Reason for Remote Reset

The Xantrex-built grid-tied GridTek10 inverter sold with the 10 kW Bergey turbine is poorly designed. Under windy conditions, it is prone to bus over-voltage conditions that results in the GridTek10 going off-line. The only recourse is to reset it manually by pressing the Reset Button (Fig. 1).

Figure 1: The RESET button on the GridTek10 is a NC switch. Pushing the button causes an open circuit condition that causes the reset. The toggle switch (SPST) above was added to enable or disable the REMOTE RESET. See details below.

The bus over-voltage condition occurs on windy days and is a consequence of poor and, in my opinion, unsafe operating conditions. The GridTek10 is supposed to regulate power output to a maximum of 10 kW but it fails to adequately keep power output below 10 kW hence when output exceeds 12.4 kW it goes off-line for 5 min (see R#12 in http://www.ualberta.ca/~mtyree/SWIEP/Publications.html). While the GridTek10 is off-line the turbine is unloaded and free-wheels causing very high air-foil RPM and high generator-voltage output. The unsafe design-fault of the GridTek10 results from the tendency of the unit to go back on-line after a 5-min wait regardless of the RPM. When the RPM exceeds about 450, an over-voltage condition occurs and the bus over-voltage fault requires a manual reset. This unsafe condition could be easily engineered out of the operating system by having the controller look at RPM and NOT go on line when the RPM exceed 420. Failing to do this, subjects the bus to a dangerous over-voltage condition, and each time this happens it damages and shortens the life of the electrolytic capacitors in the GridTek10. These capacitors are expensive components and

are more prone to failure than any other components in inverters (Prof. L. Chang, EE and designer of inverters, personal communication).

Installing a Remote Reset does NOT correct the damaging propensity of the Gridtek10 to bus voltage overloads. However, I estimate that I loose 20% of my potential power production during the winter months because of the length of time the GridTek10 is off line before I notice that it needs a reset. During windy events, I have to trudge down to my basement several times a day to check if the GridTek10 needs a reset. I am tired of doing that. Also when I am on business travel or vacation I can loose one or two weeks of power production at a time of year when typical daily energy production is 40 to 60 kWh per day.

I am currently using a computer and data-logger to monitor energy components in my house at a 1 Hz rate. I measure: GridTek10 power input, power output, blade RPM, wind speed, and power usage by my hot water tank, water pump and Geothermal Heat Pump. Since I have a computer in my basement anyway for this energy-monitoring project it was easy to implement a Remote Reset function.

Components for Remote Reset for GridTek10 Bergey Turbine Inverter

National Instruments USB-6501 USB to Digital I/O board ($99)
http://sine.ni.com/nips/cds/view/p/lang/en/nid/201630

Windford TTL Relay Switch ($33)
http://www.winfordeng.com/products/rly102.php

WebCam: any cheap ($30)

SPST switch ($3)

Implementation of the Remote Reset

In the old days, all microcomputers had a TTL digital I/O port, i.e., a parallel printer port. So in the old days I could add $20 worth of external components to boost the weak TTL signal from the parallel port to be enough to actuate a relay switch (a reed or larger solenoid relay switch). I have used this trick many times in the past to make automated computer controls to turn on and off external loads such as lights and pumps. Unfortunately modern microcomputers are no longer supplied with parallel ports. Hence a more expensive solution is needed.

I bought a National Instruments USB-6501 which uses a USB port to regulate the same kind of parallel port chip as used to be in older computers. I also bought a Wndford TTL Relay Switch which provided the external components to turn on a relay switch. After receiving these components I installed the N.I. software and experimented with it. I discovered that the USB-6501 passes thru the 5 V DC 100 mA USB 2.0 power supply to screw terminals and that this power was enough to run the Windford TTL Relay Switch without having to provide an independent 5 volt supply.

Since computers occasional need to be shut down or reset, I next experimented with the consequence of doing a reboot of the computer with the USB-6501 + TTL Relay Switch attached. I was disappointed to notice that the reboot sequence caused the Relay Switch to turn on and off 3 times! This makes the computer control of the Relay Switch unstable and hence cannot be used to control critical devices which have to be in known states at all times. Thanks to the efforts of Bill Gates and Microsoft Windows XP, my computer based TTL Switch cannot be reliably controlled. All automatic software updates have to be turned off because sometimes these updates activate automatic resets! However when I am in the room with the computer I can still load new software and reboot my compute by adding one more switch.

The SPST toggle switch in Fig 1 was installed near the GridTek10 RESET switch. There are 2 wires; one to and one from the RESET switch; one of these wires was cut and wired thru the terminals of the SPST switch. The TTL relay switch is ALSO wired to the same SPST toggle switch terminals. When this toggle switch is ON (Remote Reset Disabled) then the circuit of the RESET switch is connected regardless of the status of the TTL relay switch. In contrast, when the SPST toggle switch is OFF then the TTL relay switch is the only component that keeps the circuit closed. Remote reset is activated by opening the TTL relay switch. So when I need to reboot my computer I just turn the toggle switch to Remote Reset Disabled.

How do I tell when a Remote Reset is needed?

My data logging computer is connected to the internet and is set up to allow remote access using the Windows Remote Desktop Connection. When connected I can look at real-time values of the turbine condition. When I see that RPM > 60 but GridTek10 power output is ZERO then a reset condition may be indicated. However, to be sure I wanted to be able to look at the control LED screen of the GridTek10. To do this I also mounted a cheap Web-Cam on the door. So I turn on the Web-Cam and examine the status of the LED display (see Fig 2). If a reset condition is indicated then I can activate a remote reset using the N.I. software that came with the USB-6501.

CAUTION: SHOCK HAZARD!

Do not attempt what I have done in your own home unless you are experienced in electronics. There are life-threatening electric shock hazards! Turn off the breaker switches on both the input and the output of the GridTek10 BEFORE you open the door. And wait for the electrolytic capacitors to fully discharge BEFORE you attempt to do any work inside the GridTek10. I also warn you that making these changes will probably void the warranty on your GridTek10.

Good news: Even when I am working a home, I no longer need to trudge down to my basement to see if I need to reset the GridTek10. I can now do it from my home-office computer!

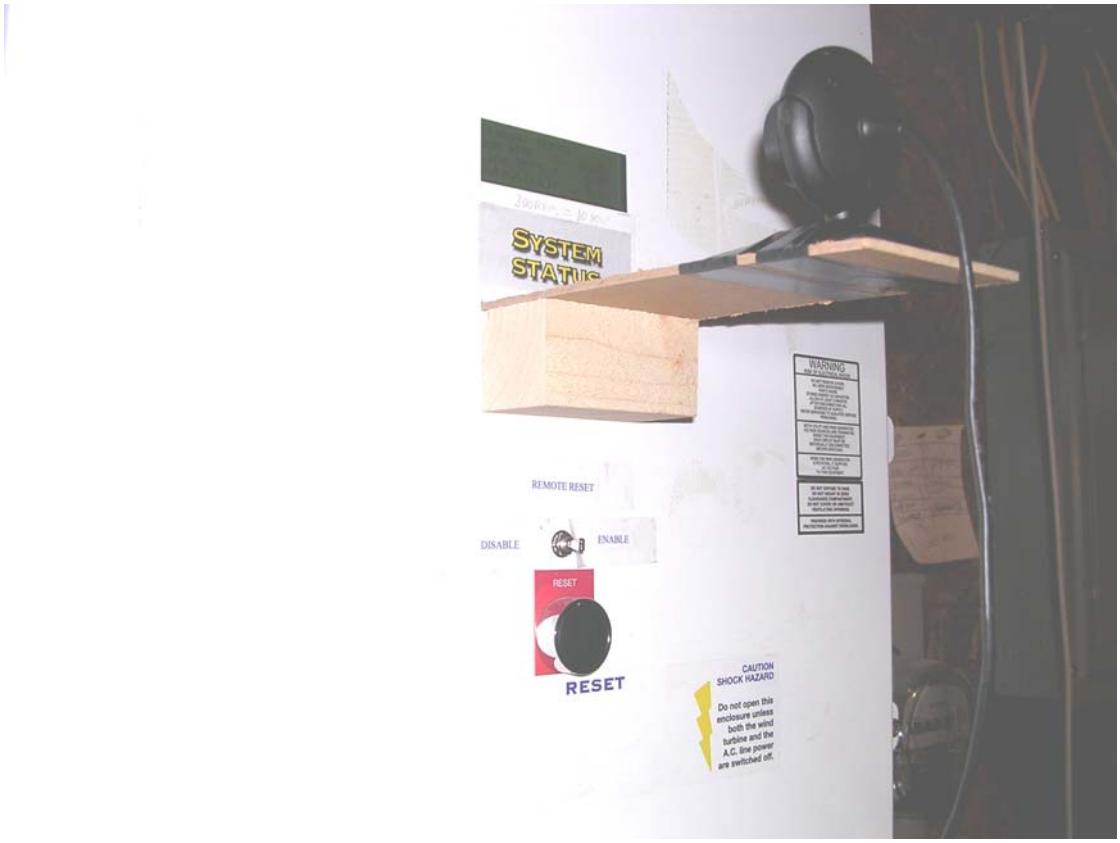

Figure 2: A cheap Web-Cam is mounted on a wooden shelf (1.5” by 7”) attached to a wooden block (1.5” x 1.5” x 3”). Two 1/8” holes were drilled into the GridTek10 door to pass two wood screws thru the sheet metal to attach the wooden block.

If you have any questions please Email me at mtyree@hotmail.com

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