

CUE

Installation and operating instructions



CUE
Data booklet
English
<http://net.grundfos.com/qr/i/96706948>



CUE
Safety instructions
<http://net.grundfos.com/qr/i/99674140>

CUE

English (GB)

Installation and operating instructions	4
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English (GB) Installation and operating instructions

Original installation and operating instructions

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1. General information



Read this document before you install the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1.1 Hazard statements

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.



DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:



SIGNAL WORD

Description of the hazard

Consequence of ignoring the warning

- Action to avoid the hazard.

1.2 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.



Observe these instructions for explosion-proof products.



A blue or grey circle with a white graphical symbol indicates that an action must be taken.



A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.



If these instructions are not observed, it may result in malfunction or damage to the equipment.



Tips and advice that make the work easier.

1.3 References

Technical documentation for the Grundfos CUE products:

- The manual contains all information required for putting the CUE into operation.
- The data booklet contains all technical information about the construction and applications of the unit.
- The service instructions contain all required information for disassembling and repairing the frequency converter.

Technical documentation is available at the Grundfos Product Center at www.grundfos.com.

If you have any questions, contact the nearest Grundfos company or service workshop.

2. Product introduction

2.1 Product description

The CUE is an external frequency converter especially designed for pumps.

With the integrated startup guide, the installer can quickly set central parameters and put the unit into operation.

Connected to a sensor or an external control signal, the CUE quickly adapts the pump speed to the actual demand.

The operating panel displays any alarms or warnings.



If the pump speed exceeds the rated speed, the pump is overloaded.

2.2 Intended use

The CUE frequency converters can be used in both new and existing installations. Local operation is performed via the operating panel that has a graphic display showing the menu structure. The menu structure uses the same system as the Grundfos E-pumps.

Remote operation is performed via external signals, for instance, via digital inputs or GENIbus communication.



Do not use the CUE to control ATEX-approved motors and do not use it in applications with a potential of explosion risk.

2.3 Applications

The CUE series and the Grundfos standard pumps are a supplement to the Grundfos E-pumps range with an integrated frequency converter.

A CUE solution offers the same E-pump functionality in the following cases:

- in mains voltage or power ranges not covered by the E-pump range
- in applications where an integrated frequency converter is not desirable or permissible.

2.4 Identification

2.4.1 Nameplate

The CUE can be identified by the nameplate or the packaging label.



Example of a nameplate

Designation	Description
Prod. no	Product number
T/C	Product name
S/N	Serial number, the last three digits indicating the production date
1.1 kW (1.5 hp)	Typical shaft power of the motor
IN	Supply voltage, frequency and maximum input current
OUT	Motor voltage, frequency and maximum output current ¹⁾

Designation	Description
Open Type/IP20	Enclosure class
T _{amb.}	Maximum ambient temperature
FRAME	Enclosure size

- 1) The maximum output frequency usually depends on the pump type

3. Receiving the product

WARNING
Crushing of feet
Death or serious personal injury



- Use safety shoes during transportation and avoid stacking boxes.

CAUTION
Lifting hazard
Minor or moderate personal injury



- Use proper lifting equipment when handling the product.
- Follow local regulations.

3.1 Transporting the product

To prevent damage during transport, the unit must only be unpacked at the installation site.

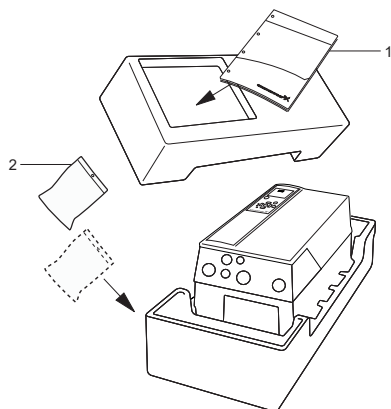
3.2 Inspecting the product

Check on receipt that the packaging is intact and the unit is complete. In case of damage, contact the carrier immediately.

 The CUE is delivered in packaging that is not suitable for outdoor storage.

3.3 Scope of delivery

The packaging contains one or more accessory bags, the documentation and the unit itself.



TM038857

CUE packaging

Pos.	Description
1	Documentation
2	Accessory bags

3.4 Lifting the product

3.4.1 0.55-90 kW / 0.75-125 hp: A2-A5, B1-B4, C1-C4

To determine a safe lifting method, check the weight of the unit. See the chapter on dimensions and weights.

Ensure that the lifting device is suitable for the task. If necessary, use a hoist, crane, or forklift with the appropriate rating to move the unit.

Make sure to use the hoist rings on the unit, if provided.

3.4.2 110-315 kW / 150-450 hp: D1h-D7h

WARNING

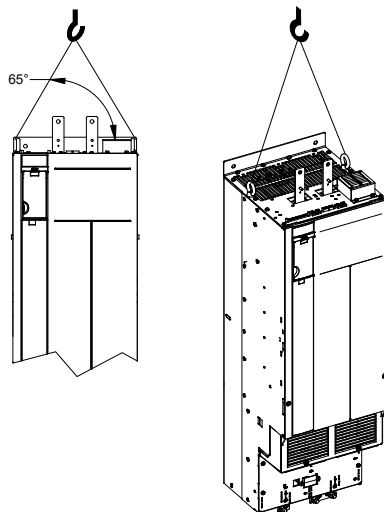
Overhead load

Death or serious personal injury

- Use lifting equipment rated for the weight of the product, and follow local regulations when lifting the product.
- Never walk under suspended loads.
- Wear suitable personal protective equipment.
- Make sure that the angle from the top of the drive module to the lifting cables is at least 65°, as the angle affects the maximum load force exerted on the cable.
- Observe the center of gravity and position the load correctly to avoid unexpected shifting during lifting and transport.



Always lift the drive using the dedicated eye bolts at the top of the drive.



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Related information

[12.5.2 Enclosures D1h-D7h, E1h and E2h](#)

3.4.3 355-560 kW / 500-750 hp: E1h-E2h

WARNING

Overhead load

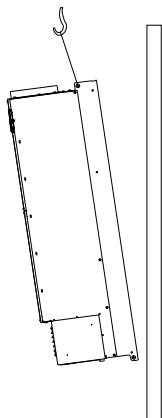
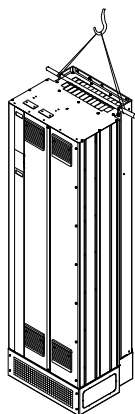
Death or serious personal injury

- Use lifting equipment rated for the weight of the product, and follow local regulations when lifting the product.
- Never walk under suspended loads.
- Wear suitable personal protective equipment.
- Make sure that the angle from the top of the drive module to the lifting cables is at least 60°, as the angle affects the maximum load force exerted on the cable.
- Observe the center of gravity and position the load correctly to avoid unexpected shifting during lifting and transport.



Always lift the drive using a lifting bar inserted into the lifting eyes.

The maximum diameter for the lifting bar must be 20 mm (0.8 inch).



TM089642

Related information

[12.5.2 Enclosures D1h-D7h, E1h and E2h](#)

4. Installation requirements

WARNING

Sharp element

Death or serious personal injury



- Use safety knives and protective gloves when unpacking the product.

WARNING

Lifting hazard

Death or serious personal injury



- Use proper lifting equipment when handling the product.
- Follow local regulations.

WARNING

Electric shock

Death or serious personal injury



- Before starting any work on the product, make sure that the power supply is switched off, and that it cannot be switched on accidentally. Follow the minimum waiting time after powering off, as described in the table below.
- Touching the electrical parts may be fatal, even after the CUE is switched off.



Any installation, maintenance and inspection must be carried out by trained personnel.

Minimum waiting time after switching off the power supply

Supply voltage	Power P2		Min. waiting time
	[kW]	[hp]	[min]
200-240	0.75 - 3.7	1 - 5	4
	5.5 - 45	6.5 - 60	15
	0.55 - 7.5	0.8 - 10	4
380-500	11 - 90	15 - 125	15
	110 - 315	150 - 450	20
	355 - 560	500 - 750	40
525-600	0.75 - 7.5	1 - 10	4
	11 - 90	15 - 125	15
	1.1 - 7.5	1.5 - 10	7
525-690	11 - 90	15 - 125	15
	110 - 315	150 - 450	20



A shorter waiting time is only allowed if stated so on the nameplate of the product.

Related information

[6. Electrical connection](#)

[10. Servicing the product](#)

4.1 Safety regulations

- The **OFF** button of the operating panel does not disconnect the CUE from the power supply, and therefore must not be used as a safety switch.
- The CUE must be earthed correctly and protected against indirect contact, according to local regulations.
- The leakage current to protective earth exceeds 3.5 mA.
- Enclosures with an IP20/21 rating must be equipped with an access panel to prevent free access to the unit.
- Enclosures with an IP54/55 rating must not be installed outdoors without additional protection against weather conditions and UV radiation.
- The STO function does not disconnect the CUE from the power supply, and therefore must not be used as a safety switch.
- The STO function does not prevent unwanted movement from external forces on the motor, such as back pressure.
- A protective cover must be installed on the motor shaft.

Always observe local regulations concerning cable cross-section, short-circuit protection and overcurrent protection.

The general safety necessitates special considerations as to the following aspects:

- fuses and switches for overcurrent and short-circuit protection
- selection of cables (mains current, motor, load distribution and relay)
- net configuration (IT, TN, earthing)
- safety regarding connecting inputs and outputs (PELV).

4.2 IT mains

If the drive is supplied from an isolated mains source, for instance, IT mains, floating delta or grounded delta, or a TT/TN-S system with a grounded leg, it is recommended to turn off the RFI switch via the parameter **14-50 RFI Filter** on the drive, and the parameter **14-50 RFI Filter** on the filter itself, as described in the standard IEC 364-3. In the Off position, the filter capacitors between the chassis and the DC link are cut off to avoid damage to the DC link and reduce the ground capacity currents, according to the IEC 61800-3.

In the following cases, it is recommended to set the parameter **14-50 RFI Filter** to **[1] On**:

- optimum EMC performance is required
- multimotor setup
- the motor cable length is above 25 m (82 ft).



Do not connect 380-500 V CUE frequency converters to mains supplies with a voltage between phase and protective earth of more than 440 V.



It is not recommended to use output contactors for 525-690 V drives connected to an IT mains network.



It is important to use isolation monitors that are rated for use with power electronics, in accordance with the IEC 61557-8.

4.3 Environmental restrictions

Aggressive environments



Do not install the CUE in an environment where the air contains liquids, particles or gases that may affect and damage the electronic components.

The unit contains a large number of mechanical and electronic components, that are all vulnerable to environmental impact.

Performance reduction

Low air pressure



At altitudes above 2000 m (6600 ft), the PELV requirements cannot be met.

At low air pressure, the cooling capacity of air is reduced, and the CUE automatically reduces the performance to prevent overload. It may be necessary to select a unit with higher performance.

Long motor cables

The maximum allowed cable length is 300 m (1000 ft) for unscreened and 150 m (500 ft) for screened cables. In case longer cables are needed, contact Grundfos.

Related information

[6.3 Cable requirements](#)

[6.3.1 Cable cross-sections to signal terminals](#)

5. Mechanical installation

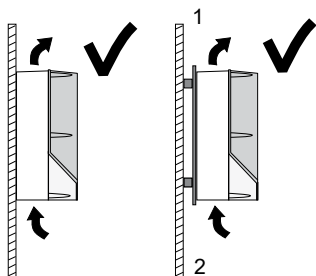


Products with an integrated STO function must be installed in an IP54 cabinet according to the IEC 60529 or in an equivalent environment. In special applications, a higher IP degree may be necessary.

Mounting requirements

The CUEs can be mounted side by side, but the following requirements must be observed to provide sufficient air circulation for cooling:

- There must be sufficient free space from other components above and below the CUE cabinet. See the table below.
- The ambient temperature can be up to 50 °C (122 °F).
- In case of wall mounting, the CUE cabinet must be hung directly on the wall or fitted with a back plate.

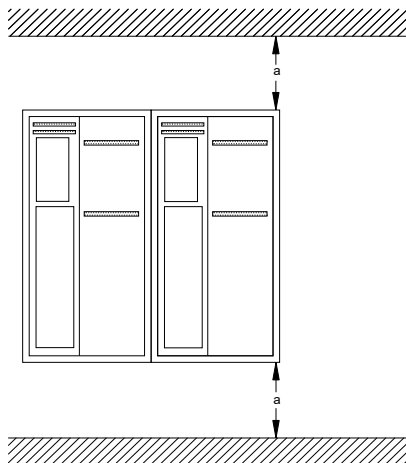


Example of correct mounting methods

Pos.	Description
1	Outlet airflow
2	Inlet airflow

Space requirements

Enclosure type	Free space	
	[mm]	[inch]
A2, A3, A4, A5	100	3.9
B1, B2, B3, B4, C1, C3	200	7.9
C2, C4, D1h, D2h, D5h, D7h, E1h, E2h	225	8.9



TM089662

Related information

12.1 Enclosure

5.1 Mounting the product

WARNING

Crushing of feet

Death or serious personal injury



- The CUE is very heavy and may fall over if the pedestal is not anchored to the floor.



The user is responsible for mounting the CUE securely on a firm surface.

5.1.1 A, B, C type enclosures

Cooling



The improper mounting of the unit can cause it to overheat and reduce its performance.

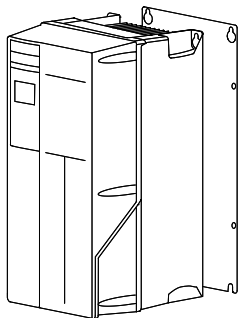
Mounting

- Make sure that the mounting surface is strong enough to support the weight of the unit.
- Install the unit as close as possible to the motor and use the shortest possible motor cables.
- Mount the unit vertically to a solid flat surface or to the optional backplate to provide sufficient airflow for cooling.

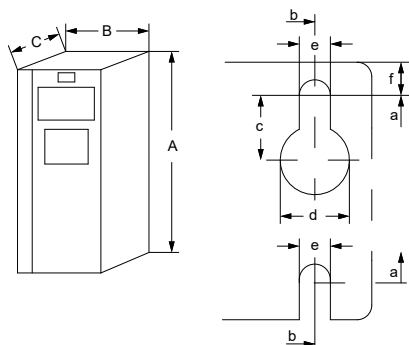


If the drive is free-standing or mounted on an uneven surface, it needs to be installed on a backplate. A backplate is also required when the drive is mounted on railings.

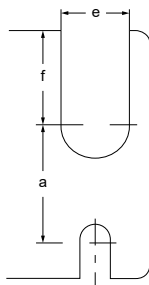
- Use the slotted mounting holes on the unit to secure it to a wall.



Mounting with backplate and railings



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Related information

12.5.1 Enclosures A2-A5, B1-B4 and C1-C4

5.1.2 D1h-D7h type enclosures

Depending on the drive model and configuration, the drive is floor- and wall-mountable. See the overview below.

Both mounting methods require a clearance of at least 225 mm (9 inch) above and below the drive for proper airflow. In case of floor-mounting, this can be achieved by mounting the drive on a pedestal.



The D7h models come with a standard pedestal. Optional kits are available for other D-sized drives.

Drive model	Floor-mounting	Wall-mounting
D1h	•	•
D2h	•	•
D3h ²⁾	-	•
D4h ²⁾	-	•
D5h	•	•
D7h	•	-

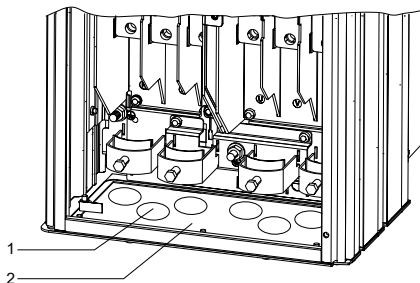
²⁾ The D3h and D4h models are P20/chassis drives, that is, they can be mounted on walls or on mounting plates within cabinets.

Creating cable entries

Prior to attaching the drive to the pedestal and installing it on the floor, cable entries need to be created on the gland plate, and the plate needs to be attached to the bottom of the drive.

The mains and motor cables can be routed through the gland plate, while the plate ensures to maintain the IP21/IP54 (NEMA Type 1 and Type 12) protection ratings. See the chapter on the gland plate dimensions.

- In case of metal gland plates, use a sheet metal punch to create cable entry holes on the plate, then insert cable fittings into the holes.

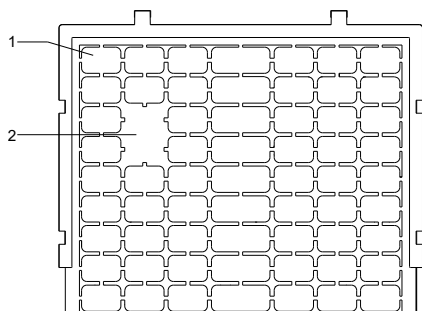


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TM089654

Pos.	Description
1	Cable entry hole
2	Metal gland plate

- For plastic gland plates, punch out the required number of plastic tabs.



TM089653

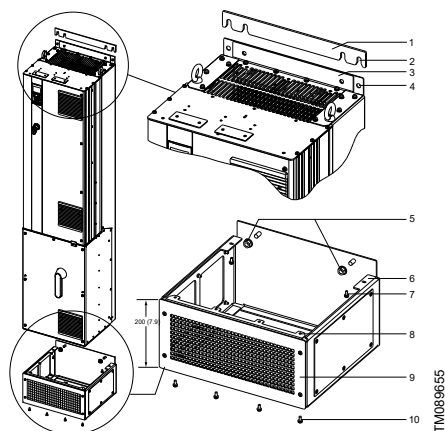
Pos.	Description
1	Plastic tabs
2	Tabs removed for cable access

5.1.2.1 Floor mounting

Installing the drive onto the pedestal

Standard pedestals can be installed by following the procedure below. In case of optional pedestals, refer to the instructions included in the kit.

- Loosen the 4 M5 screws and remove the front cover plate from the pedestal.
- Fasten 2 M10 nuts onto the threaded studs on the back cover of the pedestal, thus securing it to the back channel.
- Drive 2 M5 screws through the back flange of the pedestal and into the mounting bracket of the drive.
- Drive 4 M5 screws through the front flange of the pedestal and into the mounting holes of the gland plate.



TM089655

Pos.	Description
1	Pedestal wall spacer
2	Fastener slots
3	Mounting flange at the top of the drive
4	Mounting holes
5	M10 nuts
6	Pedestal back flange
7	M5 screw for back flange
8	Pedestal front flange
9	Pedestal front cover plate
10	M5 screw for front flange

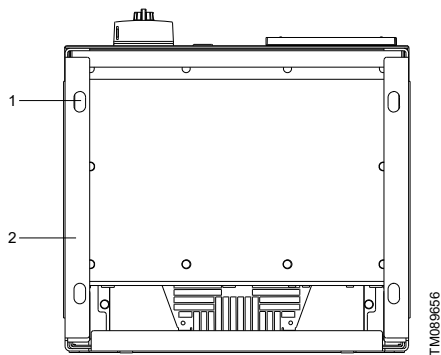
Floor mounting

Observe the following steps to secure the pedestal to the floor.

- Secure the pedestal to the floor by fastening 4 M10 bolts in the mounting holes at the bottom of the pedestal.
- Fit the pedestal front cover and fasten it with 4 M5 screws.
- Slide the wall spacer of the pedestal behind the mounting flange at the top side of the drive.
- Depending on the enclosure size, use 2-4 M10 bolts to secure the drive to the wall through the mounting holes at the top side of the drive.



Use only 1 bolt per mounting hole.



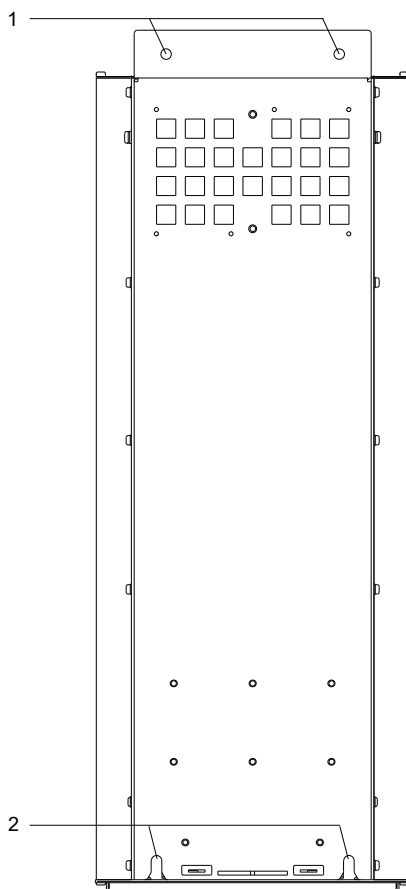
TM089656

Pos.	Description
1	Mounting holes
2	Bottom of the pedestal

5.1.2.2 Wall mounting

Use the following steps to mount the drive on a wall.

1. Align the fastener slots at the bottom side of drive to the correct position by driving 2 M10 bolts into the wall through them.
2. Position the fastener slots onto the M10 bolts.
3. Place the drive against the wall and secure it by fastening 2 M10 bolts in the mounting holes at the top side of the drive.



TM089657

Pos.	Description
1	Top mounting holes
2	Lower fastener slots

5.1.3 E1h-E2h type enclosures

The E1h and E2h enclosure sizes are intended only for floor installation. They are shipped with a pedestal and a cable entry plate, and both needs to be installed for proper mounting.

The pedestal has a height of 200 mm (7.9 inch) and is equipped with a ventilation port in the front to provide sufficient air-cooling for the power components of the drive.

The cable entry plate is necessary for air-cooling to the control components of the drive via a door fan, and for maintaining the IP21/IP54 (NEMA Type 1/Type 12) protection rating.

Creating cable entries

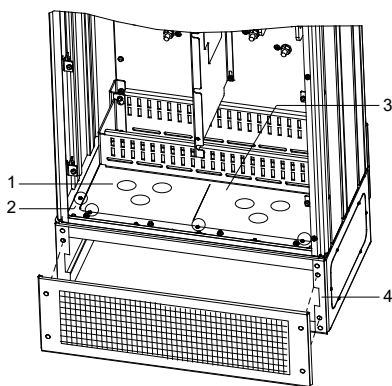
The cable entry plate also provides cable entry and termination points, and it is installed between the drive enclosure and the pedestal. Depending on stud orientation, the plate can be installed either through the enclosure or the pedestal. See the chapter on the gland plate dimensions.

1. Use a sheet metal punch to create cable entry holes on the plate.
2. Insert the cable entry plate using one of the following methods:

Through the pedestal: slide the plate through the slot (4) in the front side of the pedestal.

Through the enclosure: align the plate in such an angle that it can be slid under the slotted brackets.

3. Align the studs on the cable entry plate to the holes on the pedestal and secure them with 10 M5 nuts (2).
4. Tighten each nut to 2.3 Nm (1.7 ft-lb).



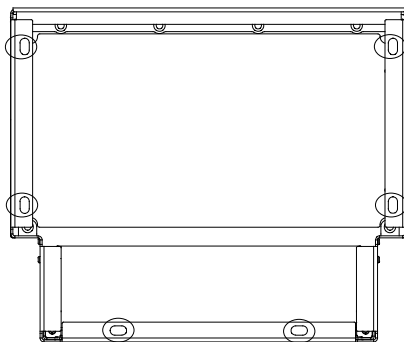
TM089G46

Pos.	Description
1	Cable entry hole
2	M5 nut
3	Cable entry plate
4	Slot in pedestal base

5.1.3.1 Floor mounting

Securing the pedestal to the floor

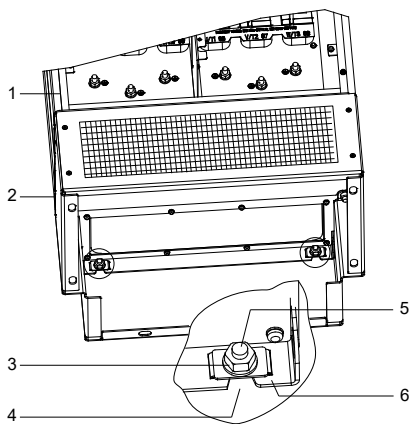
1. Determine a suitable location for the unit observing the requirements regarding operating conditions and cable access.
2. Remove the front panel of the pedestal to gain access to the mounting holes.
3. Set the pedestal on the floor at the desired location and secure it by fastening 6 bolts through the mounting holes.



TM089G43

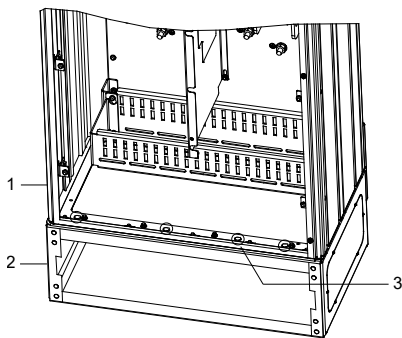
Installing the drive onto the pedestal

1. Lift the drive onto the pedestal. There are 2 bolts in the rear of the pedestal that slide into the 2 slotted holes in the rear of the enclosure.
2. Align the drive to the correct position by adjusting the bolts up or down, and loosely secure it with 2 M10 nuts and locking brackets.
3. Make sure that there is a clearance of 225 mm (9 inch) at the top of the unit for proper airflow.
4. Make sure that the air intake at the bottom front of the unit is not obstructed.
5. Secure the enclosure to the top of the pedestal using 6 M10×30 fasteners. Loosely tighten each of them until all bolts are installed.
6. Tighten each bolt to 19 Nm (14 ft-lb).
7. Tighten the 2 M10 nuts at the rear side of the enclosure to 19 Nm (14 ft-lb).



TM089644

Pos.	Description
1	Enclosure
2	Pedestal
3	M10 nut
4	Slotted hole in enclosure
5	Bolt at the rear of the pedestal
6	Locking bracket



TM089645

Pos.	Description
1	Enclosure
2	Pedestal
3	M10x30 fasteners

6. Electrical connection

WARNING

Electric shock

Death or serious personal injury



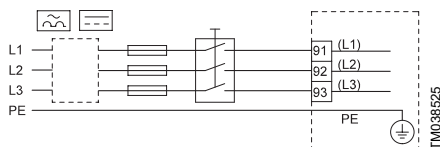
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be accidentally switched on. For required waiting times after powering off, see the section on installation requirements.
- Touching the electrical parts may be fatal, even after the CUE is switched off.

The owner or installer is responsible for ensuring correct earthing and protection according to local regulations, along with proper security measures.



For products equipped with the Safe Torque Off (STO) function, ensure short-circuit protection of the cable between terminal 37 and the external safety device.

The frequency converter parameters can be password protected.



Example of three-phase mains connection of CUE with main switch, backup fuses and additional protection

Related information

- 4. Installation requirements
- 6.2 EMC-compliant installation
- 6.6 Motor and mains connection
- 9.3 Checking the direction of the motor rotation

6.1 Electrical protection

6.1.1 Protection against electric shock, indirect contact

CAUTION

Electric shock

Minor or moderate personal injury



- The CUE must be earthed correctly and protected against indirect contact according to local regulations.
- If the leakage current is greater than 3.5 mA, use a PE cable with a minimum cross-section of at least 10 mm² (7 AWG), or use 2 separate PE cables with the same cross section as the power cable.

The leakage currents are measured in accordance with the EN 61800-5-1:2007.

Protective conductors must always have a yellow and green (PE) or yellow, green and blue (PEN) colour marking.

A permanent installation and mains connection is required for the CUE.

6.1.2 Short-circuit current

The CUE and the supply system must be protected against short-circuit currents.

Grundfos requires that the specified backup fuses are used for protection against short-circuit currents. See the section on cable cross-sections regarding signal terminals.

The unit offers complete short-circuit protection in case of a short-circuit occurs on the motor output.

Related information

6.3.1 Cable cross-sections to signal terminals

6.1.3 Additional protection

WARNING

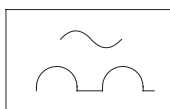
Electric shock

Death or serious personal injury

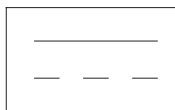


- The leakage current to protective earth must exceed 3.5 mA.

If the CUE is connected to an electrical installation where an earth leakage circuit breaker/residual-current device (ELCB/RCD) is used as additional protection, the ELCB/RCD must be a Type B, marked with the following symbols:



TMA06789



TM006789

The total leakage current of all the electrical equipment in the installation must be taken into account.

For the leakage current of the CUE during normal operation, see the section on electrical data.

During startup and in asymmetrical supply systems, the leakage current can be higher than normal and may cause the ELCB/RCD to trip.

Motor protection

The motor requires no external motor protection as the CUE protects it against thermal overloading and blocking.

Protection against overcurrent

The CUE has internal overcurrent protection to provide overload protection on the motor output side.

Protection against mains voltage transients

The CUE frequency converters are protected against mains voltage transients in compliance with second environment locations defined by the EN 61800-3.

Related information

12.3 Inputs and outputs

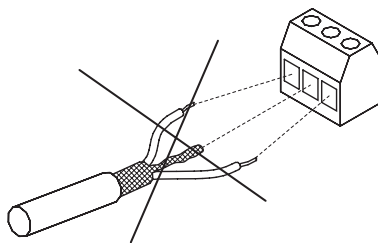
6.2 EMC-compliant installation



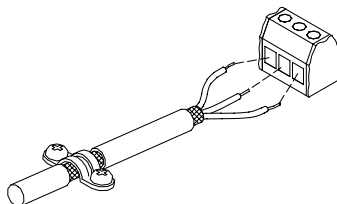
A screened motor cable must be used for the CUE to meet the EMC requirements.

This section provides guidelines for good practice when installing the CUE. Follow these guidelines to comply with first environment location requirements defined by the EN 61800-3.

- In applications without an output filter, use only motor and signal cables with a braided metal screen.
- Keep the screen as close to the connecting terminals as possible.
- Avoid terminating the screen by twisting the ends. Use cable clamps or screwed EMC cable entries instead.



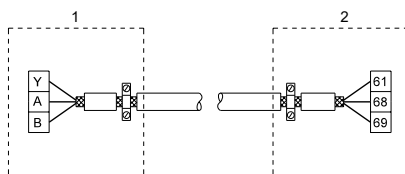
TM038812



TM021325

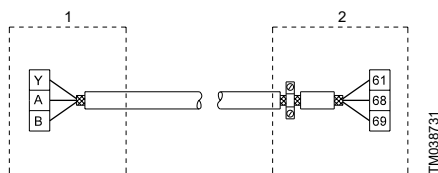
- Connect the screen to the frame at both ends for both the motor and the signal cables. If the controller has no cable clamps, connect only the screen to the CUE cabinet.
- Do not use unscreened motor and signal cables in electrical cabinets containing frequency converters.
- Make the motor cable as short as possible in applications without an output filter to limit the noise level and minimise leakage currents.
- Screws for frame connections must always be tightened whether a cable is connected or not.
- Keep mains cables, motor cables and signal cables separated in the installation, if possible.

Other installation methods may provide similar EMC results, if you follow the above guidelines for good practice.



TM038732

Controller with cable clamps



Controller without cable clamps

Pos.	Description
1	Controller
2	CUE

Related information[6. Electrical connection](#)**6.3 Cable requirements**

Always comply with local regulations on cable cross-sections.

Cable type	Max. length	
	[m]	[ft]
Screened motor cable	150	500
Unscreened motor cable	300	1000
Signal cable	300	1000

Related information[4.3 Environmental restrictions](#)**6.3.1 Cable cross-sections to signal terminals**

Conductor type	Cable cross-section	
	[mm ²]	[AWG]
Rigid	0.5 - 1.5	20-14
Flexible	0.5 - 1.0	20-18

Related information[4.3 Environmental restrictions](#)[6.1.2 Short-circuit current](#)**6.4 RFI filters**

To fulfil EMC requirements, the CUEs are equipped with a built-in radio-frequency interference filter (RFI). The RFI filter types are specified according to the standard EN 61800-3.

Supply voltage [V]	Power P2		RFI filter type
	[kW]	[hp]	
1 × 200-240 ³⁾	1.1 - 7.5	1.5 - 10	C2
3 × 200-240	0.75 - 45	1 - 60	C1
	0.55 - 90	0.75 - 125	C1
3 × 380-500	110 - 560	150 - 750	C3
	75 - 90	100 - 125	C3
3 × 525-600	75 - 90	100 - 125	C3
3 × 525-690	11 - 315	15 - 450	C3

³⁾ Single-phase input with three-phase output

C1 fulfils the requirements for residential areas.

C2 fulfils the requirements for residential areas if the system is operated and installed by qualified personnel.

C3 fulfils the requirements for industrial areas with a low-voltage transformer installed on site.



In a residential environment, C3 category power drive systems (PDS) are expected to cause radio interference, in which case supplementary mitigation measures are required.

Related information[12.7 Sound pressure level](#)**6.4.1 Output filters**

Output filters are used for reducing the voltage stress on the motor windings and the motor insulation system. They are also used for decreasing acoustic noise from the motor driven by the frequency converter.

Two output filter types are available as accessories for CUEs:

- dU/dt filters
- sine-wave filters.

The table below shows our recommendations for the application and type of output filters. Observe the following factors:

- pump type
- motor cable length
- required reduction rate of the acoustic noise from the motor.

Application	dU/dt	Sine-wave
Motor cable length [m] ([ft])		
SP, BM, BMB pumps with a supply voltage of 380 V and up	-	0-300 (0-1000)
Pumps with MG71/80 motors up to 1.5 kW (2 hp)	-	0-300 (0-1000)
Environments where a low rate of dU/dt and noise emission reduction is required	0-150 (0-500)	-
Environments where a high rate of dU/dt and noise emission reduction is required	-	0-300 (0-1000)
Involving motors with a supply voltage of 500 V and up	-	0-300 (0-1000)

6.5 Motor cable

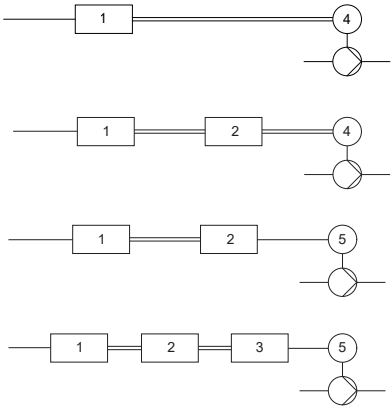


A screened motor cable must be used to comply with the requirements of the EN 61800-3, regardless whether an output filter is installed.

The mains cable does not need to be screened.

The cable between the CUE and filter must be short.

Examples:



Symbol	Description
1	CUE
2	Filter
3	Connection box
4	Standard motor
5	Submersible motor
<i>Single line</i>	Unscreened cable
<i>Double line</i>	Screened cable

6.6 Motor and mains connection



Confirm that the mains voltage and frequency correspond to the values on the nameplate of the CUE and the motor.



A screened motor cable is required for the CUE to meet the EMC requirements.

The supply voltage and frequency are marked on the nameplate of the CUE. Make sure that the unit is suitable for the power supply conditions of the installation site.



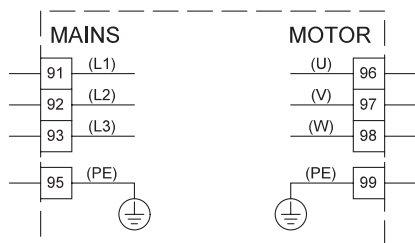
A main switch can be installed before the CUE cabinet, according to local regulations. See the section on EMC-compliant installation.

Three-phase mains connection

The cables in the terminal box must be as short as possible. However, the separated protective earth conductor must be so long that it is the last one to be disconnected in case the cable is inadvertently pulled out of the cable entry.



Use the terminals L1 and L2 for single-phase connections. The CUE drives, including single-phase drives, can only drive three-phase motors.



TM038799

Wiring diagram, three-phase mains connection

Terminal	Function
91 (L1)	Three-phase mains supply
92 (L2)	
93 (L3)	
95/99 (PE)	Protective earth connection
96 (U)	Three-phase motor connection, 0-100 % of mains voltage
97 (V)	
98 (W)	

Related information

6. Electrical connection

6.8.3.1 Enclosures A2, A3 and B3

6.8.3.2 Enclosures A5, B1, B2, B4, C1, C2, C3, C4, D and E

6.6.1 Enclosures A2, A3, A4 and A5



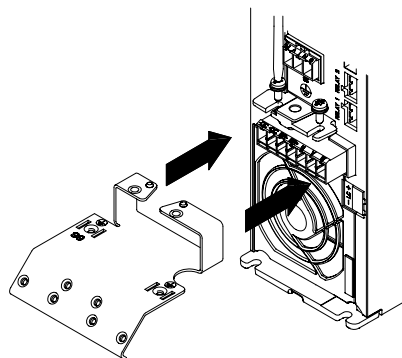
Make sure that the mains voltage and frequency correspond to the values stated on the nameplate of the CUE.

Tightening torque [Nm] [(ft-lb)]

Mains, Motor	Protective earth	Relay
1.8 (1.3)	3 (2.2)	0.6 (0.4)



For the enclosures A2 and A3, a mounting plate needs to be fitted for cable mounting.

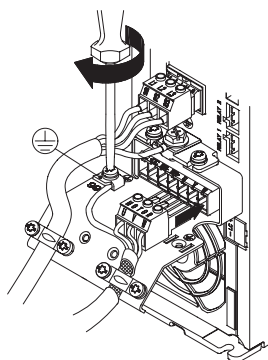


TM039010

A2, A3

Motor connection

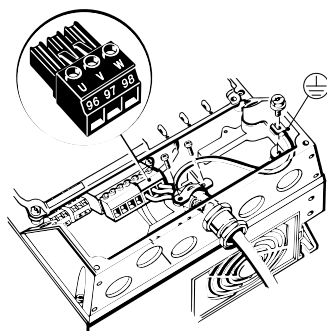
1. Connect the earth conductor to terminal 99 (PE).



TM074879

A2, A3

2. Connect the motor conductors to terminals 96 (U), 97 (V) and 98 (W) of the motor plug.
3. Insert the motor plug into the socket marked MOTOR.
4. Fix the screened cable with a cable clamp.

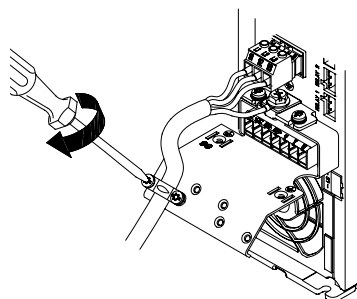


TM039018

A4, A5

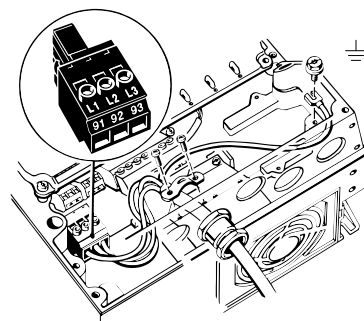
Mains connection

1. Connect the earth conductor to terminal 95 (PE).
2. Connect the mains conductors to terminals 91 (L1), 92 (L2) and 93 (L3) of the mains plug.
3. Insert the mains plug into the socket marked MAINS.
4. Fix the mains cable with a cable clamp.



TM039014

A2, A3



TM039017

A4, A5

Related information

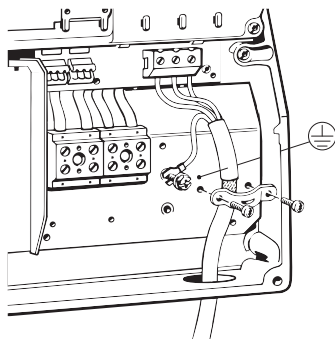
[6.8.3.1 Enclosures A2, A3 and B3](#)

6.6.2 Enclosures B1, B2, B3 and B4

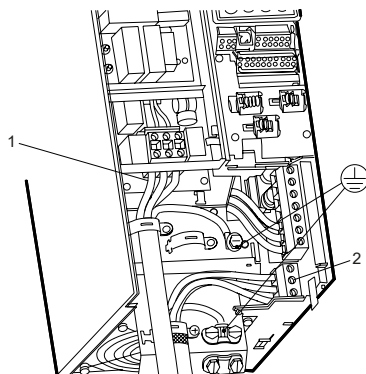
Enclosure	Tightening torque [Nm] ([ft-lb])		
	Mains, Motor	Protective earth	Relay
B1, B3	1.8 (1.3)	3 (2.2)	0.6 (0.4)
B2, B4	4.5 (3.3)	3 (2.2)	0.6 (0.4)

Motor connection

1. Connect the earth conductor to terminal 99 (PE).
2. Connect the motor conductors to terminals 96 (U), 97 (V) and 98 (W).
3. Fix the screened cable with a cable clamp.



TM039020



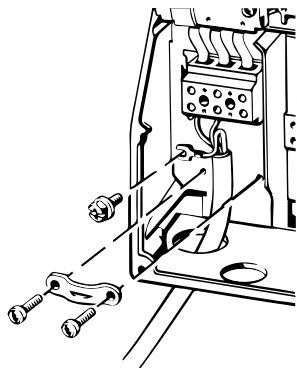
TM039446

Mains and motor connection, B3

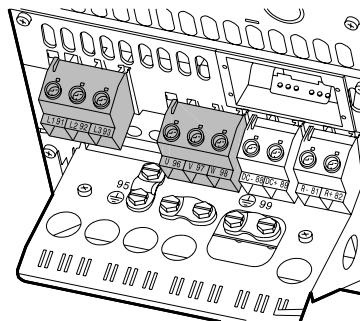
Pos.	Description
1	Mains
2	Motor

Mains connection

1. Connect the earth conductor to terminal 95 (PE).
2. Connect the mains conductors to terminals 91 (L1), 92 (L2) and 93 (L3).
3. Fix the mains cable with a cable clamp.



TM039019



TM039449

Mains and motor connection, B4

B1, B2

6.6.3 Enclosures C1, C2, C3 and C4

Enclosure	Tightening torque [Nm] [(ft-lb)]		
	Mains, Motor	Protective earth	Relay
C1, C3	10 (7.4)	3 (2.2)	0.6 (0.4)
C2, C4	14 / 24 (10.3 / 17.7) ⁴⁾	3 (2.2)	0.6 (0.4)

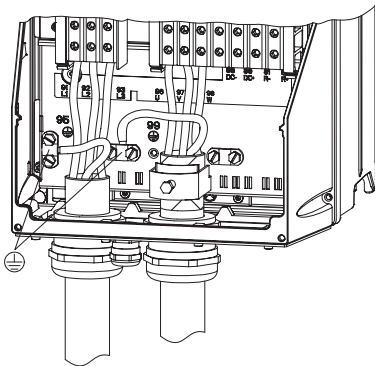
⁴⁾ $\varnothing \leq 95 \text{ mm}^2$ (4/0 AWG) / $\varnothing \geq 95 \text{ mm}^2$ (4/0 AWG)

Motor connection

1. Connect the earth conductor to terminal 99 (PE).
2. Connect the motor conductors to terminals 96 (U), 97 (V) and 98 (W).
3. Secure the screened cable with a cable clamp.

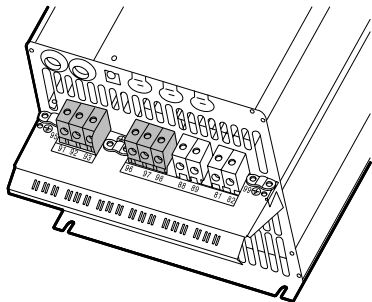
Mains connection

1. Connect the earth conductor to terminal 95 (PE).
2. Connect the mains conductors to terminals 91 (L1), 92 (L2) and 93 (L3).
3. Secure the mains cable with a cable clamp.



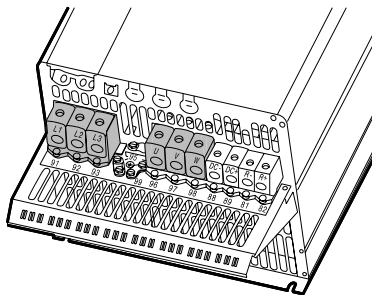
C1, C2

TM039016



C3

TM039448



C4

TM039447

6.6.4 Enclosures D1h, D2h, D3h, D4h, D5h and D7h

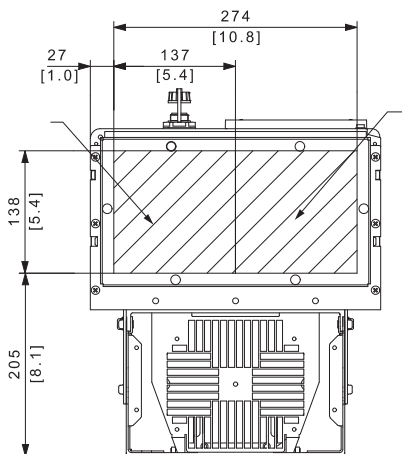
Tightening torque [Nm] ([ft-lb])

Mains, Motor [M10 / M12]	Protective earth [M8 / M10]	Relay [-]
19 / 37 (14 / 28)	9.6 / 19 (7 / 14)	0.5 (0.3)

Gland plate

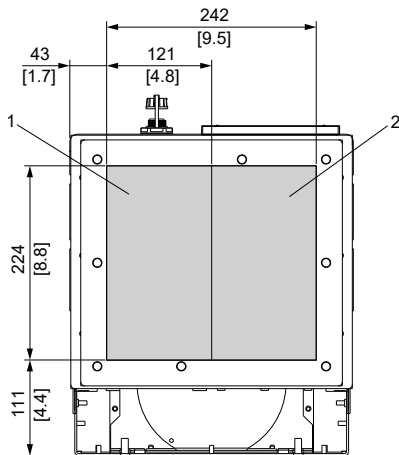
Cables are connected through the gland plate from the bottom. The gland plate must be fitted to the CUE to ensure the specified protection degree, as well as to ensure sufficient cooling.

Drill holes in the marked areas.



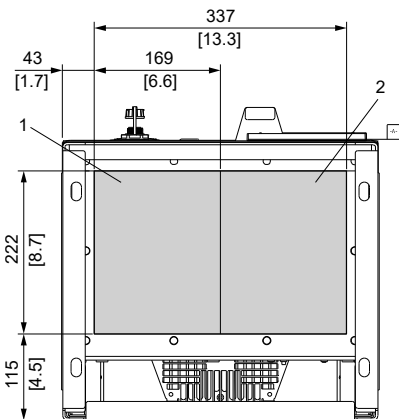
TM059326

Bottom view of a CUE



TM077429

Gland plate, enclosure D5h

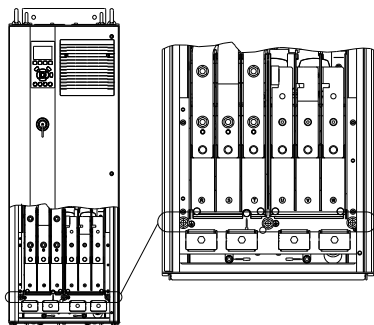


TM077430

Gland plate, enclosure D7h

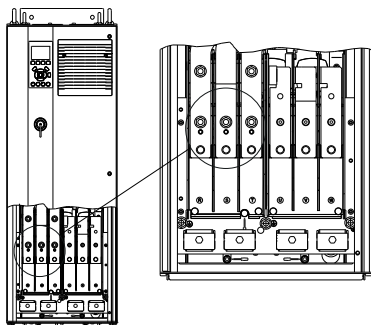
Motor connection

1. Connect the earth conductor to terminal 99 (PE).
2. Connect the motor conductors to terminals 96 (U), 97 (V) and 98 (W).
3. Secure the screened cable with a cable clamp.



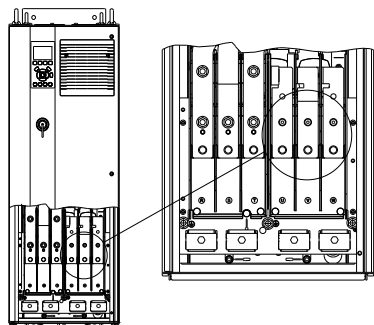
TM089659

Ground terminals



TM089660

Mains terminals



TM089658

Motor terminals

Mains connection

1. Connect the earth conductor to terminal 95 (PE).
2. Connect the mains conductors to terminals 91 (L1), 92 (L2) and 93 (L3).
3. Secure the mains cable with a cable clamp.

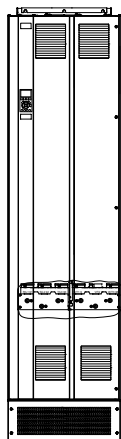
6.6.5 Enclosures E1h and E2h

Tightening torque [Nm] ([ft-lb])

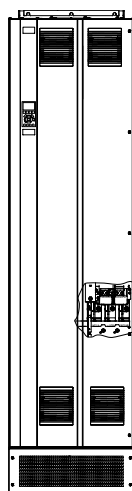
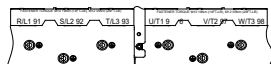
Mains, Motor [M10 / M12]	Protective earth [M8 / M10]	Relay [-]
19 / 37 (14 / 28)	9.6 / 19 (7 / 14)	0.5 (0.3)

Motor connection

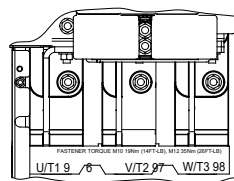
1. Connect the earth conductor to terminal 99 (PE).
2. Connect the motor conductors to terminals 96 (U), 97 (V) and 98 (W).
3. Secure the screened cable with a cable clamp.



Ground terminals

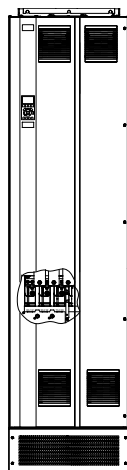


Motor terminals

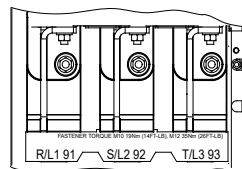


Mains connection

1. Connect the earth conductor to terminal 95 (PE).
2. Connect the mains conductors to terminals 91 (L1), 92 (L2) and 93 (L3).
3. Secure the mains cable with a cable clamp.



Mains terminals



TM089699

TM089781

TM089699

6.7 Connecting the signal terminals



Signal cables must be separated from other cable groups by reinforced insulation in their entire lengths.

Connect the signal cables according to the guidelines for good practice to ensure an EMC-compliant installation.

- Use screened signal cables with a cable cross-section of 0.5 - 1.5 mm² (20 - 14 AWG).
- Use a screened 3-core bus cable in new systems.

Connection terminals for inputs and outputs



The RS-485 screen must be connected to the frame.

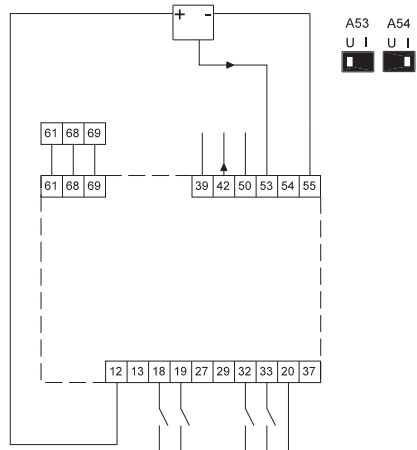
Terminal	Type	Function
12	+24 V out	Supply to sensor
13	+24 V out	Additional supply
18	DI1	Digital input, programmable
19	DI2	Digital input, programmable
20	GND	Common frame for digital inputs
27	DI/O 1	Digital input/output, programmable
29	DI/O 2	Digital input/output, programmable
32	DI3	Digital input, programmable
33	DI4	Digital input, programmable
37	Safe stop	Safe stop
39	GND	Frame for analog output
42	AO 1	Analog output, 0-20 mA
50	+10 V out	Supply to potentiometer
53	AI 1	External setpoint, 0-10 V, 0/4-20 mA

Terminal	Type	Function
54	AI 2	Sensor input, sensor 1, 0/4-20 mA
55	GND	Common frame for analog inputs
61	RS-485 GND Y	Frame
68	RS-485 A	Signal A (+)
69	RS-485 B	Signal B (-)

Connection examples

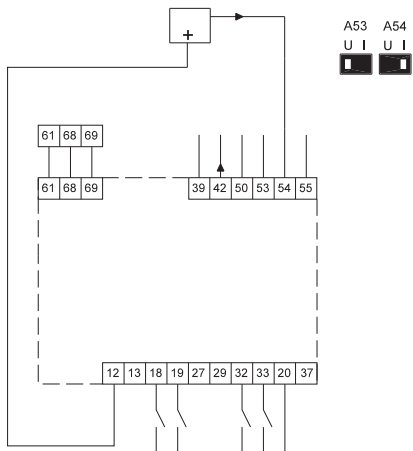
U: 0-10 V

I: 0/4-20 mA

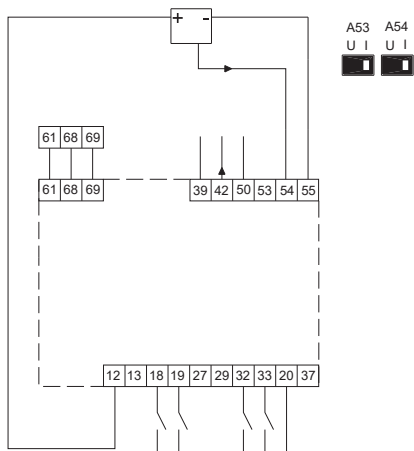


External setpoint, voltage input

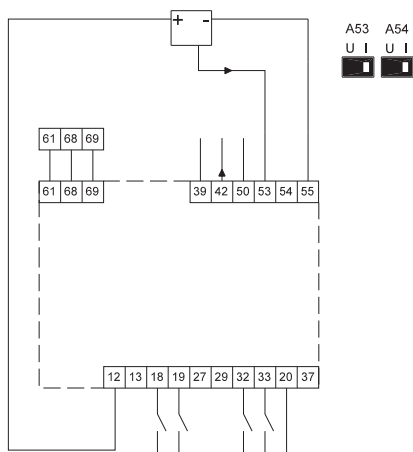
TM0515106



2-wire sensor



3-wire sensor



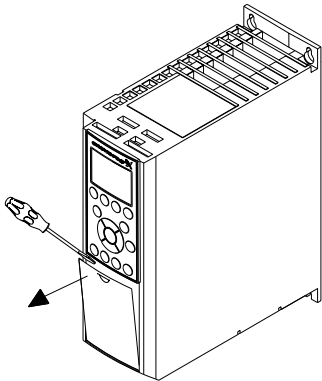
External setpoint, current input

Related information

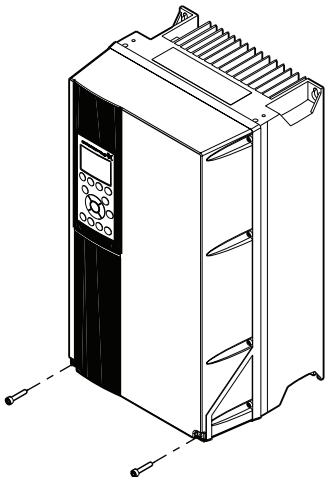
[6.9.2 Restart behaviour after STO activation](#)

6.7.1 Accessing the signal terminals

All signal terminals are located behind the terminal cover on the front side of the CUE. Remove the terminal cover as shown in the figures below.



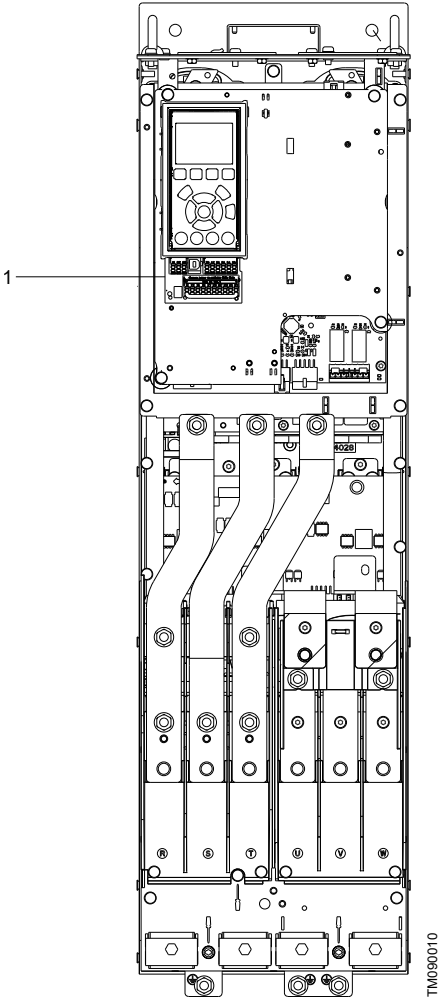
A2 and A3



A4, A5, B1, B2, B3, B4, C1, C2, C3 and C4

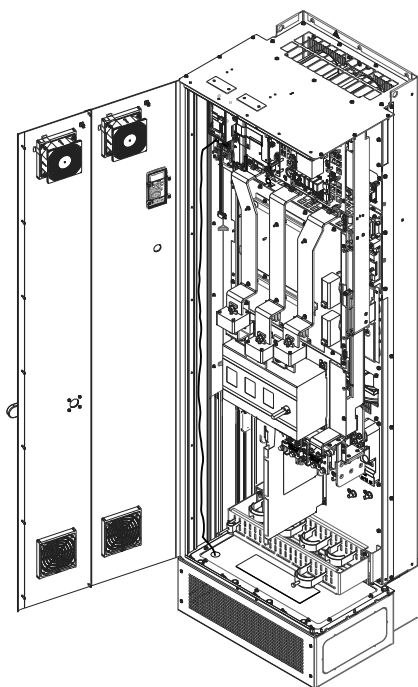
TM039003

TM039004



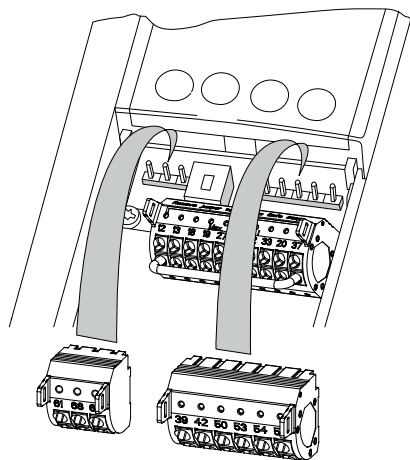
D1h-D7h

TM090010



TM089783

E1h-E2h



TM089661

Signal terminals, all enclosures

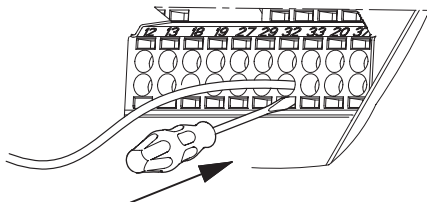
6.7.2 Connecting a thermistor (PTC) to the CUE

A PELV circuit provides protection against electric shock. Special connection requirements apply to this type of circuit, as described in the EN 61800-5-1.

To maintain the PELV range, all connections made to the control terminals must be of the PELV range, for example, the thermistor must have reinforced or double insulation.

6.7.3 Fitting the conductor

1. Remove the insulation at a length of 9-10 mm (0.35 - 0.39 inch) on the conductor cable.
2. Insert a screwdriver with a tip width of maximum 0.4×2.5 mm (0.016×0.10 inch) into the square opening.
3. Insert the conductor into the corresponding round opening.



TM039026

4. Remove the screwdriver.

The conductor is now fixed in the terminal.

6.7.4 Setting the analog inputs, terminals 53 and 54

The contacts A53 and A54 are positioned behind the operating panel and used for setting the signal type of the two analog inputs.

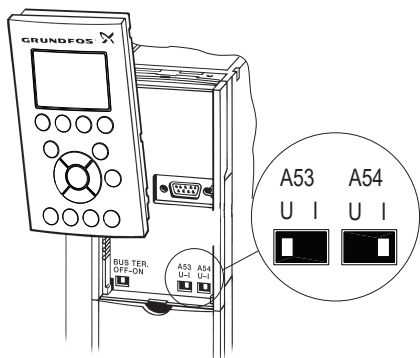
The factory setting of the inputs is voltage signal **U**.



Switch off the power supply before setting the contact A54.

If a 0/4-20 mA sensor is connected to the terminal 54, the input must be set to current signal **I**.

Remove the operating panel to set the contact.



TM039104

Setting contact A54 to current signal I

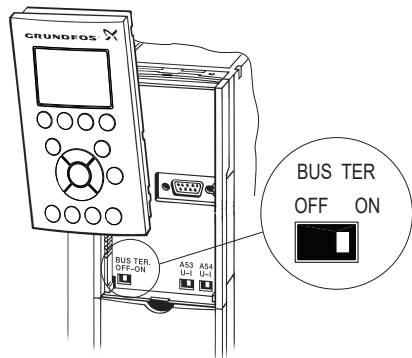
6.7.5 Network connection protocols

One or more CUEs can be connected to a control unit via the GENibus, BACnet MS/TP or Modbus RTU protocols.

The reference potential, GND, for RS-485 (Y) communication must be connected to the terminal 61. If more than one CUE is connected to a GENibus/ BACnet MS/TP/Modbus RTU network, the termination contact of the last unit must be set to ON (termination of the RS-485 port).

The factory setting of the termination contact is OFF (not terminated).

Remove the operating panel to set the contact.



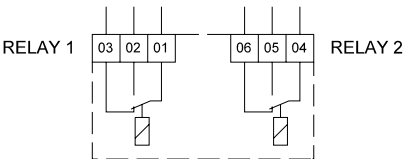
TM039006

Setting the termination contact to ON

6.8 Connecting the signal relays



Signal cables must be separated from other cable groups by reinforced insulation in their entire lengths.



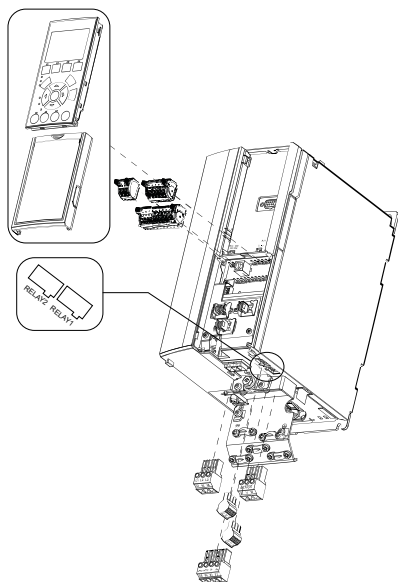
TM038801

Terminals for signal relays in non-activated state

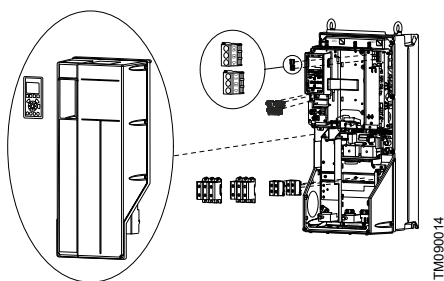
Terminal		Function
01	04	Common
02	05	Normally open contact
03	06	Normally closed contact

6.8.1 Access to signal relays

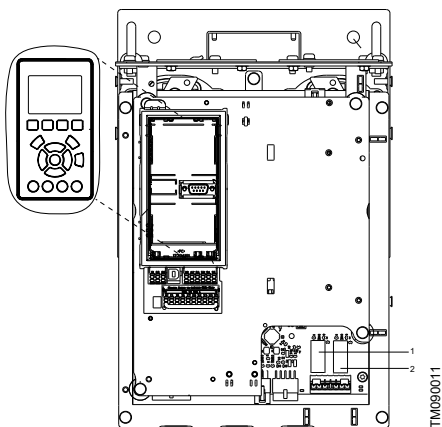
The relay outputs are positioned as shown in the figures below.



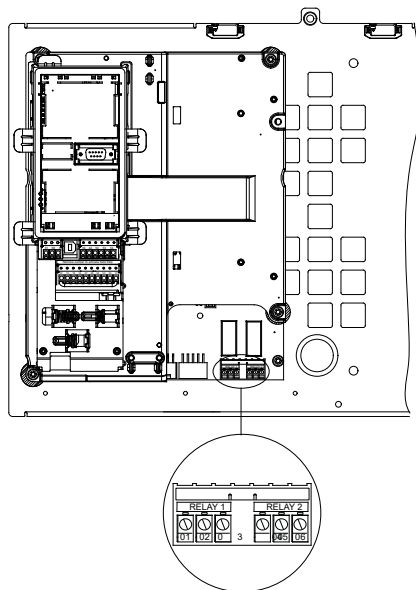
A2, A3, A4, A5



B1, B2, B3, B4, C1, C2, C3, C4



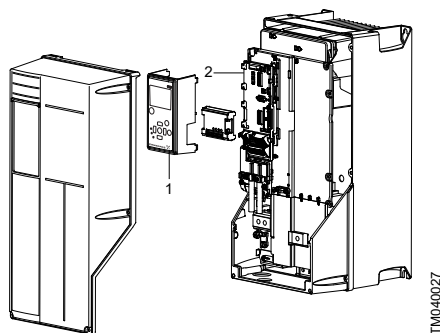
D1h, D2h, D3h, D4h, D5, Dh7



Terminals for relay connection, E1h and E2h

6.8.3.2 Enclosures A5, B1, B2, B4, C1, C2, C3, C4, D and E

1. Switch off the power to the CUE.
2. Remove the operating panel and the cradle from the unit.
3. Fit the MCB 114 module into the port B.
4. Connect the signal cables and fasten them with the enclosed cable strips.
5. Install the cradle and the operating panel.
6. Connect power to the CUE.



Enclosures A5, B1, B2, B4, C1, C2, C3, C4, D and E sizes

Pos.	Description
1	Cradle
2	Port B

Related information

[6.6 Motor and mains connection](#)

6.9 STO application

The STO signal must be SELV or PELV supplied.

European directive

Description	Standard
	EN ISO 13849-1
Machinery Directive (2006/42/EC)	EN IEC 62061
	EN IEC 61800-5-2
	EN 50011
EMC Directive (2014/30/EU)	EN 61000-6-3
	EN 61800-3
Low Voltage Directive (2014/35/EU)	EN 50178
	EN 61800-5-1

Safety standards

Description	Standard
	EN ISO 13849-1
Safety of machinery	IEC 62061
	IEC 60204-1
	IEC 61508-1 to IEC 61508-7
Functional safety	IEC 61800-5-2

Safety function

Description	Standard
Safe Torque Off, STO	IEC 61800-5-2
Stop Category 0	IEC 60204-1

Safety performance

Description	Value
ISO 13849-1	
Category	Cat 3
Diagnostic Coverage, DC	90 %, medium
Mean Time to Dangerous Failure, MTTFd	14 000 years, high
Performance Level, PL	PL d
IEC 61508 / IEC 62061	
Safety Integrity Level, SIL	SIL 2, SIL CL2
Probability of Dangerous Failure per Hour, PFH	1R-10/h, High Demand Mode
Probability of Dangerous Failure On Demand, PFD	1E-10/h, Low Demand Mode

Description	Value
Safe Failure Fraction, SFF	> 99 %
Hardware Fault Tolerance, HFT	0 (1oo1)
Proof Test Interval, T1	20 years
Mission Time, TM	20 years

Reaction time

Description	Value
Input to output response time	Max. 20 ms

6.9.1 STO installation

DANGER
Exposure to high pressure or toxic liquids
Death or serious personal injury



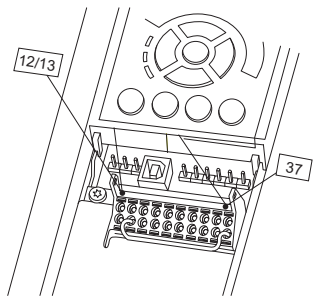
- Make sure to remove the jumper. Doing otherwise disables the STO function and the motor might not stop as intended.
- Make sure to use a safety-monitoring relay compliant with the Category 3/PL d (ISO 13849-1) or the SIL 2 (EN 62061, IEC 61508).
- Perform a functional test every 12 months to ensure that the system works properly.

The integrated STO function can be enabled by the following steps:

1. Remove the jumper wire between the control terminals 37 and 12 or 13.

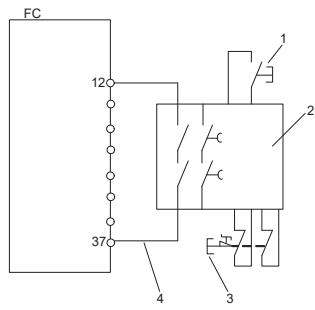


Cutting or breaking the jumper is not sufficient to avoid short-circuiting.



2. Connect an external safety-monitoring relay via a NO safety function to the terminal 37 (STO) and either terminal the 12 or 13, 24 V DC.

Select and apply the components in the safety control system appropriately to achieve the desired level of operational safety. Before integrating and using the STO in an installation, carry out a thorough risk analysis on the installation to determine whether the STO functionality and the safety levels are appropriate and sufficient.



STO wiring

Pos.	Description
1	Reset button
2	Safety relay, category 3, PL d or SIL2
3	Emergency stop button
4	Short-circuit protected cable, if the product is not installed inside an IP54 cabinet

6.9.2 Restart behaviour after STO activation

By default, the STO function is set to unintended-restart prevention behaviour. To terminate the STO and resume normal operation with a manual reset, do the following:

- Re-apply 24 V DC supply to the terminal 37.
- Send a reset signal via the bus, the Digital I/O or the reset button.
- Set the STO function to automatic restart by changing the value of the parameter **5-19 Safe Stop** from default value **1 Safe Stop Alarm** to value **3 Safe Stop Warning**.

Automatic restart means that the STO is terminated and normal operation is resumed as soon as the 24 V DC is applied to the terminal 37. No reset signal is required.

Related information

[6.7 Connecting the signal terminals](#)

6.9.3 Restart settings

- Remove the 24 V DC voltage supply to the terminal 37 using the interrupt device while the frequency converter drives the motor, that is, while the mains supply is not interrupted.
- Confirm that the motor coasts and that the alarm **Safe Stop** displays in the local operating panel, if mounted.
- Re-apply 24 V DC to the terminal 37.
- Make sure that the motor remains in the coasted state.
- Send a reset signal via the bus, the Digital I/O or the reset button.
- Make sure that the motor becomes operational again.

7. Starting up the product



All service-, maintenance- and inspection-related work on the product must be carried out by qualified personnel.

Before you switch on the power supply, complete the following steps:

1. Close the cover.
2. Make sure that all cable glands are tightened properly.
3. Make sure that there is no phase-to-phase and phase-to-earth voltage on the output terminals.
4. Confirm continuity for the motor by measuring the resistance values on the terminals U-V, V-W and W-U.
5. Check for proper earthing of the frequency converter and the motor.
6. Confirm that there are no loose connections on the terminals.
7. Confirm that the supply voltage matches the voltage of the frequency converter and the motor.

7.1 Switching on the product

- Confirm that the input voltage is balanced within 3 %. If not, correct the input-voltage imbalance before proceeding. Repeat this procedure after the voltage correction.
- Make sure that the wiring of any optional equipment matches the installation application.
- Make sure that all operator devices are in the OFF position. The panel doors must be closed, and covers must be securely fastened.
- Apply power to the unit, but do not start the frequency converter yet. For units with a disconnect switch, turn it to the ON position to apply power to the frequency converter.

7.2 Activating the STO function

The STO function is activated by removing the voltage at the terminal 37 of the frequency converter. By connecting the frequency converter to external safety devices providing a safe delay, an installation for a Safe Stop 1 is obtained. External safety devices need to fulfil the Cat./PL or SIL when connected to the terminal 37.

The STO function can be used for the following motor types:

- asynchronous
- synchronous
- permanent magnet.

When the STO function is activated, the frequency converter issues an alarm, trips the unit and coasts the motor to a stop. A manual restart is required. Use the STO function to stop the frequency converter in emergency-stop situations. In normal operating mode, when the STO is not required, use the standard stop function instead.



A successful commissioning test of the STO function must be performed after the initial installation and after each subsequent change to the installation.

8. Control functions

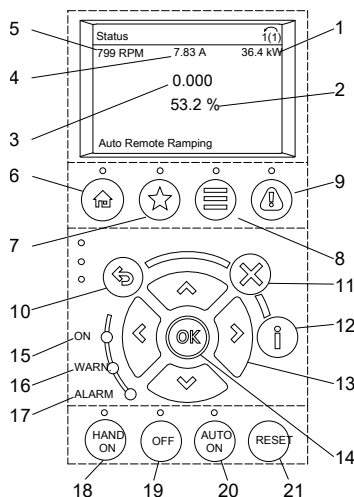


The display contrast can be adjusted by pressing [Status] and then pressing [Up] or [Down].

8.1 Operating panel

The operating panel enables manual setting and monitoring of the system:

- start, stop and speed control
- reading of operating data, warnings and alarms
- setting functions for the frequency converter
- manual reset of the frequency converter.



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Operating panel

Pos.	Display/ button	Description
1	-	Power [kW]
2	-	Reference [%]
3	-	Frequency [Hz]
4	-	Motor current [A]
5	-	Speed [rpm]
6		Status: it shows operating information.
7		Favourites: it allows access to programming parameters for initial setup instructions and many detailed application instructions.

Pos.	Display/ button	Description
8		Main menu: it allows access to all programming settings.
9		Alarm log: it shows a list of current warnings, the last 10 alarms and the maintenance log.
10		Back: it reverts to the previous step or list in the menu structure.
11		Cancel: it cancels the last change or command, as long as the display mode has not changed.
12		Status: it shows operating information.
13		Up/Down/Left/Right: use the four arrow buttons to navigate between items in the menu.
14		OK : used to access parameter groups or to accept a selection.
15	ON	The ON light activates when the frequency converter receives power from the mains voltage, a DC bus terminal or an external 24 V supply.
16	WARN.	When warning conditions are met, the yellow warning light comes on and text appears on the display identifying the problem.
17	ALARM	A fault condition causes the red alarm light to flash, and an alarm text is displayed.
18		HAND ON : it starts the frequency converter in local control.
19		An external stop signal by control input or serial communication overrides the local HAND ON function.
20		OFF : it stops the motor, but does not remove power to the frequency converter.
21		AUTO ON : it puts the system in remote operating mode.
		The system responds to an external start command issued by control terminals or serial communication.
		RESET : it resets the frequency converter manually after a fault has been cleared.

Related information

9. Setting the product

8.2 Menu overview

Overview of the main menus. The * represent a number to a submenu.

Press **OK** to select a menu and use the [Up] and [Down] buttons to navigate in the menus.

Example: To get to the menu **1-28 Motor Rotation Check**, you must do the following:

1. Navigate to **1-** Load and Motor** and press **OK**.
2. Use the [Up] and [Down] buttons to navigate to **1-2* Motor Data** and press **OK**.

3. Use the [Up] and [Down] buttons to navigate to **1-28 Motor Rotation Check** and press **OK** to select the menu.

Related information

[8.3 Menu structure](#)

[9. Setting the product](#)

8.3 Menu structure

0-** Operation / Display	14-** Special Functions	27-** Cascade CTL Option
0-0* Basic Settings	14-0* Inverter Switching	27-0* Control & Status
0-1* Set-up Operations	14-1* Mains On/Off	27-1* Configuration
0-2* LCP Display	14-2* Reset Functions	27-2* Bandwidth Settings
0-4* LCP Keypad	14-3* Current Limit Ctrl.	27-3* Staging Speed
0-5* Copy/Save	14-4* Energy Optimising	27-4* Staging Settings
0-6* Password	14-5* Environment	27-5* Alternate Settings
0-7* Clock Settings	14-6* Auto Derate	27-6* Digital Inputs
1-** Load and Motor	14-8* Options	27-7* Connections
1-0* General Settings	14-9* Fault Settings	27-8* Advanced Settings
1-1* Motor Selection	15-** Drive Information	27-9* Readouts
1-1* VVC+ PM	15-0* Operating Data	29-** Water Application Functions
1-2* Motor Data	15-3* Alarm Log	29-0* Pipe Fill
1-3* Adv. Motor Data	15-4* Drive Identification	29-1* Deragging Function
1-5* Load Indep. Setting	15-6* Option Ident	29-2* Derag Power Tuning
1-6* Load Depen. Setting	15-8* Operating Data II	29-4* Pre/Post Lube
1-7* Start Adjustments	15-9* Parameter Info	30-** Special Features
1-8* Stop Adjustments	16-** Data Readouts	30-2* Adv. Start Adjust
1-9* Motor Temperature	16-0* General Status	35-** Sensor Input Option
2-** Brakes	16-1* Motor Status	35-0* Temp. Input Mode
2-0* DC-Brake	16-3* Drive Status	35-1* Temp. Input X48/4
2-1* Brake Energy Funct.	16-5* Ref. & Feedb.	35-2* Temp. Input X48/7
4-** Limits / Warnings	16-6* Inputs & Outputs	35-3* Temp. Input X48/10
4-1* Motor Limits	16-8* Fieldbus & FC Port	35-4* Analog Input X48/2
4-5* Adj. Warnings	16-9* Diagnosis Readouts	40-** Special Settings
4-6* Speed Bypass	18-** Info & Readouts	40-4* Extended. Alarm Log
5-** Digital In/Out	18-0* Maintenance Log	200 - Operation Settings
5-0* Digital I/O mode	18-3* Analog Readouts	200-0* Operation Settings

5-1* Digital Inputs	18-6* Inputs & Outputs 2	200-1* Setpoint Handling
5-3* Digital Outputs	20-** Drive Closed Loop	200-2* Proportional Pressure Setup
5-4* Relays	20-0* Feedback	200-3* Proportional Pressure Setup 2
5-8* I/O Options	20-2* Feedback/Setpoint	200-4* Pump Setup
6-** Analog In/Out	20-8* PID Basic Settings	200-5* Special Command Parameters
6-1* Analog Input 53	20-9* PID Controller	200-6* Setpoint Configuration Parameters
6-2* Analog Input 54	21-** Ext. Closed Loop	200-7* Configuration Command Parameters
6-5* Analog Output 42	21-1* Ext. CL 1 Ref./Fb.	201- Key Functions
8-** Comm. and Options	21-2* Ext. CL 1 PID	201-0* Limit Exceed
8-0* General Settings	21-3* Ext. CL 2 Ref./Fb.	201-1* Bearing Supervision
8-1* Control Settings	21-4* Ext. CL 2 PID	201-3* Constant Pressure Stop Function
8-3* FC Port Settings	22-** Appl. Functions	201-5* Stop Adjustments Ext.
8-4* FC MC protocol set	22-0* Miscellaneous	202 - Sensors
8-5* Digital/Bus	22-2* No-Flow Detection	202-0* Analog Input Sensor Setup
8-7* BACnet	22-3* No-Flow Power Tuning	202-1* Temperature Input Sensor Setup
8-8* FC Port Diagnostics	22-4* Sleep Mode	202-2* Sensorless Setup
8-9* Bus Jog / Feedback	22-5* End of Curve	203 - Status Monitor
13-** Smart Logic	23-** Timer-based Functions	203-0* Grundfos Readouts
13-1* Comparators	23-0* Timed Actions	203-1* GENIbus
13-1* RS Flip Flops	23-1* Maintenance	203-3* Alarm/Warning Log
13-4* Logic Rules	23-1* Maintenance Reset	203-4* Accumulated Flow
	23-5* Energy Log	203-5* GENIbus Readout Parameters
	23-6* Trending	203-7* GENIbus Setpoint Readout
	23-8* Payback Counter	203-8* Misc. Functions

Related information

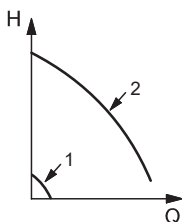
[8.2 Menu overview](#)

8.4 Operating modes

The following operating modes are set on the operating panel using the **[Favourites]** menu. The operating mode can be modified via the parameter **200-6**.

Operating mode	Description
Normal	The pump is running in the selected control mode.
Stop	The pump has been stopped, and the green indicator light is flashing.
Min.	The pump is running at minimum speed.
Max.	The pump is running at maximum speed.
User curve	The pump is running at a user-defined speed.

Minimum and maximum curves



TM077364

Pos.	Description
1	Minimum
2	Maximum

The pump speed is kept at a given set value for minimum and maximum speed.

Example:

- Maximum curve operation can, for instance, be used in connection with venting the pump during installation.
- Minimum curve operation can, for instance, be used in periods with a very small flow rate requirement.

8.5 Control modes

The control mode is set in the **[Favourites]** menu. The control mode can be modified via the parameter **200-6**.

There are two basic control modes:

- uncontrolled operation (open loop)
- controlled operation (closed loop) with a sensor connected.

Related information

[8.5.1 Uncontrolled operation \(open loop\)](#)

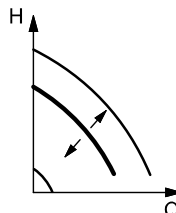
[8.5.2 Controlled operation \(closed loop\)](#)

8.5.1 Uncontrolled operation (open loop)

Constant curve

The speed is kept at a set value in the range between the minimum and maximum curves.

The setpoint is set in percentage corresponding to the required speed.



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Examples:

- Operation on constant curve can, for instance, be used for pumps with no sensor connected.
- It is typically used in connection with an overall control system, such as the MPC or another external controller.

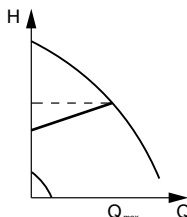
Related information

[8.5 Control modes](#)

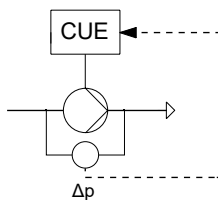
8.5.2 Controlled operation (closed loop)

Proportional differential pressure

The differential pressure is reduced at falling flow rate and increased at rising flow rate.

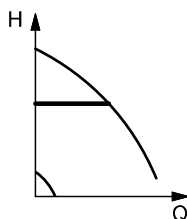


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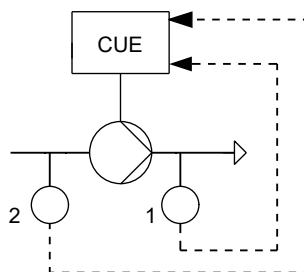


Constant differential pressure

The differential pressure is kept constant, independently of the flow rate.



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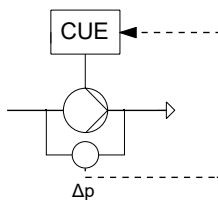
TM040622

Pos.	Description
1	Sensor 1
2	Sensor 2

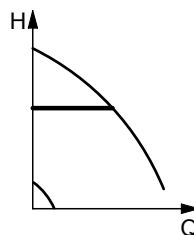
Constant pressure

The pressure is kept constant, independently of the flow rate.

TM038476

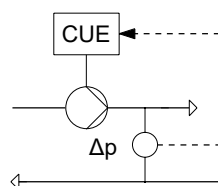


TM077356

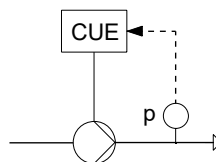


TM038476

Pump



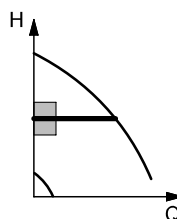
TM077357



TM077358

With stop function

The outlet pressure is kept constant at high flow rate. It provides on/off operation at low flow rate.



TM038477

System

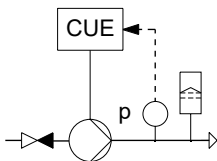
Differential pressure from two sensors

The differential pressure can be controlled by using measurements from two separate pressure sensors.

It can be used in the following control modes:

- proportional differential pressure
- constant differential pressure.

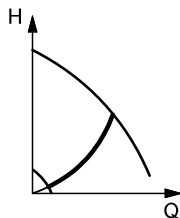
The function requires an MCB 114 sensor input module.



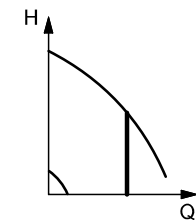
TM077359

Constant level

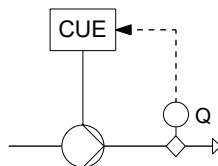
The liquid level is kept constant, independently of the flow rate.



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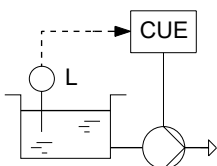
TM038478



TM077362

Constant temperature

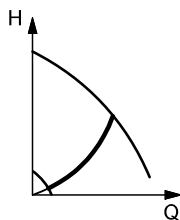
The liquid temperature is kept constant, independently of the flow rate.



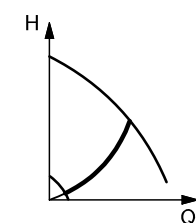
TM077360

With stop function

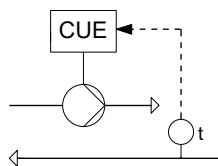
The liquid level is kept constant at high flow rate. It provides on/off operation at low flow rate.



TM038482



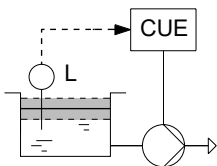
TM038482



TM077363

Sensorless proportional differential pressure

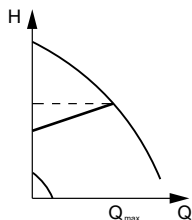
The differential pressure of the pump is reduced at falling flow rate and increased at rising flow rate, without using a physical sensor to measure the pressure.



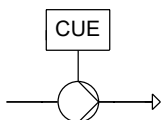
TM077361

Constant flow rate

The flow rate is kept constant, independently of the head.

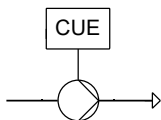
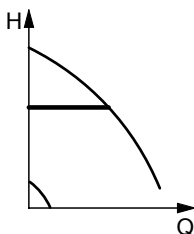


TM038475



Sensorless constant differential pressure

The differential pressure of the pump is kept constant, independently of the flow rate, without using a physical sensor to measure the pressure.



Related information

[8.5 Control modes](#)

TM090015

TM038476

TM090015

9. Setting the product

The programmed data is saved internally in the frequency converter and it is possible to make a backup of the data by uploading it to the memory of the operating panel.

The menus can be accessed or modified from the **Main menu** or the **Favourites** menu on the operating panel. However, not all menus are available in **Favourites**.

All settings are logged in the **Changes Made** submenu of **Favourites**.

Related information

[8.1 Operating panel](#)

[8.2 Menu overview](#)

9.1 First-time setup via the startup guide

The startup guide starts automatically the first time the product is switched on or after the startup of the frequency converter. It enables the quick configuration of the basic pump and the application parameters.

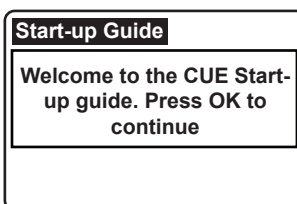
Make sure that the CUE is connected to the power supply and the connected equipment is ready for startup.

Have the nameplate data for the motor, pump and CUE ready, as you need to enter some data during the process.



You can reactivate the startup guide from the **Favourites** menu.

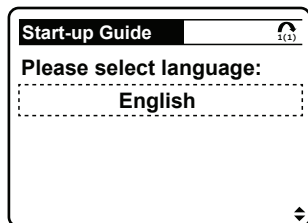
1. Press **OK** to begin the startup guide and follow the on-screen instructions.



Welcome screen

TM077488

2. Press **OK** to select the desired language.



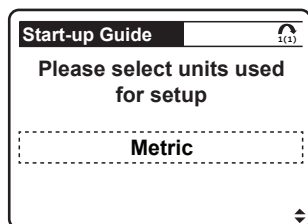
TM077489

Language

Parameter 0-01

- Language

3. Select the unit type depending on the region where the CUE is installed.



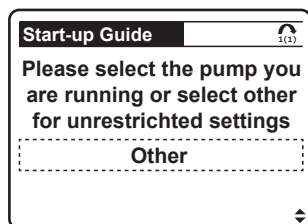
TM077490

Unit

Parameter 0-03 Regional settings

- [0] International: Metric
- [1] North America: Imperial

4. Select a specific pump type, or select **Other** for an unrestricted setting.



TM077491

Pump types

Parameter 200-40 Pump family

- AFG, SFG
- SMD
- AMG, SMG
- BM
- CM, CMV
- CR, CRI, CRN, CRT
- CRK
- DP, EF
- LS
- LC, LF
- MTH, MTR
- MTB
- NB, NK
- NBG, NKG
- S
- SE, SEV, SL, SLV
- SP, SE
- SPK
- SRG
- VL
- MTS
- TP Series 100
- TP Series 200
- TP Series 300
- VLS
- BMSHs, BMSHp
- KPL, KWM, KPG
- DPK, DWK
- Other

5. Select the required motor type. Based on the motor type, the related parameters appear for adjustment.



It is possible to skip the motor settings and the thermal protection parameters.

Start-up Guide

Please select the motor of the pump or select "skip motor setup"

Asynchronous motor

Motor types

Parameter 01-10

- Asynchron
- PM, non salient SPM
- PM, salient IPM
- SybRM
- PMaSynRM

6. If there is a sine-wave filter installed, select **Yes** and define the switching frequency on the next screen.

Start-up Guide

Do you have a Sine-wave filter connected on the output?

No

Sine-Wave filter

Menu options

- Yes
- No

Parameter 14-55 Output filter

- [0] No Filter
- [1] Sine-wave Filter
- [2] Sine-wave Filter Fixed

7. Set up the Automatic Motor Adaptation (AMA) function. The AMA measures the electrical characteristics of the motor to provide an accurate electronic model of it without running the motor. The AMA can also be started via the parameter **01-29**. If you select **Yes**, continue with the next steps.

Start-up Guide

Run an automatic motor adaptation (AMA) procedure?

No

Run AMA

Menu options

- Yes
- No

Parameter 01-29 Automatic Motor Adaptation

- [0] Off
- [1] Enable Complete AMA
- [2] Enable Reduced AMA
- [3] Enable Complete AMA 2
- [4] Enable Reduced AMA 2

8. Enter the acceleration time needed to reach the rated motor speed from 0 rpm, and the deceleration time needed to reach 0 rpm from the rated motor speed.

Start-up Guide

Acceleration time

1.00s

Deceleration time

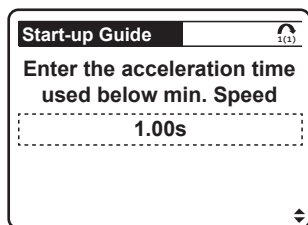
3.00s

Acceleration and deceleration time

Parameter

- 03-41 Ramp 1 Ramp Up Time
- 03-42 Ramp 1 Ramp Down Time

9. Enter the ramp time between 0 rpm and the minimum speed.



Start-up Guide 1(1)

Enter the acceleration time used below min. Speed

1.00s

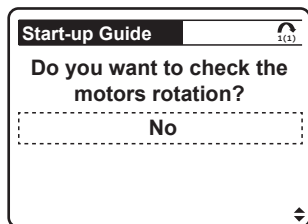
TM077511

Initial ramp time

Parameter

03-84 Initial Ramp Time

10. The direction of rotation is set for the CUE by default. If necessary, double-check the direction of rotation by selecting **Yes**, and follow the steps below. If the **Other** pump type is selected, there are two screen options after the direction check: **Min. frequency** and **Max. frequency**.



Start-up Guide 1(1)

Do you want to check the motors rotation?

No

TM077512

Direction of rotation check

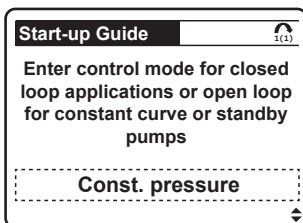
Menu options

- Yes
- No

Parameter 01-06 Clockwise Direction

- [0] Normal
- [1] Inverse

11. Select the relevant control mode for the desired application. It is preset according to the pump type selected by the user.



Start-up Guide 1(1)

Enter control mode for closed loop applications or open loop for constant curve or standby pumps

Const. pressure

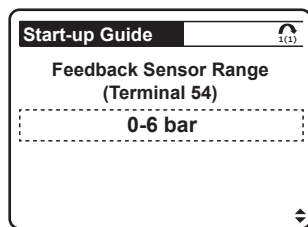
Control mode

Parameter 200-08 Control Mode

- Const. diff. pressure
- Const. flow rate
- Constant level
- Const. other value
- Const. pressure
- Const. temperature
- Open loop
- Pro. diff. pressure
- Sensorless Pro. diff. pres
- Sensorless Const. diff. pres

TM077549

12. This screen is shown if the user selects one of the closed-loop control modes.



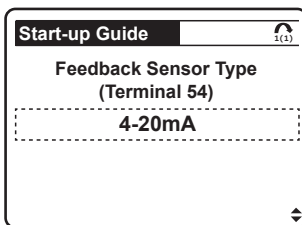
Feedback sensor range

Parameter 202-00 Feedback Sensor Range

- 0-0.6 bar
- 0-0.1 bar
- 0-1.6 bar
- 0-2.5 bar
- 0-4 bar
- 0-6 bar
- 0-10 bar
- 0-16 bar
- 0-25 bar
- 1-1.5 m³/h
- 2-10 m³/h
- 6-30 m³/h
- 15-75 m³/h
- 1-5 m³/h
- -25 to +25 °C
- 0 to 20 °C
- 0 to 25 °C
- 0 to 50 °C
- 0 to 150 °C
- 50 to 100 °C
- 0-2 m
- 0-4 m
- 0-10 m

13. After choosing the sensor range, select the electrical signal range in accordance with the dip-switch adjustment.

TM077550

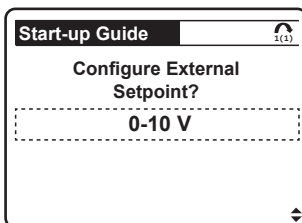


Feedback sensor type

Parameter 202-01 Feedback Sensor Type

- --
- 0-20 mA
- 4-20 mA
- 0-10 V
- 2-10 V
- 0-5 V
- 0.5-3.5 V

14. The setpoint can be influenced by the external setpoint input, and the electrical signal must be configured in this step.



External setpoint configuration

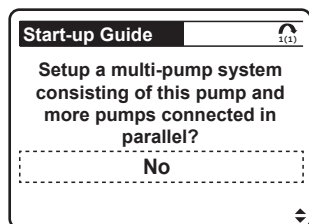
Parameter 202-02 Feedback Sensor Type

- --
- 0-20 mA
- 4-20 mA
- 0-10 V
- 2-10 V
- 0-5 V
- 0.5-3.5 V

TM077551

TM077552

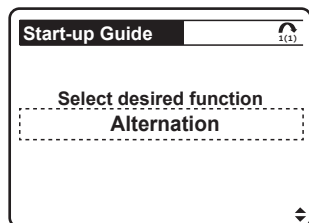
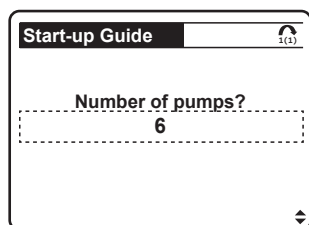
15. In this step, you can set a multipump system with multiple pumps connected in parallel:
- Variable speed pumps only: Alternation, Backup and Cascade
 - Variable and Fixed speed pumps.



Multipump configuration via Modbus RTU

Menu options

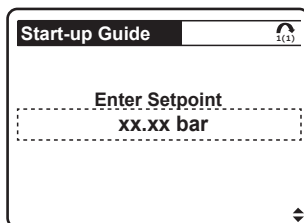
- NO
- Variable speed only
- Variable speed and Fixed speed



Menu options

- Alternation
- Backup
- Cascade
- Multi-master pump

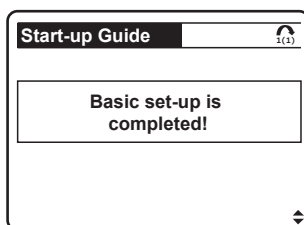
16. Enter the setpoint value based on the selected control mode and feedback sensor.



Setpoint

Parameter 200-05 Setpoint

17. Press **OK** to finish the setup.



Setup completed

9.2 Data transfer

It is possible to download the data stored on a frequency converter and upload it to another.



You cannot transfer data between the CUE 202 and CUE 203. The platform of the CUE 203 is not compatible with the keypad, storing and uploading settings of the CUE 202.

- Navigate to **0-5* Copy/Save** and press **OK**.
- Press **OK** to activate **0-50 LCP Copy**.
- Press [Up] to select **[1] All to LCP** to upload data to the operating panel, or select **[2] All from LCP** to download.
- Press **OK**. A progress bar shows the uploading or downloading progress.

9.3 Checking the direction of the motor rotation



There is a risk of damage to the pumps or the compressors if the motor is running in the wrong direction. Before starting the frequency converter, check the direction of the motor rotation.

1. Navigate to **1-28 Motor Rotation Check** and press **OK**.
2. Scroll to **[1] Enable**.

The following text appears: **Note! Motor may run in wrong direction.**

1. Press **OK**.
2. Follow the on-screen instructions.

To change the direction of rotation, remove power to the frequency converter and wait before touching the product. See the waiting time in the section for installation requirements.

- Reverse the connection of any two of the three motor cables on the motor or frequency-converter side of the connection.

Related information

6. Electrical connection

9.4 Setting the motor

To set a motor manually in the **Main menu**, enter the following motor data available on the motor nameplate.

Program the following parameters in the listed order, based on the motor type.



If only line-to-line data is available, divide it by two to get the line-to-common or start point value.

Back EMF (Electromotive Force): The voltage generated by a PM motor when no frequency converter is connected and the shaft is turned externally. It is normally specified for nominal motor speed or for 1000 rpm measured between two lines. If the value is not available for 1000 rpm, it can be calculated with the following formula:

$$\text{Back EMF} = (\text{voltage} / \text{rpm}) \times 1000$$

Asynchronous motors:

- **1-20 Motor Power [kW] or 1-21 Motor Power [HP]**
- **1-22 Motor Voltage**
- **1-23 Motor Frequency**
- **1-24 Motor Current**
- **1-25 Motor Nominal Speed**
- **1-29 Automatic Motor Adaptation (AMA).**

Synchronous reluctance motors:

- **1-10 Motor Construction**
- **1-23 Motor Frequency**
- **1-24 Motor Current**
- **1-25 Motor Nominal Speed**
- **1-26 Motor Cont. Rated Torque**
- **1-29 Automatic Motor Adaptation (AMA).**

Permanent-magnet motors:

Set **1-10 Motor Construction** to **[1] PM, non salient SPM**.

Set **0-02 Motor Speed Unit** to **[0] RPM**.

- **1-24 Motor Current**
- **1-26 Motor Cont. Rated Torque**
- **1-25 Motor Nominal Speed**
- **1-39 Motor Poles**
- **1-30 Stator Resistance (Rs)**
- **1-37 d-axis Inductance (Ld)**
- **1-40 Back EMF at 1000 RPM.**

Permanent-magnet assisted synchronous reluctance motors:

Set **0-02 Motor Speed Unit** to **[0] RPM**.

- **1-24 Motor Current**
- **1-26 Motor Cont. Rated Torque**
- **1-25 Motor Nominal Speed**
- **1-39 Motor Poles**
- **1-30 Stator Resistance (Rs)**
- **1-37 d-axis Inductance (Ld)**
- **1-38 q-axis Inductance (Lq)**
- **1-40 Back EMF at 1000 RPM**
- **1-29 Automatic Motor Adaptation (AMA).**

Testing the motor operation

1. Start the motor at a speed of 100-200 rpm. If it does not run, check if the installation, general programming and motor data are correct.
2. Make sure that the start function set in **1-70 PM Start Mode** fits the application requirements.

9.5 Automatic Energy Optimisation (AEO)



AEO is not relevant for permanent-magnet motors.

AEO is a procedure which minimises voltage to the motor, thereby reducing energy consumption, heat and noise.

To activate AEO, set **1-03 Torque Characteristics** to **[2] Auto Energy Optim. CT** or **[3] Auto Energy Optim. VT**.

9.6 Testing the local control

1. Press **HAND ON** to provide a local start command to the frequency converter.
2. Accelerate the frequency converter to full speed by pressing [Up]. Moving the cursor left of the decimal point provides quicker input changes.
3. Note any acceleration problems.
4. Press **OFF**. Note any deceleration problems.

9.7 Starting the system

The below steps require wiring and application programming to be completed. We recommend that you follow this procedure after application setup is completed.

1. Press **AUTO ON**.
2. Apply an external run command.
3. Adjust the speed reference throughout the speed range.
4. Remove the external run command.
5. Check the sound and vibration levels of the motor to ensure that the system is working as intended. If warnings or alarms occur, see the overview of warnings and alarms or refer to the service instructions for the frequency converter.

Related information

[11.1 Overview of warnings and alarms](#)

9.8 Resetting to default settings



You can make a backup of the changed settings first by uploading them to the operating panel.

9.8.1 Recommended reset

We recommend that you use **14-22 Operation Mode** to perform a reset to default settings. In this way, some settings are kept, such as operating hours, serial communication selections, personal menu settings, fault log, alarm log and other monitoring functions.

1. Navigate to **14-** Special Functions** and press **OK**.
2. Select **14-22 Operation Mode** and press **OK**.
3. Use [Up] and [Down] to navigate to **[2] Initialisation** and press **OK**.
4. Switch off the power to the unit and wait for the display to switch off.
5. Reconnect the power.

6. Alarm 80, **Drive initialised to default value**, is displayed.
7. Press **RESET** to return to operating mode.

9.8.2 Manual reset

You can also reset to default settings manually, but this method deletes all motor, programming, localisation and monitoring data. It does not reset settings for parameters **15-00 Operating hours**, **15-03 Power Up's**, **15-04 Over Temp's** and **15-05 Over Volt's**.

1. Switch off the power to the unit and wait for the display to switch off.
2. Press and hold **Status**, **Main Menu** and **OK** at the same time while switching on the power to the unit. The fan starts after approximately 5 seconds or when you hear an audible click.

10. Servicing the product

CAUTION

Electric shock

Minor or moderate personal injury



- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be accidentally switched on. Follow the minimum waiting time after powering off as described in the section on installation requirements.
- Touching the electrical parts may be fatal, even after the CUE is switched off.

Safe Torque Off (STO) functional test

Conduct a functional test every 12 months to detect any failure or malfunction of the STO functionality.

To conduct the functional test, perform the following steps:

1. Remove the 24 V DC voltage supply from the terminal 37.
2. Check if the operating panel displays the alarm **Safe Stop A68**.
3. Verify that the frequency converter trips the unit.
4. Verify that the motor coasts to a complete stop.
5. Verify that the motor cannot be started.
6. Reconnect the 24 V DC voltage supply to the terminal 37.
7. Verify that the motor is not started automatically and restarts only by receiving a reset signal, either via the bus, the digital I/O or the **RESET** button.

Related information

- [4. Installation requirements](#)

11. Fault finding the product

11.1 Overview of warnings and alarms

Type	LED indicator
Warning	Yellow
Alarm	Flashing red
Trip lock	Yellow and red

Designation	Description	Warning	Alarm	Alarm, trip lock
1	10 V low	●	-	-
2	Live zero error	(●) ⁵⁾	(●)	-
3	No motor	(●)	-	-
4	Mains phase loss	(●)	(●)	(●)
5	DC voltage high	●	-	-
6	DC voltage low	●	-	-
7	DC overvoltage	●	●	-
8	DC undervoltage	●	●	-
9	Inverter overloaded	●	●	-
10	Motor overtemperature	(●)	(●)	-
11	Motor thermistor overtemperature	(●)	(●)	-
12	Torque limit	●	●	-
13	Overcurrent	●	●	●
14	Protective earth fault	-	●	●
15	Hardware mismatch	-	●	●
16	Short circuit	-	●	●
17	Control word timeout	(●)	(●)	-
18	Start failed	-	●	-
21	Parameter error	●	●	-
23	Internal fan fault	●	-	-
24	External fan fault	●	-	-
25	Brake resistor short-circuit	●	-	-
26	Brake resistor power limit	(●)	(●)	-
27	Brake chopper fault	●	●	-
28	Brake check failed	(●)	(●)	-

Designation	Description	Warning	Alarm	Alarm, trip lock
29	Heat sink temperature	●	●	●
30	Motor phase U missing	(●)	(●)	(●)
31	Motor phase V missing	(●)	(●)	(●)
32	Motor phase W missing	(●)	(●)	(●)
33	Inrush fault	-	●	●
34	Fieldbus communication fault	●	●	-
35	Option fault	(●)	-	-
36	Mains failure	●	●	-
38	Internal fault	-	●	●
39	Heat sink sensor	-	●	●
40	Overload of digital output, terminal 27	(●)	-	-
41	Overload of digital output, terminal 29	(●)	-	-
42	Overload X30/6 or X30/7	(●)	-	-
45	Protective earth fault 2	●	●	●
46	Power card supply	-	●	●
47	24 V supply low	●	●	●
48	1.8 V supply low	-	●	●
49	Speed limit	●	-	-
50	AMA calibration failed	-	●	-
51	AMA check U_{nom} and I_{nom}	-	●	-
52	AMA low I_{nom}	-	●	-
53	AMA motor too large	-	●	-
54	AMA motor too small	-	●	-
55	AMA parameter out of range	-	●	-
56	AMA interrupted by user	-	●	-
57	AMA timeout	-	●	-
58	AMA internal fault	●	●	-
59	Current limit	●	-	-
60	External interlock	●	●	-
61	Feedback error	(●)	(●)	-

Designation	Description	Warning	Alarm	Alarm, trip lock
62	Output frequency at maximum limit	●	-	-
64	Voltage limit	●	-	-
65	Control card overtemperature	●	●	●
66	Heat sink temperature low	●	-	-
67	Option configuration has changed	-	●	-
68	Safe stop activated	(●)	(●) ⁶⁾	-
69	Power card temperature	-	●	●
70	Illegal FC configuration	-	-	●
71	PTC 1 safe stop	●	●	-
72	Dangerous failure	●	●	●
76	Power unit setup	●	-	-
77	Reduced power mode	●	-	-
79	Illegal power section configuration	-	●	-
80	Drive initialised to default value	-	●	-
81	CSIV corrupt	-	●	-
82	CSIV parameter error	-	●	-
90	Feedback monitor	(●)	(●)	-
91	Analog input 54 wrong settings	-	-	●
92	No flow	(●)	(●)	-
93	Dry pump	(●)	(●)	-
94	End of curve	(●)	(●)	-
96	Start delayed	(●)	-	-
97	Stop delayed	(●)	-	-
98	Clock fault	●	-	-
99	Locked rotor	-	●	-
100	Derag limit fault	-	●	(●)
104	Mixing fan fault	(●)	(●)	-
148	System temperature	●	●	-
200	Fire mode	(●)	-	-
201	Fire mode was active	(●)	-	-
243	Brake IGBT	●	●	-

Designation	Description	Warning	Alarm	Alarm, trip lock
244	Heat sink temperature	●	●	●
245	Heat sink sensor	-	●	●
246	Power card supply	-	●	●
247	Power card temperature	-	●	●
248	Illegal power section configuration	-	●	●
249	Temperature of the rectifier heat sink	●	-	-
250	New spare part	-	-	●
251	New type code	-	●	●
274	The flow is not confirmed	-	●	-
275	Flow switch failure	-	●	-
2004	External fault	-	●	-
2007	Too high bearing temperature	●	●	-
2008	Too high bearing temperature	●	●	-
2010	Setpoint signal is outside range	-	●	-
2011	Sensor 1 is outside range	-	●	-
2012	Sensor 2 is outside range	-	●	-
2013	Temperature sensor 1 is outside range	-	●	-
2014	Temperature sensor 2 is outside range	-	●	-
2016	Limit 1 is exceeded	●	●	-
2017	Limit 2 is exceeded	●	●	-

5) The warnings and alarms marked with parentheses are programmable.

6) This warning or alarm cannot be auto reset via parameter selection.

Related information

[9.7 Starting the system](#)

12. Technical data

12.1 Enclosure

The below tables show an overview of the different enclosure classes based on typical motor power and and mains supply ranges.

Power P2		Mains supply [V]			
		1 x 200-240 (S2)			
		Enclosure class			
[kW]	[hp]	IP20	IP21	IP55	IP66 (US only)
0.55	0.75	-	-	-	-
0.75	1	-	-	-	-
1.1	1.5	●	-	●	-
1.5	2	-	●	●	●
2.2	3	-	●	●	●
3	4	-	●	●	●
3.7	5	-	●	●	-
4	5	-	-	-	-
5.5	7.5	-	●	●	●
7.5	10	-	●	●	●

Power P2		Mains supply [V]													
		3 x 200-240 V (T2)			3 x 380-500 (T5)					3 x 525-600 (T6)		3 x 525-690 (T7)			
Enclosure class															
[kW]	[hp]	IP20	IP55	IP66 (US only)	IP20	IP21	IP54	IP55	IP66 (US only)	IP20	IP55	IP20	IP21	IP54	IP55
0.55	0.75	-	-	-	●	-	-	●	●	-	-	-	-	-	-
0.75	1	●	●	●	●	-	-	●	●	●	●	-	-	-	-
1.1	1.5	●	●	●	●	-	-	●	●	●	●	●	-	-	-
1.5	2	●	●	●	●	-	-	●	●	●	●	●	-	-	-
2.2	3	●	●	●	●	-	-	●	●	●	●	●	-	-	-
3	4	●	●	●	●	-	-	●	●	●	●	●	-	-	-
3.7	5	●	●	●	-	-	-	-	-	-	-	-	-	-	-
4	5	-	-	-	●	-	-	●	●	●	●	●	-	-	-
5.5	7.5	●	●	●	●	-	-	●	●	●	●	●	-	-	-
7.5	10	●	●	●	●	-	-	●	●	●	●	●	-	-	-
11	15	●	●	●	●	-	-	●	●	●	●	-	●	-	●
15	20	●	●	●	●	-	-	●	●	●	●	-	●	-	●
18.5	25	●	●	●	●	-	-	●	●	●	●	-	●	-	●

Power P2		Mains supply [V]													
		3 x 200-240 V (T2)			3 x 380-500 (T5)					3 x 525-600 (T6)		3 x 525-690 (T7)			
		Enclosure class													
[kW]	[hp]	IP20	IP55	IP66 (US only)	IP20	IP21	IP54	IP55	IP66 (US only)	IP20	IP55	IP20	IP21	IP54	IP55
22	30	•	•	•	•	-	-	•	•	•	•	-	•	-	•
30	40	•	•	•	•	-	-	•	•	•	•	-	•	-	•
37	50	•	•	•	•	-	-	•	•	•	•	-	•	-	•
45	60	•	•	•	•	-	-	•	•	•	•	-	•	-	•
55	75	-	-	-	•	-	-	•	•	•	•	-	•	-	•
75	100	-	-	-	•	-	-	•	•	•	•	-	•	-	•
90	125	-	-	-	•	-	-	•	•	•	•	-	•	-	•
110	150	-	-	-	• ⁷⁾	•	•	-	-	-	-	-	•	•	-
132	200	-	-	-	• ⁷⁾	•	•	-	-	-	-	-	•	•	-
160	250	-	-	-	• ⁷⁾	•	•	-	-	-	-	-	•	•	-
200	300	-	-	-	• ⁷⁾	•	•	-	-	-	-	-	•	•	-
250	350	-	-	-	• ⁷⁾	•	•	-	-	-	-	-	•	•	-
315	450	-	-	-	• ⁷⁾	•	•	-	-	-	-	-	•	•	-
355	500		-	-	-	•	•	-	-	-	-	-	-	-	-
400	550	-	-	-	-	•	•	-	-	-	-	-	-	-	-
450	600	-	-	-	-	•	•	-	-	-	-	-	-	-	-
500	650	-	-	-	-	•	•	-	-	-	-	-	-	-	-
560	750	-	-	-	-	•	•	-	-	-	-	-	-	-	-

7) Available only in China

Related information

5. Mechanical installation

12.2 Operating conditions

Humidity

Description	Percentage [%]
Relative humidity	5-95

Ambient temperature

Description	0.55-90 kW / 0.75-125 hp	110-560 kW / 150-750 hp
	Temperature	
	[°C] / [°F]	[°C] / [°F]
Ambient temperature	Max. 50 / 122	Max. 45 / 113
• with derating	Max. 55 / 131	Max. 55 / 131
Minimum ambient temperature	0 / 32	0 / 32
• at full operation		
• at reduced operation	-10 / 14	-10 / 14
Temperature during storage and transport	-25 to +65 / -13 to +149	-25 to +65 / -13 to +149

Installation altitude

Maximum altitude above sea level	[m]	[ft]
Without performance reduction	1000	3280
With performance reduction	3000	9840

12.3 Inputs and outputs

Mains supply



Do not use the power supply for switching the CUE on and off.

Terminals: L1, L2, L3.

Supply voltage:

- 200-240 V $\pm$ 10 %
- 380-500 V $\pm$ 10 %
- 525-600 V $\pm$ 10 %
- 525-690 V $\pm$ 10 %.

Supply frequency: 50/60 Hz.

Maximum temporary imbalance between phases: 3 % of the rated value.

Leakage current to protective earth: > 3.5 mA.

Number of cut-ins, enclosure A: maximum 2 times/min.

Number of cut-ins, enclosures B and C: maximum 1 time/min.

Motor output



Switching on output is not recommended.

Terminals: U, V, W.

Output voltage: 0-100 %, in percentage of supply voltage.

Output frequency: 0-590 Hz, depending on the selected pump family.

RS-485 connection

Terminals: 68 (A), 69 (B), 61 GND (Y).

The RS-485 circuit is functionally separated from other central circuits and galvanically separated from the supply voltage (PELV).

Digital inputs

Terminals: 18, 19, 32, 33.

Voltage level: 0-24 VDC.

Voltage level, open contact: > 19 VDC.

Voltage level, closed contact: < 14 VDC.

Maximum voltage on input: 28 VDC.

Input resistance, R_i : approximately 4 k Ω .

All digital inputs are galvanically separated from the supply voltage (PELV) and other high-voltage terminals.

Signal relays

Terminals

- Relay 01: 1 (C), 2 (NO), 3 (NC)
- Relay 02: 4 (C), 5 (NO), 6 (NC)
- C: Common
- NO: Normally open
- NC: Normally closed.

The maximum terminal load is specified in accordance with the IEC 60947 Part 4 and 5.

Maximum terminal load (AC-1): 240 VAC, 2 A.

Maximum terminal load (AC-15): 240 VAC, 0.2 A.

Maximum terminal load (DC-1): 50 VDC, 1 A.

Minimum terminal load:

- 24 VDC, 10 mA
- 24 VAC, 20 mA.

The relay contacts are galvanically separated from other circuits by reinforced insulation (PELV).

Analog inputs

Analog input 1

Terminal: 53

Voltage signal: A53 = U (factory setting)

Voltage range: 0-10 V

Input resistance, R_i : Approx. 200 Ω

Maximum current: 30 mA

Maximum fault: 0.5 % of full scale

Analog input 2

Terminal: 54

Current signal: A54 = I (factory setting)

Current range: 0-20, 4-20 mA

Input resistance, R_i : Approx. 200 Ω

Maximum current: 30 mA

Maximum fault: 0.5 % of full scale

All analog inputs are galvanically separated from the supply voltage (PELV) and other high-voltage terminals.

Analog output

Analog output 1

Terminal: 42

Current range: 0-20 mA

Maximum load to frame: 500 Ω

Maximum fault: 0.8 % of full scale

The analog output is galvanically separated from the supply voltage (PELV) and other high-voltage terminals.

MCB 114 sensor input module

Analog input 3

Terminal: 2

Current range: 0/4-20 mA

Input resistance: < 200 Ω

Analog input 4 and 5

Terminal: 4, 5 and 7, 8

Signal type, 2- or 3-wire: Pt100/Pt1000

Related information[6.1.3 Additional protection](#)**12.4 Recommended fuses and circuit breakers**

The recommended fuses are suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, depending on the voltage rating of the drive. With the proper fuses, the short-circuit current rating (SCCR) of the drive is 100,000 rms symmetrical amperes.

12.4.1 Recommended CE fuses and circuit breakers**Enclosures A, B and C****200-240 V**

Enclosure	Power		Fuse size	Max. fuse size	Circuit breaker Moeller	Max. trip level [A]
	[kW]	[hp]				
A2	0.75	1	gG-10	gG-32	PKZM0-25	25
	1.1	1.5	gG-10			
	1.5	2	gG-10			
	2.2	3	gG-16			
A3	3	4	gG-16	gG-32	PKZM0-25	25
	3.7	5	gG-20			
A4	0.75	1	gG-10	gG-32	PKZM0-25	25
	1.1	1.5	gG-10			
	1.5	2	gG-10			
	2.2	3	gG-16			

Enclosure	Power		Fuse size	Max. fuse size	Circuit breaker Moeller	Max. trip level [A]
	[kW]	[hp]				
A5	0.75	1	gG-10	gG-32	PKZM0-25	25
	1.1	1.5	gG-10			
	1.5	2	gG-10			
	2.2	3	gG-16			
	3	4	gG-16			
	3.7	5	gG-20			
B1	5.5	7.5	gG-25	gG-80	PKZM4-63	63
	7.5	10	gG-32			
	11	15	gG-32			
B2	15	20	gG-50	gG-100	NZMB1-A100	100
B3	5.5	7.5	gG-25	gG-63	PKZM4-50	50
	7.5	10	gG-25			
	11	15	gG-32			
B4	15	20	gG-50	gG-125	NZMB1-A100	100
	18	25	gG-63			
C1	18	25	gG-63	gG-160	NZMB2-A200	160
	22	30	gG-80			
	30	40	gG-100	aR-160		
C2	37	50	aR-160	aR-200	NZMB2-A250	250
	45	60	aR-200	aR-250		
C3	22	30	gG-80	gG-150	NZMB2-A200	150
	30	40	aR-125	aR-160		
C4	27	50	aR-160	aR-200	NZMB2-A250	250
	45	60	aR-200	aR-250		

3 × 380-500 V

Enclosure	Power		Fuse size	Max. fuse size	Circuit breaker Moeller	Max. trip level [A]
	[kW]	[hp]				
A2	1.1	1.5	gG-10	gG-25	PKZM0-25	25
	1.5	2	gG-10			
	2.2	3	gG-10			
	3	4	gG-10			
	4	5	gG-16			
A3	5.5	7.5	gG-16	gG-32	PKZM0-25	25
	7.5	10	gG-16			

Enclosure	Power		Fuse size	Max. fuse size	Circuit breaker Moeller	Max. trip level [A]
	[kW]	[hp]				
A4	1.1	1.5	gG-10	gG-32	PKZM0-25	25
	1.5	2	gG-10			
	2.2	3	gG-10			
	3	4	gG-10			
	4	5	gG-16			
A5	1.1	1.5	gG-10	gG-32	PKZM0-25	25
	1.5	2	gG-10			
	2.2	3	gG-10			
	3	4	gG-10			
	4	5	gG-16			
	5.5	7.5	gG-16			
	7.5	10	gG-16			
B1	11	15	gG-40	gG-80	PKZM4-63	63
	15	20	gG-40			
	18	25	gG-40			
B2	22	30	gG-50	gG-100	NZMB1-A100	100
	30	40	gG-63			
B3	11	15	gG-40	gG-63	PKZM4-50	50
	15	20	gG-40			
	18	25	gG-40			
B4	22	30	gG-50	gG-125	NZMB1-A100	100
	30	40	gG-63			
	37	50	gG-80			
C1	37	50	gG-80	gG-160	NZMB2-A200	160
	45	60	gG-100			
	55	75	gG-160			
C2	75	100	aR-200	aR-250	NZMB2-A250	250
	90	125	aR-250			
C3	45	60	gG-100	gG-150	NZMB2-A200	150
	55	75	gG-160	gG-160		
C4	75	100	aR-200	aR-250	NZMB2-A250	250
	90	125	aR-250			

3 × 525-600 V

Enclosure	Power		Fuse size	Max. fuse size	Circuit breaker Moeller	Max. trip level [A]
	[kW]	[hp]				
A2	1.1	1.5	gG-10	gG-25	PKZM0-25	25
	1.5	2	gG-10			
	2.2	3	gG-10			
	3	4	gG-10			
	4	5	gG-10			
A3	5.5	7.5	gG-10	gG-32	PKZM0-25	25
	7.5	10	gG-16			
A5	1.1	1.5	gG-10	gG-32	PKZM0-25	25
	1.5	2	gG-10			
	2.2	3	gG-10			
	3	4	gG-10			
	4	5	gG-10			
	5.5	7.5	gG-10			
	7.5	10	gG-16			
B1	11	15	gG-25	gG-80	PKZM4-63	63
	15	20	gG-32			
	18.5	25	gG-40			
B2	22	30	gG-50	gG-100	NZMB1-A100	100
	30	40	gG-63			
B3	11	15	gG-25	gG-63	PKZM4-50	50
	15	20	gG-32			
	18	25	gG-32			
B4	22	30	gG-40	gG-125	NZMB1-A100	100
	30	40	gG-50			
	37	50	gG-63			
C1	37	50	gG-63	gG-160	NZMB2-A200	160
	45	60	gG-100	-		
	55	60	aR-160	aR-250		
C2	75	100	aR-200	aR-250	NZMB2-A250	250
	90	125	aR-200			
C3	45	60	gG-63	gG-150	NZMB2-A200	150
	55	75	gG-100			
C4	75	100	aR-160	aR-250	NZMB2-A250	250
	90	125	aR-200			

3 × 525-690 V

Enclosure	Power		Fuse size	Max. fuse size	Circuit breaker Moeller	Max. trip level [A]
	[kW]	[hp]				
A3	1.1	1.5	gG-6	gG-25	PKZM0-16	16
	1.5	2	gG-6			
	2.2	3	gG-6			
	3	4	gG-10			
	4	5	gG-10			
	5.5	7.5	gG-16			
	7.5	10	gG-16			
B2	11	15	gG-25	gG-63	-	-
	15	20	gG-25			
	18	24	gG-32			
	22	30	gG-32			
C2	30	40	gG-40	gG-80	-	-
	37	50	gG-63	gG-100		
	45	60	gG-63	gG-125		
	55	75	gG-80	gG-160		
	75	100	gG-100			
C3	37	50	gG-100	gG-125	-	-
	45	60	gG-125	gG-160		

Enclosures D1h-D7h**3 × 380-500 V**

Power		Recommended fuse size
[kW]	[hp]	
110	150	aR-315
132	200	aR-350
160	250	aR-400
200	300	aR-500
250	350	aR-630
315	450	aR-800

3 × 525-690 V

Power		Recommended fuse size
[kW]	[hp]	
110	150	aR-315
132	200	aR-315
160	250	aR-315

Power		Recommended fuse size
[kW]	[hp]	
200	300	aR-550
250	350	aR-550
315	450	aR-550

Space heater fuse recommendation

Rating		Bussmann
Current [A]	Supply voltage [V]	
2.5	600	LPJ-21/2SP

Enclosures E1h and E2h

380-500 and 525-690 V

Supply voltage [V]	Bussmann
380-500	170M7309
525-690	170M7342

Space heater fuse recommendation

Rating		Bussmann
Current [A]	Supply voltage [V]	
2.5	600	LPJ-21/2SP

12.4.2 Recommended UL fuses

Enclosures A, B and C

1 × 200-240 V

Power		Max. pre-fuse size [A]	Bussmann						
[kW]	[hp]		JFHR2	RK1	Type J	Type T	Type CC	Type CC	Type CC
1.1	1.5	15	FWX-15	KTN-15	JKS-15	JJN-15	FNQ-R-15	KTK-R-15	LP-CC-15
1.5	2.0	20	FWX-20	KTN-20	JKS-20	JJN-20	FNQ-R-20	KTK-R-20	LP-CC-20
2.2	3.0	30	FWX-30	KTN-30	JKS-30	JJN-30	FNQ-R-30	KTK-R-30	LP-CC-30
3.0	4.0	35	FWX-35	KTN-35	JKS-35	JJN-35	-	-	-
3.7	5.0	50	FWX-50	KTN-50	JKS-50	JJN-50	-	-	-
5.5	7.5	60	FWX-60	KTN-60	JKS-60	JJN-60	-	-	-
7.5	10	80	FWX-80	KTN-80	JKS-80	JJN-80	-	-	-
15	20	150	FWX-150	KTN-150	JKS-150	JJN-150	-	-	-
22	30	200	FWX-200	KTN-200	JKS-200	JJN-200	-	-	-

Power		Max. pre-fuse size [A]	SIBA	Littelfuse	Ferraz Shawmut		
[kW]	[hp]		Type RK1	Type RK1	Type CC	Type RK1	Type J
1.1	1.5	15	5017906-016	KLN-R15	ATM-R15	A2K-15R	HSJ15
1.5	2.0	20	5017906-020	KLN-R20	ATM-R20	A2K-20R	HSJ20
2.2	3.0	30	5017906-032	KLN-R30	ATM-R30	A2K-30R	HSJ30
3.0	4.0	35	-	KLN-R35	-	A2K-35R	HSJ35
3.7	5.0	50	5017906-050	KLN-R50	-	A2K-50R	HSJ50
5.5	7.5	60	5017906-063	KLN-R60	-	A2K-60R	HSJ60
7.5	10	80	5017906-080	KLN-R80	-	A2K-80R	HSJ80
15	20	150	5017906-150	KLN-R150	-	A2K-150R	HSJ150
22	30	200	5017906-200	KLN-R200	-	A2K-200R	HSJ200

3 × 200-240 V

Power		Bussmann						
[kW]	[hp]	JFHR2	RK1	Type J	Type T	Type CC	Type CC	Type CC
0.55	0.75	FWX-10	KTN-R10	JKS-10	JJN-10	FNQ-R-10	GTK-R-10	LP-CC-10
0.75	1.0	FWX-10	KTN-R10	JKS-10	JJN-10	FNQ-R-10	GTK-R-10	LP-CC-10
1.1	1.5	FWX-10	KTN-R10	JKS-10	JJN-10	FNQ-R-10	GTK-R-10	LP-CC-10
1.5	2.0	FWX-15	KTN-R15	JKS-15	JJN-15	FNQ-R-15	GTK-R-15	LP-CC-15
2.2	3.0	FWX-20	KTN-R20	JKS-20	JJN-20	FNQ-R-20	GTK-R-20	LP-CC-20
3.0	4.0	FWX-25	KTN-R25	JKS-25	JJN-25	FNQ-R-25	GTK-R-25	LP-CC-25
3.7	4.0	FWX-30	KTN-R30	JKS-30	JJN-30	FNQ-R-30	GTK-R-30	LP-CC-30
5.5	7.5	FWX-50	KTN-R50	JKS-50	JJN-50	-	-	-
7.5	10	FWX-50	KTN-R50	JKS-50	JJN-50	-	-	-
11	15	FWX-60	KTN-R60	JKS-60	JJN-60	-	-	-
15	20	FWX-80	KTN-R80	JKS-80	JJN-80	-	-	-
18	25	FWX-125	KTN-R125	JKS-125	JJN-125	-	-	-
22	30	FWX-125	KTN-R125	JKS-125	JJN-125	-	-	-
30	40	FWX-150	KTN-R150	JKS-150	JJN-150	-	-	-
37	50	FWX-200	KTN-R200	JKS-200	JJN-200	-	-	-
45	60	FWX-250	KTN-R250	JKS-250	JJN-250	-	-	-

Power		SIBA		Littelfuse		Ferraz Shawmut		
[kW]	[hp]	Type RK1	Type RK1	JFHR2	Type CC	Type RK1	JFHR2	Type J
0.55	0.75	5017906-010	KLN-R-10	-	ATM-R-10	A2K-10-R	-	HSJ-10
0.75	1.0	5017906-010	KLN-R-10	-	ATM-R-10	A2K-10-R	-	HSJ-10
1.1	1.5	5017906-010	KLN-R-10	-	ATM-R-10	A2K-10-R	-	HSJ-10
1.5	2.0	5017906-016	KLN-R-15	-	ATM-R-15	A2K-15-R	-	HSJ-15
2.2	3.0	5017906-020	KLN-R-20	-	ATM-R-20	A2K-20-R	-	HSJ-20
3.0	4.0	5017906-025	KLN-R-25	-	ATM-R-25	A2K-25-R	-	HSJ-25

Power		SIBA	Littelfuse			Ferraz Shawmut		
[kW]	[hp]	Type RK1	Type RK1	JFHR2	Type CC	Type RK1	JFHR2	Type J
3.7	4.0	5012406-032	KLN-R-30	-	ATM-R-30	A2K-30-R	-	HSJ-30
5.5	7.5	5014006-050	KLN-R-50	-	-	A2K-50-R	-	HSJ-50
7.5	10	5014006-050	KLN-R-50	-	-	A2K-50-R	-	HSJ-50
11	15	5014006-063	KLN-R-60	-	-	A2K-60-R	-	HSJ-60
15	20	5014006-080	KLN-R-80	-	-	A2K-80-R	-	HSJ-80
18	25	5017906-125	KLN-R-125	-	-	A2K-125-R	-	HSJ-125
22	30	2028220-125	KLN-R-125	-	-	A2K-125-R	-	HSJ-125
30	40	2028220-150	KLN-R-150	L25S-150	-	A2K-150-R	A25X-150	HSJ-150
37	50	2028220-200	KLN-R-200	L25S-200	-	A2K-200-R	A25X-200	HSJ-200
45	60	2028220-250	KLN-R-250	L25S-250	-	A2K-250-R	A25X-250	HSJ-250

3 × 380-500 V

Power		Bussmann						
[kW]	[hp]	JFHR2	RK1	Type J	Type T	Type CC	Type CC	Type CC
-	-	FWH-6	KTS-R-6	JKS-6	JJS-6	FNQ-R-6	CTK-R-5	LP-CC-6
1.1	1.5	FWH-10	KTS-R-10	JKS-10	JJS-10	FNQ-R-10	CTK-R-10	LP-CC-10
1.5	2.0	FWH-10	KTS-R-10	JKS-10	JJS-10	FNQ-R-10	CTK-R-10	LP-CC-10
2.2	3.0	FWH-10	KTS-R-10	JKS-10	JJS-10	FNQ-R-10	CTK-R-10	LP-CC-10
3.0	4.0	FWH-15	KTS-R-15	JKS-15	JJS-15	FNQ-R-15	CTK-R-15	LP-CC-15
4.0	5.0	FWH-20	KTS-R-20	JKS-20	JJS-20	FNQ-R-20	CTK-R-20	LP-CC-20
5.5	7.5	FWH-25	KTS-R-25	JKS-25	JJS-25	FNQ-R-25	CTK-R-25	LP-CC-25
7.5	10	FWH-30	KTS-R-30	JKS-30	JJS-30	FNQ-R-30	CTK-R-30	LP-CC-30
11	15	FWH-40	KTS-R-40	JKS-40	JJS-40	-	-	-
15	20	FWH-50	KTS-R-50	JKS-50	JJS-50	-	-	-
22	30	FWH-60	KTS-R-60	JKS-60	JJS-60	-	-	-
30	40	FWH-80	KTS-R-80	JKS-80	JJS-80	-	-	-
37	50	FWH-100	KTS-R-100	JKS-100	JJS-100	-	-	-
45	60	FWH-125	KTS-R-125	JKS-125	JJS-125	-	-	-
55	75	FWH-150	KTS-R-150	JKS-150	JJS-150	-	-	-
75	100	FWH-200	KTS-R-200	JKS-200	JJS-150	-	-	-
90	125	FWH-250	KTS-R-250	JKS-250	JJS-250	-	-	-

Power		SIBA	Littelfuse			Ferraz Shawmut		
[kW]	[hp]	Type RK1	Type RK1	JFHR2	Type CC	Type RK1	JFHR2	Type J
-	-	5017906-006	KLS-R-6	-	ATM-R-6	A6K-6-R	-	HSJ-6
1.1	1.5	5017906-010	KLN-R-10	-	ATM-R-10	A6K-10-R	-	HSJ-10
1.5	2.0	5017906-010	KLN-R-10	-	ATM-R-10	A6K-10-R	-	HSJ-10
2.2	3.0	5017906-010	KLN-R-10	-	ATM-R-10	A6K-10-R	-	HSJ-10

Power		SIBA	Littelfuse		Ferraz Shawmut			
[kW]	[hp]	Type RK1	Type RK1	JFHR2	Type CC	Type RK1	JFHR2	Type J
3.0	4.0	5017906-016	KLN-R-15	-	ATM-R-15	A6K-15-R	-	HSJ-15
4.0	5.0	5017906-020	KLN-R-20	-	ATM-R-20	A6K-20-R	-	HSJ-20
5.5	7.5	5017906-025	KLN-R-25	-	ATM-R-25	A6K-25-R	-	HSJ-25
7.5	10	5012406-032	KLN-R-30	-	ATM-R-30	A6K-30-R	-	HSJ-30
11	15	5014006-040	KLS-R-40	-	-	A6K-40-R	-	HSJ-40
15	20	5014006-050	KLN-R-50	-	-	A6K-50-R	-	HSJ-50
22	30	5014006-063	KLN-R-60	-	-	A6K-60-R	-	HSJ-60
30	40	2028220-120	KLN-R-80	-	-	A6K-80-R	-	HSJ-80
37	50	2028220-125	KLN-R-100	-	-	A6K-100-R	-	HSJ-100
45	60	2028220-125	KLN-R-125	-	-	A6K-125-R	-	HSJ-125
55	75	2028220-160	KLN-R-150	-	-	A6K-150-R	-	HSJ-150
75	100	2028220-200	KLN-R-200	L50-S-225	-	A6K-200-R	A50-P-225	HSJ-200
90	125	2028220-250	KLN-R-250	L50-S-250	-	A6K-250-R	A50-P-250	HSJ-250

525-600 V

Power		Bussmann					
[kW]	[hp]	Type RK1	Type J	Type T	Type CC	Type CC	Type CC
0.75	1.5	KTS-R-5	JKS-5	JJS-6	FNQ-R-5	GTK-R-5	LP-CC-5
1.1	1.5	KTS-R-5	JKS-5	JJS-6	FNQ-R-5	GTK-R-5	LP-CC-5
1.5	2.0	KTS-R-10	JKS-10	JJS-10	FNQ-R-10	GTK-R-10	LP-CC-10
2.2	3.0	KTS-R-10	JKS-10	JJS-10	FNQ-R-10	GTK-R-10	LP-CC-10
3.0	4.0	KTS-R-15	JKS-15	JJS-15	FNQ-R-15	GTK-R-15	LP-CC-15
4.0	5.0	KTS-R-20	JKS-20	JJS-20	FNQ-R-20	GTK-R-20	LP-CC-20
5.5	7.5	KTS-R-25	JKS-25	JJS-25	FNQ-R-25	GTK-R-25	LP-CC-25
7.5	10	KTS-R-30	JKS-30	JJS-30	FNQ-R-30	GTK-R-30	LP-CC-30
11	15	KTS-R-35	JKS-35	JJS-35	-	-	-
15	20	KTS-R-35	JKS-35	JJS-35	-	-	-
18	24	KTS-R-45	JKS-45	JJS-45	-	-	-
22	30	KTS-R-50	JKS-50	JJS-50	-	-	-
30	40	KTS-R-60	JKS-60	JJS-60	-	-	-
37	50	KTS-R-80	JKS-80	JJS-80	-	-	-
45	60	KTS-R-100	JKS-100	JJS-100	-	-	-
55	75	KTS-R-125	JKS-125	JJS-125	-	-	-
75	100	KTS-R-150	JKS-150	JJS-150	-	-	-
90	125	KTS-R-175	JKS-175	JJS-175	-	-	-

Power		SIBA	Littelfuse	Ferraz Shawmut	
[kW]	[hp]	Type RK1	Type RK1	Type RK1	Type J
0.75	1.5	5017906-005	KLS-R-005	A6K-5-R	HSJ-6
1.1	1.5	5017906-005	KLS-R-005	A6K-5-R	HSJ-6
1.5	2.0	5017906-010	KLS-R-010	A6K-10-R	HSJ-10
2.2	3.0	5017906-010	KLS-R-010	A6K-10-R	HSJ-10
3.0	4.0	5017906-016	KLS-R-015	A6K-15-R	HSJ-15
4.0	5.0	5017906-020	KLS-R-020	A6K-20-R	HSJ-20
5.5	7.5	5017906-025	KLS-R-025	A6K-25-R	HSJ-25
7.5	10	5017906-030	KLS-R-030	A6K-30-R	HSJ-30
11	15	5014006-040	KLS-R-035	A6K-35-R	HSJ-35
15	20	5014006-040	KLS-R-035	A6K-35-R	HSJ-35
18	24	5014006-050	KLS-R-045	A6K-45-R	HSJ-45
22	30	5014006-050	KLS-R-050	A6K-50-R	HSJ-50
30	40	5014006-063	KLS-R-060	A6K-60-R	HSJ-60
37	50	5014006-080	KLS-R-075	A6K-80-R	HSJ-80
45	60	5014006-100	KLS-R-100	A6K-100-R	HSJ-100
55	75	2028220-125	KLS-R-125	A6K-125-R	HSJ-125
75	100	2028220-150	KLS-R-150	A6K-150-R	HSJ-150
90	125	2028220-200	KLS-R-175	A6K-175-R	HSJ-175

525-690 V

Power		Bussmann		
[kW]	[hp]	E52273 RK1/JDDZ	E4273 J/JDDZ	E4273 T/JDDZ
11	15	KTS-R-30	JKS-30	JJS-30
15	20	KTS-R-30	JKS-30	JJS-30
18	25	KTS-R-45	JKS-45	JJS-45
22	30	KTS-R-45	JKS-45	JJS-45
30	40	KTS-R-60	JKS-60	JJS-60
37	50	KTS-R-80	JKS-80	JJS-80
45	60	KTS-R-90	JKS-90	JJS-90
55	75	KTS-R-100	JKS-100	JJS-100
75	100	KTS-R-125	JKS-125	JJS-125
90	125	KTS-R-150	JKS-150	JJS-150

Power		SIBA	Littelfuse	Ferraz Shawmut	
[kW]	[hp]	E180276 RK1/ JDDZ	E81895 RK1/ JDDZ	E163267/E2137 RK1/JDDZ	E2137 J/HSJ
11	15	5017906-030	KLS-R-030	A6K-30-R	HST-30
15	20	5017906-030	KLS-R-030	A6K-30-R	HST-30
18	25	5014006-050	KLS-R-045	A6K-45-R	HST-45
22	30	5014006-050	KLS-R-045	A6K-45-R	HST-45
30	40	5014006-063	KLS-R-60	A6K-60-R	HST-60
37	50	5014006-080	KLS-R-75	A6K-80-R	HST-80
45	60	5014006-100	KLS-R-90	A6K-90-R	HST-90
55	75	5014006-100	KLS-R-100	A6K-100-R	HST-100
75	100	2028220-125	KLS-R-150	A6K-125-R	HST-125
90	125	2028220-150	KLS-R-175	A6K-150-R	HST-150

Enclosures D1h-D7h

380-500 V, power/semiconductor fuse options

Power		Bussmann		Littelfuse	
[kW]	[hp]				
110	150	170M2619	FWH-300A	LA50QS300-4	L50S-300
132	200	170M2620	FWH-350A	LA50QS350-4	L50S-350
160	250	170M2621	FWH-400A	LA50QS400-4	L50S-400
200	300	170M4015	FWH-500A	LA50QS500-4	L50S-500
250	350	170M4016	FWH-600A	LA50QS600-4	L50S-600
315	450	170M4017	FWH-800A	LA50QS800-4	L50S-800

Power		Siba		Ferraz Shawmut	
[kW]	[hp]			Europe	North America
110	150	20 189 20.315	A50QS300-4	6,9URD31D08A0315	A070URD31KI0315
132	200	20 189 20.340	A50QS350-4	6,9URD31D08A0350	A070URD31KI0350
160	250	20 189 20.400	A50QS400-4	6,9URD31D08A0400	A070URD31KI0400
200	300	20 189 20.550	A50QS500-4	6,9URD31D08A0550	A070URD31KI0550
250	350	20 189 20.630	A50QS600-4	6,9URD31D08A0630	A070URD31KI0630
315	450	20 189 20.800	A50QS800-4	6,9URD31D08A0800	A070URD31KI0800

525-690 V, power/semiconductor fuse options

Power		Bussmann		Ferraz Shawmut	
[kW]	[hp]			Europe	North America
110	150	170M2619	20 610 31.315	6,9URD31D08A0315	A070URD31KI0315
132	200	170M2619	20 610 31.315	6,9URD31D08A0350	A070URD31KI0350
160	250	170M2619	20 610 31.315	6,9URD31D08A0400	A070URD31KI0400

Power		Bussmann	Siba	Ferraz Shawmut	
[kW]	[hp]			Europe	North America
200	300	170M4015	20 620 31.550	6,9URD31D08A0550	A070URD31KI0550
250	350	170M4015	20 620 31.550	6,9URD31D08A0630	A070URD31KI0630
315	450	170M4015	20 620 31.550	6,9URD31D08A0800	A070URD31KI080

Space heater fuse recommendation

Rating		Bussmann
Current [A]	Supply voltage [V]	
2.5	600	LPJ-21/2SP

Enclosures E1h and E2h

380-500 and 525-690 V

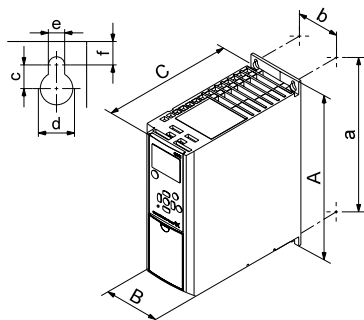
Supply voltage [V]	Bussmann
380-500	170M7309
525-690	170M7342

Space heater fuse recommendation

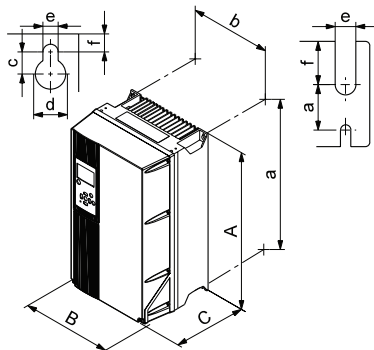
Rating		Bussmann
Current [A]	Supply voltage [V]	
2.5	600	LPJ-21/2SP

12.5 Dimensions and weights

12.5.1 Enclosures A2-A5, B1-B4 and C1-C4



A2 and A3



A4, A5, B1, B2, B3, B4, C1, C2, C3 and C4

Enclosure	Max. height [mm]		Max. width [mm]		Max. depth [mm]		Screw holes [mm]					Weight [kg]
	A	a	B	b	C	C	c	Ød	Øe	f		
A2	268	257	90	70	205	219	8	11	5.5	9	4.9	
A3	268	257	130	110	205	219	8	11	5.5	9	6.6	
A4	420	401	200	171	175	175	8.2	12	6.5	6	9.2	
A5	420	402	242	215	200	200	8.2	12	6.5	9	14	
B1	480	454	242	210	260	260	12	19	9	9	23	
B2	650	624	242	210	260	260	12	19	9	9	27	
B3	399	380	165	140	248	262	8	12	6.8	7.9	12	
B4	520	495	231	200	242	242	-	-	8.5	15	23.5	
C1	680	648	308	272	310	310	12	19	9	9.8	45	
C2	770	739	370	334	335	335	12	19	9	9.8	65	
C3	550	521	308	270	333	333	-	-	8.5	17	35	
C4	660	631	370	330	333	333	-	-	8.5	17	50	

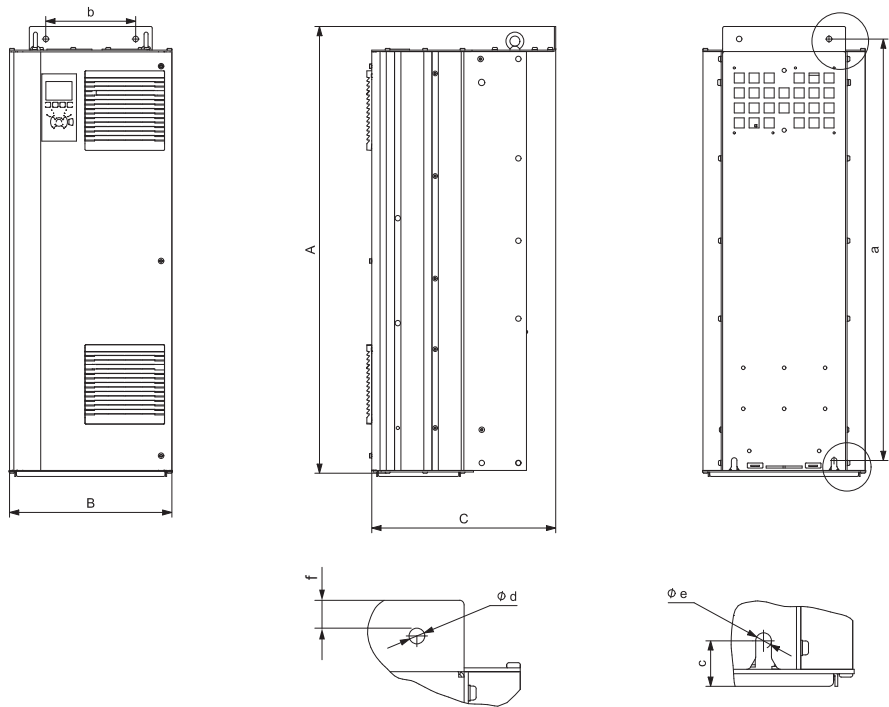
Enclosure	Max. height [in]		Max. width [in]		Max. depth [in]	Screw holes [in]				Weight [lb]
	A	a	B	b	C	c	Ød	Øe	f	
A2	10.5	10.1	3.5	2.8	8.1	0.3	0.43	0.22	0.35	10.8
A3	10.5	10.1	5.1	4.3	8.1	0.3	0.43	0.22	0.35	14.5
A4	16.5	15.7	7.8	6.7	7.0	0.2	0.49	0.25	0.35	20.3

Enclosure	Max. height [in]		Max. width [in]		Max. depth [in]		Screw holes [in]			Weight [lb]
	A	a	B	b	C	c	Ød	Øe	f	
A5	16.5	15.8	9.5	8.7	7.8	0.32	0.47	0.25	0.25	30.8
B1	18.9	17.8	9.5	8.2	10.2	0.47	0.75	0.35	0.35	50.7
B2	25.6	24.5	9.5	8.2	10.2	0.47	0.75	0.35	0.35	59.5
B3	15.7	14.9	6.5	5.5	9.7	0.3	0.47	0.26	0.31	26.4
B4	20.3	19.5	9.1	7.8	9.5	-	-	0.33	0.59	51.8
C1	26.9	25.5	12.1	10.7	12.2	0.49	0.75	0.35	0.4	99.2
C2	30.2	29.0	14.6	13.1	13.2	0.49	0.75	0.35	0.4	136.5
C3	21.6	20.5	12.1	10.6	13.1	-	-	0.33	0.67	77.1
C4	25.9	24.8	14.5	12.9	13.1	-	-	0.33	0.67	110.2

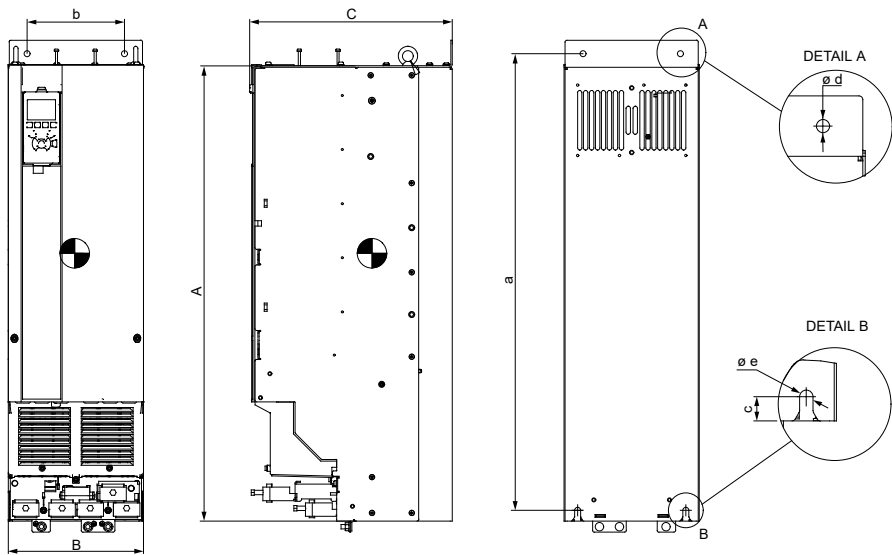
Related information

5.1.1 A, B, C type enclosures

12.5.2 Enclosures D1h-D7h, E1h and E2h

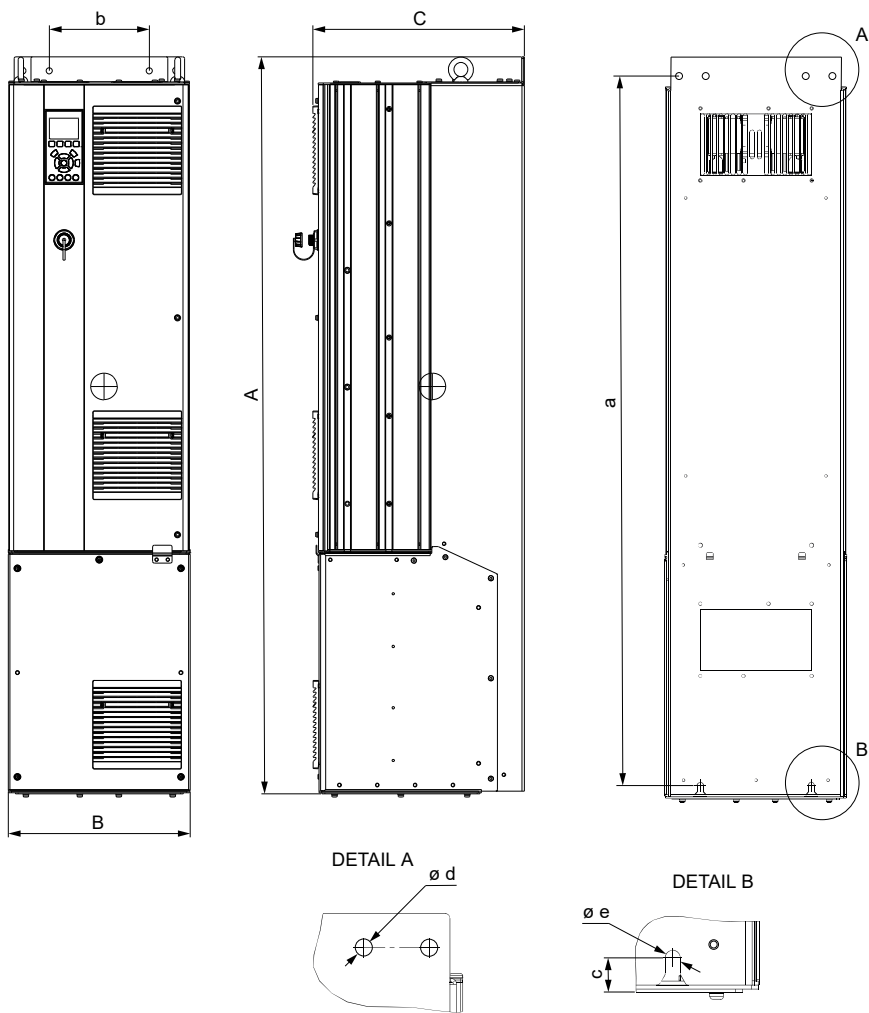


Dimensions for enclosures D1h and D2h



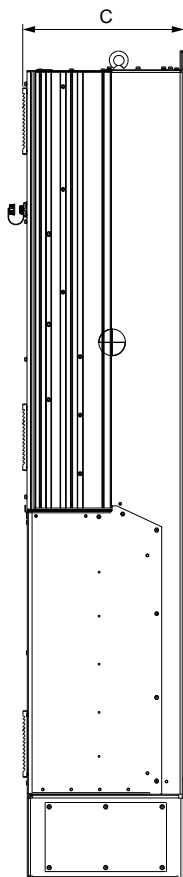
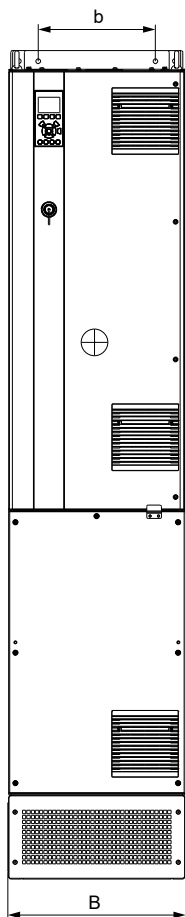
Dimensions for enclosures D3h and D4h

TM089701

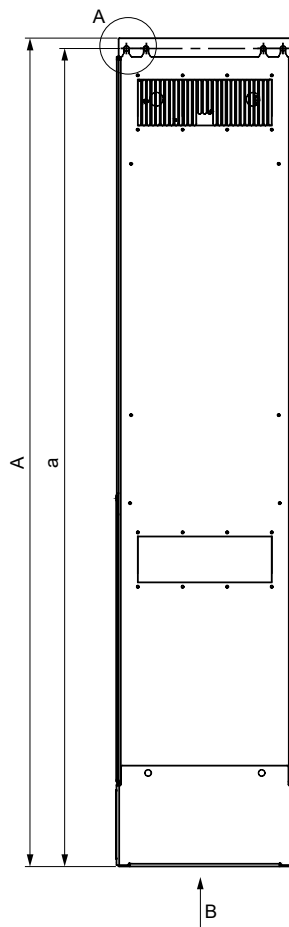
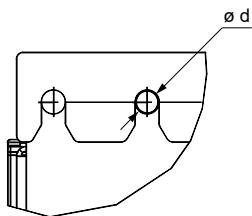


Dimensions for enclosure D5h

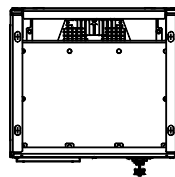
TM077501



DETAIL A

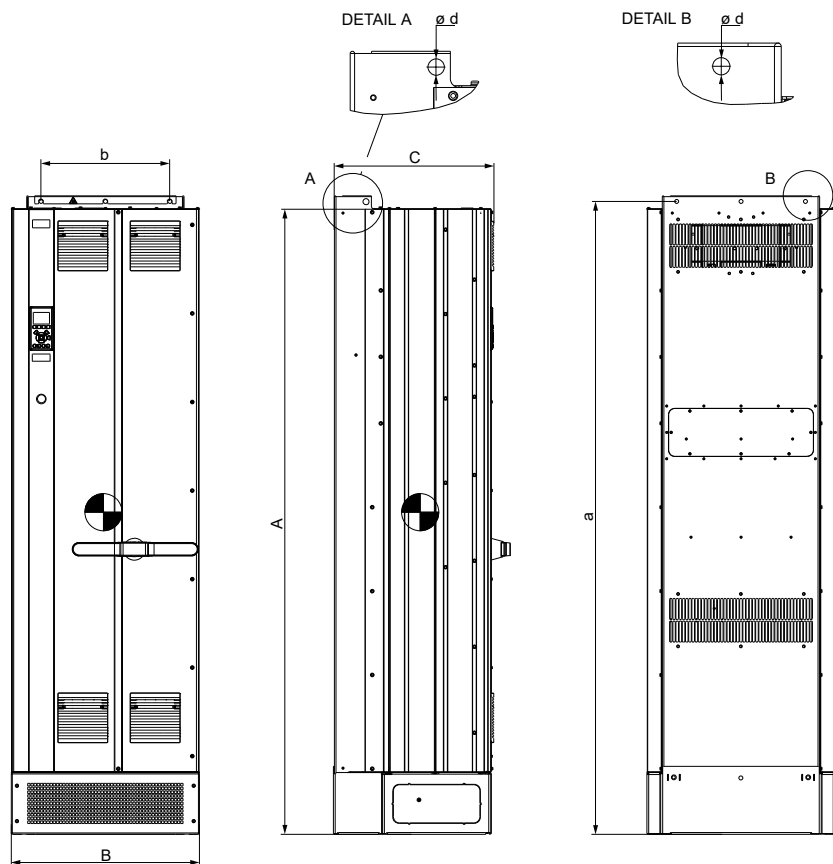


VIEW B



Dimensions for enclosure D7h

TM077502



TM089703

Dimensions for enclosures E1h and E2h

Enclosure	Max. height [mm]		Max. width [mm]		Max. depth [mm]	Screw holes [mm]				Weight [kg]
	A	a	B	b		c	Ød	Øe	f	
D1h	901	844	325	180	378	20	11	11	25	62
D2h	1107	1051	325	280	378	20	11	11	25	125
D3h	909	844	250	180	375	20	11	11	25	62
D4h	1027	1051	375	280	375	20	11	11	25	125
D5h	1324	1276	325	276/180	381	20	11	11	25	99
D7h	1978	1953	420	374/280	386	20	11	11	25	185
E1h	2043	-	602	412	513	-	13	-	18	295
E2h	2043	-	698	508	513	-	13	-	18	318

Enclosure	Max. height [in]		Max. width [in]		Max. depth [in]	Screw holes [in]				Weight [lb]
	A	a	B	b		c	Ød	Øe	f	
D1h	35.5	33.2	12.8	7.1	14.9	0.8	0.4	0.4	1	137
D2h	43.6	41.4	12.8	11	14.9	0.8	0.4	0.4	1	27
D3h	35.8	33.2	9.8	7.1	14.8	0.8	0.4	0.4	1	137
D4h	40.4	41.4	14.8	11	14.8	0.8	0.4	0.4	1	276
D5h	52.1	50.2	12.8	10.9/7.1	15	0.8	0.4	0.4	1	218
D7h	77.9	76.9	16.5	14.7/11	15.2	-	-	0.4	1	408
E1h	80.4	-	23.7	16.2	20.2	-	-	-	-	650
E2h	80.4	-	20.2	20	20.2	-	-	-	-	700

Shipping dimensions

Enclosure	Max. height		Max. width		Max. depth	
	[mm]	[in]	[mm]	[in]	[mm]	[in]
D1h	587	23	997	39	460	18
D2h	587	23	1170	46	535	21
D3h	587	23	997	39	460	18
D4h	587	23	1170	46	535	21
D5h	1805	71	510	20	635	25
D7h	2490	98	585	23	640	25
E1h	2191	86.3	768	30.2	870	34.3
E2h	2191	86.3	768	30.2	870	34.3

Related information

3.4.2 110-315 kW / 150-450 hp: D1h-D7h

3.4.3 355-560 kW / 500-750 hp: E1h-E2h

12.6 Cable entry sizes

Enclosure		Number and size	
IEC	NEMA	Standard [mm]	Imperial [inch]
A3 IP20/21	Type 1	3 × 22.5	3 × 1/2
		3 × 28.4	3 × 3/4
		1 × 22.5	1 × 1/2
A4 IP55	Type 12	3 × 28.4	3 × 3/4
		6 × 26.3	6 × 3/4
A5 IP55	Type 12	2 × 22.5	2 × 1/2
		3 × 37.2	3 × 1

Enclosure		Number and size	
IEC	NEMA	Standard [mm]	Imperial [inch]
B1 IP55	Type 12	2 × 21.5	2 × 1/2
		1 × 26.3	1 × 3/4
		3 × 33.1	3 × 1
B2 IP21 and IP55	Type 1 and 12	1 × 21.5	1 × 1/2
		1 × 26.3	1 × 3/4
		1 × 33.1	1 × 1
		2 × 42.9	2 × 1/4

12.7 Sound pressure level

The sound pressure level of the CUE is maximum 70 dB(A).

Operation through a frequency converter might increase the sound pressure level of the motor.

Related information

6.4 RFI filters

13. Disposing of the product

This product or parts of it must be disposed of in an environmentally sound way.

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.
3. Dispose of the waste battery through the national collective schemes. If in doubt, contact your local Grundfos company.



The crossed-out wheeled bin symbol on a product means that it must be disposed of separately from household waste. When a product marked with this symbol reaches its end of life, take it to a collection point designated by the local waste disposal authorities. The separate collection and recycling of such products will help protect the environment and human health.

See also end-of-life information at www.grundfos.com/product-recycling.

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