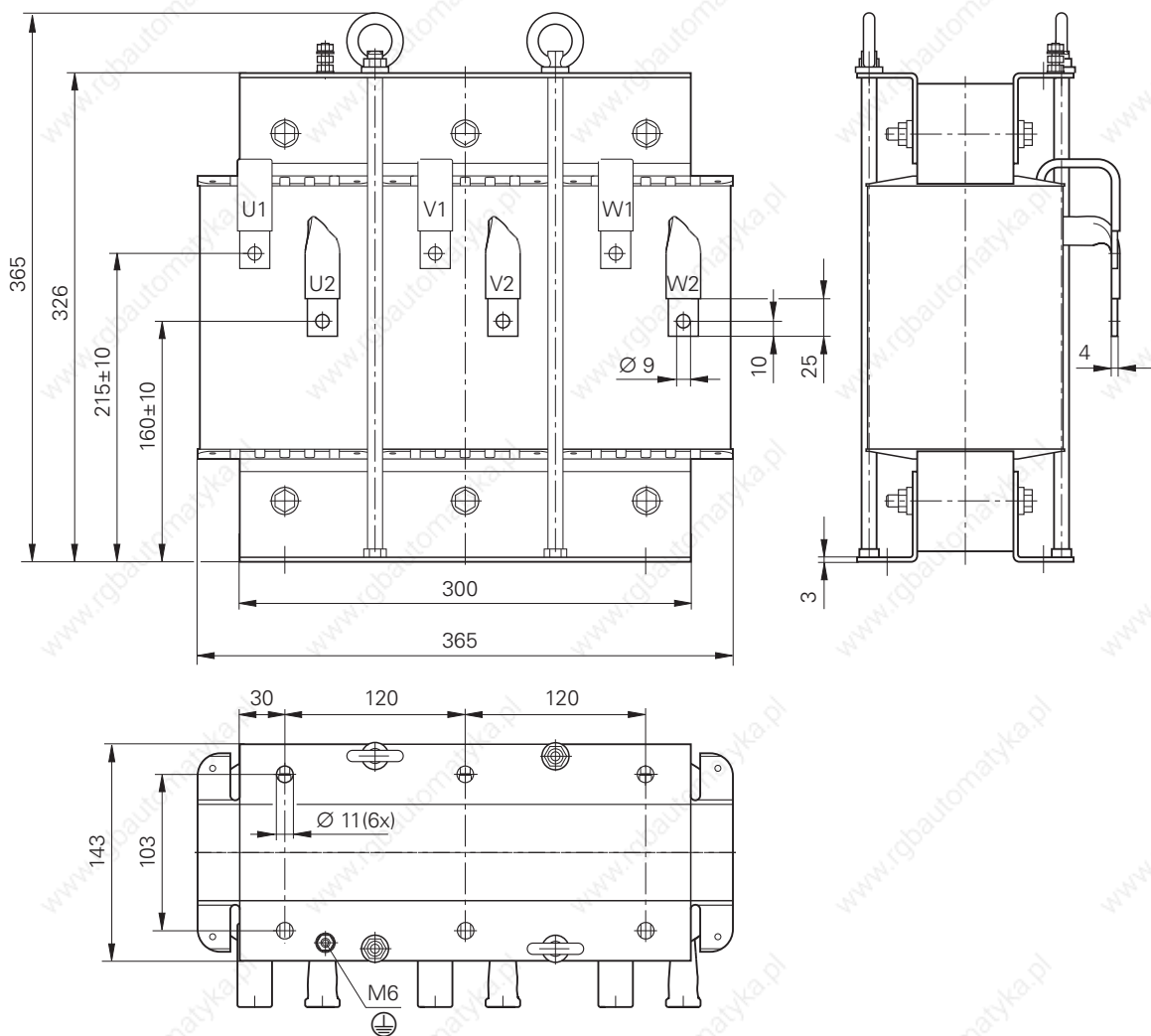
KDR 140



KDR 150



KDR 160



Dimensions in mm

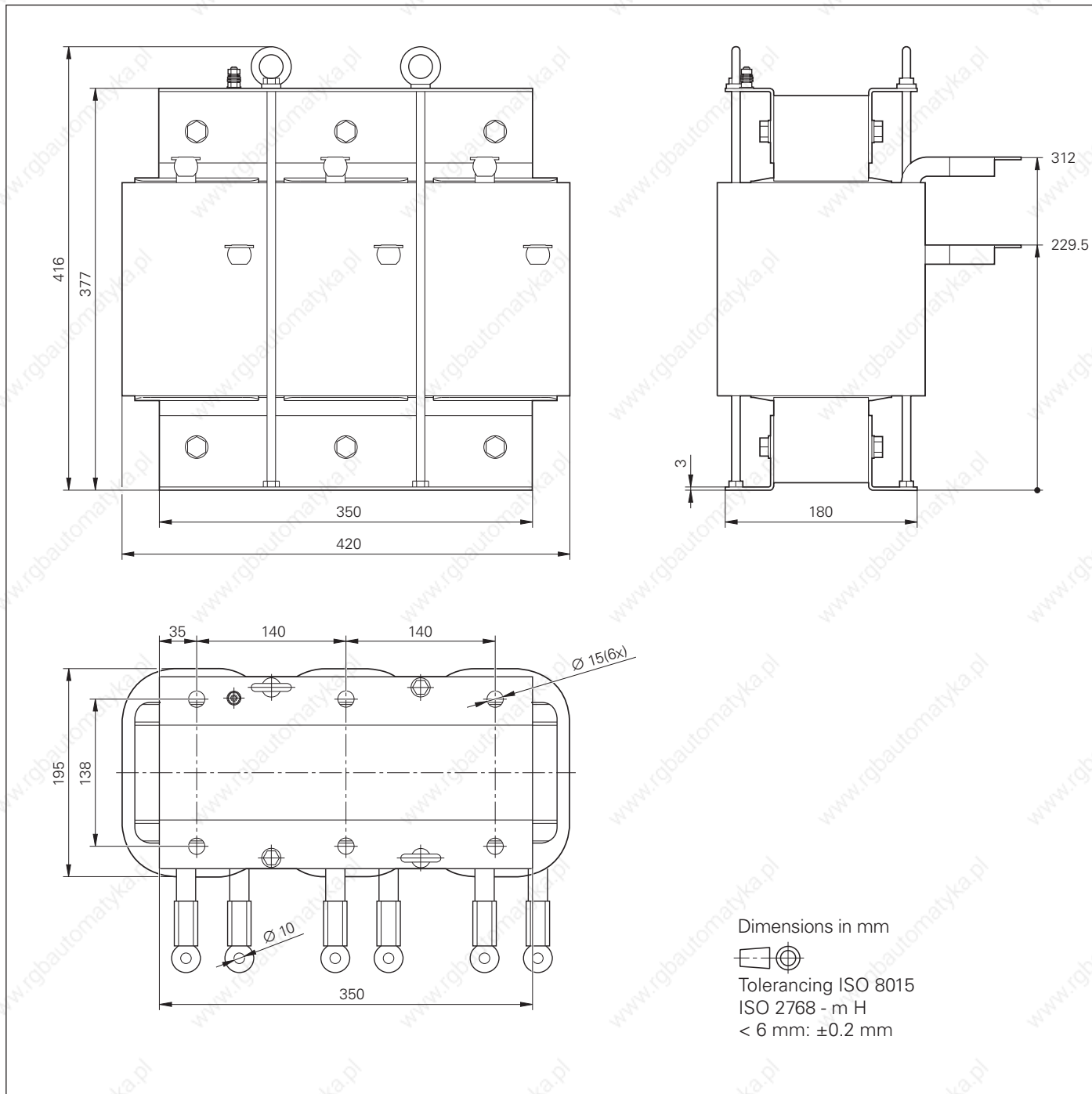


Tolerancing ISO 8015

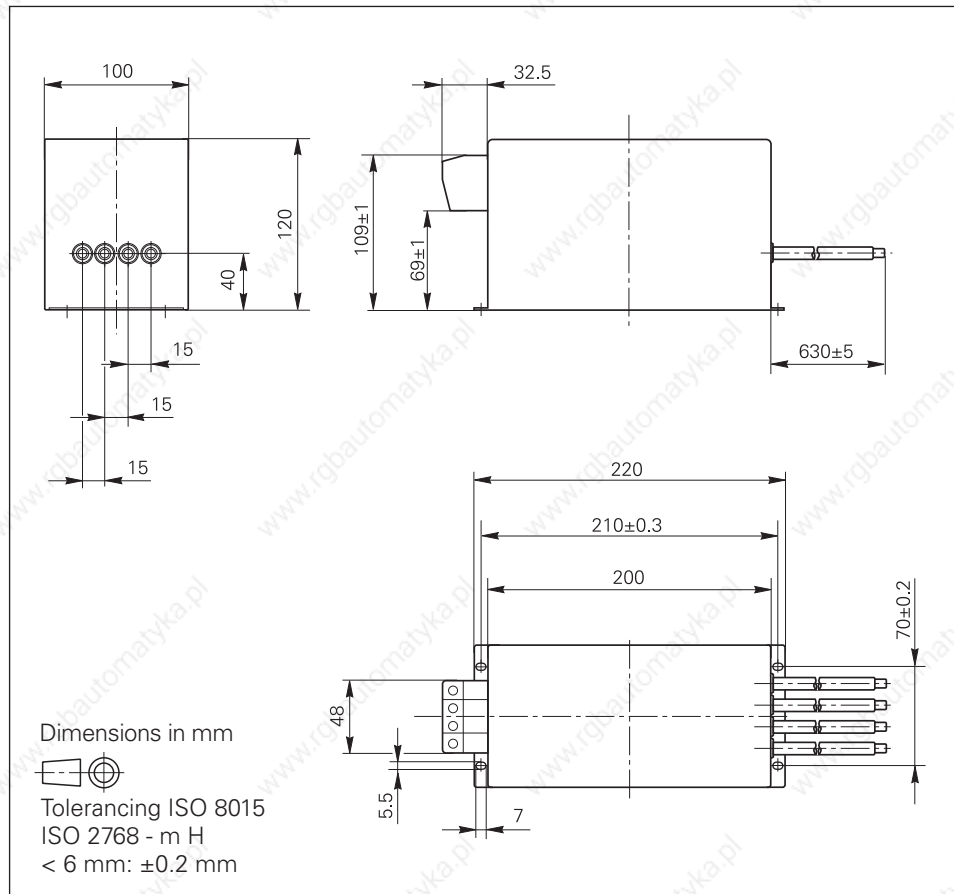
ISO 2768 - m H

< 6 mm: ± 0.2 mm

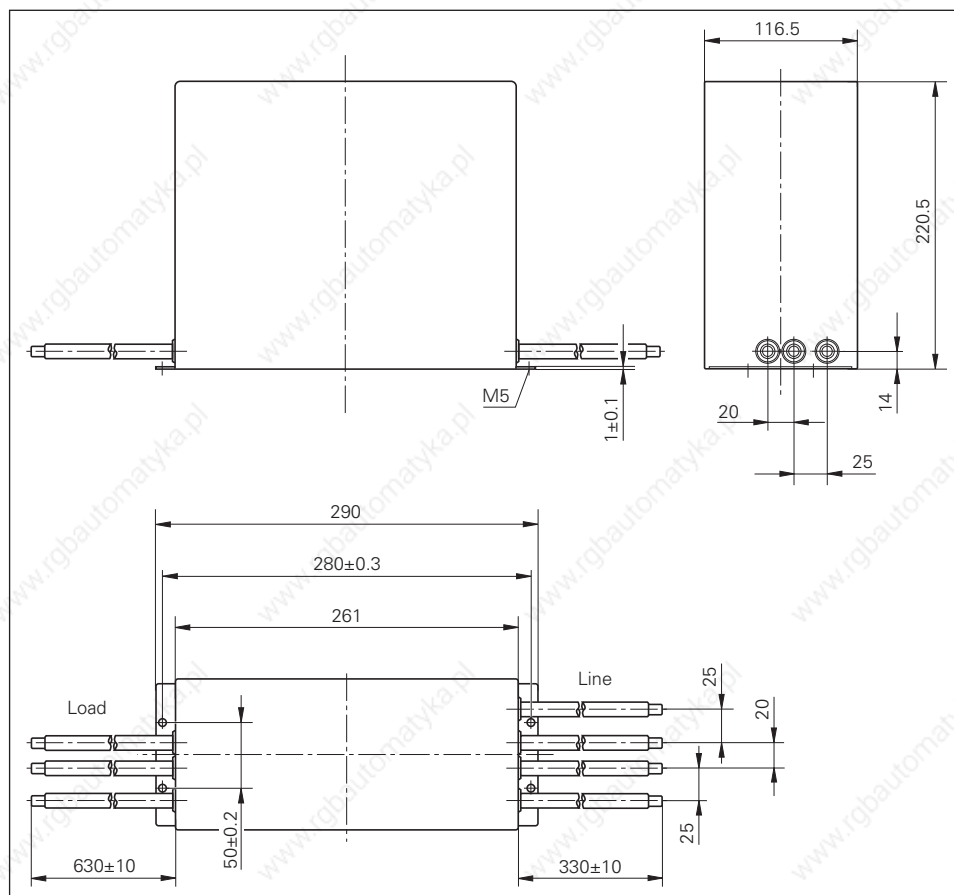
KDR 170



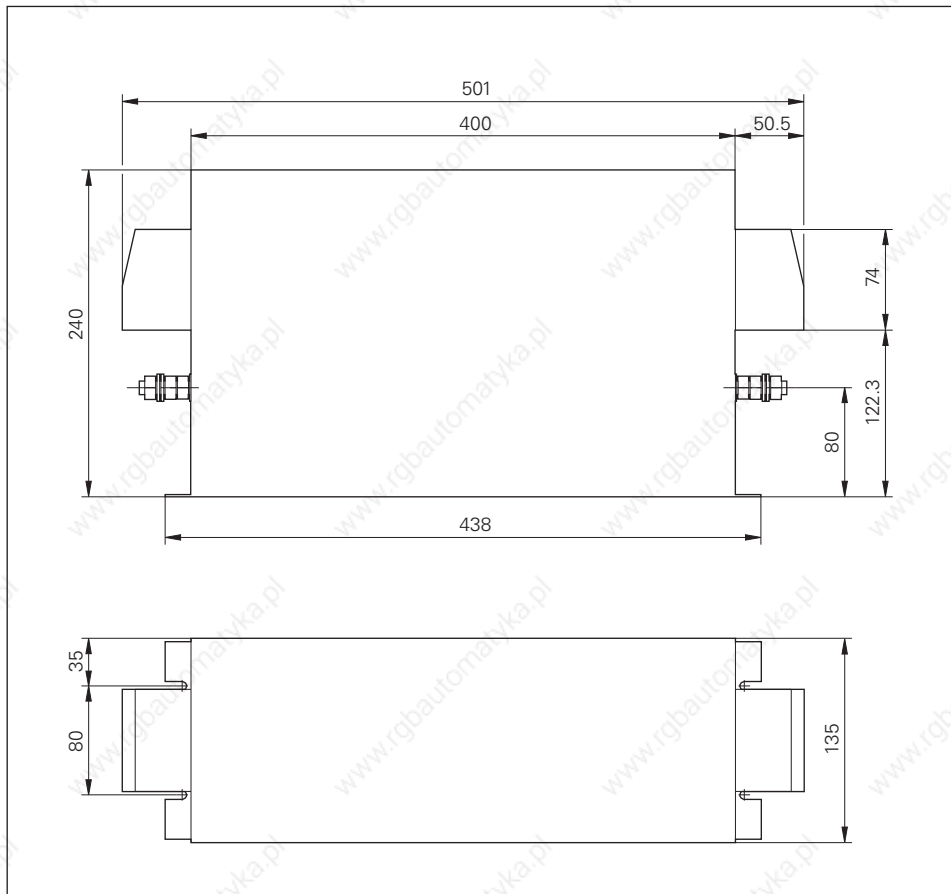
EPCOS 35A



EPCOS 80A



EPCOS 120A



Dimensions in mm

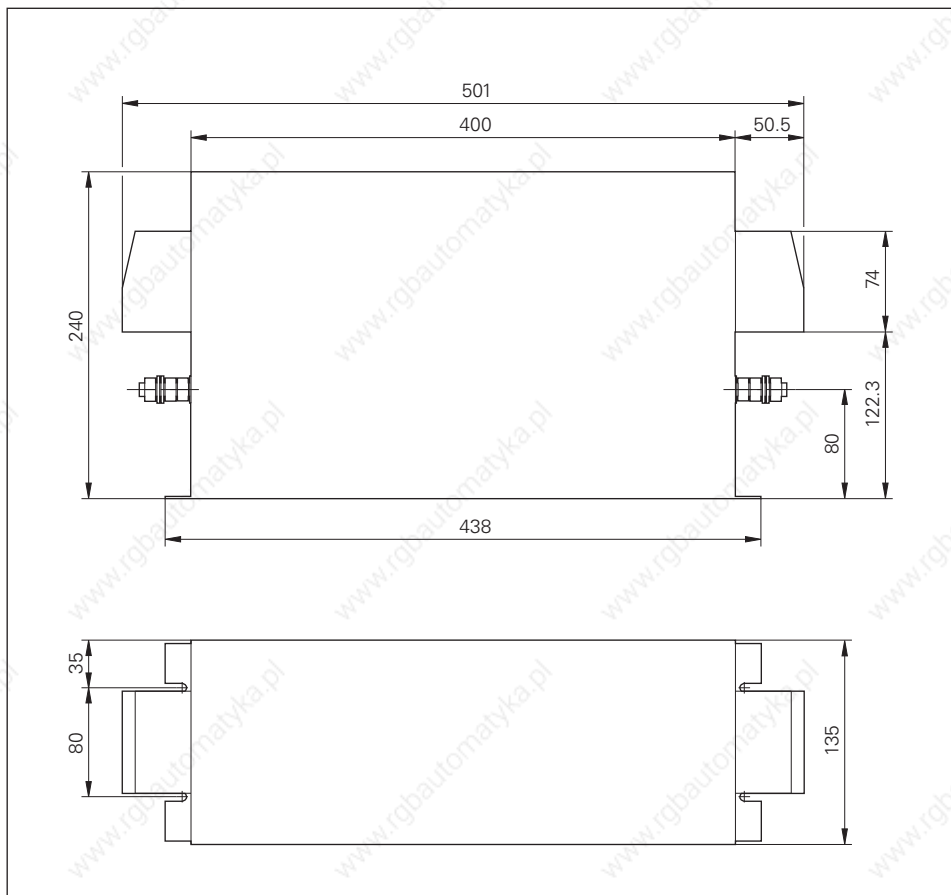


Tolerancing ISO 8015

ISO 2768 - m H

< 6 mm: ± 0.2 mm

EPCOS 200A



Dimensions in mm

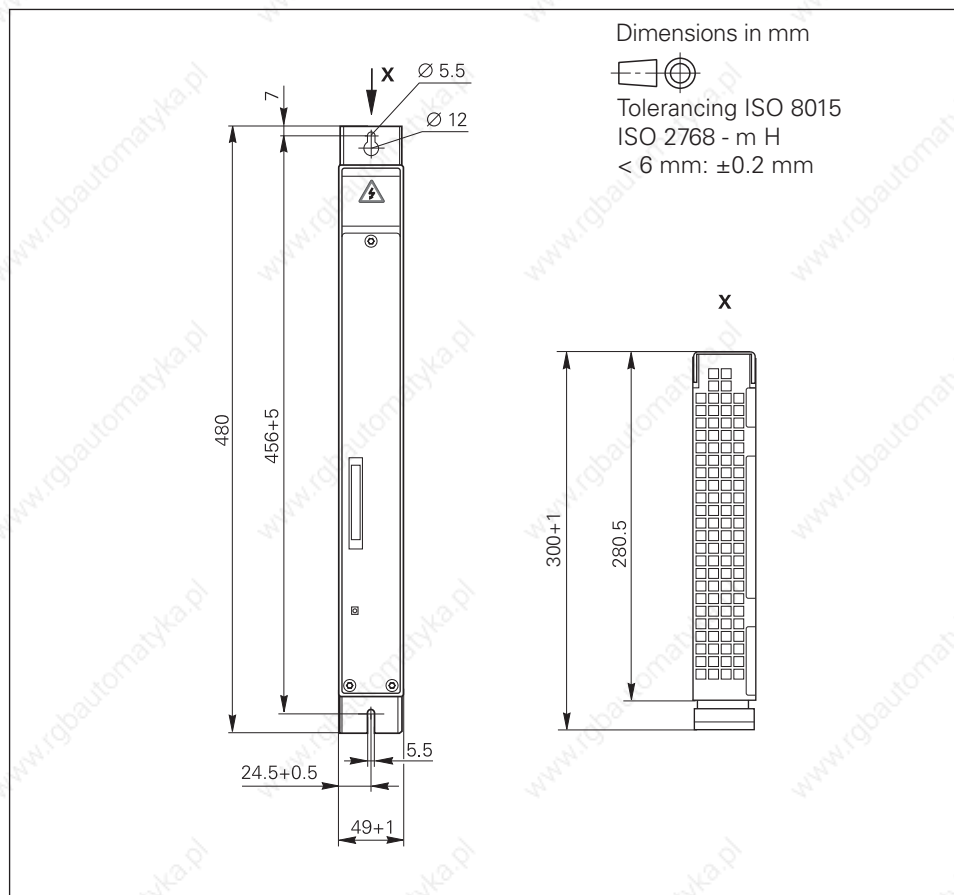


Tolerancing ISO 8015

ISO 2768 - m H

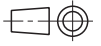
< 6 mm: ± 0.2 mm

UP 110
UP 120



PW 210

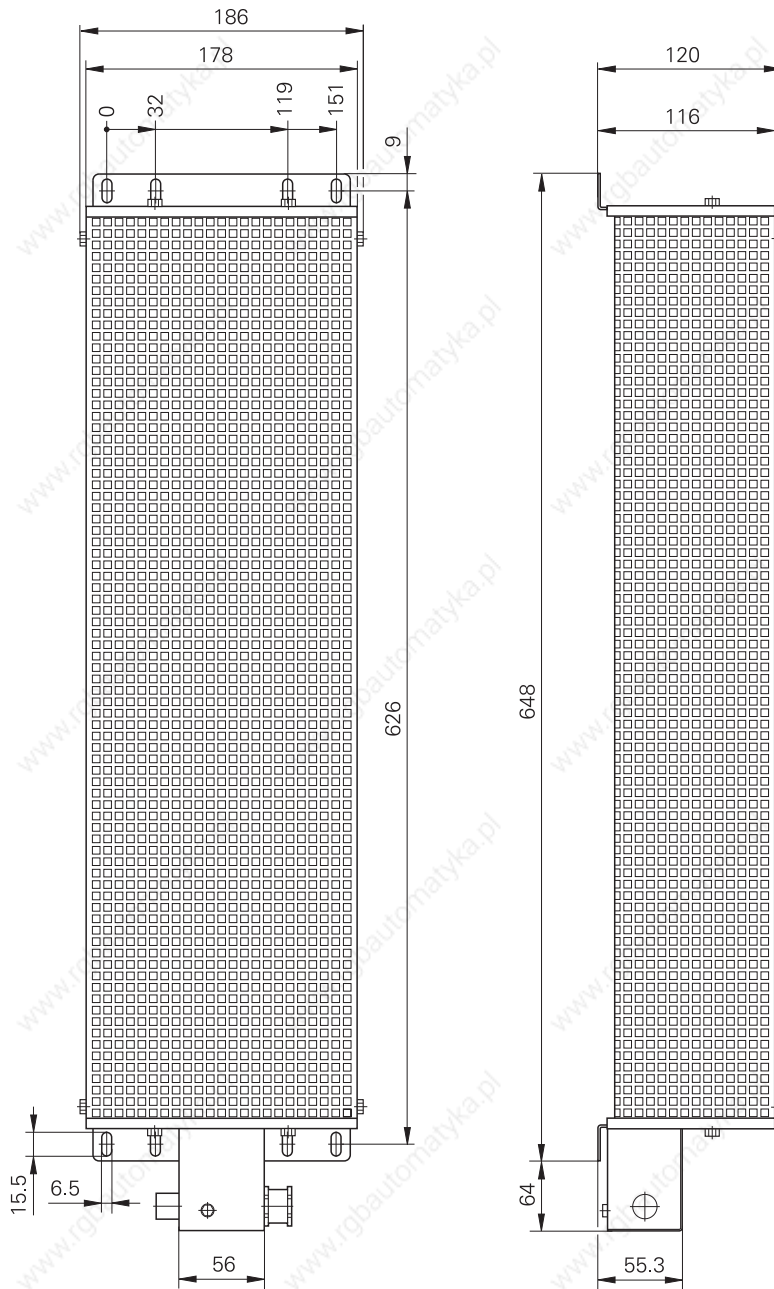
Dimensions in mm



Tolerancing ISO 8015

ISO 2768 - m H

< 6 mm: ± 0.2 mm



Subject Index

A

Axis-release module 25

B

Braking resistor 21
Braking resistor module 22

C

Capacitor modules 24
CMH 120 24
CML 110 24
Commutating reactor 20
Compact inverters 5, 10
Coolant connection 23
Covers for the ribbon cables 26

D

DC-link filter 22
DC-link voltage 4

E

Electromagnetic compatibility 35
EPCOS 35 A 20, 51
EPCOS 80 A 20, 51
EPCOS 120 A 20, 52
EPCOS 200 A 20, 52

F

Fan cooling 17
Functional safety (FS) 4

I

IOconfig software for PCs 14

K

KDR 120 20, 47
KDR 130 C 20, 47
KDR 140 20, 48
KDR 150 20, 48
KDR 160 20, 49
KDR 170 20, 50

L

Line filter 20

M

Modular inverters 5, 15, 16
Mounting instructions 34
MS 110 30, 45
MS 111 30, 45
Multi-row configuration 30

N

Nonregenerative compact inverters 11
Nonregenerative inverters 4

P

Power modules 15, 16
Power supply unit 18
PW 210 21, 54

R

Regenerative compact inverters 9
Regenerative inverters 4
Ribbon cable for PWM signals 28
Ribbon cable for supply voltage 27
Ribbon cable for unit bus 28
Ribbon cables and covers 6, 26

S

SM 110 23, 44
SM 130 23, 44

T

Three-phase current capacitor 21, 45

U

UE 1xx 37
UE 2xx B 37
UE 2xx D 37
UE 110 11
UE 112 11
UE 210 D 11
UE 211 D 11
UE 212 D 11
UE 230 B 12
UE 240 B 12

UE 242 B 12
UEC 11x 14
UEC 111 14, 36
UEC 112 14, 36
UM 111 BD 15, 41
UM 111 D 15, 41
UM 112 D 15, 41
UM 113 D 15, 41
UM 114 D 15, 41
UM 115 D 16, 42
UM 116 D 16
UM 116 DW 16, 42
UM 116 D with fan unit 43
UM 117 DW 16, 42
UM 121 BD 16, 41
UM 121 D 16, 41
UM 122 D 16, 41
UP 110 22, 53
UP 120 22, 53
UR 2xx D 36
UR 230 D 9
UR 240 D 9
UR 242 D 9
UV 130 D 18, 40
UVR 120 D 18, 38
UVR 130 D 18, 38
UVR 140 D 18, 38
UVR 150 D 18, 38
UVR 160 D 18, 39
UVR 160 DW 18, 39
UVR 170 DW 18, 40

V

Voltage-protection module 23

W

Water cooling 16, 17

Z

ZKF 110 22, 46
ZKF 120 22, 46
ZKF 130 22, 46
ZKF 140 22, 46

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

+49 8669 31-0

+49 8669 5061

E-mail: info@heidenhain.de

www.heidenhain.de

Vollständige und weitere Adressen siehe www.heidenhain.de
For complete and further addresses see www.heidenhain.de

DE	HEIDENHAIN Technisches Büro Nord 12681 Berlin, Deutschland ☎ 030 54705-240	ES	FARRESA ELECTRONICA S.A. 08028 Barcelona, Spain www.farresa.es	PH	Machinebanks` Corporation Quezon City, Philippines 1113 E-mail: info@machinebanks.com
	HEIDENHAIN Technisches Büro Mitte 08468 Heinsdorfergrund, Deutschland ☎ 03765 69544	FI	HEIDENHAIN Scandinavia AB 02770 Espoo, Finland www.heidenhain.fi	PL	APS 02-489 Warszawa, Poland www.apserwis.com.pl
	HEIDENHAIN Technisches Büro West 44379 Dortmund, Deutschland ☎ 0231 618083-0	FR	HEIDENHAIN FRANCE sarl 92310 Sèvres, France www.heidenhain.fr	PT	FARRESA ELECTRÓNICA, LDA. 4470 - 177 Maia, Portugal www.farresa.pt
	HEIDENHAIN Technisches Büro Südwest 70771 Leinfelden-Echterdingen, Deutschland ☎ 0711 993395-0	GB	HEIDENHAIN (G.B.) Limited Burgess Hill RH15 9RD, United Kingdom www.heidenhain.co.uk	RO	HEIDENHAIN Reprezentantă Romania Braşov, 500338, Romania www.heidenhain.ro
	HEIDENHAIN Technisches Büro Südost 83301 Traunreut, Deutschland ☎ 08669 31-1345	GR	MB Milionis Vassilis 17341 Athens, Greece www.heidenhain.gr	RS	Serbia → BG
AR	NAKASE SRL. B1653AOX Villa Ballester, Argentina www.heidenhain.com.ar	HK	HEIDENHAIN LTD Kowloon, Hong Kong E-mail: sales@heidenhain.com.hk	RU	OOO HEIDENHAIN 125315 Moscow, Russia www.heidenhain.ru
AT	HEIDENHAIN Techn. Büro Österreich 83301 Traunreut, Germany www.heidenhain.de	HR	Croatia → SL	SE	HEIDENHAIN Scandinavia AB 12739 Skärholmen, Sweden www.heidenhain.se
AU	FCR Motion Technology Pty. Ltd Laverton North 3026, Australia E-mail: vicsales@fcrmotion.com	HU	HEIDENHAIN Kereskedelmi Képviselet 1239 Budapest, Hungary www.heidenhain.hu	SG	HEIDENHAIN PACIFIC PTE LTD. Singapore 408593 www.heidenhain.com.sg
BA	Bosnia and Herzegovina → SL	ID	PT Servitama Era Toolsindo Jakarta 13930, Indonesia E-mail: ptset@group.gts.co.id	SK	KOPRETINA TN s.r.o. 91101 Trenčín, Slovakia www.kopretina.sk
BE	HEIDENHAIN NV/SA 1760 Roosdaal, Belgium www.heidenhain.be	IL	NEUMO VARGUS MARKETING LTD. Tel Aviv 61570, Israel E-mail: neumo@neumo-vargus.co.il	SL	Posredništvo HEIDENHAIN NAVO d.o.o. 2000 Maribor, Slovenia www.heidenhain-hubl.si
BG	ESD Bulgaria Ltd. Sofia 1172, Bulgaria www.esd.bg	IN	HEIDENHAIN Optics & Electronics India Private Limited Chetpet, Chennai 600 031, India www.heidenhain.in	TH	HEIDENHAIN (THAILAND) LTD Bangkok 10250, Thailand www.heidenhain.co.th
BR	DIADUR Indústria e Comércio Ltda. 04763-070 – São Paulo – SP, Brazil www.heidenhain.com.br	IT	HEIDENHAIN ITALIANA S.r.l. 20128 Milano, Italy www.heidenhain.it	TR	T&M Mühendislik San. ve Tic. LTD. ŞTİ. 34728 Ümraniye-Istanbul, Turkey www.heidenhain.com.tr
BY	Belarus GERTNER Service GmbH 50354 Huerth, Germany www.gertner.biz	JP	HEIDENHAIN K.K. Tokyo 102-0083, Japan www.heidenhain.co.jp	TW	HEIDENHAIN Co., Ltd. Taichung 40768, Taiwan R.O.C. www.heidenhain.com.tw
CA	HEIDENHAIN CORPORATION Mississauga, Ontario L5T2N2, Canada www.heidenhain.com	KR	HEIDENHAIN Korea LTD. Gasam-Dong, Seoul, Korea 153-782 www.heidenhain.co.kr	UA	Gertner Service GmbH Büro Kiev 01133 Kiev, Ukraine www.gertner.biz
CH	HEIDENHAIN (SCHWEIZ) AG 8603 Schwerzenbach, Switzerland www.heidenhain.ch	ME	Montenegro → SL	US	HEIDENHAIN CORPORATION Schaumburg, IL 60173-5337, USA www.heidenhain.com
CN	DR. JOHANNES HEIDENHAIN (CHINA) Co., Ltd. Beijing 101312, China www.heidenhain.com.cn	MK	Macedonia → BG	VE	Maquinaria Diekmann S.A. Caracas, 1040-A, Venezuela E-mail: purchase@diekmann.com.ve
CZ	HEIDENHAIN s.r.o. 102 00 Praha 10, Czech Republic www.heidenhain.cz	MX	HEIDENHAIN CORPORATION MEXICO 20235 Aguascalientes, Ags., Mexico E-mail: info@heidenhain.com	VN	AMS Co. Ltd HCM City, Vietnam E-mail: davidgoh@amsvn.com
DK	TPTEKNIK A/S 2670 Greve, Denmark www.tp-gruppen.dk	MY	ISOSERVE Sdn. Bhd 56100 Kuala Lumpur, Malaysia E-mail: isoserve@po.jaring.my	ZA	MAFEMA SALES SERVICES C.C. Midrand 1685, South Africa www.heidenhain.co.za
		NL	HEIDENHAIN NEDERLAND B.V. 6716 BM Ede, Netherlands www.heidenhain.nl		
		NO	HEIDENHAIN Scandinavia AB 7300 Orkanger, Norway www.heidenhain.no		

