GRUNDFOS **DATA BOOKLET**

SQFlex battery back-up system

Renewable-energy powered water supply systems

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Contents

General data

SQFlex battery back-up systems

Battery back-up systems can be used with an SQFlex pumping system. These systems are typically used in applications where the pump is not running during most of the peak sun hours of the day or where it is impossible or impractical to store large volumes of water. Examples include remote homes or cabins, automatic livestock waterers, and very low-yielding wells.

System set-up

The system will be wired as shown in the accompanying diagram.

- Power is provided by the calculated number of solar modules wired to produce 60 to 110 VDC (rated).
- Power from the solar modules is fed into a 48 VDC charge controller which controls the current fed to the batteries.
- From the charge controller, power passes into the battery bank, which consists of the number of appropriately sized batteries, wired in series to achieve 48 VDC (nominal) output.
- Power is drawn from the battery bank and routed through a CU 200 SQFlex control unit.
  Option: To enable disconnection of the DC voltage, an IO 100 or IO 101 SQFlex switch box is to be installed.
  If an IO 101 is installed, it is possible to add a generator to the system.
- Power is run from the control unit to the SQFlex pump.

Charge controller

The charge controller is used for battery charging in SQFlex water supply systems with battery back-up.

The charge controller is a non-Grundfos product and therefore supplied with the manufacturer's instructions.

The charge controller is a fully automatic battery charger and the only setting required is the selection of battery type.

There are three battery types to choose from:

- gel battery
- sealed battery
- flooded battery.

The charge controller enables manual disconnection of the pump, the solar modules or both at the same time via the push button.

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Fig. 1 Charge controller

Battery bank

Batteries used should be marine or other type of deep-cycle battery.

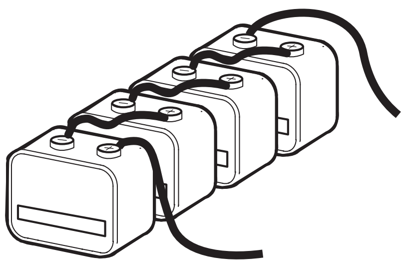

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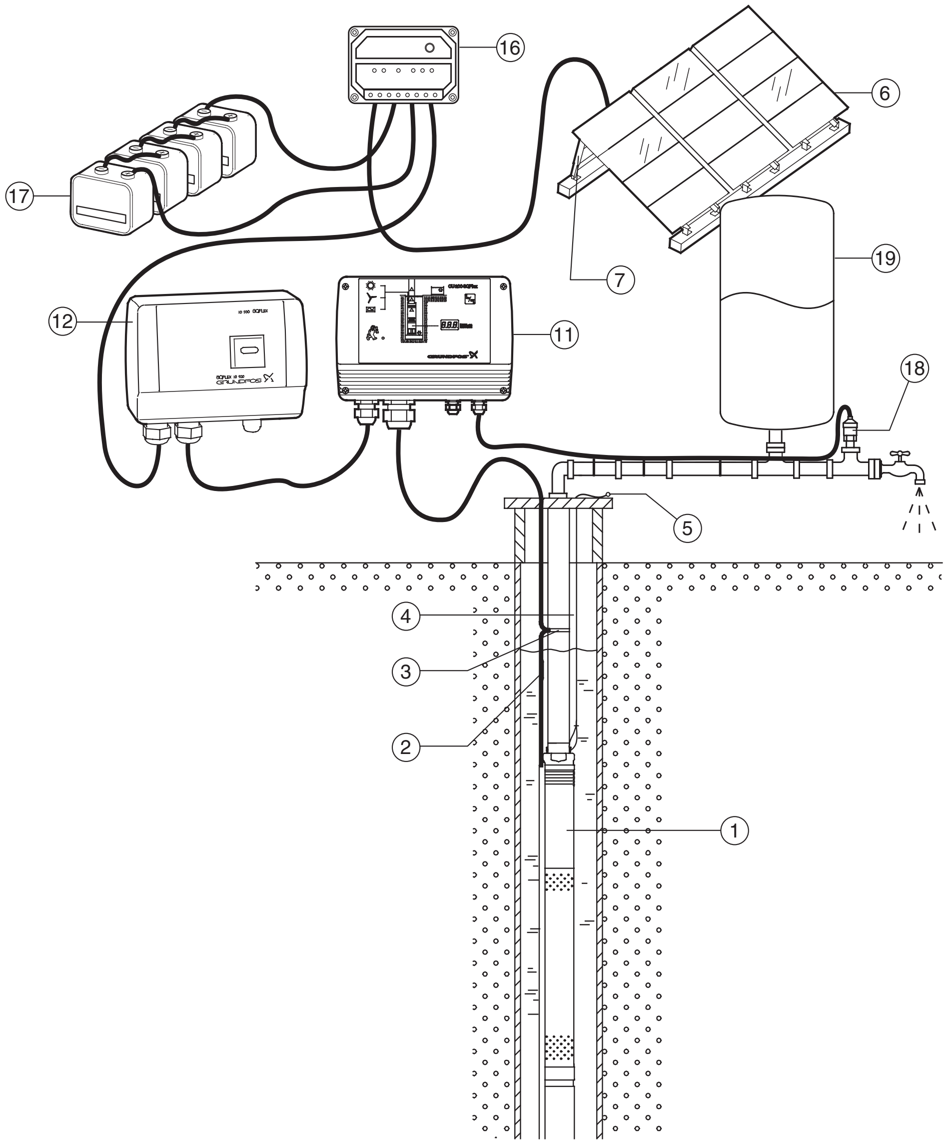
Fig. 2 Battery bank

For domestic water supply applications

The CU 200 SQFlex control unit should be selected since it includes terminals for a pressure switch which will control the pump's on/off operation via the pressure in the pressure tank.

The pressure switch should be of a normally open configuration where the contacts within the switch are in the open position when the pressure is below the maximum setpoint. When the pressure in the system rises to the desired maximum pressure, the contacts will close, signalling the pump to stop.

Note: A safety valve must be included in the system.



1 SQF pump
2 Submersible drop cable
3 Cable clips
4 Straining wire
5 Wire clamp
6 Solar array
7 Support structure
11 CU 200 SQFlex control unit
12 IO 101 SQFlex switch box (optional)
16 Charge controller
17 Battery bank
18 Pressure switch
19 Pressure tank

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Fig. 3 Example of SQFlex system with battery back-up

Sizing the system

Sizing the system consists of three steps:

1. Selecting the SQFlex pump
2. Sizing the solar array
3. Sizing the battery bank.

Selecting the SQFlex pump

1. Calculate the total dynamic head (TDH) of the system as you would for a normal water supply application.
2. Determine the required flow rate.
3. Locate your calculated TDH in the "Head" column in table A. Follow the row to the right and select the pump model which provides the desired flow rate at that head.

Sizing the solar array

Step	Action	Result
1	Enter the number of run-time hours per day (for normal household use, enter 2).	
2	Multiply by 10 for maximum pump current draw and battery losses.	x 10 =
3	Enter average kWh/m^2 per day in your area (from table B or WinCAPS data), see example on page 6.	
4	Divide line 2 by line 3 to get the total solar amps required.	=
5	Enter current (Imp), see the data sheet of the actual solar module.	
6	Divide line 4 by line 5.	=
7	Round up to next higher whole number.	=
8	Enter the number of modules in series needed to achieve 48 VDC (only 1 for GF 101, GF 110, GF 120, GF 130).	
9	Multiply line 7 by line 8. This is the total number of solar modules required.	=

Sizing the battery bank

Step	Action	Result
1	Enter the result from line 2 above.	
2	Enter the number of consecutive days without solar power you need.	
3	Multiply line 1 by line 2.	=
4	Multiply by 2 for allowable minimum level of battery discharge.	x 2 =
5	Determine the lowest temperature that the batteries will be exposed to during use. Enter temperature correction factor (from table C).	
6	Multiply line 4 by line 5. This is the total battery capacity in amp-hours for each battery required.	=
7	The total number of batteries required is equal to 48 V divided by the voltage output of each battery (4 for 12 VDC battery).	

Table A

Head at 3 bar discharge pressure [m]	Flow [m^3/h]		
	SQF 0.6-2	SQF 1.2-2	SQF 2.5-2
10	0.5	1.1	1.8
20	0.5	1.1	1.5
30	0.5	1.1	1.2
40	0.5	1.0	0.9
50	0.5	1.0	0.6
60	0.5	0.9	0.3
70	0.5	0.75	0.1
80	0.5	0.65	–
90	0.5	0.55	–

Note: If the discharge pressure differs from 3 bar, the flow will change too.

Table B

Country	City	Average kWh/m^2 day
Spain	Sevilla	4.90
	Madrid	4.51
	Barcelona	4.22
South Africa	Bloemfontein	5.87
	Pretoria	5.47

Table C

Temperature	Correction factor
27°C	1.00
21°C	1.04
15.6°C	1.11
10°C	1.19
4.4°C	1.30
–1.1°C	1.40
–6.7°C	1.59

Example

1. Open WinCAPS and enter the Sizing tool in the Renewable-energy systems section.

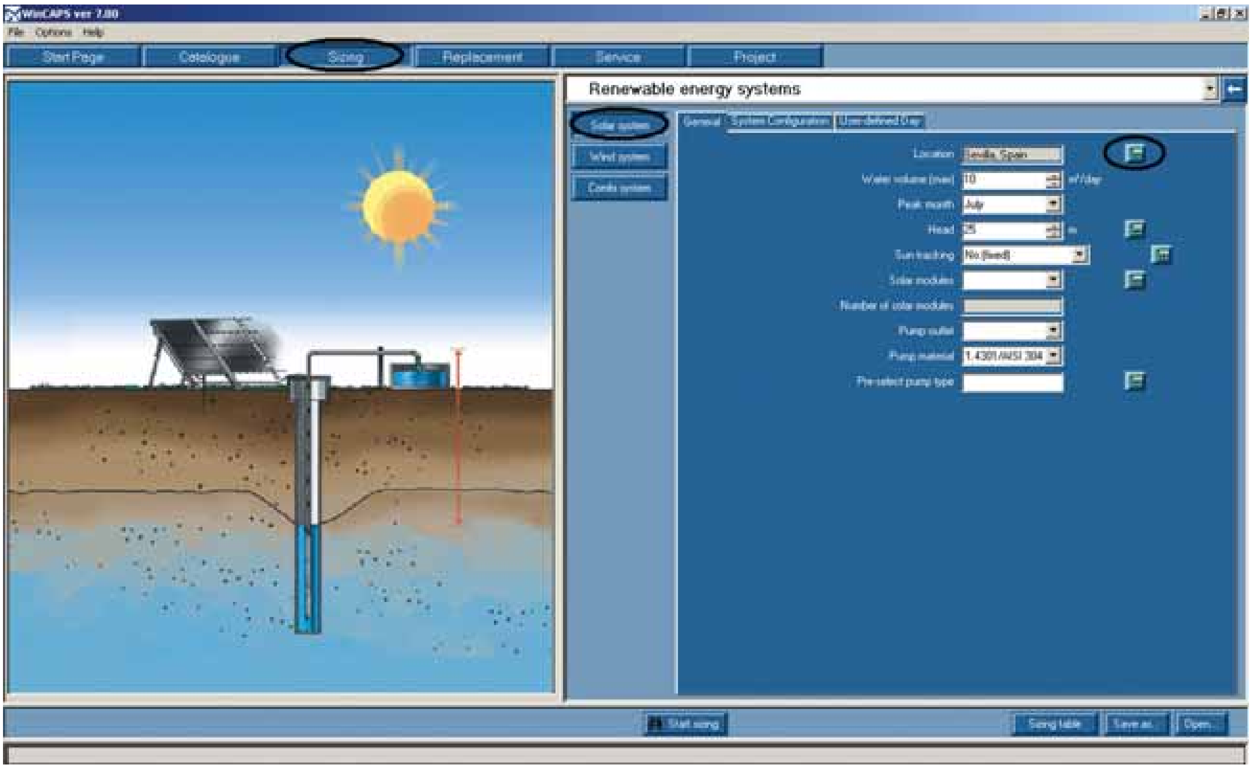

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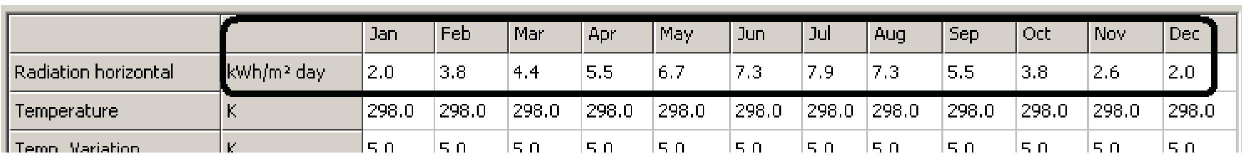
Fig. 4 Screen from WinCAPS\Sizing\Renewable-energy systems\Solar system\Location – Sevilla, Spain

2. Click the  button. The screen shows a map of the default region, i.e. USA.

3. Select the desired location. In this example: Sevilla, Spain.

4. Click the  button. The solar radiation in kWh/m^2 per day of your location will appear:



		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Radiation horizontal	kWh/m² day	2.0	3.8	4.4	5.5	6.7	7.3	7.9	7.3	5.5	3.8	2.6	2.0
Temperature	K	298.0	298.0	298.0	298.0	298.0	298.0	298.0	298.0	298.0	298.0	298.0	298.0
Temp. Variation	K	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

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Fig. 5 Solar radiation data in kWh/m^2 per day of Sevilla, Spain, given by WinCAPS

5. Calculate average kWh/m^2 per day and insert the value into "Sizing the solar array".
Example for Sevilla: 58.8 / 12 = 4.9 kWh/m^2 per day.

Charge controller

Product	Product number
Charge controller	96023194

Technical data

Maximum voltage (solar input)	110 VDC
Maximum current (solar input)	15 A
Maximum output current (load)	15 A
Ambient temperature	–40°C to +60°C
Weight	0.75 lb (0.34 kg)

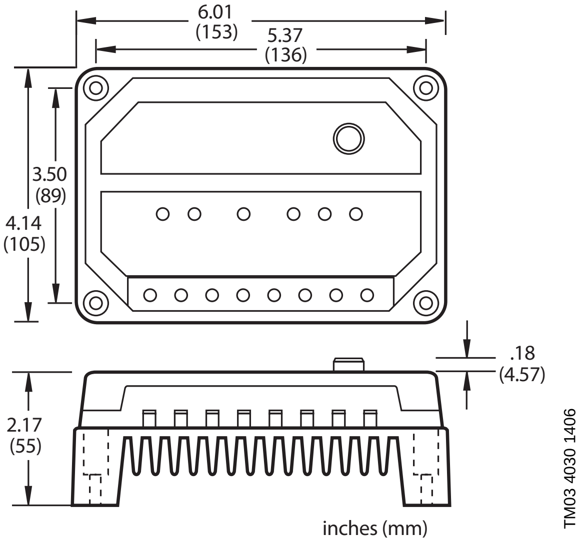

Fig. 6 Dimensional sketch of the charge controller

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Subject to alterations.

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