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

1.0 Introduction and Description

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

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.

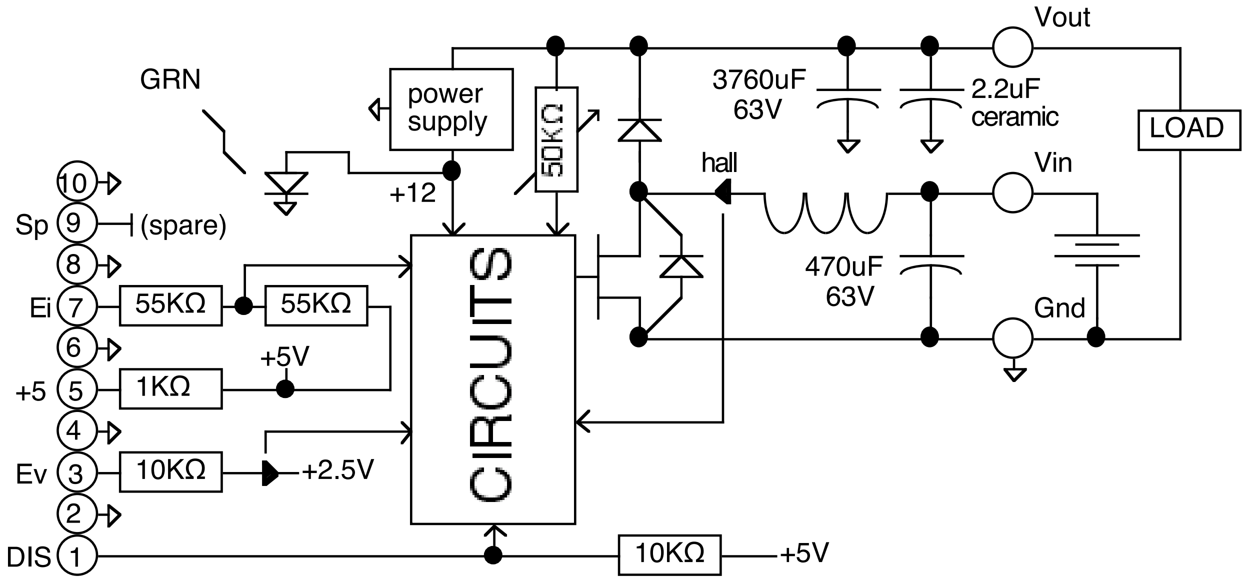
The input voltage and the output voltage share a power common. Therefore, there is no isolation between the power input and the power output. The input power source (battery) shares its power common with the load power common.

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 an Ev input voltage and a 50KΩ, 20 turn pot. There is a 5vdc supply available for this.

The input current limit can be controlled by Ei.

The internal temperature of the DCDC6350-SU-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 UP DC TO DC CONVERTER
ZAHN ELECTRONICS INC 10-08

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. Input current is sensed by a hall sensor. This is shown on the right hand side of Figure 1.

The voltage at Vout is sensed by the current thru 50kΩ resistor and current thru 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 Vout and Gnd. It 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. Only 11.1V 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. This is ideal for a fuel cell charging a battery. Once the output voltage, Vout, is at some voltage above +12.5V, the input can be dropped to a much lower voltage.

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 voltages, Ev and Ei. This is available at terminal 5 of the left hand side.The +5 has a 1K resistor to the internal +5v.

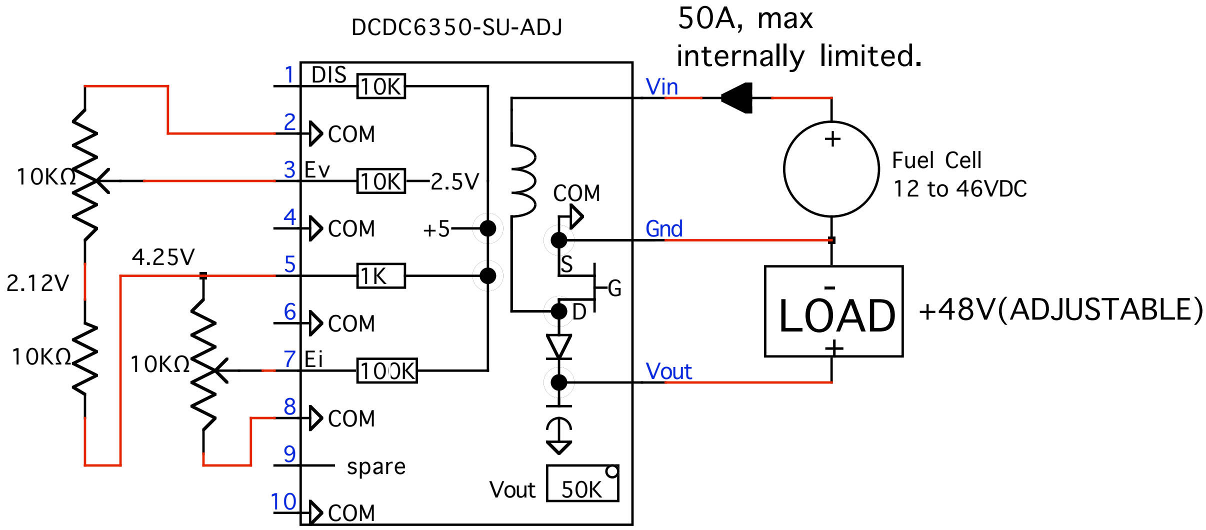
Ei is an input, terminal 7 on the left hand side. The voltage at the center of this 110KΩ is sensed and controls the input current limit. Ei controls the input current limit of the unit.

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.

INSTALLATION WIRING

12V TO 48V STEP UP DC/DC CONVERTER.

10-08



NOTES:
1 NO Ev control:
Leave Ev open.
ADJUST Vout, 50KΩ POT, FOR DESIRED LOAD VOLTAGE.
WITH Ev control:
ADJUST Ev, for desired voltage. 2.5V<=Ev<=+5V
ADJUST Vout, 50KΩ POT, FOR DESIRED LOAD VOLTAGE.
Load voltage, Vout, must be greater than fuel cell terminal voltage, Vin.
2 Fuel cell CURRENT IS INTERNALLY LIMITED TO 50A, with Ei terminal vacant.
3 The current limit can be controlled with a signal to Ei pin.
0V at Ei=>0A. 5V at Ei (or open terminal)=>50A

su1220

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 2.5 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:

$$Vout=15 + 62.5X - Ev*(5*X+1),$$

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

For X=.76,
Ev=0, Vout=62.5 volts
Ev=2.5V, Vout=50.5 volts.
Thus for X=.76, Ev can control the output voltage, Vout from 50.5V to 62.5

If a Pot is used for controlling the input current limit, The input to Ei should swing from 0 to 5V. The input current limit is 0 when Ei=0, and 50Adc when Ei=5V or when the Ei terminal is vacant.

The formula for Iin(current limit) versus Ei, is:

$$Iin(current\ limit)=50*(Ei/5),$$

For Ei=0, Iin=0Adc. For Ei=+5, Iin=50Adc.
Note that if the load is such that the input current needed is less than the current limit value, the unit will not go into current limit

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

4.13 Current feedback (Current loop is not allowed for step up converters).
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 hardware is 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-SU-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;

Iout=Vin*Iin*.95/Vout. If the input current is limited by either Ei or the internal current limit of 50Adc, the Iout can still be calculated,
Iout=Vin*50*.95/Vout, or Iout=Vin*Iin(limited)*.95/Vout

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

Iout for these numbers is:
Iout=24*50*.95/48=23.75adc

5.00

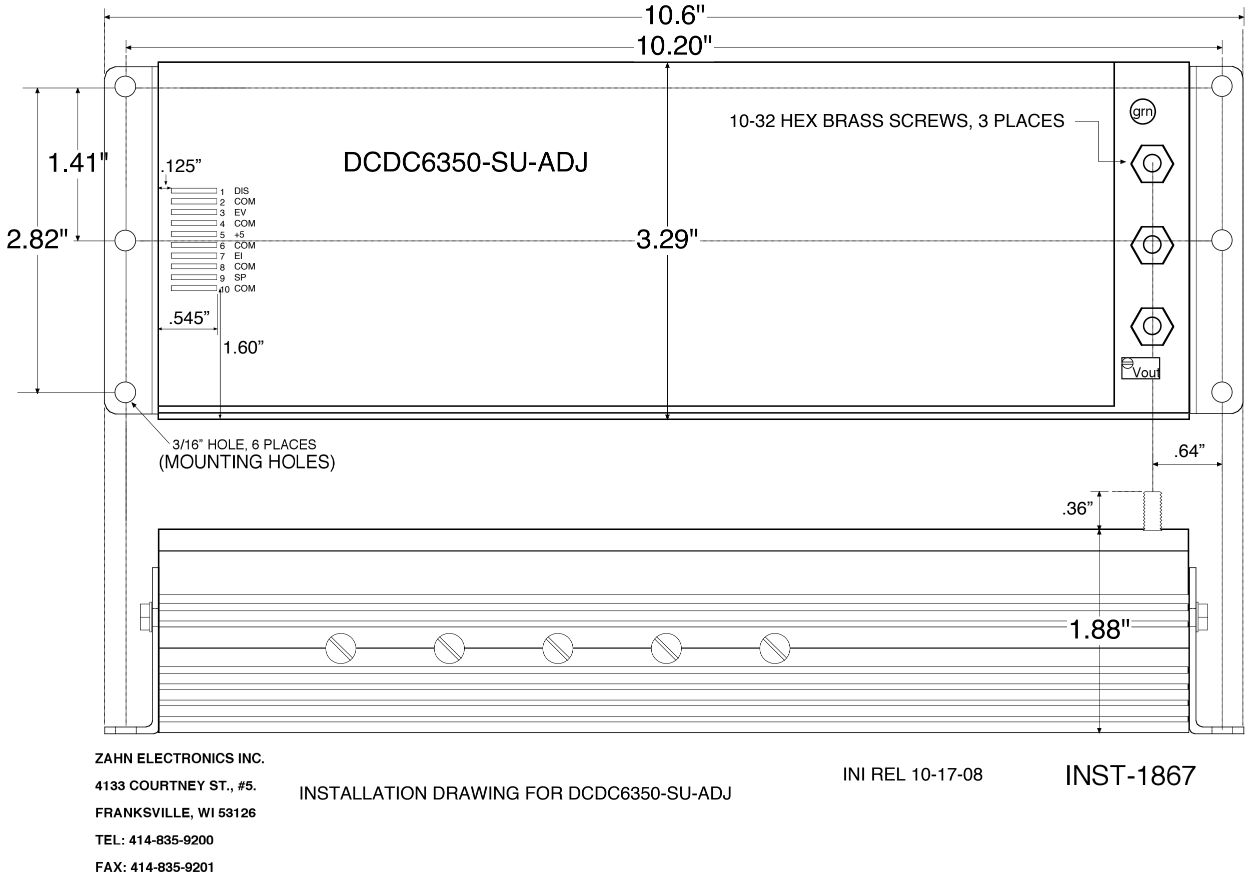

10.6"
10.20"
10-32 HEX BRASS SCREWS, 3 PLACES
grn
1.41"
.125"
DCDC6350-SU-ADJ
1 DIS
2 COM
3 EV
4 COM
5 +5
6 COM
7 EI
8 COM
9 SP
10 COM
2.82"
3.29"
.545"
1.60"
Vout
3/16" HOLE, 6 PLACES
(MOUNTING HOLES)
.64"
.36"
1.88"
ZAHN ELECTRONICS INC.
4133 COURTNEY ST., #5.
FRANKSVILLE, WI 53126
TEL: 414-835-9200
FAX: 414-835-9201
INSTALLATION DRAWING FOR DCDC6350-SU-ADJ
INI REL 10-17-08
INST-1867

Figure 3.

6.00 Specifications.

6.10 Mechanical Installation.

The mechanical dimensions of the DCDC6350-SU-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 63vdc. (11.1 will start it.)
Vout Ripple: less than 150mv, RMS, 12V in, 48V out, 42Amp load.
Vin range: 11.5 to 61vdc. After the unit is on, Vin can be reduced to 7vdc.
Iout range: 0 to 50adc. This must be calculated.
In range: 30ma to 50adc.
Standby current, Vin=12Vdc, Vout=24Vdc DIS=1, 40ma. DIS=0, 118ma
Standby current, Vin=24Vdc, Vout=48Vdc DIS=1, 28ma. DIS=0, 87ma
Standby current, Vin=24Vdc, Vout=63Vdc DIS=1, 27ma. DIS=0, 125ma
Efficiency, 12/24@50Adc in, 92.7%, 12/24@10Adc in, 94.6%
12/48@50Adc in, 91.9%, 12/48@10Adc in, 93.0%
24/48@50Adc in, 95%, 24/48@10Adc in, 96%
50KΩ on board 20turn pot. See Figure 2.
This pot adjusts Vout. The pot's position is X. 0<=X<=1

Vout=15 + 62.5X – Ev*(5*X+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. Vout=15 + 62.5X – Ev*(5*X+1), See 4.11
Terminal 4 common
Terminal 5 +5, +5 thru a 1kΩ resistor
Terminal 6 common
Terminal 7 Ei 110KΩ to +5V. The middle voltage is sensed.
Iin(current limit)=50*(Ei/5), see 4.11
Terminal 8 common
Terminal 9 Spare
Terminal 10 common

6.40 Switching Frequency: 120,000Hz, RC controlled

7.00 Example:

A DCDC6350-SU-ADJ has an input voltage of 12.5 to 28 volts. The output voltage is set at 52 volts. 12.5 to 28 volts is within the range of 12.5 to 61 volts and the maximum input voltage is 24 volts lower than the output voltage of 52 volts. The output voltage is 63-52=11 volts lower than the maximum allowed.

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

Continuous **Output** Current: (maximum allowed)
The continuous output current must be calculated. It depends on, Vin, Iout, Vout, and the efficiency of the unit.
Iout(max)=(Efficiency*Vin*Iin)/Vout=(Efficiency*Pin)/Vout
Example: For a DCDC6350-SU-ADJ with Vin=12.5v, Iin=50A, Vout=52v, Efficiency=.96,
Iout(max)=(.96*12.5*50)/52=11.54A, where Pout is 600 Watts.

8.00 Operational Modes. All One quadrant.

1. Voltage Loop, without external input current limit without Vout offset.
2. Voltage Loop, without external input current limit with Vout offset.
3. Voltage Loop, with external input current limit without Vout offset.
4. Voltage Loop, with external input current limit with Vout offset.
5. Current Loop, not allowed.