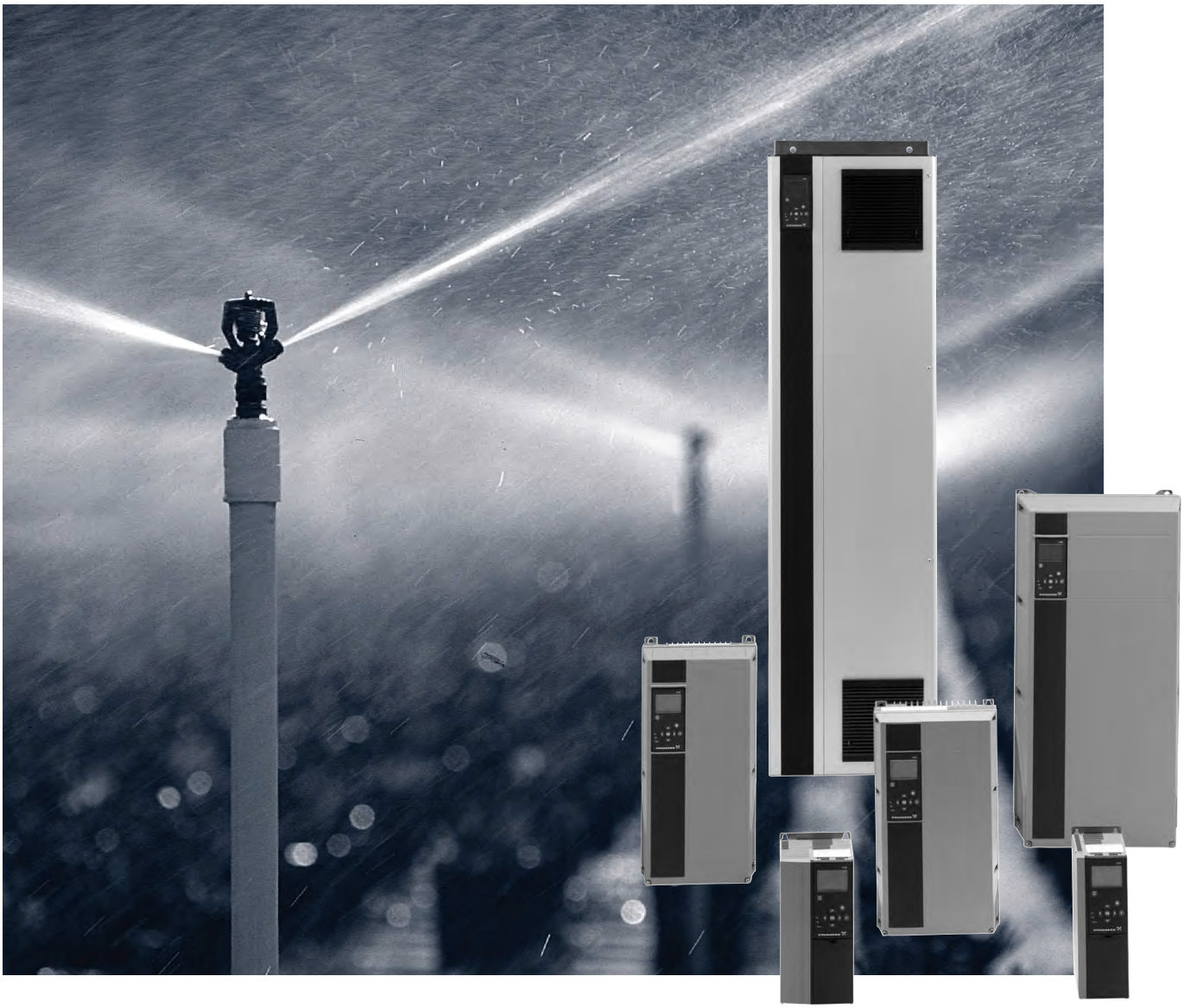
Grundfos CUE

Frequency converters for pump control
60 Hz



Contents

Introduction
Grundfos CUE 4

Features and benefits
User interface 6
Functions 6
Inputs and outputs 6
Accessories 7

Applications
Overview applications 8

Identification
Nameplate 9

Product range
Overview 10

Functions
Overview 11
Operating modes 13
Control modes 14
Setpoints 17
Setting the direction of rotation 20
Status functions 20
Logging functions 20
PID controller 21
Stop functions 22
Dry-running protection 23
Duty/standby 23
Operating range 24
Motor bearing monitoring 24
Standstill heating 24
Ramps 25
Proportional differential pressure, parabolic 25
Hmax update 26
Differential pressure from two sensors 26
Start delay after power-up 26
Auto/manual restart after alarm 26
Limit exceeded 27
Digital inputs 27
Signal relays 28
Analog inputs 28
Analog output 28
MCB 114 sensor input module 29
GENIbus 29
Copy of setting 30
Pipe fill (PC Tool) 30

Installation
Mechanical installation 31
Electrical installation 32
RFI filters 34
Output filters 34
EMC-correct installation 35

Operation
Control panel 37
Start-up guide 37
Warning and alarm list 38

CUE selection
How to select a CUE 39
Special conditions 40
Selection tables 41

Technical data
Main dimensions and weight 42
Surroundings 47
Sound pressure level 47
Terminal tightening torques 47
Cables 47
Fuses 48
Inputs and outputs 51

Accessories
Product numbers 52
MCB 114 sensor input module 53
Grundfos Local Control Panel, GLCP 54
Remote-mounting option for GLCP 54
Floor-mounting option 55
IP21/NEMA1 kit 55
Output filters 56
Grundfos differential pressure sensor, DPI 59

Further product documentation
WebCAPS 59
WinCAPS 60

Mission

— to successfully develop, produce and sell high-quality pumps and pumping systems worldwide, contributing to a better quality of life and a healthy environment

Bjerringbro, Denmark

Fresno, California

Olathe, Kansas

Monterrey, Mexico

Allentown, Pennsylvania

Oakville, Ontario

- One of the 3 largest pump companies in the world
- The second largest manufacturer of submersible motors in the world
- World headquarters in Denmark
- North American headquarters in Kansas City - Manufacturing in Fresno, California
- 72 companies in 41 countries
- More than 10 million motors and pumps produced annually worldwide
- North American companies operating in USA, Canada and Mexico
- Continuous reinvestment in growth and development enables the company to

  BE responsible, **THINK** ahead, and **INNOVATE**

Grundfos CUE

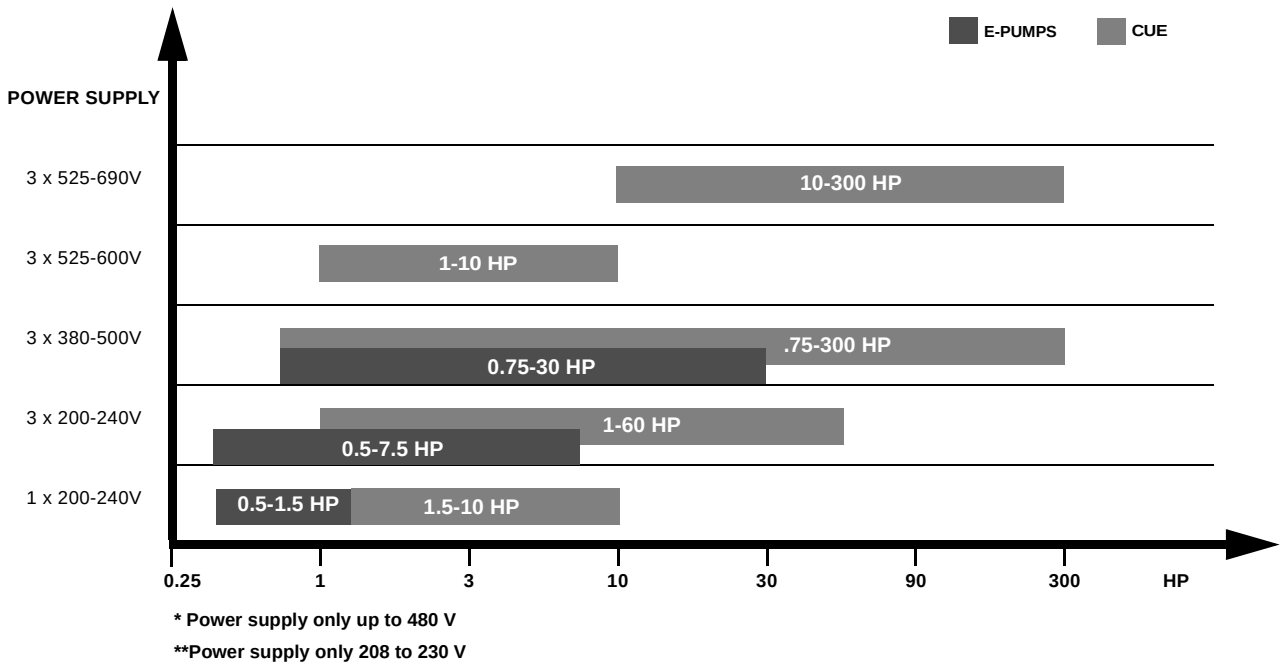
The CUE is a series of frequency converters designed for speed control of a wide range of Grundfos pumps.

Fig. 1 Grundfos CUE solution

Built-in E-pump functionality

The CUE solution contains the same control functionality as the Grundfos E-pumps and is thus a supplement to the E-pump range. See the table below.

All CUE Solutions are available in two enclosure classes: IP21 (NEMA 1) or IP55 (Nema 12).



*** Power supply only up to 480 V**

****Power supply only 208 to 230 V**

Introduction

Designed for Grundfos pumps

The CUE can be used in both new and existing installations, but the pump and motor should be suitable for use with frequency converters.

The table below shows which Grundfos pump types the CUE is designed for.

Pump type
AFG
AMD
AMG
BM, BMB, BMP
BME, BMET, BMEX
CH, CHI, CHN, CHV
CHIU
Contra
CPH, CPV
CR, CRI, CRN, CRT
CRK
CV
DP, EF
durietta
Euro HYGIA
F&B HYGIA
HS
LC, LF
MAXA, MAXANA
MTA, MTH, MTR
MTB
NB, NK
NBG, NKG
S
SE, SEN, SEV
SP,SP-G, SP-NE
SPK
SRP
TP
VL

Further technical documentation

- Installation and operating instructions contain all information for putting the CUE into operation.
- Installation and operating instructions of the MCB 114 sensor input module contain all information for installation of the MCB 114.

Technical documentation is available on www.grundfos.com > International website > WebCAPS.
If you have any questions, please contact the nearest Grundfos company or service workshop.

Features and benefits

User interface

The user interface offers these possibilities:

- Local operation via a control panel with graphic display where the menu structure is based on the well-known system from Grundfos E-pumps.
- Remote operation via external signals, for instance via digital inputs or GENIbus.
- Monitoring of operating status via indicator lights and signal relays.
- Display of alarm or warning and logging of the last five alarms and warnings.

Functions

Control modes for centrifugal pumps

The CUE has a wide range of pump-specific functions:

- Open loop:
  The speed is kept at a set value in the range of min. and max. speed.
- Proportional differential pressure:
  The differential pressure is reduced at a falling flow rate and increased at a rising flow rate.
- Constant differential pressure:
  The differential pressure is kept constant, independently of the flow rate.
- Constant pressure:
  The pressure is kept constant, independently of the flow rate.
- Constant level:
  The liquid level is kept constant, independently of the flow rate.
- Constant flow rate:
  The flow rate is kept constant, independently of the head.
- Constant temperature:
  The liquid temperature is kept constant, independently of the flow rate.
- Constant other value:
  Any other value is kept constant.

Start-up guide

The CUE has a start-up guide, which begins at the first start-up. Here a number of parameters are set automatically on basis of the pump type. Other parameters are set manually on basis of the data on the motor and pump nameplates.

Thanks to the start-up guide, the installer can quickly set central parameters and put the CUE into operation.

Direction of rotation test

During the start-up guide, the CUE automatically tests and sets the correct direction of rotation without changing the cable connections. This feature is activated only if a pressure or flow sensor is installed.

Duty/standby

The duty/standby function is used to alternate between two pumps. Each pump is connected to a CUE unit. The primary task is to start the standby pump if the duty pump is stopped due to an alarm and to alternate the two pumps at least every 24 hours.

Duty/standby operation increases the security of supply and ensures even use between the two pumps.

Dry-running protection

To protect the pump, select the dry-running function together with an external sensor so that lack of inlet pressure or water shortage can be detected.

Low-flow stop function

In control mode constant pressure or constant level, the stop function is used for changing between on/off operation at low or no flow and continuous operation at high flow rate.

The low-flow stop function protects the pump and saves energy.

Monitoring of lubrication of motor bearings

When the bearing monitoring function is active, a warning will appear in the display when the motor bearings are to be relubricated or replaced. Furthermore, the function gives an estimated time to service.

This aids in motor maintenance programs.

Inputs and outputs

The CUE is equipped with a number of inputs and outputs:

- 1 analog input, 0-10 V, 4-20 mA
  - external setpoint
- 1 analog input, 4-20 mA
  - sensor input, feedback sensor
- 1 analog output, 0-20 mA
- 4 digital inputs
  - start/stop and 3 programmable inputs
- 2 signal relays (C/NO/NC)
  - programmable
- 1 RS-485 GENIbus connection.

Accessories

Grundfos offers a number of accessories for the CUE.

MCB 114 sensor input module

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

- 1 analog input, 4-20 mA
- 2 inputs for Pt100/Pt1000 temperature sensors.

Output filters

Output filters are used primarily for protecting the motor against overvoltage and increased operating temperature. However, output filters can also be used for reduction of acoustic motor noise.

Grundfos provides two types of output filter as accessories for the CUE:

- dU/dt filters
- sine-wave filters.

Floor mounting option

The CUE is default installed on the wall. The enclosures D1 and D2 can also be installed on the floor on a pedestal designed for that purpose.

For information about enclosures, see page 45.

Remote mounting kit

Allows control pad to be mounted remotely; 9.8 ft (3m) cable.

Applications

Overview applications

The CUE is a multi-purpose frequency converter suitable for a variety of applications demanding reliable and cost-efficient pump operation.

The CUE is used in five main fields of application:

Water supply and pressure boosting

Besides general water supply in municipal and industrial waterworks, the CUE is used for these specific applications:

- water supply
- pressure boosting
- washing.

The typical control modes are constant pressure, constant flow rate. Stop functions are used to stop the pump when low or no flow is detected.

Heating and air-conditioning

Liquid transfer in:

- heating applications
- cooling and air-conditioning applications.

The typical control modes are proportional pressure or constant temperature.

Process and sanitary applications

Liquid transfer in:

- breweries and dairies
- pure-water applications
- process applications
- purification applications.

The CUE is typically controlled by an external controller. The typical control mode is Open loop.

Groundwater

Typical applications:

- groundwater supply to waterworks
- irrigation in horticulture and agriculture
- dewatering.

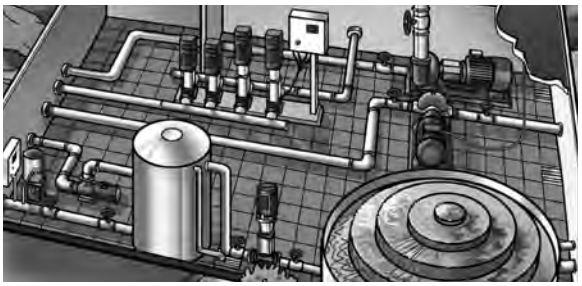
The typical control modes are constant pressure, constant flow rate or constant level control.

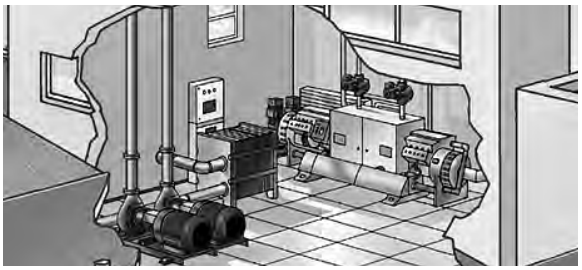
Wastewater

Transfer of:

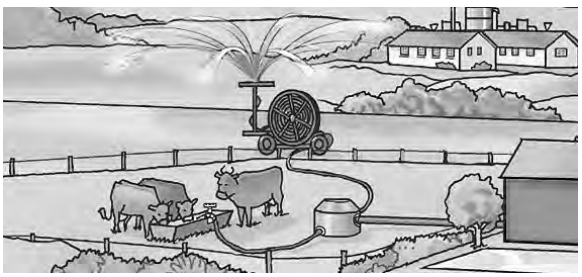
- wastewater
- effluent
- drainage water
- process water.

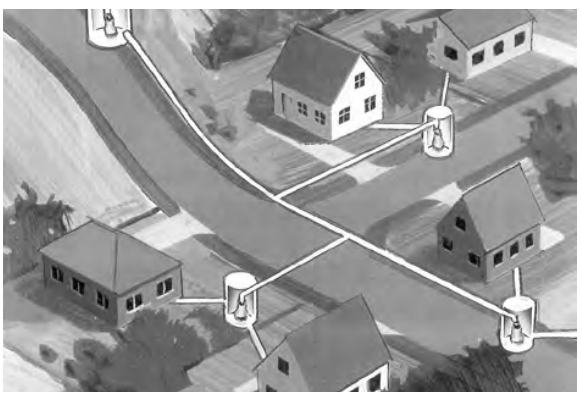
The typical control mode is constant level function (emptying function).


TM03 0146 4204


TM03 0147 4204

TM03 0148 4204


TM03 0149 4204


TM04 0223 5107

Identification

Nameplate

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

Fig. 2 Example of nameplate

Text	Description
T/C:	CUE (product name) 202P132... (internal code)
Prod.no:	Product number: 96754515*
S/N:	Serial number: 123456G123 The last three digits indicate the production date: 12 is the week, and 3 is the year 2003.
0.75 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

* Product number is for drive only. Refer to price lists for packaged drive part numbers.

Product range

Overview

The CUE cabinet sizes are characterised by their enclosures. The table shows the relation between power size (P2), mains supply (V) and enclosure class (IP). It shows the complete range of the CUE.

Typical shaft power P2		Mains supply and enclosure class													
		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	IP21	IP54	IP55	IP20	IP55	IP21	IP54	IP55
0.55	0.75						●			●					
0.75	1				●	●	●			●	●	●			
1.1	1.5	●		●	●	●	●			●	●	●			
1.5	2		●	●	●	●	●			●	●	●			
2.2	3		●	●	●	●	●			●	●	●			
3	4		●	●	●	●	●			●	●	●			
3.7	5		●	●	●	●									
4	5						●			●	●	●			
5.5	7.5		●	●	●	●	●			●	●	●			
7.5	10		●	●	●	●	●			●	●	●			
11	15				●	●	●			●			●		●
15	20				●	●	●			●			●		●
18.5	25				●	●	●			●			●		●
22	30				●	●	●			●			●		●
30	40				●	●	●			●			●		●
37	50				●	●	●			●			●		●
45	60				●	●	●			●			●		●
55	75						●			●			●		●
75	100						●			●			●		●
90	125						●			●			●		●
110	150							●	●				●	●	
132	200							●	●				●	●	
160	250							●	●				●	●	
200	300							●	●				●	●	
250	350							●	●				●	●	

* CUE Hp ratings do not always match motor Hp ratings. Always size CUE by max amperage output and motor amperage.

Functions

Overview

The table below shows the functions settings offered by the CUE.

CUE functions	Setting or reading via:		
	CUE	GENIbus	PC Tool*
Operating modes, see page 13			
Normal	●	❍	☐
Stop	●	❍	☐
Min.	●	❍	☐
Max.	●	❍	☐
Control modes, see page 14			
Open loop	●	❍	☐
Proportional differential pressure	●	❍	☐
Constant differential pressure	●	❍	☐
Constant pressure	●	❍	☐
Constant pressure with stop function	●	❍	☐
Constant level	●	❍	☐
Constant level with stop function	●	❍	☐
Constant flow rate	●	❍	☐
Constant temperature	●	❍	☐
Constant other value	●	❍	☐
Setpoints, see page 17			
Setpoint, CUE menu	●		
External setpoint	●	❍	☐
GENIbus setpoint		❍	
Predefined setpoints from digital inputs			☐
Additional functions, see page 20			
Setting the direction of rotation	●		☐
Status information	●		☐
Logging information	●		☐
PID controller	●	❍	☐
Stop functions	●		☐
Dry-running protection	●		☐
Duty/standby	●		☐
Operating range	●	❍	☐
Motor bearing monitoring	●	❍	☐
Standstill heating	●	❍	☐
Ramps	●		☐
Proportional differential pressure, parabolic			☐
Hmax update			☐
Differential pressure from two sensors			☐
Start delay after power-up			☐
Auto/manual restart after alarm		❍	☐
Limit exceeded		❍	☐
Copy settings	●		
Pipe fill		❍	☐

Functions

CUE functions	Setting or reading via:		
	CUE	GENIbus	PC Tool*
Digital inputs, see page 27			
Start/stop	●		☐
Min. (Min. curve)	●		☐
Max. (Max. curve)	●		☐
External fault	●		☐
Flow switch	●		☐
Alarm reset	●		☐
Dry running (from external sensor)	●		☐
Accumulated flow (from pulse flow sensor)	●		☐
Additional set of ramps, ramp selector			☐
Predefined setpoints from digital input			☐
Signal relays, see page 28			
Ready	●		☐
Warning	●		☐
Alarm	●		☐
Operation	●		☐
Pump running	●		☐
Relubricate	●		☐
External relay control			☐
Limit exceeded			☐
Analog inputs, see page 28			
External setpoint	●		☐
Sensor 1	●		☐
Analog output, see page 28			
Feedback value			☐
Speed			☐
Frequency			☐
Motor current			☐
External setpoint input			☐
Limit exceeded			☐
MCB 114 sensor input module, see page 29			
Sensor input 2	●		☐
Temperature sensor 1	●		☐
Temperature sensor 2	●		☐

● Default

❍ Optional with GENIbus

☐ Optional with PC-tool

* The PC Tool is a software program supplied on a CD and hardware connecting your computer with the CUE.

Operating modes

These operating modes can be selected with the CUE:

- Normal
- Stop
- Min.
- Max.

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

Normal

The pump operates in the control mode selected. See page 14.

The control modes are different ways of controlling the pump speed when the operating mode is set to Normal.

Stop

The pump has been stopped by user.

Min. curve

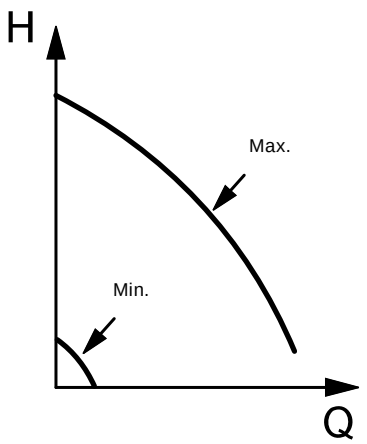
The pump is running at a set value for minimum speed. See fig. 3.

This operating mode can for instance be used in periods with a very small flow requirement.

Max. curve

The pump is running at a set value for maximum speed. See fig. 3.

This operating mode can for instance be used for venting the pump during installation.



TM03 8813 2507

Fig. 3 Min. and max. curves

Functions

Control modes

The CUE has a built-in PID controller that provides closed-loop control of the value you want to control. The CUE can also be set to open-loop control where the setpoint represents the desired pump speed.

Open loop is typically used without sensor. All other control modes require a sensor.

The table below shows the functions and possible settings offered by the CUE.

Overview

Pump type	Open loop	Proportional differential pressure	Constant differential pressure	Constant pressure	Constant level	Constant flow rate	Constant temperature	Constant other value
AFG	●				●	●		●
AMD	●				●	●		●
AMG	●				●	●		●
BM, BMB	●			●	●	●		●
BME, BMET, BMEX	●			●	●	●		●
BMP	●	●	●	●		●		●
CH, CHI, CHN, CHV	●			●	●	●	●	●
CHIU	●			●	●	●	●	●
Contra	●			●	●	●	●	●
CPH, CPV	●			●	●	●	●	●
CR, CRI, CRN, CRT	●			●	●	●	●	●
CRK	●			●	●	●	●	●
CV	●			●	●	●	●	●
DP, EF	●			●	●	●		●
durietta	●			●	●	●	●	●
Euro HYGIA	●			●	●	●	●	●
F&B HYGIA	●			●	●	●	●	●
HS	●		●	●		●	●	●
LC, LF	●		●	●		●	●	●
MAXA, MAXANA	●		●	●	●	●	●	●
MTA, MTH, MTR	●			●	●	●	●	●
MTB	●			●	●	●	●	●
NB, NK	●		●	●	●	●	●	●
NBG, NKG	●		●	●	●	●	●	●
S	●			●	●	●		●
SE, SEN, SEV	●			●	●	●		●
SP,SP-G, SP-NE	●			●	●	●	●	●
SPK	●			●	●	●	●	●
SRP	●				●	●		●
TP	●	●	●	●	●	●	●	●
VL	●			●		●	●	●
Other	●	●	●	●	●	●	●	●

See fur her description on the next pages.

Open loop, constant curve

The speed is kept at a set value in the range between the min. and max. curves. See fig. 4.

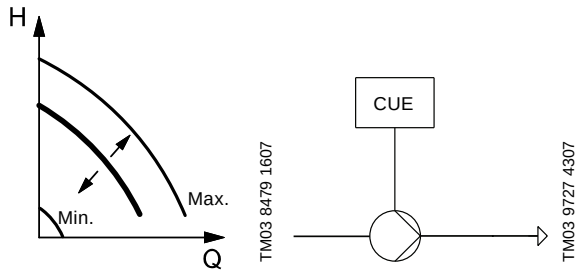


Fig. 4 Open loop, constant curve

In control mode Open loop, the setpoint is set in% of the nominal speed. The setting range will lie between the min. and max. curves.

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

This control mode is also typically used in connection with an overall control system such as Control MPC or another external controller.

Proportional differential pressure

The differential pressure of the pump is reduced at falling flow rate and increased at rising flow rate. See fig. 5.

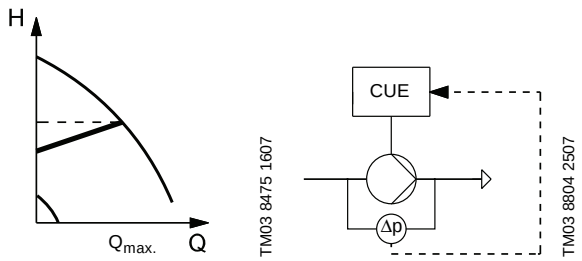


Fig. 5 Proportional differential pressure

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

Constant differential pressure, pump

The differential pressure of the pump is kept constant, independently of the flow rate. See fig. 6.

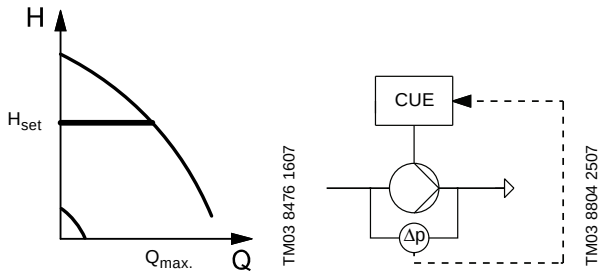


Fig. 6 Constant differential pressure, pump

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

Constant differential pressure, system

The differential pressure of the system is kept constant, independently of the flow rate. See fig. 7.

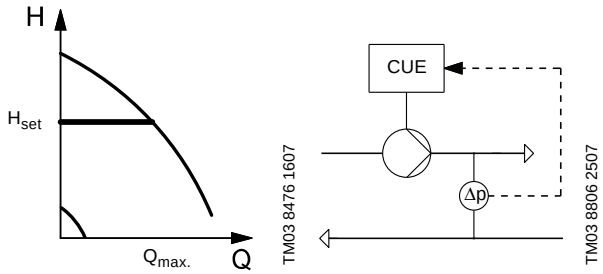


Fig. 7 Constant differential pressure, system

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

Constant pressure with stop function

The outlet pressure is kept constant at high flow rate. On/off operation at low flow rate. See fig. 8.

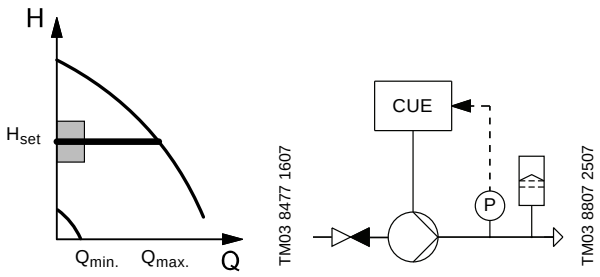


Fig. 8 Constant pressure with stop function

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

Constant level

The liquid level is kept constant, independently of the flow rate. See fig. 9.

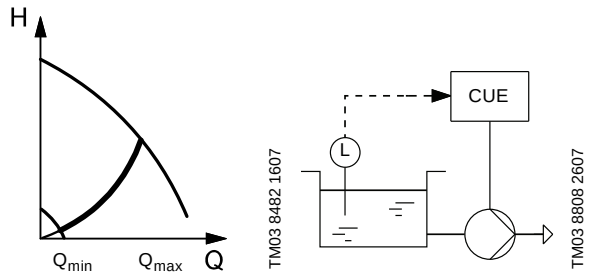


Fig. 9 Constant level

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

The function is default an emptying function.

Constant level with stop function

The liquid level is kept constant at high flow rate. On/off operation at low flow rate. See fig. 10.

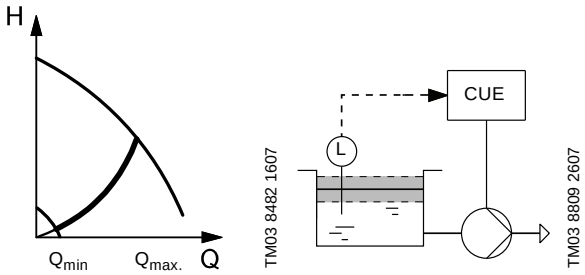


Fig. 10 Constant level with stop function

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

The function is default an emptying function.

Constant flow rate

The flow rate is kept constant, independently of the head. See fig. 11.

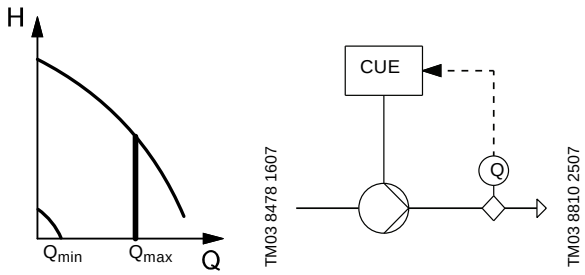


Fig. 11 Constant flow rate

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

Constant temperature

The liquid temperature is kept constant, independently of the flow rate. See fig. 12.

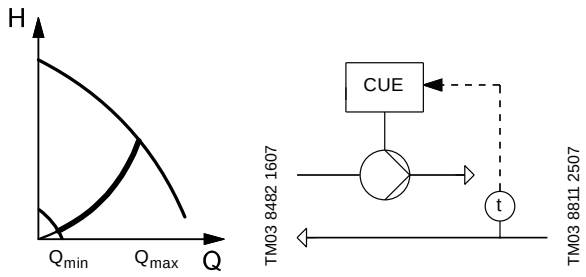


Fig. 12 Constant temperature

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

Constant other value

Any other value is kept constant. See the CUE installation and operation instructions for further information.

Setpoints

The setpoint is normally set in the menu Operation via the CUE control panel. If needed, the setpoint can be influenced via the external setpoint input.

The CUE offers these setpoint possibilities:

- Setpoint, CUE menu (default)
- External setpoint (default)
- Predefined setpoints (setting via PC Tool)
- GENIbus setpoint (setting via GENIbus).

Setpoint, CUE menu

The setpoint can be set by the user via the CUE control panel when the CUE is in local operating mode and no digital inputs are used for predefined setpoints.

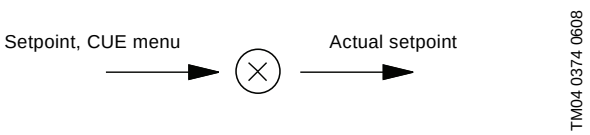


Fig. 13 Setpoint, CUE menu

The setpoint range depends on the selected control mode.

In control mode Open loop, the setpoint is set in% corresponding to the required speed. The setting range is between the min. and max. curves.

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

In all other control modes, the setting range is equal to the sensor measuring range.

External setpoint

The setpoint set via the CUE menu can be influenced by connecting an analog signal to the external setpoint input.

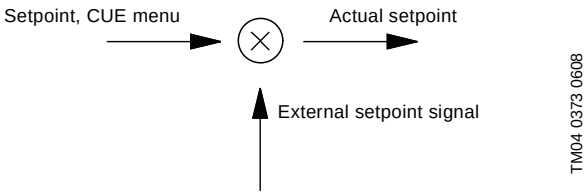


Fig. 14 Setpoint, CUE menu and external setpoint signal

This function offers these possibilities:

- External setpoint (default)
- Inverse external setpoint (setting via control panel)
- External setpoint with stop (setting via PC Tool)
- External setpoint based on a reference table (setting via PC Tool).

The external setpoint signal is used for calculating the actual setpoint. The minimum signal is the minimum setpoint, and the maximum signal is the setpoint set via the CUE menu. See fig. 15.

External setpoint influence (default)

The actual setpoint is a linear function of the external setpoint signal. See fig. 15.

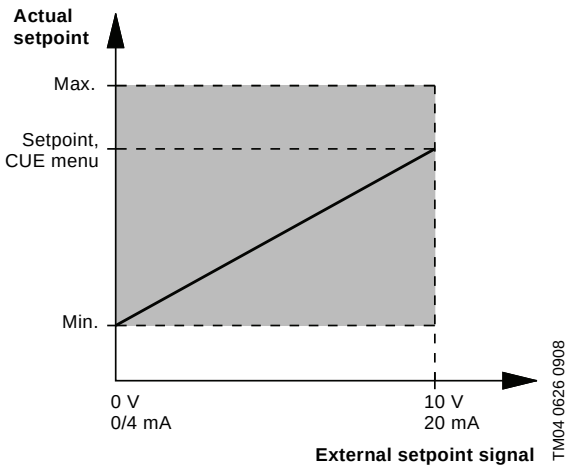


Fig. 15 External setpoint

The minimum and maximum values of the external setpoint signal can be set via the PC Tool. See fig. 16.

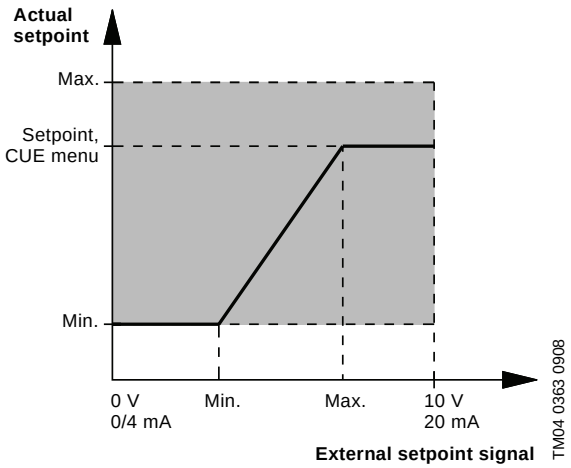


Fig. 16 Reduced external setpoint signal

Inverse external setpoint

The actual setpoint is an inverse linear function of the external setpoint signal. See fig. 17.

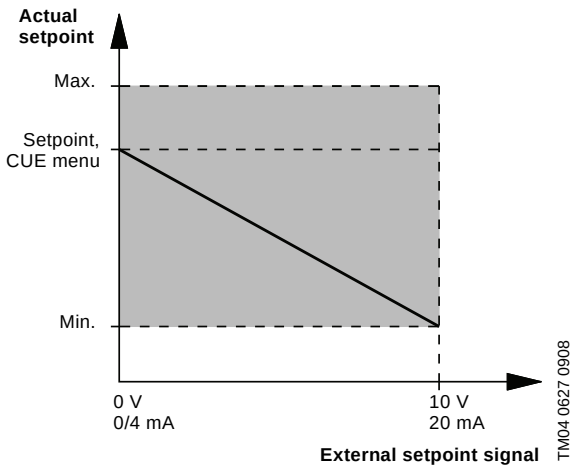


Fig. 17 Inverse external setpoint signal

The minimum and maximum values of the external setpoint signal can be set via the control panel. See fig. 18.

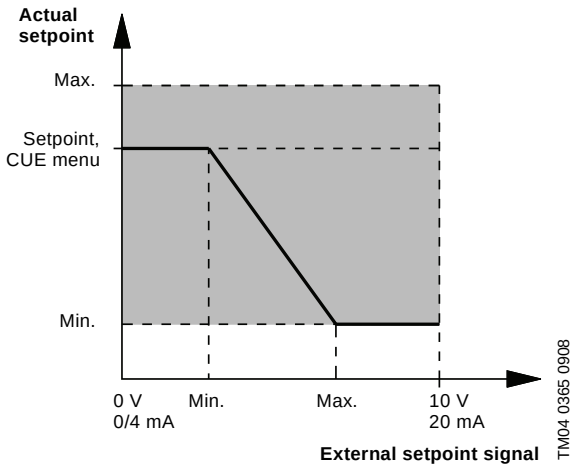


Fig. 18 Reduced inverse external setpoint signal

External setpoint with stop function

Setting via PC Tool.

The actual setpoint with stop is a linear function of the external setpoint signal above 20% signal and on/off operation below 20% signal. See fig. 19.

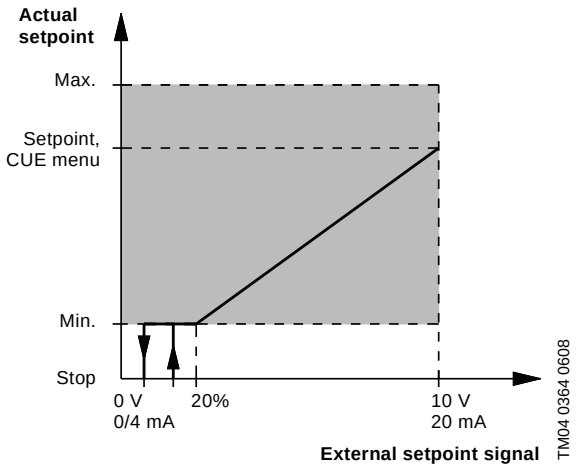


Fig. 19 External setpoint with stop function

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

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

External setpoint based on a reference table

Setting via PC Tool.

The actual setpoint is a piecewise linear function of the external setpoint signal. See fig. 20.

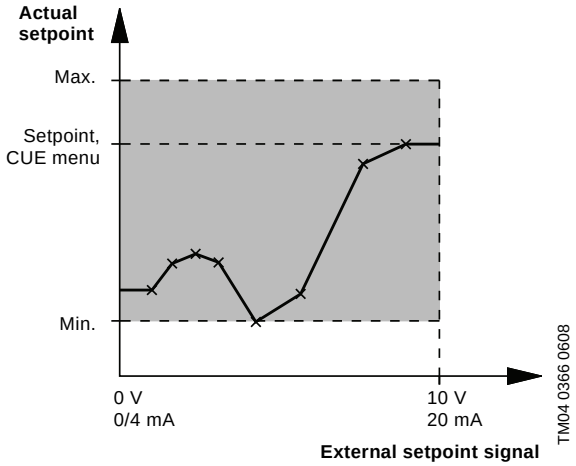


Fig. 20 External setpoint based on a reference table

The linear function is defined as an interpolation between the points in a table. The table has of up to 8 points.

Predefined setpoints

Setting via PC Tool.

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

The setpoints are selected as a binary coding of the digital inputs as shown in the table below.

Predefined setpoint	DI 2	DI 3	DI 4
1	x		
2		x	
3	x	x	
4			x
5	x		x
6		x	x
7	x	x	x

x = Closed contact

If none of the digital inputs are activated, the operating mode can be configured to Stop or to being controlled according to a setpoint set via the control panel.

If Min., Max. or Stop is selected via the control panel, the predefined setpoints are overruled.

Note: Predefined setpoints cannot be influenced by the external setpoint input.

GENIbus setpoint

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

Note: The GENIbus setpoint cannot be influenced by the external setpoint signal.

Setting the direction of rotation

The start-up guide begins the first time the CUE is connected to supply voltage. While going through the start-up guide, the CUE tests and sets the correct direction of rotation without changing the cable connections to the motor.

The correct direction of rotation can be set in these ways:

- automatic setting
- manual setting when the direction of rotation is visible
- manual setting when the direction of rotation is not visible.

Automatic setting

The CUE automatically tests and sets the correct direction of rotation without changing the cable connections. This feature is activated only if a flow or pressure sensor is installed.

This test is not suitable for all pump types and will in certain cases not be able to determine for 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.

Manual setting when the direction of rotation is visible

The correct direction of rotation is set manually without changing the cable connections. This requires that it is possible to observe the motor fan or shaft.

Manual setting when the direction of rotation is not visible

The correct direction of rotation is set manually without changing the cable connections. This requires that it is possible to observe the head or flow rate.

Status functions

The CUE shows these data:

- power consumption
- operating hours
- accumulated flow
- energy per m^3 or gallon (requires flow meter).

The status information can be shown in the display.

Power consumption

The value of the power consumption is an accumulated value calculated from the pump's birth and cannot be reset. No additional sensor is required.

Operating hours

The value of operating hours is an accumulated value calculated from the pump's birth and cannot be reset. No additional sensor is required.

Accumulated flow

The value of accumulated flow is calculated by means of a flow measurement from either a digital pulse input or an analog input.

When using a digital input, the number of pulses is counted and multiplied by the litre/pulse parameter in order to get the accumulated flow.

When using an analog input, the accumulated flow value is updated every 10 seconds with the volume pumped in that period.

Energy per m^3 or gallon

The actual energy per m^3 (kWh/m^3) is calculated as actual power consumption divided by actual flow rate.

Logging functions

Alarm and warning log

The latest five alarms and five warnings are logged with a timestamp corresponding to the power on time after the fault has occurred. The alarm and warning log can be shown directly on the display.

See the warning and alarm list page 38.

Correlated histogram (setting via PC Tool)

The correlated histogram is a way to examine the joint distribution of two parameters. The logging for a correlated histogram are count of the number of samples that at the same time are within a given interval of variable 1 and variable 2.

PID controller

The CUE has a built-in PID controller for speed control of pumps. The factory setting of gain (K_p) and integral time (T_i) can easily be changed in the control panel.

The controller can operate in both normal and inverse mode.

Normal mode

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

Normal mode is selected by setting the gain (K_p) to a positive value in the control panel.

Inverse mode

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

Inverse mode is selected by setting the gain (K_p) to a negative value in the control panel.

Description

The PID controller compares the required setpoint (p_{set}) with the actual value (p) measured by the transmitter (P). See fig. 21.

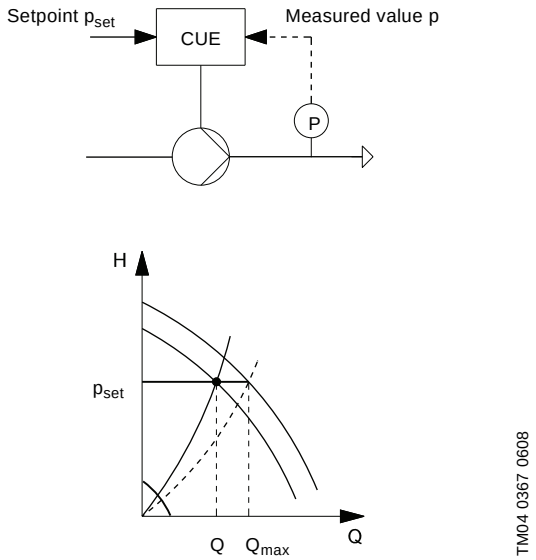
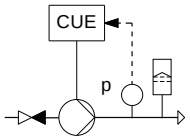
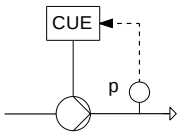
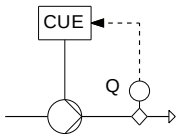
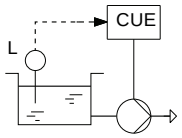
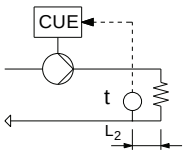
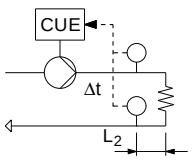
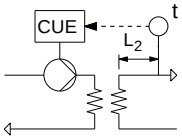
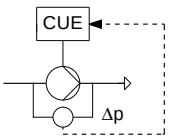
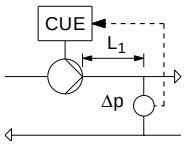


Fig. 21 Constant pressure control

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

Suggested controller settings

System/application	K_p		T_i
	Heating system [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*

*Ti = 100 seconds (factory setting).
Heating systems are systems in which an increase in pump performance will result in a **rise** in temperature at the sensor.
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.

Stop functions

Constant pressure with stop function

The purpose of the stop function is to stop the pump when low or no flow is detected.

When low flow is detected, the pump is in on/off operation. If there is flow, the pump will continue operating according to the setpoint. See fig. 22.

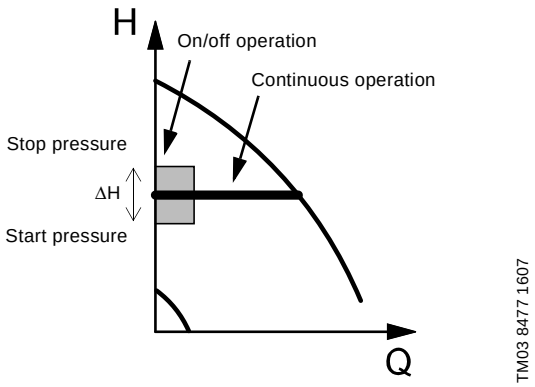


Fig. 22 Constant pressure with stop function. Difference between start and stop pressures (ΔH)

Low flow can be detected in two different ways:

- a built-in low-flow detection function
- a flow switch connected to a digital input.

Low-flow detection function

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

Low-flow detection with flow switch

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

Operating conditions for the stop function

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

- a pressure sensor
- a non-return valve
- a diaphragm tank.

Note: The non-return valve must always be installed before the pressure sensor. See figs 23 and 24.

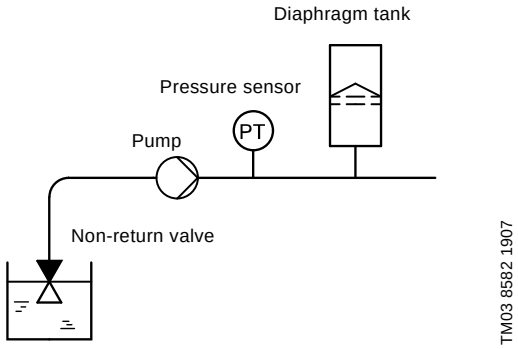


Fig. 23 Position of the non-return valve and pressure sensor in a system with suction lift operation

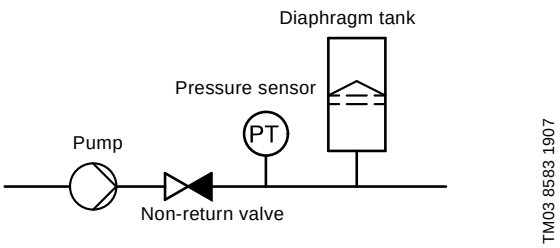


Fig. 24 Position of the non-return valve and pressure sensor in a system with positive inlet pressure

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 gpm (m^3/h)	Typical diaphragm tank size gal (litres)
0-25 (0-6)	2 (8)
25-100 (7-24)	4 (18)
100-175 (25-40)	14 (50)
175-300 (41-70)	32 (120)
300-450 (71-100)	44 (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.

Constant level with stop function

The purpose of the stop function is to stop the pump when low or no flow is detected.

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

When low flow is detected, the pump is in on/off operation. If there is flow, the pump will continue operating according to the setpoint. See fig. 25.

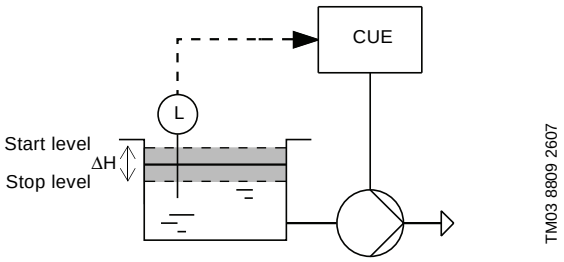


Fig. 25 Constant level with stop function. Difference between start and stop levels (ΔH)

Low flow can be detected in two different ways:

- with the built-in low-flow detection function
- with a flow switch connected to a digital input.

Low-flow detection function

The low-flow detection function will check the flow regularly by measurement of speed and power.

Low-flow detection with flow switch

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

Dry-running protection

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

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

- With a switch connected to a digital input configured to dry-running protection.
- The CUE checks if the shaft power is below a dry-pump limit for a configurable time (setting via PC Tool).

The use of a digital input requires an accessory, such as:

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

The pump cannot restart as long as the input is activated. Restart may be delayed by up to 30 minutes, depending of the pump family.

Duty/standby

The built-in duty/standby function applies to two pumps connected in parallel to ensure reliability of supply. See fig. 26.

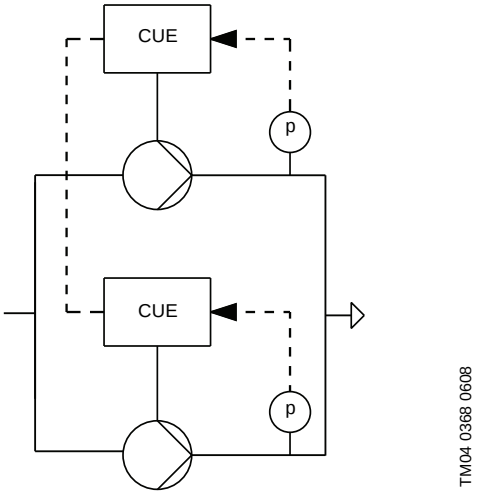


Fig. 26 Two pumps connected in parallel and controlled via GENIbus

These are the primary purposes of the function:

- To let one pump run at a time.
- To start the standby pump if the duty pump stops due to an alarm.
- To alternate the pumps at least every 24 hours.

Description

The two pumps are electrically connected by means of the GENIbus interface. Each pump must be connected to its own CUE and sensor.

Note: The two pumps running duty/standby in this way cannot use the GENIbus interface for remote communication.

The function is activated via the control panel.

Operating mode

The two pumps use their own local operating mode. For instance, pump 1 can operate in Normal mode, and pump 2 can operate in Max. mode.

Control mode

Both pumps must have the same control mode.

Operating range

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 area defined by the pump-dependent speed range.

For some pump families over synchronous operation (max. speed above 100%) will be possible. This requires an over-size motor to deliver the shaft power required by the pump during over-synchronous operation.

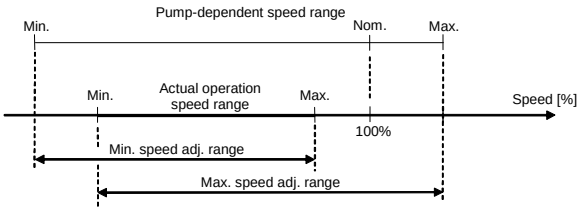


Fig. 27 Setting of the min. and max. speed in % of the nominal speed of the pump

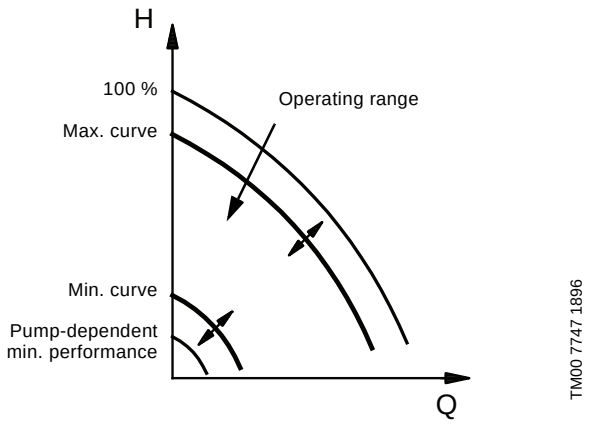


Fig. 28 Operating range of the CUE

Motor bearing monitoring

This function is used to give an indication when it is time to relubricate or change the motor bearings.

It shows these pieces of information:

- When to relubricate the motor bearings.
- How many times relubrication has been confirmed,
- When to replace the motor bearings.

Default function

The default function is based on the "mileage" of the pump and takes into account if the pump has been running with reduced speed.

Extended function

The bearing temperature is also included in the calculation.

The extended function requires an MCB 114 sensor input module and Pt100/Pt1000 sensors measuring the bearing temperature.

Monitoring of motor bearing temperatures

When temperature sensor 1 and 2 are used for measuring the motor bearing temperature, a warning or an alarm will be generated if the bearing temperature gets too high.

Warnings and alarms are generated and reset using hysteresis. See fig. 29.

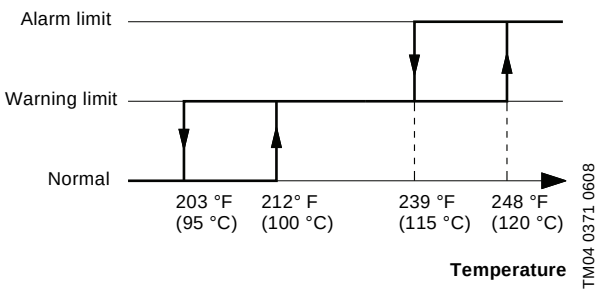


Fig. 29 Monitoring of bearing temperature with warning and alarm limits

Standstill heating

This function pre-heats the motor during standstill in order to avoid condensation within the motor.

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

The pre-heating of the motor is especially important when the motor is installed under these conditions:

- high humidity
- outdoor installation.

The consequences of condensed moisture within the motor are for example corrosion damage to electrical contacts and the bearings of the motor shaft.

Ramps

The controller incorporates two types of ramp:

- ramp-up and ramp-down (default)
- initial and final ramps (setting via PC-Tool).

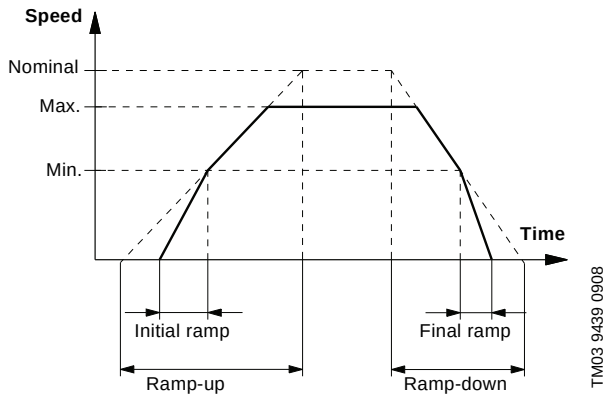


Fig. 30 Ramp-up and ramp-down of the CUE

Ramp-up and ramp-down

The ramp-up and ramp-down are used for protection against overload when starting and stopping the CUE. The setting is done by means of the control panel.

The ramp-up time is the acceleration time from 0 rpm to nominal motor speed.

The ramp-down time is the deceleration time from nominal motor speed to 0 rpm.

Additional set of ramp-up and ramp-down (setting via PC Tool)

An additional set of ramp-up and ramp-down can be remote-set to predefined ramps by means of a digital input.

Initial and final ramps

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

The setting is done automatically based on the pump family selected in the start-up guide.

Proportional differential pressure, parabolic

Setting via PC Tool.

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

- linear (default), see page 15
- parabolic (setting via PC Tool).

When the flow dependency is selected as parabolic, the differential pressure of the pump will be reduced with a parabolic curve at falling flow rate and increased at rising flow rate. See fig. 31.

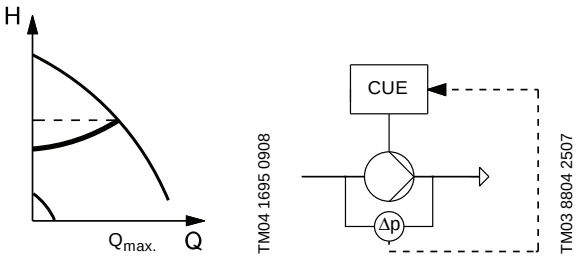


Fig. 31 Proportional differential pressure, parabolic curve

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

Hmax update

Setting via PC Tool.

This function is used in connection with the control mode Proportional differential pressure. The purpose is to find the "true" value of the maximum head at no flow and nominal pump speed. See fig. 32.

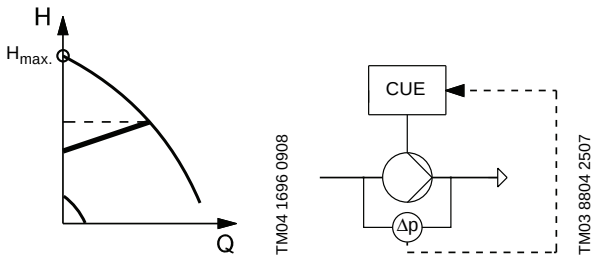


Fig. 32 Proportional differential pressure, H_{max} update

The function consists of two steps:

1. Ramping up the speed to nominal speed.
2. Measuring Hmax for 20 seconds at nominal speed.

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

Differential pressure from two sensors

Setting via PC Tool.

The purpose of this function is to make differential pressure control possible by using measurements from two separate pressure sensors.

It can be used in these control modes:

- Proportional differential pressure. See page 15
- Constant differential pressure. See page 15.

The function requires an MCB 114 sensor input module.

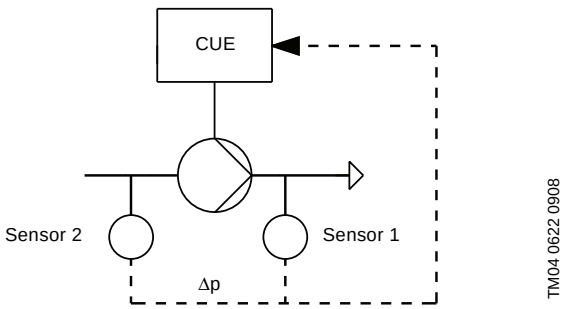


Fig. 33 Differential pressure from two sensors

Sensor 1 is connected to the sensor input 1.

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

Start delay after power-up

Setting via PC Tool.

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

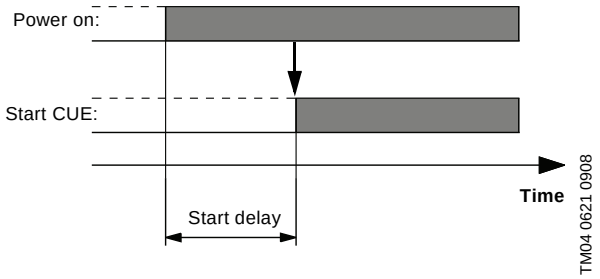


Fig. 34 Start delay after power-up

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

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

Auto/manual restart after alarm

Setting via PC Tool.

In case of an alarm, the CUE will stop the pump or change the operating mode, depending on the alarm and pump type. See Warning and alarm list on page 38.

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

The CUE can be configured to activate and deactivate automatic restart for all alarms or for groups of alarms.

Limit exceeded

Setting via PC Tool.

This is a monitoring function offering information, warning or alarm when a low or high limit is exceeded. See fig. 35.

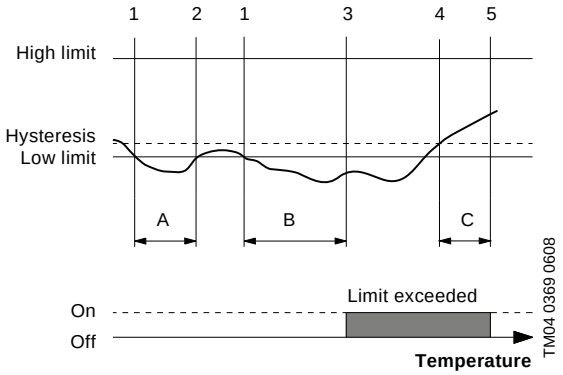


Fig. 35 Example of low limit exceeded

Description

The function has two timers: a detection delay timer and a reset delay timer.

The detection delay timer starts when a limit is exceeded (1). See fig. 35. The time is configurable.

A: If the limit is no longer exceeded (2) when the detection time expires, the timer will be reset.

B: If the limit is still exceeded (3) when the detection time expires, the output of the detector will change to “limit exceeded”.

The reset delay timer starts when the detector output is “limit exceeded” and the limit is no longer exceeded, using hysteresis (4).

C: When the delay time has expired (5), the detector output changes to “limit not exceeded”.

Input possibilities

It is possible to have two limit exceeded functions in parallel with these inputs:

- all analog inputs
- all Pt100/Pt1000 inputs.

The use of Pt100/Pt100 inputs requires an MCB 114 sensor input module.

Output possibilities

There are these output possibilities:

- signal relay 1 and 2
- analog output
- warning and alarm.

Digital inputs

As standard, the CUE offers these digital inputs:

- one digital input for external start/stop
- three programmable digital inputs.

The three digital inputs can be set to these functions:

- min. (min. curve)
- max. (max. curve)
- external fault
- flow switch
- alarm reset
- dry-running protection (via external switch)
- accumulated flow (pulse flow, only DI 4)
- predefined ramps (setting via PC Tool)
- predefined setpoints (setting via PC Tool).

Start/stop

The pump will start if the pump is ready to run (the state of the on/off button is on, and no alarms prevent the pump from running.

Min.

The pump will run according to the min. curve.

Max.

The pump will run according to the max. curve.

External fault

If the input is activated for more than 5 seconds, external fault will be indicated.

Flow switch

The flow switch indicates no flow in constant pressure with stop function and constant level with stop function. It requires an external signal from a flow switch or a controller.

Alarm reset

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

Dry running

Indicates lack of inlet pressure or water shortage, and the pump will be stopped. The pump cannot restart as long as the input is activated. Restart may be delayed by up to 30 minutes, depending of the pump family.

For further information, see page 23.

Accumulated flow (only DI 4)

The number of pulses is counted and multiplied by the litre/pulse parameter in order to get the accumulated flow. This requires the use of an accessory, such as a pulse sensor.

Predefined ramps (setting via PC Tool)
The ramp-up and ramp-down time can be remote-set from the default setting to a predefined setting by means of PC Tool.

For further information, see page 25.

Predefined setpoints (setting via PC Tool)
One to seven predefined setpoints can be selected via digital inputs configured for this purpose.

For further information, see Predefined setpoints on page 19.

Signal relays

The two relay outputs can be independently set to these indications:

- ready
- alarm
- operation
- pump running
- warning
- relubricate
- external control (setting via PC Tool)
- limit exceeded (setting via PC Tool).

Ready
The pump is ready to run or running.

Warning
There is a warning.

Alarm
There is an alarm.

Operation
The pump is running or has been stopped by a stop function.

Pump running
The pump is running.

Relubricate
Lubrication time is exceeded.

External relay control (setting via PC Tool)
This function offers information, warning or alarm when a signal is given via GENIbus.

Limit exceeded (setting via PC Tool)
This function offers information, warning or alarm when a low or high limit is exceeded.

Analog inputs

As standard, the CUE offers these analog inputs:

- one analog input for external setpoint
- one analog input for sensor 1.

External setpoint
The setpoint can be influenced by connecting an analog signal to the setpoint input.

For further information, see page 17.

Sensor 1
The sensor 1 is default used for control in closed loop.

In closed loop, the feedback signal is kept at a given setpoint by a PID controller.

In open loop, sensor 1 can be used for monitoring.

Analog output

The analog output (0-20 mA) can be set via the PC Tool to one of these indications:

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

The analog output is default set to not active.

Feedback value
The output signal is a function of the actual feedback value.

Speed
The output signal is a function of the actual pump speed.

Frequency
The output signal is a function of the actual frequency.

Motor current
The output signal is a function of the actual motor current.

External setpoint input
The output signal is a function of the external setpoint input.

Limit exceeded
The output signal indicates whether the limit is exceeded:

- Minimum output = limit is not exceeded.
- Maximum output = limit is exceeded.

Default setting is NOT ACTIVE.

MCB 114 sensor input module

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

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

Sensor 2

The analog 4-20 mA input is used for these functions:

- Monitoring of measured value of sensor 2 (default setting).
- Measured value of sensor 2 used for control purpose. This makes differential pressure control possible by using measurements from sensor 1 and sensor 2 (setting by means of PC Tool).

Temperature sensors 1 and 2

The analog Pt100/Pt1000 inputs are used for monitoring of these temperatures:

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

Displays

MCB 114 input	Display Menu Number	
	Reading	Setting
Sensor 2	(2.5)	(3.16)
Temperature sensor 1	(2.12)	(3.21)
Temperature sensor 2	(2.13)	(3.22)

Further information

See MCB 114 sensor input module, page 53.

See also the CUE and MCB 114 installation and operating instructions.

GENIbus

The CUE supports serial communication via the RS-485 connection. The communication 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.

Protocol

Using GENIbus interface, the protocol selection of the RS-485 port must be selected to GENIbus, and the communication must be set according to the Grundfos GENIbus standard.

Pump number

Using GENIbus interface, a pump number between 1 and 199 must be allocated to each pump via the control panel.

Local/remote operating mode

In local operating mode, the unit is controlled from local sources, i.e. control panel and digital input.

In remote operating mode, the unit is controlled via GENIbus. Change to remote operating mode is done via the GENIbus.

Priority of settings

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.

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 operating mode *Max.*, it will only be possible to stop the pump.

Remote 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 operating mode *Max.*, it will only be possible to stop the pump.

Copy of Settings

The Grundfos Local Control Panel (GLCP) can be used to copy the settings made on one CUE to another CUE.

The function includes two different possibilities:

- Make a copy of the setup from the present CUE to the Grundfos Local Control Panel
- Make a copy of the setup stored in the Grundfos Local Control Panel to the CUE

Both functions must be used in the correct order to copy a setup from one CUE to another.

A setup can be used for more than once, when it is loaded into the Grundfos Local Control Panel.

The copy can only be performed between units of the same size and firmware version.

Pipe fill (PC Tool)

The pipe fill function is used for filling empty pipes with water in a controlled manner. With pipe fill disabled the speed will go to maximum speed when filling the pipes in pressure controlled systems where pipes are empty at start up, and when the pipes are filled the high speed will give pressure spikes in the system, before the speed is reduced properly to fit the actual need in the application.

The pipe filling function can be used to avoid these pressure spikes, by introducing a pipe filling sequence before the system is turned into normal operation.

The pipe filling function can limit the speed of the pump during fill mode operation; this will decrease the pressure spikes at full pipes. A time limit or a filled pipe pressure can be used to deactivate the pipe fill function and turn the CUE into normal operation.

The following parameters are used in fill mode:

Pipe fill

- Activate or deactivate the function

Pipe fill speed

- The maximum speed used during pipe filling (horizontal piping)

Pipe fill time

- The time it takes to fill the pipes, the CUE turns into normal operation when the pipe fill time has passed

Pipe fill rate

- If a vertical pipe system is being filled a pipe fill rate in scale of the used transmitter can be used to limit the pipe filling rate Example: [0.3bar/sec] (vertical piping)

Filled setpoint

- The setpoint where the pipe fill function is deactivated and the CUE turns into normal operation.

Mechanical installation

The CUE cabinet sizes are characterised by their enclosure. The CUE is available in three enclosure classes: IP21, IP54 and IP55. To see the relationship of enclosure class and enclosure type, see tables starting on page 41.

The general installation requirements necessitate special considerations as to these aspects:

- Enclosure class IP54/55 must be installed freely accessible, but must not be installed outdoors without additional protection against water and the sun.
- The CUE contains a large number of mechanical and electronic components and must therefore not be installed in an environment where the air contains liquids, particles or gasses which may affect and damage the electronic components.
- In applications requiring Ex approval, the CUE should be installed outside the hazardous area.

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.
- Hang the CUE directly on the wall, or fit it with a back plate to secure sufficient air flow for cooling. See fig. 36.

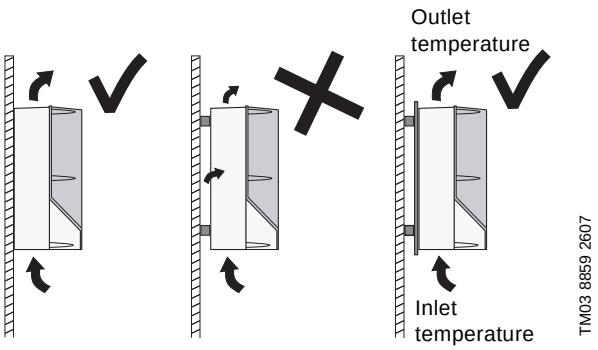


Fig. 36 CUE hung directly on the wall or fitted with a back plate

Required free space above and below the CUE

Enclosure	Space - in [mm]
A2, A3, A5	4 (100)
B1, B2, B3, B4, C1, C3	8 (200)
C2, C4, D1, D2	9 (225)

Required free space in front of the CUE

Furthermore, there must be sufficient space in front of the CUE for opening the door of the CUE. See fig. 37.

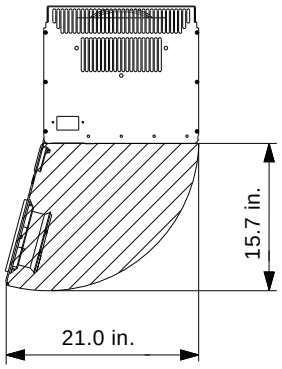


Fig. 37 Free space in front of CUE enclosures D1 and D2

Ventilation of built-in CUE

The CUE can be mounted in a control cabinet if sufficient air circulation is ensured. The quantity of air flow required for cooling the CUE can be calculated as follows:

$$q_v = \frac{\sum P \times 3.285}{\Delta T} \qquad [ft^3/min]$$

Insert P in Watt and ΔT in F (Fahrenheit.

P is the power loss of all equipment integrated in the same cabinet. Calculate the power loss P of the CUE by means of the typical shaft power P2 multiplied by the efficiency.

ΔT is the difference between the outlet temperature and the inlet temperature (ambient) of the cooling air. See fig. 36.

Note: The inlet and outlet temperatures must not be higher than the values in the table below.

Output current	Max. inlet temperature	Max. outlet temperature
Up to 177 amps	122 °F (50 °C)	131 °F (55 °C)
Over 177 amps	113°F (45 °C)	122 °F (50 °C)

The average inlet temperature over 24 hours must be 9 °F lower.

The outlet from the ventilation must be placed above the highest-mounted CUE. Allowance must be made for the pressure loss across the inlet filters of the control panel and for the fact that the pressure will drop as the filters get choked.

Example: Calculate the required air flow for cooling of a built-in CUE when the ambient temperature is 80° F (27 °C). The CUE has a typical shaft power of 11.0 kW (ISHP) and an efficiency of 0.98. See page 44.

Calculate the power loss of the CUE:

P = P2 x efficiency = 11.0 x (1-0.98) x 1000= 220 W.

Calculate the required air flow for cooling the CUE:

q_v = (P x 3.285) / (ΔT) = (220 x 3.285) / (131-80) = **14.2 ft^3/min**.

Electrical installation

Note: Always observe national and local regulations as to cable cross-section, short circuit protection and over-current when installing the CUE.

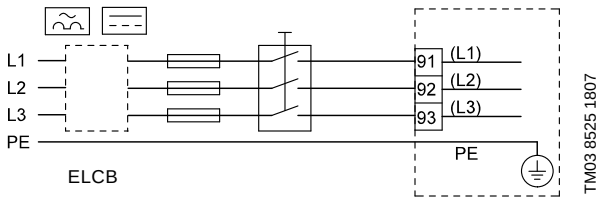


Fig. 38 Example of three-phase mains connection of the CUE with mains switch, back-up fuses and additional protection

Electrical protection

Protection against electric shock, indirect contact

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 8 AWG [10 mm^2].

Protection against short-circuit, fuses

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

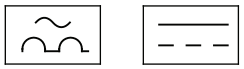
Grundfos demands that the fuses mentioned on 48 are used for protection against short-circuit.

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

Additional protection

Note: The leakage current to earth exceeds 3.5 A.

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.

Leakage current of the CUE in normal operation, see page 51.

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

Motor protection

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

Protection against overcurrent

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

Protection against mains voltage transients

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

Mains and motor connection

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

Mains switch

A mains switch can be installed before the CUE according to local regulations. See fig. 38.

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.

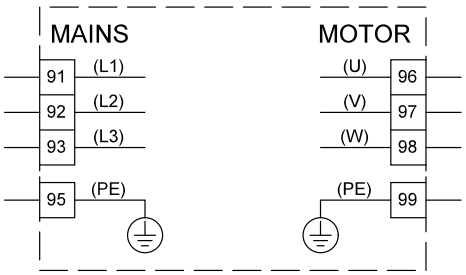


Fig. 39 Wiring diagram, three-phase mains connection

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: use terminals 91 and 92 for single phase CUE's.

Connecting the signal terminals

Note: 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.

Wiring diagram, signal terminals

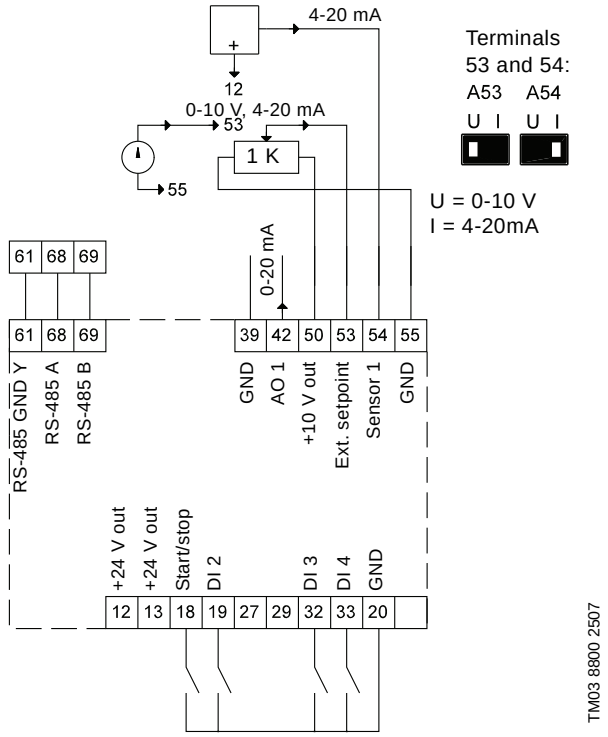


Fig. 40 Wiring diagram, signal terminals

Terminal	Type	Function
12	+24 V out	Supply to sensor
13	+24 V out	Additional supply
18	DI 1	Digital input, start/stop
19	DI 2	Digital input, programmable
20	GND	Common frame for digital inputs
32	DI 3	Digital input, programmable
33	DI 4	Digital input, programmable
39	GND	Frame for analog output
42	AO 1	Analog output, 0-20 mA
50	+10 V out	Supply to potentiometer
53	AI 1	External setpoint, 0-10 V, 0/4-20 mA
54	AI 2	Sensor input, sensor 1, 0/4-20 mA
55	GND	Common frame for analog inputs
61	RS-485 GND Y	GENIbus, screen (frame)
68	RS-485 A	GENIbus, signal A (+)
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 *EMC-correct installation*, 35.

- Use shielded signal cables.
- Use a 3-conductor shielded bus cable.

RFI filters

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

Voltage	Typical shaft power P2	RFI filter type
1 x 200-240 V	1.5-10 Hp (1.1-7.5 kW)	C1
3 x 200-240 V	1-60 Hp (0.75-45 kW)	C1
3 x 380-500 V	0.75-125 Hp (0.55-90 kW)	C1
	150-350 Hp (110-250 kW)	C2
3 x 525-600 V	1-10 Hp (0.75-7.5 kW)	C3
3 x 525-690 V	15-350 Hp (11-250 kW)	C3

RFI filter types are according to EN 61800-3.

C1 is a high-performance filter. C2 and C3 are typically RFI filter types for standard frequency converters.

Description of RFI filter types

C1: For use in domestic areas.

C2: For use in domestic and industrial areas, connected permanently to the mains supply. In domestic areas, special care should be taken regarding EMC-correct installation.

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

Equipment of category C2

- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.

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.

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.

Grundfos offers two types of output filter as accessories for the CUE:

- dU/dt filters
- sine-wave filters

The filters are IP20/NEMA1 enclosure.

dU/dt filters

Motor insulation stress is often caused by the combination of rapid voltage and current increase. The rapid energy changes can also be reflected back to the DC line in the inverter and cause shut down. The dU/dt filter is designed to reduce the voltage rise time/the rapid energy change in the motor, and by that intervention, it prevents premature aging and flashover in the motor insulation.

The dU/dt filters have a positive influence on the radiation of magnetic noise in the cable that connects the drive to the motor. The voltage wave form is still pulse-shaped but the du/dt ratio is reduced in comparison with the installation without filter.

Sine-wave filters

Sine-wave filters are designed to allow only low frequencies to pass. High frequencies are consequently shunted away, which results in a sinusoidal phase-to-phase voltage waveform and sinusoidal current waveforms.

With the sinusoidal waveforms, the use of special adjustable frequency drive motors with reinforced insulation is no longer needed. The acoustic noise from the motor is also damped as a consequence of the wave condition.

Besides the features of the dU/dt filter, the sine-wave filter also reduces insulation stress and bearing currents in the motor, thus leading to prolonged motor lifetime and longer periods between service. Sine-wave filters enable use of longer motor cables in applications where the motor is installed far from the drive. The length is unfortunately limited because the filter does not reduce leakage currents in the cables.

Use of output filters

The table below explains in which cases an output filter is required. From the table it can be seen if a filter is needed, and which type to use.

The selection depends of:

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

Pump type	Typical shaft power P2	dU/dt filter	Sine-wave filter
SP, BM, BMB with 380 V motor and up	Up to 10 Hp	–	0-1000 ft (0-300 m)
	15 Hp and up	0-500 ft (0-150 m)	500-1000 ft (150-300 m)
Other pumps, noise reduction	Up to 10 Hp	–	0-1000 ft (0-300 m)
	15 Hp and up	0-500 ft (0-150 m)	500-1000 ft (150-300 m)
Other pumps, higher noise reduction	Up to 10 Hp	–	0-1000 ft (0-300 m)
	15 Hp and up	–	0-1000 ft (0-300 m)
Pumps with 690 V motor	All	0-500 ft (0-150 m)	500-1000 ft (150-300 m)

The lengths stated apply to the motor cable.

Motor cable

Use a shielded/armored motor cable to comply with EMC emission specifications (or install the cable in a metal conduit). Keep the motor cable as short as possible to reduce the noise level and leakage currents. Connect the motor cable shield/armor to both the decoupling plate of the adjustable frequency drive and to the metal of the motor. (Same applies to both ends of the metal conduit if used instead of a shield.)

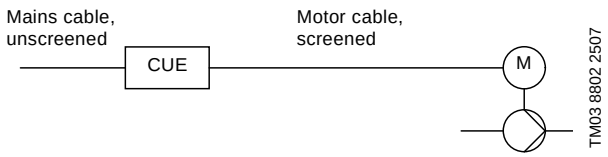


Fig. 41 Example of installation without filter

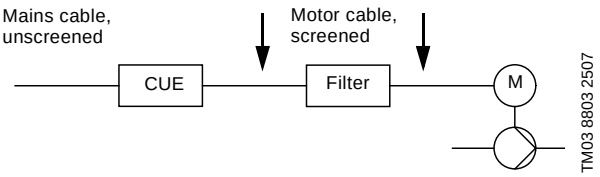


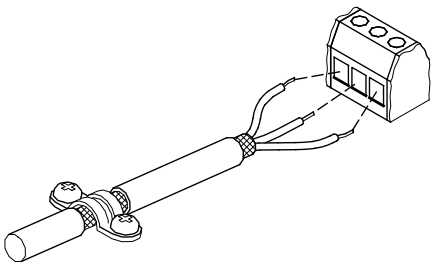
Fig. 42 Example of installation with filter. The cable between the CUE and filter must be short

EMC-correct installation

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

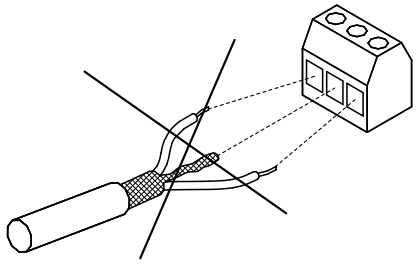
- Use only motor and signal cables with a braided metal screen in applications without output filter.
- There are no special requirements to supply cables, apart from local requirements.
- Leave the screen as close to the connecting terminals as possible. See fig. 43.
- Avoid terminating the screen by twisting the ends. See fig. 44. 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. 45. If the controller has no cable clamps, connect only the screen to the CUE. See fig. 46.
- 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 minimize 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.



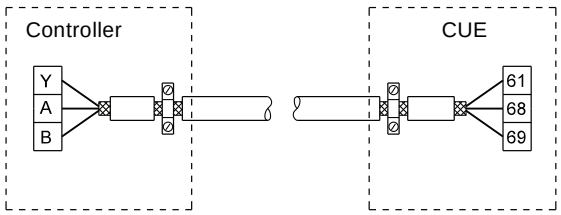
TM02 1325 0901

Fig. 43 Example of stripped cable with screen



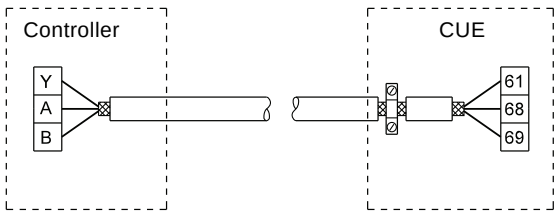
TM03 8812 2507

Fig. 44 Do not twist the screen ends



TM03 8732 2407

Fig. 45 Example of connection of a 3-conductor bus cable with screen connected at both ends

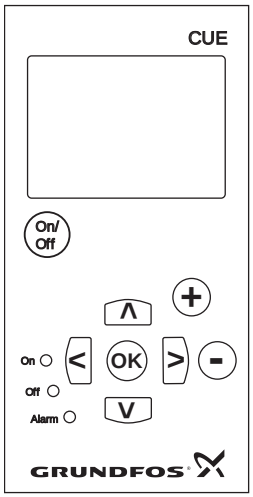


TM03 8731 2407

Fig. 46 Example of connection of a 3-conductor bus cable with screen connected at the CUE (controller with no cable clamps)

Control panel

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



TM03 8719 2507

Fig. 47 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.

Indicator lights

The operating condition of the pump is indicated by the indicator lights on the front of the control panel. See fig. 47.

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.

Start-up guide

Use the start-up guide for the general setting of the CUE including the setting of the correct direction of rotation.

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

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[2] did not succeed	●			–	Man.

1) In case of an alarm, the CUE will change the operating mode depending on the pump type. For example: In constant pressure mode, SP's will run at min. speed while CR's will run at 70% of max. speed.

2) AMA, Automatic Motor Adaptation.

3) Warning is reset in display 3.20.

In case of fault or malfunction of the CUE, the latest five warnings and latest five alarms can be found in the log menus.

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 if the warning has been present for a period.

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.

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 (S*tart/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.

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 electricity supply to the CUE for approx. 30 seconds. Switch on the electricity supply, and press OK in the alarm display to reset the alarm.

CUE selection

How to select a CUE

The size of the CUE is determined quickly and precisely based on the max. motor current. See fig. 48.

The power size, which is the typical shaft power P2, is only an approximate value and cannot be used to select the nominal size of the CUE.

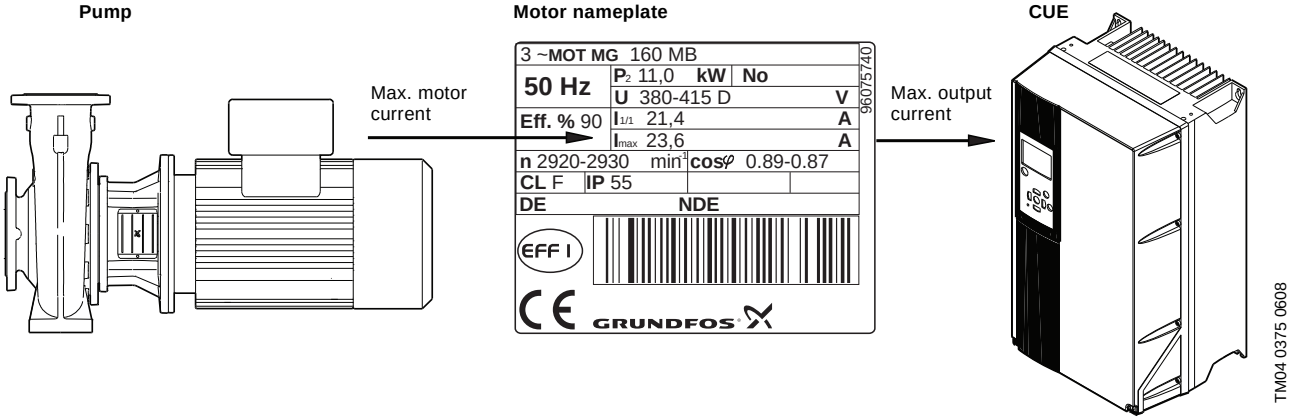


Fig. 48 Selection of CUE based on max. motor current

The main steps

When you have selected the pump, follow these steps to select a CUE:

1. Select the voltage range of the CUE. It should fit the motor voltage and the mains supply at the installation site.
2. Find the max. motor current*****on the motor nameplate or in the data sheet of the selected motor. Select the first CUE that is able to deliver the max. motor current. See selection tables starting on page 41.
3. Select the enclosure class. Choose IP21 or IP54/55. See selection tables starting on page 41.
4. Check if an output filter is required. Select the output filter according to the table on page 34.
5. Select the accessories required for the application. It could be sensors or additional input modules.

Selecting the different accessories may require additional steps.

*** Important note: If motor has service factor, use service factor amperes for max. motor current.**

The actual motor current should always be less than or equal to the output current of the CUE.

If not, the CUE will reduce the maximum speed when the maximum limit is reached during operation.

Example 1

These data are given:

- voltage range is 3 x 460 V
- max. motor current is 23.6 A.
- enclosure class of the CUE must be IP21.

Select the CUE according to the selection tables in section Mains supply 3 x 440 - 500V on 43.

Data of the CUE selected:

Max. output current:	27A
Product number (IP21):	91136772

Special conditions

Derating must be taken into account when using the CUE in these situations:

- low air pressure (heights)
- low speeds
- installations with long motor cables
- cables with a large cross-section
- high ambient temperature.

The required action is described in the next sections.

Low air pressure

At low air pressure, the cooling capability of air is reduced.

At altitudes above 3,280 ft (1,000 m), the max. output current should be derated in accordance with the diagram in fig. 49.

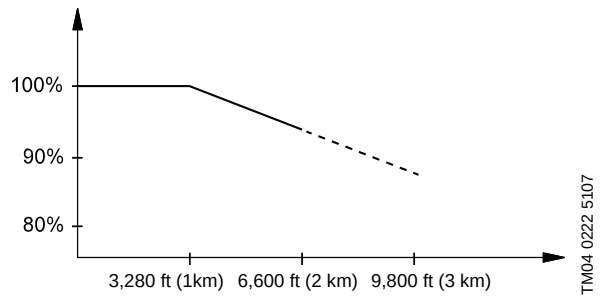


Fig. 49 Derating of output current at low air pressure

At altitudes above 6,600 ft (2,000 m), PELV cannot be met. PELV = Protective Extra Low Voltage.

An alternative is to lower the ambient temperature at high altitudes and thereby ensure 100% output current at high altitudes.

Example 2

At an altitude of 6,600 ft (2,000 m), the output current 27 A of the selected CUE in example 1 must be derated to 92% according to fig. 49. This is equal to 25 A.

High ambient temperature

If the output current is reduced to 80 % of the nominal output current of the CUE in questions, the ambient may be 5 °C higher.

The other possibility is to use a unit one size bigger. For higher temperature increases, bigger units are required. The efficiency of the CUE will, however, be reduced at higher temperatures.

If the CUE gets too hot, it will reduce the switching frequency.

Note that the nominal temperature rating depends on the enclosure type.

The maximum ambient temperature of the different enclosures can be found in section *Technical data* on p. 45.

CUE selection

Selection tables

Mains supply 1 x 200-240 V

Rated Input Voltage	CUE output amps	enclosure rating	CUE only part number	CUE constant pressure* part number	Enclosure	Max conductor (AWG)	Efficiency	output filter	
								dU/dt	Sine wave
1 x 200-240V	6.6	IP21	91136746	91136789	A3	10	0.96		96754973
	6.6	IP55	91136854	91136908	A5	10	0.96		96754973
	7.5	IP21	91136832	91136843	B1	8	0.96		96754973
	7.5	IP55	91136855	91136909	B1	8	0.96		96754973
	10.6	IP21	91136833	91136844	B1	8	0.96		96754976
	10.6	IP55	91136856	91136910	B1	8	0.96		96754976
	12.5	IP21	91136834	91136845	B1	8	0.96		96754976
	12.5	IP55	91136857	91136911	B1	8	0.96		96754976
	16.7	IP21	91136835	91136846	B1	8	0.96		96754976
	16.7	IP55	91136858	91136912	B1	8	0.96		96754976
	24.2	IP21	91136836	91136847	B1	8	0.98		96754977
	24.2	IP55	91136859	91136913	B1	8	0.98		96754977
	30.8	IP21	91136837	91136848	B2	2	0.98		96754978
	30.8	IP55	91136860	91136914	B2	2	0.98		96754978

* includes CUE and 0-120 psi 4-20mA sensor

Mains supply 3 x 200-240 V

Rated Input Voltage	CUE output amps	enclosure rating	CUE only part number	CUE constant pressure* part number	Enclosure	Max conductor (AWG)	Efficiency	output filter	
								dU/dt	Sine wave
3 x 200-240V	4.6	IP21	91136747	91136790	A2	10	0.95		96754973
	4.6	IP55	91136861	91136915	A5	10	0.95		96754973
	6.6	IP21	91136748	91136791	A2	10	0.96		96754973
	6.6	IP55	91136862	91136916	A5	10	0.96		96754973
	7.5	IP21	91136749	91136792	A2	10	0.96		96754973
	7.5	IP55	91136863	91136917	A5	10	0.96		96754973
	10.6	IP21	91136750	91136793	A2	10	0.96		96754976
	10.6	IP55	91136864	91136918	A5	10	0.96		96754976
	12.5	IP21	91136751	91136794	A3	10	0.96		96754976
	12.5	IP55	91136865	91136919	A5	10	0.96		96754976
	16.7	IP21	91136752	91136795	A3	10	0.96		96754976
	16.7	IP55	91136866	91136920	A5	10	0.96		96754976
	24.2	IP21	91136753	91136796	B3	8	0.96		96754977
	24.2	IP55	91136867	91136921	B1	8	0.96		96754977
	30.8	IP21	91136754	91136797	B3	8	0.96		96754978
	30.8	IP55	91136868	91136922	B1	8	0.96		96754978
	46.2	IP21	91136755	91136798	B3	8	0.96		96755019
	46.2	IP55	91136869	91136923	B1	8	0.96		96755019
	59.4	IP21	91136756	91136799	B4	2	0.96		96755021
	59.4	IP55	91136870	91136924	B2	2	0.96		96755021
	74.8	IP21	91136757	91136800	B4	1/0	0.96		96755032
	74.8	IP55	91136871	91136925	C1	1/0	0.96		96755032
	88	IP21	91136758	91136801	C3	1/0	0.97		96755033
	88	IP55	91136872	91136926	C1	1/0	0.97		96755033
	115	IP21	91136759	91136802	C3	1/0	0.97		96755033
	115	IP55	91136873	91136927	C1	1/0	0.97		96755033
	143	IP21	91136760	91136803	C4	4/0	0.97		96755034
	143	IP55	91136874	91136928	C2	4/0	0.97		96755034
	170	IP21	91136761	91136804	C4	250 MCM	0.97		96755034
	170	IP55	91136875	91136929	C2	250 MCM	0.97		96755034

* includes CUE and 0-120 psi 4-20mA sensor

CUE selection

Mains supply 3 x 440 - 500V

Rated Input Voltage	CUE output amps	enclosure rating	CUE only part number	CUE constant pressure* part number	Enclosure	Max conductor (AWG)	Efficiency	output filter	
								dU/dt	Sine wave
3 x 440 - 500V	1.6	IP21	91136762	91136805	A2	10	0.95		96754941
	1.6	IP55	91136876	91136930	A5	10	0.95		96754941
	2.1	IP21	91136763	91136806	A2	10	0.96		96754941
	2.1	IP55	91136877	91136931	A5	10	0.96		96754941
	2.7	IP21	91136764	91136807	A2	10	0.96		96754972
	2.7	IP55	91136878	91136932	A5	10	0.96		96754972
	3.4	IP21	91136765	91136808	A2	10	0.97		96754972
	3.4	IP55	91136879	91136933	A5	10	0.97		96754972
	4.8	IP21	91136766	91136809	A2	10	0.97		96754973
	4.8	IP55	91136880	91136934	A5	10	0.97		96754973
	6.3	IP21	91136767	91136810	A2	10	0.97		96754973
	6.3	IP55	91136881	91136935	A5	10	0.97		96754973
	8.2	IP21	91136768	91136811	A2	10	0.97		96754974
	8.2	IP55	91136882	91136936	A5	10	0.97		96754974
	11	IP21	91136769	91136812	A3	10	0.97		96754976
	11	IP55	91136883	91136937	A5	10	0.97		96754976
	14.5	IP21	91136770	91136813	A3	10	0.97		96754976
	14.5	IP55	91136884	91136938	A5	10	0.97		96754976
	21	IP21	91136771	91136814	B3	8	0.98	96755062	96754977
	21	IP55	91136885	91136939	B1	8	0.98	96755062	96754977
	27	IP21	91136772	91136815	B3	8	0.98	96755063	96754978
	27	IP55	91136886	91136940	B1	8	0.98	96755063	96754978
	34	IP21	91136773	91136816	B3	8	0.98	96755063	96754978
	34	IP55	91136887	91136941	B1	8	0.98	96755063	96754978
	40	IP21	91136774	91136817	B4	2	0.98	96755063	96755019
	40	IP55	91136888	91136942	B2	2	0.98	96755063	96755019
	52	IP21	91136775	91136818	B4	2	0.98	96755064	96755021
	52	IP55	91136889	91136943	B2	2	0.98	96755064	96755021
	65	IP21	91136776	91136819	B4	1/0	0.98	96755064	96755032
	65	IP55	91136890	91136944	C1	1/0	0.98	96755064	96755032
	80	IP21	91136777	91136820	C3	1/0	0.98	96755066	96755033
	80	IP55	91136891	91136945	C1	1/0	0.98	96755066	96755033
	105	IP21	91136778	91136821	C3	1/0	0.98	96755066	96755033
	105	IP55	91136892	91136946	C1	1/0	0.98	96755066	96755033
	130	IP21	91136779	91136822	C4	4/0	0.98	96755067	96755034
	130	IP55	91136893	91136947	C2	4/0	0.98	96755067	96755034
	160	IP21	91136780	91136823	C4	250 MCM	0.99	96755067	96755034
	160	IP55	91136894	91136948	C2	250 MCM	0.99	96755067	96755034
	190	IP21	96754649	-	D1	2 x 2/0	0.98	96755069	96755037
	190	IP54	96754666	-	D1	2 x 2/0	0.98	96755069	96755037
	240	IP21	96754651	-	D1	2 x 2/0	0.98	96755069	96755037
	240	IP54	96754669	-	D1	2 x 2/0	0.98	96755069	96755037

* includes CUE and 0-120 psi 4-20mA sensor

CUE selection

Mains supply 3 x 525-600 V

Rated Input Voltage	CUE output amps	enclosure rating	CUE only part number	CUE constant pressure* part number	Enclosure	Max conductor (AWG)	Efficiency	output filter	
								dU/dt	Sine wave
3 x 525 - 600V	1.7	IP21	91136781	91136824	A3	10	0.97		96755040
	1.7	IP55	91136900	91136954	A5	10	0.97		96755040
	2.4	IP21	91136782	91136825	A3	10	0.97		96755040
	2.4	IP55	91136901	91136955	A5	10	0.97		96755040
	2.7	IP21	91136783	91136826	A3	10	0.97		96755040
	2.7	IP55	91136902	91136956	A5	10	0.97		96755040
	3.9	IP21	91136784	91136827	A3	10	0.97		96755040
	3.9	IP55	91136903	91136957	A5	10	0.97		96755040
	4.9	IP21	91136785	91136828	A3	10	0.97		96755040
	4.9	IP55	91136904	91136958	A5	10	0.97		96755040
	6.1	IP21	91136786	91136829	A3	10	0.97		96755040
	6.1	IP55	91136905	91136959	A5	10	0.97		96755040
	9	IP21	91136787	91136830	A3	10	0.97		96755040
	9	IP55	91136906	91136960	A5	10	0.97		96755040
	11	IP21	91136788	91136831	A3	10	0.97		96755040
	11	IP55	91136907	91136961	A5	10	0.97		96755040

* includes CUE and 0-120 psi 4-20mA sensor

Main dimensions and weight

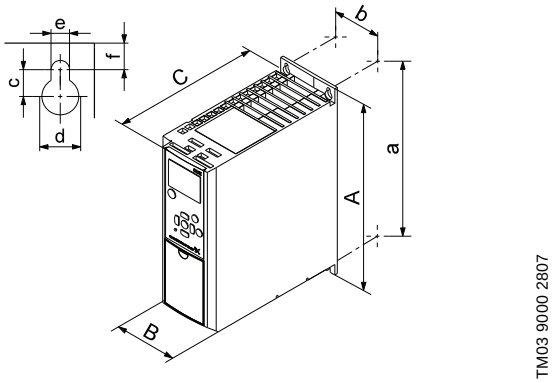


Fig. 50 Enclosures A2 and A3

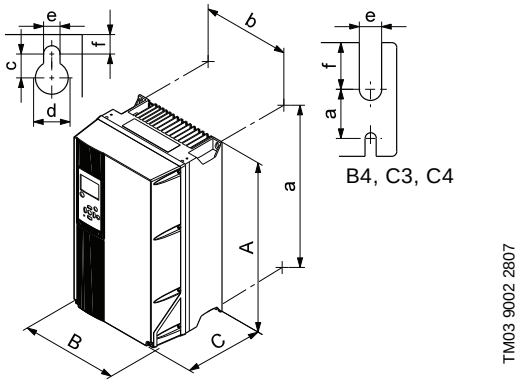


Fig. 51 Enclosures A5, B1, B2, B3, B4, C1, C2, C3 and C4

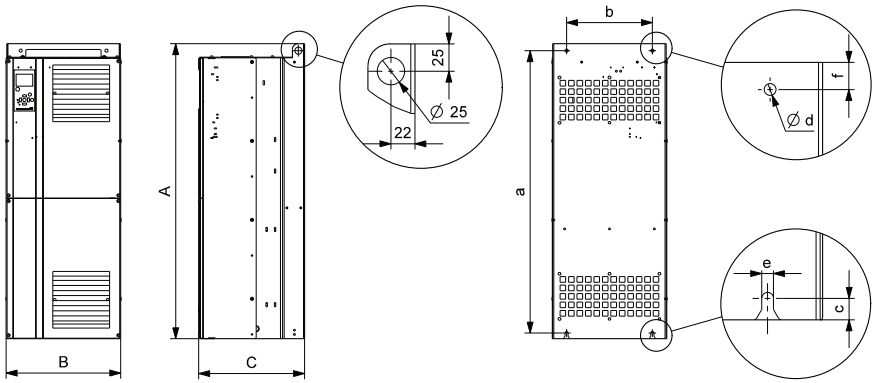


Fig. 52 Enclosures D1 and D2

Enclosure	Height [in (mm)] 1)		Width [in (mm)] 1)		Depth [in (mm)] 1)		Screw holes [in (mm)]				Weight [lb (kg)]
	A	a	B	b	C	C 2)	c	∅d	∅e	f	
A2	10.55 (268)	10.12 (257)	3.54 (90)	2.76 (70)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	10.8 (4.9)
with IP21/NEMA1 kit	14.76 (375)	13.78 (350)	3.54 (90)	2.76 (70)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	11.7 (5.3)
A3	10.55 (268)	10.12 (257)	5.12 (130)	4.34 (110)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	14.6 (6.6)
with IP21/NEMA1 kit	14.76 (375)	13.78 (350)	5.12 (130)	4.34 (110)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	15.4 (7.0)
A5	16.54 (420)	15.83 402)	9.53 (242)	8.47 (215)	7.87 (200)	7.87 (200)	.323 (8.2)	.472 (12)	.256 (6.5)	.354 (9.0)	30.9 (14)
B1	18.90 (480)	17.87 (454)	9.53 (242)	8.27 (210)	10.24 (260)	10.24 (260)	.472 (12 0)	.748 (19)	.354 (9.0)	.354 (9.0)	26.5 (23)
B2	25.59 (650)	24.57 (624)	9.53 (242)	8.27 (210)	10.24 (260)	10.24 (260)	.472 (12 0)	.748 (19)	.354 (9.0)	.354 (9.0)	59.5 (27)
B3	15.71 (399)	14.96 (380)	6.50 (165)	5.52 (140)	9.76 (248)	10.32 (262)	.315 (8 0)	.472 (12)	.268 (6.8)	.311 (7.9)	26.5 (12)
with IP21/NEMA1 kit	18.71 (475)	–	6.50 (165)	–	9.80 (249)	10.32 (262)	.315 (8 0)	.472 (12)	.268 (6.8)	.311 (7.9)	–
B4	20.47 (520)	19.49 (495)	9.09 in (231)	7.87 (200)	9.53 (242)	9.53 (242)	–	–	.335 (8.5)	.591 (15.0)	51.8 (23.5)
with IP21/NEMA1 kit	26.38 (670)	–	10.04 (255)	–	9.69 (246)	9.69 (246)	–	–	.335 (8.5)	.591 (15.0)	–
C1	26.77 (680)	25.52 (648)	12.13 in (308)	10.71 (272)	12.21 (310)	12.21 (310)	.472 (12 0)	.748 (19)	.354 (9.0)	.386 (9.8)	99.2 (45)

Enclosure	Height [in (mm)] [1]		Width [in (mm)] [1]		Depth [in (mm)] [1]		Screw holes [in (mm)]				Weight [lb (kg)]
	A	a	B	b	C	C [2]	c	∅d	∅e	f	
C2	30.31 (770)	29.09 (739)	14.57 (370)	13.15 (334)	13.19 (335)	13.19 (335)	.472 (12 0)	.748 (19)	.354 (9.0)	.386 (9.8)	143.3 (65)
C3	21.65 (550)	20.51 (521)	12.13 (308)	10.63 (270)	13.11 (333)	13.11 (333)	–	–	.335 (8.5)	.669 (17.0)	77.2 (35)
with IP21/NEMA1 kit	21.65 (755)	–	12.95 (329)	–	13.27 (337)	13.27 (337)	–	–	.335 (8.5)	.669 (17.0)	–
C4	25.98 (660)	24.84 (631)	14.57 (370)	12.99 (330)	13.11 (333)	13.11 (333)	–	–	.335 (8.5)	.669 (17.0)	110 2 (50)
with IP21/NEMA1 kit	37.40 (950)	–	15.39 (391)	–	13.27 (337)	13.27 (337)	–	–	.335 (8.5)	.669 (17.0)	–
D1	47.60 (1209)	45.43 (1154)	16.54 (420)	11.97 (304)	14.96 (380)	–	.787 (20)	.433 (11)	.433 (11)	.984 (25)	229.3 (104)
D2	62.56 (1589)	60.43 (1535)	16.54 (420)	11.97 (304)	14.96 (380)	–	.787 (20)	.433 (11)	.433 (11)	.984 (25)	332.9 (151)

[1] The dimensions are maximum height, width and depth.

[2] Depth with MCB 114 option

Shipping dimensions of D1 and D2:
Height x width x length = 650 x 570 x 1730 mm.

Surroundings

Relative humidity	5-95 % RH
Minimum ambient temperature at full operation	32° F (0 °C)
Minimum ambient temperature at reduced operation	14° F (–10 °C)
Temperature during storage and transportation	–13° F to 149° F (–25 to 65 °C)
Storage duration	Max. 6 months
Maximum altitude above sea level with full performance	3,280 ft (1 km)
Maximum altitude above sea level with performance reduction	6,600 ft (2 km)
CUE, up to 160 amps	
Ambient temperature	Max. 122 °F (50 °C)
Average ambient temperature over 24 hours	Max. 113° F (45 °C)
CUE, 190 amps and above	
Ambient temperature	Max. 113° F (45 °C)
Average ambient temperature over 24 hours	Max. 104° F (40 °C)

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

Sound pressure level

Maximum sound pressure level measured at a distance of 1 m from the unit:

Enclosure	Sound pressure level [dBA]
A2	60
A3	60
A5	63
B1	67
B2	70
B3	63 [1]
B4	63
C1	62
C2	65
C3	67
C4	–
D1	76
D2	74

[1] The sound pressure level for B3 in the 3 x 525-600 V range is 70 dBA.

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.

Terminal tightening torques

Enclosure	Tightening torque [Nm]			
	Mains	Motor	Ground	Relay
A2	1.8	1.8	3	0.6
A3	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
D1	19	19	19	0.6
D2	19	19	19	0.6

[1] Conductor cross-section ≤ 95 mm^2.

[2] Conductor cross-section ≥ 95 mm^2.

Cables

Cable length

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

Cable cross-section to signal terminals

Maximum cable cross-section to signal terminals, rigid conductor	16 AWG (1.5 mm^2)
Maximum cable cross-section to signal terminals, flexible conductor	18 AWG (1.0 mm^2)
Minimum cable cross-section to signal terminals	22 AWG (0.5 mm^2)

Note: For cable cross-section to mains and motor, see next section Fuses on page 48.

Fuses

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

Typical shaft power P2	Maximum fuse size	Fuse type	Maximum conductor cross-section
[kW]	[A]		[AWG] (mm^2)
1 x 200-240 V			
1.1	20	–	12 (4)
1.5	30	–	8 (10)
2.2	40	–	8 (10)
3	40	–	8 (10)
3.7	60	–	8 (10)
5.5	80	–	8 (10)
7.5	100	–	2 (35)
3 x 200-240 V			
0.75	10	gG	12 (4)
1.1	20	gG	12 (4)
1.5	20	gG	12 (4)
2.2	20	gG	12 (4)
3	32	gG	12 (4)
3.7	32	gG	12 (4)
5.5	63	gG	8 (10)
7.5	63	gG	8 (10)
11	63	gG	8 (10)
15	80	gG	2 (35)
18.5	125	gG	1 (50)
22	125	gG	1 (50)
30	160	gG	1 (50)
37	200	aR	3/0 (95)
45	250	aR	4/0 (120)
3 x 380-500 V			
0.55	10	gG	12 (4)
0.75	10	gG	12 (4)
1.1	10	gG	12 (4)
1.5	10	gG	12 (4)
2.2	20	gG	12 (4)
3	20	gG	12 (4)
4	20	gG	12 (4)
5.5	32	gG	12 (4)
7.5	32	gG	12 (4)
11	63	gG	8 (10)
15	63	gG	8 (10)
18.5	63	gG	8 (10)
22	63	gG	2 (35)
30	80	gG	2 (35)
37	100	gG	1 (50)
45	125	gG	1 (50)
55	160	gG	1 (50)
75	250	aR	3/0 (95)
90	250	aR	4/0 (120)
110	300	gG	2 x 70
132	350	gG	2 x 70
160	400	gG	2 x 185
200	500	gG	2 x 185
250	600	gR	2 x 185
3 x 525-600 V			
0.75	10	gG	12 (4)
1.1	10	gG	12 (4)
1.5	10	gG	12 (4)
2.2	20	gG	12 (4)
3	20	gG	12 (4)
4	20	gG	12 (4)
5.5	32	gG	12 (4)
7.5	32	gG	12 (4)
3 x 525-690 V			
11	–	–	–
15	–	–	–
18.5	–	–	–
22	–	–	–
30	–	–	–
37	–	–	–
45	–	–	–
55	–	–	–
75	–	–	–
90	–	–	–
110	225	–	2 x 70
132	250	–	2 x 70
160	350	–	2 x 185
200	400	–	2 x 185
250	500	–	2 x 185

UL fuses and conductor cross-section to mains and motor

CUE Output Amps	Fuse type							Maximum conductor cross-section
[Amp (kW)]	Bussmann RK1	Bussmann J	Bussmann T	SIBA RK1	Littel Fuse RK1	Ferraz-Shawmut CC	Ferraz-Shawmut RK1	[AWG]
1 x 200-240 V								
6.6 (1.1)	KTN-R20	–	–	–	–	–	–	10
7.5 (1.5)	KTN-R30	–	–	–	–	–	–	7
10.6 (2.2)	KTN-R40	–	–	–	–	–	–	7
12.5 (3)	KTN-R40	–	–	–	–	–	–	7
16.7 (3.7)	KTN-R60	–	–	–	–	–	–	7
24.2 (5.5)	–	–	–	–	–	–	–	7
30.8 (7.5)	–	–	–	–	–	–	–	2
3 x 200-240 V								
4.6 (0.75)	KTN-R10	JKS-10	JJN-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
6.6 (1.1)	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
7.5 (1.5)	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
10.6 (2.2)	KTN-R20	JKS-20	JJN-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
12.5 (3)	KTN-R30	JKS-30	JJN-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
16.7 (3.7)	KTN-R30	JKS-30	JJN-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
24.2 (5.5)	KTN-R50	JKS-50	JJN-50	5012406-050	KLN-R50	–	A2K-50R	7
30.8 (7.5)	KTN-R50	JKS-60	JJN-60	5012406-050	KLN-R60	–	A2K-50R	7
46.2 (11)	KTN-R60	JKS-60	JJN-60	5014006-063	KLN-R60	A2K-60R	A2K-60R	7
59.4 (15)	KTN-R80	JKS-80	JJN-80	5014006-080	KLN-R80	A2K-80R	A2K-80R	2
74.8 (18.5)	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R	1/0
88 (22)	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R	1/0
115 (30)	FWX-150	–	–	2028220-150	L25S-150	A25X-150	A25X-150	1/0
143 (37)	FWX-200	–	–	2028220-200	L25S-200	A25X-200	A25X-200	4/0
170 (45)	FWX-250	–	–	2028220-250	L25S-250	A25X-250	A25X-250	250 MCM
3 x 380-500 V								
1.6 (0.55)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.1 (0.75)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.7 (1.1)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
3.4 (1.5)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
4.3 (2.2)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
6.3 (3)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
8.2 (4)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
11 (5.5)	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
14.5 (7.5)	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
21 (11)	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	–	A6K-40R	7
27 (15)	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	–	A6K-40R	7
34 (18.5)	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	–	A6K-50R	7
40 (22)	KTS-R60	JKS-60	JJS-60	5014006-063	KLS-R60	–	A6K-60R	2
52 (30)	KTS-R80	JKS-80	JJS-80	2028220-100	KLS-R80	–	A6K-80R	2
65 (37)	KTS-R100	JKS-100	JJS-100	2028220-125	KLS-R100	–	A6K-100R	1/0
80 (45)	KTS-R125	JKS-150	JJS-150	2028220-125	KLS-R125	–	A6K-125R	1/0
105 (55)	KTS-R150	JKS-150	JJS-150	2028220-160	KLS-R150	–	A6K-150R	1/0
130 (75)	FWH-220	–	–	2028220-200	L50S-225	–	A50-P225	4/0
160 (90)	FWH-250	–	–	2028220-250	L50S-250	–	A50-P250	250 MCM
3 x 525-600 V								
1.7 (0.75)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.4 (1.1)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
2.7 (1.5)	KTS-R10	JKS-10	JJS-10	5017906-010	KTN-R10	ATM-R10	A2K-10R	10
3.9 (2.2)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
4.9 (3)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
6.1 (4)	KTS-R20	JKS-20	JJS-20	5017906-020	KTN-R20	ATM-R20	A2K-20R	10
9 (5.5)	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10

CUE Output Amps	Fuse type							Maximum conductor cross-section
[Amp (kW)]	Bussmann RK1	Bussmann J	Bussmann T	SIBA RK1	Littel Fuse RK1	Ferraz-Shawmut CC	Ferraz-Shawmut RK1	[AWG]
11 (7.5)	KTS-R30	JKS-30	JJS-30	5012406-032	KTN-R30	ATM-R30	A2K-30R	10
3 x 525-690 V								
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–

CUE Output Amps	Fuse type							Maximum conductor cross-section
[Amps (kW)]	Bussmann E1958 JFHR2	Bussmann E4273 T/JDDZ	Bussmann E4274 H/JDDZ	Bussmann E125085 JFHR2	SIBA E180276 RKI/JDDZ	Littel Fuse E71611 JFHR2	Ferraz-Shawmut E60314 JFHR2	[AWG]
3 x 380-500 V								
190 (110)	FWH-300	JJS-300	NOS-300	170M3017	2028220-315	L50S-300	A50-P300	2 x 2/0
240 (132)	FWH-350	JJS-350	NOS-350	170M3018	2028220-315	L50S-350	A50-P350	2 x 2/0
302 (160)	FWH-400	JJS-400	NOS-400	170M4012	206xx32-400	L50S-400	A50-P400	2 x 350 MCM
361 (200)	FWH-500	JJS-500	NOS-500	170M4014	206xx32-500	L50S-500	A50-P500	2 x 350 MCM
443 (250)	FWH-600	JJS-600	NOS-600	170M4016	206xx32-600	L50S-600	A50-P600	2 x 350 MCM
–	–	–	–	Bussmann E125085 JFHR2	SIBA E180276 JFHR2	–	Ferraz-Shawmut E76491 JFHR2	–
3 x 525-690 V								
155 (110)	–	–	–	170M3017	2061032.315	–	6.6URD30D08A0315	2 x 2/0
192 (132)	–	–	–	170M3018	2061032.350	–	6.6URD30D08A0350	2 x 2/0
242 (160)	–	–	–	170M4011	2061032.350	–	6.6URD30D08A0350	2 x 350 MCM
290 (200)	–	–	–	170M4012	2061032.400	–	6.6URD30D08A0400	2 x 350 MCM
344 (250)	–	–	–	170M4014	2061032.500	–	6.6URD30D08A0500	2 x 350 MCM

Inputs and outputs

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.
Number of cut-ins, enclosures D	max. 1 time/2 min.

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

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.

RS-485 GENIbus connection

Terminal number	68 (A), 69 (B), 61 GND (Y)

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

Digital inputs

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

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

Signal relays

Relay 01, terminal number	1 (C), 2 (NO), 3 (NC)
Relay 02, terminal number	4 (C), 5 (NO), 6 (NC)
Maximum terminal load (AC-1) [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 V DC 10 mA 24 V AC 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).

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
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

The factory setting is voltage signal “U”.

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

Analog output

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

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

MCB 114 sensor input module

Analog input 3, terminal number	2
Current range	0/4-20 mA
Input resistance	< 200 Ω
Analog inputs 4, terminal number	4, 5
Analog inputs 5, terminal number	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.

Accessories

Product numbers

CUE accessories

Add-on module, see page 53	Type	Product number
Sensor input module	MCB 114	96760901
Control panel, see page 54		
Grundfos Local Control Panel	GLCP	96809398
Remote-mounting option for GLCP, with 9.8 ft (3 m) cable	GLCP remote mounting	96801229
Floor-mounting option, see page 55		
Enclosure D1 and D2, option including pedestal parts and instructions	Floor mounting	96801230
Output filters, see page 56		
Sine-wave filters		1)
dU/dt filters		1)

1) Product numbers for sine-wave filters and dU/dt filters, see pages 41 to 44.

Communication modules

Gateways	Type	Product number
LonWorks gateway	CIU 100	96753736
Profibus gateway	CIU 150	96753081
Modbus gateway	CIU 200	96753082
GSM modem	CIU 250	96787106

Sensors

Danfoss pressure sensor	Type	Measuring range [psi] (bar)	Product number
Pressure connection: NPT 1/2”	Kit*	0-120 psi (0-8 bar)	96437852
	6 ft potted cable	0-200 psi (0-14 bar)	91120777
	Kit*	0-87 psi (0-6 bar)	91136169
	Kit*	0-145 psi (0-10 bar)	91136170
	Kit*	0-232 psi (0-16 bar)	91136171
	Kit*	0-362 psi (0-25 bar)	91136172
	Kit*	0-580 psi (0-40 bar)	91136173
	Kit*	0-870 psi (0-60 bar)	91136174
Grundfos differential pressure sensor option, 0.9 m screened cable			
Pressure connection: 7/16” Including fittings for pressure connection (1/4" - 7/16"), brackets for wall and motor mounting, 3 capillary tubes (short/long) and 5 cable clips (black), installation and operating instructions, service kit instructions		0-8.7 psi (0-0.6 bar)	96611522
		0-14.5 psi (0-1.0 bar)	96611523
		0-23 psi (0-1.6 bar)	96611524
		0-36 psi (0-2.5 bar)	96611525
		0-58 psi (0-4.0 bar)	96611526
		0-87 psi (0-6.0 bar)	96611527
		0-145 psi (0-10 bar)	96611550

*** Note:** Kits include a 6 ft cable with removable potted plug in addition to a standard plug for remote mounting. All sensors have a 4-20 mA output.

Other accessories

Dry-running protection 1)	Type	Product number
LiqTec dry-run protector 1 x 115V	LiqTec	96556430
LiqTec dry-run protector 1 x 220V	LiqTec	96556429
LiqTec Extension Cable Kit	LiqTec Ext. Cable	96443676

1) Main pump types CR, CRI, CRN, MTR, SPK, CRK, CHI.
2) Sensor connection: 1/2”.

MCB 114 sensor input module

TM04 0293 0308

Fig. 53 MCB 114 sensor input module

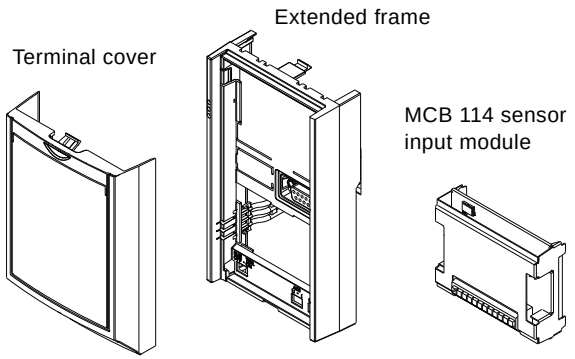
The MCB 114 offers three additional analog inputs for the CUE:

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

The three analog inputs are default used for monitoring. For further information, see section MCB 114 sensor input module on page 29.

Scope of delivery

The MCB 114 comes with a terminal cover, an extended frame and an identification label to put onto the CUE.



TM04 0026 4807

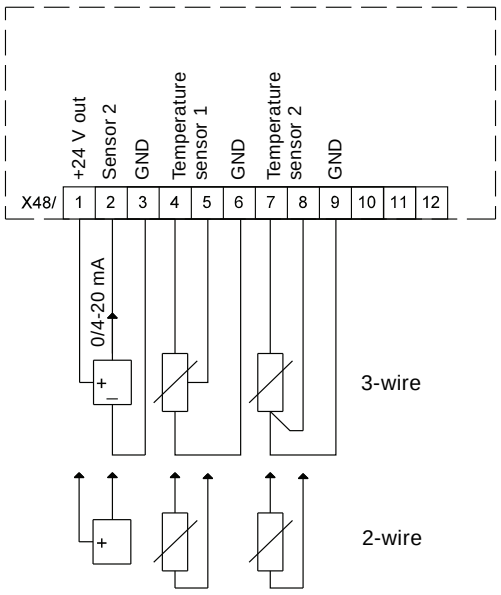
Fig. 54 Scope of delivery

Technical data

Relative humidity	5-95% RH
Ambient temperature during operation	14 to 131° F (–10 to 55° C)
Temperature during storage and transportation	–13 to 158° F (–25 to 70° C)
Maximum length, signal cable	984 ft (300 m)
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

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

Wiring diagram



TM03 9483 4007

Fig. 55 Wiring diagram, MCB 114

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

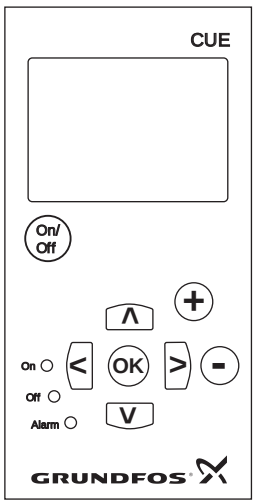
Terminals 10, 11 and 12 are not used

Grundfos Local Control Panel, GLCP

GLCP is used for local setting of the CUE.

The CUE unit comes default with a GLCP fitted, but the control panel is also available as an option.

Cable is not included in the option.



TM03 8719 2507

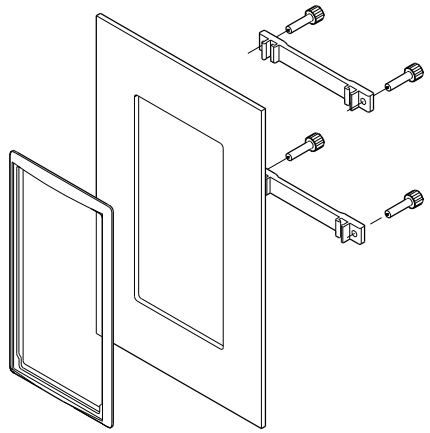
Fig. 56 Control panel of the CUE

For further information, see the installation and operating instructions of the CUE.

Remote-mounting option for GLCP

By means of a remote-mounting option, the GLCP can also be moved to the front of a cabinet. The enclosure is IP65. The fastening screws must be tightened to a torque of maximum 1 Nm.

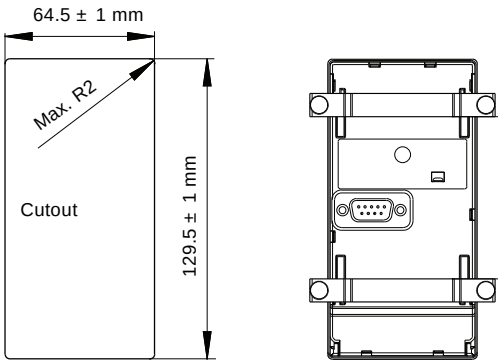
The remote-mounting option includes fasteners, 3 m cable and gasket.



TM04 0376 0608

Fig. 57 Remote-mounting option for GLCP

Dimensions



TM04 0377 0608

Fig. 58 Cabinet mounting, dimensions of cutout

For further information, see the installation and operating instructions of the remote-mounting option.

Floor-mounting option

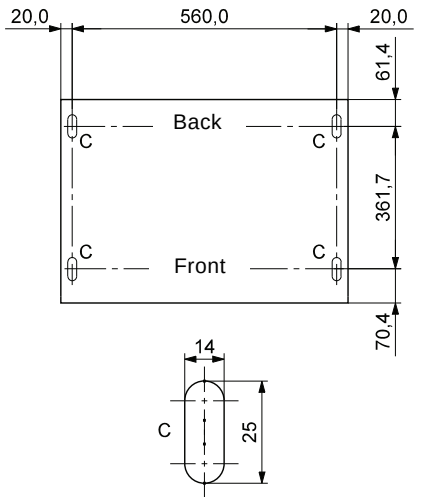
By means of a pedestal, the CUE can also be mounted on the floor. A pedestal has been designed for that purpose.

One pedestal fits both enclosure D1 and D2.

Scope of delivery

- Primary pedestal frame
- Vented front cover
- Two side covers
- Two front brackets
- Hardware for assembly
- Instructions.

Drilling dimensions



TM03 9923 4607

Fig. 59 Drilling template for pedestal [mm]

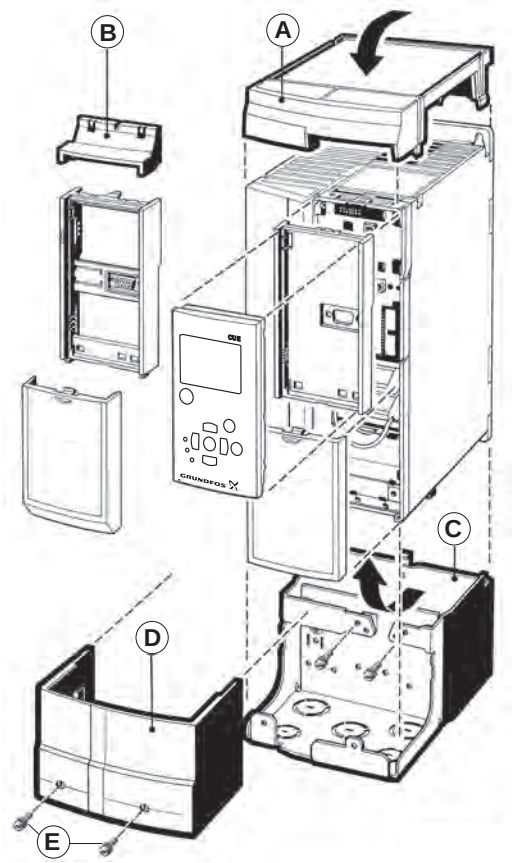
TM03 9895 4607

Fig. 60 CUE enclosure D1 or D2 on a pedestal

Please see the instructions of the pedestal option for further information.

IP21/NEMA1 kit

An IP20 enclosure can be upgraded to IP21/NEMA1 with the IP20/NEMA1 kit. The power terminals (mains and motor) will be covered. See fig. 61.



TM04 0372 0608

Fig. 61 Example of IP21/NEMA1 kit for enclosure A3

- A: Top cover
- B: Brim
- C: Base part
- D: Base cover
- E: Screw(s).

If the MCB 114 sensor input module is fitted, the brim (B) must be fitted on the top cover (A).

Output filters

Grundfos offers two types of output filter as accessories for the CUE:

- dU/dt filters
- sine-wave filters.

The filters are in IP20/NEMA1 enclosure.

GrA 4456

Fig. 62 Wall-mounted sine-wave filters

Use of output filters

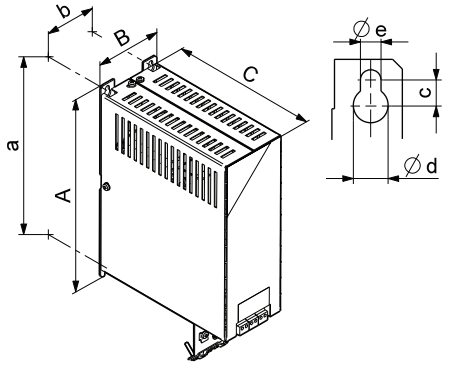
The table below explains in which cases an output filter is required. From the table, it can be seen if a filter is needed and which type to use.

Pump type	Typical shaft power P2	dU/dt filter	Sine-wave filter
SP, BM, BMB with 380 V motor and up	Up to 7.5 kW	–	0-984 ft (0-300 m)
	11 kW and up	0-492 ft (0-150 m)	492-984 ft (150-300 m)
Other pumps, noise reduction	Up to 7.5 kW	–	0-984 ft (0-300 m)
	11 kW and up	0-492 ft (0-150 m)	492-984 ft (150-300 m)
Other pumps, higher noise reduction	Up to 7.5 kW	–	0-984 ft (0-300 m)
	11 kW and up	–	0-984 ft (0-300 m)
Pumps with 690 V motor	All	0-492 ft (0-150 m)	492-984 ft (150-300 m)

The lengths stated apply to the motor cable.

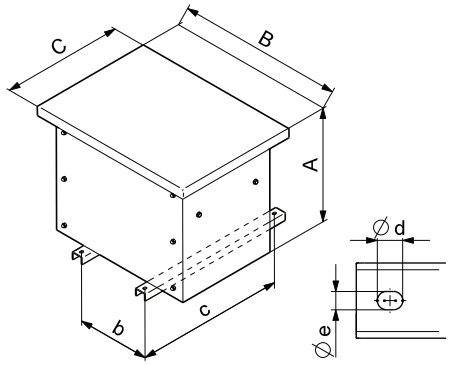
For information about installation, see page 34.

Dimensions and weight of output filters



TM04 0625 0908

Fig. 63 Wall mounting



TM04 0624 0908

Fig. 64 Floor mounting

Product number	Mounting	Height [in (mm)]		Width [in (mm)]		Depth [in (mm)]		Screw holes [in (mm)]			Weight [lbs (kg)]
		A	a	B	b	C	c	∅d	∅e	f	
Sine-wave filters											
96754941	Wall	7.87 (200)	7.48 (190)	2.95 (75)	2 36 (60)	8 07 (205)	–	.315 (8)	.177 (4.5)	276 (7)	7 3 (3 3)
96754972	Wall	7.87 (200)	7.48 (190)	2.95 (75)	2 36 (60)	8 07 (205)	–	.315 (8)	.177 (4.5)	276 (7)	9 3 (4 2)
96754973	Wall	10 55 (268)	10.12 (257)	3.54 (90)	2.76 (70)	8.11 (206)	–	.433 (11)	.256 (6 5)	.315 (8)	101.0 (5.8)
96754974	Wall	10 55 (268)	10.12 (257)	3.54 (90)	2.76 (70)	8 07 (205)	–	.433 (11)	.256 (6 5)	.315 (8)	103.9 (7.1)
96754976	Wall	10 55 (268)	10.12 (257)	5.12 (130)	3 54 (90)	8 07 (205)	–	.433 (11)	256 (6 5)	315 (8)	20.1 (9.1)
96754977	Wall	12 99 (330)	12.28 (312)	5.90 (150)	4.72 (120)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	37 3 (16.9)
96754978	Wall	16 93 (430)	16.22 (412)	5.90 (150)	4.72 (120)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	43 9 (19.9)
96755019	Wall	20 87 (530)	19.69 (500)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	86.0 (39)
96755021	Wall	24 02 (610)	22.83 (580)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	90.4 (41)
96755032	Wall	24 02 (610)	22.83 (580)	6.69 (170)	5.32 (135)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	119 0 (54)
96755033	Floor	20 55 (522)	–	26.38 (670)	11.42 (290)	19.69 (500)	18.11 (460)	.591 (15)	.433 (11)	–	191 8 (87)
96755034	Floor	30.79 (782)	–	37.01 (940)	15.74 (400)	25.60 (650)	24 02 (610)	.591 (15)	.433 (11)	–	249.1 (113)
96755037	Floor	30.79 (782)	–	37.01 (940)	15.74 (400)	25.60 (650)	24 02 (610)	.591 (15)	.433 (11)	–	418.9 (190)
96755038	Floor	30.79 (782)	–	37.01 (940)	16 93 (430)	25.60 (650)	24 02 (610)	.591 (15)	.433 (11)	–	540.1 (245)
96755039	Floor	29 21 (742)	–	4 39 (1050)	16 93 (430)	29.92 (760)	28 32 (720)	.591 (15)	.433 (11)	–	683.4 (310)
96755040	Wall	16 93 (430)	16.22 (412)	5.90 (150)	4.72 (120)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	36 8 (16.7)
96755041	Floor	20 55 (522)	–	26.38 (670)	8.66 (220)	19.69 (500)	18.11 (460)	.591 (15)	.433 (11)	–	121 3 (55)
96755042	Floor	20 55 (522)	–	26.38 (670)	10 24 (260)	19.69 (500)	18.11 (460)	.591 (15)	.433 (11)	–	154 3 (70)
96755043	Floor	20 55 (522)	–	26.38 (670)	12 20 (310)	19.69 (500)	18.11 (460)	.591 (15)	.433 (11)	–	231.5 (105)
96755044	Floor	20 55 (522)	–	25.20 (640)	14 96 (380)	19.69 (500)	18.11 (460)	.591 (15)	.433 (11)	–	330.7 (150)
96755045	Floor	30.79 (782)	–	35.83 (910)	16 93 (430)	25.60 (650)	24 02 (610)	.591 (15)	.433 (11)	–	485.0 (220)
96755047	Floor	30.79 (782)	–	37.01 (940)	19 69 (500)	25.60 (650)	24 02 (610)	.591 (15)	.433 (11)	–	628.3 (285)
96755049	Floor	43.35 (1152)	–	50.79 (1290)	19 29 (490)	31.50 (800)	29 92 (760)	.591 (15)	.433 (11)	–	815.7 (370)
96755050	Floor	43.35 (1152)	–	50.79 (1290)	21 26 (540)	31.50 (800)	29 92 (760)	–	–	–	1212 5 (550)
dU/dt filters											
96755062	Wall	10 55 (268)	10.12 (257)	4.72 (120)	3 54 (90)	8 07 (205)	–	.433 (11)	256 (6 5)	315 (8)	11.5 (5.2)
96755063	Wall	12 99 (330)	12.28 (312)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	20.5 (9.3)
96755064	Wall	12 99 (330)	12.28 (312)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	23 6 (10.7)
96755066	Wall	12 99 (330)	12.28 (312)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	28 2 (12.8)
96755067	Floor	18.19 (462)	–	24.02 (610)	6.89 (175)	17.32 (440)	15.74 (400)	.591 (15)	.433 (11)	–	72.8 (33)
96755069	Floor	18 23 (463)	–	24.02 (610)	7.48 (190)	17.32 (440)	15.74 (400)	.591 (15)	.433 (11)	–	110 2 (50)
96755070	Floor	22.48 (571)	–	30.31 (770)	7.48 (190)	21.56 (550)	20 08 (510)	.591 (15)	.433 (11)	–	132.3 (60)
96755071	Floor	20 55 (522)	–	26.38 (670)	8.47 (215)	19.69 (500)	18.11 (460)	.591 (15)	.433 (11)	–	127.9 (58)
96755078	Wall	–	11.81 (300)	5.91 (150)	4.72 (120)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	18.3 (8.3)
96755079	Wall	–	12.28 (312)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	20.7 (9.4)
96755080	Wall	12 99 (330)	12.28 (312)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	26.01 (11 8)
96755081	Wall	12 99 (330)	12.28 (312)	6.69 (170)	4.92 (125)	10.24 (260)	–	.748 (19)	.354 (9)	.472 (12)	26 9 (12.2)
96755082	Floor	20 55 (522)	–	26.38 (670)	8.47 (215)	19.69 (500)	18.11 (460)	.591 (15	.433 (11)	–	99.2 (45)
96755083	Floor	20 55 (522)	–	25.20 (640)	8.47 (215)	19.69 (500)	18.11 (460)	.591 (15	.433 (11)	–	103.6 (47)
96755084	Floor	20 55 (522)	–	26.38 (670)	8.47 (215)	19.69 (500)	18.11 (460)	.591 (15	.433 (11)	–	103.6 (47)
96755085	Floor	20 55 (522)	–	26.38 (670)	8.47 (215)	19.69 (500)	18.11 (460)	.591 (15	.433 (11)	–	114 6 (52)

Grundfos differential pressure sensor, DPI

Product description

A cable (pos. 1) goes through an M12 x 1.5 pg connection. See fig. 65.

The sensor housing and parts in contact with the medium are made of Inox DIN W.-Nr. 1.4305 (pos. 3) with composite PA top (pos. 2). The pressure connections (pos. 4) are DIN W.-Nr. 1.4305, 7/16" UNF, and gaskets are FKM.

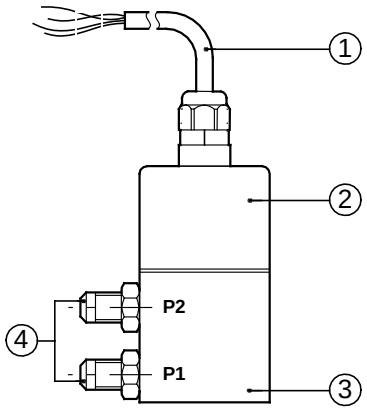


Fig. 65 DPI position numbers

The sensor is supplied with angular bracket for mounting on motor or bracket for wall mounting. See fig. 67.

Options with other cable lengths and various fitting connectors are available.

Dimensions

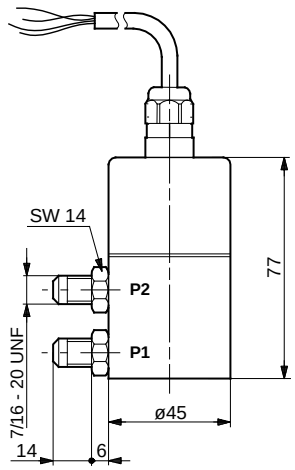


Fig. 66 Dimensions, DPI

Wiring diagram

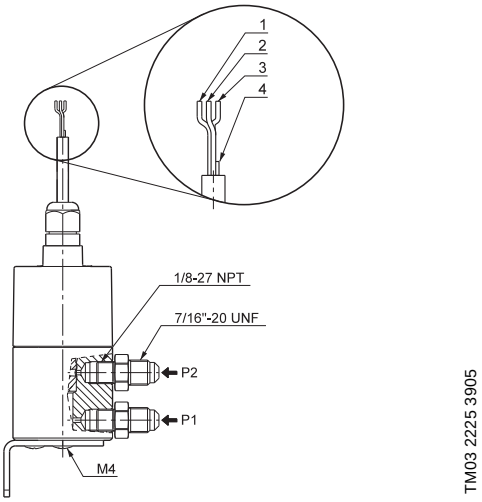


Fig. 67 Wiring diagram, DPI

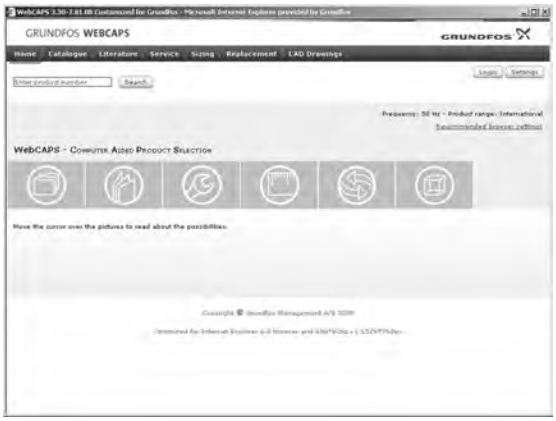
No	Colour	Function
1	Brown	Supply voltage, 12-30 V
2	Yellow	GND
3	Green	Control signal
4	White	Test signal. Must not be connected to supply voltage (conductor can be cut off)

Technical data

Supply voltage	12-30 VDC
Output signal	4-20 mA
Load [Ω]	24 V: max. 500 [Ω] 16 V: max. 200 [Ω] 12 V: max. 100 [Ω]
Max. system pressure, P1 and P2 simultaneously	232 psi (16 bar)
Rupture pressure [bar]	1.5 x system pressure
Measuring accuracy	2 5% BFSL
Response time	< 0.5 sec
Media temperature range	+14 °F to +158 °F (–10 °C to +70 °C)
Storage temperature range	–40 °F to 176 °F (–40 °C to +80 °C)
Electrical connection	3-wire 0.13 mm^2 2.9 ft (0.9 m) cable M12 x 1.5 in sensor top
Short-circuit proof	Yes
Protected against reverse polarity	Yes
Over supply voltage	Yes
Materials in contact with medium	DIN W.-Nr. 1.4305 FKM and PPS
Enclosure class	IP55
Weight	550 g
EMC (electromagnetic compatibility)	According to EN 61326-1
Emission/immunity	According to EN 61326-1
Connections	7/16"-UNF
Sealing material	FKM

Further product documentation

WebCAPS

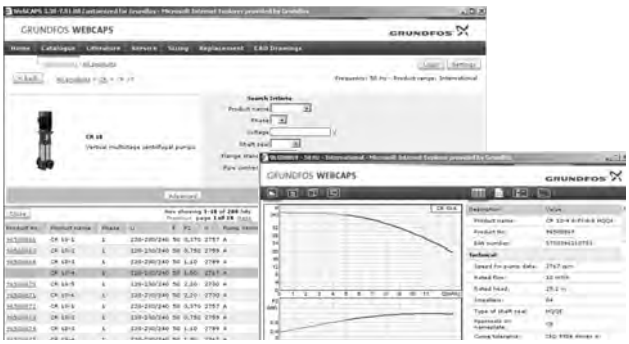


WebCAPS is a **Web**-based **C**omputer **A**ided **P**roduct **S**election program available on www.grundfos.com.

WebCAPS contains detailed information on more than 185,000 Grundfos products in more than 20 languages.

In WebCAPS, all information is divided into 6 sections:

- Catalogue
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



Catalogue

This section is based on fields of applica ion and pump types, and contains
- technical data
- curves (QH, Eta, P1, P2, etc) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.

Literature

In this section you can access all the latest documents of a given pump, such as
- data booklets
- installation and operating instructions
- service documentation, such as Service kit catalogue and Service kit instructions
- quick guides
- product brochures, etc.

Service

This section contains an easy-to-use interactive service catalogue. Here you can find and identify service parts of bo h existing and discontinued Grundfos pumps.
Furthermore, this section contains service videos showing you how to replace service parts.

Further product documentation

Sizing

This section is based on different fields of applica ion and installation examples, and gives easy step-by-step instructions in how to
- select the most suitable and efficient pump for your installation
- carry out advanced calculations based on energy consumption, payback periods, load profiles, life cycle costs, etc.
- analyse your selected pump via the built-in life cycle cost tool
- determine the flow velocity in wastewater applications, etc.

Replacement

In this section you find a guide to selecting and comparing replacement data of an installed pump in order to replace the pump with a more efficient Grundfos pump.
The section contains replacement data of a wide range of pumps produced by other manufacturers than Grundfos.

Based on an easy step-by-step guide, you can compare Grundfos pumps with the one you have installed on your site. When you have specified the installed pump, the guide will suggest a number of Grundfos pumps which can improve both comfort and efficiency.

CAD drawings

In this section it is possible to download 2-dimensional (2D) and 3-dimensional (3D) CAD drawings of most Grundfos pumps.

These formats are available in WebCAPS:

2-dimensional drawings:
- .dxf, wireframe drawings
- .dwg, wireframe drawings.

3-dimensional drawings:
- .dwg, wireframe drawings (without surfaces)
- .stp, solid drawings (with surfaces)
- .eprt, E-drawings.

WinCAPS

Fig. 1 WinCAPS CD-ROM

WinCAPS is a **Win**dows-based **C**omputer **A**ided **P**roduct **S**election program containing detailed information on more than 185,000 Grundfos products in more than 20 languages.

The program contains the same features and functions as WebCAPS, but is an ideal solution if no Internet connection is available.

WinCAPS is available on CD-ROM and updated once a year.

BE > THINK > INNOVATE >

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

L-CUE-PG-01 1009 **US**
Rep. 1108

© 2008, 2009 Grundfos Pumps Corp.

Subject to alterations.

The name Grundfos, the Grundfos logo, and the payoff Be–Think–Innovate are registered trademarks owned by Grundfos Management A/S or Grundfos A/S, Denmark. All rights reserved worldwide.

GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: +1-913-227-3400
Telefax: +1-913-227-3500

GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario L6H 6C9 Canada
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
Apodaca, N.L. Mexico 66600
Phone: +52-81-8144 4000
Telefax: +52-81-8144 4010

www.grundfos.com

GRUNDFOS