# Quick Start Manual for Set-up

# Frequency Inverter

# Series KFU 210- / 410-

0,25 to 9,2 kW – 230 V – KFU 210-
0,25 to 400 kW – 400 V – KFU 410-
>400 kW to 1,6 MW  On Request

KN 621.1710 EN

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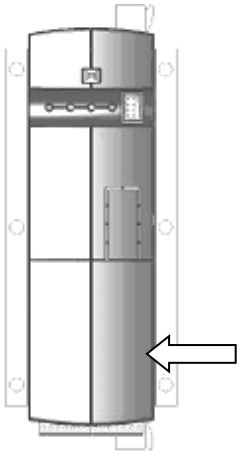
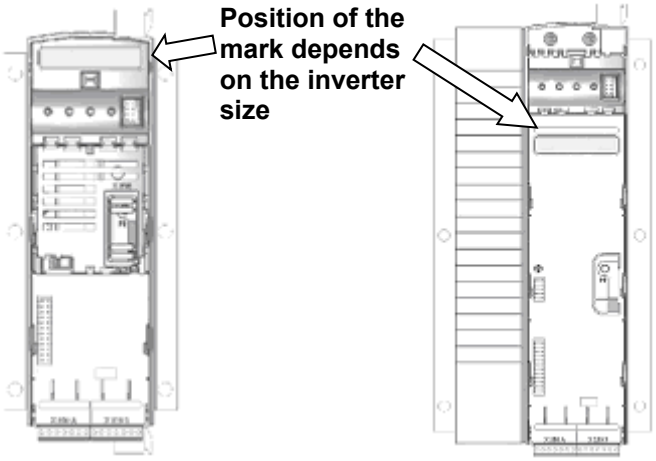
# 1 General Information

This documentation describes the first steps for easy commissioning of frequency inverters series KFU 210- / 410-.

This series can be recognized by its label on the case and the identification below the top cover.






## 1.1 Safety Instructions

**WARNING**

- Note and follow all safety and usage instructions in this manual.
- This manual must be read before installation and commissioning of the frequency inverter.
- Non-compliance with the safety and usage instructions may result in death, serious injuries and significant material damage.
- Only qualified technical personnel who is familiar with the installation, commissioning and use of frequency inverters may work on the frequency inverter.
- The electrical installation must be carried out by qualified electricians according to the general and regional safety and installation directives.
- Persons not familiar with the operation of the frequency inverter and children must not have access to the device.
- When working at the frequency inverter, comply with the relevant accident prevention regulations, the applicable standards BGV A2 (VBG 4), VDE 0100, standards governing work on systems with dangerous voltages (e.g. EN 50178) and other national directives.
- Prior to commissioning and start of operation as intended, all covers must be fixed, all standard equipment components of the frequency inverter must be installed, and the terminals must be checked.
- No connection work shall be carried out while power supply is on.
- Do not touch any terminals as long as the DC-link capacitors are charged.
  Sizes 1 through 7 (up to 132 kW): The DC-link may have dangerous voltage levels even up to 3 minutes after shutdown.
  Size 8 (as from 160 kW): The DC-link may have dangerous voltage levels even up to 10 minutes after shutdown.

**WARNING**!

- Do not touch the heat sink of the frequency inverter during operation. Danger of burns due to high surface temperatures.
- Do not remove any covers of the frequency inverter during operation.
- Please note that Küenle Antriebssysteme will not accept any responsibility for compatibility with third-party products (e.g. motors, cables, filters, etc.). If you use the device in combination with third-party products, you do so at your own risk.
- The earth leakage current of the frequency inverter may exceed AC 3.5 mA or DC 10 mA.
- Please note (according to EN61800-5-1): This product may cause direct current in the protective earth conductor. Where residual current devices (RCD) or residual current monitors (RCM) are used as a protection against direct or indirect contact, only RCDs / RCMs of Type B are permissible on the power supply side of this product.
- Do not touch electronic components or contacts.
- Defective components must not be put into operation.
- Any repair work may only be carried out by the manufacturer or persons approved/licensed by the manufacturer.
- Any repair work must be carried out by qualified electricians.
- Except for modifications described in this document, the frequency inverter must not be changed in any way.
- Do not connect inappropriate voltage sources.
- Keep the instructions accessible to the user.

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**NOTE**

The frequency inverter may be connected to power supply every 60 s.

This must be considered when operating a mains contactor in jog operation mode. For commissioning or after an emergency stop, a non-recurrent, direct restart is permissible.

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**NOTE**

For more information about the range of functions of the frequency inverter and about operation, maintenance and storage, refer to the co-applicable Operating Instructions.

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## 1.2 Designated use

The product is a frequency inverter. It is designed for

- installation in machines and electrical equipment
- industrial environments

The frequency inverters are electrical drive components intended for stationary installation in electrical cabinets of industrial plants or machines. They may only be used for driving asynchronous three-phase squirrel cage motors or permanently excited three-phase synchronous motors which are designed for operation with frequency inverters. Where built-in motor temperature sensors are evaluated via the frequency inverter, a double/reinforced insulation of the temperature sensor against the motor winding must be provided according to DIN EN 61800-5-1.

Commissioning and start of operation is not allowed until it has been verified that the machine meets the requirements of the EC Machinery Directive 2006/42/EC and DIN EN 60204-1.

The frequency inverters meet the requirements of the low voltage directive 2006/95/EEC and DIN EN 61800-5-1. CE-labeling is based on these standards. Responsibility for compliance with the EMC Directive 2004/108/EC lies with the operator.

Frequency inverters are only available at specialized dealers and are exclusively intended for commercial use as per EN 61000-3-2.

No capacitive loads may be connected to the frequency inverter.

## 1.3 Transport and strorage

- Ambient temperature: -25 ... 55 °C
- Relative humidity: 5 ... 95%, no water condensation
- Store product in its original package in dust-free room.
- Avoid high temperatures.
- After one year of storage, connect the device to mains voltage for 60 minutes.

## 1.4 After unpacking

- Check if the delivered devices corresponds to the order.
- Check the device for transport damage and completeness.
- Any defects/damage must be reported to the supplier immediately.

## 1.5 Place of installation

- In rooms without weather exposure.
- Avoid direct insolation.
- Avoid dust.
- Not in the neighborhood of strong electromagnetic fields.
- Not in the neighborhood of inflammable material.
- Provide for sufficient cooling. Install a fan if the frequency inverter is installed in a closed electrical cabinet.
- Altitude of installation: ≤ 4000 m, above 1000 m with reduced power (reduced output current).
- Ingress protection rating of frequency inverter: IP20.
- The frequency inverter produces noise. For this reason it should be installed in areas where people normally don't stay.
- Noise emission in operation is < 85 dB(A) in the case of sizes 1 through 7.
- Noise emission in operation is approx. 86 dB(A) in the case of size 8. Ear protectors must be used when staying near the frequency inverter
- Use of the device in explosive atmospheres is not permitted.

## 1.6 Operation conditions

- Size 1…7:

  Ambient temperature: 0…55°C, as from 40°C, power reduction of 2.5% / K should be considered.
- Size 8

  Ambient temperature: -25…55°C, as from 45°C, power reduction of 2.5% / K should be considered.
- Relative humidity: 5 ... 85%, no water condensation
- Ambient pressure: 70 ... 106 kPa to be checked
- The frequency inverter may be operated in TN, TT and IT grid types.
- Operation in a corner-grounded TN grid shall not be permissible.
- Environment specification: Pollution degree 2 and overvoltage category III (IEC 60664-1 /DIN VDE 0110-1).
- The frequency inverter may be connected to power supply every 60 s. If the unit is switched on more frequently, it may be damaged. This must be considered when operating a mains contactor in jog operation mode.
- Max. permissible expected short circuit current at mains connection:
- up to 132 kW device power (Size 7): 5 kA;
- 160…250 kW device power (size 8): 18 kA
- as from 315 kW device power (size 8): 30 kA

# 2 Frequency inverter – type

- Identify the type of frequency inverter.
- Check if frequency inverter rated voltage matches the local mains voltage.

## 2.1 Identifications on the data plate

- Type identifier, e.g. KFU 410-075/37/1.5 xxxx
  - 410: Rated voltage 400 V (or 210: = rated voltage 230 V)
  - 075: Rated current = identifier
  - 37: Recommended power
  - 1,5: …-x Rated torque
  - xxxx: Special design, where applicable
- Marking for UL508c (where applicable)
- Part number
- Serial number
- Warning symbols


Warning! Components sensitive to electrostatic energy.


Warning! High leakage current.


Warning! Dangerous voltage. Danger of electric shock.


Warning! Hot surface,

| Identifier | Size | Recommended power KFU 210: AC 1x230V / 3x230V |
|---|---|---|
| -1,6 | 1 | 0,25 kW |
| -2,5 | | 0,37 kW |
| -3,0 | | 0,55 kW |
| -4,0 | | 0,75 kW |
| -5,4 | | 1,1 kW |
| -7,0 | 2 | 1,5 kW |
| -9,5 | | 2,2 kW |
| -12,5 | | 3,0 kW[1)] |
| -18,0 | 3 | 4,0 kW |
| -22,0 | | 5,5 kW[2)] |
| -32,0 | 4 | 7,5 kW[2)] |
| -35,0 | | 9,2 kW[2)] |
| -32 | 4 | 15,0 kW |
| -40 | 5 | 18,5 kW |
| -45 | | 22,0 kW |
| -60 | | 30,0 kW |
| -75 | 6 | 37,0 kW |
| -90 | | 45,0 kW |
| -110 | | 55,0 kW |
| -125 | | 65,0 kW |
| -150 | 7 | 75,0 kW |
| -180 | | 90,0 kW |
| -210 | | 110,0 kW |
| -250 | | 132,0 kW |
| -305 | 8 | 160,0 kW |
| -380 | | 200,0 kW |
| -475 | | 250,0 kW |
| -595 | | 315,0 kW |

| Identifier | Size | Recommended power KFU 410: AC 3x400V |
|---|---|---|
| -1,0 | 1 | 0,25 kW |
| -1,6 | | 0,37 kW |
| -1,8 | | 0,55 kW |
| -2,4 | | 0,75 kW |
| -3,2 | | 1,1 kW |
| -3,8 | | 1,5 kW |
| -4,2 | 2 | 1,85 kW |
| -5,8 | | 2,2 kW |
| -7,8 | | 3,0 kW |
| -9,0 | | 4,0 kW |
| -14,0 | 3 | 5,5 kW |
| -18,0 | | 7,5 kW |
| -22 | | 9,2 kW |
| -25 | 4 | 11,0 kW |
| -645 | | 355,0 kW |
| -735 | | 400,0 kW |

| Identifier | Size | Recommended power KFU 510: AC 3x525V KFU 610: AC 3x690V |
|---|---|---|
| | 8 | 160,0 kW |
| | | 200,0 kW |
| | | 250,0 kW |
| | | 315,0 kW |
| | | 355,0 kW |
| | | 400,0 kW |

[1)] Maximum output current = 9.5 A with single-phase and two-phase connection

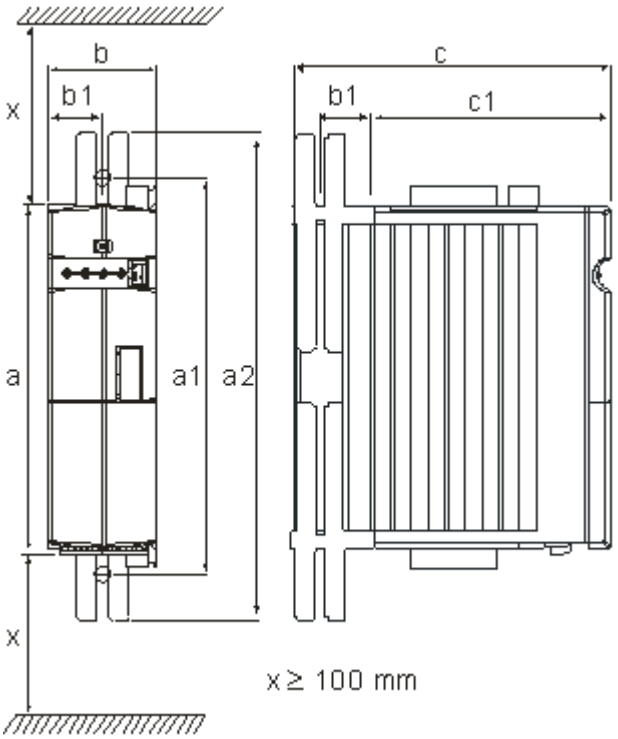
[2)] Three-phase connection permissible only.

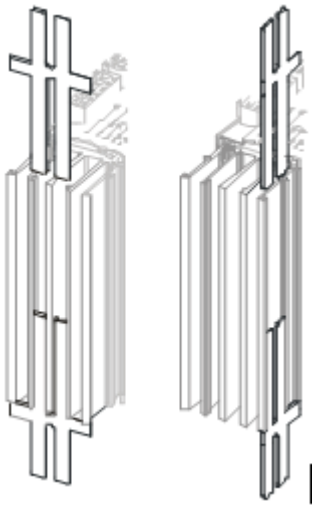
# 3 Mechanical Installation

**WARNING**!

- During installation, comply with the following installation and safety instructions as well as the installation and safety instructions of the co-applicable documents.
- Mount the devices with sufficient clearance to other components so that the cooling air can circulate freely. Avoid soiling by grease and air pollution by dust, aggressive gases, etc.
- Make sure that no foreign particles (e.g. dust, chips, wires, screws, tools) can get inside the frequency inverter.
- Install the frequency inverter on a non-flammable surface.
- The frequency inverter may only be installed in vertical position.
- Screw the frequency inverter on a metal surface (unpainted).
- The frequency inverter must be grounded.
- For equipotential bonding, connect the frequency inverter, electrical cabinet, motor case, filter, etc. to a common grounding point via short cables.

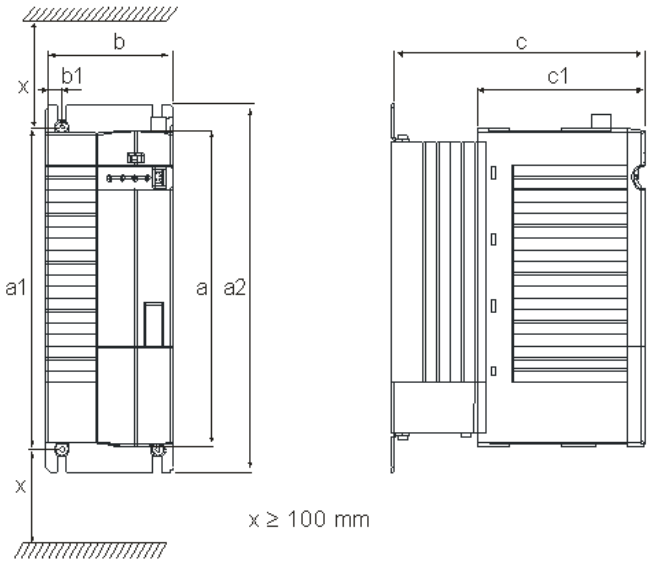
### 3.1.1 KFU 210 sizes 1 and 2 (up to 3,0 kW) – KFU 410 sizes 1 and 2 (up to 4,0 kW)

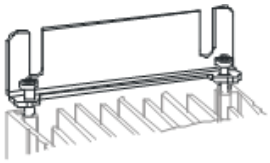


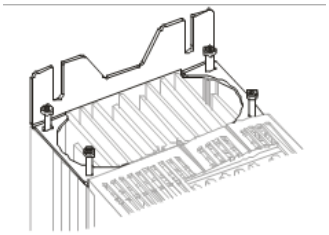



Screw fixing brackets to heat sink and mounting plate.

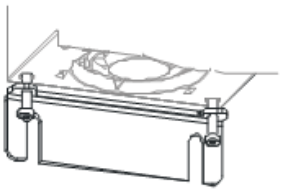
### 3.1.2 KFU 210 sizes 3 and 4 (4,0 - 9,2 kW) – KFU 410 sizes 3 and 4 (5,5 – 15 kW)

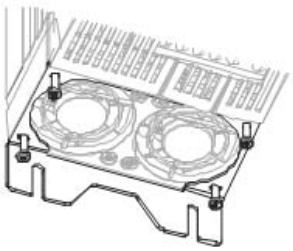




Top fixing bracket
(screws M4x20)

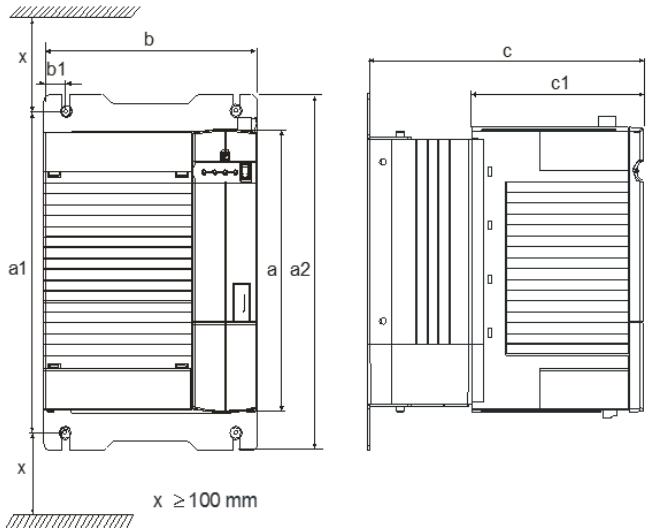


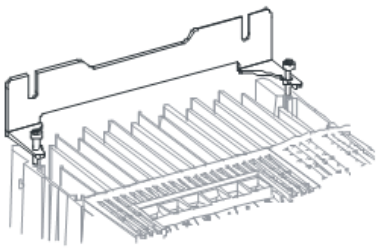


Bottom fixing bracket
(screws M4x60)

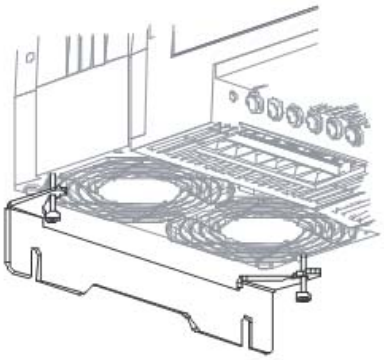
Screw fixing brackets to heat sink and mounting plate.

### 3.1.3 KFU 410 size 5 (18,5 – 30 kW)



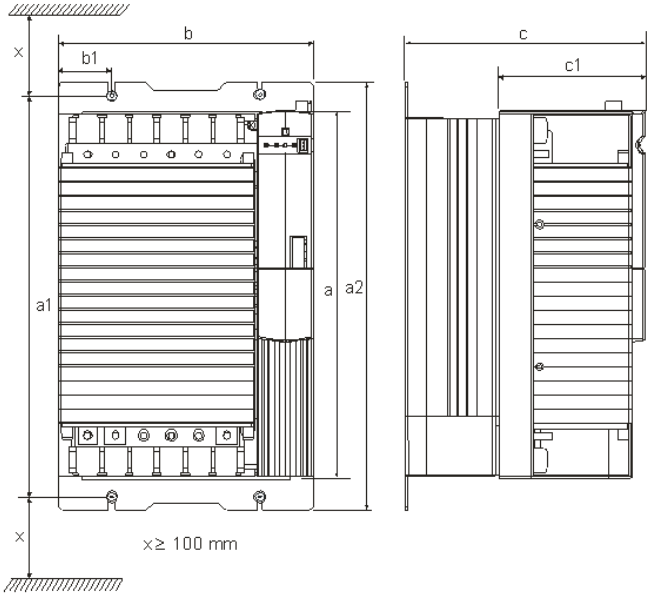
Top screw fixture
M4x20

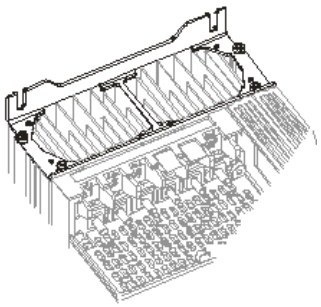


Bottom screw
fixture M4x70

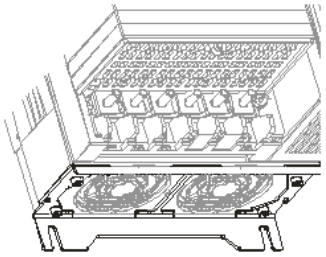
Screw fixing brackets to heat sink of frequency inverter and mounting plate.

### 3.1.4 KFU 410 size 6 (37 - 65 kW)



Top screw fixture M5x20



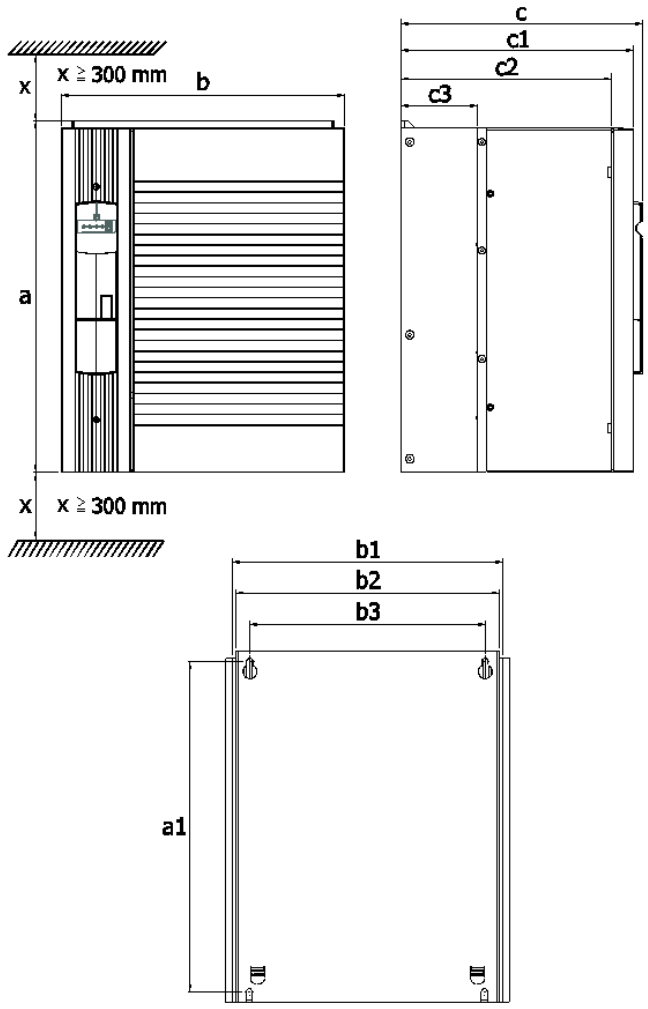
Bottom screw fixture M5x20

Screw fixing brackets to heat sink of frequency inverter and mounting plate.

### 3.1.5 Dimensions without optional components

| | Dimensions in mm | | | | Assenmbly dimensions in mm | | | |
|---|---|---|---|---|---|---|---|---|
| | **kW** | **a** | **b** | **c** | **a1** | **a2** | **b1** | **c1** |
| **KFU 210** | **0,25…1,1** | 190 | 60 | 178 | 210…230 | 260 | 30 | 133 |
| | **1,5…3,0** | 250 | 60 | 178 | 270…290 | 315 | 30 | 133 |
| | **4,0…5,5** | 250 | 100 | 200 | 270...290 | 315 | 12 | 133 |
| | **7,5…9,2** | 250 | 125 | 200 | 270...290 | 315 | 17,5 | 133 |
| **KFU 410** | **0,55…1,5** | 190 | 60 | 178 | 210…230 | 260 | 30 | 133 |
| | **1,85…4,0** | 250 | 60 | 178 | 270…290 | 315 | 30 | 133 |
| | **5,5…9,2** | 250 | 100 | 200 | 270...290 | 315 | 12 | 133 |
| | **11,0…15,0** | 250 | 125 | 200 | 270...290 | 315 | 17,5 | 133 |
| | **18,5…30,0** | 250 | 200 | 260 | 270…290 | 315 | 20 | 160 |
| | **37,0…65,0** | 400 | 275 | 260 | 425…445 | 470 | 20 | 160 |

### 3.1.6 KFU 410 size 7 (75 - 132 kW)



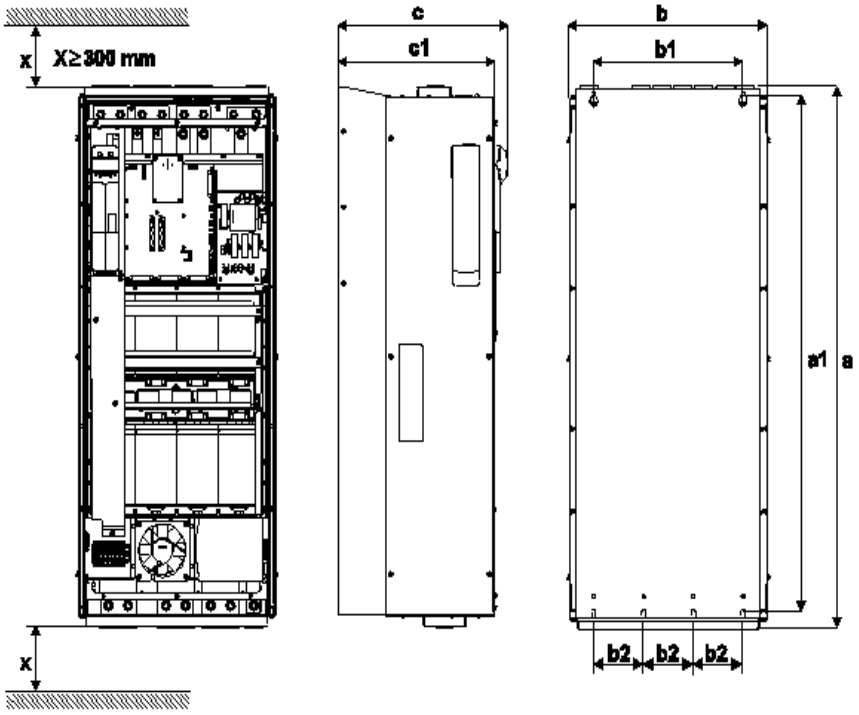

The diameter of the fixing holes is 9 mm.

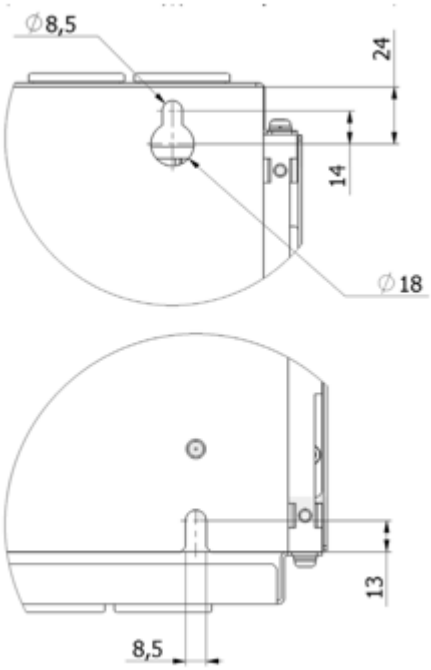
Screw the rear wall of the frequency inverter heat sink to the mounting plate.

### 3.1.7 Dimensions without optional components size 7

| | Dimensions in mm | | | | Assembly dimensions in mm | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **KFU410** | **kW** | a | b | c | a1 | b1 | b2 | b3 | c1 | c2 | c3 |
| | **75,0…132,0** | 510 | 412 | 351 | 480 | 392 | 382 | 342 | 338 | 305 | 110 |

### 3.1.8 KFU 410 / KFU 510 / KFU 610 size 8 (160 – 400 kW)




The diameter of the fixing holes is 8.5 mm.

Screw the rear wall of the frequency inverter heat sink to the mounting plate.

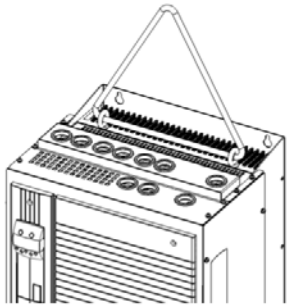
### 3.1.9 Dimensions without optional components size 8

| | Dimensions in mm | | | | Assembly dimensions in mm | | | |
|---|---|---|---|---|---|---|---|---|
| Type | **kW** | a | b | c | a1 | b1 | b2 | c1 |
| **KFU410**<br>**KFU510**<br>**KFU610** | 160,0...400,0 | 1067 | 439 | 375 | 1017 | 330 | 110 | 345 |

**NOTE**

Before unpacking the frequency inverter, transfer it as close as possible to the designated place of installation.

- First, remove the protective packaging.
- Screw 2 crane eyebolts into the threads provided for that purpose.
- Use the crane eyebolts and a crane for lifting, handling and installation. The crane must be of a design that it can carry the weight of the frequency inverter.



# 4 Electrical installation

⚠ **DANGER** !

- The five safety rules must be complied with.
- Disconnect the frequency inverter from mains voltage (AC and DC) and protect it against being energized unintentionally.
- Verify safe isolation from power supply.
- When the frequency inverter is disconnected from power supply, the mains, DC-link voltage and motor terminals may still be live for some time. Wait for some minutes until the DC link capacitors have discharged before starting to work at the unit.
- Sizes 1 through 7 (up to 132 kW): The DC-link may have dangerous voltage levels even up to 3 minutes after shutdown.
- Size 8 (as from 160 kW): The DC-link may have dangerous voltage levels even up to 10 minutes after shutdown.
- Switch off power supply before connecting or disconnecting the mains cables to/from terminal X1, and the motor cables and braking resistor to X2.

**NOTE**

- The cables connected to the frequency inverters may not be subjected to high-voltage insulation tests.
- Use copper cables designed for an ambient temperature of at least 30 °C.
- In the case of UL/CSA installations: Only use 75°C copper cables.
- The earth leakage current of the frequency inverter may exceed AC 3.5 mA or DC 10 mA.

**NOTE**

Please note (according to EN61800-5-1):

- This product may cause direct current in the protective earth conductor. Where residual current de-vices (RCD) or residual current monitors (RCM) are used as a protection against direct or indirect contact, only RCDs / RCMs of Type B are permissible on the power supply side of this product.

## 4.1 EMC information and connection

The frequency inverter is designed according to the requirements and limit values of product norm EN 61800-3 with an interference immunity factor (EMI) for operation in industrial applications. Electromagnetic interference is to be avoided by expert installation and observation of the specific product information.

**Measures**

Install the frequency inverters and commutating chokes on a metal mounting panel. Ideally, the mounting panel should be galvanized, not painted.

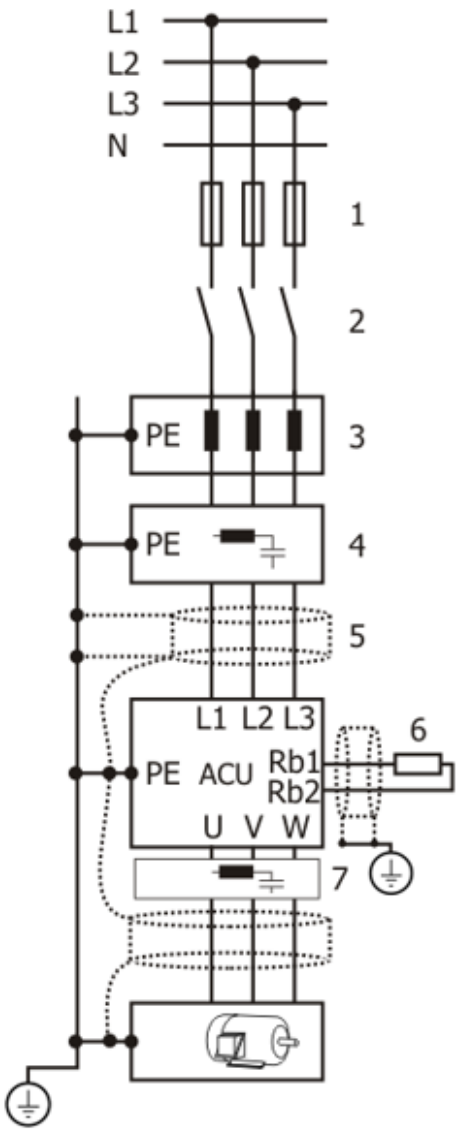
Provide proper equipotential bonding within the system or plant. Plant components such as electrical cabinets, control panels, machine frames must be connected by means of PE cables, i.e. sufficient area and with good conductivity.

The shield of the control cables is to be connected to ground potential properly, i.e. with good conductivity, on both sides (shield clamp). Mount shield clamps for cable shields close to the unit.

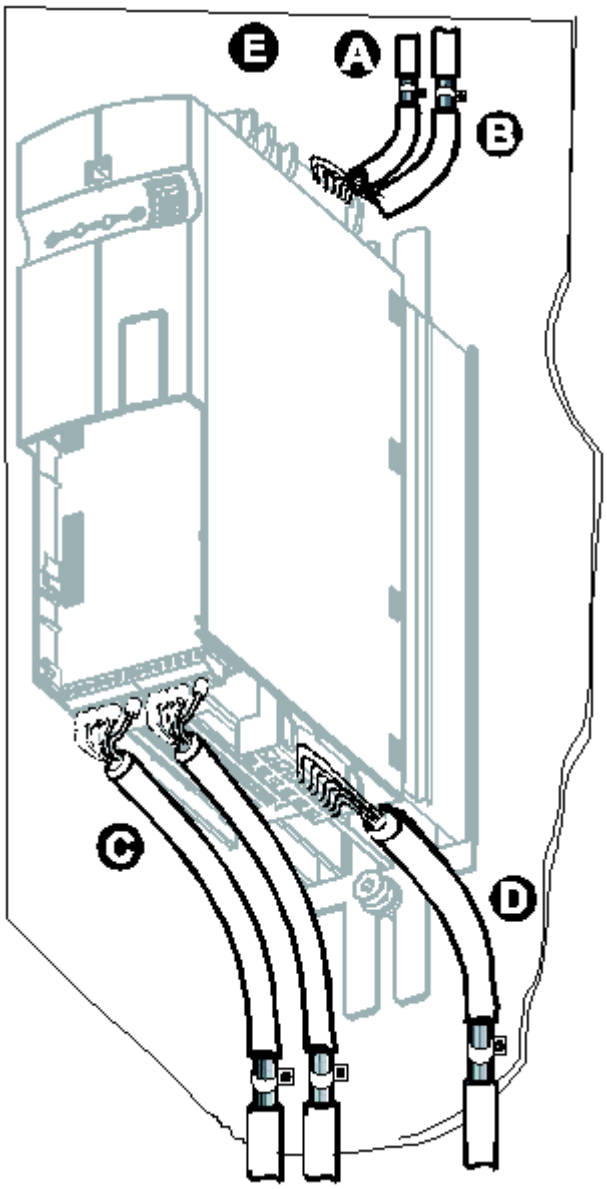
Connect the frequency inverter, the commutating choke, external filters and other components to an earthing point via short cables.

Excessive cable length and loosely suspended cabling must be avoided.

Contactors, relays and solenoids in the electrical cabinet are to be provided with suitable interference suppression components.




1. Fuse
2. Circuit breaker
3. Line choke (optional or mandatory)
4. Input filter (optional)
5. Cable shield (recommended)
6. Brake resistor (optional)
7. Output filter (optional)




**A** **Mains connection**

The mains supply cable may be as long as required. To be separated from control, data and motor cable.

**B** **DC-link connection**

The frequency inverter is to be connected to the same mains potential or a common direct voltage source. Cables with a length >300 mm must be shield-ed, the cable shield must be connected to the mounting plate on both sides. Use twisted cables where possible.

**C** **Control connection**

Control and signal cables must be kept physically separate from the power cables. Analog signal lines are to be connected to the shield potential on one side. Install sensor cables separate from motor cables.

The low voltage circuits (e.g. terminal X210A, X210B) are isolated from the main circuit (e.g. U, V, W) by way of safety isolation and safety impedance.

**D** **Motor and brake resistor**

The shield of the motor cable is to be connected to ground potential properly on both sides. On the motor side use a metal compression gland. On the frequency inverter side an appropriate shield clamp is to be used. The signal cable used for monitoring the motor temperature must be kept separate from the motor cable. Connect the shield of this line on both sides. If a braking resistor is used, the connection cable must also be shielded, and the shield is to be connected to earth potential on both sides.

**E** **Relay**

The relay enables using high-energy signals.

As from size 8, with AC 3x525 V or AC 3x690 V mains operation, terminal X13 must be connected additionally. Note the connection information for size 8.

**Line choke**

Line chokes reduce mains harmonics and reactive power. In addition, a longer service life of the frequency inverter is possible. When using a line choke, note that line chokes may reduce the maximum output voltage of the frequency inverter. The line choke must be installed between the mains connection and the input filter.

**Input filter**

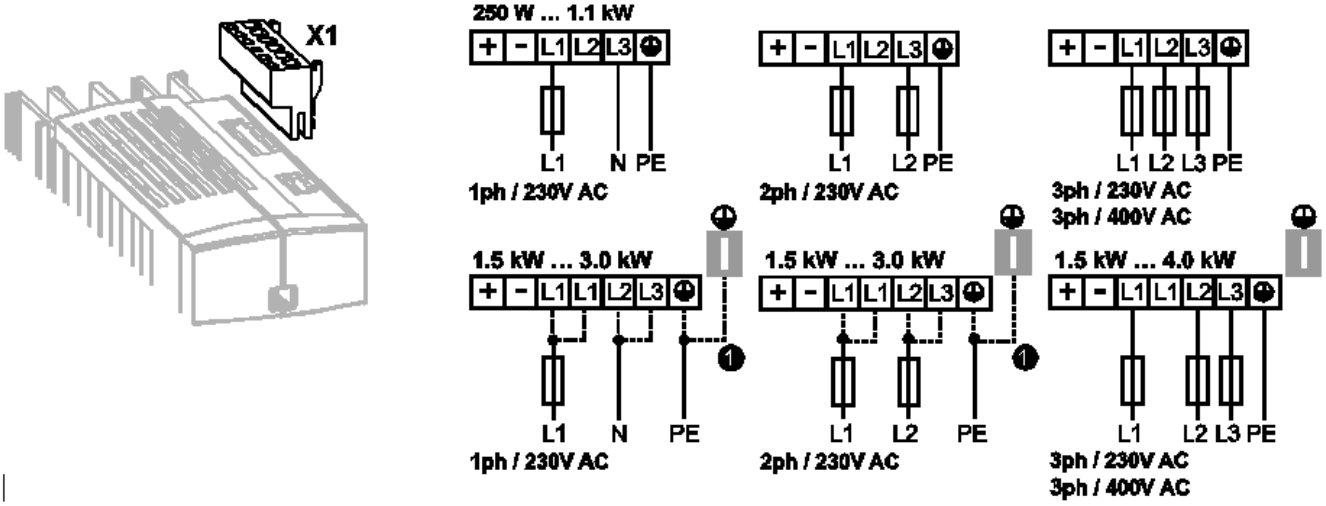
Input filters reduce grid-bound, high-frequency radio interference voltage. Install input filter on the mains side up-stream of the frequency inverter.

**Caution!**

The frequency inverters meet the requirements of the low-voltage directive 2006/95/EC and the requirements of the EMC directive 2004/108/EC. The EMC product standard EN 61800-3 relates to the drive system. The documentation provides information on how the applicable standards can be complied if the frequency inverter is a component of the drive system. The declaration of conformity is to be issued by the supplier of the drive system.

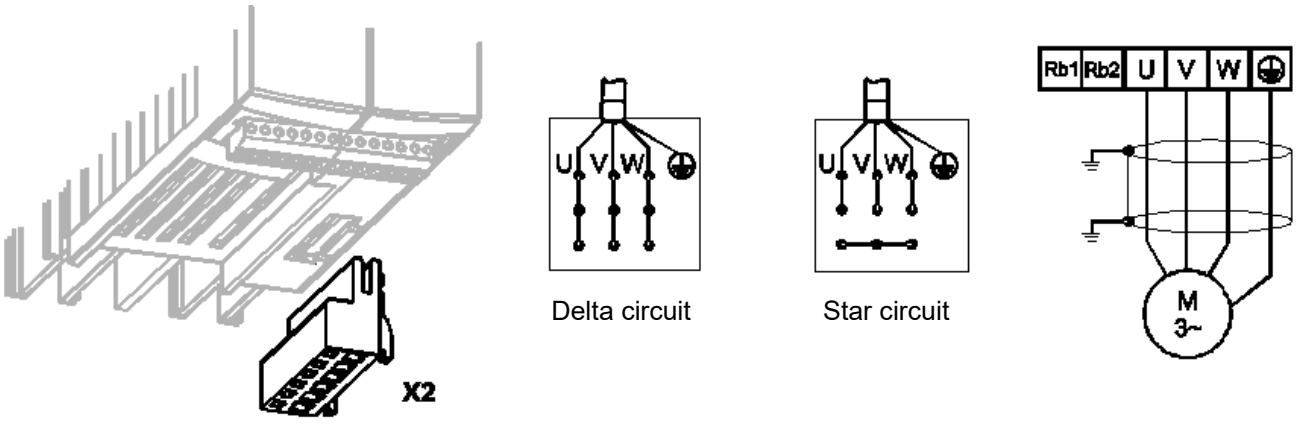
### 4.1.1 KFU 210 (up to 3,0 kW) and 410 (up to 4,0 kW)

Mains connection, X1




❶ With a mains current above 10 A, the mains power connection 230 V 1ph/N/PE and the mains power connection 230 V 2ph/N/PE are to be done on two terminals.

Motor connection

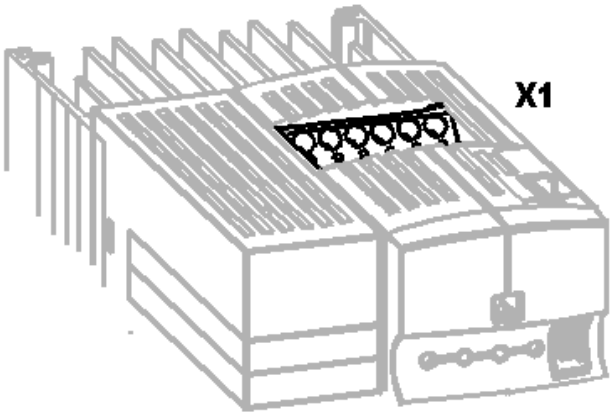


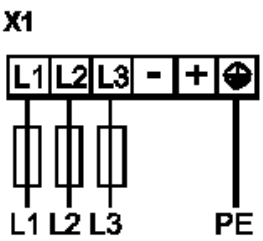

For connection of the ground conductor of the mains and motor cable, use the provided terminal connection options X1 and X2. Other connection options for connecting the mains and motor cable are not permissible.

For connection of a braking resistor, use terminals $R_{b1}$ and $R_{b2}$.

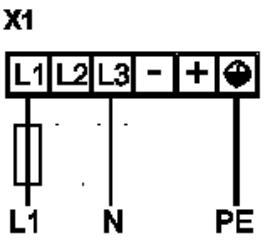
### 4.1.2 KFU 210 (4,0 to 9,2 kW) and 410 (5,5 and 15,0 kW)

**Mains connection**

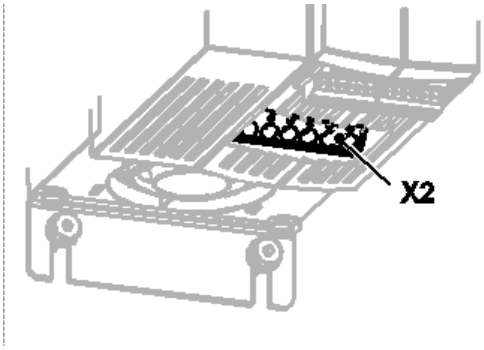


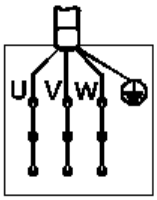




KFU 210-18,0

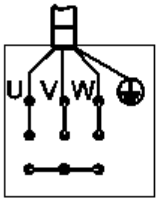



**Motor connection**

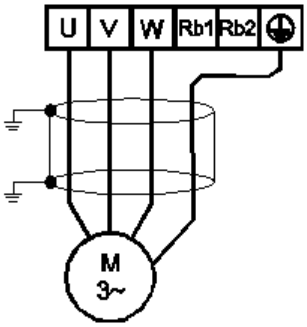



Delta circuit




Star circuit

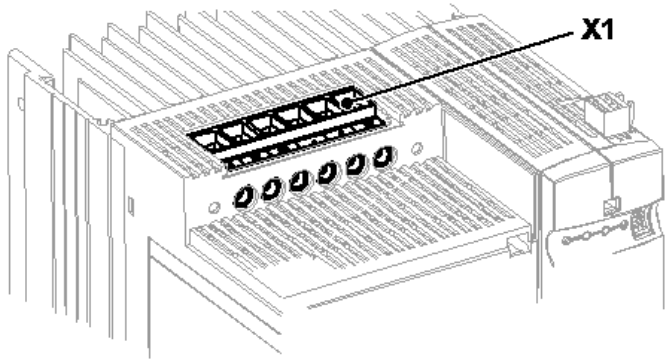


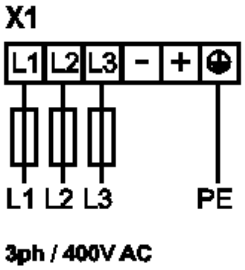

For connection of the ground conductor of the mains and motor cable, use the provided terminal connection options X1 and X2. Other connection options for connecting the mains and motor cable are not permissible.

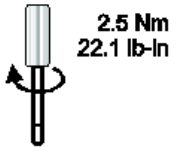
For connection of a braking resistor, use terminals $R_{b1}$ and $R_{b2}$.

### 4.1.3 KFU 410 (18,5 to 30 kW)

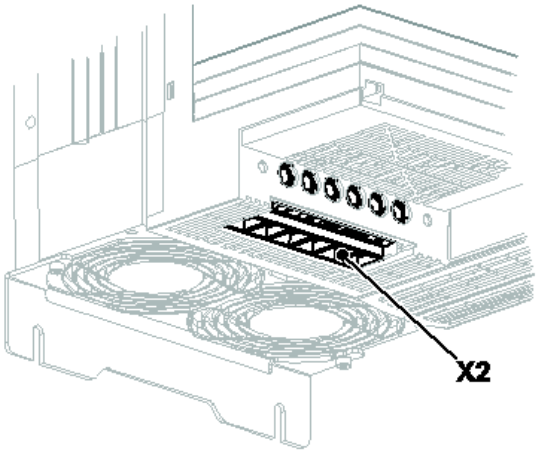
**Mains connection**

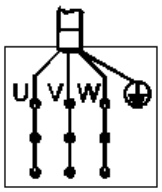


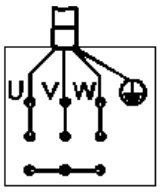




**Motor connection**

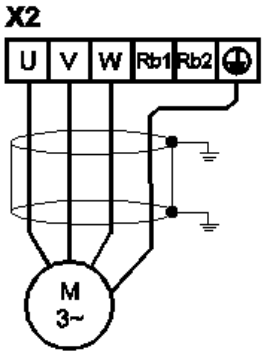


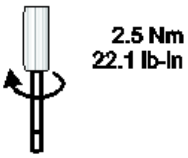




Delta circuit




Star circuit



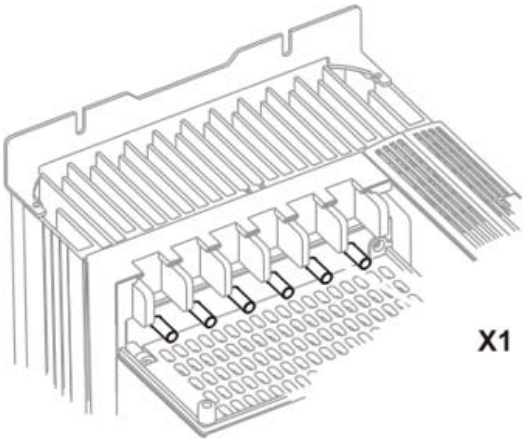



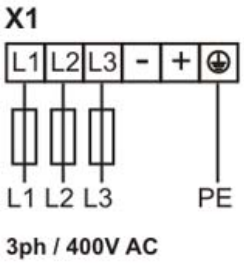

For connection of the ground conductor of the mains and motor cable, use the provided terminal connection options X1 and X2. Other connection options for connecting the mains and motor cable are not permissible.

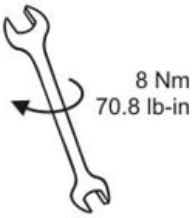
For connection of a braking resistor, use terminals $R_{b1}$ and $R_{b2}$.

### 4.1.4 KFU 410 (37 to 65 kW)

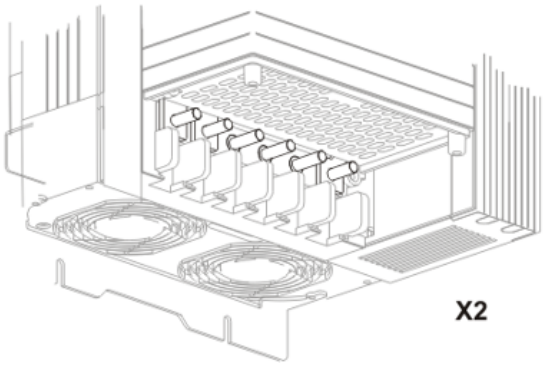
**Mains connection**

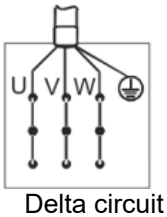


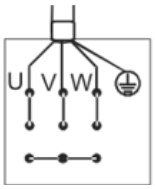




**Motor connection**

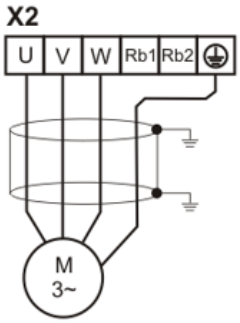


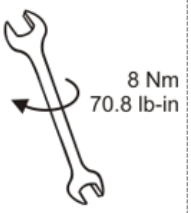




Delta circuit




Star circuit



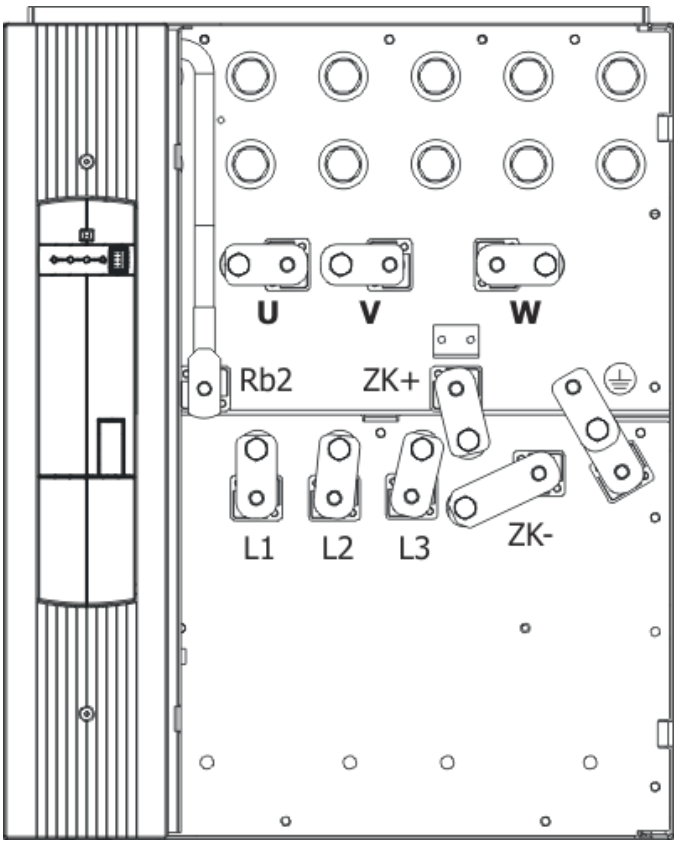

For connection of the ground conductor of the mains and motor cable, use the provided terminal connection options X1 and X2. Other connection options for connecting the mains and motor cable are not permissible.

For connection of a braking resistor, use terminals $R_{b1}$ and $R_{b2}$.

IP20 ingress protection rating is reached with the covers installed. Make sure that the covers are always installed in operation.

Optionally, devices of this size are available without brake chopper. These devices are designed without connecting terminals for the braking resistor.

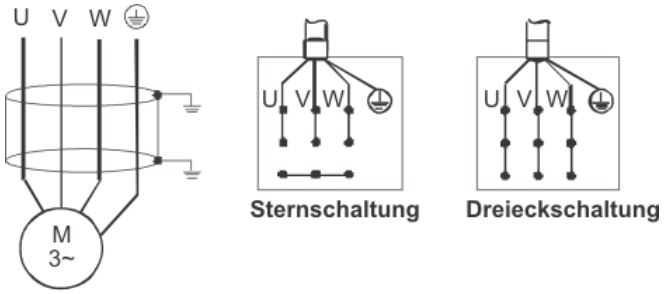
### 4.1.5 KFU 410 (75 to 132 kW)



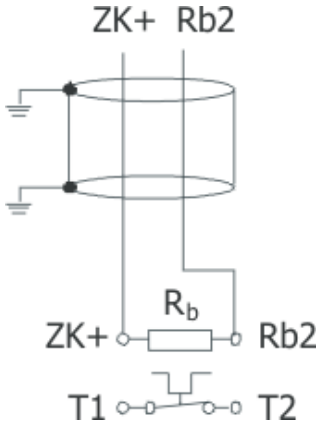

**Mains connection**

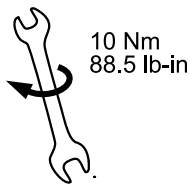

**3ph / 400V AC**

**Motor connection**




**Connection of brake resistor with temperature switch**



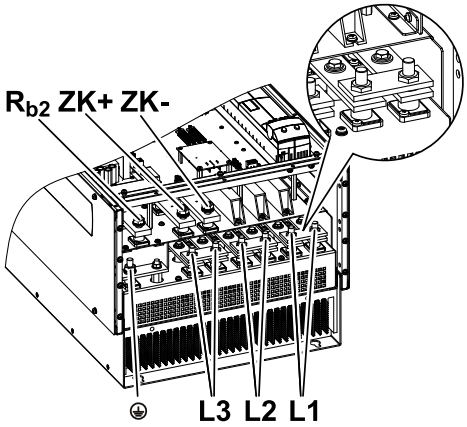

Threaded bolt M8x20

IP20 ingress protection rating is reached with the covers installed. Make sure that the covers are always installed in operation.

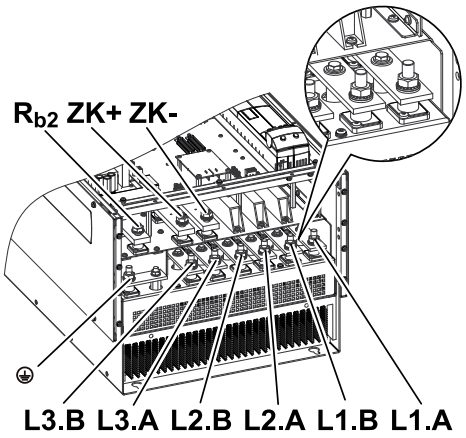
Optionally, devices of this size are available without brake chopper. These devices are designed without connecting terminals for the braking resistor.

### 4.1.6 KFU 410 / KFU 510 / KFU 610 (160 to 400 kW)

Mains connection 3 phases:



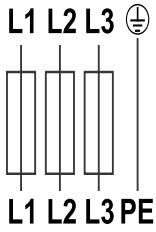

Mains connection 6 phases:




Motor connection:

**Mains connection**

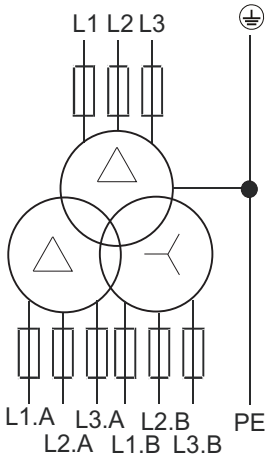
3 phases:



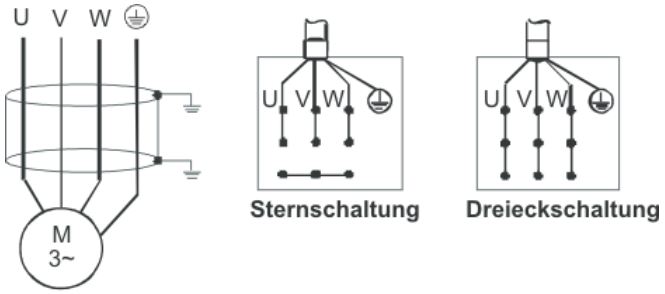

3ph/400V AC or 3ph/525V AC or 3ph/690V AC

6 phases*:

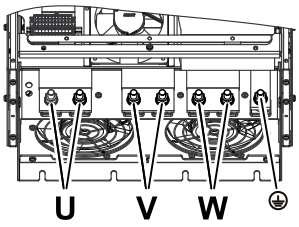
3ph/400V AC or 3ph/525V AC or 3ph/690V AC

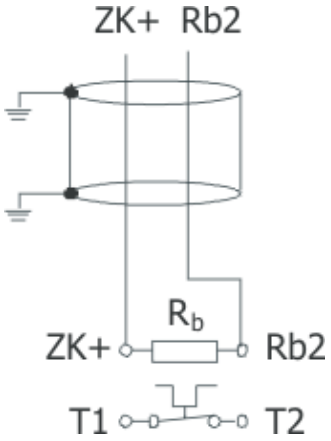


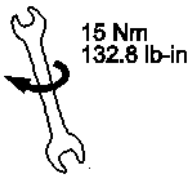

**Motor connection**




**Connection of brake resistor with temperature switch**



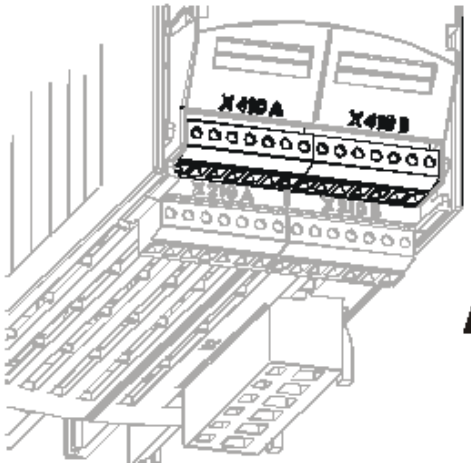

Threaded bolt M10x20

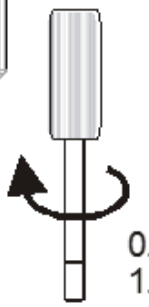
IP20 ingress protection rating is reached with the covers installed. Make sure that the covers are always installed in operation.

* 6-phase connection must be done via the same mains feeders and a suitable transformer (e.g. one d and one y winding on secondary side) which shifts all phases by 30° to one another. Alternatively, two transformers can be used (one with d-winding, one with y-winding on secondary side).

## 4.2 Control terminals

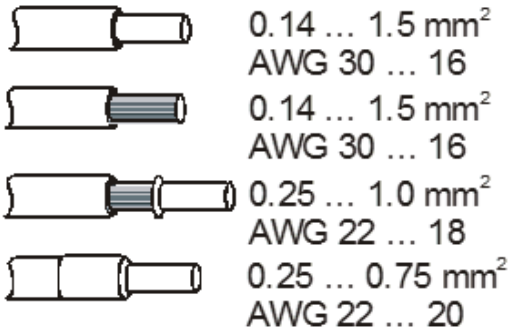
**Signal terminals X210 and X410**





0.2 … 0.3 Nm
1.8 … 2.7 lb-in

**Wieland DST85 / RM3,5**



0.14 … 1.5 mm²
AWG 30 … 16

0.14 … 1.5 mm²
AWG 30 … 16

0.25 … 1.0 mm²
AWG 22 … 18

0.25 … 0.75 mm²
AWG 22 … 20

---

**Caution**!

Power supply must be turned off before connecting control inputs and outputs. Non-compliance can destroy the device.

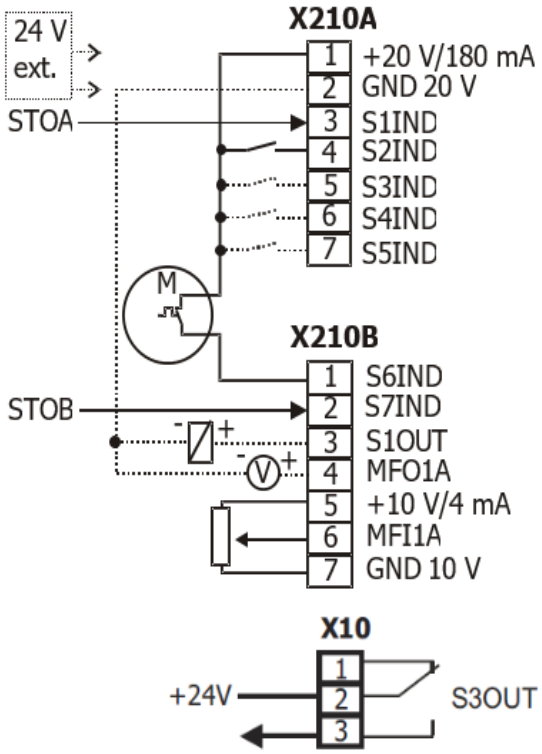
---

**NOTE**

In order to minimize electromagnetic faults and achieve good signal quality, connect the shield of the cable is to be connected to ground potential properly, i.e. with good conductivity, on both sides.

---

### 4.2.1 Control terminals X210A and X210B




**Control terminal X210A**

| | | |
|---|---|---|
| X210A.1 | Voltage output DC +20 V or input for external power supply DC 24 V ±10% | |
| X210A.2 | GND 20 V/ GND 24 V (ext.) | |
| X210A.3 | Digital input STOA (first shut-down path) | |
| X210A.4 | Digital input [1)] | Start clockwise (default setting.) |
| X210A.5 | Digital input [1)] | Start anticlockwise (default set..) |
| X210A.6 | Digital input [1)] | Data Set Changeover. 1 (default.) |
| X210A.7 | Digital input [1)] | Data Set Changeover. 2 (default) |

**Control terminal X210B**

| | |
|---|---|
| X210B.1 | Digital input [1)] |
| X210B.2 | Digital input STOB (second shut-down path) |
| X210B.3 | S1OUT: Digital output[1)] |
| X210B.4 | Multifunktion output [1)] (voltage signal pro portional actual frequency, default setting) |
| X210B.5 | Supply voltage DC +10 V for reference value potentiometer, ($I_{max}$=4 mA) |
| X210B.6 | Multifunction input [1)] (reference speed 0 … +10 V, default setting) |
| X210B.7 | Ground 10 V |

[1] Control terminals are freely configurable

**Relay output X10**

| | |
|---|---|
| S3OUT | Parameterizable relay output |

Control “Safe Torque Off” (STO): Contacts on X210A.3 and X210B.2 open (“Low level”).
Release of frequency inverter: Contacts on X210A.3 and X210B.2 closed (“High level”).

The above assignment of the functions to the control terminals is the default setting of parameter Configuration 30 to value 110 or 410. The functions can be assigned to the control terminals as required. For more configurations, refer to the Operating Instructions.

**Technical data of control terminals**

**Digital inputs** (X210A.3 … X210B.2): Low Signal: DC 0 V … 3 V, High signal: DC 12 V … 30 V,
Input resistance: 2.3 kΩ, response time: 2 ms (STOA and STOB: 10 ms), PLC compatible

**Digital output S1OUT** (X210B.3): Low Signal: DC 0 V… 3 V, High Signal: DC 12 V … 30 V,
Maximum output current: 50 mA, PLC compatible

**Multifunction output MFO1** (X210B.4):
Digital output: Low Signal: DC 0 V… 3 V, High Signal: DC 12 V … 30 V, PLC compatible
Analog output: DC 19 … 28 V, maximum output current: 50 mA, pulse-width modulated ($f_{PWM}$= 116 Hz),
Frequency signal: Output voltage: DC 0 V … 24 V, maximum output current: 40 mA,
maximum output frequency: 150 kHz

**Multifunction input MF1** (X210B.6):
Analog signal: Input voltage: DC 0 … 10 V ($R_i$=70 kΩ), Input current: DC 0 … 20 mA ($R_i$=500 Ω),
Digital signal: Low Signal: DC 0 V … 3 V, High signal: DC 12 V…30 V, response time: 4 ms, PLC compatible

**Conductor cross-section**:
The signal terminals are suitable for the following cable sizes:
with ferrule: 0.25 … 1.0 mm²
without ferrule: 0.14 … 1.5 mm²

### 4.2.2 External 24 V power supply X210A.1 & X210A.2

The bidirectional control terminals X210A.1/ X210A.2 can be used as a voltage output or voltage input. By connecting an external power supply of DC 24 V ±10% to terminals X210A.1/X210A.2, the function of inputs and outputs as well as the communication can be parameterized and maintained, even when mains voltage is off.

**Requirements to be met by external power supply**

| | |
|---|---|
| Input voltage range | DC 24 V ±10% |
| Rated input current | Max. 1.1 A |
| Peak inrush current | Typically: < 25 A |
| External fuse | Via standard fuse elements for rated current, characteristic: slow |
| Safety | Safety extra low voltage (SELV) according to EN 61800-5-1 |

**CAUTION**!

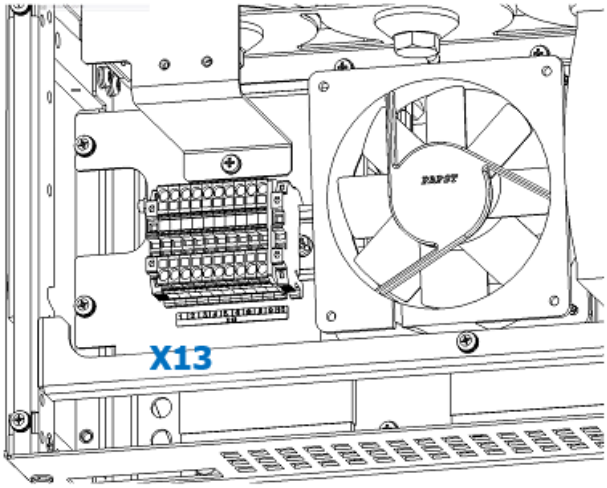
The digital inputs and the DC 24 V terminal of the electronic control equipment can withstand external voltage up to DC 30 V. Avoid higher voltage levels. Higher voltages may destroy the unit.

### 4.2.3 Control terminal X10

| Term. | Description |
|---|---|
| 1 ... 3 | Relay output, floating change-over contact, response time approx. 40 ms,<br>maximum contact load:<br>make contact: AC 5 A / 240 V, DC 5 A (ohmic) / 24 V<br>break contact: AC 3 A / 240 V, DC 1 A (ohmic) / 24 V |

## 4.3 X13 connection in KFU510 and KFU610

When and KFU 510 or KFU 610 is used, connection of AC 3x400 V an X13 is required.




**Auxiliary voltage terminal X13**

| | |
|---|---|
| 1 … 6 | Not used |
| 7 | ⏚ PE |
| 8 | L1 |
| 9 | L2 |
| 10 | L3 |

**Connection**

| | |
|---|---|
| Connected load | ≥ 1,2 kW |
| Supply voltage | 400 V +- 10 % |
| Supply frequency | 50 / 60 Hz |

# 5 Commissioning

The frequency inverter may be connected to power supply every 60 s. If the unit is switched on more frequently, it may be damaged. This must be considered when operating a mains contactor in jog operation mode.

- Disable release of frequency inverter; there may be no signals at inputs STOA (digital input S1IND/terminal X210A.3) and STOB (digital input S7IND/terminal X210B.2).
- Turn mains voltage on.
- The frequency inverter will perform a self-test.

Other ways of commissioning (e.g. by means of optional communication modules) are described in the co-applicable Operating Instructions.

## 5.1 Guided commissioning

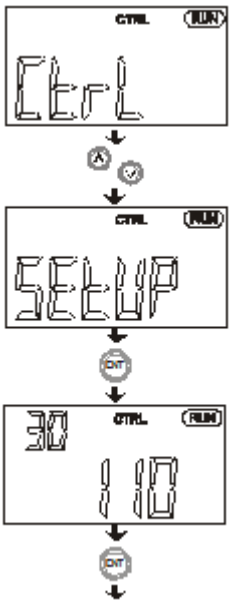
**NOTE**

The frequency inverter may be connected to power supply every 60 s. If the unit is switched on more frequently, it may be damaged. This must be considered when operating a mains contactor in jog operation mode.

- Disable release of frequency inverter; there may be no signals at inputs STOA (digital input S1IND/terminal X210A.3) and STOB (digital input S7IND/terminal X210B.2).
- Turn mains voltage on.

The frequency inverter will perform a self-test.

Before the start of guided commissioning, the motor should not have been operated, as a part of the machine data is dependent upon the operating temperature.




If the unit is in "as-delivered" condition or after resetting the unit to the factory settings, “SetUP” will be displayed automatically for guided commissioning. After successful commissioning, the guided commissioning can be carried out again later via the sub-menu CTRL.

- Use the ENT key to switch to the CTRL sub-menu.
- In the CTRL sub-menu, select the menu item “SetUP” and confirm by pressing the ENT key.
- Use the ENT key to select parameter Configuration 30.
- Use the arrow keys to enter the number 110 or 410.
  110: sensor-less control acc. to U/f characteristic
  410: sensor-less, field-oriented control

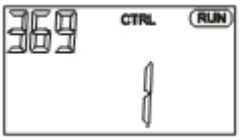
If the setup was changed, the “SEtUP” message will be displayed again.

- Confirm this message by pressing the ENT key in order to continue the commissioning procedure.

- After initialization, confirm the selected configuration by pressing the ENT key.
- Select the connected machine via parameter Motor type 369.

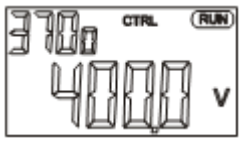
**NOTE**
If the motor type is not entered correctly, the drive may be damaged.

Configure and display the parameters and contolling the inverter can be happen by the optional KP500. This will be plugged on to the front side of the inverter.




| Opertation Mode | | Function |
|---|---|---|
| 0 - | Unknown | The motor is not a standard type. |
| 1 - | Asynchronous | Three-phase asynchronous motor, squirrel cage |
| 2 - | Synchronous | Three-phase synchronous motor |
| 3 - | Reluctance | Three-phase reluctance motor |
| 10 - | Transformer | Transformer with three primary windings |

- Enter the motor data indicated on the rating plate in the following parameters.

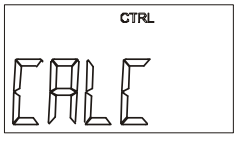



| No. | Description | No | Description |
|---|---|---|---|
| 370 | Rated Voltage | 374 | Rated Cosinus Phi |
| 371 | Rated Current | 375 | Rated Frequency |
| 372 | Rated Speed | 376 | Rated Mech. Power |

- Use the arrow keys to select the required parameter and edit the parameter value.
- Use the ENT key to confirm the selected parameter and the parameter values entered..

The rated data of the motor are to be entered according to the specifications on the rating plate for the motor connection type used (star or delta connection).

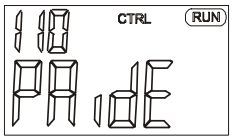
If the data entered deviate from the rating plate, the parameters will not be identified correctly. The rated data is to be parameterized as per the motor rating plate. Consider the increased rated current of the connected three-phase motor when the motor is switched from star to delta.




After input of the machine data, the calculation or examination of the parameters is automatically started. The display changes over to "CALC" for a short time. If the verification of the entered machine data is successful, the guided commissioning procedure continues with the identification of the parameters (automatic measurement of further machine data).

Note the warnings and error messages displayed during guided commissioning.

- To ignore the warning messages, press the ENT key. The guided commissioning is continued. However, it is recommended that the data be checked and corrected if necessary.
- To correct the entered parameter values after the warning or error message, press the ESC key. Use the arrow keys to switch to the parameter value which is to be corrected.




Further machine data are measured while the drive is at a standstill. These measurements will be entered automatically in the relevant parameters by the parameter identification feature.

- Confirm the display "PAidE" by pressing the ENT key.

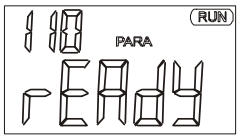
- Note the warnings or error messages upon completion of the parameter identification.


No signals at digital inputs S1IND (STOA) and S7IND (STOB). If signals were already applied at the beginning of the guided commissioning, the "StO" message is not displayed.

---

For release of the output stage, wiring of digital inputs S1IND (STOA) and S7IND (STOB) is required.

---




- Confirm the final "rEAdY" message by pressing the ENT key.

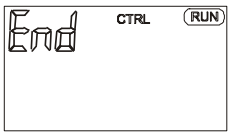
Canceling the operation with the ESC key or withdrawing the enable signal S1IND (STOA) or S7IND (STOP) results in an incomplete take-over of the values.

---

In the case of higher requirements as regards the accuracy of the speed/torque control, you should carry out the guided commissioning procedure once again under operating conditions because part of the machine data depends on the operating temperature.

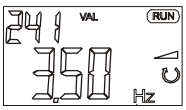
During this procedure, confirm the rated machine values already entered.

---




- Confirm the "End" display by pressing the ENT key.

The guided commissioning of the frequency inverter is terminated via a reset and the initialization of the frequency inverter. The relay output X10 signals a fault.




After successful initialization of the frequency inverter, the factory-set parameter Actual Frequency 241 is displayed.

The drive is accelerated to the set Min. frequency 418 (default 3.50 Hz) by:

- Signals at digital inputs S1IND (STOA) and S7IND (STOB) and
- Start clockwise by rising signal edge at S2IND or Start anticlockwise by rising signal edge at S3IND

# 6 Parameter

## 6.1 Description of parameters

The parameters are partly set via the guided commissioning. The following overviews refer to configurations **110** and **410**. For additional configurations enabling setting of other parameters, refer to the Operating Instructions.

### 6.1.1 Adjustable parameters

**Parameters relevant to KFU**

| No. | Description | Unit | Explanation |
|---|---|---|---|
| 28 | Control Level | - | These instructions describe the parameters on Control Level 1. Higher control level parameters are described in the Operating Instructions and should only be set by expert users. |
| 30 | Configuration | - | The basic function of the control inputs and outputs as well as the assignment of the software modules is selected by the configuration. The selection is made during the guided commissioning. |
| 34 | Program(ming) | - | The factory settings of all parameters is restored or a fault message is acknowledged (alternative to signal at digital input STO). |
| 369 | Motor Type | - | Selection of connected motor or transformer. The selection is considered in the test of the entered rated values and the guided commissioning. |
| 370 | Rated Voltage | V | Enter the voltage indicated on the type plate of the asynchronous motor. |
| 371 | Rated Current | A | Enter the rated current indicated on the type plate of the asynchronous motor for the selected circuit. |
| 372 | Rated Speed | U/min | Enter the motor speed indicated on the type plate of the asynchronous motor at rated frequency. |
| 374 | Rated Cosinus Phi | - | Enter the cos(ϕ) value indicated on the type plate of the asynchronous motor. |
| 375 | Rated Frequency | Hz | Enter the rated frequency (at parameterized rated speed) indicated on the type plate of the asynchronous motor. |
| 376 | Rated mech. Rated power | kW | Enter the power (in KW) indicated on the type plate of the asynchronous motor. |
| 400 | Switching frequency | Hz | The default switching frequency settings depend on configuration (Configuration 110: 2 kHz, Configuration 410: 4 kHz). Higher switching frequencies reduce the motor noise, but reduce the output current (refer to technical data in Operating Instructions) |
| 401 | Min. Switching Frequency | Hz | Frequency to which the switching frequency is reduced in case the frequency inverter is overloaded. |
| 418 | Min. Frequency | Hz | The start command entered via the control unit or digital inputs S2IND, S3IND results in an acceleration of the drive to the minimum frequency. |
| 419 | Max. Frequency | Hz | The speed range of the drive is limited by the maximum output frequency of the frequency inverter. |

| | | | |
|---|---|---|---|
| 420 | Acceleration (Clockwise) | Hz/s | The ramps define how quickly the output frequency is changed if the reference value changes or after a start, stop or brake command. |
| 421 | Deceleration (Clockwise) | | |
| 452 | Op. Mode Multifunction Input | - | The reference value at input MFI1 can be adjusted in this operation mode according to the connected signal source. |
| 480 | Fixed Frequency 1 | Hz | Switching between the fixed frequency values is done via the fixed frequency change-over of multifunction input MFI1 (Operation Mode Multifunction Input 452 to setting 3). Via the data record change-over S4IND, S5IND, the fixed frequency in one of the four data records can be selected. Up to 8 fixed frequencies can be parameterized and selected via the control of the digital inputs. |
| 481 | Fixed Frequency 2 | | |
| 530 | Op. Mode Digital Output 1 | - | Various control and monitoring functions can be assigned to digital output S1OUT and relay output S3OUT. |
| 532 | Op. Mode Digital Output 3 | | |
| 553 | Op. Mode Analog Operation MFO1 | - | Output MFO1 supplies a pulse width modulated |
| 570 | Motor Temp. Operation Mode | - | signal (0 V ... 10 V) which is proportional to an actual value. |
| 571 | Operation Mode Motor Circuit Breaker | - | Monitoring the motor temperature protects the drive system. Connect a suitable sensor to digital input S6IND. |
| 572 | Frequency Limit Motor Circuit Breaker | % | Motor circuit breakersare used for protecting a motor and its supply cable against overheating by overload. Depending on the overload level, they disconnect the motor from power supply immediately in the case of a short-circuit or they disconnect the motor if an overload has occurred for some time. |
| 645 | Operation Mode Synchronization | - | Motor protection, in particular self-ventilation motors, is improved via the Frequency Limit 572 which can be set as a percentage of the rated frequency. |
| 651 | Operation mode Autostart | - | Synchronization to a rotating drive is useful in some applications such as pumps and fans or after acknowledgment of an error switch-off. If synchronization to the motor speed is not possible, the function is quit and a fault message is issued. |
| 670 | Operation mode of voltage controller | - | Automatic startup of the drive is permissible only in accordance with VDE 0113 (Section 5.4, 5.5), VDE 0100 Part 227 and the national regulations. Make sure that automatic startup does not result in any dangerous situation. |
| 722 | Integral Time 1 | ms | The DC link voltage, which increases due to generatoric operation and/or deceleration operations, is limited by means of the voltage controller or an external braking resistor in order to avoid an error switch-off due to overvoltage. |
| 728 | Current Limit | A | The control behavior of configuration 410 is to be adapted, depending on the mechanical moment of inertia, via the integral time of the speed controller. The smaller the value is, the more dynamic the behavior. The increase in inherent instability of the system is proportional to the reduction of the integral time. |

[1)] Parameter is active in configurations with field-oriented control (FOR), e.g. 210, 410

**NOTE**

In the KP500 control unit, parameter numbers > 999 are shown in hexadecimal form (999, A00 … B5 … C66).

### 6.1.2 Actual value parameters

**Parameters relevant to KFU**

| No. | Description | Unit | Explanation |
|---|---|---|---|
| 211 | R.m.s Current | A | Effective output current (motor current) of the frequency inverter calculated from the measurement in the three motor phases. |
| 212 | Output Voltage | V | Output voltage of frequency inverter modulated depending on the operating point of the motor |
| 213 | Active Power | kW | Calculated power of the asynchronous motor at the current operating point. Product of output voltage, current and cosine phi |
| 240 | Actual Speed | 1/min | Speed of the asynchronous machine calculated using the machine model and the current load point. |
| 241 | Actual Frequency | Hz | The current output frequency of the frequency inverter or actual frequency of the drive calculated from the machine model. |
| 259 | Current Error | - | The cause of the error-switch-off and the corresponding error key are displayed. The current error is used for error diagnosis. |
| 269 | Warnings | - | If a critical condition is detected, this condition is indicated by the field WARN. The warning status can be displayed via parameter 269. |
| 273 | Application Warnings | - | An application-specific warning can be read. For detailed functions, refer to Operating Instructions. |
| 310 | Last Error | - | The fault message is displayed immediately when a fault occurs. The frequency inverter will try to acknowledge some faults automatically, other faults will be reset via digital input S1IND. The last fault code is saved for fault diagnosis. |
| 783 | SETUP adjusted motor parameters | - | The listed parameters (separated by commas) were changed by motor commissioning. |

## 6.2 Parameter setting options

| Parameter | | Setting | | |
|---|---|---|---|---|
| **No.** | **Description** | **Min.** | **Max.** | **Factory setting** |
| | | | | |
| 28 | Control Level | 1 | 3 | 1 |
| 370 | Rated Voltage | $0.17 \cdot U_{FUN}$ [1)] | $2 \cdot U_{FUN}$ [1)] | $U_{FUN}$ [1)] |
| 371 | Rated Current | $0.01 \cdot I_{FUN}$ [1)] | $10 \cdot ü \cdot I_{FUN}$ [1)] | $I_{FUN}$ [1)] |
| 372 | Rated Speed | 96 $min^{-1}$ | 60 000 $min^{-1}$ | $n_N$ |
| 374 | Rated Cosinus Phi | 0.01 | 1.00 | $\cos(\varphi)_N$ |
| 375 | Rated Frequency | 10.00 Hz | 599.00 Hz | 50.00 |
| 376 | Rated mech. Rated power | $0.01 \cdot P_{FUN}$ [1)] | $10 \cdot P_{FUN}$ [1)] | $P_{FUN}$ [1)] |
| 400 | Switching frequency | 2 kHz | 16 kHz | 2 kHz [2A)]<br>4 kHz [2B)] |
| 401 | Min. Switching Frequency | 2 kHz | 16 kHz | 2 kHz |
| 418 | Minimum frequency | 0.00 Hz | 599.00 Hz | 3.50 Hz [3A)]<br>0.00 Hz [3B)] |
| 419 | Maximum frequency | 0.00 Hz | 599.00 Hz | 50.00 Hz |
| 420 | Acceleration (Clockwise) | 0.00 Hz/s | 9999.99 Hz/s | 5.00 Hz/s |
| 421 | Deceleration (Clockwise) | 0.01 Hz/s | 9999.99 Hz/s | 5.00 Hz/s |

| | | | | |
|---|---|---|---|---|
| 572 | Frequency Limit Motor Circuit Breaker | 0% | 300% | 0% |
| 722 | Integral Time 1 | 0 ms | 60000 ms | - [4] |
| 728 | Current Limit | 0.0 A | ü·$I_{FUN}$ [1] | ü·$I_{FUN}$ [1] |

| No. | Description | Setting | | Factory setting |
|---|---|---|---|---|
| 30 | Configuration | 110 – | sensor-less control | 110 |
| | | 410 – | sensor-less field oriented regulation | |
| | | For further configurations (incl. servo motors), refer to Operating Instructions. | | |
| 34 | Program(ming) | 111 – | Parameter transmission | 110 |
| | | 110 – | Standard operation | |
| | | 123 – | Reset | |
| | | 4444 – | Reset parameter | |
| 369 | Motor Type | 0 – | Unknown | 1 |
| | | 1 – | Asynchronous | |
| | | 2 – | Synchronous | |
| | | 3 – | Reluctance | |
| | | 10 – | Transformer | |
| 452 | Op. Mode Multifunction Input | 1 – | Voltage Input | 1: Standard value in Configuration 110 and 410. Other configurations may deviate. |
| | | 2 – | Current Input | |
| | | 3 – | Digital input | |
| 530 | Op. Mode Digital Output 1 | see Operation Instructions | | |
| 532 | Op. Mode Digital Output 3 | | | |
| 553 | Analog Operation MFO1 | | | |
| 570 | Motor Temp. Operation Mode | 0 – | off | 0 |
| | | 1 – | Therm.-Cont.: Warning only | |
| | | 2 – | Error switch-off | |
| | | 3 – | Err.Switch-Off 1 min delayed | |
| | | 4 – | Err.Switch-Off 5 min delayed | |
| | | 5 – | Err.Switch-Off 10 min delayed | |
| 571 | Operation Mode Motor Circuit Breaker | see Operation Instructions | | |
| 645 | Operation Mode Synchronization | see Operation Instructions | | |
| 651 | Operation mode Autostart | 0 – | off | 0 |
| | | 1 – | On | |
| 670 | Operation mode of voltage controller | 0 – | off | 0 |
| | | 1 – | DC link limitation active | |
| | | 2 – | Power regulation active | |
| | | 3 – | Ud lim. & mains support active | |
| | | 12 – | Mains support active, without chopper | |
| | | 13 – | Udc-Lim. & Mains Supp. active, Chopper not active | |

[1)] $I_{Fun}$, $U_{Fun}$, $P_{Fun}$: Rated values of frequency inverter (listed in Operating Instructions in “Technical Data”), ü: overload capability of frequency inverter

[2A)] in Configurations 1xx,

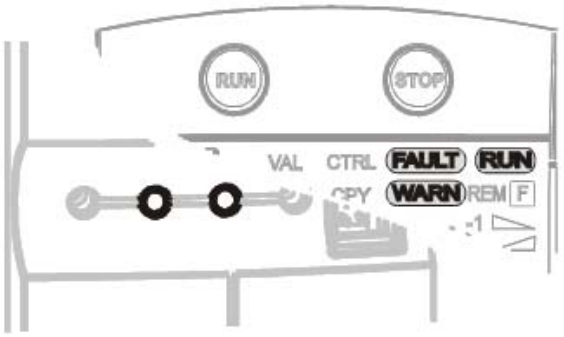
[2B)] in Configurations 2xx, 4xx, 5xx, 6xx

[3A)] in Configurations 1xx, 4xx, 6xx

[3B)] in Configurations 2xx, 5xx (see Operating Instructions)

[4)] machine-related

# 7 Control unit messages




**Status indication**

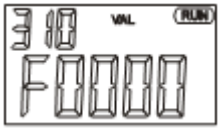
| LED | | | | |
|---|---|---|---|---|
| **green** | **red** | **Display** | **Description** | **Rotary field on motor** |
| off | off | - | no supply voltage | no |
| on | on | - | initialization and self-test | no |
| flashing | off | RUN flashing | ready, no output signal | no |
| on | off | RUN | operating message | yes |
| on | flashing | RUN + WARN | Operational message, current Warning 269 | yes |
| flashing | flashing | RUN + WARN | Ready for operation, current Warning 269 | no |
| off | flashing | FAULT flashing | Current Error 259 of frequency inverter | no |
| off | on | FAULT | Current Error 259, acknowledge fault | no |

## 7.1 Warning and error messages during operation


The code displayed via parameter Warnings 269 can be composed of several messages. Key A0088 signals warnings A0008 + A0080, for example.

**Warning messages**

| Key | Meaning |
|---|---|
| A0000 | No warning present. |
| A0001 | Frequency inverter overloaded, warning code (A0002 or A0004) |
| A0002 | Frequency inverter overload (60 s). Check load behavior. |
| A0004 | Short-term overload (1 s). Check motor and application parameters. |
| A0008 | Max. heat sink temperature reached, check cooling system and fan. |
| A0010 | Max. interior temperature reached, check cooling system and fan. |
| A0020 | Speed set point is limited by a controller. |
| A0080 | Max. motor temperature reached, check motor and sensor. |
| A0100 | Mains phase failure, check mains fuses and supply cable. |
| A0400 | Limit frequency reached; output frequency is limited. |
| A4000 | DC link voltage has reached the type-specific minimum. |
| A8000 | Application-specific warning: For detailed functions, refer to Operating Instructions. |




Current Error 259 and Last Error 310 make troubleshooting easier, an error code is displayed.

The error message can be acknowledged via the control unit buttons and STO input.

**Error messages**

| Key | | Meaning |
|---|---|---|
| F00 | 00 | No fault has occurred. |

**Overload**

| | | |
|---|---|---|
| F01 | 02 | Frequency inverter overloaded (60 s), check load behavior |
| | 03 | Short-term overload (1 s), check motor and application parameters |

**Heat sink**

| | | |
|---|---|---|
| F02 | 00 | Heat sink temperature too high, check cooling system and fan. |
| | 01 | Temperature sensor defective or ambient temperature too low. |

**Interior**

| | | |
|---|---|---|
| F03 | 00 | Interior temperature too high, check cooling system and fan. |
| | 01 | Interior temperature too low, check control cabinet heating. |

**Motor connection**

| | | |
|---|---|---|
| F04 | 00 | Motor temperature too high or sensor defective, check connection S6IND. |
| | 03 | Phase failure, check motor and wiring. |

**Output current**

| | | |
|---|---|---|
| F05 | 00 | Overloaded, check load situation and ramps. |
| | 03 | Short circuit or earth fault, check motor and wiring. |
| | 05 | Asymmetric motor current, check current and wiring. |
| | 06 | Motor phase current too high, check motor and wiring. |
| | 07 | Message from phase monitoring, check motor and wiring. |

**DC-Link voltage**

| | | |
|---|---|---|
| F07 | 00 | DC link voltage too high, check deceleration ramps and connected brake resistor. |
| | 01 | DC link voltage too low, check mains voltage. |
| | 02 | Mains failure, check mains voltage and circuit. |
| | 03 | Phase failure, check mains fuse and circuit. |
| | 04 | Mains voltage UDC too high when turned on, check voltage. |
| | 05 | Mains voltage BC too high when turned on, check voltage. |
| | 06 | Mains voltage MC too high when turned on, check voltage. |

**Electronic voltage**

| | | |
|---|---|---|
| F08 | 01 | Electronics voltage too low, check control terminals. |
| | 04 | Electronic voltage too high, check wiring of control terminals. |

**Output frequency**

| | | |
|---|---|---|
| F11 | 00 | Output frequency too high, check control signals and settings. |
| | 01 | Max. frequency reached by control (voltage control), check deceleration ramps and connected brake resistor |

**Safety fuction STO**

| | | |
|---|---|---|
| F12 | 01 | Diagnosis error of function STO; at least one of the shut-down paths STOA and STOB is defective. Check the devices connected to the shut-down paths; check wiring and EMC. |
| | 04 | Software self-diagnosis has detected an internal error. Parameter Error Environment 1 262 describes the cause of the error.. Consult Küenle customer service. |
| | 05 | Fault message of 5-second monitoring. Shut-down paths STOA and STOB were not actuated at the same time, but with an offset of more than 5 seconds. Check addressing of shut-down paths or control of protection provision. |

**Motor connection**

| | | |
|---|---|---|
| F13 | 00 | Earth fault at output, check filter and cabling. |
| | 10 | Minimum current monitoring, check motor and wiring. |

**Control connection**

| | | |
|---|---|---|
| F14 | 01 | Reference value on multifunction input 1 faulty, check signal. |
| | 07 | Overcurrent on multifunction input 1, check signal. |

## 7.2 Status messages during commissioning (SS…)

The following status messages are possible when Setup is run:

| Status message | | Meaning |
|---|---|---|
| SS000 | OK | Auto set-up routine has been carried out. |
| SS001 | PC Phase 1 | The plausibility check (PC) of the motor data is active. |
| SS002 | PC Phase 2 | The calculation of dependent parameters is active. |
| SS003 | STO | The parameter identification requires release on digital input STOA and STOB. |
| SS004 | Parameter identification | The rated motor values are checked by the parameter identification feature. |
| SS010 | Setup already active | The setup routine via the control panel is being carried out. |
| SS030 | No Release | The parameter identification demands the controller release on digital input STOA and STOB. |
| SS031 | Error – check P. 259 | Error during the auto set-up routine. Check value of Current Error 259. |
| SS032 | Warning Phase Asymmetry | The parameter identification feature diagnosed an unbalance during the measurements in the three motor phases. |
| SS099 | Setup not carried out yet. | Self-setup has not yet been carried out. |

## 7.3 Warning and error messages during commissioning (SA…/SF…)

**Warning messages during guides commisioning**

| Code | Meaning / Measure |
|---|---|
| SA000 | No warning message present. |
| SA001 | The value of the parameter Rated Voltage 370 is out of the rated voltage range of the frequency inverter The maximum reference voltage is indicated on the nameplate of the frequency inverter. |
| SA002 | For a three-phase motor, the calculated efficiency is in the limit range. Check the values entered for parameters Rated Voltage 370, Rated Current 371 and Rated Mech. Power 376. |
| SA003 | The value entered for parameter Rated Cosinus Phi 374 is outside of the normal range (0.6 to 0.95). Check the value. |
| SA004 | For three-phase motor, the calculated slip is in the limit range. Check the values for parameters Rated Speed 372 and Rated Frequency 375. |

**Warning messages after parameter identification**

| Code | Meaning / Measure |
|---|---|
| SA011 | Current control setting, no typical value; see Operating Instructions |
| SA012 | Current control setting, no typical value at 2 kHz; see Operating Instructions |
| SA014 | Current control setting, no typical value at 4 kHz; see Operating Instructions |
| SA018 | Current control setting, no typical value at 8 kHz; see Operating Instructions |
| SA021<br>SA022 | Stator resistance (SA021) or rotor resistance (SA022) is very high. The following causes are possible:<br>The motor cable cross-section is not sufficient.<br>The motor cables are too long.<br>The motor cables are not connected correctly.<br>The contacts are not in a proper condition (corrosion). |
| SA031 | Shorten Motor Line using Switchfrequ. 16 kHz. |
| SA032 | Shorten Motor Line using Switchfrequ. 12 kHz and higher. |
| SA033 | Shorten Motor Line using Switchfrequ. 8 kHz and higher. |
| SA041 | The slip speed was not determined correctly. Check the values for parameters Rated Speed 372 and Rated Frequency 375. |
| SA042 | The slip speed was not determined correctly. Check the values for parameters Rated Speed 372 and Rated Frequency 375. |

**Warning messages after parameter identification**

| | |
|---|---|
| SA051 | The machine data for star connection were entered, the motor, however, is connected in delta. For star operation, change the motor cable connection. For delta operation, check the entered rated motor values.<br>Repeat the parameter identification |
| SA052 | The machine data for delta connection were entered, the motor, however, is connected in star. For delta operation, change the motor cable connection. For star operation, check the entered rated motor values.<br>Repeat the parameter identification |
| SA053 | A phase asymmetry was measured. Check the cables at the terminals of the motor and the frequency inverter for proper connection and check the contacts for corrosion. |
| SA054 | Resolver offset not adjusted. |

**Errow messages during guided commissioning**

| Code | Meaning / Measure |
|---|---|
| SF000 | No Error |
| SF001 | The value entered for parameter *Rated Current* **371** is too low. Correct the value. |
| SF002 | The value for parameter *Rated Current* **371** is too high, referred to parameters *Rated Mech. Power* **376** and *Rated Voltage* **370**. Correct the values. |
| SF003 | The value entered for parameter *Rated Cosinus Phi* **374** is wrong (greater than 1 or smaller than 0.3). Correct the value. |
| SF004 | The calculated slip frequency is negative. Correct the values entered for parameters *Rated Speed* **372** and *Rated Frequency* **375**. |
| SF005 | The calculated slip frequency is too high. Correct the values entered for parameters *Rated Speed* **372** and *Rated Frequency* **375**. |
| SF006 | The calculated total output of the drive is lower than the rated power. Correct the value entered for parameter *Rated Mech. Power* **376**. |
| SF007 | The set configuration is not supported by the guided commissioning. In these instructions, configurations 110 and 410 are described. Select one of these configurations for parameter *Configuration* **30**. |

**Error messages after parameter identification**

| Code | Meaning / Measure |
|---|---|
| SF011<br>SF012 | The main or leakage inductance measurement has failed because the motor has a high slip. Correct the rated motor values in parameters 370, 371, 372, 374, 375 and 376. Carry out the guided commissioning once again. In case an error message is displayed again, enter the value 110 for parameter *Configuration* **30** (sensorless regulation according to U/f-characteristic) if value 410 was set so far. Carry out the guided commissioning once again. |
| SF021<br>SF022 | The measurement of the stator or rotor resistance did not deliver a plausible value. Check the cables at the terminals of the motor and the frequency inverter for proper connection and check the contacts for corrosion and safe contact. Repeat the parameter identification |
| SF026 | Setup aborted |

# 8 Technical Data

## 8.1 Size 1 - KFU 210 (0,25 to 1,1 kW, 230 V)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Type** | | | | | | | |
| KFU 201 | | | -1,6 | -2,5 | -3,0 | -4,0 | -5,4 |
| Size | | | 1 | | | | |
| **Output, motorside** | | | | | | | |
| Recommended motor shaft power | P | kW | 0,25 | 0,37 | 0,55 | 0,75 | 1,1 |
| Output current | I | A | 1,6 | 2,5 | 3,0 | 4,0 | 5,4 [5] |
| Long-term overload current (60 s) | I | A | 3,2 | 5,0 | 4,5 | 6,0 | 7,3 |
| Short-time overload current (1 s) | I | A | 3,2 | 5,0 | 6,0 | 8,0 | 8,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | | |
| Protection | - | - | Short circuit / earth fault proof | | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | | |
| Switching frequency | f | kHz | 2, 4, 8, 12, 16 | | | | |
| **Output, braking resistor** | | | | | | | |
| min. braking resistor | R | Ω | 100 | 100 | 100 | 100 | 100 |
| Recommended braking resistor ($U_{dBC}$ = 385 V) | R | Ω | 430 | 300 | 230 | 160 | 115 |
| **Input, mains side** | | | | | | | |
| Mains current [3] 3ph<br>1ph/N/PE; 2ph | I | A | 1,6<br>2,9 | 2,5<br>4,5 | 3<br>5,4 | 4<br>7,2 | 5,5 [1]<br>9,5 [2] |
| Mains voltage | U | V | 184 ... 264 | | | | |
| Mains frequency | f | Hz | 45 ... 66 | | | | |
| Fuse 3ph<br>1ph/N; 2ph | I | A | 6<br>6 | 6<br>10 | | | 10<br>16 |
| UL-Typ 250 VAC RK5, 3ph<br>1ph/N; 2ph | I | A | 6<br>6 | 6<br>10 | | | 10<br>15 |
| **Mechanical** | | | | | | | |
| Dimensions | HxWxD | mm | 190 x 60 x 175 | | | | |
| Weight approx.. | m | kg | 1,2 | | | | |
| Ingres protection rating | - | - | IP20 (EN60529) | | | | |
| Connection terminals | A | $mm^2$ | 0,2 ... 1,5 | | | | |
| Form of assembly | - | - | vertical | | | | |
| **Ambient conditions** | | | | | | | |
| Energy dissipation<br>(2 kHz switching frequency) | P | W | 32 | 38 | 43 | 53 | 73 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | | |
| Rel. humidity | - | % | 15 ... 85; not condensing | | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [6]** | | | | | |
|---|---|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | | | |
| | 2 kHz | 4 kHz | 8 kHz | 12 kHz | 16 kHz |
| 0,25 kW | 1,6 A | 1,6 A | 1,6 A | 1,3 A | 1,1 A |
| 0,37 kW | 2,5 A | 2,5 A | 2,5 A | 2,1 A | 1,7 A |
| 0,55 kW | 3,0 A | 3,0 A | 3,0 A | 2,5 A | 2,0 A |
| 0,75 kW | 4,0 A | 4,0 A | 4,0 A | 3,4 A | 2,7 A |
| 1,1 kW | 5,4 A [2] | 5,4 A [2] [5] | 5,4 A [2] [5] | 4,5 A [2] [5] | 3,7 A [5] |

[1] Three-phase connection requires a commutating choke.

[2] One- and two-phase connection requires a commutating choke.

[3] Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)

[4] Maximum output current = 9.5 A with single-phase and two-phase connection

[5] Reduction of switching frequency in thermal limit range

[6] Maximum current in continuous operation

## 8.2 Size 2 KFU 210 (0,25 to 1,1 kW, 230 V)

| **Type** | | | | | |
|---|---|---|---|---|---|
| KFU 201 | | | -7,0 | -9,5 | -12,5 |
| Size | | | 2 | | |
| **Output, motorside** | | | | | |
| Recommended motor shaft power | P | kW | 1,5 | 2,2 | 3,0 4) |
| Output current | I | A | 7,0 | 9,5 | 12,5 4) 5) |
| Long-term overload current (60 s) | I | A | 10,5 | 14,3 | 16,2 |
| Short-time overload current (1 s) | I | A | 14,0 | 19,0 | 19,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | |
| Protection | - | - | Short circuit / earth fault proof | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | |
| Switching frequency | f | kHz | 2, 4, 8, 12, 16 | | |
| **Output, braking resistor** | | | | | |
| min. braking resistor | R | Ω | 37 | 37 | 37 |
| Recommended braking resistor ($U_{dBC}$ = 385 V) | R | Ω | 75 | 55 | 37 |
| **Input, mains side** | | | | | |
| Mains current [3] 3ph<br>1ph/N/PE; 2ph | I | A | 7<br>13,2 | 9,5<br>16,5 2) | 10,5 1)<br>16,5 2) 4) |
| Mains voltage | U | V | 184 ... 264 | | |
| Mains frequency | f | Hz | 45 ... 66 | | |
| Fuse 3ph<br>1ph/N; 2ph | I | A | 10<br>16 | 16<br>20 | 16<br>20 |
| UL-Typ 250 VAC RK5, 3ph<br>1ph/N; 2ph | I | A | 10<br>15 | 15<br>20 | 15<br>20 |
| **Mechanical** | | | | | |
| Dimensions | HxWxD | mm | 250 x 60 x 175 | | |
| Weight approx.. | m | kg | 1,6 | | |
| Ingres protection rating | - | - | IP20 (EN60529) | | |
| Connection terminals | A | mm 2 | 0,2 ... 1,5 | | |
| Form of assembly | - | - | vertical | | |
| **Ambient conditions** | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 84 | 115 | 170 |
| Coolant temperature | Tn | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | |
| Storage temperature | TL | °C | -25 ... 55 | | |
| Transport temperature | TT | °C | -25 ... 70 | | |
| Rel. humidity | - | % | 15 ... 85; not condensing | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [6]** | | | | | |
|---|---|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | | | |
| | 2 kHz | 4 kHz | 8 kHz | 12 kHz | 16 kHz |
| 1,5 kW | 7,0 A | 7,0 A | 7,0 A | 5,9 A | 4,8 A |
| 2,2 kW | 9,5 A 2) | 9,5 A 2) | 9,5 A 2) | 8,0 A 2) | 6,5 A |
| 3,0 kW 2) 4) | 12,5 A 1) | 12,5 A 1) 5) | 12,5 A 1) 5) | 10,5 A 1) 5) | 8,5 A 5) |

1) Three-phase connection requires a commutating choke.
2) One- and two-phase connection requires a commutating choke.
3) Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
4) Maximum output current = 9.5 A with single-phase and two-phase connection
5) Reduction of switching frequency in thermal limit range
6) Maximum current in continuous operation

## 8.3 Size 3 and 4 KFU 210 (4,0 to 9,2 kW, 230 V)

| **Type** | | | | | | |
|---|---|---|---|---|---|---|
| KFU 210 | | | -18,0 | -22,0 | -32,0 | -35,0 |
| Size | | | 3 | | 4 | |
| **Output motorside** | | | | | | |
| Recommended motor shaft power | P | kW | 4,0 | 5,5 [4)] | 7,5 [4)] | 9,2 [4)] |
| Output current | I | A | 18,0 | 22,0 | 32,0 | 35,0 |
| Long-term overload current (60 s) | I | A | 26,3 | 30,3 | 44,5 | 51,5 |
| Short-time overload current (1 s) | I | A | 33,0 | 33,0 | 64,0 | 64,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | |
| Protection | - | - | Short circuit / earth fault proof | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | |
| Switching frequency | f | kHz | 2, 4, 8, 12, 16 | | | |
| **Output, braking resistor** | | | | | | |
| min. Bremswiderstand | R | Ω | 24 | 24 | 12 | 12 |
| Empfohlener Bremswiderstand ($U_{dBC}$ = 385 V) | R | Ω | 30 | 24 | 16 | 12 |
| **Input main side** | | | | | | |
| Mains current [3)] 3ph<br>1ph/N; 2ph | I | A | 18<br>28 [2) 7)] | 20 [1)]<br>- [4)] | 28,2 [1)]<br>- [4)] | 35,6 [1)]<br>- [4)] |
| Mains voltage | U | V | 184 ... 264 | | | |
| Mains frequncy | f | Hz | 45 ... 66 | | | |
| Fuse 3ph<br>1ph/N; 2ph | I | A | 25<br>35 | 25<br>- [4)] | 35<br>- [4)] | 50<br>- [4)] |
| **Mechanical** | | | | | | |
| Dimensions | HxWxD | mm | 250x100x200 | | 250x125x200 | |
| Weight approx. | m | kg | 3,0 | | 3,7 | |
| Ingress protection rating | - | - | IP20 (EN60529) | | | |
| Connection terminals | A | $mm^2$ | 0,2 … 6 | | 0,2 … 16 | |
| Form of assembly | - | - | vertical | | | |
| **Ambient conditions** | | | | | | |
| Energy dissipation<br>(2 kHz switching frequency) | P | W | 200 | 225 | 310 | 420 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | |
| Rel. humidity | - | % | 15 ... 85; not condensing | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [6)]** | | | | | |
|---|---|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | | | |
| | 2 kHz | 4 kHz | 8 kHz | 12 kHz | 16 kHz |
| 4,0 kW | 18,0 A [2)] | 18,0 A [2)] | 18,0 A [2)] | 15,1 A [2)] | 12,2 A |
| 5,5 kW [4)] | 23,0 A [1)] | 22,7 A [1), 5)] | 22,0 A [1), 5)] | 18,5 A [5)] | 15,0 A [5)] |
| 7,5 kW [4)] | 32,0 A [1)] | 32,0 A [1)] | 32,0 A [1)] | 26,9 A [1)] | 21,8 A |
| 9,2 kW [4)] | 40,0 A [1)] | 38,3 A [1), 5)] | 35,0 A [1), 5)] | 29,4 A [1), 5)] | 23,8 A [5)] |

[1)] Three-phase connection requires a commutating choke.
[2)] One- and two-phase connection requires a commutating choke.
[3)] Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
[4)] Three-phase connection permissible only.
[5)] Reduction of switching frequency in thermal limit range
[6)] Maximum current in continuous operation
[7)] Device for single-phase mains connection is not included in the product catalog. However, it is available upon request.

## 8.4 Size 1 KFU 410 (1,85 to 4,0 kW, 400 V)

| **Type** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KFU 410 | | | -1,0 | -1,6 | -1,8 | -2,4 | -3,2 | -3,8 |
| Size | | | 1 | | | | | |
| **Output motorside** | | | | | | | | |
| Recommended motor shaft power | P | kW | 0,25 | 0,37 | 0,55 | 0,75 | 1,1 | 1,5 |
| Output current | I | A | 1,0 | 1,6 | 1,8 | 2,4 | 3,2 | 3,8 [3)] |
| Long-term overload current (60 s) | I | A | 2,0 | 3,2 | 2,7 | 3,6 | 4,8 | 5,7 |
| Short-time overload current (1 s) | I | A | 2,0 | 3,2 | 3,6 | 4,8 | 6,4 | 7,6 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | | | |
| Protection | - | - | Short circuit / earth fault proof | | | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | | | |
| Switching frequency | f | kHz | 2, 4, 8, 12, 16 | | | | | |
| **Output, braking resistor** | | | | | | | | |
| Min. braking resistance | R | Ω | 300 | 300 | 300 | 300 | 300 | 300 |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 930 | 930 | 930 | 634 | 462 | 300 |
| **Input, mains side** | | | | | | | | |
| Power supply current [2)] | I | A | 1,0 | 1,6 | 1,8 | 2,4 | 2,8 [1)] | 3,3 [1)] |
| Mains voltage | U | V | 320 ... 528 | | | | | |
| Mains frequency | f | Hz | 45 ... 66 | | | | | |
| Fuses | I | A | 6 | | | | | |
| UL type 600 VAC RK5 | I | A | 6 | | | | | |
| **Mechanical** | | | | | | | | |
| Dimensions | HxWxD | mm | 190 x 60 x 175 | | | | | |
| Weight approx. | m | kg | 1,2 | | | | | |
| Ingress protection rating | - | - | IP20 (EN60529) | | | | | |
| Connection terminals | A | $mm^2$ | 0,2 ... 1,5 | | | | | |
| Form of assembly | - | - | vertical | | | | | |
| **Ambient conditions** | | | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 30 | 35 | 40 | 46 | 58 | 68 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [4)]** | | | | | |
|---|---|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | | | |
| | 2 kHz | 4 kHz | 8 kHz | 12 kHz | 16 kHz |
| 0,25 kW | 1,0 A | 1,0 A | 1,0 A | 0,8 A | 0,7 A |
| 0,37 kW | 1,6 A | 1,6 A | 1,6 A | 1,3 A | 1,1 A |
| 0,55 kW | 1,8 A | 1,8 A | 1,8 A | 1,5 A | 1,2 A |
| 0,75 kW | 2,4 A | 2,4 A | 2,4 A | 2,0 A | 1,6 A |
| 1,1 kW | 3,2 A [1)] | 3,2 A [1)] | 3,2 A [1)] | 2,7 A [1)] | 2,2 A |
| 1,5 kW [1)] | 3,8 A | 3,8 A [3)] | 3,8 A [3)] | 3,2 A [3)] | 2,6 A [3)] |

[1)] Three-phase connection requires a commutating choke.
[2)] Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
[3)] Reduction of switching frequency in thermal limit range
[4)] Maximum current in continuous operation

## 8.5 Size 2 KFU 410 (1,85 to 4,0 kW, 400 V)

| **Type** | | | | | | |
|---|---|---|---|---|---|---|
| KFU 410 | | | -4,2 | -5,8 | -7,8 | -9,0 |
| Size | | | 2 | | | |
| **Output motor side** | | | | | | |
| Recommended motor shaft power | P | kW | 1,85 | 2,2 | 3,0 | 4,0 |
| Output current | I | A | 4,2 | 5,8 | 7,8 | 9,0 **3)** |
| Long-term overload current (60 s) | I | A | 6,3 | 8,7 | 11,7 | 13,5 |
| Short-time overload current (1 s) | I | A | 8,4 | 11,6 | 15,6 | 18,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | |
| Protection | - | - | Short circuit / earth fault proof | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | |
| Switching frequency | f | kHz | 2, 4, 8, 12, 16 | | | |
| **Output, braking resistor** | | | | | | |
| Min. braking resistance | R | Ω | 136 | 136 | 136 | 92 |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 300 | 220 | 148 | 106 |
| **Input, mains side** | | | | | | |
| Power supply current **2)** | I | A | 4,2 | 5,8 | 6,8 **1)** | 7,8 **1)** |
| Mains voltage | U | V | 320 ... 528 | | | |
| Mains frequency | f | Hz | 45 ... 66 | | | |
| Fuses | I | A | 6 | 10 | | |
| UL type 600 VAC RK5 | I | A | 6 | 10 | | |
| **Mechanical** | | | | | | |
| Dimensions | HxWxD | mm | 250 x 60 x 175 | | | |
| Weight approx. | m | kg | 1,6 | | | |
| Ingress protection rating | - | - | IP20 (EN60529) | | | |
| Connection terminals | A | $mm^2$ | 0,2 ... 1,5 | | | |
| Form of assembly | - | - | vertical | | | |
| **Ambient conditions** | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 68 | 87 | 115 | 130 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | |
| Rel. humidity | - | % | 15 ... 85, nicht betauend | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current 4)** | | | | | |
|---|---|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | | | |
| | 2 kHz | 4 kHz | 8 kHz | 12 kHz | 16 kHz |
| 1,85 kW | 4,2 A | 4,2 A | 4,2 A | 3,5 A | 2,9 A |
| 2,2 kW | 5,8 A | 5,8 A | 5,8 A | 4,9 A | 3,9 A |
| 3,0 kW | 7,8 A **1)** | 7,8 A **1)** | 7,8 A **1)** | 6,6 A **1)** | 5,3 A |
| 4,0 kW | 9,0 A **1)** | 9,0 A **1) 3)** | 9,0 A **1) 3)** | 7,6 A **1) 3)** | 6,1 A **3)** |

1) Three-phase connection requires a commutating choke.
2) Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
3) Reduction of switching frequency in thermal limit range
4) Maximum current in continuous operation

## 8.6 Size 3 and 4 KFU 410 (5,5 to 15,0 kW, 400 V)

| **Type** | | | | | | | |
|---|---|---|---|---|---|---|---|
| KFU 410 | | | -14,0 | -18,0 | -22 | -25 | -32 |
| Size | | | 3 | | | 4 | |
| Output, motor side | | | | | | | |
| Recommended motor shaft power | P | kW | 5,5 | 7,5 | 9,2 | 11,0 | 15,0 |
| Output current | I | A | 14,0 | 18,0 | 22,0 **3)** | 25,0 | 32,0 |
| Long-term overload current (60 s) | I | A | 21,0 | 26,3 | 30,3 | 37,5 | 44,5 |
| Short-time overload current (1 s) | I | A | 28,0 | 33,0 | 33,0 | 50,0 | 64,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | | |
| Protection | - | - | Short circuit / earth fault proof | | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | | |
| Switching frequency | f | kHz | 2, 4, 8, 12, 16 | | | | |
| Output, braking resistor | | | | | | | |
| Min. braking resistance | R | Ω | 48 | 48 | 48 | 32 | 32 |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 80 | 58 | 48 | 48 | 32 |
| Input, mains side | | | | | | | |
| Mains current 2) | I | A | 14,2 | 15,8 1) | 20,0 1) | 26,0 | 28,2 1) |
| Mains voltage | U | V | 320 ... 528 | | | | |
| Mains frequency | f | Hz | 45 ... 66 | | | | |
| Fuses | I | A | 16 | 25 | | 35 | |
| UL type 600 VAC RK5 | I | A | 20 | | | 30 | 40 |
| Mechanical | | | | | | | |
| Dimensions | HxWxD | mm | 250x100x200 | | | 250x125x200 | |
| Weight approx. | m | kg | 3,0 | | | 3,7 | |
| Ingress protection rating | - | - | IP20 (EN60529) | | | | |
| Connection terminals | A | $mm^2$ | 0,2 ... 6 | | | 0,2 ... 16 | |
| Form of assembly | - | - | vertical | | | | |
| **Ambient conditions** | | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 145 | 200 | 225 | 240 | 310 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current 4)** | | | | | |
|---|---|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | | | |
| | 2 kHz | 4 kHz | 8 kHz | 12 kHz | 16 kHz |
| 5,5 kW | 14,0 A | 14,0 A | 14,0 A | 11,8 A | 9,5 A |
| 7,5 kW | 18,0 A **1)** | 18,0 A **1)** | 18,0 A **1)** | 15,1 A **1)** | 12,2 A |
| 9,2 kW **1)** | 23,0 A | 22,7 A **3)** | 22,0 A **3)** | 18,5 A **3)** | 15,0 A **3)** |
| 11 kW | 25,0 A | 25,0 A | 25,0 A | 21,0 A | 17,0 A |
| 15 kW | 32,0 A **1)** | 32,0 A **1)** | 32,0 A **1)** | 26,9 A **1)** | 21,8 A |

## 8.7 Size 5 KFU 410 (18,5 to 30,0 kW, 400 V)

| **Typ** | | | | | |
|---|---|---|---|---|---|
| KFU 410 | | | -40 | -45 | -60 |
| Size | | | 5 | | |
| **Output, motor side** | | | | | |
| Recommended motor shaft power | P | kW | 18,5 | 22,0 | 30,0 |
| Output current | I | A | 40,0 | 45,0 | 60,0 |
| Long-term overload current (60 s) | I | A | 60,0 | 67,5 | 90,0 |
| Short-time overload current (1 s) | I | A | 80,0 | 90,0 | 120,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | |
| Protection | - | - | Short circuit / earth fault proof | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | |
| Switching frequency | f | kHz | 2, 4, 8 | | |
| Output, braking resistor | | | | | |
| Min. braking resistance | R | Ω | 16 | | |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 26 | 22 | 16 |
| Input, mains side | | | | | |
| Mains current [2] | I | A | 42,0 | 50,0 | 58,0 [1] |
| Mains voltage | U | V | 320 ... 528 | | |
| Mains frequency | f | Hz | 45 ... 66 | | |
| Fuses | I | A | 50 | | 63 |
| UL type 600 VAC RK5 | I | A | 50 | | 60 |
| Mechanical | | | | | |
| Dimensions | HxWxD | mm | 250x200x260 | | |
| Weight approx. | m | kg | 8 | | |
| Ingress protection rating | - | - | IP20 (EN60529) | | |
| Connection terminals | A | $mm^2$ | to 25 | | |
| Form of assembly | - | - | vertical | | |
| **Ambient conditions** | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 445 | 535 | 605 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [3]** | | | |
|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | |
| | 2 kHz | 4 kHz | 8 kHz |
| 18,5 kW | 40,0 A | 40,0 A | 40,0 A |
| 22 kW | 45,0 A | 45,0 A | 45,0 A |
| 30 kW | 60,0 A [1] | 60,0 A [1] | 60,0 A [1] |

[1] Three-phase connection requires a commutating choke.
[2] Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
[3] Maximum current in continuous operation

## 8.8 Size 6 KFU 410 (37 to 65kW, 400 V)

| **Typ** | | | | | | |
|---|---|---|---|---|---|---|
| KFU 410 | | | -75 | -90 | -110 | -125 |
| Size | | | 6 | | | |
| **Output, motorside** | | | | | | |
| Recommended motor shaft power | P | kW | 37,0 | 45,0 | 55,0 | 65,0 |
| Output current | I | A | 75,0 | 90,0 | 110,0 | 125,0 |
| Long-term overload current (60 s) | I | A | 112,5 | 135,0 | 165,0 | 187,5 |
| Short-time overload current (1 s) | I | A | 150,0 | 180,0 | 220,0 | 250,0 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | |
| Protection | - | - | Short circuit / earth fault proof | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | |
| Switching frequency | f | kHz | 2, 4, 8 | | | |
| **Output, bgranking resistor [5)]** | | | | | | |
| Min. braking resistance | R | Ω | 7,5 | | | |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 13 | 11 | 9 | 7,5 |
| **Input, mains side** | | | | | | |
| Netzstrom [2)] | I | A | 87,0 | 104,0 | 105,0 [1)] | 120,0 [1)] |
| Netzspannung | U | V | 320 ... 528 | | | |
| Netzfrequenz | f | Hz | 45 ... 66 | | | |
| Sicherungen | I | A | 100 | 125 | 125 | 125 |
| UL-Typ 600 VAC RK5 | I | A | 100 | 125 | 125 | 125 |
| **Mechanik** | | | | | | |
| Dimensions | HxWxD | mm | 400x275x260 | | | |
| Weight approx. | m | kg | 20 | | | |
| Ingress protection rating | - | - | IP20 (EN60529) | | | |
| Connection terminals | A | $mm^2$ | up to 70 | | | |
| Form of assembly | - | - | vertical | | | |
| **Ambient conditions** | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 665 | 830 | 1080 | 1255 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [4)]** | | | |
|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | |
| | 2 kHz | 4 kHz | 8 kHz |
| 37 kW | 75,0 A | 75,0 A | 75,0 A |
| 45 kW | 90,0 A | 90,0 A | 90,0 A |
| 55 kW | 110,0 A [1)] | 110,0 A [1)] | 110,0 A [1)] |
| 65 kW | 125,0 A [1) 3)] | 125,0 A [1) 3)] | 125,0 A [1) 3)] |

[1)] Three-phase connection requires a commutating choke.
[2)] Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
[3)] Reduction of switching frequency in thermal limit range
[4)] Maximum current in continuous operation
[5)] As an option, the frequency inverter of this size is available without internal brake transistor.

## 8.9 Size 7 KFU 410 (75 to 132 kW, 400 V)

| **Type** | | | | | | |
|---|---|---|---|---|---|---|
| KFU 410 | | | -150 | -180 | -210 | -250 |
| Size | | | 7 | | | |
| **Output, motor side** | | | | | | |
| Recommended motor shaft power | P | kW | 75 | 90 | 110 | 132 |
| Output current | I | A | 150 | 180 | 210 | 250 |
| Long-term overload current (60 s) | I | A | 225 | 270 | 315 | 332 |
| Short-time overload current (1 s) | I | A | 270 | 325 | 375 | 375 |
| Output voltage | U | V | Maximum input voltage, three-phase | | | |
| Protection | - | - | Short circuit / earth fault proof | | | |
| Rotary field frequency | f | Hz | 0 ... 599, depending on switching frequency | | | |
| Switching frequency | f | kHz | 2, 4, 8 | | | |
| **Output, braking resistor (external) [5)]** | | | | | | |
| Mit braking resistance | R | Ω | 4,5 | | 3,0 | |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 6,1 | 5,1 | 4,1 | 3,8 |
| **Input mains side** | | | | | | |
| Mains current [2)] | I | A | 143 [1)] | 172 [1)] | 208 [1)] | 249 [1)] |
| Mains voltage | U | V | 320 ... 528 | | | |
| Mains frequency | f | Hz | 45 ... 66 | | | |
| Fuses | I | A | 160 | 200 | 250 | 315 |
| Fuses as per UL[6)] Cooper Bussmann | Typ | | FWH-250A | FWH-300A | FWH-350A | FWH-400A |
| **Mechanical** | | | | | | |
| Dimensions | HxWxD | mm | 510 x 412 x 351 | | | |
| Weight approx. | m | kg | 45 | | 48 | |
| Ingress protection rating | - | - | IP20 (EN60529) | | | |
| Connection terminals | A | $mm^2$ | up to 2 x 95 | | | |
| Form of assembly | - | - | vertical | | | |
| **Ambient conditions** | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 1600 | 1900 | 2300 | 2800 |
| Coolant temperature | $T_n$ | °C | 0 ... 40 (3K3 DIN IEC 721-3-3) | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [4)]** | | | |
|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | |
| | 2 kHz | 4 kHz | 8 kHz |
| 75 kW | 150 A | 150 A | 150 A |
| 90 kW | 180 A | 180 A | 180 A |
| 110 kW | 210 A | 210 A | 210 A[3)] |
| 132 kW | 250 A | 250 A | 250 A[3)] |

[1)] Three-phase connection requires a commutating choke.
[2)] Mains current with relative mains impedance ≥ 1% (see chapter„Electrical installation“)
[3)] Reduction of switching frequency in thermal limit range
[4)] Maximum current in continuous operation
[5)] As an option, the frequency inverter of this size is available without internal brake transistor.
[6)] For UL-compliant fusing, the specified Cooper Bussmann fuses must be used. Other fuses must not be used for UL-conforming fusing.

## 8.10 Size 8 KFU 410 (160 to 400 kW, 400 V)

| **Type** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KFU 410 | | | -305 | -380 | -475 | -595 | -645 | -735 |
| Size | | | 8 | | | | | |
| **Output, motor side** | | | | | | | | |
| Recommended motor shaft power | P | kW | 160 | 200 | 250 | 315 | 355 | 400 |
| Output current | I | $A_{eff.}$ | 305 | 380 | 475 | 595 | 645 | 735 |
| Long-term overload current (60 s) [1] | I | $A_{eff.}$ | 460 | 570 | 715 | 895 | 970 | 1100 |
| Short-term overload current (1 s) [2] | I | $A_{eff.}$ | 550 | 685 | 855 | 1070 | 1160 | 1330 |
| Output voltage | U | $V_{eff.}$ | Maximum input voltage, three-phase | | | | | |
| Protection | - | - | Short circuit / earth fault proof | | | | | |
| Rotary field frequency | f | Hz | ±500 Hz [3] | | | | | |
| Switching frequency | f | kHz | 2, 4, 8 [4] | | | | | |
| **Output, braking restor (external)** [5] | | | | | | | | |
| Min. braking resistance | R | Ω | 1,20 | 1,20 | 1,20 | 0,80 | 0,80 | 0,80 |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 1,50 | 1,50 | 1,50 | 1,00 | 1,00 | 1,00 |
| **Input, mains side** | | | | | | | | |
| Mains current [6] | I | A | 280 | 350 | 440 | 550 | 620 | 690 |
| Mains voltage | U | V | 320 … 528 | | | | | |
| Mains frequency | f | Hz | 45 … 66 | | | | | |
| Fuses [7] | I | A | 400 | 500 | 630 | 700 | 800 | 900 |
| Fuses as per UL [8] in preparation | Typ | | 170M5*08 or 170M5*58 | 170M5*10 or 170M5*60 | 170M5*12 or 170M5*62 | 170M5*13 or 170M5*63 | 170M5*14 or 170M5*64 | 170M5*15 or 170M5*65 |
| **Mechanical** | | | | | | | | |
| Dimensions | HxWxD | mm | 1067 x 439 x 375 | | | | | |
| Weight approx. | m | kg | 120 | 120 | 120 | 140 | 140 | 140 |
| Ingress protection rating | - | - | IP20 (EN60529) | | | | | |
| Connection terminals | A | $mm^2$ | up to 2 x 240 | | | | | |
| Form of assembly | - | - | vertical | | | | | |
| **Ambient conditions** | | | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 3800 | 4500 | 5600 | 6300 | 6850 | 7900 |
| Coolant temperature | $T_n$ | °C | -25 … 45 (3K3 DIN IEC 60721-3-3) | | | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

**Output current** [9]

| Frequency inverter nominal power | Switching frequency | | |
|---|---|---|---|
| | 2 kHz | 4 kHz | 8 kHz |
| 160 kW | 305 | 305 | 305 |
| 200 kW | 380 | 380 | 380 |
| 250 kW | 475 | 475 | 475 |
| 315 kW | 595 | 595 | 595 |
| 355 kW | 645 | 645 | 645 |
| 400 kW | 735 | 735 | 735 |

[1] Power reduction with torsional frequencies below 10 Hz
[2] Only with torsional frequencies above 10 Hz
[3] Depending on switching frequency
[4] Reduction of switching frequency possible on certain conditions
[5] As an option, the frequency inverter of this size is available without internal brake transistor
[6] Rated value with recommended motor power, 400V mains voltage and mains inductance $U_K$=4%
[7] Semiconductor fuses recommended (e.g. Bussmann Type 170M)
[8] For UL-compliant fusing, the specified Cooper Bussmann fuses must be used. * is a placeholder for assembly.
[9] Maximum current in continuous operation

## 8.11 Size 8 KFU 510 (160 to 400 kW, 525 V)

| **Type** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KFU 510 | | | --230 | -290 | -360 | -450 | -490 | -560 |
| Size | | | 8 | | | | | |
| **Output, motor side** | | | | | | | | |
| Recommended motor shaft power | P | kW | 160 | 200 | 250 | 315 | 355 | 400 |
| Output current | I | $A_{eff.}$ | 230 | 290 | 360 | 450 | 490 | 560 |
| Long-term overload current (60 s) [1] | I | $A_{eff.}$ | 345 | 435 | 540 | 675 | 735 | 840 |
| Short-term overload current (1 s) [2] | I | $A_{eff.}$ | 420 | 520 | 650 | 810 | 880 | 1000 |
| Output voltage | U | $V_{eff.}$ | Maximum input voltage, three-phase | | | | | |
| Protection | - | - | Short circuit / earth fault proof | | | | | |
| Rotary field frequency | f | Hz | ±500 Hz [3] | | | | | |
| Switching frequency | f | kHz | 2, 4, 8 [4] | | | | | |
| **Output, braking resistor (external)** [5] | | | | | | | | |
| Min. braking resistance | R | Ω | 1,20 | 1,20 | 1,20 | 0,80 | 0,80 | 0,80 |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 2,70 | 2,70 | 2,70 | 1,50 | 1,50 | 1,50 |
| **Imput. mains side** | | | | | | | | |
| Mains current [6] | I | A | 215 | 270 | 335 | 420 | 470 | 525 |
| Mains voltage [7] | U | V | 525 | | | | | |
| Mains frequency | f | Hz | 50 (60) | | | | | |
| Fuses [8] | I | A | 315 | 350 | 450 | 550 | 630 | 700 |
| **Mechanical** | | | | | | | | |
| Dimensions | HxWxD | mm | 1067 x 439 x 375 | | | | | |
| Weight approx. | m | kg | 120 | 120 | 120 | 140 | 140 | 140 |
| Ingress protection rating | - | - | IP20 (EN60529) | | | | | |
| Connection terminals | A | $mm^2$ | up to 2 x 240 | | | | | |
| Form of assembly | - | - | vertical | | | | | |
| **Ambient conditions** | | | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 3800 | 4500 | 5600 | 6300 | 6850 | 7900 |
| Coolant temperature | $T_n$ | °C | -25 … 45 (3K3 DIN IEC 60721-3-3) | | | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current** [9] | | | |
|---|---|---|---|
| Frequency inferter nominal power | Switching frequency | | |
| | 2 kHz | 4 kHz | 8 kHz |
| 160 kW | 230 | 230 | 230 |
| 200 kW | 290 | 290 | 290 |
| 250 kW | 360 | 360 | 360 |
| 315 kW | 450 | 450 | 450 |
| 355 kW | 490 | 490 | 490 |
| 400 kW | 560 | 560 | 560 |

[1] Power reduction with torsional frequencies below 10 Hz
[2] Only with torsional frequencies above 10 Hz
[3] Depending on switching frequency
[4] Reduction of switching frequency possible on certain conditions
[5] As an option, the frequency inverter of this size is available without internal brake transistor
[6] Rated value with recommended motor power, 525V mains voltage and mains inductance $U_K$=4%
[7] Note that, in addition to AC 3x525V connection, AC 3x400V connection is also required, see Chapter 4.3
[8] Semiconductor fuses recommended (e.g. Bussmann Type 170M)
[9] Maximum current in continuous operation

## 8.12 Size 8 KFU 610 (160 to 400 kW, 690 V)

| **Type** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KFU 610 | | | -180 | -230 | -280 | -350 | -400 | -450 |
| Size | | | 8 | | | | | |
| **Output motor side** | | | | | | | | |
| Recommended motor shaft power | P | kW | 160 | 200 | 250 | 315 | 355 | 400 |
| Output current | I | $A_{eff.}$ | 180 | 230 | 280 | 350 | 400 | 450 |
| Long-term overload current (60 s) [1] | I | $A_{eff.}$ | 270 | 350 | 420 | 530 | 600 | 675 |
| Short-term overload current (1 s) [2] | I | $A_{eff.}$ | 330 | 420 | 510 | 630 | 720 | 750 |
| Output voltage | U | $V_{eff.}$ | Maximum input voltage, three-phase | | | | | |
| Protection | - | - | Short circuit / earth fault proof | | | | | |
| Rotary field frequency | f | Hz | ±500 Hz [3] | | | | | |
| Switching frequency | f | kHz | 2, 4, 8 [4] | | | | | |
| **Output, braking resistor (external)** | | | | | | | | |
| Min. braking resistance | R | Ω | 3,00 | 3,00 | 3,00 | 1,80 | 1,80 | 1,80 |
| Recommended braking resistor ($U_{dBC}$ = 770 V) | R | Ω | 5,00 | 5,00 | 5,00 | 3,00 | 3,00 | 3,00 |
| **Input, mains side** | | | | | | | | |
| Power supply current [6] | I | A | 160 | 200 | 250 | 320 | 360 | 410 |
| Mains voltage [7] | U | V | 690 (for UL reduced: 600) | | | | | |
| Mains frequency | f | Hz | 50 (60) | | | | | |
| Fuses [8] | I | A | 250 | 315 | 350 | 450 | 500 | 550 |
| **Mechanical** | | | | | | | | |
| Dimensions | HxWxD | mm | 1067 x 439 x 375 | | | | | |
| Weight approx. | m | kg | 120 | 120 | 120 | 140 | 140 | 140 |
| Ingress protection rating | - | - | IP20 (EN60529) | | | | | |
| Connection terminals | A | $mm^2$ | up to 2 x 240 | | | | | |
| Form of assembly | - | - | vertical | | | | | |
| **Ambient conditions** | | | | | | | | |
| Energy dissipation (2 kHz switching frequency) | P | W | 3200 | 3950 | 4500 | 5500 | 6250 | 6900 |
| Coolant temperature | $T_n$ | °C | -25 … 45 (3K3 DIN IEC 721-3-3) | | | | | |
| Storage temperature | $T_L$ | °C | -25 ... 55 | | | | | |
| Transport temperature | $T_T$ | °C | -25 ... 70 | | | | | |
| Rel. humidity | - | % | 15 ... 85, not condensing | | | | | |

If required by the customer, the switching frequency may be increased if the output current is reduced at the same time. Comply with the applicable standards and regulations for this operating point.

| **Output current [9]** | | | |
|---|---|---|---|
| Frequency inverter nominal power | Switching frequency | | |
| | 2 kHz | 4 kHz | 8 kHz |
| 160 kW | 180 | 180 | 180 |
| 200 kW | 230 | 230 | 230 |
| 250 kW | 280 | 280 | 280 |
| 315 kW | 350 | 350 | 350 |
| 355 kW | 400 | 400 | 400 |
| 400 kW | 450 | 436 | 410 |

**1)** Power reduction with torsional frequencies below 15 Hz
**2)** Only with torsional frequencies above 15 Hz
**3)** Depending on switching frequency
**4)** Reduction of switching frequency possible on certain conditions
**5)** As an option, the frequency inverter of this size is available without internal brake transistor
**6)** Rated value with recommended motor power, 690V mains voltage and mains inductance UK=4%
**7)** Note that, in addition to AC 3x690V connection, AC 3x400V connection is also required, see Chapter 4.3.
**8)** Semiconductor fuses recommended (e.g. Bussmann Type 170M)
**9)** Maximum current in continuous operation