

LC 110, LCD 110

Installation and operating instructions

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GB Declaration of Conformity

We, Grundfos, declare under our sole responsibility that the products LC/LCD 107, LC/LCD 108, LC/LCD 109 and LC/LCD 110, to which this declaration relates, are in conformity with these Council directives on the approximation of the laws of the EC member states:

- Machinery Directive (2006/42/EC).
Standard used: EN 60204-1: 2006.
- Low Voltage Directive (2006/95/EC).
Standard used: EN 60439-1: 2004.
- EMC Directive (2004/108/EC).
Standards used: EN 61000-6-2: 2005 and EN 61000-6-3: 2007.

D Konformitätserklärung

Wir, Grundfos, erklären in alleiniger Verantwortung, dass die Produkte LC/LCD 107, LC/LCD 108, LC/LCD 109 und LC/LCD 110, auf die sich diese Erklärung bezieht, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EU-Mitgliedsstaaten übereinstimmen:

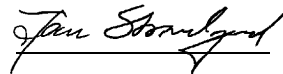
- Maschinenrichtlinie (2006/42/EG).
Norm, die verwendet wurde: EN 60204-1: 2006.
- Niederspannungsrichtlinie (2006/95/EG).
Norm, die verwendet wurde: EN 60439-1: 2004.
- EMV-Richtlinie (2004/108/EG).
Normen, die verwendet wurden: EN 61000-6-2: 2005 und EN 61000-6-3: 2007.

DK Overensstemmelseserklæring

Vi, Grundfos, erklærer under ansvar at produkterne LC/LCD 107, LC/LCD 108, LC/LCD 109 og LC/LCD 110 som denne erklæring omhandler, er i overensstemmelse med disse af Rådets direktiver om indbyrdes tilnærmelse til EF-medlemsstaternes lovgivning:

- Maskindirektivet (2006/42/EF).
Anvendt standard: EN 60204-1: 2006.
- Lavspændingsdirektivet (2006/95/EF).
Anvendt standard: EN 60439-1: 2004.
- EMC-direktivet (2004/108/EF).
Anvendte standarder: EN 61000-6-2: 2005 og 61000-6-3: 2007.

Bjerringbro, 15th June 2010



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LC 110, LCD 110

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Before beginning installation procedures, these installation and operating instructions should be studied carefully. The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

1. General – LC 110

The LC 110 controller is designed for the control of pumps in wastewater, water supply and drainage systems.

Type key:

Example	LC	110	400	3	23
LC = one-pump controller					
110 = type designation					
Phase voltage [V]					
1 = single-phase					
3 = three-phase					
Maximum operating current per pump [A]					

1.1 Applications

The LC 110 enables:

- control of one pump based on level signals from electrodes ,
- selection of automatic test run during long periods of inactivity (every 24 hours),
- battery back-up in case of mains supply failure (accessory for certain variants),
- starting delay within the range from 0 to 255 sec. (random) after returning from battery operation to mains operation (resulting in an even mains load when several pumping stations are started up at the same time),
- selection of automatic alarm resetting,
- selection of automatic restarting,
- setting of stop delays matching the actual operating conditions,
- indication of liquid level,
- alarm indication of:
 - inadmissibly high liquid level,
 - overload (via motor protection relay),
 - overtemperature (via thermal switch in motor),
 - wrong phase sequence (only three-phase versions),
 - mains supply failure (only certain variants),
 - dirty or defective electrode,
 - dry running.

As standard, the LC 110 has one alarm output for common alarm. Certain variants have an additional alarm output for separate high-level alarm.

Furthermore, the controller incorporates a buzzer (only certain variants).

1.2 Variants

The actual controller type, voltage variant, etc. are stated in the type key on the nameplate situated on the side of the controller cabinet.

The LC 110 is available for direct-on-line starting.

The LC 110 can be connected and set to operation/control in 3 different ways, see sections 3. to 5.:

- Section 3. *Systems with 2 levels (3 electrodes)*.
- Section 4. *Systems with 3 levels (4 electrodes)*.
- Section 5. *Systems with 4 levels (5 electrodes)*.

2. Location and mounting



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

The installation must be carried out by authorized personnel in accordance with local regulations.

2.1 Location



The LC 110 controller *must not* be installed in explosion hazard areas.

The LC 110 can be mounted at ambient temperatures ranging from -30 °C to +50 °C.

Enclosure class: IP 65.

When installed outdoors, the LC 110 must be placed in a protective shed or cupboard.

The LC 110 must not be exposed to direct sunlight.

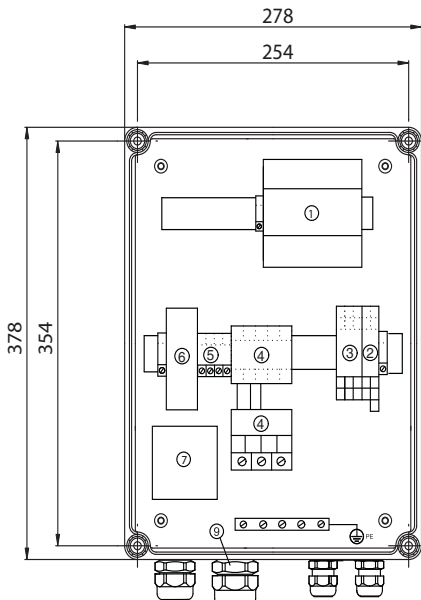
2.2 Mounting of LC 110

Before mounting, remove the transport protectors, if any, from inside the cabinet.

Mount the LC 110:

- on a plane wall surface,
- with the Pg cable entries pointing downwards (additional Pg cable entries, if required, must be fitted in the bottom plate of the cabinet),
- with four screws through the mounting holes in the back plate of the cabinet. The mounting holes must be bored with a 4 mm bore. Fit the mounting holes and tighten securely. Fit the plastic caps supplied with the controller on the screws (IP 65).

Figure 1 shows the *internal* construction of the LC 110.



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Fig. 1

Figure 2 shows the terminals listed under positions 2 and 3.

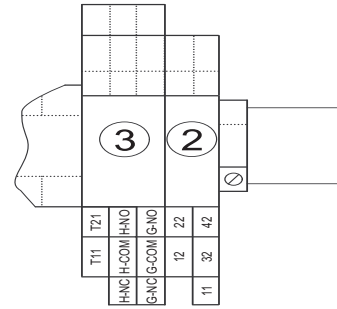


Fig. 2

Key to the symbols in figs. 1 and 2:

Pos.	Description
1	Module CU 213.
2	Terminal block for level inputs (11-12, 22, 32 and 42). Terminal block with: <ul style="list-style-type: none"> • input for the motor PTC resistor/thermal switch (T11-T21),
3	<ul style="list-style-type: none"> • input for the motor thermal switch (T11-T21), • output for external alarm device for high-level alarm (H-NC, H-COM, H-NO) (only certain variants), • output for external alarm device for common alarm (G-NC, G-COM, G-NO).
4	Motor protection relay (contacts and thermal relay fitted).
5	Terminal block for electricity supply.
6	Fuse holders for control circuit fuses (1 to 3 depending on voltage/current variant).
9	Pg cable entries.
10	Earth bar (⊕ PE).

Note: If the distance between the controller and pit exceeds 20 metres, it is not advisable to use electrodes as problems with the signal values sent back to the controller may arise.

In such cases, it is recommended to use float switches.

Note: Cables of up to 100 metres can be connected between the controller and the float switches.

3. Systems with 2 levels (3 electrodes)

Description (see also page 97):

The pump is controlled by the liquid level in the pit.

- The pump is started when the electrode, pos. 1, registers liquid.
- When the electrode, pos. 1, *no longer* registers liquid, the stop delay (can be set) is activated. After expiration of the stop delay, the pump is stopped.
- The top electrode, pos. 2, activates the high-level alarm.

Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.



Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

3.1 Electrical connection

Systems with 2 levels (3 electrodes), page 97.



Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0.

Any external voltage connected to the system must be switched off before work is started.

Figure A1 on page 97 shows all electrical connections required to connect the LC 110 for 2 levels (3 electrodes).



The LC 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. A1 on page 97:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for start/stop of pump.	12
2	Electrode for high-level alarm.	32

3.2 Setting

Systems with 2 levels (3 electrodes), page 97.

The module CU 213 has a 10-pole DIP switch in the bottom right corner, see fig. 3.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

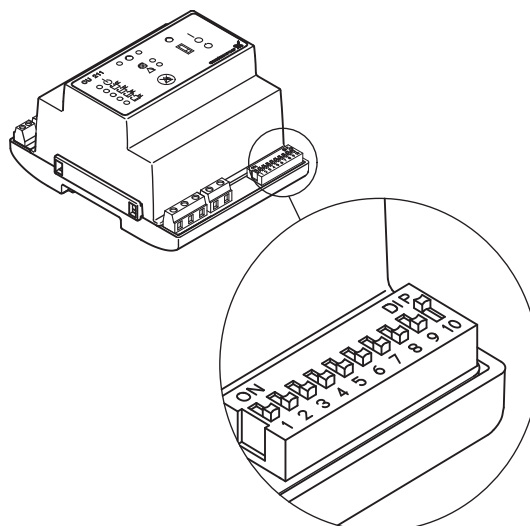


Fig. 3

Set the DIP switch as shown in fig. 3.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches 1, 2 and 3, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (2 levels (3 electrodes), page 97).

- Switch 4, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.

Automatic test run carried out every 24 hours.



After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.

No automatic test run.

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- Switches **5, 6 and 7**, stop delay:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.

It must be ensured that the pump is not running dry.

0 sec.		60 sec.	
15 sec.		90 sec.	
30 sec.		120 sec.	
45 sec.		180 sec.	

- Switch **8**:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (*2 levels (3 electrodes), page 97*), but this setting *must* be maintained!

- Switch **9**, automatic alarm resetting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.



At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 3.5).

- Switch **10**, automatic restarting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.



When the pump connected is used in an explosion hazard area, switch 10 *must not* be in this position!

At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 3.5).



When the pump connected is used in an explosion hazard area, switch 10 *must* be in this position!

3.3 Control panel

Systems with 2 levels (3 electrodes), page 97.

Figure 4 shows the control panel of the CU 213 module.

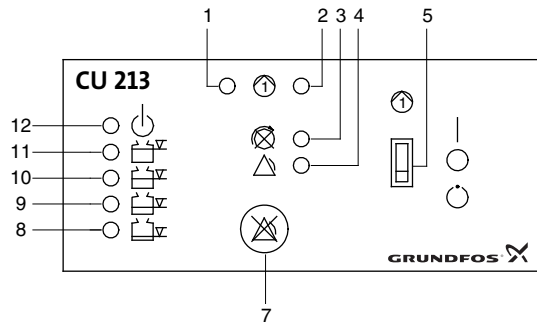


Fig. 4

Key to the symbols in fig. 4:

Pos.	Description
1	Green indicator light, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light, indicating pump fault Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch, three positions, see section 3.5.
7	Reset button, push-button for manual resetting of alarm signals to <i>external</i> alarm devices and the built-in buzzer (only certain variants), see section 3.5.
8	Orange indicator light, which is activated by the electrode for start/stop of pump.
9, 10 and 11	3 orange indicator lights, which are activated by the electrode for high-level alarm. In case of high-level alarm, the top indicator light is flashing and the two other indicator lights are permanently on.
12	Green indicator light, indicating that the electricity supply has been switched on.

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3.4 Battery back-up functions

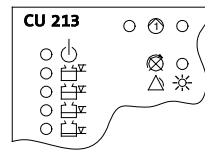
Systems with 2 levels (3 electrodes), page 97.

If a back-up battery for CU 213 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LC 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – *cannot* be reset!
- If the *external* alarm device for common alarm is supplied from an external power source, this device will be active – *cannot* be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the liquid level in the pit rises above the level for high-level alarm, the top **orange** indicator light will be **flashing** and the second **orange** indicator light from the top will be permanently on.
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 3.2.

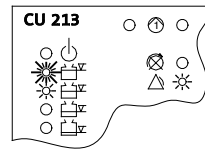
The table below shows the situations which may occur if the normal electricity supply to the LC 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊛ = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is *off*.

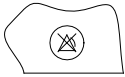


Mains supply failure *and* high-level alarm:

- The common alarm is active. The **red** indicator light is on.
- The top **orange** indicator light is **flashing**.
- The second **orange** indicator light from the top is on.
- The green indicator light (electricity supply switched on) is *off*.

3.5 Reset button and ON-OFF-AUTO selector switch

Systems with 2 levels (3 electrodes), page 97.



The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)). Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** has three different positions:

ON (|), top position:

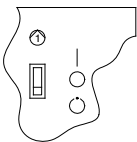
- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.



In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 3.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (⊚), the alarm indication will be repeated immediately.



AUTO (⊚), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 3.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 3.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

4. Systems with 3 levels (4 electrodes)

Description (see also page 98):

The pump is controlled by the liquid level in the pit.

- The electrode, pos. 2, starts the pump.
- The electrode, pos. 1, stops the pump. It is possible to set a "stop delay" which delays the stop of the pump.
- The top electrode, pos. 3, activates the high-level alarm.



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

4.1 Electrical connection

Systems with 3 levels (4 electrodes), page 98.



Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0.

Any external voltage connected to the system must be switched off before work is started.

Figure B1 on page 98 shows all electrical connections required to connect the LC 110 for 3 levels (4 electrodes).



The LC 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. B1 on page 98:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for stop of pump.	12
2	Electrode for start of pump.	22
3	Electrode for high-level alarm.	32

4.2 Setting

Systems with 3 levels (4 electrodes), page 98.

The module CU 213 has a 10-pole DIP switch in the bottom right corner, see fig. 5.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

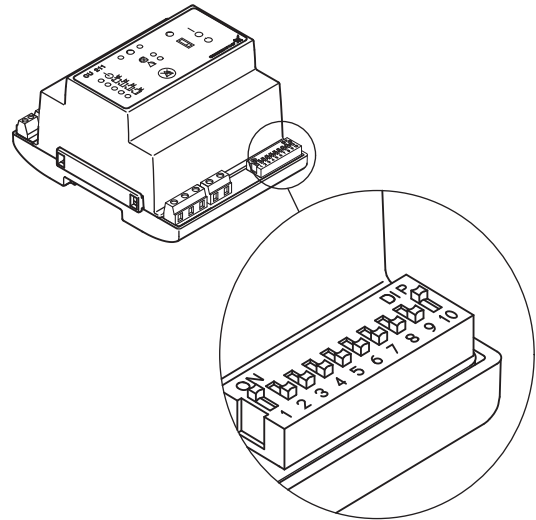


Fig. 5

Set the DIP switch as shown in fig. 5.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches 1, 2 and 3, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (3 levels (4 electrodes), page 98).

- Switch 4, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.
Automatic test run carried out every 24 hours.



After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.
No automatic test run.









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- Switches 5, 6 and 7, stop delay:

When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.

It must be ensured that the pump is not running dry.

0 sec. 	60 sec. 
15 sec. 	90 sec. 
30 sec. 	120 sec. 
45 sec. 	180 sec. 

- Switch 8:

When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (3 levels (4 electrodes), page 98), but this setting *must* be maintained!

- Switch 9, automatic alarm resetting:

When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.



At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 4.5).

- Switch 10, automatic restarting:

When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.



When the pump connected is used in an explosion hazard area, switch 10 *must not* be in this position!

At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 4.5).



When the pump connected is used in an explosion hazard area, switch 10 *must* be in this position!

4.3 Control panel

Systems with 3 levels (4 electrodes), page 98.

Figure 6 shows the control panel of the CU 213 module.

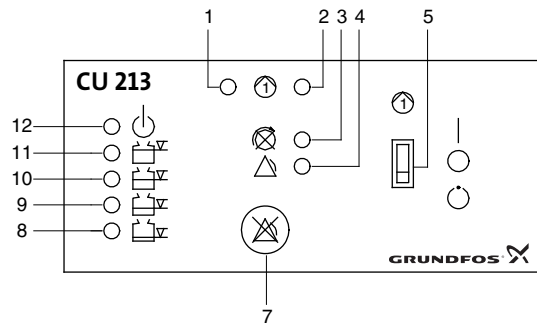


Fig. 6

Key to the symbols in fig. 6:

Pos.	Description
1	Green indicator light, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light, indicating pump fault. Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch, three positions, see section 4.5.
7	Reset button, push-button for manual resetting of alarm signals to external alarm devices and the built-in buzzer (only certain variants), see section 4.5.
8	Orange indicator light, which is activated by the electrode for stop of pump.
9	Orange indicator light, which is activated by the electrode for start of pump.
10 and 11	2 orange indicator lights, which are activated by the electrode for high-level alarm. In case of high-level alarm, the top indicator light is flashing and the other indicator light is permanently on.
12	Green indicator light, indicating that the electricity supply has been switched on.

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4.4 Battery back-up functions

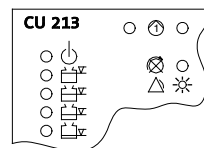
Systems with 3 levels (4 electrodes), page 98.

If a back-up battery for CU 213 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LC 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – *cannot* be reset!
- If the *external* alarm device for common alarm is supplied from an external power source, this device will be active – *cannot* be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the liquid level in the pit rises above the level for high-level alarm, the top **orange** indicator light will be **flashing** and the second **orange** indicator light from the top will be permanently on.
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 4.2.

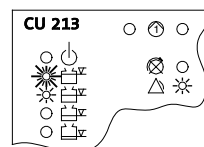
The table below shows the situations which may occur if the normal electricity supply to the LC 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊗ = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is *off*.



Mains supply failure *and* high-level alarm:

- The common alarm is active. The **red** indicator light is on.
- The top **orange** indicator light is **flashing**.
- The second **orange** indicator light from the top is on.
- The green indicator light (electricity supply switched on) is *off*.

4.5 Reset button and ON-OFF-AUTO selector switch

Systems with 3 levels (4 electrodes), page 98.



The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)).

Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** has three different positions:

ON (|), top position:

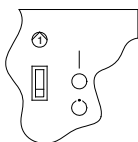
- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.



In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 4.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (○), the alarm indication will be repeated immediately.



AUTO (○), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 4.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 4.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

5. Systems with 4 levels (5 electrodes)

Description (see also page 99):

The pump is controlled by the liquid level in the pit.

- The electrode, pos. 3, starts the pump.
- The electrode, pos. 2, stops the pump. It is possible to set a "stop delay" which delays the stop of the pump.
- The top electrode, pos. 4, activates the high-level alarm.
- The bottom electrode, pos. 1, activates the dry-running alarm.



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

5.1 Electrical connection

Systems with 4 levels (5 electrodes), page 99.



Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0.

Any external voltage connected to the system must be switched off before work is started.

Figure C1 on page 99 shows all electrical connections required to connect the LC 110 for 4 levels (5 electrodes).



The LC 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. C1 on page 99:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for dry-running alarm.	12
2	Electrode for stop of pump.	22
3	Electrode for start of pump.	32
4	Electrode for high-level alarm.	42

5.2 Setting

Systems with 4 levels (5 electrodes), page 99.

The module CU 213 has a 10-pole DIP switch in the bottom right corner, see fig. 7.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

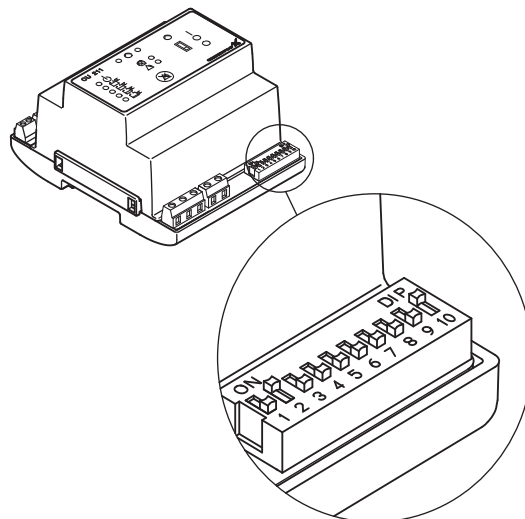


Fig. 7

Set the DIP switch as shown in fig. 7.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches 1, 2 and 3, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (4 levels (5 electrodes), page 99).

- Switch 4, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.
Automatic test run carried out every 24 hours.



After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.
No automatic test run.

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- Switches **5, 6 and 7**, stop delay:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.

It must be ensured that the pump is not running dry.

0 sec.		60 sec.	
15 sec.		90 sec.	
30 sec.		120 sec.	
45 sec.		180 sec.	

- Switch **8**:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (*4 levels (5 electrodes), page 99*), but this setting *must* be maintained!

- Switch **9**, automatic alarm resetting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.



At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 5.5).

- Switch **10**, automatic restarting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.



When the pump connected is used in an explosion hazard area, switch 10 *must not* be in this position!

At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 5.5).



When the pump connected is used in an explosion hazard area, switch 10 *must* be in this position!

5.3 Control panel

Systems with 4 levels (5 electrodes), page 99.

Figure 8 shows the control panel of the CU 213 module.

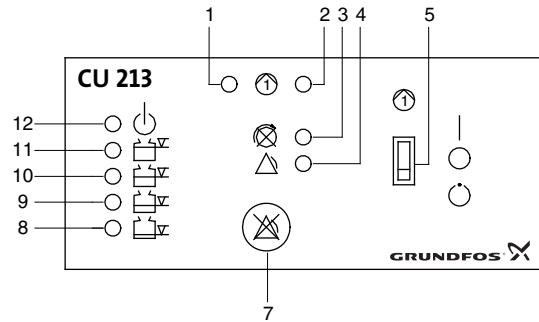


Fig. 8

Key to the symbols in fig. 8:

Pos.	Description
1	Green indicator light, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light, indicating pump fault. Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch, three positions, see section 5.5.
7	Reset button, push-button for manual resetting of alarm signals to <i>external</i> alarm devices and the built-in buzzer (only certain variants), see section 5.5.
8	Orange indicator light, which is activated by the electrode for dry-running alarm. In case of dry-running alarm, the indicator light is flashing. Under normal operating conditions, the indicator light is permanently on.
9	Orange indicator light, which is activated by the electrode for stop of pump.
10	Orange indicator light, which is activated by the electrode for start of pump.
11	Orange indicator light, which is activated by the electrode for high-level alarm. In case of high-level alarm, the indicator light is flashing.
12	Green indicator light, indicating that the electricity supply has been switched on.

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5.4 Battery back-up functions

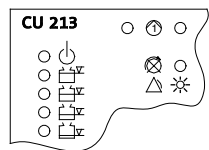
Systems with 4 levels (5 electrodes), page 99.

If a back-up battery for CU 213 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LC 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – *cannot* be reset!
- If the *external* alarm device for common alarm is supplied from an external power source, this device will be active – *cannot* be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the liquid level in the pit rises above the level for high-level alarm, the top **orange** indicator light will be **flashing** and the second **orange** indicator light from the top will be permanently on.
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 5.2.

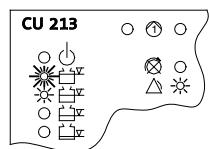
The table below shows the situations which may occur if the normal electricity supply to the LC 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊛ = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is *off*.



Mains supply failure *and* high-level alarm:

- The common alarm is active. The **red** indicator light is on.
- The top **orange** indicator light is **flashing**.
- The second **orange** indicator light from the top is on.
- The green indicator light (electricity supply switched on) is *off*.

5.5 Reset button and ON-OFF-AUTO selector switch

Systems with 4 levels (5 electrodes), page 99.



The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)).

Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** has three different positions:

ON (|), top position:

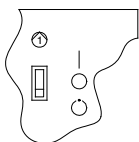
- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.



In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 5.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (○), the alarm indication will be repeated immediately.



AUTO (○), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 5.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 5.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

6. Start-up



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

Prior to start-up, the connection and DIP switch setting must have been carried out according to sections 3. to 5.

Start-up must be carried out by authorized personnel.

Proceed as follows:

1. Check whether the electrodes have been connected according to the wiring diagram for the actual application.
2. Check that the pump inlet is submerged in the liquid to be pumped.
3. Set the motor protection relay to the rated current stated on the nameplate.
4. Warning:



Set the motor-protective circuit breaker to the rated current stamped on the nameplate.

5. Switch on the electricity supply.

Three-phase pumps only: Check for wrong phase sequence (the pump cannot be started if the phase sequence is wrong!).
6. Start the pump, see section 3.5, 4.5 or 5.5.
7. Check that the pump is not running dry. The risk of dry running can be eliminated by a renewed time setting by means of the DIP switch (stop delay) according to section 3.2, 4.2 or 5.2 and/or by moving/shortening the electrodes.
8. **Three-phase pumps only:** Check whether the direction of rotation of the pump is correct according to the installation and operating instructions for the pump in question.
9. Select the required operating mode by means of the ON-OFF-AUTO selector switch, see section 3.5, 4.5 or 5.5.

7. Maintenance



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

During normal application and operation, the LC 110 controller is maintenance-free.

However, it is advisable to carry out minor checks of the LC 110 controller, pump pits, tanks, pumps, etc. at suitable intervals. These checks should be carried out by authorized personnel.

- Check the gaskets of the LC 110 cabinet front and those of the Pg cable entries.
- Check for possible deposits/sludge build-up in the pump pit/tank. Sludge may settle in areas with almost stagnant liquid.
- Check for beginning sludge build-up around the electrodes.
- Check for possible blockage on the suction side of the pump. A blockage will typically be a large solid object.
- If the LC 110 has been installed in a particularly aggressive environment, it is advisable to check the motor protection contacts in order to identify possible chemical attack resulting in corrosion. In typical installations, the motor protection contacts will work for several years and do not require any inspection.

Note: The above list is *not* complete. The LC 110 may be installed in systems, installations and/or environments which require thorough and regular maintenance.

8. Technical data – LC 110

Voltage variants, nominal voltages

- 1 x 230 V.
- 3 x 400 V.

Voltage tolerances

–15%/+10% of nominal voltage.

See also installation and operating instructions for the pump in question.

Mains frequency

50/60 Hz.

See also installation and operating instructions for the pump in question.

Supply system earthing

For TN systems and TT systems.

Rated insulation voltage, U_i

4 kV.

Rated impulse withstand voltage, U_{imp}

4 kV.

Back-up fuse

Depending on variant, see nameplate.

Control circuit fuse

Fine-wire fuse: 250 mA / F / 32 mm x Ø6 mm.

Ambient temperature

- During operation: –30 to +50 °C (must not be exposed to direct sunlight).
- In stock: –30 to +60 °C.

Enclosure class

IP 65.

EMC (electromagnetic compatibility)

According to EN 61 000-6-2 and EN 61 000-6-3.

LC 110 cabinet

- External dimensions:
Height = 410 mm, width = 278 mm, depth = 150 mm.
- Material: ABS (Acrylonitrile butadiene styrene)
- Weight: Depending on variant, see nameplate.

Outputs for alarm devices

Max. 230 VAC / max. 2 A / min. 10 mA / AC1.

9. Fault finding chart



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LC 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

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Fault	Cause	Remedy
1. The pump does not run.	a) No electricity supply. Without battery back-up: None of the indicator lights are on. With battery back-up (accessory for certain variants): See section 3.4, 4.4 or 5.4.	Switch on the electricity supply.
	b) The ON-OFF-AUTO selector switch is in position OFF (○), see section 3.5, 4.5 or 5.5.	Push the ON-OFF-AUTO selector switch into position ON () or AUTO (⊙).
	c) Control circuit fuses are blown.	Check and eliminate the cause. Replace the control circuit fuses (see pos. 6 in fig. 1).
	d) The motor protection relay has cut out the pump (the red indicator light for pump fault is permanently on).	Check the pump/pit.
	e) The motor thermal switch has cut out the pump (the red indicator light for pump fault is flashing).	Allow the pump to cool. After cooling, the pump will restart automatically unless the LC 110 has been set to manual restarting, see section 3.2, 4.2 or 5.2. If so, the ON-OFF-AUTO selector switch must be pushed into position OFF (○) for a short period. If the pump cutout was caused by choked-up electrodes, these must be cleaned or replaced.
	f) The control circuit for the motor protection relay has been broken or fails (the green indicator light indicating pump operation is permanently on, see section 3.3, 4.3 or 5.3).	Check the control circuit.
	g) Motor/supply cable is defective.	Check motor and cable.
	h) The electrodes are dirty or defective.	Check cables and electrodes.
	i) The CU 213 module is defective.	Replace the CU 213 module.
	j) The new DIP switch setting does not work correctly.	Switch off the electricity supply to the controller for 1 minute and switch it on again (normal procedure). See section 3.2, 4.2 or 5.2.
2. The pump is starting/stopping too frequently.	a) The electrodes are dirty or defective.	Check cables and electrodes.

See also installation and operating instructions for the pump in question.

10. Disposal

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

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

11. General – LCD 110

The LCD 110 controller is designed for the control of pumps in wastewater systems.

Type key:

Example	LCD	110	400	3	23
LCD = two-pump controller					
110 = type designation					
Phase voltage [V]					
1 = single-phase					
3 = three-phase					
Maximum operating current per pump [A]					

11.1 Applications

The LCD 110 enables:

- control of two pumps based on level signals from electrodes ,
- automatic pump changeover (even distribution of operating hours on both pumps),
- selection of automatic test run during long periods of inactivity (every 24 hours),
- battery back-up in case of mains supply failure (accessory for certain variants),
- starting delay within the range from 0 to 255 sec. (random) after returning from battery operation to mains operation (resulting in an even mains load when several pumping stations are started up at the same time),
- selection of automatic alarm resetting,
- selection of automatic restarting,
- setting of stop delays matching the actual operating conditions,
- indication of liquid level,
- alarm indication of:
 - inadmissibly high liquid level,
 - overload (via motor protection relay),
 - overtemperature (via thermal switch in motor),
 - wrong phase sequence (only three-phase versions),
 - mains supply failure (only certain variants),
 - dirty or defective electrode.

As standard, the LCD 110 has one alarm output for common alarm. Certain variants have an additional alarm output for separate high-level alarm.

Furthermore, the controller incorporates a buzzer (only certain variants).

11.2 Variants

The actual controller type, voltage variant, etc. are stated in the type key on the nameplate situated on the side of the controller cabinet.

The LCD 110 is available for direct-on-line starting.

The LCD 110 can be connected and set to operation/control in 4 different ways, see sections 13. to 16.:

- Section 13. Systems for parallel operation with 3 levels (4 electrodes).
- Section 14. Systems for parallel operation with 4 levels (5 electrodes).
- Section 15. Systems for 100 % standby operation with 4 levels (5 electrodes).
- Section 16. Systems for full-control operation with 4 levels (5 electrodes).

12. Location and mounting



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

The installation must be carried out by authorized personnel in accordance with local regulations.

12.1 Location



The LCD 110 controller *must not* be installed in explosion hazard areas.

The LCD 110 can be mounted at ambient temperatures ranging from -30 °C to +50 °C.

Enclosure class: IP 65.

When installed outdoors, the LCD 110 must be placed in a protective shed or cupboard.

The LCD 110 must not be exposed to direct sunlight.

12.2 Mounting of LCD 110

Before mounting, remove the transport protectors, if any, from inside the cabinet.

Mount the LCD 110:

- on a plane wall surface,
- with the Pg cable entries pointing downwards (additional Pg cable entries, if required, must be fitted in the bottom plate of the cabinet),
- with four screws through the mounting holes in the back plate of the cabinet. The mounting holes must be bored with a 4 mm bore. Fit the screws into the mounting holes and tighten securely. Fit the plastic caps supplied with the controller on the screws (IP 65).

Figure 9 shows the *internal* construction of the LCD 110.

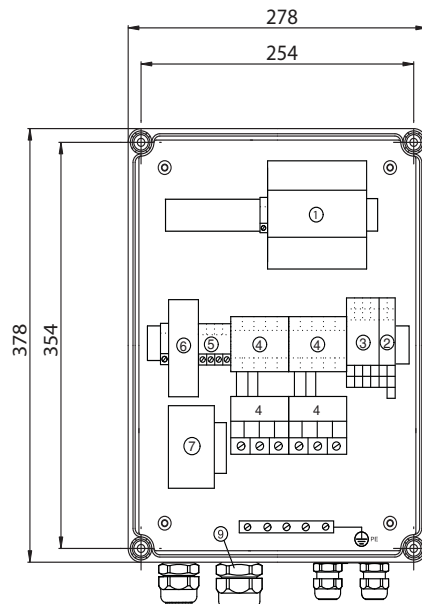


Fig. 9

Figure 10 shows the terminals listed under positions 2 and 3.

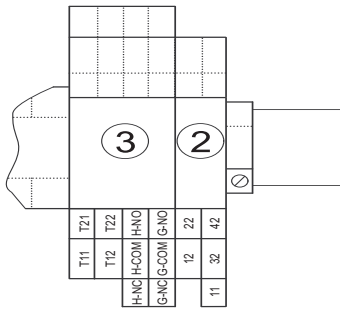


Fig. 10

Key to the symbols in figs. 9 and 10:

Pos.	Description
1	Module CU 214.
2	Terminal block for level inputs (11-12, 22, 32 and 42). Terminal block with: <ul style="list-style-type: none"> input for the motor PTC resistor/thermal switch (T11-T21, T12-T22), input for the motor thermal switch (T11-T21, T12-T22),
3	<ul style="list-style-type: none"> output for external alarm device for high-level alarm (H-NC, H-COM, H-NO) (only certain variants), output for external alarm device for common alarm (G-NC, G-COM, G-NO).
4	Motor protection relays, pumps 1 and 2 (contacts and thermal relay fitted).
5	Terminal block for electricity supply.
6	Fuse holders for control circuit fuses (1 to 3 depending on voltage/current variant).
7	Isolating transformer.
9	Pg cable entries.
10	Earth bar (⊕ PE).

13. Systems for parallel operation with 3 levels (4 electrodes)

Description (see also page 100):

The pumps are controlled by the liquid level in the pit.

- When the electrode, pos. 1, registers liquid, the first pump is started.
- When the electrode, pos. 2, registers liquid, the next pump is started.
- When the electrode, pos. 1, *does not* register any liquid, the “stop delay” is initiated (can be set). After expiration of the stop delay, both pumps are stopped.
- The pumps operate alternately.
- The top electrode, pos. 3, activates the high-level alarm.

Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.



Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

13.1 Electrical connection

Systems for parallel operation with 3 levels (4 electrodes), page 100.

Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0.



Any external voltage connected to the system must be switched off before work is started.

Figure D1 on page 100 shows all electrical connections required to connect the LCD 110 for *parallel operation with 3 levels (4 electrodes)*.



The LCD 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. D1 on page 100:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for start of the first pump/ common stop.	12
2	Electrode for start of the next pump.	22
3	Electrode for high-level alarm.	32

13.2 Setting

Systems for parallel operation with 3 levels (4 electrodes), page 100.

The module CU 214 has a 10-pole DIP switch in the bottom right corner, see fig. 11.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

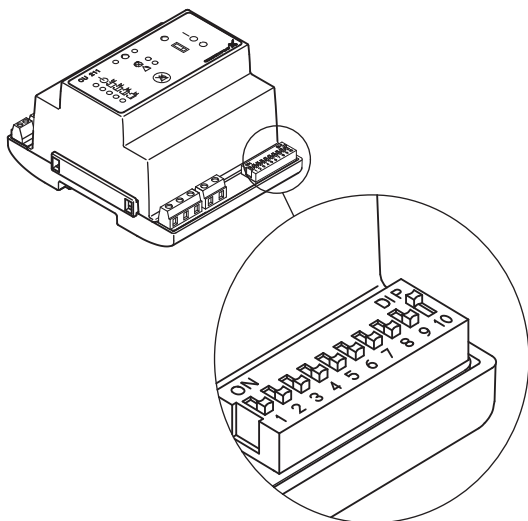


Fig. 11

Set the DIP switch as shown in fig. 11.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches 1, 2 and 3, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (*parallel operation with 3 levels (4 electrodes), page 100*).

- Switch 4, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.

Automatic test run carried out every 24 hours.



After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.

No automatic test run.

- Switches 5, 6 and 7, stop delay:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.

It must be ensured that the pump is not running dry.

0 sec.		60 sec.	
15 sec.		90 sec.	
30 sec.		120 sec.	
45 sec.		180 sec.	

- Switch 8:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (*parallel operation with 3 levels (4 electrodes), page 100*), but this setting *must* be maintained!

- Switch 9, automatic alarm resetting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.



At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 13.5).

- Switch 10, automatic restarting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.



When the pumps connected are used in explosion hazard areas, switch 10 *must not* be in this position!



At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 13.5).



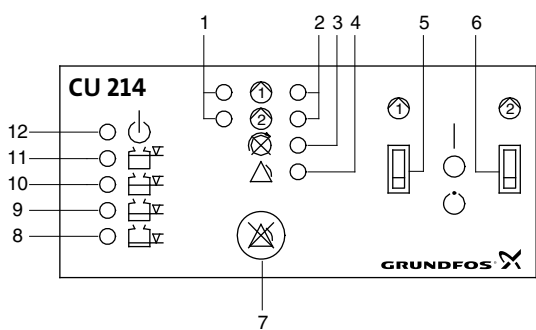
When the pumps connected are used in explosion hazard areas, switch 10 *must* be in this position!

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13.3 Control panel

Systems for parallel operation with 3 levels (4 electrodes), page 100.

Figure 12 shows the control panel of the CU 214 module.



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Fig. 12

Key to the symbols in fig. 12:

Pos.	Description
1	Green indicator light for pump 1 and 2, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light for pump 1 and 2, indicating pump fault. Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch for pump 1, three positions, see section 13.5.
6	ON-OFF-AUTO selector switch for pump 2, three positions, see section 13.5.
7	Reset button, push-button for manual resetting of alarm signals to external alarm devices and the built-in buzzer (only certain variants), see section 13.5.
8	Orange indicator light, which is activated by the electrode for start of the first pump/common stop.
9	Orange indicator light, which is activated by the electrode for start of the next pump.
10 and 11	Two orange indicator lights, which are activated by the electrode for high-level alarm. In case of high-level alarm, the top indicator light is flashing and the other is permanently on.
12	Green indicator light, indicating that the electricity supply has been switched on.

13.4 Battery back-up functions

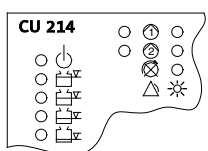
Systems for parallel operation with 3 levels (4 electrodes), page 100.

If a back-up battery for CU 214 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LCD 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – cannot be reset!
- If the external alarm device for common alarm is supplied from an external power source, this device will be active – cannot be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the liquid level in the pit rises above the level for high-level alarm, the top **orange** indicator light will be **flashing** and the second **orange** indicator light from the top will be permanently on.
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 13.2.

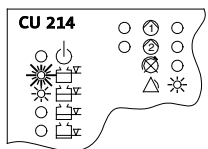
The table below shows the situations which may occur if the normal electricity supply to the LCD 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊛ = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is off.



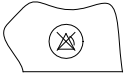
Mains supply failure and high-level alarm:

- The common alarm is active. The **red** indicator light is on.
- The top **orange** indicator light is **flashing**.
- The second **orange** indicator light from the top is on.
- The green indicator light (electricity supply switched on) is off.

13.5 Reset button and ON-OFF-AUTO selector switch

Systems for parallel operation with 3 levels (4 electrodes),
page 100.

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The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)).

Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** for each pump has three different positions:

ON (|), top position:

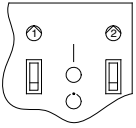
- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.



In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 13.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (○), the alarm indication will be repeated immediately.



AUTO (○), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 13.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 13.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

14. Systems for parallel operation with 4 levels (5 electrodes)

Description (see also page 101):

The pumps are controlled by the liquid level in the pit.

- The electrode, pos. 2, starts the first pump.
- The electrode, pos. 3, starts the next pump.
- The electrode, pos. 1, stops both pumps after expiration of the "stop delay" (can be set).
- The pumps operate alternately.
- The top electrode, pos. 4, activates the high-level alarm.

Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.



Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

14.1 Electrical connection

Systems for parallel operation with 4 levels (5 electrodes), page 101.



Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0. Any external voltage connected to the system must be switched off before work is started.

Figure E1 on page 101 shows all electrical connections required to connect the LCD 110 for parallel operation with 4 levels (5 electrodes).



The LCD 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. E1 on page 101:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for common stop.	12
2	Electrode for start of the first pump.	22
3	Electrode for start of the next pump.	32
4	Electrode for high-level alarm.	42

14.2 Setting

Systems for parallel operation with 4 levels (5 electrodes), page 101.

The module CU 214 has a 10-pole DIP switch in the bottom right corner, see fig. 13.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

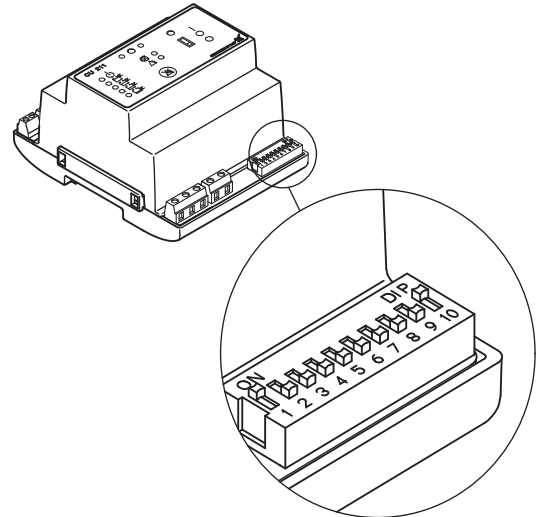


Fig. 13

Set the DIP switch as shown in fig. 13.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches **1, 2** and **3**, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (parallel operation with 4 levels (5 electrodes), page 101).

- Switch **4**, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.

Automatic test run carried out every 24 hours.











After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.

No automatic test run.

- Switches **5, 6 and 7**, stop delay:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.

It must be ensured that the pump is not running dry.

0 sec.		60 sec.	
15 sec.		90 sec.	
30 sec.		120 sec.	
45 sec.		180 sec.	

- Switch **8**:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (*parallel operation with 4 levels (5 electrodes), page 101*), but this setting *must* be maintained!

- Switch **9**, automatic alarm resetting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.




At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 14.5).

- Switch **10**, automatic restarting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!




This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.

 When the pumps connected are used in explosion hazard areas, switch 10 *must not* be in this position!



At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 14.5).

 When the pumps connected are used in explosion hazard areas, switch 10 *must* be in this position!

14.3 Control panel

Systems for parallel operation with 4 levels (5 electrodes), page 101.

Figure 14 shows the control panel of the CU 214 module.

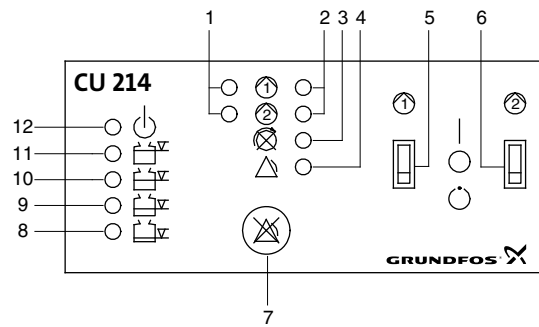


Fig. 14

Key to the symbols in fig. 6:

Pos.	Description
1	Green indicator light for pump 1 and 2, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light for pump 1 and 2, indicating pump fault. Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch for pump 1, three positions, see section 14.5.
6	ON-OFF-AUTO selector switch for pump 2, three positions, see section 14.5.
7	Reset button, push-button for manual resetting of alarm signals to <i>external</i> alarm devices and the built-in buzzer (only certain variants), see section 14.5.
8	Orange indicator light, which is activated by the electrode for common stop.
9	Orange indicator light, which is activated by the electrode for start of the first pump.
10	Orange indicator light, which is activated by the electrode for start of the next pump.
11	Orange indicator light, which is activated by the electrode for high-level alarm. In case of high-level alarm, the indicator light is flashing.
12	Green indicator light, indicating that the electricity supply has been switched on.

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14.4 Battery back-up functions

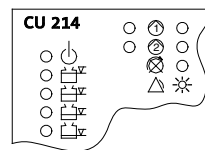
Systems for parallel operation with 4 levels (5 electrodes), page 101.

If a back-up battery for CU 214 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LCD 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – *cannot* be reset!
- If the *external* alarm device for common alarm is supplied from an external power source, this device will be active – *cannot* be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the liquid level in the pit rises above the level for high-level alarm, the top **orange** indicator light will be **flashing** and the second **orange** indicator light from the top will be permanently on.
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 14.2.

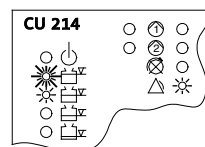
The table below shows the situations which may occur if the normal electricity supply to the LCD 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊛ = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is *off*.



Mains supply failure *and* high-level alarm:

- The common alarm is active. The **red** indicator light is on.
- The top **orange** indicator light is **flashing**.
- The second **orange** indicator light from the top is on.
- The green indicator light (electricity supply switched on) is *off*.

14.5 Reset button and ON-OFF-AUTO selector switch

Systems for parallel operation with 4 levels (5 electrodes), page 101.



The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)).

Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** for each pump has three different positions:

ON (|), top position:

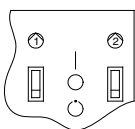
- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.



In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 14.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (○), the alarm indication will be repeated immediately.



AUTO (○), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 14.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 14.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

15. Systems for 100 % standby operation with 4 levels (5 electrodes)

Description (see also page 102):

The pumps are controlled by the liquid level in the pit.

- The electrode, pos. 2, starts the first pump.
- The electrode, pos. 4, starts the next pump.
- The electrode, pos. 1, stops both pumps after expiration of the "stop delay" (can be set).
- The pumps operate alternately.
- The electrode, pos. 3, activates the high-level alarm.

Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.



Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

15.1 Electrical connection

Systems for 100% standby operation with 4 levels (5 electrodes), page 102.



Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0. Any external voltage connected to the system must be switched off before work is started.

Figure F1 on page 102 shows all electrical connections required to connect the LCD 110 for 100% standby operation with 4 levels (5 electrodes).



The LCD 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. F1 on page 102:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for common stop.	12
2	Electrode for start of the first pump.	22
3	Electrode for high-level alarm.	32
4	Electrode for start of the next pump.	42

15.2 Setting

Systems for 100% standby operation with 4 levels (5 electrodes), page 102.

The module CU 214 has a 10-pole DIP switch in the bottom right corner, see fig. 15.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

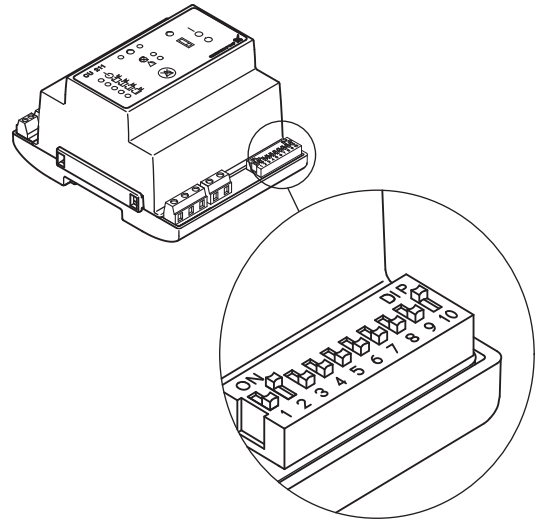


Fig. 15

Set the DIP switch as shown in fig. 15.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches **1, 2** and **3**, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (100% standby operation with 4 levels (5 electrodes), page 102).

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- Switch 4, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.

Automatic test run carried out every 24 hours.



After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.

No automatic test run.

- Switches 5, 6 and 7, stop delay:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.

It must be ensured that the pump is not running dry.

0 sec.		60 sec.	
15 sec.		90 sec.	
30 sec.		120 sec.	
45 sec.		180 sec.	

- Switch 8:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (*100% standby operation with 4 levels (5 electrodes)*, page 102), but this setting *must* be maintained!

- Switch 9, automatic alarm resetting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.



At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 15.5).

- Switch 10, automatic restarting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.



When the pumps connected are used in explosion hazard areas, switch 10 *must not* be in this position!



At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 15.5).



When the pumps connected are used in explosion hazard areas, switch 10 *must* be in this position!

15.3 Control panel

Systems for 100% standby operation with 4 levels (5 electrodes), page 102.

Figure 16 shows the control panel of the CU 214 module.

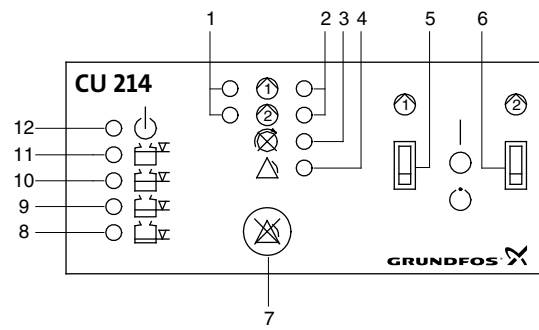


Fig. 16

Key to the symbols in fig. 16:

Pos.	Description
1	Green indicator light for pump 1 and 2, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light for pump 1 and 2, indicating pump fault. Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch for pump 1, three positions, see section 15.5.
6	ON-OFF-AUTO selector switch for pump 2, three positions, see section 15.5.
7	Reset button, push-button for manual resetting of alarm signals to <i>external</i> alarm devices and the built-in buzzer (only certain variants), see section 15.5.
8	Orange indicator light, which is activated by the electrode for common stop.
9	Orange indicator light, which is activated by the electrode for start of the first pump.
10	Orange indicator light, which is activated by the electrode for high-level alarm. In case of high-level alarm, the indicator light is flashing.
11	Orange indicator light, which is activated by the electrode for start of the next pump.
12	Green indicator light, indicating that the electricity supply has been switched on.

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15.4 Battery back-up functions

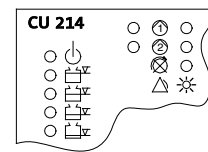
Systems for 100% standby operation with 4 levels (5 electrodes), page 102.

If a back-up battery for CU 214 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LCD 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – *cannot* be reset!
- If the *external* alarm device for common alarm is supplied from an external power source, this device will be active – *cannot* be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the liquid level in the pit rises above the level for high-level alarm, the second **orange** indicator light from the top will be **flashing**. If the liquid level is higher than the level for start of the next pump, the top **orange** indicator light will be permanently on.
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 15.2.

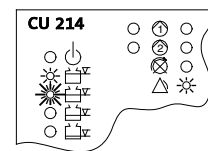
The table below shows the situations which may occur if the normal electricity supply to the LCD 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊗* = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is *off*.

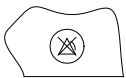


Mains supply failure *and* high-level alarm:

- The common alarm is active. The **red** indicator light is on.
- The top **orange** indicator light is on.
- The second **orange** indicator light from the top is **flashing**.
- The green indicator light (electricity supply switched on) is *off*.

15.5 Reset button and ON-OFF-AUTO selector switch

Systems for 100% standby operation with 4 levels (5 electrodes), page 102.



The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)).

Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** for each pump has three different positions:

ON (|), top position:

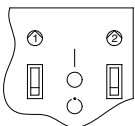
- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.



In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 15.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (○), the alarm indication will be repeated immediately.



AUTO (○), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 15.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 15.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

16. Systems for full-control operation with 4 levels (5 electrodes)

Description (see also page 103):

The pumps are controlled by the liquid level in the pit.

- The electrode, pos. 3, starts the first pump.
- The electrode, pos. 4, starts the next pump.
- The electrode, pos. 2, stops the last pump but one and the electrode, pos. 1, stops the last pump. It is possible to set a "stop delay" which delays the stop of the pumps.
- The pumps operate alternately.

Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.



Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

16.1 Electrical connection

Systems for full-control operation with 4 levels (5 electrodes), page 103.



Before starting work on the system, switch off the supply voltage and lock the mains switch in position 0.

Any external voltage connected to the system must be switched off before work is started.

Figure G1 on page 103 shows all electrical connections required to connect the LCD 110 for full-control operation with 4 levels (5 electrodes).



The LCD 110 must be connected in accordance with the rules and standards in force for the application in question.

The operating voltage and frequency are marked on the controller nameplate. Make sure that the controller is suitable for the electricity supply on which it will be used.

All cables/wires must be fitted through the Pg cable entries and gaskets (IP 65).

Maximum back-up fuse is stated on the controller nameplate.

If required according to local regulations, an external mains switch must be installed.

Note: If the motor PTC resistor/thermal switch is connected, the factory-fitted short-circuit jumper *must be removed* (terminals T11-T21). For correct installation of PTC resistor/thermal switch, see the installation and operating instructions of the pump.

Key to the symbols in fig. G1 on page 103:

Pos.	Description	Terminal number
R	Reference electrode.	11
1	Electrode for stop of the last pump.	12
2	Electrode for stop of the last pump but one.	22
3	Electrode for start of the first pump.	32
4	Electrode for start of the next pump.	42

16.2 Setting

Systems for full-control operation with 4 levels (5 electrodes), page 103.

The module CU 214 has a 10-pole DIP switch in the bottom right corner, see fig. 17.

Note: During setting, the controller must be off circuit for at least 1 minute to ensure the correct configuration during start-up after change of the DIP switch setting.

The DIP switch setting offers the following possibilities:

- selection of starting delay and automatic test run (switch 4),
- setting of stop delay (switches 5, 6 and 7),
- selection of automatic alarm resetting (switch 9),
- selection of automatic restarting (switch 10).

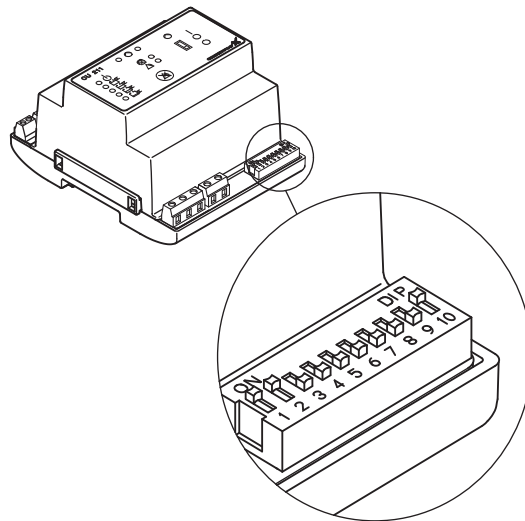


Fig. 17

Set the DIP switch as shown in fig. 17.

Each individual switch (1 to 10) of the DIP switch can be set to position OFF or ON.

Note: The DIP switch *must not* be set to other switch combinations than those described in this section.

Set the switches 1 to 10 as follows:

- Switches **1, 2 and 3**, application type:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting determines the actual application type (full-control operation with 4 levels (5 electrodes), page 103).

- Switch **4**, starting delay and automatic test run (only in the case of battery back-up):
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



At this setting, the start-up is delayed within the range from 0 to 255 sec. (random) after the electricity supply has been switched on *when* the liquid level is sufficiently high.
Automatic test run carried out every 24 hours.











After the electricity has been switched on, the pump will start immediately *when* the liquid level is sufficiently high.
No automatic test run.

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- Switches **5, 6 and 7**, stop delay:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!

The **stop delay** is the time from the stop signal is given until the pump is stopped.*

It must be ensured that the pump is not running dry.

0 sec. 	60 sec. 
15 sec. 	90 sec. 
30 sec. 	120 sec. 
45 sec. 	180 sec. 

* The stop delay applies to both stop electrodes, pos. 1 and 2, on page 103. If the two stop electrodes are placed so close to each other that the stop delay for the upper stop electrode has *not* expired before the liquid level reached the lower stop electrode, then both pumps will not be stopped until the stop delay for the lower stop electrode has expired.

- Switch **8**:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



Switch 8 has no function in connection with the actual application (*full-control operation with 4 levels (5 electrodes), page 103*), but this setting *must* be maintained!

- Switch **9**, automatic alarm resetting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting ensures automatic resetting of alarm signals to external alarm devices and the built-in buzzer. However, an alarm signal will only be reset if the cause of the fault no longer exists.



At this setting, the alarm signal must be reset manually by means of the reset button (the reset button is described in section 16.5).

- Switch **10**, automatic restarting:
When the DIP switch setting is changed, the controller must be switched off for at least 1 minute!



This setting enables automatic restarting after the motor thermal switch has cut out the pump. Restarting will not be carried out until the motor has cooled to normal temperature.



When the pumps connected are used in explosion hazard areas, switch 10 *must not* be in this position!



At this setting, the pump must be restarted manually after the motor thermal switch has cut out the pump. To restart the pump, push the ON-OFF-AUTO selector switch into position OFF for a short period (the ON-OFF-AUTO selector switch is described in section 16.5).



When the pumps connected are used in explosion hazard areas, switch 10 *must* be in this position!

16.3 Control panel

Systems for full-control operation with 4 levels (5 electrodes), page 103.

Figure 18 shows the control panel of the CU 214 module.

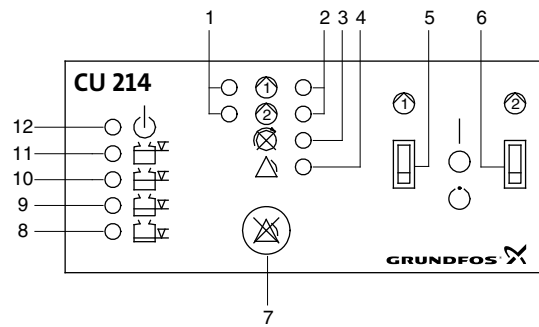


Fig. 18

Key to the symbols in fig. 18:

Pos.	Description
1	Green indicator light for pump 1 and 2, indicating starting delay (flashing) and pump operation (permanently on).
2	Red indicator light for pump 1 and 2, indicating pump fault. Flashing: Fault in PTC resistor/thermal switch On: Fault in motor-protective circuit breaker.
3	Red indicator light, indicating wrong phase sequence (only certain variants and three-phase pumps only).
4	Red indicator light, indicating common alarm.
5	ON-OFF-AUTO selector switch for pump 1, three positions, see section 16.5.
6	ON-OFF-AUTO selector switch for pump 2, three positions, see section 16.5.
7	Reset button, push-button for manual resetting of alarm signals to <i>external</i> alarm devices and the built-in buzzer (only certain variants), see section 16.5.
8	Orange indicator light, which is activated by the electrode for stop of the last pump.
9	Orange indicator light, which is activated by the electrode for stop of the last pump but one.
10	Orange indicator light, which is activated by the electrode for start of the first pump.
11	Orange indicator light, which is activated by the electrode for start of the next pump.
12	Green indicator light, indicating that the electricity supply has been switched on.

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16.4 Battery back-up functions

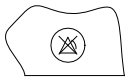
Systems for full-control operation with 4 levels (5 electrodes), page 103.

If a back-up battery for CU 214 (accessory for certain variants) is installed, the following functions will be carried out if the normal electricity supply to the LCD 110 fails (see also the illustrations below):

- The common alarm is active, the **red** indicator light is on – *cannot* be reset!
- If the *external* alarm device for common alarm is supplied from an external power source, this device will be active – *cannot* be reset by means of the reset button!
- The built-in buzzer (only certain variants) is activated – can be reset by means of the reset button!
- If the starting delay function and automatic test run were selected (switch 4 of the DIP switch), the start-up will be delayed after the electricity supply has been switched on when the liquid level is sufficiently high, see section 16.2.

16.5 Reset button and ON-OFF-AUTO selector switch

Systems for full-control operation with 4 levels (5 electrodes), page 103.




The **reset button** is a push-button for manual resetting of alarm signals to *external* alarm devices and the built-in buzzer (i.e. *not* for resetting of the alarm memory as this is reset by means of the ON-OFF-AUTO selector switch, see position OFF (○)). Even if the fault condition still exists, the *external* alarm devices and the built-in buzzer will be reset when the reset button is pressed.

The **ON-OFF-AUTO selector switch** for each pump has three different positions:

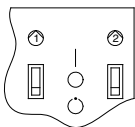
ON (|), top position:

- The pump will start when the selector switch is pushed into this position (unless the motor protection relay has cut out the pump).
- If the motor thermal switch registers overtemperature, the pump will be switched off.

 In explosion hazard areas, switch 10 of the DIP switch *must* be set as stated in section 16.2. Consequently, the pump *cannot* be started when the motor thermal switch registers overtemperature.

OFF (○), middle position:

- The pump *cannot* start when the selector switch has been set to this position.
- The alarm memory is reset by pushing the selector switch into position OFF (○). The alarm memory is the light indication of a fault condition which has disappeared. If a fault condition still exists when the selector switch is pushed into position ON (|) or AUTO (◐), the alarm indication will be repeated immediately.

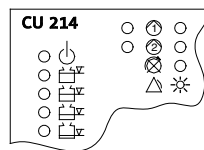


AUTO (◐), bottom position:

- The pump is controlled by the input signals from the electrodes and the pump according to the selected DIP switch setting.
- Alarm signals will automatically be reset. Switch 9 of the DIP switch can, however, be set to manual resetting which is carried out by means of the reset button, see section 16.2.
- The pump will restart automatically when a given fault condition disappears. However, this is dependent on the setting of switch 10 of the DIP switch, see section 16.2.
- When the pump starts automatically after a fault condition which has disappeared, the indicator light will continue to show the fault condition (alarm memory) and the indication can only be removed by resetting the alarm memory, see position OFF (○).

The table below shows the situation which may occur if the normal electricity supply to the LCD 110 fails and a back-up battery is connected:

- = the indicator light is off.
- ⊗ = the indicator light is on.
- ⊛ = the indicator light is flashing.



Mains supply failure:

- The common alarm is active. The **red** indicator light is on.
- The green indicator light (electricity supply switched on) is *off*.

17. Start-up



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

Prior to start-up, the connection and DIP switch setting must have been carried out according to sections 13. to 16.

Start-up must be carried out by authorized personnel.

Proceed as follows:

1. Check whether the electrodes have been connected according to the wiring diagram for the actual application.
2. Check that the pump inlets are submerged in the liquid to be pumped.
3. Set the motor protection relays to the rated current stated on the nameplates.
4. Warning:



Set the motor-protective circuit breakers to the rated current stamped on the nameplates.

5. Switch on the electricity supply.
 - Three-phase pumps only:** Check for wrong phase sequence (the pump cannot be started if the phase sequence is wrong!).
6. Start the pumps, see section 13.5, 14.5, 15.5 or 16.5.
7. Check that the pumps are not running dry. The risk of dry running can be eliminated by a renewed time setting by means of the DIP switch (stop delay) according to section 13.2, 14.2, 15.2 or 16.2 and/or by moving/shortening the electrodes.
8. **Three-phase pumps only:** Check whether the direction of rotation of the pumps is correct according to the installation and operating instructions for the pumps in question.
9. Select the required operating mode by means of the ON-OFF-AUTO selector switch, see section 13.5, 14.5, 15.5 or 16.5.

18. Maintenance



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

During normal application and operation, the LCD 110 controller is maintenance-free.

However, it is advisable to carry out minor checks of the LCD 110 controller, pump pits, tanks, pumps, etc. at suitable intervals. These checks should be carried out by authorized personnel.

- Check the gaskets of the LCD 110 cabinet front and those of the Pg cable entries.
- Check for possible deposits/sludge build-up in the pump pit/tank. Sludge may settle in areas with almost stagnant liquid.
- Check for beginning sludge build-up around the electrodes.
- Check for possible blockage on the suction side of the pump. A blockage will typically be a large solid object.
- If the LCD 110 has been installed in a particularly aggressive environment, it is advisable to check the motor protection contacts in order to identify possible chemical attack resulting in corrosion. In typical installations, the motor protection contacts will work for several years and do not require any inspection.

Note: The list above is *not* complete. The LCD 110 may be installed in systems, installations and/or environments which require thorough and regular maintenance.

19. Technical data – LCD 110

Voltage variants, nominal voltages

- 1 x 230 V.
- 3 x 400 V.

Voltage tolerances

–15%/+10% of nominal voltage.

See also installation and operating instructions for the pump in question.

Mains frequency

50/60 Hz.

See also installation and operating instructions for the pump in question.

Supply system earthing

For TN systems and TT systems.

Rated insulation voltage, U_i

4 kV.

Rated impulse withstand voltage, U_{imp}

4 kV.

Back-up fuse

Depending on variant, see nameplate.

Control circuit fuse

Fine-wire fuse: 250 mA / F / 32 mm x \varnothing 6 mm.

Ambient temperature

- During operation: –30 to +50 °C (must not be exposed to direct sunlight).
- In stock: –30 to +60 °C.

Enclosure class

IP 65.

EMC (electromagnetic compatibility)

According to EN 61 000-6-2 and EN 61 000-6-3.

LCD 110 cabinet

- External dimensions:
Height = 410 mm, width = 278 mm, depth = 150 mm.
- Material: Technopolymer and polycarbonate.
- Weight: Approx. 5 kg, depending on variant, see nameplate.

Outputs for alarm devices

Max. 230 VAC / max. 2 A / min. 10 mA / AC1.

20. Fault finding chart



Before starting any work on pumps used to pump liquids which could be constituted as being hazardous to health, thorough cleaning/venting of pumps, pits, etc. must be carried out according to local regulations.

Before making any connections in the LCD 110 or work on pumps, pits, etc., it must be ensured that the electricity supply has been switched off and that it cannot be accidentally switched on.

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Fault	Cause	Remedy
1. The pumps do not run.	a) No electricity supply. Without battery back-up: None of the indicator lights are on. With battery back-up (accessory for certain variants): See section 13.4, 14.4, 15.4 or 16.4.	Switch on the electricity supply.
	b) The ON-OFF-AUTO selector switch is in position OFF (○), see section 13.5, 14.5, 15.5 or 16.5.	Push the ON-OFF-AUTO selector switch into position ON () or AUTO (⊙).
	c) Control circuit fuses are blown.	Check and eliminate the cause. Replace the control circuit fuses (see pos. 6 in fig. 9).
	d) The motor protection relays have cut out the pumps (the red indicator light for pump fault is permanently on).	Check the pump/pit.
	e) The motor thermal switch has cut out the pump (the red indicator light for pump fault is flashing).	Allow the pump to cool. After cooling, the pump will restart automatically unless the LCD 110 has been set to manual restarting, see section 13.2, 14.2, 15.2 or 16.2. If so, the ON-OFF-AUTO selector switch must be pushed into position OFF (○) for a short period. If the pump cutout was caused by choked-up electrodes, these must be cleaned or replaced.
	f) The control circuit for the motor protection relays has been broken or fails (the green indicator light indicating pump operation is permanently on, see section 13.3, 14.3, 15.3 or 16.3).	Check the control circuit.
	g) Motor/supply cable is defective.	Check motor and cable.
	h) The electrodes are dirty or defective.	Check cables and electrodes.
	i) The CU 214 module is defective.	Replace the CU 214 module.
	j) The new DIP switch setting does not work correctly.	Switch off the electricity supply to the controller for 1 minute and switch it on again (normal procedure). See section 13.2, 14.2, 15.2 or 16.2.
2. The pumps are starting/stopping too frequently.	a) The electrodes are dirty or defective.	Check cables and electrodes.

See also installation and operating instructions for the pump in question.

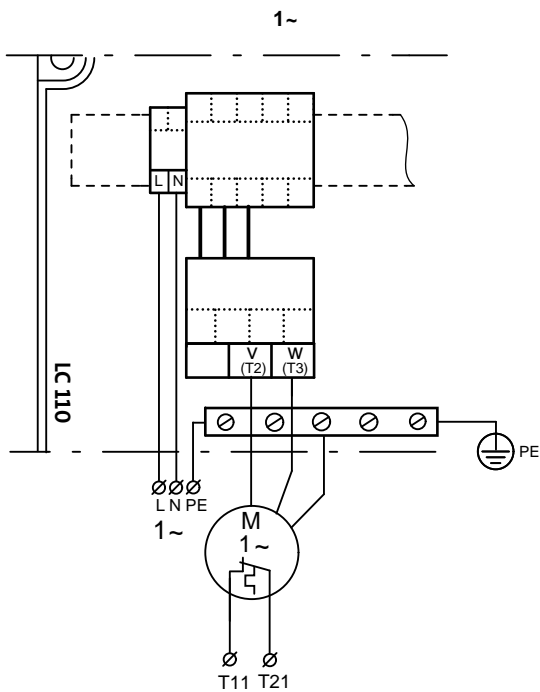
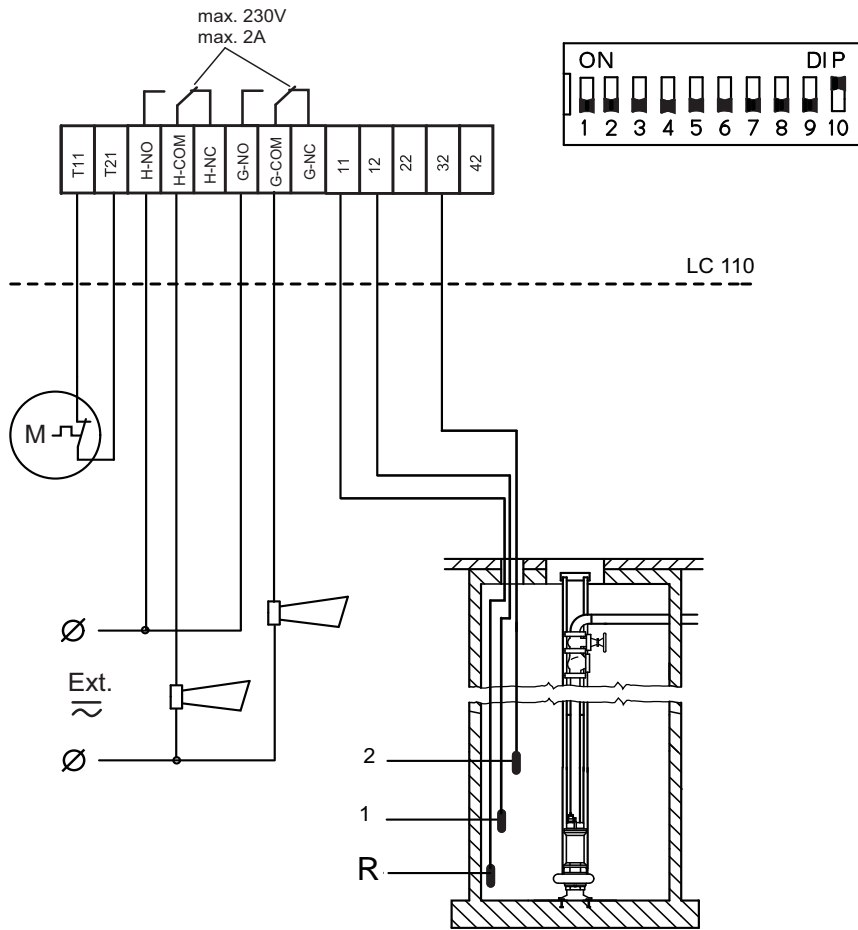
21. Disposal

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

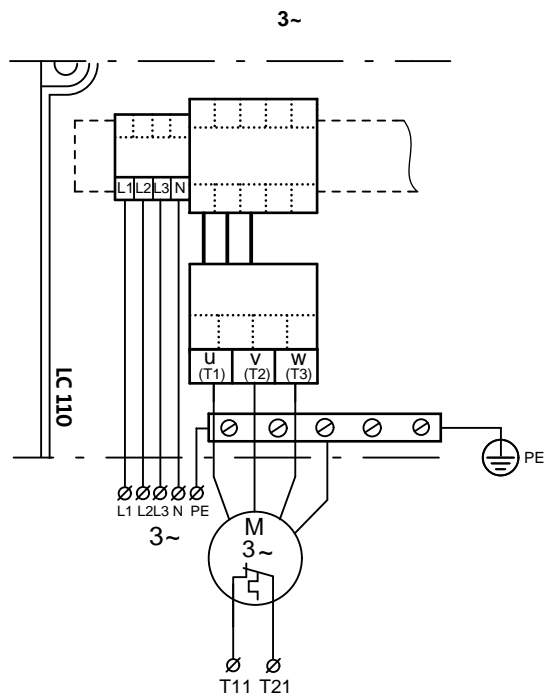
1. Use the local public or private waste collection service.
2. In case such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest Grundfos company or service workshop.

Subject to alterations.

Fig. A1



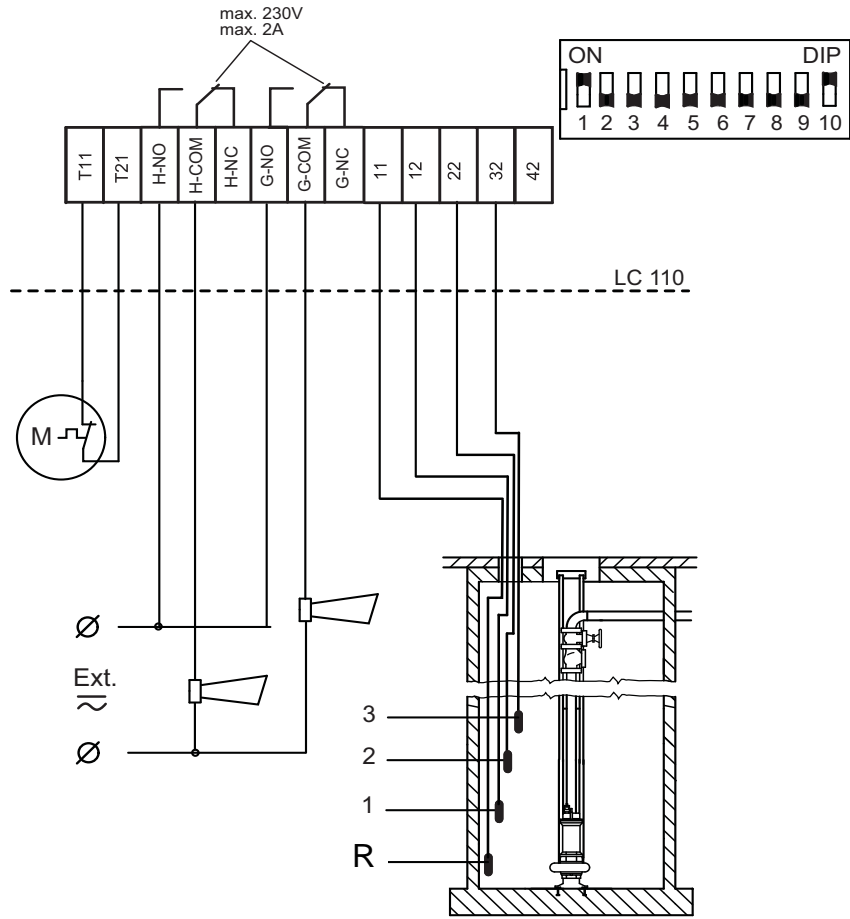
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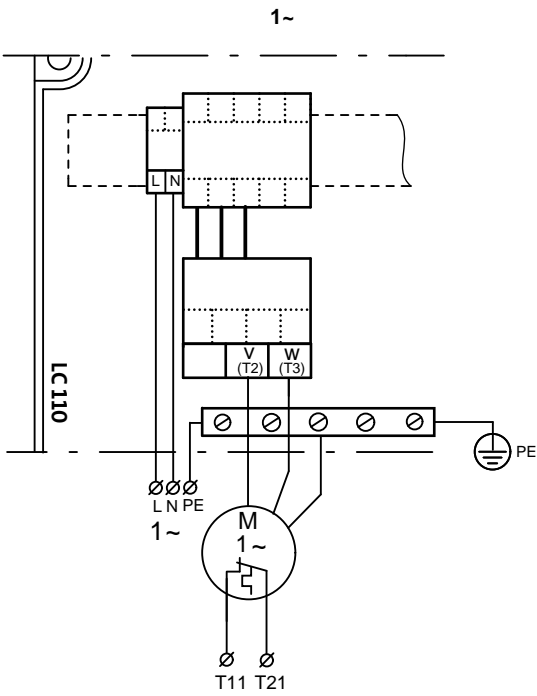
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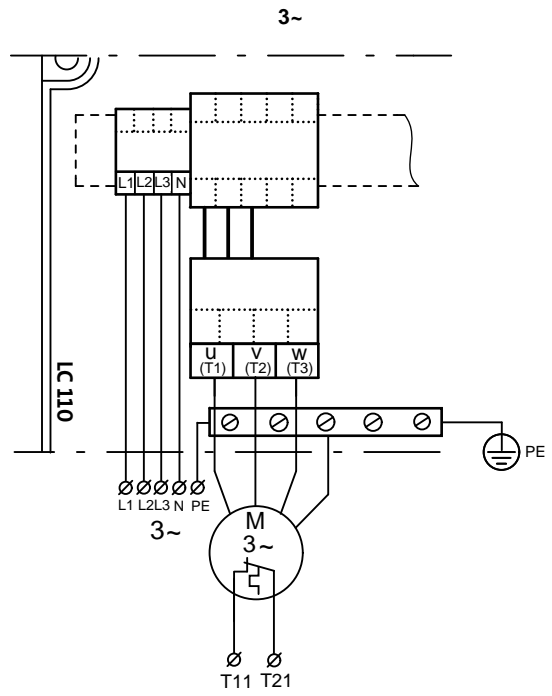
Fig. B1



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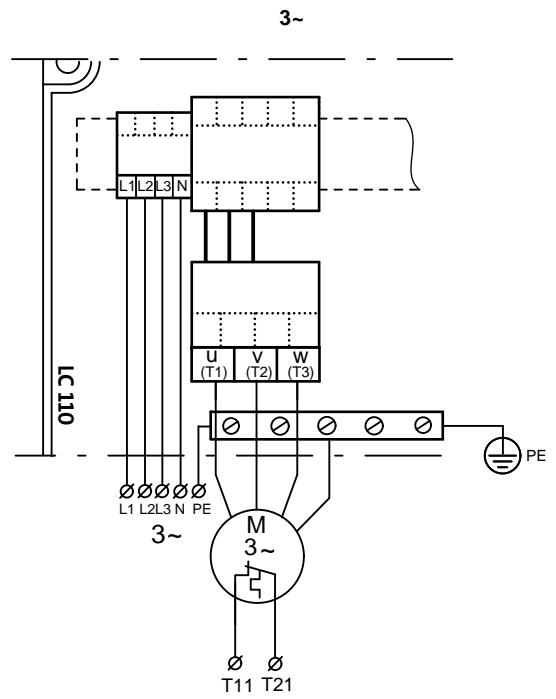
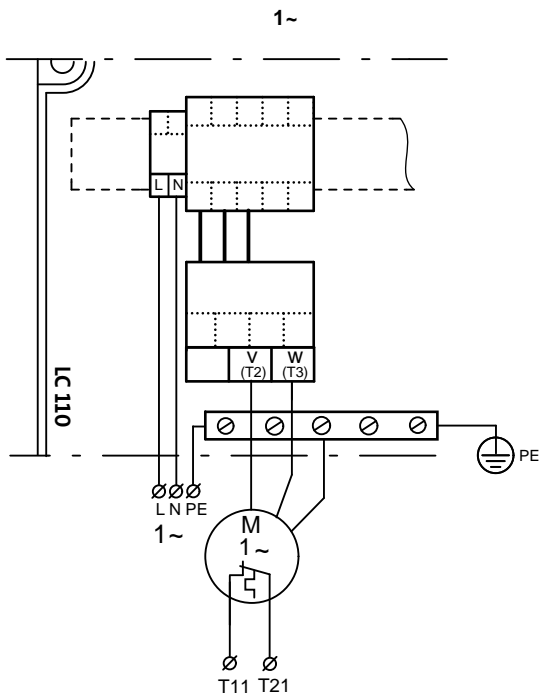
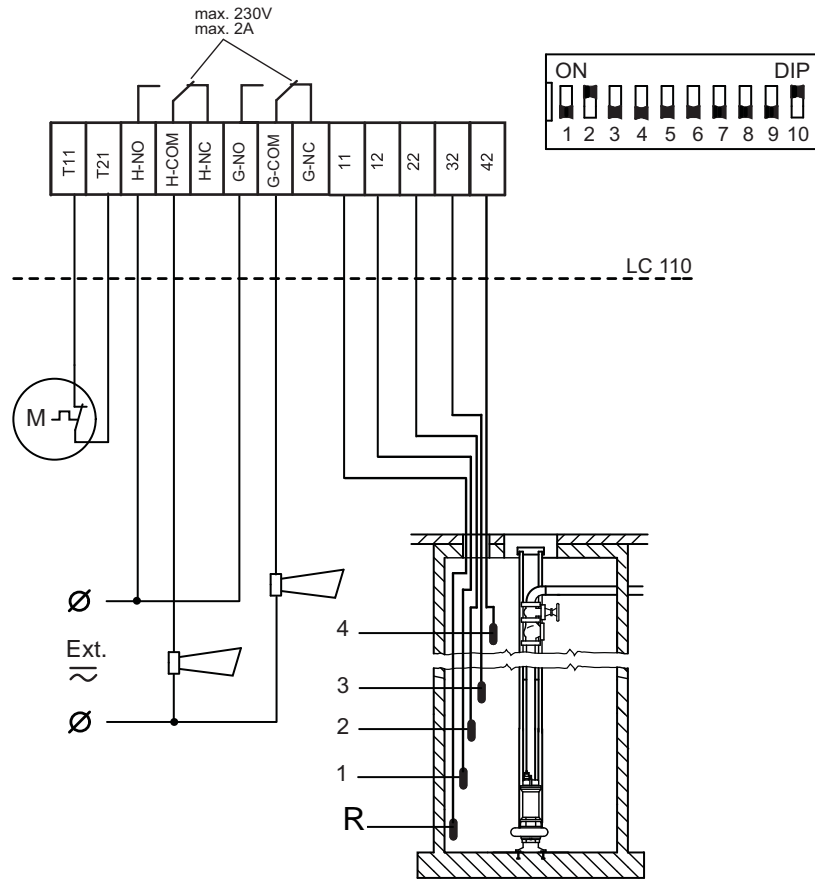


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Fig. C1

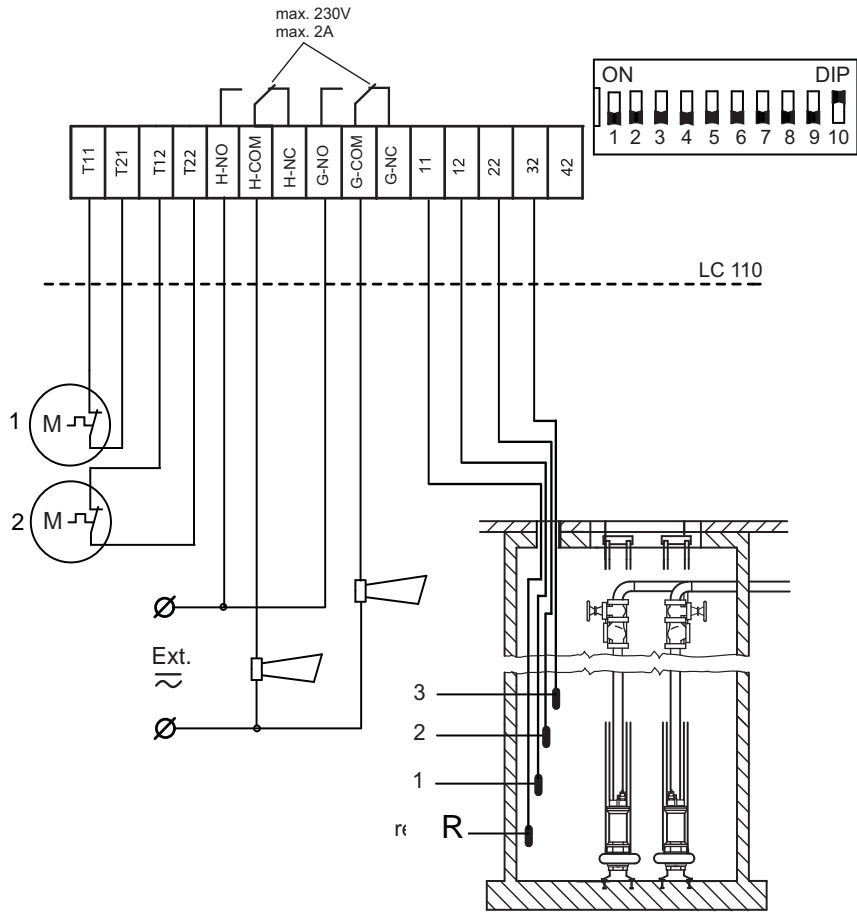


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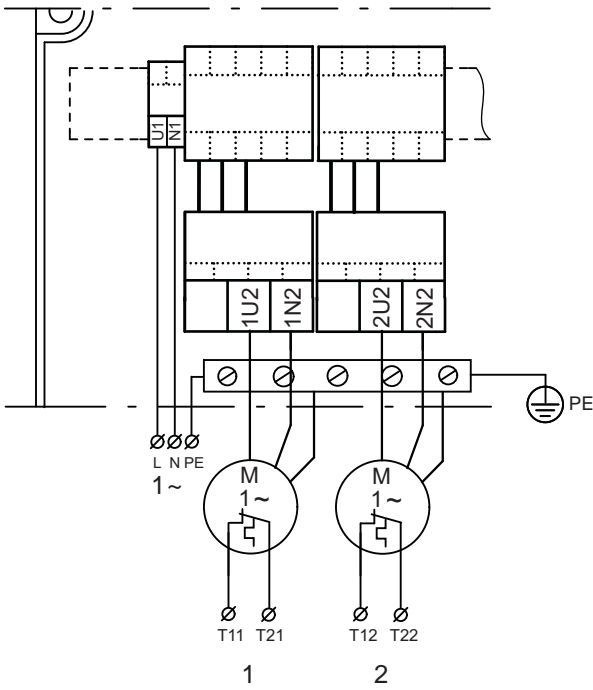
TM02 4616 2308

Fig. D1

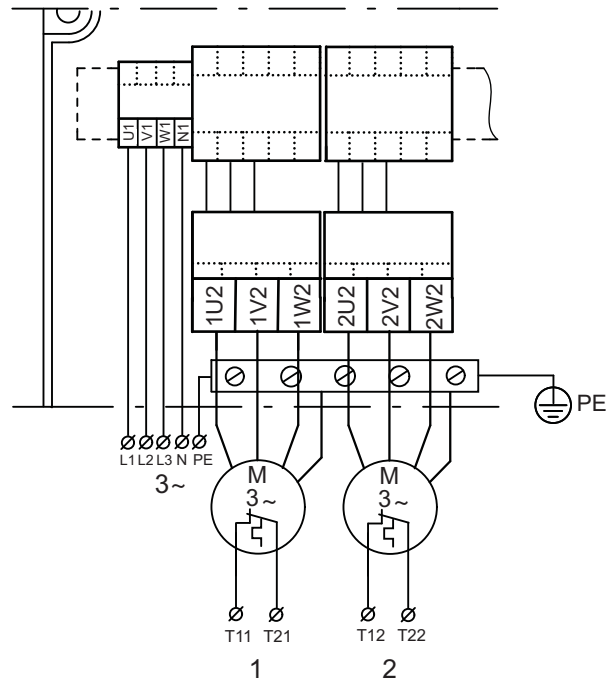


1~

3~



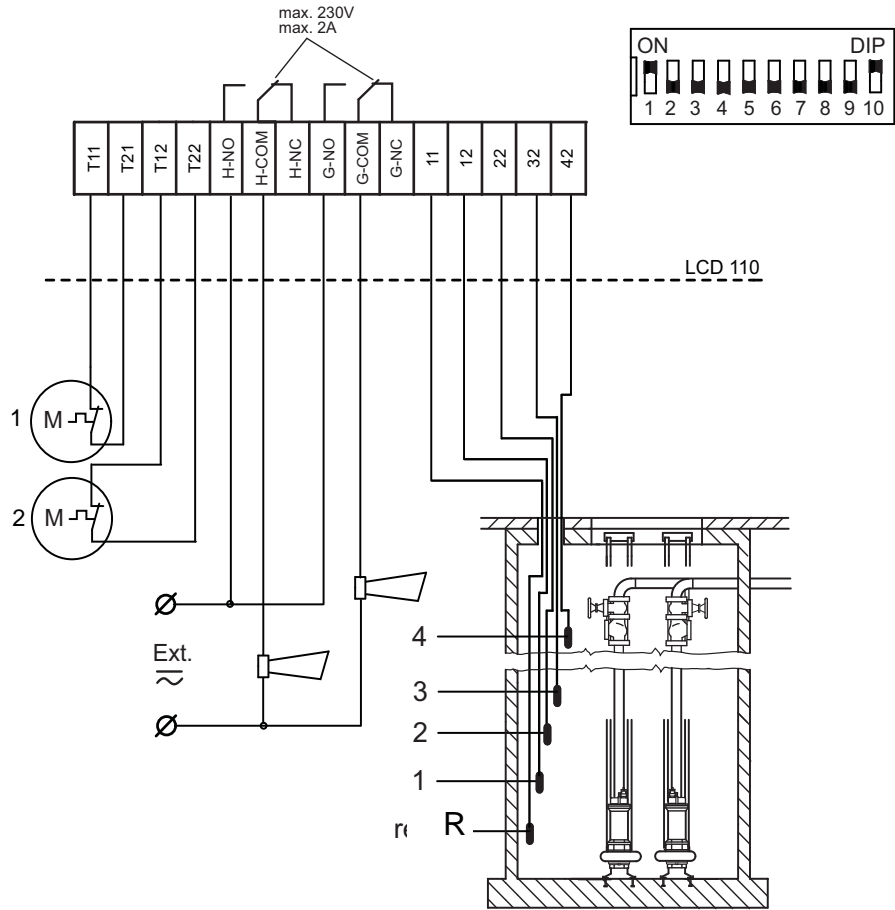
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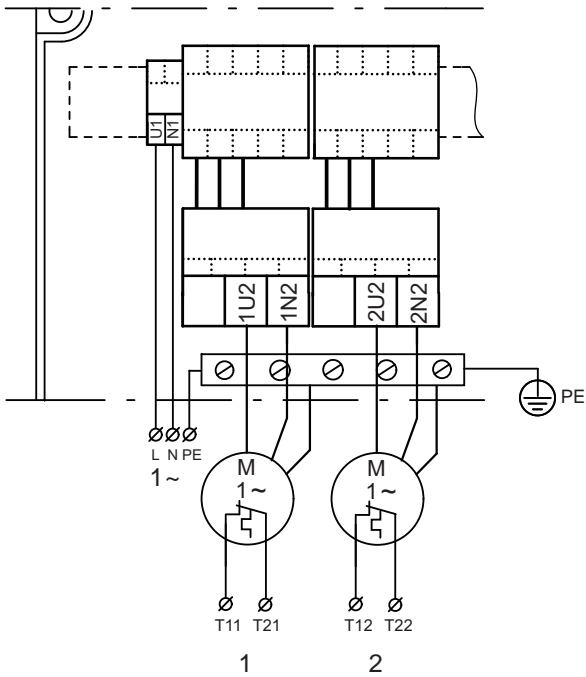
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Fig. E1

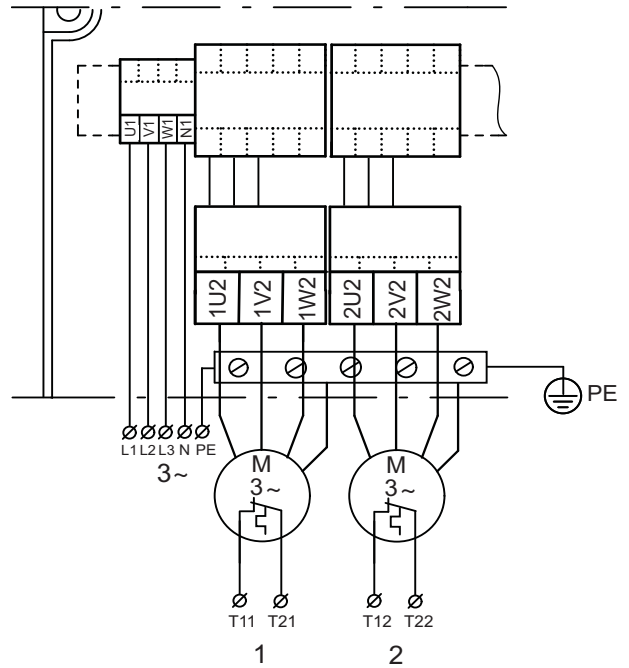


1~

3~



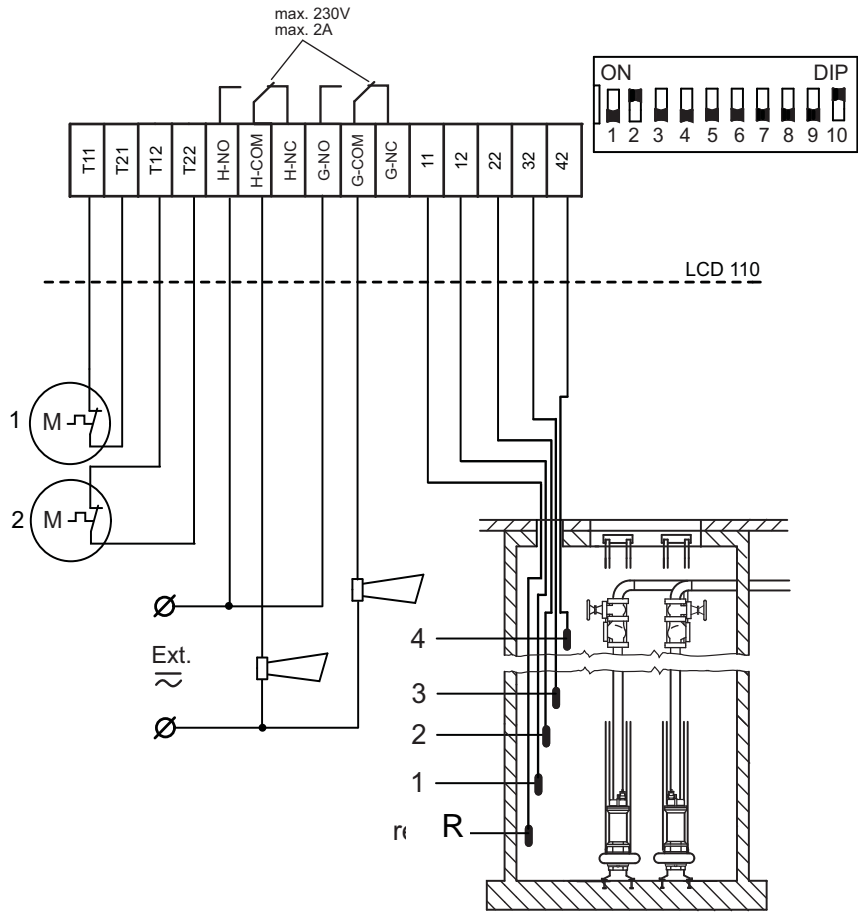
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TM02 4663 2308

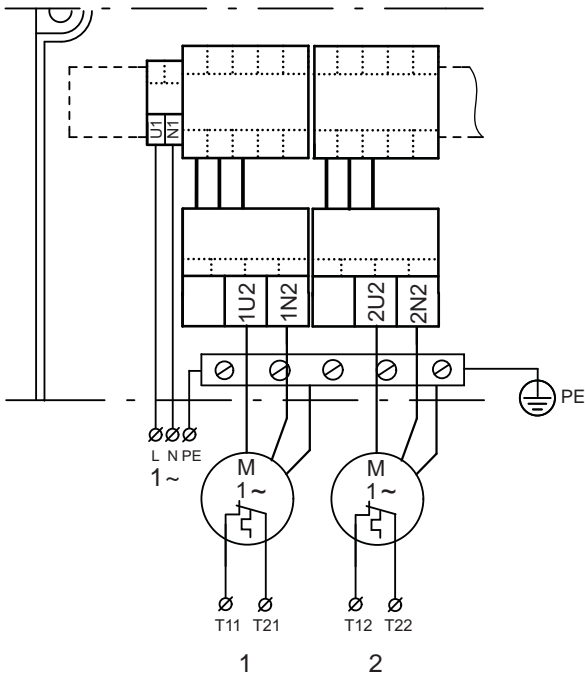
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Fig. F1

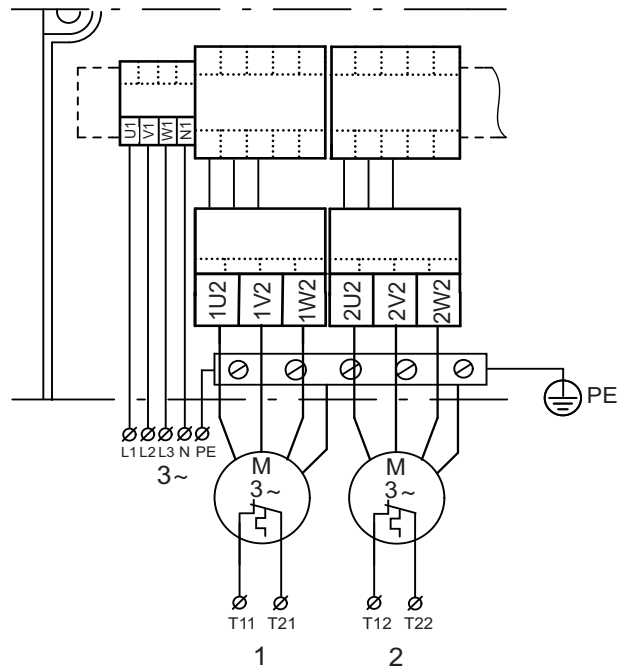


1~

3~



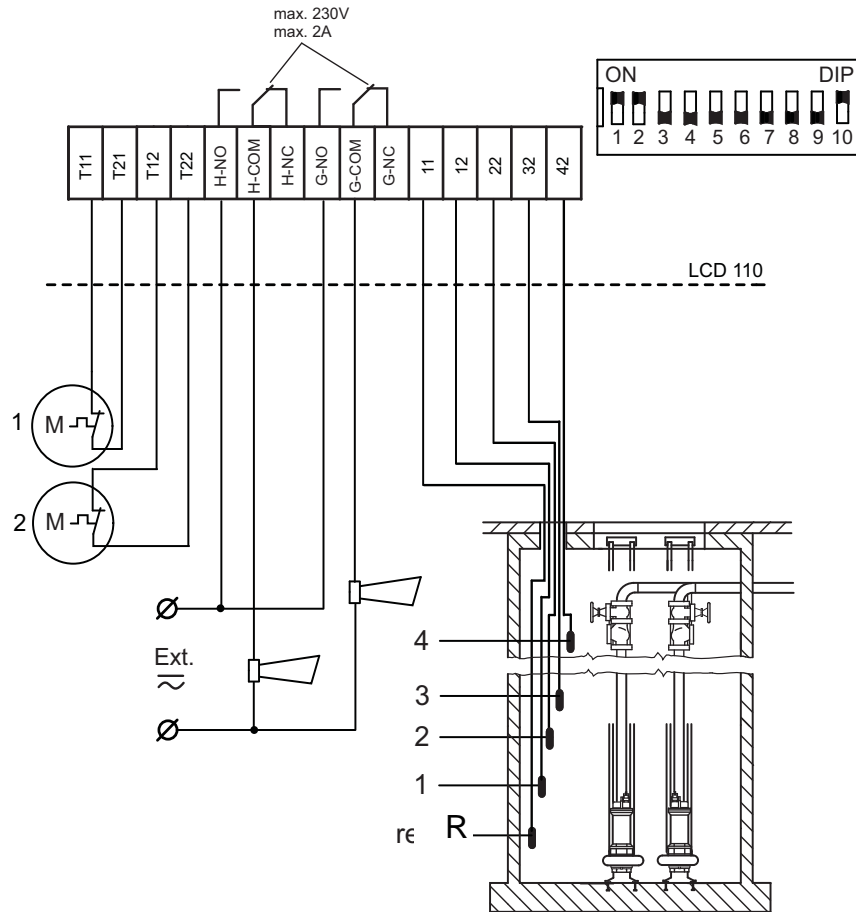
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TM02 4663 2308

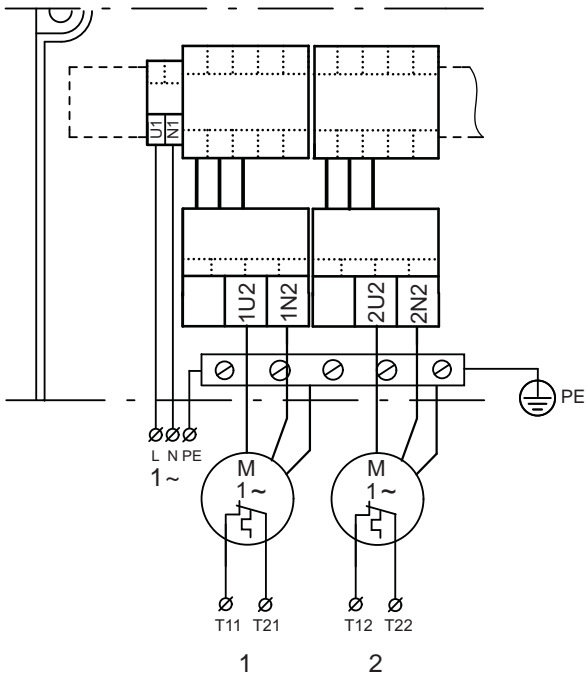
TM02 4693 2308

Fig. G1

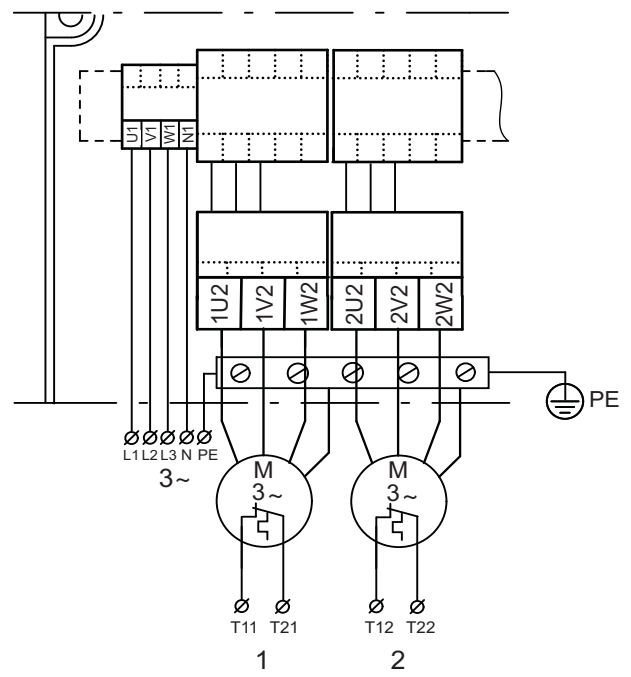


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TM02 4663 2308

TM02 4706 2308

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