

# IO 113

## Installation and operating instructions



Other languages

<http://net.grundfos.com/qr/i/98097396>

# English (GB) Installation and operating instructions

## Original installation and operating instructions

These installation and operating instructions describe Grundfos IO 113.

Sections 1-4 give the information necessary to be able to unpack, install and start up the product in a safe way.

Sections 4-12 give important information about the product, as well as information on service, fault finding and disposal of the product.

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Read this document before installing the product. Installation and operation must comply with local regulations and accepted codes of good practice.

## 1. General information

### 1.1 Hazard statements

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

#### DANGER



Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

#### WARNING



Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

#### CAUTION



Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

#### SIGNAL WORD



#### Description of hazard

Consequence of ignoring the warning.  
- Action to avoid the hazard.

## 1.2 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.



Observe these instructions for explosion-proof products.



A blue or grey circle with a white graphical symbol indicates that an action must be taken.



A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.



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



Tips and advice that make the work easier.

## 2. Receiving the product



### CAUTION

#### Sharp element

Minor or moderate personal injury  
- Wear protective gloves.

On receipt of the product, do the following:

- Check that the product is as ordered. If the product is not as ordered, contact the supplier.
- Check all visible parts for damage. In case of damage, contact the carrier immediately.

## 3. Installing the product

### DANGER

#### Electric shock

Death or serious personal injury

- Before installing IO 113, make sure that the power supply has been switched off and that it cannot be accidentally switched on.
- Always use suitable insulated cables.
- The insulation between the cabinet and the product must have a suitable insulation resistance, or the cabinet must be connected to protective earth.
- Ensure separation between power cables and sensor cables.
- The power supply must be a limited power source or Class II.



### CAUTION

#### Electric shock

Minor or moderate personal injury

- Check that the polarity matches the installation instructions.



### 3.1 General installation data

The power supply must be a limited power source or Class II.

|                      |                      |
|----------------------|----------------------|
| Supply voltage:      | 24 VAC $\pm$ 10 %    |
|                      | 50 or 60 Hz          |
| Supply current:      | 24 VDC $\pm$ 10 %    |
|                      | Minimum size: 2.4 A* |
|                      | Maximum size: 8 A*   |
| Power consumption:   | Maximum 5 W          |
| Ambient temperature: | -25 to +65 °C        |
| Enclosure class:     | IP20                 |

\* Peak value for power line communication.

### WARNING

#### Electric shock

Minor or moderate personal injury

- Check that the supply voltage corresponds to the values stated on the nameplate.



### 3.2 Location

IO 113 is only for indoor installation.

#### CAUTION

##### Explosive environment

- Minor or moderate personal injury
- Do not install IO 113 in potentially explosive environments.

Pumps with sensors may, however, be installed in an explosive environment provided that they have the necessary product certification.

#### Safety information

IO 113 enclosure class is IP20.

It is designed to meet IEC-61010-2-030 concerning measurement category II.

In order to meet the requirements of Pollution Degree 2, install IO 113 in a protected environment with enclosure class IPX4 or better according to IEC 60529. The cabinet must be of a flame-retardant material.

#### Ambient temperature

-25 to +65 °C.

IO 113 must not be exposed to direct sunlight.

#### Installation altitude

Maximum 2000 m above sea level.

#### Relative humidity

Maximum 95 %.



ATEX/IEC Ex protection can be activated by means of DIP switch 10. This enables additional alarms, see section [4.8 ATEX/IEC Ex protection](#).

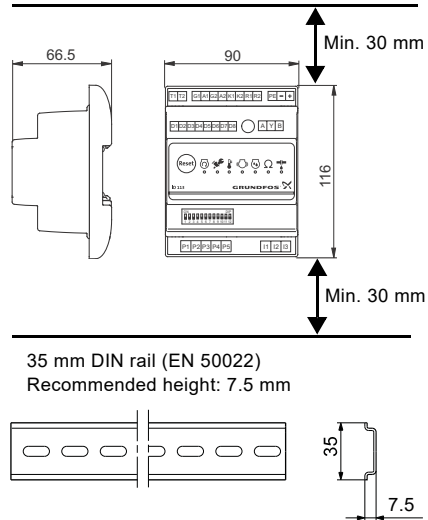
### 3.3 Dimensions and mounting

#### DANGER



##### Electric shock

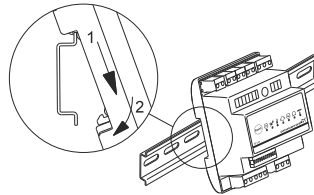
- Death or serious personal injury
- Always install the product in a suitable cabinet.



**Fig. 1** Module and DIN rail

IO 113 is prepared for mounting on a 35 mm DIN rail (EN 50022).

Fit the IO 113 module by hooking the top onto the DIN rail and clicking the bottom onto the rail.



**Fig. 2** Mounting on DIN rail

The IO 113 module can be removed by pushing it upwards and free of the DIN rail.

TM05 1994 4111 - TM03 0934 0805

TM05 1967 4111

### 3.4 EMC-compliant installation

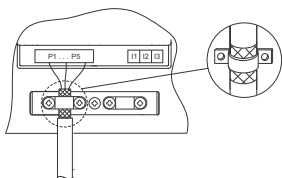


If the motor cable between the pump and any frequency converter is more than 10 metres long, we recommend that you equip the frequency converter with an output filter to prevent incorrect analog measurements.

It is especially important to ensure EMC-compliant installation of pumps with a frequency converter or when using more than one IO 113 in a cabinet.

The following rules must be observed:

- Connect the cable screen to earth.
- Do not twist screen ends as this will destroy the screening effect at high frequencies. Use cable clamps as shown in fig. 3.
- Ensure a good electrical contact from the mounting plate through the mounting screws to the metal cabinet of the frequency converter.
- Use toothed washers and a galvanically conducting mounting plate.



TM05 4056 2012

**Fig. 3** Screen fixed with cable clamp



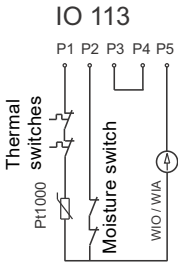
Screen both ends of the motor cable to earth. The insulating plastic layer between screen and sheath must be as close to the terminals as possible.

3.5 Electrical connection

3.5.1 Wiring diagrams

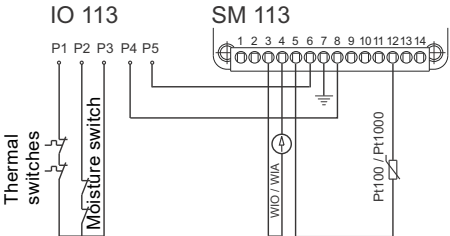
The wiring diagrams below show the regular applications of WIO/WIA sensors, moisture switch, thermal switches, Pt100/Pt1000/PTC sensors, as well as sensor monitoring board SM 113 with speed sensor, vibration sensor and components.

For information about setting the DIP switches, see section 4.2 *DIP switch configuration*.



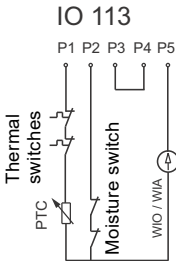
TM05 2493 0112

PA - Thermal switches, Pt1000 sensor, moisture switch, WIO/WIA sensor



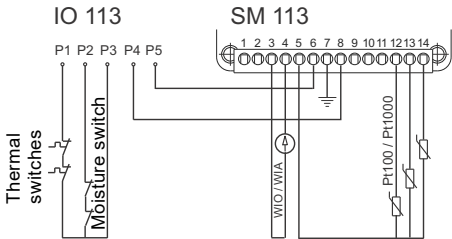
TM05 2794 0612

PB - With SM 113. Thermal switch, moisture switch, WIO/WIA sensor, Pt100/Pt1000 sensor



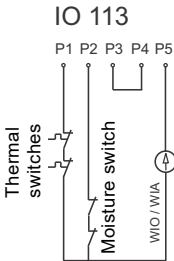
TM05 2494 0112

PA - Thermal switches, PTC sensor, moisture switch, WIO/WIA sensor



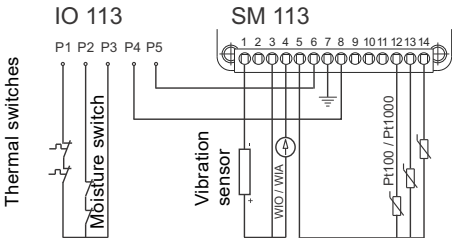
TM05 2795 0612

PB - With SM 113. Thermal switches, moisture switch, WIO/WIA sensor, Pt100/Pt1000 sensors



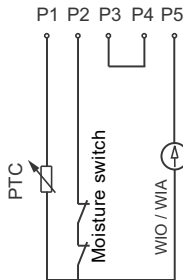
TM05 2789 0612

PA - Thermal switches, moisture switch, WIO/WIA sensor



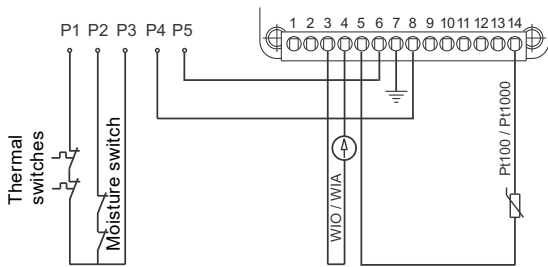
TM05 2796 0612

PB - With SM 113. Thermal switches, moisture switch, WIO/WIA sensor, Pt100/Pt1000 sensors, vibration sensor



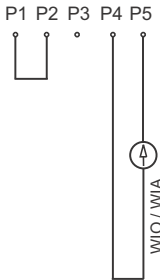
PA - PTC sensor, moisture switch, WIO sensor

TM05 2790 0612



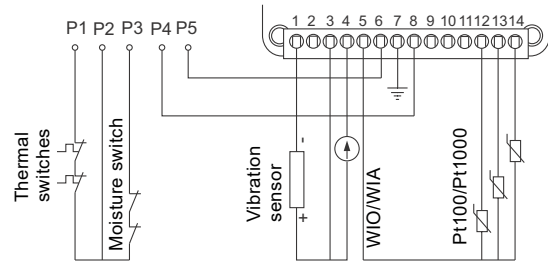
PB - With SM 113. Thermal switches, moisture switch, WIO/WIA sensor, Pt100/Pt1000 sensors

TM05 2798 0612



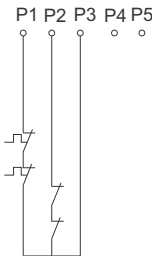
PA - WIO/WIA sensor

TM05 4507 2412



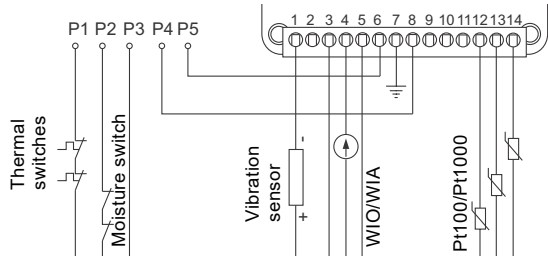
PC - IO 113 with SM 113 module

TM06 1788 2914



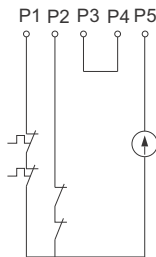
PA - IO 113 without a WIO/WIA sensor

TM06 1791 2914



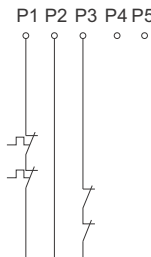
PB - IO 113 with SM 113 module

TM06 1789 2914



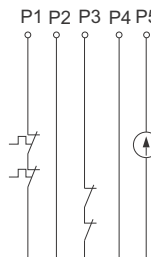
PA - With WIO/WIA sensor

TM06 1792 2914



PD - Without WIO/WIA sensor

TM06 1793 2914



PD - With WIO/WIA sensor

TM06 1790 2914

### 3.5.2 Electrical connection

All terminals are rated for maximum 8 A.

Terminals 1, 2, 3, 5, 10 and 11 are for wire size 0.08 - 3.3 mm<sup>2</sup> (AWG 28-12); terminal 17 is for wire size 0.08 - 1.3 mm<sup>2</sup> (AWG 28-16). For voltage rating of the individual terminals, see section [3.5 Electrical connection](#).

For terminals 5 and 17, one 3-hole socket and one 8-hole socket are provided as accessories in the package.

Terminals T1 and T2 are normally connected to 220-240 VAC. See fig. 20, pos. 1.

Terminal I3 may be connected to up to 600 VAC. See fig. 20, pos. 10 and the diagrams at the end of these instructions.



The insulation between the cabinet in which the module is fitted and the sensor input terminals must have a dielectric strength of 2210 VAC, or the cabinet must be connected to earth.



External controllers connected to the IO 113 module via the RS-485 connection must meet the requirements of IEC 60950-1 or 61010-1 (USA: UL 60950-1).



If SM 113 is used in the installation, connect a PTC sensor to IO 113.

## 4. Configuring the product

### 4.1 Potentiometer

Set the warning limit for stator insulation resistance by means of a potentiometer. See fig. 20 (4). The warning limit can be set between 1 and 10 MΩ. The alarm limit is 1 MΩ.



Fig. 4 Potentiometer

### 4.2 DIP switch configuration

IO 113 must be configured for the connected pump by means of the DIP switches. See fig. 20 (12).



Fig. 5 Shows that all DIP switches are in OFF position

A configuration alarm will be given in the following cases:

- The configuration does not correspond to the pump connected.
- The configuration fault is of safety-related importance (see section [6.7 Approval](#)).

A configuration warning will be given if the configuration fault is of function-related importance (see section [6.7 Approval](#)).

TM03 34/15 0306

TM05 1978 4111



### 4.3 Pump variant

IO 113 must be configured for the connected pump.  
The pump type designation indicates an A, B, C or D.

**Example 1**, internal wiring:

SE1 80 80 40 **A** Ex 4 5 1D

**Example 2**, external wiring:

SE2.90.250.2250.4.S.496.Ex.S.5.13.**C**.Q.S

The letters **A** and **C** in the examples can be found on the pump nameplate and must be referred to when setting DIP switches 1 and 2.

| Pump variant | <div> <div>ON</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div>DIP</div> </div> <div> <div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div><div>10</div><div>11</div><div>12</div> </div> | Description                                                                                                                              |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| PA           | <div>ON</div> <div> <input checked="" type="checkbox"/> <input type="checkbox"/> </div> <div>1 2</div>                                                                                                                                                                                                                                                                                                                                                                                                                              | IO 113 without SM 113.<br>Sensors are connected directly to IO 113.<br>Position 1 ON<br>Position 2 OFF                                   |
| PB           | <div>ON</div> <div> <input type="checkbox"/> <input checked="" type="checkbox"/> </div> <div>1 2</div>                                                                                                                                                                                                                                                                                                                                                                                                                              | IO 113 with SM 113.<br>Sensors are connected to SM 113.<br>Position 1 OFF<br>Position 2 ON                                               |
| PC           | <div>ON</div> <div> <input type="checkbox"/> <input checked="" type="checkbox"/> </div> <div>1 2</div>                                                                                                                                                                                                                                                                                                                                                                                                                              | IO 113 without SM 113.<br>For SE/SL 9-30 kW pumps only.<br>Sensors are connected directly to IO 113.<br>Position 1 OFF<br>Position 2 OFF |
| PD           | <div>ON</div> <div> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> </div> <div>1 2</div>                                                                                                                                                                                                                                                                                                                                                                                                                   | IO 113 without SM 113.<br>The WIO/WIA sensors are connected directly to the pump.<br>Position 1 ON<br>Position 2 ON                      |

4.4 Address for bus communication

IO 113 can communicate with control systems via a bus connection. For the purpose of bus communication, IO 113 is slave. As a control system must be able to identify the slave units with which it communicates, the IO 113 modules must have unique addresses. An address between 32 and 231 can be selected. By default, the address is set to 231.

When an SM 113 is used together with an IO 113 as a pair, SM 113 is slave. In one control system, a maximum of seven pairs may be used. Each IO 113 must be identified by a unique address, configured by means of DIP switches 3, 4 and 5. See the below table.

Another way to set the unique address of an SM 113 in the control system is by bus. In this case, DIP switches 3, 4 and 5 must be toggled to OFF.

| Address            | <div><div>ON</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>DIP</div></div><div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div><div>10</div><div>11</div><div>12</div></div></div> | Description                                                                           |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 40                 | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | IO 113 address 1                                                                      |
| 41                 | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | IO 113 address 2                                                                      |
| 42                 | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | IO 113 address 3                                                                      |
| 43                 | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | IO 113 address 4                                                                      |
| 44                 | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | IO 113 address 5                                                                      |
| 45                 | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | IO 113 address 6                                                                      |
| Address set by bus | <div><div><div></div><div></div><div></div></div><div><div>3</div><div>4</div><div>5</div></div></div>                                                                                                                                                                                                                                                         | Unique address for IO 113 set in the control system via bus.<br>Default address: 231. |

### 4.5 SM 113 sensor detection and address setting

The first time voltage is applied, SM 113 will check all inputs to detect which sensors are connected.

| Power supply to SM 113 | <div>ON</div> <div> <div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div><div>10</div><div>11</div><div>12</div> </div> <div>DIP</div> | Description                                                                             |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Power on               |                                                                                                              | The slave SM 113 detects sensor status and communicates with IO 113 to set the address. |
| Power off              |                                                                                                              | The slave SM 113 is off.                                                                |

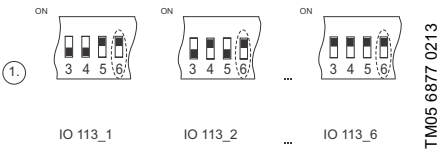
If a valid signal is measured, SM 113 will detect that a sensor is present and save the status.

If IO 113 indicates a sensor error or configuration error, repeat the sensor detection. See section [8. Fault finding the product](#). Change DIP switch 6 on IO 113 from OFF to ON, then switch from ON to OFF. After approximately 5 seconds, SM 113 will reset and the sensor detection is completed.

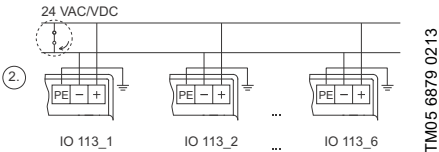


If more than one pair of IO 113 and SM 113 are used in a control system, make sure the address setting is handled pair by pair. Only one pair of IO 113 and SM 113 may be on and initialised at a time when performing settings. All other IO 113 and SM 113 modules must be off; otherwise, the address setting may fail.

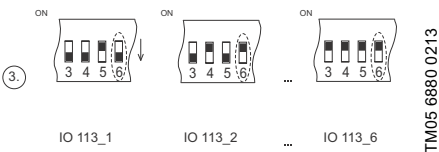
**Example:** (six pairs)



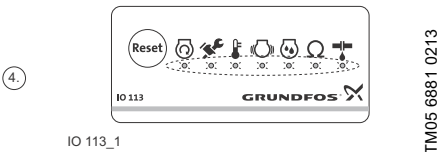
**Fig. 6** DIP 6 "ON"



**Fig. 7** Power on



**Fig. 8** IO 113\_1, DIP 6 "OFF"



**Fig. 9** All indicator lights flashing

After approximately 5 seconds:

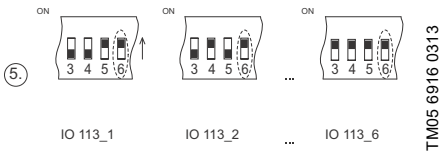


Fig. 10 IO 113\_1, DIP 6 "ON"

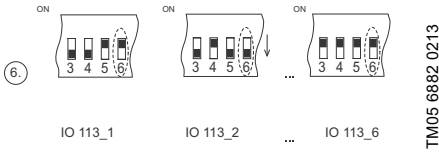


Fig. 11 IO 113\_2, DIP 6 "OFF"

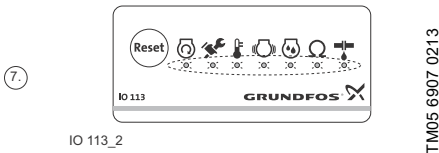


Fig. 12 All indicator lights flashing

After approximately 5 seconds:

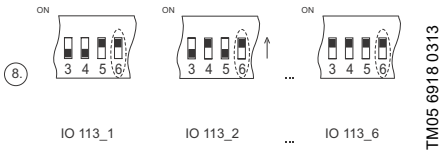


Fig. 13 IO 113\_2, DIP 6 "ON"

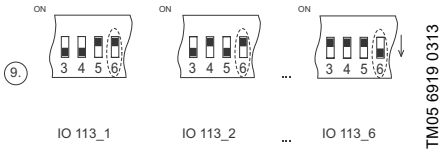


Fig. 14 IO 113\_6, DIP 6 "OFF"

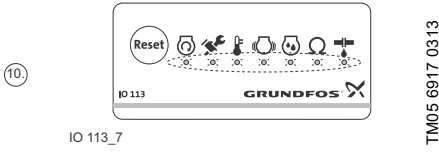


Fig. 15 All indicator lights flashing

After approximately 5 seconds:

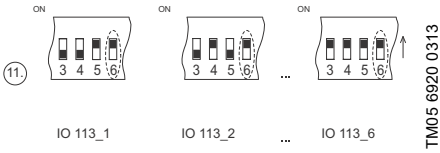


Fig. 16 IO 113\_7, DIP 6 "ON"

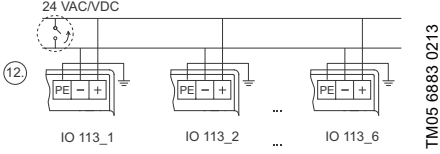


Fig. 17 Power off

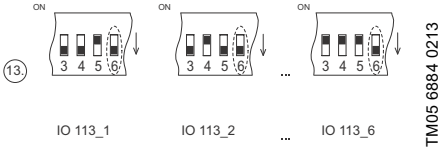


Fig. 18 DIP 6, "OFF"

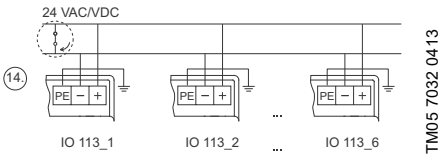
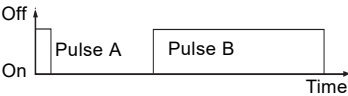


Fig. 19 Power on

### 4.6 Analog outputs

The analog outputs of IO 113 can be set to various types of output signal.

| Analog output                                      | <div>ON</div> <div> <div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div> </div> <div>DIP</div> <div>1 2 3 4 5 6 7 8 9 10</div> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analog output 2:<br>G2 and A2. See fig. 24<br>(2). |                                                                                                         | Motor temperature<br>4-20 mA, 0-180 °C<br>0 mA = no sensor                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Analog output 2:<br>G2 and A2. See fig. 24<br>(2)  |                                                                                                         | Motor temperature<br>Pt1000 emulator<br>1000-1685 Ω, 0-180 °C                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Analog output 1:<br>G1 and A1. See fig. 24<br>(2)  |                                                                                                         | Water in oil:<br>4-20 mA, 0-20 %<br>0 mA = Water-in-oil sensor not fitted<br>3.5 mA = Alarm, air in oil chamber<br>22 mA = Warning, water content far outside the measuring range<br><br>Water in air:<br>0 mA = Water-in-oil sensor not fitted<br>3.5 mA, OK<br>22 mA = Alarm                                                                                                                                                                                                                    |
| Analog output 1:<br>G1 and A1. See fig. 24<br>(2)  |                                                                                                         | Water in oil:<br>Pulse output: 0-20 %<br>Maximum connection: 24 V, 100 mA<br>Status of output transistor<br><br><br><b>Pulse A, water in oil:</b><br>0.5-3.66 s = 0-20 %<br>10 s = Water content far outside the measuring range<br><b>Pulse A, water in air:</b><br>0.5-3.66 s = OK<br>10 s = Water content exceeds alarm range<br><br><b>Pulse B, insulation resistance:</b><br>0.5 s = 0 MΩ<br>10.5 s = 20 MΩ |

4.7 Bus protocol

By setting the bus protocol, the type of bus connection can be chosen.

GENIbus is a Grundfos standard protocol for Grundfos products.

The Modbus protocol is used for communication between IO 113 and a control unit from another supplier.

| Bus protocol | <div><div>ON</div><div>DIP</div><div>12</div></div> |   |   |   |   |   |   |   |   |    |    |    | Description                                                                                                        |
|--------------|-----------------------------------------------------|---|---|---|---|---|---|---|---|----|----|----|--------------------------------------------------------------------------------------------------------------------|
|              | 1                                                   | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |                                                                                                                    |
| GENIbus      |                                                     |   |   |   |   |   |   |   |   |    |    |    | Grundfos standard protocol for communication between Grundfos products.                                            |
| Modbus       |                                                     |   |   |   |   |   |   |   |   |    |    |    | Go to the Grundfos Product Center online and search Literature for document number: 98288208 - IO 113, via Modbus. |

4.8 ATEX/IEC Ex protection

ATEX/IEC Ex protection can be enabled or disabled by means of DIP switch 10.

| ATEX/IEC Ex protection | <div><div>ON</div><div>DIP</div><div>12</div></div> |   |   |   |   |   |   |   |   |    |    |    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|-----------------------------------------------------|---|---|---|---|---|---|---|---|----|----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | 1                                                   | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Disabled               |                                                     |   |   |   |   |   |   |   |   |    |    |    | <div>Activation of ATEX/IEC Ex protection enables additional alarms:</div> <ul style="list-style-type: none"><li>• Main bearing temperature too high. Default alarm temperature: 140 °C (installation with SM 113)</li><li>• Support bearing temperature too high. Default alarm temperature: 140 °C (installation with SM 113)</li><li>• Missing signal from bearing sensor (installation with SM 113)</li><li>• Missing signal from WIO/WIA sensor</li><li>• Communication alarm (installation with SM 113).</li></ul> |
| Enabled                |                                                     |   |   |   |   |   |   |   |   |    |    |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

4.9 Product type

IO 113 must be configured for the connected pump by configuring DIP switches 11 and 12.

| Product type | <div><div>ON</div><div>DIP</div><div>1 2 3 4 5 6 7 8 9 10 11 12</div></div>       |  |  |  |  |  |  |  |  |  |  |  | Description                        |
|--------------|-----------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|------------------------------------|
|              |                                                                                   |  |  |  |  |  |  |  |  |  |  |  |                                    |
| Pump         |  |  |  |  |  |  |  |  |  |  |  |  | Pump with WIO sensor.              |
| Pump         |  |  |  |  |  |  |  |  |  |  |  |  | Pump with WIA sensor.              |
| n/a          |  |  |  |  |  |  |  |  |  |  |  |  | Reserved for future configuration. |
| Pump         |  |  |  |  |  |  |  |  |  |  |  |  | Pump without WIO/WIA sensor.       |

## 5. Commissioning the product

Before installation, check the following items:

- IO 113 is the variant you ordered.
- IO 113 is suitable for the supply voltage and frequency available at the installation site.
- IO 113 has not been damaged during transportation.

### DANGER

#### Electric shock



Death or serious personal injury

- Before installing IO 113, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

The installation must be carried out by authorised persons in accordance with local regulations.

All safety regulations must be observed on the installation site.

When IO 113 has been set up as described in section [2. Receiving the product](#), startup must be carried out by an authorised person.

1. Switch on the power supply to IO 113 before starting the pump.
2. IO 113 now carries out a self-test. All indicator lights on the front panel will turn on for a few seconds. If IO 113 does not detect any fault, all indicator lights will go out except those for water in oil and stator insulation resistance. If a fault is detected, an indicator light for the fault will light up.
3. Check that there are no warnings or alarms before switching on the pump.

## 6. Product introduction

### 6.1 Product description

IO 113 provides an interface between a Grundfos wastewater pump equipped with sensors and the pump controller(s). The most important sensor status information is indicated on the front panel.

One pump can be connected to one IO 113 module.

Together with the sensors, IO 113 provides a galvanic isolation between the motor voltage in the pump and the connected controller(s).

IO 113 can do the following as standard:

- protect the pump against overheating
- monitor the status of these items:
  - motor winding temperature
  - leakage (WIO/WIA)\*
  - moisture in pump
- measure the stator insulation resistance
- stop the pump in case of alarm
- remotely monitor the pump via RS-485 communication (Modbus or GENIbus)
- control the pump via a frequency converter.

When IO 113 is combined with an SM 113, it is also possible to monitor the following:

- bearing temperature
- vibration in pump.
- \* WIO and WIA are abbreviations for water-in-oil and water-in-air.

If SM 113 is installed, connection of the leakage sensor must be done via the SM 113 device.



IO 113 must not be used for other purposes than those specified above.

IO 113 V0 and V1 are not compatible with SM 113 V2. IO 113 and SM 113 V2 units are compatible, see the table below.

#### Compatibility list

|           | SM 113<br>V0 | SM 113<br>V1 | SM 113<br>V2 | SM 113<br>V3 |
|-----------|--------------|--------------|--------------|--------------|
| IO 113 V0 | OK           | OK           | -            | -            |
| IO 113 V1 | OK           | OK           | -            | -            |
| IO 113 V2 | -            | -            | OK           | OK           |

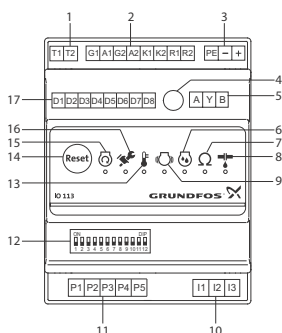
### 6.2 Intended use

The product is used to handle internal and external signals from pumps, sensors and controls. The product has potential-free alarm and operating relays to stop the pump in case they detect a situation that requires it to stop.

The product is intended to be placed outside Ex zones but can be used to monitor pumps placed inside Ex zones.



### 6.3 User interface

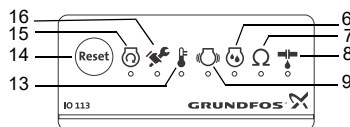


**Fig. 20** IO 113 module

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### 6.4 Indicator lights and their function

On the front, IO 113 has seven indicator lights for sensor status. Figure 21 shows the location of lights on IO 113, and the table explains their meanings.



**Fig. 21** Indicator lights on IO 113

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#### Pos. Description

|    |                                                                             |
|----|-----------------------------------------------------------------------------|
| 1  | Terminals for alarm relay                                                   |
| 2  | Terminals for analog and digital inputs and outputs                         |
| 3  | Terminals for supply voltage                                                |
| 4  | Potentiometer for setting the warning limit of stator insulation resistance |
| 5  | Terminals for RS-485 for GENIbus or Modbus                                  |
| 6  | Indicator light for measurement of moisture                                 |
| 7  | Indicator light for stator insulation resistance                            |
| 8  | Indicator light for leakage (WIO/WIA)                                       |
| 9  | Indicator light for vibration in pump                                       |
| 10 | Terminals for measurement of stator insulation resistance                   |
| 11 | Terminals for connection of pump sensors                                    |
| 12 | DIP switch for configuration                                                |
| 13 | Indicator light for motor temperature                                       |
| 14 | Button for resetting alarms                                                 |
| 15 | Indicator light for motor running                                           |
| 16 | Indicator light for service                                                 |
| 17 | Terminals for digital outputs                                               |

## 6.5 Description of indicator lights

| Pos. | Symbol                                                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6    |    | <b>Moisture</b><br><b>Red</b> indicator light flashing for alarm in case of moisture in the motor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 7    |    | <b>Insulation resistance</b><br>Stator insulation resistance is indicated by a green, yellow or red light.<br><b>Green</b> indicator light is on when the insulation resistance is correct, i.e. above the warning level set on the potentiometer.<br><b>Yellow</b> indicator light is permanently on when the <b>warning</b> limit has been reached, see <a href="#">4.1 Potentiometer</a> .<br><b>Red</b> indicator light flashing when the <b>alarm</b> limit has been reached, i.e. below 1 MΩ.<br><b>Note:</b> The indicator lights are only active if the conductor for contactor status is connected (K1, K2 ). This measurement is only correct when the motor is stopped.                                                                                                                                  |
| 8    |    | <b>Leakage</b><br>For wastewater pumps:<br><b>Green</b> indicator light permanently on indicates leakage below 5 %.<br><b>Green</b> indicator light flashing indicates leakage between 5 and 10 %.<br><b>Yellow</b> indicator light permanently on indicates leakage between 10 and 15 %.<br><b>Yellow</b> indicator light flashing indicates that the input signal is out of range.<br><b>Red</b> indicator light flashing indicates leakage between 15 and 20 %.<br><b>Red</b> indicator light permanently on indicates leakage above 20 %, or oil chamber is empty.<br><br>For SE/SL 9-30 kW:<br>The indicator light is off when the WIO/WIA sensor is disabled.<br><b>Green</b> indicator light permanently on indicates that the pump works correctly.<br><b>Red</b> indicator light flashing indicates alarm. |
| 9    |    | <b>Vibrations</b><br><b>Yellow</b> indicator light permanently on when vibrations are in the warning range (exceeds alarm range).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 13   |    | <b>Temperature</b><br><b>Red</b> indicator light flashing for alarm when temperature is above the limit.<br>If ATEX/IEC Ex protection is activated (DIP switch 10), this indicator light can also indicate the following: <ul style="list-style-type: none"> <li>• bearing temperature too high.</li> <li>• missing signal from bearing sensor (with SM 113).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 15   |  | <b>Motor running</b><br><b>Green</b> indicator light is permanently on when motor is running.<br><b>Note:</b> The indicator light is only active if the conductor for contactor status is connected (K1, K2).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 16   |  | <b>Service</b><br><b>Yellow</b> indicator light permanently on when there is a communication problem between IO 113 and SM 113.<br><b>Yellow</b> indicator light flashing when there is a warning. Immediate service is needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## 6.6 Identification

### 6.6.1 Type key

| Code | Meaning           | IO | 1 | 1 | 3 |
|------|-------------------|----|---|---|---|
| IO   | Input/output unit |    |   |   |   |
| 11   | Controller series |    |   |   |   |
| 3    | Model number      |    |   |   |   |

### 6.6.2 Nameplate

The nameplate is fitted on the side of IO 113.

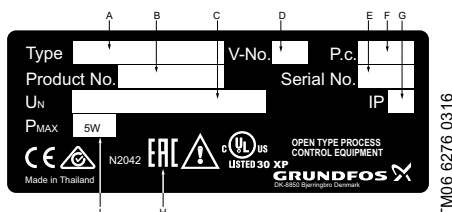


Fig. 22 Nameplate

| Pos. | Description                     |
|------|---------------------------------|
| A    | Type designation                |
| B    | Product number                  |
| C    | Rated voltage                   |
| D    | Version number                  |
| E    | Serial number                   |
| F    | Production code (year and week) |
| G    | Enclosure class                 |
| H    | EAC approval logo               |
| I    | Power consumption               |

## 6.7 Approval



IO 113 is UL listed to US and Canadian safety standards.

## 6.8 Variants

IO 113 is available in two variants:

- without communication module (standard variant)
- with communication module.

The product number on the nameplate shows the variant:

- 98097391 = standard variant
- 98711370 = variant with communication module.

## 6.9 Expansion using SM 113

SM 113 may be used for the collection and transfer of additional sensor data. SM 113 works together with IO 113 (98711370) as shown below.

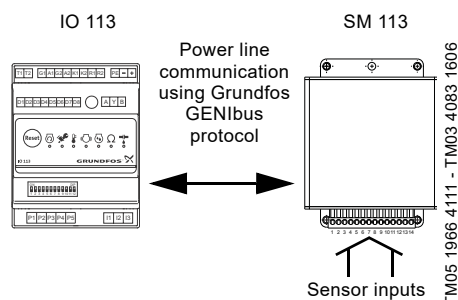


Fig. 23 IO 113 and SM 113

SM 113 can be built into a pump or mounted next to IO 113 in a control cabinet.

SM 113 can collect data from these devices:

- current sensors, 4-20 mA\*
- Pt100\*\*/Pt1000\*\*\* thermal sensors.
- \* Vibration sensor, water-in-oil or water-in-air sensor (WIO or WIA)

\*\* Maximum three Pt100 sensors

\*\*\* Maximum four Pt1000 sensors

## 6.10 WIO/WIA sensor

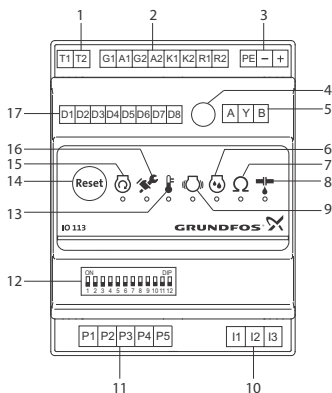


In Ex and IEC Ex applications, the maximum current supplied to the sensor must not exceed 350 mA according to EN/IEC 60079-18.

As IO 113 is equipped with this current limitation, no further protection is required when using IO 113.

For more information about the WIO/WIA sensor, see the installation and operating instructions at <http://net.grundfos.com/qri/i/96591899>.

7. Control functions

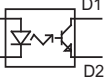
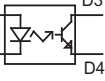
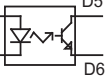
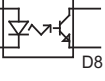


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Fig. 24 IO 113 module

| Pos. | Terminal | Description                                 | Data                                | Function                                                                                                                                                                                                                                                                  | Diagram |
|------|----------|---------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1    | T1       | Terminal for alarm relay                    | Max. 250 VAC                        | All alarms trip the alarm relay. The alarm relay is closed during normal operation.<br>In case of alarm or if IO 113 is not connected to the power supply, the relay opens and breaks the connection between T1 and T2.                                                   |         |
|      | T2       | Terminal for alarm relay                    | Max. 250 VAC                        |                                                                                                                                                                                                                                                                           |         |
| 2    | G1       | GND for analog output 1                     | 1) 0 V<br>2) 0 V                    | Analog output 1 has two functions set via DIP switch 8. See section <a href="#">4.6 Analog outputs</a> .<br>1. 4-20 mA for content of water in the oil. Load resistance: max. 250 Ω.<br>2. Pulse output for content of water in the oil and stator insulation resistance. |         |
|      | A1       | Terminal for analog output 1                | 1) 15 VDC<br>2) 24 VDC, max. 100 mA |                                                                                                                                                                                                                                                                           |         |
|      | G2       | GND for analog output 2                     | 1) 0 V<br>2) 0 V                    |                                                                                                                                                                                                                                                                           |         |
|      | A2       | Terminal for analog output 2                | 1) 15 VDC<br>2) 24 VDC, rated 1 mA  |                                                                                                                                                                                                                                                                           |         |
|      | K1       | GND connection                              | 0 V                                 | Feedback from motor contactor whether the pump is running or not. Short-circuit the input when the pump is running. The signal is used by IO 113 for filtering measuring signals and for analysis during fault indication.                                                |         |
|      | K2       | Terminal for conductor for contactor status | Digital input                       |                                                                                                                                                                                                                                                                           |         |
|      | R1       | GND connection                              | 0 V                                 |                                                                                                                                                                                                                                                                           |         |
|      | R2       | Terminal for resetting                      | Digital input                       |                                                                                                                                                                                                                                                                           |         |

| Pos. | Terminal | Description                                              | Data                                               | Function                                                                                                                                                                                                                              | Diagram                                                                            |
|------|----------|----------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 3    | PE       | Earth                                                    | Earth                                              | Supply voltage to IO 113                                                                                                                                                                                                              |  |
|      | -        | GND for supply voltage                                   | 0 VDC<br>24 VAC<br>+ 10 %/- 10 %                   |                                                                                                                                                                                                                                       |                                                                                    |
|      | +        | Positive for supply voltage                              | 24 VAC<br>+ 10 %/- 10 %<br>24 VDC<br>+ 10 %/- 10 % |                                                                                                                                                                                                                                       |                                                                                    |
| 5    | A        | RS-485 A                                                 | Bus input                                          | RS-485 communication connection (9600 baud)                                                                                                                                                                                           |   |
|      | Y        | RS-485 GND                                               | 0 V                                                |                                                                                                                                                                                                                                       |                                                                                    |
|      | B        | RS-485 B                                                 | Bus input                                          |                                                                                                                                                                                                                                       |                                                                                    |
| 10   | I1       | Earth                                                    | Earth                                              | The insulation resistance between stator windings and earth is measured. The measurement is only correct when the motor is stopped. Measurement voltage: 10 VDC.                                                                      |  |
|      | I2       | Not connected                                            | -                                                  |                                                                                                                                                                                                                                       |                                                                                    |
|      | I3       | Terminal for measurement of stator insulation resistance | CAT II 600 V                                       |                                                                                                                                                                                                                                       |                                                                                    |
| 11   | P1       | Terminal for sensors in the pump                         | Sensor input                                       | Thermal switch or PTC sensor according to DIN 44081 and 44082.<br><br>P1 to P5 are used for the connection of sensors in the pump. All sensors in contact with phase voltage must be double insulated according to UL/IEC/EN 61010-1. |  |
|      | P2       | Terminal for supply voltage to sensors in the pump       | 15 V                                               |                                                                                                                                                                                                                                       |                                                                                    |
|      | P3       | Terminal for sensors in the pump                         | Sensor input                                       |                                                                                                                                                                                                                                       |                                                                                    |
|      | P4       | Terminal for supply voltage to sensors in the pump       | 15 V                                               |                                                                                                                                                                                                                                       |                                                                                    |
|      | P5       | Terminal for sensors in the pump                         | Sensor input                                       |                                                                                                                                                                                                                                       |                                                                                    |

| Pos. | Terminal | Description                                               | Data                                                                             | Function                                                                                                                                                                                                                                                                                                                                                                                                                             | Diagram                                                                             |
|------|----------|-----------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|      | D1       | Terminal for alarm in case of too high stator temperature | Digital output<br>24 VDC<br>Min. impedance<br>10 kΩ<br>Max. rated current 2.4 mA | Alarm for temperature too high in the stator windings. The output is closed during normal operation. If an alarm occurs, the connection is broken between D1 and D2.                                                                                                                                                                                                                                                                 |   |
|      | D2       | GND for alarm in case of too high stator temperature      | 0 V                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |
|      | D3       | Terminal for alarm in case of moisture in the pump        | Digital output<br>24 VDC<br>Min. impedance<br>10 kΩ<br>Max. rated current 2.4 mA | Alarm for moisture in the motor part of the pump. The output is closed during normal operation. If an alarm occurs, the connection is broken between D3 and D4.                                                                                                                                                                                                                                                                      |   |
|      | D4       | GND for alarm in case of moisture in the pump             | 0 V                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |
| 17   | D5       | Output for alarm in case of insulation fault              | Digital output<br>24 VDC<br>Min. impedance<br>10 kΩ<br>Max. rated current 2.4 mA | Alarm for too low insulation value between stator windings and earth. The output is closed during normal operation. If an alarm occurs, the connection is broken between D5 and D6.                                                                                                                                                                                                                                                  |   |
|      | D6       | GND for alarm in case of insulation fault                 | 0 V                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |
|      | D7       | Terminal for warning                                      | Digital output<br>24 VDC<br>Min. impedance<br>10 kΩ<br>Max. rated current 2.4 mA | <b>Warning:</b> The output is closed during normal operation. If a warning occurs, the connection is broken between D7 and D8.<br>The following warnings can occur: <ul style="list-style-type: none"><li>– communication warning</li><li>– configuration warning</li><li>– too much water in the oil</li><li>– stator insulation resistance below warning limit.</li></ul> See section <a href="#">8. Fault finding the product</a> |  |
|      | D8       | GND for warning                                           | 0 V                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |

## 8. Fault finding the product

### WARNING

#### Electric shock

Death or serious personal injury

- Before any fault finding, make sure that the fuses have been removed or the main switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on. OBS: terminals T1 and T2 are normally connected to 220-240 VAC. Terminal I3 may be connected to up to 600 VAC.



| Fault                                                                                                                                                                                                 | Cause                                                                                                                                                                                                                 | Remedy                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|  Green indicator light is off when the pump is running.                                                              | Conductor for contactor status has not been connected to terminals K1 and K2.                                                                                                                                         | Connect the conductor.                                                                                                          |
|  Yellow indicator light is flashing at startup.                                                                      | This indicates configuration setting conflicts. The DIP switch settings are incorrect.                                                                                                                                | Reset the DIP switches.                                                                                                         |
|  Yellow indicator light is permanently on.                                                                           | The connection between IO 113 and SM 113 is interrupted, or the setting of DIP switches 1 and 2 is incorrect.                                                                                                         | Re-establish the connection or reconfigure DIP switches 1 and 2.                                                                |
|  Red indicator light is flashing.                                                                                    | Motor winding or bearing temperature is too high, or missing signal from bearing sensor.                                                                                                                              | Check connection to SM 113.                                                                                                     |
|  Yellow indicator light is permanently on.                                                                           | The warning limit for stator insulation resistance is too low.                                                                                                                                                        | Set a higher limit using the potentiometer. See section <a href="#">4.1 Potentiometer</a> .                                     |
|  New oil does not show 4 mA on analog output 1.                                                                       | The oil in the oil chamber has not been changed completely, or it was changed to another type.                                                                                                                        | Calibrate IO 113 for the new oil, see section <a href="#">10. Calibration</a> .                                                 |
|  The water-in-oil sensor previously indicated water in the oil, but now it indicates less than 5 % water in the oil. | The power supply to IO 113 has been interrupted.                                                                                                                                                                      | Let the pump run for some time and check again.                                                                                 |
|  Yellow indicator light is flashing.                                                                                | <ul style="list-style-type: none"> <li>• WIO sensor is disconnected.</li> <li>• WIO sensor is defect.</li> <li>• WIO sensor short circuit.</li> <li>• Wrong configuration (only applications with SM 113).</li> </ul> | Reconnect the sensor or replace the sensor. For SM 113, choose the correct setting of the DIP switches.                         |
| SM 113 cannot detect the sensor. Only applicable to non-Ex applications with DIP switch 10 in the OFF position.                                                                                       | Fault in signal from sensor.                                                                                                                                                                                          | Re-establish the signal, e.g. by changing the setting of DIP switch 9 or by securing the wire connection from sensor to SM 113. |

## 9. Overview of alarms and warnings

IO 113 has two categories of fault:

1. **Alarm.** The pump stops. The fault is related to a primary functionality (e.g. motor temperature too high). The relay opens and breaks the connection between T1 and T2 in case of alarm or if IO 113 is not connected to the power supply. An alarm is shown by the indicator lights on the front panel of IO 113 and via the four digital outputs. See fig. 20 (17).
2. **Warning.** The pump does not stop. The fault is related to a secondary functionality (e.g. too much water in the oil). A warning is shown by the indicator lights on the front panel of IO 113. The warning status can be read via the digital outputs D7 and D8. See fig. 20 (17).

| Fault                                   | Standard |       | ATEX/IECEx protection activated |       |
|-----------------------------------------|----------|-------|---------------------------------|-------|
|                                         | Warning  | Alarm | Warning                         | Alarm |
| Stator winding temperature too high     | •        | •     | •                               | •     |
| Moisture in top cover                   |          | •     |                                 | •     |
| Moisture in stator housing              |          | •     |                                 | •     |
| Moisture in bottom of motor             |          | •     |                                 | •     |
| Water in air                            |          | •     |                                 | •     |
| Missing signal from water-in-air sensor |          | •     |                                 | •     |
| Water in the oil exceeds limit          | •        |       | •                               |       |
| Missing signal from water-in-oil sensor | •        |       |                                 | •     |
| Insulation resistance too low           | •        | •     | •                               | •     |
| Configuration conflict                  | •        | •     | •                               | •     |
| Main bearing temperature too high*      | •        |       | •                               | •     |
| Support bearing temperature too high*   | •        |       | •                               | •     |
| Missing signal from bearing sensor*     | •        |       |                                 | •     |
| Communication fault*                    | •        |       |                                 | •     |
| Time for service                        | •        |       | •                               |       |
| Internal fault                          | •        |       | •                               |       |
| Vibrations exceed limit                 | •        | •     | •                               | •     |

\* Pump with SM 113

### 9.1 Alarm resetting

Alarms can be reset by means of terminals R1 and R2.

#### Manual resetting

Alarms can be reset by short-circuiting R1 and R2. The reset button also short-circuits R1 and R2. Never press the reset button for more than 2 seconds to reset alarms. See section 10. Calibration.

#### Automatic resetting

If you make a permanent short circuit between R1 and R2, alarms will automatically be reset when the cause of the alarm has disappeared.



## 10. Calibration

After an oil change, the measurement of water in the oil must be calibrated for the new oil:

1. Let the pump run for at least one minute.
2. Press the reset button for more than five seconds.
3. 4 mA can now be read between terminals A1 and G1 of analog output 1. See fig. 20 (2). (4 mA = 0 %).



If this is done with used oil, the measurement of water in the oil may be incorrect.

## 11. Maintenance and service

IO 113 cannot be serviced, nor does it need maintenance. If the module is faulty, it must be replaced.

## 12. Disposing of the product

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.



The crossed-out wheeled bin symbol on a product means that it must be disposed of separately from household waste. When a product marked with this symbol reaches its end of life, take it to a collection point designated by the local

waste disposal authorities. The separate collection and recycling of such products will help protect the environment and human health.

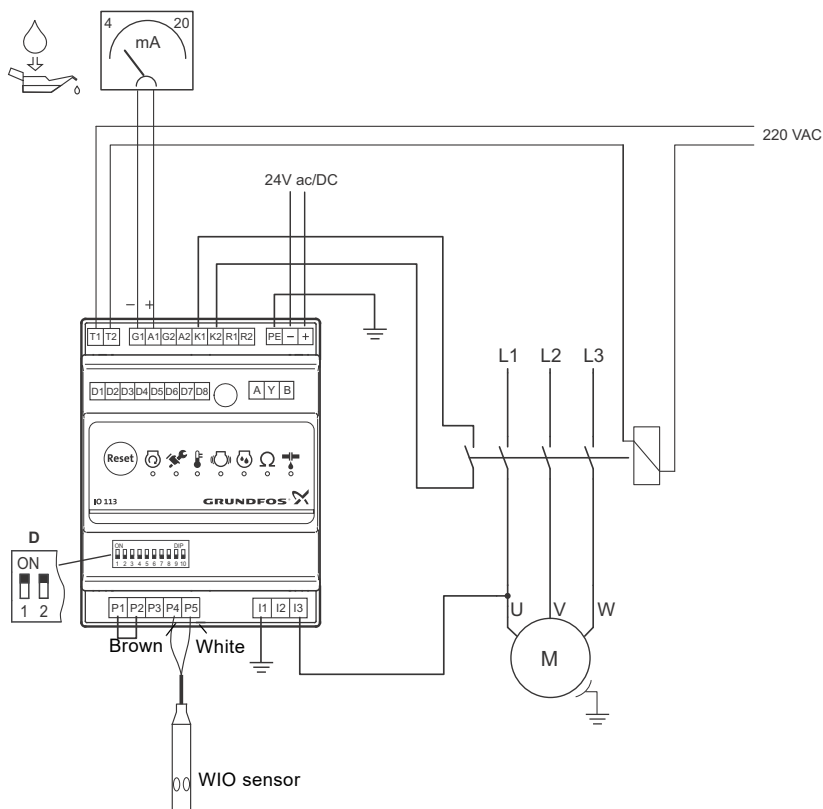
You can look up your product on:

[www.grundfos.com/products/product-sustainability/product-recycling.html](http://www.grundfos.com/products/product-sustainability/product-recycling.html)

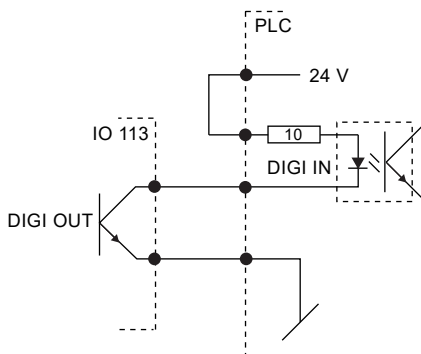


# Appendix

## External WIO sensor and stator insulation resistance measurement



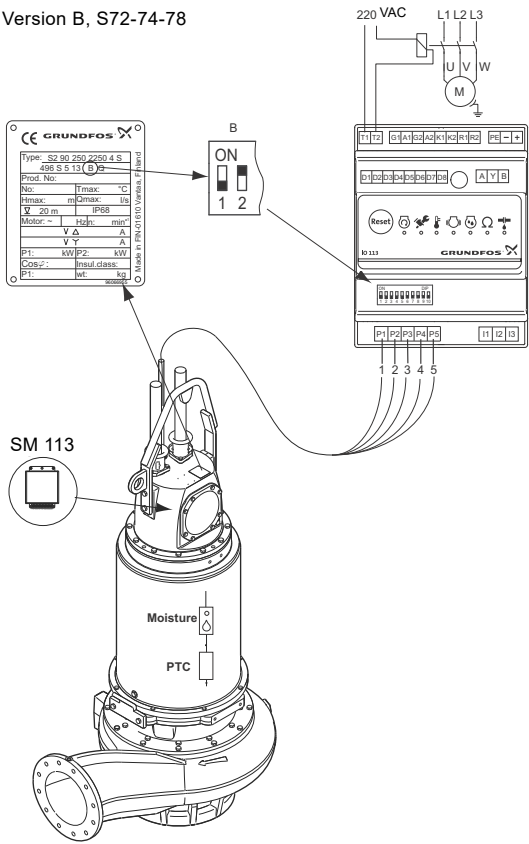
### Connection example DIGI-OUT IO111



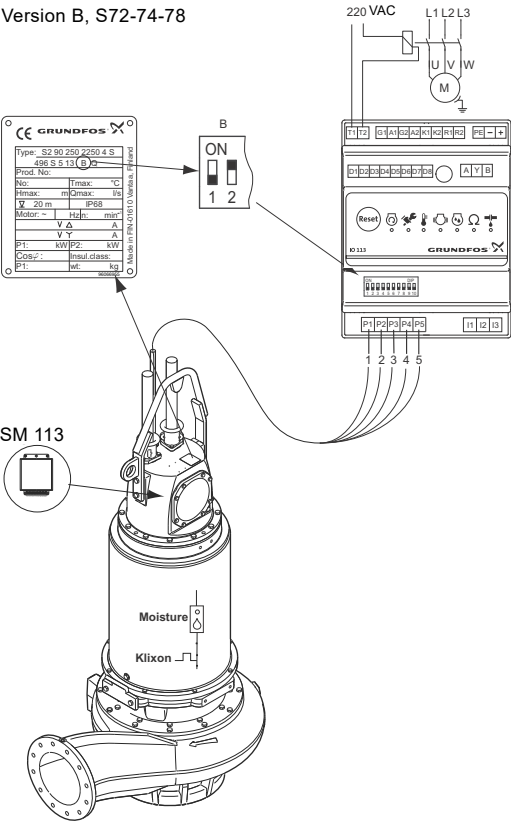
\* The 10 kΩ resistor is the minimum impedance required. The maximum current is 2.4 mA.

TM03 3832 1007

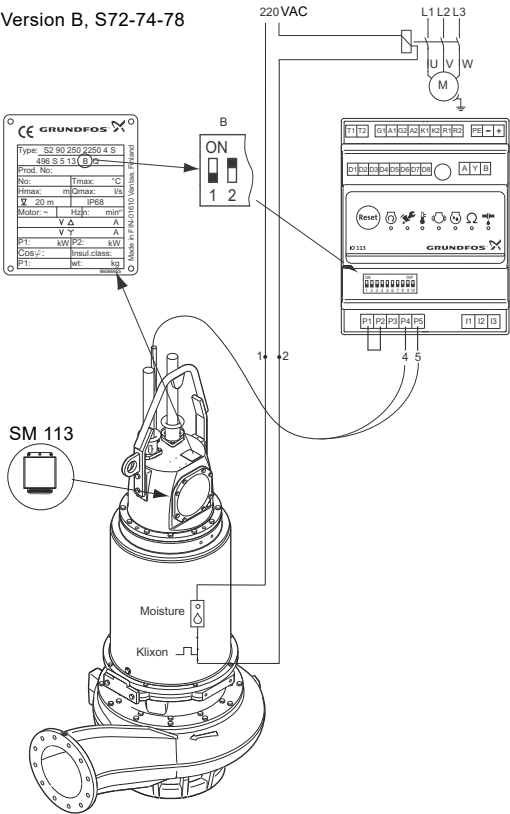
TM04 0307 0308

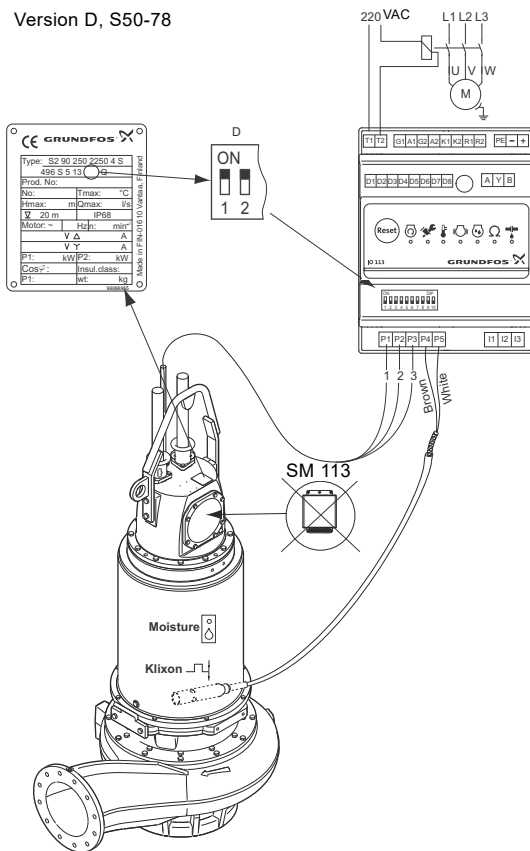


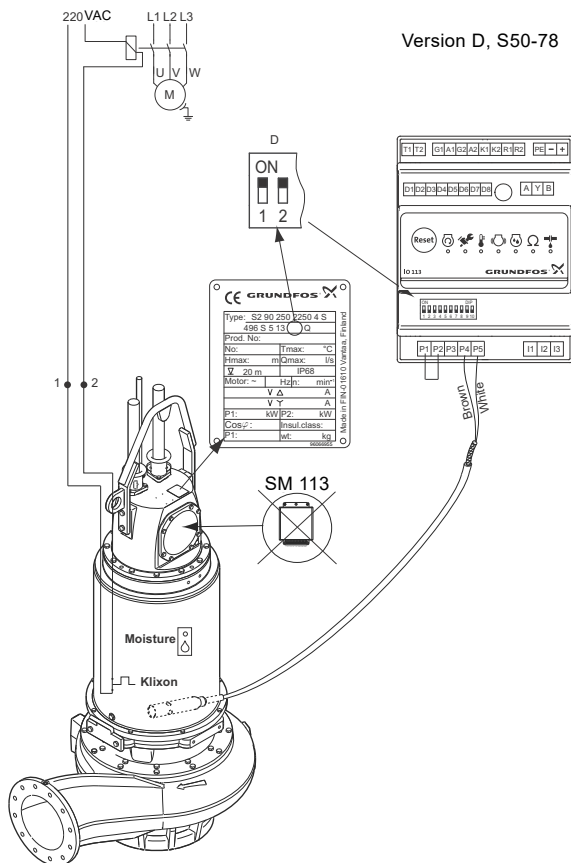
Version B, S72-74-78



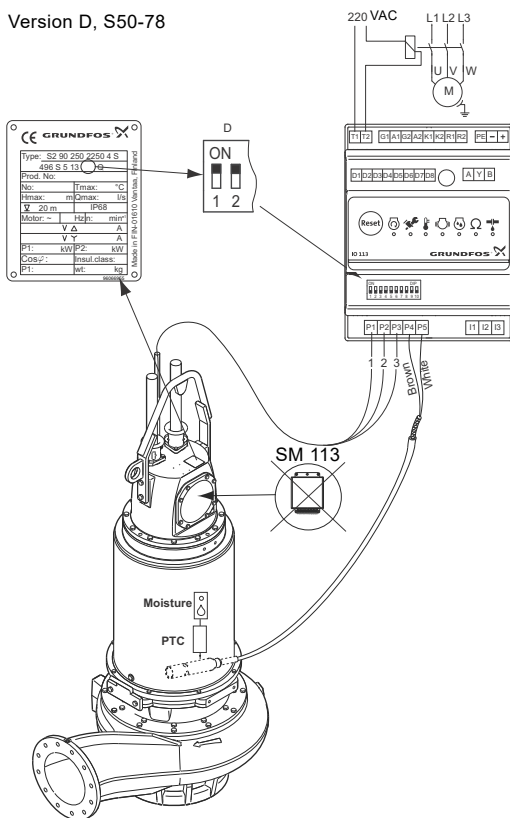
TM03 3830 1007







TM03 3836 1007





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| SUNPO<br>ELEKTRİK<br>ADANA                    | YEŞİLOBA MAH. 46003 SOK.<br>ARSLANDAMI İŞ MERK. C BLOK<br>NO:6/2-I SEYHAN ADANA                    | 0322 428 50 14<br>0533 461 71 14<br>0322 428 48 49 | LEVENT BAKIRKOL<br>sunpo-elektrik@hotmail.com          |
| ARDA POMPA<br>ANKARA                          | 26 NOLU İŞ MERKEZİ 1120.SOKAK<br>NO:5/1,5/5 OSTİM/ANKARA                                           | 0312 385 98 93<br>0541 805 89 44<br>0312 385 8904  | METİN ENGİN CANBAZ<br>metincanbaz@ardapompa.com.tr     |
| UĞUR SU<br>POMPA LARI<br>ANKARA               | AHI EVRAN MAHALLESİ ÇAĞRIŞIM<br>CADDESİ NO:2/15 SINCAN /ANKARA                                     | 0312 394 37 52<br>0532 505 12 62<br>0312 394 37 19 | UĞUR YETİŞ ÖCAL<br>uguryetisocal@gmail.com             |
| GROSER A.Ş.<br>ANTALYA                        | ŞAFAK<br>MAHALLESİ.5041.SOKAK.SANAYİ 28 C<br>BLOK NO:29 KEPEZ ANTALYA                              | 0242 221 43 43<br>0532 793 89 74<br>0242 221 43 42 | DOĞAN YÜCEL<br>servis@groseras.com                     |
| KOÇYİĞİTLER<br>ELEKTRİK<br>BOBİNAJ<br>ANTALYA | ORTA MAH. SERİK CAD. NO.116 SERİK<br>ANTALYA                                                       | 0242 722 48 46<br>0532 523 29 34<br>0242 722 48 46 | BİLAL KOÇYİĞİT<br>kocyyigitler@kocyyigitlerbobinaj.com |
| TEKNİK<br>BOBİNAJ<br>BURSA                    | ALAADDİN BEY MH.624.SK MESE 5 İŞ<br>MERKEZİ NO:26 D:10 NİLÜFER/BURSA                               | 0224 443 78 83<br>0507 311 19 08<br>0224 443 78 95 | GÜLDEN MÜÇEOĞLU<br>gulden@tbobinaj.com.tr              |
| ASİN<br>TEKNOLOJİ<br>GAZİANTEP                | MÜCAHİTLER MAHALLESİ 54 NOLU<br>SOKAK.GÜNEYDOĞU İŞ MERKEZİ<br>NO:10/A ŞEHİTKAMİL                   | 0342 321 69 66<br>0532 698 69 66<br>0342 321 69 61 | MEHMET DUMAN<br>mduman@asinteknoloji.com.tr            |
| ARI MOTOR<br>İSTANBUL                         | ORHANLI MESCİT MH.DEMOKRASİ<br>CD.BİRMES SAN.SİT.A-3 BLOK NO:9<br>TUZLA İSTANBUL                   | 0216 394 21 67<br>0532 501 47 69<br>0216 394 23 39 | EMİN ARI<br>aycan@arimotor.com.tr                      |
| SERİ MEKANİK<br>İSTANBUL                      | SEYİTNİZAM MAH. DEMİRCİLER SİT.<br>7.YOL . NO:6 ZEYİTNİBURNU İSTANBUL                              | 0212 679 57 23<br>0532 740 18 02<br>0212 415 61 98 | TAMER ERÜNSAL<br>servis@serimekanik.com                |
| DAMLA POMPA<br>İZMİR                          | 1203/4 SOKAK NO:2/E YENİŞEHİR İZMİR                                                                | 0232 449 02 48<br>0532 277 96 44<br>0232 459 43 05 | NEVZAT KIYAK<br>nkiyak@damlapompa.com                  |
| ÇAĞRI<br>ELEKTRİK<br>KAYSERİ                  | ESKİ SANAYİ BÖLGESİ 3.CADDE<br>NO:3-B KOCASINAN-KAYSERİ                                            | 0352 320 19 64<br>0532 326 23 25<br>0352 330 37 36 | ADEM ÇAKICI<br>kayseri.cagrielektrik@gmail.com         |
| MAKSOM<br>OTOMASYON<br>SAMSUN                 | 19 MAYIS<br>MAHALLESİ.642.SOKAK.NO:23<br>TEKKEKÖY SAMSUN                                           | 0362 256 23 56<br>0532 646 61 42<br>-              | MUSTAFA SARI<br>info@maksom.com                        |
| DETAY<br>MÜHENDİSLİK<br>TEKİRDAĞ              | ZAFER MAHALLESİ ŞEHİT YÜZBAŞI<br>YÜCEL KENTER CADDESİ 06/A BLOK<br>NO:5-6 ÇORLU TEKİRDAĞ           | 0282 673 51 33<br>0549 668 68 68<br>0282 673 51 35 | EROL KARTOĞLU<br>erol@detay-muhendislik.com            |
| ROTATEK<br>ENDÜSTRİYEL<br>TEKİRDAĞ            | ZAFER MH. ŞEHİT YÜZBAŞI YÜCEL<br>KENTER CD. YENİ SANAYİ SİTESİ 08-A<br>BLOK NO:14 ÇORLU / TEKİRDAĞ | 0282 654 51 99<br>0532 788 11 39<br>0282 654 51 81 | ÖZCAN AKBAŞ<br>ozcan@rotaendustriyel.com               |
| İLDEM TEKNİK<br>ISITMA VAN                    | ŞEREFİYE MAH ORDU CAD ARAS AP<br>NO 75 İPEKYOLU VAN                                                | 0432 216 20 83<br>0532 237 54 59<br>0432 216 20 83 | BURHAN DEMİREKİ<br>il-dem-teknik@hotmail.com           |
| BARIŞ BOBİNAJ<br>K.K.T.C.                     | LARNAKA YOLU ÜZERİ.PAPATYA<br>APT.NO:3-4 GAZİMAĞUSA                                                | 0542 884 06 62<br>0542 854 11 35<br>0533 884 06 62 | BARIŞ KIZILKILINÇ<br>barisbobinaj@hotmail.com          |

**Argentina**

Bombas GRUNDFOS de Argentina S.A.  
Ruta Panamericana km. 37.500 Centro  
Industrial Garin  
1619 Garin Pcia. de B.A.  
Phone: +54-3327 414 444  
Telefax: +54-3327 45 3190

**Australia**

GRUNDFOS Pumps Pty. Ltd.  
P.O. Box 2040  
Regency Park  
South Australia 5942  
Phone: +61-8-8461-4611  
Telefax: +61-8-8340 0155

**Austria**

GRUNDFOS Pumpen Vertrieb  
Ges.m.b.H.  
Grundfosstraße 2  
A-5082 Grödig/Salzburg  
Tel.: +43-6246-883-0  
Telefax: +43-6246-883-30

**Belgium**

N.V. GRUNDFOS Bellux S.A.  
Boomsesteenweg 81-83  
B-2630 Aartselaar  
Tel.: +32-3-870 7300  
Télécopie: +32-3-870 7301

**Belarus**

Представительство ГРУНДФОС в  
Минске  
220125, Минск  
ул. Шафарнянская, 11, оф. 56, БЦ  
«Порт»  
Тел.: +375 17 397 397 3  
+375 17 397 397 4  
Факс: +375 17 397 397 1  
E-mail: minsk@grundfos.com

**Bosnia and Herzegovina**

GRUNDFOS Sarajevo  
Zmaja od Bosne 7-7A,  
BH-71000 Sarajevo  
Phone: +387 33 592 480  
Telefax: +387 33 590 465  
www.ba.grundfos.com  
e-mail: grundfos@bih.net.ba

**Brazil**

BOMBAS GRUNDFOS DO BRASIL  
Av. Humberto de Alencar Castelo  
Branco, 630  
CEP 09850 - 300  
São Bernardo do Campo - SP  
Phone: +55-11 4393 5533  
Telefax: +55-11 4343 5015

**Bulgaria**

Grundfos Bulgaria EOOD  
Slatina District  
Iztocna Tangenta street no. 100  
BG - 1592 Sofia  
Tel. +359 2 49 22 200  
Fax. +359 2 49 22 201  
email: bulgaria@grundfos.bg

**Canada**

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

**China**

GRUNDFOS Pumps (Shanghai) Co. Ltd.  
10F The Hub, No. 33 Suhong Road  
Minhang District  
Shanghai 201106  
PRC  
Phone: +86 21 612 252 22  
Telefax: +86 21 612 253 33

**COLOMBIA**

GRUNDFOS Colombia S.A.S.  
Km 1.5 vía Siberia-Cota Conj. Potrero  
Chico,  
Parque Empresarial Arcos de Cota Bod.  
1A.  
Cota, Cundinamarca  
Phone: +57(1)-2913444  
Telefax: +57(1)-8764586

**Croatia**

GRUNDFOS CROATIA d.o.o.  
Buzinski prilaz 38, Buzin  
HR-10010 Zagreb  
Phone: +385 1 6595 400  
Telefax: +385 1 6595 499  
www.hr.grundfos.com

**GRUNDFOS Sales Czechia and Slovakia s.r.o.**

Čajkovského 21  
779 00 Olomouc  
Phone: +420-585-716 111

**Denmark**

GRUNDFOS DK A/S  
Martin Bachs Vej 3  
DK-8850 Bjerringbro  
Tlf.: +45-87 50 50 50  
Telefax: +45-87 50 51 51  
E-mail: info\_GDK@grundfos.com  
www.grundfos.com/DK

**Estonia**

GRUNDFOS Pumps Eesti OÜ  
Peterburi tee 92G  
11415 Tallinn  
Tel: + 372 606 1690  
Fax: + 372 606 1691

**Finland**

OY GRUNDFOS Pumput AB  
Trukkikuja 1  
FI-01360 Vantaa  
Phone: +358-(0) 207 889 500

**France**

Pompes GRUNDFOS Distribution S.A.  
Parc d'Activités de Chesnes  
57, rue de Malacombe  
F-38290 St. Quentin Fallavier (Lyon)  
Tél.: +33-4 74 82 15 15  
Télécopie: +33-4 74 94 10 51

**Germany**

GRUNDFOS GMBH  
Schlüterstr. 33  
40699 Erkrath  
Tel.: +49-(0) 211 929 69-0  
Telefax: +49-(0) 211 929 69-3799  
e-mail: infoservice@grundfos.de  
Service in Deutschland:  
e-mail: kundendienst@grundfos.de

**Greece**

GRUNDFOS Hellas A.E.B.E.  
20th km. Athinon-Markopoulou Av.  
P.O. Box 71  
GR-19002 Peania  
Phone: +0030-210-66 83 400  
Telefax: +0030-210-66 46 273

**Hong Kong**

GRUNDFOS Pumps (Hong Kong) Ltd.  
Unit 1, Ground floor  
Siu Wai Industrial Centre  
29-33 Wing Hong Street &  
68 King Lam Street, Cheung Sha Wan  
Kowloon  
Phone: +852-27861706 / 27861741  
Telefax: +852-27858664

**Hungary**

GRUNDFOS Hungária Kft.  
Tópark u. 8  
H-2045 Törökbálint,  
Phone: +36-23 511 110  
Telefax: +36-23 511 111

**India**

GRUNDFOS Pumps India Private  
Limited  
118 Old Mahabalipuram Road  
Thoraipakkam  
Chennai 600 096  
Phone: +91-44 2496 6800

**Indonesia**

PT. GRUNDFOS POMPA  
Graha Intirub Lt. 2 & 3  
Jln. Cililitan Besar No.454. Makasar,  
Jakarta Timur  
ID-Jakarta 13650  
Phone: +62 21-469-51900  
Telefax: +62 21-460 6910 / 460 6901

**Ireland**

GRUNDFOS (Ireland) Ltd.  
Unit A, Merrywell Business Park  
Ballymount Road Lower  
Dublin 12  
Phone: +353-1-4089 800  
Telefax: +353-1-4089 830

**Italy**

GRUNDFOS Pompe Italia S.r.l.  
Via Gran Sasso 4  
I-20060 Truccazzano (Milano)  
Tel.: +39-02-95838112  
Telefax: +39-02-95309290 / 95838461

**Japan**

GRUNDFOS Pumps K.K.  
1-2-3, Shin-Miyakoda, Kita-ku,  
Hamamatsu  
431-2103 Japan  
Phone: +81 53 428 4760  
Telefax: +81 53 428 5005

**Korea**

GRUNDFOS Pumps Korea Ltd.  
6th Floor, Aju Building 679-5  
Yeoksam-dong, Kangnam-ku, 135-916  
Seoul, Korea  
Phone: +82-2-5317 600  
Telefax: +82-2-5633 725

**Latvia**

SIA GRUNDFOS Pumps Latvia  
Deglava biznesa centrs  
Augusta Deglava ielā 60, LV-1035, Rīga,  
Tālr.: + 371 714 9640, 7 149 641  
Fakss: + 371 914 9646

**Lithuania**

GRUNDFOS Pumps UAB  
Smolensko g. 6  
LT-03201 Vilnius  
Tel: + 370 52 395 430  
Fax: + 370 52 395 431

**Malaysia**

GRUNDFOS Pumps Sdn. Bhd.  
7 Jalan Peguam U1/25  
Glenmarie Industrial Park  
40150 Shah Alam  
Selangor  
Phone: +60-3-5569 2922  
Telefax: +60-3-5569 2866

**Mexico**

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

**Netherlands**

GRUNDFOS Netherlands  
Veluwezoom 35  
1326 AE Almere  
Postbus 22015  
1302 CA ALMERE  
Tel.: +31-88-478 6336  
Telefax: +31-88-478 6332  
E-mail: info\_gnl@grundfos.com

**New Zealand**

GRUNDFOS Pumps NZ Ltd.  
17 Beatrice Tinsley Crescent  
North Harbour Industrial Estate  
Albany, Auckland  
Phone: +64-9-415 3240  
Telefax: +64-9-415 3250

**Norway**

GRUNDFOS Pumper A/S  
Strømsveien 344  
Postboks 235, Leirdal  
N-1011 Oslo  
Tlf.: +47-22 90 47 00  
Telefax: +47-22 32 21 50

**Poland**

GRUNDFOS Pompy Sp. z o.o.  
ul. Klonowa 23  
Baranowo k. Poznania  
PL-62-081 Przeźmierowo  
Tel: (+48-61) 650 13 00  
Fax: (+48-61) 650 13 50

**Portugal**

Bombas GRUNDFOS Portugal, S.A.  
Rua Calvet de Magalhães, 241  
Apartado 1079  
P-2770-153 Paço de Arcos  
Tel.: +351-21-440 76 00  
Telefax: +351-21-440 76 90

**Romania**

Grundfos Pompe România SRL  
S-PARK BUSINESS CENTER, Clădirea  
A2, etaj 2, Str. Tipografilor, Nr. 11-15,  
Sector 1, Cod 013714, Bucuresti,  
Romania,  
Tel: 004 021 2004 100  
E-mail: romania@grundfos.ro  
www.grundfos.ro

**Russia**

ООО Грундфос Россия  
ул. Школьная, 39-41  
Москва, RU-109544, Russia  
Тел. (+7) 495 564-88-00 (495)  
737-30-00  
Факс (+7) 495 564 8811  
E-mail grundfos.moscow@grundfos.com

**Serbia**

Grundfos Srbija d.o.o.  
Omladinskih brigada 90b  
11070 Novi Beograd  
Phone: +381 11 2258 740  
Telefax: +381 11 2281 769  
www.rs.grundfos.com

**Singapore**

GRUNDFOS (Singapore) Pte. Ltd.  
25 Jalan Tukang  
Singapore 619264  
Phone: +65-6681 9688  
Telefax: +65-6681 9689

**Slovakia**

GRUNDFOS s.r.o.  
Prievozská 4D  
821 09 BRATISLAVA  
Phona: +421 2 5020 1426  
sk.grundfos.com

**Slovenia**

GRUNDFOS LJUBLJANA, d.o.o.  
Leskoškova 9e, 1122 Ljubljana  
Phone: +386 (0) 1 568 06 10  
Telefax: +386 (0) 1 568 06 19  
E-mail: tehnika-si@grundfos.com

**South Africa**

Grundfos (PTY) Ltd.  
16 Lascelles Drive, Meadowbrook Estate  
1609 Germiston, Johannesburg  
Tel.: (+27) 10 248 6000  
Fax: (+27) 10 248 6002  
E-mail: lgradidge@grundfos.com

**Spain**

Bombas GRUNDFOS España S.A.  
Camino de la Fuentecilla, s/n  
E-28110 Algete (Madrid)  
Tel.: +34-91-848 8800  
Telefax: +34-91-628 0465

**Sweden**

GRUNDFOS AB  
Box 333 (Lunnagårdsgatan 6)  
431 24 Mölndal  
Tel.: +46 31 332 23 000  
Telefax: +46 31 331 94 60

**Switzerland**

GRUNDFOS Pumpen AG  
Bruggacherstrasse 10  
CH-8117 Fällanden/ZH  
Tel.: +41-44-806 8111  
Telefax: +41-44-806 8115

**Taiwan**

GRUNDFOS Pumps (Taiwan) Ltd.  
7 Floor, 219 Min-Chuan Road  
Taichung, Taiwan, R.O.C.  
Phone: +886-4-2305 0868  
Telefax: +886-4-2305 0878

**Thailand**

GRUNDFOS (Thailand) Ltd.  
92 Chaloeam Phrakiat Rama 9 Road,  
Dokmai, Pravej, Bangkok 10250  
Phone: +66-2-725 8999  
Telefax: +66-2-725 8998

**Turkey**

GRUNDFOS POMPA San. ve Tic. Ltd. Sti.  
Gebze Organize Sanayi Bölgesi  
İhsan dede Caddesi,  
2. yol 200. Sokak No. 204  
41490 Gebze/ Kocaeli  
Phone: +90 - 262-679 7979  
Telefax: +90 - 262-679 7905  
E-mail: satis@grundfos.com

**Ukraine**

Бізнес Центр Європа  
Столичне шосе, 103  
м. Київ, 03131, Україна  
Телефон: (+38 044) 237 04 00  
Факс.: (+38 044) 237 04 01  
E-mail: ukraine@grundfos.com

**United Arab Emirates**

GRUNDFOS Gulf Distribution  
P.O. Box 16768  
Jebel Ali Free Zone  
Dubai  
Phone: +971 4 8815 166  
Telefax: +971 4 8815 136

**United Kingdom**

GRUNDFOS Pumps Ltd.  
Grovebury Road  
Leighton Buzzard/Beds. LU7 4TL  
Phone: +44-1525-850000  
Telefax: +44-1525-850011

**U.S.A.**

GRUNDFOS Pumps Corporation  
9300 Loiret Blvd.  
Lenexa, Kansas 66219  
Phone: +1-913-227-3400  
Telefax: +1-913-227-3500

**Uzbekistan**

Grundfos Tashkent, Uzbekistan The  
Representative Office of Grundfos  
Kazakhstan in Uzbekistan  
38a, Oybek street, Tashkent  
Телефон: (+998) 71 150 3290 / 71 150 3291  
Факс: (+998) 71 150 3292

Addresses Revised 09.09.2020

|                 |         |
|-----------------|---------|
| <b>98097396</b> | 10.2020 |
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