NBE, NBGE, NKE, NKGE, TPE Series 1000, TPE Series 2000

(from 30 kW 2-pole and 18.5 kW 4-pole)

Installation and operating instructions



NBE, NBGE, NKE, NKGE, TPE Series 1000, TPE Series 2000
Installation and operating instructions
Other languages
http://net.grundfos.com/qr/i/99457466

GRUNDFOS

NBE, NBGE, NKE, NKGE, TPE Series 1000, TPE Series 2000

English (GB)
Installation and operating instructions 4
Appendix A **28**

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.



Read the installation and operation instruction and safety installation and operation instruction of the motor for motor safety information, if the motor is not a Grundfos motor.

1.1 Original installation and operating instructions

These instructions are a supplement to the installation and operating instructions for the standard pump NB, NBG, NK, NKG, TP. For instructions not mentioned specifically in this manual, see the installation and operating instructions for the standard pump. In these instructions the frequency converter part of the NBE, NBGE, NKE, NKGE, TPE Series 1000 and TPE Series 2000 is referred to as CUE.

1.2 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.

1.3 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.

1.4 References

Technical documentation for Grundfos CUE:

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

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

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

2. Product introduction

2.1 Identification

2.1.1 Nameplate

CUE can be identified by means of the nameplate. An example is shown below.



TM043272

Example of nameplate

Text	Description
T/C:	CUE (product name) 202P1M2... (internal code)
Prod. no:	Product number: 12345678
S/N:	Serial number: 123456G234 The last three digits indicate the production date: 23 is the week, and 4 is the year 2004.
1.5 kW (2 hp)	Typical shaft power on the motor
IN:	Supply voltage, frequency and maximum input current
OUT:	Motor voltage, frequency and maximum output current. The maximum output frequency usually depends on the pump type.
CHASSIS/IP20	Enclosure class
Tamb.	Maximum ambient temperature

3. Receiving the product

WARNING
Crushing of feet
Death or serious personal injury
- Use safety shoes during transport and avoid stacking the boxes.

CAUTION
Heavy lifting
Minor or moderate personal injury
- Use proper lifting equipment when handling the product.
- Follow local regulations.

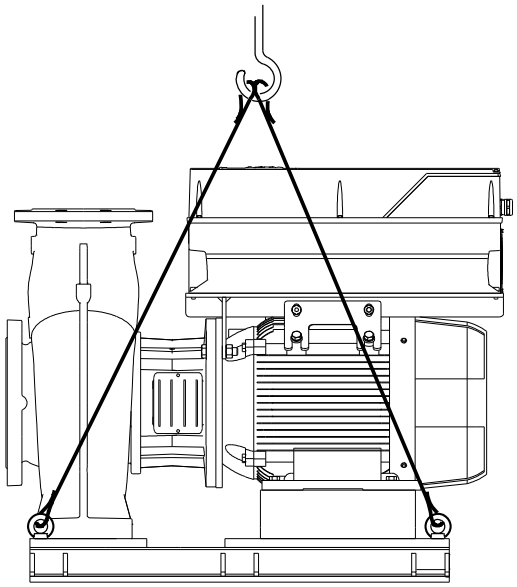
3.1 Delivery

The pump is delivered from the factory in a wooden package, which is specially designed for transport by fork-lift truck or a similar vehicle.

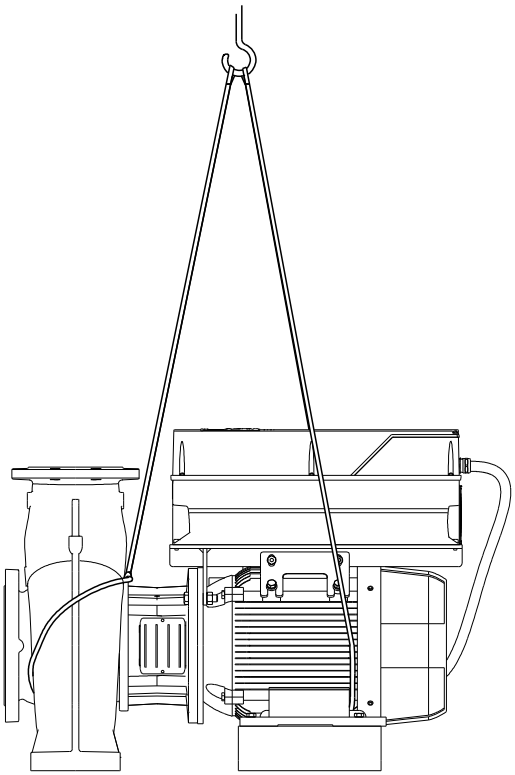
3.2 Handling

WARNING
Heavy dumping
Death or serious personal injury
- Make sure that the pump remains in a stable position during unpacking and installation by means of the straps used for lifting the pump.
- Note that typically the centre of gravity of the pump is close to the motor.

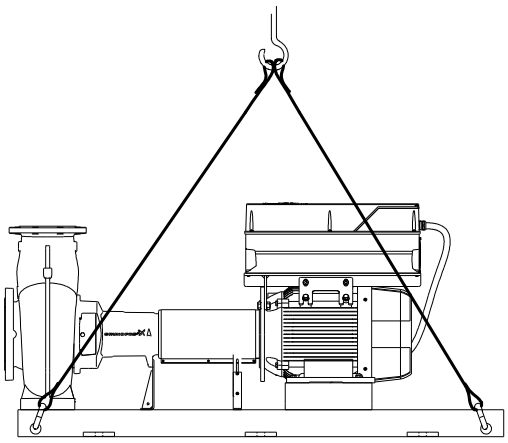
The pump must be lifted by means of straps and shackles. See figures below.



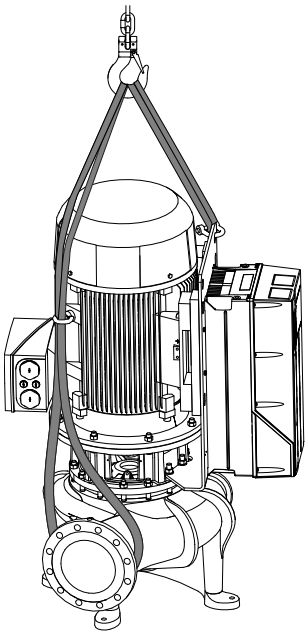
TM080646



TM080601



TM080600



TM082792

4. Installation requirements

Never stand on the CUE, motor and the pump.

Any installation, maintenance and inspection must be carried out by qualified, experienced and authorized persons.

Read the installation and operation instruction and safety installation and operation instruction of the motor for motor safety information, if the motor is not a Grundfos motor.

WARNING
Sharp element
Death or serious personal injury
- Use safety knives and protective gloves when unpacking the product.

WARNING
Heavy lifting
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 has been switched off at least for as long as stated below and that it cannot be accidentally switched on.
- Touching the electrical parts may be fatal, even after CUE has been switched off.

Voltage	Min. waiting time
380-500 V	15 minutes
	22-55 kW (30-74 hp)

DANGER
Intoxication or risk of chemical burn
Death or serious personal injury
- The battery can cause severe or fatal injuries in 2 hours or less if it is swallowed or placed inside any part of the body. In such event, seek medical attention immediately.

- The replacement or servicing of batteries must be carried out by a qualified person.
- The battery contained within this product, whether new or used, is hazardous and is to be kept away from children.

Safety regulations

DANGER
Magnetic field
Death or serious personal injury
- Do not dismantle, assemble or maintain the motor if you have a pacemaker or any other implanted electronic device.
- Keep the working environment clean, make sure no magnetized dust exist.

- The OFF button of the operating panel does not disconnect CUE from the power supply and must therefore not be used as a safety switch.
- CUE must be earthed correctly and protected against indirect contact according to local regulations.
- The leakage current to protective earth exceeds 3.5 mA.
- Enclosure class IP20/21 must not be installed freely accessible, but only in a panel.

- Enclosure class IP54/55 must not be installed outdoors without additional protection against weather conditions and the sun.
- The STO function does not disconnect CUE from the power supply and must therefore not be used as a safety switch.
- The STO function does not prevent unwanted movement from external forces on the motor, for example, back pressure, and the motor shaft must be covered.

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

The general safety necessitates special considerations as to these 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 on connecting inputs and outputs (PELV).

Related information

6. Electrical connection

4.1 IT mains

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.

In connection with IT mains and earthed delta mains, the mains voltage may exceed 440 V between phase and protective earth.

4.2 Aggressive environment

CUE must not be installed in an environment where the air contains liquids, particles or gases which may affect and damage the electronic components.

CUE contains a large number of mechanical and electronic components. They are all vulnerable to environmental impact.

4.3 Reduced performance under certain condition

CUE reduces its performance under the condition of low air pressure (at high altitude).

The required measures are described in the next section.

4.3.1 Reduction at low air pressure

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

PELV = Protective Extra Low Voltage.

At low air pressure, the cooling capacity of air is reduced, and CUE automatically reduces the performance to prevent overload.

It may be necessary to select a CUE unit with a higher performance.

5. Mechanical installation

The individual CUE cabinet sizes are characterised by their enclosures. The table in section Enclosure shows the relationship between enclosure class and enclosure type.

Related information

11.1 Enclosure

5.1 Enclosure types

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

5.2 Location

To ensure sufficient motor and CUE cooling, leave at least 50 mm between the end of the fan covers of both motor and CUE and a wall or another fixed object.

6. Electrical connection

WARNING
Electric shock
Death or serious personal injury

- Before starting any work on the product, make sure that the power supply has been switched off and that it cannot be accidentally switched on. See section Installation requirements.
- Touching the electrical parts may be fatal, even after CUE has been switched off.

Voltage	Min. waiting time
380-500 V	15 minutes
	22-55 kW (30-74 hp)

WARNING
Electric shock
Death or serious personal injury

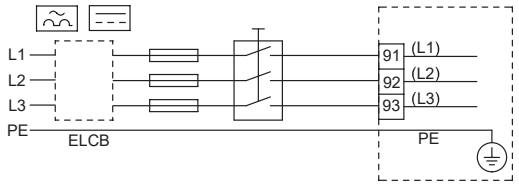
- Before carrying out any work, ensure that the motor is not rotating. Even when not supplied with power, there is voltage at the terminals of a rotating magnet-assisted reluctance motor.

The owner or installer is responsible for ensuring correct earthing and protection according to local standards.

For products with STO, ensure short-circuit protection of the cable between terminal 37 and the external safety device.

Security measures are the responsibility of the user.

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

6.1 Electrical protection

6.1.1 Protection against electric shock, indirect contact

CAUTION
Electric shock
Minor or moderate personal injury
- CUE must be earthed correctly and protected against indirect contact according to local regulations.

The leakage current to protective earth exceeds 3.5 mA, and a reinforced earth connection is required.

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

Instructions according to EN IEC 61800-5-1:

- CUE must be stationary, installed permanently and connected permanently to the mains supply.
- The protective earth connection must be carried out with duplicate protective conductors or with a single reinforced protective conductor with a cross-section of minimum 10 mm^2.

6.1.2 Protection against short circuit, fuses

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

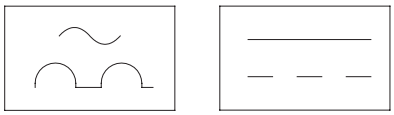
Grundfos requires that the backup fuses mentioned in section Cable cross-section to signal terminals are used for protection against short circuit.

CUE offers complete short-circuit protection in case of a short circuit on the motor output.

6.1.3 Additional protection

WARNING
Electric shock
Death or serious personal injury
- The leakage current to protective earth exceeds 3.5 mA.

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



ELCB/RCD

The circuit breaker is type B.

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

The leakage current of CUE in normal operation can be seen in section 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.

Related information

11.4 Electrical data

6.1.4 Motor protection

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

6.1.5 Protection against overcurrent

CUE has an internal overcurrent protection for overload protection on the motor output.

6.1.6 Protection against mains voltage transients

CUE is protected against mains voltage transients according to EN 61800-3, second environment.

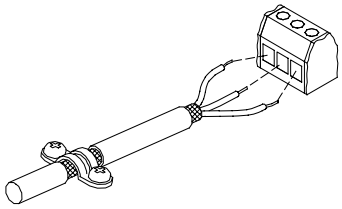
6.2 EMC-correct installation

The motor cable must be screened for CUE to meet EMC requirements.

This section provides guidelines for good practice when installing CUE. Follow these guidelines to meet EN 61800-3, first environment.

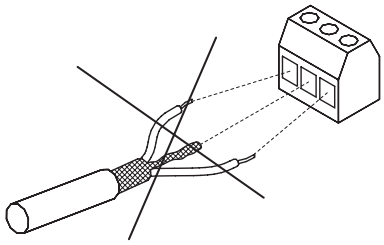
- Use only motor and signal cables with a braided metal screen in applications without output filter.
- There are no special requirements to supply cables, apart from local requirements.
- Leave the screen as close to the connecting terminals as possible. See fig. Example of stripped cable with screen.
- Avoid terminating the screen by twisting the ends. See fig. Do not twist the screen ends. Use cable clamps or EMC screwed cable entries instead.
- Connect the screen to frame at both ends for both motor and signal cables. See fig. Example of connection of a 3-conductor bus cable with screen connected at both ends. If the controller has no cable clamps, connect only the screen to the CUE cabinet. See fig. Example of connection of a 3-conductor bus cable with screen connected to CUE (controller with no cable clamps).
- Avoid unscreened motor and signal cables in electrical cabinets with frequency converters.
- Make the motor cable as short as possible in applications without 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 give similar EMC results if the above guidelines for good practice are followed.



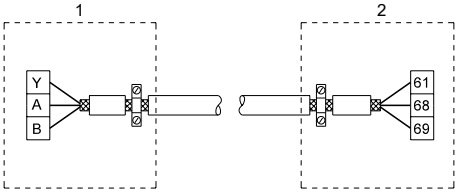
TM021325

Example of stripped cable with screen



TM038812

Do not twist the screen ends

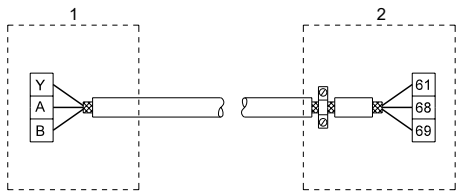


TM038732

Example of connection of a 3-conductor bus cable with screen connected at both ends

Pos.	Description
1	Controller

Pos.	Description
2	CUE



TM038731

Example of connection of a 3-conductor bus cable with screen connected to CUE (controller with no cable clamps)

Pos.	Description
1	Controller
2	CUE

6.3 RFI filters

To meet the EMC requirements, CUE comes with the following types of built-in radio-frequency interference filter (RFI).

Voltage [V]	Typical shaft power P2 [kW (hp)]	RFI filter type
3 × 380-500	0.55 - 90 (0.75 - 125 hp)	C1

Description of RFI filter type

C1: For use in domestic areas.

RFI filter type is according to EN 61800-3.

Related information

6.7.2 Fitting MCB 114 in CUE

6.4 Mains and motor connection

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

The motor cable must be screened for CUE to meet EMC requirements.

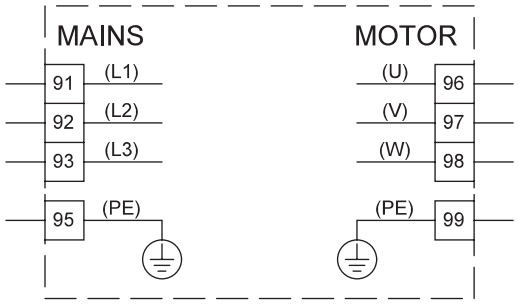
The supply voltage and frequency are marked on the CUE nameplate. Make sure that CUE is suitable for the power supply of the installation site.

6.4.1 Main switch

A main switch can be installed before the CUE cabinet according to local regulations. See figure Example of three-phase mains connection of CUE with main switch, backup fuses and additional protection.

6.4.2 Wiring diagram

The wires in the terminal box must be as short as possible. Excepted from this is the protective conductor which 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.



TM038799

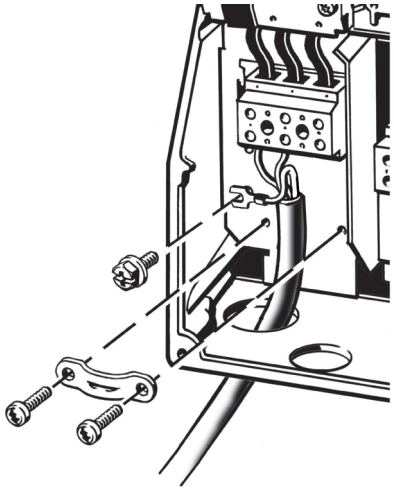
Wiring diagram, three-phase mains connection

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)	

6.4.3 Mains connection, enclosures B2

Enclosure	Torque Nm (ft*lb)			
	Mains	Motor	Protective earth	Relay
B2	4.5 (3.3)	4.5 (3.3)	3 (2.2)	0.6 (0.4)

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



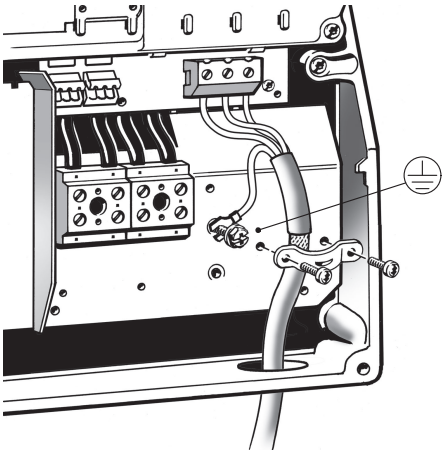
TM039019

Mains connection, B2

For single-phase connection, use L1 and L2.

6.4.4 Motor connection, enclosures B2

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



TM039020

Motor connection, B2

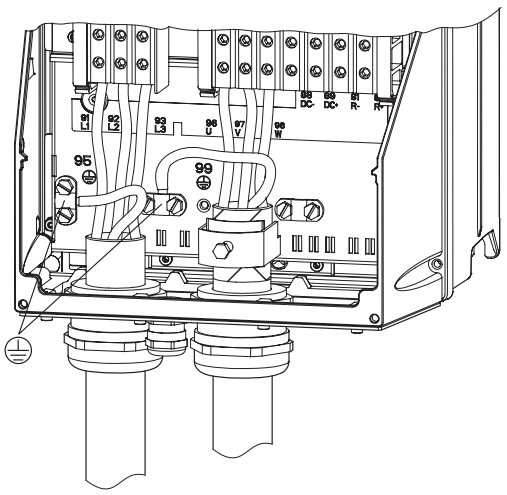
6.4.5 Mains connection, enclosures C1

Enclosure	Torque Nm (ft*lb)			
	Mains	Motor	Protective earth	Relay
C1	10 (7.4)	10 (7.4)	3 (2.2)	0.6 (0.4)

1. Connect the earth conductor to terminal 95 (PE). See figure Mains and motor connection, C1.
2. Connect the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3).

6.4.6 Motor connection, enclosures C1

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



TM039016

Mains and motor connection, C1

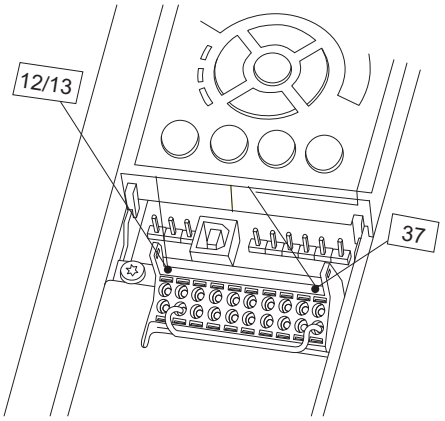
6.5 STO installation, optional

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

- Failure to remove the jumper will disable the STO function and the motor might not stop as intended and can cause severe injury or death.
- Failure to use safety-monitoring relay compliant with Category 3 /PL "d", ISO 13849-1 or SIL 2, EN 62061 and IEC 61508. Perform a functional test every 12 months to ensure that the system works properly.

To enable the integrated STO, follow these steps:

1. Remove the jumper wire between control terminals 37 and 12 or 13. Cutting or breaking the jumper is not sufficient to avoid short-circuiting.

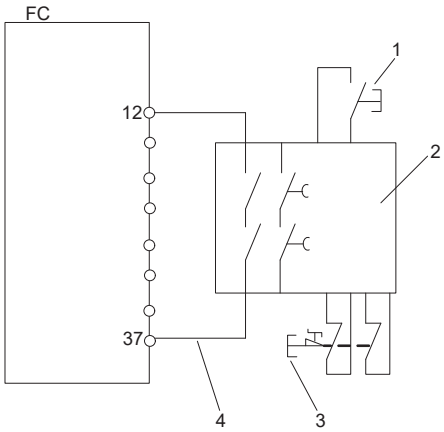


TM074595

Remove jumper

2. Connect an external safety-monitoring relay via a NO safety function to terminal 37 (STO) and either terminal 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 STO in an installation, carry out a thorough risk analysis on the installation to determine whether the STO functionality and safety levels are appropriate and sufficient.



TM074594

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.

6.5.1 Restart behaviour after STO activation

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

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

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

Related information

6.6 Connecting the signal terminals

6.5.2 Restart settings

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

6.6 Connecting the signal terminals



As a precaution, signal cables must be separated from other groups by reinforced insulation in their entire lengths.

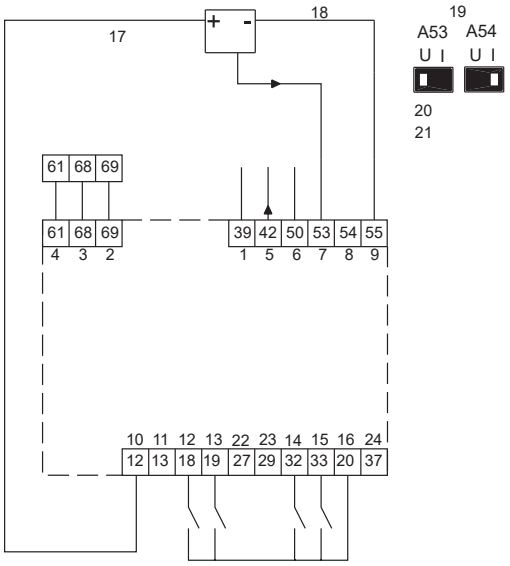
Connect the signal cables according to the guidelines for good practice to ensure EMC-correct installation. See section Restart behaviour after STO activation.

- Use screened signal cables with a conductor cross-section of minimum 0.5 mm^2 and maximum 1.5 mm^2.
- Use a 3-conductor screened bus cable in new systems.

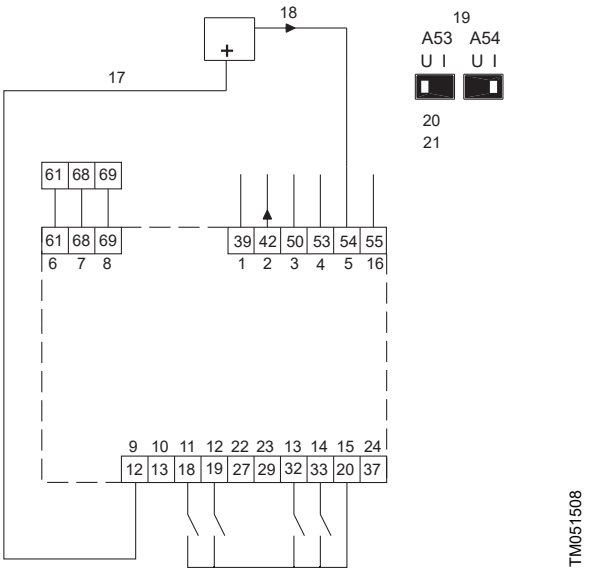
Related information

6.5.1 Restart behaviour after STO activation

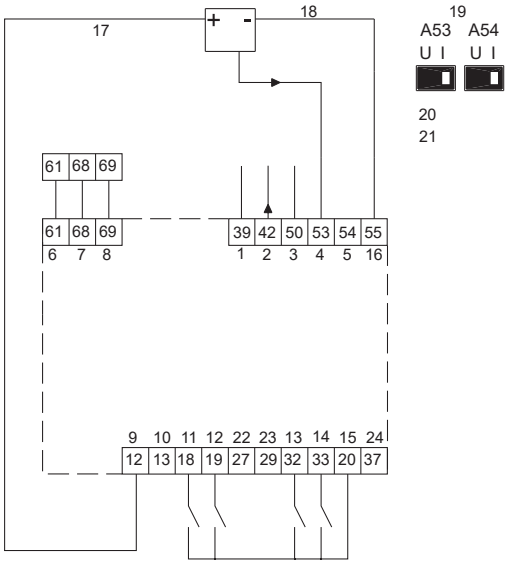
6.6.1 Wiring diagram, signal terminals

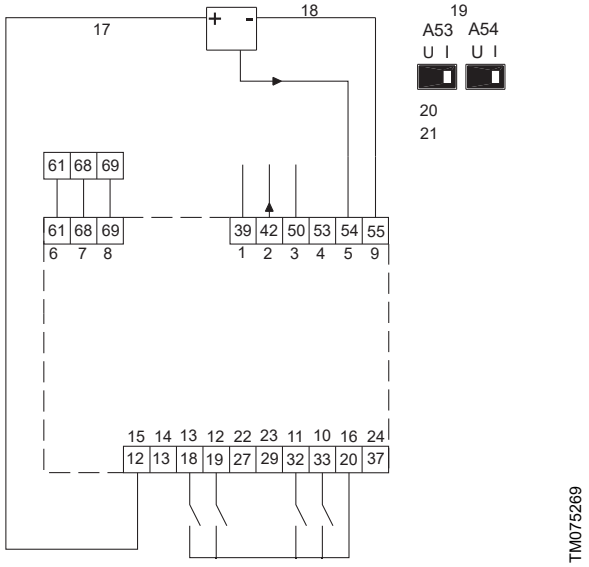


Pos.	Description
1	GND
2	RS-485 B
3	RS-485 A
4	RS-485 GND Y
5	AO 1
6	+10 V out
7	Ext. setpoint
8	Sensor 1
9	GND
10	+24 V out
11	+24 V out
12	DI 1
13	DI 2
14	DI 3
15	DI 4
16	GND
17	External setpoint, voltage input
18	0-10 V
19	Terminals
20	U: 0-10 V
21	I: 0/4-20 mA
22	DI/O 1
23	DI/O 2
24	Safe stop



Pos.	Description
1	GND
2	AO 1
3	+10 V out
4	Ext. setpoint
5	Sensor 1
6	RS-485 GND Y
7	RS-485 A
8	RS-485 B
9	+24 V out
10	+24 V out
11	DI 1
12	DI 2
13	DI 3
14	DI 4
15	GND
16	GND
17	Two-wire sensor
18	0/4-20 mA
19	Terminals
20	U: 0-10 V
21	I: 0/4-20 mA
22	DI/O 1
23	DI/O 2
24	Safe stop





Pos.	Description
1	GND
2	AO 1
3	+10 V out
4	Ext. setpoint
5	Sensor 1
6	RS-485 GND Y
7	RS-485 A
8	RS-485 B
9	+24 V out
10	+24 V out
11	DI 1
12	DI 2
13	DI 3
14	DI 4
15	GND
16	GND
17	External setpoint, current input
18	0/4-20 mA
19	Terminals
20	U: 0-10 V
21	I: 0/4-20 mA
22	DI/O 1
23	DI/O 2
24	Safe stop

Pos.	Description
1	GND
2	AO 1
3	+10 V out
4	Ext. setpoint
5	Sensor 1
6	RS-485 GND Y
7	RS-485 A
8	RS-485 B
9	GND
10	DI 4
11	DI 3
12	DI 2
13	DI 1
14	+24 V out
15	+24 V out
16	GND
17	Three-wire sensor
18	0/4-20 mA
19	Terminals
20	U: 0-10 V
21	I: 0/4-20 mA
22	DI/O 1
23	DI/O 2
24	Safe stop

Default connections made in TPE Series 1000:

- DI1 connected to GND.

Default connections made in TPE Series 2000:

- DI1 connected to GND.
- A three-wire sensor is connected to terminal 12, 54 and 55.

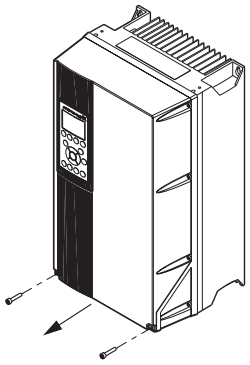
Terminal	Type	Function	Terminal	Type	Function
12	+24 V out	Supply to sensor	39	GND	Frame for analog output
13	+24 V out	Additional supply	42	AO 1	Analog output, 0-20 mA
18	DI 1	Digital input, programmable	50	+10 V out	Supply to potentiometer
19	DI 2	Digital input, programmable	53	AI 1	External setpoint, 0-10 V, 0/4-20 mA
20	GND	Common frame for digital inputs	54	AI 2	Sensor input, sensor 1, 0/4-20 mA
27	DI/O 1	Digital input/output, programmable	55	GND	Common frame for analog inputs
29	DI/O 2	Digital input/output, programmable	61	RS-485 GND Y	GENIbus, frame
32	DI 3	Digital input, programmable	68	RS-485 A	GENIbus, signal A (+)
33	DI 4	Digital input, programmable	69	RS-485 B	GENIbus, signal B (-)
37	Safe stop	Safe stop			



The RS-485 screen must be connected to frame.

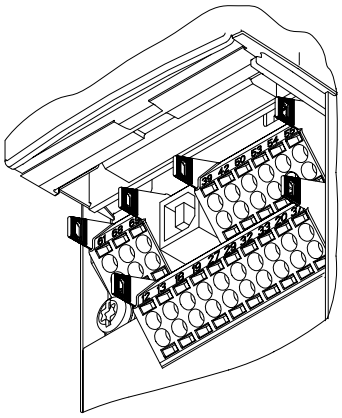
Access to signal terminals

All signal terminals are behind the terminal cover of the CUE front. Remove the terminal cover as shown in the figure below.



TM039004

Access to signal terminals, B2, C1

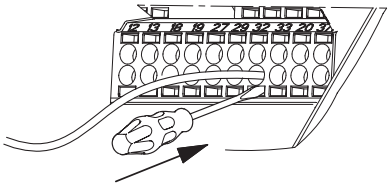


TM039025

Signal terminals, all enclosures

Fitting the conductor

1. Remove the insulation at a length of 9 to 10 mm.
2. Insert a screwdriver with a tip of maximum 0.4 x 2.5 mm into the square hole.
3. Insert the conductor into the corresponding round hole. Remove the screwdriver. The conductor is now fixed in the terminal.



TM039026

Fitting the conductor into the signal terminal

Setting the analog inputs, terminals 53 and 54

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

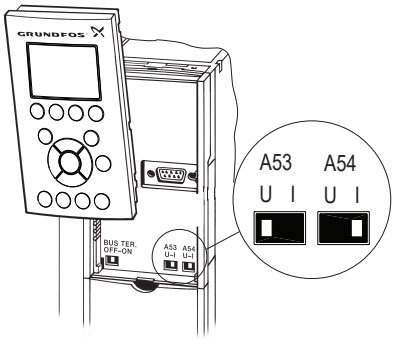
The factory setting of the inputs is voltage signal "U" and "U".

The factory setting of TPE Series 2000 inputs is voltage signal "U" and "I".

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

Switch off the power supply before setting contact A54.

Remove the operating panel to set the contact. See the figure below.



TM039104

Setting contact A54 to current signal "I"

RS-485 GENIbus network connection

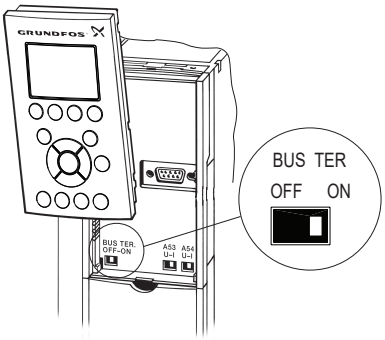
One or more CUE units can be connected to a control unit via GENIbus.

The reference potential, GND, for RS-485 (Y) communication must be connected to terminal 61.

If more than one CUE unit is connected to a GENIbus network, the termination contact of the last CUE 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. See the figure below.

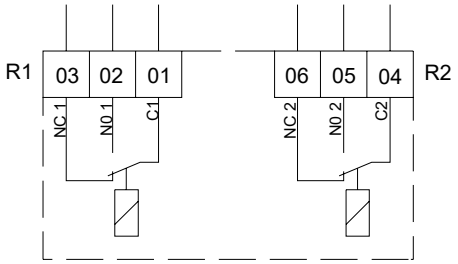


TM039006

Setting the termination contact to "ON"

6.7 Connecting the signal relays

As a precaution, signal cables must be separated from other groups by reinforced insulation in their entire lengths.



TM038801

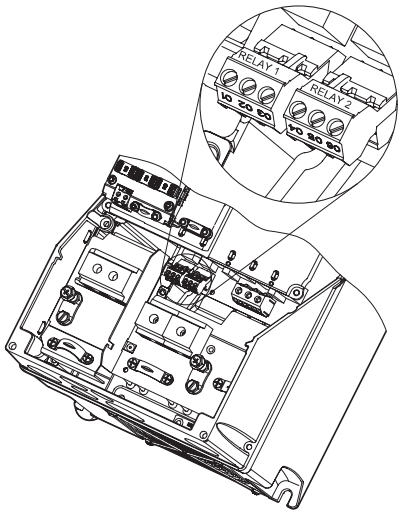
Terminals for signal relays in normal state (not activated)

Pos.	Description
R1	RELAY 1
R2	RELAY 2

Terminal		Function
C 1	C 2	Common
NO 1	NO 2	Normally open contact
NC 1	NC 2	Normally closed contact

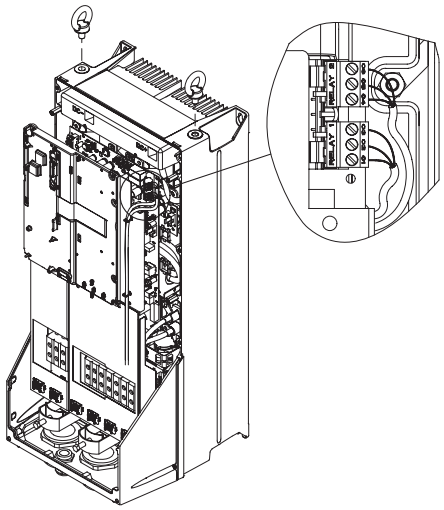
6.7.1 Access to signal relays

The relay outputs are positioned as shown in below figures.



TM039008

Terminals for relay connection, B2



TM039009

Terminals for relay connection, C1Connecting the MCB 114 sensor input module

The MCB 114 is an option offering additional analog inputs for CUE.

Configuration of MCB 114

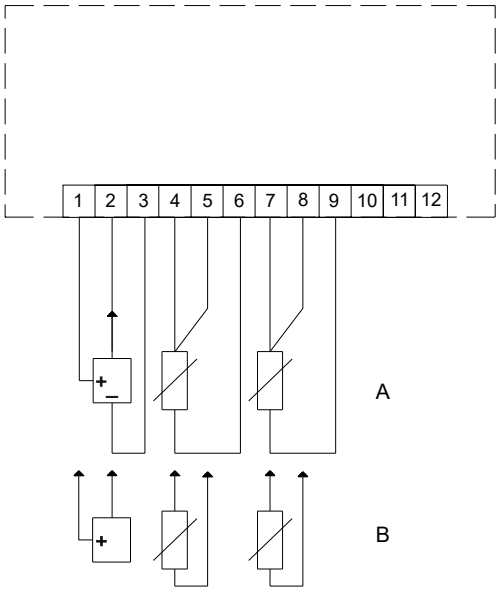
MCB 114 is equipped with three analog inputs for the following sensors:

- One additional sensor 0/4-20 mA.
- Two Pt100/Pt1000 temperature sensors for measurement of motor bearing temperature or an alternative temperature, such as liquid temperature.

When MCB 114 has been installed, CUE automatically detects if the sensor is Pt100 or Pt1000 when it is switched on.

Wiring diagram, MCB 114

When using Pt100 with a 3-wire cable, the resistance must not exceed 30 Ω.



Wiring diagram, MCB 114

Pos.	Description
A	3-wire
B	2-wire

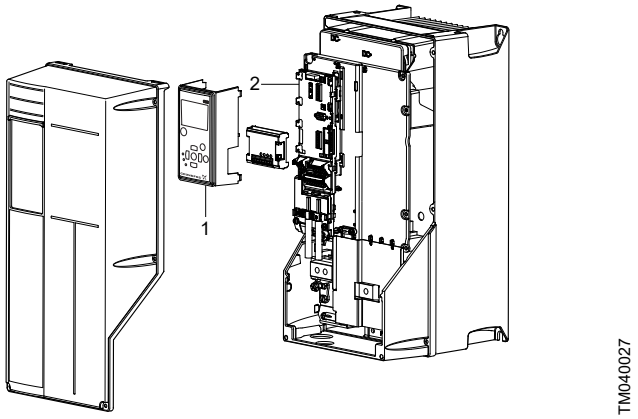
Terminal	Type	Function
1 (VDO)	+24 V out	Supply to sensor
2 (I IN)	AI 3	Sensor 2, 0/4-20 mA
3 (GND)	GND	Common frame for analog input
4 (TEMP) 5 (WIRE)	AI 4	Temperature sensor 1, Pt100/Pt1000
6 (GND)	GND	Common frame for temperature sensor 1
7 (TEMP) 8 (WIRE)	AI 5	Temperature sensor 2, Pt100/Pt1000
9 (GND)	GND	Common frame for temperature sensor 2

Terminals 10, 11 and 12 are not used.

6.7.2 Fitting MCB 114 in CUE

Enclosures B2, C1

1. Switch off the power to CUE. See section RFI filter type is according to EN 61800-3.
2. Remove the operating panel and the cradle from CUE. See the figure below.
3. Fit MCB 114 into port B.
4. Connect the signal cables, and fasten the cables with the enclosed cable strips. See the figure below.
5. Fit the cradle and the operating panel.
6. Connect power to CUE.



Enclosures B2, C1

Pos.	Description
1	Cradle
2	Port B

Related information

6.3 RFI filters

7. Starting up the product



Any installation, maintenance and inspection must be carried out by qualified, experienced and authorized persons.

Before you switch on the power supply, you must do the following:

- Close the cover.
- Ensure that all cable glands are tightened properly.
- Check that there are no loose connections on the terminals.
- 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.
- Ensure that any optional equipment wiring matches the installation application.
- Ensure that all operator devices are in the OFF position.
- 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 optional STO function

The STO function is activated by removing the voltage at 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 fulfill Cat./PL or SIL when connected to terminal 37.

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

- asynchronous
- synchronous
- permanent magnet motors.

When terminal 37 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, the STO terminal 37 must be deactivated to start the motor.



A successful commissioning test of the STO function is required after the initial installation and after each subsequent change to the installation.

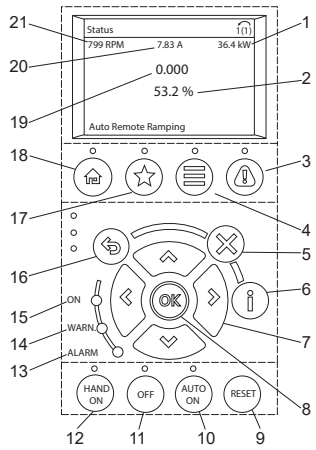
8. Control functions

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

8.1 Operating panel

The operating panel consists of a display and several buttons. It enables manual setting and monitoring of the system, such as follows:

- Start, stop and control of speed.
- Reading of operating data and warnings and alarms.
- Setting functions for the frequency converter.
- Manual reset of the frequency converter.



TM074597

Operating panel

Pos.	Buttons	Description
1		Power [kW]
2		Reference [%]
3		[Alarm log]: shows a list of current warnings, the last 10 alarms and the maintenance log.
4		[Main menu]: allows access to all programming settings.
5		[Cancel]: cancels the last change or command as long as the display mode has not changed.
6		[Info]: press for a definition of the function being displayed.
7		[Up]/[Down]/[Left]/[Right]: use the four arrow buttons to navigate between items in the menu.
8	OK	[OK]: used to access parameter groups or to accept a selection.
9	RESET	[RESET]: resets the frequency converter manually after a fault has been cleared.
10	AUTO ON	[AUTO ON]: puts the system in remote operational mode. • Responds to an external start command by control terminals or serial communication.
11	OFF	[OFF]: stops the motor but does not remove power to the frequency converter.
12	HAND ON	[HAND ON]: starts the frequency converter in local control. • An external stop signal by control input or serial communication overrides the local [Hand On] function.
13	[Alarm] Red	A fault condition causes the red alarm light to flash and an alarm text is displayed.
14	[Warn.] Yellow	When warning conditions are met, the yellow warning light comes on and text appears in the display area identifying the problem.
15	[On] Green	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		[Back]: reverts to the previous step or list in the menu structure.
17		[Favourites]: allows access to programming parameters for initial set-up instructions and many detailed application instructions.
18		[Status]: shows operational information.
19		Frequency
20		Motor current
21		Speed, RPM

8.2 Menu overview

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

- "0-** Operation / Display"
- "1-** Load and Motor"
- "2-** Brakes"
- "3-** Reference / Ramps"
- "4-** Limits / Warnings"
- "5-** Digital In/Out"
- "6-** Analog In/Out"
- "8-** Comm.and Options"
- "14-** Special Functions"
- "15-** Drive Information"
- "16-** Data Readouts"
- "18-** Info & Readouts"
- "20-** Drive Closed Loop"
- "21-** Ext. Closed Loop"
- "22-** Appl. Functions"
- "23-** Timer-based Functions"
- "27-** Cascade CTL Option"
- "29-** Water Application Functions"
- "30-** Special Features"
- "35-** Sensor Input Option"
- "200 - Operation Settings"
- "201- Key Functions"
- "202 - Sensors"
- "203 - Status Monitor"

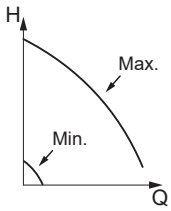
Example: To get to the menu "1-28 Motor Rotation Check", you must do the following:

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.

8.3 Operating modes

The following operating modes are set on the operating panel using the [Favourites] menu.

Operating mode	Description
Normal	The pump is running in the operating mode selected.
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 user-defined speed.



Minimum and maximum curves.

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.

Example: Minimum curve operation can for instance be used in periods with a very small flow rate requirement.

8.4 Control modes

The control mode is set in the [Favourites] menu.

There are two basic control modes:

- Uncontrolled operation (open loop).
- Controlled operation (closed loop) with a sensor connected.

See sections Uncontrolled operation (open loop) and Controlled operation (closed loop).

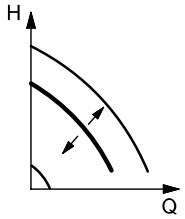
Default control mode made in NBE, NBGE, NKE, NKGE, TPE Series 1000:

- Open loop.

Default control mode made in TPE Series 2000:

- Proportional differential pressure.

8.4.1 Uncontrolled operation (open loop)



Constant curve.

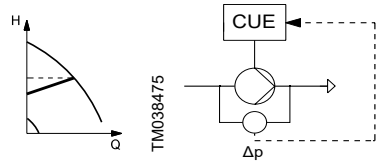
The speed is kept at a set value in the range between the minimum and maximum curves.

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

Example: Operation on constant curve can for instance be used for pumps with no sensor connected.

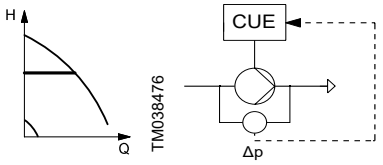
Example: Typically used in connection with an overall control system such as MPC or another external controller.

8.4.2 Controlled operation (closed loop)



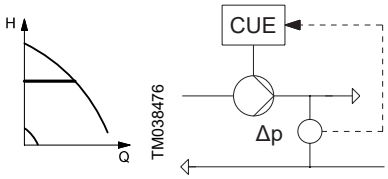
Proportional differential pressure.

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



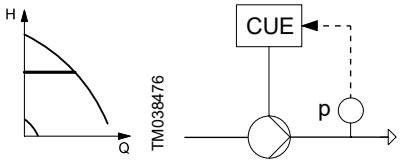
Constant differential pressure, pump.

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



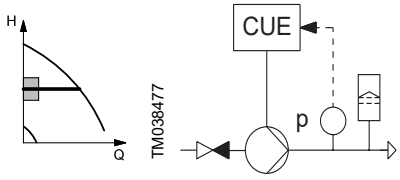
Constant differential pressure, system.

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



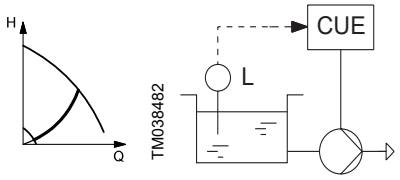
onstant pressure.

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



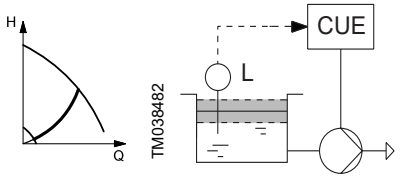
Constant pressure with stop function.

The outlet pressure is kept constant at high flow rate. On/off operation at low flow rate.



Constant level.

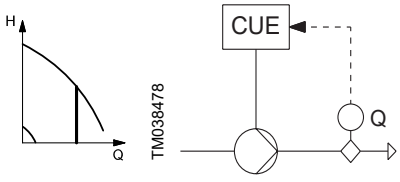
The liquid level is kept constant, independently of the flow rate.



Constant level with stop function.

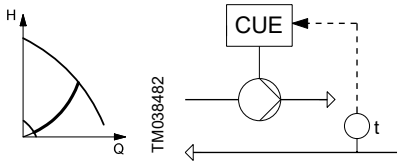
The liquid level is kept constant at high flow rate.

On/off operation at low flow rate.



Constant flow rate.

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



Constant temperature.

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

9. Servicing the product



Never stand on the CUE, motor and the pump.

CAUTION
Electric shock
Minor or moderate personal injury



- Before starting any work on the product, make sure that the power supply has been switched off and that it cannot be accidentally switched on. See section Installation requirements.
- Touching the electrical parts may be fatal, even after CUE has been switched off.

Voltage	Min. waiting time
380-500 V	15 minutes
	22-55 kW (30-74 hp)

WARNING
Electric shock
Death or serious personal injury



- Before carrying out any work, ensure that the motor is not rotating. Even when not supplied with power, there is voltage at the terminals of a rotating magnet-assisted reluctance motor.

DANGER
Magnetic field
Death or serious personal injury



- Do not dismantle, assemble or maintain the motor if you have a pacemaker or any other implanted electronic device.
- Keep the working environment clean, make sure no magnetized dust exist.

DANGER
Intoxication or risk of chemical burn
Death or serious personal injury



- The battery can cause severe or fatal injuries in 2 hours or less if it is swallowed or placed inside any part of the body. In such event, seek medical attention immediately.



- The replacement or servicing of batteries must be carried out by a qualified person.
- The battery contained within this product, whether new or used, is hazardous and is to be kept away from children.

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:

- Remove the 24 V DC voltage supply at terminal 37.
- Check if the operating panel displays the alarm "Safe Stop A68".
- Verify that the frequency converter trips the unit.
- Verify that the motor is coasting and comes to a complete stop.
- Verify that the motor cannot be started.
- Reconnect the 24 V DC voltage supply to terminal 37.
- Verify that the motor is not started automatically and restarts only by giving a reset signal (via bus, Digital I/O, or the [Reset] button).

10. Fault finding the product

10.1 Overview of warnings and alarms

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

Number	Description	Warning	Alarm	Alarm, trip lock
1	10 V low	●	-	-
2	Live zero error	(●)	(●)	-
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	(●)	(●)	-
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}	-	●	-

Number	Description	Warning	Alarm	Alarm, trip lock
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	(●)	(●)	-
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	(●)	(●) [1)]	-
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	(●)	(●)	-
95	Broken belt	(●)	(●)	-
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	●	●	-
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	●	●	

Number	Description	Warning	Alarm	Alarm, trip lock
2008	Too high bearing temperature	●	●	-
2010	Setpoint signal 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	●	●	-

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

(●) This warning or alarm is programmable. Warnings and alarms depend on the parameter settings.

11. Technical data

11.1 Enclosure

Typical shaft power P2		Enclosure (3 × 380-500 V, IP55)
[kW]	[hp]	
22	30	B2
30	40	
37	50	C1
45	60	
55	75	

Related information

5. Mechanical installation

11.2 Operating conditions

Relative humidity	5-95 % RH
Ambient temperature	Max. 50 °C (122 °F)
Minimum ambient temperature	-10 °C (14 °F)
Temperature during storage and transport	-25 to 65 °C (-13 to 149 °F)
Storage duration	Max. 6 months
Maximum altitude above sea level without performance reduction	1000 m (3280 ft)
Maximum altitude above sea level with performance reduction	3000 m (9840 ft)

TPE comes in a packaging which is not suitable for outdoor storage.

11.3 Mechanical data

11.3.1 Cable gland

Enclosure	Standard gland holes
B2 IP21 / NEMA type 1 and B2 IP55 / NEMA type 12	1 × 21.5
	1 × 26.3
	1 × 33.1
	2 × 42.9

11.3.2 Cable requirements

Maximum length, screened motor cable	150 m (500 ft)
Maximum length, unscreened motor cable	300 m (1000 ft)
Maximum length, signal cable	300 m (1000 ft)

Always comply with local regulations as to cable cross-sections.

11.3.3 Cable cross-section to signal terminals

Maximum cable cross-section to signal terminals, rigid conductor	1.5 mm^2 (14 AWG)
Maximum cable cross-section to signal terminals, flexible conductor	1.0 mm^2 (18 AWG)
Minimum cable cross-section to signal terminals	0.5 mm^2 (20 AWG)

11.3.4 Non-UL fuses and conductor cross-section to mains and motor, for installations outside North America

Typical shaft power P2	Maximum fuse size	Fuse type	Maximum conductor cross-section [2]
[kW (hp)]	[A]		[mm^2]
3 × 380-500 V			
22 (30)	63	gG	35
30 (40)	80	gG	35
37 (50)	100	gG	50
45 (60)	125	gG	50
55 (75)	160	gG	50

2) Screened motor cable, unscreened supply cable. AWG. See section Electrical data.

Related information

11.4 Electrical data

11.4 Electrical data

Mains supply (L1, L2, L3)

Supply voltage	380-500 V ± 10 %
Supply frequency	50/60 Hz
Maximum temporary imbalance between phases	3 % of rated value
Leakage current to protective earth	> 3.5 mA
Number of cut-ins, enclosures B and C	Max. 1 time/min.

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

RS-485 GENIbus connection

Terminal number	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

Terminal number	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	Approx. 4 kΩ

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

Signal relays

Relay 01, terminal number	1 (C), 2 (NO), 3 (NC)
Relay 02, terminal number	4 (C), 5 (NO), 6 (NC)
Maximum terminal load (AC-1) [3]	240 VAC, 2 A
Maximum terminal load (AC-15) [3]	240 VAC, 0.2 A
Maximum terminal load (DC-1) [3]	50 VDC, 1 A
Minimum terminal load	24 VDC 10 mA 24 VAC 20 mA

3) IEC 60947, parts 4 and 5.

C	Common
NO	Normally open
NC	Normally closed

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

Analog inputs

Analog input 1, terminal number	53
Voltage signal	A53 = "U" [4]
Voltage range	0-10 V
Input resistance, R_i	Approx. 10 kΩ
Maximum voltage	± 20 V
Current signal	A53 = "I" [4]
Current range	0-20, 4-20 mA
Input resistance, R_i	Approx. 200 Ω
Maximum current	30 mA
Maximum fault, terminals 53, 54	0.5 % of full scale
Analog input 2, terminal number	54
Current signal	A54 = "I" [4]
Current range	0-20, 4-20 mA
Input resistance, R_i	Approx. 200 Ω
Maximum current	30 mA
Maximum fault, terminals 53, 54	0.5 % of full scale

4) The factory setting is voltage signal "U".

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

Analog output

Analog output 1, terminal number	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 number	2
Current range	0/4-20 mA
Input resistance	< 200 Ω
Analog inputs 4 and 5, terminal number	4, 5 and 7, 8
Signal type, 2- or 3-wire	Pt100/Pt1000

Related information

6.1.3 Additional protection

11.3.4 Non-UL fuses and conductor cross-section to mains and motor, for installations outside North America

11.5 Miscellaneous data

11.5.1 STO application

The STO signal must be SELV or PELV supplied.

European directive	Machinery Directive (2006/42/EC)	EN ISO 13849-1
		EN IEC 62061
		EN IEC 61800-5-2
	EMC Directive (2004/108/EC)	EN 50011
		EN 61000-6-3
		EN 61800-3
	Low Voltage Directive (2006/95/EC)	EN 50178
		EN 61800-5-1
Safety standards	Safety of machinery	EN ISO 13849-1, IEC 62061, IEC 60204-1
	Functional safety	IEC 61508-1 to -7, IEC 61800-5-2
Safety function		IEC 61800-5-2 (Safe Torque Off, STO) IEC 60204-1 (Stop Category 0)
Safety performance	**IOS 13849-1**	
	Category	Cat 3
	Diagnostic Coverage	DC: 90 %, medium
	Mean Time to Dangerous Failure	MTTFd: 14000 years, high
	Performance Level	PL d
	IEC 61508 / IEC 62061	
	Safety Integrity Level	SIL 2, SIL CL2
	Probability of Dangerous Failure per Hour	PFH: 1E-10/h. High Demand Mode.
	Probability of Dangerous Failure on Demand	PFD: 1E-10. Low Demand Mode.
	Safe Failure Fraction	SFF: > 99 %
	Hardware Fault Tolerance	HFT: 0 (1oo1)
	Proof Test Interval T1	20 years
	Mission time TM	20 years
Reaction time	Input to output response time	Maximum 20 ms

12. Disposing of the product



DANGER
Magnetic field
Death or serious personal injury

- Do not dismantle, assemble or maintain the motor if you have a pacemaker or any other implanted electronic device.
- Keep the working environment clean, make sure no magnetized dust exist.

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.



The crossed-out wheelie 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*.

Appendix A

A.1. 中国 RoHS

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴联苯 (PBB)	多溴联苯醚 (PBDE)
泵壳	X	O	O	O	O	O
印刷电路板	X	O	O	O	O	O
紧固件	X	O	O	O	O	O
管件	X	O	O	O	O	O
定子	X	O	O	O	O	O
转子	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制

O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X： 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 该规定的限量要求。



该产品环保使用期限为 10 年，标识如左图所示。
此环保期限只适用于产品在安装与使用说明书中所规定的条件下工作

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