Specification for Backup Power Supply: SCADA Transmitters

1. Overview

METCOM has identified a need to provide backup/emergency power to remote data collection transmitters (SCADA) located at various sites throughout the county. This equipment is generally powered from the standard utility power grid but can be powered by a 12 VDC source in the event of grid failure. SCADA equipment provides general alarm and monitoring information necessary to maintain continued safe operation of said equipment on 24x7 basis.

2. Requirement

Provide backup power per the following specs:

Output voltage:	12 VDC (10.5 VDC minimum – 14 VDC maximum)
Current draw:	~8 amps peak; 3-5 amps expected; 1-2 amps idle
Output time:	50 hours continuous operation
Voltage drop:	<1.5 VDC over 50 hours
Min Output voltage:	10.5 (after 50 hours operation)
Battery Type:	12 VDC AGM no maintenance
Recharge type:	Solar Panel(s)
Recharge Time:	20 hours (accumulated)

As previously outlined, SCADA equipment needs to be operational at all times and in all conditions in order to keep operators appraised of pump and well conditions and fluid levels. To meet this end, a standby power supply is required to provide uninterrupted operation of the equipment for a specified minimum of fifty (50) hours of continuous operation supplying 12 VDC (nominal) at a maximum peak, intermittent current draw of ~8 amps @ 12 VDC (approx 100 watts) The duty cycle is expected to be less than 50% giving a total of approx 2500 watt/hrs over 50m hours of operation.

Basic Calculations and Standards

1. Equipment power requirements

As with most complex electronic systems, power requirements vary. Therefore, we shall extrapolate an average power consumption requirement based on the worst case scenario or, in this case, the highest expected continuous current draw, eight (8) amps (transmitting) at 12 VDC. This gives us a continuous power consumption figure of one hundred (100) watts at peak consumption. Since our transmitter "on air" time approximates a 50% duty cycle, we can average the total power consumption to 50 watts for 50 hours or 2500 watt/hrs.

We can now figure the total battery capacity needed to meet the specs: 2500 watt hours or 150 amp hours battery capacity (50 watts per hour X 50 hour run time). Since most 12 volt storage batteries are rated in amp hours, we will use this capacity measurement for the remainder of this document. (average 4 amp draw X 50 hours = 200 amp hours total)

Also, with the actual output of lead acid 12 volt storage batteries at approximately 13.8 volts, we will have some reserve capacity if we standardize on a 12 volt requirement. There for, figuring a 10% standard loss in the system (wiring, heat loss, connection loss, etc) we would require a battery bank capable of supplying 220 amp hours at 12 VDC.

Now that we know the capacity needed, we can figure the charge rate and solar panel size required.

Since we are only providing power for emergency backup, we only need a panel that is capable of replacing, during peak daylight hours, however much energy the system has pulled from the battery bank during operation. Let's use the worst case scenario again and assume the batteries are discharged (10.5 VDC). The only real variable here is how long do we want to allow for battery charging? Since this requirement has the ability to greatly influence the system cost, we shall settle on 20 hours of accumulated time to reach full charge after a total discharge event. This gives us a solar panel specification of 220 watts output in bright sunlight. Two 8 amp panels in parallel will easily provide the required voltage and amperage in combination with a 16 amp charge controller. The following assumptions are made:

The system will use energy from the battery bank continuously while on back up power but, we only have approximately 5 hours of high output per day from a fixed solar panel under the best of conditions.

Panel output is figured on a yearly average at a given latitude, southwest facing panel at 45 degrees, no obstructions, in bright sunlight.

Total battery bank discharge to 10.5 VDC should not occur in normal operation but is possible.

Recommended Equipment

1. Batteries

Requirement:	200 amp hour capacity, 12 VDC battery bank
Recommendation:	Three (3) Optima 12 volt, 75 amp hr, AGM Deep Cycle batteries connected in parallel. Optima Part# D31A

I recommend AGM (Absorbent Glass Mat) marine grade, deep cycle batteries since their power output is relatively flat over the life of the battery and they require no regular maintenance. Also, these batteries provide higher power output at extreme temperatures than other lead acid storage batteries.

Since a 12 volt lead acid battery regardless of electrolyte type is considered dead at ~10.5 volts we know that we can already meet the requirement of a maximum voltage drop of 1.5 volts over the life of the system's continuous output.

Specs may be reviewed at: http://www.1st-optima-batteries.com/

2. Solar Panels

Requirement:	100 watts (12 VDC@8 amps)
Recommendation:	GE GEPV-110 or equivalent

Panels may use single or multi-crystal cells with the following specs:

Peak Power:	110 watts
Max Power Voltage (Vmp):	16.1
Open Circuit Voltage:	20.6
Short Circuit Current:	7.1 amps
Short Circuit Temperature Coefficient:	-0.08 V/°C

Aluminum frame with pre drilled holes preferred. Outdoor commercial/industrial rating required. Built in weatherproof junction box (on panel) preferred.

Specs may be reviewed at: http://shop.altenergystore.com

3. Charge Controller

Requirement:	16 amps @ up to 26 vdc input
	UL listed and FM approved for hazardous locations
Recommendation:	Specialty Concepts ASC-12/16AE

Charge controller should be rated for hazardous environments and include lightening protection and blocking diode (to prevent batteries from discharging through solar cells at night). The unit should be 100% solid state with input noise suppression.

Specs may be reviewed at: http://shop.altenergystore.com
FM Global: http://www.fmglobal.com/approvals/approved/categories/locations.asp

4. Miscellaneous

All switches, circuit breakers, connection boxes, wire and miscellaneous parts needed to complete the system and meet all applicable safety requirements. This may vary according to existing conditions at each installation site. A basic specification should be included.

5. Conclusion

While certain parts/systems have been recommended here, the basic need to build a cost effective system that meets the specifications as outlined in "Section 2: Requirement" is the prime focus of this document. Keep in mind that these systems will be operating in a less than friendly environment, year round, without more that basic maintenance and sometimes without any maintenance. When considering parts and ultimate design, this should be kept foremost in mind.

Prepared by: Robert J. Fehn Sr.

SCADA External Battery Backup / Solar Charging Circuit