Inverter Systems
UV 1xx, UVR 1xx, UM 1xx, UEC 1xx, UE 2xx, UR 2xx
For HEIDENHAIN Controls

Information for the Machine Tool Builder
HEIDENHAIN inverter systems

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

This brochure describes inverter systems with UVR 1xx, UM 1xx, UE 2xx, UR 2xx, UEC 1xx, and their accessories for operation with a CC 61xx. The Gen 3 drives inverter system is described in a separate brochure (ID 1303180-xx).

Intended use
The products described in this brochure • may be used only for NC controlled machine tools • may be used only in an industrial environment, for commercial applications and in research facilities • may be operated only in accordance with the product specifications (technical data, ambient data, safety instructions, etc.) • may be operated only in an electrical cabinet

For the use of the devices as part of a safety function, the machine manufacturer must ensure that the end product meets all requirements of the Machinery Directive (2006/42/EC).

Improper use
The devices are not intended for applications in areas where a failure would result in considerable risks for humans or the environment.

Use in potentially explosive atmospheres is prohibited.

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 fans in inverters from HEIDENHAIN are subject to wear.

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

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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 14 kW to 125 kW. They can be supplied as compact inverters or in modular versions as regenerative or non-regenerative systems.

Regenerative inverters
In the energy-recovery inverters, the braking energy of the motors is normally returned to line power. Regenerative systems need additional components, such as line filters and commutating reactors (see Accessories for inverter systems).

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

Supply voltage
Please refer to the following tables for the respective supply voltage. The inverter systems are designed for connection to a TN public power grid. 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 to the 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 non-regenerative 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.

Regenerative inverters
In a single enclosure, UE, UR and UEC 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 22 kW. As an alternative, the internal braking resistor can be replaced by an external resistor to reduce heat generation in the electrical cabinet (but not with UE 11x). Higher power ratings require regenerative systems.

For special cases, additional power modules 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 of the UE and UR is connected to the compact inverter over a ribbon cable and uses PWM signals to control the IGBTs.

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.

Additional power supply
Compact inverters and power supply units have a DC 5 V output (connector X8) in addition to the supply bus (connector X69). It additionally supplies the CC and thus also the connected encoders with power.

Failure rates
For HEIDENHAIN devices, such as control components, encoders, and motors, your HEIDENHAIN contact person can provide you with additional device-specific data upon request (such as failure rates, information on fault exclusion).
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 supply unit's own current consumption also has to be taken into account. The data specified in the specifications for current consumption apply for PWM frequencies up to 5 kHz. For PWM frequencies from 5 kHz to 10 kHz, the given values must be multiplied by the following factor:

If the total current consumption exceeds the maximum value, an MS 111 must be used with the provision of external +24 V.

The UV(R) supply units have an additional integrated power pack that supplies the following voltages for the control system:
- DC 5 V NC for supply of the CC controller unit and connected encoders (connector X70)
- DC 15 V and DC 24 V for supply of the connected inverters (connector X90), protective extra-low voltage, safely separated
- Only on UVR 170(DW), UV 130(D)-DC 24 V PLC for supply of the PLC components (connector X90, basic insulation)

The integrated power pack is buffered via the DC link, thereby ensuring that in the event of a power failure the connected components will continue to be supplied to that concluding actions, such as the LIFTOFF function, can be performed. The power failure must be considered separately. As a machine tool builder, you should—where required—take into account measures to be taken regarding a power failure.

The performance data of the power pack can be found in the Specifications. During planning, please also consider the power requirements of the connected inverters, encoders, and controller units in addition to the HSCI/PLC components. In rare cases it may be necessary to use an additional external power supply unit, such as a PSL 130, if the power output of the integrated power pack does not suffice. For further information on project planning, refer to the Inverter Systems and Motors Technical Manual.

For the entire HSCI system, the +24 V NC supply voltage is required to be safely separated voltage. Safely separated circuits or circuits with basic insulation must not be mixed or connected with each other.

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).

The individual control components are connected through ribbon cables for PWM signals, supply 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 standard covers for compact inverters are included in delivery.

### Overview

#### Type

- **Rated power**
- **Rated current**

#### Compact inverters

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated power</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regenerative</td>
<td>UR 230D</td>
<td>22 kW</td>
</tr>
<tr>
<td></td>
<td>UR 240D</td>
<td>22 kW</td>
</tr>
<tr>
<td></td>
<td>UR 242D</td>
<td>22 kW</td>
</tr>
<tr>
<td>Non-regenerative</td>
<td>UE 210 D</td>
<td>15 kW</td>
</tr>
<tr>
<td></td>
<td>UE 211 D</td>
<td>15 kW</td>
</tr>
<tr>
<td></td>
<td>UE 212 D</td>
<td>15 kW</td>
</tr>
<tr>
<td></td>
<td>UE 230 D</td>
<td>22 kW</td>
</tr>
<tr>
<td></td>
<td>UE 240 D</td>
<td>22 kW</td>
</tr>
<tr>
<td></td>
<td>UE 241 D</td>
<td>22 kW</td>
</tr>
<tr>
<td></td>
<td>UE 242 D</td>
<td>22 kW</td>
</tr>
</tbody>
</table>

#### Non-regenerative, integrated controller unit

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated power</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>UEC 111</td>
<td>14 kW</td>
<td>2 x 6 A + 1 x 9 A</td>
</tr>
<tr>
<td>UEC 112</td>
<td>14 kW</td>
<td>3 x 6 A + 1 x 9 A</td>
</tr>
<tr>
<td>UEC 113</td>
<td>14 kW</td>
<td>4 x 6 A + 1 x 9 A</td>
</tr>
<tr>
<td>UMC 111 FS</td>
<td>14 kW</td>
<td>4 x 9 A</td>
</tr>
</tbody>
</table>

#### Modular inverters

#### Power module

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated power</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>For one axis</td>
<td>UM 111 D</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 111 BD</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 112 D</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 113 D</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 114 D</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 115 D</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 116 D</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 116 DW</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UM 117 DW</td>
<td>–</td>
</tr>
</tbody>
</table>

#### For two axes

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated power</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM 121 D</td>
<td>–</td>
<td>2 x 75 A</td>
</tr>
<tr>
<td>UM 121 BD</td>
<td>–</td>
<td>1 x 15 A</td>
</tr>
<tr>
<td>UM 122 D</td>
<td>–</td>
<td>1 x 25 A</td>
</tr>
</tbody>
</table>

#### Supply unit

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated power</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regenerative</td>
<td>UVR 120 D</td>
<td>22 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 130 D</td>
<td>30 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 140 D</td>
<td>45 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 150 D</td>
<td>55 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 160 D</td>
<td>80 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 160 DW</td>
<td>80 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 170 D</td>
<td>125 kW</td>
</tr>
<tr>
<td></td>
<td>UVR 170 DW</td>
<td>125 kW</td>
</tr>
</tbody>
</table>

| Non-regenerative | UV 130 D | 30 kW | – | – |

1) At PWM frequency of 5 kHz, except for UEC 1xx, where the PWM frequency is 3.33 kHz
2) Depending on whether the Axis or Spindle mode of operation is selected
## Compact inverters

### Regenerative compact inverters

<table>
<thead>
<tr>
<th>2 axes and spindle or 3 axes</th>
<th>3 axes and spindle or 4 axes</th>
<th>4 axes and spindle or 5 axes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UR 230 D</strong></td>
<td><strong>UR 240 D</strong></td>
<td><strong>UR 242 D</strong></td>
</tr>
<tr>
<td>2 axes</td>
<td>3 axes</td>
<td>3 axes</td>
</tr>
<tr>
<td>Spindle/Axis</td>
<td>Spindle/Axis</td>
<td>1 axis/spindle</td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td><strong>Maximum current</strong></td>
<td><strong>Power loss</strong></td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td><strong>Maximum current</strong></td>
<td><strong>Peak power</strong></td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td><strong>Maximum current</strong></td>
<td><strong>Peak power</strong></td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td><strong>Rated power of DC link</strong></td>
<td><strong>Peak power</strong></td>
</tr>
<tr>
<td><strong>Power loss</strong></td>
<td><strong>DC-link voltage</strong></td>
<td><strong>Power loss</strong></td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td><strong>Module width</strong></td>
<td><strong>Power loss</strong></td>
</tr>
<tr>
<td><strong>Functional safety</strong></td>
<td><strong>ID</strong></td>
<td><strong>Commutating reactor</strong></td>
</tr>
<tr>
<td><strong>Additional components for regenerative compact inverters</strong> (see Accessoires for inverters)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Supply voltage
- 3AC 400 V (±10 %), 50 Hz to 60 Hz
- 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
- 22 kW

### Peak power
- 30 kW / 40 kW
- 30 kW / 40 kW
- 30 kW / 40 kW

### Power loss
- ≥ 680 W
- ≥ 750 W
- ≥ 830 W

### DC-link voltage
- DC 650 V
- DC 650 V
- DC 650 V

### Module width
- 250 mm
- 250 mm
- 250 mm

### Mass
- ≥ 22.5 kg
- ≥ 22.5 kg
- ≥ 22.5 kg

### Functional safety
- ✓
- ✓
- ✓

### ID
- 741356-xx
- 741357-xx
- 741359-xx

### Additional components for regenerative compact inverters

1. Spindle: 40 % cyclic duration factor for cycle duration of 10 minutes (S6-40 %)
2. Axis: 0.2 s cyclic duration factor for cycle duration of 10 s with 70 % rated current preload
3. 1st value: 40 % cyclic duration factor for cycle duration of 10 minutes (S6-40 %)
4. Only for direct drives with the use of an additional UM 1xx D
5. Only for synchronous or torque motors with field weakening

### Commutating reactor
- KDR 120
- KDR 120
- KDR 120

### Line filter
- EPCOS 26 A
- EPCOS 26 A
- EPCOS 26 A

### Braking resistor
- UP 110
- UP 110
- UP 110

### DC-link filter
- ZKF 110 or ZKF 120
- ZKF 110 or ZKF 120
- ZKF 110 or ZKF 120

### Surge protector
- VALMS 230 FM
- VALMS 230 FM
- VALMS 230 FM

### Voltage protection module
- SM 110
- SM 110
- SM 110
## Non-regenerative compact inverters

(continued on next double-page spread)

### 3 axes and spindle

<table>
<thead>
<tr>
<th></th>
<th>UE 210D</th>
<th>UE 211D</th>
<th>UE 212D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current $I_T$</td>
<td>9.0 A</td>
<td>9.0 A</td>
<td>9.0 A</td>
</tr>
<tr>
<td>at $f_{\text{max}}$</td>
<td>18.0 A</td>
<td>18.0 A</td>
<td>18.0 A</td>
</tr>
<tr>
<td>Maximum current $I_{\text{max}}$</td>
<td>36.0 A/18.0 A</td>
<td>36.0 A/18.0 A</td>
<td>36.0 A/18.0 A</td>
</tr>
</tbody>
</table>

### 4 axes and spindle

<table>
<thead>
<tr>
<th></th>
<th>UE 210D</th>
<th>UE 211D</th>
<th>UE 212D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current $I_T$</td>
<td>8.3 A</td>
<td>8.3 A</td>
<td>8.3 A</td>
</tr>
<tr>
<td>at $f_{\text{max}}$</td>
<td>16.5 A</td>
<td>16.5 A</td>
<td>16.5 A</td>
</tr>
<tr>
<td>Maximum current $I_{\text{max}}$</td>
<td>33.0 A/33.0 A</td>
<td>33.0 A/33.0 A</td>
<td>33.0 A/33.0 A</td>
</tr>
</tbody>
</table>

### 5 axes and spindle

<table>
<thead>
<tr>
<th></th>
<th>UE 210D</th>
<th>UE 211D</th>
<th>UE 212D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current $I_T$</td>
<td>75 A</td>
<td>75 A</td>
<td>75 A</td>
</tr>
<tr>
<td>at $f_{\text{max}}$</td>
<td>15.0 A</td>
<td>15.0 A</td>
<td>15.0 A</td>
</tr>
<tr>
<td>Maximum current $I_{\text{max}}$</td>
<td>20.0 A/15.0 A</td>
<td>20.0 A/15.0 A</td>
<td>20.0 A/15.0 A</td>
</tr>
</tbody>
</table>

### Supply voltage

3AC 400 V (±10 %); 50 Hz to 60 Hz or 3AC 480 V (+6 %/-10 %); 50 Hz to 60 Hz

### Rated power of DC link

15 kW

### Peak power of DC link

23 kW / 40 kW

### Power loss at $I_T$

- ≈ 475 W
- ≈ 525 W
- ≈ 595 W

### DC-link voltage

DC 565 V

### Integral braking resistor

1 kW / 27 kW

### Module width

200 mm

### Mass

≈ 20 kg

### Functional safety

✓

### ID

733421-xx

### Additional components for non-regenerative compact inverters

(see Accessories for inverters)

<table>
<thead>
<tr>
<th>Component</th>
<th>UE 210D</th>
<th>UE 211D</th>
<th>UE 212D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braking resistor</td>
<td>PW 210</td>
<td>PW 210</td>
<td>PW 210</td>
</tr>
<tr>
<td>Surge protector</td>
<td>VALMS 230/FM</td>
<td>VALMS 230/FM</td>
<td>VALMS 230/FM</td>
</tr>
<tr>
<td>Voltage protection module</td>
<td>SM 110</td>
<td>SM 110</td>
<td>SM 110</td>
</tr>
</tbody>
</table>

1) Spindle: 40 % cyclic duration factor for cycle duration of 10 minutes (S6-40 %)
2) Axes: 0.2 s cyclic duration factor for cycle duration of 10 s with 70 % rated current preload
3) Spindle: 10 s cyclic duration factor for cycle duration of 60 s with 70 % rated current preload
4) Power loss during idle running: approx. 10 % of the power loss at rated current
5) 1st value: 15 % cyclic duration factor for cycle duration of 120 s
6) Only for synchronous or torque motors with field weakening

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**Note:** The table and text are extracted from a document, and the information is presented in a structured format to facilitate easier reading and understanding.
## Non-regenerative compact inverters

### Table of Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>UE 230D</th>
<th>UE 240D</th>
<th>UE 241D</th>
<th>UE 242D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated current IN</strong></td>
<td>3.3 A</td>
<td>3.3 A</td>
<td>3.3 A</td>
<td>3.3 A</td>
</tr>
<tr>
<td>60 Hz</td>
<td>9.0 A</td>
<td>9.0 A</td>
<td>9.0 A</td>
<td>9.0 A</td>
</tr>
<tr>
<td>120 Hz</td>
<td>18.0 A</td>
<td>18.0 A</td>
<td>18.0 A</td>
<td>18.0 A</td>
</tr>
<tr>
<td>1000 Hz</td>
<td>8.3 A</td>
<td>8.3 A</td>
<td>8.3 A</td>
<td>8.3 A</td>
</tr>
<tr>
<td>2000 Hz</td>
<td>16.5 A</td>
<td>16.5 A</td>
<td>16.5 A</td>
<td>16.5 A</td>
</tr>
<tr>
<td>5000 Hz</td>
<td>75 A</td>
<td>75 A</td>
<td>75 A</td>
<td>75 A</td>
</tr>
<tr>
<td>6666 Hz</td>
<td>6.3 A</td>
<td>6.3 A</td>
<td>6.3 A</td>
<td>6.3 A</td>
</tr>
<tr>
<td>8000 Hz</td>
<td>5.5 A</td>
<td>5.5 A</td>
<td>5.5 A</td>
<td>5.5 A</td>
</tr>
<tr>
<td>10000 Hz</td>
<td>4.6 A</td>
<td>4.6 A</td>
<td>4.6 A</td>
<td>4.6 A</td>
</tr>
<tr>
<td>12000 Hz</td>
<td>9.2 A</td>
<td>9.2 A</td>
<td>9.2 A</td>
<td>9.2 A</td>
</tr>
<tr>
<td><strong>Peak power</strong></td>
<td>30 kW</td>
<td>30 kW</td>
<td>30 kW</td>
<td>30 kW</td>
</tr>
<tr>
<td>22 kW</td>
<td>22 kW</td>
<td>22 kW</td>
<td>22 kW</td>
<td>22 kW</td>
</tr>
<tr>
<td><strong>Power loss</strong></td>
<td>11.2 W</td>
<td>11.2 W</td>
<td>11.2 W</td>
<td>11.2 W</td>
</tr>
<tr>
<td>22 kW</td>
<td>770 W</td>
<td>770 W</td>
<td>770 W</td>
<td>770 W</td>
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<tr>
<td><strong>DC-link voltage</strong></td>
<td>360 V</td>
<td>360 V</td>
<td>360 V</td>
<td>360 V</td>
</tr>
<tr>
<td><strong>Integral braking resistor</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Module width</strong></td>
<td>200 mm</td>
<td>200 mm</td>
<td>200 mm</td>
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<tr>
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<td>23 kg</td>
<td>23 kg</td>
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<tr>
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<td>733426-xx</td>
<td>733427-xx</td>
<td>733428-xx</td>
</tr>
</tbody>
</table>

### Additional components

- **Braking resistor**: PW 210
- **Surge protector**: VALMS 230FM
- **Voltage protection module**: SM 110

---

1) Spindle: 40% cyclic duration factor for cycle duration of 10 minutes (S6-40%)
2) Axis: 10 s cyclic duration factor for cycle duration of 60 s with 70% rated current preload
3) 1st value: 40% cyclic duration factor for cycle duration of 10 minutes (S6-40%)
4) Power loss during idle running: approx. 10 % of the power loss at rated current
5) Only for direct drives with the use of an additional UM 1xx D
6) Only for synchronous or torque motors with field weakening

---

**Compact inverters**

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

### Controllers
- Position controller, speed controller, current controller
- HSCI interface
- Interfaces to the speed and position encoders

### Inverters
- Power electronics
- Connections for axis motors and spindle motor
- Connections for motor holding brakes
- Additional DC-link connection on the front panel (for connection of a PSL 130)

### System PL
- Interfaces for one workpiece touch probe and one tool touch probe
- Integrated PLC (expandable with PL 61xx)
- UEC 11x: 38 free inputs, 23 free outputs
- UEC 11xFS: 38 free inputs, 28 free outputs
  - (7 of which can be switched off)
- 8 free FS inputs, 8 free FS outputs
- Configuration with IOconfig PC software

### UMC 111FS
The UMC 111 is a compact inverter with integrated controller unit and PLC inputs/outputs. It is especially suitable for controlling the auxiliary axes: the UMC automatically enables the control loops required for the auxiliary axes. Further options are unnecessary.

### Controllers
- Position controller, speed controller, current controller
- HSCI interface
- Interfaces to the speed encoders

### Inverters
- Power electronics
- Connections for axis motors
- Connections for motor holding brakes

### System PL
- Interfaces for one workpiece touch probe and one tool touch probe
- Integrated PLC (expandable with PL 61xx)
- UMC 111FS: 38 free inputs, 28 free outputs
  - (7 of which can be switched off)
- 8 free FS inputs, 8 free FS outputs
- Configuration with IOconfig PC software

### DC-link connections
The UMC is supplied from an external DC link.

### UEC 111/UEC 112/UEC 113
- Controllers: 4/5/6 digital control loops
- Speed inputs: 4/5/6 x 1 Vpp or EnDat 2.2
- Position inputs: 4/5/6 x 1 Vpp or EnDat 2.2
- Inverters: 2/3/4 axes
- Rated current IN: 3 333 Hz
  - 6.0 A/12.0 A
  - 9.0 A/18.0 A
- Maximum current \( I_{\text{max}} \) at PWM frequency:
  - 4 000 Hz
    - 5.5 A/11.0 A
    - 8.3 A/16.5 A
  - 5 000 Hz
    - 6.0 A/12.0 A
    - 9.0 A/18.0 A
  - 6 666 Hz
    - 4.2 A/8.4 A
    - 6.3 A/12.6 A
  - 8 000 Hz
    - 3.6 A/7.3 A
    - 5.5 A/11.0 A
  - 10 000 Hz
    - 3.0 A/6.0 A
    - 4.6 A/9.2 A
- Supply voltage:
  - 3AC 400 V (±10 %); 50 Hz
  - 3AC 480 V (+6 %/–10 %); 60 Hz
- DC-link voltage: 115 V DC
- Rated power of DC link:
  - 14 kW
- Peak power of DC link:
  - 18 kW / 25 kW
- Power loss at IN:
  - 450 W
  - 400 W
- DC-link voltage:
  - DC 565 V
  - DC 565 V or DC 650 V
- Current consumption:
  - 24 V PLC
    - 0.4 A
  - 24 V PLC (with 6.0 V–10.0 %; 60 Hz):
    - 0.4 A
- Integral braking resistance:
  - 2.1 kW / 27 kW
- Power pack for HSCI components:
  - DC 24 V/3.5 A
- Module width:
  - 150 mm
- Mass:
  - 14 kg
  - 11 kg
- Functional safety:
  - ü ü

### UMC 111 FS
- Controllers: 4 digital control loops
- Speed inputs: 4 x 1 Vpp or EnDat 2.2
- Position inputs: --
- Inverters: 1 axis Spindle
- Rated current IN:
  - 6.0 A/12.0 A
  - 9.0 A/18.0 A
- Maximum current \( I_{\text{max}} \) at PWM frequency:
  - 4 000 Hz
    - 5.5 A/11.0 A
    - 8.3 A/16.5 A
    - 22.0 A/33.0 A
    - 8.3 A/16.5 A
  - 5 000 Hz
    - 6.0 A/12.0 A
    - 9.0 A/18.0 A
    - 20.0 A/30.0 A
    - 75 A/15.0 A
  - 6 666 Hz
    - 4.2 A/8.4 A
    - 6.3 A/12.6 A
    - 16.8 A/25.2 A
    - 6.3 A/12.6 A
  - 8 000 Hz
    - 3.6 A/7.3 A
    - 5.5 A/11.0 A
    - 14.6 A/21.9 A
    - 5.5 A/11.0 A
  - 10 000 Hz
    - 3.0 A/6.0 A
    - 4.6 A/9.2 A
    - 12.2 A/18.3 A
    - 4.6 A/9.2 A
- Supply voltage:
  - 3AC 480 V (±10 %); 50 Hz
  - 3AC 480 V (+6 %/–10 %); 60 Hz
- DC-link voltage:
  - DC 565 V
  - DC 565 V or DC 650 V
- Rated power of DC link:
  - 14 kW
- Peak power of DC link:
  - 18 kW / 25 kW
- Power loss at IN:
  - 450 W
  - 400 W
- DC-link voltage:
  - DC 565 V
  - DC 565 V or DC 650 V
- Current consumption:
  - 24 V PLC
    - 0.4 A
  - 24 V PLC (with 6.0 V–10.0 %; 60 Hz):
    - 0.4 A
- Integral braking resistance:
  - 2.1 kW / 27 kW
- Power pack for HSCI components:
  - DC 24 V/3.5 A
- Module width:
  - 150 mm
- Mass:
  - 14 kg
  - 11 kg
- Functional safety:
  - ü ü

### Additional components
- Braking resistor:
  - PW 210
- Surge protector:
  - VALMS 239/FM
- Voltage-protection module:
  - SM 110

---

1. Axis: 0.2 s cyclic duration factor for cycle duration of 10 s with 70 % rated current preload
2. Spindle: 10 s cyclic duration factor for cycle duration of 60 s with 70 % rated current preload
3. 1st value: 40 % cyclic duration factor for cycle duration of 10 minutes (S6-40 %)
4. 2nd value: 4 s cyclic duration factor for cycle duration of 20 s
5. 1st value: Continuous power
6. 2nd value: Peak power (1.5 % cyclic duration factor for cycle duration of 120 s)
Modular inverters
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 1xx D modules feature electronic ID labels. This permits advanced diagnostic functions.

Water cooling

The UM 116DW or 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 as accessories. Pay attention to further information in the “Inverter Systems and Motors” Technical Manual.

Fan cooling

Because the UM 116D and UVR 170D run with such high power, a separate fan unit is required as an accessory (see page 24). Please take this additional space requirement in the electrical cabinet into consideration (see Overall dimensions).

---

Power modules

Single-axis power modules

<table>
<thead>
<tr>
<th>Power modules</th>
<th>UM 111D</th>
<th>UM 111BD</th>
<th>UM 112D</th>
<th>UM 113D</th>
<th>UM 114D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis</td>
<td>9.0 A</td>
<td>175 A</td>
<td>24.5 A</td>
<td>29.5 A</td>
<td>40.4 A</td>
</tr>
<tr>
<td>Axis</td>
<td>16.0 A</td>
<td>35.0 A</td>
<td>35.0 A</td>
<td>59.0 A</td>
<td>59.9 A</td>
</tr>
<tr>
<td>Axis</td>
<td></td>
<td></td>
<td></td>
<td>90.0 A</td>
<td>94.0 A</td>
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<td>Spindle</td>
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<td>470 A</td>
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<td>670 A</td>
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<td>70.0 A</td>
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<td>108.0 A</td>
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<td>125.0 A</td>
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<td>Axis</td>
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<td>Spindle</td>
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<td></td>
<td></td>
<td></td>
<td>140.0 A</td>
</tr>
<tr>
<td>Rated current $I_N$</td>
<td>3 333 Hz</td>
<td>6 800 Hz</td>
<td>10 000 Hz</td>
<td>6 666 Hz</td>
<td>8 000 Hz</td>
</tr>
<tr>
<td>Maximum current $I_{max}$</td>
<td>9.4 A</td>
<td>12.6 A</td>
<td>11.0 A</td>
<td>9.3 A</td>
<td>6.5 A</td>
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<tr>
<td></td>
<td>17.5 A</td>
<td>25.0 A</td>
<td>22.0 A</td>
<td>9.0 A</td>
<td>11.0 A</td>
</tr>
<tr>
<td></td>
<td>26.5 A</td>
<td>26.0 A</td>
<td>22.0 A</td>
<td>9.0 A</td>
<td>11.0 A</td>
</tr>
<tr>
<td></td>
<td>31.5 A</td>
<td>42.0 A</td>
<td>37.0 A</td>
<td>9.9 A</td>
<td>12.0 A</td>
</tr>
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<td>40.0 A</td>
<td>47.0 A</td>
<td>49.0 A</td>
<td>12.0 A</td>
<td>12.0 A</td>
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<tr>
<td></td>
<td>47.5 A</td>
<td>55.0 A</td>
<td>51.9 A</td>
<td>15.0 A</td>
<td>15.0 A</td>
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<td>52.5 A</td>
<td>60.0 A</td>
<td>51.9 A</td>
<td>15.0 A</td>
<td>15.0 A</td>
</tr>
<tr>
<td>Current consumption $I_{N}$</td>
<td>120 mA</td>
<td>150 mA</td>
<td>140 mA</td>
<td>170 mA</td>
<td>250 mA</td>
</tr>
</tbody>
</table>

Power loss $\eta$ at $I_N$

| 70 W                   | 120 W   | 160 W   | 180 W   | 270 W   | 280 W   | 430 W   | 420 W   | 650 W   |
|                       | $=70$ W | $=120$ W| $=160$ W| $=180$ W| $=270$ W| $=280$ W| $=430$ W| $=420$ W| $=650$ W|

Cooling

| Air                     | Air      | Air      | Air      | Air      | Air      |

Module width

| 50 mm                   | 50 mm    | 100 mm   | 100 mm   | 100 mm   | 100 mm   |

Mass

| $=5.5 \ kg$             | $=5.5 \ kg$| $=9.0 \ kg$| $=9.0 \ kg$| $=12.0 \ kg$|

Functional safety

- ✓
- ✓
- ✓
- ✓
- ✓

ID

| 607945-xx | 671968-xx | 731584-xx | 720435-xx | 671288-xx |

---

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

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

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

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

---

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### Modular inverters

#### Power modules

<table>
<thead>
<tr>
<th>Power modules</th>
<th>Single-axis power modules</th>
<th>Double-axis power modules</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>UM 115D</td>
<td>UM 116D</td>
</tr>
<tr>
<td></td>
<td>UM 116DW</td>
<td>UM 117DW</td>
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<td>UM 121BD</td>
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<tr>
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<td>UM 122D</td>
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<th>Spindle</th>
<th>Axis</th>
<th>Spindle</th>
<th>Axis</th>
<th>Spindle</th>
<th>Axis</th>
<th>Spindle</th>
<th>Axis</th>
<th>Spindle</th>
<th>Axis</th>
<th>Spindle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current $I_f$</td>
<td>3 333 Hz</td>
<td>115.0 A</td>
<td>175.0 A</td>
<td>250.0 A</td>
<td>175.0 A</td>
<td>250.0 A</td>
<td>250.0 A</td>
<td>350.0 A</td>
<td>9.0 A</td>
<td>175.0 A</td>
<td>24.5 A</td>
<td>29.5 A</td>
</tr>
<tr>
<td>at PWM frequency</td>
<td>4 000 Hz</td>
<td>106.0 A</td>
<td>165.0 A</td>
<td>211.0 A</td>
<td>165.0 A</td>
<td>211.0 A</td>
<td>211.0 A</td>
<td>330.0 A</td>
<td>8.3 A</td>
<td>16.5 A</td>
<td>22.6 A</td>
<td>27.5 A</td>
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<tr>
<td>5000 Hz</td>
<td>96.0 A</td>
<td>125.0 A</td>
<td>300.0 A</td>
<td>300.0 A</td>
<td>250.0 A</td>
<td>360.0 A</td>
<td>360.0 A</td>
<td>450.0 A</td>
<td>7.5 A</td>
<td>15.0 A</td>
<td>20.0 A</td>
<td>25.0 A</td>
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<tr>
<td>6 666 Hz</td>
<td>80.6 A</td>
<td>126.0 A</td>
<td>150.0 A</td>
<td>300.0 A</td>
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<td>189.0 A</td>
<td>269.0 A</td>
<td>6.3 A</td>
<td>12.5 A</td>
<td>21.0 A</td>
<td>28.5 A</td>
</tr>
<tr>
<td>8 000 Hz</td>
<td>70.0 A</td>
<td>141.0 A</td>
<td>221.0 A</td>
<td>160.0 A</td>
<td>160.0 A</td>
<td>160.0 A</td>
<td>160.0 A</td>
<td>262.0 A</td>
<td>5.5 A</td>
<td>11.0 A</td>
<td>14.5 A</td>
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<tr>
<td>10 000 Hz</td>
<td>59.0 A</td>
<td>117.0 A</td>
<td>160.0 A</td>
<td>160.0 A</td>
<td>137.0 A</td>
<td>196.0 A</td>
<td>196.0 A</td>
<td>275.0 A</td>
<td>4.6 A</td>
<td>9.0 A</td>
<td>12.0 A</td>
<td>15.5 A</td>
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</table>

<table>
<thead>
<tr>
<th>Current consumption</th>
<th>360 m/460 mA</th>
<th>400 m/220 mA</th>
<th>400 m/220 mA</th>
<th>450 m/250 mA</th>
<th>200 m/140 mA</th>
<th>220 m/110 mA</th>
<th>240 m/160 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power loss at $I_f$</td>
<td>$610 , \text{W}$</td>
<td>$870 , \text{W}$</td>
<td>$1115 , \text{W}$</td>
<td>$1560 , \text{W}$</td>
<td>$1115 , \text{W}$</td>
<td>$1560 , \text{W}$</td>
<td>$1400 , \text{W}$</td>
</tr>
<tr>
<td>Cooling</td>
<td>Air</td>
<td>Fan unit</td>
<td>Water</td>
<td>Air</td>
<td>Air</td>
<td>Air</td>
<td>Air</td>
</tr>
<tr>
<td>Module width</td>
<td>150 mm</td>
<td>200 mm</td>
<td>200 mm</td>
<td>200 mm</td>
<td>50 mm</td>
<td>100 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td>Mass</td>
<td>$19.0 , \text{kg}$</td>
<td>$24.0 , \text{kg}$</td>
<td>$24.0 , \text{kg}$</td>
<td>$24.5 , \text{kg}$</td>
<td>$5.5 , \text{kg}$</td>
<td>$9.0 , \text{kg}$</td>
<td>$12.0 , \text{kg}$</td>
</tr>
<tr>
<td>Functional safety</td>
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<td>✔</td>
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<td>689572-xx</td>
<td>667838-xx</td>
<td>667842-xx</td>
<td>667633-xx</td>
</tr>
</tbody>
</table>

Additional components for power modules (see Accessories for inverters):

- Cooling: Fan unit
- Hose (set): Hose (set)
- Spindle: 40 % cyclic duty factor for cycle duration of 10 minutes (5x-40 %)
- Axis: 0.2 s cyclic duty factor for cycle duration of 10 s with 70 % rated current preload, with UM 117 DW 0.15 s
- Spindle: 10 s cyclic duty factor for cycle duration of 60 s with 70 % rated current preload

1) Spindle: 40 % cyclic duration factor for cycle duration of 10 minutes (5x-40 %)
2) Axis: 0.2 s cyclic duration factor for cycle duration of 10 s with 70 % rated current preload, with UM 117 DW 0.15 s
3) Spindle: 10 s cyclic duty factor for cycle duration of 60 s with 70 % rated current preload
4) With this 2-axis module, only the lower power stage can be used for controlling the spindle
5) Is dissipated via water cooling, remaining heat in electrical cabinet: ≈ 50 W
6) Power loss during idle running: approx. 10 % of the power loss at rated current
7) Power module 1x axis / 1x spindle: 280 W
8) Power module 2x axis: 240 W
9) Power module 1x axis / 1x spindle: 280 W
10) Power module 2x axis: 360 W
# Modular inverters

## Power supply unit

<table>
<thead>
<tr>
<th>Supply unit</th>
<th>Regenerative</th>
<th>Regenerative</th>
<th>Non-regenerative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UVR 120D</td>
<td>UVR 130D</td>
<td>UVR 150D</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>3AC 400 V (±10 %); 50 to 60 Hz</td>
<td>3AC 400 V (±10 %); 50 to 60 Hz</td>
<td>3AC 400 V (±10 %); 50 to 60 Hz</td>
</tr>
<tr>
<td>Rated power (DC link)</td>
<td>22 kW</td>
<td>30 kW</td>
<td>45 kW</td>
</tr>
<tr>
<td>Peak power (DC link)</td>
<td>30 kW</td>
<td>45 kW</td>
<td>65 kW</td>
</tr>
<tr>
<td>Power loss</td>
<td>= 300 W</td>
<td>= 370 W</td>
<td>= 570 W</td>
</tr>
<tr>
<td>DC-link voltage</td>
<td>DC 650 V</td>
<td>DC 650 V</td>
<td>DC 650 V</td>
</tr>
<tr>
<td>Current consumption 15 V/24 V</td>
<td>170 mA/310 mA</td>
<td>200 mA/400 mA</td>
<td>250 mA/310 mA</td>
</tr>
<tr>
<td>Integrated 24 V power supply unit 7)</td>
<td>24 V NC/400 W</td>
<td>24 V NC/400 W</td>
<td>24 V NC/400 W</td>
</tr>
<tr>
<td>Cooling</td>
<td>Air</td>
<td>Air</td>
<td>Air</td>
</tr>
<tr>
<td>Module width</td>
<td>150 mm</td>
<td>150 mm</td>
<td>200 mm</td>
</tr>
<tr>
<td>Mass</td>
<td>= 12 kg</td>
<td>= 12.5 kg</td>
<td>= 20.0 kg</td>
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<td>1095625-xx</td>
<td>1095626-xx</td>
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</tbody>
</table>

### Additional components for supply unit

- Commutating reactor: KDR 120, KDR 130 C, KDR 140, KDR 150, KDR 160, KDR 160, KDR 170, KDR 170
- Line filter: EPCOS 25A, EPCOS 80A, EPCOS 80A, EPCOS 80A, EPCOS 120A, EPCOS 200A
- Braking resistor: UP 110, UP 110, UP 110 or UP 120, UP 120, 2 x UP 120
- DC-link filter 2) ZKF 110 or ZKF 120 or ZKF 130, ZKF 110 or ZKF 120 or ZKF 130, ZKF 110 or ZKF 120 or ZKF 130
- Voltage protection module 3) SM 1xx, SM 1xx, SM 1xx, SM 1xx, SM 1xx, SM 1xx
- Cooling: –, –, –, –, Hose (set), Fan unit

1) 0.2 s cyclic duration factor for cycle duration of 5 s
2) 3 s cyclic duration factor for cycle 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: ≈ 100 W
6) For NRTL approval 62 kW
7) In addition to the HSCI/PLC components, the power requirements of the connected inverters, encoders, and controller units must also be considered (also refer to the Inverter Systems and Motors Technical Manual)
Commutating reactors

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 module (see Cable overview).

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

<table>
<thead>
<tr>
<th>Use</th>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Power loss</th>
<th>Rated frequency</th>
<th>Degree of protection</th>
<th>Mass</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>KDR 120 UR 2xx D UVR 120D</td>
<td>3AC 400 V</td>
<td>3 x 35 A</td>
<td>= 200 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 11 kg</td>
<td>344505-01</td>
</tr>
<tr>
<td>KDR 130C UVR 130D</td>
<td>3AC 400 V</td>
<td>3 x 45 A</td>
<td>= 250 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 15 kg</td>
<td>646271-01</td>
</tr>
<tr>
<td>KDR 140 UVR 140D</td>
<td>3AC 400 V</td>
<td>3 x 70 A</td>
<td>= 340 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 22 kg</td>
<td>333068-01</td>
</tr>
<tr>
<td>KDR 150 UVR 150D</td>
<td>3AC 400 V</td>
<td>3 x 80 A</td>
<td>= 350 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 23 kg</td>
<td>355253-01</td>
</tr>
<tr>
<td>KDR 160 UVR 160D UVR 160DW</td>
<td>3AC 400 V</td>
<td>3 x 117 A</td>
<td>= 525 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 57 kg</td>
<td>573265-01</td>
</tr>
<tr>
<td>KDR 170 UVR 170D UVR 170DW</td>
<td>3AC 400 V</td>
<td>3 x 185 A</td>
<td>= 875 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 106 kg</td>
<td>735663-01</td>
</tr>
</tbody>
</table>

Line filters

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. A 3 x 32 µF three-phase current capacitor is integrated. The line filter must be connected between the power line and the commutating reactor (see Cable overview).

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

<table>
<thead>
<tr>
<th>Use</th>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Power loss</th>
<th>Rated frequency</th>
<th>Degree of protection</th>
<th>Mass</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPCOS 35A UVR 120D</td>
<td>3AC 400 V</td>
<td>3 x 35 A</td>
<td>= 50 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 5 kg</td>
<td>676759-01</td>
</tr>
<tr>
<td>EPCOS 80A UVR 140D UVR 150D</td>
<td>3AC 400 V</td>
<td>3 x 80 A</td>
<td>= 75 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 11 kg</td>
<td>640908-01</td>
</tr>
<tr>
<td>EPCOS 120A UVR 160D UVR 160DW</td>
<td>3AC 400 V</td>
<td>3 x 120 A</td>
<td>= 115 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 13.5 kg</td>
<td>573292-01</td>
</tr>
<tr>
<td>EPCOS 200A UVR 170DW</td>
<td>3AC 400 V</td>
<td>3 x 200 A</td>
<td>= 170 W</td>
<td>50 Hz/80 Hz</td>
<td>IP00</td>
<td>≈ 20.0 kg</td>
<td>735642-01</td>
</tr>
</tbody>
</table>

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, and heat is removed through radiation.

When the non-regenerative inverter systems UE 230D, UE 240D, UE 241D, UE 242D and UE 130/D 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 21x D.

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

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

<table>
<thead>
<tr>
<th>Spindle power</th>
<th>Recommended braking resistor</th>
<th>Continu- ous power</th>
<th>Peak power*</th>
<th>Resis- tance</th>
<th>Degree of protection</th>
<th>Mass</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 15 kW</td>
<td>PW 210 1 x PW 210</td>
<td>2 kW</td>
<td>= 27 kW</td>
<td>18 ohms</td>
<td>IP20</td>
<td>≈ 5.5 kg</td>
<td>333081-01</td>
</tr>
<tr>
<td>Over 15 kW</td>
<td>PW 210 2 x PW 210 in parallel</td>
<td>4 kW</td>
<td>= 54 kW</td>
<td>9 ohms</td>
<td>IP20</td>
<td>≈ 11 kg</td>
<td>333081-01</td>
</tr>
</tbody>
</table>

* 1.5 % cyclic duration factor for cycle duration of 120 s

Braking resistor module

Regenerative inverters feed the braking energy back into the line power system. When the power network 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.

<table>
<thead>
<tr>
<th>Switching voltage</th>
<th>Module width</th>
<th>Peak power (for 2 s)</th>
<th>Degree of protection</th>
<th>Mass</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 760 V</td>
<td>50 mm</td>
<td>≈ 60 kW</td>
<td>IP20</td>
<td>7 kg</td>
<td>341516-01</td>
</tr>
<tr>
<td>DC 120 V</td>
<td>50 mm</td>
<td>≈ 150 kW</td>
<td>IP20</td>
<td>9 kg</td>
<td>605731-01</td>
</tr>
</tbody>
</table>
Direct drives (linear motors, torque motors, in rare cases also synchronous spindles) used with regenerative inverter systems result in voltage peaks, which can destroy the drive. Therefore, during operation with UVR 1xx D and UR 2xx regenerative inverters, the DC-link filter ZKF 1xx 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 motors must not exceed the power 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 HEIDENHAIN service technicians on-site to ensure that the leakage current is less than 1.3 A. With the ZKF 120, ZKF 130, ZKF 140 and ZKF 150, this measurement is not necessary because a leakage current of 6 A is sufficient in any case.

### DC-link filter parameters

| ZKF 110  | 50 W 100 mm | ≤ 1.3 A | 30 kW 47 kV | 67 kV 110 kW | IP20 | 10 kg | 385764-01 |
| ZKF 120  | 100 W 100 mm | ≤ 3 A | 30 kW 25 kW 47 kV | 67 kW 55 kV | IP20 | 12 kg | 391232-01 |
| ZKF 130  | 200 W 100 mm | ≤ 6 A | 56 kW 80 kW | 100 kW 110 kW | IP20 | 13 kg | 531388-01 |
| ZKF 140  | 250 W 100 mm | ≤ 6 A | 80 kW 110 kW | 140 kW 160 kW | IP20 | 15 kg | 597854-01 |
| ZKF 150  | 400 W 100 mm | ≤ 6 A | 125 kW 180 kW 220 kW | 250 kW IP20 | 16.5 kg | 1068459-01 |

### Voltage-protection module

**SM 110**

- **Switching voltage**: DC 830 V
- **Max. phase current**: 63 A
- **Max. braking time**: 10 s
- **Min. waiting time**: 5 min
- **Degree of protection**: IP20
- **Mass**: 2 kg
- **ID**: 368453-01

**SM 130**

- **Switching voltage**: DC 830 V
- **Max. phase current**: 300 A
- **Max. braking time**: 10 s
- **Min. waiting time**: 10 min
- **Degree of protection**: IP20
- **Mass**: 6.5 kg
- **ID**: 540739-02

### Surge protector

Voltage surges on the supply network can damage power supply units and inverters. An overvoltage protector should therefore be installed in the supply path (preferably after the line filter) to limit any voltage peaks to max. 1350 V.

Surge protectors from the Phönix Company are well suited to this task. One VALMS 230/FM module is required per phase, while the FLT-CP-3C-350 module protects all three phases. They are mounted on a top hat rail.

<table>
<thead>
<tr>
<th>Suited for</th>
<th>Nominal discharge surge current</th>
<th>IEC test class</th>
<th>EN type</th>
<th>Width</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALMS 230/FM</td>
<td>All except UVR 170D(W)</td>
<td>20 kA</td>
<td>II</td>
<td>T2</td>
<td>177 mm</td>
</tr>
<tr>
<td>FLT-CP-3C-350</td>
<td>UVR 170D(W)</td>
<td>75 kA</td>
<td>I and II</td>
<td>T1 + T2</td>
<td>106.9 mm</td>
</tr>
</tbody>
</table>

### Surge protector parameters

- **Suitable for**: All except UVR 170D(W)
- **Nominal discharge surge current**: 20 kA
- **IEC test class**: II
- **EN type**: T2
- **Width**: 177 mm
- **ID**: 827105-01 (contains 3 units)

### Surge protector suitability

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. It shortens the motor phases in case of a fault.

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

The rated current of the motor and the max. short-circuit current I<sub>sc</sub> of the motor must be less than the maximum phase current of the SM. I<sub>sc</sub> = U<sub>ph</sub>/\(\sqrt{3}\) \(X_h\) with \(X_h\) in ohms

The SM 130 features an integrated temperature switch, which (if correctly wired) prevents the drive from being switched on at temperatures above 60 °C.
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 control 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 control attempts to retract the tool in a defined manner using the energy remaining in the DC-link.

The capacitor modules provide support regarding 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 releases of the control system are maintained even after a power failure. The CML is installed in the electrical cabinet via a top hat rail.

If a PSL 130 is used as 24 V voltage supply, the CML 110 can be omitted. The PSL 130 maintains the 24 V control voltage through the supply via the DC link.

<table>
<thead>
<tr>
<th>Supply Voltage</th>
<th>Capacitance</th>
<th>Charging Current</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>CML 110</td>
<td>DC 24 V</td>
<td>≤ 2.4 A</td>
<td>574087-02</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>DC-link Voltage</th>
<th>Capacitance</th>
<th>Module Width</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMH 120</td>
<td>≤ DC 850 V</td>
<td>10.0 mF</td>
<td>591116-01</td>
</tr>
</tbody>
</table>

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 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 UH(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.

For standard cover: ID 573732-02
For high cover: ID 573732-03
Ribbon cables and covers

In modular regenerative inverter systems an additional power supply unit may become necessary if you are using inverters or motors with a high power demand. The adapter module makes it possible to connect this power supply unit to the present inverter system. In this way one power supply unit can, for example, supply the power to a high-performance spindle and the other power supply unit can be used for the axes.

The two power supply units are coupled via the supply bus X069a/X069b – X069i, and are then also monitored by the system.

This results in two separate supply systems whose power modules operate independently of each other, but are monitored by the control.

### Adapter module

<table>
<thead>
<tr>
<th>Mass</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 kg</td>
<td>252762-02</td>
</tr>
</tbody>
</table>

The ribbon cables must be covered to protect them against interference. The covers are available in two versions.

- **Standard cover** (height 19 mm)
- **High cover** (height 34 mm) for machines with many drives

#### Standard cover

The UVR power supply unit is shipped with a standard cover (329031-03) to protect the following modules.

- UVR: 1xD
- UM 115 D or
- one UM 1xx D with 100 mm width and one UM 1xx D with 50 mm width

A standard cover for the CC is included in the items supplied with the CC. If you use further power modules and the UP 110 braking resistor module, you need to order suitable covers separately.

#### High cover

High covers for control components must always be ordered separately. The required spacer bolts are included with the high covers. Special covers are available for the UVR supply modules and CC 61xx controller units (see table).

#### Selecting the covers

- Add the widths of all modules between the UVR 1xD and CC (including UP 110)
- Subtract 150 mm from this total width (cover included with the UVR 1xD)
- Subtract 50 mm from the remaining width for each axis-release module (cover included with the items supplied)
- Select the appropriate covers from the following table to protect the remaining width
Accessories for ribbon cables

Plastic holding elements for the PWM cables facilitate mounting the covers. They are simply plugged onto the mounted spacer bolts, thus fixing the PWM cables. These holding elements can be used for standard covers and high covers. They can be ordered separately in a collective package containing 20 units. The items supplied with the high cover for UVR already include four holding elements.

ID 1113339-01

50-pin ribbon cable for supply voltage

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

<table>
<thead>
<tr>
<th>Length</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 mm</td>
<td>325816-01</td>
</tr>
<tr>
<td>400 mm</td>
<td>325816-02</td>
</tr>
<tr>
<td>500 mm</td>
<td>325816-03</td>
</tr>
<tr>
<td>600 mm</td>
<td>325816-04</td>
</tr>
<tr>
<td>700 mm</td>
<td>325816-05</td>
</tr>
<tr>
<td>800 mm</td>
<td>325816-06</td>
</tr>
<tr>
<td>900 mm</td>
<td>325816-07</td>
</tr>
<tr>
<td>1000 mm</td>
<td>325816-08</td>
</tr>
<tr>
<td>1200 mm</td>
<td>325816-12</td>
</tr>
<tr>
<td>1400 mm</td>
<td>325816-14</td>
</tr>
</tbody>
</table>

Selecting a cable length

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

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

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).

<table>
<thead>
<tr>
<th>Length</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 mm</td>
<td>325817-01</td>
</tr>
<tr>
<td>400 mm</td>
<td>325817-02</td>
</tr>
<tr>
<td>500 mm</td>
<td>325817-03</td>
</tr>
<tr>
<td>600 mm</td>
<td>325817-04</td>
</tr>
<tr>
<td>700 mm</td>
<td>325817-05</td>
</tr>
<tr>
<td>800 mm</td>
<td>325817-06</td>
</tr>
<tr>
<td>900 mm</td>
<td>325817-07</td>
</tr>
<tr>
<td>1000 mm</td>
<td>325817-08</td>
</tr>
<tr>
<td>1200 mm</td>
<td>325817-12</td>
</tr>
<tr>
<td>1400 mm</td>
<td>325817-14</td>
</tr>
</tbody>
</table>

Selecting a cable length

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

UV 130 D: Add 80 mm to the width of all modules between the UV 130 D 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.

<table>
<thead>
<tr>
<th>Module</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM 111 D, UM 121 D</td>
<td>50 mm</td>
</tr>
<tr>
<td>UM 111 BD, PSL 13</td>
<td>100 mm</td>
</tr>
<tr>
<td>UM 112 D, UM 122 D</td>
<td>100 mm</td>
</tr>
<tr>
<td>UM 111 BD, UM 121 BD</td>
<td>150 mm</td>
</tr>
<tr>
<td>UM 113 D, UM 114 D</td>
<td>200 mm</td>
</tr>
<tr>
<td>UP 110, UP 120</td>
<td>50 mm</td>
</tr>
<tr>
<td>UV 105</td>
<td>50 mm</td>
</tr>
</tbody>
</table>
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 $a$ | Module width $b$
---|---|---
MS 110, MS 111 mounting cases, UM 111 BD, UM 111 D, UM 121 D | $\approx 40$ mm | 50 mm
UM 121 BD | $\approx 85$ mm | 100 mm
UM 112 D, UM 112 D, UM 114 D, UM 122 D | $\approx 90$ mm | 100 mm
UM 115 D | $\approx 140$ mm | 150 mm
UM 116 D(W), UM 117 DW | $\approx 190$ mm | 200 mm

### Distance $c_n$

| CC 61xx | Distance in mm | $c_1$ | $c_2$ | $c_3$ | $c_4$ | $c_5$
---|---|---|---|---|---|---
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 115 D and the controller unit:

\[
l = a + b_1 + b_2 + b_3 + c_3
\]

\[
\approx (140 + 100 + 50 + 50 + 56) \text{ mm}
\]

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

---

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

- 20-pin ribbon cable for PWM signals

- Connection between the controller unit and a UM 115 D power module (one cable per drive)

<table>
<thead>
<tr>
<th>Length</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>250479-07</td>
</tr>
<tr>
<td>200 mm</td>
<td>250479-08</td>
</tr>
<tr>
<td>300 mm</td>
<td>250479-09</td>
</tr>
<tr>
<td>400 mm</td>
<td>250479-10</td>
</tr>
<tr>
<td>500 mm</td>
<td>250479-11</td>
</tr>
<tr>
<td>600 mm</td>
<td>250479-12</td>
</tr>
<tr>
<td>700 mm</td>
<td>250479-13</td>
</tr>
<tr>
<td>800 mm</td>
<td>250479-14</td>
</tr>
<tr>
<td>900 mm</td>
<td>250479-15</td>
</tr>
<tr>
<td>1000 mm</td>
<td>250479-16</td>
</tr>
<tr>
<td>1200 mm</td>
<td>250479-20</td>
</tr>
</tbody>
</table>
Sometimes limited space prevents the control and inverter systems 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 (unit 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 supply unit. In addition, the MS 111 features two connectors for the unit bus, which permits use in single-row and double-row configurations. This is necessary in rare cases when the DC 24 V voltage from the UVR 1xx D 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 UVR (R).

**Setup without additional DC 24 V feeding**

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

**Setup with additional DC 24 V 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 voltage 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**
  - 658132-01
- **MS 111 mounting case**
  - 673685-02
- **Unit bus cable** (round, shielded with 37-pin D-sub connector at both ends; max. length: 3 m)
  - 664023-xx
- **PWM cable** (round) with ribbon connector at both ends; max. length: 5 m
  - 664332-xx
- **Supply bus cable** (round) with ribbon connector at both ends, max. length: 5 m (required only if UVR (R) 1xx D is not in the same row as CC/MC)
  - 361508-xx
- **Wire** for DC link (16 mm², shielded), max. length: 3 m
  - Color: Red
  - Color: Blue
  - 655440-xx
  - 655438-xx

**Double-row configuration**

Double-row arrangement; fan power supply of the 2nd row via MS 111
Notes

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.
- 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 non-regenerative system, the resulting maximum power is approx. 25 kW.
- Use fast-acting semiconductor fuses for protection of the UV(R) 1xx D 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.
Double-row arrangement, each row with its own UVR 1xx D and CC 6xxx

1) Supply bus X69
2) Unit bus X79
3) PWM cables
4) HSCI connection

Double-row arrangement with two UVRs and one CC 6108 or CC 6110

1) Supply bus X69
2) Unit bus X79
3) PWM cables
4) HSCI connection

Double-row arrangement with one UVR 1xx D and one CC 6xxx

1) Supply bus X69
2) Unit bus X79
3) PWM cables
4) HSCI connection
5) PWM cables (round)
6) Supply bus cable (round)
7) DC link
Cable overview

Inverters

Mounting information

Mounting position

When mounting the control and inverter components, please observe the proper minimum clearances, space requirements, length and position of the connecting cables.

Leave space for servicing and connecting cables!

* Leave space for exchanging the HDR hard disk

Leave space for air circulation!

Temperatures of > 150 °C may occur with the UE 21x B with integrated braking resistor; do not mount any temperature-sensitive parts!

Leave space for air circulation and servicing!

Leave space for servicing!

Leave space for air circulation!
Mounting and electrical installation

Keep the following in mind during mounting and electrical installation:

• 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 IP54 (dust and splash-proof protection):

• Display unit (installed)
• Keyboard unit (installed)
• Machine operating panel (installed)
• Handwheel

All electric and electronic control components must be installed in an environment (e.g. electrical cabinet, housing) 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 also comply with protection class IP54, just like the HEIDENHAIN operating panel components.

Electromagnetic compatibility

Intended place of operation

The units comply with EN 50370, 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

Interference is mainly produced by capacitive and inductive coupling into electrical conductors or into device interfaces, caused by e.g.:

• 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 by means of closed metal housings.
• Use equipotential bonding lines according to the grounding plan.
• Use only genuine HEIDENHAIN cables, connectors and couplings.

Installation elevation

The maximum installation altitude for HEIDENHAIN power modules or inverters (UVR, UV, UM, UE, UEC, UR, etc.) for direct connection to line power is 2000 m above sea level. If the HEIDENHAIN control system is connected to line power through an isolating transformer, the maximum installation altitude increases to 3000 m above sea level.

Note that performance is degraded by current derating when HEIDENHAIN power modules are installed at altitudes greater than 1000 m above sea level. To reduce this effect, you can reduce the maximum ambient temperature by 3.5 K per 500 m.

Interpolation is linear for current derating:

- 0 to 2000 m: 100 % to 84 %
- 2000 to 3000 m: 84 % to 75 %

Dimensions

UR 2xx D series

UEC 111, UEC 112, UEC 113, UMC 111 series
UM 115D

UM 116 D with fan unit

UM 116 DW, UM 117 DW
SM 110

Terminal for temperature switch

SM 130

Three-phase current capacitor

MS 110, MS 111

Cover included in items supplied.
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