

# NBE/NBE Series 2000, NKE/NKE Series 2000, NBSE/NBSE Series 2000

Installation and operating instructions



**NBE, NKE, NBSE with integrated CUE**  
**Installation and operating instructions**  
(all available languages)  
<http://net.grundfos.com/qr/i/93238783>







# NBE/NBE Series 2000, NKE/NKE Series 2000, NBSE/NBSE Series

## 2000

English (US)

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## English (US) 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.



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, NK, NBS. 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, NKE, NBSE 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.

Please ensure that the safety instructions and I&O documentation are prepared on your end before commencing the service work.



## 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](http://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.



TM087585

Example of nameplate

Text	Description
T/C:	CUE (product name) 203N315... (internal code)
P/N	Product number: 132H2972
S/N:	Serial number: 123456H123 The last three digits indicate the production date: 12 is the week, and 3 is the year 2023.
315 kW (450 HP)	Typical shaft power on the motor
IN:	Supply voltage <sup>1)</sup> , frequency and maximum input current
OUT:	Motor voltage, frequency and maximum output current. The maximum output frequency usually depends on the pump type.
UL Type 1/IP21	Enclosure class
Tamb.	Maximum ambient temperature
IE	Efficiency
SCCR	Short Circuit Current Rating

<sup>1)</sup> The supply voltage must also be equal to or higher than the motor rated voltage.

For Grundfos pumps, according to the equipped CUE and motor, the supply voltage should be one of below:

- 3 x 200-240 V (CUE rated 3 x 200-240V, motor rated 3 x 200 V)
- 3 x 460-500 V (CUE rated 3 x 380-500V, motor rated 3 x 460 V)
- 3 x 575-600 V (CUE rated 3 x 525-600V, motor rated 3 x 575 V)
- 3 x 575-690 V (CUE rated 3 x 525-690V, motor rated 3 x 575 V)

### 2.2 UL listed motor

The pumps are equipped with UL listed motors. Due to structural constraints, the UL listed mark on the motor nameplate might not be visible.



### 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

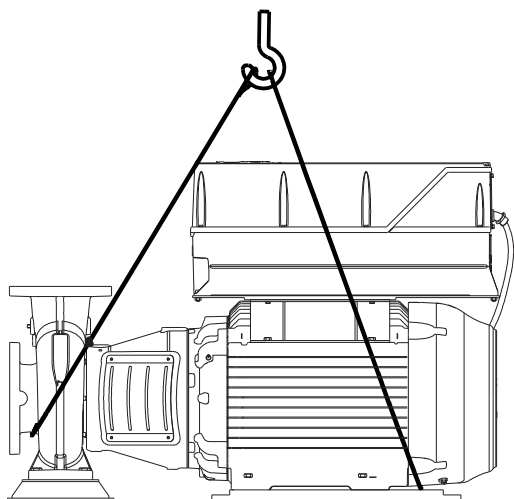
##### Heavy dumping

Death or serious personal injury

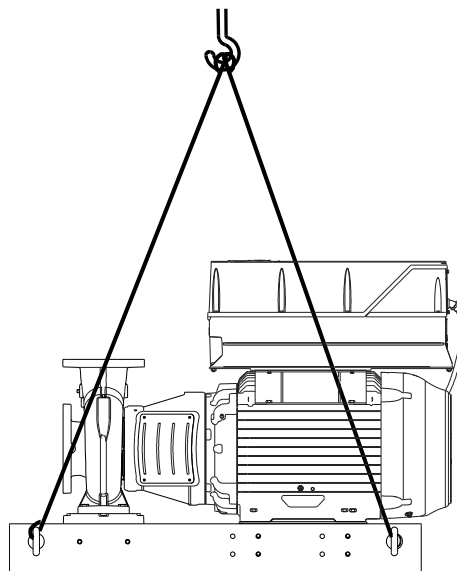


- Make sure that the pump remains in a stable position during unpacking and installation by means of the straps used for lifting the pump.
- Note that typically the centre of gravity of the pump is close to the motor.

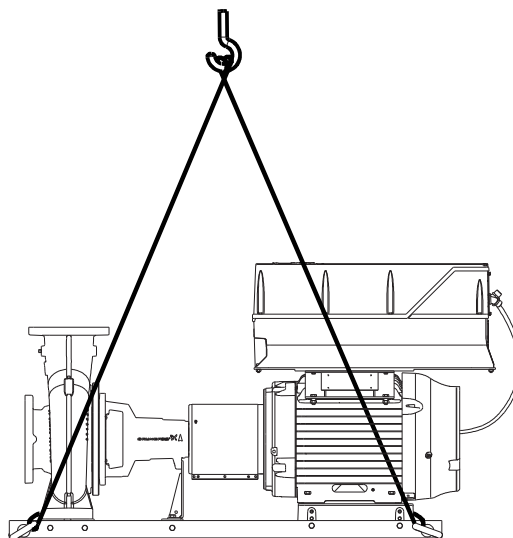
The pump must be lifted by means of straps and shackles. See figures below.



TM087582



TM087583



TM087584



## 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		
	4 minutes	15 minutes	20 minutes
200-240 V	0.75 - 3.7 kW (1 - 5 hp)	5.5 - 45 kW (7.5 - 60 hp)	
380-500 V	0.55 - 7.5 kW (0.75 - 10 hp)	11 - 90 kW (15 - 125 hp)	110 - 250 kW (150 - 350 hp)
525-600 V	0.75 - 7.5 kW (1 - 10 hp)	11 - 90 kW (15 - 125 hp)	
525-690 V			11 - 250 kW (15 - 350 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](#)

[9. Servicing the product](#)

### 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 2 inches (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		
	4 minutes	15 minutes	20 minutes
200-240 V	0.75 - 3.7 kW (1 - 5 hp)	5.5 - 45 kW (7.5 - 60 hp)	
380-500 V	0.55 - 7.5 kW (0.75 - 10 hp)	11 - 90 kW (15 - 125 hp)	110 - 250 kW (150 - 350 hp)
525-600 V	0.75 - 7.5 kW (1 - 10 hp)	11 - 90 kW (15 - 125 hp)	
525-690 V			11 - 250 kW (15 - 350 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.



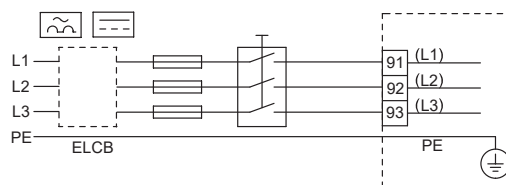
The owner or installer is responsible for ensuring correct earthing and protection according to local standards.



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 8 AWG (10 mm<sup>2</sup>).

#### 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

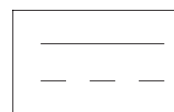
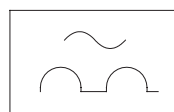
### WARNING

#### 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

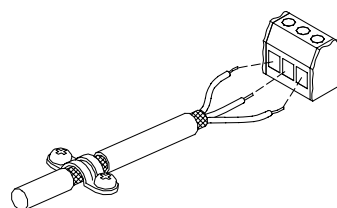


The motor cable must be screened for CUE to meet EMC requirements.

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

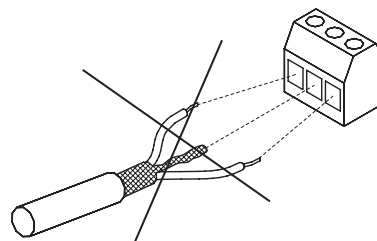
- Use only motor and signal cables with a braided metal screen in applications without output filter.
- There are no special requirements to supply cables, apart from local requirements.
- Leave the screen as close to the connecting terminals as possible. See figure Example of stripped cable with screen.
- Avoid terminating the screen by twisting the ends. See figure 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 figure 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 figure 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.



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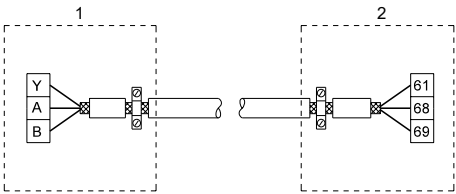
Example of stripped cable with screen



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Do not twist the screen ends

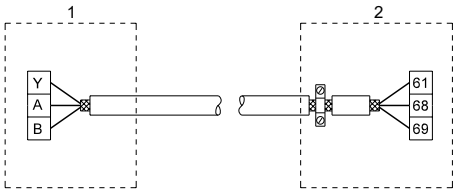




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Example of connection of a 3-conductor bus cable with screen connected at both ends

Pos.	Description
1	Controller
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 filters (RFI).

Voltage [V]	Typical shaft power P2 [kW (hp)]	RFI filter type
3 x 200-240	0.75 - 45 (1 - 60)	C1
3 x 380-500	0.55 - 90 (0.75 - 125)	C1
3 x 380-500	110 - 250 (150 - 350)	C3
3 x 525-600	0.75 - 90 (1 - 125)	C3
3 x 525-690	11 - 250 (15 - 350)	C3

Description of RFI filter types

C1:	For use in domestic areas.
C3:	For use in industrial areas with own low-voltage transformer.

RFI filter types are according to EN 61800-3.

Equipment of category C3

- This type of power drive system (PDS) is not intended to be used on a low-voltage public network which supplies domestic premises.

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.

Make sure that the pump is suitable for the power supply of the installation site.

The supply frequency is marked on the CUE nameplate. According to the equipped CUE and motor, the supply voltage should be one of below:

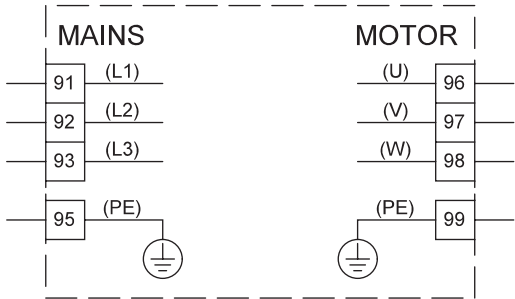
- 3 x 200-240V (CUE rated 3 x 200-240V, motor rated 3 x 200V)
- 3 x 460-500V (CUE rated 3 x 380-500V, motor rated 3 x 460V)
- 3 x 575-600V (CUE rated 3 x 525-600V, motor rated 3 x 575V)
- 3 x 575-690V (CUE rated 3 x 525-690V, motor rated 3 x 575V)

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.



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Wiring diagram, three-phase mains connection

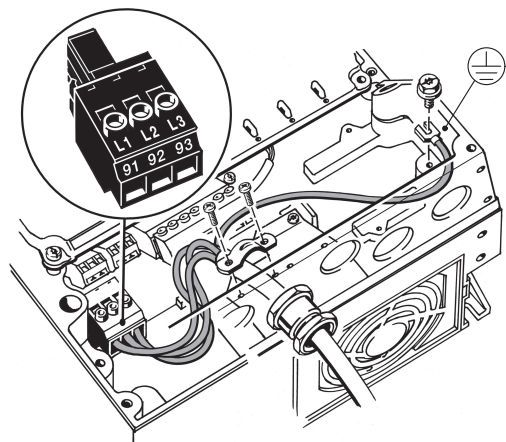
Terminal	Function
91	(L1)
92	(L2)
93	(L3)
95/99	(PE) Protective earth connection
96	(U)
97	(V)
98	(W)
	Three-phase motor connection, 0-100 % of mains voltage



### 6.4.3 Mains connection, enclosures A4 and A5

Enclosure	Torque Nm [ft-lb]			
	Mains	Motor	Protective earth	Relay
A4	1.8 (1.3)	1.8 (1.3)	3 (2.2)	0.6 (0.4)
A5	1.8 (1.3)	1.8 (1.3)	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) 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.



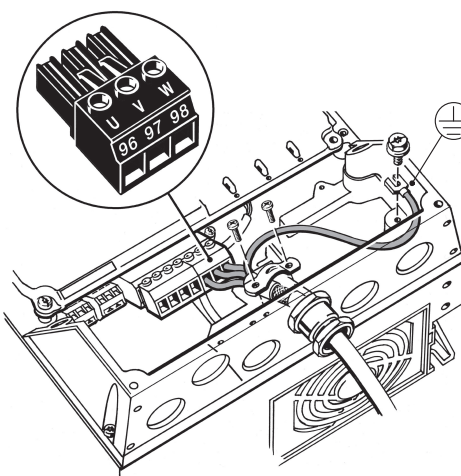
Mains connection, A4 and A5



For single-phase connection, use L1 and L2.

### 6.4.4 Motor connection, enclosures A4 and A5

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

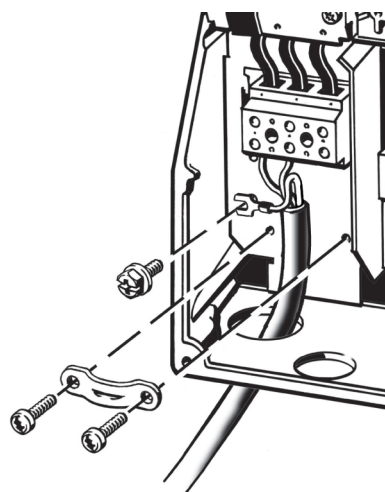


Motor connection, A4 and A5

### 6.4.5 Mains connection, enclosures B1 and B2

Enclosure	Torque Nm [ft-lb]			
	Mains	Motor	Protective earth	Relay
B1	1.8 (1.3)	1.8 (1.3)	3 (2.2)	0.6 (0.4)
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) and 93 (L3).
3. Fix the mains cable with a cable clamp.



Mains connection, B1 and B2



For single-phase connection, use L1 and L2.

### 6.4.6 Motor connection, enclosures B1 and 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) and 98 (W).

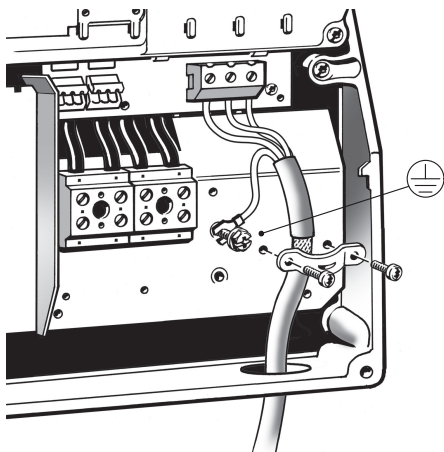
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3. Fix the screened cable with a cable clamp.



Motor connection, B1 and B2

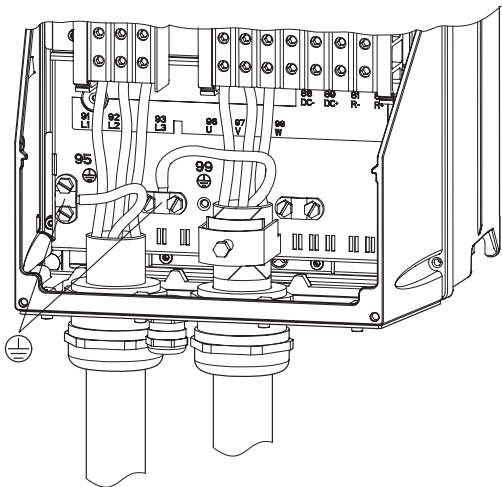
6.4.7 Mains connection, enclosures C1 and C2

Enclosure	Torque Nm [ft-lb]			
	Mains	Motor	Protective earth	Relay
C1	10 (7.4)	10 (7.4)	3 (2.2)	0.6 (0.4)
C2	14 <sup>2)</sup> /24 <sup>3)</sup> (10.3 <sup>2)</sup> / 17.7 <sup>3)</sup> )	14 <sup>2)</sup> /24 <sup>3)</sup> (10.3 <sup>2)</sup> / 17.7 <sup>3)</sup> )	3 (2.2)	0.6 (0.4)

- <sup>2)</sup> Conductor cross-section  $\leq 95 \text{ mm}^2$  ( $\leq 4/0 \text{ AWG}$ )
- <sup>3)</sup> Conductor cross-section  $\geq 95 \text{ mm}^2$  ( $\geq 4/0 \text{ AWG}$ ).
1. Connect the earth conductor to terminal 95 (PE). See figure Mains and motor connection, C1 and C2.
  2. Connect the mains conductors to terminals 91 (L1), 92 (L2) and 93 (L3).

6.4.8 Motor connection, enclosures C1 and C2

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



Mains and motor connection, C1 and C2



## 6.5 STO installation, optional

### DANGER

#### Exposure to high pressure or toxic liquids

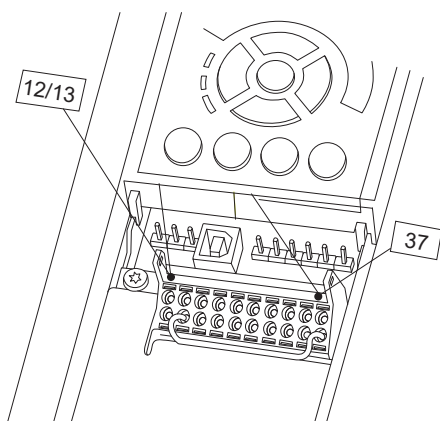
Death or serious personal injury



- 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.

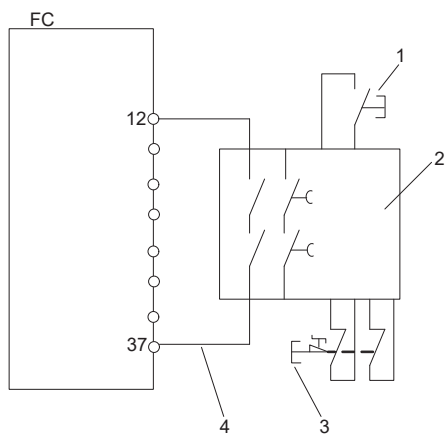


TM074595

#### 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

[6.7 Connecting the signal relays](#)

### 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.

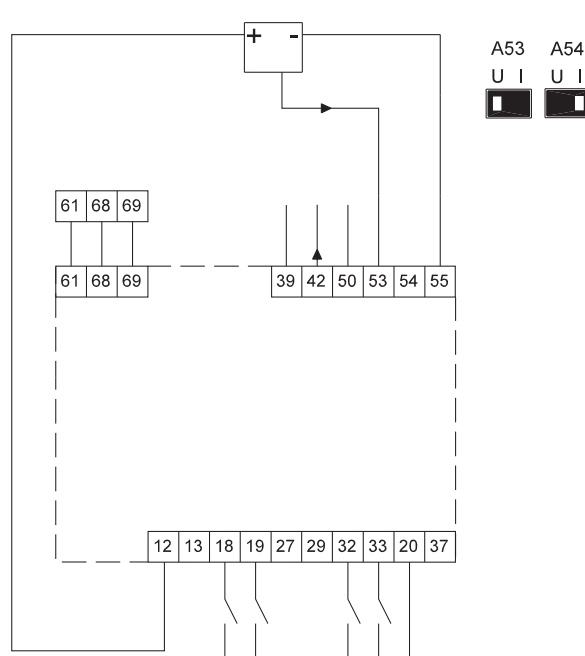
Connect the signal cables according to the guidelines for good practice to ensure EMC-correct installation. See section Restart behaviour after STO activation.

- Use screened signal cables with a conductor cross-section of minimum 20 AWG (0.5 mm<sup>2</sup>) and maximum 14 AWG (1.5 mm<sup>2</sup>).
- Use a 3-conductor screened bus cable in new systems.

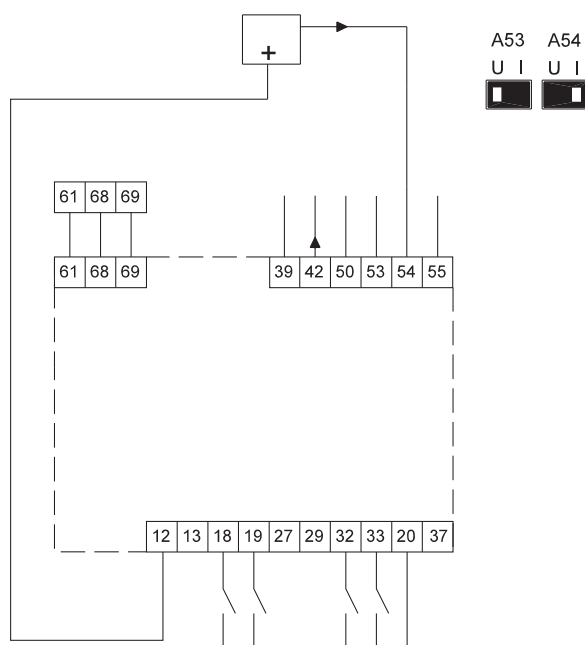
#### 6.6.1 Wiring diagram, signal terminals

U: 0-10 V

I: 0/4-20 mA



External setpoint, voltage input

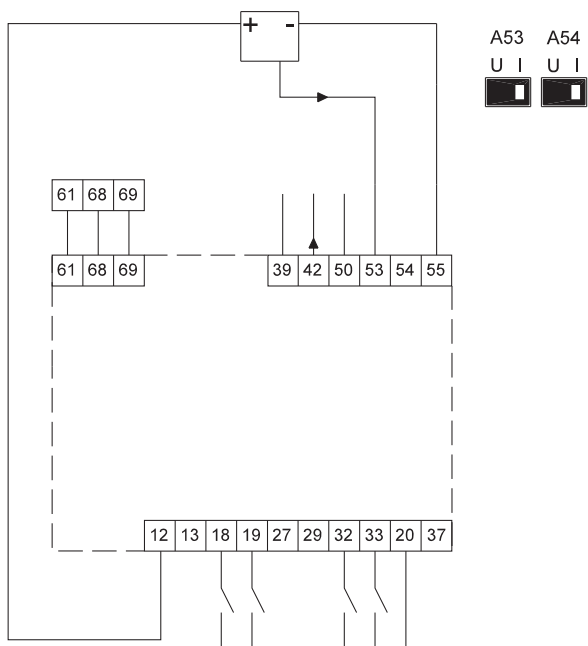


2-wire sensor

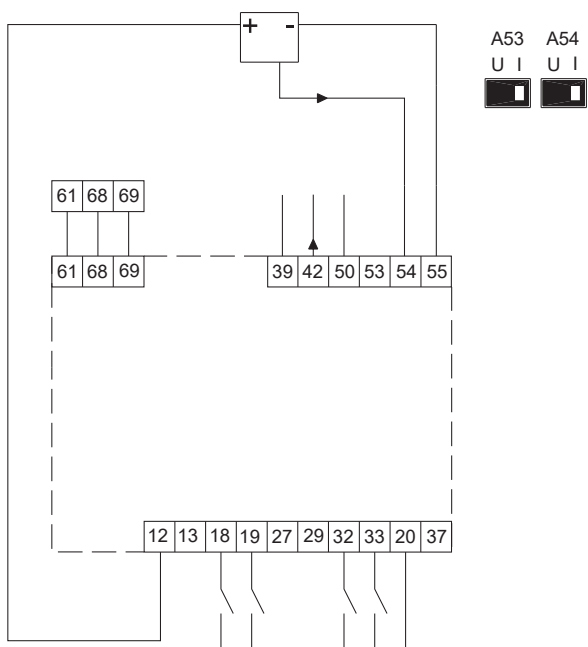
TM051506

TM051508





External setpoint, current input



3-wire sensor

Terminal	Type	Function
12	+24 V out	Supply to sensor
13	+24 V out	Additional supply
18	DI 1	Digital input, programmable
19	DI 2	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	DI 3	Digital input, programmable

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

Default connections made in NBE, NKE, NBSE:

- DI1 connected to GND.

Default connections made in NBE, NKE, NBSE Series 2000:

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



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

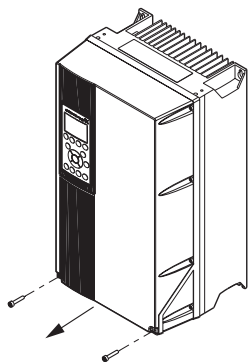
TM051507

TM075269

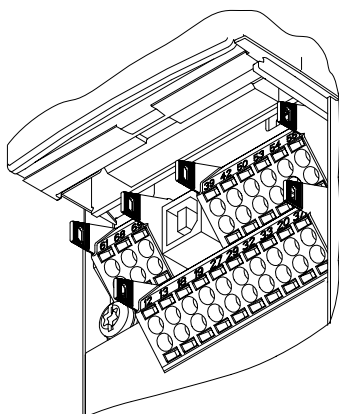


### 6.6.2 Access to signal terminals

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



Access to signal terminals

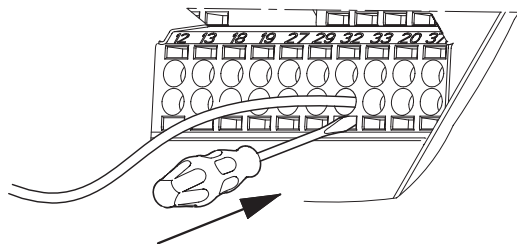


Signal terminals, all enclosures

### 6.6.3 Fitting the conductor

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

The conductor is now fixed in the terminal.



Fitting the conductor into the signal terminal

### 6.6.4 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.

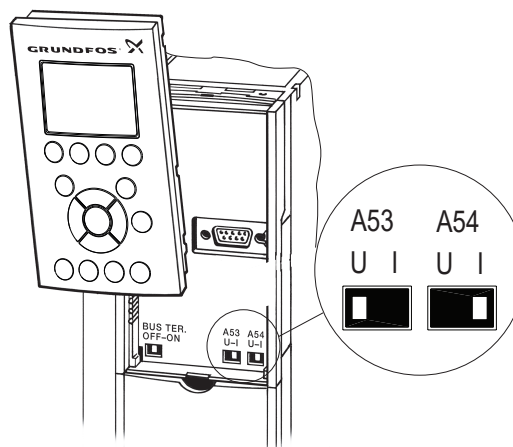
The factory setting of the inputs for non-sensor version pump is "U" and "U". The factory setting of sensor version pump is "U" and "I".



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.



Setting contact A54 to current signal "I"

### 6.6.5 Network connection protocols

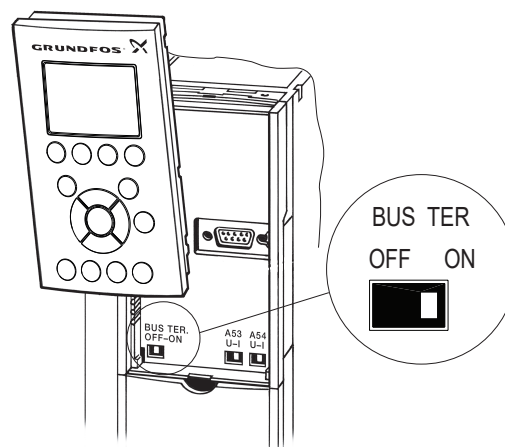
One or more CUEs can be connected to a control unit via the GENibus, BACnet MS/TP or Modbus RTU protocols.

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.



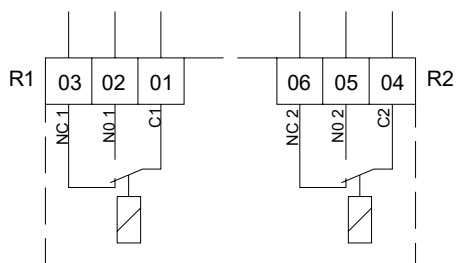
Setting the termination contact to ON



## 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	

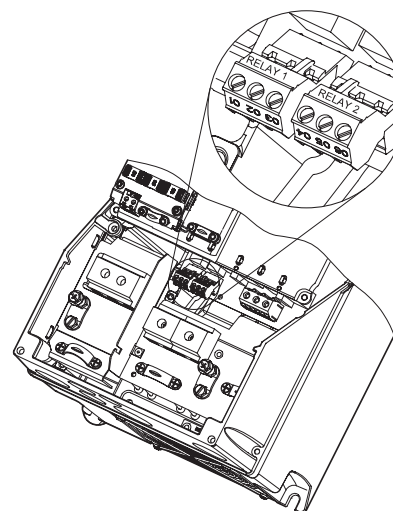
Terminal	Function	
C 1	C 2	Common
NO 1	NO 2	Normally open contact
NC 1	NC 2	Normally closed contact

### Related information

[6.5.1 Restart behaviour after STO activation](#)

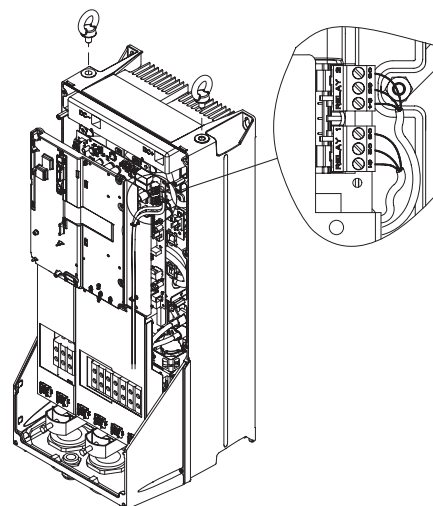
### 6.7.1 Access to signal relays

The relay outputs are positioned as shown in below figures.



TM039008

Terminals for relay connection, A5, B1 and B2



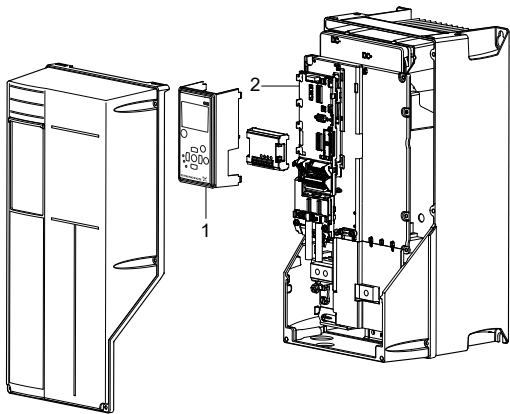
TM039009

Terminals for relay connection, C1 and C2



6.7.2 Fitting MCB 114 in CUE  
Enclosures A5, B1, B2, C1, C2

- 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

6.8 BACnet MS/TP connection

Grundfos CUE has integrated BACnet MS/TP. For detailed configuration, go to <https://www.grundfos-eica.com> or scan the QR code.



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.

TM040027



## 8. Control functions

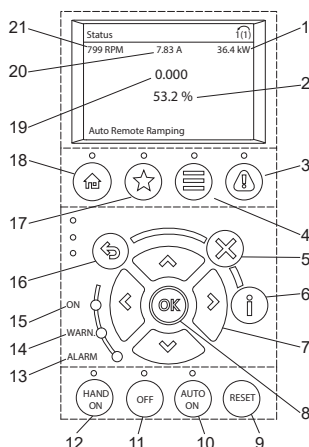


The display contrast can be adjusted by pressing [Status] and then pressing [Up] or [Down].

### 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	<b>OK</b>	[OK]: used to access parameter groups or to accept a selection.
9		[RESET]: resets the frequency converter manually after a fault has been cleared.
10		[AUTO ON]: puts the system in remote operational mode. • Responds to an external start command by control terminals or serial communication.
11		[OFF]: stops the motor but does not remove power to the frequency converter.

Pos.	Buttons	Description
12		[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 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

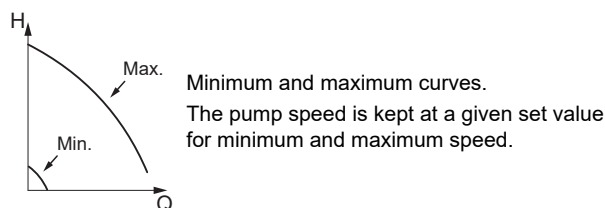


8-5* Digital/Bus	22-2* No-Flow Detection	202-0* Analog Input Sensor Setup
8-7* BACnet	22-3* No-Flow Power Tuning	202-1* Temperature Input Sensor Setup
8-8* FC Port Diagnostics	22-4* Sleep Mode	202-2* Sensorless Setup
8-9* Bus Jog / Feedback	22-5* End of Curve	203 - Status Monitor
13-** Smart Logic	23-** 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

## 8.4 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.



**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.

## 8.5 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 or based on calculated value (sensorless function).

The sensorless function uses calculated head or flow for the pump control and it is not as accurate as the pump control with a feedback sensor. **This function must be ordered in advance and calibrated at the factory prior to shipment.**

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

Default control mode made in NBE, NKE, NBSE:

- Open loop.

Default control mode made in NBE, NKE, NBSE Series 2000:

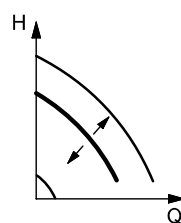
- Proportional differential pressure.

### Related information

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

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

### 8.5.1 Uncontrolled operation (open loop)



**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.

### Related information

[8.5 Control modes](#)

### 8.5.2 Controlled operation (closed loop)

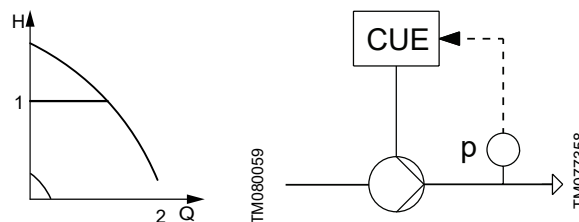
If you choose a sensor version pump, a differential pressure sensor is installed by Grundfos. For some functions mentioned in this section and section Other functions, additional sensors or accessories may be needed.

### Related information

[8.5 Control modes](#)

#### 8.5.2.1 Constant pressure

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



Pos.	Description
1	$H_{set}$
2	$Q_{max}$

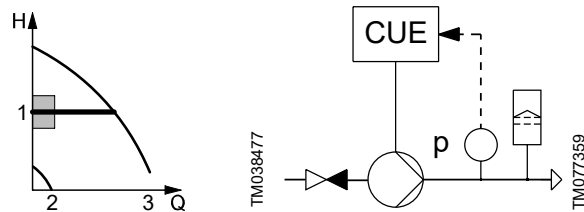
#### Constant pressure

The pump is controlled according to a constant pressure measured after the pump. This means that the pump offers a constant pressure in the Q-range of 0 to  $Q_{max}$ , represented by the horizontal line in the QH diagram.

#### Constant pressure with stop function



The outlet pressure is kept constant at high flow rate ( $Q > Q_{\min}$ ). There is on/off operation at low flow rate.



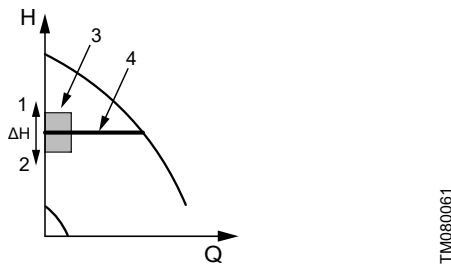
Pos.	Description
1	$H_{\text{set}}$
2	$Q_{\min}$
3	$Q_{\max}$

### Constant pressure with stop function

The pump is controlled according to a constant pressure measured after the pump. This means that the pump offers a constant pressure in the Q-range of  $Q_{\min}$  to  $Q_{\max}$ , represented by the horizontal line in the QH diagram.

The Stop function is activated by default for constant pressure, but can be deactivated in parameter 200-19 **Stop function**.

The purpose of the Stop function is to stop the pump when low or no flow is detected. When low flow is detected, the pump is in on/off operation. If there is flow, the pump continues to operate according to the setpoint.



Constant pressure with stop function, difference between start and stop pressures ( $\Delta H$ )

Pos.	Description
1	Stop pressure <sup>4)</sup>
2	Start pressure <sup>5)</sup>
3	On/off operation
4	Continuous operation

<sup>4)</sup> Stop pressure = Setpoint  $\times (1 + \Delta H \times 201-43)$

<sup>5)</sup> Start pressure = Setpoint  $\times (1 - \Delta H \times (1 - 201-43))$

Note:  $\Delta H = \text{Setpoint} \times 201-42$

Low flow detection can be configured in two different ways via the parameter 201-36:

- **0 - Open loop:** with the built-in low-flow detection function
- **1 - Close loop:** with a flow switch connected to a digital input.

The low-flow detection function checks the flow regularly by reducing the speed for a short time. No or only a small change in pressure means that there is low flow.

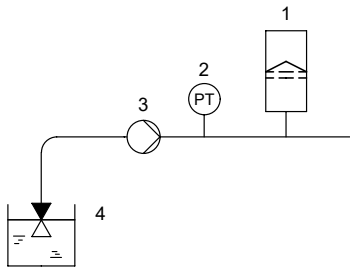
When a flow switch detects low flow, the digital input is activated.

It is only possible to use the stop function if the system incorporates the following components:

- a pressure sensor

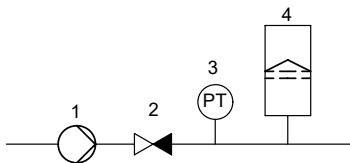
- a non-return valve
- a diaphragm tank.

The non-return valve must always be installed before the pressure sensor.



Position of the non-return valve and pressure sensor in a system with suction lift

Pos.	Description
1	Diaphragm tank
2	Pressure sensor
3	Pump
4	Non-return valve



Position of the non-return valve and pressure sensor in a system with positive inlet pressure

Pos.	Description
1	Pump
2	Non-return valve
3	Pressure sensor
4	Diaphragm tank

The stop function requires a diaphragm tank of a certain minimum size. The tank must be installed as close as possible after the pump, and the precharge pressure must be the 70 % of actual setpoint.

Recommended diaphragm tank sizes:

Rated flow rate of pump [m <sup>3</sup> /h (gpm)]	Typical diaphragm tank size [litres (gallons)]
0-6 (0-26)	8 (2)
7-24 (26-110)	18 (5)
25-40 (110-180)	50 (13)
41-70 (180-310)	120 (32)
71-100 (310-440)	180 (48)

If a diaphragm tank of the above size is installed in the system, the factory setting of  $\Delta H$  is the correct setting. If the tank installed is too small, the pump starts and stops too often.

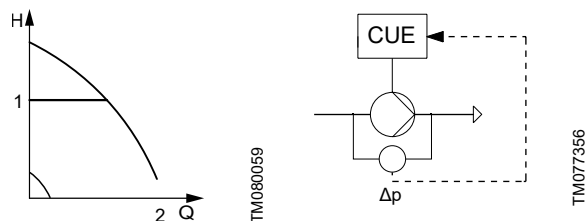
The stop function is activated by default in constant pressure applications. If not desired, it can be deactivated in the parameter 200-19 **Stop function**.



### 8.5.2.2 Constant differential pressure

#### Pump

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



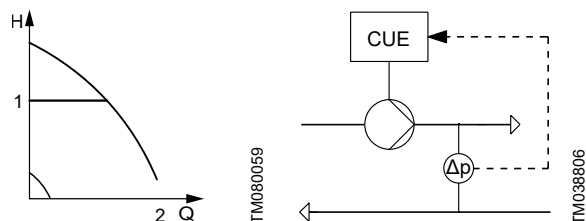
Pos.	Description
1	$H_{set}$
2	$Q_{max}$

#### Constant differential pressure, pump

The pump is controlled according to a constant differential pressure measured across the pump. This means that the pump system offers constant differential pressure in the Q-range of 0 to  $Q_{max}$ , represented by the horizontal line in the QH diagram.

#### System

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



Pos.	Description
1	$H_{set}$
2	$Q_{max}$

#### Constant differential pressure, system

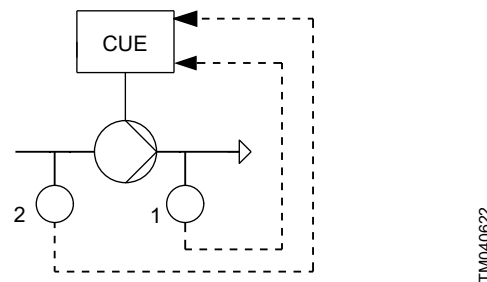
The pump is controlled according to a constant differential pressure measured across the system. This means that the pump system offers constant differential pressure of the system in the Q-range of 0 to  $Q_{max}$ , represented by the horizontal line in the QH diagram.

#### Differential pressure from two sensors

This function is for making differential pressure control possible 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.



Differential pressure from two sensors

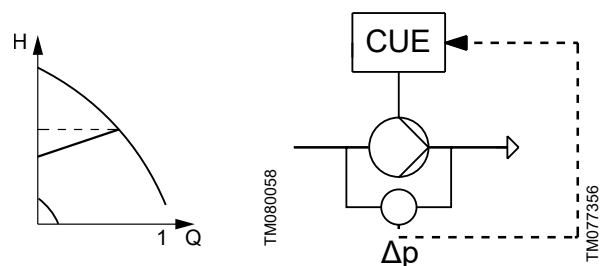
Pos.	Description
1	Sensor 1
2	Sensor 2

The sensor 1 is connected to the sensor input 1.

The sensor 2 is connected to the sensor input 2 of an MCB 114 sensor input module.

### 8.5.2.3 Proportional differential pressure

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



Proportional differential pressure

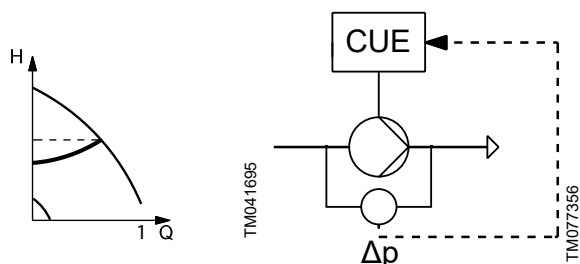
Pos.	Description
1	$Q_{max}$

The pump is controlled according to a differential pressure measured across the pump. This means that the pump system offers a proportional differential pressure in the Q-range of 0 to  $Q_{max}$ , represented by the sloping line in the QH diagram.

The proportional differential pressure can be selected with one of the following flow dependencies:

- linear, default
- quadratic.

When the flow dependency is selected as quadratic, the differential pressure of the pump is reduced with a quadratic curve at falling flow rate and increased at rising flow rate.



Proportional differential pressure, quadratic curve

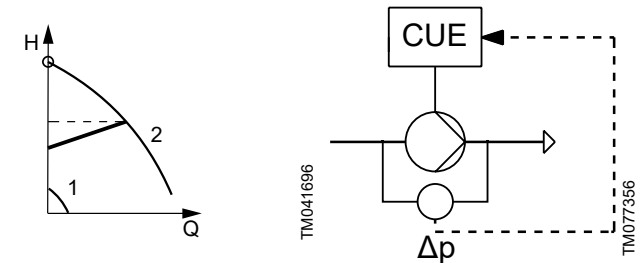


Pos.	Description
1	$Q_{\max}$

The pump is controlled according to a differential pressure measured across the pump. This means that the pump system offers a flow-compensated differential pressure in the Q-range of 0 to  $Q_{\max}$  represented by the quadratic curve in the QH diagram.

**$H_{\max}$  update**

This function can be used in connection with the control mode Proportional differential pressure. The purpose is to find the actual value of the maximum head at no flow and nominal pump speed.



Pos.	Description
1	Minimum
2	Maximum

*Proportional differential pressure,  $H_{\max}$  update*

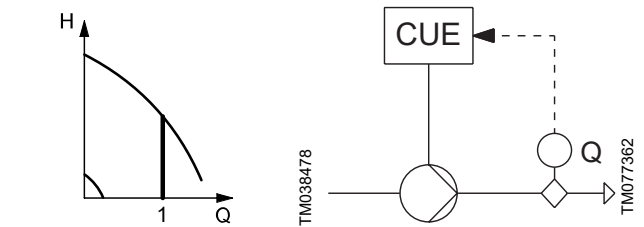
The function can be activated in parameter 200-27 and it consists of two steps:

1. The speed must be ramped up to nominal speed.
2. The  $H_{\max}$  must be measured for 20 seconds at nominal speed.

Valves must be closed so that the pump is operating without flow.

**8.5.2.4 Constant flow rate**

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



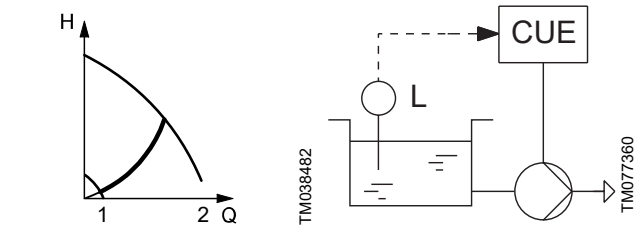
*Constant flow rate*

Pos.	Description
1	$Q_{\text{set}}$

The pump is controlled according to a constant flow rate, represented by the vertical line in the QH diagram.

**8.5.2.5 Constant level**

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



*Constant level*

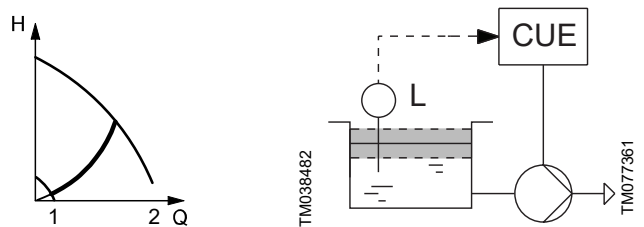
Pos.	Description
1	$Q_{\min}$
2	$Q_{\max}$

The pump is controlled according to a constant liquid level. This means that the pump offers a constant level in the Q-range of  $Q_{\min}$  to  $Q_{\max}$ , represented by the quadratic line in the QH diagram.

The function is an emptying function by default.

**Constant level with stop function**

The liquid level is kept constant at high flow rate. On/off operation is at low flow rate.



*Constant level with stop function*

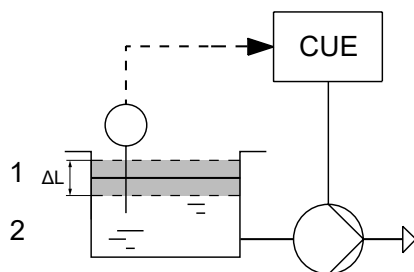
Pos.	Description
1	$Q_{\min}$
2	$Q_{\max}$



The pump is controlled according to a constant liquid level. This means that the pump offers a constant level in the Q-range of  $Q_{\min}$  to  $Q_{\max}$ , represented by the quadratic line in the QH diagram.

The function is an emptying function by default.

The purpose of the stop function is to stop the pump when low or no flow is detected. When low flow is detected, the pump is in on/off operation. If there is flow, the pump continues to operate according to the setpoint.



TM038809

Constant level with stop function, difference between start and stop levels ( $\Delta L$ )

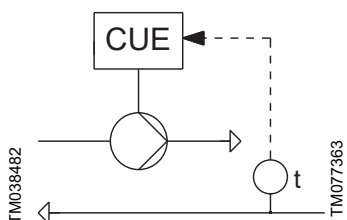
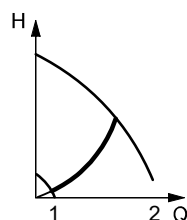
Pos.	Description
1	Start level
2	Stop level

Constant level with stop function is achieved with the **Limit Exceed** function.

If the desired Stop level is 1 meter and the start level is 5 meters, you can set the parameter 201-04 Limit Value to 1 and the parameter 201-05 Reset Hysteresis Value to 4.

#### 8.5.2.6 Constant temperature

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



TM038482

TM077363

Constant temperature

Pos.	Description
1	$Q_{\min}$
2	$Q_{\max}$

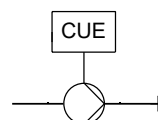
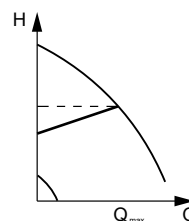
The pump is controlled according to a constant temperature. This means that the pump offers a variable flow rate in the Q-range of  $Q_{\min}$  to  $Q_{\max}$ , represented by the quadratic line in the QH diagram.

#### 8.5.2.7 Constant other value

Any other sensor signals that can be read through the terminal AI54 can be utilized as the object of the PID controller. The CUE calculates an output based on the deviation between the desired setpoint and the actual measured value, to control the motor speed and make the actual measured value follow the setpoint.

#### 8.5.2.8 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.

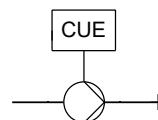
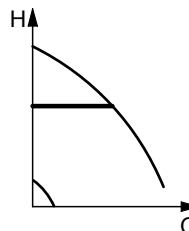


TM038475

TM090015

#### 8.5.2.9 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.



TM038476

TM090015

#### 8.5.3 Other functions

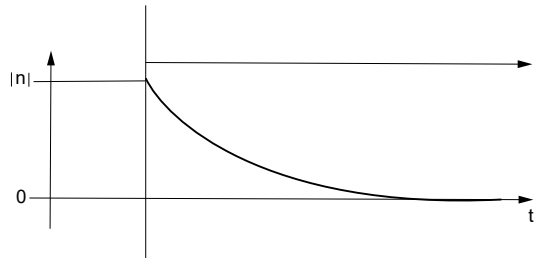
The pumps are pre-configured with basic parameters for immediate use. To optimize the system, refer to the following functions for more advanced settings.

If you need the "Start-up guide", press the "Favourites" button in the operating panel and then select "Q5 Start-up guide". **And you must continue with "Current Value" if you want to keep the existing configured parameters.** Otherwise, the drive will be initialized.



8.5.3.1 Safe Torque Off (STO)

The Safe Torque Off is an optional built-in safety function for the CUE. The STO is the required base for drive-based functional safety as defined per the EN IEC 61800-5-2, as the STO function brings the drive safely to a no-torque state. The STO is typically used for preventing an unexpected start-up (EN 1037) of the machinery, or for an emergency stop fulfilling the stop category 0 (EN 60204-1). When the STO is activated, it immediately switches off the drive output to the motor. The motor speed then coasts to a stop.



Motor speed coasting to stop after activating the STO

TM090017

8.5.3.2 Setpoints

The setpoint is normally pre-configured in Grundfos and changed via the **Favourites** menu on the CUE operating panel. If needed, the setpoint can be influenced via the external setpoint input.

The CUE offers the following setpoint possibilities:

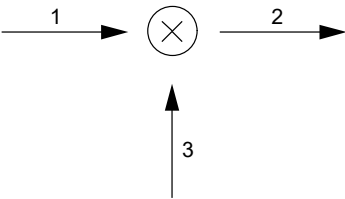
- external setpoint
- predefined setpoints
- communication bus setpoint.

The setpoint range depends on the selected control mode:

- In **Open loop** control mode, the setpoint is set in percentage corresponding to the required speed. The setting range is between the minimum and maximum curves in percentage of the nominal frequency. The related parameters are the following:
  - 200-82: **User Defined Minimum Frequency**
  - 200-83: **User Defined Maximum Frequency**.
- In **Proportional differential pressure** control mode, the setting range is equal to 25 % to 90 % of maximum head. For 25 % the related parameters are the following:
  - 200-62: **Proportional Pressure Minimum Setpoint**
  - 200-63: **Proportional Pressure Maximum Setpoint**
  - 200-22: **H<sub>max</sub>** .
- In all other control modes, the setting range is equal to the sensor measuring range. The parameters related to this range are the following:
  - 06-24: **Terminal 54 Low Ref./Feedback Value**
  - 06-25: **Terminal 54 High Ref./Feedback Value**.

External setpoint influence

The setpoint can be influenced by connecting an analog signal to the external setpoint input and is activated in the startup guide.



TM040373

Setpoint, CUE menu and external setpoint signal

Pos.	Description
1	Setpoint, CUE menu
2	Actual setpoint
3	External setpoint signal

The signal can influence the actual setpoint by the following possibilities of the function:

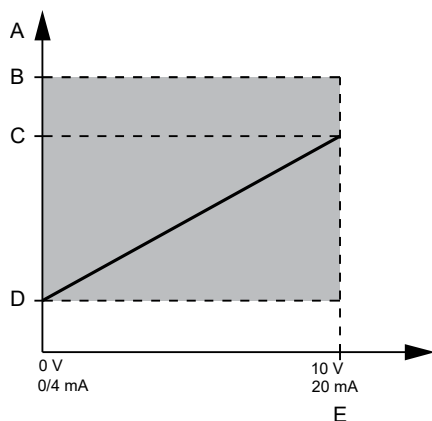
- External setpoint, default
- Inverse external setpoint
- External setpoint with stop
- External setpoint based on a reference table.

The external setpoint signal is used for calculating the actual setpoint. The minimum signal is the minimum setpoint, and the maximum signal is the normal setpoint.

External setpoint, default

The actual setpoint is a linear function of the external setpoint signal.



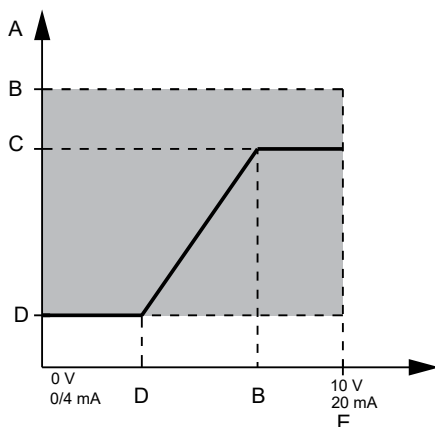


TM040626

*External setpoint*

Pos.	Description
A	Actual setpoint
B	Maximum
C	Setpoint, CUE menu
D	Minimum
E	External setpoint signal

The minimum and maximum values of the external setpoint signal are default within the full scale of 0 to 10 V (0/4-20 mA), but can be set in the parameters 200-11 to 200-14 within 20-1x **Setpoint Handling**.



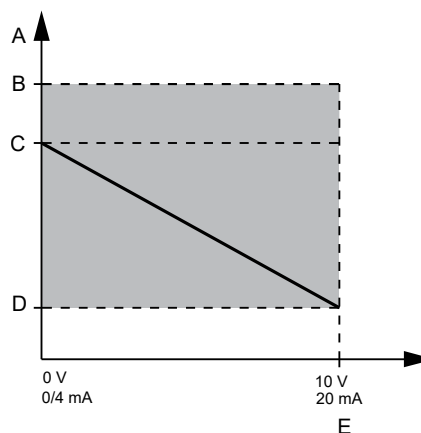
TM040363

*Reduced external setpoint signal*

Pos.	Description
A	Actual setpoint
B	Maximum
C	Setpoint, CUE menu
D	Minimum
E	External setpoint signal

**Inverse external setpoint**

The actual setpoint is an inverse linear function of the external setpoint signal and is activated in the **Main** menu parameter 200-10 **External setpoint**.

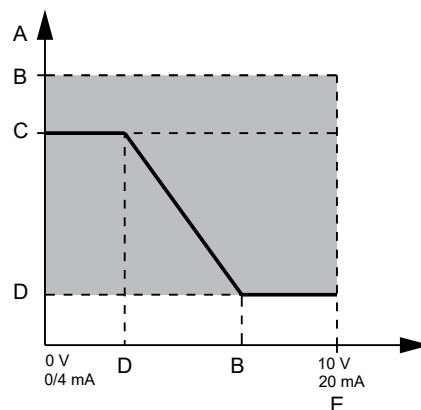


TM040627

*Inverse external setpoint signal*

Pos.	Description
A	Actual setpoint
B	Maximum
C	Setpoint, CUE menu
D	Minimum
E	External setpoint signal

The maximum and minimum values of the external setpoint signal are default within the full scale of 0 to 10 V (0/4-20 mA), but can be set in the parameters 200-11 to 200-14 within 20-1x **Setpoint Handling**.



TM040365

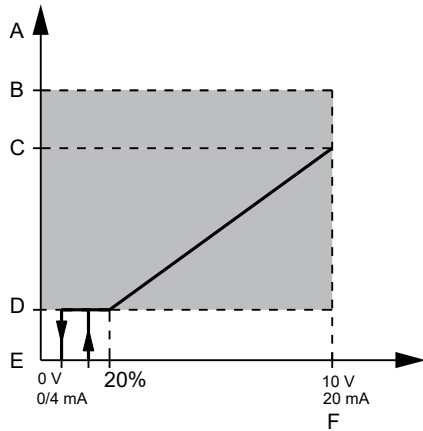
*Reduced inverse external setpoint signal*

Pos.	Description
A	Actual setpoint
B	Maximum
C	Setpoint, CUE menu
D	Minimum
E	External setpoint signal



### External setpoint with stop function

The actual setpoint with stop is a linear function of the external setpoint signal above 20 % signal and on/off operation below 20 % signal. Linear with stop is selected in the **Main** menu, parameter 200-10 **External setpoint**.



TM040364

External setpoint with stop function

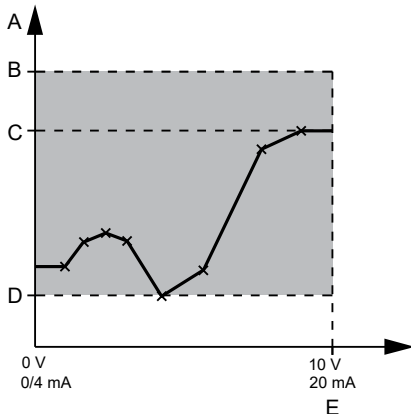
Pos.	Description
A	Actual setpoint
B	Maximum
C	Setpoint, CUE menu
D	Minimum
E	Stop
F	External setpoint signal

When the external setpoint signal is below 10 %, the operating mode is **Stop**.

When the external setpoint signal is above 15 %, the operating mode is **Normal**.

### External setpoint based on a reference table

The actual setpoint is a piecewise linear function of the external setpoint signal and is activated in the **Main** menu, parameter 200-10 **External setpoint**.



TM040366

External setpoint based on a reference table

Pos.	Description
A	Actual setpoint
B	Maximum
C	Setpoint, CUE menu
D	Minimum
E	External setpoint signal

The linear function is defined as an interpolation between the points in a table. The table has up to eight points that are adjustable in the **Main** menu, group 200-1x **Setpoint Handling**.

The parameters of the eight points are the following:

- 200-15: **Number of reference influence table points**
- 200-16: **Reference Influence, input value**
- 200-17: **Reference Influence, output value**.

### Predefined setpoints

This function makes it possible to select up to seven predefined setpoints using one to three digital inputs.

The setpoints are selected as a binary coding of the digital inputs as shown in the table below. The predefined setpoints are adjustable in the **Main** menu, parameter 310 **Preset Reference**.

Predefined setpoint	DI 2	DI 3	DI 4
15 %	x	-	-
30 %	-	x	-
45 %	x	x	-
60 %	-	-	x
75 %	x	-	x
90 %	-	x	x
100 %	x	x	x

x = Closed contact

If none of the digital inputs are activated, the operating mode can be configured to Stop or to being controlled according to a setpoint set via the **Main** menu, parameter 200-18 **Predefined Setpoint Zero Function**.

If the Min., Max. or Stop in the parameter 200-06 operating model is selected via the operating panel, the predefined setpoints are overruled.

Predefined setpoints cannot be influenced by the external setpoint input.

### Communication setpoint

If the CUE is remote-controlled via the communication input, the setpoint is set via the bus.

The communication setpoint cannot be influenced by the external setpoint signal.



### 8.5.3.3 PID controller

The CUE has a built-in PID controller for speed control of the pumps. The factory setting of gain ( $K_p$ ) and integral time ( $T_i$ ) are automatically adjusted to suggested settings based on the control mode chosen. The values can easily be changed in the operating panel. The parameter group of the PID controller is 20-9x.

The controller can operate in both normal and inverse mode and is selected in parameter 20-81 **PID Normal/Inverse Control**.

#### Normal mode

Normal mode is used in systems in which an increase in pump performance results in a rise in the value measured at the feedback sensor. This is typically the case in most CUE applications.

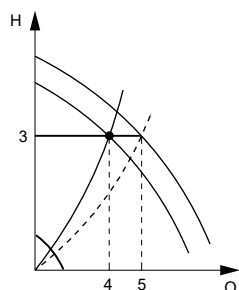
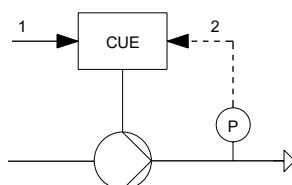
#### Inverse mode

Inverse mode is used in systems in which an increase in pump performance would result in a drop in the value measured at the feedback sensor. This mode is typically used for constant level operation (emptying tank) and for constant temperature operation in cooling systems.

Negative  $K_p$  value corresponds to inverse mode.

#### Description

The PID controller compares the required setpoint ( $p_{set}$ ) with the actual value ( $p$ ) measured by the transmitter (P).



#### Constant pressure control

Pos.	Description
1	Setpoint $p_{set}$
2	Measured value $p$
3	$P_{set}$
4	$Q$
5	$Q_{max}$

If the measured value is higher than the required setpoint, the PID controller reduces the speed and the performance of the pump until the measured value is equal to the required setpoint.

### Suggested controller settings

System/ application	$K_p$		$T_i$
	Heating system <sup>6)</sup>	Cooling system <sup>7)</sup>	
	0.2		0.5
	SP, SP-G, SP-NE: 0.5		0.5
	0.2		0.5
	SP, SP-G, SP-NE: 0.5		0.5
	0.2		0.5
	-2.5		100
	0.5	-0.5	$10 + 5L_2$
	0.5		$10 + 5L_2$
	0.5	-0.5	$30 + 5L_2$
	0.5		0.5
	0.5		$L_1 < 5 \text{ m (16 ft):}$ 0.5 $L_1 > 5 \text{ m (16 ft):}$ 3 $L_1 > 10 \text{ m (32 ft):}$ 5

<sup>6)</sup> Heating systems are systems in which an increase in pump performance results in a rise in temperature at the sensor.

<sup>7)</sup> Cooling systems are systems in which an increase in pump performance results in a drop in temperature at the sensor.

$L_1$  = Distance in m (ft) between pump and sensor



$L_2$  = Distance in m (ft) between heat exchanger and sensor

The setting of gain ( $K_p$ ) and integral time ( $T_i$ ) can be manually changed in the operating panel via the **Main** menu group 20-9x **PID Controller**.

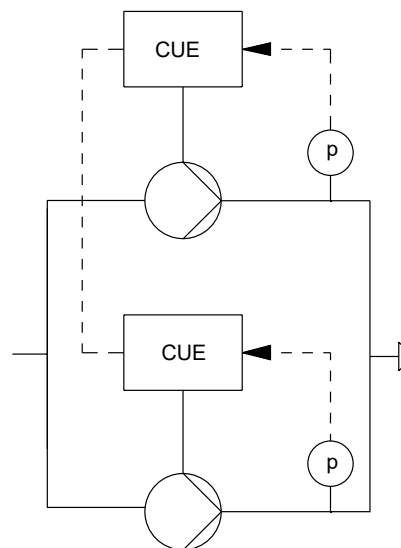
#### 8.5.3.4 Duty/standby, multi-master cascade

Use the startup guide for setting the multi-pump system with the following options:

- No (used for CUE controlling single pumps)
- Variable and fixed speed
- Variable speed only.

##### Duty/standby

The built-in duty/standby function applies to **Variable speed only** pumps connected in parallel to ensure the reliability of supply.



*Two pumps connected in parallel and controlled via the Modbus RTU*

The duty/standby function is set by choosing **Variable speed only** in the startup guide, then by setting the desired function to **Alternation** or **Back-up**.

The primary purposes of the function are the following:

- to let one pump run at a time
- to start the standby pump if the duty pump stops due to an alarm
- to alternate the pumps at least every 24 hours, only if alternation function is selected.

The two pumps are electrically connected by the Modbus RTU protocol on the serial communication port.

The two pumps running duty/standby in this way cannot use the serial communication port for remote communication. The two pumps use their own local operating mode. See the section about operating modes.

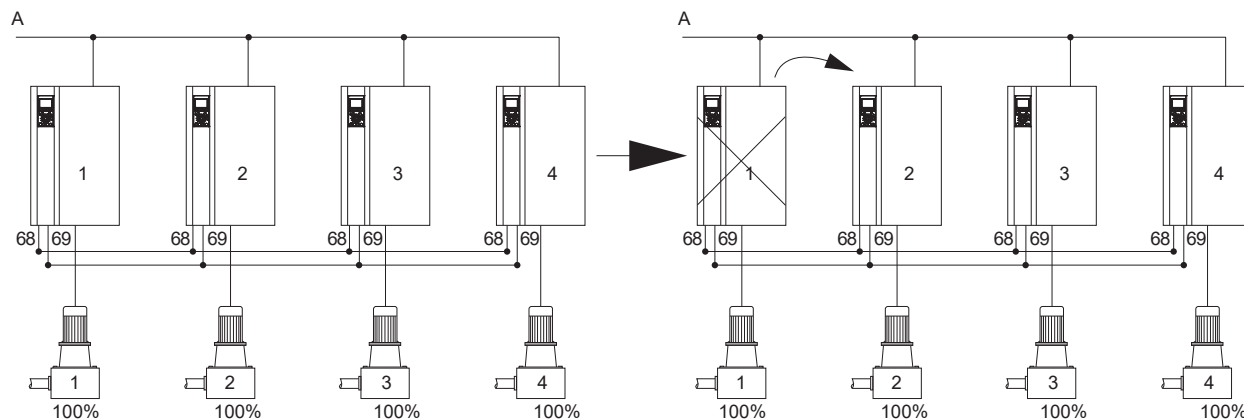
Both pumps must have the same control mode. See the section about control modes.

##### Multi-master cascade

The **Multi-master cascade** functions are used for cascading additional variable speed pumps. Each pump is connected to a CUE. All pumps must be of the equal size. The system can support a maximum of 8 pumps in the cascade configuration.

TM040368





TM090100

The line supply (A) of four pumps connected in parallel and controlled via the Modbus RTU

The master driver determines the sequence of pump start and stop based on the running time of each pump. If the currently running pump is unable to maintain the pressure, the next pump is activated. In case of master drive failure, the system automatically reallocates the master functionality.

The master driver needs to be changed when the following occurs on the primary master:

- The supply power is turned off.
- There is a control card defect.
- There is a warning, Live Zero error.

The entire system shuts down when the master driver detects any of the following alarms:

- Alarm 68: **Safe Stop Activated**
- Alarm 94: **End of Curve**
- Alarm 92: **No Flow Alarm**
- Alarm 93: **Dry Pump Alarm**
- Alarm 60: **External Interlock.**

Follower drivers operate when the primary master driver stops:

- any other alarm
- LCP status: M:X F:D F:D F:D.

The CUE uses the on-board RS485 communication terminals, and the communication protocol is the Modbus RTU that requires an absolute minimum setup of parameters. The startup guide makes this configuration easy.

The cascade control ensures that the performance of the pumps is automatically adapted to consumption by switching pumps on or off and by changing the speed of the pumps in operation. This makes the system run as energy-efficiently as possible with a limited number of pumps.

#### Setting the master drivers

The **Multi-master cascade** function is set by selecting **Variable speed** only in the startup guide, then setting the desired function to **Cascade**. The variable speed cascade function is then set by choosing **Variable speed** only in the startup guide, then setting the total number of pumps in the system.

#### Setting the follower drivers

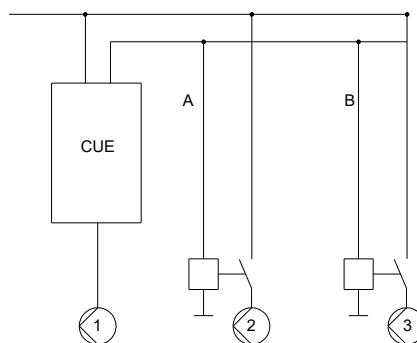
Set the control mode to **Open loop** then confirm that the pump is an assist pump in a **Multi-master cascade** system.

#### Setting the drivers' addresses

If there are multiple master drivers, the master status is determined by parameter **8-31 Address** where the lowest assigned is the **Primary Master**. All back-up master drivers power up as assigned follower drivers as they do not have the lowest address. The ID of the drive must be ordered from 1 to 8 and should be sequential.

#### Fixed-speed cascade

The fixed-speed cascade function is used for cascading additional fixed-speed pumps. Only one duty pump is connected to a CUE.



TM075451

One duty pump connected with two fixed-speed pumps controlled via relays

Pos.	Description
A	Relay 1
B	Relay 2

The fixed-speed cascade function is set by selecting **Variable and Fixed speed** in the startup guide, then setting the total number of pumps in the system. When **Variable and Fixed speed** is selected, this pump runs as a duty pump in the fixed-speed cascade system. The following steps must be performed:

- For a two-pump setup: The Relay 1 is automatically set to activate/deactivate one fixed-speed pump based on pressure demand
- For a three-pump setup: The Relay 1 and Relay 2 are automatically set to activate/deactivate one additional fixed-speed pump at the same time based on pressure demand.

The primary purposes of the function are the following:

- to let the duty pump run all the time (except if low flow stop is activated)
- to start the fixed-speed pumps if the system pressure decreases below 90 % of the sensor range
- to stop the fixed-speed pumps if the system pressure increases above 110 % of the sensor range.

The cascade control ensures that the performance of the pumps is automatically adapted to consumption by switching pumps on or off and by changing the speed of the duty pump in operation.



8.5.3.5 Dry running

This function protects the pump against dry running. When lack of inlet pressure or water shortage is detected, the pump is stopped before being damaged.

Lack of inlet pressure or water shortage can be detected in three ways:

- with a switch connected to a digital input configured to dry-running protection
- the CUE checks if the shaft power is below a dry-pump limit for a configurable time
- the CUE checks if the pressure cannot be reached at full speed for a configurable time.

Note that the dry-running function requires a sensor. This means that the function does not work in **Open loop**.

The following conditions must be present to activate the dry-running alarm:

- The power consumption must be below a certain level (set by the parameters).
- The pump must run at full speed (handled by the control mode and the sensor).

The CUE increases the speed to maximum if no water is present. Without a sensor, it does not work.

Setting the dry-running protection based on a switch connected to a digital input

Using a digital input requires an accessory, such as:

- a Grundfos LiqTec® dry-running switch
- a pressure switch installed on the suction side of the pump
- a float switch installed on the suction side of the pump.

See the section about accessories for more information on the required sensors. The pump cannot restart if the input is activated. Restart may be delayed by up to 30 minutes, depending on the pump family.

The digital inputs of the CUE (terminals, 18, 19, 27, 29, 32, 33) can be set individually to different functions in the **Main** menu, parameter group 5-1x **Digital Inputs**.

Select dry running to activate the detection based on a switch.

Setting the dry-running protection based on a shaft power

The use of shaft power requires an actual power reading at two frequencies.

Procedure without pump curve

After completing the startup guide, do the steps:

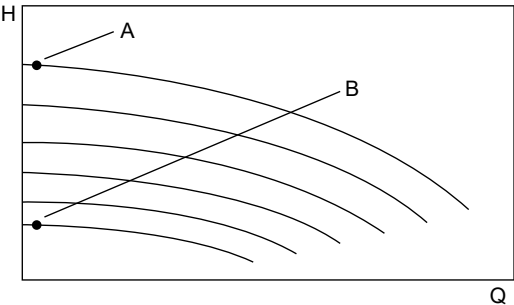
1. Close the valve. No flow is required during the test.
2. Press **Hand on** and set the speed to 50 % (30 Hz or equivalent RPM). The CUE starts the pump.
3. Go to the **Main** menu parameter 16-10 **Power [kW]** and read the input power. Make a note of the low limit value.
4. Press **Home** to return to the status screen.
5. Press **Hand on** and set the speed to 90 % (54 Hz or equivalent RPM). The CUE starts the pump.
6. Go to the **Main** menu parameter 16-10 **Power [kW]** and read the input power. Make a note of the high limit value.
7. Stop the CUE and open the valve.

Procedure with pump curve

Go to the Grundfos Product Center and enter the part number for your pump:

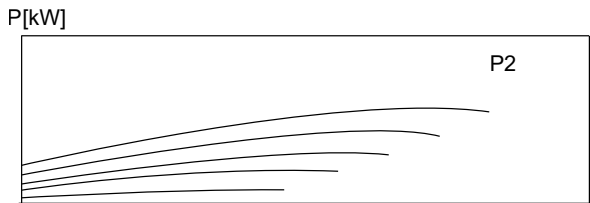
1. Enter **Show advanced options**.
2. Go to the **Hydraulic layout** and set variable speed to **Yes**.
3. Click on the pump curve to set the duty point as close to  $f_{min}$  and enter Q to 0.1 as the **Operating point**.
4. Read output power (P2) and speed (n) as low limit values.

5. Click on the pump curve to set the duty point as close to 90 % speed and enter Q to 0.1 as **Operating point**.
6. Read output power (P2) and speed (n) as high limit values.



QH curve for variable speed pump for choosing low flow operating points

Pos.	Description
A	90 % of $f_{max}$
B	$f_{min}$



QP curve for variable speed pump for reading P2 at low flow

The data must be entered in the **Main** menu parameter group 22-3x **No-flow Power Tuning** as follows:

- 22-32 **Low Speed [RPM]** or 22-33 **Low Speed [Hz]** = 30 Hz
- 22-34 **Low Speed Power [kW]** = the power readout at Low limit in previous procedure
- 22-36 **High Speed [RPM]** or 22-37 **High Speed [Hz]** = 54 Hz
- 22-38 **High Speed Power [kW]** = the power readout at High limit in previous procedure.

Activate the desired protection function, for example an alarm, in the **Main** menu parameter 22-26 **Dry Pump Function**.

The dry-running stop function is now set correctly. The time setting is 10 seconds from no-flow delay (22-24) with additional 10 seconds from dry-running detection delay (22-27), adding up to a total of 20 seconds.

Setting the dry-running protection based on an end of the curve

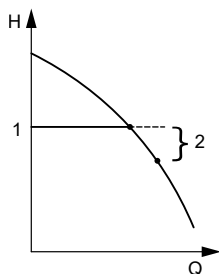
By default, the CUE issues an alarm at end of the curve. This also occurs under the dry-running conditions of water shortage and no flow.

In constant pressure control mode, the end of curve is detected if the pressure is below a 20 % tolerance of the sensor range of the setpoint and the pump is running at maximum speed for a 10-second delay. The pump cannot build up the setpoint pressure due to water shortage.

The end of curve tolerance, delay and protection function can be adjusted in the **Main** menu, parameter group 22-5x **End of Curve**.

Example: A constant pressure system with a 0-16 bar sensor and setpoint at 11.75 bar (120 m head) gives an end of curve alarm if the pressure is below 11.75 bar minus 20 % of 16 bar, that is, 8.55 bar, and the pump is running at maximum speed.





TM075611

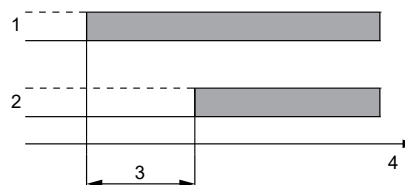
Pos.	Description
1	$H_{set}$
2	H tolerance

Dry-running detection based on the end of curve also gives an alarm, if there is actual water and the system head curve shifts to high flow range, which means that the function may need to be adjusted to work properly in the high flow area.

### 8.5.3.6 Start adjustments

#### Start delay

The start delay after power-on is a delay between power being applied and the pump starting.



TM040621

#### Start delay after power-on

Pos.	Description
1	Power-on
2	Start CUE
3	Start delay
4	Time

The purpose is to allow the remote-control equipment to start up before the pump.

The start delay is deactivated if a remote command is received via communication port.

This can be set in the **Main** menu, parameter 1-71 **Start Delay**.

#### Flying start

This function makes it possible to catch a motor that is spinning freely due to a mains drop-out. This prevents a high current draw from the CUE by starting on a rotating motor.

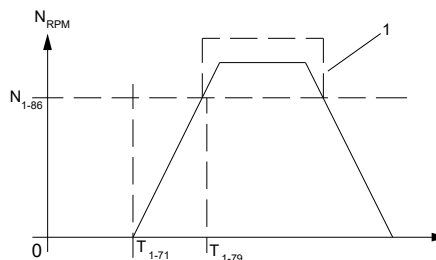
When flying start is enabled, the start delay function is not active.

This can be set in the **Main** menu, parameter 1-73 **Flying Start**.

#### Blocked pump

Some pumps are sensitive to operating at low speed due to insufficient cooling or lubrication.

If the pump does not reach the speed **Trip speed low (Hz)** within the **Pump Start Max. Time to trip**, the CUE gives an alarm.



TM075474

#### Advanced minimum speed monitoring

Designation	Description
$T_{1-71}$	Parameter 1-71 <b>Start Delay</b>
$T_{1-79}$	Parameter 1-79 <b>Pump Start Max. Time to Trip</b> (including the time in $T_{1-71}$ )
$N_{1-86}$	Parameter 1-86 <b>Trip Speed Low [RPM]</b> If the speed drops below this value during normal operation, the frequency converter drops.
1	Normal operation



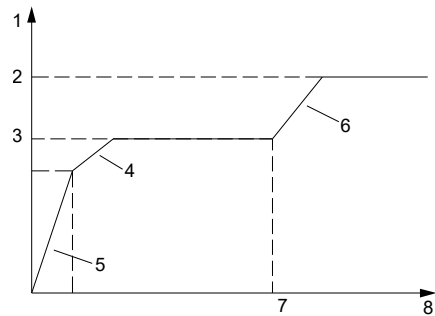
Note that timers for the parameter 1-71 **Start Delay** and the parameter 1-79 **Pump Start Max. Time to Trip** start at the same time when the start command is issued. This entails that if the start delay is more than or equal to the pump start max. time, the CUE never starts.

8.5.3.7 Pipe fill

This function is used for filling empty pipes with water in a controlled manner. If the function is not activated, pipes are filled at maximum speed. In pressure-controlled systems where pipes are empty at startup, high speed causes water hammer until the speed is reduced to fit the actual demand.

Water hammer can be prevented by introducing a pipe fill sequence before the system is running normal operation. The pipe fill function can limit the speed of the pump when filling pipes, thus reduce water hammer in filled pipes. A time limit or a pressure can be set to deactivate the pipe fill function and turn the CUE into normal operation.

Since pressure in horizontal pipe systems does not climb as the system fills, in such systems, it is necessary to determine a user-specified speed and time to fill the pipes or a user-specified pressure setpoint.

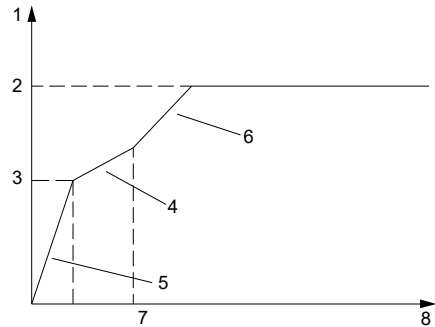


TM075475

Horizontal pipe system

Pos.	Description
1	Speed
2	Maximum speed
3	Minimum speed
4	Normal ramp
5	Initial ramp
6	Closed loop
7	Fill time or filled setpoint
8	Time

In a vertical pipe system it is recommended to use the PID function to ramp the pressure at a user-specified rate between the motor speed low limit and a user-specified pressure.



TM075476

Vertical pipe system

Pos.	Description
1	Speed
2	Maximum speed
3	Minimum speed
4	Fill rate unit/second
5	Initial ramp
6	Closed loop
7	Filled setpoint
8	Time

Activation or deactivation is done in the parameter 29-00 **Pipe Fill Enable**.

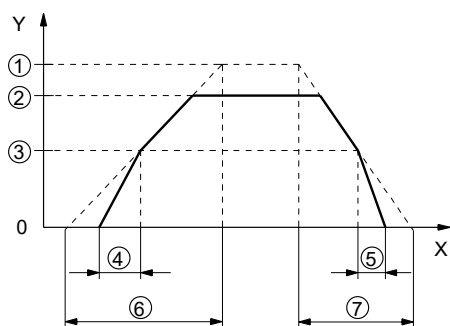


### 8.5.3.8 Operation

#### Ramps

The CUE startup guide incorporates adjustment of two types of ramp:

- ramp-up and ramp-down
- initial and final ramps.



Ramp-up and ramp-down of the CUE

Pos.	Description
X	Time
Y	Speed
1	Nominal
2	Maximum
3	Minimum
4	Initial ramp
5	Final ramp
6	Ramp-up
7	Ramp-down

The ramp-up and ramp-down are used for protection against overload when starting and stopping the CUE, and the time is defined as acceleration time from 0 rpm to nominal motor speed, and the deceleration time from nominal motor speed to 0 rpm, respectively. The settings are manually set in the parameter 3-41 **Ramp 1 Ramp Up Time** and the parameter 3-42 **Ramp 1 Ramp Down Time** of the operating panel.

The initial and final ramps prevent operation for a longer time than necessary at speeds below the minimum speed.

The setting is done automatically based on the pump family selected in the startup guide.

#### Operating range

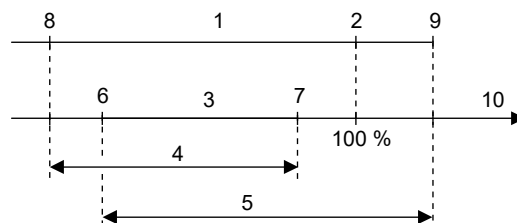
Set the operating range as follows:

1. Set the minimum speed within the range from a pump-dependent minimum speed to the adjusted maximum speed. The factory setting depends on the pump family.
2. Set the maximum speed within the range from the adjusted minimum speed to the pump-dependent maximum speed. The factory setting is equal to 100 %, that is, the speed stated on the pump nameplate.

The area between the minimum and maximum speed is the actual operating range of the pump.

The operating range can be changed by the user within the pump-dependent speed range.

For some pump families, oversynchronous operation (maximum speed above 100 %) is possible. This requires an oversize motor to deliver the shaft power required by the pump during oversynchronous operation.



Setting of the minimum and maximum curves in percentage of the maximum performance

Pos.	Description
1	Pump dependent speed range
2	Nominal speed
3	Actual speed range
4	Minimum speed, adjusted
5	Maximum speed, adjusted
6	Minimum
7	Maximum
8	Minimum speed
9	Maximum speed
10	Speed [%]

The minimum and maximum speed can be manually overwritten in the parameter 4-11 **Motor Speed Low Limit** and the parameter 4-13 **Motor Speed High Limit**, respectively. Note that the maximum speed cannot exceed the maximum output frequency set in the parameter 4-19.

Running outside the pump-dependent minimum and maximum speeds may damage the pumps.

#### Skip bands

Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system.

- If the CUE is in **RPM** mode, enter the lower limit of the speeds to be avoided in the parameter 4-60[0] and the upper limit in the parameter 4-62[0].
- If the CUE is in **Hz** mode, enter the lower limit of the speeds to be avoided in the parameter 4-61[0] and the upper limit in the parameter 4-63[0].

A maximum of four frequency or speed ranges can be avoided in rare cases. To add more skip bands, use the index 1, 2 or 3 for the above-mentioned parameters.



### Standstill heating

Standstill heating preheats the motor during standstill to avoid condensation within the motor.

When the pump is stopped by a stop command, a current is applied to the motor windings to keep the temperature within the motor above the dew point temperature. No external heater is needed.

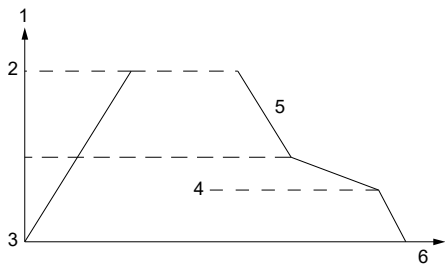
The preheating of the motor is especially important when the motor is installed under the following conditions:

- high humidity
- outdoor installation.

A consequence of condensed moisture within the motor is, for example, corrosion damage to electrical contacts and the bearings of the motor shaft.

This can be activated in the parameter 1-80 **Function at Stop**.

### Check valve ramps



TM075556

Check valve ramp

Pos.	Description
1	Speed
2	Motor speed high
3	Motor speed low
4	Check valve end speed
5	Normal ramp
6	Time

To protect ball check valves in a stop situation, the check valve ramp time can be utilised as a temporary slower ramp rate. When the parameter 3-85 **Check Valve Ramp Time** is different from 0 s, the check valve ramp time is effectuated between the motor speed low and the check valve end speed.

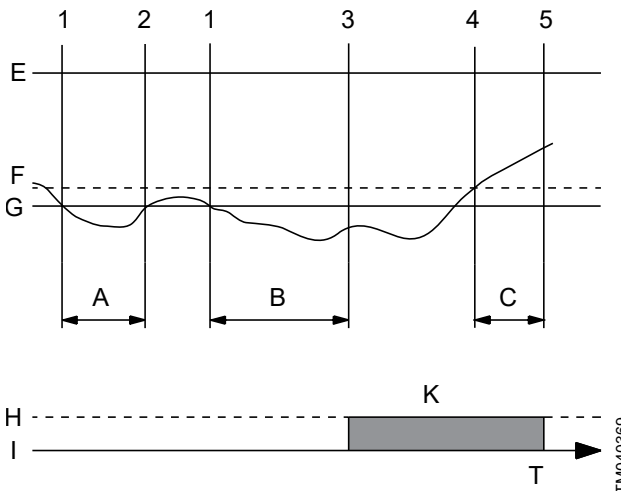
Set the check valve end speed where the check valve is expected to be closed and the check valve is no longer active.

### Over-voltage control (OVC)

When deceleration is too fast in case of higher inertia, the braking energy can cause an overvoltage in the CUE. This can be overcome by enabling overvoltage control in the **Main** menu parameter 2-17, and the CUE automatically prolongs the deceleration times, that is, normal ramps, final ramps and check valve ramps to stop the CUE without an alarm.

### 8.5.3.9 Limit exceed

The CUE has two independent limit-exceed functions. These are monitoring functions offering information, warning, alarm or change of operating mode when a low or high limit is exceeded.



Example of low limit exceeded

Pos.	Description
E	High limit
F	Hysteresis
G	Low limit
H	On
I	Off
K	Low limit exceeded
T	Temperature

The two limit-exceed functions are set in the **Main** menu, parameter group 201-0x **Limit Exceed**. Parameters are grouped so that **Limit Exceed - 1** is set in index 0 and **Limit Exceed - 2** is set in index 1.

The default setting of this function is **Not active** and is activated in the parameter 201-00. Enabled and Disabled can be set to activate or deactivate the alarm when the limit is exceeded. Enabled with event action and Disabled with event action can be set to activate or deactivate actions, such as Stopping or Minimum speed, after the limit is exceeded.

The function has two timers, a detection delay timer and a reset delay timer, which are adjustable in the parameters 201-06 and 201-07, respectively.

The limits can either be a high or a low limit adjusted in the parameter 201-01, and the actual limit value must be entered in the parameter 201-04.

The detection delay timer starts when a limit is exceeded (1). See the figure above.

- A: If the limit is no longer exceeded (2) when the detection time expires, the timer is reset.
- B: If the limit is still exceeded (3) when the detection time expires, the output of the detector changes to **Limit exceeded**. The reset delay timer starts when the detector output is **Limit exceeded** and the limit is no longer exceeded, and hysteresis (4) applies.
- C: When the delay time has expired (5), the detector output changes to **Limit not exceeded**.

### Input possibilities

It is possible to have two limit-exceeded functions in parallel with the following inputs set in the parameter 201-02:

- all analog inputs



- all Pt100/Pt1000 inputs (this requires an MCB 114 sensor input module)
- internal measured values: Power consumption (P2), Motor speed or Motor current.

### Output possibilities

There are the following output possibilities:

- signal relay 1 and 2 activated in the parameters 5-40[0] and 5-40[1], respectively
- digital output activated in the parameters 5-30 and 5-31, respectively
- analog output activated in the parameter 6-50.

### Event actions

Change of operating mode as event action is set in the parameter 201-03.

- Warning only
- Stop
- Maximum speed
- Minimum speed
- User curve speed.

The default setting of this function is **Not active**.

### 8.5.3.10 Digital and Analog I/O

The CUE digital inputs can be configured to either PNP or NPN mode in the **Main** menu, parameter 5-00 **Digital I/O Mode**:

- NPN - Active at 0 V
- PNP - Active at 24 V.

The CUE has six terminals for digital input and output functions:

Terminal No.	Name	Parameter	Default	I/O mode
18	DI 1	5-10	Start	-
19	DI 2	5-11		-
27	DI/O 1	5-12 for input or 5-30 for output	No operation	5-01
29	DI/O 2	5-13 for input or 5-31 for output		5-02
32	DI 3	5-14		-
33	DI 4	5-15		-

### Digital input functions

- **Reset**: used for resetting an alarm manually from external signal.
- **Coast**: used for immediately stopping the pump without ramping down. The pump stops free-wheeling.
- **Start**: used for starting the pump manually in [Auto on] mode.
- **Reversing**: used for reversing the motor speed. Do not use this function on a pump.
- **Jog**: used for setting the motor speed fixed to Jog Speed [Hz] of parameter 3-11.
- **Preset ref bit 0 through 2**: used for setting the pump setpoint fixed to values of parameter 3-10.
- **Freeze output**: used for continuing pump speed at the current speed.
- **Hand/Auto start**: used for selecting hand or auto start. The high signal selects auto-on only, the Low signal selects hand-on only.
- **Hand start**: a signal applied to put the CUE into hand-on mode like pressing [Hand On], and a normal stop command is overridden.
- **Auto start**: a signal applied to put the CUE into auto-on mode like pressing [Auto On], and a normal stop command is overridden.
- **External fault**: If the input is activated for more than 5 seconds, an external fault is indicated.

Note that if the signal is disconnected, the motor stops. To make any other start command valid, assign another digital input to [54] Auto Start and apply a signal to this. [Hand On] and [Auto On] have no impact. [Off] overrides local start and auto start. Press either [Hand On] or [Auto On] to make local start and auto start active again. If there is no signal on either [53] Hand start or [54] Auto start, the motor stops regardless of any normal start command applied. If a signal is applied to both [53] Hand start and [54] Auto start, the function is auto start. When pressing [Off], the motor stops regardless of signals on [53] Hand start and [54] Auto start.

- **Min.:** changes the operating mode to **Min.**
- **Max.:** changes the operating mode to **Max.**
- **User curve:** changes the operating mode to **User curve**.

Note that most functions are available with and without inverse. Choose with inverse if you want a specific function to be activated other than the PNP or NPN mode.

### Digital and Relay output functions

- **Control ready**: The control board receives supply voltage.
- **Drive ready**: The CUE is ready for operation and applies a supply signal on the control board.



- **Drive ready/remote control:** The CUE is ready for operation and is in auto-on mode.
- **Standby/no warning:** The CUE is ready for operation. No start or stop command has been given (start/disable). There are no warnings.
- **Running:** The pump is running.
- **Running/no warning:** The pump is running and there are no warnings.
- **Run on reference/no warning:** The motor is running at reference speed.
- **Alarm:** An alarm activates the output.
- **Alarm or warning:** An alarm or a warning activates the output.
- **At torque limit:** The torque limit set in the parameter 4-16 Torque Limit Motor Mode has been exceeded.
- **Torque limit and stop:** It is used in performing a coast stop and in torque limit condition. If the frequency converter receives a stop signal and is at the torque limit, the signal is logic 0.
- **Out of current range:** The motor current is outside the range set in the parameter 4-18 Current Limit.
- **Below current, low:** The motor current is lower than the setting in the parameter 4-50 Warning Current Low.
- **Above current, high:** The motor current is higher than the setting in the parameter 4-51 Warning Current High.
- **Out of speed range:** The output speed is outside the ranges set in the parameter 4-52 Warning Speed Low and the parameter 4-53 Warning Speed High.
- **Below speed, low:** The output speed is lower than the setting in the parameter 4-52 Warning Speed Low.
- **Above speed, high:** The output speed is higher than the setting in the parameter 4-53 Warning Speed High.
- **Out of feedback range:** The feedback is outside the ranges set in the parameter 4-56 Warning Feedback Low and the parameter 4-57 Warning Feedback High.
- **Below feedback low:** The feedback is below the limit set in the parameter 4-56 Warning Feedback Low.
- **Above feedback high:** The feedback is above the limit set in the parameter 4-57 Warning Feedback High.
- **Thermal warning:** The thermal warning turns on when the temperature exceeds the limit in the motor, the CUE or the thermistor.
- **Bus OK:** There is active communication (no timeout) via the serial communication port.
- **Out of ref range:** The reference is outside the ranges set in the parameter 4-54 Warning Reference Low and the parameter 4-55 Warning Reference High.
- **Below reference low:** The reference is below the limit set in the parameter 4-54 Warning Reference Low.
- **Above reference high:** The reference is above the limit set in the parameter 4-55 Warning Reference High.
- **Comparator 0 through 5:** The signal outputs correspond to the logic output of the [Main] menu parameter group 13-1x Comparators.
- **Logic Rule 0 through 5:** The signal outputs correspond to the logic output of the [Main] menu parameter group 13-4x Logic Rules.
- **Running reverse:** The CUE is running counterclockwise.
- **Start command active:** The CUE has received an active start command, for example auto on, and a start command via digital input or bus is active or [Hand On]. It is not necessarily running.
- **Drive in hand mode:** The CUE is in hand-on mode (as indicated by the indicator light above [Hand on]).
- **Drive in auto mode:** The CUE is in auto-on mode (as indicated by the indicator light above [Auto on]).
- **Preventive Maintenance:** One or more of the preventive maintenance events have passed the time for the specified action.
- **Deragging:** The deragging procedure is active.
- **AHF Capacitor Connect:** The automatic control of the AHF capacitor connect at low loads under 20 %.
- **External Fan Control:** The external fan control is active.
- **No-Flow:** A no-flow situation or minimum speed situation has been detected.
- **Dry Pump:** A dry pump condition has been detected.
- **End of Curve:** An end of curve condition has been detected.
- **Sleep Mode:** The CUE has entered sleep mode.
- **Pipe Filling:** It is active when the pipe fill function is operating.

### Analog outputs

The analog output (0/4-20 mA) can be set in the **Main** menu, parameter 6-50 to one of the following indications:

- feedback value
- speed
- frequency
- motor current
- external setpoint input
- limit exceeded.

The analog output is set to not active by default.

- **Feedback value:** The output signal is a function of the actual feedback value.
- **Speed:** The output signal is a function of the actual pump speed.
- **Frequency:** The output signal is a function of the actual frequency.
- **Motor current:** The output signal is a function of the actual motor current.
- **External setpoint input:** The output signal is a function of the external setpoint input.
- **Limit exceeded:** The output signal is on/off when the limit is exceeded: Off = 0/4 mA and On = 20 mA.

### MCB 114 sensor input module

The MCB 114 sensor input module offers three additional analog inputs for the CUE:

- one analog 0/4-20 mA input for an additional sensor
- two analog Pt100/Pt1000 inputs for temperature sensors.

### Sensor 2

The analog 0/4-20 mA input is used for the following functions:

- It monitors the measured value of the sensor 2 (default setting).
- The measured value of the sensor 2 is used for control purpose. This makes differential pressure control possible by using measurements from the sensor 1 and sensor 2 (setting by PC Tool).

### Temperature sensors 1 and 2

The analog Pt100/Pt1000 inputs are used for monitoring the following temperatures:

- drive-end motor bearing
- non-drive-end motor bearing
- other liquid 1
- other liquid 2
- motor windings
- pumped liquid
- ambient temperature.



## Displays

MCB 114 input	Displays	
	Reading	Setting
Sensor 2	2.5	3.16
Temperature sensor 1	2.12	3.21
Temperature sensor 2	2.13	3.22

## 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.

**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.

Voltage	Min. waiting time		
	4 minutes	15 minutes	20 minutes
200-240 V	0.75 - 3.7 kW (1 - 5 hp)	5.5 - 45 kW (7.5 - 60 hp)	
380-500 V	0.55 - 7.5 kW (0.75 - 10 hp)	11 - 90 kW (15 - 125 hp)	110 - 250 kW (150 - 350 hp)
525-600 V	0.75 - 7.5 kW (1 - 10 hp)	11 - 90 kW (15 - 125 hp)	
525-690 V			11 - 250 kW (15 - 350 hp)

**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).

#### **Related information**

[\*4. Installation requirements\*](#)



## 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	-	●	●



Number	Description	Warning	Alarm	Alarm, trip lock
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	(●)	(●)	-
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	(●)	(●) <sup>8)</sup>	-
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	-	●	●



Number	Description	Warning	Alarm	Alarm, trip lock
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 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	●	●	-

8) 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

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

CUE rated Voltage (V)	Power (hp)	Power (kW)	IP class	Frame size	RFI Filter
200-240V	1.5	1.1	IP55	A5	C1
	2	1.5	IP55	A5	C1
	3	2.2	IP55	A5	C1
	7.5	5.5	IP55	B1	C1
	10	7.5	IP55	B1	C1
	15	11	IP55	B1	C1
	20	15	IP55	B2	C1
	25	18.5	IP55	C1	C1
	30	22	IP55	C1	C1
	40	30	IP55	C1	C1
	50	37	IP55	C2	C1
	60	45	IP55	C2	C1
380-500V	50	37	IP55	C1	C1
	60	45	IP55	C1	C1
	75	55	IP55	C1	C1
	100	75	IP55	C2	C1
525-600V	1	0.75	IP55	A5	No RFI
	1.5	1.1	IP55	A5	No RFI
	2	1.5	IP55	A5	No RFI
	3	2.2	IP55	A5	No RFI
	7.5	5.5	IP55	A5	No RFI
	10	7.5	IP55	A5	No RFI
525-690V	20	15	IP55	B2	C3
	30	22	IP55	B2	C3
	40	30	IP55	B2	C3
	60	45	IP55	C2	C3
	75	55	IP55	C2	C3
	100	75	IP55	C2	C3

#### 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)



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

### 11.3 Mechanical data

#### 11.3.1 Cable glands

Select standard gland holes for CUE frequency converters used outside USA and Canada.

Select imperial gland holes for CUE frequency converters used in USA and Canada.

Enclosure	Standard gland holes	Imperial gland holes
A5 IP55 / NEMA type 12	6 x 26.3	6 x 28.4 (3/4")
B1 IP21 / NEMA type 1	2 x 22.5 (1/2")	2 x 22.5 (1/2")
	3 x 37.2	3 x 34.7 (1")
B1 IP55 / NEMA type 12	2 x 21.5	2 x 22.5 (1/2")
	1 x 26.3	1 x 28.4 (3/4")
	3 x 33.1	3 x 34.7 (1")
	1 x 21.5	1 x 22.5 (1/2")
B2 IP21 / NEMA type 1 and B2 IP55 / NEMA type 12	1 x 26.3	1 x 28.4 (3/4")
	1 x 33.1	1 x 34.7 (1")
	2 x 42.9	2 x 44.2 (1 1/4")

#### 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 <sup>2</sup> (14 AWG)
Maximum cable cross-section to signal terminals, flexible conductor	1.0 mm <sup>2</sup> (18 AWG)
Minimum cable cross-section to signal terminals	0.5 mm <sup>2</sup> (20 AWG)



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

Typical shaft power P2	Maximum fuse size	Fuse type	Maximum conductor cross-section <sup>9)</sup>
[kW (hp)]	[A]		[mm <sup>2</sup> ]
<b>3 x 200-240 V</b>			
0.75 (1)	10	gG	4
1.1 (1.5)	20	gG	4
1.5 (2)	20	gG	4
2.2 (3)	20	gG	4
3 (4)	32	gG	4
3.7 (5)	32	gG	4
5.5 (7.5)	63	gG	10
7.5 (10)	63	gG	10
11 (15)	63	gG	10
15 (20)	80	gG	35
18.5 (25)	125	gG	50
22 (30)	125	gG	50
30 (40)	160	gG	50
37 (50)	200	aR	95
45 (60)	250	aR	120
<b>3 x 380-500 V</b>			
0.55 (0.75)	10	gG	4
0.75 (1)	10	gG	4
1.1 (1.5)	10	gG	4
1.5 (2)	10	gG	4
2.2 (3)	20	gG	4
3 (4)	20	gG	4
4 (5)	20	gG	4
5.5 (7.5)	32	gG	4
7.5 (10)	32	gG	4
11 (15)	63	gG	10
15 (20)	63	gG	10
18.5 (25)	63	gG	10
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
75 (100)	250	aR	95
90 (125)	250	aR	120
110 (150)	300	gG	2 × 70
132 (200)	350	gG	2 × 70
160 (250)	400	gG	2 × 185

Typical shaft power P2	Maximum fuse size	Fuse type	Maximum conductor cross-section <sup>9)</sup>
200 (300)	500	gG	2 × 185
250 (350)	600	aR	2 × 185
<b>3 x 525-600 V</b>			
0.75 (1)	10	gG	4
1.1 (1.5)	10	gG	4
1.5 (2)	10	gG	4
2.2 (3)	20	gG	4
3 (4)	20	gG	4
4 (5)	20	gG	4
5.5 (7.5)	32	gG	4
7.5 (10)	32	gG	4
11 (15)	40	gG	10
15 (20)	40	gG	10
18.5 (25)	50	gG	10
22 (30)	60	gG	35
30 (40)	80	gG	35
37 (50)	100	gG	35
45 (60)	150	gG	50
55 (75)	160	gG	50
75 (100)	225	aR	150
90 (125)	250	aR	150
<b>3 x 525-690 V</b>			
11 (15)	63	gG	35
15 (20)	63	gG	35
18.5 (25)	63	gG	35
22 (30)	63	gG	35
30 (40)	63	gG	35
37 (50)	80	gG	95
45 (60)	100	gG	95
55 (75)	125	gG	95
75 (100)	160	gG	95
90 (125)	160	gG	95
110 (150)	225	-	2 × 70
132 (200)	250	-	2 × 70
160 (250)	350	-	2 × 70
200 (300)	400	-	2 × 185
250 (350)	500	-	2 × 185

<sup>9)</sup> Screened motor cable, unscreened supply cable.

#### Related information

##### [11.4 Electrical data](#)



## 11.3.5 UL fuses and conductor cross-sections to mains and motor, for installations in North America

Typical shaft power P2	Fuse type							Maximum conductor cross-section
	Bussmann			SIBA	Littel Fuse	Ferraz-Shawmut		
	RK1/E1958/ JFHR2	J/E4273 T/ JDDZ	T/E4274 H/ JDDZ	RK1/ Bussmann E125085 JFHR2	RK1/SIBA E180276 RKI/ JDDZ	CC/Littel Fuse E71611 JFHR2	RK1/E60314 JFHR2	
[kW (hp)]								[AWG]
3 x 200-240 V								
0.75 (1)	KTN-R10	JKS-10	JJN-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.1 (1.5)	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
1.5 (2)	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
2.2 (3)	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
3 (4)	KTN-R30	JKS-30	JJN-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
3.7 (5)	KTN-R30	JKS-30	JJN-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
5.5 (7.5)	KTN-R50	JKS-50	JJN-50	5012406-050	KLN-R50	-	A2K-50R	7
7.5 (10)	KTN-R50	JKS-60	JJN-60	5012406-050	KLN-R60	-	A2K-50R	7
11 (15)	KTN-R60	JKS-60	JJN-60	5014006-063	KLN-R60	A2K-60R	A2K-60R	7
15 (20)	KTN-R80	JKS-80	JJN-80	5014006-080	KLN-R80	A2K-80R	A2K-80R	2
18.5 (25)	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R	1/0
22 (30)	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R	1/0
30 (40)	FWX-150	-	-	2028220-150	L25S-150	A25X-150	A25X-150	1/0
37 (50)	FWX-200	-	-	2028220-200	L25S-200	A25X-200	A25X-200	4/0
45 (60)	FWX-250	-	-	2028220-250	L25S-250	A25X-250	A25X-250	250 MCM
3 x 380-500 V								
0.55 (0.75)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
0.75 (1)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.1 (1.5)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.5 (2)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.2 (3)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
3 (4)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
4 (5)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
5.5 (7.5)	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
7.5 (10)	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
11 (15)	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	-	A6K-40R	7
15 (20)	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	-	A6K-40R	7
18.5 (25)	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	-	A6K-50R	7
22 (30)	KTS-R60	JKS-60	JJS-60	5014006-063	KLS-R60	-	A6K-60R	2
30 (40)	KTS-R80	JKS-80	JJS-80	2028220-100	KLS-R80	-	A6K-80R	2
37 (50)	KTS-R100	JKS-100	JJS-100	2028220-125	KLS-R100	-	A6K-100R	1/0
45 (60)	KTS-R125	JKS-150	JJS-150	2028220-125	KLS-R125	-	A6K-125R	1/0
55 (75)	KTS-R150	JKS-150	JJS-150	2028220-160	KLS-R150	-	A6K-150R	1/0
75 (100)	FWH-220	-	-	2028220-200	L50S-225	-	A50-P225	4/0
90 (125)	FWH-250	-	-	2028220-250	L50S-250	-	A50-P250	250 MCM
110 (150)	FWH-300	JJS-300	NOS-300	170M3017	2028220-38	L50S-300	A50-P300	2 x 2/0
132 (200)	FWH-350	JJS-350	NOS-350	170M3018	2028220-38	L50S-350	A50-P350	2 x 2/0
160 (250)	FWH-400	JJS-400	NOS-400	170M4012	206xx32-400	L50S-400	A50-P400	2 x 350 MCM
200 (300)	FWH-500	JJS-500	NOS-500	170M4014	206xx32-500	L50S-500	A50-P500	2 x 350 MCM
250 (350)	FWH-600	JJS-600	NOS-600	170M4016	206xx32-600	L50S-600	A50-P600	2 x 350 MCM



Typical shaft power P2	Fuse type							Maximum conductor cross-section
	Bussmann			SIBA	Littel Fuse	Ferraz-Shawmut		
[kW (hp)]	RK1/E1958/ JFHR2	J/E4273 T/ JDDZ	T/E4274 H/ JDDZ	RK1/ Bussmann E125085 JFHR2	RK1/SIBA E180276 RK1/ JDDZ	CC/Littel Fuse E71611 JFHR2	RK1/E60314 JFHR2	[AWG]
-	-	-	-	Bussmann E125085 JFHR2	SIBA E180276 JFHR2	-	Ferraz- Shawmut E76491 JFHR2	-
3 x 525-600 V								
0.75 (1)	KTS-R-5	JKS-5	JJS-6	5017906-005	KLS-R-005	-	A6K-5-R	12
1.1 (1.5)	KTS-R-10	JKS-5	JJS-6	5017906-005	KLS-R-005	-	A2K-5-R	12
1.5 (2)	KTS-R-10	JKS-10	JJS-10	5017906-010	KLS-R-010	-	A2K-10-R	12
2.2 (3)	KTS-R-10	JKS-10	JJS-10	5017906-010	KLS-R-010	-	A2K-10-R	12
3 (4)	KTS-R-15	JKS-15	JJS-15	5017906-016	KLS-R-020	-	A2K-15-R	12
4 (5)	KTS-R-20	JKS-20	JJS-20	5017906-020	KLS-R-020	-	A2K-20-R	12
5.5 (7.5)	KTS-R-25	JKS-25	JJS-25	5017906-025	KLS-R-030	-	A2K-25-R	12
7.5 (10)	KTS-R-30	JKS-30	JJS-30	5017906-030	KLS-R-030	-	A2K-30-R	12
11 (15)	KTS-R-35	JKS-35	JJS-35	5014006-040	KLS-R-035	-	A6K-35-R	8
15 (20)	KTS-R-35	JKS-35	JJS-35	5014006-040	KLS-R-035	-	A6K-35-R	8
18.5 (25)	KTS-R-45	JKS-45	JJS-45	5014006-050	KLS-R-045	-	A6K-45-R	8
22 (30)	KTS-R-50	JKS-50	JJS-50	5014006-050	KLS-R-050	-	A6K-50-R	2
30 (40)	KTS-R-60	JKS-60	JJS-60	5014006-063	KLS-R-060	-	A6K-60-R	2
37 (50)	KTS-R-80	JKS-80	JJS-80	5014006-080	KLS-R-075	-	A6K-80-R	2
45 (60)	KTS-R-100	JKS-100	JJS-100	5014006-100	KLS-R-100	-	A6K-100-R	1
55 (75)	KTS-R-125	JKS-125	JJS-125	2028220-125	KLS-R-125	-	A6K-125-R	1
75 (100)	KTS-R150	JKS-150	JJS-150	2028220-150	KLS-R-150	-	A6K-150-R	300 MCM
90 (125)	KTS-R175	JKS-175	JJS-175	2028220-200	KLS-R-175	-	A6K-175-R	300 MCM
3 x 525-690 V								
11 (15)	KTS-R-25	JKS-25	JJS-25	5017906-025	KLS-R-025	HST25	A6K-25R	1/0
15 (20)	KTS-R-30	JKS-30	JJS-30	5017906-030	KLS-R-030	HST30	A6K-30R	1/0
18.5 (25)	KTS-R-45	JKS-45	JJS-45	5014006-050	KLS-R-045	HST45	A6K-45R	1/0
22 (30)	KTS-R-45	JKS-45	JJS-45	5014006-050	KLS-R-045	HST45	A6K-45R	1/0
30 (40)	KTS-R-60	JKS-60	JJS-60	5014006-063	KLS-R-060	HST60	A6K-60R	1/0
37 (50)	KTS-R-80	JKS-80	JJS-80	5014006-080	KLS-R-075	HST80	A6K-80R	1/0
45 (60)	KTS-R-90	JKS-90	JJS-90	5014006-100	KLS-R-090	HST90	A6K-90R	1/0
55 (75)	KTS-R-100	JKS-100	JJS-100	5014006-100	KLS-R-100	HST100	A6K-100R	1/0
75 (100)	KTS-R-125	JKS-125	JJS-125	2028220-125	KLS-R-125	HST125	A6K-125R	1/0
90 (125)	KTS-R-150	JKS-150	JJS-150	2028220-150	KLS-R-150	HST150	A6K-150R	1/0
110 (150)	-	-	-	170M3017	2061032.38	-	6.6URD30D08 A038	2 x 2/0
132 (200)	-	-	-	170M3018	2061032.350	-	6.6URD30D08 A0350	2 x 2/0
160 (250)	-	-	-	170M4011	2061032.350	-	6.6URD30D08 A0350	2 x 2/0
200 (300)	-	-	-	170M4012	2061032.350	-	6.6URD30D08 A0400	2 x 350 MCM
250 (350)	-	-	-	170M4014	2061032.500	-	6.6URD30D08 A0500	2 x 350 MCM

10) Screened motor cable, unscreened supply cable.

11) American Wire Gauge.



## 11.4 Electrical data

### Mains supply (L1, L2, L3)

Supply voltage	200-240 V $\pm$ 10 %
Supply voltage	460-500 V $\pm$ 10 %
Supply voltage	575-600 V $\pm$ 10 %
Supply voltage	575-690 V $\pm$ 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, enclosure A	Max. 2 times/min
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 k $\Omega$

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)	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

<sup>12)</sup> 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"
Voltage range	0-10 V

Input resistance, $R_i$	Approx. 10 k $\Omega$
Maximum voltage	$\pm$ 20 V
Current signal	A53 = "I"
Current range	0-20, 4-20 mA
Input resistance, $R_i$	Approx. 200 $\Omega$
Maximum current	30 mA
Maximum fault, terminals 53, 54	0.5 % of full scale
Analog input 2, terminal number	54
Current signal	A54 = "I"
Current range	0-20, 4-20 mA
Input resistance, $R_i$	Approx. 200 $\Omega$
Maximum current	30 mA
Maximum fault, terminals 53, 54	0.5 % of full scale

<sup>13)</sup> 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 $\Omega$
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 $\Omega$
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-sections 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
Safety standards	Safety of machinery	EN 61800-5-1
		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	<b>IOS 13849-1</b>	
	Category	Cat 3
	Diagnostic Coverage	DC: 90 %, medium
	Mean Time to Dangerous Failure	MTTFd: 14000 years, high
	Performance Level	PL d
	<b>IEC 61508 / IEC 62061</b>	
	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 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](http://www.grundfos.com/product-recycling).

## 13. Document quality feedback

To provide feedback about this document, use your smart device to scan the QR code.



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## Limited consumer warranty

### 1. Limited consumer warranty

This Limited Warranty is provided for Consumer Products sold in the United States only and applies to Consumer Transactions as defined in and applicable under the Magnusson-Moss Warranty Act and any other applicable Federal and/or State laws. In case of non-Consumer Products, please refer to Grundfos' warranty terms defined in clause 10 of Grundfos US Terms and Conditions of Sale of Product and Services available at <https://www.grundfos.com/legal/grundfos-customer-terms/usa-grundfos-general-terms-for-sales-of-products-and-services>

**This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from State to State.**

New products manufactured by Grundfos are warranted to the original purchaser only and are to be free from defects in design, material and workmanship under normal use and service for no greater than a period of thirty (30) months from the date of manufacture which is set forth on the product's nameplate and on the product's packaging or the minimum period required by the applicable State law. For New Jersey, the applicable period is one year from the date of purchase.

The warranty period for replacement products, parts and components expires thirty (30) months from the original date of manufacture of the product originally purchased, unless a longer period is required under the applicable State law. For New Jersey, the warranty period for replacement products, parts and components expires one year from the original date of purchase of the product, not the date of replacement.

Products sold by Grundfos that are manufactured by others are not covered by this warranty.

**Note that when purchasing a Grundfos product online, it is important to check the date of manufacture and the duration of the warranty with the seller as the product might no longer be covered under this Limited Warranty.**

**When a product is subject to this Limited Warranty a purchaser should contact the seller from which it purchased the product to make a claim.**

If the seller of a product is no longer in business, the purchaser should contact a Grundfos Authorized Service Partner, which can be found at [www.grundfos.com/us](http://www.grundfos.com/us) under > Support > Contact Service.

As part of making a claim, a purchaser shall return a defective product at the purchaser's cost, to the extent allowed by applicable law, along with proof of purchase and an explanation of the defect, date the defect occurred and circumstances surrounding the defect. For New Jersey there is no prohibition on returning a defective product at a purchaser's cost. If Grundfos is required by applicable State law to pay for the cost of shipment under applicable State law, then a purchaser should contact a Grundfos Authorized Service Partner to arrange for shipment. A purchaser also needs to promptly respond to Grundfos as to any inquiries regarding a warranty claim.

**Grundfos' liability under this Limited Warranty to purchaser is limited to the repair or replacement of a product (at Grundfos' decision) that is the sole and exclusive remedy for purchaser to the extent permissible by applicable law.** For New Jersey this limitation is permissible.

This warranty does not cover the following: ordinary wear and tear; use of a product for applications for which it is not intended; use of a product in an unsuitable environment; modifications, alterations or repair undertaken by anyone not acting with Grundfos' written authorization; failure to follow Grundfos' instructions, operations manuals, any other guidelines or good industry practice; use of faulty or inadequate ancillary equipment in combination with a product; application of spare or replacement parts not provided or authorized by Grundfos; accidental or intentional damage or misuse of a product.

The time period for making a claim under the implied warranty of merchantability and implied warranty of fitness are limited to the same time period as provided by this warranty to the extent permissible by applicable law. For residents of New Jersey, this limitation is permissible, but note that some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

**Grundfos shall not be liable for any incidental and consequential damages in connection with a product to the extent permissible by applicable law.** For residents of New Jersey, this limitation is permissible, but note that some states do not allow limitations of incidental or consequential damages, so the above limitation may not apply to you.



## 2. Garantía limitada del consumidor

Esta garantía limitada se proporciona únicamente para los productos de consumo vendidos en los Estados Unidos y es aplicable a las transacciones de consumo tal y como se define en y resulta aplicable en virtud de la ley de Garantías Magnusson-Moss y cualquier otra legislación federal y/o estatal aplicable. Para el caso de productos que no sean de consumo, consulte los términos de la garantía de Grundfos definidos en la cláusula 10 de los términos y condiciones de venta de productos y servicios de Grundfos para los EE. UU., disponibles en <https://www.grundfos.com/legal/grundfos-customer-terms/usa-grundfos-general-terms-for-sales-of-products-and-services>.

**Esta garantía limitada le confiere derechos legales específicos. Puede que también tenga otros derechos en virtud de su jurisdicción estatal.**

Se garantiza únicamente al comprador original que los productos fabricados por Grundfos estarán libres de defectos de diseño, materiales y mano de obra en condiciones normales de uso y servicio durante un periodo no mayor a treinta (30) meses a partir de la fecha de fabricación que figura en la placa de datos del producto y en el empaque del mismo o el periodo mínimo exigido por la legislación estatal aplicable. Para Nueva Jersey, el periodo aplicable es de un año a partir de la fecha de compra.

El periodo de garantía para los productos, partes y componentes de repuesto vence a los treinta (30) meses contados a partir de la fecha de fabricación original del producto adquirido en primer lugar, a menos que la legislación estatal aplicable exija un periodo más largo. Para Nueva Jersey, el periodo de garantía de los productos, partes y componentes de repuesto vence un año contado a partir de la fecha original de compra del producto, no de la fecha de sustitución.

Los productos vendidos por Grundfos que sean producidos por otros fabricantes no están cubiertos por esta garantía.

**Tenga en cuenta que, al comprar un producto Grundfos en línea, es importante revisar la fecha de fabricación y la duración de la garantía con el vendedor, ya que es posible que el producto ya no esté cubierto por esta garantía limitada.**

**Cuando un producto esté sujeto a esta garantía limitada, el comprador deberá ponerse en contacto con el vendedor al que haya comprado el producto para presentar una reclamación.**

Si el vendedor de un producto ya no está en el negocio, el comprador debe ponerse en contacto con socio de servicio autorizado por Grundfos, que puede encontrar en la dirección [www.grundfos.com/us](http://www.grundfos.com/us), en la sección "Support" > "Contact Service".

Como parte de la presentación de una reclamación, el comprador deberá devolver el producto descompuesto a su costa, en la medida en la que lo permita la legislación aplicable, junto con el comprobante de compra y una explicación del defecto, la fecha en que este se haya producido y las circunstancias en torno al defecto. En Nueva Jersey no existe ninguna prohibición de devolver un producto descompuesto a costa del comprador. Si la legislación estatal aplicable obliga a Grundfos a hacerse cargo de los gastos de envío, el comprador deberá ponerse en contacto con un servicio técnico autorizado por Grundfos para organizar el envío. El comprador también debe responder con prontitud a Grundfos cualquier consulta relacionada con una reclamación de garantía.

**La responsabilidad de Grundfos hacia el comprador en virtud de esta garantía limitada se limita a la reparación o sustitución de un producto (a decisión de Grundfos), que es el único y exclusivo remedio para el comprador en la medida permitida por la legislación aplicable.** Para Nueva Jersey, esta limitación resulta permisible.

Esta garantía no cubre lo siguiente: el desgaste ordinario; el uso de un producto para aplicaciones para las que no está diseñado; el uso de un producto en un entorno inadecuado; las modificaciones, alteraciones o reparaciones realizadas por cualquier persona que no actúe con la autorización por escrito de Grundfos; el incumplimiento de las instrucciones, manuales de operación, cualquier otro lineamiento o las buenas prácticas industriales de Grundfos; el uso de equipos auxiliares descompuestos o inadecuados en combinación con un producto; el uso de repuestos o partes de sustitución no proporcionados ni autorizados por Grundfos; el daño accidental o deliberado o el uso indebido de un producto.

El periodo para presentar una reclamación en virtud de la garantía implícita de comerciabilidad y la garantía implícita de idoneidad se limita al mismo periodo previsto por esta garantía en la medida permitida por la legislación aplicable. Para los residentes de Nueva Jersey, esta limitación resulta permisible, si bien se debe tener en cuenta que algunos estados no permiten limitaciones en cuanto a la duración de una garantía implícita, por lo que la limitación anterior puede no resultar aplicable en su caso.

**Grundfos no será responsable de ningún daño indirecto o consecuente en relación con un producto en la medida en la que lo permita la legislación aplicable.** Para los residentes de Nueva Jersey, esta limitación resulta permisible, si bien debe tenerse en cuenta que algunos estados no permiten limitaciones en cuanto a daños indirectos o consecuentes, por lo que la limitación anterior puede no resultar aplicable en su caso.



## Limited manufacturer's warranty

### 1. Limited manufacturer's warranty

This Limited Manufacturer's Warranty outlines applicable coverage and claims procedures for the pumps manufactured by Grundfos (the "Product").

This Limited Manufacturer's Warranty is provided for consumer products sold and used in Canada only and applies to consumer transactions as defined in the applicable provincial and territorial laws. In case of non-consumer products, please refer to Grundfos' warranty terms defined in clause 10 of Grundfos Canada Terms and Conditions of Sale of Product and Services available at: <https://www.grundfos.com/ca/legal/general-terms-and-conditions-of-sales-and-delivery>

This Limited Manufacturer's Warranty provides specific rights and limitations. Some of the limitations may not apply to you, and you may also have other rights that vary from province to province.

#### Scope of the Limited Manufacturer's Warranty

Subject to the following warranty terms and conditions, Grundfos Canada Inc. of 2941 Brighton Rd, Oakville, ON L6H 6C9, Canada ("Grundfos"), warrants to the original consumer (the "Purchaser") that the new Product manufactured by Grundfos is free from defects in design, material and workmanship under normal use and service for a period of twenty-four (24) months from the date of retail purchase but no greater than a period of thirty (30) months from the date of manufacture which is set forth on the Product's nameplate and on the Product's packaging (the "Warranty Period").

**Note that when purchasing a Grundfos Product online, it is important to check the date of manufacture and the duration of the warranty with the seller as the Product might no longer be covered under this Limited Manufacturer's Warranty.**

This Limited Manufacturer's Warranty applies exclusively to a new Grundfos Product sold and used in Canada. This Limited Manufacturer's Warranty does not apply to any Product sold "as is" or "sales final". This Limited Manufacturer's Warranty is not transferrable by the original Purchaser. Products sold by Grundfos that are manufactured by others are not covered by this warranty.

The sole and exclusive remedy under this Limited Manufacturer's Warranty is the repair or, at the discretion of Grundfos, the replacement of the Product, as set out below. Defects or damages are not covered by the Limited Manufacturer's Warranty if they are due to:

- ordinary wear and tear;
- use of the Product for an application for which it is not intended;
- installation of the Product in an environment not suitable for the Product;
- any modification, alteration or repair of the Product undertaken by the Purchaser or a third party (not acting on Grundfos' behalf);
- failure to follow Grundfos' instructions, including in the installation manual, operation manual, maintenance manual or service manual;
- installation, commissioning, operation (including the use of the Product or any Grundfos product outside its specifications) or maintenance of the Product other than in accordance with Grundfos installation manual, operation manual, maintenance manual or service manual or with good industry practice;
- use of faulty or inadequate ancillary equipment in combination with the Product;
- the application of spare parts of poor quality (excluding the application of any Grundfos original spare parts);
- accidental or intentional damage or misuse of the Products or services by the Purchaser or a third party (not acting on Grundfos' behalf); or
- the non-compliance of the Purchaser or of the Purchaser's own products with applicable law and regulation.

#### How to get service under the Limited Manufacturer's Warranty:

When a Product is subject to this Limited Manufacturer's Warranty, the Purchaser should contact the seller from which it purchased the Product to make a claim within 24 months from the date of retail purchase but no later than thirty (30) months from the date of manufacture which is set forth on the Product's nameplate and on the Product's packaging (the "Warranty Notification Period").

If the seller of a Product is no longer in business, the Purchaser should contact Grundfos Service at [www.grundfos.com/us](http://www.grundfos.com/us) under **Support > Contact Service**.

To exercise the rights under this Limited Manufacturer's Warranty, the Purchaser shall return a defective Product at the Purchaser's cost, to the extent allowed by applicable law, along with proof of purchase and an explanation of the defect, date the defect occurred and circumstances surrounding the defect.

The Purchaser is responsible for any expenses for dismounting and mounting the Product and for any and costs related to removal, reinstallation, transportation, and insurance. If Grundfos is required by applicable provincial or territorial law to pay for the cost of transportation, then the Purchaser should contact Grundfos Service Partner to arrange for shipment. The Purchaser also needs to promptly respond to Grundfos as to any inquiries regarding a warranty claim.

Unless requested by Grundfos, the Product may not be disassembled prior to remedy. Any failure to comply herewith will render this Limited Manufacturer's Warranty void.

Grundfos will either arrange the repair of the defective Product under this Limited Manufacturer's Warranty or, at Grundfos' option, provide the Purchaser with a replacement of the defective Product. The replacement unit can be new or remanufactured.

**To the extent permissible by applicable law, Grundfos shall not be liable for any incidental and consequential damages or losses of any kind whatsoever arising under, relating to or in connection with the Product, use of the Product or the inability to use the Product.**



## 2. Garantie limitée du fabricant

Cette garantie limitée du fabricant décrit la couverture applicable et les procédures de réclamation pour les pompes fabriquées par Grundfos (ci-après le « Produit »).

Cette garantie limitée du fabricant est fournie pour les produits de consommation vendus et utilisés au Canada uniquement et s'applique aux transactions de consommateurs telles que définies dans les lois provinciales et territoriales applicables. Dans le cas de produits non destinés aux consommateurs, se référer aux conditions de garantie de Grundfos définies à l'article 10 des Conditions générales de vente des produits et services de Grundfos Canada, qui sont disponibles à l'adresse suivante : <https://www.grundfos.com/ca/fr/legal/general-terms-and-conditions-of-sales-and-delivery>

Cette garantie limitée du fabricant prévoit des droits et des limitations spécifiques. Certaines des limitations peuvent ne pas s'appliquer à vous, et vous pouvez également bénéficier d'autres droits qui varient d'une province à l'autre.

### Champ d'application de la garantie limitée du fabricant

Sous réserve des conditions générales de garantie suivantes, Grundfos Canada Inc., dont le siège social est situé au 2941, Brighton Rd, Oakville, ON L6H 6C9, Canada (ci-après « Grundfos »), garantit au consommateur initial (ci-après « l'Acheteur ») que le nouveau Produit fabriqué par Grundfos est exempt de défauts de conception, de matériaux et de fabrication dans des conditions normales d'utilisation et d'entretien pendant une période de vingt-quatre (24) mois à compter de la date d'achat au détail, mais pas plus de trente (30) mois à compter de la date de fabrication indiquée sur la plaque signalétique et sur l'emballage du Produit (« Période de garantie »).

**Lors de l'achat d'un Produit Grundfos en ligne, il est important de vérifier la date de fabrication et la durée de la garantie auprès du vendeur, car le Produit pourrait ne plus être couvert par cette garantie limitée du fabricant.**

Cette garantie limitée du fabricant s'applique exclusivement à un Produit Grundfos neuf vendu et utilisé au Canada. Cette garantie limitée du fabricant ne s'applique pas aux Produits vendus « en l'état » ou « vente finale ». La présente garantie limitée du fabricant n'est pas transférable par l'Acheteur initial. Les produits vendus par Grundfos qui sont fabriqués par des tiers ne sont pas couverts par cette garantie.

Le seul et unique recours dans le cadre de cette garantie limitée du fabricant est la réparation ou, à la discrétion de Grundfos, le remplacement du Produit, comme indiqué ci-dessous. Les défauts ou dommages ne sont pas couverts par la garantie limitée du fabricant s'ils sont dus à :

- l'usure normale ;
- l'utilisation du Produit pour une application pour laquelle il n'est pas prévu ;
- l'installation du Produit dans un environnement non adapté au Produit ;
- toute modification, altération ou réparation du Produit entreprise par l'Acheteur ou un tiers (n'agissant pas pour le compte de Grundfos) ;
- la non-observation des instructions de Grundfos, y compris dans les notices d'installation, d'utilisation, de maintenance ou d'entretien ;
- l'installation, la mise en service, l'utilisation (y compris l'utilisation du Produit ou de tout produit Grundfos en dehors de ses spécifications) ou l'entretien du Produit autrement que conformément aux notices d'installation, d'utilisation, de maintenance ou d'entretien Grundfos ou aux bonnes pratiques de l'industrie ;
- l'utilisation d'un équipement auxiliaire défectueux ou inadéquat en combinaison avec le Produit ;
- l'utilisation de pièces de rechange de mauvaise qualité (à l'exclusion de l'utilisation de pièces de rechange d'origine Grundfos) ;
- tout dommage accidentel ou intentionnel ou toute mauvaise utilisation des Produits ou des services par l'Acheteur ou un tiers (n'agissant pas pour le compte de Grundfos) ; ou
- la non-conformité de l'Acheteur ou de ses propres produits aux lois et règlements applicables.

### Procédure à suivre pour bénéficier d'un service dans le cadre de la garantie limitée du fabricant :

Lorsqu'un Produit est soumis à la présente garantie limitée du fabricant, l'Acheteur doit contacter le vendeur auprès duquel il a acheté le produit pour faire une réclamation dans les 24 mois suivant la date d'achat au détail, mais au plus tard trente (30) mois à compter de la date de fabrication indiquée sur la plaque signalétique du Produit et sur l'emballage du Produit (« Période de notification de garantie »).

Si le vendeur d'un Produit n'est plus en activité, l'Acheteur doit contacter le service Grundfos à l'adresse [www.grundfos.com/us](http://www.grundfos.com/us) sous **Support > Contact Service**.

Pour exercer les droits prévus par la présente garantie limitée du fabricant, l'Acheteur doit renvoyer le Produit défectueux à ses frais, dans la mesure où la loi applicable le permet, accompagné de la preuve d'achat et d'une explication du défaut, de la date à laquelle le défaut s'est produit et des circonstances entourant le défaut.

L'Acheteur est responsable de tous les frais de démontage et de montage du Produit et de tous les frais liés à l'enlèvement, à la réinstallation, au transport et à l'assurance. Si Grundfos est tenu par la loi provinciale ou territoriale applicable de payer les frais de transport, l'Acheteur doit contacter le partenaire de service Grundfos pour organiser l'expédition. L'Acheteur doit également répondre rapidement à Grundfos pour toute demande concernant une réclamation au titre de la garantie.

Sauf demande de Grundfos, le Produit ne doit pas être démonté avant d'être remis en état. Tout manquement à ces dispositions entraînera l'annulation de la présente garantie limitée du fabricant.

Grundfos procédera à la réparation du Produit défectueux dans le cadre de cette garantie limitée du fabricant ou, à la convenance de Grundfos, fournira à l'Acheteur un produit de remplacement du Produit défectueux. L'unité de remplacement peut être neuve ou refabriquée.

**Dans la mesure autorisée par la loi applicable, Grundfos ne sera pas responsable des dommages accessoires et indirects ou des pertes de quelque nature que ce soit découlant de, liés à ou en rapport avec le Produit, l'utilisation du Produit ou l'incapacité d'utiliser le Produit.**



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