HEIDENHAIN

Gen 3 Drives

For HEIDENHAIN Controls

Information for the Machine Tool Builder

07/2019

HEIDENHAIN inverter systems

The Gen 3 inverter systems from HEIDENHAIN are suitable for operation on HEIDENHAIN controls with digital speed control and communication over Gigabit HSCI. They are designed for operating synchronous and asynchronous motors from HEIDENHAIN.

UVR 340, CC 3xx
with modular inverters

Intended use

The products described in this brochure:
- may be used only for NC-controlled machine tools,
- must be used only in an industrial setting, for commercial applications, or in research institutions,
- must be operated in accordance with the product requirements (specifications, environmental data, safety instructions, etc.),
- and must be operated in an electrical cabinet.

The machine manufacturer must ensure that the end product meets all of the requirements of the Machinery Directive (2006/42/EC). This is particularly the case when the devices are used as part of a safety function.

Improper use

The devices are not intended for applications in areas where a failure would result in considerable risk to humans or the environment. Usage in potentially explosive atmospheres is prohibited.

System test

Controls, motors, and encoders from HEIDENHAIN are usually integrated as components into complete systems. In such cases, comprehensive testing of the complete system is required, irrespective of the specifications of the individual devices.

Parts subject to wear

Power modules (power supply units, inverters, and compact inverters) from HEIDENHAIN contain parts subject to wear—particularly fans.

Standards

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

Validity

This brochure supersedes all previous editions, which thereby become invalid. **Subject to change without notice.**

Contents

HEIDENHAIN inverter systems

HEIDENHAIN Gen 3 inverter systems are available with a power rating of 15 kW to 135 kW and as non-regenerative compact inverters or as modular regenerative systems.

UVR 340

Regenerative inverter systems

With **regenerative inverter systems**, the braking energy of the motor is fed back into the power supply network.
To this end, regenerative modular inverter systems require additional components such as a **line filter** and a **commutating reactor** (see *Accessories for inverter systems*).

Compact inverters can be retrofitted into a regenerative inverter system by means of an **optional regenerative feedback module**. With the compact inverters, no further components are then needed for regenerative feedback.

Non-regenerative inverter systems

With **non-regenerative inverter systems**, the braking energy of the motors is converted into heat. This requires a **braking resistor** (see *Accessories for inverter systems*).

Supply voltage

For the respective supply voltage, please refer to the following specifications. The inverter systems are intended for connection to a TN supply network. Other power supply systems or other line voltages may need to be adapted by means of a transformer. HEIDENHAIN recommends a TN-S, TN-C, or TN-C-S network for the operation of its power modules. Please refer to the Technical Manual of your inverter system.

DC-link voltage

Both inverter systems use a rectifier bridge circuit to convert the connected line power into the DC-link voltage and other auxiliary voltages for the power module electronics and other control components, such as for the controller unit and the main computer. The rectified and—in the case of a UVR 3xx power supply unit—closed-loop DC-link voltage is directed through the IGBTs to the drive motors with controlled frequency and voltage. Control is accomplished by PWM signals.

The DC-link voltage is DC 565 V for compact inverters and DC 650 V or DC 720 V for modular systems with a UVR 3xx.

Safety functions for external safety

HEIDENHAIN inverter systems enable the centralized switch-off of the inverters via special inputs for deactivating the pulse enable for the PWM drive circuit of the IGBTs (e.g., in the event of an emergency stop). This is equivalent to the STO safety function. The Gen 3 inverters also support a dual-channel SBC system via corresponding outputs directly on the inverter. In addition, the machine manufacturer can configure an SS1 stop reaction with which emergency stop braking to a standstill is performed, controlled by the controller unit.

If needed, up to eight axis groups can be formed for which separate switch-off is possible (e.g., axes for the tool magazine). For controls without integrated functional safety (FS), the safety functions are triggered over a special PL module for the **drive enable**.

Integrated functional safety (FS)

HEIDENHAIN also offers control systems with integrated functional safety (FS). These control systems offer a series of safety functions (STO, SLS, SLP, SBC, SS1, SS2, and safe PLC program), as well as the easy implementation of up to four safety-related operating modes.

Control systems with functional safety (FS) have two redundant safety channels that operate in complete independence of each other. They capture, process, and output all safety-relevant signals in two channels. Refer to the Technical Manual for the Gen 3 inverter system and the Technical Manual for functional safety (FS).

Functional safety (FS) is scalable by means of software options. Only the number of safe motors that you actually need must be enabled. For more information on these software options, please refer to the brochure for your control:

Brochure	**ID**
TNC 640	896020-xx
TNC 620	895922-xx
TNC 320	1113513-xx
TNC 128	827228-xx
CNC PILOT 640	896094-xx
MANUALplus 620	743682-xx

Compact inverters

The housing of the **UEC 3xx** contains both the rectifier for producing the DC-link voltage and the IGBT full bridges for up to five motors. Compact inverters are available with a power rating of 15 kW to 30 kW. An external braking resistor is required as well. Higher power ratings require regenerative systems.

The compact inverters can be expanded to include additional inverters and controller units of the modular system in order, for example, to retrofit axes on a machine. These inverters and controller units are connected to the compact inverter via a 24 V bus mounting and a DC-link bus mounting. Please note that the total power consumption of the connected motors must not exceed the power rating of the compact inverter!

Modular inverters

Modular inverter systems consist of the following modules:

- A UVR supply unit, including the necessary additional components (e.g., KDR, line filter)
- Multiple UM power modules for axes and spindles
- One or more controller units and optical fiber cables for control of the inverters

In modular systems, the UVR 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 UMs are supplied with the necessary 24 V supply voltage over the 24 V bus mounting.

The controller unit is connected to the modular inverters by optical fiber cables, and it controls the IGBTs by means of PWM signals.

UM 315

Additional power supply

Compact inverters and supply units additionally have a DC 24 V output (X90 connector). This voltage is buffered in the DC link and can be used to supply the MC main computer and other control components with a 24 V power supply.

Safety parameters

For HEIDENHAIN devices, such as control components, encoders, and motors, your HEIDENHAIN contact person can provide you with device-specific, safety-relevant parameters upon request (failure rates, information on fault exclusion, etc.).

Power supply for connected modules

The current consumption for the electronics of the modular inverters and controller units depends heavily on their power rating. If many high-power modules are used, then, in rare cases, the maximum permissible current provided by the power supply unit can be exceeded. Thus, please check the current consumption of the DC 24 V supply in the *Specifications*. The power supply unit's own consumption does not need to be considered in this.

The UVR power supply units feature an additional integrated power supply unit that provides a DC 24 V voltage for the control system and other PLC components:

- Supply of components that are connected to the 24 V bus mounting of the inverter (inverter and its brakes, controller units, and electrical cabinet version of the main computer)
- Supply of further control components such as the main computer in the operating panel, monitor, machine operating panel, PL modules, etc.
- Supply of machine-specific PLC components, such as 24 V relays

UVR 350

The integrated power supply unit is buffered by the DC link, thereby ensuring that, in the event of a power failure, the connected components will continue to be supplied so that any concluding actions, such as the LIFTOFF function, can still be performed. A complete power failure must be considered separately. As a machine manufacturer, you should consider measures with regard to a power failure wherever applicable.

For the performance data of the power supply unit, please refer to the specifications. When planning, please also consider the power requirements of the connected inverters, encoders, and controller units, in addition to the HSCI/PLC components. For further information on project planning, please refer to the technical manual of your inverter system.

The +24 V supply voltage is required for the complete control system as a safely separated voltage. These safely separated circuits must not be mixed with or connected to supply circuits with basic insulation or other supply circuits.

Motor currents

The modular inverters and compact inverters are available in grades that allow for excellent adaptation to the required motor currents or torques. In addition, the PWM frequency can be adjusted to the motor current. Please bear in mind that very high spindle speeds require a higher PWM frequency.

Optical fiber cable and bus mounting

Optical fiber cables, connectors for the 24 V bus mounting, and DC-link busbars are used for the connection of the individual modular inverters. The optical fiber cables must be cut to size or ordered at the correct length. They are not included in delivery.

The connectors for the 24 V bus mounting and the DC-link busbars for the specific device are included in shipment.

Modular inverters
System overview

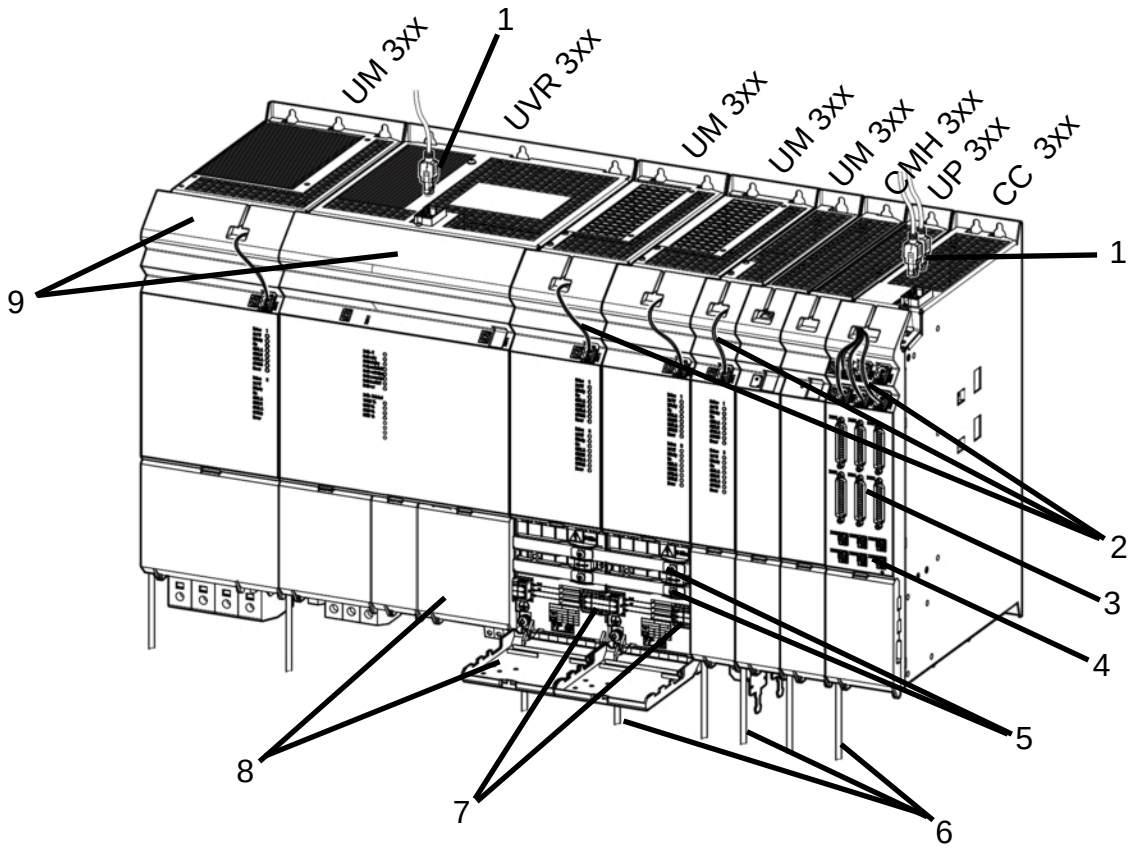
A HEIDENHAIN control system with a modular inverter system typically consists of the following components:

- MC main computer, monitor, keyboard, and machine operating panel
- PLB 62xxFS or PLB 62xx system PL and PAE-H 08-00-01
- CC controller unit
- UVR 3xx power supply unit
- UM 3xx modular inverters
- KDR 3xx commutating reactor
- Line filter for the UVR 3xx
- Siemens SITOR gR or gS line fuse
- UP 3xx braking resistor module (optional)
- Surge protector (optional)
- SM 3xx voltage protection module (optional)
- CMH 3xx capacitor module (optional)
- Shielded motor power cables
- Feed and spindle motors

The Gen 3 drives are characterized by the following features:

- Higher peak and nominal currents with an overall more compact enclosure design
- Fast Gbit HSCI communication extending all the way to the UVR 3xx power supply unit, for greater flexibility and improved diagnostics
- Digital optical fiber technology for control of the inverters, for faster and interference-free data transfer
- Contiguous bus mounting for supply voltages (DC link, 24 V), allowing for very simple wiring and any desired arrangement or sequence of the power supply unit, power module, controller unit, and main computer
- Hybrid connector for the connection of motor phases, the brake, and the shield—all with a single connecting element
- New, miniaturized connector technology for the connection of purely serial EnDat encoders

Example of the structure of a modular inverter system:

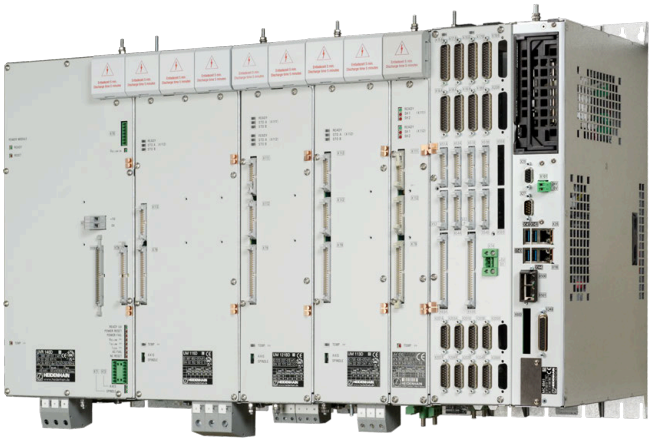


1 HSCI connection to the UVR and CC,
Gbit HSCI cable, ID 1257765-xx
2 Optical fiber cables between the CC and UM:
ID 1125124-xx or ID 1265351-xx (cut to size)
3 1 V_{PP} or EnDat encoder inputs
4 EnDat 2.2 encoder inputs
5 DC-link bus mounting of the UVR and UM;
the required bars are supplied with the corresponding component
6 Protective conductor connection of each individual component; comply with the specifications in the Technical Manual
7 +24 V bus mounting of the UVR, UM, CC, and accessories;
the required connectors are supplied with the corresponding component
8 Cover for DC-link connection and 24 V supply bar
9 Handle strip for easy carrying of the components

Differences between the inverter generations

Brief overview

The following figures show a comparison between the two inverter generations.



Generation 1xx

Gen 3

Power module generations based on devices

Device/function	Generation 1xx inverters	Gen 3 inverters
Inverters	UM 1x1 to UM 1x7	UM 3x0 to UM 3x7
Power supply units	UVR 130 to UVR 170 UV 130 D	UVR 330 to UVR 370 UEC 3xx, not yet available
Controller units	CC 6106, CC 6108, and CC 6110	CC 302, CC 306, CC 308, and CC 310
Compact inverters	UEC 1xx, UE 2xx, and UR 2xx	UEC 3xx, planned
Regenerative module for compact inverter	None	RM 330
DC-link filters	ZKF 1x0	Not required
Commutating reactors	KDR 120 to KDR 170	KDR 330 to KDR 370
Line filters	EPCOS 35 A to 200 A	EPCOS 46 A to 202 A
DC-link capacitor modules	CMH 120	CMH 310 and CMH 320
Braking resistors	UP 110 and UP 120	UP 310 and UP 320
Power packs	PSL 13x	Integrated into the power supply unit
External safety	Axis-enable module(s), ID 573732-xx	PAE-H 08-00-01, ID 1203881-xx
Wiring of the power modules	Ribbon cables for PWM signals, device bus, and supply bus	Optical fiber cables, bus mountings
Covers	Covers for ribbon cables	Not required
Multi-row configuration	MS 11x	Connection kits for convenient wiring
24 V capacitor module	CML 110, ID 574087-xx	Not required
Control components	MC, MB, TE, PLB with 100 Mbit HSCI	MC, MB, TE, PLB with Gbit HSCI
Motor power cables	Unshielded cables	Shielded cables
Adapter module	Adapter module, ID 352762-xx	Not required
Fan unit	For the UM 116D and UVR 170D, ID 749973-xx	Not required
Water cooling	Hose kit, ID 584862-01	Hose kit, ID 584862-01

Differences based on ID number

Power supply units

Generation 1xx inverters		Gen 3 inverters	
UVR 120D	ID 1095625-xx	UVR 330	ID 1164511-xx
UVR 130D	ID 1095626-xx		
UVR 140D	ID 1084190-xx	UVR 340	ID 1168321-xx
UVR 150D	ID 1080611-xx	UVR 350	ID 1064350-xx
UVR 160D	ID 1095627-xx	UVR 360	ID 1118870-xx
UVR 160DW	ID 1095809-xx	UVR 360W	ID 1237086-xx
UVR 170D	ID 807429-xx	UVR 370	ID 1163158-xx
UVR 170DW	ID 546911-xx	UVR 370W	ID 1237988-xx
UV 130 D	ID 824215-xx	UEC 3xx	Not yet available

Modular inverters

Generation 1xx inverters		Gen 3 inverters	
UM 111D	ID 667945-xx	UM 310[1]	ID 1108101-xx
UM 111BD	ID 671968-xx	UM 311[1]	ID 1108147-xx
UM 112D	ID 731984-xx	UM 312	ID 1108153-xx
UM 113D	ID 730435-xx	UM 313	ID 1108164-xx
UM 114D	ID 671288-xx	UM 314	ID 1108167-xx
UM 115D	ID 671566-xx	UM 315	ID 1129203-xx
UM 116D	ID 667954-xx	UM 316	ID 1123915-xx
UM 116DW	ID 667946-xx	UM 316W	ID 1237090-xx
UM 117DW	ID 689572-xx	UM 317W	ID 1237092-xx
UM 121D	ID 667838-xx	UM 320[1]	ID 1073027-xx
UM 121BD	ID 667942-xx	UM 321[1]	ID 1107902-xx
UM 122D	ID 667633-xx	UM 322	ID 1043586-xx

[1] Connectors for motor and brake connections must be ordered separately (ID 1249132-xx)

Comply with the specifications for the modular inverters when migrating to the new inverter generation. The UM 3xx devices are more powerful than the previous UM 1xx units. Depending on the motor or drive, it may be possible to use a smaller inverter with the UM 3xx devices.

Commutating reactors

Generation 1xx inverters		Gen 3 inverters	
KDR 120	ID 344505-xx	KDR 330	ID 1164204-xx
KDR 130C	ID 646271-xx		
KDR 140	ID 333068-xx	KDR 340	ID 1164205-xx
KDR 150	ID 355253-xx	KDR 350	ID 1164206-xx
KDR 160	ID 573265-01	KDR 360	ID 1164276-xx
KDR 170	ID 735563-xx	KDR 370	ID 1164277-xx

Line filters

Generation 1xx inverters, without star point		Gen 3 inverters, with star point S	
EPCOS 35A	ID 676759-xx	EPCOS 46A	ID 1169716-xx
EPCOS 80A	ID 640908-xx	EPCOS 83A	ID 1169717-xx
EPCOS 120A	ID 575292-xx	EPCOS 135A	ID 1169718-xx
EPCOS 200A	ID 735542-xx	EPCOS 202A	ID 1169719-xx

Braking resistor, capacitor, and voltage-protection modules

Generation 1xx inverters		Gen 3 inverters	
UP 110	ID 341516-xx	UP 310	ID 1119332-xx
UP 120	ID 605731-xx	UP 320	ID 1119330-xx
SM 110	ID 368453-xx	SM 320	ID 1276063-xx
SM 130	ID 540739-xx	SM 330	ID 1237089-xx
CMH 120	ID 59116-01	CMH 320	ID 1164215-xx
		CMH 310	ID 1265319-xx

Controller units

Generation 1xx inverters		Gen 3 inverters	
-		CC 302	ID 1243183-xx
CC 6106	ID 662636-xx	CC 306	ID 1074384-xx
CC 6108	ID 662637-xx	CC 308	ID 1074385-xx
CC 6110	ID 662638-xx	CC 310	ID 1243647-xx

Please note that, in contrast to the CC 61xx controller units, only half of the encoder inputs on a CC 3xx are designed for encoders with 1 V_{PP} or EnDat interface.

Connecting cables of the power modules and control components

Generation 1xx inverters		Gen 3 inverters	
Ribbon cable for CC supply voltage	ID 325816-xx	Not required	
Ribbon cable for supply bus	ID 325816-xx	Not required	
Ribbon cable for device bus	ID 325817-xx	Not required	
Ribbon cable for PWM connection	ID 250479-xx	Optical fiber cables	ID 1265351-xx
Adapter module for temperature sensor	ID 336377-xx, ID 312533-xx	Can continue to be used at X40x of the CC 3xx	
HSCI cable	ID 618893-xx	Gbit HSCI cable	ID 1257765-xx
Monitor cable	ID 625901-xx	New HDL2 interface	ID 1161508-xx
PWM covers	ID 329031-xx, ID 538427-xx, ID 1102784-xx	Not required	
MS 11x	ID 658132-xx, ID 673685-xx	Connection kits for convenient wiring	ID 1274603-xx and ID 1278910-03

Panel MCs

Generation 1xx inverters		Gen 3 inverters	
MC 7410	1039531-11	MC 8410	1175057-01
MC 7420	1066650-02		
MC 8410	1175057-01		
MC 7410T	1034791-01	MC 8420T	1213689-01
MC 8420T	1213689-01		
MC 7522	1071597-02	MC 8512	1243919-01
MC 8512	1243919-01		
MC 7532	1124449-01, -02	MC 8532	1189190-01
MC 8532	1189190-01		
MC 366	1246689-01	MC 366	1246689-01

Monitors

Generation 1xx inverters – HDL		Gen 3 inverters – HDL2	
BF 750	785080-01	–	
BF 760	732589-01		
BF 860	1169174-01	BF 860	1244875-01
–		BF 360	1275079-01

Generation 1xx inverters		Gen 3 inverters	
MC 6541	1081185-02	MC 306	1180045-01
MC 6542	1081188-03		
MC 6641	811550-02		

Industrial PCs

Generation 1xx inverters		Gen 3 inverters	
IPC 6490	1039541-02	IPC 304	TBA
IPC 6641	1039543-01	IPC 306	TBA
IPC 8420	1249510-01	IPC 8420	1249510-01

PLB modules

Generation 1xx inverters		Gen 3 inverters	
PLB 6204	ID 1129809-01	PLB 6204	ID 1129809-02
PLB 6206	ID 1129812-01	PLB 6206	ID 1129812-02
PLB 6208	ID 1129813-01	PLB 6208	ID 1129813-02
PLB 6204 FS	ID 1129808-01	PLB 6204 FS	ID 1223032-01
PLB 6206 FS	ID 1129811-01	PLB 6206 FS	ID 1223033-01
PLB 6208 FS	ID 1129810-01	PLB 6208 FS	ID 1223034-01
PLB 6104	ID 591828-xx	PLB 6104	ID 1129799-01
PLB 6106	ID 630058-xx	PLB 6106	ID 1129803-01
PLB 6108	ID 630059-xx	PLB 6108	ID 1129804-01
PLB 6104 FS	ID 590479-xx	PLB 6104 FS	ID 1129796-01
PLB 6106 FS	ID 804755-xx	PLB 6106 FS	ID 1129806-01
PLB 6108 FS	ID 804756-xx	PLB 6108 FS	ID 1129807-01

Generation 1xx inverters		Gen 3 inverters	
MB 720	784803-02	MB 720	784803-03
MB 720 FS	805474-02	MB 720 FS	805474-03
MB 720T	1043707-02	MB 720T	1043707-03
MB 721	1164974-01	MB 721	1164974-02
MB 721 FS	1164975-01	MB 721 FS	1164975-02

Keyboard units

Generation 1xx inverters		Gen 3 inverters	
TE 725T FS	1211940-01	TE 725T FS	1211940-02
TE 735	771898-02	–	
TE 735 FS	805493-02		
TE 735T	823058-02 1034924-02	–	
TE 745	679817-02 679817-12 1219757-01	TE 745	1219757-02
TE 745 FS	805482-02 805482-12 1219759-01	TE 745 FS	1219759-02
–		TE 360 TE 361	TBA
–		TE 360 FS TE 361 FS	TBA
TE 745T	801306-03	TE 745T	801306-04

Modular inverters

An inverter is a power module (DC-AC inverter) that provides energy to the connected motor(s). For UM 3xx modular inverters, the UVR 3xx power supply unit generates the rectified DC-link supply voltage. The DC-link voltage and the +24 V supply voltage are transmitted to the inverters over conductor bars. The CC 3xx controller unit controls the connected modular inverters by means of PWM signals over optical fiber cables.

The UM 3xx inverters differ in the number of axes they support and the maximum currents they permit. The UM 31x inverter can be connected to only a single motor, whereas the UM 32x inverter can be connected to and be used to operate two motors.

The components required for operating the modular HEIDENHAIN inverters include the following:

- MC main computer
- PLB 62xxFS or PLB 62xx system PL and PAE-H 08-00-01 or UEC 3xx with integrated system PL
- CC 3xx controller unit
- UVR 3xx or UEC 3xx power supply unit
- KDR 3xx commutating reactor
- Line filter for the UVR 3xx
- UP 3xx braking resistor module (optional)
- Surge protector (optional)
- SM 3xx voltage protection module (optional)
- Further HEIDENHAIN UM 3xx modular inverters (optional)
- CMH 3xx capacitor module (optional)

The UM 3xx inverters can be combined as desired, but the total required power of all connected UM 3xx inverters or motors must not exceed the power rating of the UVR 3xx power supply unit.

Modular inverters	**UM 310**	**UM 311**	**UM 312**
Power supply	DC link: DC 650 V or DC 720 V		
Rated current (PWM frequency of 5 kHz, for rotational frequencies > 10 Hz)[1]	12 A	21 A	35 A
Conductor cross section for the X8x and X38x motor connections	The required conductor cross section depends on the rated current of the inverter and the connected motor, as well as on the type of cable and its manner of routing, which must be determined and protected by the machine manufacturer.		
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 3.33 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 1.5 mm^2 (AWG 16)	Min. 4 mm^2 (AWG 12)	Min. 10 mm^2 (AWG 8)
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 5 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 1.5 mm^2 (AWG 18)	Min. 2.5 mm^2 (AWG 14)	Min. 6 mm^2 (AWG 8)
Conductor type, type of routing for the specified minimum conductor cross section	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2
Max. current consumption at 24 V via bus mounting, without current for brake control	1.0 A	1.0 A	1.0 A
Power loss during rated operation	85 W	180 W	300 W
Cooling method	Integrated fans		
Max. output current per braking connection (+24 V, HSLS)	2.5 A		
Protection class	IP20		
Maximum permissible PWM frequency	16 kHz		
NRTL approval	–	–	–
Module width	50 mm	50 mm	100 mm
Mass	5 kg	5 kg	7.5 kg
ID	1108101-xx	1108147-xx	1108153-xx

[1] Derating at rotational frequencies < 10 Hz: see *Derating of the output currents*

Modular inverters	**UM 313**	**UM 314**	**UM 315**
Power supply	DC link: DC 650 V or DC 720 V		
Rated current (PWM frequency of 5 kHz, for rotational frequencies > 10 Hz)[1]	60 A	90 A	130 A
Conductor cross section for the X8x and X38x motor connections	The required conductor cross section depends on the rated current of the inverter and the connected motor, as well as on the type of cable and its manner of routing, which must be determined and protected by the machine manufacturer.		
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 3.33 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 16 mm^2 (AWG 6)	Min. 35 mm^2 (AWG 2)	Min. 70 mm^2 (AWG 2/0)
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 5 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 16 mm^2 (AWG 6)	Min. 25 mm^2 (AWG 3)	Min. 50 mm^2 (AWG 1)
Conductor type, type of routing for the specified minimum conductor cross section	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2
Maximum current consumption at 24 V via bus mounting, without current for brake control	1.0 A	2.0 A	2.0 A
Power loss during rated operation	420 W	650 W	950 W
Cooling method	Integrated fans		
Max. output current per braking connection (+24 V, HSLS)	2.5 A		
Protection class	IP20		
Maximum permissible PWM frequency	16 kHz		
NRTL approval	–	–	–
Module width	100 mm	100 mm	150 mm
Mass	9.5 kg	10 kg	17 kg
ID	1108164-xx	1108167-xx	1129203-xx

[1] Derating at rotational frequencies < 10 Hz: see *Derating of the output currents*

Modular inverters	**UM 316** **UM 316W**	**UM 317W**
Power supply	DC link: DC 650 V or DC 720 V	
Rated current (PWM frequency of 5 kHz, at rotational frequencies > 10 Hz)[1]	230 A	320 A
Conductor cross section for the X8x and X38x motor connections	The required conductor cross section depends on the rated current of the inverter and the connected motor, as well as on the type of cable and its manner of routing, which must be determined and protected by the machine manufacturer.	
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 3.33 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 120 mm^2 or 2 x 50 mm^2 (300 kcmill)	Min. 2 x 70 mm^2 (AWG 4/0)
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 5 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 95 mm^2 (AWG 4/0)	Min. 2 x 70 mm^2 (AWG 3/0)
Conductor type, type of routing for the specified minimum conductor cross section	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: C	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: C
Max. current consumption at 24 V via bus mounting, without current for brake control	2.0 A	2.0 A
Power loss during rated operation	1850 W	2500 W
Cooling method	UM 316: integrated fans UM 316 W: water	Water
Max. output current per braking connection (+24 V, HSLS)	2.5 A	
Protection class	IP20	
Maximum permissible PWM frequency	16 kHz	
NRTL approval	–	–
Module width	200 mm	200 mm
Mass	23 kg	23 kg
ID	UM 316: 1123915-xx UM 316W: 1237090-xx	UM 317W: 1237092-xx

[1] Derating at rotational frequencies < 10 Hz: see *Derating of the output currents*

Modular inverters	**UM 320**	**UM 321**	**UM 322**
Power supply	DC link: DC 650 V or DC 720 V		
Rated current per drive (PWM frequency of 5 kHz, at rotational frequencies > 10 Hz)[1]	12 A	21 A	35 A
Conductor cross section for the X8x and X38x motor connections	The required conductor cross section depends on the rated current of the inverter and the connected motor, as well as on the type of cable and its manner of routing, which must be determined and protected by the machine manufacturer.		
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 3.33 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 1.5 mm^2 (AWG 16)	Min. 4 mm^2 (AWG 12)	Min. 10 mm^2 (AWG 8)
Minimum conductor cross section for the X8x and X38x motor connections at a PWM frequency ≥ 5 kHz, as per VDE 0298-4 (as per UL 508A)	Min. 1.5 mm^2 (AWG 16)	Min. 2.5 mm^2 (AWG 14)	Min. 6 mm^2 (AWG 8)
Conductor type, type of routing for the specified minimum conductor cross section	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2	ÖLFLEX Servo FD 795CP, copper, at least AC 480 V, routing type: B2
Max. current consumption at 24 V via bus mounting, without current for brake control	1.0 A	1.0 A	1.0 A
Power loss during rated operation	170 W	360 W	600 W
Cooling method	Integrated fans		
Max. output current per braking connection (+24 V, HSLS)	2.5 A		
Protection class	IP20		
Maximum permissible PWM frequency	10 kHz		
NRTL approval	–	–	–
Module width	50 mm	50 mm	100 mm
Cooling method	Fans		
Mass	6 kg	6 kg	10 kg
ID	1073027-xx	1107902-xx	1043586-xx

[1] Derating at rotational frequencies < 10 Hz: see *Derating of the output currents*

Output currents

Output currents of the UM 3xx modular inverters based on the PWM frequency at a DC-link voltage of DC 650 V:

	PWM frequency	UM 310, UM 320	UM 311, UM 321	UM 312, UM 322	UM 313
Rated current I_N, BM 1 Current 0.71 * I_N, BM 2 Current S6-40 %, BM 3 Maximum current I_{Max}, BM 4, BM 5	3.3 kHz	14 A 10 A 20 A 28 A	24.5 A 17 A 35 A 49 A	40 A 28 A 57 A 80 A	70 A 49.5 A 99 A 140 A
	4.0 kHz	13 A 9 A 18 A 26 A	23 A 16 A 32.5 A 46 A	38 A 26.5 A 53.5 A 76 A	66 A 46.5 A 93 A 132 A
	5.0 kHz	12 A 8.5 A 17 A 24 A	21 A 14.5 A 30 A 42 A	35 A 24.5 50 A 70 A	60 A 42 A 85 A 120 A
	6.6 kHz	11 A 7.5 A 15.5 A 22 A	19 A 13 A 27 A 38 A	31.5 A 22 A 44.5 A 63 A	54 A 38 A 76 A 108 A
	8.0 kHz	10 A 7 A 14 A 20 A	17.5 A 12 A 24.5 A 35 A	28.5 A 20 A 40 A 57 A	49 A 34.5 A 69 A 98 A
	10 kHz	8.5 A 6 A 12 A 17 A	15 A 10.5 A 21 A 30 A	24 A 16.5 A 34 A 48 A	42 A 29.5 A 60 A 84 A
	13.3 kHz	7 A 4 A 10 A 14 A	12 A 8.5 A 17 A 24 A	19.5 A 13.5 A 27.5 A 39 A	35 A 24.7 A 49 A 70 A
	16.0 kHz	6 A 4 A 8.5 A 12 A	10 A 7 A 14 A 20 A	16 A 11 A 23 A 32 A	29 A 20.5 A 41 A 58 A

For UM 32x modular inverters for two drives, the following applies:
The output current given here is the current per drive. In periodic duty (S6-40 %), however, only one of the two drives may be operated at a time.

For a description of the BM operating modes or load cycles, see Page 26.

Output currents of the UM 3xx modular inverters based on the PWM frequency at a DC-link voltage of DC 650 V:

Currents	**PWM frequency**	**UM 314**	**UM 315**	**UM 316 UM 316W**	**UM 317W**
Rated current I_N, BM 1 Current 0.71 * I_N, BM 2 Current S6-40 %, BM 3 Maximum current I_{Max}, BM 4, BM 5	3.3 kHz	99 A 70 A 140 A 198 A	142 A 100 A 200 A 284 A	265 A 187 A 295 A 375 A	350 A 247.5 A 400 A 500 A
	4.0 kHz	95 A 67 A 134 A 190 A	137 A 96.5 A 193 A 274 A	251 A 177.5 A 281 A 354 A	338 A 239 A 384 A 477 A
	5.0 kHz	90 A 63.5A 127 A 180 A	130 A 91 A 184 A 260 A	230 A 163 A 280 A 325 A	320 A 226 A 360 A 455 A
	6.6 kHz	80 A 56.5 A 113 A 160 A	117 A 82.5 A 165 A 234 A	205 A 145 A 233 A 289 A	287 A 202.5 A 323 A 405 A
	8.0 kHz	72 A 50.5 A 102 A 144 A	106 A 74.5 A 150 A 212 A	186 A 131.5 A 212 A 262 A	260 A 183.5 A 294 A 367 A
	10 kHz	60 A 42 A 85 A 120 A	90 A 63.5 A 127 A 180 A	156 A 110 A 180 A 220 A	220 A 155.5 A 250 A 310 A
	13.3 kHz	49.5 A 35 A 70 A 99 A	74.5 A 52.5 A 105 A 149 A	130 A 91.5 A 150 A 183 A	181 A 127.5 A 206 A 255 A
	16.0 kHz	41 A 29 A 58 A 82 A	62 A 43.5 A 88 A 124 A	110 A 77.5 A 125 A 156 A	150 A 106 A 170 A 212 A

For a description of the BM operating modes or load cycles, see Page 26.

Planning and selection of the inverter

The selection of the inverter depends on the currents required by the connected motor. In many cases, the inverter is selected based on the stall current of the motor being used. For selection of the inverter, HEIDENHAIN recommends the following:

For a feed axis without a weight load or without a high load from process forces, or for a spindle:
- Rated current of the inverter (rotational frequency > 10 Hz) ≥ Motor stall current

For feed axes with a weight load or with a high load from process forces, make sure to consider the derating of the inverter output current mentioned below:
- Rated derating current (current at a rotational frequency < 10 Hz) ≥ Motor stall current
  where: Rated derating current = Rated current of the inverter (rotational frequency > 10 Hz) / √2

Derating of the output currents

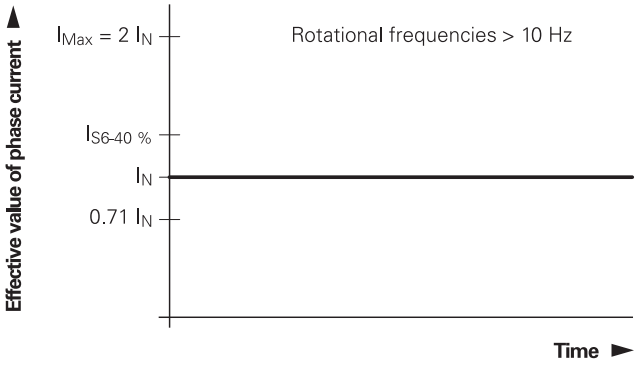
Derating based on the rotational frequency of the motor:
At rotational frequencies < 10 Hz (electrical frequency), the following derating must be considered for the limit values of the output currents:
Current value from the specification tables / √2 = Current at rotational frequencies of < 10 Hz

Example:
Rated current of the UM 314 (5 kHz, rotational frequency of > 10 Hz) = 90 A
Rated current of the UM 314 (5 kHz, rotational frequency = 0 Hz) = 90 A / √2 = 63.8 A

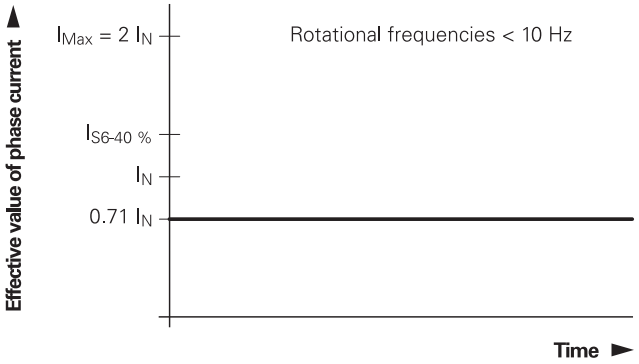
Derating based on the DC-link voltage:
At a DC-link voltage of DC 720 V, a 10 % derating of the rated current must be taken into account.

Load cycles or operating modes of the UM 3xx inverters

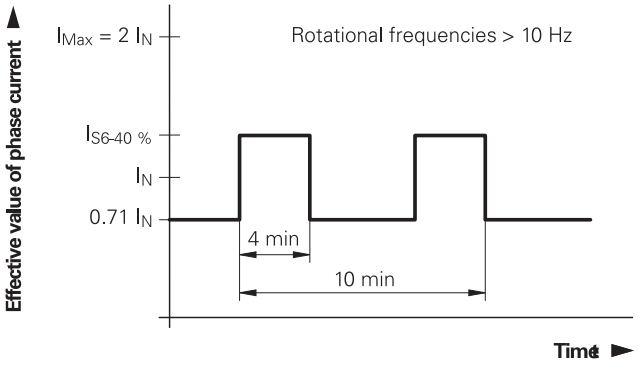
BM 1 operating mode, rated current at rotational frequencies > 10 Hz (electrical frequency):



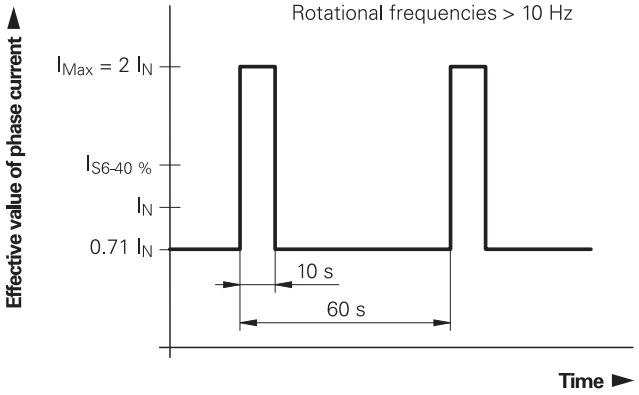
BM 2 operating mode, rated current at rotational frequencies < 10 Hz (electrical frequency):



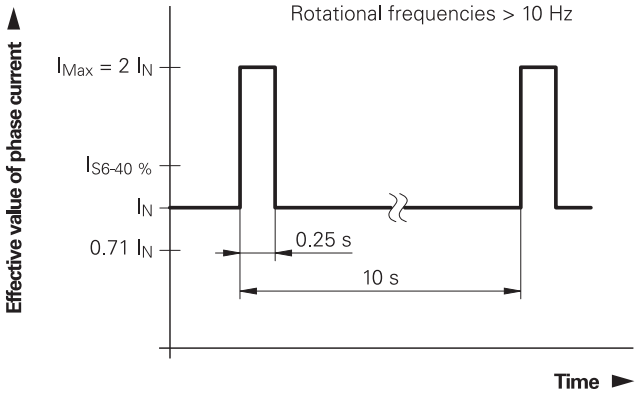
BM 3 operating mode, current at S6-40% at rotational frequencies > 10 Hz (electrical frequency):



BM 4 operating mode, maximum current at rotational frequencies > 10 Hz (electrical frequency):



BM 5 operating mode, maximum current at rotational frequencies > 10 Hz (electrical frequency) and rated current between the pulses:



Accessories for UM 3xx modular inverters

Modular inverters	**UM 3x0, UM 3x1**	**UM 3x2, UM 313, UM 314, UM 315, UM 316**	**UM 316W, UM 317W**
Optical fiber cable (mandatory)	One piece for connection to the controller unit		
Cooling method (device-specific)	Fans integrated in device		Water cooling via coolant hose (must be ordered separately)
Bus mounting of DC link and 24 V supply voltage (mandatory)	Included with the device		
Connectors for motor/brake connection (mandatory)	Connectors for X38x (must be ordered separately)	Included with the device	
Shield plate for shield connection (optional)		(depends on the inverter type, must be ordered separately)	
Power cables for connecting motors (mandatory)	For information on HEIDENHAIN power cables to the motor, please refer to the brochure or to the Technical Manual for the motors.		
Voltage protection module (optional)	SM 320 for UM 3x0 to UM 315 SM 330 for UM 316(W) and UM 317(W)		
Power supply unit (mandatory)	UVR 3xx		

Power supply unit

For UM 3xx inverters, the UVR 3xx regenerative power supply unit produces the rectified DC-link voltage and the +24 V supply voltage from the connected line voltage. The DC-link voltage and the +24 V supply voltage are transmitted to the inverters via conductor bars. The CC 3xx controller unit controls the connected inverters with PWM signals sent over optical fiber cables.

During braking, the motors connected to the inverters can feed energy back into the DC link. The UVR 3xx feeds this energy back into the power supply network if there is such a connection. The power supply unit communicates with the control via the HSCI connection.

The UVR 3xx power supply units differ in terms of their permissible DC-link power. Refer to the specifications of the supply units.

The components required for operating the HEIDENHAIN power supply unit include the following:
- MC main computer
- PLB 62xxFS or PLB 62xx system PL and PAE-H 08-00-01
- CC 3xx controller unit
- UM 3xx or UMC 3xx modular inverters
- KDR 3xx commutating reactor
- Line filter for the UVR 3xx
- Siemens SITOR gR or gS line fuse
- UP 3xx braking resistor module (optional)
- Surge protector (optional)
- SM 3xx voltage protection module (optional)
- CMH 3xx capacitor module (optional)

The total simultaneously required power of all connected UM 3xx inverters and motors must not exceed the power rating of the UVR 3xx power supply unit.

Specifications of the UVR 3xx power supply units

Power supply unit	**UVR 330**	**UVR 340**
Power supply (input side)	3AC 400 V (–10 %) to 3AC 480 V (+6 %)	
Rated frequency	50 / 60 Hz	
Phase conductor current at rated power (input side at 3AC 400 V)	46 A	68 A
Connected load (input side)	32 kW	47 kW
DC-link voltage (output side)	DC 650 V or DC 720 V	
DC-link rated power	30 kW	45 kW
DC-link power during periodic S6-40 % duty[1]	45 kW	65 kW
Maximum DC-link power [2]	60 kW	90 kW
Min. conductor cross section and type for voltage supply at X31 as per VDE 0298-4 (as per UL 508A)	H07 V2-K single conductor: 10 mm^2 (AWG 8), at least 90 °C, copper, at least AC 480 V, routing type: B1, C, or E	H07 V2-K single conductor: 25 mm^2 (AWG 4), at least 90 °C, copper, at least AC 480 V, routing type: B1, C, or E
Siemens SITOR gR or gS line fuse	50 A 3NE1817-0, gS or 3NE8017-1, gR	80 A 3NE1820-0, gS or 3NE1020-2, gR
Integrated power pack with 24 V power supply	Max. 1 kW, 40 A	
Cooling method	Integrated fans	
Protection class	IP20	
Power loss during rated operation P_V	Max. 0.4 kW	Max. 0.6 kW
NRTL approval	–	–
Module width	150 mm	200 mm
Mass	12.5 kg	18.5 kg
ID	1164511-xx	1168321-xx

[1] S6-40 %: at 4 minutes, 1.4-fold rated power; at 6 minutes, 0.4-fold rated power
[2] Maximum power: at 4 seconds, 2-fold rated power; at 16 seconds, 0.4-fold rated power

Power supply unit	**UVR 350**	**UVR 360** **UVR 360W**	**UVR 370** **UVR 370W**
Power supply (input side)	3AC 400 V (–10 %) to 3AC 480 V (+6 %)		
Rated frequency	50 / 60 Hz		
Phase conductor current at rated power (input side at 3AC 400 V)	83 A	135 A	202 A
Connected load (input side)	58 kW	94 kW	140 kW
DC-link voltage (output side)	DC 650 V or DC 720 V		
DC-link rated power	55 kW	90 kW	135 kW
DC-link power during periodic S6-40% duty[1]	80 kW	130 kW	190 kW
Max. power of DC link (4 s with 20 s cycle duration)[2]	110 kW	180 kW	270 kW
Min. conductor cross section and type for voltage supply at X31 as per VDE 0298-4 (as per UL 508A)	H07 V2-K single conductor: 25 mm^2 (AWG 4), at least 90 °C, copper, at least AC 480 V, routing type: B1, C, or E	H07 V2-K single conductor: 50 mm^2 (AWG 1), at least 90 °C, copper, at least AC 480 V, routing type: C or E	H07 V2-K single conductor: 95 mm^2 (AWG 3/0), at least 90 °C, copper, at least AC 480 V, routing type: C or E
Siemens SITOR gR or gS line fuse	100 A 3NE1021-0, gS or 3NE1021-2, gR	160 A 3NE1224-0, gS or 3NE1224-2, gR	250 A 3NE1227-0, gS or 3NE1227-2, gR
Integrated power pack with 24 V power supply	Max. 1 kW, 40 A		
Cooling method	Integrated fans	UVR 360: integrated fans UVR 360W: water	UVR 370: integrated fans UVR 370W: water
Protection class	IP20		
Power loss during rated operation P_V	Max. 0.8 kW	Max. 1.2 kW	Max. 1.9 kW
NRTL approval	–	–	–
Module width	200 mm	250 mm	250 mm
Mass	19 kg	22 kg	22 kg
ID	1064350-xx	UVR 360: 1118870-xx UVR 360W: 1237086-xx	UVR 370: 1163158-xx UVR 370W: 1237088-xx

[1] S6-40%: at 4 minutes, 1.4-fold rated power; at 6 minutes, 0.4-fold rated power
[2] Maximum power: at 4 seconds, 2-fold rated power; at 16 seconds, 0.4-fold rated power

Accessories for the UVR 3xx power supply units

Power supply unit	**UVR 330**	**UVR 340**
HSCI cable (mandatory)	Gbit HSCI cable	Gbit HSCI cable
Siemens SITOR gR or gS line fuse (mandatory)	50 A 3NE1817-0, gS or 3NE8017-1, gR	80 A 3NE1820-0, gS or 3NE1020-2, gR
Commutating reactor (mandatory)	KDR 330	KDR 340
Line filter (mandatory)	EPCOS 46A	EPCOS 83A
Braking resistor (optional)	UP 310	UP 310 or UP 320
Surge protector (optional)	VAL-MS 230/FM	VAL-MS 230/FM
Cooling method (device-specific)	Integrated fans	
Bus mounting of DC link and 24 V supply voltage (mandatory)	Included with the device	
Inverter (mandatory)	UM 3xx	

Power supply unit	**UVR 350**	**UVR 360(W)**	**UVR 370(W)**
HSCI cable (mandatory)	Gbit HSCI cable	Gbit HSCI cable	Gbit HSCI cable
Siemens SITOR gR or gS line fuse (mandatory)	100 A 3NE1021-0, gS or 3NE1021-2, gR	160 A	250 A
Commutating reactor (mandatory)	KDR 350	KDR 360	KDR 370
Line filter (mandatory)	EPCOS 83A	EPCOS 135A	EPCOS 202A
Braking resistor (optional)	UP 310 or UP 320	UP 320	2 x UP 320
Surge protector (optional)	VAL-MS 230/FM	VAL-MS 230/FM	FLT-CP-3C-350
Cooling method (device-specific)	Integrated fans	UVR 360: Integrated fans UVR 360 W: Coolant hose	UVR 370: Integrated fans UVR 370 W: Coolant hose
Bus mounting of DC link and 24 V supply voltage (mandatory)	Included with the device		
Inverter (mandatory)	UM 3xx		

Controller unit

Due to the very short cycle times of their integrated position, speed, and current feedback control, controller units from HEIDENHAIN are equally suitable for conventional motors, direct drive motors (linear motors, torque motors), and HSC spindles. They allow for high control-loop gain and short reaction times to changing machining forces, thereby enabling high contour fidelity and workpiece surface quality. The CC 3xx controller unit is connected to the other control components over HSCI, and it controls the connected modular inverters with PWM signals over optical fiber cables.

The CC 3xx controller units differ in terms of the number of possible control loops and thus also by the number of connectable encoders. The CC 3xx does not differentiate between a position or speed encoder at the encoder inputs. The type of connected encoder is determined solely based on the configuration of the controller unit by the machine manufacturer. Half of the encoder inputs of a CC 3xx provide the option of connecting encoders with the 1 V_{PP} interface or any EnDat interface, while the other half enables the connection of purely serial encoders with EnDat 2.2.

The number of usable control loops depends on the controller unit itself and on the enabled control loops on the SIK. Additional control loops can be ordered at a later time as needed by means of a software option. Refer to the brochure or the Technical Manual of your control.

Specifications of CC 3xx controller units

Controller unit	CC 302	CC 306	CC 308	CC 310
Power supply	+24 V via 24 V supply bar at X76			
Digital control loops	Max. 2 (single-speed)	Max. 6 (single-speed)	Max. 8 (single-speed)	Max. 10 (single-speed)
Encoder inputs	2 x 1 V_{PP}, EnDat 2 x EnDat 2.2	6 x 1 V_{PP}, EnDat 6 x EnDat 2.2	8 x 1 V_{PP}, EnDat 8 x EnDat 2.2	10 x 1 V_{PP}, EnDat 10 x EnDat 2.2
Optical fiber outputs	2	6	8	10
SPI expansion slots	2	2	2	2
24 V current consumption via bus mounting[1]	0.6 A	0.8 A	1.3	1.4
Cooling method	Integrated fans			
Protection class	IP20			
Power loss during rated operation[1]	13 W	18 W	30 W	33 W
NRTL approval	–	–	–	–
Module width	25 mm	75 mm	100 mm	125 mm
Mass	3.2 kg	3.75 kg	4 kg	4.25 kg
ID	1243183-xx	1074384-xx	1074385-xx	1243647-xx

[1] Current consumption without connected encoders or other devices

Cycle times

At f_{PWM}	Current controller	Speed controller		Position controller
		Single-speed	Double-speed	
3333 Hz	150 µs	300 µs	150 µs	Same as for **speed controller**
4000 Hz	125 µs	250 µs	125 µs	
5000 Hz	100 µs	200 µs	100 µs	
6666 Hz	75 µs		150 µs	
8000 Hz	62.5 µs		125 µs	
10 000 Hz	50 µs		100 µs	
13 333 Hz	37.5 µs		75 µs	
16 000 Hz	31.25 µs		62.5 µs	

Single-speed, double-speed

Single-speed control loops are usually sufficient for linear and torque motors, and for conventional axes. **Double-speed control loops** (option 49) are preferable for HSC spindles and difficult-to-control axes. In the default setting, all axes are set to single-speed. Every axis that is switched from single-speed to double-speed can reduce the number of available control loops. PWM frequencies greater than 5 kHz require double-speed control loops. This requires option 49 to be enabled.

Accessories for inverter systems

KDR 3xx commutating reactor

Regenerative power supply units require a KDR commutating reactor, which suppresses system perturbations and serves as an energy buffer for the step-up converter. It is connected between the line filter and the power supply unit.

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

Commutating reactor	**KDR 330**	**KDR 340**	**KDR 350**
Rated voltage	3AC 400 V (–10 %) to 3AC 480 V (+6 %)		
Rated frequency	50 / 60 Hz		
Rated current at 3AC 400 V to 3AC 480 V (effective value)	46 A to 39 A	68 A to 57 A	83 A to 70 A
Maximum current (peak value)	125 A	187 A	227 A
Inductance of a winding	470 µH ±15 %		
Protection class	IP00		
Power loss during rated operation	180 W	250 W	370 W
NRTL approval	–	–	–
Mass	7 kg	11.5 kg	13 kg
Used for	UVR 330	UVR 340	UVR 350
ID	1164204-xx	1164205-xx	1164206-xx

Commutating reactor	KDR 360	KDR 370
Rated voltage	3AC 400 V (–10 %) to 3AC 480 V (+6 %)	
Rated frequency	50 / 60 Hz	
Used for	UVR 360	UVR 370
Rated current at 3AC 400 V to 3AC 480 V (effective value)	135 A to 113 A	202 A to 169 A
Maximum current (peak value)	371 A	555 A
Inductance of a winding	380 µH ±15 %	270 µH ±15 %
Protection class	IP00	
Power loss during rated operation	700 W	920 W
NRTL approval	–	–
Mass	24 kg	30 kg
Used for	UVR 360	UVR 370
ID	1164276-xx	1164277-xx

Line filter

If regenerative supply units are used, then a line filter is required in addition to the commutating reactor. Line filters suppress line-bound interference and ensure EMC-compatible energy recovery for the HEIDENHAIN inverter system. A star point S for the connection of a UVR 3x0 is provided on the load side by means of integrated capacitors. The line filter must be connected between the power connector and the commutating reactor.

The selection of the line filter depends on the supply unit being used.

Line filter	EPCOS 46A	EPCOS 83A	EPCOS 135A	EPCOS 202A
Protection class	IP20			
Power loss during rated operation	21 W	29 W	42 W	62 W
NRTL approval	–	–	–	–
Mass	4 kg	7 kg	9 kg	19 kg
Used for	UVR 330	UVR 340, UVR 350	UVR 360	UVR 370
ID	1169716-xx	1169717-xx	1169718-xx	1169719-xx

Braking resistor

In regenerative inverter systems, the braking energy of the motors is normally fed back into the power supply network. If, in rare cases, the power supply network is interrupted, then the braking energy can no longer be returned. When the motors are braked, the regenerated energy leads to an excessive increase in DC-link voltage. If a maximum DC-link voltage of 800 V is reached, the supply unit switches off all of the connected inverters by means of the DRIVE OFF signal (de-energized). On drives without a brake, this can lead to uncontrolled coasting behavior.

To prevent a power failure from damaging the machine and workpiece as a result of axes coasting to a stop, the regenerated energy or DC-link voltage should be dissipated with the UP 310 or UP 320 braking resistor module.

In certain cases, a brake integrated into the motor may be sufficient, or coasting to a stop can be considered noncritical (e.g., a spindle coasting to a stop while the guard doors are closed). However, the machine manufacturer must decide on this matter for each use case.

The UP 320 is available for powerful, regenerative inverter systems. The peak power can additionally be doubled by connecting two UP 320 units in parallel.

The machine manufacturer is responsible for selecting a suitable UP 3xx depending on the peak power that will be present when the drives are braked in the event of a power failure.

Specifications

Braking resistor module	**UP 310**	**UP 320**
Switching voltage (on)	DC 790 V (DC-link voltage)	
Switching voltage (off)	DC 757 V (DC-link voltage)	
Peak power (for max. two seconds)	75 kW	150 kW 300 kW, if two UP 320 are connected in parallel
Resistance	7.2 Ω	3.6 Ω
Protection class	IP20	
NRTL approval	–	–
Module width	50 mm	50 mm
Mass	6.5 kg	7 kg
ID	1119332-xx	1119330-xx

Motor and brake connection

Connector for motor and brake connection:
- For UM 310, UM 311, UM 320, and UM 321
- X38x hybrid connectors (not included in delivery; must be ordered separately)

One piece	ID 1249132-03
20 pieces	ID 1249132-01

Accessories for coolant connection

For the use of high-power axis motors or spindle motors, HEIDENHAIN also offers water-cooled power modules: the UVR 360W, UVR 370W, UM 316W, and UM 317W. Despite their high power rating, they are compact and emit only a small amount of heat into the electrical cabinet. The water-cooled components must be connected separately to a closed coolant loop via a distributor. As a suitable accessory, use pressure-tested HEIDENHAIN water hoses.

Hose (set)

Accessory for power modules with water cooling: UVR 360 W, UVR 370 W, UM 316 W, and UM 317 W

Coolant hose: One set contains the following (two sets required per power module):

- One pressure hose, length: 3 m
- One coupling joint for connection to the distributor block: M18 x 1.5

One coolant hose set ID 584862-01

Surge protectors

The Phoenix VAL-MS 230/FM single-pole surge protector and the three-pole FLT-CP-3C-350 are used to protect the machine from overvoltages on the lines, and they separate the protection element from the power supply network. These surge protectors are also equipped with an FM remote indication contact that is implemented as a two-way switch.

Specifications	**VAL-MS 230/FM**	**FLT-CP-3C-350**
IEC test class	II	I + II
EN type	T2	T1 + T2
Rated voltage	230 V	240 V
Rated frequency	50 / 60 Hz	50 / 60 Hz
Protector rated voltage (L-N)	AC 275 V	AC 350 V
Nominal discharge surge current	20 kA	75 kA
Maximum discharge current	40 kA	- - -
Module width	≈ 17.7 mm	≈ 106.9 mm
ID	827105-01 (contains three units)	826918-01

The optional surge protector should be installed after the fuses and the line filter for the HEIDENHAIN power modules as seen from the power connection. HEIDENHAIN recommends keeping the lines between the power supply unit and the surge protector as short as possible so as to ensure the best possible protection of the HEIDENHAIN power modules.

SM voltage protection module

If synchronous motors or direct drive motors, such as synchronous spindles or torque motors, are operated in the field weakening range (e.g., as main spindle drives), then a power interruption (e.g., power failure) of the inverters can cause a voltage increase at the power connections of the motor or inverter. This voltage increase can damage the inverters and the motor. To prevent this, an SM voltage-protection module must be installed in the motor supply line between the motor and the inverter. If a fault occurs, the SM will short-circuit the motor phases. The released braking energy is converted into heat.

Operation in the field weakening range must be enabled through machine parameters of the control. Please refer to the Technical Manual of your control.

You can use the following formula to decide whether an SM voltage protection module must be used:
$N_{Max} = (850\ V \cdot N_{Rated}) / (U_0 \cdot \sqrt{2})$

The resulting N_{max} has the following meaning: if the motor is operated at a speed greater than speed N_{max}, then a voltage protection module must be used. Please also note the production tolerances applying to the respective motor specifications. For example, the actual no-load voltage can be more than 10% higher than stated in the specifications. Take this into account when considering whether an SM 3xx is required.

For the selection of the SM voltage-protection module, the short-circuit current of the motor is decisive (evident from the motor data).

The rated current of the motor and the maximum short-circuit current I_K of a motor must be less than the maximum phase current of the SM:
Where: $X_L = X_{str1} + X_H + X_{Series\ reactor}$
If $X_{str1} = 0$ and $X_{Series\ reactor} = 0$, then the following applies: $X_L = X_H$ in Ohm
In that case the following applies to the short-circuit current:
$I_K = U_0/(\sqrt{3} \cdot X_H)$

Choosing between the SM 320 and SM 330:
- If $I_K < 200$ A, then SM 320
- If $200\ A < I_K < 350$ A, then SM 330

Specifications	**SM 320**	**SM 330**
Switching voltage	DC 830 V	
Maximum phase current	200 A	350 A
Maximum braking time at maximum phase current	10 s	
Minimum waiting period between two braking procedures	10 min	
Maximum permissible short-circuit current Time ranges:		
0 to 10 ms 10 ms to 1 s 1 s to 10 s	Max. 2000 A Max. 400 A Max. 200 A	Max. 4000 A Max. 700 A Max. 350 A
Type of connection:	SM between UM and motor (in series)	Stub lines from UM to SM (parallel)
Suited for:	UM 3x0, UM 3x1, UM 3x2, UM 313, UM 314, UM 315	UM 316(W), UM 317W
Protection class	IP20	
Mass	≈ 4.5 kg	≈ 3.8 kg
ID	1276063-xx	1237089-xx

CMH 3xx capacitor module

A CMH 3xx capacitor module may be required for maintaining the DC-link voltage if a power failure occurs. This is necessary, for example, in order to be able to perform a complete LIFTOFF when direct drives are used.

You can connect more than one CMH 3xx in parallel in an inverter system in order to increase the capacitance available for the DC-link voltage. However, a total capacitance of 40 mF must not be exceeded in an inverter system! In this context, the capacitances of the individual power modules must also be taken into account.

CMH 320

Specifications

Capacitor module	**CMH 310**	**CMH 320**
Power supply	DC-link voltage DC 650 V or DC 720 V	
Maximum voltage	DC 800 V	
Rated capacitance	5 mF	10 mF
Power loss with DC-link voltage of DC 650 V	≈ 15 W	≈ 30 W
Power loss with DC-link voltage of DC 720 V	≈ 18 W	≈ 36 W
NRTL approval	–	–
Mass	4.8 kg	6.7 kg
ID	1265319-01	1164215-xx

Multi-row configuration

In some cases, limited space prevents the control and/or the power modules from being installed in a single row or in a continuous row within the electrical cabinet. This usually means that the devices must be installed in multiple rows or side by side in separate rows.

Components such as inverters and controller units in every row must be connected to a 24 V supply bar at X76 and, possibly, to the DC-link voltage. These supply voltages are provided by one or more power supply units. If each row has its own power supply unit, then the components in this row can standardly be connected to the supply voltages via the corresponding bus mountings. Often, however, only one power supply unit is used in a multi-row configuration. Special connection kits from HEIDENHAIN must then be used to electrically connect the individual power module rows.

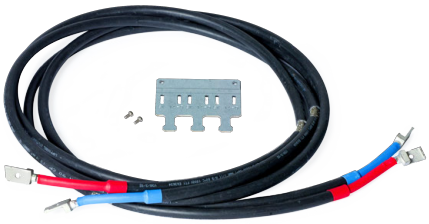
Connection kit for +24 V and DRIVE OFF (X76)

- Optional accessory for a multi-row or discontinuous configuration
- For lateral mounting at the outermost component of a power module row
- Line cross section: 4 mm², for up to 30 A

X76 connection kit	Length	ID
	2 m	1274603-02
	3 m	1274603-03

Connection kit for DC link

- Optional accessory for a multi-row or discontinuous configuration
- For lateral mounting at the outermost component of a power module row
- Includes a shield plate for connecting the shield and which serves as strain relief for components with a width ≤ 75 mm
- Line cross section: 10 mm², for up to 55 A



Connection kit DC-link	Length	ID
	2 m	1278910-02
	3 m	1278910-03

Shield plates

The various shield plates are accessories for the shield connection of the motor power cable. They are each mounted with screws to the UM modular inverter and must not be used for strain relief. The screws are included in delivery.

Shield plate	Quantity	ID
UM 312, UM 322	1	1271547-01
	10	1271547-02
UM 313, UM 314	1	1271564-01
	10	1271564-02
UM 315	1	1271566-01
	5	1271566-02
UM 316, UM 317	1	1271567-01

PAE-H switch-off module

The PAE-H switch-off module for control systems with external safety is required in HEIDENHAIN control systems if all of the following conditions apply:

- The drives are digitally controlled by one or more CC 3xx controller units
- The integrated functional safety (FS) from HEIDENHAIN is not used in this system

The PAE-H switch-off module makes it possible to initiate the SS1, STO, and SBC safety functions for up to eight drives or axis groups. For this purpose, the PAE-H provides eight dual-channel inputs. In addition, the SBC function can be triggered simultaneously for all drives. This is done using an additional dual-channel input. A PAE-H must be used in a system with external safety, and no more than this one PAE-H can be used. The PAE-H can be operated in any slot of a PLB 62xx or PLB 61xx without FS. The PAE-H must be integrated with the IOconfig PC tool. A PAE-H is not required in systems with integrated functional safety (FS) and is therefore not supported.

Please follow the basic circuit diagram of your control for wiring the PAE-H inputs.

HSCI connection

With the Gen 3 drives, communication between the HSCI components is carried out over Gbit cables with gray HSCI connectors. Previous HSCI cables use black connectors.

Gbit HSCI cable ID 1257765-xx

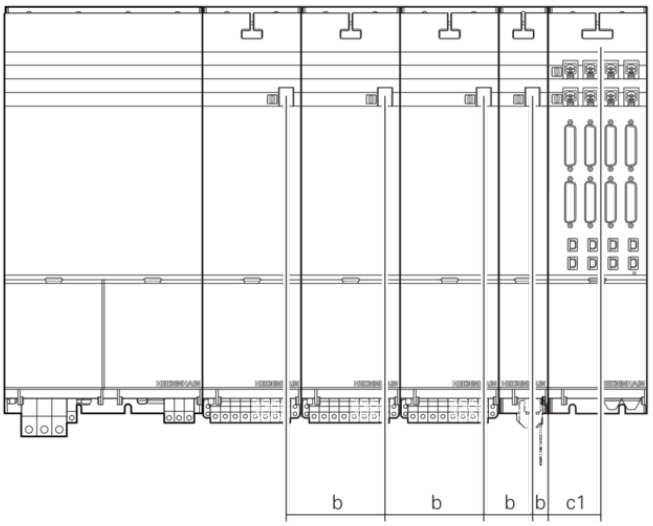
Optical fiber cables

Length of the optical fiber cable

For the length of the optical fiber cable from the CC 3xx controller unit to the UM 3xx power module, HEIDENHAIN recommends the following:

When the UM 3xx power module is located to the left of the CC 3xx controller unit:
Length of optical fiber cable = Width of the module to be connected (b) + Width of all modules (b) between the UM and the CC + 300 mm (c1)

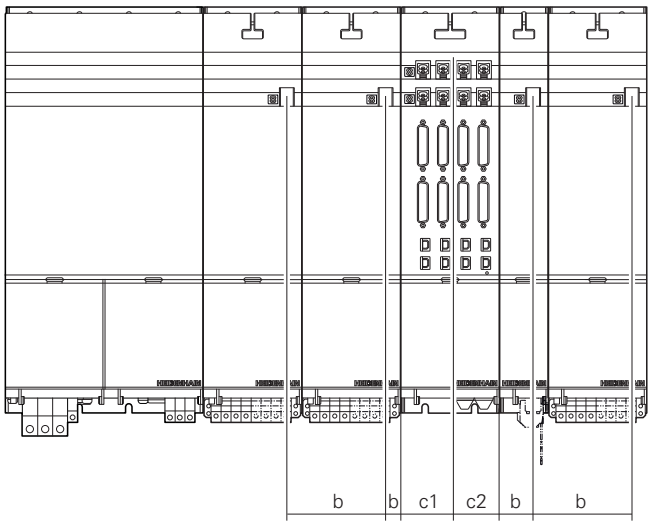
For example, the following arrangement:
UVR 340, UM 314, UM 313, UM 322, UM 321, CC 308



CC 308 to UM 314: 650 mm
CC 308 to UM 313: 550 mm
CC 308 to UM 322: 450 mm
CC 308 to UM 321: 350 mm

When the UM 3xx power module is located to the right of the CC 3xx controller unit:
Length of optical fiber cable = Width of the module to be connected (b) + Width of all modules (b) between the UM and the CC + 200 mm (c2)

For example, the following arrangement:
UVR 340, UM 314, UM 313, CC 308, UM 321, UM 322



CC 308 to UM 314: 500 mm
CC 308 to UM 313: 400 mm
CC 308 to UM 321: 300 mm
CC 308 to UM 322: 350 mm

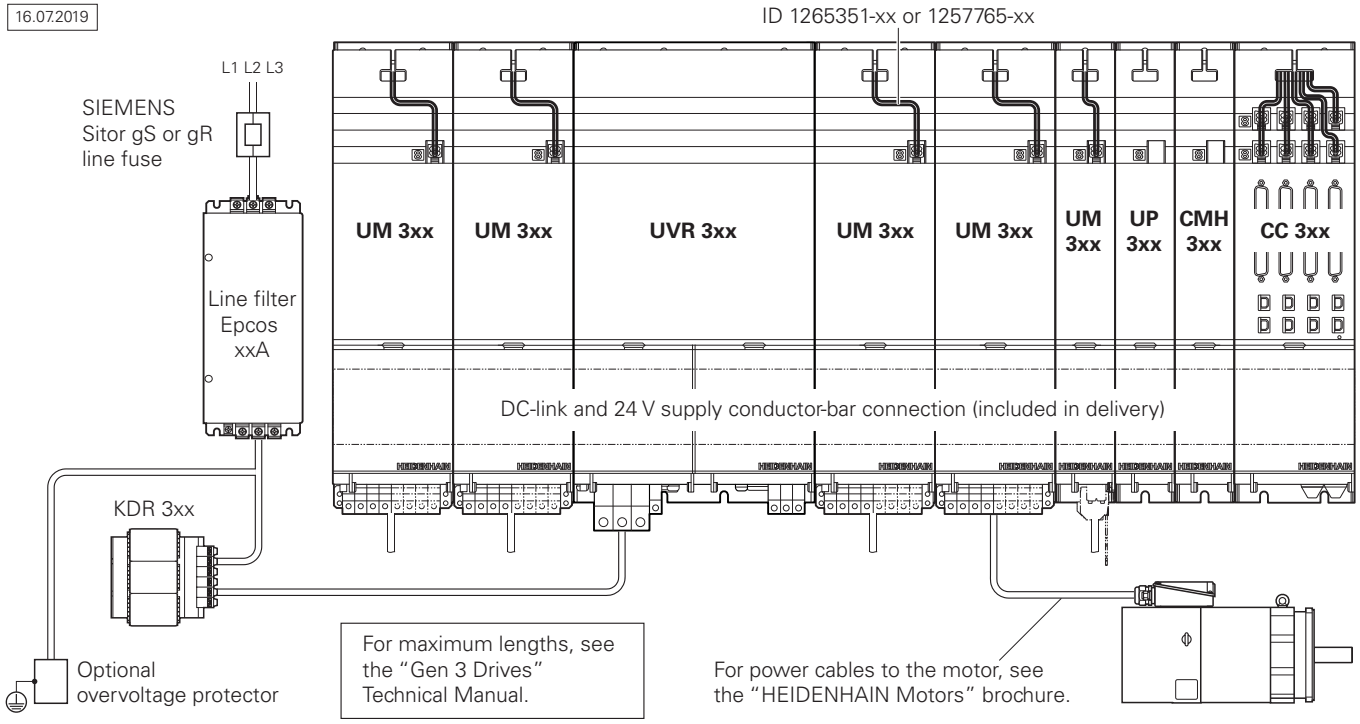
Orderable variants

The optical fiber cable can be ordered in the following variants:

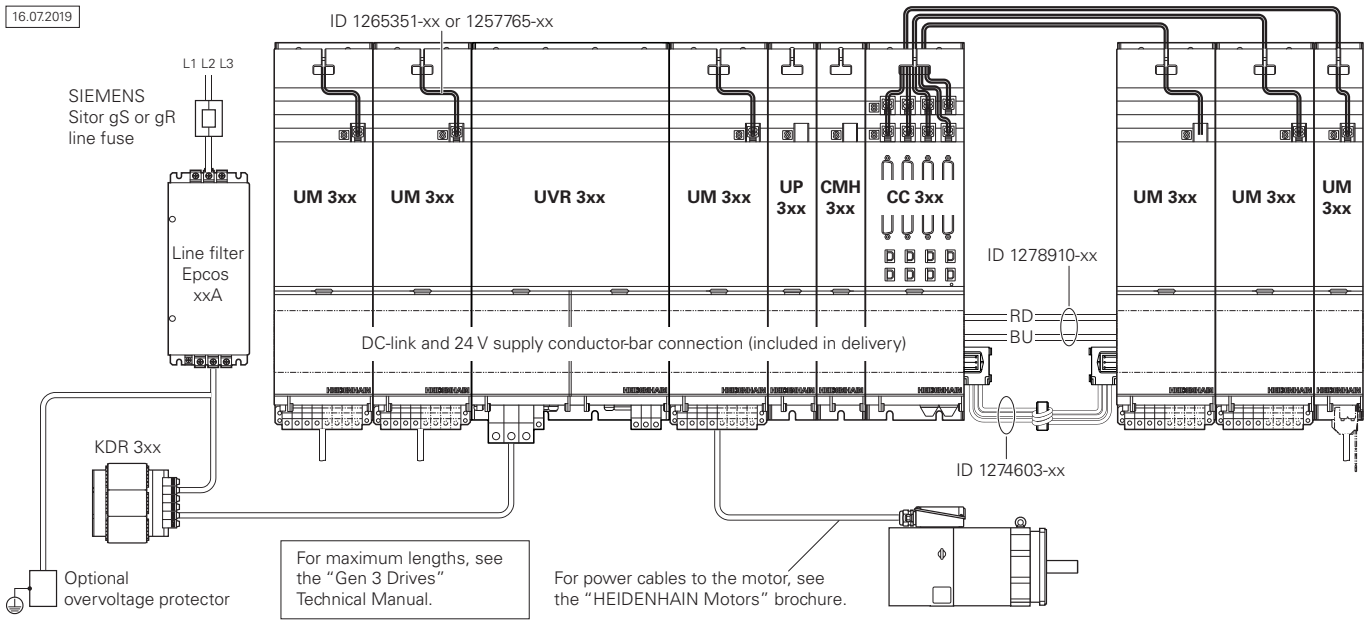
ID number	Description
1265351-90	10 m optical fiber cable on roll; to be assembled by the machine manufacturer
1265351-92	50 m optical fiber cable on roll; to be assembled by the machine manufacturer
1265351-95	100 m optical fiber cable on roll; to be assembled by the machine manufacturer
1265351-01	0.30 m optical fiber cable
1265351-02	0.35 m optical fiber cable
1265351-03	0.40 m optical fiber cable
1265351-04	0.45 m optical fiber cable
1265351-05	0.50 m optical fiber cable
1265351-06	0.55 m optical fiber cable
1265351-07	0.60 m optical fiber cable
1265351-08	0.65 m optical fiber cable
1265351-09	0.70 m optical fiber cable
1265351-10	0.75 m optical fiber cable
1265351-11	0.80 m optical fiber cable
1265351-12	0.85 m optical fiber cable
1265351-13	0.90 m optical fiber cable
1265351-14	0.95 m optical fiber cable
1265351-15	1.00 m optical fiber cable

Overview of cables

Inverters



Inverter (multi-row)



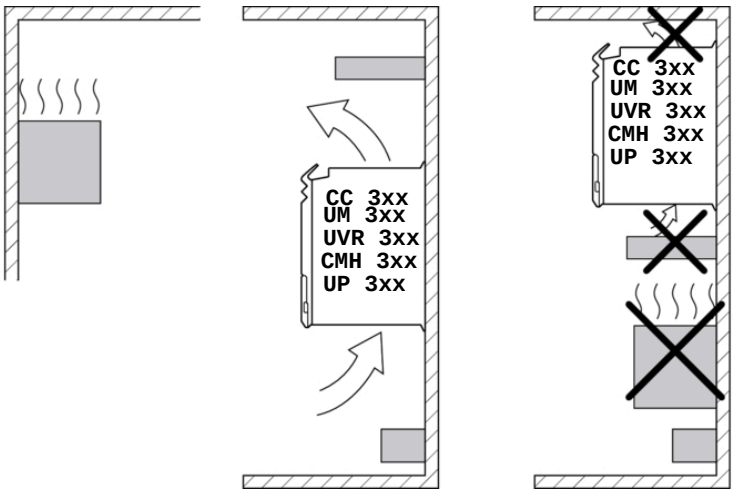
Mounting information

Mounting position

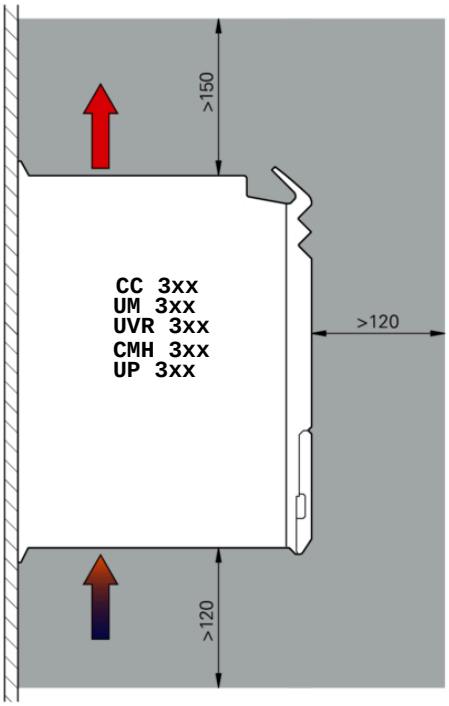
Please note the following when mounting the HEIDENHAIN power modules:

- The HEIDENHAIN power modules and control components must be operated only in enclosures or electrical cabinets that fulfill at least an IP54 rating in accordance with the European enclosure specifications. Ensure that, depending on the location of the machine, at least equivalent requirements are fulfilled. The machine manufacturer is responsible for this.
- The HEIDENHAIN power modules and control components must be mounted vertically in the electrical cabinet.
- Minimum clearances that must be maintained
- Required clearances for air circulation and servicing
- Appropriate length of the cables
- Permissible bending radii of the cables
- Do not mount any other devices that generate or dissipate heat below or in the immediate vicinity of the HEIDENHAIN power modules. Air that has already been heated should be prevented from being sucked in for the cooling of the HEIDENHAIN power modules.
- Professional mounting in connection with other devices in the electrical cabinet (see the following drawings).
- All of the HEIDENHAIN control components or devices (CC, MC, BF, MB, TE, UV(R), UR, UE, UEC, UMC, KDR, SM, etc.) must be operated only in enclosures suitable for this purpose, such as electrical cabinets or panels. Fire protection enclosures in accordance with the fire safety regulations must be used at the site of installation. The enclosures must also provide protection against electric shock.

Arrangement of HEIDENHAIN components



Clearances for HEIDENHAIN components



Mounting and electrical installation

For mounting and the electrical connection, comply with the following:

- National regulations for low-voltage installations at the operating site of the machine or components
- National regulations regarding interference and noise immunity at the operating site of the machine or components
- National regulations regarding electrical safety and operating conditions at the operating site of the machine or components
- Specifications for the installation position
- Specifications of the Technical Manual

Degrees of protection

The following components fulfill the requirements for protection class IP54 (dust- and splash-proof protection):

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

All electric and electronic control components must be installed in an environment (e.g., electrical cabinet, enclosure) that fulfills the requirements of protection class IP54 (dust- and splash-proof protection) in order to fulfill the requirements of pollution degree 2. All components of the OEM operating panel must, like the HEIDENHAIN operating panel components, comply with protection class IP54.

Electromagnetic compatibility

During installation, be sure to pay attention to the following factors regarding electromagnetic compatibility.

Intended place of operation

HEIDENHAIN power modules and their accessories comply with the following standards based on Directive 2014/30/EC:

- Interference as per EN 61800-3, Category C3 (limit values for PDS I ≤ 100 A) and EN 50370-1
- Noise immunity in accordance with EN 61800-3, second environment, and EN 50370-2

Protect your equipment from interference by following the rules and recommendations on EMC provided in the Technical Manual for the Gen 3 drives. In particular, ensure that you follow the protective measures regarding an EMC-compliant configuration.

Place of operation

The inverter systems or power modules from HEIDENHAIN are intended for operation in industrial and mixed-use areas. The devices conform to EN 50370 (product-family standard for machine tools) and EN 61800-3, and fulfill the requirements for an industrial low-voltage supply network. The devices are not intended to be used on a public, low-voltage supply network that supplies households. The devices may cause high-frequency interference.

The product conforms to category C3 as per EN 61800-3. This product can cause radio interference in residential areas. This would require the operator to ensure that appropriate measures are taken.

Installation altitude

The maximum installation altitude for HEIDENHAIN power modules and their accessories (UVR, UM, UEC, KDR, line filters, etc.), with direct connection to the supply network, is 2000 m above sea level, because the HEIDENHAIN power modules and their accessories comply with overvoltage category III as per EN 61800-5-1 and UL 61800-5-1 at an installation altitude of 2000 m above sea level.

At an installation altitude of greater than 2000 m above sea level up to a maximum permissible installation altitude of 3000 m, HEIDENHAIN power modules, as well as the control system, must be operated in a supply network that complies with overvoltage category II as per EN 61800-5-1 and UL 61800-5-1. This can be attained, for example, by means of an upstream isolation transformer.

Be aware of degraded performance due to current derating when HEIDENHAIN power modules are installed at altitudes of greater than 1000 m above sea level. Interpolation is linear for current derating:

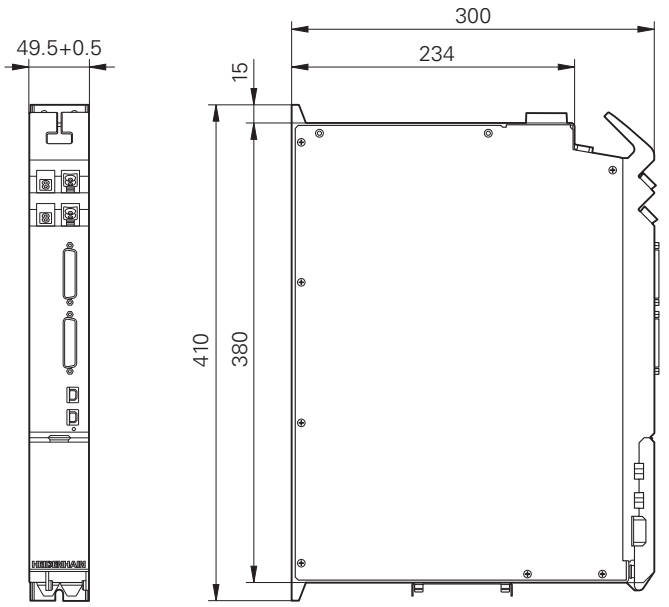
- 1000 to 2000 m: 100 % to 85 %
- 2000 to 3000 m: 85 % to 75 %

Dimensions

CC 302

mm

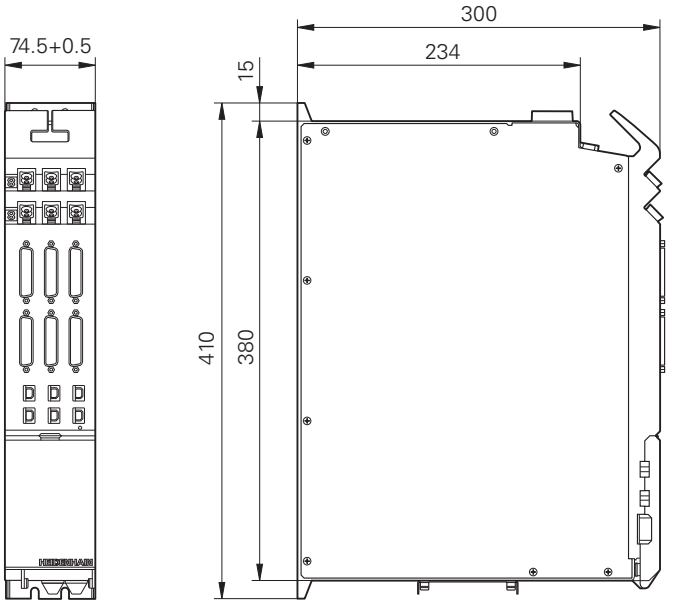
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



CC 306

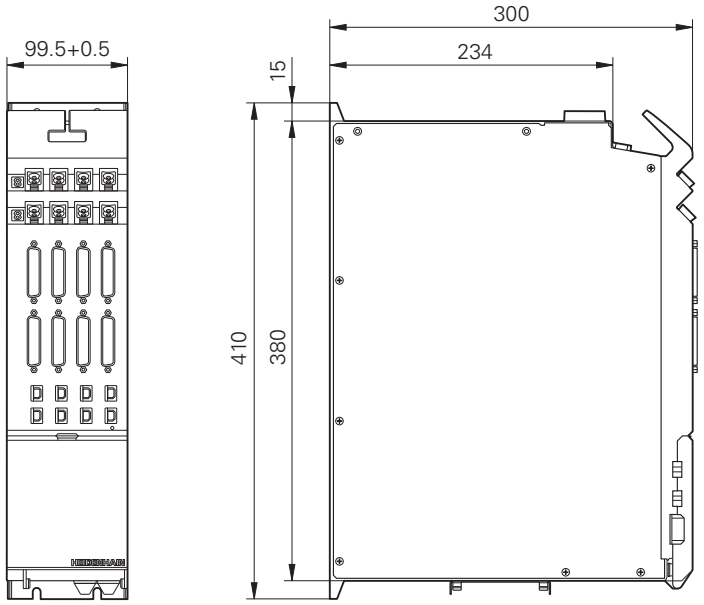
mm

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



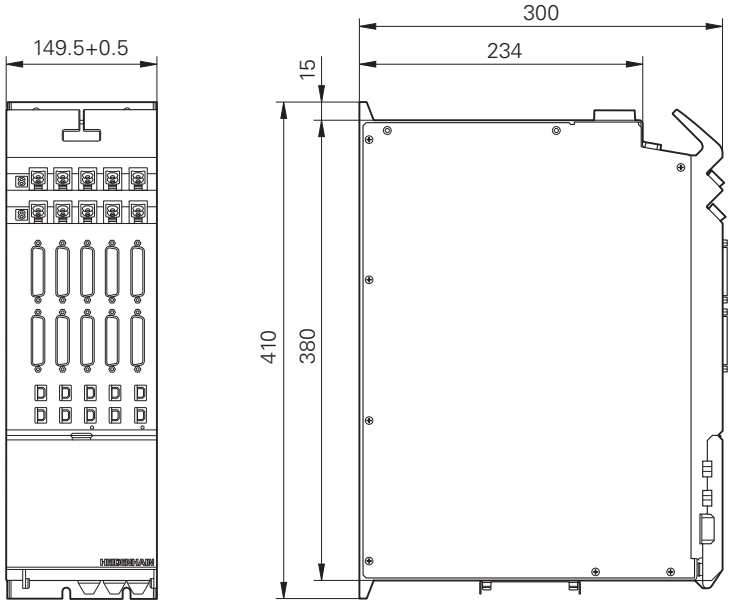
CC 308

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



CC 310

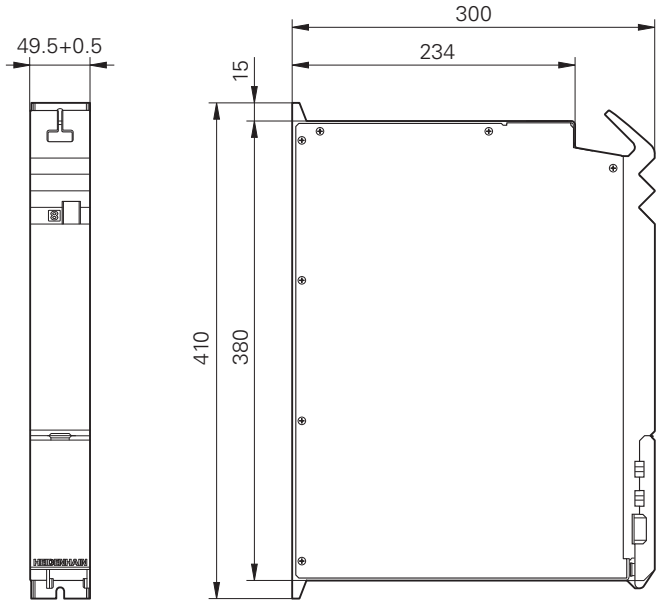
mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



CMH 310, CMH 320, UP 310, UP 320

mm

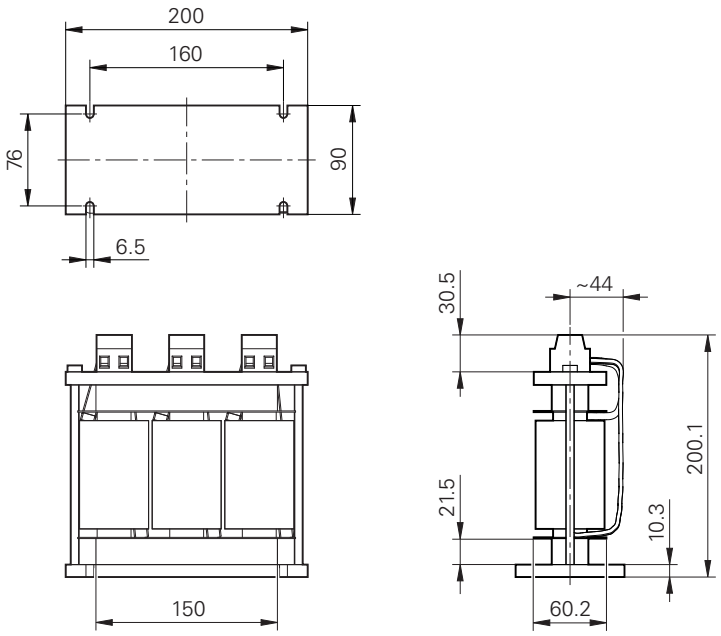
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



KDR 330

mm

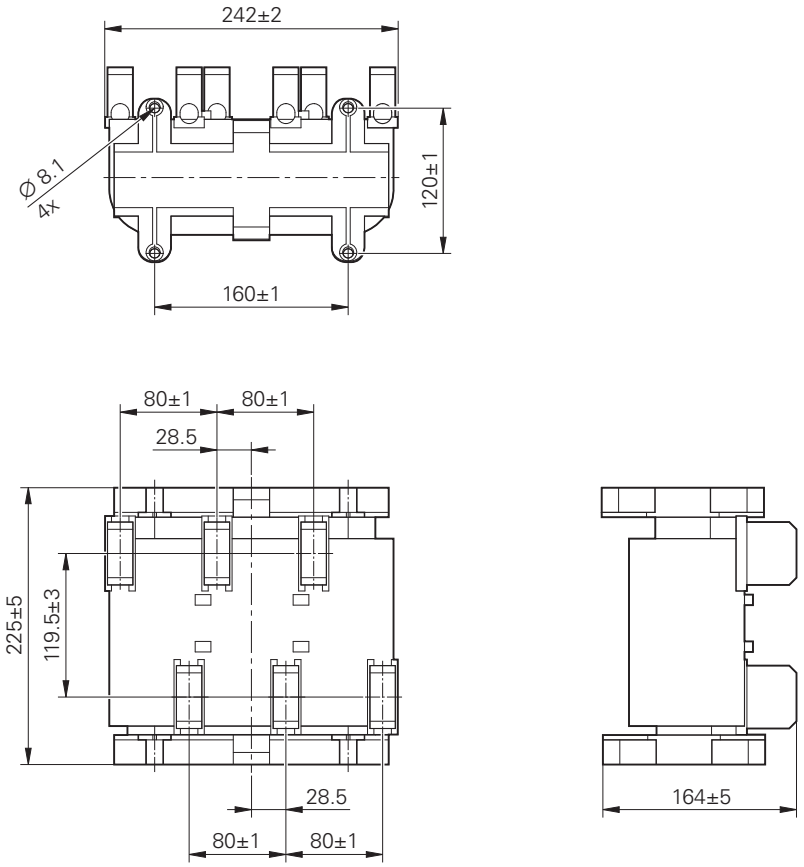
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



KDR 340

mm

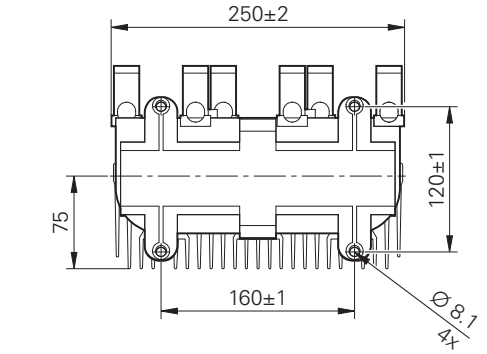
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm

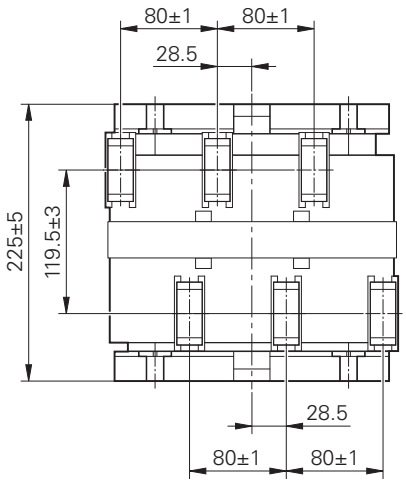


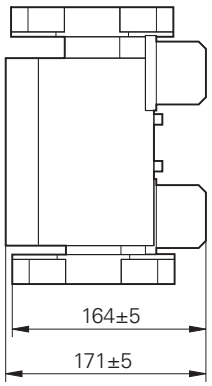
KDR 350

mm

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



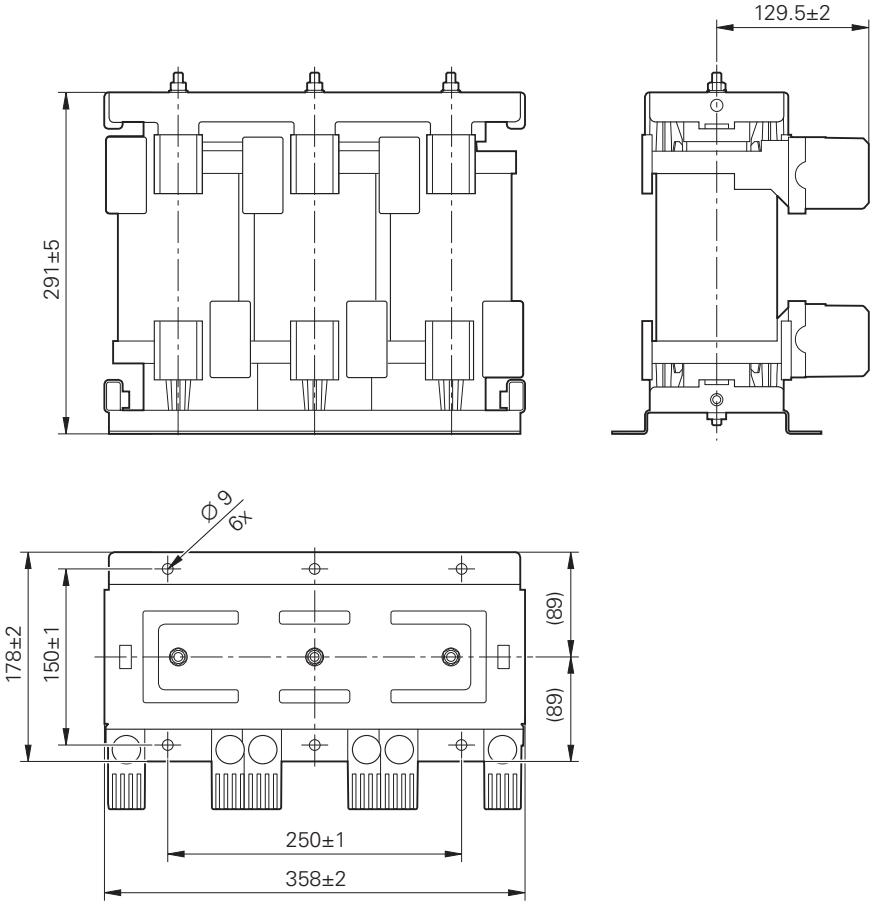




KDR 360

mm

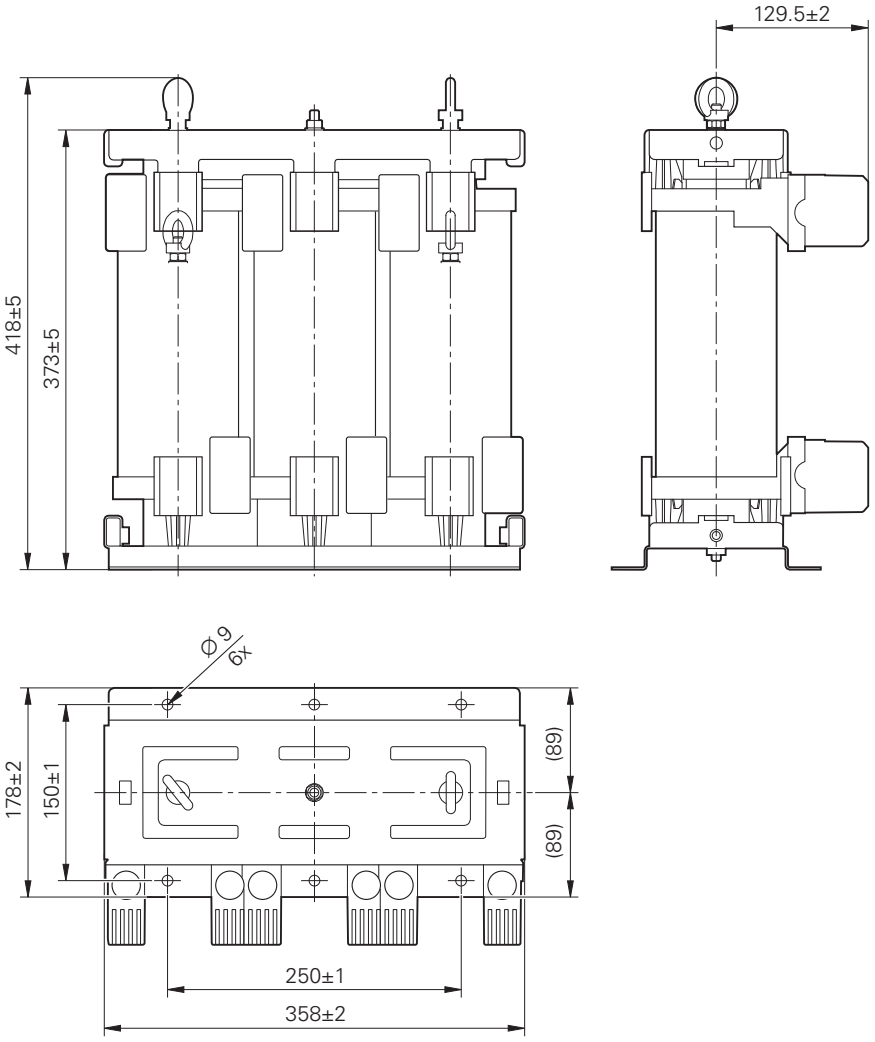
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



KDR 370

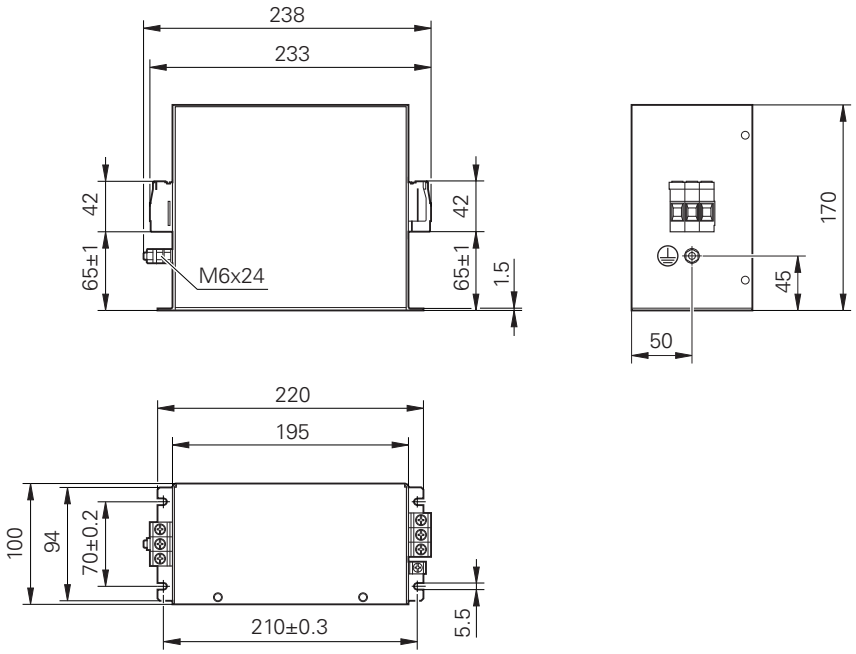
mm

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



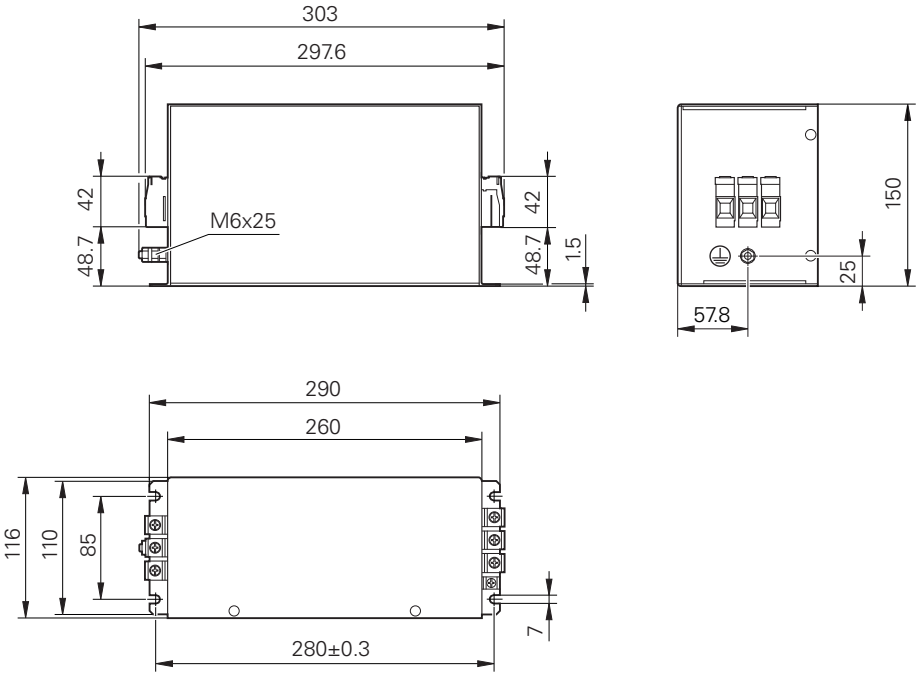
Line filter 46A

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

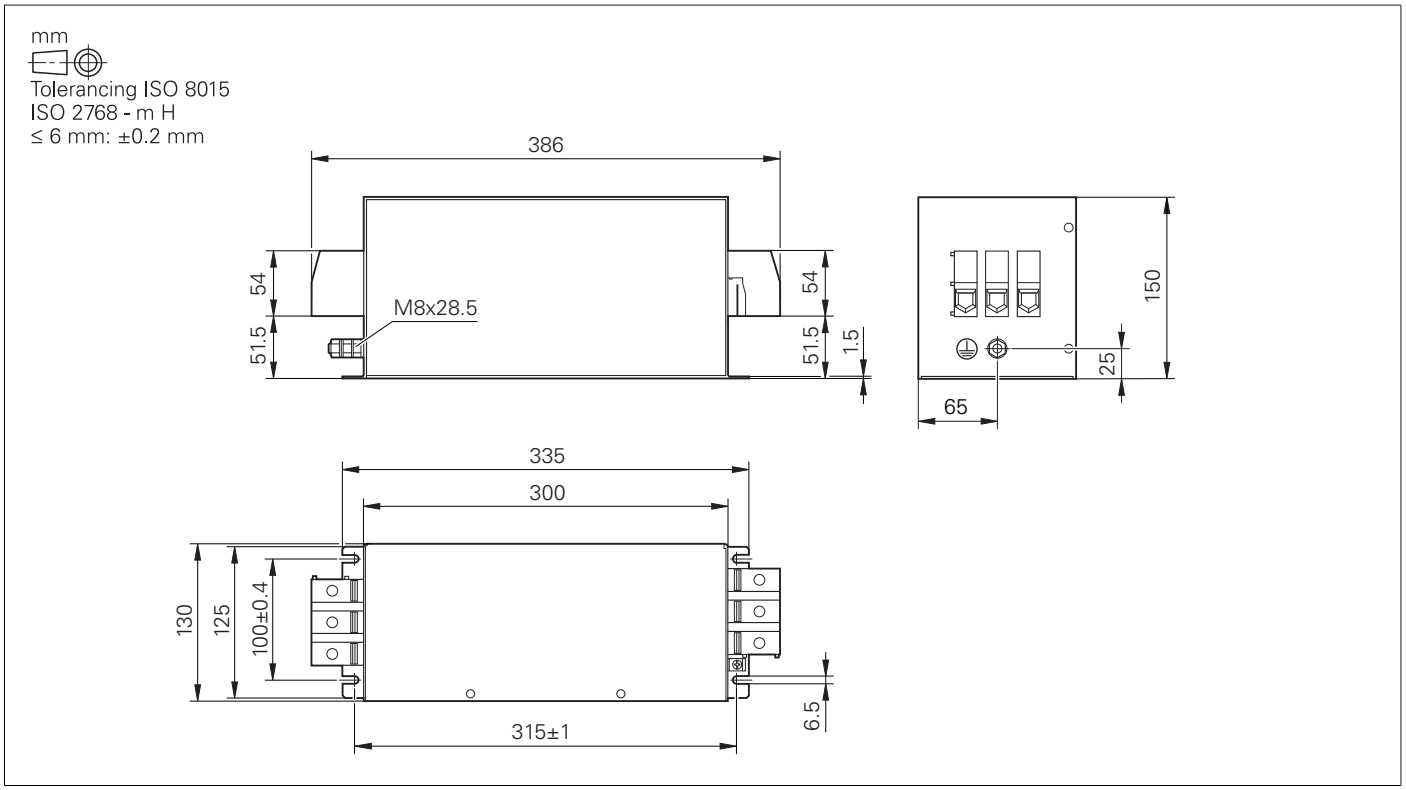


Line filter 83A

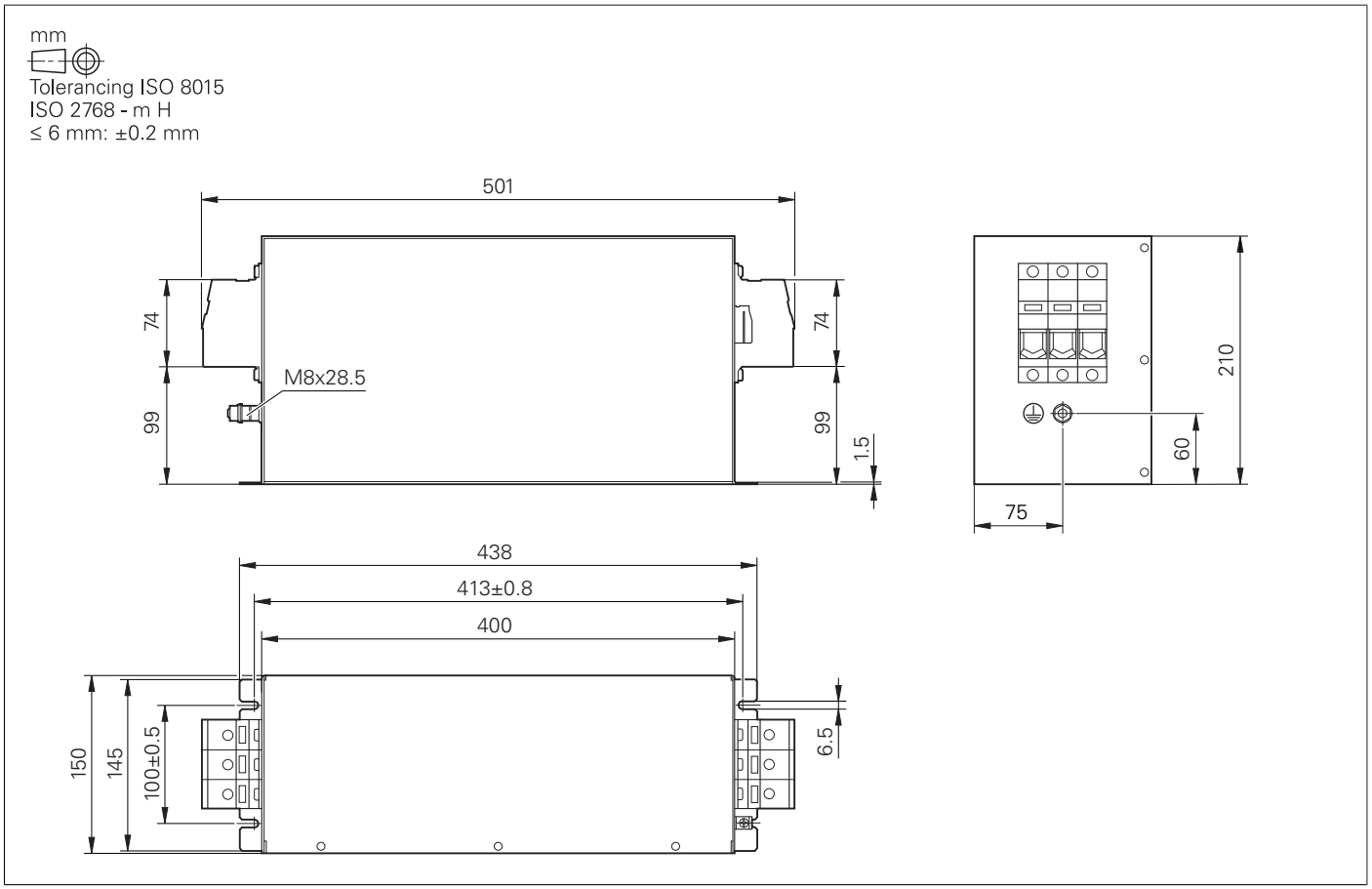
mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



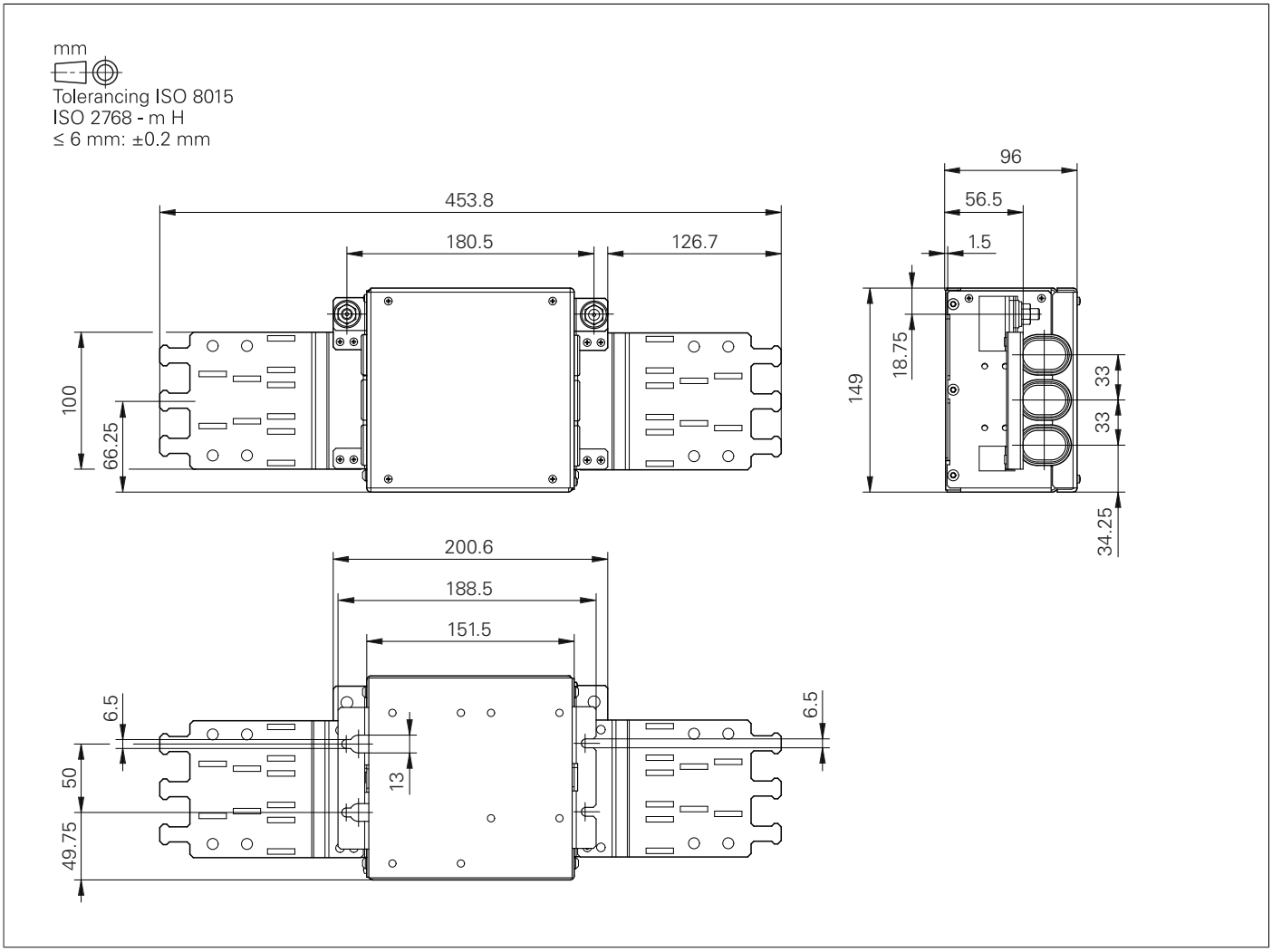
Line filter 135A



Line filter 202A



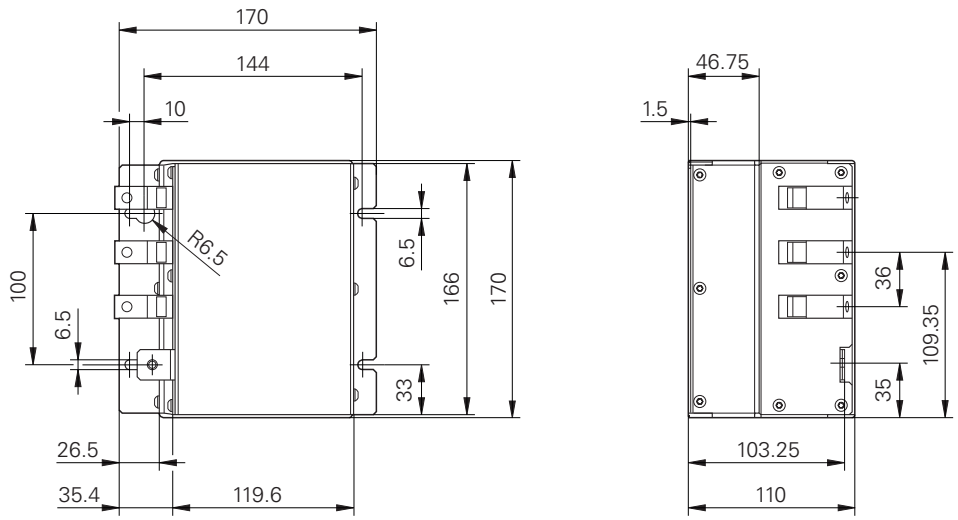
SM 320


mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm
453.8
180.5
126.7
100
66.25
96
56.5
1.5
18.75
149
33
33
34.25
200.6
188.5
151.5
6.5
6.5
13
50
49.75

SM 330

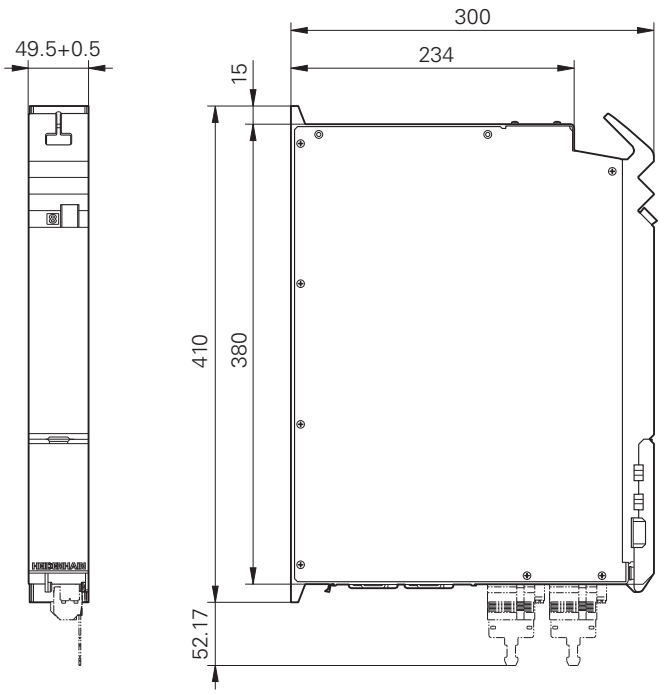
mm

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



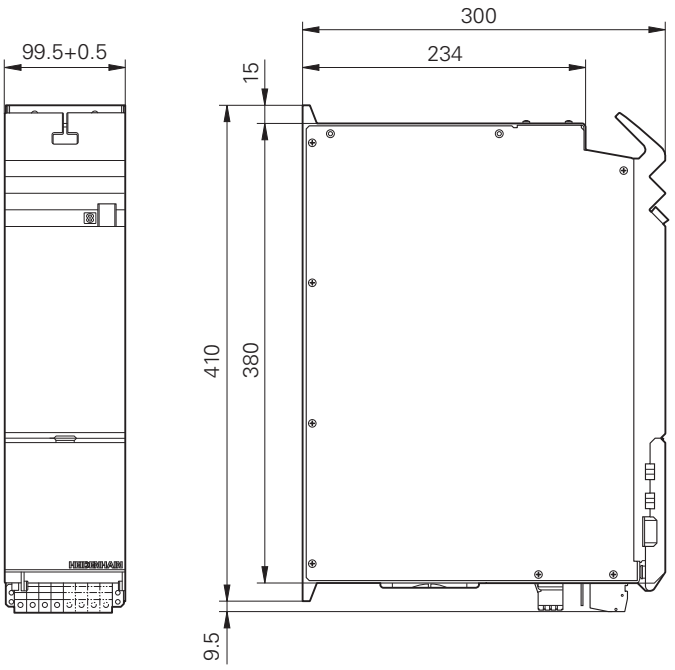
UM 310, UM 311, UM 320, UM 321

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



UM 312, UM 313, UM 314, UM 322

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

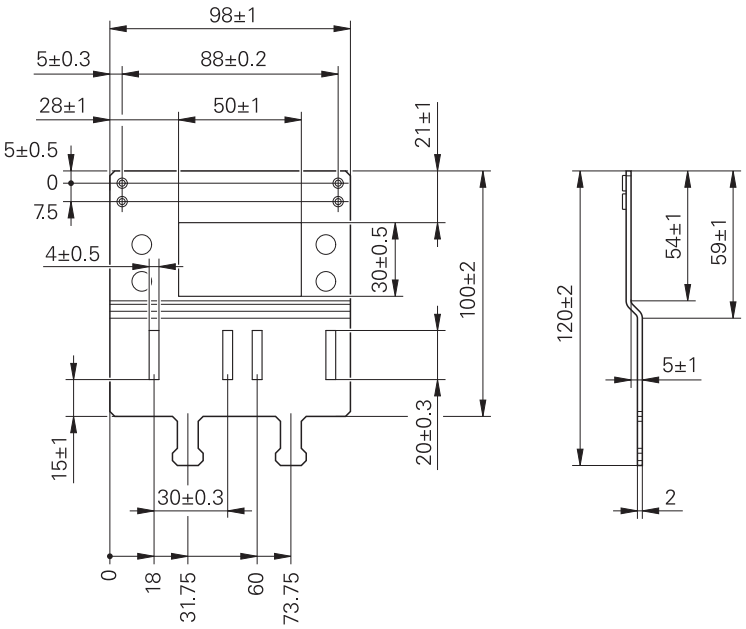


Shield plate for UM 312, UM 322, UM 313, UM 314

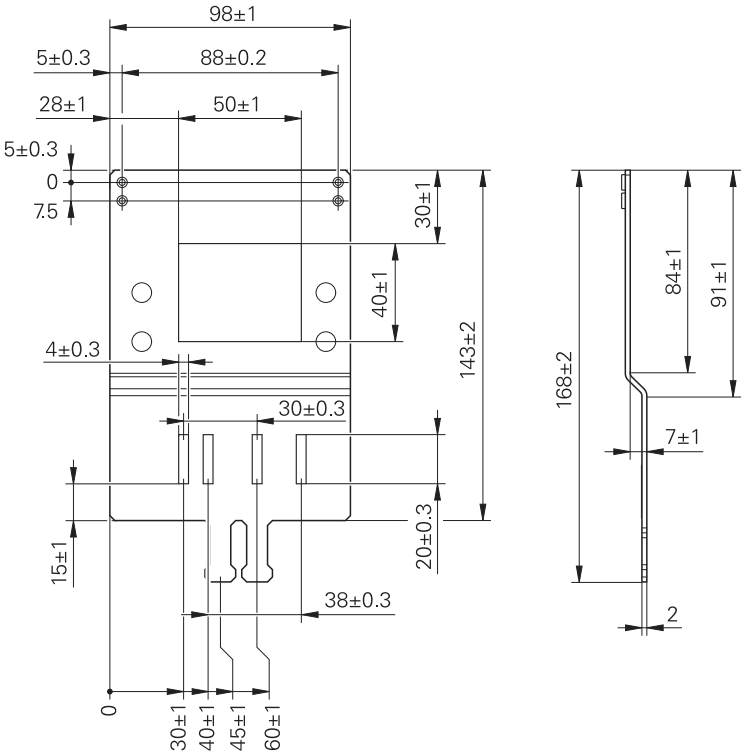
mm

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

UM 312 / UM 322



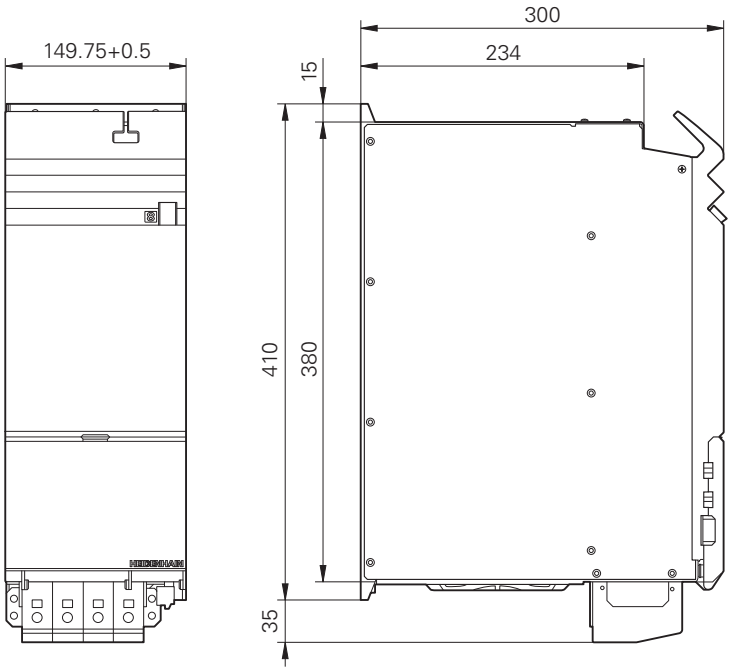
UM 313 / UM 314



UM 315

mm

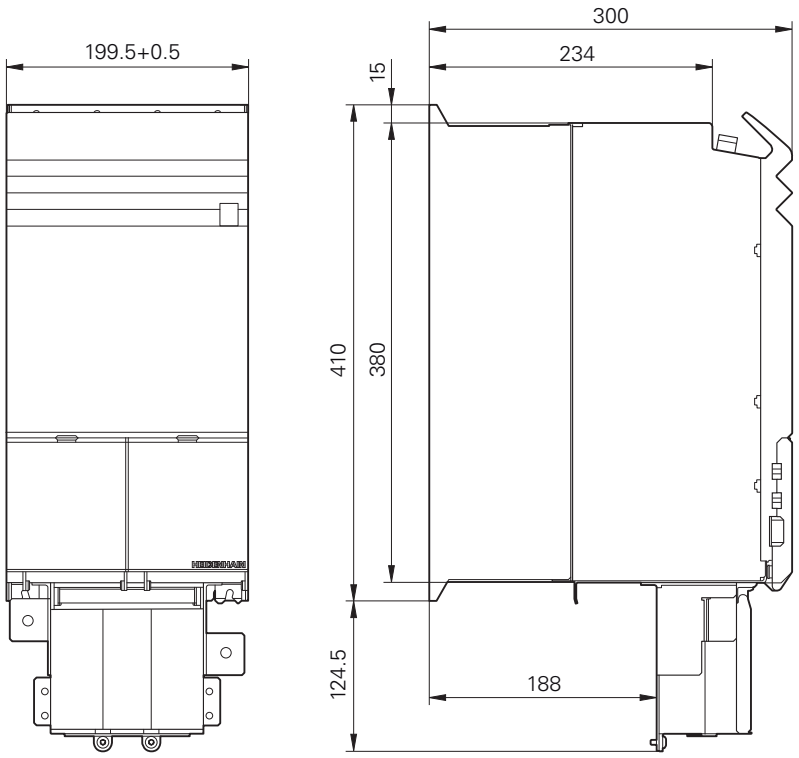
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm



UM 316, UM 316W, UM 317W

mm

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

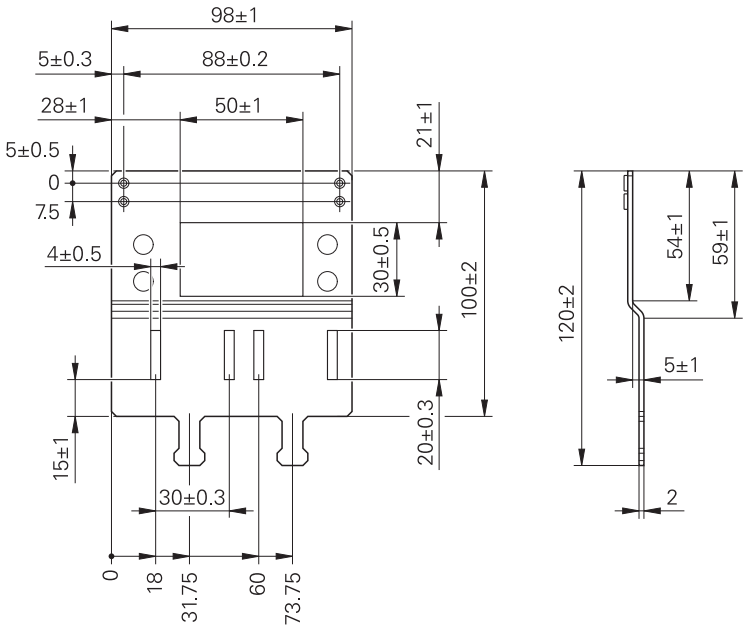


Shield plate UM 315, UM 316, UM 317

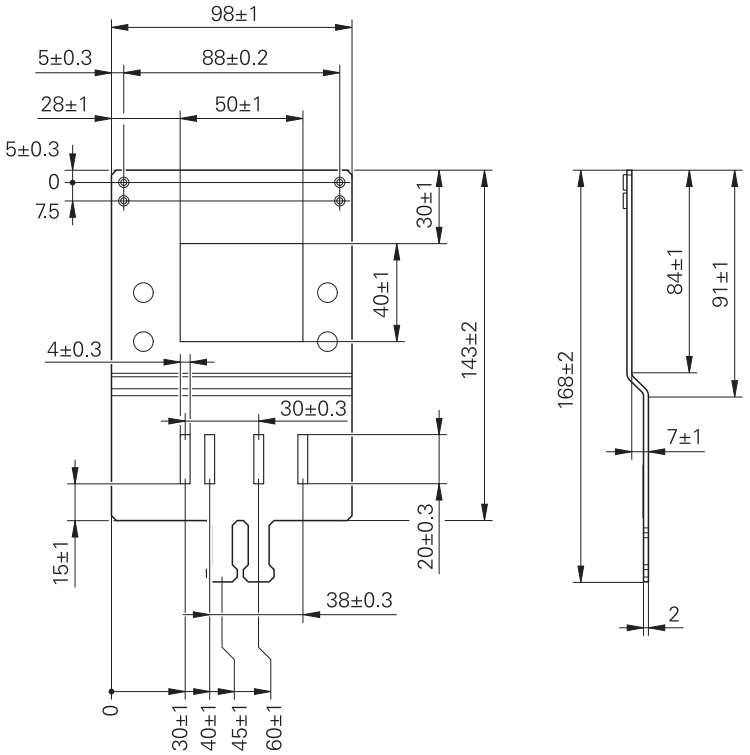
mm

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

UM 312 / UM 322

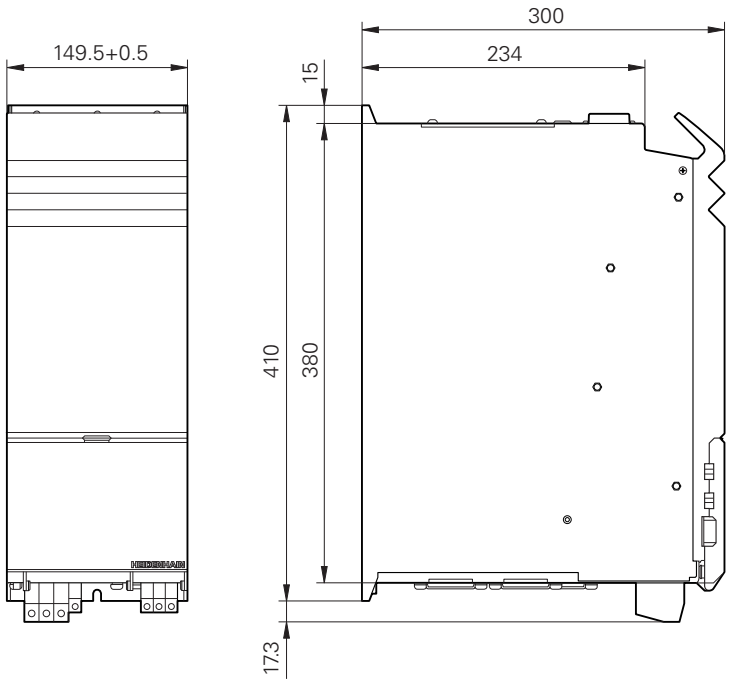


UM 313 / UM 314



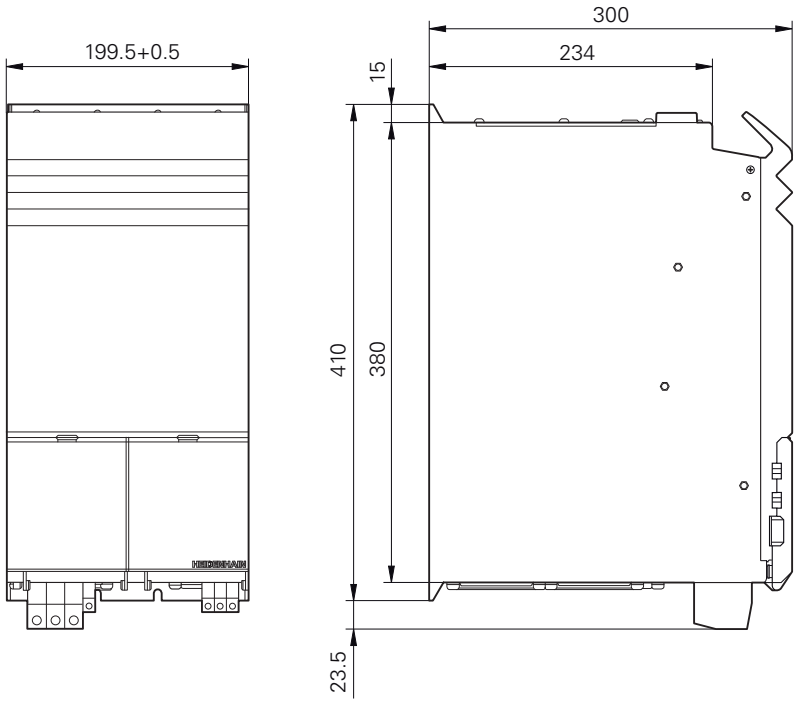
UVR 330

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



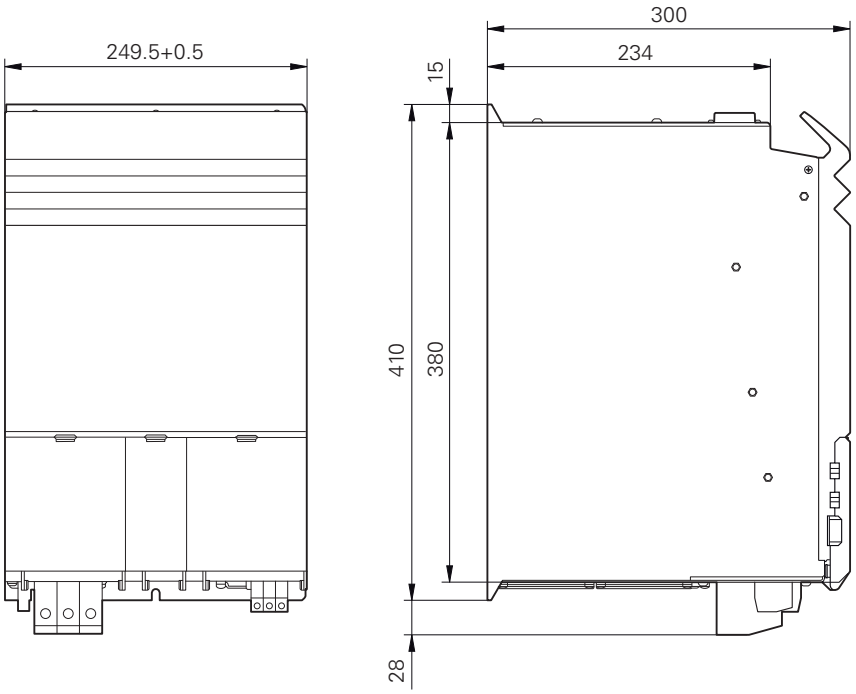
UVR 340, UVR 350

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



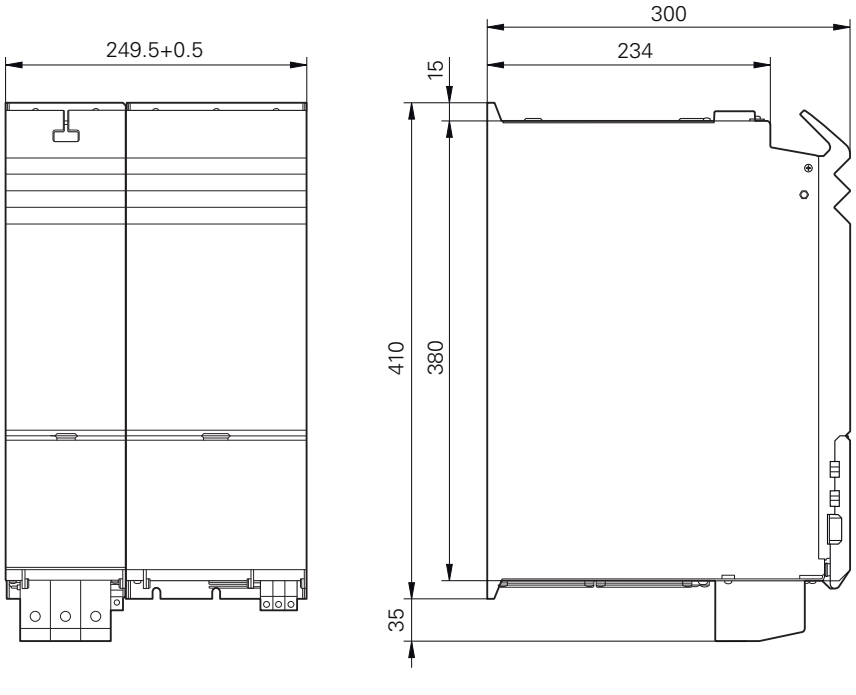
UVR 360

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



UVR 370

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



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