

SQFlex pumping systems

The SQFlex system is a reliable water supply system especially suitable for remote locations not connected to the electricity supply grid. The SQFlex system is equipped with the SQFlex submersible pump.

The SQFlex system is powered by renewable energy sources



Service instructions

SQFlex pumping systems



Table of contents

1.	SQFlex components	2
1.1	Pumps.....	2
1.2	Motor.....	5
1.3	Control and switch boxes.....	6
1.4	Solar modules.....	13
1.5	Wind turbine.....	16
2.	Maintenance	20
2.1	Solar modules.....	20
2.2	Wind turbine.....	21
3.	Fault finding	22
3.1	Solar energy pumping system	24
3.2	Solar energy pumping system with CU 200 control unit and level switch.....	26
3.3	Solar energy pumping system with generator back-up.....	28
3.4	Wind energy pumping system	30
3.5	Wind energy pumping system with CU 200 control unit and level switch.....	32
3.6	Combined energy pumping system	34
3.7	Combined energy pumping system with CU 200 control unit and level switch.....	36
3.8	Options with generator as back-up source	39

1. SQFlex components

1.1 Pumps

Two pump types are used, the helical rotor pump type and the centrifugal pump type.

1.1.1 Type identification

Type keys and nameplates give an overview of information on type designations and nameplates for SQF pumps.

1.1.1.1 Nameplate, helical rotor pump

The nameplate is engraved into the pump sleeve.



Fig. 1 Example of nameplate, helical rotor pump

Key to nameplate

Pos.	Code	Description
1	PROD. NO. 96078012	Product number
	MODEL A	Pump generation (A = first generation)
	P1 0110	Production code - Bjerringbro (P1) + production year and week
2	SQF x - xx	Type designation, see section 1.1.1.3 Type key.
3	<ul style="list-style-type: none"> Weight: x,x kg MADE IN DENMARK CE 	<ul style="list-style-type: none"> Pump net weight in lb Country of origin: Denmark. Misc. marks of approval: CE, etc.
4	1 1/4 NPT	Type and size of connecting thread

1.1.1.2 Nameplate, centrifugal pump

The nameplate is attached to the pump inlet part.

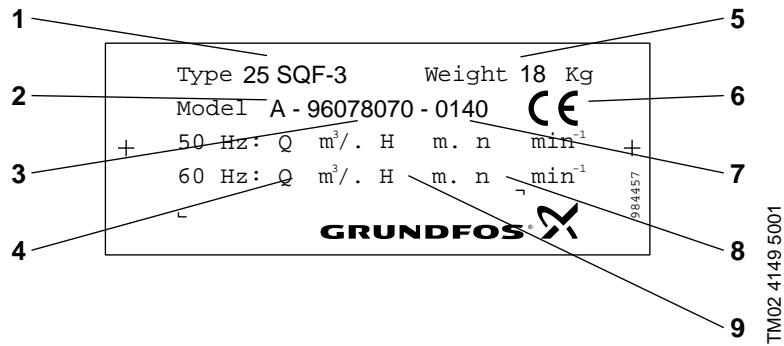


Fig. 2 Example of nameplate, centrifugal pump

Key to nameplate

Pos.	Code	Description
1	Type 25 SQF-3	Type designation, see section 1.1.1.3 Type key
2	MODEL A	Pump generation (A = first generation)
3	96078070	Product number
4	Q m ³	Rated flow rate (not indicated)
5	Weight 18 lb	Pump net weight in kg
6	CE	Misc. marks of approval: CE, etc.
7	0140	Production year and week
8	n min ⁻¹	Speed (not indicated)
9	H	Head at rated flow rate (not indicated)

1.1.1.3 Type key

N-AMREG	X	SQF	-	X
Rated flow in US GPM at 3000 min ⁻¹ (approximate value) and corresponding pump type				
<ul style="list-style-type: none"> • 3 = helical • 6 = helical • 11 = helical • 25 = SP 5A • 40 = SP 8A • 75 = SP 14A 				
Type range				
<ul style="list-style-type: none"> • SQF = Basic version 				
Number of stages				

1.1.2 Service

1.2 Motor

1.2.1 Type identification

Type keys and nameplates show an overview of the information contained in type designations and on nameplates of MSF motors.

1.2.1.1 Nameplate

The nameplate is engraved into the stator sleeve.

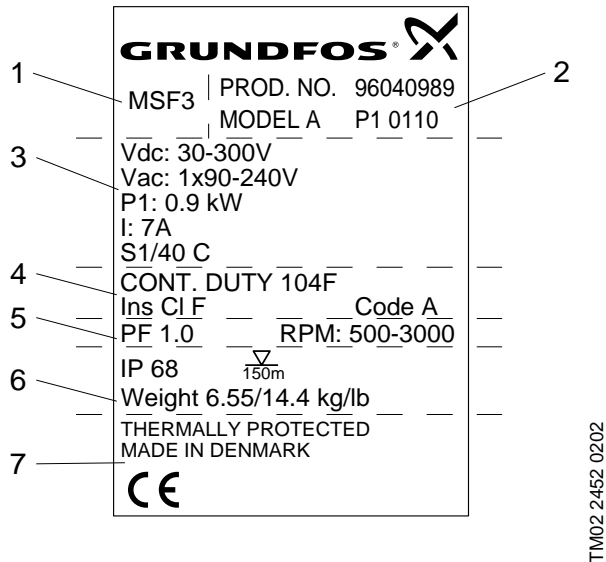


Fig. 3. Example of nameplate, motor

Key to nameplate, motor

Pos.	Code	Description
1	MSF 3	Type designation
2	PROD. NO. 96040989	Product number
	MODEL A	Pump generation (A = first generation)
	P1 0110	Production code - Bjerringbro (P1) + production year and week
3	Vdc: 30-300 V Vac: 1 x 90-240 V	The motor can be supplied with either DC or AC voltage: <ul style="list-style-type: none"> • DC: 30-300 V or • AC: 1 x 90-240 V.
	P1: 0.9 kW	Max. input power [kW]
	I: 7 A	Max. input current [A]
	S1/40 C	Suitable for continuous operation up to 40°C
4	CONT. DUTY 104F	Suitable for continuous operation at 104°F
	Ins Cl F Code A	Insulation class F. Start-kVA per hp
5	PF 1.0 RPM 500 - 3000	Power factor = 1. Rated speed 500 - 3000 rpm
6	IP 68 150 m	Enclosure class: IP 68. Max installation depth: 150 m
	Weight 6.55/14.4 kg/lb	Motor net weight in kg and pounds
7	THERMALLY PROTECTED	Temperature sensor built into the electronic unit
	MADE IN DENMARK	Country of origin: Denmark
	CE	Misc. marks of approval: CE, etc.

1.3 Control and switch boxes

1.3.1 CU 200 SQFlex control unit

1.3.1.1 General information



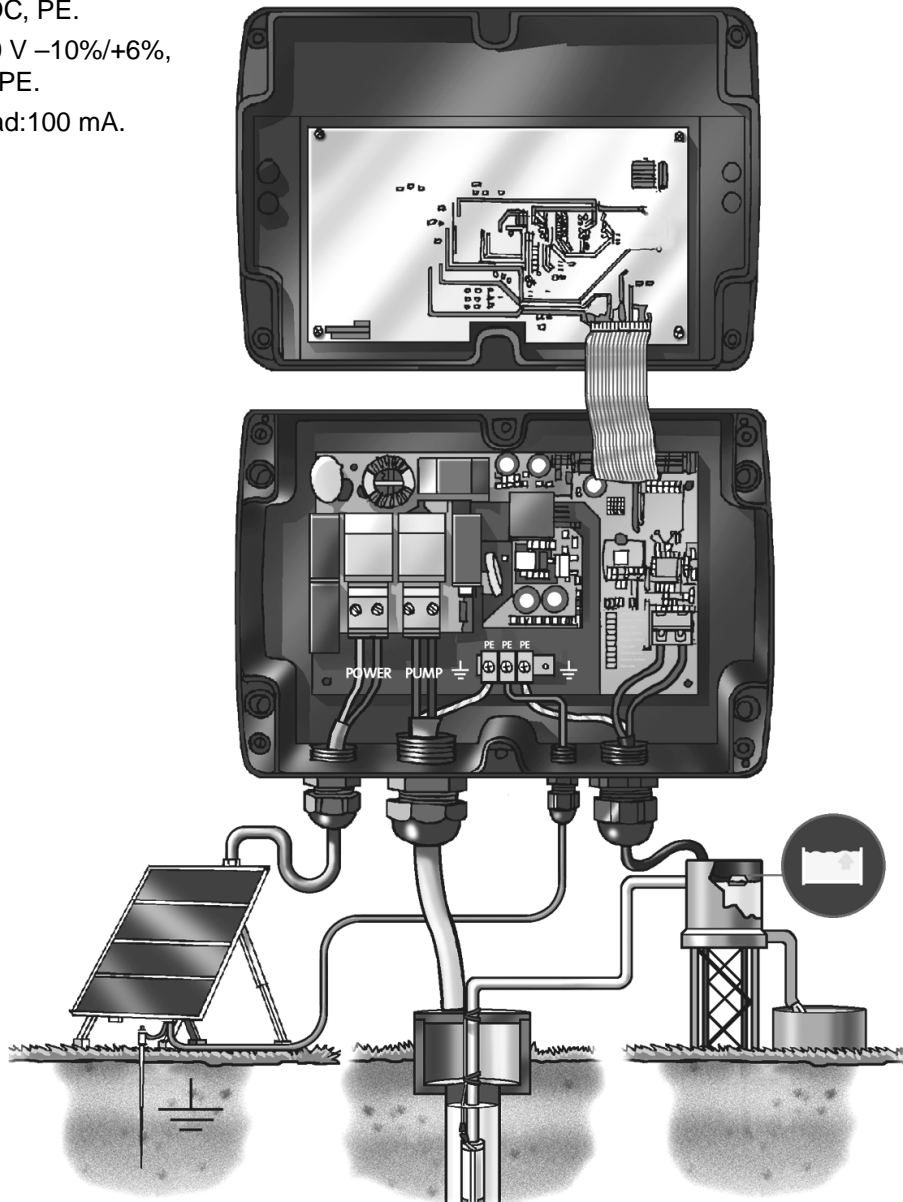
Developed for the SQFlex water supply systems, the CU 200 SQFlex control unit offers:

- system monitoring on the basis of sensor signals
- system control on the basis of sensor signals
- monitoring of operation and alarm indication.

Technical data

- 30-300 VDC, PE.
- 1 x 90-240 V $-10\%/+6\%$, 50/60 Hz, PE.

Maximum load: 100 mA.



1.3.1.2 Display and indicator lights

Pump operation

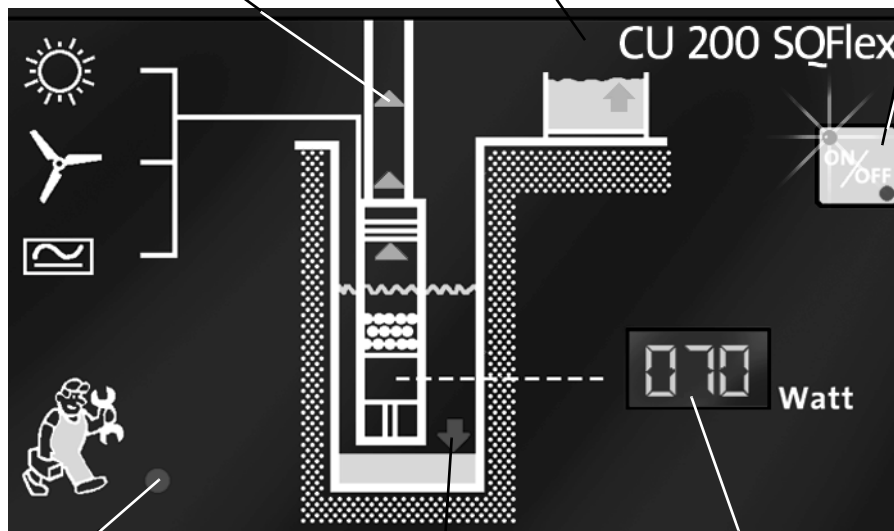
A running green light indicates that the pump is operating at more than 500 rpm.

Full water reservoir

When using a float switch the yellow light indicates that the water level in the water reservoir is high.

On/Off button

- Green light on: The system has been switched on.
- Red light on: The pump has been stopped by the button on CU 200 (system is not switched on).
- Both lights off: The system has been switched off.



Service alarm

The red light indicates alarm.

Possible causes:

- no contact
- overvoltage
- overtemperature
- overload.

Dry running

The red light indicates lack of water.

Power and alarm

The display indicates 0 Watt until the power supply is sufficient to run the pump at 500 rpm; the power is indicated in steps of 10 Watt, the maximum indication being 990 Watt.

If the pump is in a state of alarm, the display also indicates fault codes, see section 1.3.1.3 Fault finding.

1.3.1.3 Fault finding

If the pump **does not** deliver water, follow the procedures below.

Fault	Possible cause	Remedy
1. No display on front cover, no water delivered by pump.	a) No voltage supply.	<ul style="list-style-type: none"> Check the voltage from the supply source. If the LEDs indicating 5 V, 10 V and 24 V internal supply voltage are on, and the 'CONTROL INDICATOR' LED is not flashing, the CU 200 is defective.
	b) Position of flat cable is wrong or cable is defective.	<ul style="list-style-type: none"> Check that the multi-core cable connection is OK. If so, the CU 200 is defective.
2. Pump does not start. Green indicator light in On/Off button is on. No alarm indicated.	a) CU 200 or pump is defective.	<ul style="list-style-type: none"> Check that the 'CONTROL INDICATOR' LED is flashing; if not, the CU 200 is defective; Check that there is sufficient voltage on the PUMP terminals; if no voltage can be measured, the CU 200 is defective. <p>If a supply voltage to the pump can be detected, continue as follows:</p> <ul style="list-style-type: none"> Cut out the energy supply by pulling out the POWER plug. Wait for one minute, refit the POWER plug and observe what happens: <ul style="list-style-type: none"> - If the green indicator light in the On/Off button is on and the pump still does not start, the pump or pump cable is defective.
3. Off light is on.	a) Pump has been stopped.	<ul style="list-style-type: none"> Press the On/Off button on the CU 200 to start the pump.
4. CU 200 indicates 'F3 = NO CONTACT'.	a) Pump cable	<ul style="list-style-type: none"> Check ... <ul style="list-style-type: none"> - the plug connection in the CU 200 - the pump cable - the pump.
	b) Pump is defective.	<ul style="list-style-type: none"> Replace the pump.
5. CU 200 indicates 'F1 = OVERVOLTAGE'	a) Supply voltage is outside permissible range.	<ul style="list-style-type: none"> Reconnect or disconnect the solar panels to allow the voltage to drop. If a different supply source is used, check that the voltage is within the recommended voltage range. <p>Note: As the voltage is detected at the motor, allow for the voltage drop in the pump cable.</p>
6. CU 200 indicates 'F2 = OVERTEMP'.	a) Too high water temperature.	<ul style="list-style-type: none"> Check that the water temperature is below the maximum permissible level.
	b) Incrustations on motor.	<ul style="list-style-type: none"> Remove incrustations, if any, on the motor.
	c) Pump is defective.	<ul style="list-style-type: none"> Replace the pump.
7. CU 200 indicates 'F4 = OVERLOAD'.	a) Too low input voltage.	<ul style="list-style-type: none"> Increase the supply voltage.
	b) Pump is defective.	<ul style="list-style-type: none"> Replace the pump.
	c) Pumped liquid is contaminated with oil or similar substance.	<ul style="list-style-type: none"> A helical rotor pump must be replaced and the pumped liquid cleaned before a new helical rotor pump is installed.
8. Green indicator light on On/Off button is flashing.	a) Pump is blocked.	<ul style="list-style-type: none"> Service the pump.
	b) Insufficient power supply.	<ul style="list-style-type: none"> Increase the number of solar modules or connect an alternative energy supply. Possible supply sources are: solar modules, wind turbine, batteries and diesel or gasoline driven generator.
9. Running light on CU 200 but low voltage.	a) Pump is defective.	<ul style="list-style-type: none"> Replace the pump. If Centrifugal pump is used: Check that the riser pipe is not blocked.

If the pump **does** deliver water, follow the procedures below.

Fault	Possible cause	Remedy
1. No display on front cover, water delivered by pump.	a) CU 200 is defective.	<ul style="list-style-type: none"> • Replace the CU 200.
2. Pump does not stop when water reservoir is full. Alarm indicator light on CU 200 is off.	a) Level switch is defective.	<ul style="list-style-type: none"> • Check that the level switch is not stuck.
	b) Cable on level switch is damaged.	<ul style="list-style-type: none"> • Check the cable on the level switch.
3. Pump does not stop when water reservoir is full. Alarm indicator light on CU 200 is on.	a) CU 200 is defective.	<ul style="list-style-type: none"> • Replace the CU 200.

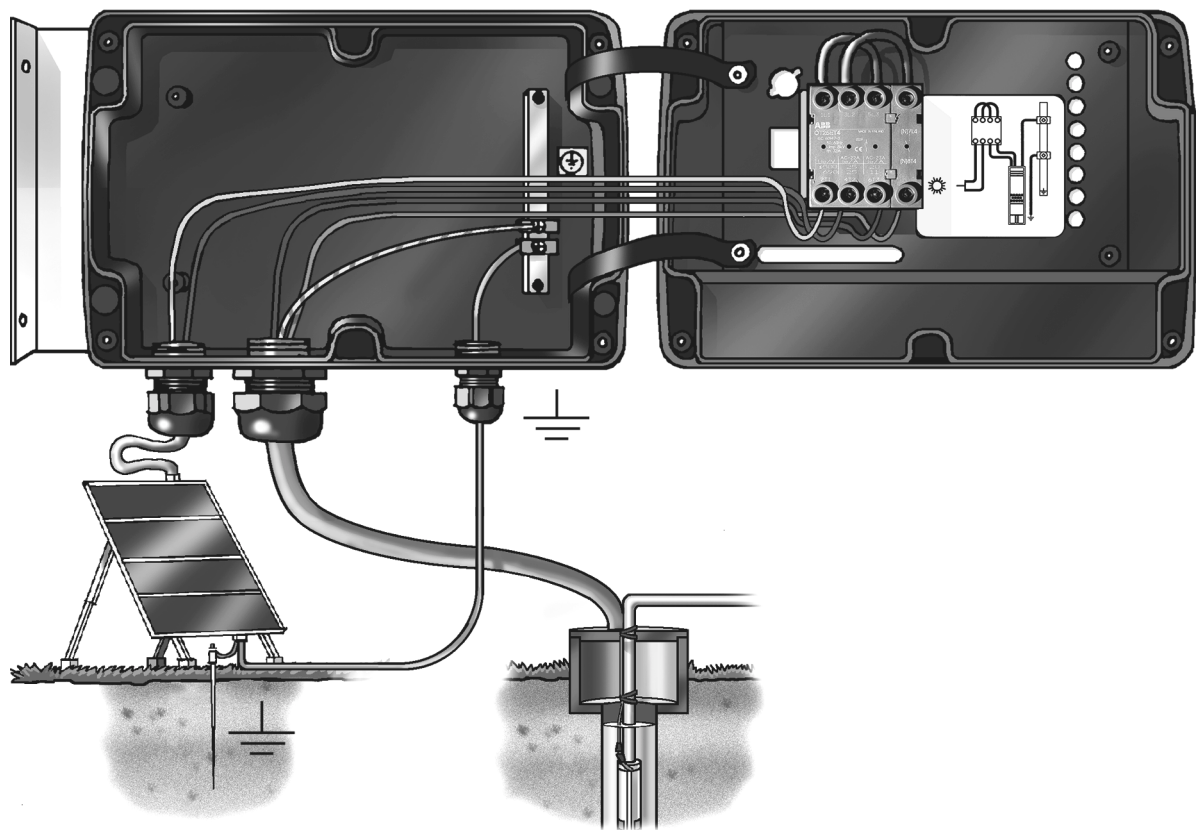
1.3.2 IO 100 SQFlex switch box

1.3.2.1 General information



The IO 100 SQFlex switch box has been developed for the SQFlex water supply systems, exclusively powered by solar modules.

The IO 100 is applicable in the SQFlex systems provided the system voltages mentioned below are not exceeded. The IO 100 enables manual starting and stopping of the pump in a solar-powered SQFlex system. In addition, the IO 100 functions as a connection point for all necessary cables.



Technical data:

DC: Max. 225 V, PE.

AC: Max. 265 V, 50/60 Hz, PE.

1.3.3 IO 101 SQFlex switch box

1.3.3.1 General information



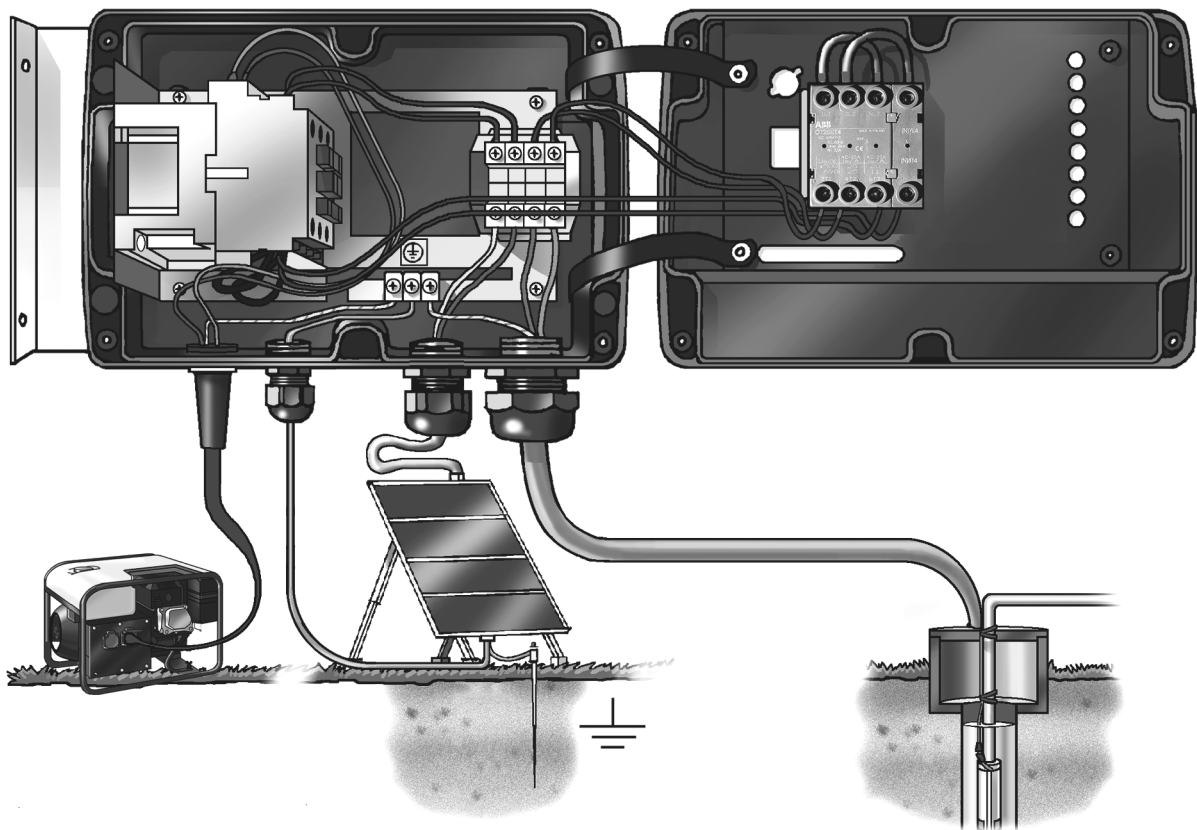
Developed for SQFlex water supply systems, the IO 101 SQFlex switch box makes it possible to ...

- switch off the voltage supply to the pump
- connect a back-up generator.

During periods of ...

- insufficient solar energy
- an immediate requirement for water supply
- a need for water supply at night,

the SQFlex water supply systems powered by solar modules can be connected to an external back-up diesel or gasoline driven generator via the IO 101.



Technical data:

- DC: Max. 225 V, PE.
- AC: Max. 265 V, 50/60 Hz, PE.

The internal relay in the IO 101 has the following rated voltage:

- 115 V $-15\%/+10\%$, 50/60 Hz, PE.

1.3.4 IO 102 SQFlex breaker box

1.3.4.1 General information



Developed for SQFlex water supply systems, the IO 102 SQFlex breaker box is applicable in any SQFlex system utilizing a wind turbine.

The IO 102 SQFlex breaker box makes it possible to:

- use a wind turbine as a power supply
- connect solar panels as well as wind turbine
- switch off the voltage supply to the pump.

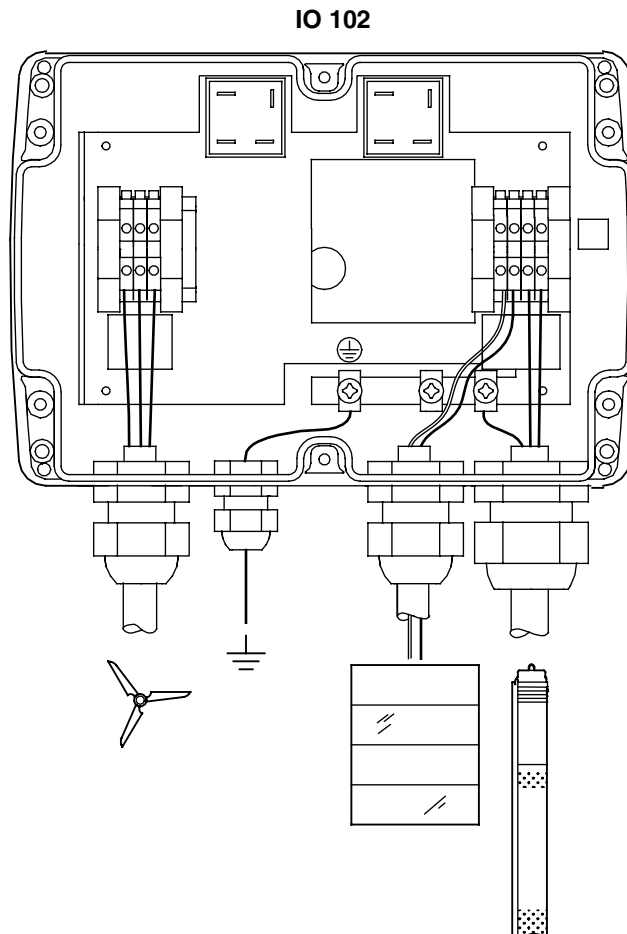
The IO 102 is applicable in SQFlex systems powered exclusively by a wind turbine or by a combination of wind turbine and solar module.

The SQFlex systems powered by solar modules can be connected, via the IO 102, to a wind turbine as a back-up or supplement to solar power.

The IO 102 is applicable in SQFlex systems provided the system voltages mentioned below are not exceeded.

Technical data:

- DC: Max. 225 V, PE
- AC: Max. 265 V, 50/60 Hz, PE.



1.4 Solar modules

1.4.1 General description



The GF 43 solar module consists of amorphous silicon thin-film solar cells.

The solar module is equipped with plugs and sockets for easy connection of several modules in parallel. The solar modules are mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy.

GRUNDFOS PART NO.: 96467737

GRUNDFOS

This module is designed only for GRUNDFOS pumping systems

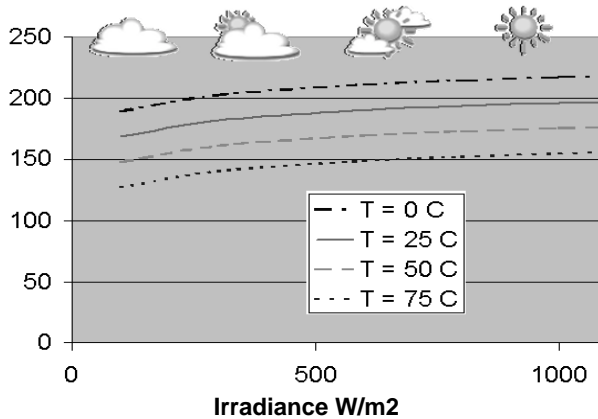
MODEL: GF 43
PART #: 901050 SERIAL #:

Product of USA Manufactured in ISO9001 certified facility

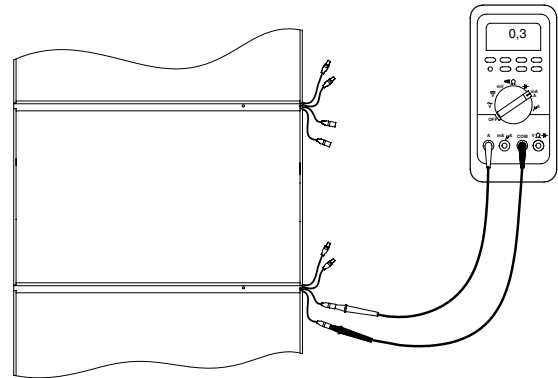
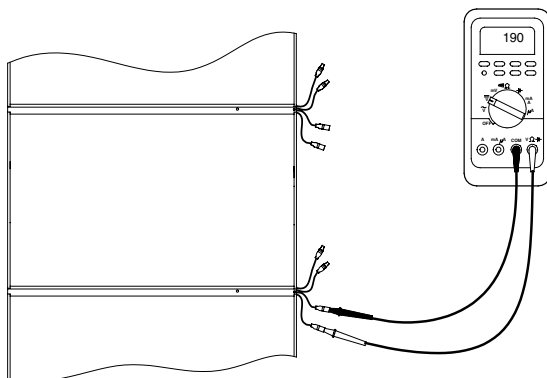
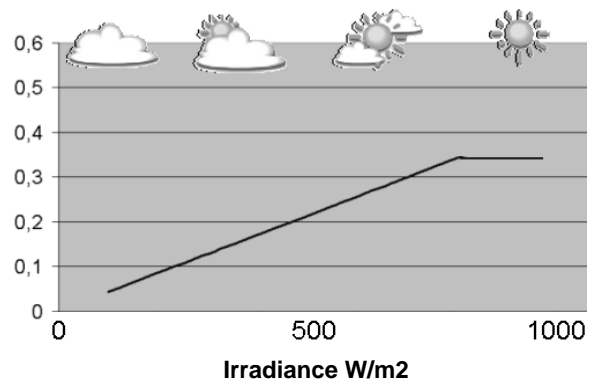
Electrical Ratings
at STC (1000 W/m² AM 1.5 spectrum, cell temperature 25 C)
All values are nominal unless designated as tested

Peak Power (Pmax)	43	W
Warranted Minimum Pmax	38.7	W
Voltage (Vmp)	140	V
Current (Imp)	0.31	A
Open Circuit Voltage (Voc)	194	V
Short Circuit Current (Isc)	0.40	A
Minimum Bypass Diode	6	A
Maximum Series Fuse	15	A

Solar module voltage (VDC)



Solar module current (A)



1.4.2 Solar panel positioning

If located in the northern hemisphere the solar panel should face south.

If located in the southern hemisphere the solar panel should face north.

The Grundfos GF 43 Watt modules must be mounted on a support structure.

The tilt angle of the support structure can be adjusted from 15° to 45° in steps of 5° for maximum utilization of the solar radiation at the location in question.

Four Grundfos GF 43 Watt modules can be mounted on each support structure. For further information on the installation of solar modules, see Grundfos instructions.

When mounting the solar modules on the support structure, see to it that the modules overlap in order to allow rain water to run off.

At each end of the solar panel, a row closure must be fitted, see, pos. A. The row closures constitute the connection point of the wires in conduit and PE conductor.

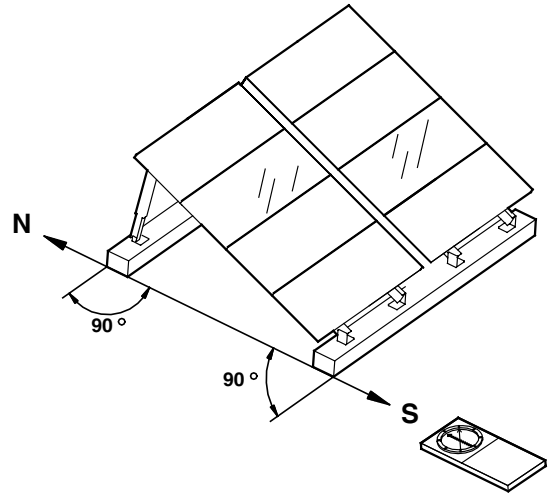


Fig. 4. Solar panel located in the northern hemisphere.

1.4.3 Electrical connection

Note: Before making any electrical connections, make sure that the solar modules are covered with an opaque covering material to ensure that the modules are dead.

The Grundfos GF 43 Watt solar module is equipped with plugs and sockets for easy connection of several solar modules in parallel.

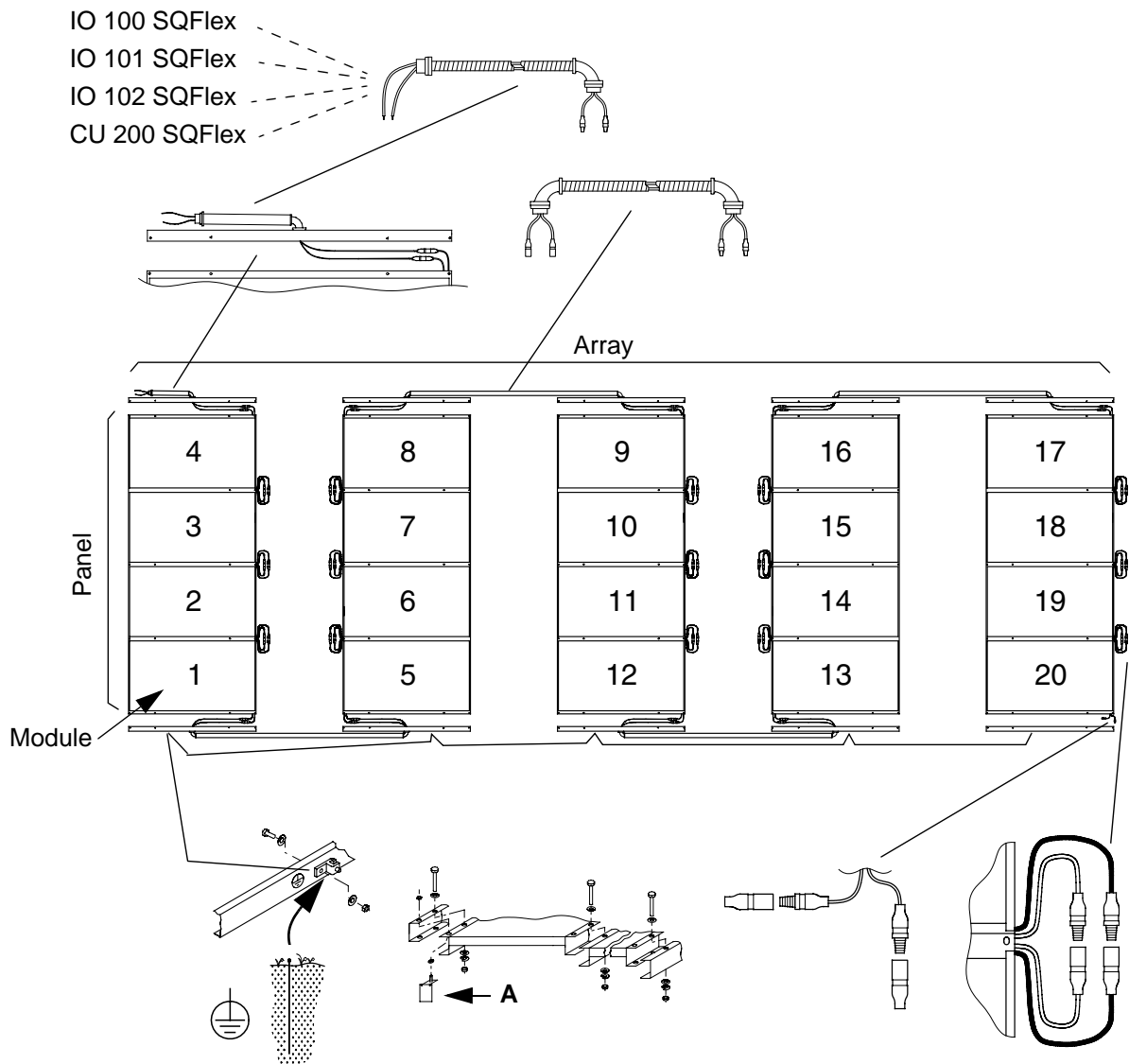
Note: The Grundfos GF 43 Watt solar modules must not be connected in series. In installations where more than four solar modules are required, the solar panels are placed in parallel and connected by means of the wires in conduit.

1.4.3.1 Connection of PE conductor

The solar panels must be connected to earth via the PE conductor (PE = **P**rotective **E**arth), supplied with the row closure kit. The PE conductor is connected to the row closure by means of a screw terminal.

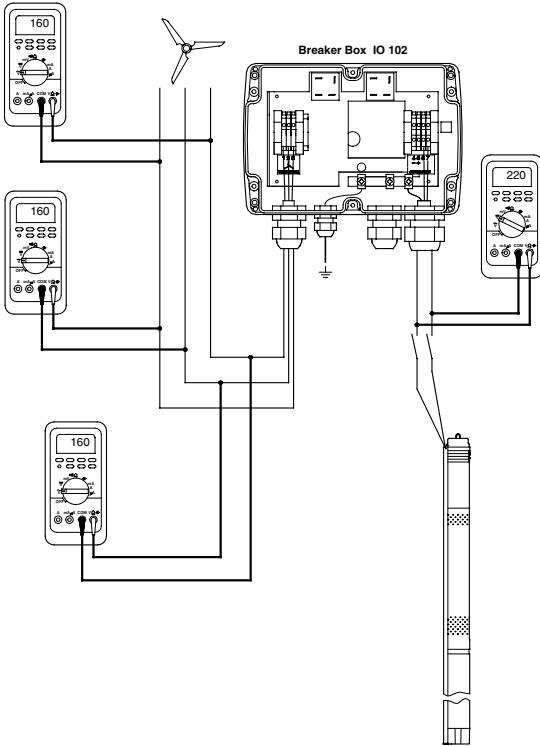
All solar modules must have connection to earth.

Note: For the sake of the earth connection and thus the safety of persons, it is of critical importance to fit the earth clips (pos. A) and earth terminals supplied with the row closure kit.

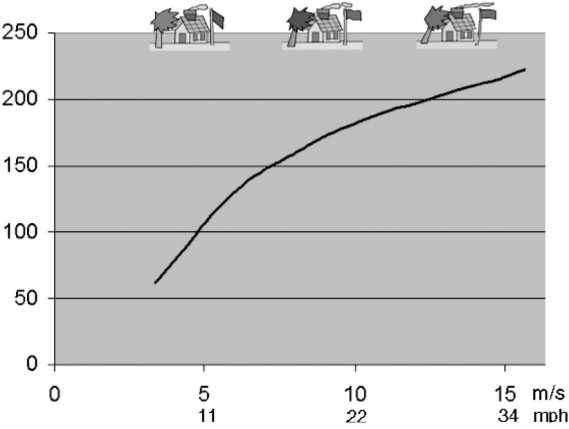


1.5 Wind turbine

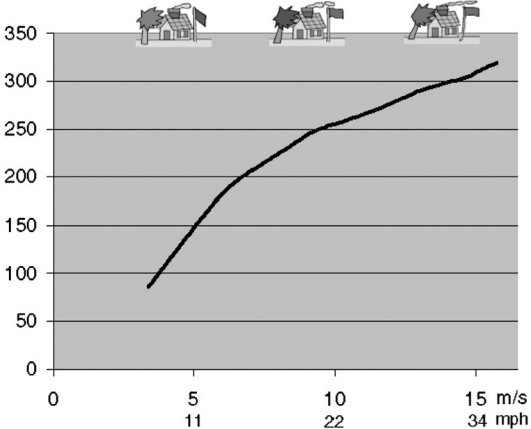
1.5.1 General description



Wind generator voltage



IO 102 voltage



Values measured between the three phases must be identical.

1.5.2 Fault finding

1. Determine if the problem is mechanical or electrical.
 - Propeller does not turn = Mechanical problem, see section 1.5.2.1 Symptoms of mechanical problems on page 18.
 - Propeller turns slowly = Electrical problem.
Electrical problems can be caused by the generator or the IO 102 breaker box. To determine which as follows:
2. Disconnect the three wires from the wind generator one at a time at the IO 102 breaker box. If the wind generator starts, the wire that allowed it to start leads to a bad diode in the IO 102 breaker box. Call the factory or the distributor to replace the diode.
3. Disconnect any two wires. If the wind generator starts, the problem is in the IO 102 breaker box. Call the factory or the distributor to replace the IO 102 breaker box, see fault finding for your specific system in section 3.0.2 Overview of possible combinations.
4. If the wind generator still does not start the problem is in the tower wiring or the wind generator, see section 1.5.2.2 Symptoms of electrical problems on page 19.
5. Wind generator is running, but may have an electrical problem. Using a voltmeter, read the voltage across the leads and see the list below as a guide to possible problems.
 - Voltage increase and decreases slowly with wind speed equally across all wires = Everything ok.
 - No voltage across two wires = One wire from wind generator not carrying power. Check in order: Check the tower wiring to insure it is properly wired. Check slip rings and brushes, stator connections and stator windings for obvious damage. Report damage to authorized distributor or factory.
 - Voltage significantly higher across two wires than the others = Contact the distributor or the factory, possibly a bad diode.
 - Voltage produced after On/Off switch turned Off = Possibly a faulty switch or a wire shorted to the other two or an internal fault has occurred in the IO 102 breaker box.
 - Voltage significantly lower across two wires than the others = Bad connection at wind turbine voltage connections or faulty stator winding. Report this failure to your distributor or the factory.
6. Should these results appear inconclusive in determining the problem proceed directly to section 1.5.2.2 Symptoms of electrical problems on page 19.

1.5.2.1 Symptoms of mechanical problems

Symptom	Possible cause	Correction
1. Propeller is stationary, even in high winds	<ul style="list-style-type: none"> • Ice in generator, or uneven ice on propeller. • Debris between rotor and stator. • Loose or high magnet. • Bad bearing. 	<ul style="list-style-type: none"> • Wait for warm weather. • Turn propeller gently by hand and blow or use piece of paper to dislodge debris. • Contact distributor. • Contact distributor.
2. Propeller will not turn at all except in high wind, scraping or rubbing sound at low rpm, always stops at same propeller position	<ul style="list-style-type: none"> • Same as above, except more likely to be high magnet or bad bearing. • Swelled wire keepers due to high moisture. 	<ul style="list-style-type: none"> • Same as above. • Contact distributor. Stator may need re-varnishing.
3. Propeller is harder starting, output is lower and there is more propeller noise than usual. Seems out of balance.	<ul style="list-style-type: none"> • Ice on blade. • Dirty blade. • Split, warped or damaged blade. • One or more blades on backwards. 	<ul style="list-style-type: none"> • Wait for warm weather. Prop will eventually shed ice, leave running unless there is substantial vibration. • Clean with soap or bug cleaner. • Contact factory or distributor to replace broken or damaged blade. • Turn blade(s) over
4. Propeller turns a little, never starts.	<ul style="list-style-type: none"> • Blades on backwards. (See blade installation). 	<ul style="list-style-type: none"> • Turn blades over. Leading edge advances clockwise from upwind view.
5. Tail, generator and tower vibrate or shake at all or some wind speeds.	<ul style="list-style-type: none"> • Blade out of balance. • Blade not tracking. • Rotor (magnet can) out of balance. • Blade plate out of balance. 	<ul style="list-style-type: none"> • Contact distributor. • Contact distributor. • Return to distributor. • Return to distributor.
6. Rattle or clunking from generator.	<ul style="list-style-type: none"> • Generator loose in tower. • Loose rotor (magnet can) on shaft loose tail, missing rubber bumper, wires slapping inside of mast, governor pivot bolt loose. • Worn bearings. • Shaft broken. 	<ul style="list-style-type: none"> • Retighten mounting hardware, use Loctite or equivalent thread-locking compound. • Repair as required. • Contact distributor. • Contact distributor.

1.5.2.2 Symptoms of electrical problems

Symptom—Generator will not start (blades spin slowly as if the brake switch)

Note: Always be aware of the danger of high voltage. Do not directly touch the wires.

Check	Observation	Possible cause
1. Check to see if the On/Off switch is on (in the normal run condition).	When On/Off switch is on, turbine should begin spinning again. If not, proceed to step 2.	
2. On a day of moderate wind, disconnect the pump.	The generator starts to turn.	<p>The pump may have a problem or the motor cable can have a short circuit or the generator is producing too little energy.</p> <p>Connect the pump again.</p> <p>If the pump still does not start:</p> <ul style="list-style-type: none"> - check the voltage to the pump - check the cable and connections - check the pump <p>Consult the Grundfos Service Instructions.</p> <p><i>Note: The wind speed must be moderate to insure that the wind energy is powerful enough to start to pump.</i></p>
3. If the generator still does not turn in moderate winds.		<p>Disconnect the three wires from the generator one at a time at the IO 102 breaker box. If the generator starts, the rectifier in the IO 102 breaker box is defective.</p> <p>Call the installer or distributor to replace the IO 102 breaker box.</p>

Symptom—Generator spins up and pump does not operate

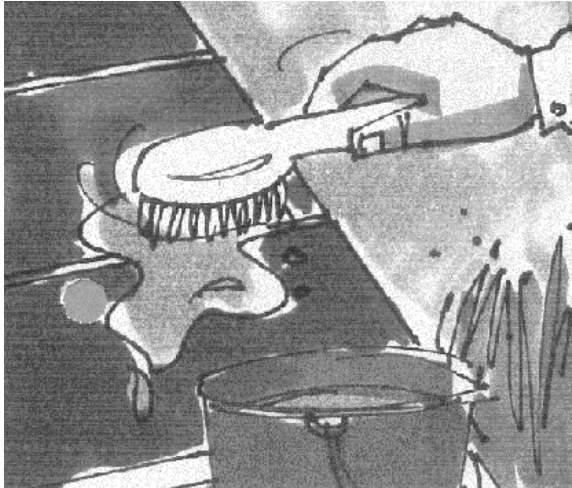
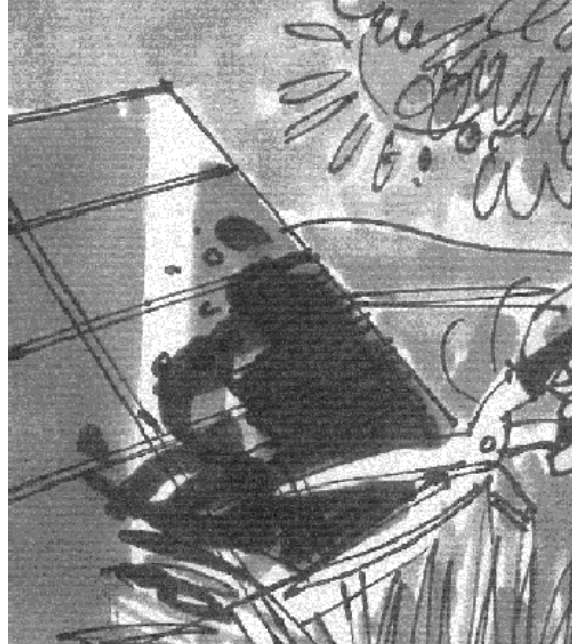
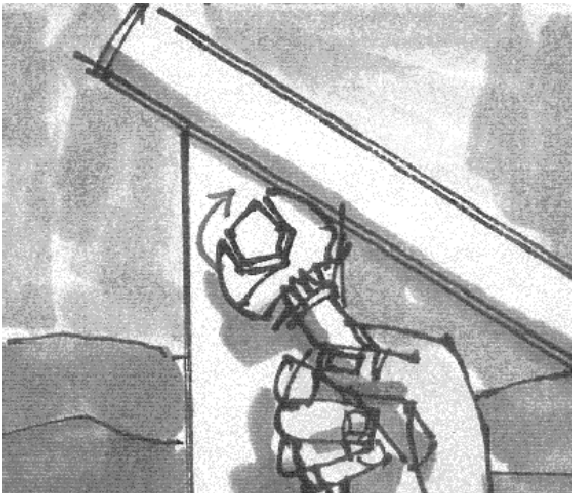
Check	Observation	Possible cause
1. Set IO 102 on/off switch to OFF (in stopped position).	The generator slows down and turns slowly or stops. If the generator does not slow down, proceed to step 2.	<p>No connection to the pump.</p> <p>Check that the pump main switch is on and in the normal run position.</p> <p>Check the motor cable for disconnections.</p>
2. If the generator does not slow down.	Turbine blades running fast and not slowing when IO 102 on/off switch is in OFF position.	<p>One or more of the three wires may be disconnected. Check the wires.</p> <p><i>Note: Be aware of high voltage. Danger exists if the wires are touch or short against each other.</i></p>

2. Maintenance

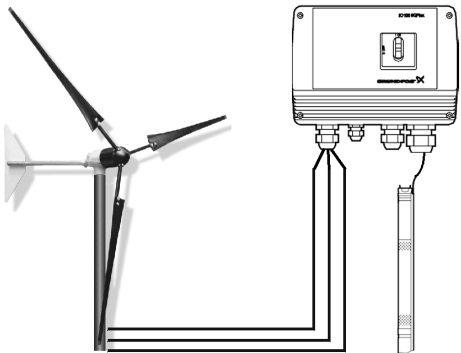
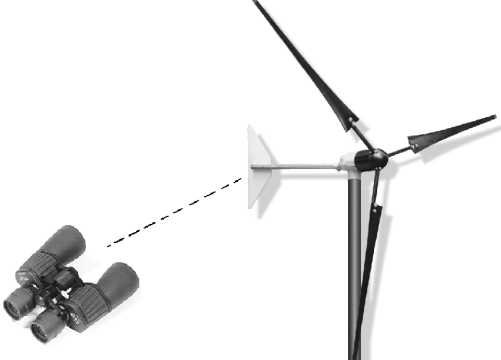
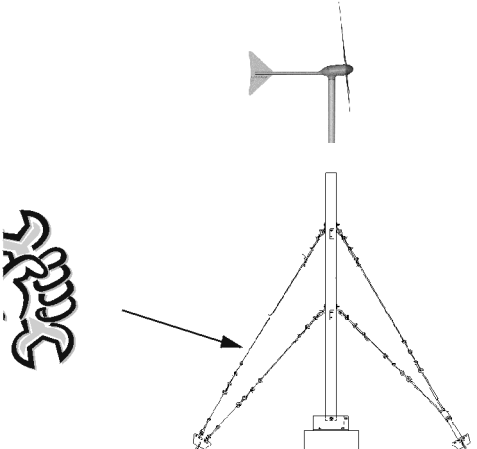
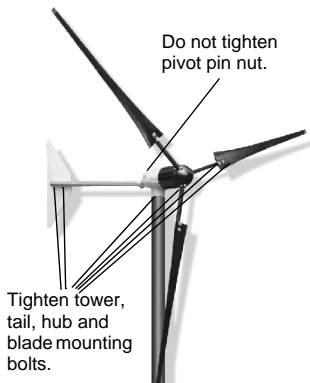
This section shows the maintenance instructions for the solar panels and the wind turbine. The pumps and the controls are maintenance free under normal conditions.

2.1 Solar modules

Routine maintenance

	<p>Cleaning</p> <p>The solar modules must be cleaned when they are dirty. Use only clean water without soap. Make sure there is no sand in the water.</p> <p>There is no need to clean the modules underneath.</p>
	<p>Cleaning</p> <p>Make sure that the sun can shine on the modules. Cut down grass or trees that shade the solar modules.</p>
	<p>Tighten</p> <p>Tighten the bolts on the support structure if they have loosened.</p>


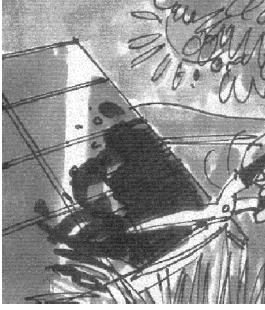
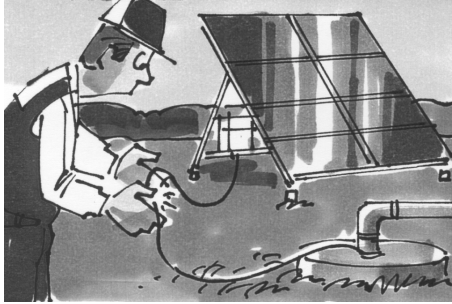
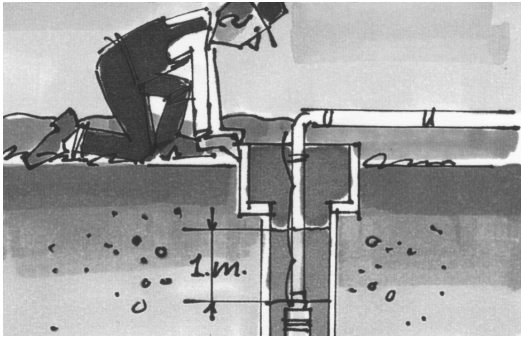

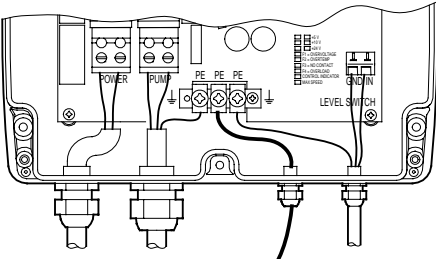
2.2 Wind turbine

Monthly maintenance	
	<p>Test brake</p> <p>(This checks electrical wiring.) <i>Stop the wind generator in a moderate wind (charging but not furling).</i> No unusual difficulty or noise should be experienced in stopping the propeller. A noise during braking can indicate a disconnected wire.</p>
	<p>Check mechanical condition</p> <p><i>Watch and listen from the tower base.</i> Use binoculars. There should be no mechanical noise, rattle or vibration. The propeller and tail must not wobble. Lower or climb the tower for inspection, if indicated. There should be no buzzing either heard or felt with your hand on the tower mast. Go to Electrical Problems, if indicated.</p>
	<p>Inspect the tower</p> <p>Follow all inspection and maintenance requirements of the tower manufacturer. Tighten all nuts and bolts, especially wire clips. Check for cracks and bent or broken parts at the anchors and base structure. Check for broken strands and tighten guy wires.</p>
Annual maintenance	
 <p>Do not tighten pivot pin nut.</p> <p>Tighten tower, tail, hub and blade mounting bolts.</p>	<p>Complete mechanical check</p> <p>Fix or replace any worn or loose parts.</p> <p>Lower tower</p> <p>Check tightness of all tower mounting nuts and bolts and propeller mounting bolts.</p> <p>Check all bearings. Just perceptible play is acceptable.</p> <p>Clean the propeller with mild scrubbing agent to remove all dirt and debris. Replace blades if they are cracked or damaged.</p>

3. Fault finding





























3.0.1 Visual/general inspection of main components

If your system in question does not include a component mentioned in the table below, continue to the next section

		<p>Visual inspection of solar panels (6)</p> <ul style="list-style-type: none"> • Check that the solar panels are intact. • Make sure that trees, grass, bushes, buildings, etc. do not cast shadows on the solar panels.
<p>Visual inspection of the wind turbine (8)</p>		<p>See section 2.2 wind turbine.</p>
	<p>Visual inspection of cables (2, 16)</p> <ul style="list-style-type: none"> • Check that the cables are intact. 	
	<p>Visual inspection of the water level (1)</p> <p>The water level must be at least 3 ft. above the pump.</p>	
	<p>Visual inspection of pipes and hoses (17)</p> <ul style="list-style-type: none"> • Check that hoses or pipes that connect the pump and tapping point are intact. 	
		<p>Test using a CU 200</p> <p>If a CU 200 is available, it can be used for testing systems which include no CU 200. Connect the CU 200 and proceed according to the instructions in in section 1.3.1 CU 200 SQFlex control unit.</p>

3.0.2 Overview of possible combinations

1. Find the application listed below includes the components corresponding to the system you are troubleshooting
2. Skip to the fault finding procedures specified for that system.
 - A system that includes solar panels should be tested in the midday on a clear and sunny day.
 - A system that includes a wind turbine should be tested on a day where the wind speed is at least 8mph.
3. Upon finding the fault in the system, you may repair or replace the defective component(s) or contact your nearest Grundfos Service Center. When contacting the service center please have the system information ready.

Section, pump systems	System components						
	Pump	Solar panel	Wind turbine with IO 102	Generator/ supply network	Switch box	Control unit	Level switch
3.1 Solar energy pumping system					 IO 100		
3.2 Solar energy pumping system with CU 200 control unit and level switch							 *
3.3 Solar energy pumping system with generator back-up					 IO 101		
3.4 Wind energy pumping system							
3.5 Wind energy pumping system with CU 200 control unit and level switch							 *
3.6 Combined energy pumping system							
3.7 Combined energy pumping system with CU 200 control unit and level switch							 *
3.8 Options with generator as back-up source		**	**		 IO 101	**	**

* Not required for installation.

** Components may be added as an option.

3.1 Solar energy pumping system

3.1.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.1.2 Fault finding in solar energy pumping system

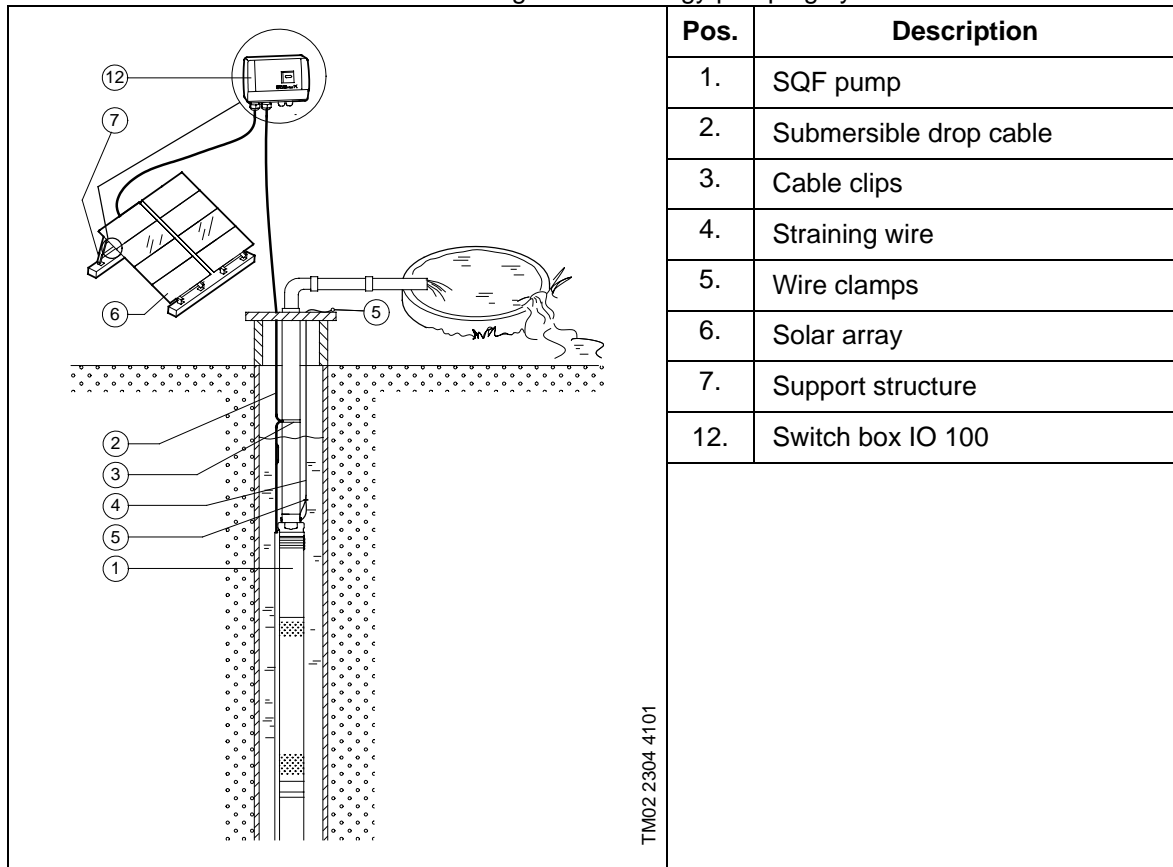
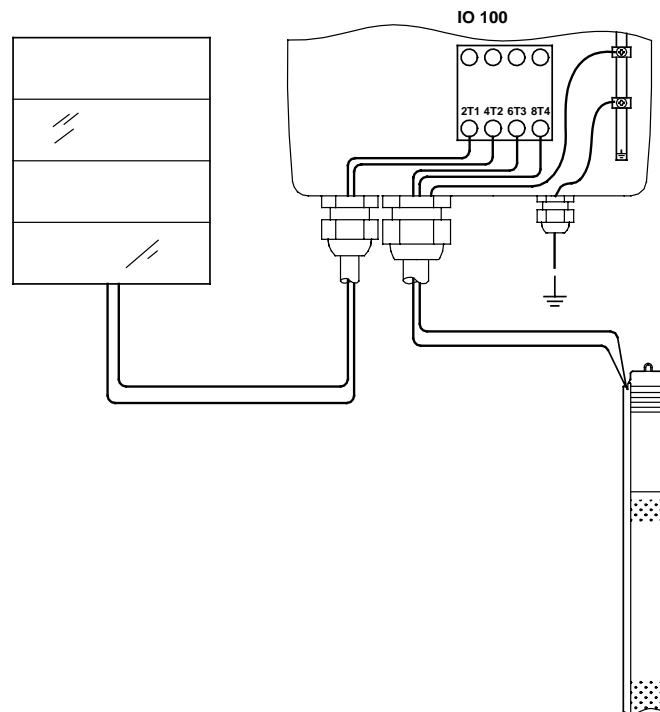


Fig. 1. Solar energy pumping system



3.1.2 Fault finding in solar energy pumping system

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

All measuring points/terminal designations in this section can be found in the IO 100 switch box.

<p>1. Switch off the pump.</p> <ul style="list-style-type: none">• Set the switch on the IO 100 to Off.• Remove the pump cable from the terminals (6T3, (N)8T4).
<p>2. Voltage measurement of solar panels.</p> <ul style="list-style-type: none">• Measure the terminals (2T1, 4T2) in the IO 100 using a voltmeter. $150 < V < 220$ VDC, see Solar module voltage (VDC) on page 13. (For Grundfos modules. Other brand modules will have other specifications.)<ul style="list-style-type: none">• If the voltage is outside the range, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the voltage is inside the range, continue the fault finding.
<p>3. Current Measurements of solar panels.</p> <ul style="list-style-type: none">• Measure the terminals (2T1, 4T2) in the IO 100 using an ammeter. See Solar module current (A) on page 13. $I = \text{Current delivered per module} \times \text{number of solar modules.}$<ul style="list-style-type: none">• If the measured value differs from the calculated value, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the current is inside the range continue the fault finding.
<p>4. Measurements in the IO 100 box.</p> <ul style="list-style-type: none">• Set the switch on the IO 100 to On.• Measure the terminals (6T3, (N)8T4) in the IO 100 using a voltmeter. The value must be identical to that measured under step 2.• Measure the terminals (6T3, (N)8T4) in the IO 100 using an ammeter. The value must be identical to that measured under step 3.<ul style="list-style-type: none">• If the values differ from those measured under step 2 and 3, the IO 100 is defective.• If the voltage and current values are ok, continue the fault finding.
<p>5. Reset of dry running alarm.</p> <ul style="list-style-type: none">• Set the switch on the IO 100 to Off.• Reconnect the pump cable to the terminals (6T3, (N)8T4) in the IO 100.• Start the pump by switching the on/off switch on the IO 100 to on.<ul style="list-style-type: none">• If the pump now starts, it has been in dry running alarm, and is now reset.• Wait five minutes. If the pump does not start, it is defective. Replace the pump.

3.2 Solar energy pumping system with CU 200 control unit and level switch

3.2.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.2.2 Fault finding in solar energy pumping system with CU 200 control unit and level switch.

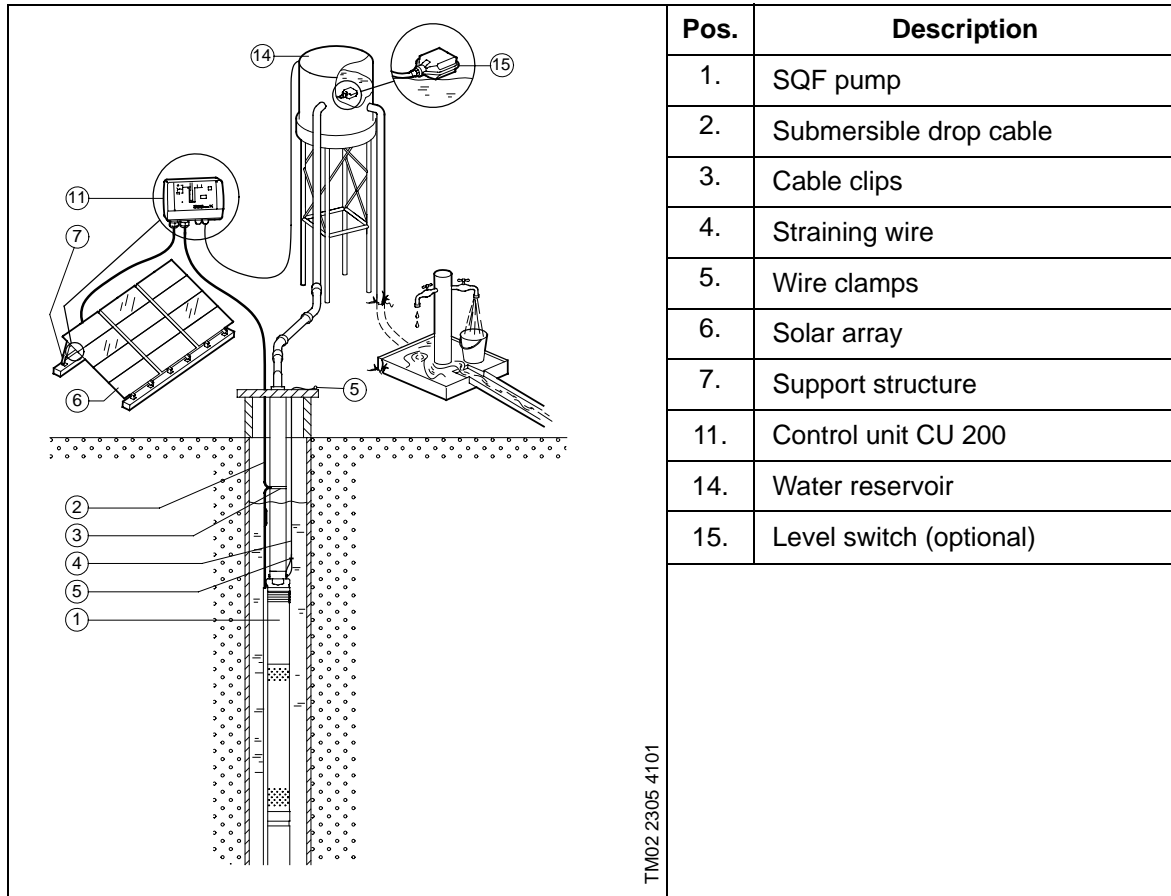
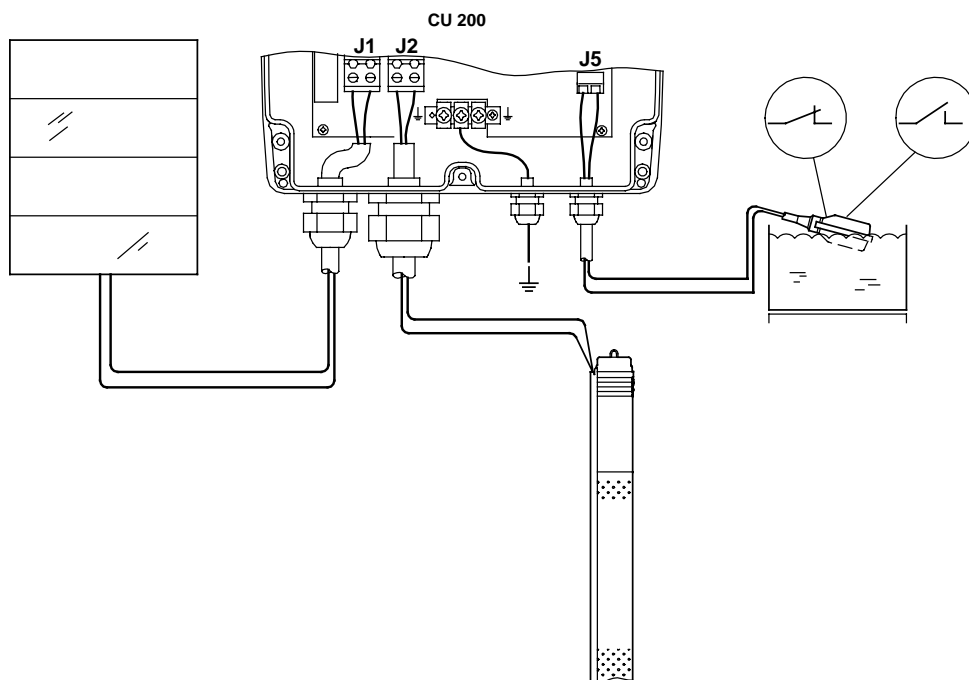


Fig. 2. Solar energy pumping system with CU 200 and level switch



3.2.2 Fault finding in solar energy pumping system with CU 200 control unit and level switch

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

All measuring points/terminal designations in this section can be found in the CU 200 control unit.

1. System check of the CU 200
1. Check the CU 200 for faults by following the fault finding section 1.3.1.3 Fault finding.
2. Switch off the pump <ul style="list-style-type: none">• Press the On/Off button on the CU 200 to switch off the pump. (the "off" indicator should be lit.)• Remove the pump cable from the terminals J2.
3. Voltage measurement of solar panels <ul style="list-style-type: none">• Measure the terminals J1 using a voltmeter. 150 < V < 220 VDC, see Solar module voltage (VDC) on page 13. (For Grundfos modules. Other brands of solar modules will have other specifications.)<ul style="list-style-type: none">• If the voltage is outside the range, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the voltage is inside the range, continue the fault finding.
4. Short-circuit measurement on the solar panels <ul style="list-style-type: none">• Measure the terminals J2 using an ammeter. See Solar module current (A) on page 13. $I = \text{Current delivered per module} \times \text{number of solar modules}$<ul style="list-style-type: none">• If the measured value differs from the calculated value, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the current is inside the range, continue the fault finding.
5. Test level switch in the water reservoir <ul style="list-style-type: none">• Remove the level switch cable from the terminals J5.• Measure the removed level switch cable leads using an ohmmeter.• Turn the level switch up => contacts in the level switch are closed, resistance should read 0 Ω.• Turn the level switch down => contacts in the level switch are open resistance should read ∞ Ω.<ul style="list-style-type: none">• If any measurements are not correct, the level switch is defective.• If the measurements are correct, continue the fault finding.
6. Measurement of the CU 200 control unit <ul style="list-style-type: none">• level switch remains disconnected.• Press the On/Off button to turn the pump on. (The "On" indicator should be lit.)• Measure the terminals for the pump (J2) using a voltmeter.• The value must be identical to that measured under step 3.• Measure the terminals for the pump (J2) using an ammeter.• The value must be identical to that measured under step 4.• If the values differ from those measured under steps 3 and 4, the CU 200 is defective.• If voltage and current are ok, continue the fault finding.
7. Reset of dry running alarm <ul style="list-style-type: none">• Press the On/Off button to turn the pump off. (The "Off" indicator should be lit.)• Fit the pump cable into the terminals J2.• Press the on/off button to turn the pump on. (The "On" indicator should be lit.)<ul style="list-style-type: none">• If the pump starts, it has been in dry running alarm, and is now reset.• Wait five minutes. If the pump does not start, it is defective. Replace the pump.

3.3 Solar energy pumping system with generator back-up

3.3.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.3.2 Fault finding in solar energy pumping system with generator back-up.

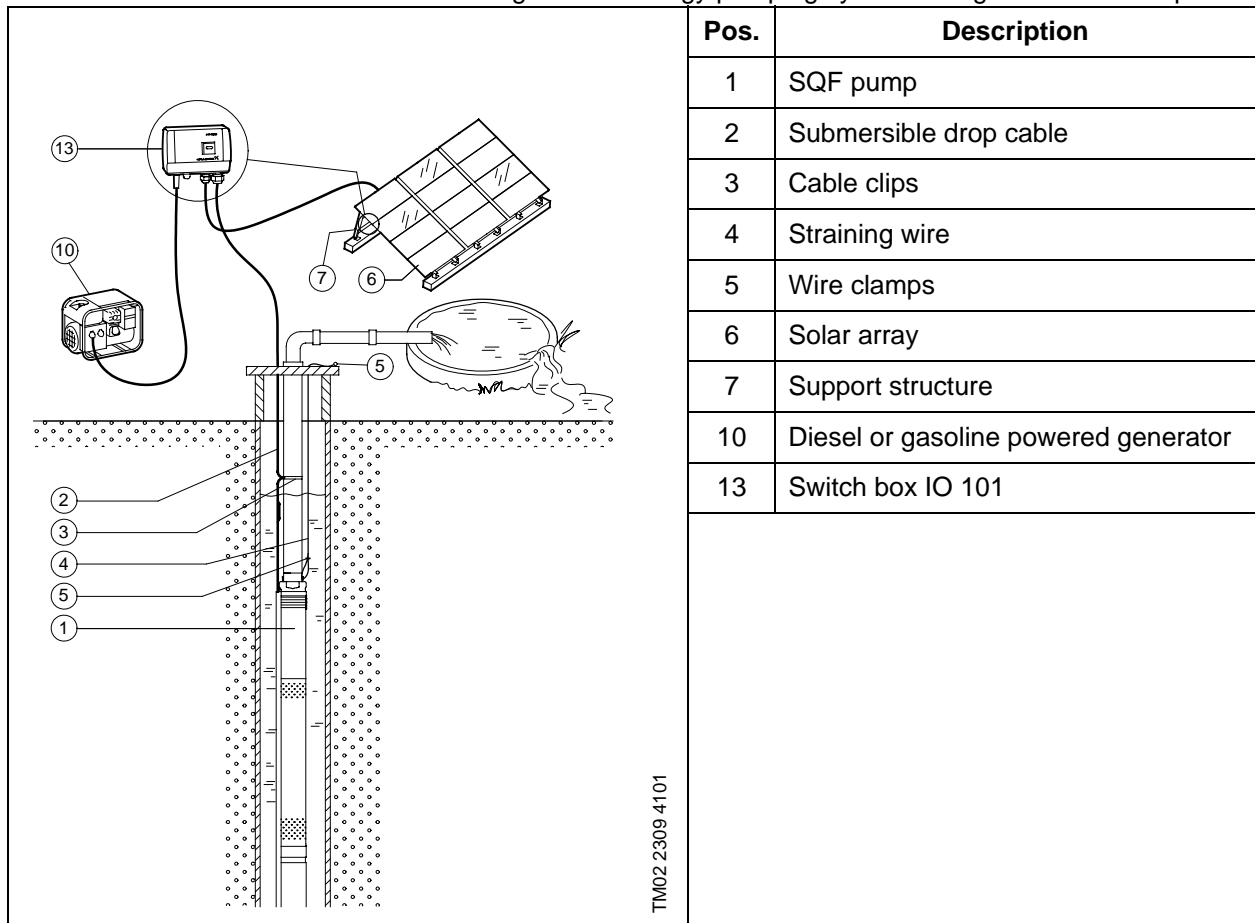
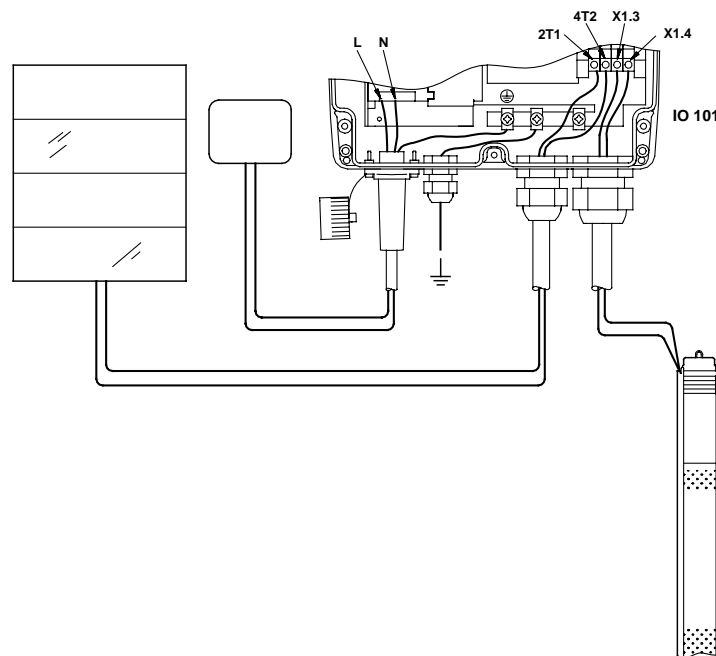


Fig. 3. Solar energy pumping system with IO 101 and generator



3.3.2 Fault finding in solar energy pumping system with generator back-up

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

All measuring points/terminal designations in this section can be found in the IO 101 switch box

<p>1. Switch off the pump.</p> <ul style="list-style-type: none">• Be sure generator is shut off.• Set the switch on the IO 101 to Off.• Remove the pump cable from the terminals (X1.3, X1.4).
<p>2. Voltage measurement of solar panels.</p> <ul style="list-style-type: none">• Measure the terminals (2T1, 4T2) using a voltmeter. 150 < V < 220 VDC, see Solar module voltage (VDC) on page 13. (For Grundfos modules. Other brands of solar modules will have other specifications.)<ul style="list-style-type: none">• If the voltage is outside the range, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the voltage is inside the range, continue the fault finding.
<p>3. Short-circuit measurement on the solar panels.</p> <ul style="list-style-type: none">• Measure the terminals (2T1, 4T2) in the IO 101 using an ammeter. See Solar module current (A) on page 13. $I = \text{Current delivered per module} \times \text{number of solar modules.}$<ul style="list-style-type: none">• If the measured value differs from the calculated value, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the current is inside the range, continue the fault finding.
<p>4. Measurement of the IO 101 box.</p> <ul style="list-style-type: none">• Set the switch on the IO 101 to On.• Measure the terminals (X1.3, X1.4) using a voltmeter. The value must be identical to that measured under step 2.• Measure the terminals (X1.3, X1.4) using an ammeter. The value must be identical to that measured under step 3.<ul style="list-style-type: none">• If the values differ from those measured under step 2 and 3, the IO 101 is defective.• If the voltage and current values are ok, continue the fault finding.
<p>5. Measurement of the generator.</p> <ul style="list-style-type: none">• Set the switch on the IO 101 to Off.• Start Generator.• Measure the terminals (L, N) using a voltmeter. V = generator nominal voltage (Check the generator name plate for value.)<ul style="list-style-type: none">• If the voltage is not correct, the fault is in the generator.• If voltage is ok, continue the fault finding.
<p>6. Measurement of IO 101 box under generator power</p> <ul style="list-style-type: none">• Set the switch on the IO 101 to On. Generator, should be running.• Measure the terminals (X1.3, X1.4) using a voltmeter.• V = nominal generator voltage (check the generator nameplate for value)<ul style="list-style-type: none">• If the voltage is not correct, the fault is in the generator.• If voltage is ok continue the fault finding.
<p>7. Reset of dry running alarm</p> <ul style="list-style-type: none">• Set the switch on the IO 101 to Off.• Reconnect the pump cable to the terminals J2.• Press the on/off button to turn the On light on.<ul style="list-style-type: none">• If the pump starts, it has been in dry running alarm, and is now reset.• Wait five minutes. If the pump does not start, it is defective.

3.4 Wind energy pumping system

3.4.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.4.2 Fault finding in wind energy pumping system.

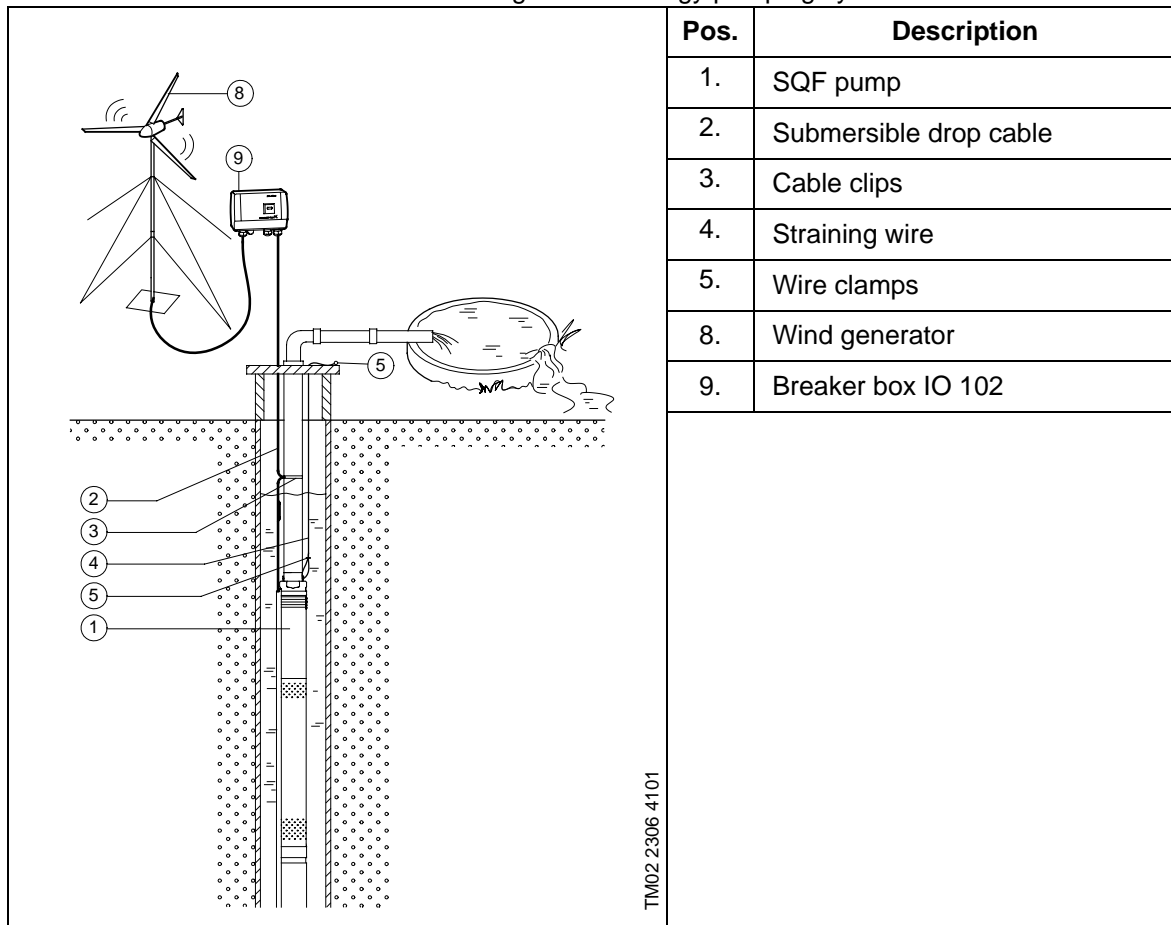
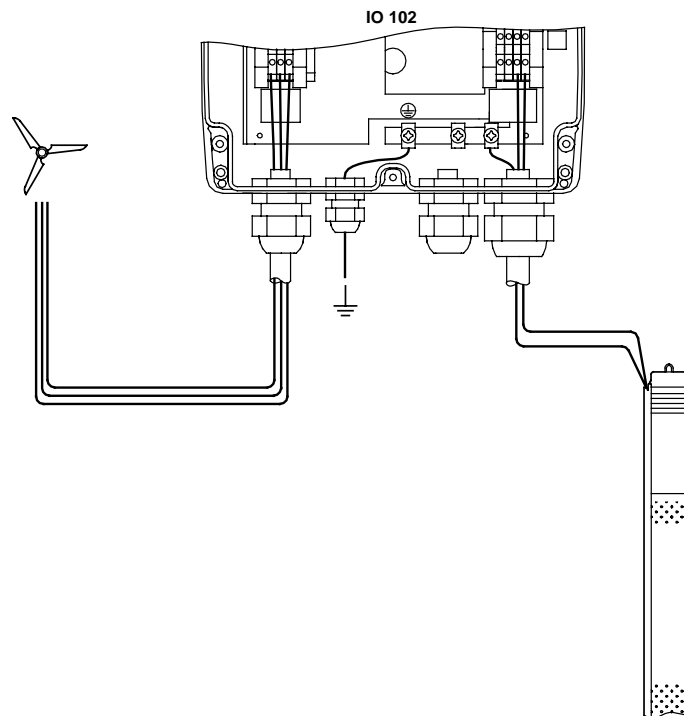


Fig. 4. Wind energy pumping system



3.4.2 Fault finding in wind energy pumping system

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

All measuring points/terminal designations in the following table refer to the IO 102 breaker box.

<p>1. Remove the pump</p> <ul style="list-style-type: none">• Stop the wind turbine by switching the On/Off switch to Off.• Remove the pump cable from the terminals in the IO 102 breaker box.• Release the wind turbine by switching the On/Off switch to On.
<p>2. Voltage measurement of the wind turbine</p> <ul style="list-style-type: none">• Measure the terminals for the wind turbine using a voltmeter.• Carry out three measurements, one between each of the three phases.• $V = 0 - 250$ VAC. The voltage depends on the wind speed, see Wind generator voltage on page 16.<ul style="list-style-type: none">• The three values measured must be identical. If they differ, the wind turbine is faulty.• If no voltage is measured and the wind turbine is turning, the wind turbine is faulty.• If the voltage is identical between the three phases, continue the fault finding.
<p>3. Voltage measurement in the IO 102 breaker box</p> <ul style="list-style-type: none">• Measure the terminals for the pump using a voltmeter. $V = 0 - 300$ VDC. The voltage depends on the wind speed, see IO 102 voltage on page 16.<ul style="list-style-type: none">• If no voltage is measured and the wind turbine is turning, the breaker box is faulty.• If the voltage is ok, continue the fault finding.
<p>4. Reset of dry running alarm</p> <ul style="list-style-type: none">• Stop the wind turbine by switching the IO 102 On/Off switch to Off.• Reconnect the pump cable to the terminals in the IO 102 breaker box.• Release the wind turbine by switching the IO 102 On/Off switch to On.<ul style="list-style-type: none">• If the pump starts, it has been in dry running alarm, and is now reset.• Wait five minutes. If the pump does not start, the pump is defective.

3.5 Wind energy pumping system with CU 200 control unit and level switch

3.5.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.5.2 Fault finding in wind energy pumping system with CU 200 control unit and level switch.

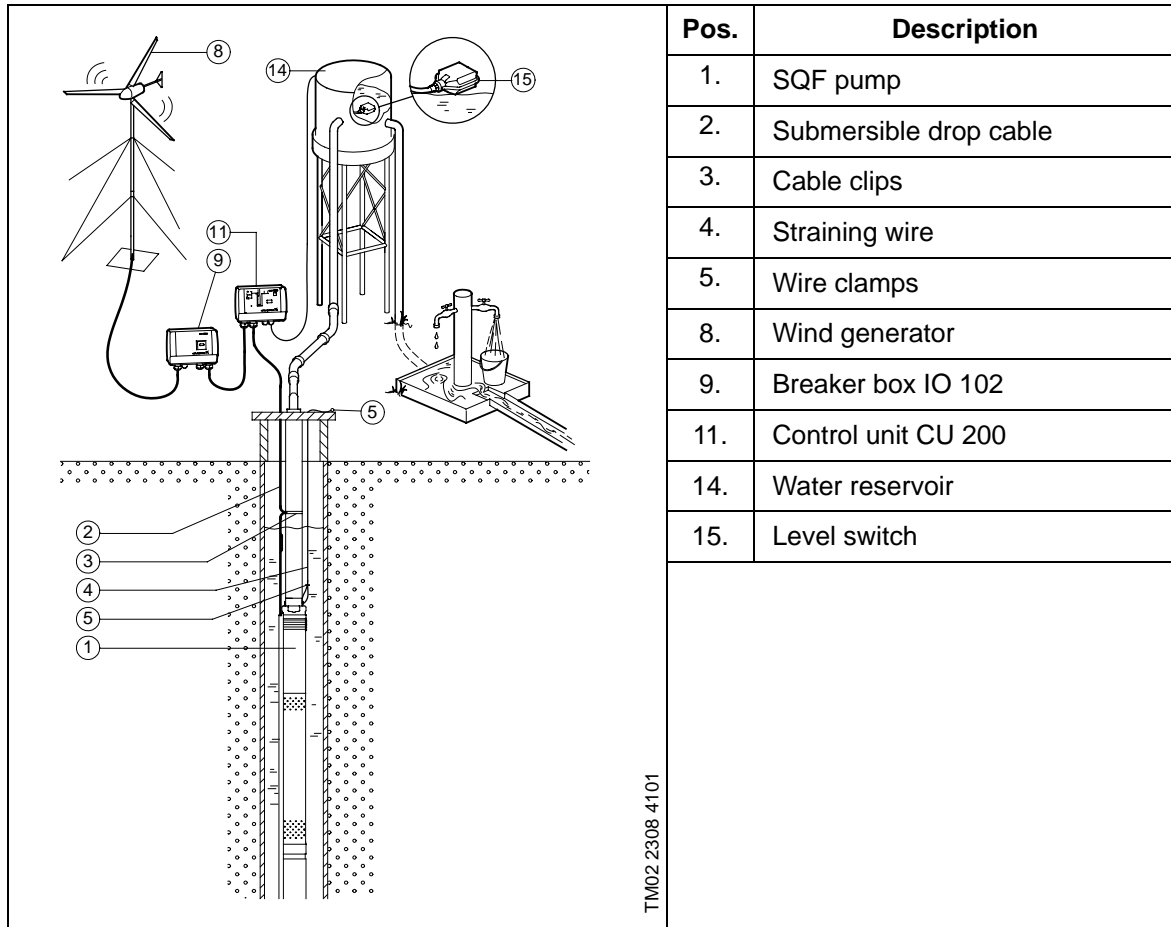
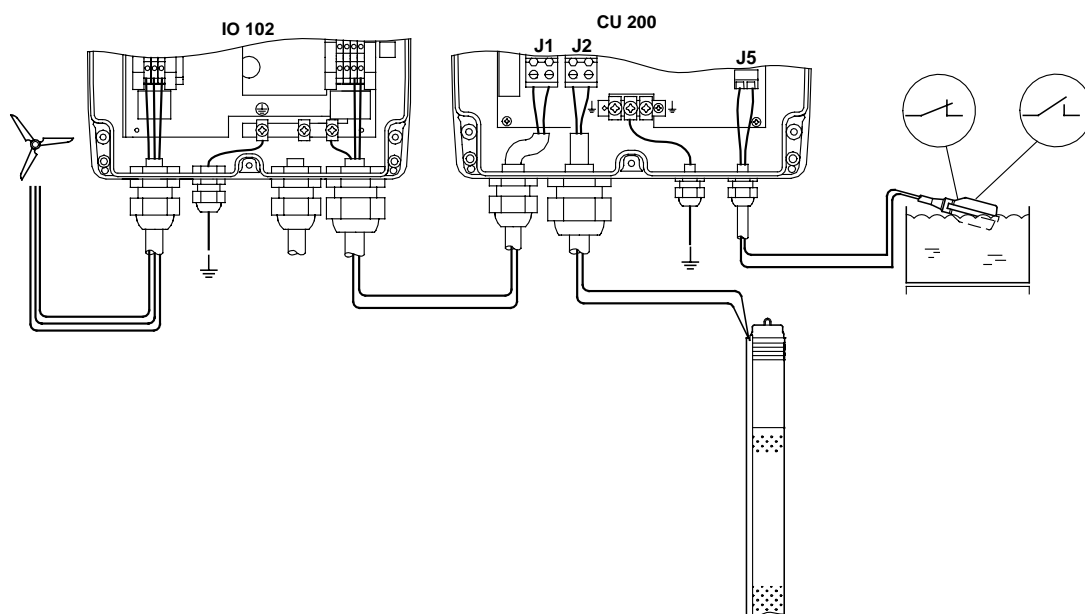


Fig. 5. Wind energy pumping system with CU 200 and level switch.



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3.5.2 Fault finding in wind energy pumping system with CU 200 control unit and level switch

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

1. System Check of CU 200 <ul style="list-style-type: none">• Check the CU 200 for faults by following the fault finding section 1.3.1.3 Fault finding.
2. Switch off the pump <ul style="list-style-type: none">• Press the On/Off button on the CU 200 to turn the pump off. (The "Off" indicator should be lit.)• Remove the pump cable from the terminals J2.
3. Voltage measurement of the wind turbine <ul style="list-style-type: none">• Measure the terminals for the wind turbine in the breaker box using a voltmeter. Carry out three measurements, one between each of the three phases. $V = 0 - 250 \text{ VAC}$. The voltage depends on the wind speed, see Wind generator voltage on page 16.<ul style="list-style-type: none">• The three values measured must be identical. If they differ, the wind turbine is faulty.• If no voltage is measured and the wind turbine is turning, the wind turbine is faulty.• If the voltage is identical between the three phases, continue the fault finding.
4. Voltage measurement in the IO 102 breaker box <ul style="list-style-type: none">• Measure the terminals leading to the CU 200 in the IO 102 breaker box using a voltmeter. $V = 0 - 300 \text{ VDC}$. The voltage depends on the wind speed, see IO 102 voltage on page 16.<ul style="list-style-type: none">• If no voltage is measured and the wind turbine is turning, the IO 102 breaker box is faulty.• If the voltage is ok, continue the fault finding.
5. Test the level switch in the water reservoir <ul style="list-style-type: none">• Remove the level switch cable from the terminals J5 in the CU 200.• Measure the removed level switch cable leads using an ohmmeter.• Turn the level switch up => contacts in the level switch are closed, resistance should read 0Ω.• Turn the level switch down => Contacts in the switch are open, resistance should read $\infty \Omega$.<ul style="list-style-type: none">• If any measurements are not correct, the level switch is defective.• If the measurements are correct, continue the fault finding.
6. Measurements in the CU 200 Control Unit <ul style="list-style-type: none">• level switch remains disconnected• Press the On/Off button to turn the pump on. (The "On" indicator should be lit.)• Measure the terminals for the pump (J2) using a voltmeter. The value must be identical to that measured under step 4.<ul style="list-style-type: none">• If the value differs from that measured under step 4, the CU 200 is defective.• If the voltage is ok, continue the fault finding.
7. Reset of dry running alarm <ul style="list-style-type: none">• Press the On/Off button on the CU 200 to turn the pump off. (The "Off" indicator should be lit.)• Reconnect the pump cable to the terminals J2.• Reconnect the level switch cable to the terminals J5. The level switch must be in the down position for the CU 200 to power the pump.• Press the On/Off button to turn the pump on. (The "On" indicator should be lit.)<ul style="list-style-type: none">• If the pump starts, it has been in dry running alarm, and is now reset.• Wait five minutes. If the pump does not start, the pump is defective.

3.6 Combined energy pumping system

3.6.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.5.2 Fault finding in wind energy pumping system with CU 200 control unit and level switch.

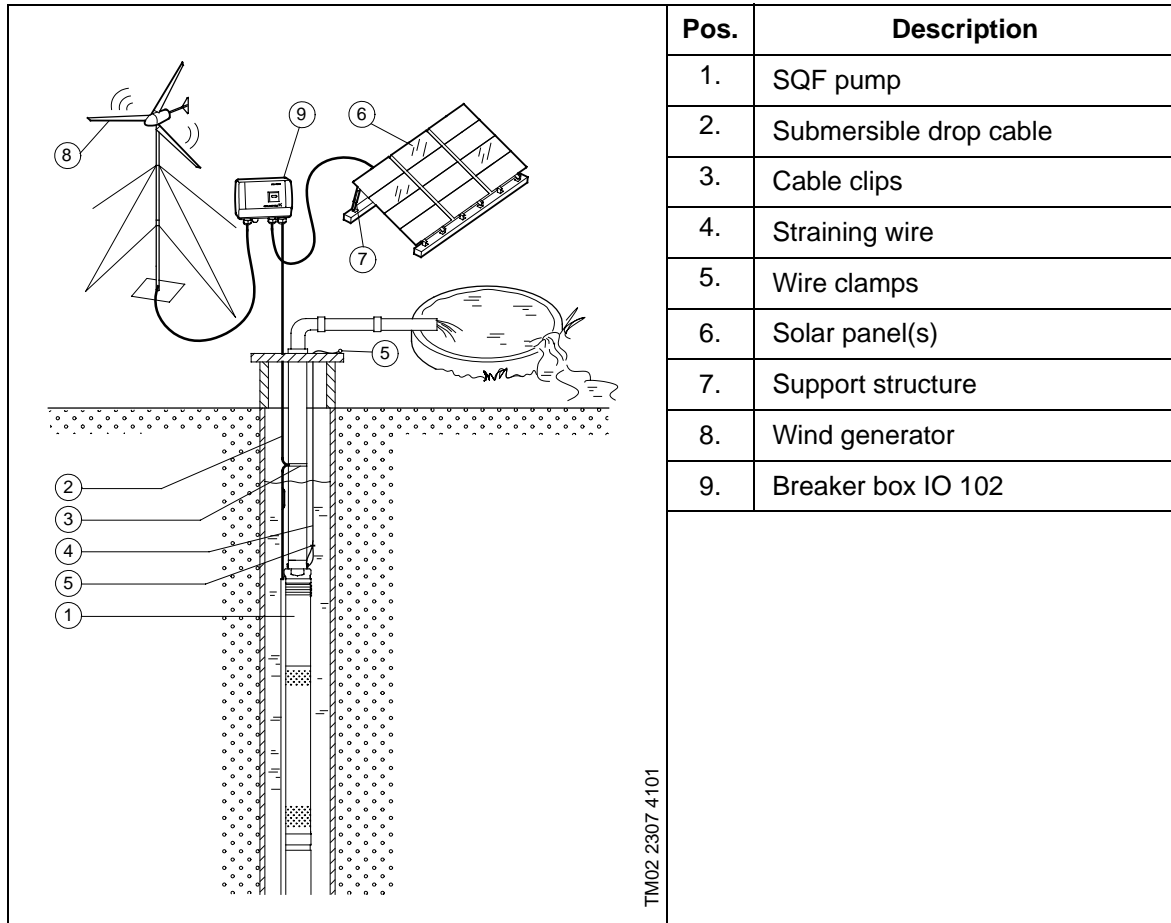
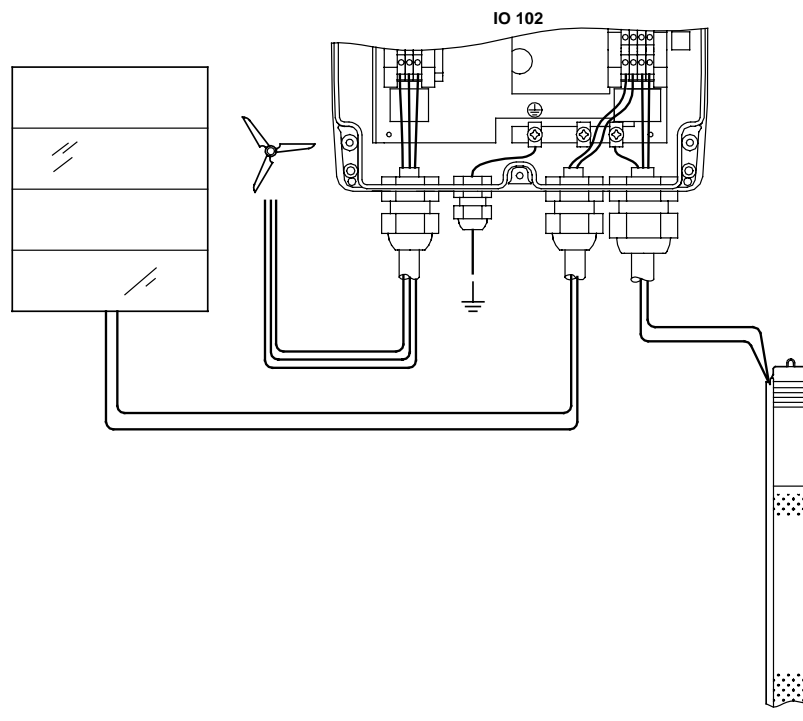


Fig. 6. Combined pumping system.



3.6.2 Fault finding in combined energy pumping system

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

All measuring points/terminal designations in the following table refer to the IO 102 breaker box.

<p>1. Disconnect the pump</p> <ul style="list-style-type: none">• Set the IO 102 On/Off switch to Off.• Remove the pump cable from the terminals. Remove the cable coming from the solar panels. (Do not touch the wire due to high voltage.)• Release the wind turbine by turning the IO 102 On/Off switch to On.
<p>2. Voltage measurement of the wind turbine</p> <ul style="list-style-type: none">• Measure the terminals for the wind turbine using a voltmeter. Carry out three measurements, one between each of the three phases. $V = 0 - 250 \text{ VAC}$. The voltage depends on the wind speed, see Wind generator voltage on page 16.• The three values measured must be identical. If they differ, the wind turbine is faulty.• If no voltage is measured and the wind turbine is turning, the wind turbine is faulty.• If the voltage is identical between the three phases, continue the fault finding.
<p>3. Voltage measurement of the IO 102 breaker box</p> <ul style="list-style-type: none">• Measure the terminals for the pump using a voltmeter. $V = 0 - 300 \text{ VDC}$. The voltage depends on the wind speed, see IO 102 voltage on page 16.• If no voltage is measured and the wind turbine is turning, the IO 102 breaker box is faulty.• If the voltage is ok, continue the fault finding.
<p>4. Voltage measurement of solar panels</p> <ul style="list-style-type: none">• Disconnect the three wires from the wind turbine one by one and short-circuit all three wires to each other in order to stop the turbine.• Reconnect the wire from the solar panels which was disconnected in step 1.• Measure the terminals for the solar panels using a voltmeter. $150 \text{ VDC} < V < 220 \text{ VDC}$, see Solar module voltage (VDC) on page 13. (For Grundfos modules. Other brands of solar modules will have other specifications.)• If the voltage is outside the range, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the voltage is inside the range, continue the fault finding.
<p>5. Short-circuit measurement on the solar panels.</p> <ul style="list-style-type: none">• Measure the terminals for the solar panels using an ammeter. See Solar module current (A) on page 13. $I = \text{Current delivered per module} \times \text{number of solar modules}$.• If the measured value differs from the calculated value, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the current is inside the range, continue the fault finding.
<p>6. Measurement of IO 102 breaker box</p> <ul style="list-style-type: none">• Reconnect cable from solar panels and switch the IO 102 On/Off switch to On.• Measure the terminals for the pump using a voltmeter. The value must be identical to that measured under step 4.• Measure the terminals for the pump using an ammeter. The value must be identical to that measured under step 5.• If the values differ from those measured under steps 4 and 5, the breaker box defective.• If voltage and current are OK, continue the fault finding.
<p>7. Reset of dry-running alarm</p> <ul style="list-style-type: none">• Switch off solar panels using "solar disconnect".• Reconnect the pump cable to the terminals.• Switch on solar panels using "solar disconnect".• If the pump starts, it has been in dry running alarm, and is now reset.• Wait five minutes. If the pump does not start, it is defective.. Replace the pump.

3.7 Combined energy pumping system with CU 200 control unit and level switch

3.7.1 Description

In case the SQ Flex pumping system consisting of the elements shown below does not work properly, follow the instructions in section 3.7.2 Fault finding in combined energy pumping system with CU 200 control unit and level switch.

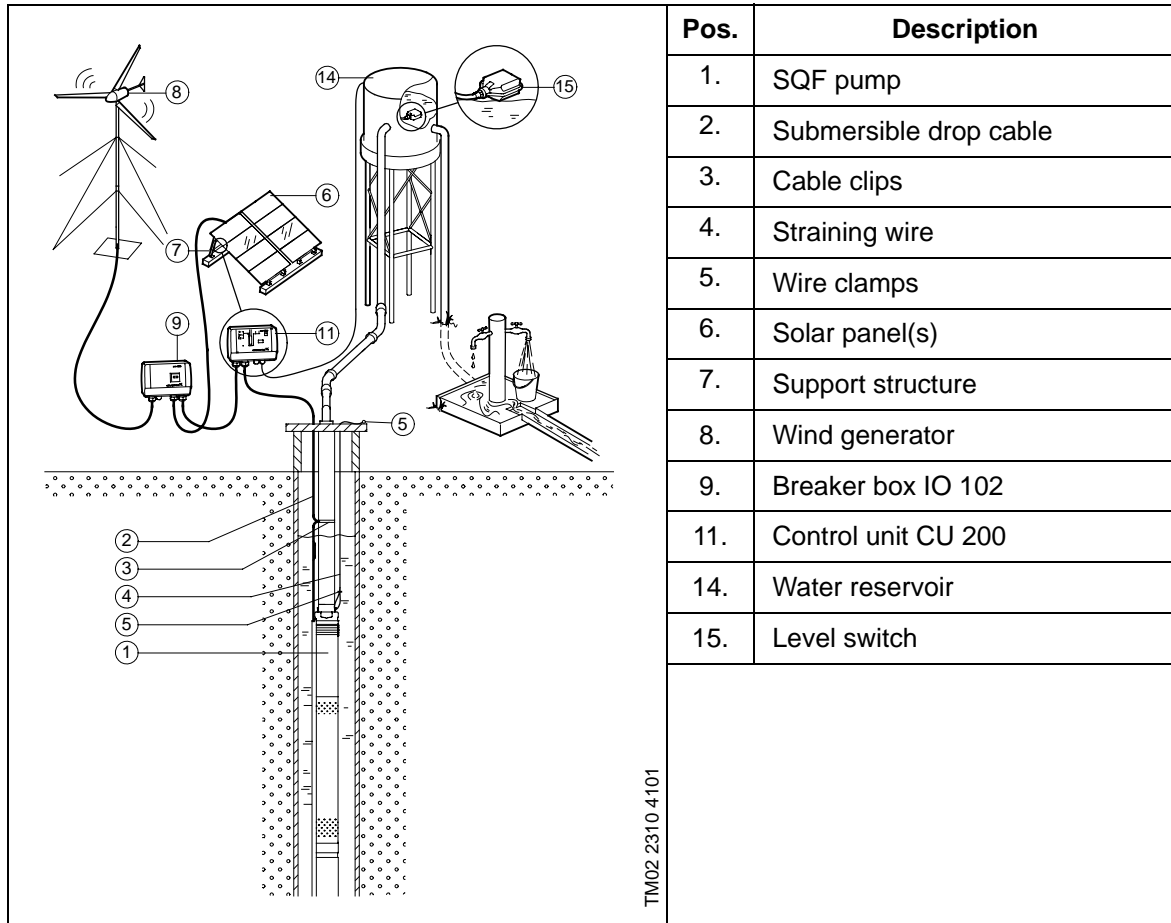
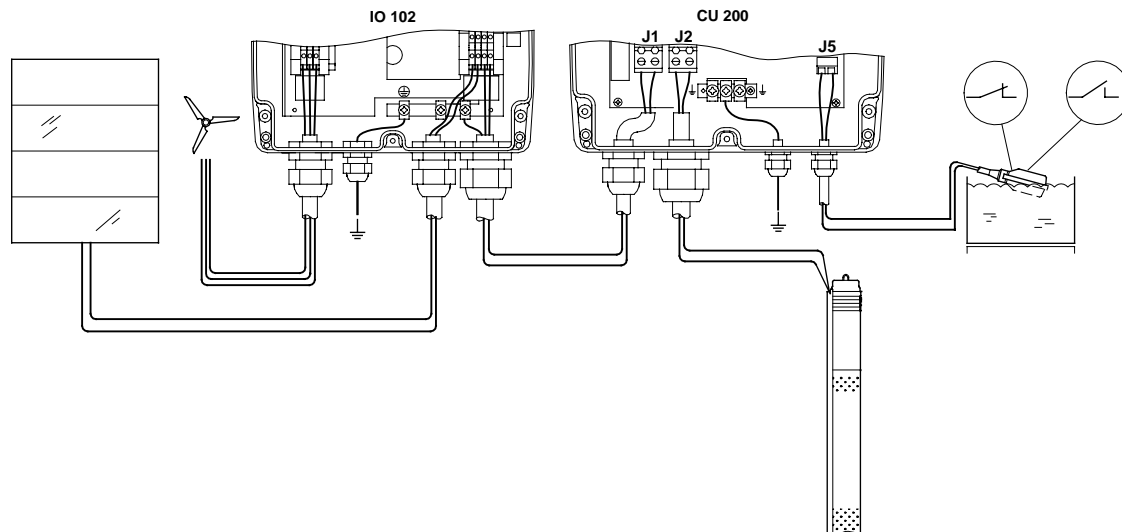


Fig. 7. Combined pumping system with CU 200 and level switch.



3.7.2 Fault finding in combined energy pumping system with CU 200 control unit and level switch

Carry out the visual inspection of the system, see section 3. Fault finding, before the application inspection described below.

Measuring points/terminal designations in the following table refer to the IO 102 breaker box eller i CU 200.

<p>1. Switch off the pump</p> <ul style="list-style-type: none">• Set the IO 102 On/Off switch to Off.• Remove the cable coming from the solar panels. (Do not touch the wire due to high voltage.)• Remove the pump cable from the terminals J2 i CU 200.• Release the wind turbine by turning the IO 102 On/Off switch to On
<p>2. Voltage measurement of the wind turbine</p> <ul style="list-style-type: none">• Measure the terminals for the wind turbine in the IO 102 breaker box using a voltmeter. Carry out three measurements, one between each of the three phases. $V = 0 - 250 \text{ VAC}$. The voltage depends on the wind speed, see Wind generator voltage on page 16.<ul style="list-style-type: none">• The three values measured must be identical. If they differ, the wind turbine is faulty.• If no voltage is measured and the wind turbine is turning, the wind turbine is faulty.• If the voltage is identical between the three phases, continue the fault finding.
<p>3. Voltage measurement of the IO 102 breaker box</p> <ul style="list-style-type: none">• Measure the terminals leading to the CU 200 in the IO 102 breaker box using a voltmeter. $V = 0 - 300 \text{ VDC}$. The voltage depends on the wind speed, see IO 102 voltage on page 16.<ul style="list-style-type: none">• If no voltage is measured and the wind turbine is turning, the breaker box is faulty.• If the voltage is ok, continue the fault finding.
<p>4. Voltage measurement of solar panels</p> <ul style="list-style-type: none">• Disconnect the three wires from the wind turbine one by one and short-circuit all three wires to each other in order to stop the turbine.• Reconnect the wire from the solar panel which was disconnected in step 1.• Measure the terminals for the solar panels in the IO 102 breaker box using a voltmeter. $150 \text{ VDC} < V < 220 \text{ VDC}$, see Solar module voltage (VDC) on page 13. (For Grundfos modules. Other brands of solar modules will have other specifications.)<ul style="list-style-type: none">• If the voltage is outside the range, there could be a fault in one of the modules. Check each module individually for faults, see Electrical connection on page 15.• If the voltage is inside the range, continue the fault finding.
<p>5. Short-circuit measurement on the solar panels.</p> <ul style="list-style-type: none">• Measure the terminals for the solar panels in the breaker box using an ammeter. See Solar module current (A) on page 13. $I = \text{Current delivered per module} \times \text{number of solar modules}$.<ul style="list-style-type: none">• If the measured value differs from the calculated value, there could be a fault in one of the modules. Check each module individually for faults.• If the current is inside the range, continue the fault finding.
<p>6. Measurement of IO 102 breaker box</p> <ul style="list-style-type: none">• Reconnect cable from solar panels and switch the IO 102 On/Off switch to On.• Measure the terminals for the pump using a voltmeter. The value must be identical to that measured under step 4.• Measure the terminals for the pump using an ammeter. The value must be identical to that measured under step 5.<ul style="list-style-type: none">• If the values differ from those measured under steps 4 and 5, the breaker box defective.• If voltage and current are OK, continue the fault finding.

7. Test level switch in the water reservoir

- Release the wind turbine by turning the IO 102 On/Off switch to On.
- Remove the level switch cable from the terminals J5 in the CU 200.
- Measure the removed level switch cable leads using an ohmmeter.
Turn level switch up => contacts in the level switch are closed. Resistance should read 0 Ω.
Turn level switch down => contacts in the switch are open. Resistance should read ∞ Ω.
 - If any measurements are not correct, the level switch is defective.
 - If the measurements are correct, continue the fault finding.

8. Measurement of CU 200 control unit

- level switch remains disconnected.
- Press the On/Off button, to turn the pump on. (The "On" indicator should be lit.)
- Measure the terminals for the pump (J2) using a voltmeter.
The value must be identical to that measured under step 4.
 - If the value differs from that measured under step 4, the CU 200 is defective.
 - If the voltage is ok, continue the fault finding.

9. Reset of dry running alarm

- Press the On/Off button on the CU 200 to turn the pump off. (The "Off" indicator should be lit.)
- Reconnect the pump cable to the terminals J2.
- Reconnect the level switch cable to the terminals J5. the level switch must be in the down position for the CU 200 to power the pump.
- Press the On/Off button to turn the pump on. (The "On" indicator should be lit.)
 - If the pump starts, it has been in dry running alarm, and is now reset.
 - Wait five minutes. If the pump does not start, the pump is defective. Replace the pump.

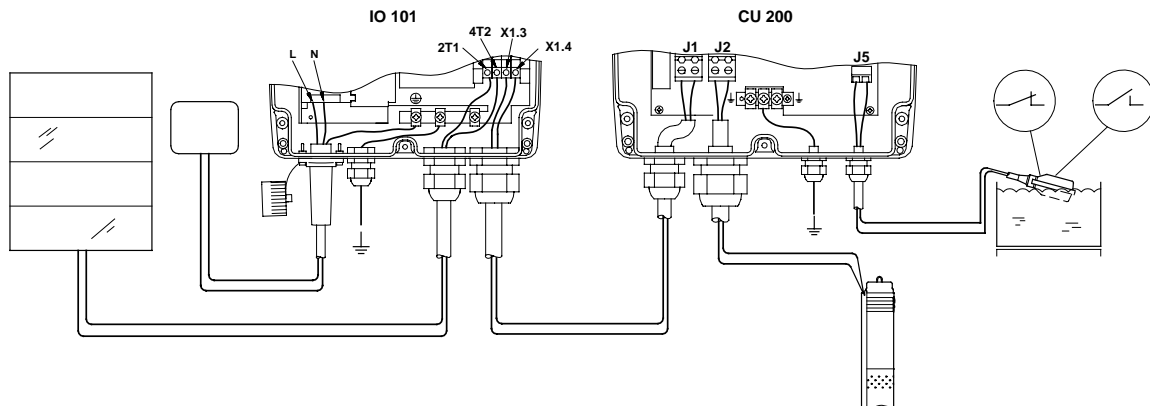
3.8 Options with generator as back-up source

Below are wiring diagram for options with generator as a back-up source.

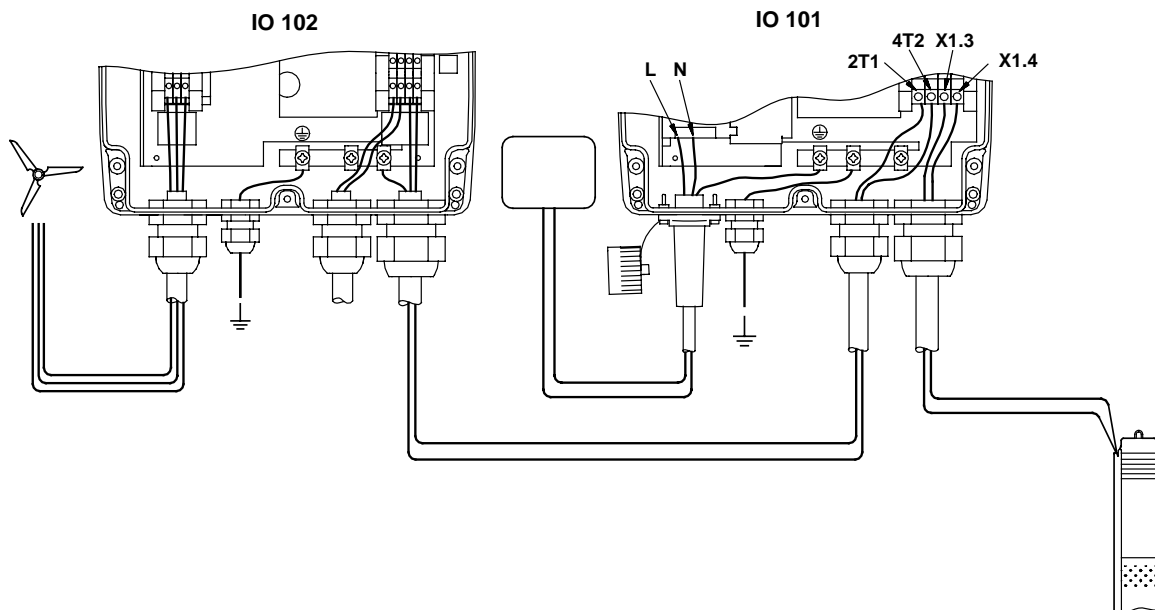
For fault finding on each individual component please see section 3.1 to 3.7.

For application overview please see section 3.0.2 Overview of possible combinations.

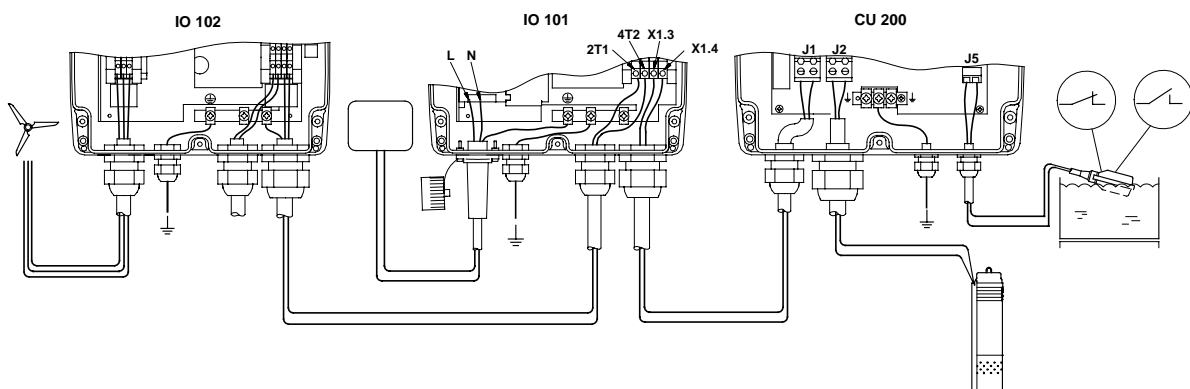
Solar energy pumping system with CU 200 control unit and level switch



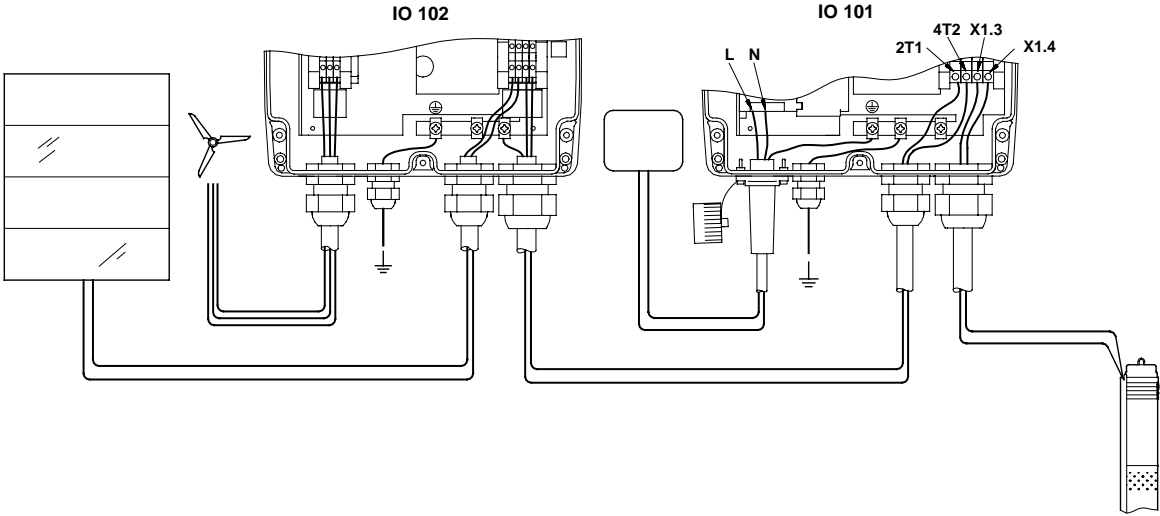
Wind energy pumping system



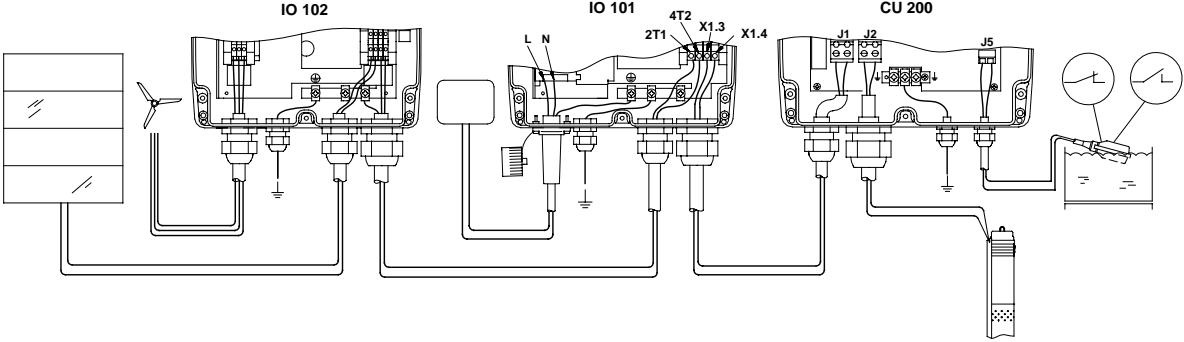
Wind energy pumping system with CU 200 control unit and level switch



Combined energy pumping system



Combined energy pumping system with CU 200 control unit and level switch



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