Electric Auto Association NEWS

FEBRUARY 1986

Vol. XVIII No. 2

200 MILES WITHOUT CHARGING WITH A NORMAL 50 MILE EV

We have found our vehicles with a normal range of 40 to 50 miles urban stop and go driving, increased their range to approx. 100 miles at 45 to 50 MPH when driving at a constant speed, on reasonably level terrain, and taking maximun advantage of coasting and regeneration when grades are encountered.

NOW WE HAVE A 100 MILE CAR

1984-85 International Rallys plus road testing has proved that doubling the battery capacity in Saied's Fiat has resulted in more than doubling the range. (without recirculation)

NOW WE HAVE A 200 MILE CAR

Driving a normal EV over 4000 miles across Canada, in normal touring time, will certainly prove something no matter how we do it.

According to AAA normal touring is 2.5 hours per 100 miles. We intend to match this time by driving 200 miles in 5 hours, charging for 5 hours, and driving another 200 miles in 5 hours. With 15 hours of daylight from dawn to dusk we can make this without driving at night.

FAST CHARGING AND SIMULATED FAST CHARGING METHODS.

WARNING!!!: Some of these suggestions are guaranteed to shorten life or outright distroy batteries. However, the end justifies the means?

BCI says you can charge deep cycle batteries at 100 amps to 80%, may need some coolin? Draining and replacing acid, you could install some poly tubes for quick draining be careful where the acid goes! Carry an extra set of batteries in a support vehicle, charge in route, one of our members uses a hospital lift for changing batteries. For paralleling an extra set of batteries in the vehicle I would use SLI bateries for weight and space saving, they should last the 20 or so cycles needed.

IF ANYONE HAS ANY MORE WIERD IDEAS PLEASE SEND THEM IN SO WE CAN PASS THEM ON. THANKS

EXPO 86 VANCOUVER

HAVE WE GOT A DEAL FOR YOU!!

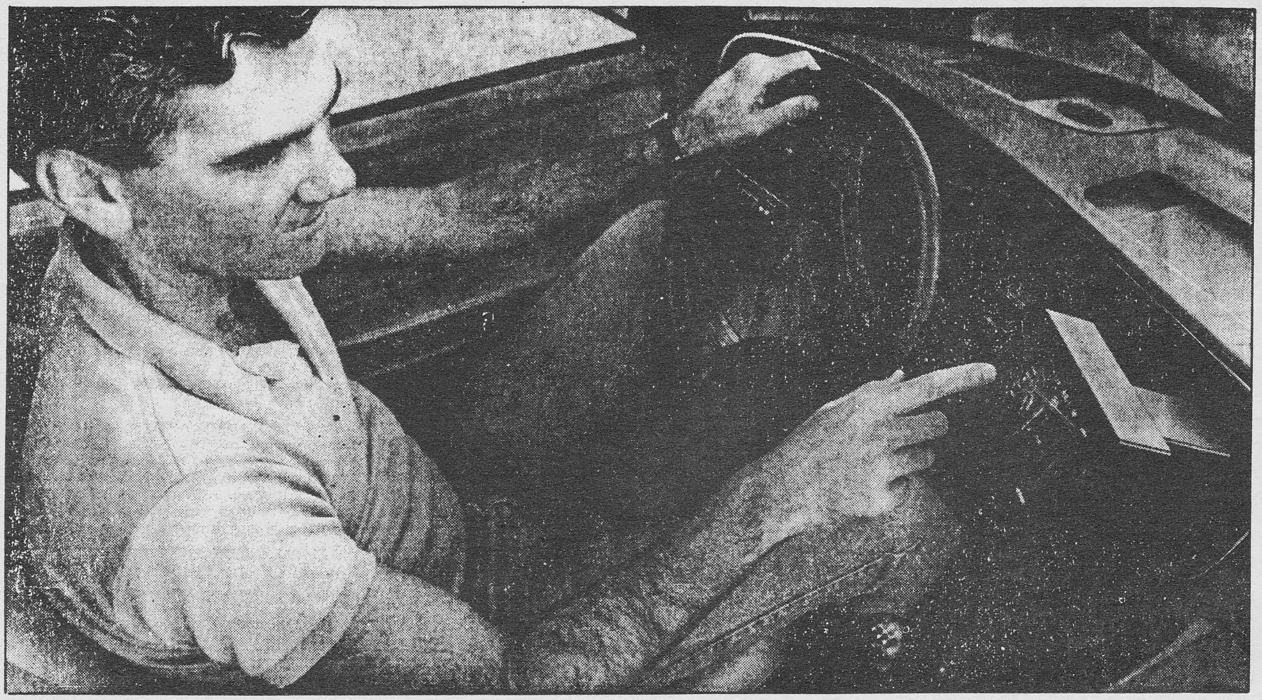
THREE WORLD CLASS SHOWS, PLUS A BIG BONUS FOR THE PRICE OF ONE

EXPO '86, THE ABBOTSFORD INTERNATIONAL AIR-SHOW, THE EAA/EVAC INTERNATIONAL ELECTRIC VEHICLE RALLYE, PLUS THE BIG BONUS THE FINISH OF THE TRANS-CANADA-EV-RALLYE WHAT MORE COULD YOU ASK!!

WE NEED TO KNOW NOW!! NOW!!
WILL YOU BE IN THE RALLY
CAN YOU STAY THROUGH THE 16th.
THEY WANT SOME EV'S AT THE EXPO FROM AUG. 11 thru 16th

PLEASE MAIL ASAP:

EAA Inernational Rally Chairman
Clarence Ellers
2892 Mesquite Dr.
Santa Clara, CA 95051



Eugene Louie — Mercury News

James Bond would covet the computerized guidance of Navigator, demonstrated by Etak's Donald Warkentin

The Navigator

A computer gives drivers a new sense of direction

By Broderick Perkins
Mercury News Staff Writer

YOU'RE lost.

Lost, not like "The Lost Weekend." But lost, like "Lost in Space." You're so lost, in fact, that if it weren't for the new computerized device on the dashboard of your car, you'd be performing the most embarrassing automotive maneuver of them all — asking a gas station attendant for directions.

But when you merely punch an address into a tiny panel of buttons, an arrow on a small screen points you in the right direction and a star marks your destination. Mileage is provided on a digital readout.

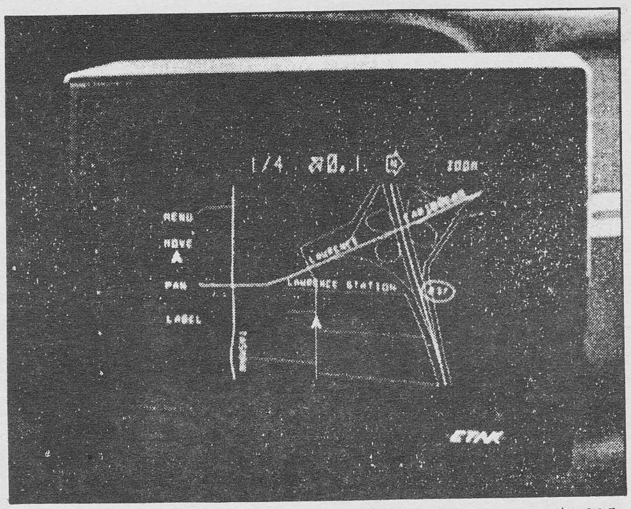
While you're driving, it takes only a glance at the video display terminal to see green lines representing the major roadways ahead within a 10-mile radius. A stationary arrow pinpoints both your position and travel direction. Every second, the map display is electronically updated to monitor your position in relation to the streets around you.

As you get closer, two stars appear on the monitor, marking your destination within a block. Press another button and you zoom in to a 1-mile-radius display to get a more detailed map of the area. Zooming farther down to the most detailed display, a quarter-mile radius view, you see the two destination stars marking the specific cross streets at both ends of your target street — and you're home free.

Sound like James Bond-style equipment? Well, you're close. It's called the Navigator, and it's the world's first in-car electronic map.

Manufactured in Sunnyvale by Etak Inc., the sophisticated Navigator allows its user a superhuman sense of direction. An installed system costs $1,395 for a 4½-inch screen or $1,595 for the 7-inch job, but even the more expensive model costs less than cellular telephones did when they were first introduced earlier this year.

According to Donald Warkentin, Etak's marketing director, the Navigator is making its way into shops in the Bay Area and the Southland — Los Angeles, San Diego and Orange counties — that sell car stereo systems, two-way radios and cellular phones. Most of the interest is from people who make their living finding their way around, such as salespeople, real-estate agents and contractors.



Display tracks car's progression; 4½-inch model costs $1,395

Two months ago, Pat Wehner, a residential and commercial painting contractor, bought a Navigator for his Mission Painting business in Campbell.

"I drive 150 to 200 miles a day, and the biggest difference (between the Navigator and maps) now is that it's pretty easy finding my way through housing developments. I didn't think it would make that big a difference. I got it because it was kind of a novelty, but it has really helped out. When you use map books, the print for the names of small streets is awfully small, and then you have to turn the map sideways to figure the direction," said Wehner.

"It's safer to look at the Navigator than the map when the truck is moving. Also, I have a mobile phone, and after I program in my destination, I can spend time making business calls. It really lessens the stress of driving. It's nice to have all the aid you can have when you do a lot of driving."

The navigating system is easy to learn and offers instructions on its own display screen.

Navigator's monochrome display (green details on a black background) provides sharp display resolution similar to that of many video games. The Navigator marks your position with a stationary arrow on the display, but as you drive your vehicle, the map shifts to show it passing through intersections, turning and proceeding along clearly marked streets. The display shifts much as you would turn a paper map to orient yourself with your surroundings.

The monitor also perpetually displays longitudinal and latitudinal coordinates. After you turn it on, a compass appears, then switches to a single arrow pointing north.

A useful tool for trip planning is Navigator's scanning ability. It lets you view areas of the map outside your current driving area.

If you are searching for a particular street, street address, intersection or landmark, just scroll through a map index until you find your destination. Select it and almost immediately you'll learn its distance relative to your vehicle and see its location represented by a destination star. If the exact address is not available, two stars will pinpoint the ends of the block in which it's located.

The map data is stored as digital information bits on audio cassettes. Right now, there are maps available for only the Bay Area as well as Los Angeles, Orange and San Diego counties. The Bay Area is divided into four cassettes of overlapping territories: Northwest Bay (Marin County to Palo Alto), Northeast Bay (Vallejo to Oakland), South Bay (Santa Clara County) and East Bay (Santa Clara County to Oakland). Each cassette sells for $35.

By the end of 1986, maps will be available for every major metropolitan area within the country, according to Warkentin. The maps will be updated annually. Under a current buyer plan, people who bought the original maps will get free updated replacements when a second edition becomes available in December.

The navigational system consists of four primary components that are installed as easily and as quickly as

CON'T NX MONTH

EVERY STATE OF THE ART EV MUST HAVE A DC TO DC CONVERTER (SAME FUNCTION AS ALTERNATOR) 3
SEE: CIRCUIT FEB. 86 CALENDAR. HERE IS SOME DESIGN BACKGROUND. SEE ERRATA NOTE PG. 6

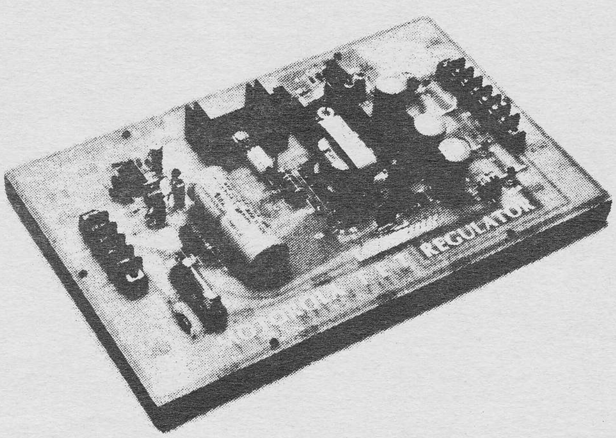
A 100kHz FET Switcher

by
R. J. Haver, Motorola Semiconductor Products Sector
J. Schwartz, Pulse Engineering, Inc.

In the ever expanding world of microprocessors, mini-computers and peripherals, there is an ever increasing demand for a low cost multiple output power supply. It was only a couple of years ago that the 20kHz flyback regulator using bipolar power transistors came on this scene and was proven to be cost effective with older linear designs in the 50 to 100W range. But the story does not end there. Now there is another revolution taking place and it was brought on by the recent introduction of the high frequency FET power switch.

Today designers are using this component in 100 to 200kHz flyback regulators and generally finding that the performance and cost are equivalent or better than the bipolar approach. The FET is currently a high cost component but systems savings are still possible because passive component size is reduced and base drive interface circuits are eliminated. The future will see even more designs like the one shown here as FET prices erode and higher operating frequencies are shown to be practical.

The circuit described here and shown below is a 60W, 100kHz FET switcher with four output voltages ±5W and ±12V. It operates from 120VAC, has an efficiency of 75% and the total parts cost is approximately $40.



Components unique to this high frequency design include the following:

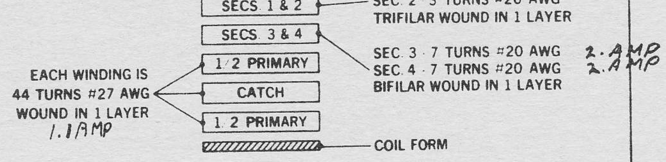
- Motorola's MTP565 power FET. This 4A, 400V device has only one ohm of on resistance and is driven directly from a linear 1C. It not only switches in less than 50ns but has enough RBSOA to eliminate the need for snubbers.
- Pulse Engineering's PE63133 power transformer. This is a continuous mode flyback transformer which is ideally suited to high frequency operation. Zener clamps are not required because the clamp winding is interleaved with primary halves. And regulation of the auxillary outputs is within ∓10% under varying conditions of line and load.
- Motorola's TL494 Switchmode control IC, 4N27 opto coupler, and MC1723 linear regulator. These devices are used in the first practical demonstration of a low cost, three chip control system. The 723 is the error amplifier, the 494 is a fixed frequency PWM, and the 27 couples the feedback signal from the 723 to the 494.
- Motorola's MBR1035 (TO-220) Schottky was used to rectify the +5V output at half the cost of a comparable DO-4. Similar cost savings result from using the TO-220 fast recovery rectifiers, i.e., the MR2400F in the ±12V outputs.
- Mepco/Electra's 3428 series of output capacitors. These high frequency electrolytic caps feature low ESR and high RMS current ratings. Only 50 to 70 mV (PP) of ripple occurs at the outputs, power loss is less than 0.5W and the caps cost only $1.30.
- The remaining sections of this article contain information about the transformer and circuit design and conclude with a discussion of the switchers' performance and cost.

Transformer Design

The transformer used in this 100kHz flyback regulator is a ferrite E core which is about 30% smaller than its 20KHz counterpart. It is shown schematically in Figure 1 and was designed using the following basic transformer design procedure:

1. Specify application
2. Select core
3. Design coil
4. Verify design

Figure 1. Transformer Coil Cross Section



NOTES:
1. BOBBIN FLANGES NOTCHED FOR LEAD EXITS
2. 1 LAYER .002 MYLAR TAPE BETWEEN ALL WINDING LAYERS.
3. PRIMARY HALVES CONNECTED IN PARALLEL

(Please turn to page 24)

A 100kHz FET Switcher

(continued from page 23)

Before showing a way to implement the procedure, it is best to be aware of a few design considerations for high frequency continuous mode flyback transformers:

1. Worst case excitation occurs at highest input voltage.
2. A Minimum primary inductance is required to maintain continuous current at the highest input voltage and lightest load.
3. Generally AC flux is low but may be high enough to generate excessive core loss.
4. Winding current waveforms have a high DC value; therefore, the core is normally gapped to prevent saturation.
5. Worst case DC bias and winding rms currents occur at the lowest input voltage.
6. Voltage on the auxiliary outputs tends to increase as current in the sensed output increases.

The following is an example as well as a transformer design procedure. Underneath each equation, the source of data to solve it is shown.

Type of circuit: Continuous mode flyback

Inputs:	Maximum DC Voltage:	$E_{iM} = 190V$
	Minimum DC Voltage:	$E_{im} = 100V$
	Operating frequency:	$f = 100kHz$
	Minimum duty factor:	$A_{pm} = .30$

Outputs:

Secondary	1	2	3	4	5
DC voltage	+5V*	−5V	+12V	−12V	+12V
Typ. diode drop	0.6V	1V	1V	1V	1V
Max DC current	5A	0.5A	1.5A	1.5A	.3A
Min DC current	1.25A	0.125A	0.375A	0.375A	.3A

(*) Control loop closed about +5V output. Design objective for other outputs: ±3% voltage tolerance at full load.
Maximum ambient temperature: 60 degrees C
Maximum operating temperature: 105 degrees C
Cooling: Normal convection and radiation
Size: 1¾ × 1¾ × 1¾ maximum, PC mountable
Other: Provide catch winding to clamp flyback overshoot.

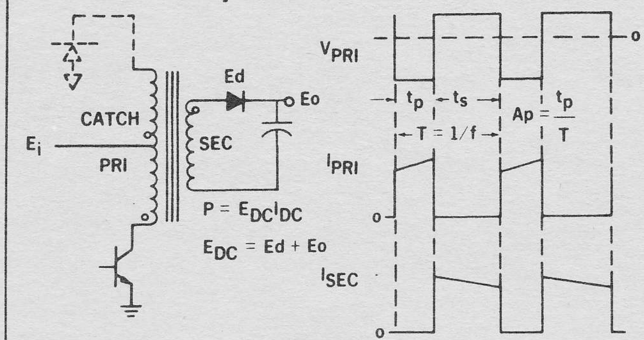
Core Selection

An easy way to select a core is to use the method developed by Pulse Engineering. To select a core by this method, multiply the maximum DC output power by the circuit sizing factor from Figure 2 to obtain the sizing VA. Next select a core with adequate rating from Figure 3.

1. Determine DC output power: $P_{dc} = \Sigma E_{dc} I_{dc}$ for all secondaries. $E_{dc} = E_{out} + E_{diode}$ = peak flyback terminal voltage.

Secondary	$P_M = E_{dc} \times I_{max}$	$P_m = E_{dc} \times I_{min}$
1	(5 + .6)5 = 28.0W	7. W
2	(5 + 1).5 = 3.0	.75
3	(12 + 1)1.5 = 19.5	4.88
4	(12 + 1)1.5 = 19.5	4.88
5	(12 + 1).3 = 3.9	.98
Total	73.9W	18.5W Min.

Figure 2. Design Data for Continuous Mode Flyback Transformer



Design Equations: M Subscript for maximum values, m for minimum. Let $a_{pm} = 0.30$ at E_{im} unless otherwise specified.

Maximum Primary Duty Factor:
$A_{pm} = 1/[1 + (E_{im}/E_{iM})((1/A_{pm}) - 1)]$

Turns Ratio:
$N_s/N_p = [(E_{DC}/E_{iM})(1 - A_{pm}/A_{pm})]$

Minimum Primary Inductance:
$L_{pm} = (E_{iM} A_{pm})^2 / 2fP_m$

Maximum Primary Peak Current:
$I_{pM} = P_M / E_{im} A_{pM} + E_{im} A_{pM} / 2fL_{pm}$

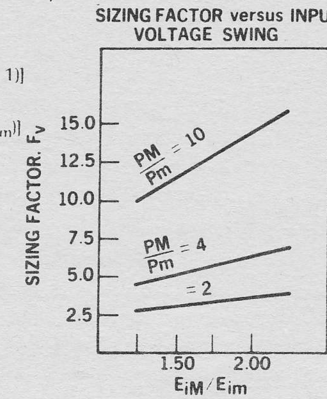
Maximum Primary RMS Current:*
$I_{pr} \cong P_M / E_{im} \sqrt{A_{pM}}$

Maximum Secondary RMS Current:*
$I_{sr} \cong I_{DC} / \sqrt{1 - A_{pM}}$

Maximum Catch RMS Current:
$I_{cr} \cong 0.18\, I_{pM}$

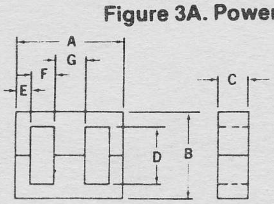
*RMS currents neglect increase due to transformer inductance. Error is less than 1% if L_{pm} is based on $P_M / P_m \geqslant 4$.

SIZING FACTOR versus INPUT VOLTAGE SWING



$F_V' = 20 / fF_V F_C F_K \sqrt{40/\Delta T}$
f = Frequency, KHZ F_V from curves
F_C = 1.0 for basic circuit
= 1.24 if catch winding used
F_k = 1.0 norm. convection cooling
= .71 with 30 CFM minimum forced air
ΔT = temperature rise

Figure 3A. Power Rated Ferrite 'E' Cores



DIMENSIONS

CORE NO.	A	B	C	D	E	F	G
	INCHES						
SW1	1.375	1.124	.375	.750	.187	.312	.375
SW2	1.625	1.312	.500	.812	.250	.312	.500
SW3	1.687	1.656	609	1.186	.234	.375	.468
SW4	1.687	1.656	.772	1.186	.234	.375	.468
SW5	2.160	2.170	812	1.480	330	.420	.660

Core No.	A_e CM^2	L_e CM	V_e CM^3	Pwr rate Watts	A_s In^2	P_{FE} Watts 1	CM/A Watts 2
SW1	.91	7.30	6.64	105	4.03	.70	320
SW2	1.61	8.26	13.30	174	5.73	.93	320
SW3	1.84	10.32	18.99	318	7.62	1.23	400
SW4	2.33	10.32	24.05	385	8.17	1.32	400
SW5	3.46	13.00	44.99	772	12.90	1.94	500

A_e: Core Cross-Sectional Area
L_e: Magnetic Path Length
V_e: Core Volume
A_s: Effective Cooling Surface Area

1. P_{FE}: Maximum Rated Core Loss
2. CM/A: Circular Mil Per Amp Wire Selection Guideline.
3. Core Vendor List in Appendix A.

Figure 3B. Core Vendors

Vendor	Stackpole	Ferroxcube	Indiana Gen	Siemens
Material	24B	3C8	05B	N-27
SW1	57-3595	E375	F3250-2	
SW2	50-867	E21	F3251-2	
SW3	50-0348	783E608	F3439-2	B66325
SW4	50-0874			B66329
SW5	50-715		F3540-2	B66335

Bobbins for the above cores are available from TIMCO, Los Angeles, California, (213) 254-5101.

2. Determine sizing factor and sizing VA:

Sizing factor:

$F'_v = (20/f)F_vF_cF_k\sqrt{40/\Delta T}$

$= 20/100 = 6.0 \times 1.24 \times 1 \times \sqrt{40/40} = 1.49$

F_v from graph in Figure 2 at specified E_{iM}/E_{im} and P_M/P_m from step 1.

F_c and F_k from Figure 2.

$\Delta T = T_{operating} - T_{ambient} - 5$ degrees

f = operating frequency in kHz NOTE: The sizing factor graph is based on reference conditions. Use of the F'_v equation adjusts for application conditions. The 5 degree term in the ΔT calculation is the hot spot allowance for temperature rise measured by the change in resistance method.

Sizing VA: $P_v = F'_vP_M = 1.49 \times 73.9 = 110W$

P_M = Maximum load power determined in step 1.

3. Select smallest core with adequate rating:

From Figure 3, core SW2 with a power rating of 174 watts is the smallest. The mounting hardware shown in Figure 4 for this core satisfies the PC mounting requirement.

Coil Design

First determine minimum useable turns and then determine wire sizes that will fit in the core window. Since minimum turns depend on maximum operating AC flux density, a good starting place is to establish the maximum AC flux density that will limit core loss to the value in Figure 3.

4. Determine maximum operating flux density using the core material loss equation:

$B_{op} = 83.5\sqrt{P_{FE}/V_eF^{1.448}}$

$= 83.5\sqrt{.93/13.3 \times 100^{1.448}} = .787$ kGauss

P_{FE} and V_e from Figure 3 for selected core.

f = operating frequency in kHz

5. Determine minimum turns of the lowest voltage winding at lowest input voltage. This approach brings turns resolution problems to light early and sets core loss where total transformer losses are highest. Avoid using half turns on windings contributing more than 20% of the total ampere turns.

$N_{S1} = (V_{S1})(1-A_{pM}) \times 10^2/B_{op}A_ef$

$= 5.6(1 - .449) \times 10^2/.787 \times 1.61 \times 100$

$= 2.43$, use 3 turns.

V_{S1}: Secondary 1 terminal voltage determined in step 1.

B_{op}: Max operating AC flux density in step 4

A_e: Core cross-sectional area from Figure 3.

A_{pM}: Maximum primary duty factor determined using equation in Figure 2.

6. Determine turns for 12V secondaries using terminal voltages and N_{S1} from step 5.

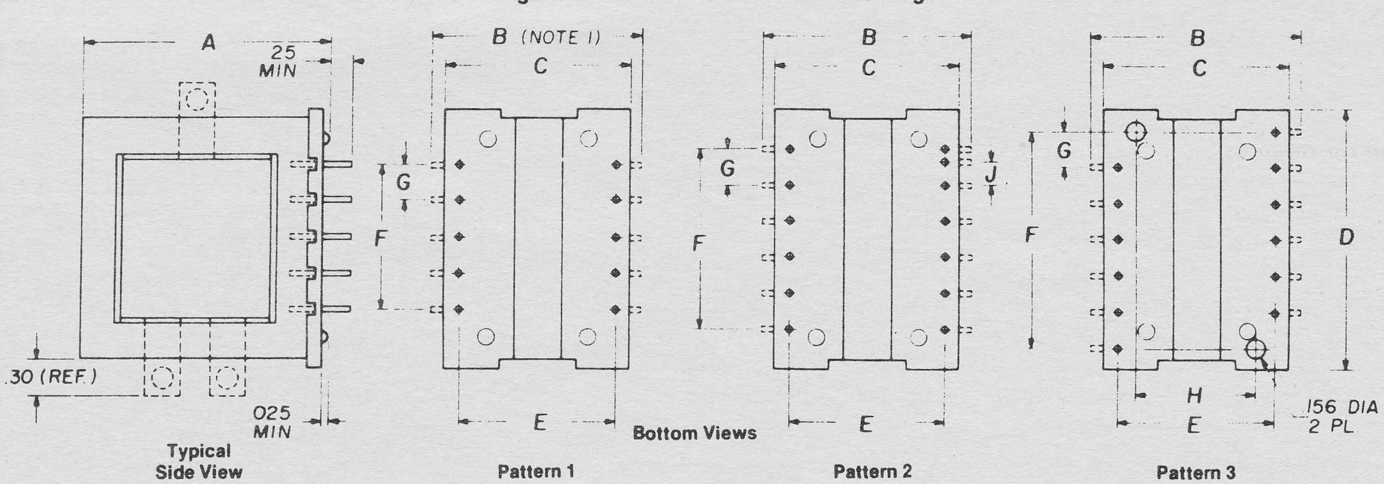
$N_{S3} = (V_{S3}/V_{S1})N_{S1} = 13/5.6(3) = 6.96$, use 7

NOTE: The 12V terminal voltage will be $N_{S3}\ V_{S1}\ /\ N_{S1} = 7/3 \times 5.6 = 13.06V$. This yields a nominal output of 13.06-1 = 12.06VDC. Also, using $N_{S2} = N_{S1}$, the -5V output will be $V_{S2} - 1 = -(5.6-1) = -4.6V$.

These outputs will vary with loading and will be highest at full load on the +5V output and minimum load on the others. Precise calculation of the variation is not practical.

(Please turn to page 28)

Figure 4. Standard Vertical Mount Packages



STANDARD PACKAGE	PATTERN	A	B	C	D	E	F	G	H	J	USED WITH CORE
		MAX				±.010					
SW1	1	1.40	1.40	1.13	1.43	.900	1.200	.300	—	—	0128.002
SW2	2	1.60	1.50	1.23	1.78	1.000	1.500	.300	—	—	0128.005
SW3	2	1.90	1.80	1.53	1.78	1.300	1.500	.300	—	.200	0128.004
SW4	2	1.90	2.00	1.73	1.78	1.500	1.500	.300	—	.200	0128.008
SW5	3	2.40	2.20	1.93	2.23	1.700	1.800	.300	1.300	—	0128.006

1. B APPLIES TO ECONOMY CONSTRUCTION - PINS PROTRUDING. C APPLIES TO MINIMUM BOARD SPACE CONSTRUCTION - PINS UP AS SHOWN IN SIDE VIEW.
2. ALL PINS .040 ± .003 ROUND OR .040 ± SQUARE, SOLDERABLE.
3. HIGH CURRENT TERMINALS, SOLDERABLE, MAY BE PROVIDED ON PACKAGE 3 THRU 5.
4. BASE MATERIAL MEETS UL94VO FLAMMABILITY RATING.
5. CORE SECURED TO HEADER WITH STAINLESS STEEL CLIP.
6. PACKAGES DEVELOPED BY PULSE ENGINEERING, INC.

EV Marketplace

FOR SALE

Must sell a partially completed conversion of a 1965 Fiat Station Wagon, 3 2CM77 Aircraft Generators, and 95% completed machine work for the conversion. Various parts and relays included in the package.

This is a unique design concept.

The conversion allows for the mounting of two of the 2CM77's using gear-belts to couple through the transmission. Two motors allows full power system testing of the drive and controls while in your garage using one generator as a motor and the other as a generator. When both Aircraft Generators are connected as motors the combination should give high peak acceleration for snappy road action.

The plan was to use two separate electrical drive systems to give redundancy for reliability.

Unfortionately I must sell the system, because I do not have time to complete the project.

I am asking $2,500 or "BEST OFFER" for the complete package as is.

CALL: (415) 967-6738 Ask for Al Harris.

FOR SALE

Prestolite 20-HP Motor, PMC 96V Controller W/Fan, and Custom adaptor housing for VW TRANSAXLE-SELL FOR $1600 or B/O Cash/MO/CC. CALL: Pete Lucerc (916) 482-0248 Sacromento, CA

Eastern exchanges

The National Academy of Sciences is now arranging scientific exchange visits for 1987 with the science academies in the Soviet Union, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and Yugoslavia.

Visits of one to 12 months for professional research are available to U.S. citizens with a doctoral degree or equivalent in the engineering, physical, or biological sciences; mathematics; social or behavioral science; or biomedical science. The NAS will arrange for expenses and salary reimbursement.

Applications must be obtained from NAS by Feb. 14, 1986. Completed applications must be received by NAS by March 3. Applications and more information can be obtained from the National Academy of Sciences, Office of International Affairs, Soviet and East European Affairs, 2101 Constitution Ave., N.W., Washington, D.C. 20418; telephone 202-334-2644.

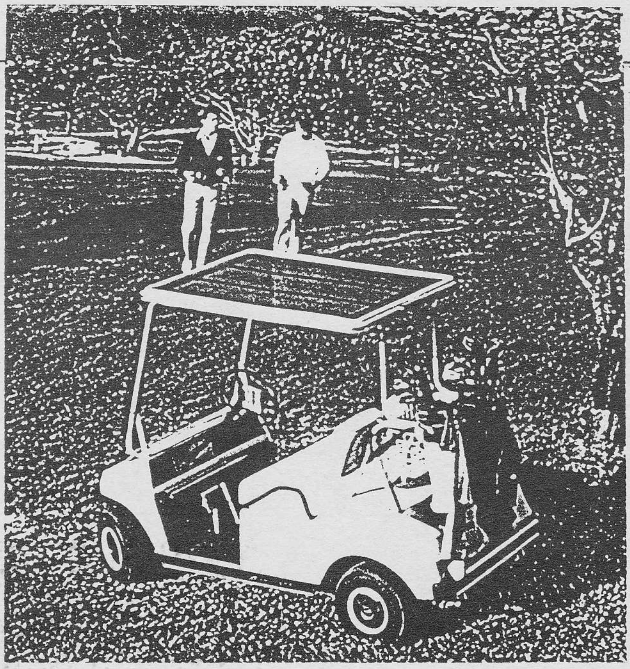
Canopy 'solarizes' golf cart fleets

Santa Barbara, CA—Solarwest Electric, Inc., has introduced a new 1985 model of its "SolarCaddy"—a canopy that allows golf carts to be driven entirely by the use of solar energy.

The panel incorporates photovoltaic solar cells to charge the cart's batteries whenever it's exposed to sunlight. The 1985 version features a universal mounting system to facilitate installation, high-output silicon solar cells, "Rovel"-capped plastic canopy, concealed wiring, high-strength box aluminum frame, four-way rain gutters, and reverse current diode protection.

Golf course owners find the SolarCaddy intriguing because it can be added to their existing fleet of golf carts, provides quiet, clean power, and since it recharges constantly, eliminates annoying trips to charging stations.

The output wattage at peak power is 120W while voltage is 49.2V. The canopy measures 54¾ inches long by 41½ inches wide by 2¼ inches thick and weighs 42 lb. □



ADS must be received with payment by the 10th of the month, for the following month's issue. AD rate is min. 1 to 5 lines $5.°°. ¼ Pg. $15, Full Pg. $50.°°, Full Pg. 2 sides $80.°°. WANTED-TRADE-FOR SALE-etc. Mail to EAA 1249 Lane St. Belmont CA 94002

WHATS HAP'N

EAA INTERNATIONAL RALLYE ABBOTSFORD, B.C. AUG

Abbotsford is the center of trade and industry for the rich fruit, livestock and dairy farms of the surrounding Fraser Valley. Several area industries and farms offer tours, including Snowcrest Packers, 1925 Riverside Rd.; Clayburn Industries, Ltd., Railway and Pine Streets; and Fraser Valley Farms, Ltd., 31632 Marshall Rd. Check locally for schedules. The Matsquie-Abbotsford Museum, 2313 Ware St., is open Mon.-Sat. 10-8, Sun. 1-8, May 15-Sept. 15.

The popular Abbotsford International Airshow, held each year at the city's airport on the second weekend in August, features aerobatics, mock dogfights, military craft from other countries, relics of war and planes of the future; phone (604) 859-9211.

SEATTLE CHAPTER
OF THE
ELECTRIC AUTO ASSOCIATION

Ray Nadreau (206) 542-5612
EVAC-Vancouver:
George McCrea (604) 663-3347

S.E.V.A.
SEATTLE ELECTRIC VEHICLE ASSOCIATION

SAE ANNUAL CONGRESS:
Cobo Hall, Detroit, MI Feb. 24-28

PLEASE!! SEND IN YOUR CLUB NEWS FOR THIS SECTION, EVENTS, PROGRAMS, OR SPEAKERS. PUBLISHED PROGRAMS INCREASE ATTENDANCE, SEND BY 10th FOR NEXT MONTHS MEETING.

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Los Angeles: Burbank Chapter
Il. Weiss 213 849-7632
Oakland: East Bay Chapter
Jim Fahey 415 848-1468
Sacramento Chapter
Weldon Martell 916 726-6257
San Bruno: Peninsula Chapter
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