

TPE(D), NBE, NKE

11-22 kW

Installation and operating instructions

GB D F I E P GR NL S
FIN DK PL RU HR YU CZ SK



Declaration of Conformity

We **Grundfos** declare under our sole responsibility that the products **TPE(D)**, **NBE** and **NKE**, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to:

- Machinery (98/37/EC).
Standard used: EN ISO 12100.
- Electromagnetic compatibility (89/336/EEC).
Standard used: EN 61 800-3.
- Electrical equipment designed for use within certain voltage limits (73/23/EEC) [95].
Standards used: EN 60 335-1 and EN 60 335-2-51.

Konformitätserklärung

Wir **Grundfos** erklären in alleiniger Verantwortung, daß die Produkte **TPE(D)**, **NBE** und **NKE**, auf die sich diese Erklärung bezieht, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EG-Mitgliedstaaten übereinstimmen:

- Maschinen (98/37/EG).
Norm, die verwendet wurde: EN ISO 12100.
- Elektromagnetische Verträglichkeit (89/336/EWG).
Norm, die verwendet wurde: EN 61 800-3.
- Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen (73/23/EWG) [95].
Normen, die verwendet wurden: EN 60 335-1 und EN 60 335-2-51.

Déclaration de Conformité

Nous **Grundfos** déclarons sous notre seule responsabilité que les produits **TPE(D)**, **NBE** et **NKE** auxquels se réfère cette déclaration sont conformes aux Directives du Conseil concernant le rapprochement des législations des Etats membres CE relatives à

- Machines (98/37/CE).
Standard utilisé: EN ISO 12100.
- Compatibilité électromagnétique (89/336/CEE).
Standard utilisé: EN 61 800-3.
- Matériel électrique destiné à employer dans certaines limites de tension (73/23/CEE) [95].
Standards utilisés: EN 60 335-1 et EN 60 335-2-51.

Dichiarazione di Conformità

Noi **Grundfos** dichiariamo sotto la nostra esclusiva responsabilità che i prodotti **TPE(D)**, **NBE** e **NKE**, ai quali questa dichiarazione si riferisce, sono conformi alle direttive del Consiglio, concernenti il ravvicinamento delle legislazioni degli Stati membri CE relativi a

- Macchine (98/37/CE).
Standard usato: EN ISO 12100.
- Compatibilità elettromagnetica (89/336/CEE).
Standard usato: EN 61 800-3.
- Materiale elettrico destinato ad essere utilizzato entro certi limiti di tensione (73/23/CEE) [95].
Standard usati: EN 60 335-1 e EN 60 335-2-51.

Declaración de Conformidad

Nosotros **Grundfos** declaramos bajo nuestra única responsabilidad que los productos **TPE(D)**, **NBE** y **NKE** a los cuales se refiere esta declaración son conformes con las Directivas del Consejo relativas a la aproximación de las legislaciones de los Estados Miembros de la CE sobre

- Máquinas (98/37/CE).
Norma aplicada: EN ISO 12100.
- Compatibilidad electromagnética (89/336/CEE).
Norma aplicada: EN 61 800-3.
- Material eléctrico destinado a utilizarse con determinados límites de tensión (73/23/CEE) [95].
Normas aplicadas: EN 60 335-1 y EN 60 335-2-51.

Declaração de conformidade

Nós **Grundfos** declaramos sob nossa responsabilidade que os produtos **TPE(D)**, **NBE** e **NKE**, aos quais esta declaração se refere, estão em conformidade com as Directivas Comunitárias com aproximação das leis dos estados membros da CE para:

- Máquinas (98/37/CE).
Norma usada: EN ISO 12100.
- Compatibilidades Electromagnéticas (89/336/CEE).
Norma usada: EN 61 800-3.
- Equipamento Eléctrico desenhado para uso de certos limites de tensão (73/23/CEE) [95].
Normas usadas: EN 60 335-1 e EN 60 335-2-51.

Δήλωση Συμμόρφωσης

Εμείς η **Grundfos** δηλώνουμε με αποκλειστικά δική μας ευθύνη ότι τα προϊόντα **TPE(D)**, **NBE** και **NKE** συμμορφώνονται με την Οδηγία του Συμβουλίου επί της σύγκλισης των νόμων των Κρατών Μελών της Ευρωπαϊκής Ένωσης σε σχέση με τα:

- Μηχανήματα (98/37/ΕΚ).
Πρότυπο που χρησιμοποιήθηκε: EN ISO 12100.
- Ηλεκτρομαγνητική συμβατότητα (89/336/ΕΕΚ).
Πρότυπο που χρησιμοποιήθηκε: EN 61 800-3.
- Ηλεκτρικές συσκευές σχεδιασμένες για χρήση εντός ορισμένων ορίων ηλεκτρικής τάσης (73/23/ΕΕΚ) [95].
Πρότυπα που χρησιμοποιήθηκαν: EN 60 335-1 και EN 60 335-2-51.

Overeenkomstigheidsverklaring

Wij **Grundfos** verklaren geheel onder eigen verantwoordelijkheid dat de producten **TPE(D)**, **NBE** en **NKE** waarop deze verklaring betrekking heeft in overeenstemming zijn met de Richtlijnen van de Raad inzake de onderlinge aanpassing van de wetgevingen van de Lid-Staten betreffende

- Machines (98/37/EG).
Norm: EN ISO 12100.
- Elektromagnetische compatibiliteit (89/336/EEG).
Norm: EN 61 800-3.
- Elektrisch materiaal bestemd voor gebruik binnen bepaalde spanningsgrenzen (73/23/EEG) [95].
Normen: EN 60 335-1 en EN 60 335-2-51.

Försäkran om överensstämmelse

Vi **Grundfos** försäkrar under ansvar, att produkterna **TPE(D)**, **NBE** och **NKE**, som denna erklæring omhandlar, er i överensstämmelse med Rådets Direktiv om inbördes närmande till EU-medlemsstaternas lagstiftning, avseende

- Maskinell utrustning (98/37/EC).
Använd standard: EN ISO 12100.
- Elektromagnetisk kompatibilitet (89/336/EC).
Använd standard: EN 61 800-3.
- Elektrisk material avsedd för användning inom vissa spänninggränser (73/23/EC) [95].
Använda standarder: EN 60 335-1 och EN 60 335-2-51.

Vastaavuusvakuutus

Me **Grundfos** vakuutamme yksin vastuullisesti, että tuotteet **TPE(D)**, **NBE** ja **NKE**, jota tämä vakuutus koskee, noudattavat direktiivejä jotka käsittelevät EY:n jäsenvaltioiden koneellisia laitteita koskevien lakien yhdenmukaisuutta seur.:

- Koneet (98/37/EY).
Käytetty standardi: EN ISO 12100.
- Elektromagneettinen vastaavuus (89/336/EY).
Käytetty standardi: EN 61 800-3.
- Määrättyjen jänniterajoitusten puitteissa käytettävät sähköiset laitteet (73/23/EY) [95].
Käytetyt standardit: EN 60 335-1 ja EN 60 335-2-51.

Overensstemmelseserklæring

Vi **Grundfos** erklærer under ansvar, at produkterne **TPE(D)**, **NBE** og **NKE**, som denne erklæring omhandler, er i overensstemmelse med Rådets direktiver om indbyrdes tilnærmelse til EF medlemsstaternes lovgivning om:

- Maskiner (98/37/EF).
Anvendt standard: EN ISO 12100.
- Elektromagnetisk kompatibilitet (89/336/EØF).
Anvendt standard: EN 61 800-3.
- Elektrisk materiel bestemt til anvendelse inden for visse spændingsgrænser (73/23/EØF) [95].
Anvendte standarder: EN 60 335-1 og EN 60 335-2-51.

Deklaracja zgodności

My **Grundfos** oświadczamy z pełną odpowiedzialnością że wyrób **TPE(D)**, **NBE** i **NKE** którego deklaracja niniejsza dotyczy, odpowiada wymogom następujących wytycznych Rady ds. Ujednolicenia Przepisów Prawnych Państw-Członków EG:

- maszyny (98/37/EG).
zastosowana norma: EN ISO 12100.
- kompatybilność elektromagnetyczna (89/336/EWG).
zastosowana norma: EN 61 800-3.
- aparatura elektryczna do stosowania w określonym zakresie napięć (73/23/EWG) [95].
zastosowane normy: EN 60 335-1 i EN 60 335-2-51.

Декларация соответствия

Фирма Grundfos заявляет о своей исключительной ответственности за то, что изделия моделей **TPE(D)**, **NBE** и **NKE** на которые распространяется эта декларация, соответствуют нижеследующим рекомендациям Совета по унификации правовых норм стран - членов Европейского Союза:

- Машины (98/37/EC).
Использованный стандарт: Европейский стандарт EN ISO 12100.
- Электромагнитная совместимость (89/336/ЕЭС).
Использованный стандарт: Европейский стандарт EN 61 800-3.
- Электрическое оборудование, применяемое в пределах определенных границ напряжения (73/23/ЕЭС) [95].
Использованные стандарты: Европейские стандарты EN 60 335-1 и EN 60 335-2-51.

Izjava o usklađenosti

Mi, **Grundfos**, izjavljujemo uz punu odgovornost, da su proizvodi **TPE(D)**, **NBE** i **NKE**, na koje se ova izjava odnosi, skladni sljedećim smjernicama Savjeta za prilagodbu propisa država-članica EZ:

- strojevi (98/37/EZ);
korištena norma: EN ISO 12100.
- Elektromagnetska kompatibilnost (89/336/EEZ);
korištena norma: EN 61 800-3.
- Električni pogonski uređaji za uporabu unutar određenih granica napona (73/23/EEZ) [95];
korištene norme: EN 60 335-1 i EN 60-335-2-51.

Izjava o usklađenosti

Mi **Grundfos** izjavljujemo pod sopstvenom odgovornošću da su proizvodi **TPE(D)**, **NBE** i **NKE**, na koje se ova izjava odnosi, u saglasnosti sa smernicama Saveta za usklađivanje pravnih propisa članica EZ koje se odnose na:

- Mašine (98/37/EZ).
Primenjen standard: EN ISO 12100.
- Elektromagnetna kompatibilnost (89/336/EEZ).
Primenjen standard: EN 61 800-3.
- Električna oprema za primenu unutar određenih naponskih granica (73/23/EEZ) [95].
Primenjeni standardi: EN 60 335-1 i EN 60 335-2-51.

Prohlášení o shodě

My, firma **Grundfos**, prohlašujeme na svou odpovědnost, že výrobky **TPE(D)**, **NBE** a **NKE**, na něž se toto prohlášení vztahuje, jsou v souladu s následujícími normativními dokumenty Rady pro vzájemné přizpůsobení právních předpisů členských států ES:

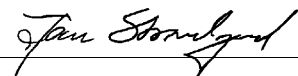
- Stroje (98/37/EC).
Norma, která byla použita: EN ISO 12100.
- Elektromagnetická kompatibilita (89/336/EEC).
Norma, která byla použita: EN 61 800-3.
- Elektrické provozní prostředky používané v rámci stanoveného rozmezí napětí (73/23/EEC) [95].
Normy, které byly použity: EN 60 335-1 a EN 60 335-2-51.

Prehlásenie o zhode

My, firma **Grundfos**, prehlasujeme na svoju zodpovednosť, že výrobky **TPE(D)**, **NBE** a **NKE**, na ktoré sa toto prehlásenie vzťahuje, sú v súlade s nasledujúcimi normatívnymi dokumentami Rady pre vzájomné prispôsobenie právnych predpisov členských štátov ES:

- Stroje (98/37/EC).
Norma, ktorá bola použitá: EN ISO 12100.
- Elektromagnetická kompatibilita (89/336/EEC).
Norma, ktorá bola použitá: EN 61 800-3.
- Elektrické prevádzkové prostriedky používané v rámci stanoveného rozmedzia napätia (73/23/EEC) [95].
Normy, ktoré boli použité: EN 60 335-1 a EN 60 335-2-51.

Bjerringbro, 15th November 2004



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TPE(D), NBE, NKE

11-22 kW

Installation and operating instructions	6	GB
Montage- und Betriebsanleitung	19	D
Notice d'installation et d'entretien	33	F
Istruzioni di installazione e funzionamento	46	I
Instrucciones de instalación y funcionamiento	60	E
Instruções de instalação e funcionamento	73	P
Οδηγίες εγκατάστασης και λειτουργίας	86	GR
Installatie- en bedieningsinstructies	99	NL
Monterings- och driftsinstruktion	112	S
Asennus- ja käyttöohjeet	125	FIN
Monterings- og driftsinstruktion	138	DK
Instrukcja montażu i eksploatacji	151	PL
Руководство по монтажу и эксплуатации	166	RU
Montažne i pogonske upute	182	HR
Uputstvo za montažu i upotrebu	196	YU
Montážní a provozní návod	210	CZ
Návod na montáž a prevádzku	224	SK

CONTENTS

1. General description	6
2. Installation	6
2.1 Motor cooling	6
2.2 Outdoor installation	6
2.3 Electrical connection	7
2.3.1 Mains switch	7
2.3.2 Protection against electric shock - indirect contact	7
2.3.3 Additional protection	7
2.3.4 Motor protection	7
2.3.5 Protection against mains voltage transients	7
2.3.6 Supply voltage	7
2.3.7 Start/stop of pump	7
2.4 Other connections	8
2.5 Signal cables	8
2.6 Bus connection cable	8
2.6.1 New installations	8
2.6.2 Replacing an existing pump	8
3. Setting the pump	9
3.1 Factory setting	9
4. Setting by means of control panel	9
4.1 Setpoint setting	9
4.2 Pump in controlled-operation mode (differential pressure control)	9
4.3 Pump in uncontrolled-operation mode	9
4.4 Setting to max. curve duty	10
4.5 Setting to min. curve duty	10
4.6 Start/stop of pump	10
5. Setting by means of R100	11
5.1 Menu OPERATION	12
5.1.1 Setpoint setting	12
5.1.2 Setting of operating mode	12
5.1.3 Fault indications	12
5.1.4 Alarm log	12
5.2 Menu STATUS	12
5.2.1 Display of actual setpoint	12
5.2.2 Display of operating mode	12
5.2.3 Display of actual value	12
5.2.4 Display of actual speed	13
5.2.5 Display of input power and power consumption	13
5.2.6 Display of operating hours	13
5.3 Menu INSTALLATION	13
5.3.1 Selection of control mode	13
5.3.2 Setting of controller	13
5.3.3 Selection of external setpoint signal	14
5.3.4 Selection of fault, operating or ready signal relay	14
5.3.5 Blocking of the buttons on the pump	14
5.3.6 Allocation of pump number	14
5.3.7 Selection of function for digital input	14
5.3.8 Setting of sensor	14
5.3.9 Setting of min. and max. curves	14
6. External forced-control signals	15
6.1 Start/stop input	15
6.2 Digital input	15
7. External setpoint signal	15
8. Bus signal	15
9. Priority of settings	16
10. Indicator lights and signal relay	17
11. Megging	17
12. Technical data	18
12.1 Supply voltage	18
12.2 Leakage current	18
12.3 Inputs/output	18
12.4 Other technical data	18
13. Re-lubrication of motor motor bearings	18
14. Disposal	18



Before beginning installation procedures, these installation and operating instructions should be studied carefully. **Furthermore, the enclosed installation and operating instructions for the standard pump should be studied carefully.** The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

1. General description

Grundfos E-pumps are pumps fitted with frequency-controlled standard motors for three-phase mains connection.

The pumps have a built-in PI controller and can be connected to an external sensor enabling control of for instance pressure, differential pressure, temperature, differential temperature or flow in the system in which the pumps are installed. The pumps can be set to uncontrolled operation, i.e. the pump performance can be set according to the demand.

The pumps are typically used as circulator pumps in large heating or cooling water systems with variable demands.

The desired value (setpoint), e.g. the desired differential pressure if a differential pressure sensor has been installed, can be set directly on the pump control panel, via an input for external setpoint signal or by means of the Grundfos wireless remote control R100.

All other settings are made by means of the R100. Important parameters such as actual value of control parameter, power consumption, etc. can be read via the R100.

The pump incorporates

- inputs for external potential-free contacts for start/stop and digital function.
The digital function enables external setting of max. curve or min. curve.
- an output for a potential-free fault, operating or ready signal.
- an input for bus communication.
Via the bus communication input, the pump can be controlled and monitored by a building management system or another external control system.

2. Installation

2.1 Motor cooling

To ensure sufficient cooling of motor and electronics, the following must be observed:

- Place the pump in such a way that sufficient cooling is ensured.
- The temperature of the cooling air must not exceed 40°C.
- Cooling fins and fan blades must be kept clean.

2.2 Outdoor installation

When installed outdoors, the pump must be provided with a suitable cover to avoid condensation on the electronic components, fig. 1.

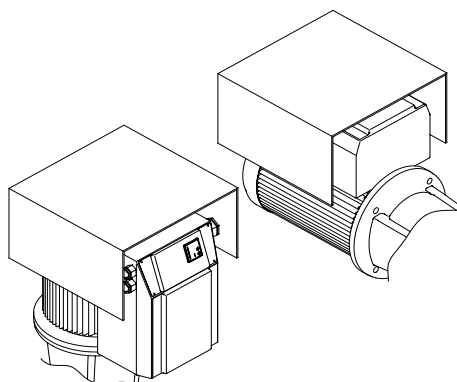


Fig. 1 Examples of covers

For further installation, see installation and operating instructions for the standard pump.

TM02 2256 3901

2.3 Electrical connection

Note: The user or the installer is responsible for the installation of the correct earthing and protection according to valid national and local standards. All operations must be carried out by a qualified electrician.



Never make any connections in the pump terminal box unless the electricity supply has been switched off for at least 5 minutes.

2.3.1 Mains switch

The pump must be connected to an external all-pole mains switch with a contact separation of at least 3 mm in each pole according to IEC 364.

2.3.2 Protection against electric shock - indirect contact



The pump must be earthed and protected against indirect contact in accordance with national regulations.

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

Note: As the leakage current is > 10 mA, these motors must be connected to *especially reliable/sturdy earth connections*.

The leakage current of the motor can be found in section 12.2 *Leakage current*.

EN 50 178 and BS 7671 specify the following:

The pump must be stationary and installed permanently. Furthermore, the pump must be connected permanently to the electricity supply.

In addition, tightened precautions as regards earth connection must be observed.

One of the following installation examples must be used:

- A single protective earth conductor having a cross-sectional area of 10 mm².
- Separate duplicate conductors each having a minimum cross-sectional area of 4 mm².
- Duplicate (protective earth) conductors in a multicore cable. One of the conductors may be the metallic armour or sheath of the cable.
- A protective earth conductor contained in a cable conduit, trunking or cable tray so forming a duplicate conductor.

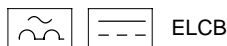
2.3.3 Additional protection

If the pump is connected to an electric installation where an earth leakage circuit breaker is used as additional protection, this circuit breaker must be of the type:

- which is suitable for handling leakage currents and cutting-in with short pulse-shaped leakage.
- which trips out when alternating fault currents and fault currents with DC content, i.e. pulsating DC and smooth DC fault currents, occur.

For these pumps an earth leakage circuit breaker **type B** must be used.

This circuit breaker must be marked with the following symbols:



Note: When an earth leakage circuit breaker is selected, the total leakage current of all the electrical equipment in the installation must be taken into account.

The leakage current of the motor can be found in section 12.2 *Leakage current*.

2.3.4 Motor protection

The pump requires no external motor protection. The motor incorporates thermal protection against slow overloading and blocking.

2.3.5 Protection against mains voltage transients

The pump is protected against mains voltage transients in accordance with EN 61 800-3.

2.3.6 Supply voltage

3 x 380-415 V ±10%, 50/60 Hz, PE.

The supply voltage and frequency are marked on the pump nameplate. Please make sure that the motor is suitable for the electricity supply on which it will be used.

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

For maximum back-up fuse, see section 12.1 *Supply voltage*.

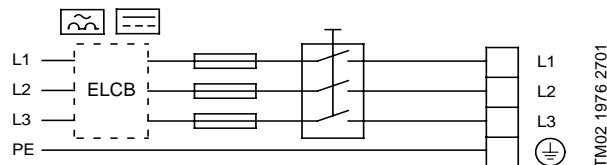


Fig. 2 Example of a mains-connected pump with mains switch, back-up fuses and additional protection

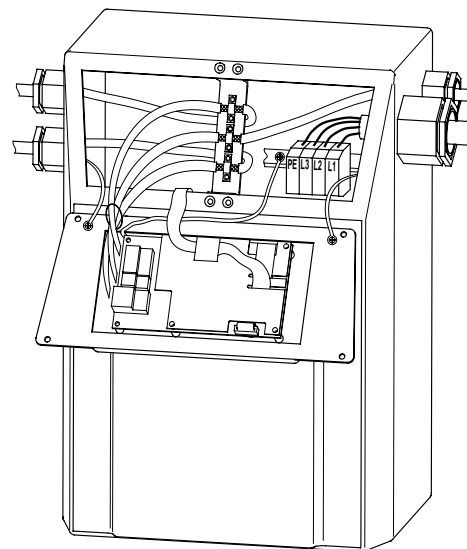


Fig. 3 Mains connection

2.3.7 Start/stop of pump

The number of starts and stops via the mains voltage must not exceed 4 times per hour.

When the pump is switched on via the mains, it will start after approx. 5 seconds.

If a higher number of starts and stops is desired, the input for external start/stop must be used when starting/stopping the pump. When the pump is started/stopped via an external on/off switch, it will start immediately.

TM02 1976 2701

TM02 1966 2701

2.4 Other connections

The connection terminals of external potential-free contacts for start/stop and digital function, external setpoint signal, sensor signal, GENIbus and relay signal are shown in fig. 4.

Note: If no external on/off switch is connected, short-circuit terminals 2 and 3 using a short wire.

Note: As a precaution, the wires to be connected to the following connection groups must be separated from each other by reinforced insulation in their entire lengths:

- Inputs** (external start/stop, digital function, setpoint and sensor signals, terminals 1-8, and bus connection, terminals A, Y, B).

All inputs (group 1) are internally separated from the mains-conducting parts by reinforced insulation and galvanically separated from other circuits.

All control terminals are supplied by protective extra-low voltage (PELV), thus ensuring protection against electric shock.

- Output** (relay signal, terminals NC, NO, C).

The output (group 2) is galvanically separated from other circuits. A maximum supply voltage of 250 V or protective extra-low voltage can be connected to the output as desired.

A galvanically safe separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 60 335.

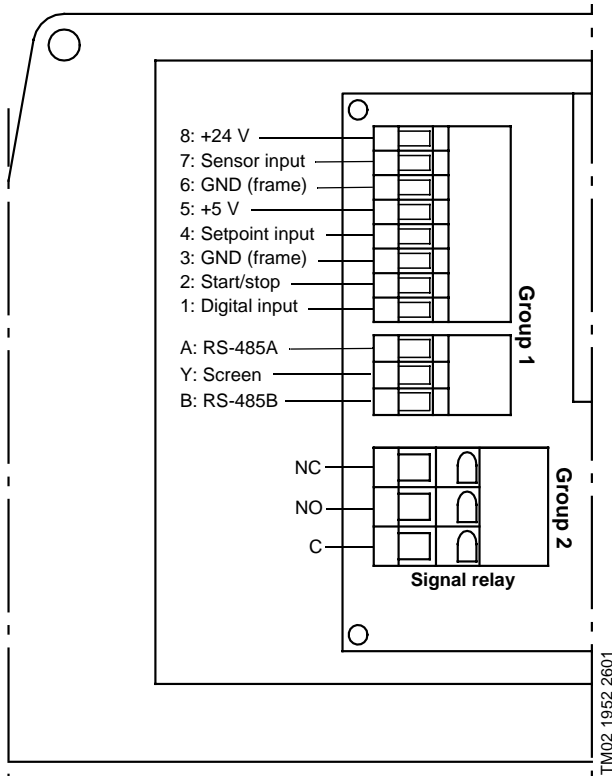


Fig. 4 Connection terminals

2.5 Signal cables

- Use screened cables having a cross-sectional area of min. 0.5 mm² and max. 1.5 mm² for external on/off switch, digital input, setpoint and sensor signals.
- The screens of the cables must be connected to frame at both ends with good frame connection. They must be as close as possible to the terminals, fig. 5.

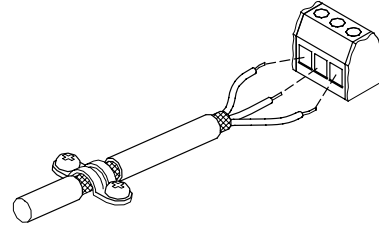


Fig. 5 Stripped cable with screen and wire connection

- Screws for frame connections must always be tightened whether a cable is fitted or not.
- The wires in the pump terminal box must be as short as possible.

2.6 Bus connection cable

2.6.1 New installations

For the bus connection a screened 3-core cable having a cross-sectional area of min. 0.5 mm² and max. 1.5 mm² must be used.

- If the pump is connected to a unit with a cable clamp which is identical to the one on the pump, the screen must be connected to this cable clamp.
- If the unit has no cable clamp as shown in fig. 6, the screen is left unconnected at this end.

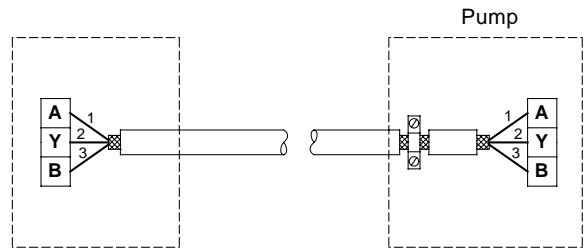


Fig. 6 Connection with screened 3-core cable

2.6.2 Replacing an existing pump

- If a screened 2-core cable is used in the existing installation, it must be connected as shown in fig. 7.

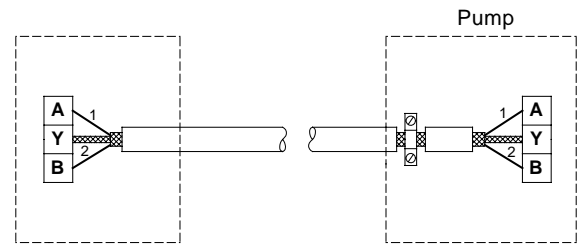


Fig. 7 Connection with screened 2-core cable

- If a screened 3-core cable is used in the existing installation, follow the instructions in section 2.6.1 *New installations*.

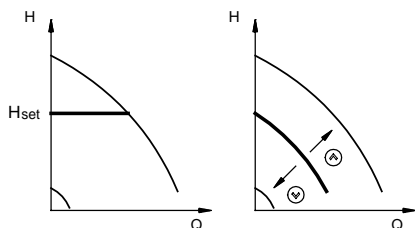
3. Setting the pump

E-pumps can be set to two control modes, i.e. controlled and uncontrolled operation, fig. 8.

In **controlled**-operation mode, the pump will adjust its performance to the desired setpoint for the control parameter (pressure, differential pressure, temperature, differential temperature or flow).

In **uncontrolled**-operation mode, the pump will operate according to the constant curve set.

Controlled operation Uncontrolled operation

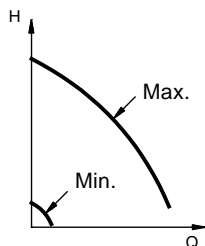


TM00 7668 0404

Fig. 8 Pump in controlled-operation mode (differential-pressure control) and in uncontrolled-operation mode

The pumps have been factory-set to uncontrolled operation, see section 3.1 *Factory setting*.

In addition to normal operation (controlled or uncontrolled operation), the following operating modes can be selected, **Stop**, **Min.** or **Max.**, fig. 9.



TM00 5547 0995

Fig. 9 Min. and max. curves

The max. curve can for instance be used in connection with the venting procedure during installation. The min. curve can be used in periods in which a minimum flow is required.

The operating modes (Stop, Normal, Min., Max.) can all be set on the pump control panel.

If the electricity supply to the pump is disconnected, the pump setting will be stored.

The remote control R100 offers additional possibilities of setting and status displays, see section 5. *Setting by means of R100*.

3.1 Factory setting

The pumps have been factory-set to uncontrolled operation.

The setpoint value corresponds to 100% of the maximum pump performance (see data sheet for the pump).

Other pump settings are marked with **bold**-faced type under each individual display in sections 5.1 *Menu OPERATION* and 5.3 *Menu INSTALLATION*.

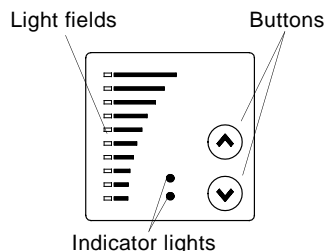
4. Setting by means of control panel



At high system temperatures, the pump may be so hot that only the buttons should be touched to avoid burns.

The pump control panel, fig. 10, incorporates the following:

- Buttons, ⊕ and ⊖, for setpoint setting.
- Light fields, yellow, for indication of setpoint.
- Indicator lights, green (operation) and red (fault).



TM00 7600 0304

Fig. 10 Control panel

4.1 Setpoint setting

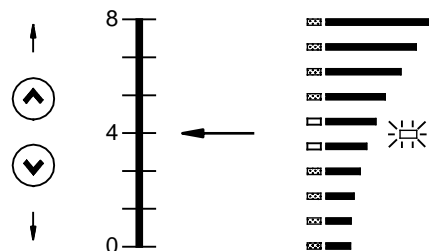
The desired setpoint is set by pressing the button ⊕ or ⊖.

The light fields on the control panel will indicate the setpoint set.

4.2 Pump in controlled-operation mode (differential pressure control)

Example:

Figure 11 shows that the light fields 5 and 6 are activated, indicating a desired setpoint of 4 m with a sensor measuring range from 0 to 8 m. The setting range is equal to the sensor measuring range (see sensor nameplate).



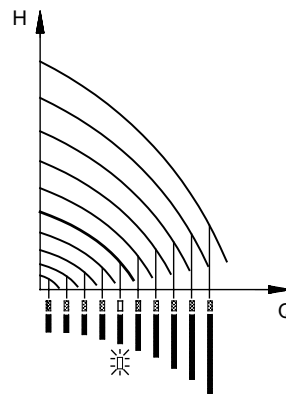
TM00 7749 4604

Fig. 11 Setpoint set to 4 m (differential pressure control)

4.3 Pump in uncontrolled-operation mode

Example:

In uncontrolled-operation mode, the pump performance is set within the range from min. to max. curve, fig. 12.



TM00 7746 1304

Fig. 12 Pump performance setting, uncontrolled-operation mode

GB

4.4 Setting to max. curve duty

Press \odot continuously to change to the max. curve of the pump (top light field flashes). When the top light field is on, \odot must be pressed for 3 seconds before the light field starts flashing.

To return to uncontrolled or controlled operation, press \ominus continuously until the desired setpoint is indicated.

TM00 7345 1304

Fig. 13 Max. curve duty

4.5 Setting to min. curve duty

Press \ominus continuously to change to the min. curve of the pump (bottom light field flashes). When the bottom light field is on, \ominus must be pressed for 3 seconds before the light field starts flashing.

To return to uncontrolled or controlled operation, press \odot continuously until the desired setpoint is indicated.

TM00 7346 1304

Fig. 14 Min. curve duty

4.6 Start/stop of pump

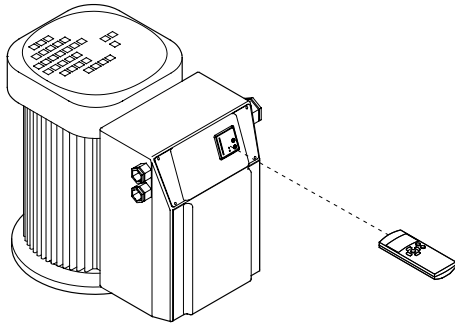
Stop the pump by continuously pressing \ominus until none of the light fields are activated and the green indicator light flashes.

Start the pump by continuously pressing \odot until the desired setpoint is indicated.

10

5. Setting by means of R100

The pump is designed for wireless communication with the Grundfos remote control R100.



TM02 2257 3901

Fig. 15 R100 communicating with the pump via infra-red light

During communication, the R100 must be pointed at the control panel. When the R100 communicates with the pump, the red indicator light will flash rapidly.

The R100 offers additional possibilities of setting and status displays for the pump.

The displays are divided into four parallel menus, fig. 16:

0. GENERAL (see operating instructions for the R100)

1. OPERATION

2. STATUS

3. INSTALLATION

The number stated at each individual display in fig. 16 refers to the section in which the display is described.

GB

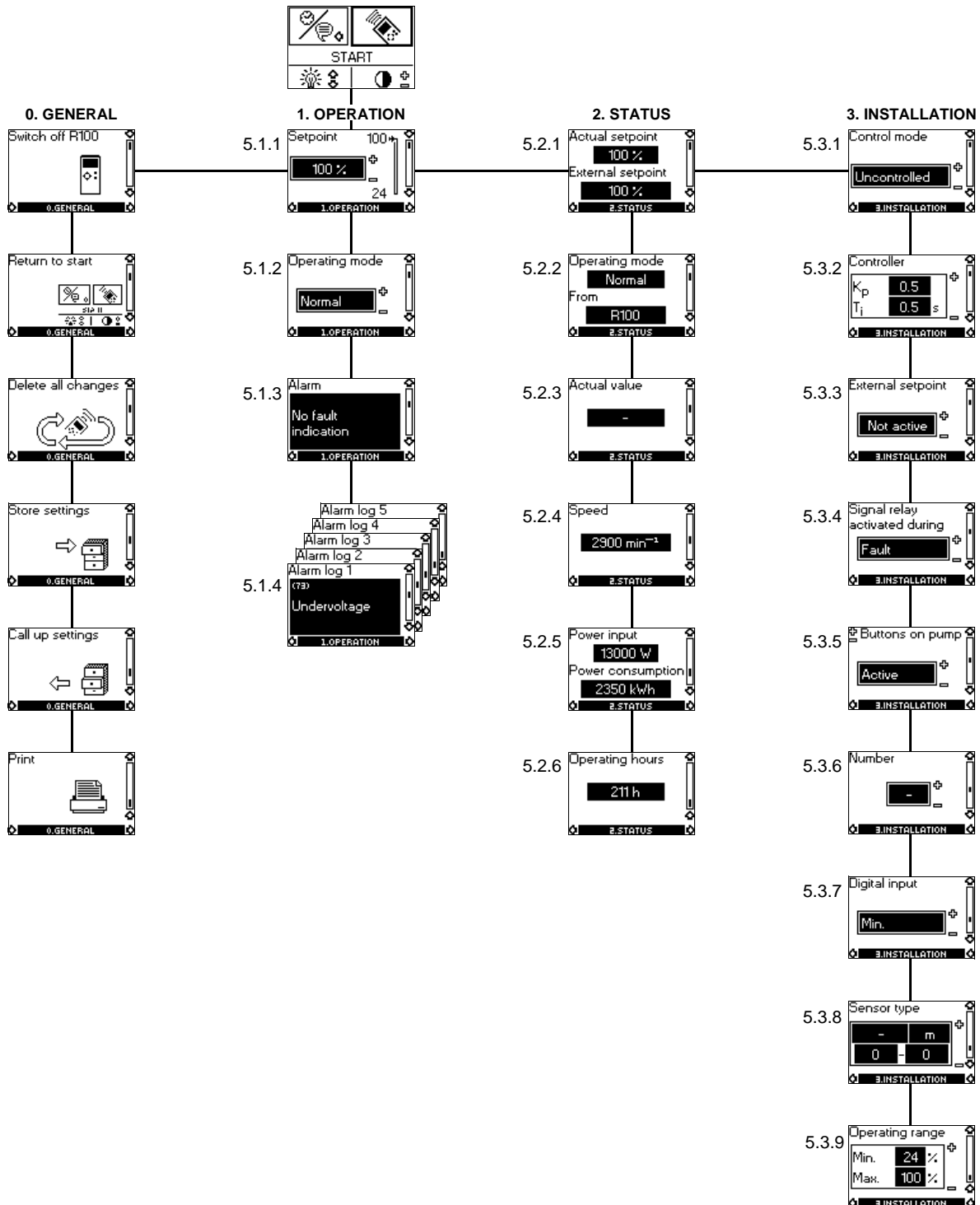
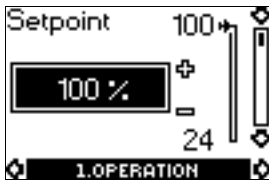


Fig. 16 Menu overview

5.1 Menu OPERATION

When communication between the R100 and the pump has been established, the first display in this menu will appear.

5.1.1 Setpoint setting



- ▶ Setpoint set
- Actual setpoint
- Actual value

In this display, the setpoint is set.

In **controlled**-operation mode, the setting range is equal to the sensor measuring range, e.g. 0 to 25 m.

In **uncontrolled**-operation mode, the setpoint is set in % of the maximum performance. The setting range will lie between the min. and max. curves.

Select one of the following operating modes:

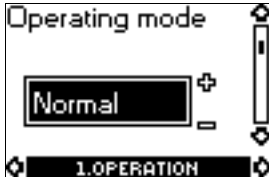
- *Stop*,
- *Min.* (min. curve),
- *Max.* (max. curve).

If the pump is connected to an external setpoint signal, the setpoint in this display will be the maximum value of the external setpoint signal, see section 7. *External setpoint signal*.

If the pump is controlled via external signals (Stop, Min. curve or Max. curve) or a bus, this will be indicated in the display if setpoint setting is attempted.

In this case, the number of possible settings will be reduced, see section 9. *Priority of settings*.

5.1.2 Setting of operating mode

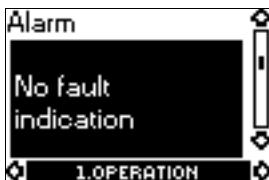


Select one of the following operating modes:

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

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

5.1.3 Fault indications



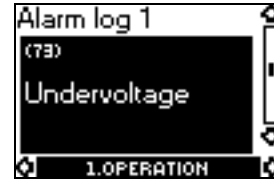
If the pump is faulty, the cause will appear in this display.

Possible causes:

- *Too high motor temperature*,
- *Undervoltage*,
- *Overvoltage*,
- *Too many restarts* (after faults),
- *Overload*,
- *Sensor signal outside signal range*,
- *Setpoint signal outside signal range*,
- *Other fault*.

A fault indication can be reset in this display if the cause of the fault has disappeared.

5.1.4 Alarm log



If faults have been indicated, the last five fault indications will appear in the alarm log. "Alarm log 1" shows the newest/latest fault. The example shows the fault indication "Undervoltage" and the fault code.

5.2 Menu STATUS

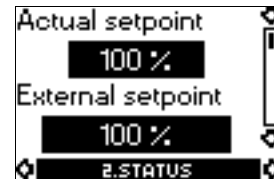
The displays appearing in this menu are status displays only. It is not possible to change or set values.

The displayed values are the values that applied when the last communication between the pump and the R100 took place. If a status value is to be updated, point the R100 at the control panel and press "OK".

If a parameter, e.g. speed, should be called up continuously, press "OK" constantly during the period in which the parameter in question should be monitored.

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

5.2.1 Display of actual setpoint



Tolerance: ±2%

This display shows the actual setpoint and the external setpoint in % of the range from minimum value to the setpoint set, see section 7. *External setpoint signal*.

5.2.2 Display of operating mode



This display shows the actual operating mode (*Stop*, *Min.*, *Normal* (duty) or *Max.*). Furthermore, it shows where this operating mode was selected (*R100*, *Pump*, *BUS* or *External*).

5.2.3 Display of actual value



The actually measured value of a connected sensor will appear in this display, e.g. 12 metres.

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

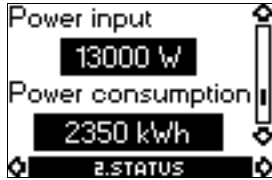
5.2.4 Display of actual speed



Tolerance: ±5%

The actual pump speed will appear in this display.

5.2.5 Display of input power and power consumption



Tolerance: ±10%

This display shows the actual pump input power from the mains supply. The power is displayed in W.

The pump power consumption can also be read from this display. The value of power consumption is an accumulated value calculated from the pump's birth and it cannot be reset.

5.2.6 Display of operating hours



Tolerance: ±2%

The value of operating hours is an accumulated value and cannot be reset.

5.3 Menu INSTALLATION

5.3.1 Selection of control mode



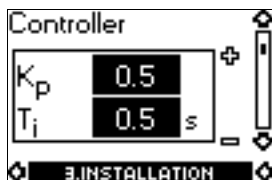
Select one of the following control modes (see fig. 8):

- *Controlled*,
- **Uncontrolled**.

The desired performance is set in section 5.1.1 *Setpoint setting*.

Note: If the pump is connected to a bus (see section 8. *Bus signal*), it is not possible to select the control mode via the R100.

5.3.2 Setting of controller



In this display, the gain (K_p) and the integral-action time (T_i) of the built-in PI controller can be set if the factory setting is not the optimum setting:

- The gain (K_p) is set within the range from 0.1 to 20.
- The integral-action time (T_i) is set within the range from 0.1 to 3600 s. If 3600 s is selected, the controller will function as a P controller.

Furthermore, it is possible to set the controller to inverse control (if the setpoint is increased, the speed will be reduced). In the case of inverse control, the gain (K_p) must be set within the range from -0.1 to -20.

Setting the PI controller:

For most applications, the factory setting of the controller constants K_p and T_i will ensure optimum pump operation. In the following cases, a change of the setting can be useful or necessary.

A change of the T_i setting can be useful:

- in a differential-pressure control system if the sensor is placed far away from the pump.

A change of the T_i setting, and in some cases the K_p setting, may be necessary:

- if the pump is controlled on the basis of temperature or differential temperature.

The table below shows the recommended controller settings:

System/ application	K_p		T_i
	Heating system ¹⁾	Cooling system ²⁾	
	0.5		0.5
	0.5		L < 5 m: 0.5 L > 5 m: 3 L > 10 m: 5
	0.5		0.5
	0.5		0.5
	0.5	-0.5	10 + 5L
	0.5		10 + 5L
	0.5	-0.5	30 + 5L

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

5.3.3 Selection of external setpoint signal



The input for external setpoint signal can be set to different signal types.

Select one of the following types:

- 0-5 V,
- 0-10 V,
- 0-20 mA,
- 4-20 mA,
- **Not active.**

If *Not active* is selected, the setpoint set by means of the R100 or on the control panel will apply.

The setpoint set is the maximum value of the external setpoint signal, section 7. *External setpoint signal*. The actual value of the external setpoint can be read from section 5.2.1 *Display of actual setpoint*.

5.3.4 Selection of fault, operating or ready signal relay



It can be selected in which situation the relay should be activated:

- **Fault** (fault indication),
- *Operation* (operating indication),
- *Ready* (ready indication).

See section 10. *Indicator lights and signal relay*.

5.3.5 Blocking of the buttons on the pump



The buttons ⊕ and ⊗ on the pump can be set to:

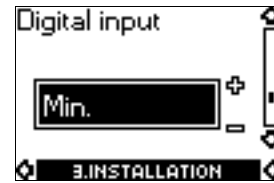
- **Active,**
- *Not active.*

5.3.6 Allocation of pump number



A number between 1 and 64 can be allocated to the pump. In the case of bus communication, a number must be allocated to each pump.

5.3.7 Selection of function for digital input



The digital input of the pump (terminal 1, fig. 4) can be set to different functions.

Select one of the following functions:

- **Min.** (min. curve),
- *Max.* (max. curve).

The selected function is activated by closing the contact between terminals 1 and 3 (fig. 4).

See also section 6.2 *Digital input*.

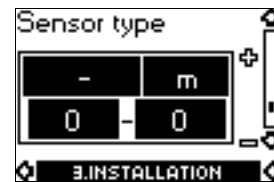
Min.:

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

Max.:

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

5.3.8 Setting of sensor



The setting of the sensor is only carried out in the case of controlled operation.

Select the following:

- Sensor output signal (0-5 V, 0-10 V, 0-20 mA or 4-20 mA),
- sensor measuring unit (*bar, mbar, m, kPa, psi, ft, m³/h, m³/s, l/s, gpm, °C, °F or %*) and
- sensor measuring range.

5.3.9 Setting of min. and max. curves



Set the min. and max. curves in % of maximum performance if the operating range must be reduced, fig. 17.

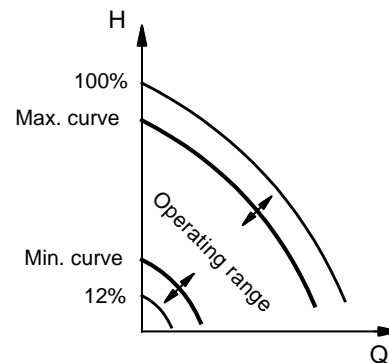


Fig. 17 Setting of the min. and max. curves in % of maximum performance

- The max. curve can be adjusted within the range from maximum performance (100%) to min. curve.
- The min. curve can be adjusted within the range from max. curve to 12% of maximum performance. The pump has been factory-set to 24% of maximum performance.
- The operating range lies between the min. and max. curves.

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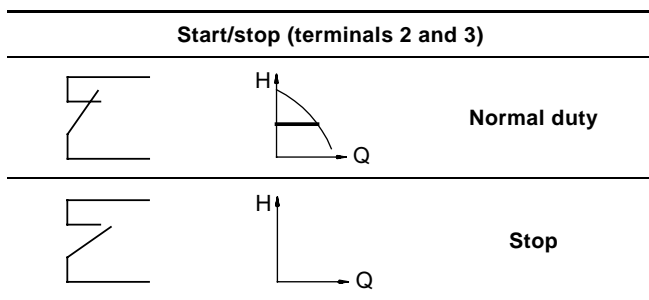
6. External forced-control signals

The pump has inputs for external signals for the forced-control functions:

- Start/stop of pump.
- Digital function.

6.1 Start/stop input

Functional diagram: Start/stop input:

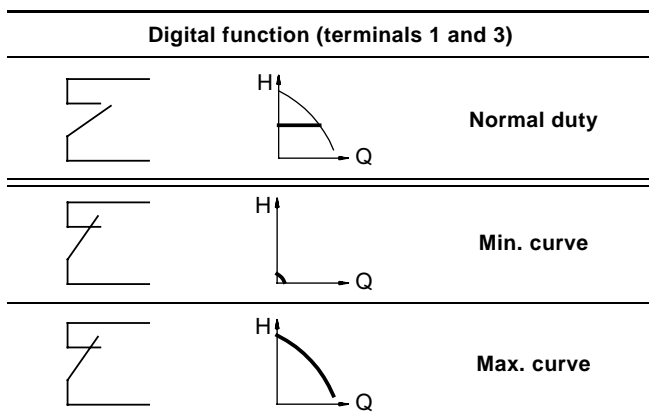


6.2 Digital input

By means of the R100, one of the following functions can be selected for the digital input:

- Min. curve.
- Max. curve.

Functional diagram: Input for digital function:



7. External setpoint signal

By connecting an analog signal transmitter to the input for the setpoint signal (terminal 4), it is possible to remote-set the setpoint.

The actual external signal (0-5 V, 0-10 V, 0-20 mA, 4-20 mA) must be selected via the R100, see section 5.3.3 *Selection of external setpoint signal*.

If uncontrolled operation is selected by means of the R100, the pump can be controlled by any controller.

In **controlled**-operation mode, the setpoint can be set externally within the range from the lower value of the sensor measuring range to the setpoint set on the pump or by means of the R100, fig. 18.

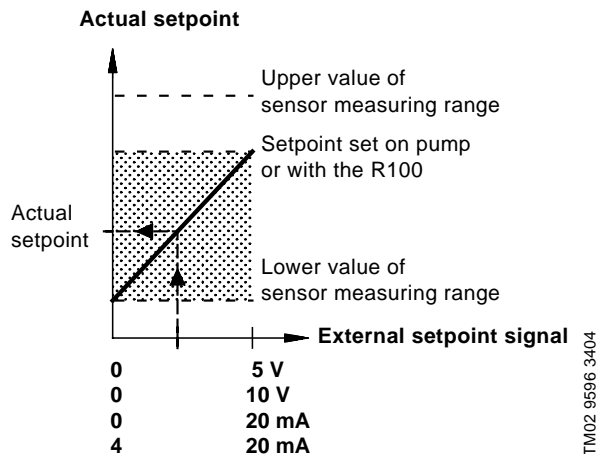


Fig. 18 Relation between the actual setpoint and the external setpoint signal in controlled-operation mode

Example: At a lower differential-pressure sensor value of 0 m, a setpoint set of 20 m and an external setpoint of 80%, the actual setpoint will be as follows:

$$\begin{aligned}
 H_{\text{actual}} &= (H_{\text{set}} - H_{\text{lower}}) \times \%_{\text{external setpoint}} + H_{\text{lower}} \\
 &= (20 - 0) \times 80\% + 0 \\
 &= 16 \text{ m}
 \end{aligned}$$

In **uncontrolled**-operation mode, the setpoint can be set externally within the range from the min. curve to the setpoint set on the pump or by means of the R100, fig. 19.

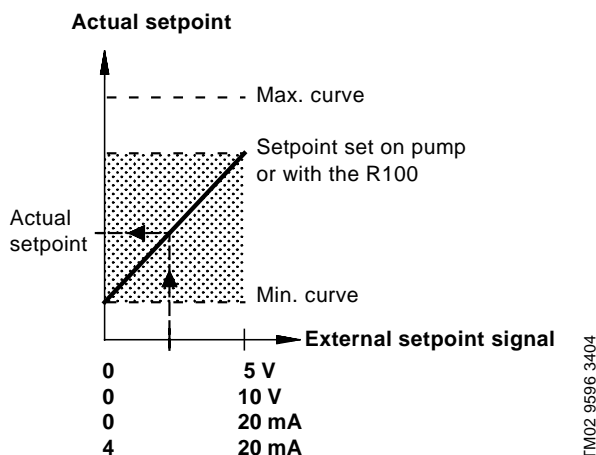


Fig. 19 Relation between the actual setpoint and the external setpoint signal in uncontrolled-operation mode

8. Bus signal

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

Via the bus signal, it is possible to remote-set pump operating parameters, like setpoint, operating mode, etc. At the same time, the pump can provide status information about important parameters, like actual value of control parameter, input power, fault indications, etc.

Contact Grundfos for further details.

Note: If a bus signal is used, the number of settings available via the R100 will be reduced.

9. Priority of settings

The start/stop and digital inputs will influence the number of possible settings.

By means of the R100, the pump can always be set to max. curve duty or to stop.

If two or more functions are activated at the same time, the pump will operate according to the function with the highest priority.

The priority of the settings is as shown in the following tables:

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Without bus signal		
Priority	Possible settings	
	Control panel on pump or R100	External signals
1	Stop	
2	Max. curve	
3		Stop
4		Max. curve
5	Min. curve	Min. curve
6	Setpoint setting	Setpoint setting

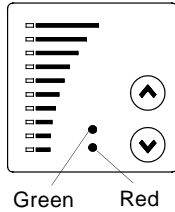
Example: If, via the digital input, the pump has been forced to operate according to the max. curve, the pump control panel and the R100 can only set the pump to stop.

With bus signal			
Priority	Possible settings		
	Control panel on pump or R100	External signals	Bus signal
1	Stop		
2	Max. curve		
3		Stop	Stop
4			Max. curve
5			Min. curve
6			Setpoint setting

Example: If, via the digital input, the pump has been forced to operate according to the max. curve, the pump control panel, the R100 and the bus signal can only set the pump to stop.

10. Indicator lights and signal relay

The operating condition of the pump is indicated by the green and red indicator lights on the pump control panel, fig. 20.



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Fig. 20 Indicator lights on control panel

Indicator lights		Signal relay activated during:			Description
Fault (red)	Operation (green)	Fault	Operation	Ready	
Off	Off				The electricity supply has been switched off.
Off	Permanently on				The pump is operating.
Off	Flashing				The pump has been set to stop.
Permanently on	Off				The pump has stopped because of a fault. Restarting will be attempted (it may be necessary to restart the pump by resetting the fault indication).
Permanently on	Permanently on				The pump is operating, but it has been stopped because of a fault. If the cause is "sensor signal outside signal range", the pump will continue operating according to the max. curve and the fault indication cannot be reset until the signal is inside the signal range. If the cause is "setpoint signal outside signal range", the pump will continue operating according to the min. curve and the fault indication cannot be reset until the signal is inside the signal range.
Permanently on	Flashing				The pump has been set to stop, but it has been stopped because of a fault.

A fault indication can be reset in one of the following ways:

- By briefly pressing the button or on the pump. This will not change the setting of the pump. A fault indication cannot be reset by means of or if the buttons have been locked.
- By switching off the electricity supply until the indicator lights are off.
- By switching the external start/stop input off/on.
- By means of the R100, see section 5.1.3 *Fault indications*.

When the R100 communicates with the pump, the red indicator light will flash rapidly.

The pump incorporates an output for a potential-free signal via an internal relay.

The signal output can be set to fault, operating or ready indication by means of the R100, see section 5.3.4 *Selection of fault, operating or ready signal relay*.

The functions of the two indicator lights and the signal relay are as shown in the following table:

11. Megging

Note: Megging of an installation incorporating E-pumps is not allowed, as the built-in electronics may be damaged.

12. Technical data

12.1 Supply voltage

3 x 380-415 V \pm 10%, 50/60 Hz, PE.

Cable: Max. 10 mm².

See nameplate.

Recommended fuse sizes

Motor size [kW]	Max. [A]
11	25
15	35
18.5	50
22	50

Standard as well as quick-blow or slow-blow fuses may be used.

12.2 Leakage current

Earth leakage current > 30 mA.

The leakage currents are measured in accordance with EN 60 355-1.

12.3 Inputs/output

Start/stop

External potential-free switch.

Voltage: 5 VDC.

Current: < 5 mA.

Screened cable: 0.5 - 1.5 mm².

Digital

External potential-free switch.

Voltage: 5 VDC.

Current: < 5 mA.

Screened cable: 0.5 - 1.5 mm².

Setpoint signals

- Potentiometer
0-5 VDC, 10 k Ω (via internal voltage supply).
Screened cable: 0.5 - 1.5 mm².
Maximum cable length: 100 m.
- Voltage signal
0-5 VDC/0-10 VDC, $R_i > 50$ k Ω .
Tolerance: +0%/-3% at maximum voltage signal.
Screened cable: 0.5 - 1.5 mm².
Maximum cable length: 500 m.
- Current signal
DC 0-20 mA/4-20 mA, $R_i = 250$ Ω .
Tolerance: +0%/-3% at maximum current signal.
Screened cable: 0.5 - 1.5 mm².
Maximum cable length: 500 m.

Sensor signals

- Voltage signal
0-5 VDC/0-10 VDC, $R_i > 50$ k Ω (via internal voltage supply).
Tolerance: +0%/-3% at maximum voltage signal.
Screened cable: 0.5 - 1.5 mm².
Maximum cable length: 500 m.
- Current signal
DC 0-20 mA/4-20 mA, $R_i = 250$ Ω .
Tolerance: +0%/-3% at maximum current signal.
Screened cable: 0.5 - 1.5 mm².
Maximum cable length: 500 m.
- Electricity supply to sensor:
+24 VDC, max. 40 mA.
+5 VDC, max. 5 mA.

Signal relay output

Potential-free changeover contact.

Maximum contact load: 250 VAC, 2 A.

Minimum contact load: 5 VDC, 10 mA.

Screened cable: 0.5 - 2.5 mm².

Maximum cable length: 500 m.

Bus input

Grundfos bus protocol, GENibus protocol, RS-485.

Screened 3-core cable: 0.5 - 1.5 mm².

Maximum cable length: 500 m.

12.4 Other technical data

EMC (electromagnetic compatibility)

EN 61 800-3.

Immunity to electromagnetic disturbance - second environment (industrial areas).

Contact Grundfos for further information.

Enclosure class

Standard: IP 54 (IEC 34-5).

Insulation class

F (IEC 85).

Ambient temperature

- During operation: -20°C to +40°C.
- During storage/transport: -30°C to +60°C.

Relative air humidity

Maximum 95%.

Sound pressure level

Motor [kW]	Speed stated on nameplate [min ⁻¹]	Sound pressure level [dB(A)]	
		2-pole	4-pole
11	2800-3000	69	63
15	2800-3000	70	65
18.5	2800-3000	70	65
22	2800-3000	73	67

13. Re-lubrication of motor motor bearings

The motor bearings are pre-lubricated on delivery. After approx. 3000 operating hours, the bearings must be re-lubricated.

Note: Before re-lubrication, the bottom plug in the motor flange and the plug in the bearing cover must be removed to ensure that old and excess grease can run out.

When lubricating the first time, use the double quantity of lubricating grease as the lubricating channel is still empty.

Frame size	Quantity of lubricating grease [ml]		Lubricating intervals [hours]
	Drive end (DE)	Non-drive end (NDE)	
MMGE 160	23	20	3000
MMGE 180	23	23	

The recommended grease type is Asonic GHY 72, which is a polycarbamide-based lubricating grease.

14. Disposal

Disposal of this product or parts of it must be carried out according to the following guidelines:

1. Use the local public or private waste collection service.
2. In case such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest Grundfos company or service workshop.

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