SLO Communications

PO Box 50 /Santa Margarita, CA 93453
17395 Oak Road/ Atascadero, CA 93422
805.438.5600 / Fax.805.438.4607
License No. 773985

October 20, 2000

Jim Kimball
Pacific Valley School
Pacific Valley #1
Big Sur, CA 93920

Dear Jim:

Here's the report on what I found at your facility during my visit.

On 9/27/2000 I made a service call to the Pacific Valley School on the Bug Sur coast at your request. The purpose of the visit was primarily to investigate a problem with one of your Trace SW4024 inverters. This inverter had exhibited a fan noise and then created some electrical smoke just prior to your call to me. We found that the inverter was able to operate. We took the cover off of the inverter and found that one of the fans was frozen and that the smoke appeared to have come from the fan windings or from a transformer that may have gotten slightly too hot. We were able to replace both fans in this unit. (Inverter number 2) while it was in place, saving the effort to disconnect the wiring and removing the inverter from the wall.

I spent as much time as I could spare figuring out how this system operates. I was able to pretty thoroughly determine how the AC wiring in the inverter room is run. Attached to this report is a drawing of that system. As you can see, the generator feeds the 4 inverters through two 220 volt circuit breakers. The feed is through two transformers which I think may not be necessary. I am still investigating that idea. The output of the two groups of inverters are feed through two transformers, the outputs of which are connected together and feed on to the loads.

The outputs of the inverters are not configured correctly. The AC wiring that leaves the equipment room is run in three wires: Two hot wires and one neutral. This is not uncommon in grid fed power systems and is called a "multi-wire feeder." Due to the fact that the AC sine waves in the two hots are exactly 180 degrees out of phase, the current drawn in the neutral wire can never exceed safe limits. This is the case whenever the generator is powering loads. The two hot wires from the generator are 180 degrees out of phase due to how a generator is built. The inverters are simply passing on generator power so the outputs are synchronized out of phase.

The problem on the outputs occurs when the generator is not running. Although

(Continued)

inverter 1 is synchronized to inverter 2 and inverter 3 is synchronized to inverter 4, the two banks of inverters are not synchronized to each other. A meter across the two outputs shows this in that the voltage between the two outputs, which should read 240 volts, gradually shifts between 240 and 0. At such times this reading is on the low end, the neutral is prone to overloading. With this condition, the neutral could draw twice as much power as it is rated for. I spoke with Larry Ross about this. When I pointed out this problem, he agreed that it needs to be resolved.

I can suggest two ways to remedy this problem:

1. Reconfigure the power distribution on campus to separate the two banks of inverters. Inverters 1 and 2 would run some buildings and inverters 3 and 4 would run the remainder of the buildings. This would require running three more wires between the equipment room and the generator shed. I don't know what size this conduit is and how far it runs through how many bends, so I can not determine from here if we can use the old conduit.

2. Replace the inverters with larger unit(s) for which it is not required that we couple so many of them together. It is possible that loads at your school are increasing to the point that you may be outgrowing the inverters you have. If this is the case, Plan 2 may be more desirable.

Jim, I suggest that I come up as soon as I can find time to investigate this system further. I will want to examine the generator shed wiring throughly. I would also like to learn more about the DC side of your system so I can advise on that, but I am not sure I will have time to do that on my next visit. I am possible available the week of October 30. Let me know if there is a day that week that would be good for you.

Sincerely,

William Miller

Encl: AC wiring block diagram
Invoice