WATERLOG® SERIES **Application Note**

App. Note Number: 1004

Title: Battery / Solar Panel Selection

Description: Battery and Solar Panel Selection Guide.

Product: General
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Battery Selection Guide

1	Equipment	Mode	Current Draw	Time Active / Hour	Avg Current
2a					
2b					
2c					
2d					
2e					
2f					
2g					
3				Total Average Current	
4	Desired run time in days			* 24 =	
5	Total Average Current * Total Hours = Calculated Battery Size				
6	Efficiency Factor			* Calc Battery Size	
7				Next Available Battery Size	

Line 1 This is a column header line

Line 2
1: List all the equipment in the different modes of operation.
2: List the current draw for each piece of equipment in each mode.
3: List the time that the mode is active, for example if an H-350 is set to log every 15 minutes and it takes about 15 seconds to log data, then the active time would be 15 Seconds / 15 Minutes or 15 Seconds / 900 Seconds or 1/60.
4: Calculate average current for each line by multiplying the Current Draw by the Time Active / Hour.

Line3 Add all the average currents from lines 2a through 2g. This is the Total Average Current.

Line 4
1: Enter in the number of days the system should run off the battery without receiving a charge.
2: Convert this to hours by multiplying by 24. This is the Total Hours.

Line 5 Calculate the battery size in Amp Hours by multiplying the Total Average Current by the total hours.

Line 6
1: Enter an efficiency factor normally between 1 and 1.5. This factor is used to make sure the selected battery has some overhead in its performance capability, and not on the edge of not working. Use the following guidelines for setting this value.
Start with a factor of 1.25.
If more equipment may be added to the site in the future then bump up the value.
If your site goes through wide temperature ranges then bump up the value.
If a used battery will be used then bump up the value.
If a new battery is to be used then lower the value.
If the site is visited very regularly then lower the value.
2: Calculate the needed battery size based on the efficiency factor by multiplying the Value in line 5 by the efficiency factor.

Line 7 Using the value in line 6, select the next higher battery for this site.

Example using an H-350XL and an H-355

1	Equipment	Mode	Current Draw	Time Active / Hour	Avg Current
2a	H350XL	Sleep	4.2 mA	1	4.2 mA
2b	H350XL	Measuring	50 mA	20/3,600 Sec. per hour	.28 mA
2c	H355	Sleep	4.5 mA	1	4.5 mA
2d	H355	Charge Pump	2.5 Amps	8/3,600 Sec. per hour	5.5 mA
2e	H355	Purge	2.5 Amps	60/86,400 Sec. per day	1.7 mA
2f					
2g					
3	**Total Average Current**				16.18 mA
4	**Desired run time in days**		7	*** 24 =**	168 Total Hours
5	**Total Average Current * Total Hours = Calculated Battery Size**				2.72 Amp Hours
6	**Efficiency Factor**		1.25	*** Calc Battery Size**	3.40 Amp Hours
7	**Next Available Battery Size**				10 Amp Hours

Line 2b is a 15 minute scan with each scan lasting about 15 seconds.

Line 2d is based on 1 tank recharge every hour (3600 seconds), and the recharge lasting 2 seconds

Line 2e is based on 1 purge per day (86400 seconds in a day), and the purge lasting 60 seconds.

Solar Panel Selection Guide

1	**Battery Size in Amp Hours**	
2	**Total Recharge time in Hours**	
3	**Calculated Charge Current: Battery Amp Hours / Charge Time**	
4	**Average System current**	
5	**Total Current required: Charge Current + Average System Current**	
6	**Calculated Panel Size: Total Current Required * 12.0 Volts**	
7	**Next Available Panel Size**	

Line 1 The battery size should have already been calculated and is rated in X number of Amp hours.

Line 2 The total recharge time is how fast the battery should recharge if completely drained. This is based on the solar cycle of so many hours of sun per day. For example a 24 hour day may only have 6 hours of usable sun. This is called insolation, the amount of usable energy from the sun. The battery should be able to be recharged in a single solar cycle.

Line 3 Calculate the required charge current by dividing the Battery Amp Hour Rating by the Charge Time.

Line 4 Enter in the average system current from the equipment running off the battery.

Line 5 Add the calculated charge current and the average system current to get the required current output of the panel. This is the total current required

Line 6 Calculate the required panel size by multiplying the Total Current Required by 12.0. The value 12.0 is the nominal battery voltage. Even though the panel will provide a higher voltage level using a value of 12.0 works good. Most charging systems also include a regulator between the solar panel and the battery. The regulator may be adjusted to give different output voltage levels.

Line 7 Using the value in Line 6, select the next higher sized solar panel for this site.

Example using the H-350XL and H-355 calculations from above.

1	**Battery Size in Amp Hours**	10 Amp Hours	7 Amp Hours
2	**Total Recharge time in Hours**	6 Hours	6 Hours
3	**Calculated Charge Current: Battery Amp Hours / Charge Time**	1.67 Amps	1.167 Amps
4	**Average System current**	16.18 mA	or .01618 mA
5	**Total Current required: Charge Current + Average System Current**	1.686	1.183
6	**Calculated Panel Size: Total Current Required * 12.0 Volts**	20.234 Watts	14.198 Watts
7	**Next Available Panel Size**	20 Watt Panel	20 Watt Panel

Final Notes: These worksheets give a good indication of what battery and solar panel sizes to use, but there is much more involved in the power source and charging system not covered in these worksheets. The type of battery should be suited for several charge / discharge cycles. The battery installation should prevent it from over heating. Of great importance is a regulator system between the charging system and the battery that prevents overcharging and other battery killing operations. Normally over 50% of the problems at a site can be contributed to power problems. This makes it more important that the power requirements and selection of the power components is understood.