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<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>Control Card, 24 V DC Output</td>
<td>77</td>
</tr>
<tr>
<td>6.4.11</td>
<td>Relay Output</td>
<td>77</td>
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<td>6.4.12</td>
<td>Control Card, 10 V DC Output</td>
<td>78</td>
</tr>
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<td>78</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Purpose of this Operating Guide

This operating guide provides information for safe installation and commissioning of the AC drive. It is intended for use by qualified personnel. Read and follow the instructions to use the drive safely and professionally. Pay particular attention to the safety instructions and general warnings. Always keep this operating guide available with the drive.

1.2 Trademarks

VLT® is a registered trademark for Danfoss A/S.

1.3 Additional Resources

1.3.1 Other Resources

Other resources are available to understand advanced drive functions and programming.

- The VLT® HVAC Basic Drive FC 101 Programming Guide provides information on how to program and includes complete parameter descriptions.
- The VLT® HVAC Basic Drive FC 101 Design Guide provides all technical information about the drive. It also lists options and accessories.

The technical documentation is available in electronic form online at www.danfoss.com.

1.3.2 MCT 10 Setup Software Support

Download the software from the service and support section on www.danfoss.com.

During the installation process of the software, enter access code 81463800 to activate the VLT® HVAC Basic Drive FC 101 functionality. A license key is not required for using the VLT® HVAC Basic Drive FC 101 functionality.

The latest software does not always contain the latest updates for drives. Contact the local sales office for the latest drive updates (in the form of *.upd files), or download the drive updates from the service and support section on www.danfoss.com.

1.4 Document and Software Version

The operating guide is regularly reviewed and updated. All suggestions for improvement are welcome.

The original language of this manual is English.

<table>
<thead>
<tr>
<th>Table 1: Document and Software Version</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Edition</strong></td>
</tr>
<tr>
<td>AQ275641848264en-000101</td>
</tr>
</tbody>
</table>

From software version 4.0x and later (production week 33 2017 and after), the variable speed heat sink cooling fan function is implemented in the drive for power sizes 22 kW (30 hp) 400 V IP20 and below, 18.5 kW (25 hp) 400 V IP54 and below, and 11 kW (15 hp) 200 V IP20 and below. This function requires software and hardware updates and introduces restrictions with regards to backwards compatibility for H1–H5 and I2–I4 enclosure sizes. Refer to the following table for the limitations.

Table 2: Software and Hardware Compatibility

<table>
<thead>
<tr>
<th>Software compatibility</th>
<th>Old control card (production week 33 2017 or before)</th>
<th>New control card (production week 34 2017 or after)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old software (OSS-file version 3.xx and below)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>New software (OSS-file version 4.xx or higher)</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardware compatibility</th>
<th>Old control card (production week 33 2017 or before)</th>
<th>New control card (production week 34 2017 or after)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old power card (production week 33 2017 or before)</td>
<td>Yes (only software version 3.xx or below)</td>
<td>Yes (MUST update software to version 4.xx or higher)</td>
</tr>
<tr>
<td>New power card (production week 34 2017 or after)</td>
<td>Yes (MUST update software to version 3.xx or below, the fan continuously runs at full speed)</td>
<td>Yes (only software version 4.xx or higher)</td>
</tr>
</tbody>
</table>

1.5 Certificates and Approvals

Table 3: Certificates and Approvals

<table>
<thead>
<tr>
<th>Certification</th>
<th>IP20</th>
<th>IP54</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC Declaration of Conformity</td>
<td>![EC Icon]</td>
<td>✓</td>
</tr>
<tr>
<td>UL Listed</td>
<td>![UL Icon]</td>
<td>✓</td>
</tr>
<tr>
<td>RCM</td>
<td>![RCM Icon]</td>
<td>✓</td>
</tr>
<tr>
<td>EAC</td>
<td>![EAC Icon]</td>
<td>✓</td>
</tr>
<tr>
<td>UkrSEPRO</td>
<td>![UkrSEPRO Icon]</td>
<td>✓</td>
</tr>
</tbody>
</table>

The drive complies with UL 508C thermal memory retention requirements. For more information, refer to the section Motor Thermal Protection in the product-specific design guide.
1.6 Disposal

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>Do not dispose of equipment containing electrical components together with domestic waste.</td>
</tr>
<tr>
<td></td>
<td>Collect it separately in accordance with local and currently valid legislation.</td>
</tr>
</tbody>
</table>
2 Safety

2.1 Safety Symbols

The following symbols are used in this manual:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🟢 DANGER</td>
<td>Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>🟡 WARNING</td>
<td>Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>🟣 CAUTION</td>
<td>Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</td>
</tr>
<tr>
<td>🟤 NOTICE</td>
<td>Indicates information considered important, but not hazard-related (for example, messages relating to property damage).</td>
</tr>
</tbody>
</table>

2.2 Qualified Personnel

To allow trouble-free and safe operation of the unit, only qualified personnel with proven skills are allowed to transport, store, assemble, install, program, commission, maintain, and decommission this equipment.

Persons with proven skills:
- Are qualified electrical engineers, or persons who have received training from qualified electrical engineers and are suitably experienced to operate devices, systems, plant, and machinery in accordance with pertinent laws and regulations.
- Are familiar with the basic regulations concerning health and safety/accident prevention.
- Have read and understood the safety guidelines given in all manuals provided with the unit, especially the instructions given in the Operating Guide.
- Have good knowledge of the generic and specialist standards applicable to the specific application.

2.3 Safety Precautions

<table>
<thead>
<tr>
<th>🟡 WARNING</th>
<th>HIGH VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC drives contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.</td>
</tr>
<tr>
<td></td>
<td>Only qualified personnel must perform installation, start-up, and maintenance.</td>
</tr>
</tbody>
</table>
**WARNING**

**UNINTENDED START**
When the drive is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. Start the motor with an external switch, a fieldbus command, an input reference signal from the local control panel (LCP), via remote operation using MCT 10 software, or after a cleared fault condition.

- Disconnect the drive from the mains.
- Press [Off/Reset] on the LCP before programming parameters.
- Ensure that the drive is fully wired and assembled when it is connected to AC mains, DC supply, or load sharing.

**WARNING**

**DISCHARGE TIME**
The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off.
Failure to wait the specified time after power has been removed before performing service or repair work could result in death or serious injury.

- Stop the motor.
- Disconnect AC mains, permanent magnet type motors, and remote DC-link supplies, including battery back-ups, UPS, and DC-link connections to other drives.
- Wait for the capacitors to discharge fully. The minimum waiting time is specified in the table **Discharge time** and is also visible on the nameplate on top of the drive.
- Before performing any service or repair work, use an appropriate voltage measuring device to make sure that the capacitors are fully discharged.

**Table 4: Discharge Time**

<table>
<thead>
<tr>
<th>Voltage [V]</th>
<th>Power range [kW (hp)]</th>
<th>Minimum waiting time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3x200</td>
<td>0.25–3.7 (0.33–5)</td>
<td>4</td>
</tr>
<tr>
<td>3x200</td>
<td>5.5–11 (7–15)</td>
<td>15</td>
</tr>
<tr>
<td>3x400</td>
<td>0.37–7.5 (0.5–10)</td>
<td>4</td>
</tr>
<tr>
<td>3x400</td>
<td>11–90 (15–125)</td>
<td>15</td>
</tr>
<tr>
<td>3x600</td>
<td>2.2–7.5 (3–10)</td>
<td>4</td>
</tr>
<tr>
<td>3x600</td>
<td>11–90 (15–125)</td>
<td>15</td>
</tr>
</tbody>
</table>

**WARNING**

**LEAKAGE CURRENT HAZARD**
Leakage currents exceed 3.5 mA. Failure to ground the drive properly can result in death or serious injury.
- Ensure the correct grounding of the equipment by a certified electrical installer.
2.4 Motor Thermal Protection

Procedure

3 Installation

3.1 Mechanical Installation

3.1.1 Side-by-side Installation

The drive can be mounted side-by-side but requires the clearance above and below for cooling.

Table 5: Clearance Required for Cooling

<table>
<thead>
<tr>
<th>Size</th>
<th>IP class</th>
<th>Power [kW (hp)]</th>
<th>Clearance above/below [mm (in)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3x200–240 V</td>
<td>3x380–480 V</td>
</tr>
<tr>
<td>H1</td>
<td>IP20</td>
<td>0.25–1.5 (0.33–2)</td>
<td>0.37–1.5 (0.5–2)</td>
</tr>
<tr>
<td>H2</td>
<td>IP20</td>
<td>2.2 (3)</td>
<td>2.2–4 (3–5)</td>
</tr>
<tr>
<td>H3</td>
<td>IP20</td>
<td>3.7 (5)</td>
<td>5.5–7.5 (7.5–10)</td>
</tr>
<tr>
<td>H4</td>
<td>IP20</td>
<td>5.5–7.5 (7.5–10)</td>
<td>11–15 (15–20)</td>
</tr>
<tr>
<td>H5</td>
<td>IP20</td>
<td>11 (15)</td>
<td>18.5–22 (25–30)</td>
</tr>
<tr>
<td>H6</td>
<td>IP20</td>
<td>15–18.5 (20–25)</td>
<td>30–45 (40–60)</td>
</tr>
<tr>
<td>H7</td>
<td>IP20</td>
<td>22–30 (30–40)</td>
<td>55–75 (70–100)</td>
</tr>
<tr>
<td>H8</td>
<td>IP20</td>
<td>37–45 (50–60)</td>
<td>90 (125)</td>
</tr>
<tr>
<td>H9</td>
<td>IP20</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>H10</td>
<td>IP20</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>I2</td>
<td>IPS4</td>
<td>–</td>
<td>0.75–4.0 (1–5)</td>
</tr>
<tr>
<td>I3</td>
<td>IPS4</td>
<td>–</td>
<td>5.5–7.5 (7.5–10)</td>
</tr>
<tr>
<td>I4</td>
<td>IPS4</td>
<td>–</td>
<td>11–18.5 (15–25)</td>
</tr>
<tr>
<td>I6</td>
<td>IPS4</td>
<td>–</td>
<td>22–37 (30–50)</td>
</tr>
<tr>
<td>I7</td>
<td>IPS4</td>
<td>–</td>
<td>45–55 (60–70)</td>
</tr>
<tr>
<td>I8</td>
<td>IPS4</td>
<td>–</td>
<td>75–90 (100–125)</td>
</tr>
</tbody>
</table>

NOTICE

With IP21/NEMA Type1 option kit mounted, a distance of 50 mm (2 in) between the units is required.
### 3.1.2 Drive Dimensions

Illustration 1: Dimensions

Table 6: Dimensions, Enclosure Sizes H1–H5

<table>
<thead>
<tr>
<th>Enclosure Size</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP class</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
</tr>
<tr>
<td>Power [kW (hp)]</td>
<td>3x200–240 V</td>
<td>3x380–480 V</td>
<td>3x525–600 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.25–1.5 (0.33–2.0)</td>
<td>0.37–1.5 (0.5–2.0)</td>
<td>–</td>
<td>11 (15)</td>
<td>18.5–22</td>
</tr>
<tr>
<td></td>
<td>2.2 (3.0)</td>
<td>2.2–4.0 (3.0–5.0)</td>
<td>–</td>
<td>(7.5–10)</td>
<td>(25–30)</td>
</tr>
<tr>
<td></td>
<td>3.7 (5.0)</td>
<td>5.5–7.5 (7.5–10)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>5.5–7.5</td>
<td>11–15 (15–20)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Height [mm (in)]</td>
<td>A</td>
<td>A (1)</td>
<td>a</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>195 (7.7)</td>
<td>273 (10.7)</td>
<td>183 (7.2)</td>
<td>75 (3.0)</td>
<td>168 (6.6)</td>
</tr>
<tr>
<td></td>
<td>227 (8.9)</td>
<td>303 (11.9)</td>
<td>212 (8.3)</td>
<td>90 (3.5)</td>
<td>190 (7.5)</td>
</tr>
<tr>
<td></td>
<td>255 (10.0)</td>
<td>329 (13.0)</td>
<td>240 (9.4)</td>
<td>100 (3.9)</td>
<td>206 (8.1)</td>
</tr>
<tr>
<td></td>
<td>296 (11.7)</td>
<td>359 (14.1)</td>
<td>275 (10.8)</td>
<td>135 (5.3)</td>
<td>241 (9.5)</td>
</tr>
<tr>
<td></td>
<td>334 (13.1)</td>
<td>402 (15.8)</td>
<td>314 (12.4)</td>
<td>150 (5.9)</td>
<td>255 (10)</td>
</tr>
<tr>
<td>Width [mm (in)]</td>
<td>B</td>
<td>b</td>
<td>C</td>
<td>d</td>
<td>e</td>
</tr>
<tr>
<td></td>
<td>56 (2.2)</td>
<td>65 (2.6)</td>
<td>74 (2.9)</td>
<td>9 (0.35)</td>
<td>4.5 (0.18)</td>
</tr>
<tr>
<td></td>
<td>62 (2.4)</td>
<td>74 (2.9)</td>
<td>105 (4.1)</td>
<td>11 (0.43)</td>
<td>5.5 (0.22)</td>
</tr>
<tr>
<td></td>
<td>74 (2.9)</td>
<td>105 (4.1)</td>
<td>120 (4.7)</td>
<td>11 (0.43)</td>
<td>5.5 (0.22)</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Depth [mm (in)]</td>
<td>C</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>168 (6.6)</td>
<td>9 (0.35)</td>
<td>4.5 (0.18)</td>
<td>5.3 (0.21)</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>190 (7.5)</td>
<td>11 (0.43)</td>
<td>5.5 (0.22)</td>
<td>7.4 (0.29)</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>206 (8.1)</td>
<td>11 (0.43)</td>
<td>5.5 (0.22)</td>
<td>8.1 (0.32)</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>241 (9.5)</td>
<td>12.6 (0.50)</td>
<td>7 (0.28)</td>
<td>8.4 (0.33)</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>255 (10)</td>
<td>12.6 (0.50)</td>
<td>7 (0.28)</td>
<td>8.5 (0.33)</td>
<td>–</td>
</tr>
<tr>
<td>Maximum weight kg (lb)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

|                | 2.1 (4.6) | 3.4 (7.5) | 4.5 (9.9) | 7.9 (17.4) | 9.5 (20.9) |

1 Including decoupling plate.

Table 7: Dimensions, Enclosure Sizes H6–H10

<table>
<thead>
<tr>
<th>Enclosure Size</th>
<th>H6</th>
<th>H7</th>
<th>H8</th>
<th>H9</th>
<th>H10</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP class</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
</tr>
</tbody>
</table>
### Table 8: Dimensions, Enclosure Sizes I2–I8

<table>
<thead>
<tr>
<th>Enclosure Size</th>
<th>I2</th>
<th>I3</th>
<th>I4</th>
<th>I6</th>
<th>I7</th>
<th>I8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IP class</strong></td>
<td>IP54</td>
<td>IP54</td>
<td>IP54</td>
<td>IP54</td>
<td>IP54</td>
<td>IP54</td>
</tr>
<tr>
<td><strong>Power [kW (hp)]</strong></td>
<td>3x380–480 V</td>
<td>3x380–480 V</td>
<td>3x380–480 V</td>
<td>3x380–480 V</td>
<td>3x380–480 V</td>
<td>3x380–480 V</td>
</tr>
<tr>
<td><strong>Height [mm (in)]</strong></td>
<td>A</td>
<td>332 (13.1)</td>
<td>368 (14.5)</td>
<td>476 (18.7)</td>
<td>650 (25.6)</td>
<td>680 (26.8)</td>
</tr>
<tr>
<td><strong>Width [mm (in)]</strong></td>
<td>B</td>
<td>115 (4.5)</td>
<td>135 (5.3)</td>
<td>180 (7.0)</td>
<td>242 (9.5)</td>
<td>308 (12.1)</td>
</tr>
<tr>
<td><strong>Depth [mm (in)]</strong></td>
<td>C</td>
<td>225 (8.9)</td>
<td>237 (9.3)</td>
<td>290 (11.4)</td>
<td>260 (10.2)</td>
<td>310 (12.2)</td>
</tr>
<tr>
<td><strong>Mounting hole [mm (in)]</strong></td>
<td>d</td>
<td>11 (0.43)</td>
<td>12 (0.47)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>19 (0.75)</td>
</tr>
<tr>
<td><strong>Maximum weight kg (lb)</strong></td>
<td>5.3 (11.7)</td>
<td>7.2 (15.9)</td>
<td>13.8 (30.42)</td>
<td>27 (59.5)</td>
<td>45 (99.2)</td>
<td>65 (143.3)</td>
</tr>
</tbody>
</table>

1 Including decoupling plate.
The dimensions are only for the physical units. When installing in an application, allow space above and below the units for cooling. The amount of space for free air passage is listed in 3.1.1 Side-by-side Installation.

3.2 Electrical Installation

3.2.1 Electrical Installation in General

All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. Copper conductors are required. 75 °C (167 °F) is recommended.

Table 9: Tightening Torques for Enclosure Sizes H1–H8, 3x200–240 V & 3x380–480 V

<table>
<thead>
<tr>
<th>Power [kW (hp)]</th>
<th>Torque [Nm (in-lb)]</th>
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<tr>
<td><strong>Enclosure size</strong></td>
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<td>IP20</td>
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1 Cable dimensions >95 mm².

Table 10: Tightening Torques for Enclosure Sizes I2–I8

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### Table 11: Tightening Torques for Enclosure Sizes H6–H10, 3x525–600 V

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1 Cable dimensions ≤95 mm².

3.2.2 IT Mains

**CAUTION**

**IT Mains**

Installation on isolated mains source, that is, IT mains.

- Ensure that the supply voltage does not exceed 440 V (3x380–480 V units) when connected to mains.

On IP20, 200–240 V, 0.25–11 kW (0.33–15 hp) and 380–480 V, IP20, 0.37–22 kW (0.5–30 hp) units, open the RFI switch by removing the screw on the side of the drive when at IT grid.
Illustration 2: IP20, 200–240 V, 0.25–11 kW (0.33–15 hp), IP20, 0.37–22 kW (0.5–30 hp), 380–480 V

On 400 V, 30–90 kW (40–125 hp) and 600 V units, set parameter 14-50 RFI Filter to [0] Off when operating in IT mains.

For IP54, 400 V, 0.75–18.5 kW (1–25 hp) units, the EMC screw is inside the drive, as shown in the following illustration.
3.2.3 Mains and Motor Connection

3.2.3.1 Introduction

The drive is designed to operate all standard 3-phase asynchronous motors.
- Use a shielded/armored motor cable to comply with EMC emission specifications and connect this cable to both the decoupling plate and the motor.
- Keep the motor cable as short as possible to reduce the noise level and leakage currents.
- For further details on mounting the decoupling plate, see VLT® HVAC Basic Drive Decoupling Plate Mounting Instruction.
- Also see EMC-Correct Installation in the 3.2.5 EMC-correct Electrical Installation.

3.2.3.2 Connecting to Mains and Motor

1. Mount the ground cables to the ground terminal.
2. Connect the motor to terminals U, V, and W, and then tighten the screws according to the torques.
3. Connect the mains supply to terminals L1, L2, and L3, and then tighten the screws according to the torques described in 3.2.1 Electrical Installation in General.

3.2.3.3 Relays and Terminals on Enclosure Sizes H1–H5

Illustration 4: Enclosure Sizes H1–H5, IP20, 200–240 V, 0.25–11 kW (0.33–15 hp), IP20, 380–480 V, 0.37–22 kW (0.5–30 hp)
3.2.3.4 Relays and Terminals on Enclosure Size H6

3.2.3.5 Relays and Terminals on Enclosure Size H7


3.2.3.6 Relays and Terminals on Enclosure Size H8

3.2.3.7 Connecting to Mains and Motor for Enclosure Size H9

Illustration 7: Enclosure Size H8, IP20, 380–480 V, 90 kW (125 hp), IP20, 200–240 V, 37–45 kW (50–60 hp), IP20, 525–600 V, 75–90 kW (100–125 hp)

Illustration 8: Connecting the Drive to the Motor, Enclosure Size H9, 600 V, 2.2–7.5 kW (3.0–10 hp)
Procedure

1. Slide the mounting plate into place and tighten the 2 screws as shown in the following illustration.

Illustration 9: Mounting the Mounting Plate

2. Mount the ground cable as shown in the following illustration.
3. Insert the mains cables to the mains plug and tighten the screws as shown in the following illustration. Use the tightening torques described in 3.2.1 Electrical Installation in General.
4. Mount the support bracket across the mains cables and tighten the screws as shown in the following illustration. Use the tightening torques described in 3.2.1 Electrical Installation in General.

Illustration 12: Mounting the Support Bracket

3.2.3.8 Relays and Terminals on Enclosure Size H10

Illustration 13: Enclosure Size H10, IP20, 600 V, 11–15 kW (15–20 hp)
3.2.3.9 Enclosure Size I2

Illustration 14: Enclosure Size I2, IP54, 380–480 V, 0.75–4.0 kW (1–5 hp)
3.2.3.10 Enclosure Size I3

Illustration 15: Enclosure Size I3, IP54, 380–480 V, 5.5–7.5 kW (7.5–10 hp)

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<td>Relays</td>
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Illustration 15: Enclosure Size I3, IP54, 380–480 V, 5.5–7.5 kW (7.5–10 hp)
3.2.3.11 Enclosure Size I4

Illustration 16: Enclosure Size I4, IP54, 380–480 V, 0.75–4.0 kW (1–5 hp)

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Illustration 16: Enclosure Size I4, IP54, 380–480 V, 0.75–4.0 kW (1–5 hp)
3.2.3.12  IP54 Enclosure Sizes I2, I3, I4

Illustration 17: IP54 Enclosure Sizes I2, I3, I4

3.2.3.13  Enclosure size I6

Illustration 18: Connecting to Mains for Enclosure Size I6, IP54, 380–480 V, 22–37 kW (30–50 hp)

Illustration 20: Relays on Enclosure Size I6, IP54, 380–480 V, 22–37 kW (30–50 hp)
3.2.3.14 Enclosure size I7, I8


3.2.4 Fuses and Circuit Breakers

3.2.4.1 Branch Circuit Protection

To prevent fire hazards, protect the branch circuits in an installation - switch gear, machines, and so on - against short circuits and overcurrent. Follow national and local regulations.

3.2.4.2 Short-circuit Protection

Danfoss recommends using the fuses and circuit breakers listed in this chapter to protect service personnel or other equipment in case of an internal failure in the unit or a short circuit on the DC link. The drive provides full short-circuit protection in case of a short circuit on the motor.

3.2.4.3 Overcurrent Protection

Provide overload protection to avoid overheating of the cables in the installation. Overcurrent protection must always be carried out according to local and national regulations. Design circuit breakers and fuses for protection in a circuit capable of supplying a maximum of 100000 A_{rms} (symmetrical), 480 V maximum.

3.2.4.4 UL/Non-UL Compliance

To ensure compliance with UL or IEC 61800-5-1, use the circuit breakers or fuses listed in this chapter. Circuit breakers must be designed for protection in a circuit capable of supplying a maximum of 10000 A_{rms} (symmetrical), 480 V maximum.
3.2.4.5 Recommendation of Fuses and Circuit Breakers

**NOTICE**

In the event of malfunction, failure to follow the protection recommendation may result in damage to the drive.

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**3x525–600 V IP20**

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</tbody>
</table>
### 3x380–480 V

<table>
<thead>
<tr>
<th>IP54</th>
<th>0.75 (1)</th>
<th>1.5 (2)</th>
<th>2.2 (3)</th>
<th>3 (4)</th>
<th>4 (5)</th>
<th>5.5 (7.5)</th>
<th>7.5 (10)</th>
<th>11 (15)</th>
<th>15 (20)</th>
<th>18.5 (25)</th>
<th>22 (30)</th>
<th>30 (40)</th>
<th>37 (50)</th>
<th>45 (60)</th>
<th>55 (70)</th>
<th>75 (100)</th>
<th>90 (125)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PKZM0-16</td>
<td>PKZM0-16</td>
<td>PKZM0-16</td>
<td>PKZM0-16</td>
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<td>FRS-R-10</td>
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<td>FRS-R-125</td>
<td>KTS-R-125</td>
<td>JKS-125</td>
<td>JJS-125</td>
<td>FRS-R-125</td>
<td>PKZM0-16</td>
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<td>KTS-R-125</td>
<td>KTS-R-125</td>
<td>JKS-125</td>
<td>JJS-125</td>
<td>KTS-R-125</td>
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<td>JJS-125</td>
<td>KTS-R-125</td>
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<td></td>
<td>KTS-R-125</td>
<td>JKS-125</td>
<td>JJS-125</td>
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<td>KTS-R-125</td>
<td>JKS-125</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>KTS-R-125</td>
</tr>
</tbody>
</table>

### 3.2.5 EMC-correct Electrical Installation

General points to be observed to ensure EMC-correct electrical installation:

- Use only shielded/armored motor cables and shielded/armored control cables.
- Ground the shield at both ends.
- Avoid installation with twisted shield ends (pigtails), because it reduces the shielding effect at high frequencies. Use the cable clamps provided.
- Ensure the same potential between the drive and the ground potential of PLC.
- Use star washers and galvanically conductive installation plates.
Illustration 22: EMC-correct Electrical Installation
3.2.6 Control Terminals

Remove the terminal cover to access the control terminals.

Use a flat-edged screwdriver to push down the lock lever of the terminal cover under the LCP, then remove the terminal cover as shown in the following illustration.

For IP54 units, control terminals can be accessed after removing the front cover.

Illustration 23: Removing the Terminal Cover

The following illustration shows all the drive control terminals. Applying start (terminal 18), connection between terminals 12-27, and an analog reference (terminal 53 or 54, and 55) make the drive run.

The digital input mode of terminal 18, 19, and 27 is set in parameter 5-00 Digital Input Mode (PNP is default value). Digital input 29 mode is set in parameter 5-03 Digital Input 29 Mode (PNP is default value).

Illustration 24: Control Terminals
### 3.2.7 Electrical Wiring

**Illustration 25: Basic Wiring Schematic Drawing**

There is no access to UDC- and UDC+ on the following units:
- IP20, 380–480 V, 30–90 kW (40–125 hp)
- IP20, 200–240 V, 15–45 kW (20–60 hp)
- IP20, 525–600 V, 2.2–90 kW (3–125 hp)
- IP54, 380–480 V, 22–90 kW (30–125 hp)
3.2.8 Acoustic Noise or Vibration

If the motor or the equipment driven by the motor - for example, a fan - is making noise or vibrations at certain frequencies, configure the following parameters or parameter groups to reduce or eliminate the noise or vibrations:

- Parameter group 4-6* Speed Bypass.
- Set parameter 14-03 Overmodulation to [0] Off.
- Switching pattern and switching frequency parameter group 14-0* Inverter Switching.
- Parameter 1-64 Resonance Dampening.
4 Programming

4.1 Local Control Panel (LCP)

The drive can be programmed from the LCP or from a PC via the RS485 COM port by installing the MCT 10 Setup Software.

The LCP is divided into 4 functional sections.

- A. Display
- B. Menu key
- C. Navigation keys and indicator lights
- D. Operation keys and indicator lights

Illustration 26: Local Control Panel (LCP)

A. Display

The LCD display is illuminated with 2 alphanumeric lines. All data is shown on the LCP. The illustration describes the information that can be read from the display.

Table 13: Legend to Section A

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parameter number and name.</td>
</tr>
<tr>
<td>2</td>
<td>Parameter value.</td>
</tr>
<tr>
<td>3</td>
<td>Setup number shows the active setup and the edit setup. If the same setup acts as both active and edit setup, only that setup number is shown (factory setting). When active and edit setup differ, both numbers are shown in the display (setup 12). The number flashing indicates the edit setup.</td>
</tr>
<tr>
<td>4</td>
<td>Motor direction is shown to the bottom left of the display – indicated by a small arrow pointing either clockwise or counterclockwise.</td>
</tr>
</tbody>
</table>
The triangle indicates if the LCP is in Status, Quick Menu, or Main Menu.

### B. Menu key

Press [Menu] to select among Status, Quick Menu, or Main Menu.

### C. Navigation keys and indicator lights

**Table 14: Legend to Section C**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Com. LED: Flashes during bus communication.</td>
</tr>
<tr>
<td>7</td>
<td>Green LED/On: Control section is working correctly.</td>
</tr>
<tr>
<td>8</td>
<td>Yellow LED/Warn.: Indicates a warning.</td>
</tr>
<tr>
<td>9</td>
<td>Flashing Red LED/Alarm: Indicates an alarm.</td>
</tr>
<tr>
<td>10</td>
<td>[Back]: For moving to the previous step or layer in the navigation structure.</td>
</tr>
<tr>
<td>11</td>
<td>[△] [▼] [▹]: For navigating among parameter groups and parameters, and within parameters. They can also be used for setting local reference.</td>
</tr>
<tr>
<td>12</td>
<td>[OK]: For selecting a parameter and for accepting changes to parameter settings.</td>
</tr>
</tbody>
</table>

### D. Operation keys and indicator lights

**Table 15: Legend to Section D**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>[Hand On]: Starts the motor and enables control of the drive via the LCP.</td>
</tr>
</tbody>
</table>

[2] Coast inverse is the default option for parameter 5-12 Terminal 27 Digital Input. If there is no 24 V supply to terminal 27, [Hand On] does not start the motor. Connect terminal 12 to terminal 27.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>[Off/Reset]: Stops the motor (Off). If in alarm mode, the alarm is reset.</td>
</tr>
<tr>
<td>15</td>
<td>[Auto On]: The drive is controlled either via control terminals or serial communication.</td>
</tr>
</tbody>
</table>

### 4.2 Setup Wizard

#### 4.2.1 Setup Wizard Introduction

The built-in wizard menu guides the installer through the setup of the drive in a clear and structured manner for open-loop and closed-loop applications, and for quick motor settings.
Illustration 27:  Drive Wiring

The wizard is shown after power-up until any parameter has been changed. The wizard can always be accessed again through the quick menu. Press [OK] to start the wizard. Press [Back] to return to the status view.

Illustration 28:  Start-up/Quit Wizard
4.2.2 Setup Wizard for Open-loop Applications

At power-up, select the preferred language.

The next screen is the Wizard screen.

The Wizard can always be reentered via the Quick Menu.

Illustration 29: Setup Wizard for Open-loop Applications
## Table 16: Setup Wizard for Open-loop Applications

<table>
<thead>
<tr>
<th>Parameter 0-03 Regional Settings</th>
<th>Option</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[0] International</td>
<td>[0] International</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter 0-06 GridType</th>
<th>Option</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[0] 200–240 V/50 Hz/IT-grid</td>
<td>[0] 200–240 V/50 Hz/IT-grid</td>
<td>Select the operating mode for restart after reconnection of the drive to mains voltage after power down.</td>
</tr>
<tr>
<td></td>
<td>[100] 200–240 V/60 Hz/IT-grid</td>
<td>[100] 200–240 V/60 Hz/IT-grid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[121] 440–480 V/60 Hz/Delta</td>
<td>[121] 440–480 V/60 Hz/Delta</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[130] 525–600 V/60 Hz/IT-grid</td>
<td>[130] 525–600 V/60 Hz/IT-grid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[132] 525–600 V/60 Hz</td>
<td>[132] 525–600 V/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Option</td>
<td>Default</td>
<td>Usage</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Parameter 1-10 Motor Construction | *[0] Asynchron [1] PM, non-salient SPM [3] PM, salient IPM | [0] Asynchron | Setting the parameter value might change these parameters:  
  • Parameter 1-01 Motor Control Principle.  
  • Parameter 1-03 Torque Characteristics.  
  • Parameter 1-08 Motor Control Bandwidth.  
  • Parameter 1-14 Damping Gain.  
  • Parameter 1-15 Low Speed Filter Time Const.  
  • Parameter 1-16 High Speed Filter Time Const.  
  • Parameter 1-17 Voltage Filter Time Const.  
  • Parameter 1-20 Motor Power.  
  • Parameter 1-22 Motor Voltage.  
  • Parameter 1-23 Motor Frequency.  
  • Parameter 1-24 Motor Current.  
  • Parameter 1-25 Motor Nominal Speed.  
  • Parameter 1-26 Motor Cont. Rated Torque.  
  • Parameter 1-30 Stator Resistance (Rs).  
  • Parameter 1-33 Stator Leakage Reactance (X1).  
  • Parameter 1-35 Main Reactance (Xh).  
  • Parameter 1-37 d-axis Inductance (Ld).  
  • Parameter 1-38 q-axis Inductance (Lq).  
  • Parameter 1-39 Motor Poles.  
  • Parameter 1-40 Back EMF at 1000 RPM.  
  • Parameter 1-44 d-axis Inductance Sat. (LdSat).  
  • Parameter 1-45 q-axis Inductance Sat. (LqSat).  
  • Parameter 1-46 Position Detection Gain.  
  • Parameter 1-48 Current at Min Inductance for d-axis.  
  • Parameter 1-49 Current at Min Inductance for q-axis.  
  • Parameter 1-66 Min. Current at Low Speed.  
  • Parameter 1-70 PM Start Mode.  
  • Parameter 1-72 Start Function.  
  • Parameter 1-73 Flying Start.  
  • Parameter 1-80 Function at Stop.  
  • Parameter 1-82 Min Speed for Function at Stop [Hz].  
  • Parameter 1-90 Motor Thermal Protection.  
  • Parameter 2-00 DC Hold/Motor Preheat Current.  
  • Parameter 2-01 DC Brake Current.  
  • Parameter 2-02 DC Braking Time.  
  • Parameter 2-04 DC Brake Cut In Speed.  
  • Parameter 2-10 Brake Function.  
  • Parameter 4-14 Motor Speed High Limit [Hz].  
  • Parameter 4-19 Max Output Frequency.  
  • Parameter 4-58 Missing Motor Phase Function.  
  • Parameter 14-65 Speed Derate Dead Time Compensation.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Option</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1-20</td>
<td>Motor Power</td>
<td>0.12–110 kW/0.16–150 hp</td>
<td>Enter the motor power from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-22</td>
<td>Motor Voltage</td>
<td>50–1000 V</td>
<td>Enter the motor voltage from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-23</td>
<td>Motor Frequency</td>
<td>20–400 Hz</td>
<td>Enter the motor frequency from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-24</td>
<td>Motor Current</td>
<td>0.01–10000.00 A</td>
<td>Enter the motor current from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-25</td>
<td>Motor Nominal</td>
<td>50–9999 RPM</td>
<td>Enter the motor nominal speed from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-26</td>
<td>Motor Cont. Rated</td>
<td>0.1–1000.0 Nm</td>
<td>This parameter is available when parameter 1-10 Motor Construction is set to options that enable permanent motor mode.</td>
</tr>
<tr>
<td>Parameter 1-29</td>
<td>Automatic Motor Adaption (AMA)</td>
<td>Off</td>
<td>Performing an AMA optimizes motor performance.</td>
</tr>
<tr>
<td>Parameter 1-30</td>
<td>Stator Resistance</td>
<td>0.000–99.990 Ω</td>
<td>Set the stator resistance value.</td>
</tr>
<tr>
<td>Parameter 1-37</td>
<td>d-axis Inductance</td>
<td>0.000–1000.000 mH</td>
<td>Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet.</td>
</tr>
<tr>
<td>Parameter 1-38</td>
<td>q-axis Inductance</td>
<td>0.000–1000.000 mH</td>
<td>Enter the value of the q-axis inductance.</td>
</tr>
<tr>
<td>Parameter 1-39</td>
<td>Motor Poles</td>
<td>2–100</td>
<td>Enter the number of motor poles.</td>
</tr>
<tr>
<td>Parameter 1-40</td>
<td>Back EMF at 1000 RPM</td>
<td>10–9000 V</td>
<td>Line-line RMS back EMF voltage at 1000 RPM.</td>
</tr>
<tr>
<td>Parameter 1-42</td>
<td>Motor Cable Length</td>
<td>0–100 m</td>
<td>Enter the motor cable length.</td>
</tr>
<tr>
<td>Parameter 1-44</td>
<td>d-axis Inductance Sat. (LdSat)</td>
<td>0.000–1000.000 mH</td>
<td>This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as parameter 1-37 d-axis Inductance (Ld). However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Option</td>
<td>Default</td>
<td>Usage</td>
</tr>
<tr>
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</tr>
<tr>
<td>Parameter 1-45 q-axis Inductance Sat. (LqSat)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as parameter 1-38 q-axis Inductance (Lq). However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.</td>
</tr>
<tr>
<td>Parameter 1-46 Position Detection Gain</td>
<td>20–200%</td>
<td>100%</td>
<td>Adjusts the height of the test pulse during position detection at start.</td>
</tr>
<tr>
<td>Parameter 1-48 Current at Min Inductance for d-axis</td>
<td>20–200%</td>
<td>100%</td>
<td>Enter the inductance saturation point.</td>
</tr>
<tr>
<td>Parameter 1-49 Current at Min Inductance for q-axis</td>
<td>20–200%</td>
<td>100%</td>
<td>This parameter specifies the saturation curve of the d- and q-inductance values. From 20–100% of this parameter, the inductances are linearly approximated due to parameter 1-37 d-axis Inductance (Ld), parameter 1-38 q-axis Inductance (Lq), parameter 1-44 d-axis Inductance Sat. (LdSat), and parameter 1-45 q-axis Inductance Sat. (LqSat).</td>
</tr>
<tr>
<td>Parameter 1-70 PM Start Mode</td>
<td>[0] Rotor Detection</td>
<td>[0] Rotor Detection</td>
<td>Select the PM motor start mode.</td>
</tr>
<tr>
<td>Parameter 1-73 Flying Start</td>
<td>[0] Disabled</td>
<td>[0] Disabled</td>
<td>Select [1] Enabled to enable the drive to catch a motor spinning due to mains drop-out. Select [0] Disabled if this function is not required. When this parameter is set to [1] Enabled, parameter 1-71 Start Delay and parameter 1-72 Start Function are not functional. Parameter 1-73 Flying Start is active in VVC+ mode only.</td>
</tr>
<tr>
<td>Parameter 3-02 Minimum Reference</td>
<td>-4999.000–4999.000</td>
<td>0</td>
<td>The minimum reference is the lowest value obtainable by summing all references.</td>
</tr>
<tr>
<td>Parameter 3-03 Maximum Reference</td>
<td>-4999.000–4999.000</td>
<td>50</td>
<td>The maximum reference is the lowest obtainable by summing all references.</td>
</tr>
<tr>
<td>Parameter 3-41 Ramp 1 Ramp Up Time</td>
<td>0.05–3600.00 s</td>
<td>Size related</td>
<td>If asynchronous motor is selected, the ramp-up time is from 0 to rated parameter 1-23 Motor Frequency. If PM motor is selected, the ramp-up time is from 0 to parameter 1-25 Motor Nominal Speed.</td>
</tr>
<tr>
<td>Parameter 3-42 Ramp 1 Ramp Down Time</td>
<td>0.05–3600.00 s</td>
<td>Size related</td>
<td>For asynchronous motors, the ramp-down time is from rated parameter 1-23 Motor Frequency to 0. For PM motors, the ramp-down time is from parameter 1-25 Motor Nominal Speed to 0.</td>
</tr>
<tr>
<td>Parameter 4-12 Motor Speed Low Limit [Hz]</td>
<td>0.0–400.0 Hz</td>
<td>0 Hz</td>
<td>Enter the minimum limit for low speed.</td>
</tr>
<tr>
<td>Parameter 4-14 Motor Speed High Limit [Hz]</td>
<td>0.0–400.0 Hz</td>
<td>100 Hz</td>
<td>Enter the maximum limit for high speed.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Option</td>
<td>Default</td>
<td>Usage</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------</td>
<td>---------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Parameter 4-19 Max Output Frequency</td>
<td>0.0–400.0 Hz</td>
<td>100 Hz</td>
<td>Enter the maximum output frequency value. If parameter 4-19 Max Output Frequency is set lower than parameter 4-14 Motor Speed High Limit [Hz], parameter 4-14 Motor Speed High Limit [Hz] is set equal to parameter 4-19 Max Output Frequency automatically.</td>
</tr>
<tr>
<td>Parameter 6-10 Terminal 53 Low Voltage</td>
<td>0.00–10.00 V</td>
<td>0.07 V</td>
<td>Enter the voltage that corresponds to the low reference value.</td>
</tr>
<tr>
<td>Parameter 6-11 Terminal 53 High Voltage</td>
<td>0.00–10.00 V</td>
<td>10 V</td>
<td>Enter the voltage that corresponds to the high reference value.</td>
</tr>
<tr>
<td>Parameter 6-12 Terminal 53 Low Current</td>
<td>0.00–20.00 mA</td>
<td>4 mA</td>
<td>Enter the current that corresponds to the low reference value.</td>
</tr>
<tr>
<td>Parameter 6-13 Terminal 53 High Current</td>
<td>0.00–20.00 mA</td>
<td>20 mA</td>
<td>Enter the current that corresponds to the high reference value.</td>
</tr>
<tr>
<td>Parameter 6-19 Terminal 53 mode</td>
<td>[0] Current</td>
<td>[1] Voltage</td>
<td>Select if terminal 53 is used for current or voltage input.</td>
</tr>
<tr>
<td>Parameter 30-22 Locked Rotor Detection</td>
<td>[0] Off</td>
<td>[0] Off</td>
<td>–</td>
</tr>
<tr>
<td>Parameter 30-23 Locked Rotor Detection Time [s]</td>
<td>0.05–1 s</td>
<td>0.10 s</td>
<td>–</td>
</tr>
</tbody>
</table>
4.2.3 Setup Wizard for Closed-loop Applications

Illustration 30: Setup Wizard for Closed-loop Applications
### Table 17: Setup Wizard for Closed-loop Applications

<table>
<thead>
<tr>
<th>Parameter 0-03 Regional Settings</th>
<th>Range</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0] International</td>
<td></td>
<td>[0] International</td>
<td></td>
</tr>
<tr>
<td>[1] US</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter 0-06 GridType</th>
<th>Range</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0] 200–240 V/50 Hz/IT-grid</td>
<td></td>
<td>Select the operating mode for restart after reconnection of the drive to mains voltage after power down.</td>
<td></td>
</tr>
<tr>
<td>[12] 380–440 V/50 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[21] 440–480 V/50 Hz/Delta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>[3] Closed loop</td>
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| Parameter 1-10 Motor Construction | *[0] Asynchron            | [0] Asynchron| Setting the parameter value might change these parameters:  
  - Parameter 1-01 Motor Control Principle.  
  - Parameter 1-03 Torque Characteristics.  
  - Parameter 1-08 Motor Control Bandwidth.  
  - Parameter 1-14 Damping Gain.  
  - Parameter 1-15 Low Speed Filter Time Const.  
  - Parameter 1-16 High Speed Filter Time Const.  
  - Parameter 1-17 Voltage Filter Time Const.  
  - Parameter 1-20 Motor Power.  
  - Parameter 1-22 Motor Voltage.  
  - Parameter 1-23 Motor Frequency.  
  - Parameter 1-24 Motor Current.  
  - Parameter 1-25 Motor Nominal Speed.  
  - Parameter 1-26 Motor Cont. Rated Torque.  
  - Parameter 1-30 Stator Resistance (Rs).  
  - Parameter 1-33 Stator Leakage Reactance (X1).  
  - Parameter 1-35 Main Reactance (Xh).  
  - Parameter 1-37 d-axis Inductance (Ld).  
  - Parameter 1-38 q-axis Inductance (Lq).  
  - Parameter 1-39 Motor Poles.  
  - Parameter 1-40 Back EMF at 1000 RPM.  
  - Parameter 1-44 d-axis Inductance Sat. (LdSat).  
  - Parameter 1-45 q-axis Inductance Sat. (LqSat).  
  - Parameter 1-46 Position Detection Gain.  
  - Parameter 1-48 Current at Min Inductance for d-axis.  
  - Parameter 1-49 Current at Min Inductance for q-axis.  
  - Parameter 1-66 Min. Current at Low Speed.  
  - Parameter 1-70 PM Start Mode.  
  - Parameter 1-72 Start Function.  
  - Parameter 1-73 Flying Start.  
  - Parameter 1-80 Function at Stop.  
  - Parameter 1-82 Min Speed for Function at Stop [Hz].  
  - Parameter 1-90 Motor Thermal Protection.  
  - Parameter 2-00 DC Hold/Motor Preheat Current.  
  - Parameter 2-01 DC Brake Current.  
  - Parameter 2-02 DC Braking Time.  
  - Parameter 2-04 DC Brake Cut In Speed.  
  - Parameter 2-10 Brake Function.  
  - Parameter 4-14 Motor Speed High Limit [Hz].  
  - Parameter 4-19 Max Output Frequency.  
  - Parameter 4-58 Missing Motor Phase Function.  
  - Parameter 14-65 Speed Derate Dead Time Compensation. |
<p>| Parameter 1-10 Motor Construction | [1] PM, non-salient SPM    |              |                                                                                                                                         |
| Parameter 1-10 Motor Construction | [3] PM, salient IPM       |              |                                                                                                                                         |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1-20 Motor Power</td>
<td>0.09–110 kW</td>
<td>Size related</td>
<td>Enter the motor power from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-22 Motor Voltage</td>
<td>50–1000 V</td>
<td>Size related</td>
<td>Enter the motor voltage from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-23 Motor Frequency</td>
<td>20–400 Hz</td>
<td>Size related</td>
<td>Enter the motor frequency from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-24 Motor Current</td>
<td>0–10000 A</td>
<td>Size related</td>
<td>Enter the motor current from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-25 Motor Nominal Speed</td>
<td>50–9999 RPM</td>
<td>Size related</td>
<td>Enter the motor nominal speed from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-26 Motor Cont. Rated Torque</td>
<td>0.1–1000.0 Nm</td>
<td>Size related</td>
<td>This parameter is available when parameter 1-10 Motor Construction is set to options that enable permanent motor mode.</td>
</tr>
<tr>
<td>Parameter 1-29 Automatic Motor Adaption (AMA)</td>
<td>–</td>
<td>Off</td>
<td>Performing an AMA optimizes motor performance.</td>
</tr>
<tr>
<td>Parameter 1-30 Stator Resistance (Rs)</td>
<td>0–99.99 Ω</td>
<td>Size related</td>
<td>Set the stator resistance value.</td>
</tr>
<tr>
<td>Parameter 1-37 d-axis Inductance (Ld)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet.</td>
</tr>
<tr>
<td>Parameter 1-38 q-axis Inductance (Lq)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>Enter the value of the q-axis inductance.</td>
</tr>
<tr>
<td>Parameter 1-39 Motor Poles</td>
<td>2–100</td>
<td>4</td>
<td>Enter the number of motor poles.</td>
</tr>
<tr>
<td>Parameter 1-40 Back EMF at 1000 RPM</td>
<td>10–9000 V</td>
<td>Size related</td>
<td>Line-line RMS back EMF voltage at 1000 RPM.</td>
</tr>
<tr>
<td>Parameter 1-42 Motor Cable Length</td>
<td>0–100 m</td>
<td>50 m</td>
<td>Enter the motor cable length.</td>
</tr>
<tr>
<td>Parameter 1-44 d-axis Inductance Sat. (LdSat)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as parameter 1-37 d-axis Inductance (Ld). However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Range</td>
<td>Default</td>
<td>Usage</td>
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</tr>
<tr>
<td>Parameter 1-45&lt;br&gt;q-axis Inductance Sat. (LqSat)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as parameter 1-38 q-axis Inductance (Lq). However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.</td>
</tr>
<tr>
<td>Parameter 1-46&lt;br&gt;Position Detection Gain</td>
<td>20–200%</td>
<td>100%</td>
<td>Adjusts the height of the test pulse during position detection at start.</td>
</tr>
<tr>
<td>Parameter 1-48&lt;br&gt;Current at Min Inductance for d-axis</td>
<td>20–200%</td>
<td>100%</td>
<td>Enter the inductance saturation point.</td>
</tr>
<tr>
<td>Parameter 1-49&lt;br&gt;Current at Min Inductance for q-axis</td>
<td>20–200%</td>
<td>100%</td>
<td>This parameter specifies the saturation curve of the d- and q-inductance values. From 20–100% of this parameter, the inductances are linearly approximated due to parameter 1-37 d-axis Inductance (Ld), parameter 1-38 q-axis Inductance (Lq), parameter 1-44 d-axis Inductance Sat. (LdSat), and parameter 1-45 q-axis Inductance Sat. (LqSat).</td>
</tr>
<tr>
<td>Parameter 1-70&lt;br&gt;PM Start Mode</td>
<td>0] Rotor Detection&lt;br&gt;[1] Parking</td>
<td>[0] Rotor Detection</td>
<td>Select the PM motor start mode.</td>
</tr>
<tr>
<td>Parameter 1-73&lt;br&gt;Flying Start</td>
<td>0] Disabled&lt;br&gt;[1] Enabled</td>
<td>[0] Disabled</td>
<td>Select [1] Enabled to enable the drive to catch a spinning motor in, for example, fan applications. When PM is selected, this parameter is enabled.</td>
</tr>
<tr>
<td>Parameter 3-02&lt;br&gt;Minimum Reference</td>
<td>-4999.000–4999.000</td>
<td>0</td>
<td>The minimum reference is the lowest value obtainable by summing all references.</td>
</tr>
<tr>
<td>Parameter 3-03&lt;br&gt;Maximum Reference</td>
<td>-4999.000–4999.000</td>
<td>50</td>
<td>The maximum reference is the highest value obtainable by summing all references.</td>
</tr>
<tr>
<td>Parameter 3-10&lt;br&gt;Preset Reference</td>
<td>-100–100%</td>
<td>0</td>
<td>Enter the setpoint.</td>
</tr>
<tr>
<td>Parameter 3-41&lt;br&gt;Ramp 1 Ramp Up Time</td>
<td>0.05–3600.0 s</td>
<td>Size related</td>
<td>Ramp-up time from 0 to rated parameter 1-23 Motor Frequency for asynchronous motors. Ramp-up time from 0 to parameter 1-25 Motor Nominal Speed for PM motors.</td>
</tr>
<tr>
<td>Parameter 3-42&lt;br&gt;Ramp 1 Ramp Down Time</td>
<td>0.05–3600.0 s</td>
<td>Size related</td>
<td>Ramp-down time from rated parameter 1-23 Motor Frequency to 0 for asynchronous motors. Ramp-down time from parameter 1-25 Motor Nominal Speed to 0 for PM motors.</td>
</tr>
<tr>
<td>Parameter 4-12&lt;br&gt;Motor Speed Low Limit [Hz]</td>
<td>0.0–400.0 Hz</td>
<td>0.0 Hz</td>
<td>Enter the minimum limit for low speed.</td>
</tr>
<tr>
<td>Parameter 4-14&lt;br&gt;Motor Speed High Limit [Hz]</td>
<td>0.0–400.0 Hz</td>
<td>100 Hz</td>
<td>Enter the minimum limit for high speed.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Range</td>
<td>Default</td>
<td>Usage</td>
</tr>
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<td>-----------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Parameter 4-19 Max Output Frequency</td>
<td>0.0–400.0 Hz</td>
<td>100 Hz</td>
<td>Enter the maximum output frequency value. If parameter 4-19 Max Output Frequency is set lower than parameter 4-14 Motor Speed High Limit [Hz], parameter 4-14 Motor Speed High Limit [Hz] is set equal to parameter 4-19 Max Output Frequency automatically.</td>
</tr>
<tr>
<td>Parameter 6-20 Terminal 54 Low Voltage</td>
<td>0.00–10.00 V</td>
<td>0.07 V</td>
<td>Enter the voltage that corresponds to the low reference value.</td>
</tr>
<tr>
<td>Parameter 6-21 Terminal 54 High Voltage</td>
<td>0.00–10.00 V</td>
<td>10.00 V</td>
<td>Enter the voltage that corresponds to the high reference value.</td>
</tr>
<tr>
<td>Parameter 6-22 Terminal 54 Low Current</td>
<td>0.00–20.00 mA</td>
<td>4.00 mA</td>
<td>Enter the current that corresponds to the low reference value.</td>
</tr>
<tr>
<td>Parameter 6-23 Terminal 54 High Current</td>
<td>0.00–20.00 mA</td>
<td>20.00 mA</td>
<td>Enter the current that corresponds to the high reference value.</td>
</tr>
<tr>
<td>Parameter 6-24 Terminal 54 Low Ref./Feedb. Value</td>
<td>-4999–4999</td>
<td>0</td>
<td>Enter the feedback value that corresponds to the voltage or current set in parameter 6-20 Terminal 54 Low Voltage/parameter 6-22 Terminal 54 Low Current.</td>
</tr>
<tr>
<td>Parameter 6-25 Terminal 54 High Ref./Feedb. Value</td>
<td>-4999–4999</td>
<td>50</td>
<td>Enter the feedback value that corresponds to the voltage or current set in parameter 6-21 Terminal 54 High Voltage/parameter 6-23 Terminal 54 High Current.</td>
</tr>
<tr>
<td>Parameter 6-26 Terminal 54 Filter Time Constant</td>
<td>0.00–10.00 s</td>
<td>0.01</td>
<td>Enter the filter time constant.</td>
</tr>
</tbody>
</table>
| Parameter 6-29 Terminal 54 mode | [0] Current  
[1] Voltage | [1] Voltage | Select if terminal 54 is used for current or voltage input.                                                                                                                                               |
| Parameter 20-81 PI Normal/Inverse Control | [0] Normal  
[1] Inverse | [0] Normal | Select [0] Normal to set the process control to increase the output speed when the process error is positive. Select [1] Inverse to reduce the output speed.                                                 |
| Parameter 20-83 PI Start Speed [Hz] | 0–200 Hz | 0 Hz    | Enter the motor speed to be attained as a start signal for commencement of PI control.                                                                                                                   |
| Parameter 20-93 PI Proportional Gain | 0.00–10.00 | 0.01    | Enter the process controller proportional gain. Quick control is obtained at high amplification. However, if amplification is too high, the process may become unstable.                            |
| Parameter 20-94 PI Integral Time | 0.1–999.0 s | 999.0 s | Enter the process controller integral time. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action. |
4.2.4 Motor Setup

The motor setup wizard guides users through the needed motor parameters.

Table 18: Motor Setup Wizard Settings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
<th>Usage</th>
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</thead>
<tbody>
<tr>
<td>Parameter 30-22 Locked Rotor Detection</td>
<td>(0) Off, (1) On</td>
<td>(0) Off</td>
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<tr>
<td>Parameter 30-23 Locked Rotor Detection Time [s]</td>
<td>0.05–1.00 s</td>
<td>0.10 s</td>
<td>–</td>
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<tr>
<td>Parameter 0-06 GridType</td>
<td>Range</td>
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<td>[0]</td>
<td>200–240 V/50 Hz/IT-grid</td>
<td>Size selected</td>
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<td>[12]</td>
<td>380–440 V/50 Hz</td>
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<td>[21]</td>
<td>440–480 V/50 Hz/Delta</td>
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<td>[22]</td>
<td>440–480 V/50 Hz</td>
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<td>[30]</td>
<td>525–600 V/50 Hz/IT-grid</td>
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<td>525–600 V/50 Hz</td>
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<td>[132]</td>
<td>525–600 V/60 Hz</td>
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</table>

Select the operating mode for restart after reconnection of the drive to mains voltage after power down.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
<th>Usage</th>
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</thead>
<tbody>
<tr>
<td>Parameter 1-10 Motor Construction</td>
<td>*[0] Asynchron</td>
<td>[0] Asynchron</td>
<td>Setting the parameter value might change these parameters:</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>• Parameter 1-08 Motor Control Bandwidth.</td>
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<td>• Parameter 1-14 Damping Gain.</td>
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<td>• Parameter 1-15 Low Speed Filter Time Const.</td>
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<td>• Parameter 1-16 High Speed Filter Time Const.</td>
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<td>• Parameter 1-17 Voltage Filter Time Const.</td>
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<td>• Parameter 1-20 Motor Power.</td>
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<td>• Parameter 1-22 Motor Voltage.</td>
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<td>• Parameter 1-23 Motor Frequency.</td>
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<td>• Parameter 1-24 Motor Current.</td>
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<td>• Parameter 1-25 Motor Nominal Speed.</td>
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<td>• Parameter 1-26 Motor Cont. Rated Torque.</td>
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<td>• Parameter 1-30 Stator Resistance (Rs).</td>
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<td>• Parameter 1-33 Stator Leakage Reactance (X1).</td>
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<td>• Parameter 1-35 Main Reactance (Xh).</td>
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<td>• Parameter 1-37 d-axis Inductance (Ld).</td>
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<td>• Parameter 1-38 q-axis Inductance (Lq).</td>
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<td>• Parameter 1-39 Motor Poles.</td>
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<td>• Parameter 1-40 Back EMF at 1000 RPM.</td>
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<td>• Parameter 1-44 d-axis Inductance Sat. (LdSat).</td>
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<td>• Parameter 1-45 q-axis Inductance Sat. (LqSat).</td>
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<td>• Parameter 1-46 Position Detection Gain.</td>
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<td>• Parameter 1-48 Current at Min Inductance for d-axis.</td>
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<td>• Parameter 1-49 Current at Min Inductance for q-axis.</td>
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<td>• Parameter 1-66 Min. Current at Low Speed.</td>
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<td>• Parameter 1-70 PM Start Mode.</td>
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<td>• Parameter 1-72 Start Function.</td>
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<td>• Parameter 1-73 Flying Start.</td>
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<td>• Parameter 1-80 Function at Stop.</td>
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<td></td>
<td></td>
<td>• Parameter 1-82 Min Speed for Function at Stop [Hz].</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 1-90 Motor Thermal Protection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 2-00 DC Hold/Motor Preheat Current.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 2-01 DC Brake Current.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 2-02 DC Braking Time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 2-04 DC Brake Cut In Speed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 2-10 Brake Function.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 4-14 Motor Speed High Limit [Hz].</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 4-19 Max Output Frequency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 4-58 Missing Motor Phase Function.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parameter 14-65 Speed Derate Dead Time Compensation.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Range</td>
<td>Default</td>
<td>Usage</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>Parameter 1-20 Motor Power</td>
<td>0.12–110 kW/0.16–150 hp</td>
<td>Size related</td>
<td>Enter the motor power from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-22 Motor Voltage</td>
<td>50–1000 V</td>
<td>Size related</td>
<td>Enter the motor voltage from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-23 Motor Frequency</td>
<td>20–400 Hz</td>
<td>Size related</td>
<td>Enter the motor frequency from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-24 Motor Current</td>
<td>0.01–10000.00 A</td>
<td>Size related</td>
<td>Enter the motor current from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-25 Motor Nominal Speed</td>
<td>50–9999 RPM</td>
<td>Size related</td>
<td>Enter the motor nominal speed from the nameplate data.</td>
</tr>
<tr>
<td>Parameter 1-26 Motor Cont. Rated Torque</td>
<td>0.1–1000.0 Nm</td>
<td>Size related</td>
<td>This parameter is available when parameter 1-10 Motor Construction is set to options that enable permanent motor mode.</td>
</tr>
<tr>
<td>Parameter 1-30 Stator Resistance (Rs)</td>
<td>0–99.990 Ω</td>
<td>Size related</td>
<td>Set the stator resistance value.</td>
</tr>
<tr>
<td>Parameter 1-37 d-axis Inductance (Ld)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet.</td>
</tr>
<tr>
<td>Parameter 1-38 q-axis Inductance (Lq)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>Enter the value of the q-axis inductance.</td>
</tr>
<tr>
<td>Parameter 1-39 Motor Poles</td>
<td>2–100</td>
<td>4</td>
<td>Enter the number of motor poles.</td>
</tr>
<tr>
<td>Parameter 1-40 Back EMF at 1000 RPM</td>
<td>10–9000 V</td>
<td>Size related</td>
<td>Line-line RMS back EMF voltage at 1000 RPM.</td>
</tr>
<tr>
<td>Parameter 1-42 Motor Cable Length</td>
<td>0–100 m</td>
<td>50 m</td>
<td>Enter the motor cable length.</td>
</tr>
<tr>
<td>Parameter 1-44 d-axis Inductance Sat. (LdSat)</td>
<td>0.000–1000.000 mH</td>
<td>Size related</td>
<td>This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as parameter 1-37 d-axis Inductance (Ld). However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.</td>
</tr>
</tbody>
</table>

**NOTICE**

Changing this parameter affects the settings of other parameters.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Default</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1-45</td>
<td>q-axis Inductance Sat. (LqSat)</td>
<td>0.000–1000.000 mH</td>
<td>Size related This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as parameter 1-38 q-axis Inductance (Lq). However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.</td>
</tr>
<tr>
<td>Parameter 1-46</td>
<td>Position Detection Gain</td>
<td>20–200%</td>
<td>100% Adjusts the height of the test pulse during position detection at start.</td>
</tr>
<tr>
<td>Parameter 1-48</td>
<td>Current at Min Inductance for d-axis</td>
<td>20–200%</td>
<td>100% Enter the inductance saturation point.</td>
</tr>
<tr>
<td>Parameter 1-49</td>
<td>Current at Min Inductance for q-axis</td>
<td>20–200%</td>
<td>100% This parameter specifies the saturation curve of the d- and q-inductance values. From 20–100% of this parameter, the inductances are linearly approximated due to parameter 1-37 d-axis Inductance (Ld), parameter 1-38 q-axis Inductance (Lq), parameter 1-44 d-axis Inductance Sat. (LdSat), and parameter 1-45 q-axis Inductance Sat. (LqSat).</td>
</tr>
<tr>
<td>Parameter 1-70</td>
<td>PM Start Mode</td>
<td>[0] Rotor Detection</td>
<td>[0] Rotor Detection Select the PM motor start mode.</td>
</tr>
<tr>
<td>Parameter 1-73</td>
<td>Flying Start</td>
<td>[0] Disabled</td>
<td>[0] Disabled Select [1] Enabled to enable the drive to catch a spinning motor.</td>
</tr>
<tr>
<td>Parameter 3-41</td>
<td>Ramp 1 Ramp Up Time</td>
<td>0.05–3600.0 s</td>
<td>Size related Ramp-up time from 0 to rated parameter 1-23 Motor Frequency.</td>
</tr>
<tr>
<td>Parameter 3-42</td>
<td>Ramp 1 Ramp Down Time</td>
<td>0.05–3600.0 s</td>
<td>Size related Ramp-down time from rated parameter 1-23 Motor Frequency to 0.</td>
</tr>
<tr>
<td>Parameter 4-12</td>
<td>Motor Speed Low Limit [Hz]</td>
<td>0.0–400.0 Hz</td>
<td>0.0 Hz Enter the minimum limit for low speed.</td>
</tr>
<tr>
<td>Parameter 4-14</td>
<td>Motor Speed High Limit [Hz]</td>
<td>0.0–400.0 Hz</td>
<td>100.0 Hz Enter the maximum limit for high speed.</td>
</tr>
<tr>
<td>Parameter 4-19</td>
<td>Max Output Frequency</td>
<td>0.0–400.0 Hz</td>
<td>100.0 Hz Enter the maximum output frequency value. If parameter 4-19 Max Output Frequency is set lower than parameter 4-14 Motor Speed High Limit [Hz], parameter 4-14 Motor Speed High Limit [Hz] is set equal to parameter 4-19 Max Output Frequency automatically.</td>
</tr>
<tr>
<td>Parameter 30-22 Locked Rotor Detection</td>
<td>[0] Off</td>
<td>[0] Off</td>
<td>–</td>
</tr>
<tr>
<td>Parameter 30-23 Locked Rotor Detection Time [s]</td>
<td>0.05–1.00 s</td>
<td>0.10 s</td>
<td>–</td>
</tr>
</tbody>
</table>
4.2.5 Changes Made Function

The changes made function lists all parameters changed from default settings.

- The list shows only parameters that have been changed in the current edit setup.
- Parameters that have been reset to default values are not listed.
- The message Empty indicates that no parameters have been changed.

4.2.6 Changing Parameter Settings

**Procedure**

1. To enter the Quick Menu, press the [Menu] key until the indicator in the display is placed above Quick Menu.
2. Press [.SelectedItemFlow] to select the wizard, closed-loop setup, motor setup, or changes made.
3. Press [OK].
4. Press [.SelectedItemFlow] to browse through the parameters in the Quick Menu.
5. Press [OK] to select a parameter.
6. Press [SelectedItemFlow] to change the value of a parameter setting.
7. Press [OK] to accept the change.
8. Press either [Back] twice to enter Status, or press [Menu] once to enter the Main Menu.

4.2.7 Accessing All Parameters via the Main Menu

**Procedure**

1. Press the [Menu] key until the indicator in the display is placed above Main Menu.
2. Press [SelectedItemFlow] to browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. Press [SelectedItemFlow] to browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. Press [SelectedItemFlow] to set/change the parameter value.
7. Press [OK] to accept the change.
| 14-4 | Energy Optimizing |
| 14-40 | VT Level |
| 14-41 | AEG Minimum Magnetisation |
| 14-44 | DC axis current optimization for PM |
| 14-5 | Environment |
| 14-50 | DC Link Voltage Compensation |
| 14-52 | Fan Control |
| 14-53 | Fan Monitor |
| 14-55 | Output Filter |
| 14-6 | Auto Drive |
| 14-61 | Function at Inverter Overload |
| 14-63 | Min Switch Frequency |
| 14-64 | Dead Time Compensation Zero Current Level |
| 14-65 | Speed Deactivate Dead-Time Compensation |
| 14-9 | Fault Settings |
| 14-90 | Fault Level |
| 15-0 | Drive Information |
| 15-00 | Operating Data |
| 15-01 | Operating hours |
| 15-02 | kWh Counter |
| 15-03 | Power Up's |
| 15-04 | Over Temp's |
| 15-05 | Over Volt's |
| 15-06 | Reset With Counter |
| 15-07 | Reset Running Hours Counter |
| 15-3 | Alarm Log |
| 15-30 | Alarm Log, Error Code |
| 15-31 | Internal Fault/Reason |
| 15-32 | Alarm Log, Time |
| 15-4 | Drive Identification |
| 15-40 | FC Type |
| 15-41 | Power Section |
| 15-42 | Voltage |
| 15-43 | Software Version |
| 15-44 | Ordered Type Code |
| 15-45 | Actual Type Code String |
| 15-46 | Drive Ordering No |
| 15-48 | ICP ID No |
| 15-49 | SW ID Control Card |
| 15-50 | SW ID Power Card |
| 15-51 | Drive Serial Number |
| 15-52 | OEM Information |
| 15-53 | Power Card Serial Number |
| 15-57 | File Version |
| 15-59 | Filename |
| 15-9 | Parameter Info |
| 15-92 | Defined Parameters |
| 15-97 | Application Type |
| 15-98 | Drive Identification |
| 16-0 | Status Monitor |
| 16-00 | General Status |
| 16-01 | Control Word |
| 16-02 | Reference (%) |
| 16-03 | Status Word |
| 16-05 | Main Actual Value [%] |
| 16-09 | Custom Readout |
| 16-17 | Power (kW) |
| 16-18 | Motor Thermal |
| 16-22 | Torque [%] |
| 16-27 | Filtered (hp) |
| 16-31 | Drive Status |
| 16-34 | Heatsink Temp. |
| 16-35 | Inverter Thermal |
| 16-36 | Inv. Nom. Current |
| 16-37 | Inv Max. Current |
| 16-54 | Feedback (Unit) |
| 16-55 | Feedback 2 (Unit) |
| 16-60 | Digital Input |
| 16-61 | Terminal 33 Setting |
| 16-62 | Analog input 53 |
| 16-63 | Terminal 34 Setting |
| 16-64 | Analog input 34 |
| 16-65 | Analog output 42 (mA) |
| 16-66 | Digital Output |
| 16-67 | Pulse input 29 [Hz] |
| 16-71 | Relay output |
| 16-72 | Counter A |
| 16-73 | Counter B |
| 16-85 | Analog output 45 [mA] |
| 16-86 | FC Port I/F 1 |
| 16-89 | Diagnosis Readouts |
| 16-91 | Alarm Word |
| 16-92 | Error Word |
| 16-95 | Ext. Status Word 2 |
| 16-96 | Warning Word 3 |
| 16-99 | Warning Word 4 |
| 16-01 | Feedback 1 Conversion |
| 16-03 | Feedback 2 Source |
| 16-12 | Reference/Feedback Unit |
| 16-20 | Feedback/Setpoint |
| 16-21 | Setpoint 1 |
| 16-26 | Power Filtered (kW) |
| 16-27 | Filtered (hp) |
| 16-31 | Drive Status |
| 16-34 | Heatsink Temp. |
| 16-35 | Inverter Thermal |
| 16-36 | Inv. Nom. Current |
| 16-37 | Inv Max. Current |
| 16-54 | Feedback (Unit) |
| 16-55 | Feedback 2 (Unit) |
| 16-60 | Digital Input |
| 16-61 | Terminal 33 Setting |
| 16-62 | Analog input 53 |
| 16-63 | Terminal 34 Setting |
| 16-64 | Analog input 34 |
| 16-65 | Analog output 42 (mA) |
| 16-66 | Digital Output |
| 16-67 | Pulse input 29 [Hz] |
| 16-71 | Relay output |
| 16-72 | Counter A |
| 16-73 | Counter B |
| 16-85 | Analog output 45 [mA] |
| 16-86 | FC Port I/F 1 |
| 16-91 | Alarm Word |
| 16-92 | Error Word |
| 16-95 | Ext. Status Word 2 |
| 16-96 | Warning Word 3 |

22-0 | Miscellaneous |
22-01 | Power Filter Time |
22-02 | Sleep Mode CL Control Mode |
22-2 | No-Flow Detection |
22-23 | No-Flow Function |
22-24 | No-Flow Delay |
22-3 | No-Flow Power Tuning |
22-30 | No-Flow Power |
22-31 | Power Correction Factor |
22-33 | Low Speed (Hz) |
22-34 | Low Speed Power (kW) |
22-37 | High Speed (Hz) |
22-38 | High Speed Power (kW) |
22-4 | Sleep Mode |
22-44 | Wake-Up Ref/RF Diff |
22-45 | Setpoint Boost |
22-46 | Maximum Boost Time |
22-47 | Sleep Speed (Hz) |
22-48 | Sleep Delay Time |
22-49 | Wake-Up Delay Time |
22-6 | Broken Belt Detection |
22-60 | Broken Belt Function |
22-61 | Broken Belt Torque |
22-62 | Broken Belt Delay |
22-8 | Flow Compensation |
22-80 | Flow Compensation |
22-81 | Square-linear Curve Approximation |
22-82 | Work Point Calculation |
22-84 | Speed at No-Flow (Hz) |
22-86 | Speed at Design Point (Hz) |
22-87 | Pressure at No-Speed (Hz) |
22-88 | Pressure at Rated Speed |
22-89 | Flow at Design Point |
22-90 | Flow at Rated Speed |
24-0 | Fire Mode |
24-00 | FM Function |
24-01 | Fire Mode Configuration |
24-03 | Fire Mode Min Reference |
24-04 | Fire Mode Max Reference |
24-05 | FM Preset Reference |
24-06 | Fire Mode Reference Source |
24-07 | Fire Mode Feedback Source |
24-08 | Mul FM Preset Reference |
24-09 | FM Alarm Handling |
24-10 | Drive Bypass |
24-11 | Drive Bypass Delay Time |
24-12 | Drive Start Adjust |
24-23 | Locked Rotor Protection |
24-25 | Locked Rotor Detection Time (s) |
24-30 | Unit Configuration |
24-35 | LockPassword |

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## 5 Warnings and Alarms

### 5.1 List of Warnings and Alarms

#### Table 19: Warnings and Alarms

<table>
<thead>
<tr>
<th>Fault number</th>
<th>Alarm/ warning bit number</th>
<th>Fault text</th>
<th>Warning</th>
<th>Alarm</th>
<th>Trip locked</th>
<th>Cause of problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>16</td>
<td>Live zero error</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Signal on terminal 53 or 54 is less than 50% of the value set in parameter 6-10 Terminal 53 Low Voltage, parameter 6-12 Terminal 53 Low Current, parameter 6-20 Terminal 54 Low Voltage, or parameter 6-22 Terminal 54 Low Current. See also parameter group 6-0* Analog I/O Mode.</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>Mains ph. loss</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Missing phase on the supply side or too high voltage imbalance. Check the supply voltage. See parameter 14-12 Function at Mains Imbalance.</td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td>DC over volt</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>DC-link voltage exceeds the limit.</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>DC under volt</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>DC-link voltage drops below voltage warning low-limit.</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Inverter overload</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>More than 100% load for a long time.</td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>Motor ETR over</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Motor is too hot due to more than 100% load for a long time. See parameter 1-90 Motor Thermal Protection.</td>
</tr>
<tr>
<td>11</td>
<td>7</td>
<td>Motor th over</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Thermistor or thermistor connection is disconnected. See parameter 1-90 Motor Thermal Protection.</td>
</tr>
<tr>
<td>13</td>
<td>5</td>
<td>Over Current</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Inverter peak current limit is exceeded.</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>Earth Fault</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Discharge from output phases to ground.</td>
</tr>
<tr>
<td>16</td>
<td>12</td>
<td>Short Circuit</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Short circuit in motor or on motor terminals.</td>
</tr>
<tr>
<td>17</td>
<td>4</td>
<td>Ctrl. word TO</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>No communication to drive. See parameter group 8-0* General Settings.</td>
</tr>
<tr>
<td>24</td>
<td>50</td>
<td>Fan Fault</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>The heat sink cooling fan is not working (only on 400 V, 30–90 kW units).</td>
</tr>
<tr>
<td>30</td>
<td>19</td>
<td>U phase loss</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Motor phase U is missing. Check the phase. See parameter 4-58 Missing Motor Phase Function.</td>
</tr>
<tr>
<td>31</td>
<td>20</td>
<td>V phase loss</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Motor phase V is missing. Check the phase. See parameter 4-58 Missing Motor Phase Function.</td>
</tr>
<tr>
<td>32</td>
<td>21</td>
<td>W phase loss</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Motor phase W is missing. Check the phase. See parameter 4-58 Missing Motor Phase Function.</td>
</tr>
<tr>
<td>38</td>
<td>17</td>
<td>Internal fault</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Contact the local Danfoss supplier.</td>
</tr>
<tr>
<td>44</td>
<td>28</td>
<td>Earth Fault</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Discharge from output phases to ground, using the value of parameter 15-31 InternalFaultReason if possible.</td>
</tr>
<tr>
<td>46</td>
<td>33</td>
<td>Control Voltage Fault</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>Control voltage is low. Contact the local Danfoss supplier.</td>
</tr>
<tr>
<td>Fault number</td>
<td>Alarm/ warning bit number</td>
<td>Fault text</td>
<td>Warning</td>
<td>Alarm</td>
<td>Trip locked</td>
<td>Cause of problem</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------</td>
<td>------------</td>
<td>---------</td>
<td>-------</td>
<td>-------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>47</td>
<td>23</td>
<td>24 V supply low</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>24 V DC supply may be overloaded.</td>
</tr>
<tr>
<td>50</td>
<td>–</td>
<td>AMA calibration failed</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>Contact the local Danfoss supplier.</td>
</tr>
<tr>
<td>51</td>
<td>15</td>
<td>AMA Unom, Inom</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>The setting of motor voltage, motor current, and motor power is wrong. Check the settings.</td>
</tr>
<tr>
<td>52</td>
<td>–</td>
<td>AMA low Inom</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>The motor current is too low. Check the settings.</td>
</tr>
<tr>
<td>53</td>
<td>–</td>
<td>AMA big motor</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>The motor is too big to perform AMA.</td>
</tr>
<tr>
<td>54</td>
<td>–</td>
<td>AMA small mot</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>The motor is too small to perform AMA.</td>
</tr>
<tr>
<td>55</td>
<td>–</td>
<td>AMA par. range</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>The parameter values found from the motor are outside the acceptable range.</td>
</tr>
<tr>
<td>56</td>
<td>–</td>
<td>AMA user interrupt</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>The AMA has been interrupted by the user.</td>
</tr>
<tr>
<td>57</td>
<td>–</td>
<td>AMA timeout</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>Try to start the AMA again a number of times, until the AMA is carried out.</td>
</tr>
<tr>
<td>58</td>
<td>–</td>
<td>AMA internal</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Contact the local Danfoss supplier.</td>
</tr>
<tr>
<td>59</td>
<td>25</td>
<td>Current limit</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>The current is higher than the value in parameter 4-18 Current Limit.</td>
</tr>
<tr>
<td>60</td>
<td>44</td>
<td>External Interlock</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the drive (via serial communication, digital I/O, or by pressing [Reset] key on the LCP).</td>
</tr>
<tr>
<td>66</td>
<td>26</td>
<td>Heat sink Temperature Low</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>This warning is based on the temperature sensor in the IGBT module (on 400 V, 30–90 kW (40–125 hp) and 600 V units).</td>
</tr>
<tr>
<td>69</td>
<td>1</td>
<td>Pwr. Card Temp</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>The temperature sensor on the power card exceeds the upper or lower limits.</td>
</tr>
<tr>
<td>70</td>
<td>36</td>
<td>Illegal FC configuration</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>The control card and power card are not matched.</td>
</tr>
<tr>
<td>79</td>
<td>–</td>
<td>Illegal power section configuration</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Internal fault. Contact the local Danfoss supplier.</td>
</tr>
</tbody>
</table>

**NOTICE**

Repeated runs may heat the motor to a level where the resistance $R_s$ and $R_r$ are increased. In most cases, however, this is not critical.
<table>
<thead>
<tr>
<th>Fault number</th>
<th>Alarm/ warning bit number</th>
<th>Fault text</th>
<th>Warning</th>
<th>Alarm</th>
<th>Trip locked</th>
<th>Cause of problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>29</td>
<td>Drive initialised</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>All parameter settings are initialized to default settings.</td>
</tr>
<tr>
<td>87</td>
<td>47</td>
<td>Auto DC Braking</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>The drive is auto DC braking.</td>
</tr>
<tr>
<td>95</td>
<td>40</td>
<td>Broken Belt</td>
<td>X</td>
<td>X</td>
<td>–</td>
<td>Torque is below the torque level set for no load, indicating a broken belt. See parameter group 22-6* Broken Belt Detection.</td>
</tr>
<tr>
<td>126</td>
<td>–</td>
<td>Motor Rotating</td>
<td>–</td>
<td>X</td>
<td>–</td>
<td>High back EMF voltage. Stop the rotor of the PM motor.</td>
</tr>
<tr>
<td>200</td>
<td>–</td>
<td>Fire Mode</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>Fire mode has been activated.</td>
</tr>
<tr>
<td>202</td>
<td>–</td>
<td>Fire Mode Limits Exceeded</td>
<td>X</td>
<td>–</td>
<td>–</td>
<td>Fire mode has suppressed 1 or more warranty voiding alarms.</td>
</tr>
<tr>
<td>250</td>
<td>–</td>
<td>New spare part</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>The power or switch mode power supply has been exchanged (on 400 V, 30–90 kW (40–125 hp) and 600 V units). Contact the local Danfoss supplier.</td>
</tr>
<tr>
<td>251</td>
<td>–</td>
<td>New Type code</td>
<td>–</td>
<td>X</td>
<td>X</td>
<td>The drive has a new type code (on 400 V, 30–90 kW (40–125 hp) and 600 V units). Contact the local Danfoss supplier.</td>
</tr>
</tbody>
</table>
6 Specifications

6.1 Mains Supply

6.1.1 3x200–240 V AC

Table 20: 3x200–240 V AC, 0.25–7.5 kW (0.33–10 hp)

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK25</th>
<th>PK37</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K7</th>
<th>P5K5</th>
<th>P7K5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>0.25</td>
<td>0.37</td>
<td>0.75</td>
<td>1.5</td>
<td>2.2</td>
<td>3.7</td>
<td>5.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>0.33</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>5.0</td>
<td>7.5</td>
<td>10.0</td>
</tr>
<tr>
<td>Protection rating IP20</td>
<td>H1</td>
<td>H1</td>
<td>H1</td>
<td>H1</td>
<td>H2</td>
<td>H3</td>
<td>H4</td>
<td>H4</td>
</tr>
<tr>
<td>Maximum cable size in terminals (mains, motor) [m² (AWG)]</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>16 (6)</td>
<td>16 (6)</td>
</tr>
</tbody>
</table>

**Output current - 40°C (104°F) ambient temperature**

| Continuous (3x200–240 V) [A] | 1.5 | 2.2 | 4.2 | 6.8 | 9.6 | 15.2 | 22.0 | 28.0 |
| Intermittent (3x200–240 V) [A] | 1.7 | 2.4 | 4.6 | 7.5 | 10.6 | 16.7 | 24.2 | 30.8 |

**Maximum input current**

| Continuous 3x200–240 V [A] | 1.1 | 1.6 | 2.8 | 5.6 | 8.6/7.2 | 14.1/12.0 | 21.0/18.0 | 28.3/24.0 |
| Intermittent 3x200–240V [A] | 1.2 | 1.8 | 3.1 | 6.2 | 9.5/7.9 | 15.5/13.2 | 23.1/19.8 | 31.1/26.4 |

**Maximum mains fuses**

See 3.2.4.5 Recommendation of Fuses and Circuit Breakers.

**Estimated power loss [W], Best case/typical**

| | 12/14 | 15/18 | 21/26 | 48/60 | 80/102 | 97/120 | 182/204 | 229/268 |
| Weight enclosure protection rating IP20 [kg (lb)] | 2.0 (4.4) | 2.0 (4.4) | 2.0 (4.4) | 2.1 (4.6) | 3.4 (7.5) | 4.5 (9.9) | 7.9 (17.4) | 7.9 (17.4) |

**Efficiency [%], best case/typical**

| 97.0/96.5 | 97.3/96.8 | 98.0/97.6 | 97.6/97.0 | 97.1/96.3 | 97.9/97.4 | 97.3/97.0 | 98.5/97.1 |

**Output current - 50°C (122°F) ambient temperature**

| Continuous (3x200–240 V) [A] | 1.5 | 1.9 | 3.5 | 6.8 | 9.6 | 13.0 | 19.8 | 23.0 |
| Intermittent (3x200–240 V) [A] | 1.7 | 2.1 | 3.9 | 7.5 | 10.6 | 14.3 | 21.8 | 25.3 |

1 Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.

2 Efficiency measured at nominal current. For energy efficiency class, see 6.4.13 Ambient Conditions. For part load losses, see Danfoss MyDrive® ecoSmart™ website.

Table 21: 3x200–240 V AC, 11–45 kW (15–60 hp)

<table>
<thead>
<tr>
<th>Drive</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>11.0</td>
<td>15.0</td>
<td>18.5</td>
<td>22.0</td>
<td>30.0</td>
<td>37.0</td>
<td>45.0</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>15.0</td>
<td>20.0</td>
<td>25.0</td>
<td>30.0</td>
<td>40.0</td>
<td>50.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Protection rating IP20</td>
<td>H5</td>
<td>H6</td>
<td>H6</td>
<td>H7</td>
<td>H7</td>
<td>H8</td>
<td>H8</td>
</tr>
</tbody>
</table>
### Drive Specifications

<table>
<thead>
<tr>
<th>Drive</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum cable size in terminals (mains, motor) [mm² (AWG)]</td>
<td>16 (6)</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>50 (1)</td>
<td>50 (1)</td>
<td>95 (0)</td>
<td>120 (4/0)</td>
</tr>
</tbody>
</table>

**Output current - 40°C (104°F) ambient temperature**

| Continuous (3x200–240 V) [A] | 42.0 | 59.4 | 74.8 | 88.0 | 115.0 | 143.0 | 170.0 |
| Intermittent (3x200–240 V) [A] | 46.2 | 65.3 | 82.3 | 96.8 | 126.5 | 157.3 | 187.0 |

**Maximum input current**

| Continuous 3x200–240 V [A] | 41.0/38.2 | 52.7 | 65.0 | 76.0 | 103.7 | 127.9 | 153.0 |
| Intermittent 3x200–240 V [A] | 45.1/42.0 | 58.0 | 71.5 | 83.7 | 114.1 | 140.7 | 168.3 |

**Estimated power loss [W], Best case/typical (1)**

| 369/386 | 512 | 697 | 879 | 1149 | 1390 | 1500 |

**Weight enclosure protection rating IP20 [kg (lb)]**

| 9.5 (20.9) | 24.5 (54) | 24.5 (54) | 36.0 (79.4) | 36.0 (79.4) | 51.0 (112.4) | 51.0 (112.4) |

**Efficiency [%], best case/typical (2)**

| 97.2/97.1 | 97.0 | 97.1 | 96.8 | 97.1 | 97.1 | 97.3 |

**Output current - 50°C (122°F) ambient temperature**

| Continuous (3x380–440 V) [A] | 33.0 | 41.6 | 52.4 | 61.6 | 80.5 | 100.1 | 119 |
| Intermittent (3x380–440 V) [A] | 36.3 | 45.8 | 57.6 | 67.8 | 88.6 | 110.1 | 130.9 |

### 6.1.2 3x380–480 V AC

**Table 22: 3x380–480 V AC, 0.37–15 kW (0.5–20 hp), Enclosure Sizes H1–H4**

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK37</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>0.37</td>
<td>0.75</td>
<td>1.5</td>
<td>2.2</td>
<td>3.0</td>
<td>4.0</td>
<td>5.5</td>
<td>7.5</td>
<td>11.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>7.5</td>
<td>10.0</td>
<td>15.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Protection rating IP20</td>
<td>H1</td>
<td>H1</td>
<td>H1</td>
<td>H2</td>
<td>H2</td>
<td>H2</td>
<td>H3</td>
<td>H3</td>
<td>H4</td>
<td>H4</td>
</tr>
<tr>
<td>Maximum cable size in terminals (mains, motor) [mm² (AWG)]</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>16 (6)</td>
<td>16 (6)</td>
<td></td>
</tr>
</tbody>
</table>

**Output current - 40°C (104°F) ambient temperature**

| Continuous (3x380–440 V) [A] | 1.2 | 2.2 | 3.7 | 5.3 | 7.2 | 9.0 | 12.0 | 15.5 | 23.0 | 31.0 |
| Intermittent (3x380–440 V) [A] | 1.3 | 2.4 | 4.1 | 5.8 | 7.9 | 9.9 | 13.2 | 17.1 | 25.3 | 34.0 |
| Continuous (3x441–480 V) [A] | 1.1 | 2.1 | 3.4 | 4.8 | 6.3 | 8.2 | 11.0 | 14.0 | 21.0 | 27.0 |
| Intermittent (3x441–480 V) [A] | 1.2 | 2.3 | 3.7 | 5.3 | 6.9 | 9.0 | 12.1 | 15.4 | 23.1 | 29.7 |

**Maximum input current**

---

1. Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.

2. Efficiency measured at nominal current. For energy efficiency class, see 6.4.13 Ambient Conditions. For part load losses, see Danfoss MyDrive® ecoSmart™ website.
<table>
<thead>
<tr>
<th>Drive</th>
<th>PK37</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>1.2</td>
<td>2.1</td>
<td>3.5</td>
<td>4.7</td>
<td>6.3</td>
<td>8.3</td>
<td>11.2</td>
<td>15.1</td>
<td>22.1</td>
<td>29.9</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>1.3</td>
<td>2.3</td>
<td>3.9</td>
<td>5.2</td>
<td>6.9</td>
<td>9.1</td>
<td>12.3</td>
<td>16.6</td>
<td>24.3</td>
<td>32.9</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>1.0</td>
<td>1.8</td>
<td>2.9</td>
<td>3.9</td>
<td>5.3</td>
<td>6.8</td>
<td>9.4</td>
<td>12.6</td>
<td>18.4</td>
<td>24.7</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>1.1</td>
<td>2.0</td>
<td>3.2</td>
<td>4.3</td>
<td>5.8</td>
<td>7.5</td>
<td>10.3</td>
<td>13.9</td>
<td>20.2</td>
<td>27.2</td>
</tr>
</tbody>
</table>

Maximum mains fuses

- **Estimated power loss [W], best case/typical**
  - 13/15
  - 16/21
  - 46/57
  - 46/58
  - 66/83
  - 95/118
  - 104/131
  - 159/198
  - 248/274
  - 353/379

- **Weight enclosure protection rating IP20 [kg (lb)]**
  - 2.0 (4.4)
  - 2.0 (4.4)
  - 2.1 (4.6)
  - 3.3 (7.3)
  - 3.3 (7.3)
  - 3.4 (7.5)
  - 4.3 (9.5)
  - 4.5 (9.9)
  - 7.9 (17.4)
  - 7.9 (17.4)

- **Efficiency [%], best case/typical**
  - 97.8/97.3
  - 98.0/97.6
  - 98.7/97.2
  - 98.3/97.9
  - 98.2/97.8
  - 98.0/97.6
  - 98.4/98.1
  - 98.2/97.8
  - 98.1/97.9
  - 98.0/97.8

Output current - 50°C (122°F) ambient temperature

- **Continuous (3x380–440 V) [A]**
  - 1.04
  - 1.93
  - 3.7
  - 4.85
  - 6.3
  - 8.4
  - 10.9
  - 14.0
  - 20.9
  - 28.0

- **Intermittent (3x380–440 V) [A]**
  - 1.1
  - 2.1
  - 3.4
  - 4.4
  - 5.5
  - 7.5
  - 10.0
  - 12.6
  - 19.1
  - 24.0

- **Continuous (3x441–480 V) [A]**
  - 1.0
  - 2.0
  - 3.7
  - 4.8
  - 6.1
  - 8.3
  - 11.0
  - 13.9
  - 21.0
  - 26.4

- **Intermittent (3x441–480 V) [A]**
  - 1.1
  - 2.0
  - 3.7
  - 4.8
  - 6.1
  - 8.3
  - 11.0
  - 13.9
  - 21.0
  - 26.4

1 Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.

2 Typical: under rated condition. Best case: the optimal condition is adopt, such as the higher input voltage and lower switching frequency.

Table 23: 3x380–480 V AC, 18.5–90 kW (25–125 hp), Enclosure Sizes H5–H8

<table>
<thead>
<tr>
<th>Drive</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>18.5</td>
<td>22.0</td>
<td>30.0</td>
<td>37.0</td>
<td>45.0</td>
<td>55.0</td>
<td>75.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>25.0</td>
<td>30.0</td>
<td>40.0</td>
<td>50.0</td>
<td>60.0</td>
<td>70.0</td>
<td>100.0</td>
<td>125.0</td>
</tr>
<tr>
<td>Protection rating IP20</td>
<td>H5</td>
<td>H5</td>
<td>H6</td>
<td>H6</td>
<td>H6</td>
<td>H7</td>
<td>H7</td>
<td>H8</td>
</tr>
<tr>
<td>Maximum cable size in terminals (mains, motor) [mm² (AWG)]</td>
<td>16 (6)</td>
<td>16 (6)</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>50 (1)</td>
<td>95 (0)</td>
<td>120 (250MC M)</td>
</tr>
</tbody>
</table>

Output current-40°C (104°F) ambient temperature

- **Continuous (3x380–440 V) [A]**
  - 37.0
  - 42.5
  - 61.0
  - 73.0
  - 90.0
  - 106.0
  - 147.0
  - 177.0

- **Intermittent (3x380–440 V) [A]**
  - 40.7
  - 46.8
  - 67.1
  - 80.3
  - 99.0
  - 116.0
  - 161.0
  - 194.0

- **Continuous (3x441–480 V) [A]**
  - 34.0
  - 40.0
  - 52.0
  - 65.0
  - 80.0
  - 105.0
  - 130.0
  - 160.0

- **Intermittent (3x441–480 V) [A]**
  - 37.4
  - 44.0
  - 57.2
  - 71.5
  - 88.0
  - 115.0
  - 143.0
  - 176.0

Maximum input current

- **Continuous (3x380–440 V) [A]**
  - 35.2
  - 41.5
  - 57.0
  - 70.0
  - 84.0
  - 103.0
  - 140.0
  - 166.0

- **Intermittent (3x380–440 V) [A]**
  - 38.7
  - 45.7
  - 62.7
  - 77.0
  - 92.4
  - 113.0
  - 154.0
  - 182.0

- **Continuous (3x441–480 V) [A]**
  - 29.3
  - 34.6
  - 49.2
  - 60.6
  - 72.5
  - 88.6
  - 120.9
  - 142.7
### Drive Specifications

<table>
<thead>
<tr>
<th>Drive</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>32.2</td>
<td>38.1</td>
<td>54.1</td>
<td>66.7</td>
<td>79.8</td>
<td>97.5</td>
<td>132.9</td>
<td>157.0</td>
</tr>
<tr>
<td>Maximum mains fuses</td>
<td>See 3.2.4.5 Recommendation of Fuses and Circuit Breakers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated power loss [W], best case/typical</td>
<td>412/456</td>
<td>475/523</td>
<td>733</td>
<td>922</td>
<td>1067</td>
<td>1133</td>
<td>1733</td>
<td>2141</td>
</tr>
<tr>
<td>Weight enclosure protection rating IP20 [kg (lb)]</td>
<td>9.5 (20.9)</td>
<td>9.5 (20.9)</td>
<td>24.5 (54)</td>
<td>24.5 (54)</td>
<td>24.5 (54)</td>
<td>36.0 (79.4)</td>
<td>36.0 (79.4)</td>
<td>51.0 (112.4)</td>
</tr>
<tr>
<td>Efficiency [%], best case/typical</td>
<td>98.1/97.9</td>
<td>98.1/97.9</td>
<td>97.8</td>
<td>97.7</td>
<td>98.0</td>
<td>98.2</td>
<td>97.8</td>
<td>97.9</td>
</tr>
</tbody>
</table>

### Output Current - 50°C (122°F) Ambient Temperature

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>34.1</td>
<td>38.0</td>
<td>48.8</td>
<td>58.4</td>
<td>72.0</td>
<td>74.2</td>
<td>102.9</td>
<td>123.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>37.5</td>
<td>41.8</td>
<td>53.7</td>
<td>64.2</td>
<td>79.2</td>
<td>81.6</td>
<td>113.2</td>
<td>136.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>31.3</td>
<td>35.0</td>
<td>41.6</td>
<td>52.0</td>
<td>64.0</td>
<td>73.5</td>
<td>91.0</td>
<td>112.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>34.4</td>
<td>38.5</td>
<td>45.8</td>
<td>57.2</td>
<td>70.4</td>
<td>80.9</td>
<td>100.1</td>
<td>123.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output Current - 40°C (104°F) Ambient Temperature

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>2.2</td>
<td>3.7</td>
<td>5.3</td>
<td>7.2</td>
<td>9.0</td>
<td>12.0</td>
<td>15.5</td>
<td>23.0</td>
<td>31.0</td>
<td>37.0</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>2.4</td>
<td>4.1</td>
<td>5.8</td>
<td>7.9</td>
<td>9.9</td>
<td>13.2</td>
<td>17.1</td>
<td>25.3</td>
<td>34.0</td>
<td>40.7</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>2.1</td>
<td>3.4</td>
<td>4.8</td>
<td>6.3</td>
<td>8.2</td>
<td>11.0</td>
<td>14.0</td>
<td>21.0</td>
<td>27.0</td>
<td>34.0</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>2.3</td>
<td>3.7</td>
<td>5.3</td>
<td>6.9</td>
<td>9.0</td>
<td>12.1</td>
<td>15.4</td>
<td>23.1</td>
<td>29.7</td>
<td>37.4</td>
</tr>
</tbody>
</table>

### Maximum Input Current

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>2.1</td>
<td>3.5</td>
<td>4.7</td>
<td>6.3</td>
<td>8.3</td>
<td>11.2</td>
<td>15.1</td>
<td>22.1</td>
<td>29.9</td>
<td>35.2</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>2.3</td>
<td>3.9</td>
<td>5.2</td>
<td>6.9</td>
<td>9.1</td>
<td>12.3</td>
<td>16.6</td>
<td>24.3</td>
<td>32.9</td>
<td>38.7</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>1.8</td>
<td>2.9</td>
<td>3.9</td>
<td>5.3</td>
<td>6.8</td>
<td>9.4</td>
<td>12.6</td>
<td>18.4</td>
<td>24.7</td>
<td>29.3</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>2.0</td>
<td>3.2</td>
<td>4.3</td>
<td>5.8</td>
<td>7.5</td>
<td>10.3</td>
<td>13.9</td>
<td>20.2</td>
<td>27.2</td>
<td>32.2</td>
</tr>
</tbody>
</table>

### Maximum Mains Fuses

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK75</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>See 3.2.4.5 Recommendation of Fuses and Circuit Breakers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>21/16</td>
<td>46/57</td>
<td>46/58</td>
<td>66/83</td>
<td>95/118</td>
<td>104/131</td>
<td>159/198</td>
<td>248/274</td>
<td>353/379</td>
<td>412/456</td>
</tr>
</tbody>
</table>
### Drive Specifications

<table>
<thead>
<tr>
<th>Drive</th>
<th>PK7S</th>
<th>P1K5</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P4K0</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
<th>P18K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight enclosure protection rating IP54 [kg (lb)]</td>
<td>5.3 (11.7)</td>
<td>5.3 (11.7)</td>
<td>5.3 (11.7)</td>
<td>5.3 (11.7)</td>
<td>7.2 (15.9)</td>
<td>7.2 (15.9)</td>
<td>13.8 (30.4)</td>
<td>13.8 (30.4)</td>
<td>13.8 (30.4)</td>
<td></td>
</tr>
<tr>
<td>Efficiency [%], best case/typical</td>
<td>98.0/9 7.6</td>
<td>97.7/9 7.2</td>
<td>98.3/9 7.9</td>
<td>98.2/9 7.8</td>
<td>98.0/9 7.6</td>
<td>98.4/9 8.0</td>
<td>98.2/9 7.8</td>
<td>98.1/9 7.9</td>
<td>98.0/9 7.8</td>
<td>98.1/9 7.9</td>
</tr>
</tbody>
</table>

#### Output current - 50°C (122°F) ambient temperature

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>1.93</td>
<td>3.7</td>
<td>4.85</td>
<td>6.3</td>
<td>7.5</td>
<td>10.9</td>
<td>14.0</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>2.1</td>
<td>4.07</td>
<td>5.4</td>
<td>6.9</td>
<td>9.2</td>
<td>12.0</td>
<td>15.4</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>1.8</td>
<td>3.4</td>
<td>4.4</td>
<td>5.5</td>
<td>6.8</td>
<td>10.0</td>
<td>12.6</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>2.0</td>
<td>3.7</td>
<td>4.8</td>
<td>6.1</td>
<td>8.3</td>
<td>11.0</td>
<td>13.9</td>
</tr>
</tbody>
</table>

---

1. Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.
2. Efficiency measured at nominal current. For energy efficiency class, see 6.4.13 Ambient Conditions. For part load losses, see Danfoss MyDrive® ecoSmart™ website.

### Table 25: 3x380–480 V AC, 22–90 kW (30–125 hp), Enclosure Sizes I6–I8

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>22.0</td>
<td>30.0</td>
<td>37.0</td>
<td>45.0</td>
<td>55.0</td>
<td>75.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>30.0</td>
<td>40.0</td>
<td>50.0</td>
<td>60.0</td>
<td>70.0</td>
<td>100.0</td>
<td>125.0</td>
</tr>
<tr>
<td>Protection rating IP54</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>17</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Maximum cable size in terminals (mains, motor) [mm² (AWG)]</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>50 (1)</td>
<td>50 (1)</td>
<td>95 (3/0)</td>
<td>120 (4/0)</td>
</tr>
</tbody>
</table>

### Output current - 40°C (104°F) ambient temperature

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>44.0</td>
<td>61.0</td>
<td>73.0</td>
<td>90.0</td>
<td>106.0</td>
<td>147.0</td>
<td>177.0</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>48.4</td>
<td>67.1</td>
<td>80.3</td>
<td>99.0</td>
<td>116.6</td>
<td>161.7</td>
<td>194.7</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>40.0</td>
<td>52.0</td>
<td>65.0</td>
<td>80.0</td>
<td>105.0</td>
<td>130.0</td>
<td>160.0</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>44.0</td>
<td>57.2</td>
<td>71.5</td>
<td>88.0</td>
<td>115.5</td>
<td>143.0</td>
<td>176.0</td>
</tr>
</tbody>
</table>

### Maximum input current

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>41.8</td>
<td>57.0</td>
<td>70.3</td>
<td>84.2</td>
<td>102.9</td>
<td>140.3</td>
<td>165.6</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>46.0</td>
<td>62.7</td>
<td>77.4</td>
<td>92.6</td>
<td>113.1</td>
<td>154.3</td>
<td>182.2</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>36.0</td>
<td>49.2</td>
<td>60.6</td>
<td>72.5</td>
<td>88.6</td>
<td>120.9</td>
<td>142.7</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>39.6</td>
<td>54.1</td>
<td>66.7</td>
<td>79.8</td>
<td>97.5</td>
<td>132.9</td>
<td>157.0</td>
</tr>
</tbody>
</table>

| Maximum mains fuses | See 3.2.4.5 Recommendation of Fuses and Circuit Breakers. |

### Estimated power loss [W], best case/typical

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>496</td>
<td>734</td>
<td>995</td>
<td>840</td>
<td>1099</td>
<td>1520</td>
<td>1781</td>
</tr>
</tbody>
</table>

### Weight enclosure protection rating IP54 [kg (lb)]

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>27 (59.5)</td>
<td>27 (59.5)</td>
<td>27 (59.5)</td>
<td>45 (99.2)</td>
<td>45 (99.2)</td>
<td>65 (143.3)</td>
<td>65 (143.3)</td>
</tr>
</tbody>
</table>

### Efficiency [%], best case/typical

<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>98.0</td>
<td>97.8</td>
<td>97.6</td>
<td>98.3</td>
<td>98.2</td>
<td>98.1</td>
<td>98.3</td>
</tr>
</tbody>
</table>

### Output current - 50°C (122°F) ambient temperature
<table>
<thead>
<tr>
<th>Drive</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x380–440 V) [A]</td>
<td>35.2</td>
<td>48.8</td>
<td>58.4</td>
<td>63.0</td>
<td>74.2</td>
<td>102.9</td>
<td>123.9</td>
</tr>
<tr>
<td>Intermittent (3x380–440 V) [A]</td>
<td>38.7</td>
<td>53.9</td>
<td>64.2</td>
<td>69.3</td>
<td>81.6</td>
<td>113.2</td>
<td>136.3</td>
</tr>
<tr>
<td>Continuous (3x441–480 V) [A]</td>
<td>32.0</td>
<td>41.6</td>
<td>52.0</td>
<td>56.0</td>
<td>73.5</td>
<td>91.0</td>
<td>112.0</td>
</tr>
<tr>
<td>Intermittent (3x441–480 V) [A]</td>
<td>35.2</td>
<td>45.8</td>
<td>57.2</td>
<td>61.6</td>
<td>80.9</td>
<td>100.1</td>
<td>123.2</td>
</tr>
</tbody>
</table>

1 Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.

2 Efficiency measured at nominal current. For energy efficiency class, see 6.4.13 Ambient Conditions. For partial load losses, see Danfoss MyDrive® ecoSmart™ website.

### 6.1.3 3x525–600 V AC

#### Table 26: 3x525–600 V AC, 2.2–15 kW (3–20 hp), Enclosure Sizes H9–H10

<table>
<thead>
<tr>
<th>Drive</th>
<th>P2K2</th>
<th>P3K0</th>
<th>P3K7</th>
<th>P5K5</th>
<th>P7K5</th>
<th>P11K</th>
<th>P15K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>2.2</td>
<td>3.0</td>
<td>3.7</td>
<td>5.5</td>
<td>7.5</td>
<td>11.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td>7.5</td>
<td>10.0</td>
<td>15.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Protection rating IP20</td>
<td>H9</td>
<td>H9</td>
<td>H9</td>
<td>H9</td>
<td>H9</td>
<td>H10</td>
<td>H10</td>
</tr>
<tr>
<td>Maximum cable size in terminals (mains, motor) [mm² (AWG)]</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>4 (10)</td>
<td>10 (8)</td>
<td>10 (8)</td>
</tr>
</tbody>
</table>

**Output current - 40°C (104°F) ambient temperature**

| Continuous (3x525–550 V) [A] | 4.1 | 5.2 | 6.4 | 9.5 | 11.5 | 19.0 | 23.0 |
| Intermittent (3x525–550 V) [A] | 4.5 | 5.7 | 7.0 | 10.5 | 12.7 | 20.9 | 25.3 |
| Continuous (3x551–600 V) [A] | 3.9 | 4.9 | 6.1 | 9.0 | 11.0 | 18.0 | 22.0 |
| Intermittent (3x551–600 V) [A] | 4.3 | 5.4 | 6.7 | 9.9 | 12.1 | 19.8 | 24.2 |

**Maximum input current**

| Continuous (3x525–550 V) [A] | 3.7 | 5.1 | 5.0 | 8.7 | 11.9 | 16.5 | 22.5 |
| Intermittent (3x525–550 V) [A] | 4.1 | 5.6 | 6.5 | 9.6 | 13.1 | 18.2 | 24.8 |
| Continuous (3x551–600 V) [A] | 3.5 | 4.8 | 5.6 | 8.3 | 11.4 | 15.7 | 21.4 |
| Intermittent (3x551–600 V) [A] | 3.9 | 5.3 | 6.2 | 9.2 | 12.5 | 17.3 | 23.6 |

**Maximum mains fuses**

See 3.2.4.5 Recommendation of Fuses and Circuit Breakers.

| Estimated power loss [W], best case/typical (1) | 65 | 90 | 110 | 132 | 180 | 216 | 294 |
| Weight enclosure protection rating IP54 [kg (lb)] | 6.6 (14.6) | 6.6 (14.6) | 6.6 (14.6) | 6.6 (14.6) | 11.5 (25.3) | 11.5 (25.3) |
| Efficiency [%], best case/typical (2) | 97.9 | 97 | 97.9 | 98.1 | 98.1 | 98.4 | 98.4 |

**Output current - 50°C (122°F) ambient temperature**

| Continuous (3x525–550 V) [A] | 2.9 | 3.6 | 4.5 | 6.7 | 8.1 | 13.3 | 16.1 |
| Intermittent (3x525–550 V) [A] | 3.2 | 4.0 | 4.9 | 7.4 | 8.9 | 14.6 | 17.7 |
Drive | P2K2 | P3K0 | P3K7 | P5K5 | P7K5 | P11K | P15K
--- | --- | --- | --- | --- | --- | --- | ---
Continuous (3x551–600 V) [A] | 2.7 | 3.4 | 4.3 | 6.3 | 7.7 | 12.6 | 15.4
Intermittent (3x551–600 V) [A] | 3.0 | 3.7 | 4.7 | 6.9 | 8.5 | 13.9 | 16.9

1 Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.

2 Efficiency measured at nominal current. For energy efficiency class, see 6.4.13 Ambient Conditions. For part load losses, see Danfoss MyDrive® ecoSmart™ website.

Table 27: 3x525–600 V AC, 18.5–90 kW (25–125 hp), Enclosure Sizes H6–H8

<table>
<thead>
<tr>
<th>Drive</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical shaft output [kW]</td>
<td>18.5</td>
<td>22.0</td>
<td>30.0</td>
<td>37</td>
<td>45.0</td>
<td>55.0</td>
<td>75.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Typical shaft output [hp]</td>
<td>25.0</td>
<td>30.0</td>
<td>40.0</td>
<td>50.0</td>
<td>60.0</td>
<td>70.0</td>
<td>100.0</td>
<td>125.0</td>
</tr>
<tr>
<td>Protection rating IP20</td>
<td>H6</td>
<td>H6</td>
<td>H6</td>
<td>H7</td>
<td>H7</td>
<td>H7</td>
<td>H8</td>
<td>H8</td>
</tr>
<tr>
<td>Maximum cable size in terminals (mains, motor) [mm² (AWG)]</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>35 (2)</td>
<td>50 (1)</td>
<td>50 (1)</td>
<td>50 (1)</td>
<td>95 (0)</td>
<td>120 (4/0)</td>
</tr>
</tbody>
</table>

Output current - 40°C (104°F) ambient temperature

<table>
<thead>
<tr>
<th>Drive</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x525–550 V) [A]</td>
<td>28.0</td>
<td>36.0</td>
<td>43.0</td>
<td>54.0</td>
<td>65.0</td>
<td>87.0</td>
<td>105.0</td>
<td>137.0</td>
</tr>
<tr>
<td>Intermittent (3x525–550 V) [A]</td>
<td>30.8</td>
<td>39.6</td>
<td>47.3</td>
<td>59.4</td>
<td>71.5</td>
<td>95.7</td>
<td>115.5</td>
<td>150.7</td>
</tr>
<tr>
<td>Continuous (3x551–600 V) [A]</td>
<td>27.0</td>
<td>34.0</td>
<td>41.0</td>
<td>52.0</td>
<td>62.0</td>
<td>83.0</td>
<td>100.0</td>
<td>131.0</td>
</tr>
<tr>
<td>Intermittent (3x551–600 V) [A]</td>
<td>29.7</td>
<td>37.4</td>
<td>45.1</td>
<td>57.2</td>
<td>68.2</td>
<td>91.3</td>
<td>110.0</td>
<td>144.1</td>
</tr>
</tbody>
</table>

Maximum input current

<table>
<thead>
<tr>
<th>Drive</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x525–550 V) [A]</td>
<td>27.0</td>
<td>33.1</td>
<td>45.1</td>
<td>54.7</td>
<td>66.5</td>
<td>81.3</td>
<td>109.0</td>
<td>130.9</td>
</tr>
<tr>
<td>Intermittent (3x525–550 V) [A]</td>
<td>29.7</td>
<td>36.4</td>
<td>49.6</td>
<td>60.1</td>
<td>73.1</td>
<td>89.4</td>
<td>119.9</td>
<td>143.9</td>
</tr>
<tr>
<td>Continuous (3x551–600 V) [A]</td>
<td>25.7</td>
<td>31.5</td>
<td>42.9</td>
<td>52.0</td>
<td>63.3</td>
<td>77.4</td>
<td>103.8</td>
<td>124.5</td>
</tr>
<tr>
<td>Intermittent (3x551–600 V) [A]</td>
<td>28.3</td>
<td>34.6</td>
<td>47.2</td>
<td>57.2</td>
<td>69.6</td>
<td>85.1</td>
<td>114.2</td>
<td>137.0</td>
</tr>
</tbody>
</table>

Maximum mains fuses

See 3.2.4.5 Recommendation of Fuses and Circuit Breakers.

Estimated power loss [W], best case/typical

<table>
<thead>
<tr>
<th>Drive</th>
<th>P18K</th>
<th>P22K</th>
<th>P30K</th>
<th>P37K</th>
<th>P45K</th>
<th>P55K</th>
<th>P75K</th>
<th>P90K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (3x525–550 V) [A]</td>
<td>385</td>
<td>458</td>
<td>542</td>
<td>597</td>
<td>727</td>
<td>1092</td>
<td>1380</td>
<td>1658</td>
</tr>
<tr>
<td>Intermittent (3x525–550 V) [A]</td>
<td>24.5 (54)</td>
<td>24.5 (54)</td>
<td>24.5 (54)</td>
<td>36.0 (79.3)</td>
<td>36.0 (79.3)</td>
<td>36.0 (79.3)</td>
<td>51.0 (112.4)</td>
<td>51.0 (112.4)</td>
</tr>
<tr>
<td>Continuous (3x551–600 V) [A]</td>
<td>98.4</td>
<td>98.4</td>
<td>98.5</td>
<td>98.5</td>
<td>98.7</td>
<td>98.5</td>
<td>98.5</td>
<td>98.5</td>
</tr>
<tr>
<td>Intermittent (3x551–600 V) [A]</td>
<td>19.6</td>
<td>25.2</td>
<td>30.1</td>
<td>37.8</td>
<td>45.5</td>
<td>60.9</td>
<td>73.5</td>
<td>95.9</td>
</tr>
<tr>
<td>Continuous (3x525–550 V) [A]</td>
<td>21.6</td>
<td>27.7</td>
<td>33.1</td>
<td>41.6</td>
<td>50.0</td>
<td>67.0</td>
<td>80.9</td>
<td>105.5</td>
</tr>
<tr>
<td>Continuous (3x551–600 V) [A]</td>
<td>18.9</td>
<td>23.8</td>
<td>28.7</td>
<td>36.4</td>
<td>43.3</td>
<td>58.1</td>
<td>70.0</td>
<td>91.7</td>
</tr>
<tr>
<td>Intermittent (3x551–600 V) [A]</td>
<td>20.8</td>
<td>26.2</td>
<td>31.6</td>
<td>40.0</td>
<td>47.7</td>
<td>63.9</td>
<td>77.0</td>
<td>100.9</td>
</tr>
</tbody>
</table>
Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to Danfoss MyDrive® ecoSmart™ website.

Efficiency measured at nominal current. For energy efficiency class, see 6.4.13 Ambient Conditions. For part load losses, see Danfoss MyDrive® ecoSmart™ website.

6.2 EMC Emission Test Results

The following test results have been obtained using a system with a drive, a shielded control cable, a control box with potentiometer, and a shielded motor cable.

Table 28: EMC Emission Test Results

<table>
<thead>
<tr>
<th>RFI filter type</th>
<th>Conduct emission. Maximum shielded cable length [m (ft)]</th>
<th>Radiated emission</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Industrial environment</td>
<td>Class A Group 1</td>
</tr>
<tr>
<td></td>
<td>Class A Group 1</td>
<td>Class B</td>
</tr>
<tr>
<td></td>
<td>Class B Housing, trades and light industries</td>
<td>Class A Group 1</td>
</tr>
<tr>
<td></td>
<td>Class B Housing, trades and light industries</td>
<td>Class B</td>
</tr>
<tr>
<td>EN 55011</td>
<td>Industrial environment</td>
<td>Industrial environ-</td>
</tr>
<tr>
<td></td>
<td>Industrial environment</td>
<td>ment</td>
</tr>
<tr>
<td>EN/IEC 61800-3</td>
<td>Category C3 Second environment</td>
<td>Category C2 First environment</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
<td>Category C1 First environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Category C2 First environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Category C1 First environment</td>
</tr>
<tr>
<td>H4 RFI filter (EN55011 A1, EN/IEC61800-3 C2)</td>
<td>Without external filter</td>
<td>Without external filter</td>
</tr>
<tr>
<td>0.25–11 kW (0.34–15 hp)</td>
<td>25 (82)</td>
<td>50 (164)</td>
</tr>
<tr>
<td>0.37–22 kW (0.5–30 hp)</td>
<td>25 (82)</td>
<td>50 (164)</td>
</tr>
<tr>
<td>H2 RFI filter (EN 55011 A2, EN/IEC 61800-3 C3)</td>
<td>Without external filter</td>
<td>Without external filter</td>
</tr>
<tr>
<td>15–45 kW (20–60 hp)</td>
<td>25 (82)</td>
<td>–</td>
</tr>
<tr>
<td>30–90 kW (40–120 hp)</td>
<td>25 (82)</td>
<td>–</td>
</tr>
<tr>
<td>0.75–18.5 kW (1–25 hp)</td>
<td>25 (82)</td>
<td>–</td>
</tr>
</tbody>
</table>
### RFI filter type

<table>
<thead>
<tr>
<th>RFI filter type</th>
<th>Conduct emission. Maximum shielded cable length [m (ft)]</th>
<th>Radiated emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>22–90 kW (30–120 hp) 3x380–480 V IP54</td>
<td>25 (82)</td>
<td>–</td>
</tr>
</tbody>
</table>

#### H3 RFI filter (EN55011 A1/B, EN/IEC 61800-3 C2/C1)

| 15–45 kW (20–60 hp) 3x200–240 V IP20 | – | – | 50 (164) | – | 20 (66) | – | Yes | – | No | – |
| 30–90 kW (40–120 hp) 3x380–480 V IP20 | – | – | 50 (164) | – | 20 (66) | – | Yes | – | No | – |
| 0.75–18.5 kW (1–25 hp) 3x380–480 V IP54 | – | – | 25 (82) | – | 10 (33) | – | Yes | – | No | – |
| 22–90 kW (30–120 hp) 3x380–480 V IP54 | – | – | 25 (82) | – | 10 (33) | – | Yes | – | No | – |

### 6.3 Special Conditions

#### 6.3.1 Derating for Ambient Temperature and Switching Frequency

Ensure that the ambient temperature measured over 24 hours is at least 5 °C (41 °F) lower than the maximum ambient temperature that is specified for the drive. If the drive is operated at a high ambient temperature, decrease the constant output current. For derating curve, see the VLT® HVAC Basic Drive FC 101 Design Guide.

#### 6.3.2 Derating for Low Air Pressure and High Altitudes

The cooling capability of air is decreased at low air pressure. For altitudes above 2000 m (6562 ft), contact Danfoss regarding PELV. Below 1000 m (3281 ft) altitude, derating is not necessary. For altitudes above 1000 m (3281 ft), decrease the ambient temperature or the maximum output current. Decrease the output by 1% per 100 m (328 ft) altitude above 1000 m (3281 ft) or reduce the maximum ambient temperature by 1 °C (33.8 °F) per 200 m (656 ft).
6.4 General Technical Data

6.4.1 Protection and Features

- Electronic motor thermal protection against overload.
- Temperature monitoring of the heat sink ensures that the drive trips if there is overtemperature.
- The drive is protected against short circuits between motor terminals U, V, W.
- When a motor phase is missing, the drive trips and issues an alarm.
- When a mains phase is missing, the drive trips or issues a warning (depending on the load).
- Monitoring of the DC-link voltage ensures that the drive trips when the DC-link voltage is too low or too high.
- The drive is protected against ground faults on motor terminals U, V, W.

6.4.2 Mains Supply (L1, L2, L3)

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>200–240 V ±10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>380–480 V ±10%</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>525–600 V ±10%</td>
</tr>
<tr>
<td>Supply frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Maximum imbalance temporary between mains phases</td>
<td>3.0% of rated supply voltage</td>
</tr>
<tr>
<td>True power factor ((\lambda))</td>
<td>(\geq 0.9) nominal at rated load</td>
</tr>
<tr>
<td>Displacement power factor (cos(\phi)) near unity</td>
<td>(&gt;0.98)</td>
</tr>
<tr>
<td>Switching on the input supply L1, L2, L3 (power-ups) enclosure sizes H1–H5, I2, I3, I4</td>
<td>Maximum 1 time/30 s</td>
</tr>
<tr>
<td>Switching on the input supply L1, L2, L3 (power-ups) enclosure sizes H6–H10, I6–I8</td>
<td>Maximum 1 time/minute</td>
</tr>
<tr>
<td>Environment according to EN 60664-1</td>
<td>Overvoltage category III/pollution degree 2</td>
</tr>
</tbody>
</table>

The unit is suitable for use on a circuit capable of delivering not more than 100000 A\(_{\text{rms}}\), symmetrical Amperes, 240/480 V maximum.

6.4.3 Motor Output (U, V, W)

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>0–100% of supply voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency</td>
<td>0–400 Hz</td>
</tr>
<tr>
<td>Switching on output</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Ramp times</td>
<td>0.05–3600 s</td>
</tr>
</tbody>
</table>

6.4.4 Cable Length and Cross-section

<table>
<thead>
<tr>
<th>Maximum motor cable length, shielded/armored (EMC-correct installation)</th>
<th>See 6.2 EMC Emission Test Results.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum motor cable length, unshielded/unarmoured</td>
<td>50 m (164 ft)</td>
</tr>
<tr>
<td>Maximum cross-section to motor, mains</td>
<td>See 6.1.2 3x380–480 V AC for more information</td>
</tr>
<tr>
<td>Cross-section DC terminals for filter feedback on enclosure sizes H1–H3, I2, I3, I4</td>
<td>4 mm(^2)/11 AWG</td>
</tr>
<tr>
<td>Cross-section DC terminals for filter feedback on enclosure sizes H4–H5</td>
<td>16 mm(^2)/6 AWG</td>
</tr>
<tr>
<td>Maximum cross-section to control terminals, rigid wire</td>
<td>2.5 mm(^2)/14 AWG</td>
</tr>
<tr>
<td>Maximum cross-section to control terminals, flexible cable</td>
<td>2.5 mm(^2)/14 AWG</td>
</tr>
</tbody>
</table>
Minimum cross-section to control terminals 0.05 mm²/30 AWG

6.4.5 Digital Inputs

Programmable digital inputs 4
Terminal number 18, 19, 27, 29
Logic PNP or NPN
Voltage level 0–24 V DC
Voltage level, logic 0 PNP <5 V DC
Voltage level, logic 1 PNP >10 V DC
Voltage level, logic 0 NPN >19 V DC
Voltage level, logic 1 NPN <14 V DC
Maximum voltage on input 28 V DC
Input resistance, \( R_i \) Approximately 4 kΩ
Digital input 29 as thermistor input Fault: >2.9 kΩ and no fault: <800 Ω
Digital input 29 as pulse input Maximum frequency 32 kHz push-pull-driven & 5 kHz (O.C.)

6.4.6 Analog Inputs

Number of analog inputs 2
Terminal number 53, 54
Terminal 53 mode Parameter 16-61 Terminal 53 Setting: 1 = voltage, 0 = current
Terminal 54 mode Parameter 16-63 Terminal 54 Setting: 1 = voltage, 0 = current
Voltage level 0–10 V
Input resistance, \( R_i \) Approximately 10 kΩ
Maximum voltage 20 V
Current level 0/4–20 mA (scalable)
Input resistance, \( R_i \) <500 Ω
Maximum current 29 mA
Resolution on analog input 10 bit

6.4.7 Analog Outputs

Number of programmable analog outputs 2
Terminal number 42, 45
Current range at analog output 0/4–20 mA
Maximum load to common at analog output 500 Ω
Maximum voltage at analog output 17 V
Accuracy on analog output Maximum error: 0.4% of full scale
Resolution on analog output 10 bit

1 Terminals 42 and 45 can also be programmed as digital outputs.
### 6.4.8 Digital Output

Number of digital outputs

**Terminals 27 and 29**

- Terminal number: 27, 29
- Voltage level at digital output: 0–24 V
- Maximum output current (sink and source): 40 mA

**Terminals 42 and 45**

- Terminal number: 42, 45
- Voltage level at digital output: 17 V
- Maximum output current at digital output: 20 mA
- Maximum load at digital output: 1 kΩ

---

1. Terminals 27 and 29 can also be programmed as input.
2. Terminals 42 and 45 can also be programmed as analog output.

The digital outputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

### 6.4.9 Control Card, RS485 Serial Communication

- Terminal number: 68 (P, TX+, RX+), 69 (N, TX-, RX-)
- Terminal number: 61 common for terminals 68 and 69

### 6.4.10 Control Card, 24 V DC Output

- Terminal number: 12
- Maximum load: 80 mA

### 6.4.11 Relay Output

Programmable relay outputs: 2

- Relay 01 and 02 (enclosure size H1–H5 & I2–I4)
  - Terminal number: 01–03 (NC), 01–02 (NO), 04–06 (NC), 04–05 (NO)
  - Maximum terminal load (AC-1)\(^{(1)}\) on 01–02/04–05 (NO) (resistive load): 250 V AC, 3 A
  - Maximum terminal load (AC-15)\(^{(1)}\) on 01–02/04–05 (NO) (inductive load @ cosφ 0.4): 250 V AC, 0.2 A
  - Maximum terminal load (DC-1)\(^{(1)}\) on 01–02/04–05 (NO) (resistive load): 30 V DC, 2 A
  - Maximum terminal load (DC-13)\(^{(1)}\) on 01–02/04–05 (NO) (inductive load): 24 V DC, 0.1 A
  - Maximum terminal load (AC-1)\(^{(2)}\) on 01–03/04–06 (NC) (resistive load): 250 V AC, 3 A
  - Maximum terminal load (AC-15)\(^{(1)}\) on 01–03/04–06 (NC) (inductive load @ cosφ 0.4): 250 V AC, 0.2 A
  - Maximum terminal load (DC-1)\(^{(1)}\) on 01–03/04–06 (NC) (resistive load): 30 V DC, 2 A
  - Minimum terminal load on 01–03 (NC), 01–02 (NO): 24 V DC 10 mA, 24 V AC 20 mA

---

\(^{(1)}\) IEC 60947 parts 4 and 5. Endurance of the relay varies with different load type, switching current, ambient temperature, driving configuration, working profile, and so forth. It is recommended to mount a snubber circuit when connecting inductive loads to the relays.
Programmable relay outputs

Relay 01 terminal number (enclosure size H9) 01–03 (NC), 01–02 (NO) (resistive load) 240 V AC, 2 A

Maximum terminal load (AC-1)\(^{(1)}\) on 01–03 (NC), 01–02 (NO) \(\cos \varphi 0.4\) 240 V AC, 0.2 A

Maximum terminal load (AC-15)\(^{(1)}\) (inductive load @ \(\cos \varphi 0.4\)) 240 V AC, 0.2 A

Maximum terminal load (DC-1)\(^{(1)}\) (resistive load) 60 V DC, 1 A

Maximum terminal load (DC-13)\(^{(1)}\) (inductive load) 24 V DC, 0.1 A

Relay 01 and 02 terminal number (enclosure size H6, H7, H8, H9 (relay 2 only), H10, and I6–I8) 01–03 (NC), 01–02 (NO), 04–06 (NC), 04–05 (NO) (resistive load) 240 V AC, 2 A

Maximum terminal load (AC-1)\(^{(1)}\) on 04–05 (NO) \(\cos \varphi 0.4\) 240 V AC, 0.2 A

Maximum terminal load (AC-15)\(^{(1)}\) on 04–05 (NO) \(\cos \varphi 0.4\) 240 V AC, 0.2 A

Maximum terminal load (DC-1)\(^{(1)}\) on 04–05 (NO) (resistive load) 80 V DC, 2 A

Maximum terminal load (DC-13)\(^{(1)}\) on 04–05 (NO) (inductive load) 24 V DC, 0.1 A

Maximum terminal load (AC-15)\(^{(1)}\) on 04–06 (NC) (resistive load) 240 V AC, 2 A

Maximum terminal load (AC-15)\(^{(1)}\) on 04–06 (NC) \(\cos \varphi 0.4\) 240 V AC, 0.2 A

Maximum terminal load (DC-1)\(^{(1)}\) on 04–06 (NC) (resistive load) 50 V DC, 2 A

Maximum terminal load (DC-13)\(^{(1)}\) on 04–06 (NC) (inductive load) 24 V DC, 0.1 A

Minimum terminal load on 01–03 (NC), 01–02 (NO), 04–06 (NC), 04–05 (NO) 24 V DC 10 mA, 24 V AC 20 mA

Environment according to EN 60664\(^{(1)}\) Overvoltage category III/pollution degree 2

---

\(^{1}\) IEC 60947 parts 4 and 5. Endurance of the relay varies with different load type, switching current, ambient temperature, driving configuration, working profile, and so forth. It is recommended to mount a snubber circuit when connecting inductive loads to the relays.

\(^{2}\) Overvoltage Category II.

\(^{3}\) UL applications 300 V AC 2 A.

### 6.4.12 Control Card, 10 V DC Output

<table>
<thead>
<tr>
<th>Terminal number</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>10.5 V ±0.5 V</td>
</tr>
<tr>
<td>Maximum load</td>
<td>25 mA</td>
</tr>
</tbody>
</table>

### 6.4.13 Ambient Conditions

<table>
<thead>
<tr>
<th>Enclosure protection rating</th>
<th>IP20, IP54 (not for outdoor installation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure kit available</td>
<td>IP21, TYPE 1</td>
</tr>
<tr>
<td>Vibration test</td>
<td>1.0 g</td>
</tr>
<tr>
<td>Maximum relative humidity</td>
<td>5–95% (IEC 60721-3-3; Class 3K3 (non-condensing)) during operation</td>
</tr>
<tr>
<td>Aggressive environment (IEC 60721-3-3), coated (standard) enclosure sizes H1–H5</td>
<td>Class 3C3</td>
</tr>
<tr>
<td>Aggressive environment (IEC 60721-3-3), non-coated enclosure sizes H6–H10</td>
<td>Class 3C2</td>
</tr>
<tr>
<td>Aggressive environment (IEC 60721-3-3), coated (optional) enclosure sizes H6–H10</td>
<td>Class 3C3</td>
</tr>
</tbody>
</table>
### Aggressive environment (IEC 60721-3-3)
- Class 3C2

### Test method according to IEC 60068-2-43 H2S (10 days)

<table>
<thead>
<tr>
<th>Ambient temperature (°C)</th>
<th>See maximum output current at 40/50 °C (104/122 °F) in 6.1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum ambient temperature during full-scale operation</td>
<td>0 °C (32 °F)</td>
</tr>
<tr>
<td>Minimum ambient temperature at reduced performance, enclosure sizes H1–H5 and I2–I4</td>
<td>-20 °C (-4 °F)</td>
</tr>
<tr>
<td>Minimum ambient temperature at reduced performance, enclosure sizes H6–H10 and I6–I8</td>
<td>-10 °C (14 °F)</td>
</tr>
<tr>
<td>Temperature during storage/transport</td>
<td>-30 to +65/70 °C (-22 to +149/158°F)</td>
</tr>
<tr>
<td>Maximum altitude above sea level without derating</td>
<td>1000 m (3281 ft)</td>
</tr>
<tr>
<td>Maximum altitude above sea level with derating</td>
<td>3000 m (9843 ft)</td>
</tr>
</tbody>
</table>

### Derating for high altitude
- See 6.3.2 Derating for Low Air Pressure and High Altitudes.

### Safety standards
- EN/IEC 61800-5-1, UL 508C
- EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
- EN 61800-3, EN 61000-3-12, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

### Energy efficiency class
- IE2

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1 Refer to Special Conditions in the design guide for:
- Derating for high ambient temperature.
- Derating for high altitude.

2 Determined according to EN 50598-2 at:
- Rated load.
- 90% rated frequency.
- Switching frequency factory setting.
- Switching pattern factory setting.
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