LRN

TI PPC NOTES

NEWSLETTER OF V7N3, 1982
THE TI PROGRAMMABLE CALCULATOR CLUB.
9213 Lanham Severn Road
Lanham MD 20706.

What we have always feared has happened: Because TI waited so long in coming out with a new one, some other company has jumped in and filled the void. What we are talking about is a revolutionary new desk-top calculator, the AF-1 from OK# Instruments. It is slated to be on the market, if our information source is correct, by April 1, 1982. You may read all about it on pages 7 and 8. We are not sure if, at the time you receive this issue, the telephone number shown on page 8 will still be active. It is interesting to note that everything connected with this new company has been cloaked by secrecy. Even their telephone number, when one translates the digits to letters by means of an ordinary American telephone pad layout, spells a secret message. I will not tell you what I read into it, lest I influence you. You just try it yourself and see if you come to the same conclusion I came to. I will publish the best interpretations.

On a new subject, the Publicity Department of John Wiley & Sons, Publishers, 605 Third Ave., New York N.Y., 10158, have our club on their freebee list. This is why I have been able to tell you about the latest arrivals in calculator-related books lately. Our club doesn't have the resources to buy every calculator on the market. I am very greatful to Wiley & Sons for providing us with this nice service of free books. So, I try to reciprocate by writing a review of every book they send me (nice review or not) although it is sometimes difficult to write something calculator-oriented about books like "Word Processing and the Modern Office." But here goes one that I love to do: Problem Solving by means of the TRS-80 Pocket Computer, by Don Inman and Jim Conlan, 255 pages, 1982. I was happy to finaly be able to compare one of those highly-toted pocket computers to our own TI-59, without actually spending money on buying one and later finding out I didn't have any use for it. Don Inman is very well known for lots of books about the TRS-80 Home Computer and also about a couple of books on TI-Basic. He knows what he is writing about and he does it superbly well. But he could not convince me to use the pocket computer as a handy calculator. It is programmed in Basic, and even if it allows you to use abbreviated statements such as "CL." for CLEAR or "FO." for FOR, it still lacks one-keystroke commands such as available on calculators. And, what is far graver, Basic removes you one more level from the "inner workings" of the machine. With calculator language you are able to synthesize almost any "scheme" with a few keystrokes, while in Basic you have to contend with the ideosynchrasies of the language itself and at times you have to become rather wordy. Of course, their is a provision for it, by supplying you with oodles of memory, so that wordiness is no objection. But I rather push less buttons. My conclusion then: Although I like the book and highly recommend it to anybody who wants to learn how to use and program the TRS-80 Pocket computer, I don't think the machine will become any serious competition to the TI-59 or the HP41C. My only hope is now that TI will also see it that way. If the new one will ever be out and if it has to have Basic, it still should retain calculator language as well. HP is doing such a great job with the HP41C and CV, by giving it interface capabilities to all sorts of peripheral devices such as voltmeters, plotters, printers and others. I hope TI will concentrate on those capabilities rather than waste its talents and effort on something we don't need in a calculator: Basic.

Maurice E.T. Swinnen.

IN THIS ISSUE:

LOST IN THE DESERT? YOUR LIFE MAY DEPEND ON A TI-59.- Professor John M. Bownds of the Mathematics Department of the University of Arizona in Tucson AZ, 85721 has written a couple of programs for the TI-59 that will help rescuers of people lost in the deadly heat of the Sonora Desert to compute the probability that a given person might be found in a given area. During the actual rescue operation that probability is constantly updated by the negative data generated (no, we can't find the person here) until the probability becomes so low that the rescue team leader might decide to stop searching that given area and commit his resources with greater effieiency somewhere else. Renting a helicopter is expensive after all.

The two programs for the TI-59 are contained on two mag cards. If you feel you might have a use for these programs, send two blank cards and a self-addressed-stamped envelope to Professor Bownds at the above address. Overseas members please add a few international response coupons available at your local post office.

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*ADDING MACHINE,- I received a letter from a recent member (also a very recent owner of a TI-59) who told me he had an urgent need for a program that would transform his TI-59/PC100 into an adding machine. He told me he was being audited by the IRS. (to our foreign members: that is the federal tax collection agency) The machine had to be able to do all four arithmetic operations and print everything with the corresponding sign of the operation in the right-hand margin.*

*I wrote this program between the morning mail pick up and the afternoon mail delivery. The only way I saw fit to do it was to use the user-defined keys A through E: A means +, B means -, C means X and D means DIV. Finally E means =, to be pressed any time to obtain subtotals and totals.*

*Does anyone know how to do it by NOT using the user-defined keys but the +, -, X, DIV and = keys instead? I will publish practical programs that actually do this, not just explanations how it could be done. And, by the way, all printing should be done in a FIX 2 mode. (Maurice Swinnen)*

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| 001 | 04 | 04 |
| 002 | 32 | X↕T |
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| 004 | 02 | 02 |
| 005 | 69 | DP |
| 006 | 06 | 06 |
| 007 | 22 | INV |
| 008 | 58 | FIX |
| 009 | 91 | R/S |
| 010 | 76 | LBL |
| 011 | 11 | A |
| 012 | 44 | SUM |
| 013 | 00 | 00 |
| 014 | 32 | X↕T |
| 015 | 04 | 4 |
| 016 | 07 | 7 |

| | | |
|---|---|---|
| 017 | 81 | RST |
| 018 | 76 | LBL |
| 019 | 12 | B |
| 020 | 22 | INV |
| 021 | 44 | SUM |
| 022 | 00 | 00 |
| 023 | 32 | X↕T |
| 024 | 02 | 2 |
| 025 | 00 | 0 |
| 026 | 81 | RST |
| 027 | 76 | LBL |
| 028 | 13 | C |
| 029 | 49 | PRD |
| 030 | 00 | 00 |
| 031 | 32 | X↕T |
| 032 | 05 | 5 |
| 033 | 00 | 0 |
| 034 | 81 | RST |

| | | |
|---|---|---|
| 035 | 76 | LBL |
| 036 | 14 | D |
| 037 | 22 | INV |
| 038 | 49 | PRD |
| 039 | 00 | 00 |
| 040 | 32 | X↕T |
| 041 | 07 | 7 |
| 042 | 02 | 2 |
| 043 | 81 | RST |
| 044 | 76 | LBL |
| 045 | 15 | E |
| 046 | 43 | RCL |
| 047 | 00 | 00 |
| 048 | 32 | X↕T |
| 049 | 06 | 6 |
| 050 | 04 | 4 |
| 051 | 81 | RST |

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*NEW DANISH CLUB,- The old Programmeringsklub (see v5n7p1) has been defunct for almost a year now. I was happily surprised to receive a stack of very good and well-written newsletters from a new club. The editor is Hans Peter Nielsen and the address is Programklubben, Vestervold 16, 6800 Varde, DenmarK. The club has about 400 members, an issue every two months and dues of $ 12.00 a year. Welcome to the club, Hans!*

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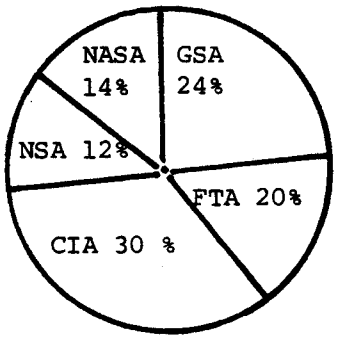
PIE CHARTS.- You have all seen those special graphic representations of percentages, in the typical "pie"-form. To do these things on a computer is not all that hard. But now, several members have asked me if it would be possible to do them on a TI-59 with PC100. Well, it is not all that simple. In fact, I think this is a formidable task. You see, the user should have the possibility to enter, together with a max five-character long name, the corresponding percentage. It is up to the designer to determine the max number of slices of the pie permitted, but I should think a min of six should be allowed.




But that is not all. The program should now convert the entered percentages into angles to draw the dividing lines. And, to have a neat drawing, this should be done in Graphics Mode.

How about it? Our friends from Programbiten will call this one an "Utmaning." And it is one that counts!

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*ERRATA: Clyde Durbin found the source of the flashing of curve # 7 in the DATA FIT TO 8 CURVES program in the newcomer's corner (v7n1/2p15 to p20):*

1. *The address at 242 in the larger of the two programs should be 46 and NOT 45. To remedy it, in keyboard mode press GTO 240 then LRN and 2nd X=T 246 LRN*
2. *The address at 614 should be 625 and NOT "GTO". There is no label defined as "GTO". You will have just enough steps in that partition to enter this extra line. BUT YOU WILL HAVE TO HUNT UP IN THE ENTIRE PROGRAM THE DIRECT ADDRESSES REFERRING TO LINES HIGHER THAN 614 AND ADD "1" TO EACH ONE OF THEM. Not too difficult, just time consuming.*

*Clyde also tells me that zero or negative coordinates result in error condition from LNX.*

*For those who don't want to do all that, may I remind you that there is a modified version of this program, written by an expert, Bill Skillman. You may obtain that one from PPX, P.O. Box 53, Lubbock TX 79408. Price is $ 4.00. The number is PPX # 208040 and the author is mentioned as Frank Blachly. It sports a much shorter wait between entry and print-out, has an automatic search for the best fit and many other goodies.*

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*MARINE NAVIGATION MODULE: Palmer Hanson writes:*

Volume 34, Number 3 of the Journal of Navigation dated September 1981 carries a nine page article entitled "Calculators for Marine Navigation" by Basil d'Oliveira. Page 457 of this British publication states:

> "The well-known German cruising yachtsman, Bobby Scheuk, in collaboration with Peter Forster, has produced a well-thought-out solid-state software module for the TI-58 and TI-59 calculators, the Scheuk Naviprog 2000. The module contains seven main programs, which are numerically prompted for input, and almanac data for the Sun, Venus and 40 bright stars; it will soon include the remaining planets. It has a useful selection of other programs including Omega. The sight-reduction program seems to be the only one available that presents the answer as the latitude and longitude of the intercept terminal point, so that you have only to plot the calculated coordinates and the direction of the resulting position line. The Scheuk Naviprog is not yet available in England but can be obtained from Germany with an English operating manual."

Unfortunately, the article does not give instructions by which a yachtsman can obtain the module. Perhaps your contacts at TISOFT or Display can help. I don't want this for myself, but suggest that you list the availability of this module as a service of TI PPC Notes.

STICKING KEYS.- I have received several accounts from members, telling me how they solved this pesky problem. Not all of us have $ 57.00 available to exchange the calculator at the slighest hint of trouble!

The first account is by Lem Matteson of Kansas City, MO. Rather than retyping his epistle, I would like to give it to you as I received it. This way I won't take away any of its coloring nor of its flavor:

I almost forgot, in the last newsletter you mentioned those sticking keys an ask what to do about them, First tell the members not to eat peanut butter and jelly sandwichs while using the calculator. Then suggest that they check V5N2P3. In that issue Peter Poloczek tells how to open the TI-59. He was telling how to adjust the card reading speed but you have to get it apart to clean the keys. He tells of the two plastic tabs that hold the bottom together.

I had a sticking key 9 (OP) It wouldnot come back up and I was sure that the return spring was shot. The key switch is part of the circuit board and is a little hump of deformed spring metal. Its something like the toy cricket kids used to play with. you push it down and it springs back to shape again.

With Peters assurance, I removed the two screws and holding it key side down I lifted the top end and pushed and wiggled the bottom untill it came apart. It is a tight fit and I was afraid to use too much force before.

With the back off the rest is easy. Four screws hold the card reader part, remove them and lift the printed circuit board with the reader still attached and put it to one side.The board is a friction fit between plastic tabs and posts along the sides. Now you have the key half of the case with the keys still in There is a thin sheet plastic foam either covering the keys or stuck to the circuit board. This acts as a spring to keep the keys tight in the frame, don't loose it. Rig up a couple of blocks so that you can lay the case down without pushing the keys out of place. Now dump the keys out into a pile and wipe each key with a soft tissue to get all the grease and dirt off. Then wash them in mild liquid soap. Do NOT use harsh chemical cleaners some tend to make plastic swell up a little or get soft and stickey. Denatured alcohol can be safely used since TI allows you to clean contacts with it. Wash and wipe the case also cotton swabs are good for getting in the holes.

Put the keys back in the right holes - Oh Oh where do they go? Everything is backwards. STOP. Do what you should have done first. Make a mirror image chart of the keyboard. The inside cover of Personal Programing has a copy of the keyboard. Your chart will have the column with E at the top on the left and the A column on the right. Now sort out the keys and fill the holes, one row at a time. Hold each key so that it reads right and turn it right to left and put it in the hole. Make a cardboard keeper 2 1/2 by 3 1/2 inches to fit over the keys and hold it in place as you turn the case over to check your work.

Now put it back together. Don't forget the plastic pad. Make sure the board is down completely, be sure the off/on switch at the top is down over it's two plastic posts and that the switch slides OK. Put the screws back in.

Hold the works face down and put the back cover on. About this time the little plastic U shaped frame arrount the module space will fall off. It fits over four small posts on the back cover. Make sure the cross piece of the U is tward the top. If you put it on the bottom you cant get the back on.

Oh yes, remove the module and the battery before you start to tale it apart.

I had taken my SR-52 apart a long time ago and the tip about the key chart dates from that project. After I got the whole thing back together I found some keys in the wrong place.

Tell our members that it's not too hard and there is a very good chance that cleaning will solve all the problems.

The next account is by Frans van den Bogaard, a very active member from Amsterdam in the Netherlands. Frans takes care of the calculator corner in the HCC Nieuwsbrief (which is Dutch for Newsletter) for microcomputers. Because there was never

a clear-cut definition as to what a microcomputer exactly is, programmable calculators have been allowed in its pages until someone complains about it. Up to now, nobody did. Although Frans is perfectly capable of putting together a passable text in English, in the newsletter he writes in Dutch for his fellow countrymen. I have taken the liberty to translate the following:

Calculator Clinic: my TI-59 started to act up after about one year of use. The keys started to work progessively worse. The A (code=11) was sometimes an 11, but most of the time it was 22, while the B, which should have been code 12, most of the time showed a 22. Going to the right of the keyboard things got gradually better, though.

The first thought that comes to mind in such cases is :"Must be a dirty keyboard, should be exchanged." No time to look after it, so let's try to sail around those problems and use other codes, or just synthesize them.

But then, in a moment of rash decision, let's take the whole shebang apart quickly. It worked rather well with the card reader, but now, how to go on? The construction was unknown and, as you know, prudence is the name of the lady who owns the porcelain shop... So, let's wait for a better insight and some more time...

Now on our latest PROCAL day ( a nice euphemism for a meeting of calculator nuts. Ed.) I found outthat everything hinged, litteraly, on two little tabs. Twelve o'clock at night is a fantastic time to test it out. The taking-apart worked without a hitch. Close inspection revealed the subtlety of the defect: nothing was dirty, it was almost impossible for dirt to get in, but a rather sloppy mounting coupled to time -read use of the keys in the upper left corner - did the rest.

The keyboard consists of 5 + 9 parallel wires running vertically, which are embedded in a carrier. The five wires run in the middle under the keys, the nine wires run two-by-two + 1 in between the keys.

Now, vertically mounted with respect to the wires are nine bronze strips, each strip consisting of five "click contacts" pressed in the strips. These form, with the five wires, the socalled matrix. The nine wires are connected to the strips. This will also nicely debunk the attractive fable about possibly extra codes by means of an extra keyboard. (see TI PPC NOTES v6n1) This keyboard doesn't have any unused rails!

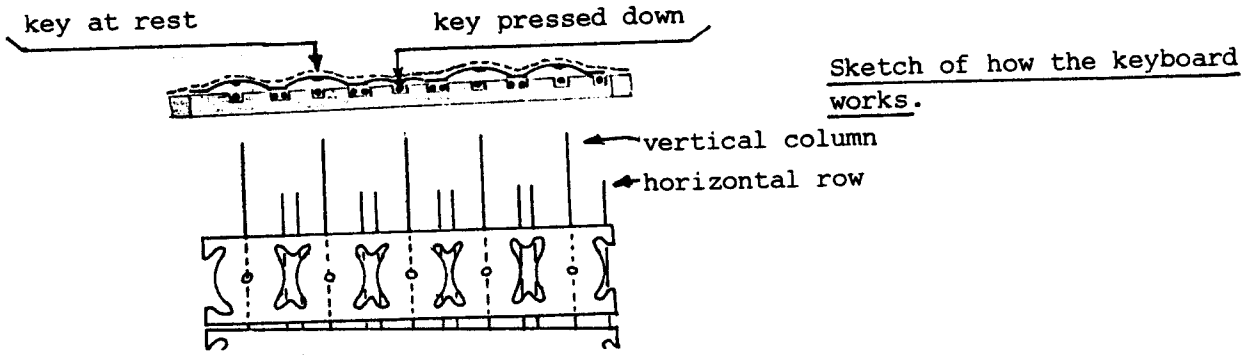
The above mentioned strips are glued above the wire matrix by means of a sticky plastic sheet, a functional, but sometimes troublesome solution.

What showed now at close inspection was, that the top strip had slid away from its intended position (poor mounting?) and was touching the adjacent strip. This way the strips make contact to each other, which explains the strange behavior.

The remedy was simple: because removal of the strip from the plastic carrier might have resulted in damage to both, I simply cut the plastic in between the spot where both strips were touching, straightened the position of the strip, fixed its new position with some more sticky plastic sheet and, all the codes are back where they are supposed to be!

By the way, when taking apart or putting together again the card reader, do not try to bend the strips. They don't, but they break easily. And I don't recommend soldering them. Positioning the motor in its frame has to be done carefully, otherwise you risk an eternally running motor after everything has been put together again.

But now that you have the whole thing apart, you might as well clean it th ouroughly. And yes, that little roller has to go back in its place, so keep on looking where exactly it goes.....




Sketch of how the keyboard works.

The third person who says he knows how to take a calculator apart and fix the keys is Stirling Hartman from Corona, California. Stirling offers the following thoughts:

Remove the battery pack, the module and two phillips screws on the back. Be of good patience and carefully work the two sections (top and bottom) apart. Start at the LED end. The calculator has a plastic hook near the S in Solid State Software. You must rotate the halfs past the hook before it will come apart.

BE CERTAIN THE KEYBOARD IS FACING DOWN OR ALL THE KEYS WILL FALL OUT !

The keys have foam under them and the switches are plastic coated belvelle springs. Usually sticky keys are caused by adhesive seeping from the face plate. I used a scalpel to remove it. The keys are shaped this way  The small end will eventually punch a hole in the foam. I have reversed the foam and solved the problem of too sensitive keys.

p.s. The 59 exchange costs $ 63.00 now.

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REGISTER OPERATIONS,- Frederic De Mees offers these three short utility subroutines:

The first one clears registers m through n; m ≤ n.

Enter m STO 00 enter n press or call A.

The second routine copies registers m througn n into registers p and following; m ≤ n; unpredictable if overlapped.

Enter p STO 00 enter m X:T enter n press or call B.

The third routine exchanges registers m through n with registers p and following; m ≤ n; unpredictable if overlapped.

Enter p STO 00 enter m X:T enter n press or call C.

In the examples, we first stored 100 in R01, 200 in R02, etc up to 600 in R06. Then we asked R01 through R06 to be copied into R07 and following. Next we asked R01 through R03 to be exchanged with R04 and following. And finally we asked R01 through R06 to be cleared. In between we made listings by means of 1 INV 2nd LIST.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100. | 01 | 0. | 01 | 000 | 76 | LBL | 030 | 46 | INS | 058 | 30 | 30 | 086 | 08 | 08 |
| 200. | 02 | 0. | 02 | 001 | 11 | A | 031 | 75 | - | 059 | 82 | HIR | 087 | 73 | RC* |
| 300. | 03 | 0. | 03 | 002 | 72 | ST* | 032 | 32 | X:T | 060 | 18 | 18 | 088 | 00 | 00 |
| 400. | 04 | 0. | 04 | 003 | 00 | 00 | 033 | 85 | + | 061 | 48 | EXC | 089 | 32 | X:T |
| 500. | 05 | 0. | 05 | 004 | 76 | LBL | 034 | 44 | SUM | 062 | 00 | 00 | 090 | 48 | EXC |
| 600. | 06 | 0. | 06 | 005 | 75 | - | 035 | 00 | 00 | 063 | 97 | DSZ | 091 | 00 | 00 |
| | | 100. | 07 | 006 | 43 | RCL | 036 | 01 | 1 | 064 | 00 | 00 | 092 | 32 | X:T |
| 100. | 01 | 200. | 08 | 007 | 00 | 00 | 037 | 54 | ) | 065 | 94 | +/- | 093 | 63 | EX* |
| 200. | 02 | 300. | 09 | 008 | 82 | HIR | 038 | 48 | EXC | 066 | 00 | 0 | 094 | 00 | 00 |
| 300. | 03 | 400. | 10 | 009 | 08 | 08 | 039 | 00 | 00 | 067 | 92 | RTN | 095 | 69 | DP |
| 400. | 04 | 500. | 11 | 010 | 73 | RC* | 040 | 76 | LBL | 068 | 76 | LBL | 096 | 30 | 30 |
| 500. | 05 | 600. | 12 | 011 | 00 | 00 | 041 | 94 | +/- | 069 | 13 | C | 097 | 32 | X:T |
| 600. | 06 | 0. | 13 | 012 | 42 | STO | 042 | 32 | X:T | 070 | 53 | ( | 098 | 48 | EXC |
| 100. | 07 | 0. | 14 | 013 | 00 | 00 | 043 | 48 | EXC | 071 | 46 | INS | 099 | 00 | 00 |
| 200. | 08 | | | 014 | 00 | 0 | 044 | 00 | 00 | 072 | 75 | - | 100 | 32 | X:T |
| 300. | 09 | | | 015 | 72 | ST* | 045 | 82 | HIR | 073 | 32 | X:T | 101 | 72 | ST* |
| 400. | 10 | | | 016 | 00 | 00 | 046 | 08 | 08 | 074 | 85 | + | 102 | 00 | 00 |
| 500. | 11 | | | 017 | 82 | HIR | 047 | 73 | RC* | 075 | 44 | SUM | 103 | 69 | DP |
| 600. | 12 | | | 018 | 18 | 18 | 048 | 00 | 00 | 076 | 00 | 00 | 104 | 30 | 30 |
| 0. | 13 | | | 019 | 42 | STO | 049 | 69 | DP | 077 | 01 | 1 | 105 | 82 | HIR |
| 0. | 14 | | | 020 | 00 | 00 | 050 | 30 | 30 | 078 | 54 | ) | 106 | 18 | 18 |
| | | | | 021 | 97 | DSZ | 051 | 32 | X:T | 079 | 48 | EXC | 107 | 48 | EXC |
| 400. | 01 | | | 022 | 40 | IND | 052 | 48 | EXC | 080 | 00 | 00 | 108 | 00 | 00 |
| 500. | 02 | | | 023 | 00 | 00 | 053 | 00 | 00 | 081 | 76 | LBL | 109 | 97 | DSZ |
| 600. | 03 | | | 024 | 75 | - | 054 | 32 | X:T | 082 | 95 | = | 110 | 00 | 00 |
| 100. | 04 | | | 025 | 00 | 0 | 055 | 72 | ST* | 083 | 48 | EXC | 111 | 95 | = |
| 200. | 05 | | | 026 | 92 | RTN | 056 | 00 | 00 | 084 | 00 | 00 | 112 | 00 | 0 |
| 300. | 06 | | | 027 | 76 | LBL | 057 | 69 | DP | 085 | 82 | HIR | 113 | 92 | RTN |
| 100. | 07 | | | 028 | 12 | B | | | | | | | | | |
| 200. | 08 | | | 029 | 53 | ( | | | | | | | | | |
| 300. | 09 | | | | | | | | | | | | | | |
| 400. | 10 | | | | | | | | | | | | | | |
| 500. | 11 | | | | | | | | | | | | | | |
| 600. | 12 | | | | | | | | | | | | | | |
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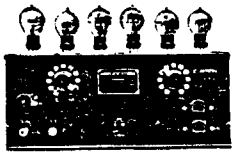
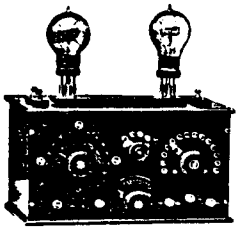
A NEW PROGRAMMABLE CALCULATOR.- The new AF-1 is truly a sensational break-through in the state of the art of designing PPCs: an enormous memory capacity for a desk-top instrument and a reasonable price. The specs, which we obtained by sheer accident, where acquired by rather devious, illegal and unethical means, we must admit. But, as we all know, the end always justifies the means. And nothing can stand in the way of bringing you the latest in our hobby.

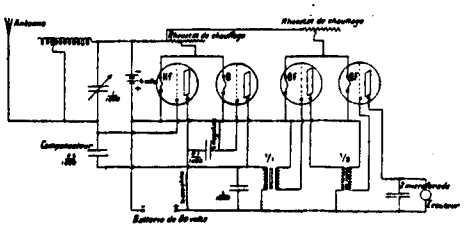
The people at OK# Instruments (R), the designers and manufacturers of this remarkable device, in order to hide their imminent break- through on the calculator market, had all their brochures and fliers printed in a small Maryland printing shop, some 3000 miles away from their home base. It just so happens that our club also employs the services of that same shop. How exactly we obtained a copy of the flier you may admire on the next page should remain a secret, of course. We might have to use that source again, so we have every reason to protect it. But the results are sensational, don't you agree?

Spurred by our initial success, we set out to find the source of all that advanced technology. Surprisingly, we found it in a neighboring state to Texas, Oklahoma. Now, I hasten to tell you that the name OK# Instruments (R) has absolutely no connection with the the name of the state it resides in. The name originally stems from "Okefenoki Swamp", the place where all the design is done.

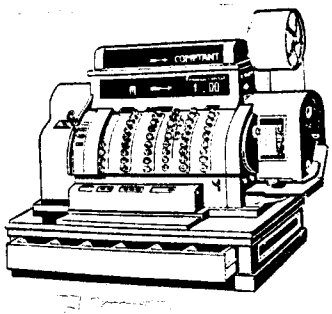
Once we had secured a working model of the calculator as it came off the assembly line, we had it shipped to Maryland, to be analyzed at our laboratories. Again we didn't spare any effort and even employed histology techniques, learned at Walter Reed. (Histology essentially boils down to freezing the sample, slicing it by means of a microtome and mounting it on glass slides) This we did and we examined it closely under a microscope. An ordinary light microscope didn't supply us with any tangible results, but great was our awe and surprise when we used the electron microscope. At magnifications greater than 80,000 we were able to identify several salient features of this calculator-to-come.

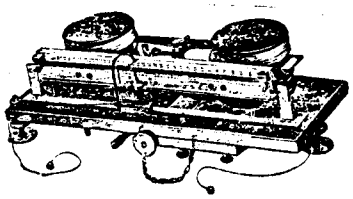






On the left everybody will instantly recognize the CPU, while the picture in the middle represents the RAM, believe it or not. And, to our utter astonishment we found a miniature schematic diagram engraved permanently on the back side of the chip. Those among you with good eyesight will be able to read French wording on the schematic. I don't have a reasonable explanation for that, but I might tell you that the lay-out expert at OK# Instruments (R) had a rather strong Gallic accent and kept adressing me with "Monsieur" instead of the usual "hay Misterr."





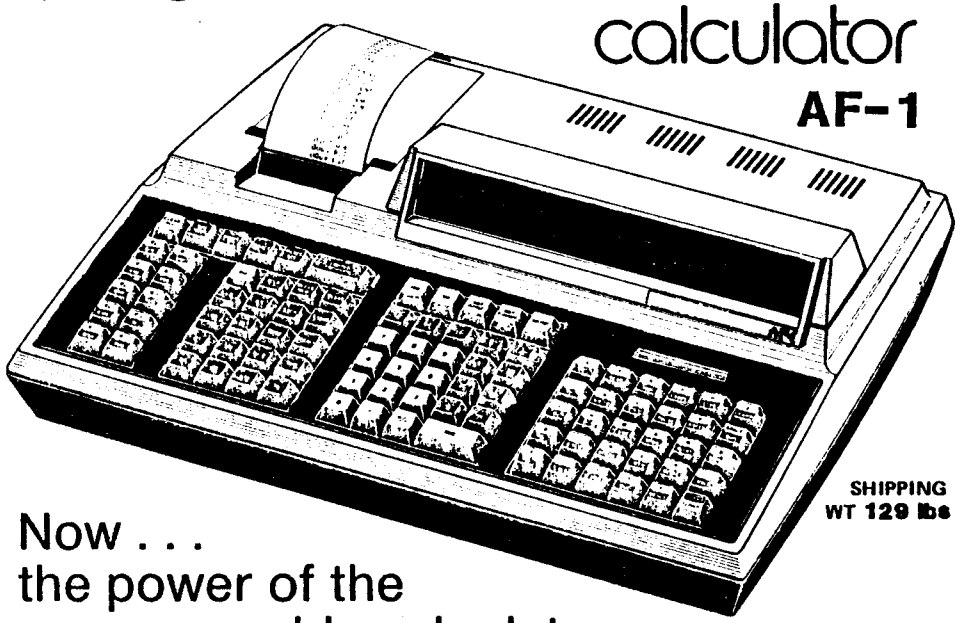
Probing some more we were able to find the T-Register (on the left) the card reader (yes, I am sad to say, no bubble memory yet) but we found some innovative advances in this one, we had never observed before. Witness, the miniature card cleaning device on the right.

In coming issues we will be able to reveal more about this marvel of technology. In the mean time, lets await the appearance of the machine, and if the price proves to be right, we should all be able to write beautifull software with it. We surely will keep you up-to-date on it in the pages of LRN.

# OK# INSTRUMENTS

# programmable prompting calculator

## AF-1



SHIPPING WT 129 lbs

## Now . . . the power of the programmable calculator can be made available to everyone.

The **AF-1** card programmable prompting printing calculator is designed to bridge the gap between simple desktop calculators and computers. A powerful asset to business and technical operations alike.

Its business capability ranges from solving intricate financial analyses and long-range forecasting, to simpler operations like payroll and amortization.

For technical applications there are **7** scientific functions on the keyboard, while **18** program memory locations and **5** data registers are available for complecated programming.

Short problems can be key-programmed. But larger custom-designed programs are easy to write and record permanently on **5 by 20** inch magnetic cards.

The **AF-1** is also supplied with a Basic Applications Library containing 10 prerecorded programs.

Although the **AF-1** has enormous calculating power, it can be operated as easily as a simple general purpose calculator. Its left-to-right algebraic operating system (AOS) allows problems to be entered just as they're written. And on the **AF-1** the answers can be displayed or printed.

Whether you are a businessman, engineer, or scientist, whenever you require special mathematical techniques, the **AF-1** aids you, and your assistants in the solution to problems.

**#OK:Okefenoke Swamp**

**The AF-1 combines the convenience, simplicity and value of a desktop calculator with the powerful features found only on its more expensive relative – the computer.**

**Prompting.** The alphanumeric prompting feature used in conjunction with programming, displays letters, numbers and special symbols that let you make words and phrases that will later "ask" for entries or decisions to solve the problem.

The **AF-1's** large (1¼ by 9¼-inch) 20-character light emitting diode display (5 by 7 dot matrix) "asks" you for your input, in terms you understand, at each stage of the problem—then waits for your keyed in response before it continues.

This rapid dialogue lets you solve a problem using different inputs, letting you explore multiple options. And, should your dialogue be interrupted, just leave the **AF-1** on and its display will tell you where you are when you return.

**Programming.** Easy to learn. No codes or special rules to master. More time can be spent formulating problems. And it's not necessary to learn all the functions to write simple programs. The **AF-1** can also handle very large problems with its: **5** data registers, **18** program memory locations, **99** flags, **2** branching instructions, **2** subroutine levels, Alphanumeric prompting, Choice of labels or absolute addressing, Direct or indirect addressing.

Prerecorded programs are also supplied. So easy to use, a person merely needs a general concept of what's to be solved to have a solution in seconds. People with a minimum math background can use prerecorded programs (or programs developed by others) with a minimum amount of instruction.

Any program can be recorded on blank magnetic cards for continual use.

**Printing.** Quiet thermal printer prints any number that appears on the display. Up to 20 characters (5 by 7 dot matrix) on 2½-inch wide thermal paper. A scaled replica of the display.

Fast and reliable, the **AF-1's** printer delivers a "hard" permanent copy of all your calculations and results. Identifies pertinent data and answers.

**Optional Memory Expansion Modules** are available to increase either program locations or data memories. The following configurations are available:

| Option | Memory | Prog. Steps |
|---|---|---|
| 1 | 10 | 19 |
| 1A | 19 | 9 |
| 2 | 31 | 38 |
| 2A | 55 | 19 |
| 3 | 43 | 57 |
| 3A | 91 | 19 |

**Optional Libraries**
Six libraries containing well over 10 different programs are available: Finance with 2 programs, Electrical Engineering with 6 programs, Math I has 2 programs, Math II, 8 programs. Statistics, 9 programs and Surveying, 7 programs.

The **AF-1** comes equipped with customized software: A 2-page Operating Manual details all keystrokes and operations. A 6-page Programming Manual provides comprehensive, detailed information and numerous examples on how to program. A Basic Library Manual shows you how to use the 8 prerecorded programs and the 2 diagnostic tests that are contained on the 5 prerecorded magnetic cards. Three blank cards and a head cleaner are also included.

There's a 50-sheet tablet of Coding Forms and User-Instructions to help you write your own programs. And finally, a dust cover and a 3-wire 120-volt power cord which plugs into a standard 115-volt outlet complete the package. (Note: The **AF-1** can also be operated by 220-volts by placing its voltage switch in the 220 position and changing the power cord.)

**CALL OUR TOLL FREE NUMBER 27745-3665**
**FOR PRICE QUOTATION BASED ON DESIRED OPTIONS**

PERSPECTIVE DRAWING.- Lester Tibbetts Jr., wrote this program, originally intended for TI-58 use. It permits point-to-point or dot-to-dot perspectives by means of your calculator. Lester wrote me that it doesn't have any bells nor whistles, but that it would be easily adapted to TI-59 use, which I could not resist doing. So, the longer program is proof of that. As Lester supplied also the mathematical formulas he used, if shortened, it could even fit on a TI-57.

Vanishing points: LBL D': VP(L) = -(L/tan Ø ; VP(R) = L·tan Ø .

All plan views must be rotated by angle Ø to a coordinate system having Line of Sight and Horizon Line (eye level) as abcissa and ordinate respectively. Polar coordinates could be used here to save program space, but the method used here is faster. Coordinate points for vanishing in two directions are generated and stored.

Coordinates: Vanishing left: LBL A; vanishing right: LBL B.

All points are vanished first to the left and then to the right.

Compute, vanish left, LBL D from steps 000 to 016. Vanish right from steps 017 to 030.

Compute, vanish left, LBL E from steps 033 to 051. Vanish right from steps 052 to 070.

As one moves around the object, different viwe points, angles and eye level may be employed. The centralized coordinate system and zero eye level used here simplify the presentation, but the selection of these parameters is no more limited than the conventional perspective drawing. The rule to remember when establishing a new picture plane location is that coordinate zero of the plan view must always be located to coincide with the true lenght line. However, it is never necessary to redraw the plan since this "lateral transfer" of coordinate zero can be accomplished mathematically by entering each point through a subroutine which adds or subtracts the required correction.

Single point perspective can be done by entering Ø as a very small angle. Zero, however, will cause erroneous results"

Using a very large value for L will eliminate perspective. An interesting application of this is the use of an L of several miles long and values for H and Ø derived from the position of the sun at noon on the 21st day of December. The sun does not "see" in perspective, since the rays arriving at earth are parallel, so an isometric drawing of a chalet thus created would accurately show whether the sun can peek under the eaves and see through the windows. A similar view for the 21st of June should show the eaves shading the windows but, as in conventional perspective drawing, viewing angles above 45 degrees create distortion.

The chalet in the example has a prow front, a recessed balcony, and a difficult roof line. Drawn to fill a 16 inch by 24 inch drafting sheet, the vanishing points would be more than 10 feet apart! These complications may confuse the eye and possibly even the artist, but not the calculator.

To gain familiarity, enter the program into the calculator and use the view point data listed for the chalet. Enter a few points from the plan view (A, B and C coordinates) and plot the results (D, E) on the perspective drawing. Note that it is not necessary for the two scales to be the same. Follow the steps as listed. A must always be entered first, followed by B. C is always entered as height above the base reference without regard to eye level. To avoid unnecessary lines enter visible areas only, roof peaks first, then the eaves and gables. Connect the dots to complete the roof, then construct the verticals from the D intercepts of the wall corners to meet the roof line. You may want to try positive or negative values for H and view the house from above or below.

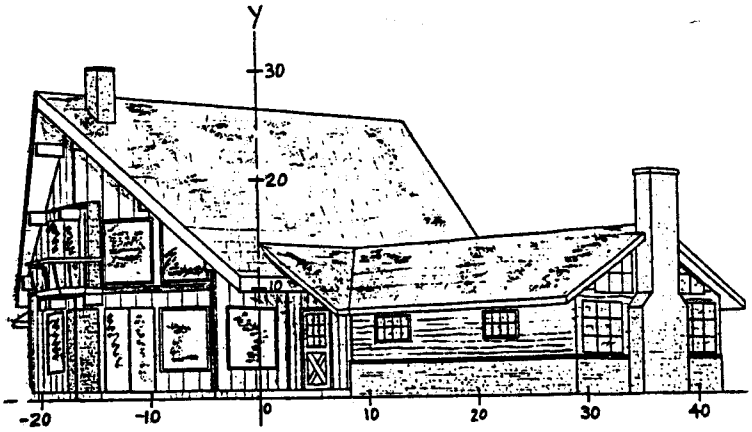
Note that in the TI-59/PC100 program, labels D and E are combined into one single label E. And, of course, I would not try to discourage you to enter the larger of the two program into a 58 and use it in combination with a PC100. It works just fine.

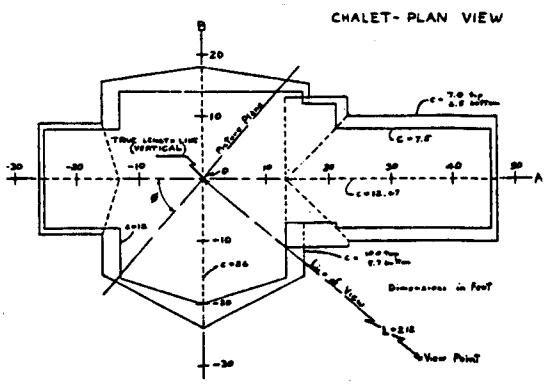
USER INSTRUCTIONS:

1. Enter Horizon (eye) Level H and press A'.
2. Enter Distance to Station Point L and press B'.
3. Enter angle, in decimal degrees, Ø and press C'.
4. Compute vanishing points VP(L) and VP(R) by pressing D'
5. Enter Plan View Coordinate and press A.
6. Enter Plan View Coordinate and press B.
7. Enter Elevation (True Height) and press C.
8. Compute X and Y by pressing D and E. In the TI-59/PC100 program press E only.
9. Repeat steps 5 through 8 for other points.
10. Repeat steps 1 through 4 when changing Station Point.

Perspective drawing (cont.)

The test data are from the rear roof peak: H=0; L=212; Ø= 50; VP(L)=-177.89; VP(R)=252.65; R=0; B=18; C=26; D=13.08 and E=24.65.




See programs on next page, please.

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FAST MODE.- Palmer O. Hansen writes:" I have belatedly discovered that the statistics and conversions functions do not work in Fast Mode. This is contrary to the implications in the temth restriction on v6n9/10p19. It is consistent with Patrick Acosta's statement on v6n8p4 where he states:'The nice thing about this method is that you may use library programs or statistics and conversions functions, then switch to Fast Mode under program control.' "

---

DIAGNOSTIC,- Palmer O. Hansen writes:" I have found a memory malfunction which is not diagnosed by the SST program, but is properly diagnosed by either the 598-TEST-1 program from the TI-58/59 Service Manual (write TI in Lubbock for a copy. I am not allowed to copy this copyrighted article. Ed.) and more completely diagnosed by the extended Memory Module Diagnostic program (PPX # 908175G. Also write PPX in Lubbock for a copy. Ed.) "
So, finally proof that our SST diagnostic is not foolproof.

---

SOLVING SIMULTANEOUS EQUATIONS,- Does anyone have any idea how to use the ML-02 routines as subroutines in a program to enable one to solve simultaneous equations? TI is not able to come up with a complete answer either. Any good solution would be accepted with thanks and published. Several members have been asking me about this problem.

---

BOOKS,- The EDUCALC Mailstore, 27963 Cabot Road, So. Laguna, CA 92677 announces the following new arrivals:

Basic College Math, A Calculator Approach. Beginner's course in pre-calculus by Ash/Robinson. Addison-Wesley, Stock # E-91, 526 pages, $ 17.95.

Mathematical Astronomy with a Pocket Calculator, by Aubrey Jones, FRAS. Stock # E-76, Halsted Press, 254 pages, hardbound, $ 19.95.

Energy Analysis with a Pocket Calculator, 2nd Edition, by G.A. Patterson, Stock # E-70, Basic Science Press, 138 pages, Softbound, $ 9.95. (TI-57 and HP-25)

Pocket Calculator Supplement for Calculus, by Rosser/Boor. Stock # E-32, Addison/Wesley 291 pages, Softbound $ 11.50. (TI-57 and HP-33E)

Practical Astronomy with your Calculator, by Peter Duffett-Smith. Stock # E-38, Cambridge University Press, 129 pages, Softbound, $ 8.95.

Combinatorial Algorithms for Computers and Calculators, by Nijenhuis/Wilf. Stock # E-25 Academic Press, 302 pages, hardbound, $ 22.50.

---

```
000  76 LBL
001  14  D
002  43 RCL
003  01  01
004  55  ÷
005  53  (
006  01  1
007  85  +
008  43 RCL
009  02  02
010  55  ÷
011  43 RCL
012  11  11
013  95  =
014  42 STO
015  08  08
016  43 RCL
017  03  03
018  55  ÷
019  53  (
020  01  1
021  85  +
022  43 RCL
023  04  04
024  55  ÷
025  43 RCL
026  11  11
```

```
027  95  =
028  42 STO
029  09  09
030  91 R/S
031  76 LBL
032  15  E
033  53  (
034  43 RCL
035  05  05
036  75  -
037  43 RCL
038  10  10
039  54  )
040  65  ×
041  53  (
042  01  1
043  75  -
044  43 RCL
045  08  08
046  55  ÷
047  43 RCL
048  06  06
049  54  )
050  65  ×
051  53  (
052  43 RCL
053  07  07
```

```
054  75  -
055  43 RCL
056  09  09
057  54  )
058  55  ÷
059  53  (
060  43 RCL
061  07  07
062  75  -
063  43 RCL
064  08  08
065  54  )
066  85  +
067  43 RCL
068  10  10
069  95  =
070  91 R/S
071  76 LBL
072  11  A
073  42 STO
074  01  01
075  65  ×
076  43 RCL
077  00  00
078  95  =
079  48 EXC
080  01  01
```

```
081  65  ×
082  43 RCL
083  12  12
084  95  =
085  94 +/-
086  42 STO
087  02  02
088  91 R/S
089  76 LBL
090  12  B
091  42 STO
092  03  03
093  65  ×
094  43 RCL
095  12  12
096  85  +
097  43 RCL
098  01  01
099  95  =
100  48 EXC
101  03  03
102  65  ×
103  43 RCL
104  00  00
105  85  +
106  43 RCL
107  02  02
```

```
108  95  =
109  42 STO
110  04  04
111  91 R/S
112  76 LBL
113  13  C
114  42 STO
115  05  05
116  91 R/S
117  76 LBL
118  19  D'
119  43 RCL
120  12  12
121  38 SIN
122  55  ÷
123  48 EXC
124  12  12
125  39 COS
126  42 STO
127  00  00
128  95  =
129  42 STO
130  07  07
131  35 1/X
132  65  ×
133  43 RCL
134  11  11
```

```
135  49 PRD
136  07  07
137  95  =
138  94 +/-
139  42 STO
140  06  06
141  91 R/S
142  76 LBL
143  10  E'
144  43 RCL
145  07  07
146  91 R/S
147  76 LBL
148  16  A'
149  42 STO
150  10  10
151  91 R/S
152  76 LBL
153  17  B'
154  42 STO
155  11  11
156  91 R/S
157  76 LBL
158  18  C'
159  42 STO
160  12  12
161  91 R/S
```

```
  0.00  HLEV
212.00  DIST
 50.00  ANGL
-177.89  VP-L
252.65  VP-R

  0.00     A
 18.00     B
 26.00     C
 13.08     X
 24.65     Y
```

```
000  76 LBL
001  99 PRT
002  55  ÷
003  01  1
004  02  2
005  22 INV
006  28 LOG
007  85  +
008  01  1
009  54  )
010  82 HIR
011  08  08
012  32 X:T
013  69 OP
014  06  06
015  92 RTN
016  76 LBL
017  15  E
018  43 RCL
019  01  01
020  55  ÷
021  53  (
022  01  1
023  85  +
024  43 RCL
025  02  02
026  55  ÷
027  43 RCL
028  11  11
029  95  =
030  42 STO
031  08  08
032  43 RCL
033  03  03
034  55  ÷
035  53  (
```

```
036  01  1
037  85  +
038  43 RCL
039  04  04
040  55  ÷
041  43 RCL
042  11  11
043  95  =
044  42 STO
045  09  09
046  32 X:T
047  04  4
048  04  4
049  71 SBR
050  99 PRT
051  53  (
052  43 RCL
053  05  05
054  75  -
055  43 RCL
056  10  10
057  54  )
058  65  ×
059  53  (
060  01  1
061  75  -
062  43 RCL
063  08  08
064  55  ÷
065  43 RCL
066  06  06
067  54  )
068  65  ×
069  53  (
070  43 RCL
071  07  07
072  75  -
073  43 RCL
074  09  09
075  54  )
076  55  ÷
077  53  (
078  43 RCL
079  07  07
080  75  -
081  43 RCL
```

```
082  08  08
083  54  )
084  85  +
085  43 RCL
086  10  10
087  95  =
088  32 X:T
089  04  4
090  05  5
091  71 SBR
092  99 PRT
093  98 ADV
094  22 INV
095  58 FIX
096  91 R/S
097  76 LBL
098  11  A
099  58 FIX
100  02  02
101  42 STO
102  01  01
103  32 X:T
104  01  1
105  03  3
106  71 SBR
107  99 PRT
108  43 RCL
109  01  01
110  65  ×
111  43 RCL
112  00  00
113  95  =
114  48 EXC
115  01  01
116  65  ×
117  43 RCL
118  12  12
119  95  =
120  94 +/-
121  42 STO
122  02  02
123  91 R/S
124  76 LBL
125  12  B
126  42 STO
127  03  03
```

```
128  32 X:T
129  01  1
130  04  4
131  71 SBR
132  99 PRT
133  43 RCL
134  03  03
135  65  ×
136  43 RCL
137  12  12
138  85  +
139  43 RCL
140  01  01
141  95  =
142  48 EXC
143  03  03
144  65  ×
145  43 RCL
146  00  00
147  85  +
148  43 RCL
149  02  02
150  95  =
151  42 STO
152  04  04
153  91 R/S
154  76 LBL
155  13  C
156  42 STO
157  05  05
158  32 X:T
159  01  1
160  05  5
161  71 SBR
162  99 PRT
163  91 R/S
164  76 LBL
165  10  E'
166  43 RCL
167  12  12
168  38 SIN
169  55  ÷
170  48 EXC
171  12  12
172  39 COS
173  42 STO
```

```
174  00  00
175  95  =
176  42 STO
177  07  07
178  35 1/X
179  65  ×
180  43 RCL
181  11  11
182  49 PRD
183  07  07
184  95  =
185  94 +/-
186  42 STO
187  06  06
188  32 X:T
189  04  4
190  02  2
191  03  3
192  03  3
193  02  2
194  00  0
195  02  2
196  07  7
197  71 SBR
198  99 PRT
199  43 RCL
200  07  07
201  32 X:T
202  04  4
203  02  2
204  03  3
205  03  3
206  02  2
207  00  0
208  03  3
209  05  5
210  71 SBR
211  99 PRT
212  98 ADV
213  22 INV
214  58 FIX
215  91 R/S
216  76 LBL
217  16  A'
218  58 FIX
219  02  02
```

```
220  42 STO
221  10  10
222  32 X:T
223  02  2
224  03  3
225  02  2
226  07  7
227  01  1
228  07  7
229  04  4
230  02  2
231  71 SBR
232  99 PRT
233  91 R/S
234  76 LBL
235  17  B'
236  42 STO
237  11  11
238  32 X:T
239  01  1
240  06  6
241  02  2
242  04  4
243  03  3
244  06  6
245  03  3
246  07  7
247  71 SBR
248  99 PRT
249  91 R/S
250  76 LBL
251  18  C'
252  42 STO
253  12  12
254  32 X:T
255  01  1
256  03  3
257  03  3
258  09  9
259  02  2
260  02  2
261  02  2
262  07  7
263  71 SBR
264  99 PRT
265  91 R/S
```

*PROGRAMMING PUZZLES,- In v7n1/2p9 I presented the following program puzzles by Charlie Williamson:*

1. MIN-MAX SORTER WITHOUT USING THE T-REGISTER COMPARISONS. Place a in the display register and b in the t-register . Devise a routine that will place max(a,b) in the t-register.

*Charlie's proposed routine has 40 steps and reads as follows:*

LBL A ( X:T - ( X:T + ( X:T + X:T ) X:T 0 ) ) ABS ( X:T - ( X:T + X:T )

X:T ) ( X:T DIV 2 ) ( X:T DIV 2 ) X:T RTN

*Clyde Durbin, Dallas,Texas, has this solution, with only 19 steps:*

LBL A - X:T = DIV 2 X ( OP 10 - 1 ) + X:T = X:T RTN

*Björn Gustavsson in Smedjebacken, Sweden, does it in 17 steps:*

LBL A + ( X:T - X:T ) ABS + X:T ) DIV 2 ) X:T RTN

*Jeff Rosedale's min-max sorter looks like this: (24 steps)*

LBL A - X:T = X (( OP 10 + 1) DIV 2 - 1) ABS - X:T = ABS RTN

*John Allen solved it in 15 steps:*

LBL A - X:T - ABS = +/- DIV 2 + X:T = X:T RTN

*And John adds this 18-step routine, in case we want to save all pending math:*

LBL A ( CE - X:T - ABS ) (+/- DIV 2 + X:T ) RTN

*In all of the above routines DIV means the division key ÷ and ABS means the absolute value key |×|. I don't use the key symbols out of sheer laziness: It requires me to change the daisy wheel on the typewriter each time for one single character. Those special characters are available only on the "symbols" daisy wheel.*

*And that is all as far as solutions received for this puzzle at the time of writing. (mid February)*

2. POWERS OF MINUS ONE. Place an integer in the display. Devise a routine which will display (-1) to the nth power.

*Palmer Hanson bettered Charlie's original routine with this 11-step one:*

LBL A ( DEG X 1 8 0 ) COS RTN

*Mike Malak, 14-years-old, in Alexandria, Virginia, phoned me this solution two days after I had mailed v7n1/2:*

LBL A X π = RAD COS RTN

*And Clyde Durbin offered exactly the same solution as the one from Mike above. Björn Gustavsson rearranged his steps a little, but came up with practically the same thing:*

LBL A RAD X π ) COS RTN

*With tongue in cheek Clyde says that he liked the programming puzzles but that he wished I would use (1) harder ones with math terms he doesn't understand or (2) easier ones that are obvious.*

*John Allen came up with the same routine as Palmer Hanson, above and Jeff Rosedale (a little older than Mike Malik, but also still a teenager) had practically the same idea as Björn Gustavsson.*
*Now Myer Boland sent in the following routine:*

PUT IN RAD MODE; RST; ANY INTEGER + OR -; PRESS RUN

000: DIV 2 ) INV INT X=T PI PI LBL PI COS RTN

*And Myer says:" 11 steps if INV INT is counted as one step."*

*Now, while I am writing down all this, and in the firm believe that no more solutions will arrive, the postman brings Bill Buechner's letter. Bill says that 23 steps are enough for # 1 and 11 for # 2:*

LBL A - X:T HIR 07 = INV STF 7 $\overline{VX}$ OP 19 CLR IFF 07 019 RTN HIR 17 X:T RTN

LBL A STO 00 1 +/- DSZ 0 005 RTN

*"But," says Bill, " If I were going to use it in an actual situation I'd prefer this solution to problem # 2. It is 4 steps longer but much faster in running time than the DSZ routine:*

LBL A +/- DIV 2 = INV INT + .1 = OP 10 RTN

*If more solutions arrive and if they are very different from the ones in this issue, I will put them in next issue. I thank all particpants. Your response was overwhelming. Maybe out of these routines we can choose a couple of good ones for our own module.*

*With respect to that module: I have been dragging my feet on it for the last two months (on purpose) hoping that TI would finally tell us what the next one is going to look like. No such luck. If the next one turns out to be an "enhanced TI-59" with, let's say for the sake of argument, modules one can write into directly, then there is no point in us developing a module. In that case everybody just "develops" his or her own module. But if the new one turns out to be an animal completely different from the TI-59 (say a sort of hand-held computer a la Radio Shack or Sharp) then we will go ahead with our own module. In that case the TI-59 will not be obsolete very soon. In any case, I would hate to waste our (collective) money on something that would become obsolete even before we finished it.*

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RPN SIMULATOR,- Björn Gustavsson. As promised in v7n1/2p4 (enhanced decimal point trick) here is Björn's RPN Simulator that uses this enhanced decimal point trick. The different user-defined keys and labels used are:

A = ENTER
B = +
C = -
D = X
E = ÷
E' = Y^X
D' = R↓ (Roll down)
SBR CLR = CLX (Clear X-reg)
SBR CE = Clear stack
SBR LNX = Last X
SBR X:T = X:Y (exchange X with Y)

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 000 | 76 | LBL | 032 | 00 | 00 | 064 | 87 | IFF | 095 | 43 | RCL | 126 | 55 | ÷ | 157 | 22 | 22 |
| 001 | 17 | B' | 033 | 40 | 40 | 065 | 01 | 01 | 096 | 22 | 22 | 127 | 61 | GTO | 158 | 48 | EXC |
| 002 | 86 | STF | 034 | 48 | EXC | 066 | 00 | 00 | 097 | 44 | SUM | 128 | 00 | 00 | 159 | 23 | 23 |
| 003 | 00 | 00 | 035 | 22 | 22 | 067 | 04 | 04 | 098 | 21 | 21 | 129 | 75 | 75 | 160 | 42 | STO |
| 004 | 92 | RTN | 036 | 48 | EXC | 068 | 48 | EXC | 099 | 61 | GTO | 130 | 76 | LBL | 161 | 24 | 24 |
| 005 | 76 | LBL | 037 | 23 | 23 | 069 | 22 | 22 | 100 | 00 | 00 | 131 | 10 | E' | 162 | 43 | RCL |
| 006 | 16 | A' | 038 | 42 | STO | 070 | 48 | EXC | 101 | 80 | 80 | 132 | 18 | C' | 163 | 21 | 21 |
| 007 | 21 | 2ND | 039 | 24 | 24 | 071 | 23 | 23 | 102 | 76 | LBL | 133 | 43 | RCL | 164 | 92 | RTN |
| 008 | 93 | . | 040 | 43 | RCL | 072 | 42 | STO | 103 | 13 | C | 134 | 22 | 22 | 165 | 76 | LBL |
| 009 | 21 | 2ND | 041 | 21 | 21 | 073 | 24 | 24 | 104 | 18 | C' | 135 | 45 | Y^ | 166 | 32 | X:T |
| 010 | 21 | 2ND | 042 | 48 | EXC | 074 | 92 | RTN | 105 | 43 | RCL | 136 | 61 | GTO | 167 | 48 | EXC |
| 011 | 17 | B' | 043 | 22 | 22 | 075 | 43 | RCL | 106 | 22 | 22 | 137 | 00 | 00 | 168 | 22 | 22 |
| 012 | 92 | RTN | 044 | 48 | EXC | 076 | 21 | 21 | 107 | 75 | - | 138 | 75 | 75 | 169 | 42 | STO |
| 013 | 76 | LBL | 045 | 23 | 23 | 077 | 95 | = | 108 | 61 | GTO | 139 | 76 | LBL | 170 | 21 | 21 |
| 014 | 17 | B' | 046 | 42 | STO | 078 | 42 | STO | 109 | 00 | 00 | 140 | 19 | D' | 171 | 92 | RTN |
| 015 | 22 | INV | 047 | 24 | 24 | 079 | 21 | 21 | 110 | 75 | 75 | 141 | 48 | EXC | 172 | 76 | LBL |
| 016 | 86 | STF | 048 | 86 | STF | 080 | 43 | RCL | 111 | 76 | LBL | 142 | 24 | 24 | 173 | 24 | CE |
| 017 | 00 | 00 | 049 | 01 | 01 | 081 | 24 | 24 | 112 | 14 | D | 143 | 48 | EXC | 174 | 25 | CLR |
| 018 | 92 | RTN | 050 | 43 | RCL | 082 | 48 | EXC | 113 | 18 | C' | 144 | 23 | 23 | 175 | 42 | STO |
| 019 | 76 | LBL | 051 | 21 | 21 | 083 | 23 | 23 | 114 | 43 | RCL | 145 | 48 | EXC | 176 | 24 | 24 |
| 020 | 11 | A | 052 | 92 | RTN | 084 | 42 | STO | 115 | 22 | 22 | 146 | 22 | 22 | 177 | 42 | STO |
| 021 | 16 | A' | 053 | 76 | LBL | 085 | 22 | 22 | 116 | 49 | PRD | 147 | 42 | STO | 178 | 23 | 23 |
| 022 | 87 | IFF | 054 | 18 | C' | 086 | 43 | RCL | 117 | 21 | 21 | 148 | 21 | 21 | 179 | 42 | STO |
| 023 | 00 | 00 | 055 | 16 | A' | 087 | 21 | 21 | 118 | 61 | GTO | 149 | 92 | RTN | 180 | 22 | 22 |
| 024 | 00 | 00 | 056 | 87 | IFF | 088 | 22 | INV | 119 | 00 | 00 | 150 | 76 | LBL | 181 | 76 | LBL |
| 025 | 40 | 40 | 057 | 00 | 00 | 089 | 86 | STF | 120 | 80 | 80 | 151 | 23 | LNX | 182 | 25 | CLR |
| 026 | 42 | STO | 058 | 00 | 00 | 090 | 01 | 01 | 121 | 76 | LBL | 152 | 43 | RCL | 183 | 86 | STF |
| 027 | 25 | 25 | 059 | 04 | 04 | 091 | 92 | RTN | 122 | 15 | E | 153 | 25 | 25 | 184 | 01 | 01 |
| 028 | 48 | EXC | 060 | 42 | STO | 092 | 76 | LBL | 123 | 18 | C' | 154 | 48 | EXC | 185 | 00 | 0 |
| 029 | 21 | 21 | 061 | 25 | 25 | 093 | 12 | B | 124 | 43 | RCL | 155 | 21 | 21 | 186 | 42 | STO |
| 030 | 87 | IFF | 062 | 48 | EXC | 094 | 18 | C' | 125 | 22 | 22 | 156 | 48 | EXC | 187 | 21 | 21 |
| 031 | 01 | 01 | 063 | 21 | 21 | | | | | | | | | | 188 | 92 | RTN |

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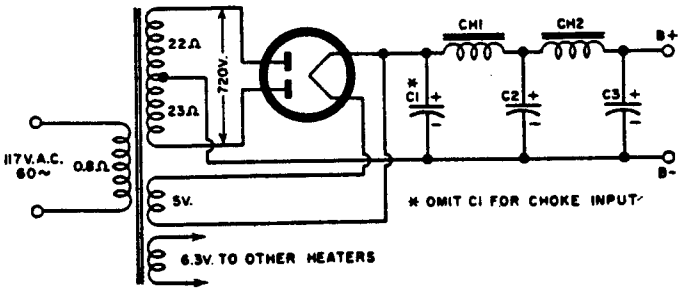
*NEWCOMER'S CORNER. How to transform a problem into a program. Maurice E.T. Swinnen.*

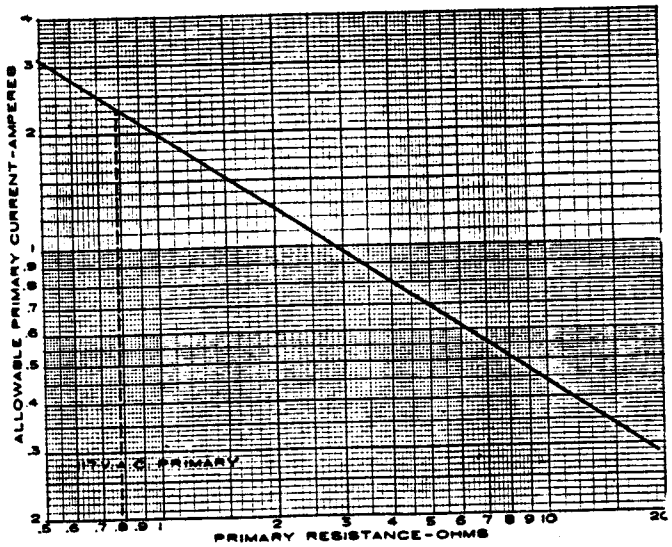
*At the TI seminars newcomers often ask me:"How do you start writing a program? What is the logic behind it?" My answer is usually "let me show you by means of an example." And that is what I am going to do here also.*

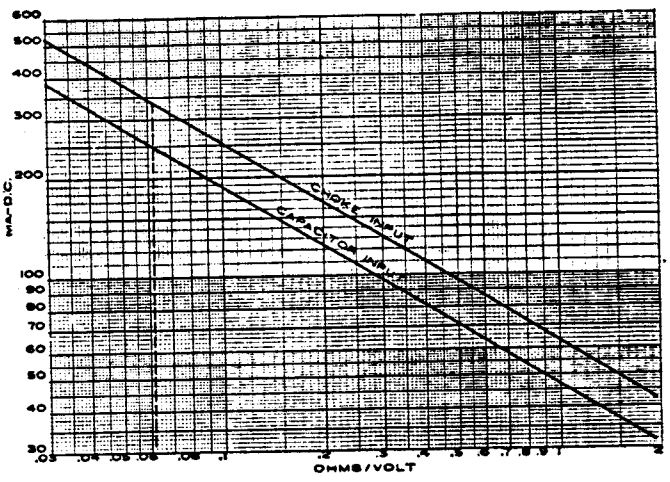
*The example comes for the electronics field. That is the only profession I can talk about with some degree of selfassuredness. For those not in the EE trade, don't despair. Just follow the equations, even if they don't mean very much to you. Mathematics is, after all, THE universal language, bridging almost all professions.*

*In my junk box I have collected over the years many power transformers. They originate mostly from radios and TV sets taken apart. The sets were donations from friends and neigbors who knew that "Maurice somehow plays with that kind of stuff." Then, when I feel the urge of being creative and concoct some device that is supposed to benefit our household, I delve in my supply of parts (the junk box) and to my utter despair I find that all those nice transformers I kept for years have no markings on them. So, out comes the trusted VOM and I start measuring everything measurable about them. Most of these relics come out of tube sets. A representative schematic appears on the left. You might say:"In these days of transistors and ICs, what is that old mastodont good for?" Note the 720 volts high voltage winding. Note also the 110 volts primary winding. Divide one by the other and you get a ratio of roughly 6.5 to 1. Now if you apply 110 volts where normally the 720 would go, you would measure on the other side (where normally the 110 would be connected) about 17 volts. Wouldn't that be a suitable voltage for transistor or IC circuits? On the other hand, in the kind of electronics in which I dabble, microwaves, tubes still reign supreme. So, the old power transformers are still up to date. Whatever use you are going to make of these oldies, (and you hate to throw them away) you will want to know all their characteristics, especially the current limit, before you put them in any circuit.*




*Now, long time ago, a technician friend of mine gave me two curves. With painstaking patience he had plotted high-voltage winding ohms/volt versus permissible current on one curve and primary ohms versus allowable current on the other curve for transformers of different manufacturers. He told me that, with a very small spread, they all agreed with each other. Using these curves then is easy. Just measure the resistances (the transformer disconnected from the 110 volts, please!) and read the permissible current from the curves.*



*newcomer's conner. (cont.)*

*One drawback of the curves is that they are rather small and inaccurate. So, I decided to "transform a problem into a program." Using the program solved also the problem of finding out "where exactly I left those curves." Over the years I had made at least ten copies of them and filed them at strategic places, never to find them again. Now they would be kept on magnetic cards and neatly filed in the EE programs folder.*

*In order to write a program, I first needed some equations. The best place to obtain these equations are the curves themselves. So, by means of my best magnifying glass I read off a series of data and run them through the "Data Fit to 8 Curves" (see newcomer's corner v7n1/2p15) The resulting equations, using curve fit # 7, are: For the primary current = (1.978) times ( primary resistance to the power -.65)*

*For the high-voltage windings:*

*a. For choke input: max current = (63) times (ohms/volt to the -.6 power)*

*b. For capacitive input: max current is (47) times (ohms/volt to the -.6 power)*

*For the 5 and 6.3 volt windings I simply measured the diameter either in mm or in thousands of an inch and computed the maximum permisible current on the basis of one ampere per 700 circular mills, a rather conservative estimate.*

*If you want to use a factor of 2 instead of 1.978 in the primary equation, you will make am error of only 1.11 %.*

*Now, we are ready to write the program. We are, of course, going to write one with all the bells and whistles. So, we intend to use the nice OP 04 OP 06 type of printing with descriptors in the margins.*

*Label A will permit to enter the resistance of the high-voltage winding, label B the entry of the voltage of the high-voltage winding , label C will be used to obtain the max permissible current with capactive input and label D with choke input. So, we write:*

LBL A STO 00 X:T 32 23 30 36 OP 04 X:T FIX 3 OP 06 INV FIX RTN *(prints OHMS)*

LBL B STO 01 X:T 42 32 27 37 OP 04 X:T FIX 3 OP 06 INV FIX RTN *(prints VOLT)*

*We see at once that the portion OP 04 X:T FIX 3 OP 06 INV FIX is repeated in both routines and thus may be a good candidate for a subroutine. We will call it SBR PRT. So, we rewrite both LBL A and LBL B, and add a LBL PRT:*

LBL PRT OP 04 X:T FIX 3 OP 06 INV FIX RTN

LBL A STO 00 X:T 32 23 30 36 SBR PRT RTN LBL B STO 01 X:T 42 32 27 37 SBR PRT RTN

*No come LBL C and LBL D:*

LBL C RCL 00 DIV RCL 01 = $Y^X$ .6 +/- = X 48 = X:T 30 13 00 00 SBR PRT RTN

LBL D RCL 00 DIV RCL 01 = $Y^X$ .6 +/- = X 63 = X:T 30 13 00 00 SBR PRT RTN

*Two new candidates for subroutines appear: RCL 00 DIV RCL 01 = $Y^X$ .6 +/- = X and = X:T 30 13 00 00 . So we call the first one SBR RCL and the second one SBR X:T.*

LBL RCL RCL 00 DIV RCL 01 = $Y^X$ .6 +/- = X RTN

LBL X:T = X:T 30 13 00 00 RTN

LBL C SBR RCL 47 SBR X:T SBR PRT RTN LBL D SBR RCL 63 SBR X:T SBR PRT RTN

*Because the calculator starts searching for the corresponding label FROM THE TOP OF THE PROGRAM every time you call a SBR, it pays to place all your subroutines at the top of your program. You will gain considerable execution time this way.*

*Now LBL E will permit entry of the resistance of the primary winding (110 or 220 volts. A 220 volt winding is approximately twice as long as a 110 one and therefore should be entered with one-quarter of the resistance in the curves. It is wound with one-half the cross-sectional area, which doubles the resistance per unit length. Take these facts in consideration when adapting this program to 220 volts primary windings) LBL E will at the same time compute the max permissible current in the primary winding. (why press two keys when you can do it with one?)*

LBL E X:T 32 23 30 36 SBR PRT $Y^X$ .65 +/- = X 1.978 = X:T 13 30 33 36 SBR PRT RTN

*But again we see that the portion X:T 32 23 30 36 is common with LBL A above. So we call this new subroutine LBL STO.*

*newcomer's corner (cont.2)*

*And, of course, we rewrite LBL E with the SBR STO in it.*

*If we run the data on the diameter of the wire of the 5 and the 6.3 volt windings versus the max permissible current through the DATA FIT TO 0 CURVES program (a # 22 wire will carry .9 A., a # 20 about 1.5 A., a # 18 about 2.3 A., a # 16 about 3.7 A., and a # 14 about 5.9 A.) we end up with an equation as follows:*

*Max permissible current in Amps = 2.2 times (diameter of wire in mm to the square) Multiplying an entry in thousands of an inch by 0.0254 will permit now to enter either mm or thousands of an inch. LBL A' is used for entry of thousands of an inch and prints out MILS, while LBL B' is used for mm entry and prints out MM.*

LBL A' X:T 30 24 27 36 SBR PRT X .0254 = LBL B' X:T 30 30 00 00 SBR PRT $X^2$

X 2.2 = X:T 13 30 33 36 SBR PRT R/S

*And finally we notice that again we have a good candidate for a subroutine . The portion X:T 13 30 33 36 we have in common with LBL E. We could call that subroutine E'. And in the bargain we gain one step when calling it, as it is NOT necessary to say SBR E'. A simple E' is enough.*

*And, here is the final product. The only additions to it are a few, strategically placed, ADVs to make the print-out look a little better and more meaningfull.*

```
                50.000    OHMS
               720.000    VOLT
               232.871    MA
               312.146    MA

                 0.800    OHMS
                 2.287    AMPS

               181.000    MILS
                 4.597    MM
                46.499    AMPS

                 5.000    MM
                55.000    AMPS

000  76 LBL    020  45 Y×    040  42 STO    075  42 STO    109  76 LBL    143  71 SBR
001  10 E'     021  93 .     041  32 X:T    076  01 01     110  15 E      144  99 PRT
002  32 X:T    022  06 6     042  03 3      077  32 X:T    111  71 SBR    145  65 ×
003  01 1      023  94 +/-   043  02 2      078  04 4      112  42 STO    146  93 .
004  03 3      024  95 =     044  02 2      079  02 2      113  71 SBR    147  00 0
005  03 3      025  65 ×     045  03 3      080  03 3      114  99 PRT    148  02 2
006  00 0      026  92 RTN   046  03 3      081  02 2      115  45 Y×     149  05 5
007  03 3      027  76 LBL   047  00 0      082  02 2      116  93 .      150  04 4
008  03 3      028  99 PRT   048  03 3      083  07 7      117  06 6      151  95 =
009  03 3      029  69 OP    049  06 6      084  03 3      118  05 5      152  76 LBL
010  06 6      030  04 04    050  92 RTN    085  07 7      119  94 +/-    153  17 B'
011  92 RTN    031  32 X:T   051  76 LBL    086  71 SBR    120  65 ×      154  32 X:T
012  76 LBL    032  58 FIX   052  32 X:T    087  99 PRT    121  01 1      155  03 3
013  43 RCL    033  03 03    053  95 =      088  91 R/S    122  93 .      156  00 0
014  43 RCL    034  69 OP    054  32 X:T    089  76 LBL    123  09 9      157  03 3
015  00 00     035  06 06    055  03 3      090  13 C      124  07 7      158  00 0
016  55 ÷      036  22 INV   056  00 0      091  71 SBR    125  08 8      159  00 0
017  43 RCL    037  58 FIX   057  01 1      092  43 RCL    126  95 =      160  00 0
018  01 01     038  92 RTN   058  03 3      093  04 4      127  10 E'     161  00 0
019  95 =      039  76 LBL   059  00 0      094  07 7      128  71 SBR    162  00 0
                             060  00 0      095  71 SBR    129  99 PRT    163  71 SBR
                             061  00 0      096  32 X:T    130  98 ADV    164  99 PRT
                             062  00 0      097  71 SBR    131  91 R/S    165  33 X²
                             063  92 RTN    098  99 PRT    132  76 LBL    166  65 ×
                             064  76 LBL    099  71 SBR    133  16 A'     167  02 2
                             065  11 A      100  43 RCL    134  32 X:T    168  93 .
                             066  42 STO    101  06 6      135  03 3      169  02 2
                             067  00 00     102  03 3      136  00 0      170  95 =
                             068  71 SBR    103  71 SBR    137  02 2      171  10 E'
                             069  42 STO    104  32 X:T    138  04 4      172  71 SBR
                             070  71 SBR    105  71 SBR    139  02 2      173  99 PRT
                             071  99 PRT    106  99 PRT    140  07 7      174  98 ADV
                             072  91 R/S    107  98 ADV    141  03 3      175  91 R/S
                             073  76 LBL    108  91 R/S    142  06 6
                             074  12 B
```

*After re-reading the above article I thought it adviceable to add a few safety tips to you, children of the IC age, who don't have an idea what 720 volts could do to your disposition. (let alone your physique) First of all, measure resistances to identify the 110 (or 220) volts winding. That one should have about .5 to 5 ohms. The high-voltage windings have much higher resistances: from 15 to 50 ohms. The 5 and the 6.3 volts windings have such a low resistance that equipment found in amateur dens is usually not adequate to measure such low resistances. After you are sure about which one is the 110 (220) winding, cook your transformer under no-load conditions for a couple of hours, to see if it gets too warm. ALWAYS USE THE ONE-HAND TECHNIQUE TO MEASURE THESE BABIES WHILE UNDER VOLTAGE. STICK ONE HAND IN YOUR POCKET. You'll live longer that way.*

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