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DCAC45/120/2500, DCAC 57/120/2500, DC/AC INVERTERS

1.0 Introduction and Description.

The DCACXX/120/XXXX, referred to as the INVERTER, from now on, is a high performance 4 quadrant, crystal controlled, Dual Half H Bridge, configured in a transformer boost topology. It converts a wide range of DC voltages to a regulated 120vac or 240vac. The input, DC, can vary by a factor of 7/3.

The INVERTER is a self contained unit with its own power supply, input power filter, output power filter and transformer. Power to the unit is from a DC supply, fuel cell, solar cells, windmill or a battery. The input of the INVERTER has a large capacitor bank. Note that this capacitor bank might not be enough capacitance to keep the current variations down to an acceptable level. Additional capacitance, along with an inductor, might be needed between the DC supply and the INVERTER. Note, with a sine wave output current, the peak current coming in from the DC source is a sine squared waveform.

There are three circuits. They are: the Control circuit, the DC power in circuit, and the AC power out circuit. Each one is isolated from the other. Hall sensors are used to sense the load current and high speed opto couplers are used to control the power MOS FETs. The voltage from the DC power source is sensed and isolated with a small transformer.

There are two half bridges across the DC input supply, in each unit. Each half bridge has 10 transistors in parallel on the top, and 10 transistors in parallel on the bottom. There are a total of 40 transistors.

There are no adjustments. There is a 5 volt pot, the “5VPOT” that can be used by the customer. The unit can be disabled by connecting the DISABLE input to common. This is “DIS”. There is an ENABLE and FAULT output. There is a +5vdc power supply available for the user. There is a “SIN” input and “SOUT” output available for externally synchronizing the AC output.

The temperature of the internal capacitor board is monitored and in the event of an excessively high ambient temperature, the unit will turn off, the FAULT output will go high and the RED LED will turn on.

The load current is sensed. If it becomes excessive, an I squared T timer will eventually shut the INVERTER off, with auto restart. If the current times time squared is above a certain level, it will shut off during that line cycle.

If the load current exceeds two times the rated current, the unit will shut off immediately. This leaves the toroidal transformer in an unkown state. The load may have to be removed to restart the unit.

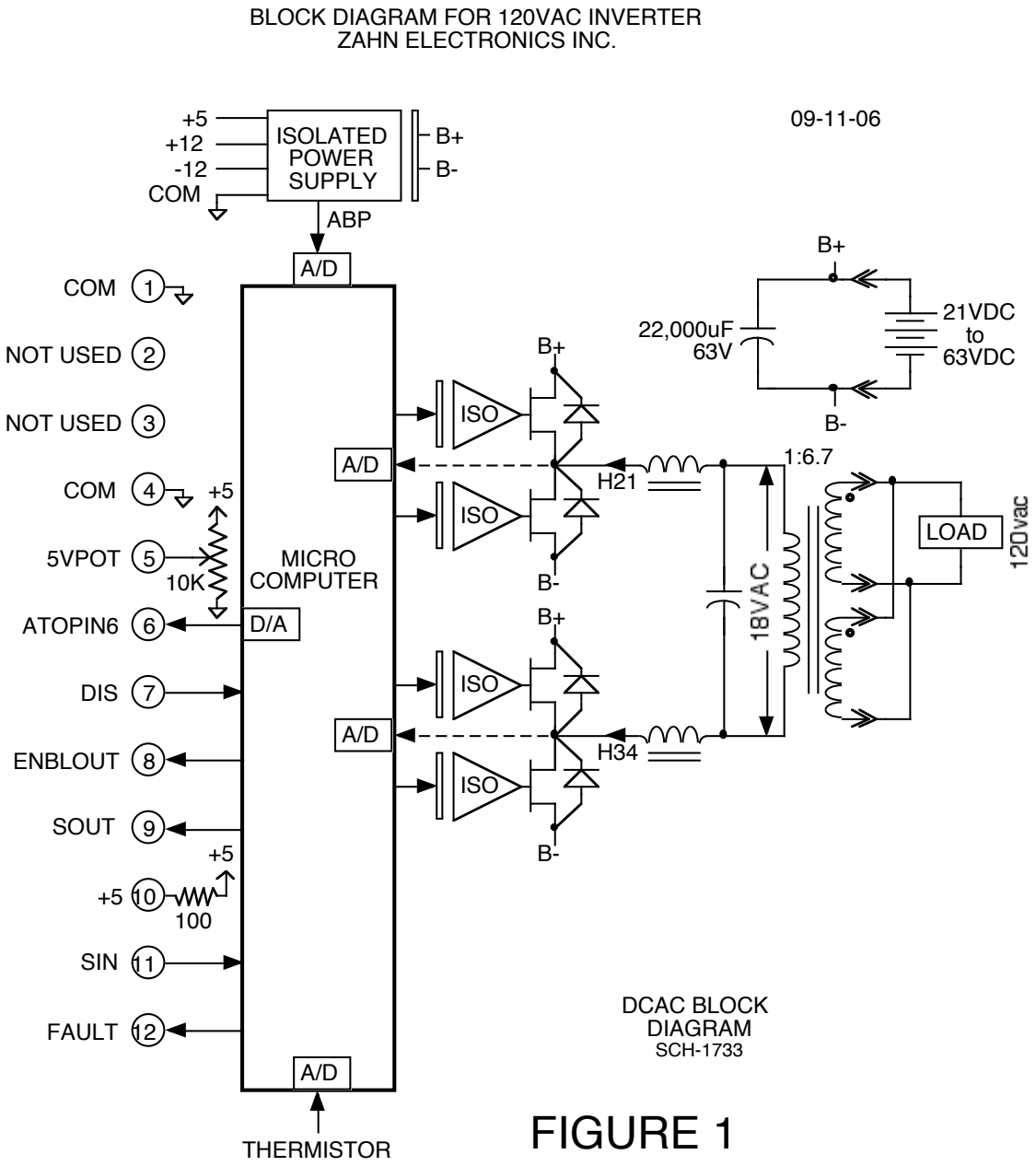

FIGURE 1

2.0 Theory of Operation.

Refer to Figure 1, which is a Block Diagram. The load is connected to the secondary of the power transformer. 120vac or 240vac can be selected. The primary of this transformer is driven with a full sine wave. The INVERTER will keep track of the I squared T, and shut down if the value is too high.

The left side shows 12 control circuit connections. If terminal 7 is connected to terminal 4, and terminal 11 is connected to terminal 10, no

connections are necessary for the simplest application. Terminals 1 and 4 are common, 2 and 3 are not used, 5 is the wiper of a 10KΩ pot with +5v across it, 6 is an analog output to monitor internal signals, 7 is the DISABLE input, 8 is an ENABLE output, 9 is SOUT(synchronized output), 10 is a +5v supply, 11 is SIN(synchronize input), and 12 is the FAULT output.

The DC input, B+, B- is switched by the four FETs to produce a sine wave at the primary of the transformer which is shown as 18VAC. This voltage is stepped up for an output of either 120VAC or 240VAC.

There are two inductors and a capacitor in Figure 1. These parts filter out the high frequency voltages that come out of the half bridges. The currents out of each of these half bridges, H21, and H34, are isolated with hall sensors and fed to the microcomputer. Then the primary of the transformer is a sine wave at 18vac, RMS, for the 27 to 63vdc unit. This is the DCAC45/120/2500. The 45 is the average of the input voltage, 27 to 63vdc, the 120 is the AC output voltage (or 240vac), and the 2500 is the output continuous power rating in watts.

The microcomputer generates 4 signals that control the FETs. The voltage of the DC power source is fed to the microcomputer thru an isolated transformer. This is labeled ABP.

A thermistor is attached to the capacitor board which gives thermal feedback. When the case temperature of the thermistor reaches 70 Degrees Centigrade the INVERTER shuts off.

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INSTALLATION WIRING, DC TO AC INVERTER

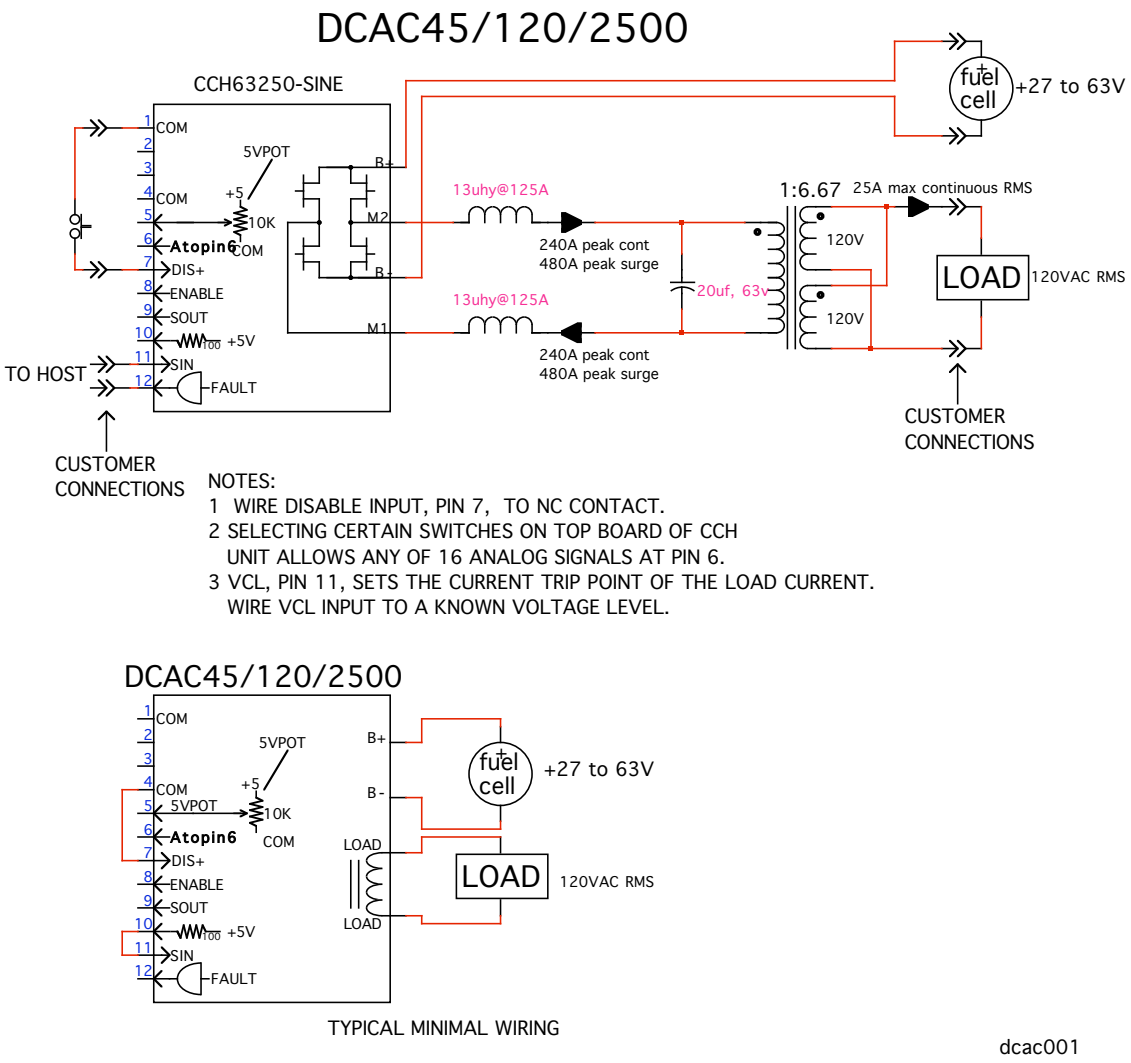

FIGURE 2.

3.00 Wiring Instructions.

See Figure 2. This shows 2 wiring diagrams.

3.10 Power Wiring.

The top of Figure 2 shows the CCH63250-SINE, two inductors, a capacitor, and a transformer. This is referred to the "loose parts" version. The bottom one includes all the top one's parts on a subpanel, in or out of a box.

To wire the bottom one, connect the input DC power source, using heavy gauge wire to B+, B- of the CCH63250-SINE. The lugs on the CCH63250-SINE will take up to #1/0 gauge wire. Connect the load to the 4 position terminal strip provided on the subpanel.

For 120vac:
Connect terminals 1 to 3 on the terminal strip.
Connect terminals 2 to 4 on the terminal strip.
Connect the load to terminals 1 and 2.

For 240vac:
Connect terminals 2 to 3 on the terminal strip.
Connect the load to terminals 1 and 4.

The gauge wire should be determined by the NEC code and for long runs. This gauge may be chosen for a lower voltage drop. We recommend 10 gauge for 120vac (21ARMS), and 14 gauge for 240vac (10.4ARMS).

The wiring of the "loose parts" is beyond the scope of this manual.

Use 22 Gauge, or thicker, for the control wiring.

3.20 Control Plug Connections.

If the "5VPOT" is used to drive a customer provided circuit, connect to terminal 5 and common, 1 or 4, of the control plug.

If an internal signal is to be used from "ATOPIN6", connect a shielded cable or at least a twisted pair from terminal 6, and common, 1 or 4, to the host. The signal selected to go out of "ATOPIN6" is selected with on board switch settings. Consult the factory to use this output.

If the disable input, "DIS", is not to be used, connect terminal 7 to common, 1 or 4, of the control plug. If the disable input is used and

controlled by the host, connect a twisted pair from terminal 7 and common, 1 or 4, to the host.

If the Enable output is used, “ENBLOUT”, connect a twisted pair from terminals 8 and common, 1 or 4, to the host.

A connection to the +5v power supply is beyond this manual.
Consult the factory to use this power supply.

The SIN input, terminal 11, should be tied to terminal 10 if not used. If used remotely, connect a shielded cable or at least a twisted pair from terminal 11 and common, 1 or 4, to the host. This is the input that synchronizes the 120/240vac output. The 120/240Vac output is in synch with SIN, and delayed by 0,90 or 120 degrees. The phase shift depends on the dip switch settings. Consult factory to use this input.

If the fault output, “FAULT” is used connect a twisted pair from terminals 12 and common, 1 or 4, to the host.

4.00 Installation Mechanical.

The mechanical dimensions of the subpanel for the INVERTER are shown in Figure 3. The 12 pin control plug is on the top right side of the CCH63250-SINE and the 120/240v output to the LOAD is shown at the upper right.

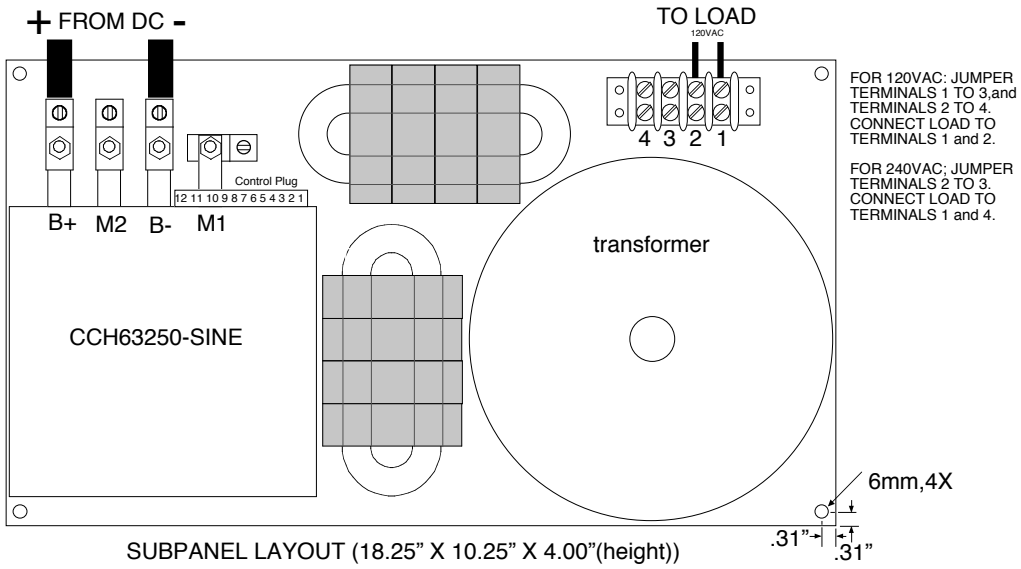

Figure 3

5.00 Specifications.

5.10 Electrical Specifications (Control).

Input resistances.

Terminal 1, common
Terminal 2, Not used.
Terminal 3, Not used.
Terminal 4, common
Terminal 5, "5VPOT" wiper of a 10kΩ pot with +5v across it.
Terminal 6, "ATOPIN6" 16 internal signals can be displayed.
Terminal 7, "DIS" 5kΩ resistor pulled up to +5V.
Terminal 8, "ENABLE" output, 5v logic.
Terminal 9, SOUT output, 5v logic.
Terminal 10, +5vdc thru a 100Ω resistor.
Terminal 11, SIN input. The negative going edge is sensed, 5v logic.
Terminal 12, Fault output, 5v logic.

Switching Frequency: 31,250Hz, crystal controlled

5.20 Electrical Specifications (Power).

5.21 Input and Output Voltages.

Input Voltage, DC: DCAC45/120/2500: 27 to 63vdc
DCAC57/120/2500: 34 to 80vdc
Output Voltage: 120vac, 60Hz or 240vac, 60Hz.
Output voltage regulation: +/-12vac, no load to full load.
+/-5vac Vdc in from min to max.

5.22 Output Current. For 120/240Vac output

Continuous Output Current: DCAC45/120/2500: 21/10.4a RMS
DCAC57/120/2500: 21/10.4a RMS
Surge Output Current: DCAC45/120/2500: 2X
DCAC57/120/2500: 2X
Surge Time: (120VAC output. Cut currents in half for 240vac)
DCAC45/120/2500: .5sec 2X,1sec 29a, (I^2T-(21)^2)=431
DCAC57/120/2500: .5sec 2X,1sec 29a, (I^2T-(21)^2)=431

Trip Output Current: This is the output current that will shut the output off, during that cycle.

Any current below this is either a surge output current or a continuous output current.
DCAC45/120/2500: 42a RMS
DCAC57/120/2500: 42a RMS

5.23 Efficiency, Power Factor and Frequency.

Efficiency: DCAC45/120/3000: 92% at 120v,21a RMS out. (2500 watts)
DCAC57/120/3000: 92% at 120v,21a RMS out. (2500 watts)

Power Factor: Any (0.00 to +1.00). The load can be fully inductive or fully capacitive.

The INVERTER is four quadrant. The power to the load is reflected back into the DC power source.

IE: For a power factor of 1.00, and a peak load current of 30a, the peak current needed from the DC power source is 215a.

For a sine wave load current, the current needed from the DC power source is sine squared. The DC level of the current from the DC power source depends on the power factor.

The RMS current from the DC power source should be analyzed.

Frequency. Between 59.995 and 60.0246 Hz. This is with the SIN input not switched. The range for synchronizing is +/-5%, or 57 to 63 Hz.

5.30 Fault

The Fault of the INVERTER is available at terminals the control plug. The The RED LED turns on and the Fault signal at pin 11 goes to +5v, when:

1. The output current of the INVERTER exceeds the spec.
2. The internal power supplies have failed.
3. The INVERTER is in thermal limiting.