CUE, 0.55 - 90 kW

Installation and operating instructions

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Original installation and operating instructions

CONTENTS

Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury.

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

Note — Notes or instructions that make the job easier and ensure safe operation.

2. Introduction

This manual introduces all aspects of your Grundfos CUE frequency converter in the power range of 0.55 to 90 kW.

Always keep this manual close to the CUE.

2.1 General description

CUE is a series of external frequency converters especially designed for pumps.

Thanks to the startup guide in the CUE, the installer can quickly set central parameters and put the CUE into operation.

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

Caution — If the pump speed exceeds the rated speed, the pump will be overloaded.

2.2 Applications

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

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

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

2.3 References

Technical documentation for Grundfos CUE:

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

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

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

3. Safety and warnings

3.1 Warning

Warning

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

Warning

Touching the electrical parts may be fatal, even after the CUE has been switched off.

Before performing any work on the CUE, the mains supply and other input voltages must be switched off at least for as long as stated below.

Voltage	Min. waiting time		
	4 minutes	15 minutes	20 minutes
200-240 V	0.75 - 3.7 kW	5.5 - 45 kW	
380-500 V	0.55 - 7.5 kW	11-90 kW	
525-600 V	0.75 - 7.5 kW		
525-690 V			11-90 kW

Wait only for shorter time if stated so on the nameplate of the CUE in question.

3.2 Safety regulations

- The on/off button of the control panel does not disconnect the CUE from the power supply and must therefore not be used as a safety switch.
- The CUE must be earthed correctly and protected against indirect contact according to local regulations.
- The leakage current to 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.
- Always observe local regulations as to cable cross-section, short-circuit protection and overcurrent protection.

3.3 Installation requirements

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).

3.3.1 IT mains

Warning

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

3.3.2 Aggressive environment

Caution

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

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

3.4 Reduced performance under certain conditions

The CUE will reduce its performance under these conditions:

- low air pressure (at high altitude)
- long motor cables.

The required measures are described in the next two sections.

3.4.1 Reduction at low air pressure

Warning

At altitudes above 2000 m, the PELV requirements cannot be met.

PELV = Protective Extra Low Voltage.

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

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

3.4.2 Reduction in connection with long motor cables

The maximum cable length for the CUE is 300 m for unscreened and 150 m for screened cables. In case of longer cables, contact Grundfos.

The CUE is designed for a motor cable with a maximum cross-section as stated in section *16.7 Fuses and cable cross-section*.

4. Identification

4.1 Nameplate

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

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Fig. 1 Example of nameplate

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

4.2 Packaging label

The CUE can also be identified by means of the label on the packaging.

5. Mechanical installation

The individual CUE cabinet sizes are characterised by their enclosures. The table in section *16.1 Enclosure* shows the relationship between enclosure class and enclosure type.

5.1 Receipt and storage

Check on receipt that the packaging is intact, and the unit is complete. In case of damage during transport, contact the transport company to complain.

Note that the CUE is delivered in packaging which is not suitable for outdoor storage.

5.2 Transportation and unpacking

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

The packaging contains accessory bag(s), documentation and the unit itself. See fig. 2.

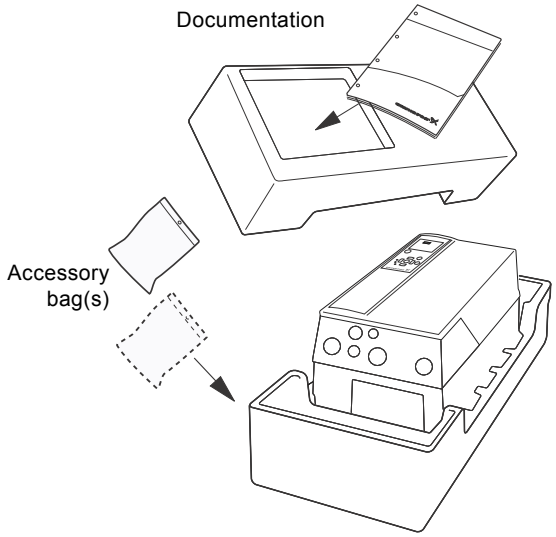

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Fig. 2 CUE packaging

5.3 Space requirements and air circulation

CUE units can be mounted side by side, but as a sufficient air circulation is required for cooling, these requirements must be met:

- Sufficient free space above and below the CUE. See table below.
- Ambient temperature up to 50 °C.
- Hang the CUE directly on the wall, or fit it with a back plate. See fig. 3.

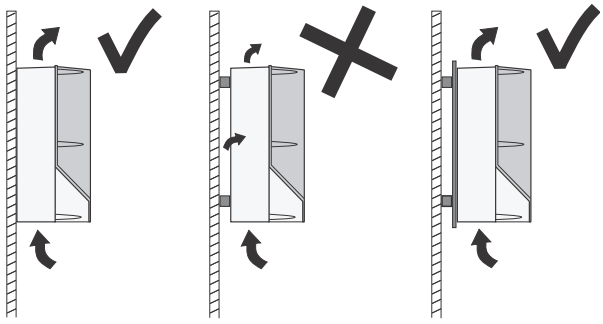

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Fig. 3 CUE hung directly on the wall or fitted with a back plate

Required free space above and below the CUE

Enclosure	Space [mm]
A2, A3, A4, A5	100
B1, B2, B3, B4, C1, C3	200
C2, C4	225

For information about enclosures, see table in section *16.1 Enclosure*.

5.4 Mounting

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

1. Mark and drill holes. See section *16.3 Main dimensions and weights*.
2. Fit the screws, but leave loose. Mount the CUE, and tighten the four screws.

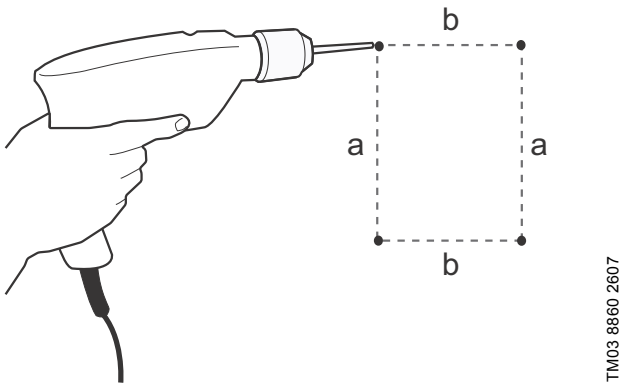


Fig. 4 Drilling of holes

6. Electrical connection

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

Warning
Before making any work on the CUE, the mains supply and other voltage inputs must be switched off for at least as long as stated in section *3. Safety and warnings*.

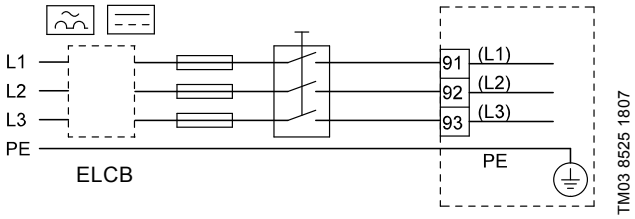


Fig. 5 Example of three-phase mains connection of the CUE with mains switch, backup fuses and additional protection

6.1 Electrical protection

6.1.1 Protection against electric shock, indirect contact

Warning
The CUE must be earthed correctly and protected against indirect contact according to local regulations.

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

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

Instructions according to EN IEC 61800-5-1:

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

6.1.2 Protection against short-circuit, fuses

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

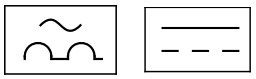
Grundfos demands that the backup fuses mentioned in section *16.7 Fuses and cable cross-section* are used for protection against short-circuit.

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

6.1.3 Additional protection

Caution The leakage current to earth exceeds 3.5 mA.

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



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 the CUE in normal operation can be seen in section *16.8.1 Mains supply (L1, L2, L3)*.

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

6.1.4 Motor protection

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

6.1.5 Protection against overcurrent

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

6.1.6 Protection against mains voltage transients

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

6.2 Mains and motor connection

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

6.2.1 Mains switch

A mains switch can be installed before the CUE according to local regulations. See fig. 5.

6.2.2 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.

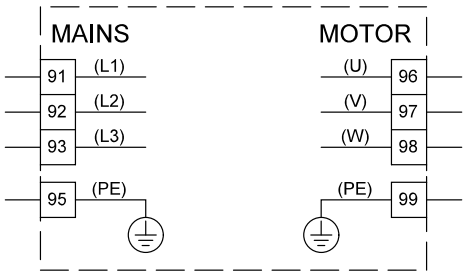


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Fig. 6 Wiring diagram, three-phase mains connection

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

Note For single-phase connection, use L1 and L2.

6.2.3 Mains connection, enclosures A2 and A3

For information about enclosures, see table in section *16.1 Enclosure*.

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

1. Fit the mounting plate with two screws.

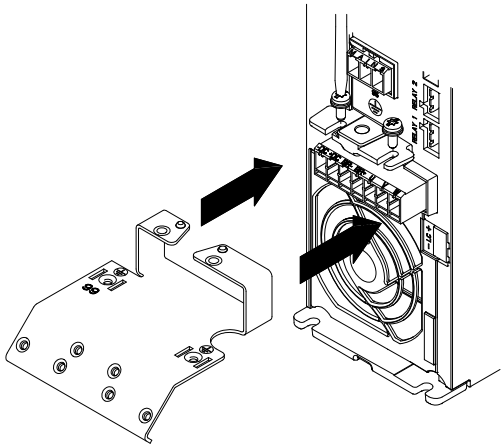

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Fig. 7 Fitting the mounting plate

2. Connect the earth conductor to terminal 95 (PE) and the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3) of the mains plug. Put the mains plug into the socket marked "MAINS".

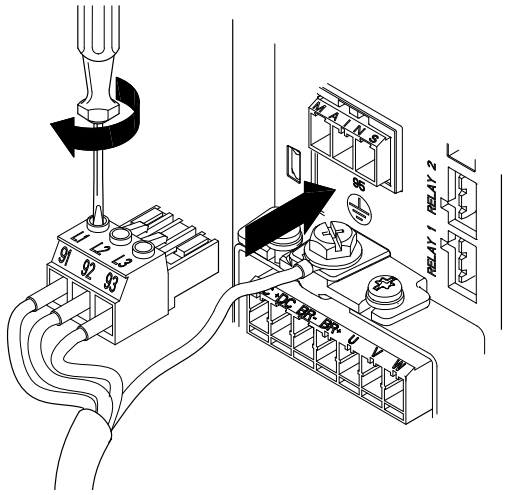

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Fig. 8 Connecting the earth conductor and mains conductors

Note For single-phase connection, use L1 and L2.

3. Fix the mains cable to the mounting plate.

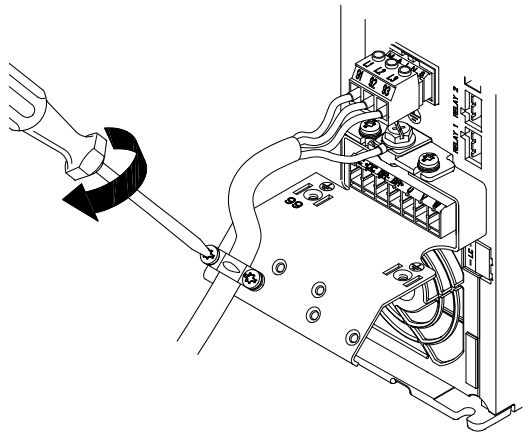

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Fig. 9 Fixing the mains cable

6.2.4 Motor connection, enclosures A2 and A3

For information about enclosures, see table in section *16.1 Enclosure*.

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

1. Connect the earth conductor to terminal 99 (PE) on the mounting plate. Connect the motor conductors to terminals 96 (U), 97 (V), 98 (W) of the motor plug.

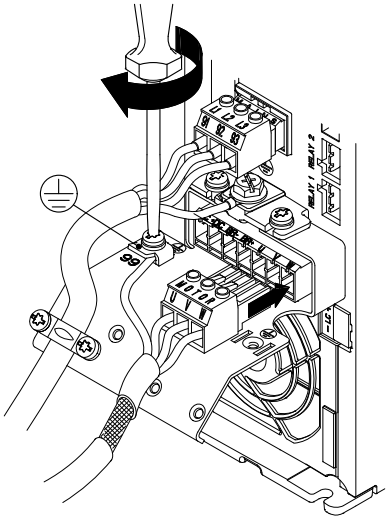

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Fig. 10 Connecting the earth conductor and motor conductors

2. Put the motor plug into the socket marked "MOTOR". Fix the screened cable to the mounting plate with a cable clamp.

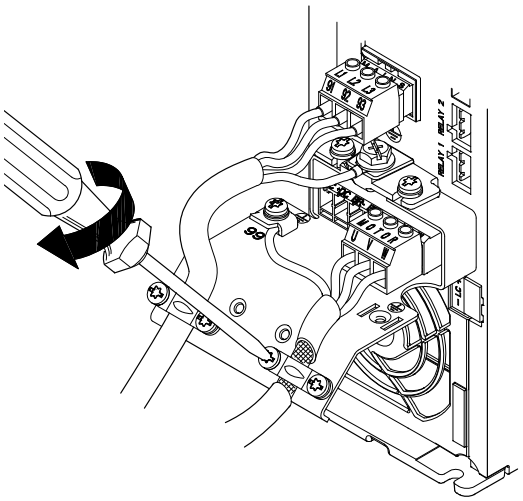

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Fig. 11 Connecting the motor plug and fixing the screened cable

6.2.5 Enclosures A4 and A5

For information about enclosures, see table in section *16.1 Enclosure*.

Mains connection

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

1. Connect the earth conductor to terminal 95 (PE). See fig. 12.
2. Connect the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3) of the mains plug.
3. Put the mains plug into the socket marked "MAINS".
4. Fix the mains cable with a cable clamp.

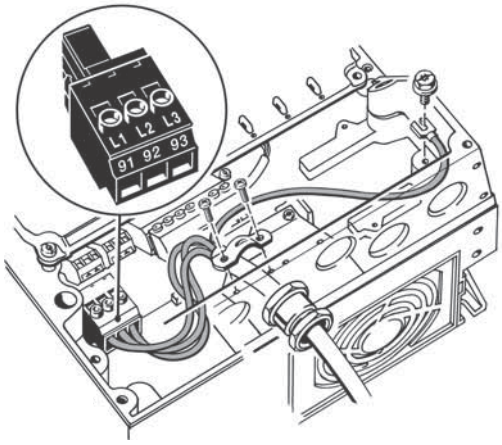

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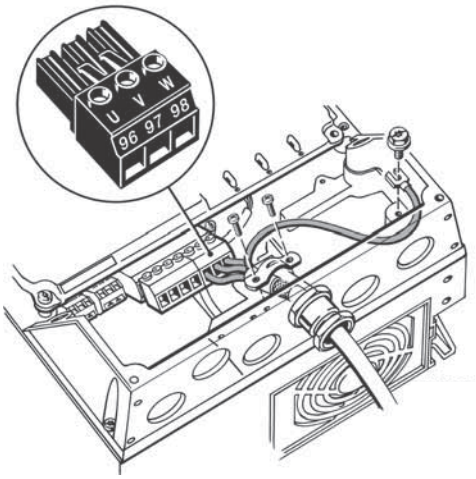
Fig. 12 Mains connection, A4 and A5

Note For single-phase connection, use L1 and L2.

Motor connection

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

1. Connect the earth conductor to terminal 99 (PE). See fig. 13.
2. Connect the motor conductors to terminals 96 (U), 97 (V), 98 (W) of the motor plug.
3. Put the motor plug into the socket marked "MOTOR".
4. Fix the screened cable with a cable clamp.



TM03 9018 2807

Fig. 13 Motor connection, A5

6.2.6 Enclosures B1 and B2

For information about enclosures, see table in section *16.1 Enclosure*.

Mains connection

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

1. Connect the earth conductor to terminal 95 (PE). See fig. 14.
2. Connect the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3).
3. Fix the mains cable with a cable clamp.

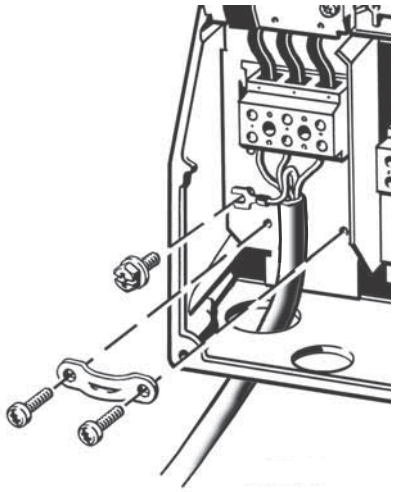


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Fig. 14 Mains connection, B1 and B2

Note For single-phase connection, use L1 and L2.

Motor connection

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

1. Connect the earth conductor to terminal 99 (PE). See fig. 15.
2. Connect the motor conductors to terminals 96 (U), 97 (V), 98 (W).
3. Fix the screened cable with a cable clamp.

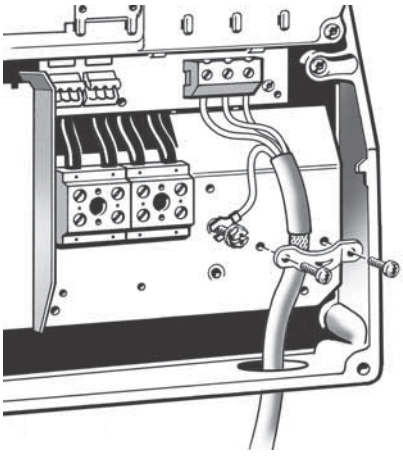

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Fig. 15 Motor connection, B1 and B2

6.2.7 Enclosures B3 and B4

For information about enclosures, see table in section *16.1 Enclosure*.

Mains connection

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

1. Connect the earth conductor to terminal 95 (PE). See figures 16 and 17.
2. Connect the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3).
3. Fix the mains cable with a cable clamp.

Motor connection

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

1. Connect the earth conductor to terminal 99 (PE). See figures 16 and 17.
2. Connect the motor conductors to terminals 96 (U), 97 (V), 98 (W).
3. Fix the screened cable with a cable clamp.

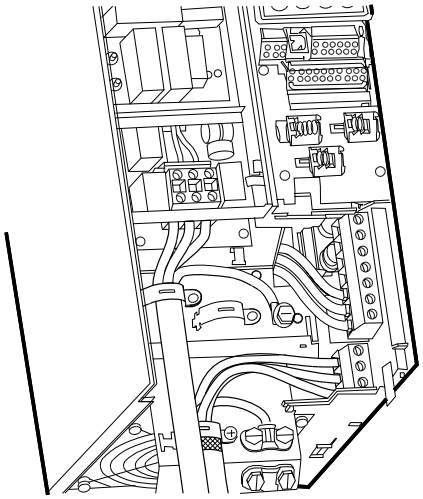

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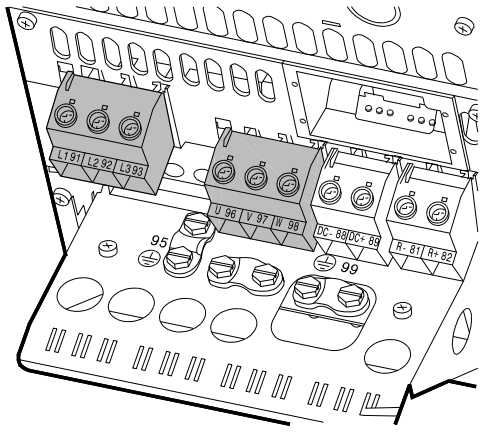
Fig. 16 Mains and motor connection, B3



TM03 9449 4007

Fig. 17 Mains and motor connection, B4

6.2.8 Enclosures C1 and C2

For information about enclosures, see table in section *16.1 Enclosure*.

Mains connection

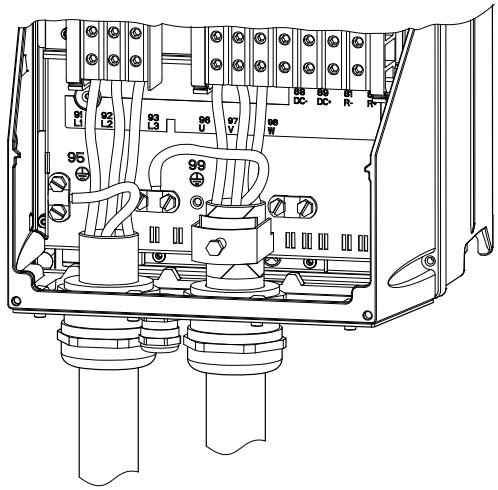
Caution Check that mains voltage and frequency correspond to the values on the nameplate of the CUE and the motor.

1. Connect the earth conductor to terminal 95 (PE). See fig. 18.
2. Connect the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3).

Motor connection

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

1. Connect the earth conductor to terminal 99 (PE). See fig. 18.
2. Connect the motor conductors to terminals 96 (U), 97 (V), 98 (W).
3. Fix the screened cable with a cable clamp.



TM03 9016 2807

Fig. 18 Mains and motor connection, C1 and C2

6.2.9 Enclosures C3 and C4

For information about enclosures, see table in section *16.1 Enclosure*.

Mains connection

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

1. Connect the earth conductor to terminal 95 (PE). See figures 19 and 20.
2. Connect the mains conductors to terminals 91 (L1), 92 (L2), 93 (L3).

Motor connection

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

1. Connect the earth conductor to terminal 99 (PE). See figures 19 and 20.
2. Connect the motor conductors to terminals 96 (U), 97 (V), 98 (W).
3. Fix the screened cable with a cable clamp.

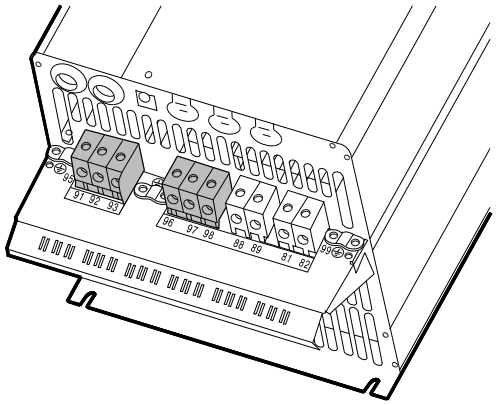


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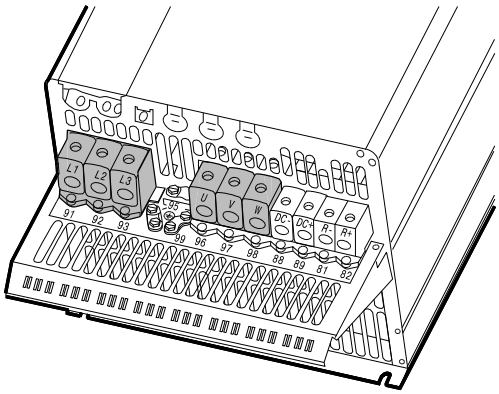
Fig. 19 Mains and motor connection, C3



TM03 9447 4007

Fig. 20 Mains and motor connection, C4

6.3 Connecting the signal terminals

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

Note If no external on/off switch is connected, short-circuit terminals 18 and 20 using a short wire.

Connect the signal cables according to the guidelines for good practice to ensure EMC-correct installation. See section *6.6 EMC-correct installation*.

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

6.3.1 Minimum connection, signal terminal

Operation is only possible when terminals 18 and 20 are connected, for instance by means of an external on/off switch or a short wire.

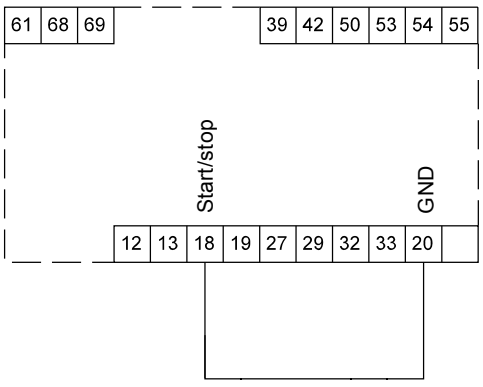


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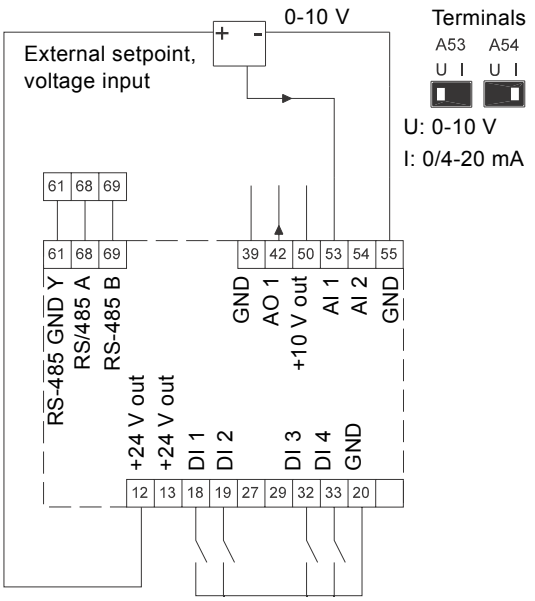
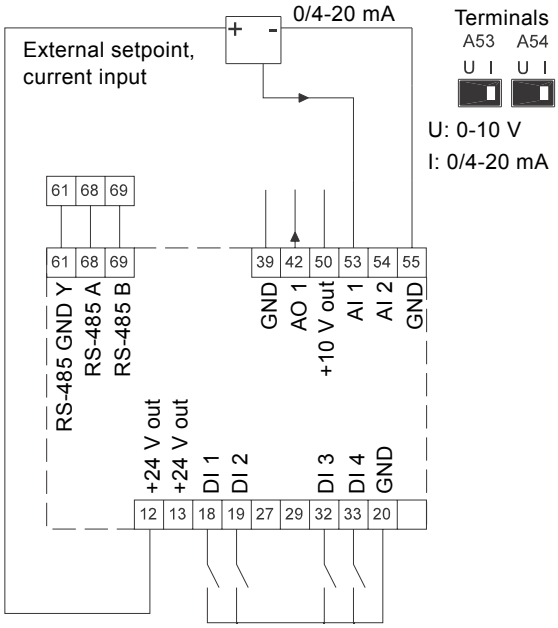
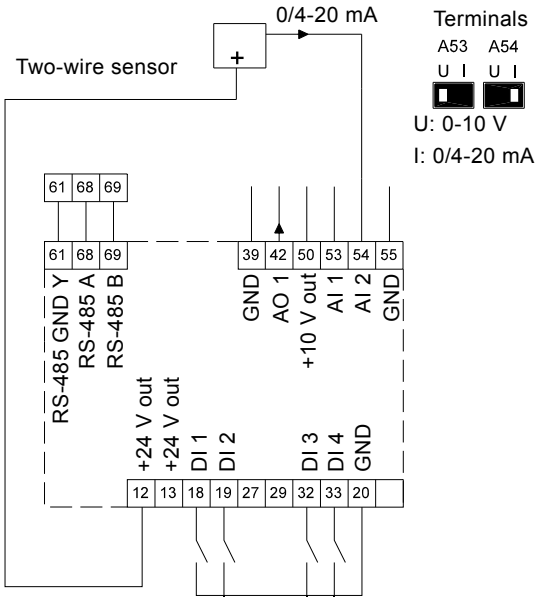
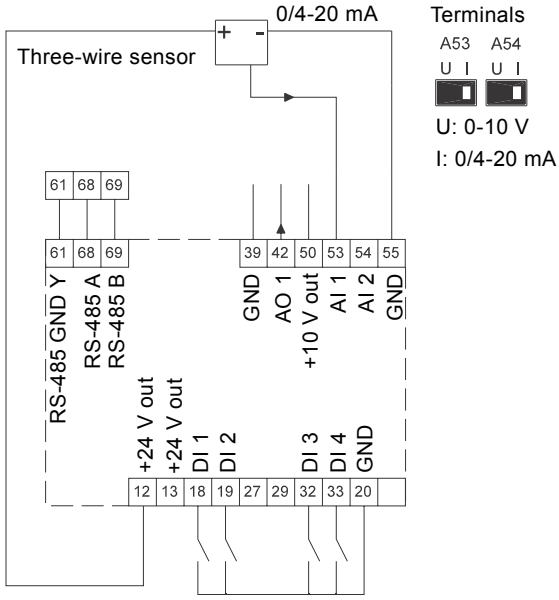
Fig. 21 Required minimum connection, signal terminal

6.3.2 Wiring diagram, signal terminals









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

Terminals 27 and 29 are not used.

Connect the signal cables according to the guidelines for good practice to ensure EMC-correct installation. See section *6.6 EMC-correct installation*.

- Use screened signal cables with a conductor cross-section of min. 0.5 mm^2 and max. 1.5 mm^2.

Use a 3-conductor screened bus cable in new systems.

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

6.3.3 Connection of a thermistor (PTC) to the CUE

The connection of a thermistor (PTC) in a motor to the CUE requires an external PTC relay.

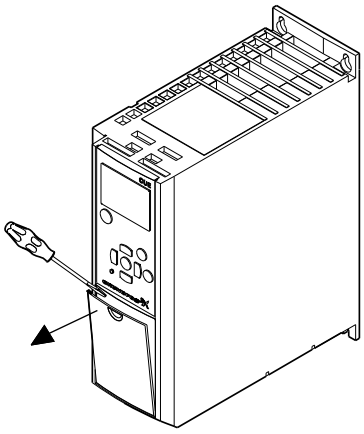
The requirement is based on the fact that the thermistor in the motor only has one layer of insulation to the windings. The terminals in the CUE require two layers of insulation since they are part of a PELV circuit.

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

In order to maintain PELV, all connections made to the control terminals must be PELV. For example, the thermistor must have reinforced or double insulation.

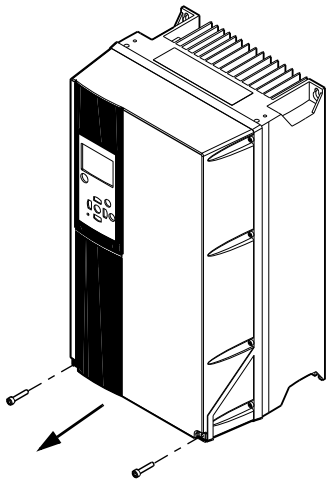
6.3.4 Access to signal terminals

All signal terminals are behind the terminal cover of the CUE front. Remove the terminal cover as shown in figures 22 and 23.



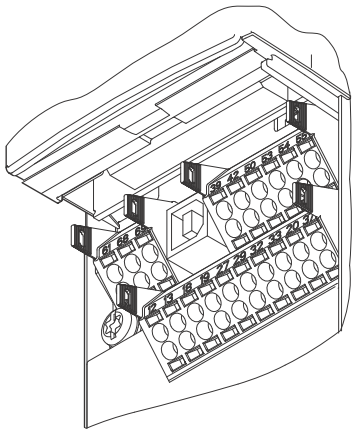
TM03 9003 2807

Fig. 22 Access to signal terminals, A2 and A3



TM03 9004 2807

Fig. 23 Access to signal terminals, A4, A5, B1, B2, B3, B4, C1, C2, C3 and C4

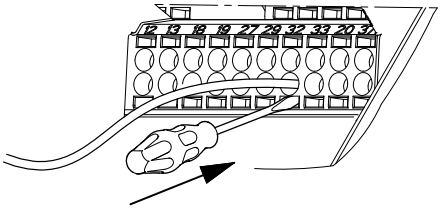


TM03 9025 2807

Fig. 24 Signal terminals (all enclosures)

6.3.5 Fitting the conductor

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



TM03 9026 2807

Fig. 25 Fitting the conductor into the signal terminal

6.3.6 Setting the analog inputs, terminals 53 and 54

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

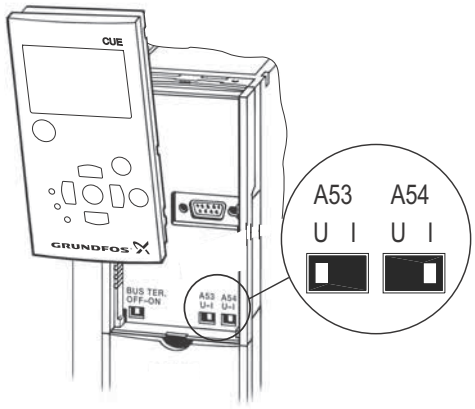
The factory setting of the inputs is voltage signal "U".

Note

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 control panel to set the contact. See fig. 26.



TM03 9104 3407

Fig. 26 Setting contact A54 to current signal "I"

6.3.7 RS-485 GENIbus network connection

One or more CUE units can be connected to a control unit via GENIbus. See the example in fig. 27.

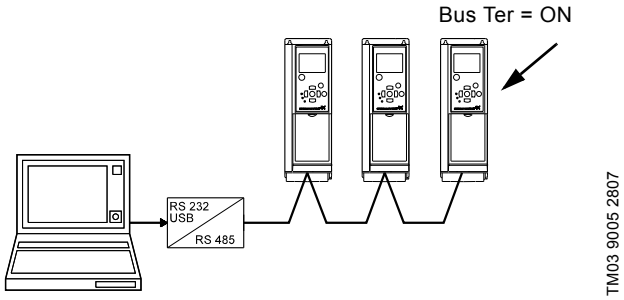


Fig. 27 Example of an RS-485 GENIbus network

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

If more than one CUE unit is connected to a GENIbus network, the termination contact of the last CUE must be set to "ON" (termination of the RS-485 port).

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

Remove the control panel to set the contact. See fig. 28.

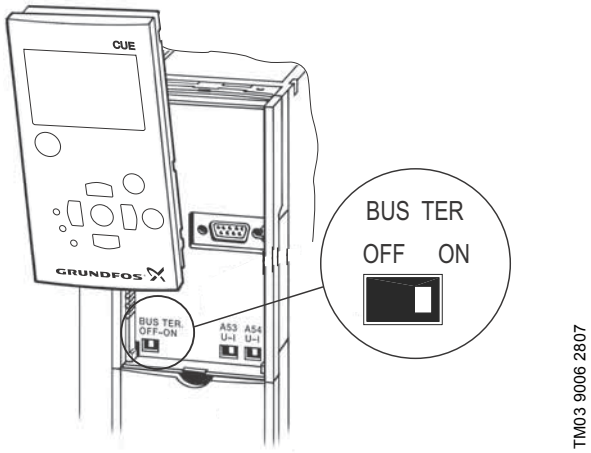


Fig. 28 Setting the termination contact to "ON"

6.4 Connecting the signal relays

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

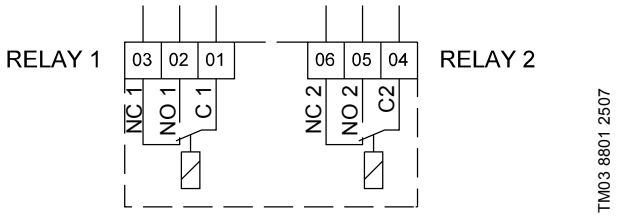


Fig. 29 Terminals for signal relays in normal state (not activated)

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

Access to signal relays

The relay outputs are positioned as shown in figures 30 to 35.

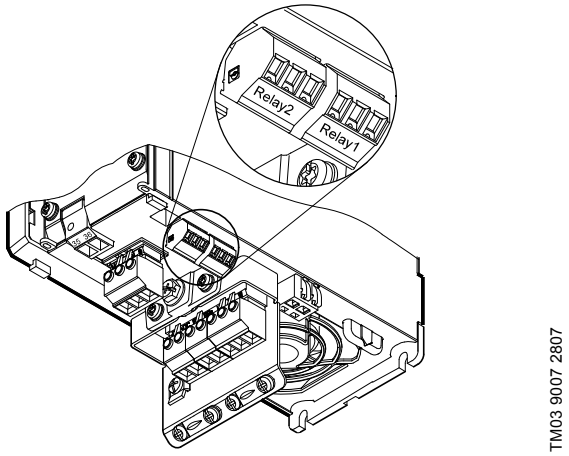


Fig. 30 Terminals for relay connection, A2 and A3

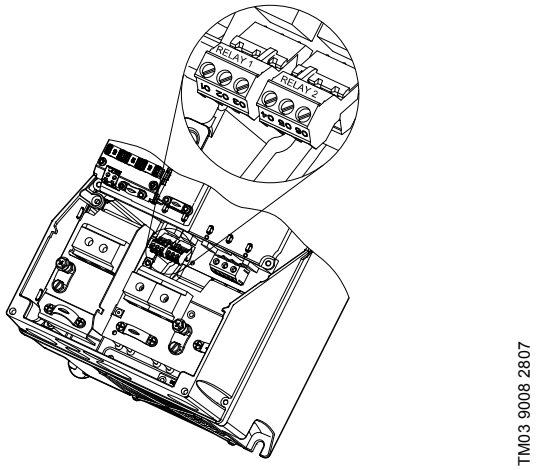
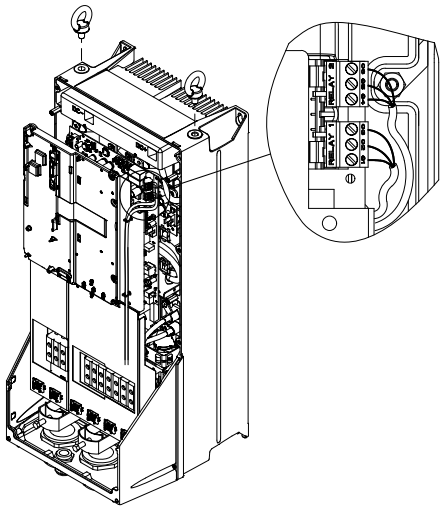
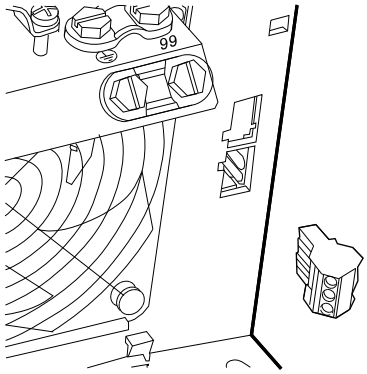


Fig. 31 Terminals for relay connection, A4, A5, B1 and B2



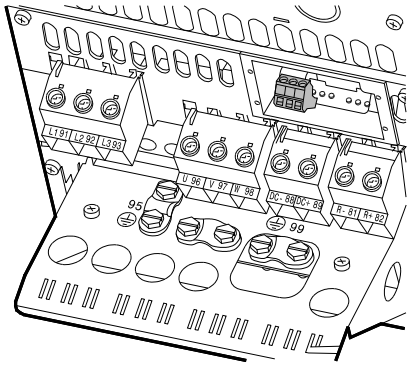
TM03 9009 2807

Fig. 32 Terminals for relay connection, C1 and C2



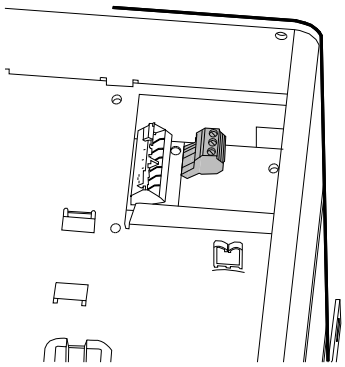
TM03 9442 4007

Fig. 33 Terminals for relay connection, B3



TM03 9441 4007

Fig. 34 Terminals for relay connection, B4



TM03 9440 4007

Fig. 35 Terminals for relay connection, C3 and C4, in the upper right corner of the CUE

6.5 Connecting the MCB 114 sensor input module

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

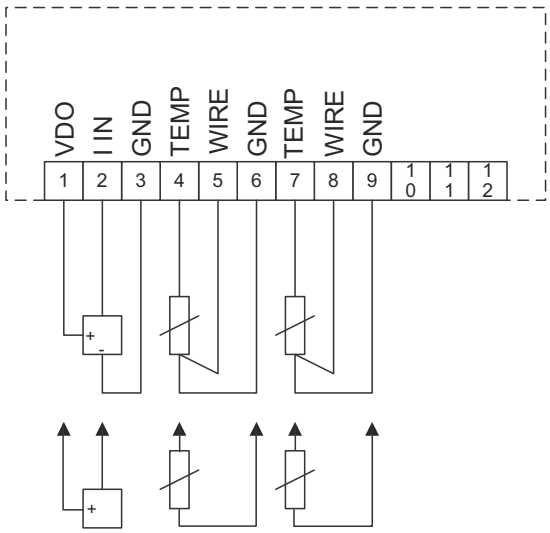
6.5.1 Configuration of the MCB 114

The MCB 114 is equipped with three analog inputs for these sensors:

- One additional sensor 0/4-20 mA. See section *10.8.14 Sensor 2 (3.16)*.
- Two Pt100/Pt1000 temperature sensors for measurement of motor bearing temperature or an alternative temperature, such as liquid temperature. See sections *10.8.19 Temperature sensor 1 (3.21)* and *10.8.20 Temperature sensor 2 (3.22)*.

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

6.5.2 Wiring diagram, MCB 114



TM04 3273 3908

Fig. 36 Wiring diagram, MCB 114

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

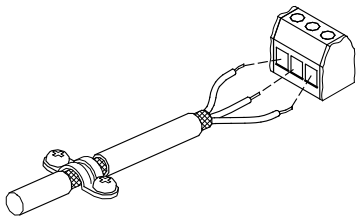
Terminals 10, 11 and 12 are not used.

6.6 EMC-correct installation

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

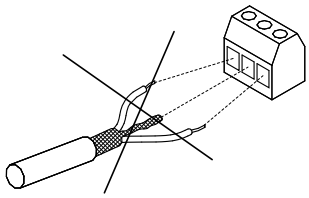
- Use only motor and signal cables with a braided metal screen in applications without output filter.
- There are no special requirements to supply cables, apart from local requirements.
- Leave the screen as close to the connecting terminals as possible. See fig. 37.
- Avoid terminating the screen by twisting the ends. See fig. 38. Use cable clamps or EMC screwed cable entries instead.
- Connect the screen to frame at both ends for both motor and signal cables. See fig. 39. If the controller has no cable clamps, connect only the screen to the CUE. See fig. 40.
- 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 main 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.



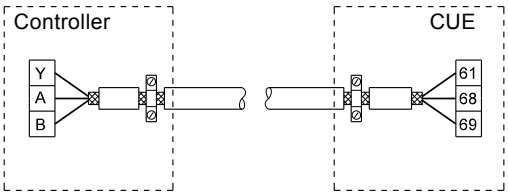
TM02 1325 0901

Fig. 37 Example of stripped cable with screen



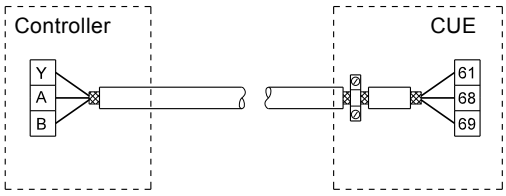
TM03 8812 2507

Fig. 38 Do not twist the screen ends



TM03 8732 2407

Fig. 39 Example of connection of a 3-conductor bus cable with screen connected at both ends



TM03 8731 2407

Fig. 40 Example of connection of a 3-conductor bus cable with screen connected at the CUE (controller with no cable clamps)

6.7 RFI filters

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

Voltage [V]	Typical shaft power P2 [kW]	RFI filter type
1 x 200-240*	1.1 - 7.5	C1
3 x 200-240	0.75 - 45	C1
3 x 380-500	0.55 - 90	C1
3 x 525-600	0.75 - 7.5	C3
3 x 525-690	11-90	C3

* Single-phase input - three-phase output.

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.

6.7.1 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.
- Radio frequency interference is expected if used on such a network.

6.8 Output filters

Output filters are used for reducing the voltage stress on the motor windings and the stress on the motor insulation system as well as for decreasing acoustic noise from the frequency converter-driven motor.

Two types of output filter are available as accessories for the CUE:

- dU/dt filters
- sine-wave filters.

Use of output filters

The table below shows when an output filter is required and the type to use. The selection depends on the following:

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

Pump type	CUE output power	dU/dt filter	Sine-wave filter
SP, BM, BMB with motor voltage from 380 V and up	All	-	0-300 m*
Pumps with MG71 and MG80 up to and including 1.5 kW	Greater than 1.5 kW	-	0-300 m*
Reduction of dU/dt and noise emission, low reduction	All	0-150 m*	-
Reduction of dU/dt, voltage peaks and noise emission, high reduction	All	-	0-300 m*
With motors of 500 V and up	All	-	0-300 m*

* The lengths stated apply to the motor cable.

6.9 Motor cable

Note

To meet EN 61800-3, the motor cable must always be a screened cable, whether an output filter is installed or not.

The mains cable need not be a screened cable. See figures 41, 42, 43 and 44.

Fig. 41 Example of installation without filter

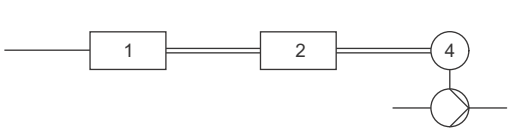


Fig. 42 Example of installation with filter. The cable between the CUE and filter must be short

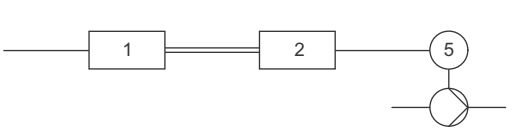


Fig. 43 Submersible pump without connection box. Frequency converter and filter installed close to the well

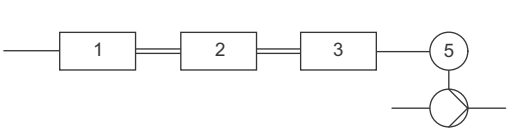


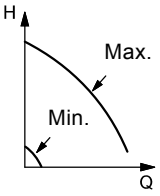
Fig. 44 Submersible pump with connection box and screened cable. Frequency converter and filter installed far away from the well and connection box installed close to the well

Symbol	Designation
1	CUE
2	Filter
3	Connection box
4	Standard motor
5	Submersible motor
One line	Unscreened cable
Double line	Screened cable

7. Operating modes

The following operating modes are set on the control panel in the "OPERATION" menu, display 1.2. See section *10.6.2 Operating mode (1.2)*.

Operating mode	Description
Normal	The pump is running in the control mode selected
Stop	The pump has been stopped (green indicator light is flashing)
Min.	The pump is running at minimum speed
Max.	The pump is running at maximum speed



TM03 8813 2507

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

Example: Max. curve operation can for instance be used in connection with venting the pump during installation.

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

8. Control modes

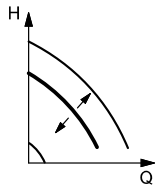
The control mode is set on the control panel in the "INSTALLATION" menu, display 3.1. See section *10.8.1 Control mode (3.1)*.

There are two basic control modes:

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

See sections *8.1 Uncontrolled operation (open loop)* and *8.2 Controlled operation (closed loop)*.

8.1 Uncontrolled operation (open loop)



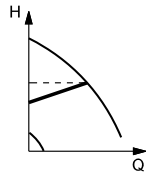
TM03 8479 1607

Constant curve.
The speed is kept at a set value in the range between the min. and max. curves.
The setpoint is set in % corresponding to the required speed.

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

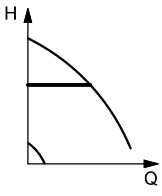
Example: Typically used in connection with an overall control system such as the MPC or another external controller.

8.2 Controlled operation (closed loop)



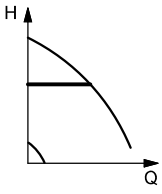
TM03 8475 1607 — TM03 8804 2507

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



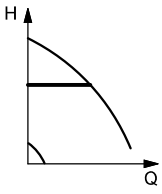
TM03 8476 1607 — TM03 8804 2507

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



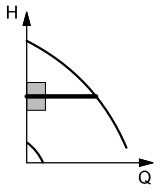
TM03 8476 1607 — TM03 8806 2507

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



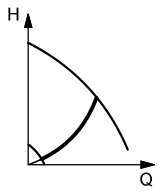
TM03 8476 1607 — TM03 8805 2507

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



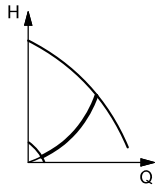
TM03 8477 1607 — TM03 8807 2507

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



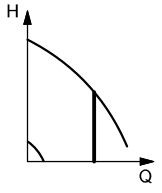
TM03 8482 1607 — TM03 8808 2607

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



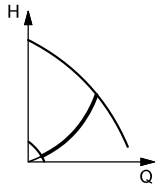
TM03 8482 1607 — TM03 8809 2607

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



TM03 8478 1607 — TM03 8810 2507

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



TM03 8482 1607 — TM03 8811 2507

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

9. Menu overview

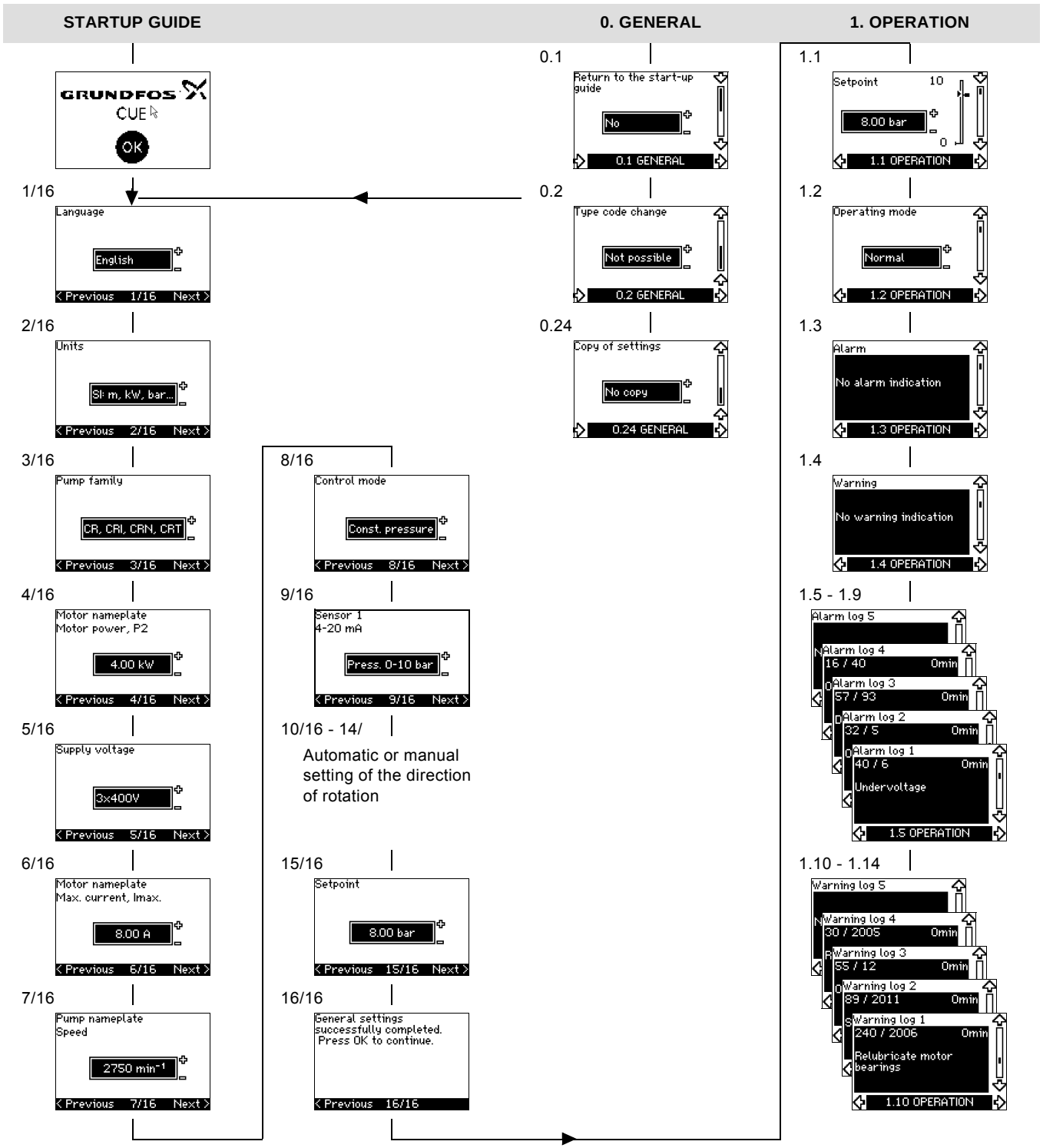
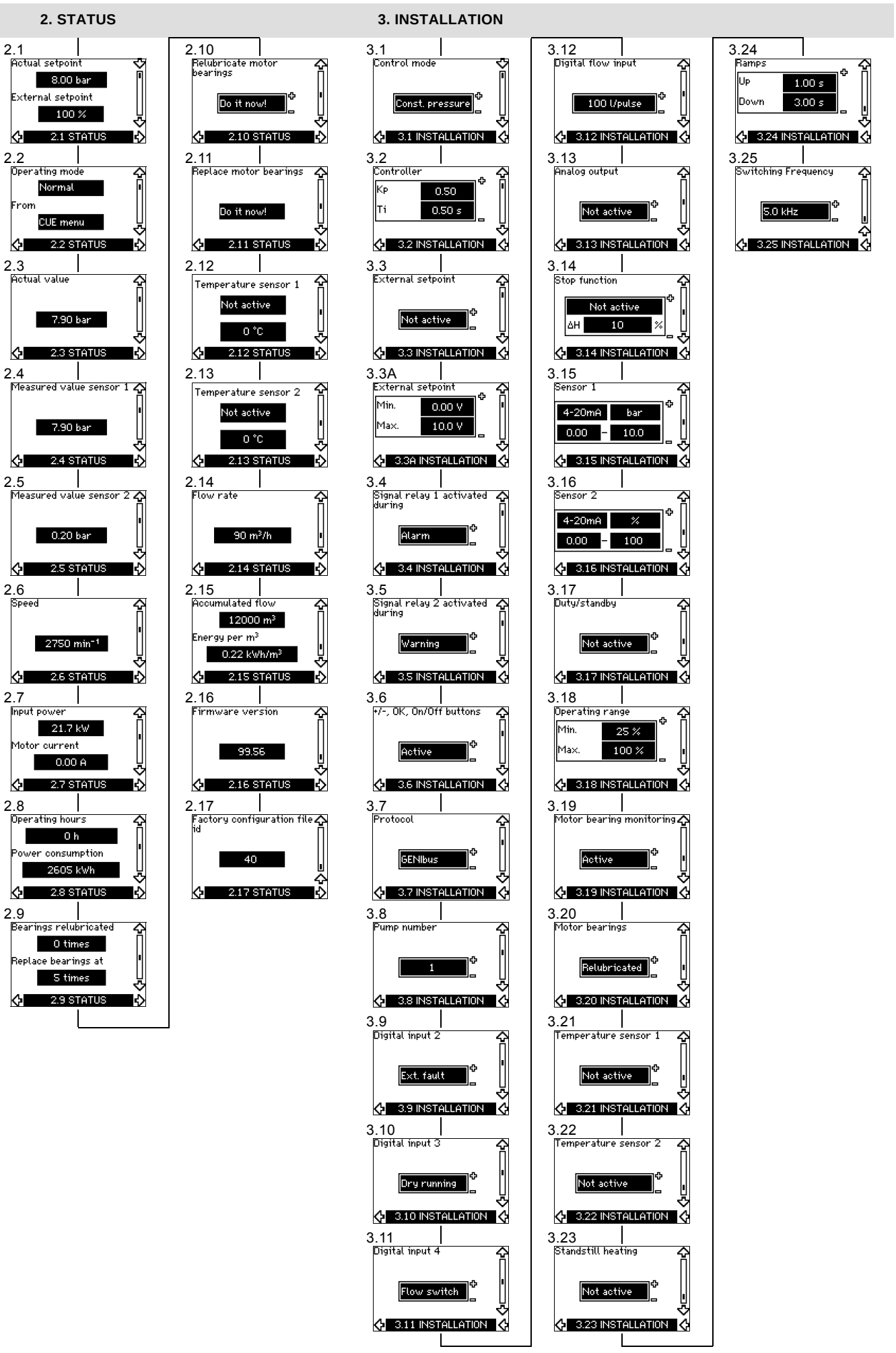


Fig. 45 Menu overview

Menu structure

The CUE has a startup guide, which is started at the first startup. After the startup guide, the CUE has a menu structure divided into four main menus:

1. "GENERAL" gives access to the startup guide for the general setting of the CUE.
2. "OPERATION" enables the setting of setpoint, selection of operating mode and resetting of alarms. It is also possible to see the latest five warnings and alarms.
3. "STATUS" shows the status of the CUE and the pump. It is not possible to change or set values.
4. "INSTALLATION" gives access to all parameters. Here a detailed setting of the CUE can be made.


2. STATUS
3. INSTALLATION
2.1
Actual setpoint
8.00 bar
External setpoint
100 %
2.1 STATUS
2.2
Operating mode
Normal
From
CUE menu
2.2 STATUS
2.3
Actual value
7.90 bar
2.3 STATUS
2.4
Measured value sensor 1
7.90 bar
2.4 STATUS
2.5
Measured value sensor 2
0.20 bar
2.5 STATUS
2.6
Speed
2750 min-1
2.6 STATUS
2.7
Input power
21.7 kW
Motor current
0.00 A
2.7 STATUS
2.8
Operating hours
0 h
Power consumption
2605 kWh
2.8 STATUS
2.9
Bearings relubricated
0 times
Replace bearings at
5 times
2.9 STATUS
2.10
Relubricate motor bearings
Do it now!
2.10 STATUS
2.11
Replace motor bearings
Do it now!
2.11 STATUS
2.12
Temperature sensor 1
Not active
0 °C
2.12 STATUS
2.13
Temperature sensor 2
Not active
0 °C
2.13 STATUS
2.14
Flow rate
90 m³/h
2.14 STATUS
2.15
Accumulated flow
12000 m³
Energy per m³
0.22 kWh/m³
2.15 STATUS
2.16
Firmware version
99.56
2.16 STATUS
2.17
Factory configuration file id
40
2.17 STATUS
3.1
Control mode
Const. pressure
3.1 INSTALLATION
3.2
Controller
Kp 0.50
Ti 0.50 s
3.2 INSTALLATION
3.3
External setpoint
Not active
3.3 INSTALLATION
3.3A
External setpoint
Min. 0.00 V
Max. 10.0 V
3.3A INSTALLATION
3.4
Signal relay 1 activated during
Alarm
3.4 INSTALLATION
3.5
Signal relay 2 activated during
Warning
3.5 INSTALLATION
3.6
+/-, OK, On/Off buttons
Active
3.6 INSTALLATION
3.7
Protocol
GENIbus
3.7 INSTALLATION
3.8
Pump number
1
3.8 INSTALLATION
3.9
Digital input 2
Ext. fault
3.9 INSTALLATION
3.10
Digital input 3
Dry running
3.10 INSTALLATION
3.11
Digital input 4
Flow switch
3.11 INSTALLATION
3.12
Digital flow input
100 l/pulse
3.12 INSTALLATION
3.13
Analog output
Not active
3.13 INSTALLATION
3.14
Stop function
Not active
ΔH 10 %
3.14 INSTALLATION
3.15
Sensor 1
4-20mA bar
0.00 – 10.0
3.15 INSTALLATION
3.16
Sensor 2
4-20mA %
0.00 – 100
3.16 INSTALLATION
3.17
Duty/standby
Not active
3.17 INSTALLATION
3.18
Operating range
Min. 25 %
Max. 100 %
3.18 INSTALLATION
3.19
Motor bearing monitoring
Active
3.19 INSTALLATION
3.20
Motor bearings
Relubricated
3.20 INSTALLATION
3.21
Temperature sensor 1
Not active
3.21 INSTALLATION
3.22
Temperature sensor 2
Not active
3.22 INSTALLATION
3.23
Standstill heating
Not active
3.23 INSTALLATION
3.24
Ramps
Up 1.00 s
Down 3.00 s
3.24 INSTALLATION
3.25
Switching Frequency
5.0 kHz
3.25 INSTALLATION

10. Setting by means of the control panel

10.1 Control panel

Warning

The on/off button on the control panel does not disconnect the CUE from the power supply and must therefore not be used as a safety switch.

The on/off button has the highest priority. In "off" condition, pump operation is not possible.

The control panel is used for local setting of the CUE. The functions available depend on the pump family connected to the CUE.

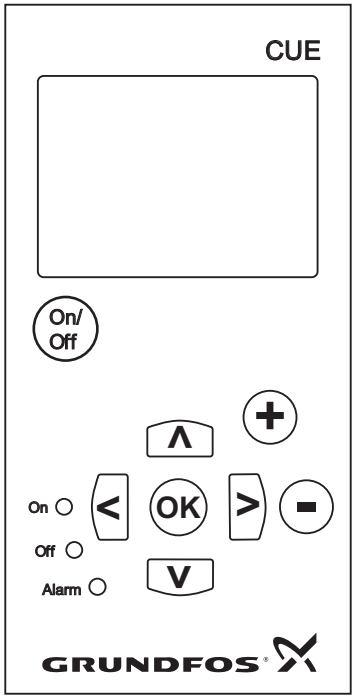


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Fig. 46 Control panel of the CUE

Editing buttons

Button	Function
On/ Off	Makes the pump ready for operation/starts and stops the pump.
OK	Saves changed values, resets alarms and expands the value field.
+ −	Changes values in the value field.

Navigating buttons

Button	Function
< >	Navigates from one menu to another. When the menu is changed, the display shown will always be the top display of the new menu.
∧ ∨	Navigates up and down in the individual menu.

The editing buttons of the control panel can be set to these values:

- Active
- Not active.

When set to "Not active" (locked), the editing buttons do not function. It is only possible to navigate in the menus and read values.

Activate or deactivate the buttons by pressing the arrow up and arrow down buttons simultaneously for 3 seconds.

Adjusting the display contrast

Press [OK] and [+] for darker display.

Press [OK] and [-] for brighter display.

Indicator lights

The operating condition of the pump is indicated by the indicator lights on the front of the control panel. See fig. 46.

The table shows the function of the indicator lights.

Indicator light	Function
On (green)	The pump is running or has been stopped by a stop function.
	If flashing, the pump has been stopped by the user (CUE menu), external start/stop or bus.
Off (orange)	The pump has been stopped with the on/off button.
Alarm (red)	Indicates an alarm or a warning.

Displays, general terms

Figures 47 and 48 show the general terms of the display.

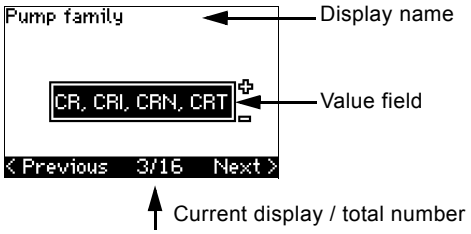

Fig. 47 Example of display in the startup guide

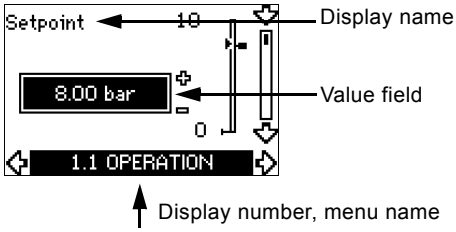

Fig. 48 Example of display in the user menu

10.2 Back to factory settings

Follow this procedure to get back to the factory settings:

1. Switch off the power supply to the CUE.
2. Press [On/Off], [OK] and [+] while switching on the power supply.

The CUE will reset all parameters to factory settings. The display will turn on when the reset is completed.

10.3 CUE settings

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The startup guide includes all parameters that can be set on the control panel of the CUE.

The document includes a special table for additional PC Tool settings and a page where special PC Tool programming details should be entered.

If you want to download the document, please contact your local Grundfos company.

10.4 Startup guide

Note

Check that equipment connected is ready for startup, and that the CUE has been connected to the power supply.

Have nameplate data for motor, pump and CUE at hand.

Use the startup guide for the general setting of the CUE including the setting of the correct direction of rotation.

The startup guide is started the first time when the CUE is connected to the power supply. It can be restarted in the "GENERAL" menu. Please note that in this case all previous settings will be erased.

Bulleted lists show possible settings. Factory settings are shown in bold.

10.4.1 Welcoming display

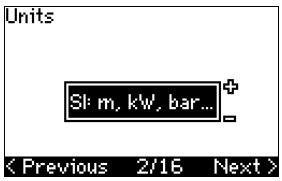
- Press [OK]. You will now be guided through the startup guide.

10.4.2 Language (1/16)

Select the language to be used in the display:

- **English UK**
- English US
- German
- French
- Italian
- Spanish
- Portuguese
- Greek
- Dutch
- Swedish
- Finnish
- Danish
- Polish
- Russian
- Hungarian
- Czech
- Chinese
- Japanese
- Korean.

10.4.3 Units (2/16)



Select the units to be used in the display:

- **SI: m, kW, bar...**
- US: ft, HP, psi...

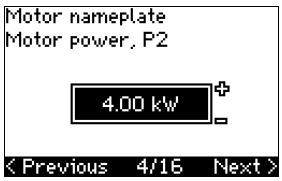
10.4.4 Pump family (3/16)

Select pump family according to the pump nameplate:

- **CR, CRI, CRN, CRT**
- SP, SP-G, SP-NE
- ...

Select "Other" if the pump family is not on the list.

10.4.5 Rated motor power (4/16)

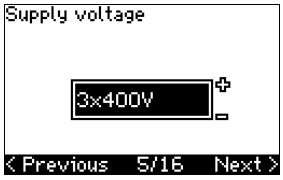


Set the rated motor power, P2, according to the motor nameplate:

- 0.55 - 90 kW.

The setting range is size-related, and the factory setting corresponds to the rated power of the CUE.

10.4.6 Supply voltage (5/16)



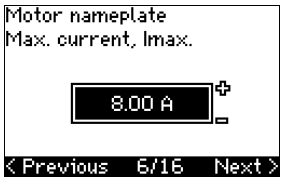
Select supply voltage according to the rated supply voltage of the installation site.

Unit 1 x 200-240 V:*	Unit 3 x 200-240 V:	Unit 3 x 380-500 V:
• 1 x 200 V	• 3 x 200 V	• 3 x 380 V
• 1 x 208 V	• 3 x 208 V	• 3 x 400 V
• 1 x 220 V	• 3 x 220 V	• 3 x 415 V
• 1 x 230 V	• 3 x 230 V	• 3 x 440 V
• 1 x 240 V.	• 3 x 240 V.	• 3 x 460 V
		• 3 x 500 V.
Unit 3 x 525-600 V:	Unit 3 x 525-690 V:	
• 3 x 575 V.	• 3 x 575 V	
	• 3 x 690 V.	

* Single-phase input - three-phase output.

The setting range depends on the CUE type, and the factory setting corresponds to the rated supply voltage of the CUE.

10.4.7 Max. motor current (6/16)



Set the maximum motor current according to the motor nameplate:

- 0-999 A.

The setting range depends on the CUE type, and the factory setting corresponds to a typical motor current at the motor power selected.

Max. current will be limited to the value on the CUE nameplate, even if it is set to a higher value during setup.

10.4.8 Speed (7/16)

Set the rated speed according to the pump nameplate:

- 0-9999 min^{-1}.

The factory setting depends on previous selections. Based on the set rated speed, the CUE will automatically set the motor frequency to 50 or 60 Hz.

10.4.9 Frequency (7A/16)

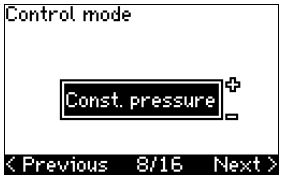
This display appears only if manual entry of the frequency is required.

Set the frequency according to the motor nameplate:

- 40-200 Hz

The factory setting depends on previous selections.

10.4.10 Control mode (8/16)



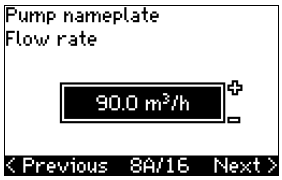
Select the desired control mode. See section *10.8.1 Control mode (3.1)*.

- Open loop
- Constant pressure
- Constant differential pressure
- Proportional differential pressure
- Constant flow rate
- Constant temperature
- Constant level
- Constant other value.

The possible settings and the factory setting depend on the pump family.

The CUE will give an alarm if the control mode selected requires a sensor and no sensor has been installed. To continue the setting without a sensor, select "Open loop", and proceed. When a sensor has been connected, set the sensor and control mode in the "INSTALLATION" menu.

10.4.11 Rated flow rate (8A/16)

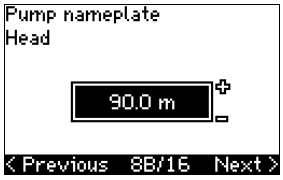


This display appears only if the control mode selected is proportional differential pressure.

Set the rated flow rate according to the pump nameplate:

- 1-6550 m^3/h.

10.4.12 Rated head (8B/16)



This display only appears if the control mode selected is proportional differential pressure.

Set the rated head according to the pump nameplate:

- 1-999 m.

10.4.13 Sensor connected to terminal 54 (9/16)

Set the measuring range of the connected sensor with a signal range of 4-20 mA. The measuring range depends on the control mode selected:

Proportional differential pressure:

- 0-0.6 bar
- 0-1 bar
- 0-1.6 bar
- 0-2.5 bar
- **0-4 bar**
- 0-6 bar
- 0-10 bar
- Other.

Constant differential pressure:

- 0-0.6 bar
- 0-1.6 bar
- 0-2.5 bar
- **0-4 bar**
- 0-6 bar
- 0-10 bar
- Other.

Constant pressure:

- 0-2.5 bar
- 0-4 bar
- 0-6 bar
- **0-10 bar**
- 0-16 bar
- 0-25 bar
- Other.

Constant flow rate:

- 1-5 m^3/h
- **2-10 m^3/h**
- 6-30 m^3/h
- 15-75 m^3/h
- Other.

Constant temperature:

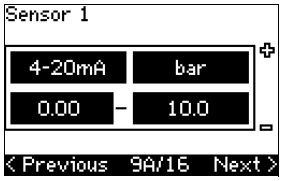
- **-25 to 25 °C**
- 0 to 25 °C
- 50 to 100 °C
- 0 to 150 °C
- Other.

Constant level:

- 0-0.1 bar
- 0-1 bar
- 0-2.5 bar
- 0-6 bar
- 0-10 bar
- Other.

If the control mode selected is "Constant other value", or if the measuring range selected is "Other", the sensor must be set according to the next section, display 9A/16.

10.4.14 Another sensor connected to terminal 54 (9A/16)

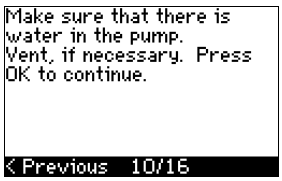


This display only appears when the control mode "Constant other value" or the measuring range "Other" has been selected in display 9/16.

- Sensor output signal:
  0-20 mA
  4-20 mA.
- Unit of measurement of sensor:
  bar, mbar, m, kPa, psi, ft, m^3/h, m^3/min, m^3/s, l/h, l/min, l/s, gal/h, gal/m, gal/s, ft^3/min, ft^3/s,°C, °F, %.
- Sensor measuring range.

The measuring range depends on the sensor connected and the measuring unit selected.

10.4.15 Priming and venting (10/16)



See the installation and operating instructions of the pump.

The general setting of the CUE is now completed, and the startup guide is ready for setting the direction of rotation:

- Press [OK] to go on to automatic or manual setting of the direction of rotation.

10.4.16 Automatic setting of the direction of rotation (11/16)

Warning

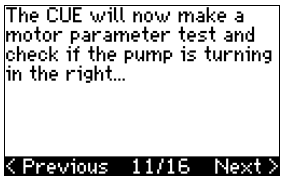
During the test, the pump will run for a short time. Ensure that no personnel or equipment is in danger!

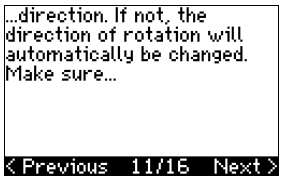
Note

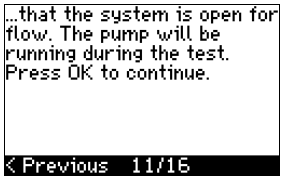
Before setting the direction of rotation, the CUE will make an automatic motor adaptation of certain pump types. This will take a few minutes. The adaptation is carried out during standstill.

The CUE automatically tests and sets the correct direction of rotation without changing the cable connections.

This test is not suitable for certain pump types and will in certain cases not be able to determine with certainty the correct direction of rotation. In these cases, the CUE changes over to manual setting where the direction of rotation is determined on the basis of the installer’s observations.

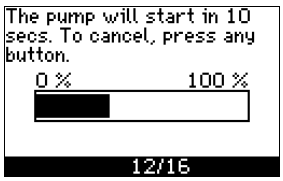






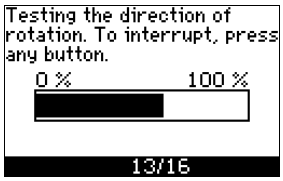
Information displays.

- Press [OK] to continue.



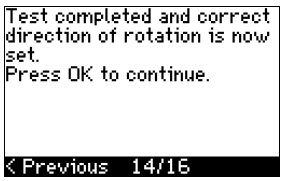
The pump starts after 10 seconds.

It is possible to interrupt the test and return to the previous display.



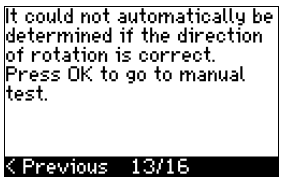
The pump runs with both directions of rotation and stops automatically.

It is possible to interrupt the test, stop the pump and go to manual setting of the direction of rotation.



The correct direction of rotation has now been set.

- Press [OK] to set the setpoint. See section *10.4.17 Setpoint (15/16)*.



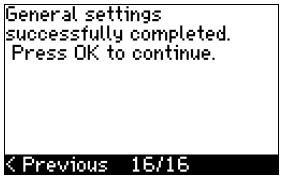
The automatic setting of the direction of rotation has failed.

- Press [OK] to go to manual setting of the direction of rotation.

10.4.17 Setpoint (15/16)

Set the setpoint according to the control mode and sensor selected.

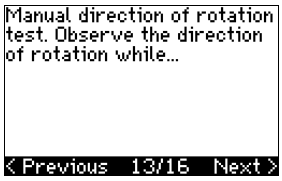
10.4.18 General settings are completed (16/16)

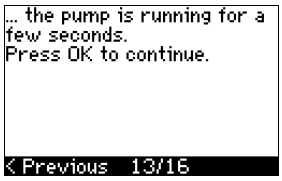


- Press [OK] to make the pump ready for operation or start the pump in the "Normal" operating mode. Then display 1.1 of the "OPERATION" menu will appear.

10.4.19 Manual setting when the direction of rotation is visible (13/16)

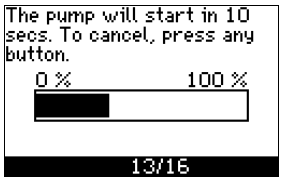
It must be possible to observe the motor fan or shaft.





Information displays.

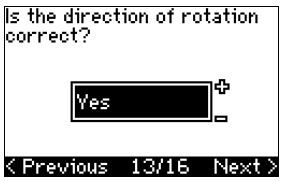
- Press [OK] to continue.



The pump starts after 10 seconds.

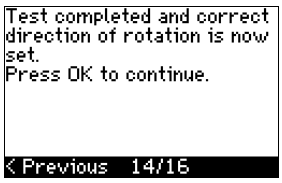
It is possible to interrupt the test and return to the previous display.

The pressure will be shown during the test if a pressure sensor is connected. The motor current is always shown during the test.



State if the direction of rotation is correct.

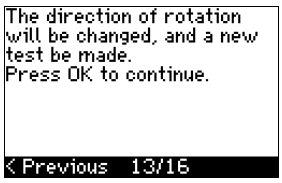
- **Yes**



The correct direction of rotation has now been set.

- Press [OK] to set the setpoint. See section *10.4.17 Setpoint (15/16)*.

- **No**

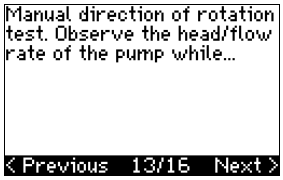


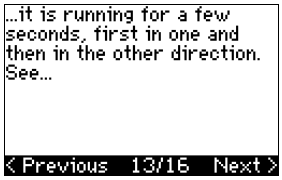
The direction of rotation is not correct.

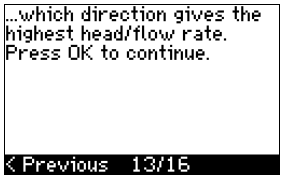
- Press [OK] to repeat the test with the opposite direction of rotation.

10.4.20 Manual setting when the direction of rotation is not visible (13/16)

It must be possible to observe the head or flow rate.

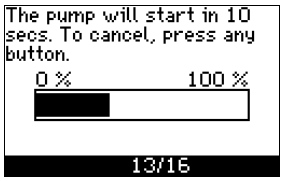






Information displays.

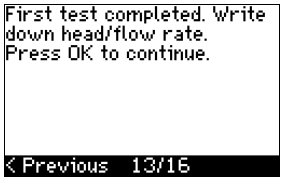
- Press [OK] to continue.

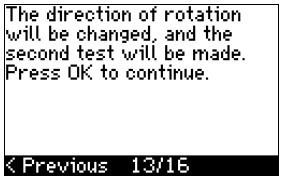


The pump starts after 10 seconds.

It is possible to interrupt the test and return to the previous display.

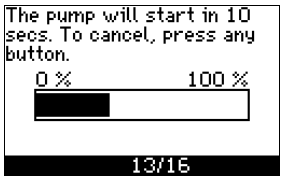
The pressure will be shown during the test if a pressure sensor is connected. The motor current is always shown during the test.





The first test is completed.

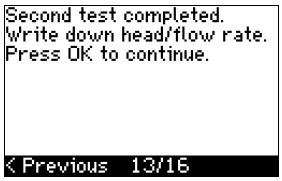
- Write down the pressure and/or flow rate, and press OK to continue the manual test with the opposite direction of rotation.

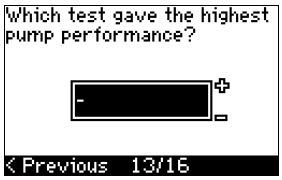


The pump starts after 10 seconds.

It is possible to interrupt the test and return to the previous display.

The pressure will be shown during the test if a pressure sensor is connected. The motor current is always shown during the test.

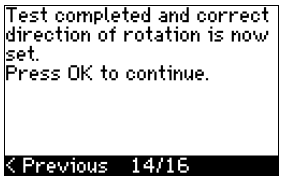




The second test is completed.

Write down the pressure and/or flow rate, and state which test gave the highest pump performance:

- First test
- Second test
- Perform new test.



The correct direction of rotation has now been set.

- Press [OK] to set the setpoint. See section *10.4.17 Setpoint (15/16)*.

10.5 GENERAL

Note If the startup guide is started, all previous settings will be erased!

Note The startup guide must be carried out on a cold motor!
Repeating the startup guide may lead to heating of the motor.

The menu makes it possible to return to the startup guide, which is usually only used during the first startup of the CUE.

10.5.1 Return to startup guide (0.1)

State your choice:

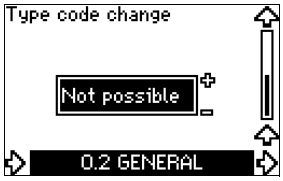
- Yes
- No.

If you select "Yes", all settings will be erased, and the entire startup guide must be completed. The CUE will return to the startup guide, and new settings can be made. Additional settings and the settings available in section *10. Setting by means of the control panel* will not require a reset.

Back to factory settings

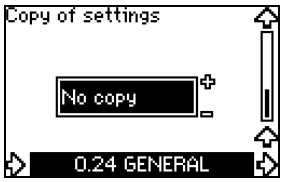
Press [On/Off], [OK] and [+] for a complete reset to factory settings.

10.5.2 Type code change (0.2)



This display is for service use only.

10.5.3 Copy of settings



It is possible to copy the settings of a CUE and reuse them in another one.

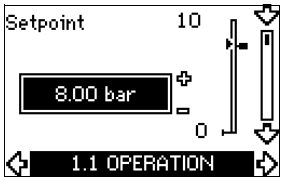
Options:

- No copy.
- to CUE (copies the settings of the CUE).
- to control panel (copies the settings to another CUE).

The CUE units must have the same firmware version. See section *10.7.16 Firmware version (2.16)*.

10.6 OPERATION

10.6.1 Setpoint (1.1)



- Setpoint set
- Actual setpoint
- Actual value

Set the setpoint in the units of the feedback sensor.

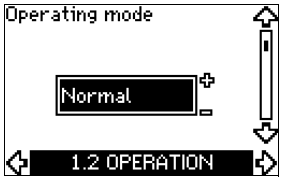
In "Open loop" control mode, the setpoint is set in % of the maximum performance. The setting range will be between the min. and max. curves. See fig. 55.

In all other control modes except proportional differential pressure, the setting range is equal to the sensor measuring range. See fig. 56.

In "Proportional differential pressure" control mode, the setting range is equal to 25 % to 90 % of max. head. See fig. 57.

If the pump is connected to an external setpoint signal, the value in this display will be the maximum value of the external setpoint signal. See section *13.2 External setpoint*.

10.6.2 Operating mode (1.2)



Set one of the following operating modes:

- **Normal** (duty)
- Stop
- Min.
- Max.

The operating modes can be set without changing the setpoint setting.

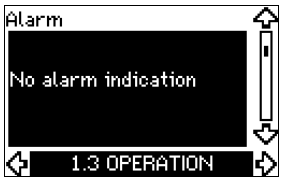
10.6.3 Fault indications

Faults may result in two types of indication: Alarm or warning.

An alarm will activate an alarm indication in CUE and cause the pump to change operating mode, typically to stop. However, for some faults resulting in alarm, the pump is set to continue operating even if there is an alarm.

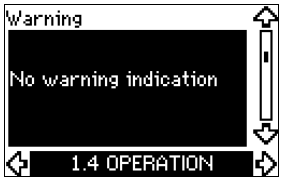
A warning will activate a warning indication in CUE, but the pump will not change operating or control mode.

Alarm (1.3)



In case of an alarm, the cause will appear in the display. See section *15.1 Warning and alarm list*.

Warning (1.4)

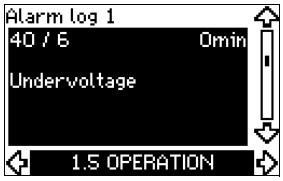


In case of a warning, the cause will appear in the display. See section *15.1 Warning and alarm list*.

10.6.4 Fault log

For both fault types, alarm and warning, the CUE has a log function.

Alarm log (1.5 - 1.9)

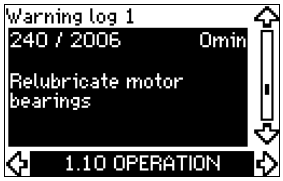


In case of an alarm, the last five alarm indications will appear in the alarm log. "Alarm log 1" shows the latest alarm, "Alarm log 2" shows the latest alarm but one, etc.

The display shows three pieces of information:

- the alarm indication
- the alarm code
- the number of minutes the pump has been connected to the power supply after the alarm occurred.

Warning log (1.10 - 1.14)



In case of a warning, the last five warning indications will appear in the warning log. "Warning log 1" shows the latest fault, "Warning log 2" shows the latest fault but one, etc.

The display shows three pieces of information:

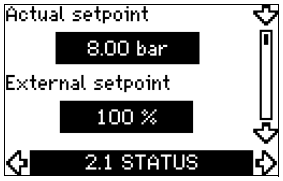
- the warning indication
- the warning code
- the number of minutes the pump has been connected to the power supply after the warning occurred.

10.7 STATUS

The displays appearing in this menu are status displays only. It is not possible to change or set values.

The tolerance of the displayed value is stated under each display. The tolerances are stated as a guide in % of the maximum values of the parameters.

10.7.1 Actual setpoint (2.1)

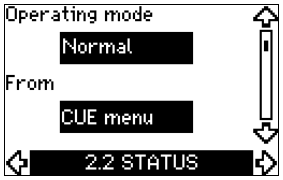


This display shows the actual setpoint and the external setpoint.

The actual setpoint is shown in the units of the feedback sensor.

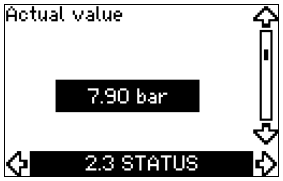
The external setpoint is shown in a range of 0 to 100 %. If the external setpoint influence is deactivated, the value 100 % is shown. See section *13.2 External setpoint*.

10.7.2 Operating mode (2.2)



This display shows the actual operating mode (Normal, Stop, Min. or Max.). Furthermore, it shows where this operating mode was selected (CUE menu, Bus, External or On/off button).

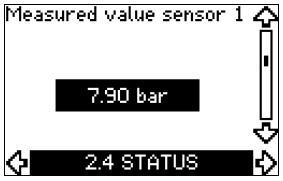
10.7.3 Actual value (2.3)



This display shows the actual value controlled.

If no sensor is connected to the CUE, "-" will appear in the display.

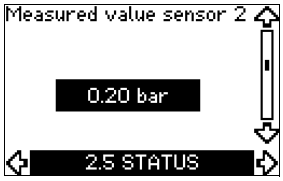
10.7.4 Measured value, sensor 1 (2.4)



This display shows the actual value measured by sensor 1 connected to terminal 54.

If no sensor is connected to the CUE, "-" will appear in the display.

10.7.5 Measured value, sensor 2 (2.5)



This display is only shown if an MCB 114 sensor input module has been installed.

The display shows the actual value measured by sensor 2 connected to an MCB 114.

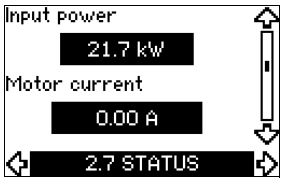
If no sensor is connected to the CUE, "-" will appear in the display.

10.7.6 Speed (2.6)

Tolerance: ± 5 %

This display shows the actual pump speed.

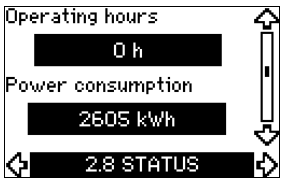
10.7.7 Input power and motor current (2.7)



Tolerance: ± 10 %

This display shows the actual pump input power in W or kW and the actual motor current in ampere [A].

10.7.8 Operating hours and power consumption (2.8)



Tolerance: ± 2 %

This display shows the number of operating hours and the power consumption. The value of operating hours is an accumulated value and cannot be reset. The value of power consumption is an accumulated value calculated from the unit's birth, and it cannot be reset.

10.7.9 Lubrication status of motor bearings (2.9)

This display shows how many times the user has given the lubrication stated and when to replace the motor bearings.

When the motor bearings have been relubricated, confirm this action in the "INSTALLATION" menu. See section *10.8.18 Confirming relubrication/replacement of motor bearings (3.20)*. When relubrication is confirmed, the figure in the above display will be increased by one.

10.7.10 Time until relubrication of motor bearings (2.10)

This display is only shown if display 2.11 is not shown.

The display shows when to relubricate the motor bearings. The controller monitors the operating pattern of the pump and calculates the period between bearing lubrications. If the operating pattern changes, the calculated time until relubrication may change as well.

The estimated time until relubrication takes into account if the pump has been running with reduced speed.

See section *10.8.18 Confirming relubrication/replacement of motor bearings (3.20)*.

10.7.11 Time until replacement of motor bearings (2.11)

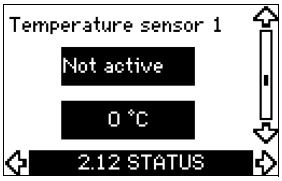
This display is only shown if display 2.10 is not shown.

The display shows when to replace the motor bearings. The controller monitors the operating pattern of the pump and calculates the period between bearing replacements.

The estimated time until replacement of motor bearings takes into account if the pump has been running with reduced speed.

See section *10.8.18 Confirming relubrication/replacement of motor bearings (3.20)*.

10.7.12 Temperature sensor 1 (2.12)

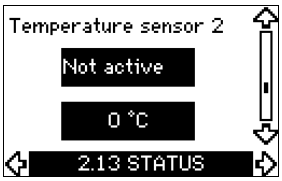


This display is only shown if an MCB 114 sensor input module has been installed.

The display shows the measuring point and the actual value measured by a Pt100/Pt1000 temperature sensor 1 connected to the MCB 114. The measuring point is selected in display 3.21.

If no sensor is connected to the CUE, "-" will appear in the display.

10.7.13 Temperature sensor 2 (2.13)

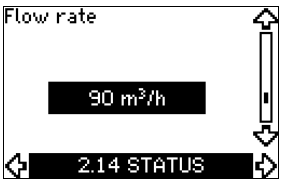


This display is only shown if an MCB 114 sensor input module has been installed.

The display shows the measuring point and the actual value measured by a Pt100/Pt1000 temperature sensor 2 connected to the MCB 114. The measuring point is selected in display 3.22.

If no sensor is connected to the CUE, "-" will appear in the display.

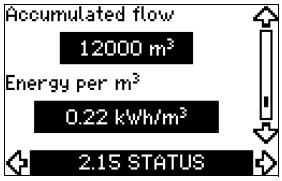
10.7.14 Flow rate (2.14)



This display is only shown if a flowmeter has been configured.

The display shows the actual value measured by a flowmeter connected to the digital pulse input (terminal 33) or the analog input (terminal 54).

10.7.15 Accumulated flow (2.15)

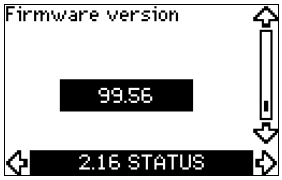


This display is only shown if a flowmeter has been configured.

The display shows the value of the accumulated flow and the specific energy for the transfer of the pumped liquid.

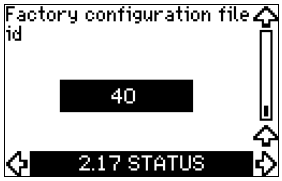
The flow measurement can be connected to the digital pulse input (terminal 33) or the analog input (terminal 54).

10.7.16 Firmware version (2.16)



This display shows the version of the software.

10.7.17 Configuration file (2.17)



This display shows the configuration file.

10.8 INSTALLATION

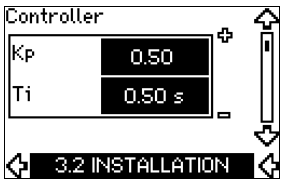
10.8.1 Control mode (3.1)

Select one of the following control modes:

- Open loop
- Constant pressure
- Constant differential pressure
- Proportional differential pressure
- Constant flow rate
- Constant temperature
- Constant level
- Constant other value.

Note If the pump is connected to a bus, the control mode cannot be selected via the CUE. See section *13.3 GENIbus signal*.

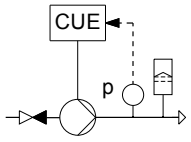
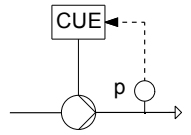
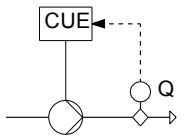
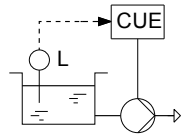
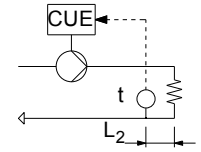
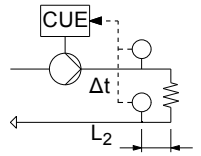
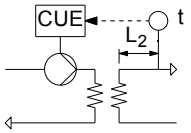
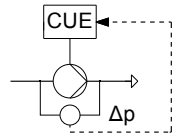
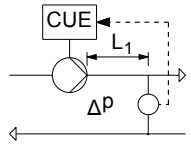
10.8.2 Controller (3.2)



The CUE has a factory setting of gain (K_p) and integral time (T_i). However, if the factory setting is not the optimum setting, the gain and the integral time can be changed in the display.

- The gain (K_p) can be set within the range from 0.1 to 20.
- The integral time (Ti) can be set within the range from 0.1 to 3600 s. If you select 3600 s, the controller will function as a P controller.
- Furthermore, it is possible to set the controller to inverse control, meaning that if the setpoint is increased, the speed will be reduced. In the case of inverse control, the gain (K_p) must be set within the range from -0.1 to -20.

The table below shows the suggested controller settings:

System/application	K_p		T_i
	Heating system[1)]	Cooling system[2)]	
	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 m: 0.5* L_1 > 5 m: 3* L_1 > 10 m: 5*

* T_i = 100 seconds (factory setting).

1. Heating systems are systems in which an increase in pump performance will result in a rise in temperature at the sensor.
2. Cooling systems are systems in which an increase in pump performance will result in a drop in temperature at the sensor.

L_1 = Distance in [m] between pump and sensor.

L_2 = Distance in [m] between heat exchanger and sensor.

How to set the PI controller

For most applications, the factory setting of the controller constants K_p and T_i will ensure optimum pump operation. However, in some applications an adjustment of the controller may be needed.

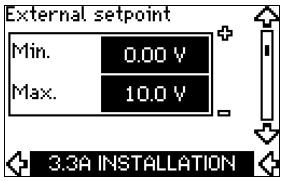
Proceed as follows:

1. Increase the gain (K_p) until the motor becomes unstable. Instability can be seen by observing if the measured value starts to fluctuate. Furthermore, instability is audible as the motor starts hunting up and down.
   As some systems, such as temperature controls, are slow-reacting, it may be difficult to observe that the motor is unstable.
2. Set the gain (K_p) to half the value of the value which made the motor unstable. This is the correct setting of the gain.
3. Reduce the integral time (T_i) until the motor becomes unstable.
4. Set the integral time (T_i) to twice the value which made the motor unstable. This is the correct setting of the integral time.

General rules of thumb:

- If the controller is too slow-reacting, increase K_p.
- If the controller is hunting or unstable, dampen the system by reducing K_p or increasing T_i.

10.8.3 External setpoint (3.3)



The input for external setpoint signal (terminal 53) can be set to the following types:

- Active
- **Not active.**

If you select "Active", the actual setpoint is influenced by the signal connected to the external setpoint input. See section *13.2 External setpoint*.

10.8.4 Signal relays 1 and 2 (3.4 and 3.5)

The CUE has two signal relays. In the display below, select in which operating situations the signal relay should be activated.

Signal relay 1

- Ready
- **Alarm**
- Operation
- Pump running
- Not active
- Warning
- Relubricate.

Signal relay 2

- Ready
- Alarm
- Operation
- Pump running
- Not active
- **Warning**
- Relubricate.

Note For the distinction between alarm and warning, see section *10.6.3 Fault indications*.

10.8.5 Buttons on the CUE (3.6)

The editing buttons (+, -, On/Off, OK) on the control panel can be set to these values:

- **Active**
- Not active.

When set to "Not active" (locked), the editing buttons do not function. Set the buttons to "Not active" if the pump should be controlled via an external control system.

Activate the buttons by pressing the arrow up and arrow down buttons simultaneously for 3 seconds.

10.8.6 Protocol (3.7)

This display shows the protocol selection for the RS-485 port of the CUE. The protocol can be set to these values:

- **GENIbus**
- FC
- FC MC.

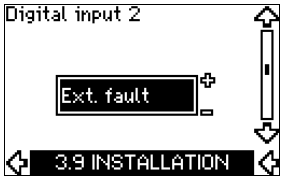
If you select "GENIbus", the communication is set according to the Grundfos GENIbus standard. FC and FC MC are for service purposes only.

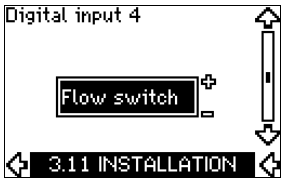
10.8.7 Pump number (3.8)

This display shows the GENIbus number. A number between 1 and 199 can be allocated to the pump. In the case of bus communication, a number must be allocated to each pump.

The factory setting is "-".

10.8.8 Digital inputs 2, 3 and 4 (3.9 to 3.11)





The digital inputs of the CUE (terminal 19, 32 and 33) can be set individually to different functions.

Select one of the following functions:

- Min. (min. curve)
- Max. (max. curve)
- Ext. fault (external fault)
- Flow switch
- Alarm reset
- Dry running (from external sensor)
- Accumulated flow (pulse flow, only terminal 33)
- Not active.

The selected function is active when the digital input is activated (closed contact). See also section *13.1 Digital inputs*.

Min.

When the input is activated, the pump will operate according to the min. curve.

Max.

When the input is activated, the pump will operate according to the max. curve.

Ext. fault

When the input is activated, a timer will be started. If the input is activated for more than 5 seconds, an external fault will be indicated. If the input is deactivated, the fault condition will cease and the pump can only be restarted manually by resetting the fault indication.

Flow switch

When this function is selected, the pump will be stopped when a connected flow switch detects low flow.

It is only possible to use this function if the pump is connected to a pressure sensor or a level sensor, and the stop function is activated. See sections *10.8.11 Constant pressure with stop function (3.14)* and *10.8.12 Constant level with stop function (3.14)*.

Alarm reset

When the input has been activated, the alarm is reset if the cause of the alarm no longer exists.

Dry running

When this function is selected, lack of inlet pressure or water shortage can be detected. This requires the use of an accessory, such as:

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

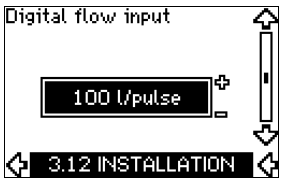
When lack of inlet pressure or water shortage (dry running) is detected, the pump will be stopped. The pump cannot restart as long as the input is activated.

Restarts may be delayed by up to 30 minutes, depending of the pump family.

Accumulated flow

When this function is set for digital input 4 and a pulse sensor is connected to terminal 33, the accumulated flow can be measured.

10.8.9 Digital flow input (3.12)



This display appears only if a flowmeter has been configured in display 3.11.

The display is used for setting the volume for every pulse for the "Accumulated flow" function with a pulse sensor connected to terminal 33.

Setting range:

- 0-1000 litres/pulse.

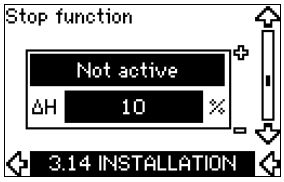
The volume can be set in the unit selected in the startup guide.

10.8.10 Analog output (3.13)

The analog output can be set to show one of the following options:

- Feedback
- Power input
- Speed
- Output frequency
- External sensor
- Limit 1 exceeded
- Limit 2 exceeded
- Not active.

10.8.11 Constant pressure with stop function (3.14)



Settings

The stop function can be set to these values:

- Active
- **Not active.**

The on/off band can be set to these values:

- ΔH is factory-set to 10 % of the actual setpoint.
- ΔH can be set within the range from 5 % to 30 % of the actual setpoint.

Description

The stop function is used for changing between on/off operation at low flow and continuous operation at high flow.

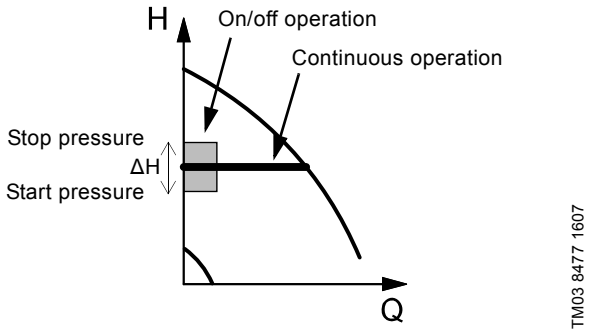


Fig. 49 Constant pressure with stop function. Difference between start and stop pressures (ΔH)

Low flow can be detected in two different ways:

1. A built-in "low-flow detection function" which functions if the digital input is not set up for flow switch.
2. A flow switch connected to the digital input.

1. Low-flow detection function

The pump will check the flow regularly by reducing the speed for a short time. If there is no or only a small change in pressure, this means that there is low flow.

The speed will be increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached and the pump will stop after a few seconds. The pump will restart at the latest when the pressure has fallen to the start pressure (actual setpoint - 0.5 x ΔH).

If the flow in the off period is higher than the low-flow limit, the pump will restart before the pressure has fallen to the start pressure.

When restarting, the pump will react in the following way:

1. If the flow is higher than the low-flow limit, the pump will return to continuous operation at constant pressure.
2. If the flow is lower than the low-flow limit, the pump will continue in start/stop operation. It will continue in start/stop operation until the flow is higher than the low-flow limit. When the flow is higher than the low-flow limit, the pump will return to continuous operation.

2. Low-flow detection with flow switch

When the digital input is activated because there is low flow, the speed will be increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached, and the pump will stop. When the pressure has fallen to start pressure, the pump will start again. If there is still no flow, the pump will reach the stop pressure and stop. If there is flow, the pump will continue operating according to the setpoint.

Operating conditions for the stop function

It is only possible to use the stop function if the system incorporates a pressure sensor, a non-return valve and a diaphragm tank.

The non-return valve must always be installed before the pressure sensor. See figures 50 and 51.

Caution If a flow switch is used to detect low flow, the switch must be installed on the system side after the diaphragm tank.

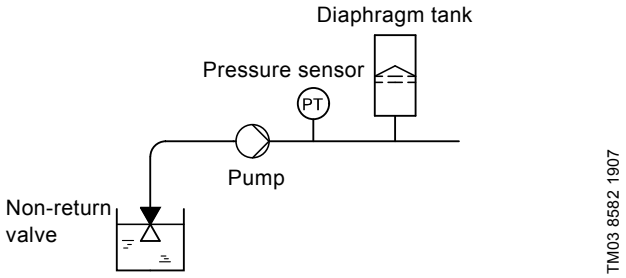


Fig. 50 Position of the non-return valve and pressure sensor in system with suction lift operation

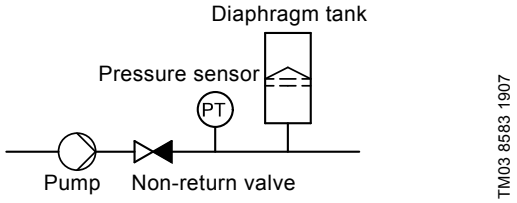


Fig. 51 Position of the non-return valve and pressure sensor in system with positive inlet pressure

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 0.7 x actual setpoint.

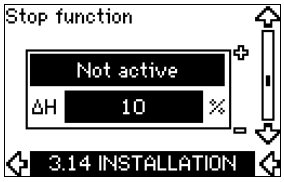
Recommended diaphragm tank size:

Rated flow rate of pump [m^3/h]	Typical diaphragm tank size [litres]
0-6	8
7-24	18
25-40	50
41-70	120
71-100	180

If a diaphragm tank of the above size is installed in the system, the factory setting of ΔH is the correct setting.

If the tank installed is too small, the pump will start and stop too often. This can be remedied by increasing ΔH.

10.8.12 Constant level with stop function (3.14)



Settings

The stop function can be set to these values:

- Active
- **Not active**.

The on/off band can be set to these values:

- ΔH is factory-set to 10 % of the actual setpoint.
- ΔH can be set within the range from 5 % to 30 % of the actual setpoint.

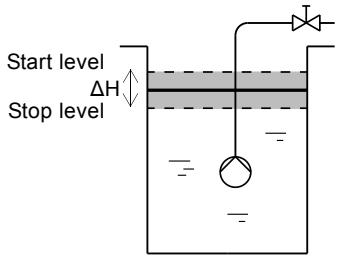
A built-in low-flow detection function will automatically measure and store the power consumption at approx. 50 % and 85 % of the rated speed.

If you select "Active", proceed as follows:

1. Close the isolating valve to create a no-flow condition.
2. Press [OK] to start the auto-tuning.

Description

The stop function is used for changing between on/off operation at low flow and continuous operation at high flow.



TM03 9099 3307

Fig. 52 Constant level with stop function. Difference between start and stop levels (ΔH)

Low flow can be detected in two different ways:

1. With the built-in low-flow detection function.
2. With a flow switch connected to a digital input.

1. Low-flow detection function

The built-in low-flow detection is based on the measurement of speed and power.

When low flow is detected, the pump will stop. When the level has reached the start level, the pump will start again. If there is still no flow, the pump will reach the stop level and stop. If there is flow, the pump will continue operating according to the setpoint.

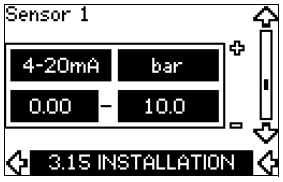
2. Low-flow detection with flow switch

When the digital input is activated because of low flow, the speed will be increased until the stop level (actual setpoint - 0.5 x ΔH) is reached, and the pump will stop. When the level has reached the start level, the pump will start again. If there is still no flow, the pump will reach the stop level and stop. If there is flow, the pump will continue operating according to the setpoint.

Operating conditions for the stop function

It is only possible to use the constant level stop function if the system incorporates a level sensor, and all valves can be closed.

10.8.13 Sensor 1 (3.15)

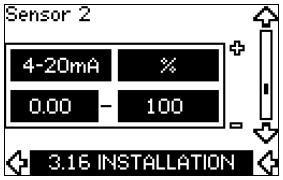


Setting of sensor 1 connected to terminal 54. This is the feedback sensor.

Select among the following values:

- Sensor output signal:
  0-20 mA
  4-20 mA.
- Sensor unit of measurement:
  bar, mbar, m, kPa, psi, ft, m^3/h, m^3/s, l/s, gpm, °C, °F, %.
- Sensor measuring range.

10.8.14 Sensor 2 (3.16)



Setting of sensor 2 connected to an MCB 114 sensor input module.

Select among the following values:

- Sensor output signal:
  0-20 mA
  4-20 mA.
- Sensor unit of measurement:
  bar, mbar, m, kPa, psi, ft, m^3/h, m^3/s, l/s, gpm, °C, °F, %.
- Sensor measuring range:
  0-100 %.

10.8.15 Duty/standby (3.17)

Settings

The duty/standby function can be set to these values:

- Active
- **Not active**.

Activate the duty/standby function as follows:

1. Connect one of the pumps to the mains supply.
   Set the duty/standby function to "Not active".
   Make the necessary settings in the "OPERATION" and "INSTALLATION" menus.
2. Set the operating mode to "Stop" in the "OPERATION" menu.
3. Connect the other pump to the mains supply.
   Make the necessary settings in the "OPERATION" and "INSTALLATION" menus. Set the duty/standby function to "Active".

The running pump will search for the other pump and automatically set the duty/standby function of this pump to "Active". If it cannot find the other pump, a fault will be indicated.

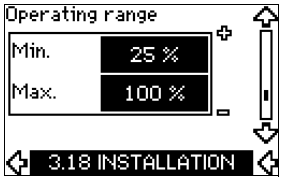
Note The two pumps must be connected electrically via the GENIbus, and nothing else must be connected on the GENIbus.

The duty/standby function applies to two pumps connected in parallel and controlled via GENIbus. Each pump must be connected to its own CUE and sensor.

The primary targets of the function is the following:

- To start the standby pump if the duty pump is stopped due to an alarm.
- To alternate the pumps at least every 24 hours.

10.8.16 Operating range (3.18)



How to set the operating range:

- Set the min. speed within the range from a pump-dependent min. speed to the adjusted max. speed. The factory setting depends on the pump family.
- Set the max. speed within the range from adjusted min. speed to the pump-dependent max. speed. The factory setting will be equal to 100 %, i.e. the speed stated on the pump nameplate.

The area between the min. and max. 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 (max. speed above 100 %) will be possible. This requires an oversize motor to deliver the shaft power required by the pump during oversynchronous operation.

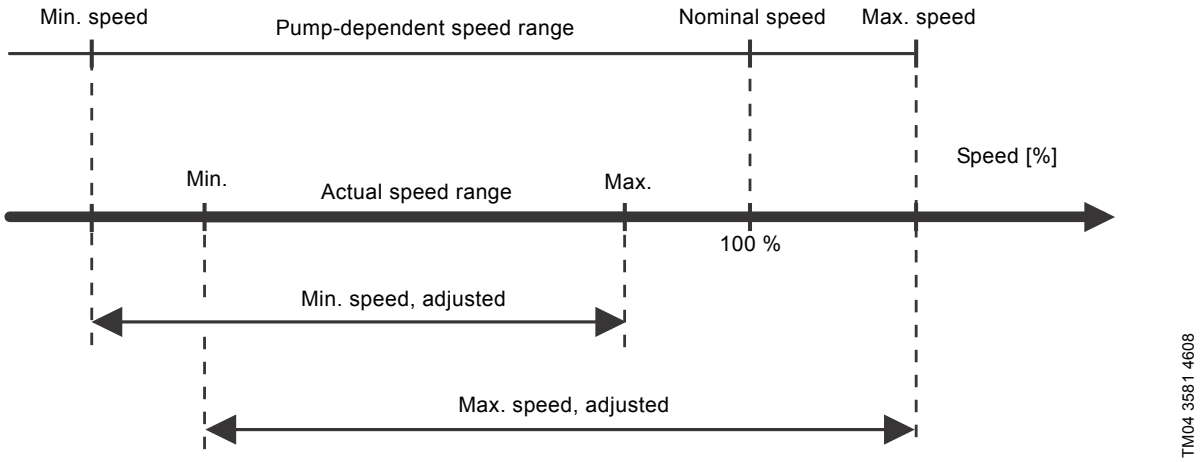


Fig. 53 Setting of the min. and max. curves in % of maximum performance

10.8.17 Motor bearing monitoring (3.19)

The motor bearing monitoring function can be set to these values:

- **Active**
- Not active.

When the function is set to "Active", the CUE will give a warning when the motor bearings are due to be relubricated or replaced.

Description

The motor bearing monitoring function is used to give an indication when it is time to relubricate or replace the motor bearings. See displays 2.10 and 2.11.

The warning indication and the estimated time take into account if the pump has been running with reduced speed. The bearing temperature is included in the calculation if temperature sensors are installed and connected to an MCB 114 sensor input module.

Note: The counter will continue counting even if the function is switched to "Not active", but a warning will not be given when it is time for relubrication.

10.8.18 Confirming relubrication/replacement of motor bearings (3.20)

This function can be set to these values:

- Relubricated
- Replaced
- **Nothing done.**

When the motor bearings have been relubricated or replaced, confirm this action in the above display by pressing [OK].

Note: Relubricated cannot be selected for a period of time after confirming relubrication.

Relubricated

When the warning "Relubricate motor bearings" has been confirmed,

- the counter is set to 0.
- the number of relubrications is increased by 1.

When the number of relubrications has reached the permissible number, the warning "Replace motor bearings" appears in the display.

Replaced

When the warning "Replace motor bearings" has been confirmed,

- the counter is set to 0.
- the number of relubrications is set to 0.
- the number of bearing changes is increased by 1.

10.8.19 Temperature sensor 1 (3.21)

This display is only shown if an MCB 114 sensor input module has been installed.

Select the function of a Pt100/Pt1000 temperature sensor 1 connected to an MCB 114:

- D-end bearing
- ND-end bearing
- Other liq. temp. 1
- Other liq. temp. 2
- Motor winding
- Pumped liq. temp.
- Ambient temp.
- Not active.

10.8.20 Temperature sensor 2 (3.22)

This display is only shown if an MCB 114 sensor input module has been installed.

Select the function of a Pt100/Pt1000 temperature sensor 2 connected to an MCB 114:

- D-end bearing
- ND-end bearing
- Other liq. temp. 1
- Other liq. temp. 2
- Motor winding
- Pumped liq. temp.
- Ambient temp.
- Not active.

10.8.21 Standstill heating (3.23)

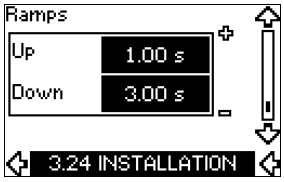
The standstill heating function can be set to these values:

- Active
- **Not active.**

When the function is set to "Active" and the pump is stopped by a stop command, a current will be applied to the motor windings.

The standstill heating function pre-heats the motor to avoid condensation.

10.8.22 Ramps (3.24)



Set the time for each of the two ramps, ramp-up and ramp-down:

- Factory setting:
  Depending on power size.
- The range of the ramp parameter:
  1-3600 s.

The ramp-up time is the acceleration time from 0 min^{-1} to the rated motor speed. Choose a ramp-up time such that the output current does not exceed the maximum current limit for the CUE.

The ramp-down time is the deceleration time from rated motor speed to 0 min^{-1}. Choose a ramp-down time such that no overvoltage arises and such that the generated current does not exceed the maximum current limit for the CUE.

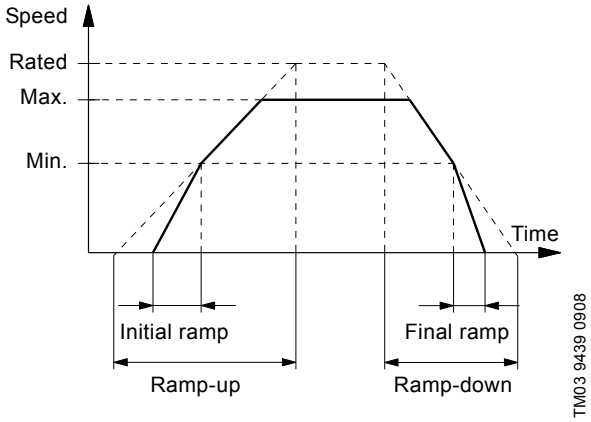


Fig. 54 Ramp-up and ramp-down, display 3.24

10.8.23 Switching frequency (3.25)

The switching frequency can be changed. The options in the menu depend on the power size of the CUE. Changing the switching frequency to a higher level will increase the losses and thus increase the temperature of the CUE.

We do not recommend increasing the switching frequency if the ambient temperature is high.

11. Setting by means of PC Tool E-products

Special setup requirements differing from the settings available via the CUE require the use of Grundfos PC Tool E-products. This again requires the assistance of a Grundfos service engineer. Contact your local Grundfos company for more information.

12. Priority of settings

On/Off — The on/off button has the highest priority. In "off" condition, pump operation is not possible.

The CUE can be controlled in various ways at the same time. If two or more operating modes are active at the same time, the operating mode with the highest priority will be in force.

12.1 Control without bus signal, local operating mode

Priority	CUE menu	External signal
1	Stop	
2	Max.	
3		Stop
4		Max.
5	Min.	Min.
6	Normal	Normal

Example: If an external signal has activated the "Max." operating mode, it will only be possible to stop the pump.

12.2 Control with bus signal, remote-controlled operating mode

Priority	CUE menu	External signal	Bus signal
1	Stop		
2	Max.		
3		Stop	Stop
4			Max.
5			Min.
6			Normal

Example: If the bus signal has activated the "Max." operating mode, it will only be possible to stop the pump.

13. External control signals

13.1 Digital inputs

The overview shows functions in connection with closed contact.

Terminal	Type	Function
18	DI 1	• Start/stop of pump
19	DI 2	• Min. (min. curve) • Max. (max. curve) • Ext. fault (external fault) • Flow switch • Alarm reset • Dry running (from external sensor) • Not active.
32	DI 3	• Min. (min. curve) • Max. (max. curve) • Ext. fault (external fault) • Flow switch • Alarm reset • Dry running (from external sensor) • Not active.
33	DI 4	• Min. (min. curve) • Max. (max. curve) • Ext. fault (external fault) • Flow switch • Alarm reset • Dry running (from external sensor) • Accumulated flow (pulse flow) • Not active.

The same function must not be selected for more than one input.

13.2 External setpoint

Terminal	Type	Function
53	AI 1	• External setpoint (0-10 V)

The setpoint can be remote-set by connecting an analog signal transmitter to the setpoint input (terminal 53).

Open loop

In "Open loop" control mode (constant curve), the actual setpoint can be set externally within the range from the min. curve to the setpoint set via the CUE menu. See fig. 55.

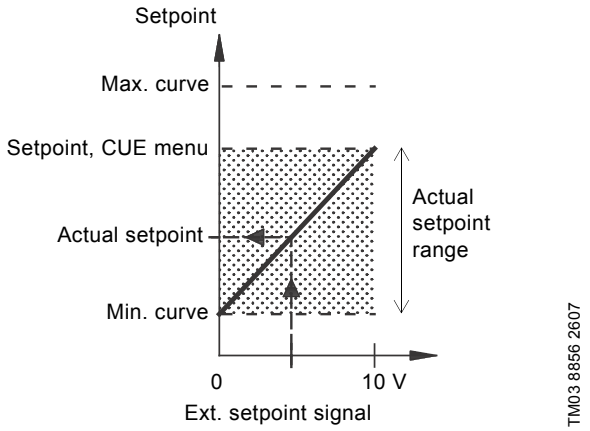


Fig. 55 Relation between the actual setpoint and the external setpoint signal in "Open loop" control mode

Closed loop

In all other control modes, except proportional differential pressure, the actual setpoint can be set externally within the range from the lower value of the sensor measuring range (sensor min.) to the setpoint set via the CUE menu. See fig. 56.

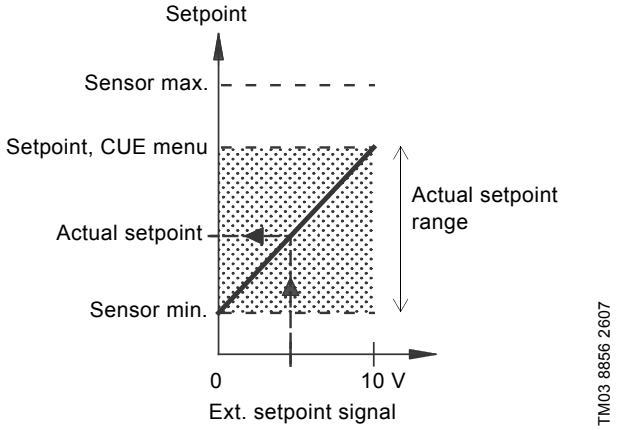


Fig. 56 Relation between the actual setpoint and the external setpoint signal in "Controlled" control mode

Example: At a sensor min. value of 0 bar, a setpoint set via the CUE menu of 3 bar and an external setpoint of 80 %, the actual setpoint will be as follows:

Actual setpoint	=	(setpoint set via the CUE menu - sensor min.) x % external setpoint signal + sensor min.
	=	(3 - 0) x 80 % + 0
	=	2.4 bar

Proportional differential pressure

In "Proportional differential pressure" control mode, the actual setpoint can be set externally within the range from 25 % of maximum head to the setpoint set via the CUE menu. See fig. 57.

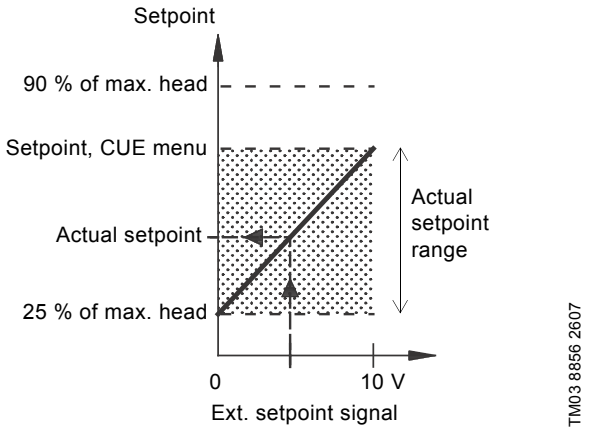


Fig. 57 Relation between the actual setpoint and the external setpoint signal in "Proportional differential pressure" control mode

Example: At a maximum head of 12 metres, a setpoint of 6 metres set via the CUE menu and an external setpoint of 40 %, the actual setpoint will be as follows:

Actual setpoint = (setpoint, CUE menu - 25 % of maximum head) x % external setpoint signal + 25 % of maximum head

= (6 - 12 x 25 %) x 40 % + 12/4

= 4.2 m

13.3 GENIbus signal

The CUE supports serial communication via an RS-485 input. The communication is carried out according to the Grundfos GENIbus protocol and enables connection to a building management system or another external control system.

Operating parameters, such as setpoint and operating mode, can be remote-set via the bus signal. At the same time, the pump can provide status information about important parameters, such as actual value of control parameter, input power and fault indications.

Contact Grundfos for further details.

Note If a bus signal is used, the number of settings available via the CUE will be reduced.

13.4 Other bus standards

Grundfos offers various bus solutions with communication according to other standards.

Contact Grundfos for further details.

14. Maintenance and service

14.1 Cleaning the CUE

Keep the cooling fins and fan blades clean to ensure sufficient cooling of the CUE.

14.2 Service parts and service kits

For further information on service parts and service kits, visit www.grundfos.com > Grundfos Product Center.

15. Fault finding

15.1 Warning and alarm list

Code	Display text	Status: Warning	Status: Alarm	Status: Locked alarm	Operating mode	Resetting
1	Too high leakage current			•	Stop	Man.
2	Mains phase failure		•		Stop	Aut.
3	External fault		•		Stop	Man.
16	Other fault		•		Stop	Aut.
				•	Stop	Man.
30	Replace motor bearings	•			-	Man.[3]
32	Overvoltage	•			-	Aut.
			•		Stop	Aut.
40	Undervoltage	•			-	Aut.
			•		Stop	Aut.
48	Overload		•		Stop	Aut.
				•	Stop	Man.
49	Overload		•		Stop	Aut.
55	Overload	•			-	Aut.
			•		Stop	Aut.
57	Dry running		•		Stop	Aut.
64	Too high CUE temperature		•		Stop	Aut.
70	Too high motor temperature		•		Stop	Aut.
77	Communication fault, duty/standby	•			-	Aut.
89	Sensor 1 outside range		•		[1]	Aut.
91	Temperature sensor 1 outside range	•			-	Aut.
93	Sensor 2 outside range	•			-	Aut.
96	Setpoint signal outside range		•		[1]	Aut.
148	Too high bearing temperature	•			-	Aut.
			•		Stop	Aut.
149	Too high bearing temperature	•			-	Aut.
			•		Stop	Aut.
155	Inrush fault		•		Stop	Aut.
175	Temperature sensor 2 outside range	•			-	Aut.
240	Relubricate motor bearings	•			-	Man.[3]
241	Motor phase failure	•			-	Aut.
			•		Stop	Aut.
242	AMA did not succeed[2]	•			-	Man.

[1] In case of an alarm, the CUE will change the operating mode depending on the pump type.

[2] AMA, Automatic Motor Adaptation. Not active in the present software.

[3] Warning is reset in display 3.20.

15.2 Resetting of alarms

In case of a fault or malfunction of the CUE, check the alarm list in the "OPERATION" menu. The latest five alarms and latest five warnings can be found in the log menus.

Contact a Grundfos technician if an alarm occurs repeatedly.

15.2.1 Warning

The CUE will continue the operation as long as the warning is active. The warning remains active until the cause no longer exists. Some warnings may switch to alarm condition.

15.2.2 Alarm

In case of an alarm, the CUE will stop the pump or change the operating mode depending on the alarm type and pump type. See section *15.1 Warning and alarm list*.

Pump operation will be resumed when the cause of the alarm has been remedied and the alarm has been reset.

Resetting an alarm manually

- Press [OK] in the alarm display.
- Press [On/Off] twice.
- Activate a digital input DI 2-DI 4 set to "Alarm reset" or the digital input DI 1 (start/stop).

If it is not possible to reset an alarm, the reason may be that the fault has not been remedied, or that the alarm has been locked.

15.2.3 Locked alarm

In case of a locked alarm, the CUE will stop the pump and become locked. Pump operation cannot be resumed until the cause of the locked alarm has been remedied and the alarm has been reset.

Resetting a locked alarm

- Switch off the power supply to the CUE for about 30 seconds. Switch on the power supply, and press OK in the alarm display to reset the alarm.

15.3 Indicator lights

The table shows the function of the indicator lights.

Indicator light	Function
On (green)	The pump is running or has been stopped by a stop function.
	If flashing, the pump has been stopped by the user (CUE menu), external start/stop or bus.
Off (orange)	The pump has been stopped with the on/off button.
Alarm (red)	Indicates an alarm or a warning.

15.4 Signal relays

The table shows the function of the signal relays.

Type	Function	
Relay 1	• Ready • **Alarm** • Operation	Pump running Warning Relubricate
Relay 2	• Ready • Alarm • Operation	Pump running **Warning** Relubricate

See also fig. 29.

16. Technical data

16.1 Enclosure

The individual CUE cabinet sizes are characterised by their enclosures. The table shows the relationship of enclosure class and enclosure type.

Example:

Read from the nameplate:

- Supply voltage = 3 x 380-500 V.
- Typical shaft power = 1.5 kW.
- Enclosure class = IP20.

The table shows that the CUE enclosure is A2.

Typical shaft power P2		Enclosure										
		1 x 200-240 V			3 x 200-240 V		3 x 380-500 V		3 x 525-600 V		3 x 525-690 V	
[kW]	[HP]	IP20	IP21	IP55	IP20	IP55	IP20	IP55	IP20	IP55	IP21	IP55
0.55	0.75						A2	A4				
0.75	1				A2	A4			A3	A5		
1.1	1.5	A3		A5								
1.5	2		B1	B1								
2.2	3											
3	4				A3	A5						
3.7	5											
4	5						A2	A4				
5.5	7.5		B1	B1	B3	B1	A3	A5	A3	A5		
7.5	10		B2	B2								
11	15						B3	B1			B2	B2
15	20				B4	B2						
18.5	25					C1						
22	30				C3		B4	B2				
30	40											
37	50				C4	C2		C1			C2	C2
45	60						C3					
55	75											
75	100						C4	C2				
90	125											

16.2 Cable gland

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

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

Enclosure	Standard gland holes	Imperial gland holes
A3 IP20/21 / NEMA type 1	3 x 22.5 (1/2")	3 x 22.5 (1/2")
	3 x 28.4 (3/4")	3 x 28.4 (3/4")
A4 IP55 / NEMA type 12	1 x 22.5 (1/2")	1 x 22.5 (1/2")
	3 x 28.4 (3/4")	3 x 28.4 (3/4")
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")
B2 IP21 / NEMA type 1 and B2 IP55 / NEMA type 12	1 x 21.5	1 x 22.5 (1/2")
	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")

16.3 Main dimensions and weights

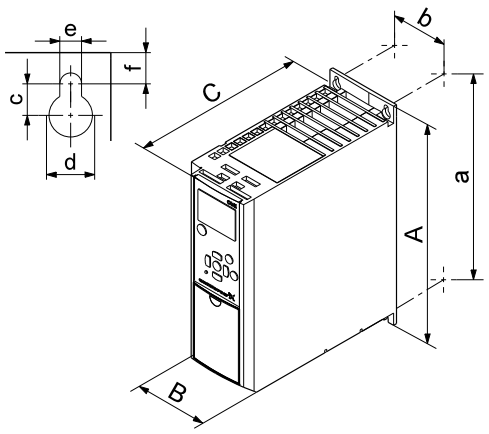


Fig. 58 Enclosures A2 and A3

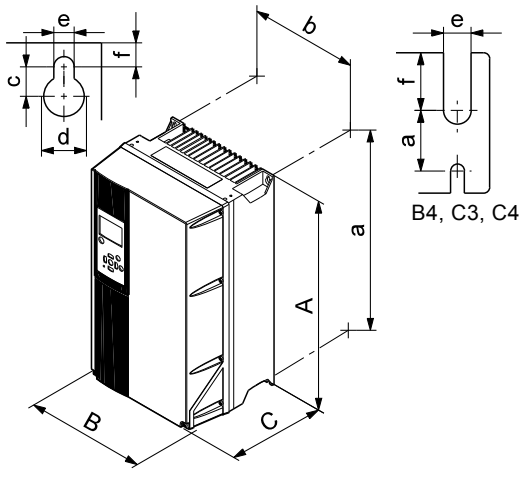


Fig. 59 Enclosures A4, A5, B1, B2, B3, B4, C1, C2, C3 and C4

Enclosure	Height [mm] 1)		Width [mm] 1)		Depth [mm] 1)		Screw holes [mm]				Weight [kg]
	A	a	B	b	C	C 2)	c	Ød	Øe	f	
A2	268	257	90	70	205	219	8	11	5.5	9	4.9
IP21/NEMA1	375	350	90	70	205	219	8	11	5.5	9	5.3
A3	268	257	130	110	205	219	8	11	5.5	9	6.6
IP21/NEMA1	375	350	130	110	205	219	8	11	5.5	9	7
A4	420	401	200	171	175	175	8.2	12	6.5	6	9.2
A5	420	402	242	215	200	200	8.2	12	6.5	9	14
B1	480	454	242	210	260	260	12	19	9	9	23
B2	650	624	242	210	260	260	12	19	9	9	27
B3	399	380	165	140	248	262	8	12	6.8	7.9	12
IP21/NEMA1	475	–	165	–	249	262	8	12	6.8	7.9	–
B4	520	495	231	200	242	242	–	–	8.5	15	23.5
IP21/NEMA1	670	–	255	–	246	246	–	–	8.5	15	–
C1	680	648	308	272	310	310	12	19	9	9.8	45
C2	770	739	370	334	335	335	12	19	9	9.8	65
C3	550	521	308	270	333	333	–	–	8.5	17	35
IP21/NEMA1	755	–	329	–	337	337	–	–	8.5	17	–
C4	660	631	370	330	333	333	–	–	8.5	17	50
IP21/NEMA1	950	–	391	–	337	337	–	–	8.5	17	–
D1	1209	1154	420	304	380	–	20	11	11	25	104
D2	1589	1535	420	304	380	–	20	11	11	25	151

1) The dimensions are maximum height, width and depth.

16.4 Surroundings

Relative humidity	5-95 % RH
Ambient temperature	Max. 50 °C
Average ambient temperature over 24 hours	Max. 45 °C
Minimum ambient temperature at full operation	0 °C
Minimum ambient temperature at reduced operation	-10 °C
Temperature during storage and transportation	-25 to 65 °C
Storage duration	Max. 6 months
Maximum altitude above sea level without performance reduction	1000 m
Maximum altitude above sea level with performance reduction	3000 m

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

16.5 Terminal torques

Enclosure	Torque [Nm]			
	Mains	Motor	Earth	Relay
A2	1.8	1.8	3	0.6
A3	1.8	1.8	3	0.6
A4	1.8	1.8	3	0.6
A5	1.8	1.8	3	0.6
B1	1.8	1.8	3	0.6
B2	4.5	4.5	3	0.6
B3	1.8	1.8	3	0.6
B4	4.5	4.5	3	0.6
C1	10	10	3	0.6
C2	14[1)]/24[2)]	14[1)]/24[2)]	3	0.6
C3	10	10	3	0.6
C4	14[1)]/24[2)]	14[1)]/24[2)]	3	0.6

1) Conductor cross-section ≤ 95 mm^2
2) Conductor cross-section ≥ 95 mm^2.

16.6 Cable length

Maximum length, screened motor cable	150 m
Maximum length, unscreened motor cable	300 m
Maximum length, signal cable	300 m

16.7 Fuses and cable cross-section

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

16.7.1 Cable cross-section to signal terminals

Maximum cable cross-section to signal terminals, rigid conductor	1.5 mm^2
Maximum cable cross-section to signal terminals, flexible conductor	1.0 mm^2
Minimum cable cross-section to signal terminals	0.5 mm^2

16.7.2 Non-UL fuses and conductor cross-section to mains and motor

Typical shaft power P2	Maximum fuse size	Fuse type	Maximum conductor cross-section 1)
[kW]	[A]		[mm^2]
1 x 200-240 V			
1.1	20	gG	4
1.5	30	gG	10
2.2	40	gG	10
3	40	gG	10
3.7	60	gG	10
5.5	80	gG	10
7.5	100	gG	35
3 x 200-240 V			
0.75	10	gG	4
1.1	20	gG	4
1.5	20	gG	4
2.2	20	gG	4
3	32	gG	4
3.7	32	gG	4
5.5	63	gG	10
7.5	63	gG	10
11	63	gG	10
15	80	gG	35
18.5	125	gG	50
22	125	gG	50
30	160	gG	50
37	200	aR	95
45	250	aR	120
3 x 380-500 V			
0.55	10	gG	4
0.75	10	gG	4
1.1	10	gG	4
1.5	10	gG	4
2.2	20	gG	4
3	20	gG	4
4	20	gG	4
5.5	32	gG	4
7.5	32	gG	4
11	63	gG	10
15	63	gG	10
18.5	63	gG	10
22	63	gG	35
30	80	gG	35
37	100	gG	50
45	125	gG	50
55	160	gG	50
75	250	aR	95
90	250	aR	120
3 x 525-600 V			
0.75	10	gG	4
1.1	10	gG	4
1.5	10	gG	4
2.2	20	gG	4
3	20	gG	4
4	20	gG	4
5.5	32	gG	4
7.5	32	gG	4
3 x 525-690 V			
11	63	gG	35
15	63	gG	35
18.5	63	gG	35
22	63	gG	35
30	63	gG	35
37	80	gG	95
45	100	gG	95
55	125	gG	95
75	160	gG	95
90	160	gG	95

1) Screened motor cable, unscreened supply cable. AWG. See section *16.7.3 UL fuses and conductor cross-section to mains and motor*.

16.7.3 UL fuses and conductor cross-section to mains and motor

Typical shaft power P2	Fuse type							Maximum conductor cross-section [1]
[kW]	Bussmann RK1	Bussmann J	Bussmann T	SIBA RK1	Littel Fuse RK1	Ferraz-Shawmut CC	Ferraz-Shawmut RK1	[AWG] [2]
1 x 200-240 V								
1.1	KTN-R20	–	–	–	–	–	–	10
1.5	KTN-R30	–	–	–	–	–	–	7
2.2	KTN-R40	–	–	–	–	–	–	7
3	KTN-R40	–	–	–	–	–	–	7
3.7	KTN-R60	–	–	–	–	–	–	7
5.5	–	–	–	–	–	–	–	7
7.5	–	–	–	–	–	–	–	2
3 x 200-240 V								
0.75	KTN-R10	JKS-10	JJN-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.1	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
1.5	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
2.2	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
3	KTN-R30	JKS-30	JJN-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
3.7	KTN-R30	JKS-30	JJN-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
5.5	KTN-R50	JKS-50	JJN-50	5012406-050	KLN-R50	–	A2K-50R	7
7.5	KTN-R50	JKS-60	JJN-60	5012406-050	KLN-R60	–	A2K-50R	7
11	KTN-R60	JKS-60	JJN-60	5014006-063	KLN-R60	A2K-60R	A2K-60R	7
15	KTN-R80	JKS-80	JJN-80	5014006-080	KLN-R80	A2K-80R	A2K-80R	2
18.5	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R	1/0
22	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R	1/0
30	FWX-150	–	–	2028220-150	L25S-150	A25X-150	A25X-150	1/0
37	FWX-200	–	–	2028220-200	L25S-200	A25X-200	A25X-200	4/0
45	FWX-250	–	–	2028220-250	L25S-250	A25X-250	A25X-250	250 MCM
3 x 380-500 V								
0.55	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
0.75	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.1	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.5	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.2	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
3	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
4	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
5.5	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
7.5	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
11	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	–	A6K-40R	7
15	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	–	A6K-40R	7
18.5	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	–	A6K-50R	7
22	KTS-R60	JKS-60	JJS-60	5014006-063	KLS-R60	–	A6K-60R	2
30	KTS-R80	JKS-80	JJS-80	2028220-100	KLS-R80	–	A6K-80R	2
37	KTS-R100	JKS-100	JJS-100	2028220-125	KLS-R100	–	A6K-100R	1/0
45	KTS-R125	JKS-150	JJS-150	2028220-125	KLS-R125	–	A6K-125R	1/0
55	KTS-R150	JKS-150	JJS-150	2028220-160	KLS-R150	–	A6K-150R	1/0
75	FWH-220	–	–	2028220-200	L50S-225	–	A50-P225	4/0
90	FWH-250	–	–	2028220-250	L50S-250	–	A50-P250	250 MCM
3 x 525-600 V								
0.75	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.1	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
1.5	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.2	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
3	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
4	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
5.5	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
7.5	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
3 x 525-690 V								
11	KTS-R-25	JKS-25	JJS-25	5017906-025	KLSR025	HST25	A6K-25R	1/0
15	KTS-R-30	JKS-30	JJS-30	5017906-030	KLSR030	HST30	A6K-30R	1/0
18.5	KTS-R-45	JKS-45	JJS-45	5014006-050	KLSR045	HST45	A6K-45R	1/0
22	KTS-R-45	JKS-45	JJS-45	5014006-050	KLSR045	HST45	A6K-45R	1/0
30	KTS-R-60	JKS-60	JJS-60	5014006-063	KLSR060	HST60	A6K-60R	1/0
37	KTS-R-80	JKS-80	JJS-80	5014006-080	KLSR075	HST80	A6K-80R	1/0
45	KTS-R-90	JKS-90	JJS-90	5014006-100	KLSR090	HST90	A6K-90R	1/0
55	KTS-R-100	JKS-100	JJS-100	5014006-100	KLSR100	HST100	A6K-100R	1/0
75	KTS-R125	JKS-125	JJS-125	2028220-125	KLS-125	HST125	A6K-125R	1/0
90	KTS-R150	JKS-150	JJS-150	2028220-150	KLS-150	HST150	A6K-150R	1/0

1) Screened motor cable, unscreened supply cable.
2) American Wire Gauge.

16.8 Inputs and outputs

16.8.1 Mains supply (L1, L2, L3)

Supply voltage	200-240 V ± 10 %
Supply voltage	380-500 V ± 10 %
Supply voltage	525-600 V ± 10 %
Supply voltage	525-690 V ± 10 %
Supply frequency	50/60 Hz
Maximum temporary imbalance between phases	3 % of rated value
Leakage current to 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.

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

16.8.2 Motor output (U, V, W)

Output voltage	0-100 %[1)]
Output frequency	0-100 Hz[2)]
Switching on output	Not recommended

1) Output voltage in % of supply voltage.
2) Depending on the pump family selected.

16.8.3 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).

16.8.4 Digital inputs

Terminal number	18, 19, 32, 33
Voltage level	0-24 VDC
Voltage level, open contact	> 19 VDC
Voltage level, closed contact	< 14 VDC
Maximum voltage on input	28 VDC
Input resistance, R_i	Approx. 4 kΩ

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

16.8.5 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)[1)]	240 VAC, 2 A
Maximum terminal load (AC-15)[1)]	240 VAC, 0.2 A
Maximum terminal load (DC-1)[1)]	50 VDC, 1 A
Minimum terminal load	24 VDC 10 mA 24 VAC 20 mA

1) 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).

16.8.6 Analog inputs

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

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

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

16.8.7 Analog output

Analog output 1, terminal number	42
Current range	0-20 mA
Maximum load to frame	500 Ω
Maximum fault	0.8 % of full scale

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

16.8.8 MCB 114 sensor input module

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

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

16.9 Sound pressure level

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

The sound pressure level of a motor controlled by a frequency converter may be higher than that of a corresponding motor which is not controlled by a frequency converter. See section *6.7 RFI filters*.

17. Disposal

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.

GB: EU declaration of conformity

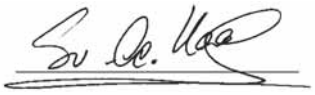
We, Grundfos, declare under our sole responsibility that the product CUE, to which the declaration below relates, is in conformity with the Council Directives listed below on the approximation of the laws of the EU member states.

— Low Voltage Directive (2014/35/EU).
Standards used: EN 61800-5-1:2007.

— EMC Directive (2014/30/EU).
Standards used: EN 61800-3:2004/A1:2012.

This EU declaration of conformity is only valid when published as part of the Grundfos safety instructions (publication number 96706951).

Bjerringbro, 25/02/2016



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