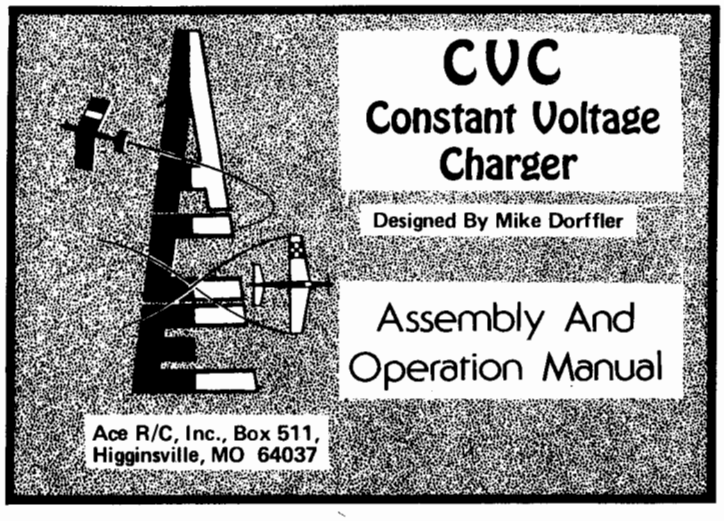
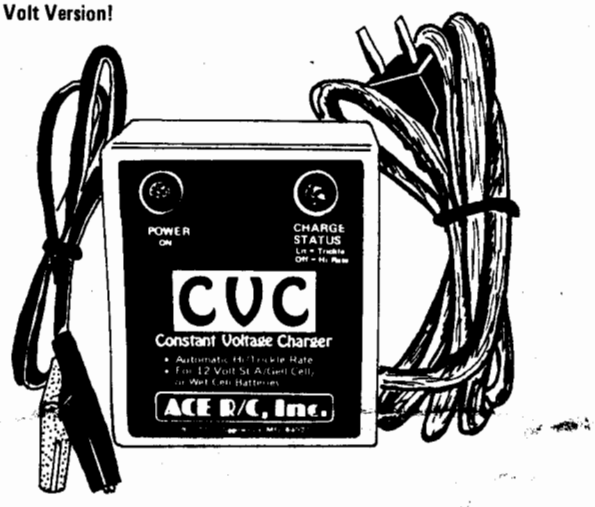


Including 6 Volt Version!



I. INTRODUCTION

The Ace CVC (Constant Voltage Charger) was created to provide reliable, safe and foolproof charging to all 6 or 12 Volt Lead Acid batteries used by modelers for field use; whether they be wet cells, gel cells, or sealed lead-acid batteries.

Mainly, it was designed so no battery could be overcharged even if it were left connected for days. An LED shows when 90% charge has been reached...the time it takes to do this, of course, depends on the capacity of the battery being charged plus its' state of discharge; generally, 10 hours or less. It then automatically shifts to a slow, safe trickle rate to complete the charge.

In addition, the CVC is virtually blow-proof. Even if you accidentally reverse the connections from the charger to the battery whether the charger is plugged in or not, it can't be damaged.

II. OPERATION

If you have a kit CVC, refer to the following construction and calibration instructions to assemble your unit and then return to this section to properly operate your CVC. Note you can build it in either the 6 Volt or the 12 Volt versison. If you have an assembled unit, it is tested and calibrated, ready for operation.

Use of the CVC is as easy as any other type of battery charger. All that you need to remember is to attach the leads to the battery before plugging the unit in. By the same token, unplug the unit from the wall before unhooking the battery. This is a good policy with any charger when working with lead/acid batteries to prevent dangerous sparks around venting gases.

ALWAYS make sure you hook the red alligator clip to the positive (+) lead of the battery and the black alligator clip to the negative (-) lead of the battery. Failure to do so can result in damage to your battery.

Note the two LED's on the front panel. The red one is simply an ON indicator and is lit while the CVC is plugged in. The yellow one indicates the charge status of the CVC; hence, will tell you when your battery is fully charged. Note the full intensity of the yellow LED when the unit is plugged in but the battery to be charged is unhooked. Now, when you hook up the battery (maintaining proper polarity!), the LED will dim or go out. If it goes out, the charger is putting maximum current into the battery (400 ma). As the battery comes close to full charge, the yellow LED will begin to glow dimly and increase in intensity as the battery reaches 100% charge. When full charge is reached, the LED will be at maximum brightness. While the yellow LED is getting brighter and brighter, the amount of charge current going into the battery is decreasing so that at maximum intensity (full charge) the charge current is at a safe trickle rate that can't hurt the battery, no matter how long it's left on. Safe and foolproof!

Although the CVC does not get hot during normal charging, it does get warm and care should be exercised not to use the unit in a confined area. If the unit can't dissipate heat during charging, then it can become damaged.

III. PARTS LIST

Components for the 6 Volt version are shown in [ ].

Resistors

( ) 1	R0-15X	1.5 Ohm 2W	(Brn,Grn,Gld,Gld)
( ) 1	R2-102	1K 1/2W	(Brn,Blk,Red,Gld)
( ) 2	R4-102	1K 1/4W	(Brn,Blk,Red,Gld)
( ) 1	R4-221	220 Ohm 1/4W	(Red,Red,Brn,Gld)
( ) 1	R4-222	2.2K 1/4W	(Red,Red,Red,Gld)
	[R4-911	910 Ohm 1/4W	(Wht,Brn,Brn,Gld)]
( ) 1	R4-241	240 Ohm 1/4W	(Red,Yel,Brn,Gld)
( ) 1	RV081 or RV081A 1K Trim Pot		
	[RV189 or RV189A 500 Ohm Trim Pot]		

Capacitors

( ) 2	CE108PI	1000 mf 25V Electrolytic

Semiconductors

( ) 1	SS029	2N4400 Transistor
( ) 1	SS045	LM317 Voltage Regulator
( ) 1	SS075	Red LED
( ) 1	SS075A	Yellow LED
( ) 4	SS120	1N4001-4005 Diode
( ) 1	SS135	1N4742 Zener Diode
	[SS140	1N4733 Zener Diode]

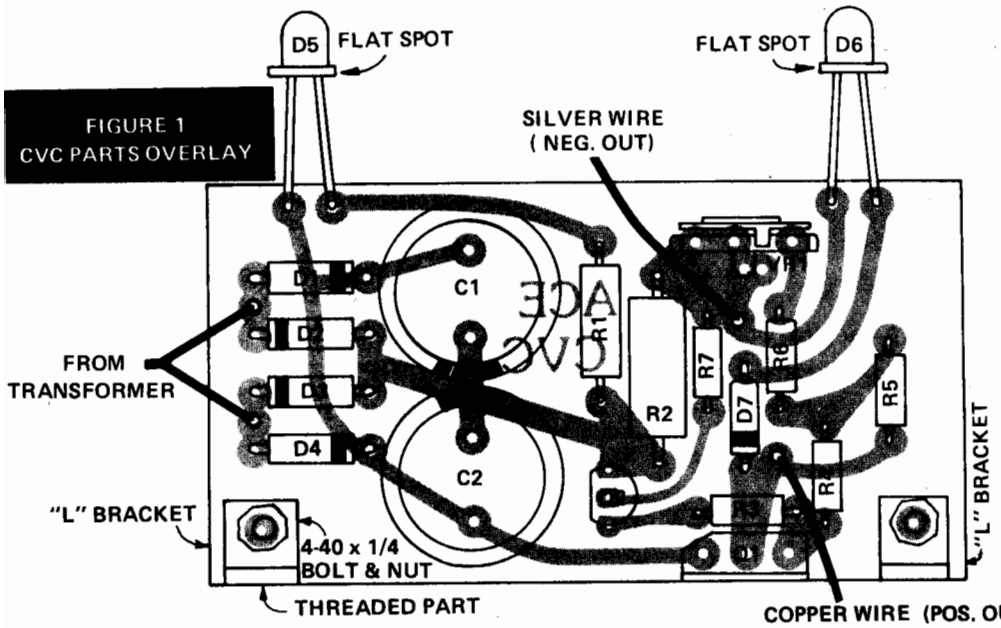
Hardware

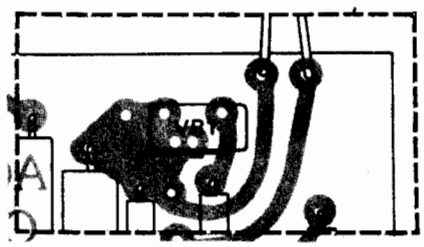
( ) 5	HW002	4-40 Hex Nuts
( ) 7	HW082A	4-40 X 1/4" Machine Screws
( ) 2	HW112	#2 X 1/4" Self Tap Screws
( ) 2	HW192	"L" Bracket
( ) 1	HW171	#6 Solder Lug
( ) 2	HW011E	#4 Lock Washers

Miscellaneous

( ) 1	PC155	CVC PC Board
( ) 1	SM193	CVC Metal Case
( ) 1	LB093	CVC Faceplate
( ) 1	TT018	Transformer
( ) 2	CC073	Alligator Clips
( ) 1	CC074	Red Insulator Boot
( ) 1	CC075	Black Insulator Boot
( ) 3	RP015A	#1A Rubber Grommet
( ) 1	RP016	#3 Rubber Grommet
( ) 4	RP025	Push-In Black Rubber Feet
( ) 36"		Two Conductor Wire
( ) 24"		Solder
( ) 1	PLA022	Small Wrap 'N' Tie
( ) 1	WW073	Three Conductor Line Cord
( ) 1	TB028	3/16" x 2" Heat Shrink Tubing
( ) 1	HW139	Mica Transistor Collector Insulator
( ) 1	HW197	Nylon Transistor Hole Insulator

FIGURE 1
CVC PARTS OVERLAY





SMALL TRIM POT
STYLE FOR VR1

ALUMINUM ELECTROLYTIC

PARTS ID LEGEND

Parts for 6 Volt version are in [ ].

( ) C1 1000 mf Electrolytic (+ to outside of board)
( ) C2 1000 mf Electrolytic (+ to outside of board)
( ) D1 1N4001/5 (Banded end to inside)
( ) D2 1N4001/5 (Banded end to outside)
( ) D3 1N4001/5 (Banded end to outside)
( ) D4 1N4001/5 (Banded end to inside)
( ) D5 Red LED (Flat side to inside)
( ) D6 Yellow LED (Flat side to inside)
( ) D7 1N4742 (Note Orientation of banded end)
[1N4733 (Note Orientation of banded end)]
( ) Q1 LM317MP (Heat sink toward bottom of board)
( ) Q2 2N4400 (Flat side toward C2)
( ) R1 1K 1/2W (Brn,Blk,Red,Gld)
( ) R2 1.5Ohm 2W (Brn,Grn,Gld,Gld)
( ) R3 1K 1/4W (Brn,Blk,Red,Gld)
( ) R4 1K 1/4W (Brn,Blk,Red,Gld)
( ) R5 240 Ohm 1/4W (Red,Yel,Brn,Gld)
( ) R6 2.2K 1/4W (Red,Red,Red,Gld)
[910 Ohm 1/4W (Wht,Brn,Brn)]
( ) R7 220 Ohm 1/4W (Red,Red,Brn,Gld)
( ) VR1 1K Trim Pot (Large or Small)
[500 Ohm Trim Pot]

IV. CONSTRUCTION

Read the "Kit Builder's Hints" before beginning.

( ) Using the Overlay Drawing (Fig. 1) and the Parts ID Legend, assemble the PC board according to the following suggested procedure. Always observe the special instructions in the Parts ID Legend concerning specific installation of parts. Also note that the parts for the 6 Volt version of the CVC are in [ ]. The parts for the 12 Volt version are unbracketed.

( ) Install and solder D1, D2, D3, and D4 noting the orientation of the banded ends. Except where indicated, keep all parts tight on the board and clip off the excess leads after soldering.

( ) Install and solder D7 (1N4742 for the 12V version; 1N4733 for the 6V)...watch the banded end!

( ) Install and solder all the resistors. (R1 through R7). Note that R1 is a 1/2W and R2 is a 2W. Also note that R6 is is a 2.2K for the 12V version and a 910 Ohm for the 6V version.

( ) Install and solder Q2, (2N4400) keeping it 1/8" off the board. Note the orientation of the flat side.

( ) Install and solder VR1 (1K Trim Pot for the 12V version; 500 Ohm for the 6V) keeping it perpendicular to the board. Note: You may have either a small or a large trim pot. The PC board will accommodate either. If you have the large one, you need to straighten the legs with a pliers before installing.

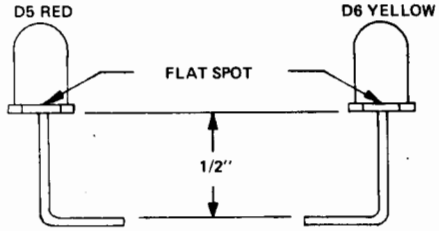
( ) Install and solder C1 and C2, (1000 mf electrolytic capacitors) noting the proper orientation of the positive lead.

( ) Install the "L" brackets to the component side of the board as shown in Fig. 1., using the 4-40 X 1/4" bolts and nuts. Do not tighten securely until you check that the brackets are level and perpendicular to the board by setting it on a flat surface.

( ) Prepare the 36" Two Wire Cable by cutting between the wires at one end and pulling them apart for about 1". Strip 3/16" of the insulation off of each wire and tin.

( ) Install and solder the ends of the wire into the PC board as shown in Fig. 1. The copper colored wire is positive and the silver wire is negative. This cable is now the charger output wire.

FIGURE 2
BENDING THE LED's



( ) Referring to Fig. 2, bend the leads of D5 and D6 (LED's) as shown. Note that there are two different colors and that the flat portion of the LED's need to be oriented as shown.

( ) Install and solder D5 and D6 (LED's) as shown in Fig. 1. Note the flat side orientation and the location of the proper colors.

( ) Install but DO NOT SOLDER Q1 (LM317MP) noting the proper orientation.

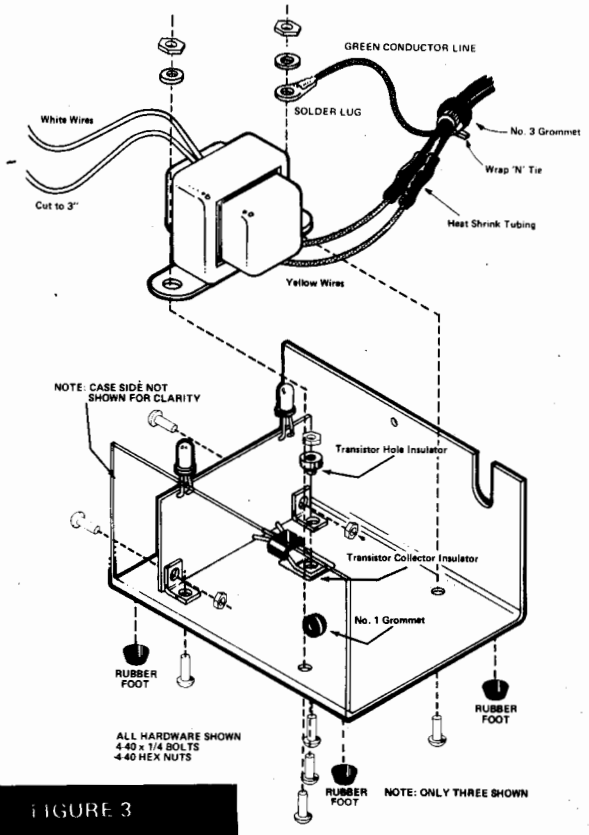


FIGURE 3
MECHANICAL ASSEMBLY

( ) As shown in Fig. 3, mount the board in the case using two 4-40 X 1/4" bolts. Note that the component side of the board faces into the case.

( ) Referring to Fig. 3, bolt transistor Q1 to the case using the hardware illustrated. Make sure the Collector Insulator is centered and the metal is not contacting the case; note the shoulder of the Hole Insulator goes into the transistor hole and lays flush on the tab. It may be necessary to use a knife to bevel the edge of the hole in the transistor to aid insertion.

( ) While the board is in the case, carefully solder Q1 to the board...clip off the excess leads.

( ) Install one of the #1A grommets in the side of the case as shown in Fig. 3...route the two wire output cable through it from the inside out.

( ) Measure and cut all four transformer wires so they are about 3" from the transformer and strip 3/16" insulation off of each and tin.

( ) Prepare the end of the three conductor line cord by carefully slitting the black insulation on both sides of the center green wire for about 1/2" with an X-acto knife; then, by hand, peel the two outer wires apart for about 1 1/2". The green wire should now be free and about 1 1/2" long.

( ) Strip 3/16" insulation off all 3 wires and tin with solder. Slip a No. 3 grommet over all three wires.

( ) Bend the solder lug half way between the two holes at a 45 degree angle and solder the center green wire to the end that has the smaller hole.

( ) Cut the 3/16"D heat shrink tubing in half and slip each piece over the two yellow primary wires of the transformer.

( ) Solder the two black line cord leads to the two yellow transformer wires. (It doesn't matter which one goes to which.)

( ) Slide the heat shrink tubing over each joint, and shrink it tightly over joint using a cigarette lighter.

( ) As shown in Fig. 3, mount the transformer to the inside of the case and tighten securely.

( ) Solder the two transformer secondary wires(white) into the PC board as shown in Fig. 1...it doesn't matter which wire goes to which of the two holes.

( ) Install a wrap 'n' tie over the line cord for strain relief. Make sure the wrap 'n' tie is secure on line cord so that it doesn't slip through the grommet.

FIGURE 4
ALLIGATOR CLIP INSTALLATION

( ) Prepare the other end of the output cable by cutting between the wires and pulling them apart about 2"...strip 1/4" insulation off each wire and tin.

( ) Referring to Fig. 4, solder an alligator clip on each wire, being sure to tin the alligator clip before soldering. Crimp the tabs over on the wire after soldering.

( ) Slip the boots over the alligator clips, making ABSOLUTELY sure the red one goes on the copper wire and the black one goes on the silver wire.

( ) Peel the backing off the pressure sensitive faceplate and install it on the front of the case. Be sure the LED designations on the faceplate are under the holes in the case and the faceplate is centered on the case. Refer to the illustration that is at the beginning of these instructions if there is any question.

( ) Using an Exacto knife, carefully cut out the holes in the faceplate for the LED's. Install a #1A grommet in each of these holes.

( ) Slide the top of the case on to the bottom to check for proper alignment of the two LED's. Carefully bend the LED legs if necessary.

V. CALIBRATION

Calibration of the CVC is easy and all that is required is a voltmeter. A digital voltmeter will give you a more accurate calibration but is not absolutely necessary.

( ) Take the case apart if it is together.

( ) Connect the voltmeter to the output leads of the CVC, making sure positive goes to the red alligator clip and negative to the black. Set the voltmeter to the lowest DC voltage range that includes 15 volts.

( ) Plug the CVC into a 120V outlet. The red LED should light...the yellow LED may or may not be lit.

( ) Adjust the trim pot VR1 to exactly 14.20 volts for the 12V version [7.10 volts for the 6V version.] Now the yellow LED should be lit.
CAUTION: If the output voltage reading is above 14.20 volts [7.10 volts], overcharge to the battery may result.
Calibration is now complete.

VI. FINAL ASSEMBLY

( ) Slide the top of the case onto the bottom and secure, using two #2 X 1/4" Self Tap Screws.

( ) Install the four rubber feet in the corners of the back by pushing them into the holes in the case.

Construction of your CVC is now complete and you are ready for operation.

VII. CIRCUIT DESCRIPTION

The circuitry of the CVC centers around the LM317MP Adjustable Voltage Regulator. This device was chosen for the design as it contains all the necessary controls needed to provide the protection desired.

The input voltage from the transformer to the LM317 is filtered by a full wave bridge rectifier composed of four rectifier diodes and two 1000 mf caps. This provides about 16 volts DC with a maximum ripple of 2V.

A maximum voltage of 14.2V [7.1V] is applied to the battery being charged by the Trim Pot...this assures that the battery can not be overcharged no matter how long it is left on. Additional control over the output voltage is provided in conjunction with the current limiting control. Note the 2N4400 transistor whose collector is resistively coupled to the adustment terminal of the 317. The 1.5 ohm resistor appearing in the return charge path and connected in conjunction with the 2N4400 senses the output current. The transistor turns on when the voltage across the resistor equals about .6V and corresponds to a current of 400 ma. As the transistor begins to turn on, it pulls the adjustment terminal of the 317 negatively, thereby reducing the output voltage. In this manner, the output voltage is controlled so that a maximum of 400 ma is always maintained during the initial charging phase.

As the battery voltage climbs above 13.6V [6.75V], the transistor begins to lose all control over the 317. As this occurs, charge current will progressively taper off from the maximum to only a few ma as the battery continues toward a fully charged condition.

At the same time the battery voltage climbs above 13.6V [6.75V], the yellow LED will begin to glow indicating the battery is nearing charge completion. The LED will be at its brightest when the battery reaches 14.2V [7.1V]. To explain how the LED performs this function, you will note that it is connected in series with a 12V [5.1V] Zener diode. A typical LED requires 1.65V to begin to glow. If we add this with the nominal Zener voltage of 12V, we see that about 13.65V [6.75V] must appear across the combination of the two before the LED will glow. Therefore this becomes a very simple method to determine the level of battery voltage.

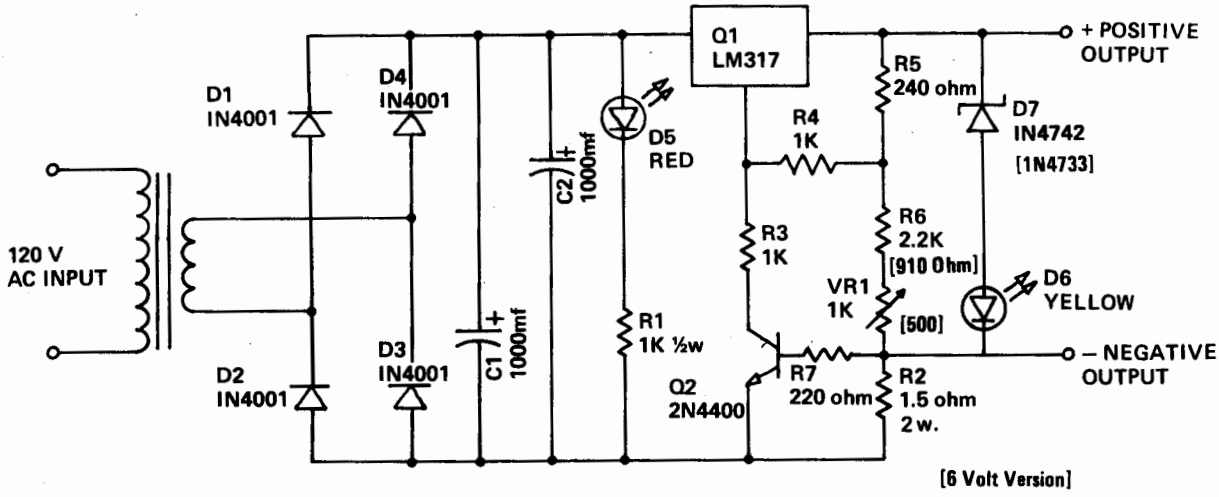


FIGURE 5
CVC SCHEMATIC

ACE R/C, Inc.

Box 511, Higginsville, MO 64037 (816) 584-7121