TABLE OF CONTENTS, DCDC6350-S-ADJ DC/DC CONVERTER

1.0 Introduction and Description

The DCDC6350-S-ADJ is a less expensive version than the DC6350F-S. It is about ½ the price. And it is half the size. However it is a 1 quadrant step down converter with limited output voltage control. The output voltage can be programmed remotely. There is a difference between output current and output current limit. Increasing the output current may not put the unit into current limit. The current limit is at the output.

It is a compact, self contained unit with its own power supply. Power to the unit is from a DC supply, a battery, or a fuel cell. The switching frequency is 125,000Hz.

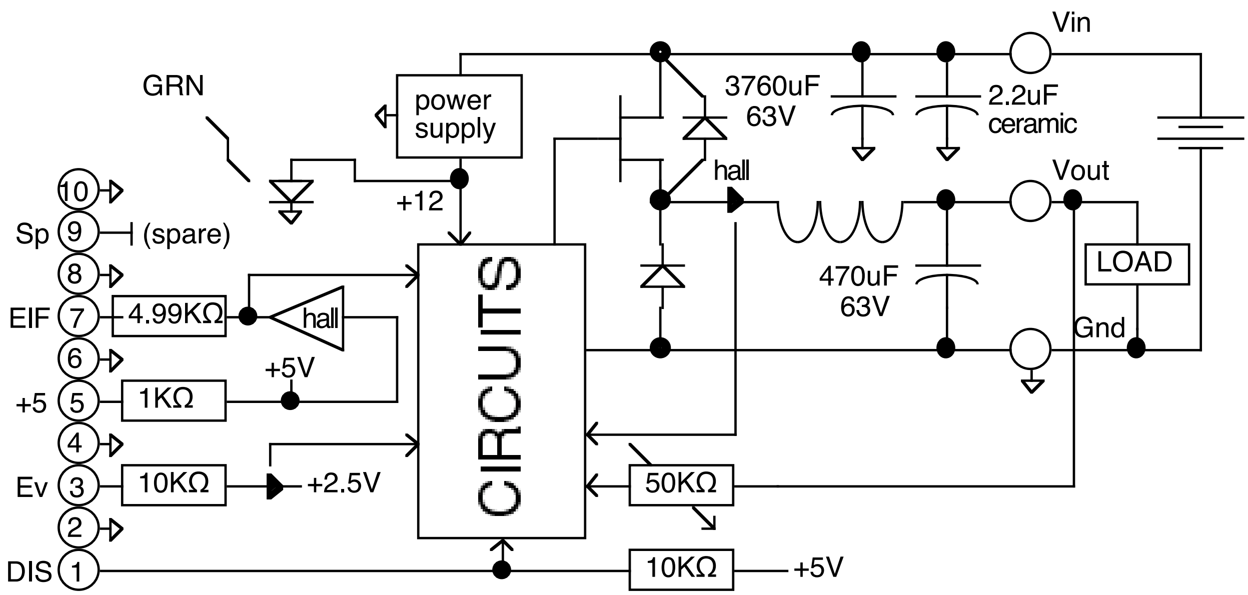
The input voltage and the output voltage share a power common. Therefore, there is no isolation between the power input and the power output. The input power source (battery) shares its power common with the load power common.

The Control signals, which are inputs and outputs, **are not** isolated from the power circuit. So the signal common should be tied to the appropriate point.

The output voltage, Vout, can be controlled by the Ev input voltage and an onboard 50KΩ, 20 turn pot. There is a 5vdc supply available for the Ev voltage.

The output current can be monitored by EIF.

The internal temperature of the DCDC6350-S-ADJ unit is monitored and in the event of an excessively high ambient temperature, input current is reduced automatically to hold the transistor temperatures to a safe level.



BLOCK DIAGRAM FOR STEP DOWN DC TO DC CONVERTER
ZAHN ELECTRONICS INC 1-12

FIGURE 1

2.0 Theory of Operation

Block Diagram.
Refer to Figure 1.

The power source, a fuel cell or a battery, is connected to terminals Vin and Gnd. Output current is sensed by a hall sensor. This is shown in Figure 1.

The voltage at Vout is sensed by the current thru 50kΩ resistor and the 10KΩ resistor connected to Ev. Vout is the power terminal on the right side, labeled Vout and Ev is the control terminal on the left side, connected to terminal #3. Both are fed into the circuits.

A power supply receives its power from Vin and Gnd. Vin supplies the circuit with +12V. +12V is indicated with a green LED. +5V is generated from this +12V. On start up only +11.5V is needed at the input, Vin, to start the whole circuit.
Since the FETs have diodes across them, only 12.0V is needed at the output to start the circuit. Since this unit is a single quadrant, the output, Vout, can be applied first. A battery can be connected to Vout, with Vin open. Vin will be close to Vout. This is ideal for a fuel cell charging a battery. Remember Vin has to be greater than Vout, to charge the battery.

A 70 degree centigrade PTC thermistor, close to the power MOSFETs, is sensed. If the temperature reaches 70C, the current limit is reduced accordingly. The current is reduced to hold the temperature at 70C.

Terminals 10,8,6,4,2, located on the left hand side, are connected to common, which is the “Gnd” on the right hand side.

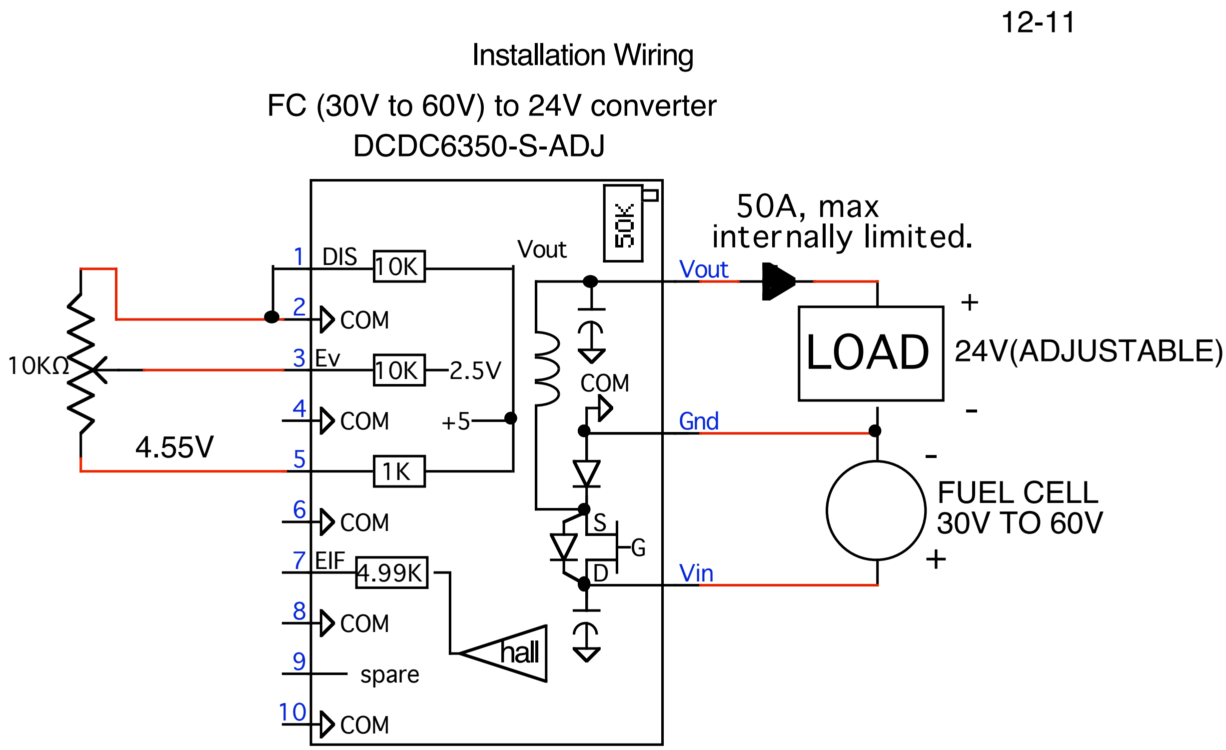
DIS is the disable input and a female jumper is attached so that DIS is tied to GND or common, and is zero volts. This Enables the unit. If one wishes to disable the unit, the female jumper can be removed and the DIS input can be tied to an open collector transistor or a signal source that swings from 0 to +5VDC.

Ev is an input, terminal 3 on the left hand side. Ev is a 10KΩ pulled up to +2.5v. The current thru the 10KΩ resistor is sensed. This current or the voltage across the 10KΩ resistor controls Vout.

The +5 is an output to be used to control the voltage Ev. This is available at terminal 5 of the left hand side. The +5 has a 1K resistor to the internal +5v.

EIF is an output, terminal 7 on the left hand side. The voltage decreases with increasing current coming out from the Vout terminal.

The spare input can be connected, via a spare square pad, to any node of the circuit. It is not connected to any node unless specified.



NOTES:

1. NO Ev control: Leave Ev open.
   Adjust Vout, 50KΩ Pot, For desired Load Voltage.

2. With Ev control:
   Adjust Ev, for desired voltage. 2.5V<=Ev<=+5
   Adjust Vout, 50KΩ Pot, For desired Load Voltage

sd1220

Figure 2

4.00 Wiring Instructions.

See Figure 2.

4.10 Control Wiring.

The Control wiring consists of connecting low current carrying wires to the 10 terminal control plug located on the top left hand side of the unit. This is the left hand side of the pc board, which is the opposite side from the power wiring. The black insulating rubber might have to be removed from the top cover to get at the connector. The 10 pin connector is underneath the top cover. The female connector, Zahn# CABL-1654-002, should be used to connect to this header. 22 gauge wire is adequate for all other connections.

4.11 Input voltage reference for Vout control.

Refer to Figure 2. The input Ev, terminal 3, is the input signal that controls the load voltage, Vout. Ev should be tied to the signal source and the signal source common should be tied to terminals 2,4,6,8 or 10. Ev in this case should swing 0.0 to +5V. If an external pot is used, see Figure 2. If a Pot is used for controlling the load voltage, a 10KΩ pot should be used. If Ev is not to be used, leave Ev, terminal 3 vacant.

The formula for Vout versus Ev, and X, the 50KΩ pot setting is:

$$Vout=12.5+50X-(Ev-2.5)*(5X+1)$$

X is the position of the 50KΩ pot. $0<=X<=1$

For X=.55,

Ev=0, Vout=49.375 volts

Ev=2.5V, Vout=40 volts.

Ev=5.0V, Vout=30.625 volts

Thus for X=.55, Ev can control the output voltage,

Vout from 30.625V to 49.375V.

The formula for EIF, is: EIF=2.5-Iout*(.0172)

EIF=2.50V, Iout=0

EIF=1.64V, Iout=50A

4.12 Voltage feedback.
The voltage feedback from Vout is internal. No wiring is necessary.

4.13 Current feedback.
The input current feedback is sensed with a hall sensor and is internal. No wiring is necessary.

4.14 +5V
There is 5V regulated supply, that can be used for external circuitry. The +5V at pin 5 is internally connected to the +5V thru a 1kΩ resistor.

4.15 POWER WIRING.
All power connections are made to the 3 #10 screws. The screws are shipped with the unit.

Connect a DC supply to terminals Vin and Gnd.

Connect the load between Vout and Gnd. The Gnd terminal is shared with the input and the output. Use the appropriate gauge wire. The maximum input current for a DC6350-S-ADJ is 50ADC. Use the appropriate gauge wire. If long runs are to be made, voltage drop should be calculated and compensated for in gauge and voltage level.

The output current can be calculated;

Iin=Vout*Iout/(.95*Vin).

The efficiency of the unit is assumed to be .95. .95 is a good efficiency at:
Vin=48vdc, Vout=24vdc, Iout=50adc.

Iin for these numbers is:
Iin=24*50/(.95*48)=26.316adc

5.00 Mechanical Installation

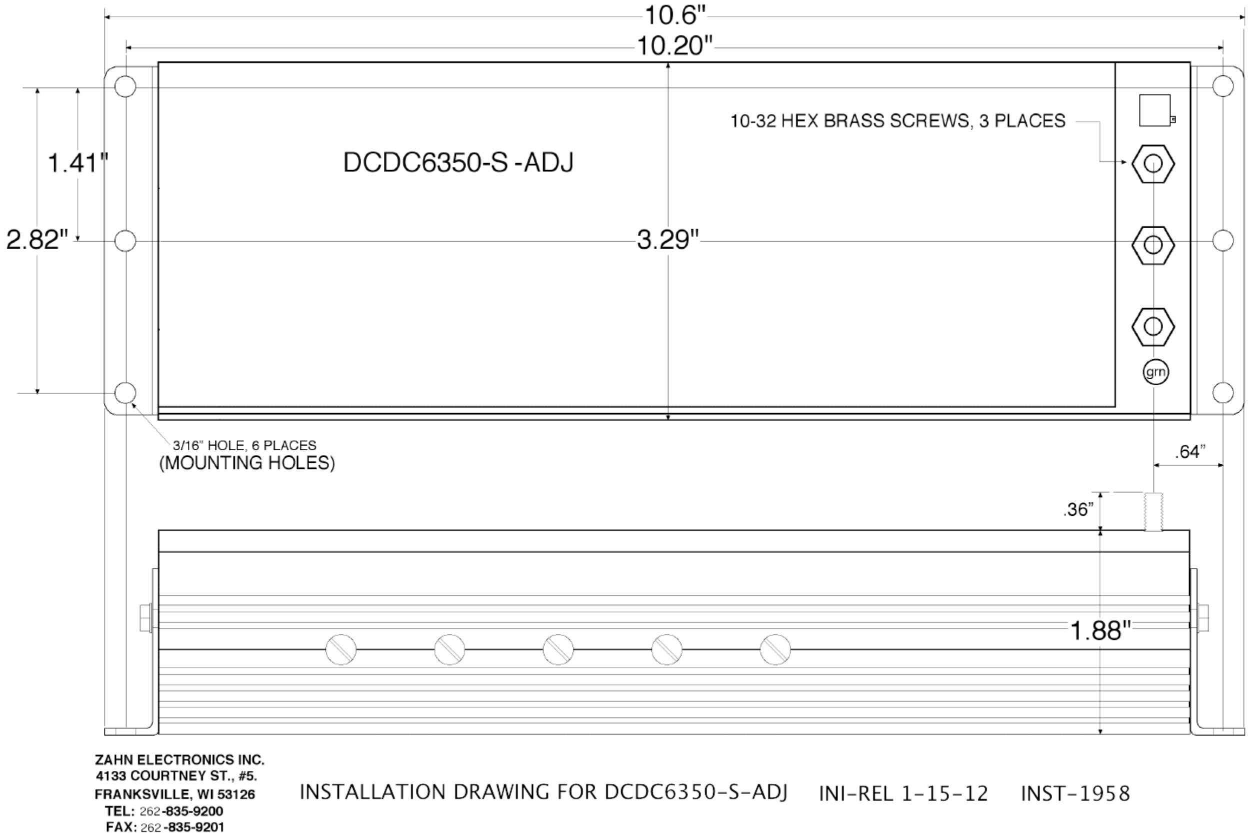


Figure 3.

6.00 Specifications.

6.10 Mechanical Installation.

The mechanical dimensions of the DCDC6350-S-ADJ are shown in Figure 3. The Power connections are made to the three 10-32 screws. Note that the Gnd terminal is shared by the Vin and Vout common connections. The 10 pin connector is located on the other side of the unit under the cover. The insulation has to be removed before connections can be made. Use Zahn# CABL-1654-002 connector to connect to this header.

6.20 Electrical Specifications (Power). See Figure 2.

Vout range: 12.5 to 60vdc. (11.2V will start it.)
Vout Ripple: less than 150mv, RMS, 48V in, 24V out, 50Amp load.
Vin range: 14.5 to 63vdc.
Iout range: 0 to 50adc.
Iin range: 30ma to 50adc. This must be calculated.
Standby current, Vout=12Vdc, Vin=24Vdc DIS=1, 27ma. DIS=0, 29ma
Standby current, Vout=24Vdc, Vin=48Vdc DIS=1, 18ma. DIS=0, 20ma
Standby current, Vout=36Vdc, Vin=63Vdc DIS=1, 17ma. DIS=0, 18ma
Efficiency, 48/24@50Adc out, 95.5%, 48/24@10Adc out, 95.4%
48/12@50Adc out, 91.1%, 48/12@10Adc out, 91.9%
48/36@50Adc out, 97.5%, 48/36@10Adc out, 97.4%
50KΩ on board 20turn pot. See Figure 2.
This pot adjusts Vout. The pot's position is X. 0<=X<=1

$$Vout=12.5 + 50X - (Ev-2.5)*(5X+1)$$, See 4.11

6.30 Electrical Specifications (Control). See Figure 2.

Terminal 1 DIS 10KΩ pulled up to +5V.
Terminal 2 common
Terminal 3 Ev 10KΩ to a 2.5V reference. The current thru the 10KΩ is sensed. See 4.11
Terminal 4 common
Terminal 5 +5, +5 thru a 1kΩ resistor
Terminal 6 common
Terminal 7 EIF the current out feedback thru a 5K resistor
Terminal 8 common
Terminal 9 Spare
Terminal 10 common

6.40 Switching Frequency: 120,000Hz, RC controlled

7.00 Example:

A DCDC6350-S-ADJ has an input voltage of 30 to 60 volts. The output voltage is set at 24 volts. 30 to 60 volts is within the range of 14.5 to 63 volts and the minimum input voltage is 6 volts higher than the output voltage of 24 volts.

Continuous **Input** Current: (maximum allowed) 50adc.

Continuous **Output** Current: (maximum allowed) 50adc.
The continuous input current must be calculated. It depends on, Vin, Iout, Vout, and the efficiency of the unit.
Iin(max)=(Vout*Iout)/(Efficiency*Vin)=(Pout)/(Efficiency*Vin)
Example: For a DCDC6350-S-ADJ with Vin=48v, Iout=50A, Vout=24v, Efficiency=.96,
Iin(max)=(24*50)/(.96*48)=26.04A, where Pout is 1200 Watts.

8.00 Operational Modes. All One quadrant.

1. Voltage Loop, without Vout offset.
2. Voltage Loop, with Vout offset.